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**VB.NET Core Classes in a Nutshell**

By Budi Kurniawan, Ted Neward

Publisher: O'Reilly
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*VB.NET Core Classes in a Nutshell*, provides a concise and thorough reference to the types found in the core namespaces of the .NET Framework Class Library. A companion to *VB.NET Language in a Nutshell*, this is a reference that VB.NET programmers will turn to repeatedly. Due to a special partnership between O'Reilly and Microsoft, this book also includes a CD that integrates the book's reference into Visual Studio .NET.


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# Preface

This book is a desktop reference for the core classes in Microsoft's .NET Framework Class Library (FCL). It is intended as a companion volume to *Visual Basic .NET Language in a Nutshell*, Second Edition, which provides a reference to the Visual Basic language.

*Visual Basic .NET Core Classes in a Nutshell* is divided into two parts. Part I, which consists of a single chapter, offers a very brief overview of and introduction to the .NET FCL.

Part II is a quick reference to the core classes of the FCL — 22 of the most important namespaces of the FCL and their more than 700 types, complete with namespace maps, type descriptions, member signatures using VB .NET syntax, and useful cross references and annotations. Part II is also available on the CD-ROM that accompanies the book (see http://examples.oreilly.com/vbdotnetcore/ for the information available on the CD-ROM).

# Who This Book Is For

As a reference guide to the core classes, we think you'll find *Visual Basic .NET Core Classes in a Nutshell* to be an essential book regardless of your level of experience with Visual Basic. Whether you are an experienced Visual Basic developer or a relatively new programmer just beginning to work with Visual Basic and the .NET platform, you'll find that Visual Basic .NET Core Classes in a Nutshell provides an extremely helpful description of each type in the namespaces documented in Part II, along with a useful list of type members that features VB syntax.

# How This Book Is Structured

This book consists of two parts: a single-chapter introduction, and a reference guide to 22 of the core namespaces of the .NET Framework Class Library.

The single chapter in Part I examines the significance of the .NET Framework Class Library, provides a summary of its contents, discusses the types found in .NET namespaces, and offers some suggestions for exploring the FCL.

Part II consists of 22 chapters, each of which is devoted to one of the 22 namespaces documented in this book. These namespaces provide the core (or system-level) classes defined in the .NET FCL. Excluded are the namespaces whose classes are designed to provide support for application development. The most notable of these excluded namespaces and their child namespaces are System.Data, System.Web, and System.Windows.Forms.

Part II includes chapters that document the following .NET FCL namespaces:

- Microsoft.Win32
- System
- System.Collections
- System.Collections.Specialized
- System.Diagnostics
- System.Globalization
- System.IO
- System.IO.IsolatedStorage
- System.Net
- System.Net.Sockets
- System.Reflection
- System.Reflection.Emit
- System.Runtime.InteropServices
- System.Runtime.Serialization
- System.Runtime.Serialization.Formatters
- System.Text
- System.Text.RegularExpressions
- System.Threading
- System.Timers
- System.XML
- System.XML.XPath
- System.Xml.Xsl

Chapter 2 explains how to get the most from this reference.

# What's on the CD

The CD (see http://examples.oreilly.com/vbdotnetcore/ for the information available on the CD-ROM) that accompanies this book contains *VB.NET Core Classes in a Nutshell for Microsoft Visual Studio .NET*. This software plugs directly into Microsoft Visual Studio .NET and makes the contents of Part II of the book, *.NET Core Classes Quick Reference*, available to you as a fully integrated member of Visual Studio .NET Dynamic Help.

By making *VB.NET Core Classes in a Nutshell* a part of your Visual Studio .NET development environment, you gain the following benefits:

- Continuous access to the contents of the .NET Core Classes Quick Reference as you work in the online Visual Studio .NET development environment
- Ability to browse the contents of the book in the Visual Studio .NET Help Contents window
- Constantly updated Dynamic Help links to relevant Quick Reference entries as you write Microsoft Visual Basic .NET code (these links appear in a separate Dynamic Help window link group named O'Reilly Help)
- Links to Quick Reference topics when you use either the Help Search facility or interactive Index
- Access to the O'Reilly web site, http://www.oreilly.com, for additional books and articles on Visual Basic .NET and the .NET Framework
- Cross-links between Quick Reference topics and related information in MSDN documentation.

For last-minute changes and more information on this software, please read the Release Notes on the CD.

To use *VB.NET Core Classes in a Nutshell for Microsoft Visual Studio .NET* you must be running an officially released version of Visual Basic .NET or Visual Studio .NET on your computer or laptop. To install *VB.NET Core Classes in a Nutshell for Microsoft Visual Studio .NET*:

1. Place the CD in the CD player.
2. Double-click on the file named *VBNETCoreClassesinaNutshell.msi*
3. Follow the instructions contained in the install program windows. Be sure to read and to accept the terms of the software license before proceeding.

To uninstall *VB.NET Core Classes in a Nutshell for Microsoft Visual Studio .NET*, repeat the above procedure, but click on the Remove button when the program prompts you to select an install option.

Making *VB.NET Core Classes in a Nutshell Quick Reference* available as a Visual Studio .NET plug-in is an experiment for both O'Reilly & Associates and Microsoft. We want very much to hear your comments and ideas.

Please send your comments to:

> bookquestions@oreilly.com

If you discover errors in content or encounter any problems in using this product, please report them to:

bookquestions@oreilly.com

For updates and more information, visit:

http://examples.oreilly.com/vbnetcore

# Conventions Used in This Book

The following typographical conventions are used in this book.

*Italic* is used for:

- Directory pathnames and filenames
- Domain names and URLs
- New terms where they are first defined

`Constant width` is used for:

- Code examples and output
- Names and keywords in C# programs, including method or field names, variable names, and class names
- XML and HTML element tags
- Registry keys

*`Constant width italic`* is used for:

- Replaceable parameter names or user-provided elements in syntax

> This icon designates a note, which is an important aside to the nearby text.

# How to Contact Us

We have tested and verified the information in this book to the best of our ability, but you may find that features have changed (or even that we have made mistakes!). Please let us know about any errors you find, as well as your suggestions for future editions, by writing to:

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We have a web site for the book, where we'll list examples, errata, and any plans for future editions. You can access this page at:

http://www.oreilly.com/catalog/vbdotnetcorenut

For more information about this book and others, see the O'Reilly web sites:

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http://dotnet.oreilly.com

# How the Reference Was Generated

Part II was generated using .NET's reflection API. Using reflection, we drilled down into selected classes, structures, enumerations, delegates, and interfaces from the Framework Class Library, and extracted detailed information on each type and its members. Next, we structured this information as DocBook XML, which we used to generate the printed pages. We also used in-house tools to generate the online Microsoft Help 2.0 version that accompanies this book.

# Acknowledgments

This book would not be possible without the contribution and support of many individuals, including family, friends, and the hardworking folks at O'Reilly & Associates, Inc.

Brian Jepson and Lenny Muellner of O'Reilly developed the programs responsible for generating Part II and Glossary. Brian also developed the namespace maps that are found in the overviews that begin each chapter of the Reference with input from Ted Neward and Peter Drayton. Ted Neward, Matthew MacDonald, Martin Smith, Steve Spainhour, and Brian Jepson wrote the more than 700 namespace and type descriptions that make the API reference so valuable.

Brad Merrill of Microsoft wrote the sections on regular expressions and provided content for Appendix A.

Brad Abrams and members of his .NET Framework team contributed to the design of the API reference and provided technical review that immeasurably improved its quality. Daniel Creeron provided an outstanding technical review of the book.

*VB.NET Core Classes in a Nutshell for Visual Studio .NET* was made possible by the work of many individuals. Mike Sierra of O'Reilly converted the API Reference to Microsoft Help 2.0 format and did the work necessary to integrate its content with the Visual Studio .NET dynamic help system. He was assisted by Lenny Muellner and Erik Ray. Greg Dickerson and Chris Valdez of the O'Reilly Tech Support group tested each version of the software. Kipper York and Shane McRoberts of the Microsoft Help team provided invaluable technical assistance at crucial moments, and Eric Promislow and Vladimir Baikalov of ActiveState built the install package that plugs our Help collection into Visual Studio .NET. Frank Gocinski of the Visual Studio .NET Integration Program was instrumental in helping us become full partners in the program. A special tip of the hat to Rob Howard of Microsoft who supported our original vision and helped us make the right connections to get this project off the ground.

# Part I: Introduction

This introduction consists of a single chapter that examines the significance of the .NET Framework Class Library (FCL) and the ways it differs from the .Win32 API and from COM automation. It also provides an overview of the functionality contained in the FCL.

# Chapter 1. Introduction

The .NET Framework is Microsoft's new computing platform that simplifies the design, development, and deployment of computer applications. Developed particularly to facilitate the creation of Internet applications and distributed Internet applications, the .NET Framework features the .NET Framework Class Library (FCL), a systematic class framework to be used for the development of system tools and utilities as well as application software. This chapter assesses the significance of the .NET FCL and discusses accessing it from Visual Basic code.

# 1.1 Before the .NET FCL

Although programmers using languages like C++ have been using frameworks for system and application development from the very inception of their language (the Microsoft Foundation Class Library, or MFC, for instance, is a framework for developers of Windows applications using C++), comprehensive frameworks or class libraries are comparatively rare in Visual Basic programming. For the most part, programmers of previous versions of Visual Basic depended on two major sources to extend the Visual Basic language: the Win32 API, and ActiveX servers exposed through COM automation.

## 1.1.1 The Win32 API

The Win32 API is a procedural library that allows the developer to create programs that run under Windows and take advantage of core Windows operating system services. The Win32 API has been enhanced on a regular basis since it was introduced to support Windows NT 3.0, and it now consists of several thousand functions and constants located in a number of dynamic link libraries (DLLs). Because it is a loose collection of functions, there are'nt necessarily any consistent conventions in naming functions or in designating function parameters. The function-based style of programming using the Win32 API has a number of limitations:

*Lack of consistency across the entire Win32 API*

Although a collection of Win32 API functions may be interdependent, at the same time each function tends to be a more or less independent entity that is called in isolation from other functions in your program. This tends to make the Win32 API as a whole difficult for all programmers to learn and master.

*Focus on C programmers*

The Win32 API originally was developed as a set of functions that would be called primarily from C code. Although the Win32 API can be called from Visual Basic code, writing code that relies heavily on calls to external DLLs has always been something of an adventure in Visual Basic. Much of the challenge centers on the fact that the type systems used by C and Visual Basic are not completely compatible, so that Visual Basic data types have to be converted to data types expected by C language routines.

To get some sense of the difference in style between the function-based, procedural programming that characterizes the Win32 API and the object-oriented programming that characterizes the .NET Framework, Examples 1-1 and 1-2 contain the source code for a console mode routine that launches the application responsible for handling the data file whose name the user enters in a text box. Example 1-1 is written in Visual Basic 6.0 (although it could have run under any version from VB 4 through VB 6) and relies extensively on Win32 API calls, and particularly on calls to the registry API. Example 1-2 is written for Visual Basic .NET and relies on the .NET Framework Class Library, and particularly on its Registry and RegistryKey classes.

### Example 1-1. Launching an application using the Win32 API

```
Option Explicit


Private Declare Function RegCloseKey Lib "advapi32.dll" ( _

        ByVal hKey As Long) As Long
```

```
Private Declare Function RegOpenKey Lib "advapi32.dll" _
        Alias "RegOpenKeyA" ( _
        ByVal hKey As Long, ByVal lpSubKey As String, _
        phkResult As Long) As Long
Public Declare Function RegQueryValue Lib "advapi32.dll" _
       Alias "RegQueryValueA" ( _
       ByVal hKey As Long, ByVal lpSubKey As String, _
       ByVal lpValue As String, lpcbValue As Long) As Long
Private Declare Function RegQueryValueEx Lib "advapi32.dll" _
       Alias "RegQueryValueExA" ( _
       ByVal hKey As Long, ByVal lpValueName As String, _
       ByVal lpReserved As Long, lpType As Long, _
       lpData As Any, lpcbData As Long) As Long
Public Declare Function WinExec Lib "kernel32" ( _
       ByVal lpCmdLine As String, ByVal nCmdShow As Long) _
       As Long

Public Const MAX_PATH = 260

Private Const HKEY_CLASSES_ROOT = &H80000000

Private Const ERROR_SUCCESS = 0&

Public Const REG_DWORD = 4
Public Const REG_SZ = 1

Public Const SW_SHOWNORMAL = 1

Private Sub Main()
   Dim strFile As String, strExten As String
```

```
Dim strProgID As String, strExe As String
Dim lPos As Long
Dim hKey As Long, lStrLen As Long

strFile = InputBox("Enter Name of File to Open: ", _
                   "Open File", "")
If strFile = "" Then Exit Sub

' Get file extension
lPos = InStrRev(1, strFile, ".")
If lPos = 0 Then
   MsgBox "Filename must include an extension."
   Exit Sub
Else
   strExten = Mid(strFile, lPos)
End If

' Get programmatic identifier
If RegOpenKey(HKEY_CLASSES_ROOT, strExten, hKey) <> _
              ERROR_SUCCESS Then
   MsgBox "File extension not found."
   Exit Sub
End If
lStrLen = 0
Call RegQueryValue(hKey, "", "", lStrLen)
strProgID = Space(lStrLen)
Call RegQueryValue(hKey, "", strProgID, lStrLen)
RegCloseKey hKey

' Get associated application
strProgID = Left(strProgID, lStrLen - 1) & _
            "\shell\open\command"
```

```
   If RegOpenKey(HKEY_CLASSES_ROOT, strProgID, hKey) <> _
                  ERROR_SUCCESS Then
      MsgBox "Open command key not found..."
      Exit Sub
   End If

   lStrLen = 0
   Call RegQueryValue(hKey, "", "", lStrLen)
   strExe = Space(lStrLen)
   Call RegQueryValue(hKey, "", strExe, lStrLen)
   RegCloseKey hKey

   ' Launch application and pass its filename as a parameter
   lPos = InStr(1, strExe, " %1")
   If lPos > 0 Then _
      strExe = Left(strExe, lPos)
   strExe = strExe & " " & strFile

   Call WinExec(strExe, SW_SHOWNORMAL)
End Sub
```

Example 1-1 is a relatively long program, largely because of the intricacies of working with the Win32 API. We need, of course, to declare all registry-related functions with their parameters, as well as all constants that we intend to use. In addition, each registry access requires that we do the following:

1. Open the relevant registry key.
2. Determine the length of the string we want to retrieve.
3. Set the string buffer to the appropriate length.
4. Retrieve the registry value.
5. Adjust the string containing the registry value by removing its terminating null character.
6. Close the open registry key.

In contrast, the VB.NET program in Example 1-2 is considerably shorter and simpler. In contrast to the numerous `Declare` and `Const` statements in Example 1-1, the program only needs to use the `Imports` statement to indicate which namespaces it will access. Registry access is also significantly simpler. The program relies on two classes: the shared Registry class, which provides access to `HKEY_CLASSES_ROOT` (HKCR), one of the top-level registry keys; and the RegistryKey class, which represents a registry key. As a result, once the program obtains a reference to HKEY_CLASSES_ROOT, registry access consists of the following steps:

1. Open the appropriate subkey by calling the top-level key's open method, passing it the path to the subkey to be opened.
2. Retrieve the newly opened key's default value.
3. Close the open registry key.

### Example 1-2. Launching an application using the .NET FCL

```
Option Strict On


Imports System

Imports Microsoft.Win32

Imports Microsoft.VisualBasic


Public Module modMain

   Public Sub Main()

      Dim strExten, strProgID, strExe As String

      Dim oProgID, oOpenCmd As RegistryKey


      Dim strFile As String = InputBox("Enter Name of File to Open: ", _

                                       "Open File", "")

      If strFile = "" Then Exit Sub


      ' Get file extension

      Dim iPos As Integer = InStrRev(strFile, ".")

      Try

         strExten = Mid(strFile, iPos)

      Catch

         MsgBox("Filename must include an extension.")

         Exit Sub
```

```
End Try

' Get Programmatic Identifier
Dim oHKCR As RegistryKey = Registry.ClassesRoot
Try
   oProgID = oHKCR.OpenSubkey(strExten)
   strProgID = CStr(oProgID.GetValue(Nothing))
   oProgID.Close()
Catch
   MsgBox("File extension not found.")
   Exit Sub
End Try

' Get associated application
Try
   oOpenCmd = oHKCR.OpenSubkey(strProgID & _
              "\shell\open\command")
   strExe = CStr(oOpenCmd.GetValue(Nothing))
   oOpenCmd.Close()
Catch
   MsgBox("Open command key not found...")
   Exit Sub
End Try

' Launch application and pass its filename as a parameter
iPos = InStr(1, strExe, " %1")
If iPos > 0 Then _
   strExe = Left(strExe, iPos)
strExe = strExe & " " & strFile
```

```
      Call Shell(strExe, AppWinStyle.NormalFocus)
   End Sub
End Module
```

### 1.1.2 COM Automation

In place of the function-based programming using the Win32 API, COM automation represented a clear step forward. COM was a more or less object-oriented technology that held out the promise of language independence; as long as a language understood the Component Object Model, it should be able to access and take advantage of COM components.

Example 1-3 shows a VB 6 program written using COM automation that, like the programs in Example 1-1 and Example 1-2, launches the application responsible for handling the data file whose name the user enters in a text box. Like the VB.NET program in Example 1-2, it is a short and fairly simple program that relies on the WScript object available from the Windows Script Host object model.

#### Example 1-3. Launching an application using COM automation

```
Option Explicit


Private Sub Main()
   On Error Resume Next


   Dim lPos As Long
   Dim strFile As String, strExten As String
   Dim strProgID As String, strExe As String


   strFile = InputBox("Enter Name of File to Open: ", _
                      "Open File", "")
   If strFile = "" Then Exit Sub


   ' Get file extension
   lPos = InStrRev(strFile, ".")
   If lPos = 0 Then
      MsgBox "Filename must include an extension."
      Exit Sub
```

```
    Else
       strExten = Mid(strFile, lPos)
    End If

    ' Initialize WSH Shell object
    Dim oShell As WshShell
    Set oShell = New WshShell

    ' Get programmatic identifier
    strProgID = oShell.RegRead("HKCR\" & strExten & "\")
    If Err.Number <> 0 Then
       MsgBox "File extension not found."
       Exit Sub
    End If

    ' Get associated application
    strProgID = "HKCR\" & strProgID & "\shell\open\command\"
    strExe = oShell.RegRead(strProgID)
    If Err.Number <> 0 Then
       MsgBox "Open command key not found..."
       Exit Sub
    End If

    ' Launch application and pass it filename as a parameter
    lPos = InStr(1, strExe, " %1")
    If lPos > 0 Then _
       strExe = Left(strExe, lPos)
    strExe = strExe & " " & strFile

    oShell.Run strExe, 5, True
End Sub
```

Despite its substantial popularity, COM suffered from a number of limitations:

- COM itself offered a model for binary code reuse; it did not offer a model for source code reuse. An implication of this is that, although COM offered interfaced-based inheritance (a feature that predominantly advanced programmers were interested in), it did not support code-based inheritance.
- Although COM offered the promise of a language-independent architecture, reality often fell far short of the promise. The root of the problem was the fact that seamless interoperability with COM presupposed that each language was able to create and manipulate common automation-compatible data types. This, however, was not the case. As a result, although COM made some real advances in the area of language independence, it also had some real weaknesses.
- COM was extremely complex, and for the most part only C++ programmers were able to work with COM directly. For VB programmers, the Visual Basic environment masked much of the complexity of COM. The inevitable result was that Visual Basic failed to give the developer full control over COM when it was needed, and many Visual Basic programmers often lacked sufficient familiarity with COM to take advantage even of those features that they were able to control.

In addition, COM did not offer an integrated class library comparable to the .NET FCL. Instead, the developers of each application or operating system service were free to implement whatever object model made sense to extend their application. As a result, there are major gaps in the functionality made available through COM automation, and there is not a good deal of consistency across object models.

The .NET platform and the .NET Framework Class Library were developed in an effort to address these weaknesses of COM.

# 1.2 The .NET Framework Class Library

The .NET Framework includes the .NET Framework Class Library (FCL), a vast collection of thousands of *types* (that is, of classes, interfaces, structures, delegates, and enumerations) that aim at encapsulating the functionality of core system and application services in order to make application programming easier and faster. There are classes that you can use to manipulate the file system, access databases, serialize objects, and launch and synchronize multiple threads of execution, to name just a few.

To make working with these classes easy, classes with similar functionality are grouped together in namespaces. Therefore, there is a namespace containing types for drawing, a number of namespaces for .NET remoting, etc. In fact, the "intrinsic" functions of the Visual Basic language (such as *InStr*, *Len*, and *UBound*) are implemented as class methods in the Microsoft.VisualBasic namespace. In total, the .NET FCL places more than 80 namespaces at your disposal.

The .NET FCL includes classes with the following functionality:

*Data type definition*

Some members of the System namespace, such as the Object, String, Int32, and Single classes, form the data types used by Visual Basic .NET (as well as by other .NET languages that rely on the .NET Common Type System).

*Exceptions*

When an exception is generated, the CLR provides exception information to the Exception class (in the System namespace) or to one of the derived classes found throughout the .NET FCL.

*Events and event handlers*

The signature of event handlers is represented by the EventHandler delegate (in the System namespace) or one of its derived delegates. The event information passed to an event handler is represented by the EventArgs class (in the System namespace) or one of its derived classes.

*Attributes*

Attributes allow custom items of information about a program element to be stored with an assembly's metadata. Since this information becomes a permanent part of the program element's description, it is always available and can be used to modify the design time, compile time, or runtime behavior of a program element. Attributes are classes derived from the Attribute class (in the System namespace) or one of its derived classes found throughout the .NET FCL.

*Collections and data structures*

The .NET FCL features a number of general-purpose and more specialized collection classes. The general-purpose classes include the Array class (in the System namespace) and the ArrayList and CollectionBase classes (in the System.Collection namespace). Specialized classes include the Stack class, a last-in, first-out structure, the Queue class, a first-in, first-out structure, in the System.Collection namespace, and the ListDictionary class, a linked list dictionary class, in the System.Collection.Specialized namespace.

*Control creation*

The .NET FCL provides full support for custom Windows and web controls that integrate with design-time environments like Visual Studio through a number of classes, including the Container class in the System.ComponentModel namespace or the CollectionEditor class in the System.ComponentModel.Design namespace.

*Configuration settings*

Using the .NET FCL, you have easy access to application configuration information from configuration files using classes such as AppSettingsReader and DictionarySectionHandler in the System.Configuration namespace. You can also access registry data using the Registry, RegistryHive, and RegistryKey classes in the Microsoft.Win32 namespace. Finally, you can access ActiveDirectory information using the members of the System.DirectoryServices namespace.

*Debugging, profiling, and diagnostics*

The .NET FCL makes a large number of debugging, diagnostic, and informational classes available that can help in locating and fixing bugs, as well as in improving overall performance. These include the Debug, Debugger, EventLog, and PerformanceCounter classes in the System.Diagnostics namespace.

*Drawing*

The FCL provides a full set of graphics objects, such as the Color structure, the Brush class, the Font class, and the Graphics class in the System.Drawing namespace.

*Input/output*

The FCL allows you to read the standard input, standard output, and standard error streams, as well as to access the file system, through classes like File, FileInfo, StreamReader, and StreamWriter in the System.IO namespace.

*Availability of metadata*

Through the Type class in the System namespace and classes like Assembly, Module, EventInfo, MethodInfo, and ParameterInfo in the System.Reflection namespace, the .NET FCL provides support for reading metadata (the data that describes particular program elements) at any time.

*Remote calls*

Through classes such as ObjRef, RemotingConfiguration, and RemotingServices in the System.Runtime.Remoting namespace, the .NET FCL adds support for remoting (calls that cross process or machine boundaries).

*String handling and manipulation*

Interestingly, in the .NET Framework, strings are immutable. This means that simple operations such as string concatenation involve an enormous performance penalty. The StringBuilder class in the System.Text namespace makes it possible to perform string concatenation efficiently. The RegEx and Match classes in System.Text.RegularExpressions make it possible to perform regular expression searches on strings.

*Control of threading*

In previous versions of Visual Basic, threading was a factor that enormously impacted VB applications but over which the VB developer had no control. With classes like Thread, Mutex, and Monitor in the System.Threading namespace, the .NET FCL for the first time places threading under the direct control of the VB.NET developer.

*Data access*

The .NET FCL features a brand new data access technology, ADO.NET. It is represented by classes like the DataSet class in the System.Data namespace, the OleDbConnection, OleDbCommand, and OleDbDataReader classes in the System.Data.OleDb namespace, and the SqlConnection, SqlCommand, and SqlDataReader classes in the System.Data.SqlClient namespace.

*Windows desktop applications*

The forms and controls that made Visual Basic the premier Rapid Application Development package for Windows have their equivalent in the .NET FCL. These classes, such as the Form class, the Button class, and the TextBox class, are found in the System.Windows.Forms namespace.

*Web application development*

In addition to Windows controls, the .NET FCL features two sets of controls for web application development. HTML server controls execute on the server but otherwise correspond more or less directly to standard client-side HTML controls. They are found in the System.Web.UI.HTMLControls namespace. Web controls (also known as ASP controls) are server controls that abstract the functionality of controls in a web application. They are found in the System.Web.UI.WebControls namespace.

*Web services*

A web service is simply a function call over the Internet. The .NET FCL supports the development of web services through the types in the System.Web.Services namespace.

As you can see, the functionality offered by the .NET FCL is extensive — and in this overview of the .NET FCL, we've only emphasized the highlights.

# 1.3 Working with the .NET FCL

Despite its vast size, the .NET FCL is a manageable collection of classes and their methods. This is because, unlike more traditional development tools such as the Win32 API, the .NET FCL is a collection of types (classes, interfaces, delegates, events, structures, modules, and enumerations) and their members organized into namespaces. A *namespace* is simply a logical grouping of classes that can in turn contain other namespaces, so that a collection of namespaces forms an inverse hierarchical tree. Organization of types into namespaces helps to prevent collisions in the event that types are identically named.

Although the .NET system of namespaces does not have a single root, we can consider the System namespace at the top of the .NET FCL hierarchy. It includes a wide variety of basic system classes, including data types, exception types, and types defining the most important attributes.

## 1.3.1 Defining Accessible Namespaces

The types in a namespace, in turn, reside in an assembly, which is simply a logical unit of deployment. An assembly provides the Microsoft Intermediate Language (MSIL) code for its contents, which is packaged in a Windows portable executable (PE) file. An assembly also specifies security permissions for itself, maintains a list of the types that it defines and their scopes, and specifies rules for resolving references to external types.

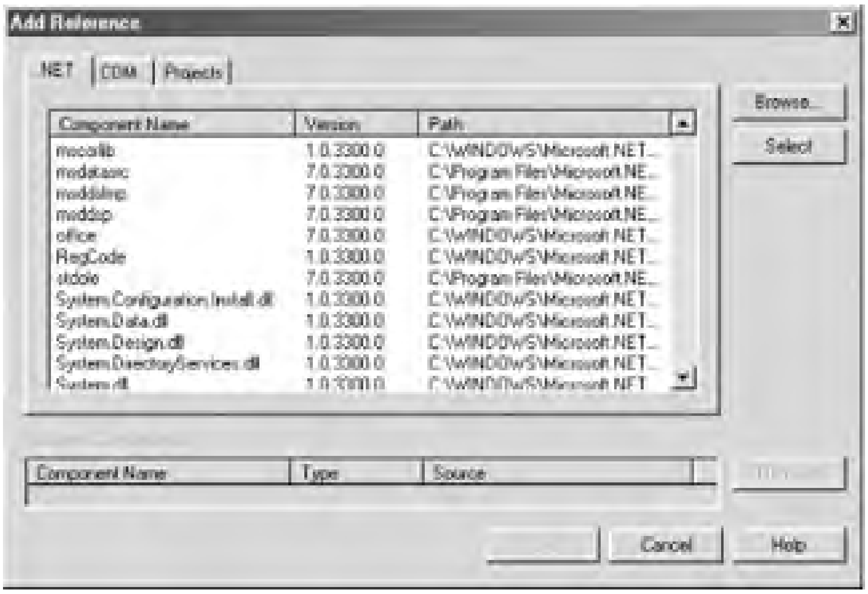
The assemblies in which namespaces of the .NET FCL reside are Windows dynamic link libraries (.DLLs). Typically, a single assembly contains multiple namespaces. In addition, however, a single namespace can reside in multiple assemblies. The System namespace, for example, resides in both *mscorlib.dll* and *system.dll*.

> You can use ILDASM, the Intermediate Language disassembler included with the .NET Framework SDK, to see which namespaces and types are available in a particular assembly or DLL.

Namespaces are made available to Visual Studio or to the Visual Basic compiler by identifying the assembly in which the namespace resides. When using Visual Studio as the development environment for your Visual Basic projects, this is done by using the References dialog, as follows:

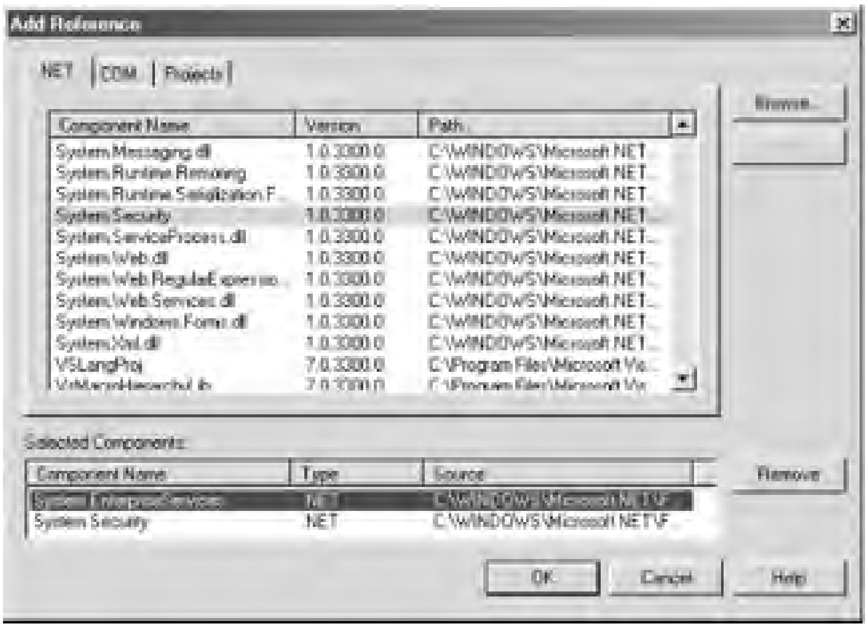
1. Select Project → Add Reference from the main menu, or right-click on References in the Solution Explorer window and select Add Reference from the popup menu.
2. When the Add Reference dialog appears, make sure the .NET tab is selected, as shown in Figure 1-1. (The tab should be selected by default.)
3. Select one or more DLL whose types you'd like to reference, then click the Select button. The assemblies you've added should appear in the Selected Components data grid. (See Figure 1-2.) Repeat this step if necessary until each assembly whose types you wish to access is displayed in the Selected Components data grid in the lower portion of the dialog.
4. Click the OK button to close the dialog.

**Figure 1-1. The .NET tab of the Add Reference dialog**




The Add Reference dialog does not list the assemblies whose references have already been added to a Visual Studio .NET project. You can see which assemblies are currently referenced by a project by expanding the References tree in the Solution Explorer window.

### Figure 1-2. Selecting assemblies whose namespaces and types will be referenced




When compiling using the VB.NET command-line compiler, assemblies are made available to the compiler by using the `/r:` (or `/reference:`) compiler switch. Commas are used to separate DLLs if multiple DLLs are referenced. For example, the following command might compile a standard Windows desktop application:

```
vbc MyWinApp.vb /t:winexe /r:system.dll,system.windows.forms.dll
```

> You may have noticed that you don't need to specify the path to .NET DLLs in order to access them. This is because they are registered in the Global Assembly Cache (or GAC), a location in which the Common Language Runtime expects to find its shared libraries.

References to some namespaces are added to every project created in the Visual Studio environment. The following are the project types supported by Visual Studio .NET, along with the .NET DLLs each project type automatically references:

*ASP.NET web applications*

- *System.dll*
- *System.Data.dll*
- *System.Drawing.dll*
- *System.Web.dll*
- *System.XML.dll*

*ASP.NET web services*

- *System.dll*
- *System.Data.dll*
- *System.Web.dll*
- *System.Web.Services.dll*
- *System.XML.dll*

*Class libraries*

- *System.dll*
- *System.Data.dll*
- *System.XML.dll*

*Console applications*

- *System.dll*
- *System.Data.dll*
- *System.XML.dll*

*Web control libraries*

- *System.dll*
- *System.Data.dll*
- *System.Drawing.dll*
- *System.Management.dll*
- *System.Web.dll*

*System.XML.dll*

*Windows applications*

*System.dll*

*System.Data.dll*

*System.Drawing.dll*

*System.Windows.Forms.dll*

*System.XML.dll*

*Windows control libraries*

*System.dll*

*System.Data.dll*

*System.Drawing.dll*

*System.Windows.Forms.dll*

*System.XML.dll*

*Windows services*

*System.dll*

*System.Data.dll*

*System.ServiceProcess.dll*

*System.XML.dll*

All Visual Studio .NET projects written using Visual Basic also transparently reference two .NET DLLs: *mscorlib.dll* (which contains portions of the System namespace, as well as namespaces such as System.Collections, System.IO, System.Reflection, and System.Threading), and *Microsoft.VisualBasic.dll* (which defines the functions, procedures, constants, and attributes of the Visual Basic .NET language). The Visual Basic command-line compiler also references these two DLLs automatically, although it doesn't automatically reference any additional .NET assemblies.

## 1.3.2 Accessing Types in Namespaces

Once you've added a reference to an assembly, you can access any of the types in its namespaces by providing a fully qualified reference to the type. For instance, the code in Example 1-4 instantiates objects of the HashTable and DictionaryEntry classes, and also calls a method of the Console class.

**Example 1-4. Using fully qualified namespace names**

```
Option Strict On

Public Module modMain
   Public Sub Main
      ' Define hashtable
      Dim States As New System.Collections.HashTable()
      ' Add items
      States.Add("NY", "New York")
      States.Add("CA", "California")
      States.Add("MI", "Michigan")
      States.Add("VT", "Vermont")
      States.Add("WA", "Washington")

     ' Define and fill DictionaryEntry object
      Dim dict(States.Count - 1) As _
               System.Collections.DictionaryEntry
      Dim item As System.Collections.DictionaryEntry
      States.CopyTo(dict, 0)

      ' Iterate dictionary
      For Each Item in dict
         System.Console.WriteLine( _
            Microsoft.VisualBasic.Strings.UCase(CStr(item.Key)) _
            & ": " & CStr(item.Value))
      Next
   End Sub
End Module
```

In each case, the source code includes the fully qualified name of the type it instantiates or accesses; the Console class is a type in the System namespace, while the HashTable and DictionaryEntry classes are both types in the System.Collections namespace. Note that even the namespace of the supposedly "intrinsic" Visual Basic *UCase* function must be specified or a compiler error ("Name 'UCase' is not declared.") results if you attempt to compile the program using the Visual Basic command-line compiler. The *UCase* function, as you can see from the code in Example 1-4, is a member of the Strings class in the Microsoft.VisualBasic namespace.

### 1.3.3 Importing Namespaces

Needless to say, fully qualifying the name of each .NET type quickly becomes rather tiresome, particularly for types that are nested deep within a hierarchical namespace. You can, however, use the `Imports` directive to import a particular namespace, thereby allowing the compiler to resolve the reference to a particular type and eliminating the need for you to provide a fully qualified path to the type. For example, the code fragment shown in Example 1-4, when rewritten to use the `Imports` directive, appears as shown in Example 1-5 (new and modified lines of code appear in boldface).

#### Example 1-5. Importing namespaces with the Imports directive

```
Option Strict On


Imports System

Imports System.Collections

Public Module modMain


Public Sub Main

   ' Define hashtable

   Dim States As New HashTable()

   ' Add items

   States.Add("NY", "New York")

   States.Add("CA", "California")

   States.Add("MI", "Michigan")

   States.Add("VT", "Vermont")

   States.Add("WA", "Washington")


   ' Define and fill DictionaryEntry object

   Dim dict(States.Count - 1) As DictionaryEntry

   Dim item As DictionaryEntry

   States.CopyTo(dict, 0)


   ' Iterate dictionary

   For Each Item in dict

      Console.WriteLine(CStr(item.Key) & ": " &
```

```
                    CStr(item.Value))
   Next
End Sub


End Module
```

Note that while no namespaces are automatically imported by the command line compiler, Visual Studio automatically imports a number of namespaces, again depending on the project type. The project types and the namespaces that they automatically import are as follows:

*ASP.NET web applications*

Microsoft.VisualBasic

System

System.Collections

System.Configuration

System.Data

System.Drawing

System.Web

System.Web.UI

System.Web.UI.HTMLControls

System.Web.UI.WebControls

*ASP.NET web services*

Microsoft.VisualBasic

System

System.Collections

System.Data

System.Diagnostics

*Class libraries*

Microsoft.VisualBasic

System

System.Collections

System.Data

System.Diagnostics

*Console applications*

- Microsoft.VisualBasic
- System
- System.Collections
- System.Data
- System.Diagnostics

*Web control libraries*

- Microsoft.VisualBasic
- System
- System.Collections
- System.Data
- System.Diagnostics
- System.Management

*Windows applications*

- Microsoft.VisualBasic
- System
- System.Collections
- System.Data
- System.Diagnostics
- System.Drawing
- System.Windows.Forms

*Windows control libraries*

- Microsoft.VisualBasic
- System
- System.Collections
- System.Data
- System.Diagnostics
- System.Drawing
- System.Windows.Forms

*Windows services*

- Microsoft.VisualBasic
- System

System.Collections

System.Data

System.Diagnostics

In addition, the *AssemblyInfo.vb* file automatically imports two additional namespaces, System.Reflection and System.Runtime.InteropServices, into every project.

You can have Visual Studio automatically import a particular namespace, which makes it available to all of the source code files in a project, as follows:

1. Select Project → Properties from the main menu, or right-click on the project name in the Solution Explorer window and select Properties from the popup menu to open the properties dialog.

2. Select Common Properties → Imports in the treeview control on the right to display the Imports property page.

3. Enter the fully qualified name of the namespace you'd like to import in the Namespace dialog and click the Add Import button. Repeat this step for each namespace you'd like to automatically import in the project.

4. Click OK to close the property page.

While the use of the `Imports` directive can save a substantial amount of typing, it does mean that the compiler is left to identify the namespace containing a particular type. This means that, if identically named types are found in the imported namespaces, Visual Basic will not be able to determine which type you wish to instantiate. For example, consider the code in Example 1-6, which defines two custom namespaces, each with a class named Person.

### Example 1-6. Classes with the same name

```
Option Strict On


Namespace Extensions.Classes


   Public Class Person

      Dim sName As String


      Public Sub New(Name As String)

         sName = Name

      End Sub


      Public Property Name() As String

         Get
```

```
            Return sName
         End Get
         Set
            sName = Value
         End Set
      End Property
   End Class
End Namespace

Namespace Extensions.Demographics
   Public Enum Gender As Short
      Male = 2
      Female = 1
   End Enum

   Public Class Person
      Dim shAge As Short
      Dim chGender As Gender

      Public Property Age() As Short
         Get
            Return shAge
         End Get
         Set
            shAge = Value
         End Set
      End Property

      Public Property Gender() As Gender
         Get
            Return chGender
```

```
            End Get
            Set
               chGender = Value
            End Set
         End Property
      End Class
   End Namespace
```

This code can be compiled into a dynamic link library. We can then attempt to access the Person class using code like that in Example 1-7.

### Example 1-7. A type collision

```
Option Strict On

Imports Extensions.Classes
Imports Extensions.Demographics
Imports System

Module modMain
   Public Sub Main()
      Dim oPerson As New Person("John Doe")
      Console.WriteLine(oPerson.Name)

      Dim oPerson2 As New Person
      oPerson2.Age = 32
      oPerson2.Gender = Gender.Female
      Console.WriteLine(oPerson2.Gender.ToString)
   End Sub
End Module
```

However, when we attempt to compile this code, the VB.NET command-line compiler raises two instances of the following compiler error:

> error BC30561: 'Person' is ambiguous, imported from the namespaces or types 'Extensions.Demographics, Extensions.Classes'.

To resolve this problem of type collisions, two solutions are available. The first is to use the fully qualified namespace name to indicate the namespace containing the type we want to instantiate, just as if we hadn't used the `Imports` statement. The second is to assign an alias to a namespace and to use that alias to identify the namespace containing the type we want to instantiate. To do this, we also use the `Imports` directive, which then has the following syntax:

```
Imports aliasname = namespace
```

where *`aliasname`* is the alias by which the namespace will be referenced in code, and *`namespace`* is the fully qualified namespace name.

We can then modify our code example from Example 1-7 to take advantage of aliasing. The result is shown in Example 1-8 (again, modified lines are shown in boldface).

### Example 1-8. Using aliasing to prevent type naming conflicts

```
Option Strict On


Imports cl = Extensions.Classes

Imports Extensions.Demographics

Imports System


Module modMain

   Public Sub Main()

      Dim oPerson As New cl.Person("John Doe")

      Console.WriteLine(oPerson.Name)


      Dim oPerson2 As New Person

      oPerson2.Age = 32

      oPerson2.Gender = Gender.Female

      Console.WriteLine(oPerson2.Gender.ToString)

   End Sub

End Module
```

Note that we have aliased a single namespace, which has magically resolved the ambiguous reference to both namespaces. The use of an alias, however, means that all further references to types in the Extensions.Classes namespace must use the alias in order to resolve the reference to the type, or we must use the fully qualified name of the type.

# 1.4 The Types of a .NET Namespace

Once you've made a namespace accessible to your code, you can access any of the types it contains. In this section, we'll survey the types that a .NET namespace can contain.

## 1.4.1 Classes

In VB.NET, classes are reference types; that is, when you create an instance of a class in code, you work with a pointer (or reference) to the object rather than with the object itself. This is similar to previous versions of Visual Basic.

When a .NET class is instantiated, its constructor (or its New subroutine) executes. Each .NET class can have one or more constructors (that is, constructors can be overloaded), and the constructor can either be parameterless or parameterized. Visual Basic .NET provides three ways to initialize a variable and invoke its constructor. These are illustrated in the following three sets of statements, each of which instantiates a System.IO.FileInfo object:

```
' Single statement
Dim oFile As New FileInfo("c:\documents\notes.txt")


' Single Statement with separate call to constructor
Dim oFile As FileInfo = New FileInfo("c:\documents\notes.txt")


' Separate declaration and initialization
Dim oFile As FileInfo
oFile = New FileInfo("c:\documents\notes.txt")
```

Once we create an instance of a class, we can invoke its properties and methods. In addition, we can handle its events (assuming that it exposes events) if we instantiate the object using the `WithEvents` keyword. For example:

```
Dim WithEvents cn As New SqlConnection()
```

Visual Basic .NET, unlike previous versions of Visual Basic, supports both instance and shared members. *Instance members* exist for each instance of a class; in previous versions of Visual Basic, all members of a class were instance members. *Shared members* are members that are not associated with a specific instance of a class or a structure, but rather are common to all instances of a class. Accessing a shared member of a class does not require that the class be instantiated; it can be accessed using the class name only. In addition, if the shared member is a property, it has a single value for all instances of the class.

In Example 1-8, we accessed the shared WriteLine method of the Console class, as follows:

```
Console.WriteLine(oPerson.Name)
```

Note that, to do this, we didn't have to instantiate an instance of the Console class; we simply called the Console class directly. A peculiarity of Visual Basic is that you can invoke shared members using either the class name or the name of an instance variable. The following code fragment, which does create an instance of the Console class, also works:

```
Dim con As Console

con.WriteLine(oPerson2.Gender.ToString)
```

### 1.4.2 Structures

Structures are very similar to classes, except that they are value types rather than reference types. Most of the primitive data types (Boolean, Byte, Char, Int16, Int32, etc.) defined in the FCL are implemented as structures. Because structures don't support parameterless constructors, you don't use the New keyword to instantiate them.

You work with structures just as you work with .NET classes, except that the `New` keyword is not used in declaring a structure:

```
' Declaration and initialization

Dim num1 As Int16 = 10



' Separate declaration and initialization

Dim num2 As Int16

num2 = 10
```

### 1.4.3 Enumerations

An enumeration is a related set of constants. You don't have to instantiate enumerations to take advantage of their members. When working with enumerations in .NET, however, you must specify the name of the enumeration in order to access one of its constants. For example:

```
Dim dy As String = WeekdayName(1, False, FirstDayOfWeek.Sunday)
```

### 1.4.4 Interfaces

Interfaces are virtual base classes; that is, they consist of members (methods, properties, and events) that have no implementation. Instead, derived classes must provide the implementation. For example, the following code fragment uses interface inheritance to define a new class:

```
Class CustomCompare

   Implements System.IComparable



   Public Function CompareTo(obj As Object) As Integer _

                   Implements System.IComparable.CompareTo

      ' Implementation of IComparable.ICompareTo

   End Function

End Class
```

## 1.4.5 Delegates

A delegate is a reference type that represents a strongly typed function pointer. All delegates are explicitly or implicitly derived from the System.Delegate class, which includes a number of members that provide information about the delegate, create object instances, or invoke the delegate. Delegates can be used in event procedures, for asynchronous callbacks, and wherever the address of a function is expected. The following example uses a delegate to define the thread procedure to be passed to the ThreadPool class's QueueUserWorkItem method:

```
Option Strict On

       Imports Microsoft.VisualBasic

       Imports System

       Imports System.Threading

       Imports System.Windows.Forms

       Public Class ThreadedForm : Inherits Form

          Protected WithEvents btnStart As Button

          Protected lblOutput As Label

          Public Shared Sub Main()

             Dim thrdForm As New ThreadedForm()

             Application.Run(thrdForm)

          End Sub

          Public Sub New()

             Me.Height = 200

             Me.Width = 400

             btnStart = New Button()

             btnStart.Text = "&Start"

             btnStart.Top = 50

             btnStart.Left = 100

             btnStart.Width = 75

             btnStart.Height = 50

             Me.Controls.Add(btnStart)

             lblOutput = New Label()

             lblOutput.Top = 125

             lblOutput.Left = 100

             lblOutput.Width = 200

             lblOutput.Height = 75
```

```
        Me.Controls.Add(lblOutput)
        Me.Text = "Asynchronous Callback Example"
    End Sub
    Protected Sub btnStart_Click(sender As Object, _
                                e As EventArgs) _
                  Handles btnStart.Click
        btnStart.Enabled = False
        Dim thrdProc As WaitCallback = AddressOf ThreadProcedure
        ThreadPool.QueueUserWorkItem(thrdProc, 1000000)
    End Sub
    Protected Sub ThreadProcedure(o As Object)
        Dim i As Integer
        If TypeOf o Is Integer Then
            i = DirectCast(o, Integer)
        Else
            Exit Sub
        End If
        Dim lCtr As Long
        For lCtr = 0 to 10000000
            If lCtr Mod 1000000 = 0 Then
                lblOutput.Text = lblOutput.Text & "X"
            End If
        Next
    End Sub
End Class
```

# 1.5 Approaching the .NET FCL

It may seem that, given both the newness and the enormity of the .NET platform, a substantial learning curve is required to "learn" the .NET FCL. In fact, this isn't the case; you can begin to take advantage of the class library immediately by selecting those classes, structures, and enumerations and their members that are of immediate interest to you and ignoring the rest. You can then gradually expand your familiarity with the .NET FCL as needed.

This incremental approach to learning the .NET FCL is possible because Visual Basic was written to run under the .NET platform, and much of the Visual Basic language (or at least the functions and procedures not implemented directly by the Visual Basic compiler) actually wrap functionality found in the .NET FCL.

The clearest example of this is to be found in the data types supported by Visual Basic. While Visual Basic's data types appear to be intrinsic, in fact they are defined by the .NET FCL; Visual Basic merely provides wrappers for each of the .NET data types for which it offers native support. This, in fact, is one of the major strengths of the .NET Framework: it features the Common Type System (CTS), which allows components and applications written in one .NET-compliant language to more or less seamlessly interoperate with components written in other .NET-compliant languages. Table 1-1 shows the "intrinsic" Visual Basic data types and their corresponding .NET FCL data types.

**Table 1-1. VB.NET data types and their corresponding .NET FCL data types**

| VB.NET data type | .NET FCL data type |
|---|---|
| Boolean | System.Boolean |
| Byte | System.Byte |
| Char | System.Char |
| Date | System.DateTime |
| Decimal | System.Decimal |
| Double | System.Double |
| Integer | System.Int32 |
| Long | System.Int64 |
| Object | System.Object |
| Short | System.Int16 |
| Single | System.Single |
| String | System.String |

That the standard VB data types are merely wrappers for CTS data types is indicated by the Visual Basic *SystemTypeName* function, which returns the name of a CTS data type that corresponds to a particular "intrinsic" VB data type. For example, the code fragment:

```
Dim i as Integer = 12345

Dim s As String = "New World"


Console.WriteLine(SystemTypeName(TypeName(i)))

Console.WriteLine(SystemTypeName(TypeName(s)))
```

shows that the VB Integer corresponds to the .NET System.Int32 data type, while the VB String data type corresponds to the .NET System.String data type. In other words, we could also declare and initialize our two variables as follows:

```
Dim i as System.Int32 = 12345

Dim s As System.String = "New World"
```

The fact that VB data types are really CTS data types means that we can access the fields, properties, and methods of CTS datatypes from VB variables. Consider, for example, the following code fragment:

```
Dim d As Double

Dim b As Byte

Dim s As String = InputBox("Enter a number (0-255): ")


If IsNumeric(s) Then

   d = CDbl(s)

   If b.MaxValue >= d And b.MinValue <= d Then

      b = CByte(s)

   End If

   Console.WriteLine(TypeName(b) & " value: " & b)

End If
```

The code simply checks whether the numeric equivalent of a string entered by the user is within the range of the VB Byte data type by retrieving the values of the System.Byte data type's MinValue and MaxValue fields.

> Because they don't exist in the Framework Class Library, two intrinsic data types found in previous versions of VB have been removed from the language. The first is the Currency data type. In its place, use the Decimal data type, which in the .NET platform is a standard data type. (In previous versions of VB, the Decimal was a subtype of the Variant data type, and variables could be cast as decimals only by calling the *CDec* conversion function.) The second is the Variant data type, which has been replaced by the Object data type as VB's "universal" data type.

Moreover, the reverse is also true: given a CTS data type, we can pass it as a parameter to methods that work on Visual Basic data types. For example:

```
Option Strict On

Imports Microsoft.VisualBasic

Imports System


Public Module modMain
```

```
Public Sub Main
   Dim iNum As Int32 = 1234
   Dim sNum As System.String = CStr(iNum)

   Console.WriteLine(Mid(sNum,3,2))
End Sub

End Module
```

This code includes two instances of calls to VB.NET methods using CTS data types. The first is the call to the *CStr* conversion function, which is passed a variable of type Int32. The second is the call to the *Mid* string manipulation function, which is passed a variable of type System.String.

This means that, when working with Visual Basic data types, you can continue to call intrinsic Visual Basic functions, and call the members of .NET data types when they provide important functionality not available directly from Visual Basic. The following sections detail some of those functions.

### 1.5.1 Array Class

Just as Visual Basic scalar data types are in fact CTS scalar data types, so Visual Basic arrays are actually members of the .NET System.Array class. Some of its members that are not readily available in Visual Basic .NET are shown in the following table:

**Table 1-2.**

| Name | Member type | Description |
|---|---|---|
| BinarySearch | Shared method | Searches a one-dimensional array for a particular value |
| Clear | Shared method | Sets a range of array elements to zero, False, or a null reference, depending on the members' data type |
| Copy | Shared method | Copies a portion of one array to another and performs any necessary type conversions |
| CopyTo | Method | Copies all the elements of a one-dimensional array to another one-dimensional array starting at a particular index position |
| IndexOf | Shared method | Returns the index of the first occurrence of a particular value in an array |
| IsFixedSize | Property | Returns a Boolean indicating whether an Array object has a fixed size |
| IsReadOnly | Property | Returns a Boolean indicating whether the elements in Array object are read-only |
| LastIndexOf | Shared method | Returns the index of the last occurrence of a particular value in an array |
| Rank | Property | Returns an Integer indicating the number of dimensions of the array |
| Reverse | Shared method | Reverses the elements in all or part of a one-dimensional array |

| | | |
|---|---|---|
| | method | |
| Sort | Shared method | Sorts a one-dimensional array |

## 1.5.2 Boolean Structure

The following table lists the members of the System.Boolean structure that are not readily available in the Visual Basic .NET language:

**Table 1-3.**

| Name | Member type | Description |
|---|---|---|
| FalseString | Shared field | Returns the string representation of the Boolean value `False`. This is a read-only constant value. |
| Parse | Shared method | Converts a string (whose value must be either Boolean.TrueString or Boolean.FalseString) to its Boolean equivalent. |
| TrueString | Shared field | Returns the string representation of the Boolean value `True`. This is a read-only constant value. |

## 1.5.3 Byte Structure

The Visual Basic .NET Byte data type is synonymous with the .NET System.Byte data type. The following table lists some of the members of the Byte class that are not readily available in Visual Basic:

**Table 1-4.**

| Name | Member type | Description |
|---|---|---|
| MaxValue | Shared field | A constant representing the largest possible value of an instance of the Byte class |
| MinValue | Shared field | A constant representing the smallest possible value of an instance of the Byte class |
| Parse | Shared method | Converts the numeric representation of a string to its Byte equivalent |

## 1.5.4 Char Structure

Char, a new data type in VB.NET, corresponds to the System.Char data type. Some of the members of the latter that offer functionality not available in VB.NET are shown in the following table:

**Table 1-5.**

| Name | Member type | Description |
|---|---|---|
| GetUnicodeCategory | Shared method | Returns a member of the `UnicodeCategory` enumeration (in the System.Globalization namespace) indicating the character type of a Char object. |
| IsControl | Shared method | Returns a Boolean indicating whether a particular Unicode character is a control character |

| | | |
|---|---|---|
| | method | character is a control character. |
| IsDigit | Shared method | Returns a Boolean indicating whether a particular Unicode character is a decimal digit. (The decimal and thousands separators are not considered digits.) |
| IsLetter | Shared method | Returns a Boolean indicating whether a particular Unicode character is a letter of the alphabet. |
| IsLetterOrDigit | Shared method | Returns a Boolean indicating whether a particular Unicode character is a digit or a letter of the alphabet. |
| IsLower | Shared method | Returns a Boolean indicating whether a particular Unicode character is a lowercase letter. The method returns `True` only for letters of the alphabet; that is, Char.IsLetter must also return `True`. |
| IsNumber | Shared method | Returns a Boolean indicating whether a particular Unicode character is a decimal or hexadecimal digit. |
| IsPunctuation | Shared method | Returns a Boolean indicating whether a particular Unicode character is a punctuation mark. |
| IsSeparator | Shared method | Returns a Boolean indicating whether a particular Unicode character is a separator character (e.g., a space). The method does not return `True` if the character is a numeric separator. |
| IsSymbol | Shared method | Returns a Boolean indicating whether a particular Unicode character is a symbol. |
| IsUpper | Shared method | Returns a Boolean indicating whether a particular Unicode character is an uppercase letter. The method returns `True` only for letters of the alphabet; that is, Char.IsLetter must also return `True`. |
| IsWhiteSpace | Shared method | Returns a Boolean indicating whether a particular Unicode character is white space. |
| MaxValue | Shared field | A constant containing the largest possible value of Char object. |
| MinValue | Shared field | A constant containing the smallest possible value of a Char object. |
| Parse | Shared method | Converts a particular character in a string to a Char object. |

## 1.5.5 DateTime Structure

The Visual Basic Date data type corresponds to the .NET Framework's DateTime structure. The following table lists the DateTime members whose functionality is not available in the date/time functions supported by the VB.NET language:

**Table 1-6.**

| Name | Member type | Description |
|---|---|---|
| AddMilliseconds | Method | Adds a designated number of milliseconds to the DateTime instance |
| AddTicks | Method | Adds a designated number of ticks to the DateTime instance |
| CompareTo | Method | Compares the current DateTime instance to an object and returns an indication of their relative values |

| | | |
|---|---|---|
| DaysInMonth | Shared method | Returns the number of days in a designated month and year |
| FromOADate | Shared method | Converts an OLE Automation Date value to a DateTime instance |
| GetDateTimeFormats | Method | Returns a String array containing all the string representations supported by the standard DateTime format specifiers |
| IsLeapYear | Shared method | Returns a Boolean indicating whether a particular year is a leap year |
| MaxValue | Shared field | A constant containing the largest possible value of a DateTime instance |
| Millisecond | Property | Retrieves the milliseconds component of a DateTime instance |
| MinValue | Shared field | A constant containing the smallest possible value of a DateTime instance |
| Now | Shared property | Returns the current local date and time |
| Parse | Shared method | Converts a string representation of a date/time to a DateTime instance |
| ParseExact | Shared method | Converts a string representation of a date/time in a specified format to its DateTime equivalent |
| Ticks | Property | Returns a Long containing the number of ticks that represent the date and time value of this instance |
| TimeOfDay | Property | Returns the current time of day |
| Today | Shared property | Returns the current date |
| ToFileTime | Method | Converts the DateTime instance to the format of the local system's file time |
| ToLocalTime | Method | Converts the current coordinated universal time (UTC) to local time |
| ToLongDateString | Method | Converts a DateTime instance to its long date string representation |
| ToLongTimeString | Method | Converts a DateTime instance to its long time string representation |
| ToOADate | Method | Converts the value of this instance to a Double representing the OLE Automation date |
| ToShortDateString | Method | Converts a DateTime instance to its short date string representation |
| ToShortTimeString | Method | Converts a DateTime instance to its short time string representation |
| ToUniversalTime | Method | Converts the value of the DateTime instance to coordinated universal time (UTC) |
| UtcNow | Shared property | Returns a DateTime instance that represents the current local date and time expressed as the coordinated universal time (UTC) |

### 1.5.6 Decimal Structure

The VB.NET Decimal data type corresponds directly to the System.Decimal structure. The CTS Decimal structure includes the following members whose functionality is not readily available in VB.NET:

**Table 1-7.**

| Name | Member type | Description |
|---|---|---|
| FromOACurrency | Shared method | Converts a Long containing an OLE Automation Currency value (e.g., a VB6 or VBScript Currency value) to a Decimal value |
| GetBits | Shared method | Converts a particular Decimal value to its binary representation and returns that value as an Integer |
| MaxValue | Shared field | A constant containing the largest possible value of a Decimal object |
| MinValue | Shared field | A constant containing the smallest possible value of a Decimal object |
| ToOACurrency | Shared method | Converts a Decimal value to an OLE Automation Currency value (e.g., a VB6 or VBScript Currency value), which it returns as a Long |

### 1.5.7 Double Structure

The VB.NET Double data type corresponds to the .NET Framework's System.Double data type. The following table lists the members of the latter that offer functionality not found in the Visual Basic .NET language:

**Table 1-8.**

| Name | Member type | Description |
|---|---|---|
| Epsilon | Shared field | A constant containing the smallest positive Double value greater than zero |
| MaxValue | Shared field | A constant containing the largest possible value of a Double object |
| MinValue | Shared field | A constant containing the smallest possible value of a Double object |
| NaN | Shared field | A constant containing the representation of a value that is **n**ot **a** **n**umber (NaN) |
| NegativeInfinity | Shared field | A constant containing a number that represents negative infinity |
| PositiveInfinity | Shared field | A constant containing a number that represents positive infinity |
| IsInfinity | Shared method | Returns a Boolean indicating whether the value of a Double object represents positive or negative infinity |
| InNaN | Shared method | Returns a Boolean indicating whether a Double object contains a value that is not a number (NaN) |
| IsNegativeInfinity | Shared method | Returns a Boolean indicating whether the value of a Double object represents negative infinity |

| | | |
|---|---|---|
| IsPositiveInfinity | Shared method | Returns a Boolean indicating whether the value of a Double object represents positive infinity |
| Parse | Shared method | Converts the string representation of a number to its Double equivalent |

### 1.5.8 Int16 Structure

The VB.NET Short data type corresponds directly to the System.Int16 structure. The members of the latter structure that offer unique functionality are shown in the following table:

**Table 1-9.**

| Name | Member type | Description |
|---|---|---|
| MaxValue | Shared field | A constant containing the largest possible value of an Int16 object |
| MinValue | Shared field | A constant containing the smallest possible value of an Int16 object |
| Parse | Shared method | Converts the string representation of a number to its Int16 equivalent |

### 1.5.9 Int32 Structure

The VB.NET Integer data type corresponds directly to the System.Int32 structure. The members of the Int32 structure that offer unique functionality are shown in the following table:

**Table 1-10.**

| Name | Member type | Description |
|---|---|---|
| MaxValue | Shared field | A constant containing the largest possible value of an Int32 object |
| MinValue | Shared field | A constant containing the smallest possible value of an Int32 object |
| Parse | Shared method | Converts the string representation of a number to its Int32 equivalent |

### 1.5.10 Int64 Structure

The VB.NET Long data type corresponds directly to the System.Int64 structure. The members of the Int64 structure that offer unique functionality are shown in the following table:

**Table 1-11.**

| Name | Member type | Description |
|---|---|---|
| MaxValue | Shared field | A constant containing the largest possible value of an Int64 object |
| MinValue | Shared field | A constant containing the smallest possible value of an Int64 object |
| Parse | Shared method | Converts the string representation of a number to its Int64 equivalent |

### 1.5.11 Object Class

The VB.NET Object data type corresponds to the System.Object class. System.Object, however, offers no functionality that is not available through the standard Visual Basic language.

## 1.5.12 Single Structure

The VB.NET Single data type corresponds to the .NET Framework's System.Single data type. The following table lists the members of the latter that offer functionality not found in the Visual Basic .NET language:

**Table 1-12.**

| Name | Member type | Description |
|---|---|---|
| Epsilon | Shared field | A constant containing the smallest positive Single value greater than zero |
| MaxValue | Shared field | A constant containing the largest possible value of a Single object |
| MinValue | Shared field | A constant containing the smallest possible value of a Single object |
| NaN | Shared field | A constant containing the representation of a value that is **n**ot **a** **n**umber (NaN) |
| NegativeInfinity | Shared field | A constant containing a number that represents negative infinity |
| PositiveInfinity | Shared field | A constant containing a number that represents positive infinity |
| IsInfinity | Shared method | Returns a Boolean indicating whether the value of a Single object represents positive or negative infinity |
| InNaN | Shared method | Returns a Boolean indicating whether a Single object contains a value that is not a number (NaN) |
| IsNegativeInfinity | Shared method | Returns a Boolean indicating whether the value of a Single object represents negative infinity |
| IsPositiveInfinity | Shared method | Returns a Boolean indicating whether the value of a Single object represents positive infinity |
| Parse | Shared method | Converts the string representation of a number to its Single equivalent |

## 1.5.13 String Class

The VB.NET String data type is equivalent to the System.String class. The members of the String class that offer functionality not incorporated in the VB.NET language are shown in the following table:

**Table 1-13.**

| Name | Member type | Description |
|---|---|---|
| Chars | Property | Returns a Char instance representing the character at a particular position in a string |
| Clone | Method | Returns an additional reference to a particular String instance |
| CompareOrdinal | Shared method | Compares two strings without considering locale settings |
| CopyTo | Method | Copies a designated number of characters starting at a particular position in a string to a character array |

| | | |
|---|---|---|
| | | position in a string to a character array |
| Empty | Shared field | A constant representing an empty string |
| EndsWith | Method | Returns a Boolean indicating whether the String instance ends with the substring passed to the method as an argument |
| Format | Shared method | Replaces each format specification in a string with its corresponding value |
| IndexOf | Method | Returns the position of the first occurrence of a character or a substring within the string instance |
| IndexOfAny | Method | Returns the index of the first occurrence in this String instance of any element in a character array |
| Insert | Method | Inserts a substring at a designated position of a String instance |
| LastIndexOf | Method | Returns the position of the last occurrence of a designated character or substring within the string instance |
| LastIndexOfAny | Method | Returns the position of the last occurrence in this String instance of any of a set of characters in a character array |
| PadLeft | Method | Right aligns the characters in a String instance by padding them with a space or another designated character |
| PadRight | Method | Left aligns the characters in a String instance by padding them with a space or another designated character |
| Remove | Method | Deletes a specified number of characters from a String instance beginning at a designated position |
| StartsWith | Method | Returns a Boolean indicating whether the String instance begins with a designated substring or character |
| ToCharArray | Method | Copies the characters in the String instance to a Unicode character array |
| | | |

## 1.5.14 Non-CTS Data Types

Note, however, that because they are not part of the Common Language Specification (the specification that defines the core functionality that a .NET platform must implement), VB does not wrap the following CTS data types:

*System.SByte*

Description: Signed byte

Value Range: -128 to 127

*System.UInt16*

Description: Unsigned 16-bit integer

Value Range: 0 to 65,535

*System.UInt32*

Description: Unsigned 32-bit integer

Value Range: 0 to 4,294,967,295

*System.UInt64*

Description: Unsigned 64-bit integer

Value Range: 0 to 18,446,744,073,709,551,615

# Part II: .NET Core Classes Quick Reference

# Chapter 2. Reference

The quick-reference section that follows packs a lot of information into a small space. This introductory section explains how to get the most out of that information. It describes how the quick reference is organized and how to read the individual quick reference entries.

# 2.1 Finding a Quick-Reference Entry

The quick reference is organized into chapters, one per namespace. Each chapter begins with an overview of the namespace and includes a hierarchy diagram for the types (classes, interfaces, enumerations, delegates, and structs) in the namespace. Following the overview are quick-reference entries for all of the types in the namespace.

Figure 2-1 is a sample diagram showing the notation used in this book. This notation is similar to that used in *Java in a Nutshell* (O'Reilly) but borrows some features from UML.

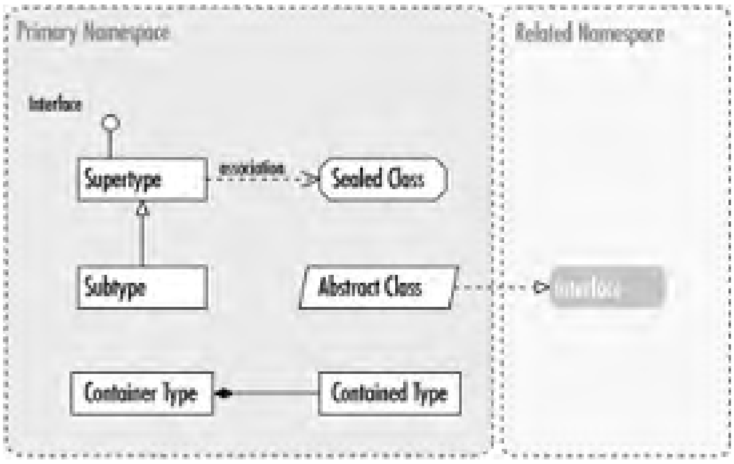
Classes marked as `MustInherit` are shown as a slanted rectangle, and classes marked as `NonInheritable` are shown as an octagonal rectangle. Inheritance is shown as a solid line from the subtype, ending with a hollow triangle that points to the base class. There are two notations that indicate interface implementation. The lollipop notation is used most of the time, since it is easier to read. In some cases, especially where many types implement a given interface, the shaded box notation with the dashed line is used.

Important relationships between types (associations) are shown with a dashed line ending with an arrow. The figures don't show every possible association. Some types have strong containing relationships with one another. For example, a System.Net.WebException object instance includes a System.Net.WebResponse object instance that represents the HTTP response containing the error details (HTTP status code and error message). To show this relationship, a filled diamond is attached to the containing type with a solid line that points to the contained type.

Entries are organized alphabetically by type *and* namespace, so that related types are grouped near each other. Thus, in order to look up a quick reference entry for a particular type, you must also know the name of the namespace that contains that type. Usually, the namespace is obvious from the context, and you should have no trouble looking up the quick-reference entry you want. Use the tabs on the outside edge of the book and the dictionary-style headers on the upper outside corner of each page to help you find the namespace and type you are looking for.

Occasionally, you may need to look up a type for which you do not already know the namespace. In this case, refer to Appendix A. This index allows you to look up a type by its name and find out what namespace it is part of.

**Figure 2-1. Class hierarchy notation**



# 2.2 Reading a Quick-Reference Entry

Each quick-reference entry contains quite a bit of information. The sections that follow describe the of a quick-reference entry, explaining what information is available, where it is found, and what it me While reading the descriptions that follow, you will find it helpful to flip through the reference section find examples of the features being described.

## 2.2.1 Type Name, Namespace, Assembly, Type Category, and Flags

Each quick-reference entry begins with a four-part title that specifies the name, namespace (followe assembly in parentheses), and type category of the type, and may also specify various additional fla describe the type. The type name appears in bold at the upper left of the title. The namespace and a appear, in smaller print, in the lower left, below the type name.

The upper-right portion of the title indicates the type category of the type (class, delegate, enum, int or struct). The "class" category may include modifiers such as `NonInheritable` or `MustInherit`

In the lower-right corner of the title, you may find a list of flags that describe the type. The possible f their meanings are as follows:

*ECMA*

The type is part of the ECMA CLI specification.

*Serializable*

The type, or a base class, implements System.Runtime.Serialization.ISerializable or has bee with the System.Serializable attribute.

*Marshal by reference*

This class, or a superclass, derives from System.MarshalByRefObject.

*Context bound*

This class, or a superclass, derives from System.ContextBoundObject.

*Disposable*

The type implements the System.IDisposable interface.

*Flag*

The enumeration is marked with the System.FlagsAttribute attribute.

## 2.2.2 Description

The title of each quick-reference entry is followed by a short description of the most important featu type. This description may be anywhere from a couple of sentences to several paragraphs long.

## 2.2.3 Synopsis

The most important part of every quick-reference entry is the synopsis, which follows the title and description. The synopsis for a type looks a lot like its source code, except that the member bodies are omitted and some additional annotations are added. If you know VB.NET syntax, you know how to r type synopsis.

The first line of the synopsis contains information about the type itself. It begins with a list of type mo such as `MustInherit` and `NonInheritable`. These modifiers are followed by the `Class`, `Deleg` `Enum`, `Interface`, or `Struct` keyword and then by the name of the type. The type name may be f by a colon (:) and a base class or interfaces that the type implements.

The type definition line is followed by a list of the members that the type defines. This list includes o members that are explicitly declared in the type, are overridden from a base class, or are implemen an interface member. Members that are simply inherited from a base class are not shown; you will r look up the base class definition to find those members.

Once again, if you understand basic VB.NET syntax, you should have no trouble making sense of th lines. The listing for each member includes the modifiers, type, and name of the member. For metho synopsis also includes the type and name of each method parameter. The member names are in bo so it is easy to scan the list of members looking for the one you want. The names of method parame in italics to indicate that they are not to be used literally. The member listings are printed on alternat and white backgrounds to keep them visually separate.

### 2.2.3.1 Member availability and flags

Each member listing is a single line that defines the syntax for that member. These listings use VB.N syntax, so their meaning is immediately clear to any VB.NET programmer. There is some auxiliary information associated with each member synopsis, however, that requires explanation.

The area to the right of the member synopsis is used to display a variety of flags that provide additio information about the member. Some of these flags indicate additional specification details that do r appear in the member syntax itself.

The following flags may be displayed to the right of a member synopsis:

*Overrides*

> Indicates that a method overrides a method in one of its base classes. The flag is followed by name of the base class that the method overrides.

*Implements*

> Indicates that a method implements a method in an interface. The flag is followed by the nam interface that is implemented.

=

> For enumeration fields and constant fields, this flag is followed by the constant value of the fie constants of primitive and String types and constants with the value `Nothing` are displayed. constant values are specification details, while others are implementation details. Some cons platform dependent, such as System.BitConverter.IsLittleEndian. Platform-dependent values this book conform to the System.PlatformID.Win32NT platform (32-bit Windows NT, 2000, or reason that symbolic constants are defined, however, is so you can write code that does not r directly upon the constant value. Use this flag to help you understand the type, but do not rely the constant values in your own programs.

### 2.2.3.2 Functional grouping of members

Within a type synopsis, the members are not listed in strict alphabetical order. Instead, they are brol
down into functional groups and listed alphabetically within each group. Constructors, events, fields,
methods, and properties are all listed separately. Instance methods are kept separate from shared (
methods. Public members are listed separately from protected members. Grouping members by cat
breaks a type down into smaller, more comprehensible segments, making the type easier to unders
This grouping also makes it easier for you to find a desired member.

Functional groups are separated from each other in a type synopsis with VB.NET comments, such a

```
 Public Constructors
```

or:

```
' Protected Instance Properties
```

or:

```
' Events
```

The various functional categories are as follows (in the order in which they appear in a type synopsi

*Constructors*

Displays the constructors for the type. Public constructors and protected constructors are dis
separately in subgroupings. If a type defines no constructor at all, the VB.NET compiler adds
parameterless constructor that is displayed here. If a type defines only private constructors, it
be instantiated, so no constructor appears. Constructors are listed first because the first thing
with most types is instantiate them by calling a constructor.

*Fields*

Displays all of the fields defined by the type, including constants. Public and protected fields a
displayed in separate subgroups. Fields are listed here, near the top of the synopsis, becaus
constant values are often used throughout the type as legal values for method parameters ar
values.

*Properties*

Lists all the properties of the type, breaking them down into subgroups for public and protecte
shared properties and public and protected instance properties. After the property name, its
accessors (get or set) are shown.

*Shared Methods*

Lists the shared methods (class methods) of the type, broken down into subgroups for public
methods and protected shared methods.

*Public Instance Methods*

Contains all the public instance methods.

*Protected Instance Methods*

Contains all the protected instance methods.

## 2.2.4 Class Hierarchy

For any type that has a non-trivial inheritance hierarchy, the synopsis is followed by a "Hierarchy" se
This section lists all of the base classes of the type, as well as any interfaces implemented by those
classes. It will also list any interfaces implemented by an interface. In the hierarchy listing, arrows in
base class to derived class relationships, while the interfaces implemented by a type follow the type
parentheses. For example, the following hierarchy indicates that System.IO.Stream implements IDis
and extends MarshalByRefObject, which itself extends Object:

```
System.Object | System.MarshalByRefObject | System.IO.Stream(System.IDisp
```

If a type has subtypes, the "Hierarchy" section is followed by a "Subtypes" section that lists those su
If an interface has implementations, the "Hierarchy" section is followed by an "Implementations" sec
lists those implementations. While the "Hierarchy" section shows ancestors of the type, the "Subtyp
"Implementations" section shows descendants.

## 2.2.5 Cross References

The hierarchy section of a quick-reference entry is followed by a number of optional cross reference
that indicate other related types and methods that may be of interest. These sections are the followi

*Passed To*

> This section lists all of the members (from other types) that are passed an object of this type a argument, including properties whose values can be set to this type. This is useful when you object of a given type and want to know where it can be used.

*Returned By*

> This section lists all of the members that return an object of this type, including properties wh values can take on this type. This is useful when you know that you want to work with an obje type, but don't know how to obtain one.

*Valid On*

> For attributes, this lists the attribute targets that the attribute can be applied to.

*Associated Events*

> For delegates, this lists the events it can handle.

## 2.2.6 A Note About Type Names

Throughout the quick reference, you'll notice that types are sometimes referred to by type name alo
at other times referred to by type name and namespace. If namespaces were always used, the type
synopses would become long and hard to read. On the other hand, if namespaces were never used
sometimes be difficult to know what type was being referred to. The rules for including or omitting th
namespace name are complex, but they can be summarized approximately as follows:

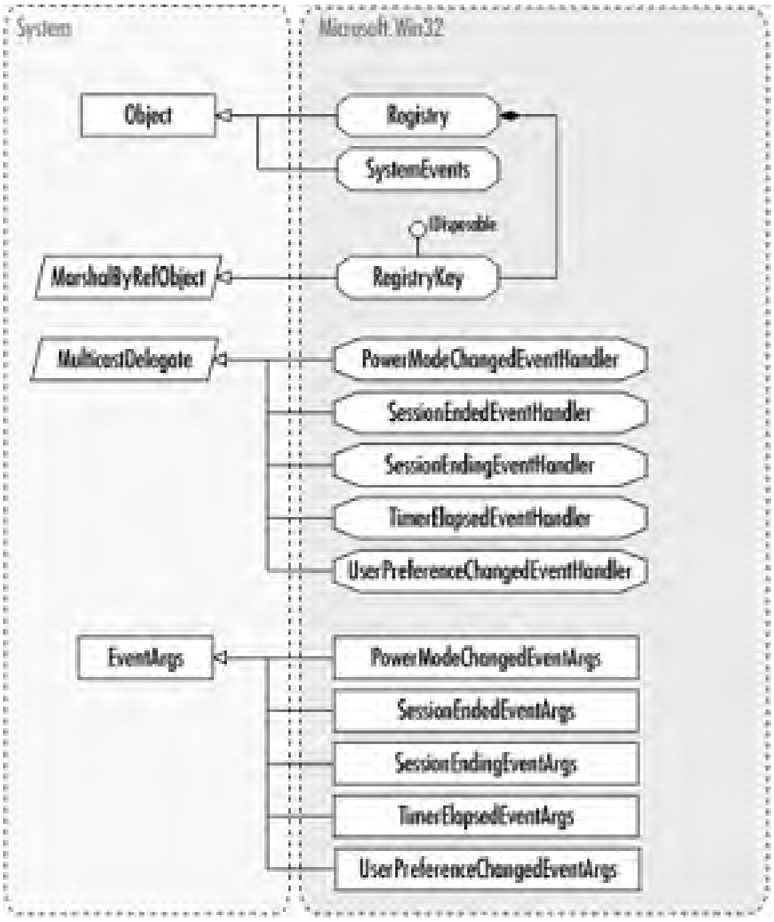
- If the type name alone is ambiguous, the namespace name is always used.
- If the type is part of the System namespace or is a very commonly used type like System.Collection.ICollection, the namespace is omitted.
- If the type being referred to is part of the current namespace (and has a quick-reference entry current chapter), the namespace is omitted. The namespace is also omitted if the type being to is part of a namespace that contains the current namespace.

# Chapter 3. Microsoft.Win32

The `Microsoft.Win32` namespace includes types you can use to interact with the Microsoft Windows platform. These types concentrate on two aspects of Windows-specific programming: receiving operating system events and manipulating the registry. Essentially, the classes, delegates, and enumerations in this namespace provide a type-safe object wrapper around a few select functions in the Windows API.

Use the `Registry` class to access the root level registry keys, which are provided as `RegistryKey` objects. These have built-in methods for retrieving and modifying key values. The `SystemEvents` class allows you to respond to system events such as timers, preference changes, and shutdown operations. All other types in this namespace are used to support the `SystemEvents` class, by providing delegates for each event and custom `System.EventArgs` objects that provide additional information to the corresponding event handlers. Figure 3-1 shows the inheritance diagram for this namespace.

**Figure 3-1. The Microsoft.Win32 namespace**



# PowerModeChangedEventArgs Class

## Microsoft.Win32 (system.dll)

This class creates a custom `System.EventArgs` object for the `PowerModeChangedEventHandler` delegate. It provides additional information to your event handler, identifying the new power mode that the system has entered.

```
Public Class PowerModeChangedEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal mode As PowerModes)

' Public Instance Properties

   Public ReadOnly Property Mode As PowerModes

End Class
```

### Hierarchy

System.Object → System.EventArgs → PowerModeChangedEventArgs

### Passed To

PowerModeChangedEventHandler.{BeginInvoke(), Invoke()}

# PowerModeChangedEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate defines the signature that an event handler must use to receive the `SystemEvents.PowerModeChanged` event. This event is raised when the computer enters or exits suspend mode, and when the power consumption level changes. A computer requires Advanced Power Management (APM) or Advanced Configuration and Power Interface (ACPI) support in order to use these operating system features. APM/ACPI is usually supported on (but not restricted to) portable computers and devices.

```
Public Delegate Sub PowerModeChangedEventHandler(

        ByVal sender As Object,

        ByVal e As PowerModeChangedEventArgs)
```

### Associated Events

`SystemEvents.PowerModeChanged()`

## PowerModes Enum

### Microsoft.Win32 (system.dll) *serializable*

This enumeration is used for the `PowerModeChangedEventArgs` class. It provides information about the current power modes, such as `Suspend`, which indicates that the computer is preparing to enter suspend mode, and `Resume`, which indicates that the computer is about to leave it. `StatusChange` simply indicates that the power mode status has changed, possibly due to automatic power-down settings, a weak or charging battery, or a transition between AC power and battery power.

```
Public Enum PowerModes

   Resume = 1

   StatusChange = 2

   Suspend = 3

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → PowerModes

### Returned By

PowerModeChangedEventArgs.Mode

### Passed To

PowerModeChangedEventArgs.PowerModeChangedEventArgs()

## Registry NotInheritable Class

## Microsoft.Win32 (mscorlib.dll)

This class is the starting point when using the Windows registry, which is the central repository usec storing user-specific settings and preferences. Each shared field of this class represents a root Reg multiple levels of subkeys. These keys are read-only, but can be manipulated using the methods of

Most applications store their settings in CurrentUser (HKEY_CURRENT_USER). The recommen subkey, create a subkey for your organization, and then create a subkey for each specific applicatio preferences are stored in HKEY_CURRENT_USER\Software\Microsoft\Internet Explorer). Analogou users on the current computer can be placed in a similar subkey in LocalMachine (HKEY_LOCAL programs often use this key to store information about installed applications. The full collection of us current computer can be retrieved from the Users key, as can the default settings for new users, w subkey of users. CurrentUser is actually a mapped subkey of Users, much as CurrentConfig

The ClassesRoot key contains information used for Windows 3.1-compatible DDE and OLE supp Windows Explorer extensions, and file associations is also stored in this key. You can use the Perf performance-related information. This data is not actually stored in the registry. Instead, it is automa system object managers when this key is accessed. Lastly, the DynData key is used to support Virt them to provide real-time data to remote Win32 applications. It is used only in Windows 95, 98, and

Much more information about the system registry is available from Microsoft's Windows platform do

```
Public NotInheritable Class Registry

' Public Shared Fields

   Public Shared ReadOnly ClassesRoot As RegistryKey              // =HKEY_

   Public Shared ReadOnly CurrentConfig As RegistryKey            // =HKEY_

   Public Shared ReadOnly CurrentUser As RegistryKey              // =HKEY_

   Public Shared ReadOnly DynData As RegistryKey                  // =HKEY_

   Public Shared ReadOnly LocalMachine As RegistryKey             // =HKEY_

   Public Shared ReadOnly PerformanceData As RegistryKey          // =HKEY_

   Public Shared ReadOnly Users As RegistryKey                    // =HKEY_

End Class
```

## RegistryHive Enum

## Microsoft.Win32 (mscorlib.dll) *serializable*

This enumeration provides values for the `RegistryKey.OpenRemoteBaseKey()` method. These values identify a registry key, just like the fields in the `Registry` class.

```
Public Enum RegistryHive

   ClassesRoot = &H080000000

   CurrentUser = &H080000001

   LocalMachine = &H080000002

   Users = &H080000003

   PerformanceData = &H080000004

   CurrentConfig = &H080000005

   DynData = &H080000006

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `RegistryHive`

### Passed To

`RegistryKey.OpenRemoteBaseKey()`

## RegistryKey NotInheritable Class

**Microsoft.Win32 (mscorlib.dll)** ***marshal by reference, disposable***

The RegistryKey class contains the core functionality for reading and writing to the Windows regi object represents an individual key in the registry. You can use the properties of this class to find ou contains (ValueCount), how many subkeys (SubKeyCount) there are, and the fully qualified key r

To open a subkey for modification, use the overloaded version of the OpenSubKey() method — wl the writable parameter — and set it to true. You can open subkeys that are several levels deep backslash (\). You can also use methods such as CreateSubKey() and DeleteSubKey(). In the groupings, and values are the entries used to store the actual data. You can use the GetValue(), DeleteValue() methods to manipulate a named value in the current key.

Changes to the registry are propagated across the system automatically and are flushed to disk aut You should never need to use methods such as Flush(), unless you require absolute certainty tha been written to disk. The OpenRemoteBaseKey() method opens the registry on a remote compute are running the remote registry service and have remote administration enabled.

```
Public NotInheritable Class RegistryKey : Inherits MarshalByRefObject : I
' Public Instance Properties
   Public ReadOnly Property Name As String
   Public ReadOnly Property SubKeyCount As Integer
   Public ReadOnly Property ValueCount As Integer
' Public Shared Methods
   Public Shared Function OpenRemoteBaseKey(
        ByVal hKey As RegistryHive,
        ByVal machineName As String) As RegistryKey
' Public Instance Methods
   Public Sub Close()
   Public Function CreateSubKey(
        ByVal subkey As String) As RegistryKey
   Public Sub DeleteSubKey( ByVal subkey As String)
   Public Sub DeleteSubKey(ByVal subkey As String,
        ByVal throwOnMissingSubKey As Boolean)
   Public Sub DeleteSubKeyTree( ByVal subkey As String)
   Public Sub DeleteValue( ByVal name As String)
```

```
   Public Sub DeleteValue(ByVal name As String,
        ByVal throwOnMissingValue As Boolean)
   Public Sub Flush()
   Public Function GetSubKeyNames() As String()
   Public Function GetValue( ByVal name As String) As Object
   Public Function GetValue(ByVal name As String,
        ByVal defaultValue As Object) As Object
   Public Function GetValueNames() As String()
   Public Function OpenSubKey(
        ByVal name As String) As RegistryKey
   Public Function OpenSubKey(ByVal name As String,
        ByVal writable As Boolean) As RegistryKey
   Public Sub SetValue(ByVal name As String,
        ByVal value As Object)
   Overrides Public Function ToString() As String
' Protected Instance Methods
   Overrides Protected Sub Finalize()
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → RegistryKey(System.IDisposal

# SessionEndedEventArgs Class

## Microsoft.Win32 (system.dll)

This class is a custom `System.EventArgs` object for the `SystemEvents.SessionEnded` delegate. It provides additional information to your event handler about why the current session has ended.

```
Public Class SessionEndedEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal reason As SessionEndReasons)

' Public Instance Properties

   Public ReadOnly Property Reason As SessionEndReasons

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `SessionEndedEventArgs`

### Passed To

`SessionEndedEventHandler.{BeginInvoke(), Invoke()}`

# SessionEndedEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate defines the signature that an event handler must use to receive the `SystemEvents.SessionEnded` event. This event is raised just before the system finishes its logoff or shutdown procedure.

```
Public Delegate Sub SessionEndedEventHandler(
        ByVal sender As Object,
        ByVal e As SessionEndedEventArgs)
```

### Associated Events

`SystemEvents.SessionEnded()`

# SessionEndingEventArgs Class

## Microsoft.Win32 (system.dll)

This class is a custom `System.EventArgs` object for the `SystemEvents.SessionEnding` delegate. It provides additional information to your event handler about why the session is ending, and allows you to request that the session continue, by setting the `Cancel` property to `true`. Note that this is only a request, and you may not always be able to successfully cancel a shutdown operation.

```
Public Class SessionEndingEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal reason As SessionEndReasons)

' Public Instance Properties

   Public Property Cancel As Boolean

   Public ReadOnly Property Reason As SessionEndReasons

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `SessionEndingEventArgs`

### Passed To

`SessionEndingEventHandler.{BeginInvoke(), Invoke()}`

# SessionEndingEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate defines the signature that an event handler must use to receive the `SystemEvents.SessionEnding` event. This event is raised when the user has chosen to log off or shutdown the system. It occurs before the `SystemEvents.SessionEnded` event. `SessionEndingEventArgs` provides a `Cancel` property, which you can set in the event handler to cancel the pending shutdown.

```
Public Delegate Sub SessionEndingEventHandler(

        ByVal sender As Object,

        ByVal e As SessionEndingEventArgs)
```

### Associated Events

`SystemEvents.SessionEnding()`

## SessionEndReasons Enum

## Microsoft.Win32 (system.dll) *serializable*

This enumeration specifies information for the `Reason` property of the `SessionEndingEventArgs` and `SessionEndedEventArgs` event arguments. It specifies whether the user who started the current application is logging off (`Logoff`) (in which case the system may continue to run) or whether the operating system is shutting down (`SystemShutdown`).

```
Public Enum SessionEndReasons
   Logoff = 1
   SystemShutdown = 2
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → SessionEndReasons

### Returned By

SessionEndedEventArgs.Reason, SessionEndingEventArgs.Reason

### Passed To

SessionEndedEventArgs.SessionEndedEventArgs(), SessionEndingEventArgs.SessionEndingEventArgs()

## SystemEvents NotInheritable Class

## Microsoft.Win32 (system.dll)

This class provides global events for select Windows operating system events. You can write event handlers to receive these. Some of the events include notifications that occur when user settings ar changed (`DisplaySettingsChanged`, `TimeChanged`, and `UserPreferenceChanged`) or when system state changes (`LowMemory`, `PowerModeChangedSessionEnded`, and `SessionEnding`). can also receive notifications about new fonts (`InstalledFontsChanged`) and palette switching i color mode (`PaletteChanged`).

System event handlers are executed on a different thread than the rest of your program. For this rea code in the event handler must be thread-safe. If your event handler needs access to other objects your program, you can use the shared method `InvokeOnEventsThread()` to instantiate these ob on the system event listener thread. This way, they are easily accessible to the event handler code.

Do not perform time-consuming tasks in a system event handler, as it may cause problems with oth applications that are also trying to handle the event.

```
Public NotInheritable Class SystemEvents

' Public Shared Methods

   Public Shared Function CreateTimer(

        ByVal interval As Integer) As IntPtr

   Public Shared Sub InvokeOnEventsThread(

        ByVal method As Delegate)

   Public Shared Sub KillTimer( ByVal timerId As IntPtr)

' Events

   Public Event DisplaySettingsChanged As EventHandler

   Public Event EventsThreadShutdown As EventHandler

   Public Event InstalledFontsChanged As EventHandler

   Public Event LowMemory As EventHandler

   Public Event PaletteChanged As EventHandler

   Public Event PowerModeChanged As PowerModeChangedEventHandler

   Public Event SessionEnded As SessionEndedEventHandler

   Public Event SessionEnding As SessionEndingEventHandler

   Public Event TimeChanged As EventHandler

   Public Event TimerElapsed As TimerElapsedEventHandler

   Public Event UserPreferenceChanged As UserPreferenceChangedEventHandle
```

```
    Public Event UserPreferenceChanging As UserPreferenceChangingEventHand

End Class
```

# TimerElapsedEventArgs Class

## Microsoft.Win32 (system.dll)

This class is a custom `System.EventArgs` object used for the `SystemEvents.TimerElapsed` delegate. It provides additional information to your event handler, identifying the ID of the timer that has changed.

```
Public Class TimerElapsedEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal timerId As IntPtr)

' Public Instance Properties

   Public ReadOnly Property TimerId As IntPtr

End Class
```

### Hierarchy

System.Object → System.EventArgs → TimerElapsedEventArgs

### Passed To

TimerElapsedEventHandler.{BeginInvoke(), Invoke()}

# TimerElapsedEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate defines the signature an event handler must use to receive the `SystemEvents.TimerElapsed` event. This event is raised whenever a windows timer interval expires.

```
Public Delegate Sub TimerElapsedEventHandler(
        ByVal sender As Object,
        ByVal e As TimerElapsedEventArgs)
```

### Associated Events

`SystemEvents.TimerElapsed()`

# UserPreferenceCategory Enum

## Microsoft.Win32 (system.dll) *serializable*

This enumeration is used for the `UserPreferenceChangedEventArgs` class. It provides information identifying the type of preference that was changed.

```
Public Enum UserPreferenceCategory
    Accessibility = 1
    Color = 2
    Desktop = 3
    General = 4
    Icon = 5
    Keyboard = 6
    Menu = 7
    Mouse = 8
    Policy = 9
    Power = 10
    Screensaver = 11
    Window = 12
    Locale = 13
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `UserPreferenceCategory`

### Returned By

`UserPreferenceChangedEventArgs.Category`, `UserPreferenceChangingEventArgs.Category`

### Passed To

`UserPreferenceChangedEventArgs.UserPreferenceChangedEventArgs()`, `UserPreferenceChangingEventArgs.UserPreferenceChangingEventArgs()`

# UserPreferenceChangedEventArgs Class

## Microsoft.Win32 (system.dll)

This class is a custom `System.EventArgs` object used for the `UserPreferenceChangedEventHandler` delegate. It provides additional information to your event handler, identifying the type of preference that was changed.

```
Public Class UserPreferenceChangedEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal category As UserPreferenceCategory)

' Public Instance Properties

   Public ReadOnly Property Category As UserPreferenceCategory

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `UserPreferenceChangedEventArgs`

### Passed To

`UserPreferenceChangedEventHandler.{BeginInvoke(), Invoke()}`

## UserPreferenceChangedEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate defines the signature an event handler must use to receive the `SystemEvents.UserPreferenceChanged` event. This event is raised when a user applies configuration changes, usually through one of the setting modules in the Control Panel. Note that not all changes raise this event, so it is best to first test it to make sure it accomplishes everything you need before you rely on it.

```
Public Delegate Sub UserPreferenceChangedEventHandler(

        ByVal sender As Object,

        ByVal e As UserPreferenceChangedEventArgs)
```

### Associated Events

`SystemEvents.UserPreferenceChanged()`

# UserPreferenceChangingEventArgs Class

## Microsoft.Win32 (system.dll)

This class represents the event arguments sent to a `UserPreferenceChangingEventHandler`. `Category` specifies the `UserPreferenceCategory` of user preferences that is changing.

```
Public Class UserPreferenceChangingEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal category As UserPreferenceCategory)

' Public Instance Properties

   Public ReadOnly Property Category As UserPreferenceCategory

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `UserPreferenceChangingEventArgs`

### Passed To

`UserPreferenceChangingEventHandler.{BeginInvoke( ), Invoke( )}`

# UserPreferenceChangingEventHandler Delegate

## Microsoft.Win32 (system.dll) *serializable*

This delegate receives the `SystemEvents.UserPreferenceChanging` event, which is similar to `SystemEvents.UserPreferenceChanged`, except it is raised as the event is changing, not after it has changed.

```
Public Delegate Sub UserPreferenceChangingEventHandler(

        ByVal sender As Object,

        ByVal e As UserPreferenceChangingEventArgs)
```

### Associated Events

`SystemEvents.UserPreferenceChanging()`

# Chapter 4. System

In many respects, the `System` namespace serves as the core namespace for the .NET libraries, in much the same way `java.lang` does for Java programmers or `stdlib.h` does for C/C++ programmers. For example, the ECMA-compliant primitive-type value types are defined in the `System` namespace, along with complementary composite types and base types. These are used in the synthesis of type generation, which is done by the compiler on the .NET programmer's behalf (for an example of this on-the-fly type synthesis, see `Array`). Figure 4-1 shows many of the types in this namespace.

`System` serves as the home for key base-type definitions, including `Object`, the root of every type in the .NET hierarchy. Every type in the system ultimately extends this class, making it the "root of all evil" in .NET. In addition, this namespace contains `ValueType`, the base type for all value types in .NET (such as the primitive types listed later in this chapter, shown in Figure 4-5), and `Type`, which in turn represents compile-time type information about other types defined within the .NET environment (the type metadata).

ECMA-compliant primitive-type value types include the fundamental types used for all .NET applications, which are basic value types such as `Int32`, `Single`, `Double`, `Decimal`, `Char`, `Byte`, and `Boolean`. All of the primitive types are aliased in VB.NET with keywords such as `Integer`, `Double`, and `Boolean`. See the description of each type for more details. In addition to these fundamental types, there are composite types such as `DateTime` and `TimeSpan`, used to handle date- and time-based calculations without having to drop down to integer math, and `Uri`, used to represent references to a Universal Resource Identifier, which is the more generic form of the ubiquitous HTTP URL identifier used on the Web.

In addition to these primitive and composite types, several interfaces defined here are intended as support interfaces. For example, the interfaces `IConvertible`, `IComparable`, and `ICloneable` let types support the same basic operations (conversion, comparison, and cloning, respectively) that the primitive types offer.

Along with the base types described earlier, `System` contains base types that programmers do not directly reference, such as the following:

`System.Array`

> The base type for any array-type declaration, allowing .NET developers to refer to any type (or rank) array without having to specify exact type.

`System.Delegate` and `System.MulticastDelegate`

> Base types for delegate types (see Figure 4-2) created using the `Delegate` keyword in VB.NET.

`System.Attribute`

> The base type required for any type that wishes to be used as an attribute on other types, or methods, fields, etc. (see Figure 4-2).

Because delegates are often used in conjunction with events and event handlers, `System` also contains the definitions for `EventHandler`, the universal delegate type, and `EventArgs`, the base type representing data sent as part of an event-handler call.

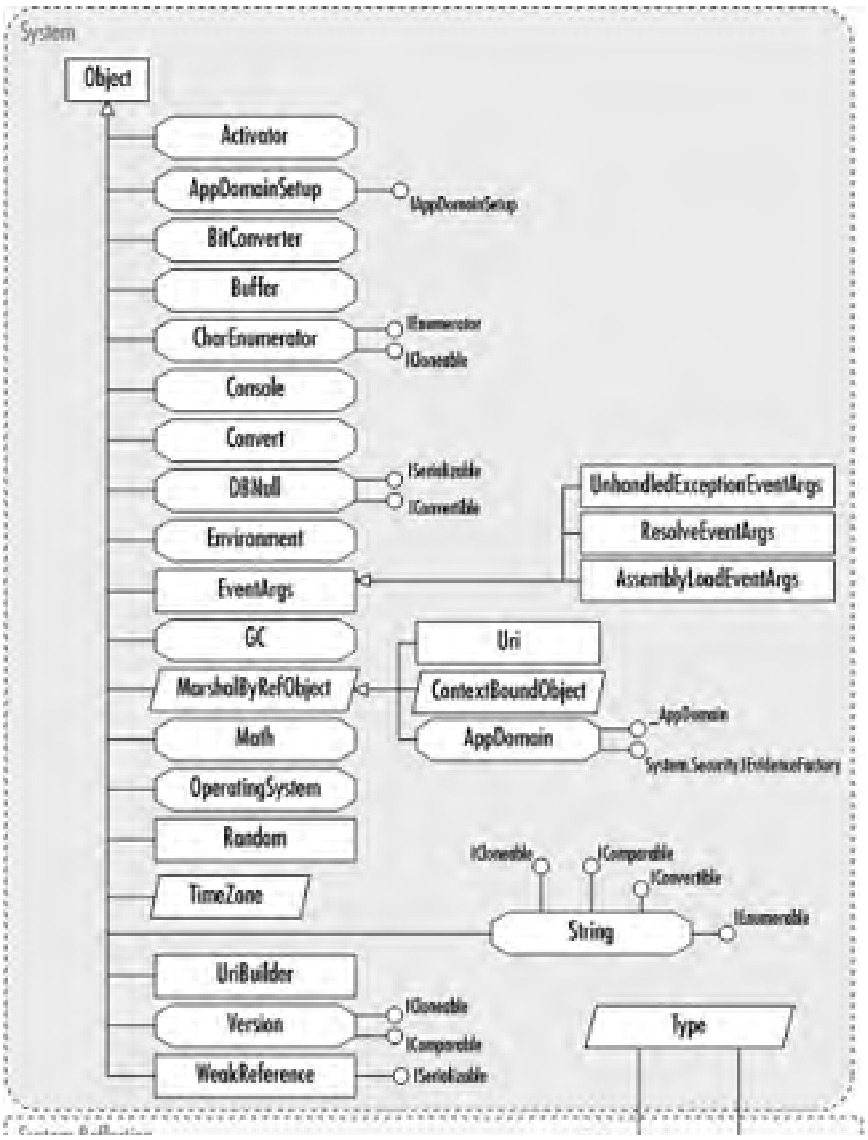
`System` also serves as the heart of the exception-handling hierarchy in .NET, defining the base type `Exception`, which is the base type for all exceptions. The exception hierarchy is then bifurcated into two realms: *system exceptions*, which are exceptions generated by or relating to the runtime itself, and *application exceptions*, which are exceptions relating to the target business domain and typically are used on a per-application basis. `SystemException` serves as the base type for the former, and `ApplicationException` is the base type for the latter. Figure 4-3 and Figure 4-4 show the exceptions in the System namespace.

`System` also contains two definitions of some importance to the .NET programmer: the `IDisposable` interface, used to help programmers define cleanup and resource-release semantics for their types, and the `GC` class, which gives the .NET programmer access to the CLR garbage collector.

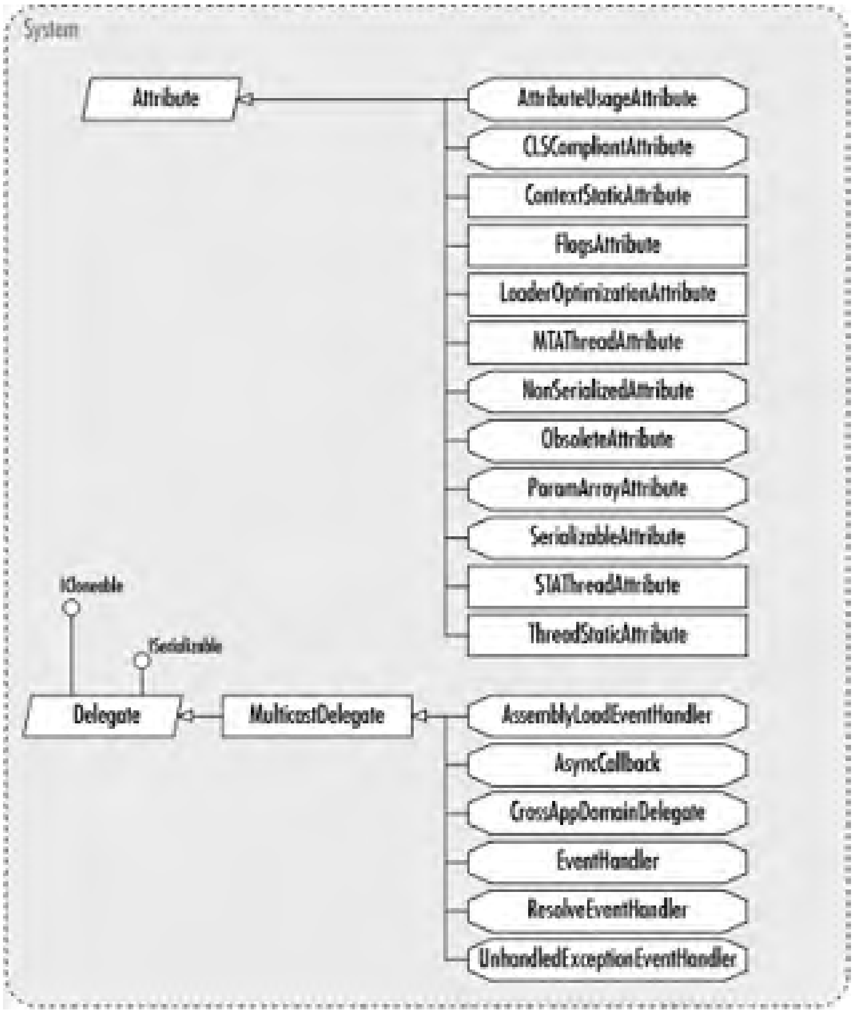
The `System` namespace also contains a few interoperability types. `Guid` represents the OSF UUID type that was made famous by COM. The attributes `STAThreadAttribute` and `MTAThreadAttribute` indicate to the runtime which sort of COM apartment-threading model the .NET component should use (but only when COM interoperability comes into play).

Finally, `System` defines the fundamental types such as `Console` and `Environment`. These give the .NET programmer access to the standard-in/standard-out streams (i.e., the command-shell console) and the environment variables of a given process, respectively. Most .NET applications will use ASP.NET or Windows Forms to present a graphical user interface. However, applications such as compilation tools, XML filters, and batch jobs use console I/O and environment variables extensively.

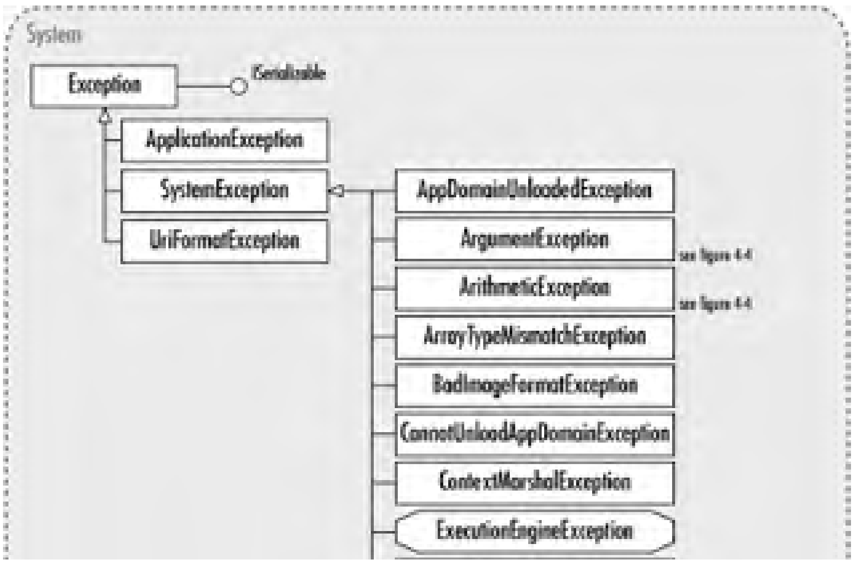
**Figure 4-1. The System namespace**

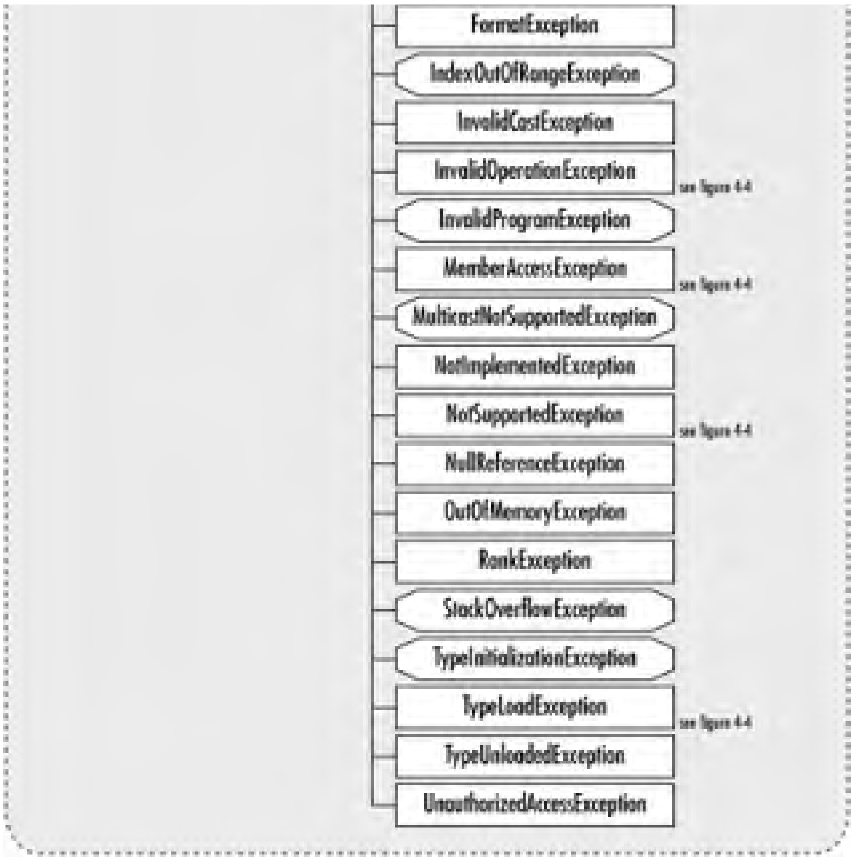



### Figure 4-2. Attributes and delegates in the System namespace

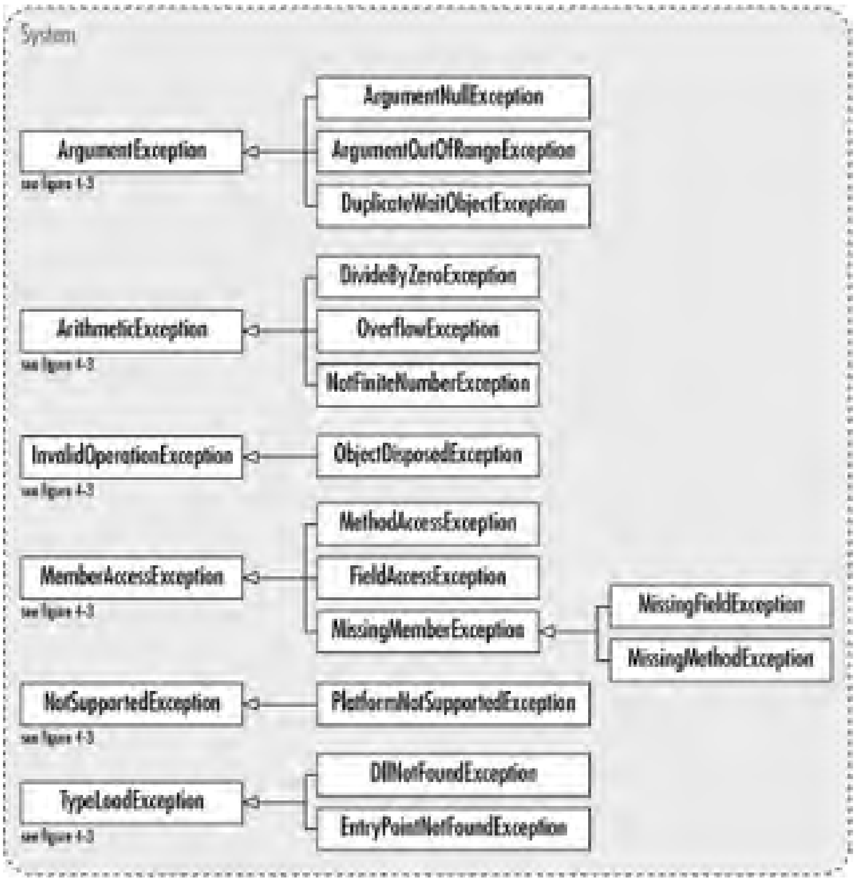



### Figure 4-3. Exceptions in the System namespace

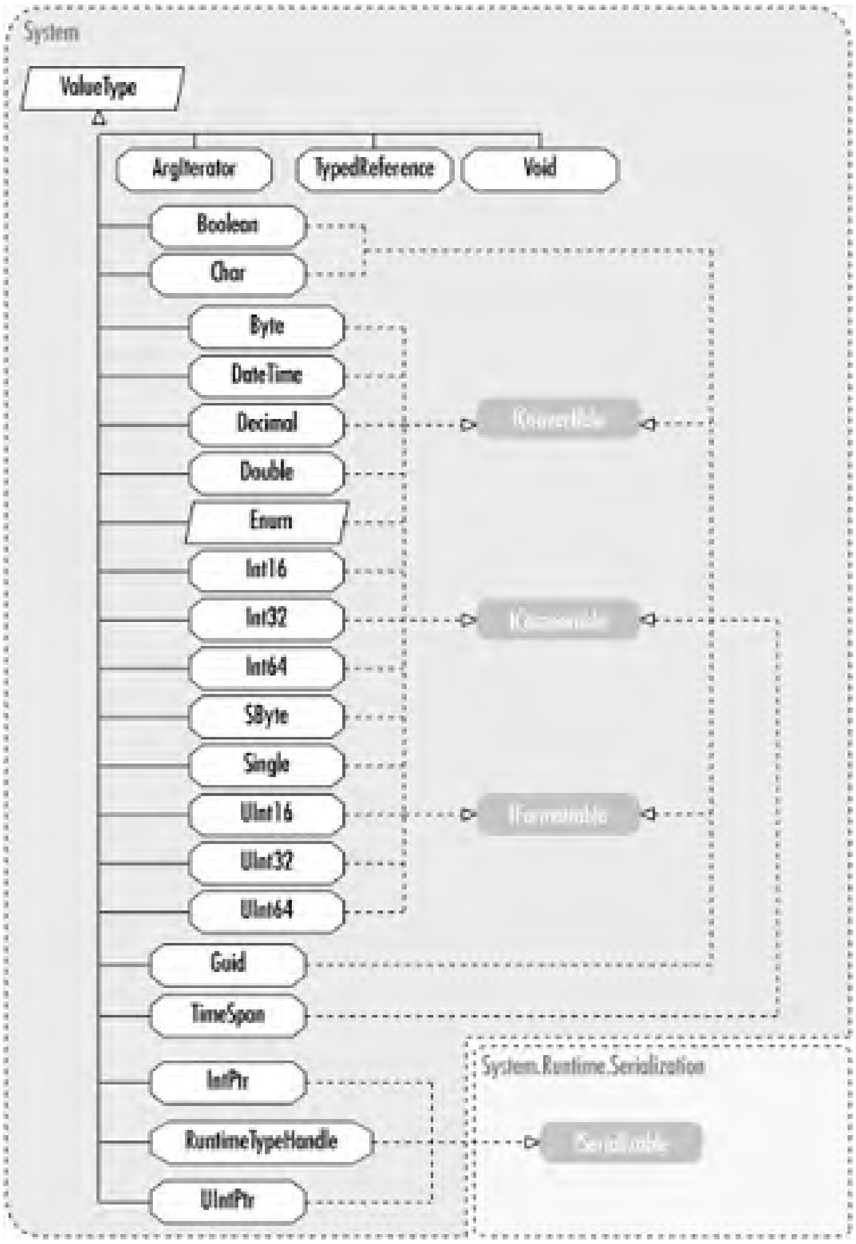





## Figure 4-4. Specialized exceptions in the System namespace



### Figure 4-5. Value types in the System namespace



## Activator NotInheritable Class

## System (mscorlib.dll)

This class is used to *activate* objects; that is, it either creates an object or obtains a handle to an exi object. This class is generally used in a variety of specialized conditions. For example, `Activator` create an object within another `AppDomain` and hold a handle to that object. This effectively gives a multidomain container application (such as ASP.NET) the ability to reach into another `AppDomain` t perform tasks within that domain (such as closing down the `AppDomain` in the event of a user requ shut down the application server).

`Activator` 's methods come in two distinct flavors: `CreateInstance()` and `CreateInstanceF` These create new objects when given particular criteria (such as the type to create and the assemb which to create it). The `GetObject()` method uses published `System.Runtime.Remoting.RemotingConfiguration` data to locate another object and obta handle to it (usually in preparation for some remote-object method invocations).

All of the methods in `Activator` return a `System.Runtime.Remoting.ObjectHandle`, not the object itself; this object is actually a proxy to the created/remote object. As such, programmers must `Unwrap()` on the returned `ObjectHandle` to use the object. (Note that an explicit downcast is req since the return value is declared to be a generic `Object`.)

```
Public NotInheritable Class Activator

' Public Shared Methods

   Public Shared Function CreateComInstanceFrom(

        ByVal assemblyName As String,

        ByVal typeName As String) As ObjectHandle

   Public Shared Function CreateInstance(

        ByVal type As Type) As Object

   Public Shared Function CreateInstance(ByVal type As Type,

        ByVal bindingAttr As System.Reflection.BindingFlags,

        ByVal binder As System.Reflection.Binder,

        ByVal args As Object(),

        ByVal culture As System.Globalization.CultureInfo) As Object

   Public Shared Function CreateInstance(ByVal type As Type,

        ByVal bindingAttr As System.Reflection.BindingFlags,

        ByVal binder As System.Reflection.Binder,

        ByVal args As Object(),

        ByVal culture As System.Globalization.CultureInfo,

        ByVal activationAttributes As Object()) As Object
```

```
Public Shared Function CreateInstance(ByVal type As Type,
     ByVal nonPublic As Boolean) As Object
Public Shared Function CreateInstance(ByVal type As Type,
     ByVal args As Object()) As Object
Public Shared Function CreateInstance(ByVal type As Type,
     ByVal args As Object(),
     ByVal activationAttributes As Object()) As Object
Public Shared Function CreateInstance(
     ByVal assemblyName As String,
     ByVal typeName As String) As ObjectHandle
Public Shared Function CreateInstance(
     ByVal assemblyName As String,
     ByVal typeName As String,
     ByVal ignoreCase As Boolean,
     ByVal bindingAttr As System.Reflection.BindingFlags,
     ByVal binder As System.Reflection.Binder,
     ByVal args As Object(),
     ByVal culture As System.Globalization.CultureInfo,
     ByVal activationAttributes As Object(),
     ByVal securityInfo As System.Security.Policy.Evidence) As ObjectHa
Public Shared Function CreateInstance(
     ByVal assemblyName As String,
     ByVal typeName As String,
     ByVal activationAttributes As Object()) As ObjectHandle
Public Shared Function CreateInstanceFrom(
     ByVal assemblyFile As String,
     ByVal typeName As String) As ObjectHandle
Public Shared Function CreateInstanceFrom(
```

```
        ByVal assemblyFile As String,
        ByVal typeName As String,
        ByVal ignoreCase As Boolean,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal activationAttributes As Object(),
        ByVal securityInfo As System.Security.Policy.Evidence) As ObjectH
   Public Shared Function CreateInstanceFrom(
        ByVal assemblyFile As String,
        ByVal typeName As String,
        ByVal activationAttributes As Object()) As ObjectHandle
   Public Shared Function GetObject(ByVal type As Type,
        ByVal url As String) As Object
   Public Shared Function GetObject(ByVal type As Type,
        ByVal url As String,
        ByVal state As Object) As Object
End Class
```

## AppDomain NotInheritable Class

## System (mscorlib.dll) *ECMA, marshal by reference*

This class represents an abstract separation within the executing process, which mimics the separa
a single machine. As a result, a single .NET process can host multiple other processes that offer the
processes, while keeping the low overhead of a single process.

Every .NET process created has at least one `AppDomain`, even when running a simple command s
*Hello, world*, created by the shim code at the start of a .NET executable file. Applications that act as
multiple `AppDomains`, loading assemblies into each `AppDomain` independently of one another. Thi
keeps multiple web applications separate from one another, so that an exception thrown from within
process.

Creating a new `AppDomain` involves using the shared `CreateDomain()` method. This method is c
common use is simply to pass in a friendly name for the `AppDomain`. When finished with a given `Ap
method to close down the `AppDomain` and all objects stored within it. Should a .NET programmer w
`AppDomain` she is currently executing within, the shared property `CurrentDomain` returns the curr

Each `AppDomain` contains an entirely separate list of loaded assemblies accessible via the `GetAss
the list of assemblies loaded for this particular `AppDomain`. `AppDomains` can also create instances
`AppDomain`, using the `CreateInstance()` family of methods. An `AppDomain` can also load and
assembly using the `ExecuteAssembly()` method, or it can load an assembly directly using one of
`AppDomains` even support the ability to create dynamic (that is, transient or temporary) assemblies
`DefineDynamicAssembly()` method.

`AppDomains` also offer a number of .NET events for interested consumers, notifying .NET program
loaded (`AssemblyLoad`), when an exception has been thrown out of a thread within that assembly
the `AppDomain` — or the process containing it — is being unloaded and torn down (`DomainUnloa
programmers can use these events to perform necessary actions, such as loading an assembly fro
assembly fails to load (`AssemblyResolve`).

`AppDomain` also contains a number of properties, which act in a role similar to environment variabl
`AppDomain` properties are, like environment variables, simple name-value mapping pairs, retrievab
`GetData()` method or via a set of predefined properties on the `AppDomain` class (such as `BaseD

```
Public NotInheritable Class AppDomain : Inherits MarshalByRefObject : Imp

System.Security.IEvidenceFactory

' Public Shared Properties

   Public Shared ReadOnly Property CurrentDomain As AppDomain

' Public Instance Properties

   Public ReadOnly Property BaseDirectory As String Implements _AppDomain

   Public ReadOnly Property DynamicDirectory As String Implements _AppDom

   Public ReadOnly Property Evidence As Evidence Implements IEvidenceFact

   Public ReadOnly Property FriendlyName As String Implements _AppDomain.

   Public ReadOnly Property RelativeSearchPath As String Implements _AppD
```

```
    Public ReadOnly Property SetupInformation As AppDomainSetup
    Public ReadOnly Property ShadowCopyFiles As Boolean Implements _AppDoma
' Public Shared Methods
    Public Shared Function CreateDomain(
        ByVal friendlyName As String) As AppDomain
    Public Shared Function CreateDomain(
        ByVal friendlyName As String,
        ByVal securityInfo As System.Security.Policy.Evidence) As AppDoma
    Public Shared Function CreateDomain(
        ByVal friendlyName As String,
        ByVal securityInfo As System.Security.Policy.Evidence,
        ByVal info As AppDomainSetup) As AppDomain
    Public Shared Function CreateDomain(
        ByVal friendlyName As String,
        ByVal securityInfo As System.Security.Policy.Evidence,
        ByVal appBasePath As String,
        ByVal appRelativeSearchPath As String,
        ByVal shadowCopyFiles As Boolean) As AppDomain
    Public Shared Function GetCurrentThreadId() As Integer
    Public Shared Sub Unload( ByVal domain As AppDomain)
' Public Instance Methods
    Public Sub AppendPrivatePath(
        ByVal path As String) Implements _AppDomain.AppendPrivatePath
    Public Sub ClearPrivatePath(
        ) Implements _AppDomain.ClearPrivatePath
    Public Sub ClearShadowCopyPath(
        ) Implements _AppDomain.ClearShadowCopyPath
    Public Function CreateComInstanceFrom(
        ByVal assemblyName As String,
        ByVal typeName As String) As ObjectHandle
    Public Function CreateInstance(
```

```
        ByVal assemblyName As String,
        ByVal typeName As String) As ObjectHandle
        Implements _AppDomain.CreateInstance
    Public Function CreateInstance(
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal ignoreCase As Boolean,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal activationAttributes As Object(),
        ByVal securityAttributes As System.Security.Policy.Evidence) As Ol
        Implements _AppDomain.CreateInstance
    Public Function CreateInstance(
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal activationAttributes As Object()) As ObjectHandle
        Implements _AppDomain.CreateInstance
    Public Function CreateInstanceAndUnwrap(
        ByVal assemblyName As String,
        ByVal typeName As String) As Object
    Public Function CreateInstanceAndUnwrap(
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal ignoreCase As Boolean,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal activationAttributes As Object(),
```

```
        ByVal securityAttributes As System.Security.Policy.Evidence) As Ol
    Public Function CreateInstanceAndUnwrap(
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal activationAttributes As Object()) As Object
    Public Function CreateInstanceFrom(
        ByVal assemblyFile As String,
        ByVal typeName As String) As ObjectHandle
        Implements _AppDomain.CreateInstanceFrom
    Public Function CreateInstanceFrom(
        ByVal assemblyFile As String,
        ByVal typeName As String,
        ByVal ignoreCase As Boolean,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal activationAttributes As Object(),
        ByVal securityAttributes As System.Security.Policy.Evidence) As Ol
        Implements _AppDomain.CreateInstanceFrom
    Public Function CreateInstanceFrom(
        ByVal assemblyFile As String,
        ByVal typeName As String,
        ByVal activationAttributes As Object()) As ObjectHandle
        Implements _AppDomain.CreateInstanceFrom
    Public Function CreateInstanceFromAndUnwrap(
        ByVal assemblyName As String,
        ByVal typeName As String) As Object
    Public Function CreateInstanceFromAndUnwrap(
```

```
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal ignoreCase As Boolean,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal activationAttributes As Object(),
        ByVal securityAttributes As System.Security.Policy.Evidence) As Ol
    Public Function CreateInstanceFromAndUnwrap(
        ByVal assemblyName As String,
        ByVal typeName As String,
        ByVal activationAttributes As Object()) As Object
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess) As
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal evidence As System.Security.Policy.Evidence) As AssemblyBui
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal evidence As System.Security.Policy.Evidence,
        ByVal requiredPermissions As System.Security.PermissionSet,
        ByVal optionalPermissions As System.Security.PermissionSet,
        ByVal refusedPermissions As System.Security.PermissionSet) As Ass
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
```

```
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal requiredPermissions As System.Security.PermissionSet,
        ByVal optionalPermissions As System.Security.PermissionSet,
        ByVal refusedPermissions As System.Security.PermissionSet) As Ass
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal dir As String) As AssemblyBuilder Implements _AppDomain.Def
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal dir As String,
        ByVal evidence As System.Security.Policy.Evidence) As AssemblyBui
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal dir As String,
        ByVal evidence As System.Security.Policy.Evidence,
        ByVal requiredPermissions As System.Security.PermissionSet,
        ByVal optionalPermissions As System.Security.PermissionSet,
        ByVal refusedPermissions As System.Security.PermissionSet) As Ass
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal dir As String,
        ByVal evidence As System.Security.Policy.Evidence,
        ByVal requiredPermissions As System.Security.PermissionSet,
```

```
        ByVal optionalPermissions As System.Security.PermissionSet,
        ByVal refusedPermissions As System.Security.PermissionSet,
        ByVal isSynchronized As Boolean) As AssemblyBuilder
        Implements _AppDomain.DefineDynamicAssembly
    Public Function DefineDynamicAssembly(
        ByVal name As System.Reflection.AssemblyName,
        ByVal access As System.Reflection.Emit.AssemblyBuilderAccess,
        ByVal dir As String,
        ByVal requiredPermissions As System.Security.PermissionSet,
        ByVal optionalPermissions As System.Security.PermissionSet,
        ByVal refusedPermissions As System.Security.PermissionSet) As Ass
        Implements _AppDomain.DefineDynamicAssembly
    Public Sub DoCallBack(
        ByVal callBackDelegate As CrossAppDomainDelegate) Implements _App
    Public Function ExecuteAssembly(
        ByVal assemblyFile As String) As Integer Implements _AppDomain.Ex
    Public Function ExecuteAssembly(
        ByVal assemblyFile As String,
        ByVal assemblySecurity As System.Security.Policy.Evidence) As Int
        Implements _AppDomain.ExecuteAssembly
    Public Function ExecuteAssembly(
        ByVal assemblyFile As String,
        ByVal assemblySecurity As System.Security.Policy.Evidence,
        ByVal args As String()) As Integer Implements _AppDomain.ExecuteA
    Public Function GetAssemblies(
        ) As Assembly() Implements _AppDomain.GetAssemblies
    Public Function GetData(
        ByVal name As String) As Object Implements _AppDomain.GetData
    Public Function GetType() As Type
    Overrides Public Function InitializeLifetimeService(
        ) As Object
    Public Function IsFinalizingForUnload() As Boolean
```

```
Public Function Load(
    ByVal assemblyRef As System.Reflection.AssemblyName) As Assembly I
Public Function Load(
    ByVal assemblyRef As System.Reflection.AssemblyName,
    ByVal assemblySecurity As System.Security.Policy.Evidence) As Ass
    Implements _AppDomain.Load
Public Function Load(
    ByVal rawAssembly As Byte()) As Assembly Implements _AppDomain.Lo
Public Function Load(ByVal rawAssembly As Byte(),
    ByVal rawSymbolStore As Byte()) As Assembly Implements _AppDomain
Public Function Load(ByVal rawAssembly As Byte(),
    ByVal rawSymbolStore As Byte(),
    ByVal securityEvidence As System.Security.Policy.Evidence) As Ass
    Implements _AppDomain.Load
Public Function Load(
    ByVal assemblyString As String) As Assembly Implements _AppDomain
Public Function Load(ByVal assemblyString As String,
    ByVal assemblySecurity As System.Security.Policy.Evidence) As Ass
    Implements _AppDomain.Load
Public Sub SetAppDomainPolicy(
    ByVal domainPolicy As System.Security.Policy.PolicyLevel)
    Implements _AppDomain.SetAppDomainPolicy
Public Sub SetCachePath(
    ByVal path As String) Implements _AppDomain.SetCachePath
Public Sub SetData(ByVal name As String,
    ByVal data As Object) Implements _AppDomain.SetData
Public Sub SetDynamicBase( ByVal path As String)
Public Sub SetPrincipalPolicy(
    ByVal policy As System.Security.Principal.PrincipalPolicy)
    Implements _AppDomain.SetPrincipalPolicy
Public Sub SetShadowCopyFiles()
```

```
    Public Sub SetShadowCopyPath(
         ByVal path As String) Implements _AppDomain.SetShadowCopyPath
    Public Sub SetThreadPrincipal(
         ByVal principal As System.Security.Principal.IPrincipal)
         Implements _AppDomain.SetThreadPrincipal
    Overrides Public Function ToString() As String
' Events
    Public Event AssemblyLoad As AssemblyLoadEventHandler
    Implements _AppDomain.AssemblyLoad
    Public Event AssemblyResolve As ResolveEventHandler
    Implements _AppDomain.AssemblyResolve
    Public Event DomainUnload As EventHandler
    Implements _AppDomain.DomainUnload
    Public Event ProcessExit As EventHandler
    Implements _AppDomain.ProcessExit
    Public Event ResourceResolve As ResolveEventHandler
    Implements _AppDomain.ResourceResolve
    Public Event TypeResolve As ResolveEventHandler
    Implements _AppDomain.TypeResolve
    Public Event UnhandledException As UnhandledExceptionEventHandler
    Implements _AppDomain.UnhandledException
End Class
```

## Hierarchy

Object → MarshalByRefObject → AppDomain(_AppDomain, System.Security.IEvi

## Returned By

System.Threading.Thread.GetDomain()

## AppDomainSetup NotInheritable Class

**System (mscorlib.dll)** ***serializable***

This class allows you to configure some settings for an application domain before creating an AppD this class, set its properties, and pass it to the appropriate AppDomain factory method.

```
Public NotInheritable Class AppDomainSetup : Implements IAppDomainSetup

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property ApplicationBase As String Implements IAppDomainSetup.Aj
   Public Property ApplicationName As String Implements IAppDomainSetup.Aj
   Public Property CachePath As String Implements IAppDomainSetup.CachePa
   Public Property ConfigurationFile As String Implements IAppDomainSetup
   Public Property DisallowPublisherPolicy As Boolean
   Public Property DynamicBase As String Implements IAppDomainSetup.Dynam
   Public Property LicenseFile As String Implements IAppDomainSetup.Licen
   Public Property LoaderOptimization As LoaderOptimization
   Public Property PrivateBinPath As String Implements IAppDomainSetup.Pr
   Public Property PrivateBinPathProbe As String Implements IAppDomainSet
   Public Property ShadowCopyDirectories As String Implements IAppDomainS
   Public Property ShadowCopyFiles As String Implements IAppDomainSetup.Sl

End Class
```

### Returned By

AppDomain.SetupInformation

### Passed To

AppDomain.CreateDomain()

## AppDomainUnloadedException Class

### System (mscorlib.dll) *serializable*

This exception signals an attempt to access an `AppDomain` that has been unloaded by `AppDomain.Unload()`.

```
Public Class AppDomainUnloadedException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `AppDomainUnloadedException`

# ApplicationException Class

## System (mscorlib.dll) *ECMA, serializable*

Derive from this class to create your own application-specific exceptions when a system-supplied exception is inappropriate. For example, if an application's methods receive an invalid argument, it makes sense to throw an `ArgumentException`. However, if an internal calculation results in a value that violates your business rules, you might choose to throw an application exception. Application exceptions should be treated as nonfatal.

```
Public Class ApplicationException : Inherits Exception

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `ApplicationException`

### Subclasses

`System.Reflection.{InvalidFilterCriteriaException, TargetException, TargetInvocationException, TargetParameterCountException}`

# ArgIterator Structure

## System (mscorlib.dll)

The .NET runtime uses this class to handle methods that take a variable number of parameters (i.e., methods with a parameter marked as `ParamArray`). The use of this class is completely hidden by language features. Unless you are writing a language compiler that needs to implement this feature, you do not need to use this class.

```
Public Structure ArgIterator

' Public Constructors

   Public Sub New( ByVal arglist As RuntimeArgumentHandle)

' Public Instance Methods

   Public Sub End()

   Overrides Public Function Equals(

        ByVal o As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Public Function GetNextArg() As TypedReference

   Public Function GetNextArg(

        ByVal rth As RuntimeTypeHandle) As TypedReference

   Public Function GetNextArgType() As RuntimeTypeHandle

   Public Function GetRemainingCount() As Integer

End Structure
```

### Hierarchy

Object → ValueType → ArgIterator

## ArgumentException Class

### System (mscorlib.dll) *ECMA, serializable*

This exception indicates that illegal data was passed to a method or constructor call. Note that *illegal* data is entirely contextual — the data may be a legitimate .NET value, but inappropriate for the use in question. Although .NET languages are type-safe in that you can't pass a string as a parameter when an integer is expected, there is nothing to keep you from passing a null or invalid value, such as sending `(2001, 13, 32)` to `DateTime`'s constructor. However, there is no 32nd day of the 13th month of the year 2001, and if you try to initialize such a date, you'll get an exception.

The `ArgumentException` class (or one of its subclasses, `ArgumentNullException` or `ArgumentOutOfRangeException`) indicates that a method argument violated such a constraint. If you need to implement this exception in your own code, consider using one of its subclasses instead, since they represent common argument exceptions.

```
Public Class ArgumentException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

   Public Sub New(ByVal message As String,

        ByVal paramName As String)

   Public Sub New(ByVal message As String,

        ByVal paramName As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

   Overridable Public ReadOnly Property ParamName As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(
```

```
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArgumentException

### Subclasses

ArgumentNullException, ArgumentOutOfRangeException, DuplicateWaitObjectException

## ArgumentNullException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is a subclass of `ArgumentException` and indicates that a null parameter value was received by a method that does not accept nulls.

```
Public Class ArgumentNullException : Inherits ArgumentException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal paramName As String)

   Public Sub New(ByVal paramName As String,

        ByVal message As String)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `ArgumentException` → `ArgumentNullException`

# ArgumentOutOfRangeException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is a subclass of `ArgumentException` and indicates that a method received an out-of-range parameter value.

```
Public Class ArgumentOutOfRangeException : Inherits ArgumentException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal paramName As String)

   Public Sub New(ByVal paramName As String,

        ByVal actualValue As Object,

        ByVal message As String)

   Public Sub New(ByVal paramName As String,

        ByVal message As String)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overridable Public ReadOnly Property ActualValue As Object

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `ArgumentException` → `ArgumentOutOfRangeException`

## ArithmeticException Class

## System (mscorlib.dll) *ECMA, serializable*

This is the base class for all math-related exceptions. You can throw this class from your own code, but use a subclass (if one exists) that specifically addresses the type of error you have encountered.

```
Public Class ArithmeticException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArithmeticException

### Subclasses

DivideByZeroException, NotFiniteNumberException, OverflowException

## Array MustInherit Class

### System (mscorlib.dll) *ECMA, serializable*

Unlike other environments (such as C++), .NET has arrays of first-class type, in that all array types a
All methods are available on any array type, regardless of its declaration. In fact, the CLR is require
matches the declaration. Thus, when you declare a variable of type `String()`, the CLR creates an
specifically for storing Strings in a one-dimensional array.

The `Array` class has a number of useful array-related methods, such as checking for bounds violat
the array that isn't in the array's declared size) and retrieval of array length. In addition, because `Ar`
`System.Collections.IList`, `System.Collections.ICollection`, and `System.Collect`
can be used anywhere these interface types are expected.

Arrays are reference types. This means that the statement `ArrayB = ArrayA` results in two objec
`ArrayB = ArrayA.Clone()` to create a duplicate copy of an array. This will be a shallow copy wi
create a deep copy in which each array has its own copy of subobjects, you must loop through the a

The `Array` class also contains useful shared methods. These include `IndexOf()`, which returns th
of an object in an array. For one-dimensional arrays, you can also use `Reverse()` to reverse a sub
of rows (provided the objects in the array implement the `IComparable` interface). If the objects in t
you can implement `System.Collections.IComparer` in a custom class and pass an instance o

The shared `Copy()` method works like the C function `memmove`: it copies a portion of an array to a
to a different array). When copying between multidimensional arrays, the array is treated like a long
element occupies a separate row. (For example, if an array has three columns, copying five elemen
all three elements in the first row and the first two elements from the second row.) The source and c
causing a problem.

Note that you can create both multidimensional arrays and ragged arrays (arrays of arrays). Arrays a
default, although you can use the `CreateInstance()` method to create an array with a different lo
the array won't be CLS (Common Language Specification)-compliant. Lastly, if you need a dynamic
collection `System.Collections.ArrayList`, which provides `Add()` and `Remove()` methods.

```
Public MustInherit Class Array : Implements ICloneable, IList, ICollectio

' Public Instance Properties

   Overridable Public ReadOnly Property IsFixedSize As Boolean Implements

   Overridable Public ReadOnly Property IsReadOnly As Boolean Implements I

   Overridable Public ReadOnly Property IsSynchronized As Boolean Impleme

   Public ReadOnly Property Length As Integer

   Public ReadOnly Property Rank As Integer

   Overridable Public ReadOnly Property SyncRoot As Object Implements ICo

' Public Shared Methods

   Public Shared Function BinarySearch(ByVal array As Array,
```

```
      ByVal index As Integer, ByVal length As Integer,
      ByVal value As Object) As Integer
Public Shared Function BinarySearch(ByVal array As Array,
      ByVal index As Integer, ByVal length As Integer,
      ByVal value As Object,
      ByVal comparer As System.Collections.IComparer) As Integer
Public Shared Function BinarySearch(ByVal array As Array,
      ByVal value As Object) As Integer
Public Shared Function BinarySearch(ByVal array As Array,
      ByVal value As Object,
      ByVal comparer As System.Collections.IComparer) As Integer
Public Shared Sub Clear(ByVal array As Array,
      ByVal index As Integer, ByVal length As Integer)
Public Shared Sub Copy(ByVal sourceArray As Array,
      ByVal destinationArray As Array,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal sourceArray As Array,
      ByVal sourceIndex As Integer,
      ByVal destinationArray As Array,
      ByVal destinationIndex As Integer,
      ByVal length As Integer)
Public Shared Function CreateInstance(
      ByVal elementType As Type,
      ByVal length As Integer) As Array
Public Shared Function CreateInstance(
      ByVal elementType As Type,
      ByVal lengths As Integer()) As Array
Public Shared Function CreateInstance(
```

```
    ByVal elementType As Type,
    ByVal lengths As Integer(),
    ByVal lowerBounds As Integer()) As Array
Public Shared Function CreateInstance(
    ByVal elementType As Type,
    ByVal length1 As Integer,
    ByVal length2 As Integer) As Array
Public Shared Function CreateInstance(
    ByVal elementType As Type,
    ByVal length1 As Integer, ByVal length2 As Integer,
    ByVal length3 As Integer) As Array
Public Shared Function IndexOf(ByVal array As Array,
    ByVal value As Object) As Integer
Public Shared Function IndexOf(ByVal array As Array,
    ByVal value As Object,
    ByVal startIndex As Integer) As Integer
Public Shared Function IndexOf(ByVal array As Array,
    ByVal value As Object, ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Shared Function LastIndexOf(ByVal array As Array,
    ByVal value As Object) As Integer
Public Shared Function LastIndexOf(ByVal array As Array,
    ByVal value As Object,
    ByVal startIndex As Integer) As Integer
Public Shared Function LastIndexOf(ByVal array As Array,
    ByVal value As Object, ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Shared Sub Reverse( ByVal array As Array)
Public Shared Sub Reverse(ByVal array As Array,
    ByVal index As Integer, ByVal length As Integer)
Public Shared Sub Sort( ByVal array As Array)
```

```
    Public Shared Sub Sort(ByVal keys As Array,
        ByVal items As Array)
    Public Shared Sub Sort(ByVal keys As Array,
        ByVal items As Array,
        ByVal comparer As System.Collections.IComparer)
    Public Shared Sub Sort(ByVal keys As Array,
        ByVal items As Array, ByVal index As Integer,
        ByVal length As Integer)
    Public Shared Sub Sort(ByVal keys As Array,
        ByVal items As Array, ByVal index As Integer,
        ByVal length As Integer,
        ByVal comparer As System.Collections.IComparer)
    Public Shared Sub Sort(ByVal array As Array,
        ByVal comparer As System.Collections.IComparer)
    Public Shared Sub Sort(ByVal array As Array,
        ByVal index As Integer, ByVal length As Integer)
    Public Shared Sub Sort(ByVal array As Array,
        ByVal index As Integer, ByVal length As Integer,
        ByVal comparer As System.Collections.IComparer)
' Public Instance Methods
    Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
    Overridable Public Sub CopyTo(ByVal array As Array,
        ByVal index As Integer) Implements ICollection.CopyTo
    Overridable Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
    Public Function GetLength(
        ByVal dimension As Integer) As Integer
    Public Function GetLowerBound(
        ByVal dimension As Integer) As Integer
    Public Function GetUpperBound(
```

```
        ByVal dimension As Integer) As Integer
    Public Function GetValue(ByVal index As Integer) As Object
    Public Function GetValue(
        ByVal indices As Integer()) As Object
    Public Function GetValue(ByVal index1 As Integer,
        ByVal index2 As Integer) As Object
    Public Function GetValue(ByVal index1 As Integer,
        ByVal index2 As Integer,
        ByVal index3 As Integer) As Object
    Public Sub Initialize()
    Public Sub SetValue(ByVal value As Object,
        ByVal index As Integer)
    Public Sub SetValue(ByVal value As Object,
        ByVal indices As Integer())
    Public Sub SetValue(ByVal value As Object,
        ByVal index1 As Integer, ByVal index2 As Integer)
    Public Sub SetValue(ByVal value As Object,
        ByVal index1 As Integer, ByVal index2 As Integer,
        ByVal index3 As Integer)
End Class
```

### Returned By

`System.Collections.ArrayList.ToArray()`, `Enum.GetValues()`

### Passed To

Multiple types

## ArrayTypeMismatchException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you store an element in an array that has a different type than the array's declared type. For example, trying to store a `String` object into an array declared to hold `Int32` instances causes this exception to be thrown.

```
Public Class ArrayTypeMismatchException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArrayTypeMismatchException

## AssemblyLoadEventArgs Class

## System (mscorlib.dll) *ECMA*

This class is used by the .NET Framework to pass information to the `AppDomain.AssemblyLoad` event. This information consists of a `System.Reflection.Assembly` object that represents the newly loaded assembly.

```
Public Class AssemblyLoadEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New(

        ByVal loadedAssembly As System.Reflection.Assembly)

' Public Instance Properties

   Public ReadOnly Property LoadedAssembly As Assembly

End Class
```

### Hierarchy

`Object` → `EventArgs` → `AssemblyLoadEventArgs`

### Passed To

`AssemblyLoadEventHandler.{BeginInvoke(), Invoke()}`

# AssemblyLoadEventHandler Delegate

## System (mscorlib.dll) *ECMA, serializable*

This delegate represents the event-handler method for the `AppDomain.AssemblyLoad` event.

```
Public Delegate Sub AssemblyLoadEventHandler(
        ByVal sender As Object,
        ByVal args As AssemblyLoadEventArgs)
```

### Associated Events

`AppDomain.AssemblyLoad()`

## AsyncCallback Delegate

## System (mscorlib.dll) *ECMA, serializable*

This delegate type is used as part of asynchronous operations on delegates in general. Delegates can be executed in an asynchronous fashion, using a random thread out of the system-managed thread pool. Frequently, however, programmers desire notification of the asynchronously executing delegate's completion, and the `AsyncCallback` is used to achieve that.

Using an `AsyncCallback` is fairly straightforward. At the asynchronous delegate's invocation, pass in an instance of this delegate (referring to a void-returning `IAsyncResult`-accepting method) as part of the `BeginInvoke()` call. When the asynchronously executing delegate has finished execution, the method on the other end of the `AsyncCallback` is invoked, with an `IAsyncResult` object as the sole parameter. (This `IAsyncResult` object contains the output parameters from the delegate's call: the return value, along with any `out` or `ref` parameters declared as part of the method's signature.)

```
Public Delegate Sub AsyncCallback(ByVal ar As IAsyncResult)
```

### Passed To

Multiple types

## Attribute — MustInherit Class

### System (mscorlib.dll) — *ECMA, serializable*

This is the base class for all custom attributes. Attributes are the .NET programmer's means of inserting additional metadata into a type's definition. For example, the .NET Serialization mechanism uses an attribute to indicate which fields in a type should not be serialized (see the `System.Reflection.FieldAttributes.NotSerialized` enumeration value). .NET programmers are free to create their own attributes (called *custom attributes*, although from a certain perspective all attributes are inherently custom) by creating a new type that claims `Attribute` as its base class type.

By themselves, attributes offer no modification to a type's behavioral semantics; that is, attributes don't modify the type's methods or execution in any way. In fact, attribute instances aren't even created until they are retrieved out of the type's metadata via the Reflection APIs. The entire purpose of an attribute is to act as a marker inside the type's metadata for consumption by some other API, library, or facility. For example, the Serialization APIs in the .NET Framework Class Library use the `Serializable` attribute to indicate which types are serializable. However, by themselves, the attributes carry no code to perform the actual act of serialization. This must be done by passing the instance of the type into instances of the Serialization classes, in which the attribute is retrieved, examined, and "appropriate" action is taken.

Attributes can be attached to any metadata component in the .NET system. This means fields, methods, properties, events, types (classes and value types), assemblies, modules, and more can all be the target of attribute declarations. (An attribute indicates which types it is restricted to by using the `AttributeTargets` enumeration.)

The base `Attribute` class provides helper functions for testing custom attributes, including the `IsDefined()` method, which examines a code element and indicates whether its metadata is decorated with a specified type of attribute. To use this method, you must provide the element using the appropriate reflection type (e.g., `System.Reflection.Assembly` or `System.Reflection.ParameterInfo`). You can also use the `GetCustomAttribute()` method to get a reference to an attribute of a specified type, or the `GetCustomAttributes()` to get an array that contains all matching attributes. When applied to a class or class member, these methods consider all ancestors. To disable this default behavior, use one of the overloaded methods that allows you to supply the `inherit` parameter, and set it to `false`.

Custom attributes should override the `TypeId` property so that it supplies a user-defined identifier that uniquely describes the instance of this attribute on the type. This is entirely because more than one instance of an attribute can be associated with any particular metadata-token (field, type, parameter, and so on) instance.

```
Public MustInherit Class Attribute

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Overridable Public ReadOnly Property TypeId As Object

' Public Shared Methods

   Public Shared Function GetCustomAttribute(
```

```
    ByVal element As System.Reflection.Assembly,
    ByVal attributeType As Type) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.Assembly,
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.MemberInfo,
    ByVal attributeType As Type) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.MemberInfo,
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.Module,
    ByVal attributeType As Type) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.Module,
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.ParameterInfo,
    ByVal attributeType As Type) As Attribute
Public Shared Function GetCustomAttribute(
    ByVal element As System.Reflection.ParameterInfo,
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Attribute
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Assembly) As Attribute()
Public Shared Function GetCustomAttributes(
```

```
    ByVal element As System.Reflection.Assembly,
    ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Assembly,
    ByVal attributeType As Type) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Assembly,
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.MemberInfo) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.MemberInfo,
    ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.MemberInfo,
    ByVal type As Type) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.MemberInfo,
    ByVal type As Type,
    ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Module) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Module,
    ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
    ByVal element As System.Reflection.Module,
    ByVal attributeType As Type) As Attribute()
Public Shared Function GetCustomAttributes(
```

```
        ByVal element As System.Reflection.Module,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
        ByVal element As System.Reflection.ParameterInfo) As Attribute()
Public Shared Function GetCustomAttributes(
        ByVal element As System.Reflection.ParameterInfo,
        ByVal inherit As Boolean) As Attribute()
Public Shared Function GetCustomAttributes(
        ByVal element As System.Reflection.ParameterInfo,
        ByVal attributeType As Type) As Attribute()
Public Shared Function GetCustomAttributes(
        ByVal element As System.Reflection.ParameterInfo,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Attribute()
Public Shared Function IsDefined(
        ByVal element As System.Reflection.Assembly,
        ByVal attributeType As Type) As Boolean
Public Shared Function IsDefined(
        ByVal element As System.Reflection.Assembly,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
Public Shared Function IsDefined(
        ByVal element As System.Reflection.MemberInfo,
        ByVal attributeType As Type) As Boolean
Public Shared Function IsDefined(
        ByVal element As System.Reflection.MemberInfo,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
Public Shared Function IsDefined(
```

```
        ByVal element As System.Reflection.Module,
        ByVal attributeType As Type) As Boolean
   Public Shared Function IsDefined(
        ByVal element As System.Reflection.Module,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
   Public Shared Function IsDefined(
        ByVal element As System.Reflection.ParameterInfo,
        ByVal attributeType As Type) As Boolean
   Public Shared Function IsDefined(
        ByVal element As System.Reflection.ParameterInfo,
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overridable Public Function IsDefaultAttribute(
        ) As Boolean
   Overridable Public Function Match(
        ByVal obj As Object) As Boolean
End Class
```

### Subclasses

Multiple types

### Valid On

All

## AttributeTargets Enum

## System (mscorlib.dll) *ECMA, serializable, flag*

This enumeration is used to set the `AttributeUsageAttribute.ValidOn` property when creating a custom attribute. It allows you to specify the code elements for which a custom attribute can be used. You can use a bitwise combination of these values to specify multiple elements.

Using this attribute is the only means by which a custom attribute can declare a restriction of its usage against various metadata types. For example, when using the `System.Reflection.AssemblyKeyFileAttribute` attribute, which simply tells the compiler which public/private keyfile to use to sign the assembly, it makes no sense to apply to any other metadata type besides the assembly. Therefore, the `AssemblyKeyFileAttribute` attribute has an `AttributeUsageAttribute` (see the `AttributeUsageAttribute` entry) declared on it with the value `Assembly`. As a result, any attempt to use the `AssemblyKeyFileAttribute` attribute on anything other than an assembly results in a compilation error.

```
Public Enum AttributeTargets

   Assembly = &H000000001

   Module = &H000000002

   Class = &H000000004

   Struct = &H000000008

   Enum = &H000000010

   Constructor = &H000000020

   Method = &H000000040

   Property = &H000000080

   Field = &H000000100

   Event = &H000000200

   Interface = &H000000400

   Parameter = &H000000800

   Delegate = &H000001000

   ReturnValue = &H000002000

   All = &H000003FFF

End Enum
```

### Hierarchy

Object → ValueType → Enum(IComparable, IFormattable, IConvertible) → AttributeTargets

### Returned By

AttributeUsageAttribute.ValidOn

### Passed To

AttributeUsageAttribute.AttributeUsageAttribute()

## AttributeUsageAttribute NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This attribute is used when developing a custom attribute class. It allows you to specify how your custom attribute must be used. The `ValidOn` property uses a bitwise combination of values from `AttributeTargets` to specify the code elements that can use your custom attribute. It's read-only and must be initialized using the constructor, as in `(AttributeUsage(AttributeTargets.Field | AttributeTargets.Property))`.

The `AllowMultiple` property specifies whether the attribute can be used more than once for the same element. The `Inherited` attribute specifies whether your custom attribute will be applied to derived classes and overridden members. These are indicated using the usual *named parameter* syntax supported by attributes, as in `(AttributeUsage(Inherited = true, AllowMultiple = true))`

```
Public NotInheritable Class AttributeUsageAttribute : Inherits Attribute
' Public Constructors
   Public Sub New( ByVal validOn As AttributeTargets)
' Public Instance Properties
   Public Property AllowMultiple As Boolean
   Public Property Inherited As Boolean
   Public ReadOnly Property ValidOn As AttributeTargets
End Class
```

### Hierarchy

`Object` → `Attribute` → `AttributeUsageAttribute`

### Valid On

Class

## BadImageFormatException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception occurs when .NET tries to load a DLL or executable that is either corrupt or invalid for the platform on which you are running.

```
Public Class BadImageFormatException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

   Public Sub New(ByVal message As String,

        ByVal fileName As String)

   Public Sub New(ByVal message As String,

        ByVal fileName As String, ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Public ReadOnly Property FileName As String

   Public ReadOnly Property FusionLog As String

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

   Overrides Public Function ToString() As String

End Class
```

## Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → BadImageFormatException

## BitConverter NotInheritable Class

## System (mscorlib.dll)

This class provides shared methods that can be used to convert portions of a byte array to simple value types. It also contains the overloaded `GetBytes()` method, which converts simple data types to byte arrays. These functions can be useful for creating custom reader and writer classes. For example, a typical writer class might take specific data, convert it to a byte array, then pass the byte array to some type of stream object.

```
Public NotInheritable Class BitConverter
' Public Shared Fields
   Public Shared ReadOnly IsLittleEndian As Boolean                // =True
' Public Shared Methods
   Public Shared Function DoubleToInt64Bits(
        ByVal value As Double) As Long
   Public Shared Function GetBytes(
        ByVal value As Boolean) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Char) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Double) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Short) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Integer) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Long) As Byte()
   Public Shared Function GetBytes(
        ByVal value As Single) As Byte()
   Public Shared Function GetBytes(
        ByVal value As UInt16) As Byte()
   Public Shared Function GetBytes(
```

```
    ByVal value As UInt32) As Byte()
Public Shared Function GetBytes(
    ByVal value As UInt64) As Byte()
Public Shared Function Int64BitsToDouble(
    ByVal value As Long) As Double
Public Shared Function ToBoolean(ByVal value As Byte(),
    ByVal startIndex As Integer) As Boolean
Public Shared Function ToChar(ByVal value As Byte(),
    ByVal startIndex As Integer) As Char
Public Shared Function ToDouble(ByVal value As Byte(),
    ByVal startIndex As Integer) As Double
Public Shared Function ToInt16(ByVal value As Byte(),
    ByVal startIndex As Integer) As Short
Public Shared Function ToInt32(ByVal value As Byte(),
    ByVal startIndex As Integer) As Integer
Public Shared Function ToInt64(ByVal value As Byte(),
    ByVal startIndex As Integer) As Long
Public Shared Function ToSingle(ByVal value As Byte(),
    ByVal startIndex As Integer) As Single
Public Shared Function ToString(
    ByVal value As Byte()) As String
Public Shared Function ToString(ByVal value As Byte(),
    ByVal startIndex As Integer) As String
Public Shared Function ToString(ByVal value As Byte(),
    ByVal startIndex As Integer,
    ByVal length As Integer) As String
Public Shared Function ToUInt16(ByVal value As Byte(),
    ByVal startIndex As Integer) As UInt16
Public Shared Function ToUInt32(ByVal value As Byte(),
    ByVal startIndex As Integer) As UInt32
Public Shared Function ToUInt64(ByVal value As Byte(),
```

```
        ByVal startIndex As Integer) As UInt64

End Class
```

## Boolean Structure

## System (mscorlib.dll) *ECMA, serializable*

This is a simple value type that contains either `true` or `false`. When converting to or from a string with a string, the `TrueString` and `FalseString` fields are used (these return `True` and `False`). available in VB.NET through the `Boolean` alias.

```
Public Structure Boolean : Implements IComparable, IConvertible
' Public Shared Fields
   Public Shared ReadOnly FalseString As String                    // =Fals
   Public Shared ReadOnly TrueString As String                     // =True
' Public Shared Methods
   Public Shared Function Parse(
        ByVal value As String) As Boolean
' Public Instance Methods
   Public Function CompareTo(
        ByVal obj As Object) As Integer Implements IComparable.CompareTo
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
End Structure
```

### Hierarchy

`Object` → `ValueType` → `Boolean(IComparable, IConvertible)`

### Returned By

Multiple types

### Passed To

Multiple types



PREVIOUS NEXT

## Buffer NotInheritable Class

## System (mscorlib.dll)

The Buffer class provides shared methods used to manipulate a region of unmanaged memory as though it were an array of Bytes. Byte arrays are traditionally used in unmanaged code to represent blocks of contiguous memory. This class includes the ByteLength() method, which indicates the total number of bytes in an array, and the GetByte() and SetByte() methods, which allow you to retrieve or set a specific Byte object in an array by specifying a zero-based index. Additionally, the BlockCopy() method can be used to move contiguous groups of bytes from one position in a buffer to another.

Note that BlockCopy ignores types when conducting its byte-shuffling operations. If you use BlockCopy to insert an otherwise incompatible type into the buffer, the copy goes through, but unpredictable results will arise later when you try to work with the buffer as its original type. For example, if you use the BlockCopy method to insert an Int32 into an array of String objects, the copy goes through, but the next time the array is accessed, there is no longer a String reference. It is an Int32, and what the CLR will do at that point is undocumented.

```
Public NotInheritable Class Buffer

' Public Shared Methods

   Public Shared Sub BlockCopy(ByVal src As Array,

        ByVal srcOffset As Integer, ByVal dst As Array,

        ByVal dstOffset As Integer, ByVal count As Integer)

   Public Shared Function ByteLength(

        ByVal array As Array) As Integer

   Public Shared Function GetByte(ByVal array As Array,

        ByVal index As Integer) As Byte

   Public Shared Sub SetByte(ByVal array As Array,

        ByVal index As Integer, ByVal value As Byte)

End Class
```

## Byte Structure

## System (mscorlib.dll) *ECMA, serializable*

This simple value type represents an unsigned 8-bit integer that can vary in value from 0 to 255. Th
method converts a number in a string (such as `122`) into a `Byte` object. This type is available in VB
`Byte` alias.

```
Public Structure Byte : Implements IComparable, IFormattable, IConvertibl
' Public Shared Fields
   Public const MaxValue As Byte                                          // =255
   Public const MinValue As Byte                                          // =0
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As Byte
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As Byte
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As Byte
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As Byte
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
   Public Function ToString(ByVal format As String) As String
```

```
   Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → Byte(IComparable, IFormattable, IConvertible)

## Returned By

Multiple types

## Passed To

Multiple types

# CannotUnloadAppDomainException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception signals that an attempt to invoke `AppDomain.Unload()` failed. This indicates that you either tried to unload the default application domain (`AppDomain.CurrentDomain`), the domain has a thread that cannot be stopped, or the domain has already been unloaded.

```
Public Class CannotUnloadAppDomainException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `CannotUnloadAppDomainException`

## Char Structure

## System (mscorlib.dll) *ECMA, serializable*

This simple value type represents a 16-bit Unicode character (from hexadecimal 0x0000 to 0xFFFF
convert a character to upper- or lowercase and get its numeric representation using the methods of
You can also test if it is a number, letter, or symbol by using the methods prefixed with `Is`. For exac
use the `GetUnicodeCategory()` method to get an enumerated value from
`System.Globalization.UnicodeCategory`. This classifies the character into one of about thir

This type is aliased as `Char` in VB.NET. If you need an array of chars, use the `String` class.

```
Public Structure Char : Implements IComparable, IConvertible

' Public Shared Fields

   Public const MaxValue As Char                                          // =&H00

   Public const MinValue As Char                                          // =&H00

' Public Shared Methods

   Public Shared Function GetNumericValue(

        ByVal c As Char) As Double

   Public Shared Function GetNumericValue(ByVal s As String,

        ByVal index As Integer) As Double

   Public Shared Function GetUnicodeCategory(

        ByVal c As Char) As UnicodeCategory

   Public Shared Function GetUnicodeCategory(

        ByVal s As String,

        ByVal index As Integer) As UnicodeCategory

   Public Shared Function IsControl(

        ByVal c As Char) As Boolean

   Public Shared Function IsControl(ByVal s As String,

        ByVal index As Integer) As Boolean

   Public Shared Function IsDigit(ByVal c As Char) As Boolean

   Public Shared Function IsDigit(ByVal s As String,

        ByVal index As Integer) As Boolean

   Public Shared Function IsLetter(
```

```
        ByVal c As Char) As Boolean
Public Shared Function IsLetter(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsLetterOrDigit(
        ByVal c As Char) As Boolean
Public Shared Function IsLetterOrDigit(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsLower(ByVal c As Char) As Boolean
Public Shared Function IsLower(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsNumber(
        ByVal c As Char) As Boolean
Public Shared Function IsNumber(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsPunctuation(
        ByVal c As Char) As Boolean
Public Shared Function IsPunctuation(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsSeparator(
        ByVal c As Char) As Boolean
Public Shared Function IsSeparator(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsSurrogate(
        ByVal c As Char) As Boolean
Public Shared Function IsSurrogate(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsSymbol(
        ByVal c As Char) As Boolean
Public Shared Function IsSymbol(ByVal s As String,
        ByVal index As Integer) As Boolean
Public Shared Function IsUpper(ByVal c As Char) As Boolean
```

```
    Public Shared Function IsUpper(ByVal s As String,
         ByVal index As Integer) As Boolean
    Public Shared Function IsWhiteSpace(
         ByVal c As Char) As Boolean
    Public Shared Function IsWhiteSpace(ByVal s As String,
         ByVal index As Integer) As Boolean
    Public Shared Function Parse( ByVal s As String) As Char
    Public Shared Function ToLower( ByVal c As Char) As Char
    Public Shared Function ToLower(ByVal c As Char,
         ByVal culture As System.Globalization.CultureInfo) As Char
    Public Shared Function ToString(ByVal c As Char) As String
    Public Shared Function ToUpper( ByVal c As Char) As Char
    Public Shared Function ToUpper(ByVal c As Char,
         ByVal culture As System.Globalization.CultureInfo) As Char
' Public Instance Methods
    Public Function CompareTo(
         ByVal value As Object) As Integer Implements IComparable.CompareT
    Overrides Public Function Equals(
         ByVal obj As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetTypeCode(
         ) As TypeCode Implements IConvertible.GetTypeCode
    Overrides Public Function ToString() As String
    Public Function ToString(
         ByVal provider As IFormatProvider) As String Implements IConverti
End Structure
```

## Hierarchy

Object → ValueType → Char(IComparable, IConvertible)

## Returned By

Multiple types

### Passed To

Multiple types

## CharEnumerator NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This class allows you to access and iterate through individual chars in an array. You can manually r a `CharEnumerator` from a `String` object using the `String.GetEnumerator()` method and the using the `MoveNext()` method to step through the string. However, VB.NET provides built-in supp the convenient `For Each` construct, which uses a `CharEnumerator` transparently.

By convention, a `CharEnumerator` starts just before the first character. When using a `CharEnume` manually, you need to call the `MoveNext()` method before you can access the first character.

```
Public NotInheritable Class CharEnumerator : Implements IEnumerator, IClo

' Public Instance Properties

   Public ReadOnly Property Current As Char

' Public Instance Methods

   Public Function Clone(

        ) As Object Implements ICloneable.Clone

   Public Function MoveNext(

        ) As Boolean Implements IEnumerator.MoveNext

   Public Sub Reset() Implements IEnumerator.Reset

End Class
```

### Returned By

`String.GetEnumerator()`

## CLSCompliantAttribute NotInheritable Class

**System (mscorlib.dll)** ***ECMA, serializable***

This attribute indicates that a program element is compliant with the CLS. If you use non-CLS compliant classes (such as `UInt32`) in a class marked as compliant, the compiler generates a compliance warning.

By default, types without this attribute are not CLS-compliant unless they are contained in a CLS-compliant type or assembly. You can specifically mark non-CLS compliant members inside a CLS-compliant type using `<CLSCompliant(False)>`.

```
Public NotInheritable Class CLSCompliantAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal isCompliant As Boolean)

' Public Instance Properties

   Public ReadOnly Property IsCompliant As Boolean

End Class
```

### Hierarchy

`Object` → `Attribute` → `CLSCompliantAttribute`

### Valid On

All

## Console NotInheritable Class

## System (mscorlib.dll) *ECMA*

The `Console` class provides shared methods that allow you to create console, or command-line, applications. If you attempt to use these methods in a Windows Forms application, they are ignored. For a console application, data is transmitted through three streams. Input is received from the *standard input stream*, output is written through the *standard output stream*, and error data is written to the *standard error output stream*. These streams are provided through the `In` property, which is a `System.IO.TextReader` object, and through the `Out` and `Error` properties, which are `System.IO.TextWriter` objects. You can use the methods of these objects directly, or you can use the methods provided by the `Console` class. For example, you can use the `Write()` method to write any basic data type to the console window (or use `WriteLine()` to write data with a trailing hard return). You can also use the `ReadLine()` method to cause the console window to wait for input. When the user presses the Enter key, this method returns with a string containing the input characters (except the final hard return).

You can use the `SetIn()`, `SetOut()`, and `SetError()` methods to bind the console to different stream objects, such as `System.IO.FileStream`. To reset the streams to their default objects, use the methods prefixed with `OpenStandard. . ..`

```
Public NotInheritable Class Console

' Public Shared Properties

   Public Shared ReadOnly Property Error As TextWriter

   Public Shared ReadOnly Property In As TextReader

   Public Shared ReadOnly Property Out As TextWriter

' Public Shared Methods

   Public Shared Function OpenStandardError() As Stream

   Public Shared Function OpenStandardError(

        ByVal bufferSize As Integer) As Stream

   Public Shared Function OpenStandardInput() As Stream

   Public Shared Function OpenStandardInput(

        ByVal bufferSize As Integer) As Stream

   Public Shared Function OpenStandardOutput() As Stream

   Public Shared Function OpenStandardOutput(

        ByVal bufferSize As Integer) As Stream

   Public Shared Function Read() As Integer

   Public Shared Function ReadLine() As String

   Public Shared Sub SetError(
```

```
    ByVal newError As System.IO.TextWriter)
Public Shared Sub SetIn(
    ByVal newIn As System.IO.TextReader)
Public Shared Sub SetOut(
    ByVal newOut As System.IO.TextWriter)
Public Shared Sub Write( ByVal value As Boolean)
Public Shared Sub Write( ByVal value As Char)
Public Shared Sub Write( ByVal buffer As Char())
Public Shared Sub Write(ByVal buffer As Char(),
    ByVal index As Integer, ByVal count As Integer)
Public Shared Sub Write( ByVal value As Decimal)
Public Shared Sub Write( ByVal value As Double)
Public Shared Sub Write( ByVal value As Integer)
Public Shared Sub Write( ByVal value As Long)
Public Shared Sub Write( ByVal value As Object)
Public Shared Sub Write( ByVal value As Single)
Public Shared Sub Write( ByVal value As String)
Public Shared Sub Write(ByVal format As String,
    ByVal arg0 As Object)
Public Shared Sub Write(ByVal format As String,
    ParamArray arg As Object())
Public Shared Sub Write(ByVal format As String,
    ByVal arg0 As Object, ByVal arg1 As Object)
Public Shared Sub Write(ByVal format As String,
    ByVal arg0 As Object, ByVal arg1 As Object,
    ByVal arg2 As Object)
Public Shared Sub Write(ByVal format As String,
    ByVal arg0 As Object, ByVal arg1 As Object,
    ByVal arg2 As Object, ByVal arg3 As Object)
Public Shared Sub Write( ByVal value As UInt32)
Public Shared Sub Write( ByVal value As UInt64)
```

```
    Public Shared Sub WriteLine()
    Public Shared Sub WriteLine( ByVal value As Boolean)
    Public Shared Sub WriteLine( ByVal value As Char)
    Public Shared Sub WriteLine( ByVal buffer As Char())
    Public Shared Sub WriteLine(ByVal buffer As Char(),
         ByVal index As Integer, ByVal count As Integer)
    Public Shared Sub WriteLine( ByVal value As Decimal)
    Public Shared Sub WriteLine( ByVal value As Double)
    Public Shared Sub WriteLine( ByVal value As Integer)
    Public Shared Sub WriteLine( ByVal value As Long)
    Public Shared Sub WriteLine( ByVal value As Object)
    Public Shared Sub WriteLine( ByVal value As Single)
    Public Shared Sub WriteLine( ByVal value As String)
    Public Shared Sub WriteLine(ByVal format As String,
         ByVal arg0 As Object)
    Public Shared Sub WriteLine(ByVal format As String,
         ParamArray arg As Object())
    Public Shared Sub WriteLine(ByVal format As String,
         ByVal arg0 As Object, ByVal arg1 As Object)
    Public Shared Sub WriteLine(ByVal format As String,
         ByVal arg0 As Object, ByVal arg1 As Object,
         ByVal arg2 As Object)
    Public Shared Sub WriteLine(ByVal format As String,
         ByVal arg0 As Object, ByVal arg1 As Object,
         ByVal arg2 As Object, ByVal arg3 As Object)
    Public Shared Sub WriteLine( ByVal value As UInt32)
    Public Shared Sub WriteLine( ByVal value As UInt64)
End Class
```

# ContextBoundObject MustInherit Class

**System (mscorlib.dll)** ***serializable, marshal by reference, context bound***

An object inheriting from ContextBoundObject shares characteristics with an object inheriting from MarshalByRefObject. The difference is that a context further subdivides a domain. While instances of MarshalByRefObject are passed to other domains by reference and must interact through proxy objects, instances of ContextBoundObject are passed by reference to other contexts, even in the same domain. Unlike domains, contexts can provide a rich environment with other services such as synchronization, transactions, just-in-time activation, and security.

For more information, consult the System.Runtime.Remoting.Contexts namespace.

```
Public MustInherit Class ContextBoundObject : Inherits MarshalByRefObject

' Protected Constructors

   Protected Sub New()

End Class
```

## Hierarchy

Object → MarshalByRefObject → ContextBoundObject

# ContextMarshalException Class

## System (mscorlib.dll) *serializable*

This exception is thrown when a marshaler fails to move an object across a context boundary. This is usually the case if a nonserializable object is passed as a parameter to a cross-context call, such as an instance of the `CrossAppDomainDelegate`.

```
Public Class ContextMarshalException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ContextMarshalException

# ContextStaticAttribute Class

## System (mscorlib.dll) *serializable*

This attribute designates that a shared field should not be shared between contexts. Each context accesses a separate copy of this field and is able to set and retrieve values without accidentally overwriting data set by another context. Just as thread-local storage is used to store data in a per-thread fashion, this is used to store shared data in a per-context fashion.

```
Public Class ContextStaticAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object → Attribute → ContextStaticAttribute`

### Valid On

Field

## Convert NotInheritable Class

### System (mscorlib.dll) *ECMA*

This class provides shared helper methods that convert base data types to other base data types. You can also convert objects to base data types, provided they implement the `IConvertible` interface and cast objects to different types with the `ChangeType()` method.

CLR languages typically allow widening conversions (e.g., `Int16` to `Int32`) through direct assignment. Narrowing conversions require the `Convert` class or explicit casting. The `Convert` class does not generate an exception when you lose numeric precision, but it does throw an overflow exception if the source value is too large for the destination data type.

Note that implicit and explicit conversions can return different results than the `Convert` class. Namely, they truncate significant digits in a narrowing conversion (for example, changing 32.6 to the integer 32), while the `Convert` class rounds the number automatically (converting 32.6 to 33). The `Convert` class uses banker's rounding, meaning that the fraction 1/2 is rounded down for even numbers (so 4.5 becomes 4) and rounded up for odd numbers (so 5.5 becomes 6). This helps combat rounding bias.

The `ToString()` methods are functionally equivalent to the `Object.ToString()` method of the corresponding base data types. The conversions from strings to numeric or date data are functionally equivalent to the `Parse()` method of the appropriate data type (e.g., `Int32.Parse()`). For string conversions, you can also supply an `IFormatProvider` object to specify culture-specific formatting information used to interpret or encode a string.

For Boolean conversions, any nonzero number becomes `true`, except for strings, which are compared against the `Boolean.TrueString` and `Boolean.FalseString` fields. When converted to a number, a Boolean `false` becomes a 0, and a Boolean `true` becomes a 1.

Some conversion methods are provided only for symmetry and always throw an `InvalidCastException`. These include any conversion between date and any data type other than string.

```
Public NotInheritable Class Convert

' Public Shared Fields

   Public Shared ReadOnly DBNull As Object

' Public Shared Methods

   Public Shared Function ChangeType(ByVal value As Object,
        ByVal conversionType As Type) As Object
   Public Shared Function ChangeType(ByVal value As Object,
        ByVal typeCode As TypeCode) As Object
   Public Shared Function ChangeType(ByVal value As Object,
```

```
      ByVal typeCode As TypeCode,
      ByVal provider As IFormatProvider) As Object
Public Shared Function ChangeType(ByVal value As Object,
      ByVal conversionType As Type,
      ByVal provider As IFormatProvider) As Object
Public Shared Function FromBase64CharArray(
      ByVal inArray As Char(), ByVal offset As Integer,
      ByVal length As Integer) As Byte()
Public Shared Function FromBase64String(
      ByVal s As String) As Byte()
Public Shared Function GetTypeCode(
      ByVal value As Object) As TypeCode
Public Shared Function IsDBNull(
      ByVal value As Object) As Boolean
Public Shared Function ToBase64CharArray(
      ByVal inArray As Byte(), ByVal offsetIn As Integer,
      ByVal length As Integer, ByVal outArray As Char(),
      ByVal offsetOut As Integer) As Integer
Public Shared Function ToBase64String(
      ByVal inArray As Byte()) As String
Public Shared Function ToBase64String(
      ByVal inArray As Byte(), ByVal offset As Integer,
      ByVal length As Integer) As String
Public Shared Function ToBoolean(
      ByVal value As Boolean) As Boolean
Public Shared Function ToBoolean(
      ByVal value As Byte) As Boolean
Public Shared Function ToBoolean(
      ByVal value As Char) As Boolean
Public Shared Function ToBoolean(
```

```
     ByVal value As Date) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Decimal) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Double) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Short) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Integer) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Long) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Object) As Boolean
Public Shared Function ToBoolean(ByVal value As Object,
     ByVal provider As IFormatProvider) As Boolean
Public Shared Function ToBoolean(
     ByVal value As SByte) As Boolean
Public Shared Function ToBoolean(
     ByVal value As Single) As Boolean
Public Shared Function ToBoolean(
     ByVal value As String) As Boolean
Public Shared Function ToBoolean(ByVal value As String,
     ByVal provider As IFormatProvider) As Boolean
Public Shared Function ToBoolean(
     ByVal value As UInt16) As Boolean
Public Shared Function ToBoolean(
     ByVal value As UInt32) As Boolean
Public Shared Function ToBoolean(
     ByVal value As UInt64) As Boolean
Public Shared Function ToByte(
```

```
    ByVal value As Boolean) As Byte
Public Shared Function ToByte(ByVal value As Byte) As Byte
Public Shared Function ToByte(ByVal value As Char) As Byte
Public Shared Function ToByte(ByVal value As Date) As Byte
Public Shared Function ToByte(
    ByVal value As Decimal) As Byte
Public Shared Function ToByte(
    ByVal value As Double) As Byte
Public Shared Function ToByte(
    ByVal value As Short) As Byte
Public Shared Function ToByte(
    ByVal value As Integer) As Byte
Public Shared Function ToByte(ByVal value As Long) As Byte
Public Shared Function ToByte(
    ByVal value As Object) As Byte
Public Shared Function ToByte(ByVal value As Object,
    ByVal provider As IFormatProvider) As Byte
Public Shared Function ToByte(
    ByVal value As SByte) As Byte
Public Shared Function ToByte(
    ByVal value As Single) As Byte
Public Shared Function ToByte(
    ByVal value As String) As Byte
Public Shared Function ToByte(ByVal value As String,
    ByVal provider As IFormatProvider) As Byte
Public Shared Function ToByte(ByVal value As String,
    ByVal fromBase As Integer) As Byte
Public Shared Function ToByte(
    ByVal value As UInt16) As Byte
Public Shared Function ToByte(
```

```
     ByVal value As UInt32) As Byte
Public Shared Function ToByte(
     ByVal value As UInt64) As Byte
Public Shared Function ToChar(
     ByVal value As Boolean) As Char
Public Shared Function ToChar(ByVal value As Byte) As Char
Public Shared Function ToChar(ByVal value As Char) As Char
Public Shared Function ToChar(ByVal value As Date) As Char
Public Shared Function ToChar(
     ByVal value As Decimal) As Char
Public Shared Function ToChar(
     ByVal value As Double) As Char
Public Shared Function ToChar(
     ByVal value As Short) As Char
Public Shared Function ToChar(
     ByVal value As Integer) As Char
Public Shared Function ToChar(ByVal value As Long) As Char
Public Shared Function ToChar(
     ByVal value As Object) As Char
Public Shared Function ToChar(ByVal value As Object,
     ByVal provider As IFormatProvider) As Char
Public Shared Function ToChar(
     ByVal value As SByte) As Char
Public Shared Function ToChar(
     ByVal value As Single) As Char
Public Shared Function ToChar(
     ByVal value As String) As Char
Public Shared Function ToChar(ByVal value As String,
     ByVal provider As IFormatProvider) As Char
Public Shared Function ToChar(
```

```
    ByVal value As UInt16) As Char
Public Shared Function ToChar(
    ByVal value As UInt32) As Char
Public Shared Function ToChar(
    ByVal value As UInt64) As Char
Public Shared Function ToDateTime(
    ByVal value As Boolean) As Date
Public Shared Function ToDateTime(
    ByVal value As Byte) As Date
Public Shared Function ToDateTime(
    ByVal value As Char) As Date
Public Shared Function ToDateTime(
    ByVal value As Date) As Date
Public Shared Function ToDateTime(
    ByVal value As Decimal) As Date
Public Shared Function ToDateTime(
    ByVal value As Double) As Date
Public Shared Function ToDateTime(
    ByVal value As Short) As Date
Public Shared Function ToDateTime(
    ByVal value As Integer) As Date
Public Shared Function ToDateTime(
    ByVal value As Long) As Date
Public Shared Function ToDateTime(
    ByVal value As Object) As Date
Public Shared Function ToDateTime(ByVal value As Object,
    ByVal provider As IFormatProvider) As Date
Public Shared Function ToDateTime(
    ByVal value As SByte) As Date
Public Shared Function ToDateTime(
```

```
    ByVal value As Single) As Date
Public Shared Function ToDateTime(
    ByVal value As String) As Date
Public Shared Function ToDateTime(ByVal value As String,
    ByVal provider As IFormatProvider) As Date
Public Shared Function ToDateTime(
    ByVal value As UInt16) As Date
Public Shared Function ToDateTime(
    ByVal value As UInt32) As Date
Public Shared Function ToDateTime(
    ByVal value As UInt64) As Date
Public Shared Function ToDecimal(
    ByVal value As Boolean) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Byte) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Char) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Date) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Decimal) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Double) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Short) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Integer) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Long) As Decimal
Public Shared Function ToDecimal(
```

```
    ByVal value As Object) As Decimal
Public Shared Function ToDecimal(ByVal value As Object,
    ByVal provider As IFormatProvider) As Decimal
Public Shared Function ToDecimal(
    ByVal value As SByte) As Decimal
Public Shared Function ToDecimal(
    ByVal value As Single) As Decimal
Public Shared Function ToDecimal(
    ByVal value As String) As Decimal
Public Shared Function ToDecimal(ByVal value As String,
    ByVal provider As IFormatProvider) As Decimal
Public Shared Function ToDecimal(
    ByVal value As UInt16) As Decimal
Public Shared Function ToDecimal(
    ByVal value As UInt32) As Decimal
Public Shared Function ToDecimal(
    ByVal value As UInt64) As Decimal
Public Shared Function ToDouble(
    ByVal value As Boolean) As Double
Public Shared Function ToDouble(
    ByVal value As Byte) As Double
Public Shared Function ToDouble(
    ByVal value As Char) As Double
Public Shared Function ToDouble(
    ByVal value As Date) As Double
Public Shared Function ToDouble(
    ByVal value As Decimal) As Double
Public Shared Function ToDouble(
    ByVal value As Double) As Double
Public Shared Function ToDouble(
```

```
    ByVal value As Short) As Double
Public Shared Function ToDouble(
    ByVal value As Integer) As Double
Public Shared Function ToDouble(
    ByVal value As Long) As Double
Public Shared Function ToDouble(
    ByVal value As Object) As Double
Public Shared Function ToDouble(ByVal value As Object,
    ByVal provider As IFormatProvider) As Double
Public Shared Function ToDouble(
    ByVal value As SByte) As Double
Public Shared Function ToDouble(
    ByVal value As Single) As Double
Public Shared Function ToDouble(
    ByVal value As String) As Double
Public Shared Function ToDouble(ByVal value As String,
    ByVal provider As IFormatProvider) As Double
Public Shared Function ToDouble(
    ByVal value As UInt16) As Double
Public Shared Function ToDouble(
    ByVal value As UInt32) As Double
Public Shared Function ToDouble(
    ByVal value As UInt64) As Double
Public Shared Function ToInt16(
    ByVal value As Boolean) As Short
Public Shared Function ToInt16(
    ByVal value As Byte) As Short
Public Shared Function ToInt16(
    ByVal value As Char) As Short
Public Shared Function ToInt16(
```

```
     ByVal value As Date) As Short
Public Shared Function ToInt16(
     ByVal value As Decimal) As Short
Public Shared Function ToInt16(
     ByVal value As Double) As Short
Public Shared Function ToInt16(
     ByVal value As Short) As Short
Public Shared Function ToInt16(
     ByVal value As Integer) As Short
Public Shared Function ToInt16(
     ByVal value As Long) As Short
Public Shared Function ToInt16(
     ByVal value As Object) As Short
Public Shared Function ToInt16(ByVal value As Object,
     ByVal provider As IFormatProvider) As Short
Public Shared Function ToInt16(
     ByVal value As SByte) As Short
Public Shared Function ToInt16(
     ByVal value As Single) As Short
Public Shared Function ToInt16(
     ByVal value As String) As Short
Public Shared Function ToInt16(ByVal value As String,
     ByVal provider As IFormatProvider) As Short
Public Shared Function ToInt16(ByVal value As String,
     ByVal fromBase As Integer) As Short
Public Shared Function ToInt16(
     ByVal value As UInt16) As Short
Public Shared Function ToInt16(
     ByVal value As UInt32) As Short
Public Shared Function ToInt16(
```

```
     ByVal value As UInt64) As Short
Public Shared Function ToInt32(
     ByVal value As Boolean) As Integer
Public Shared Function ToInt32(
     ByVal value As Byte) As Integer
Public Shared Function ToInt32(
     ByVal value As Char) As Integer
Public Shared Function ToInt32(
     ByVal value As Date) As Integer
Public Shared Function ToInt32(
     ByVal value As Decimal) As Integer
Public Shared Function ToInt32(
     ByVal value As Double) As Integer
Public Shared Function ToInt32(
     ByVal value As Short) As Integer
Public Shared Function ToInt32(
     ByVal value As Integer) As Integer
Public Shared Function ToInt32(
     ByVal value As Long) As Integer
Public Shared Function ToInt32(
     ByVal value As Object) As Integer
Public Shared Function ToInt32(ByVal value As Object,
     ByVal provider As IFormatProvider) As Integer
Public Shared Function ToInt32(
     ByVal value As SByte) As Integer
Public Shared Function ToInt32(
     ByVal value As Single) As Integer
Public Shared Function ToInt32(
     ByVal value As String) As Integer
Public Shared Function ToInt32(ByVal value As String,
```

```
    ByVal provider As IFormatProvider) As Integer
Public Shared Function ToInt32(ByVal value As String,
    ByVal fromBase As Integer) As Integer
Public Shared Function ToInt32(
    ByVal value As UInt16) As Integer
Public Shared Function ToInt32(
    ByVal value As UInt32) As Integer
Public Shared Function ToInt32(
    ByVal value As UInt64) As Integer
Public Shared Function ToInt64(
    ByVal value As Boolean) As Long
Public Shared Function ToInt64(
    ByVal value As Byte) As Long
Public Shared Function ToInt64(
    ByVal value As Char) As Long
Public Shared Function ToInt64(
    ByVal value As Date) As Long
Public Shared Function ToInt64(
    ByVal value As Decimal) As Long
Public Shared Function ToInt64(
    ByVal value As Double) As Long
Public Shared Function ToInt64(
    ByVal value As Short) As Long
Public Shared Function ToInt64(
    ByVal value As Integer) As Long
Public Shared Function ToInt64(
    ByVal value As Long) As Long
Public Shared Function ToInt64(
    ByVal value As Object) As Long
Public Shared Function ToInt64(ByVal value As Object,
```

```
     ByVal provider As IFormatProvider) As Long
Public Shared Function ToInt64(
     ByVal value As SByte) As Long
Public Shared Function ToInt64(
     ByVal value As Single) As Long
Public Shared Function ToInt64(
     ByVal value As String) As Long
Public Shared Function ToInt64(ByVal value As String,
     ByVal provider As IFormatProvider) As Long
Public Shared Function ToInt64(ByVal value As String,
     ByVal fromBase As Integer) As Long
Public Shared Function ToInt64(
     ByVal value As UInt16) As Long
Public Shared Function ToInt64(
     ByVal value As UInt32) As Long
Public Shared Function ToInt64(
     ByVal value As UInt64) As Long
Public Shared Function ToSByte(
     ByVal value As Boolean) As SByte
Public Shared Function ToSByte(
     ByVal value As Byte) As SByte
Public Shared Function ToSByte(
     ByVal value As Char) As SByte
Public Shared Function ToSByte(
     ByVal value As Date) As SByte
Public Shared Function ToSByte(
     ByVal value As Decimal) As SByte
Public Shared Function ToSByte(
     ByVal value As Double) As SByte
Public Shared Function ToSByte(
```

```
    ByVal value As Short) As SByte
Public Shared Function ToSByte(
    ByVal value As Integer) As SByte
Public Shared Function ToSByte(
    ByVal value As Long) As SByte
Public Shared Function ToSByte(
    ByVal value As Object) As SByte
Public Shared Function ToSByte(ByVal value As Object,
    ByVal provider As IFormatProvider) As SByte
Public Shared Function ToSByte(
    ByVal value As SByte) As SByte
Public Shared Function ToSByte(
    ByVal value As Single) As SByte
Public Shared Function ToSByte(
    ByVal value As String) As SByte
Public Shared Function ToSByte(ByVal value As String,
    ByVal provider As IFormatProvider) As SByte
Public Shared Function ToSByte(ByVal value As String,
    ByVal fromBase As Integer) As SByte
Public Shared Function ToSByte(
    ByVal value As UInt16) As SByte
Public Shared Function ToSByte(
    ByVal value As UInt32) As SByte
Public Shared Function ToSByte(
    ByVal value As UInt64) As SByte
Public Shared Function ToSingle(
    ByVal value As Boolean) As Single
Public Shared Function ToSingle(
    ByVal value As Byte) As Single
Public Shared Function ToSingle(
```

```
    ByVal value As Char) As Single
Public Shared Function ToSingle(
    ByVal value As Date) As Single
Public Shared Function ToSingle(
    ByVal value As Decimal) As Single
Public Shared Function ToSingle(
    ByVal value As Double) As Single
Public Shared Function ToSingle(
    ByVal value As Short) As Single
Public Shared Function ToSingle(
    ByVal value As Integer) As Single
Public Shared Function ToSingle(
    ByVal value As Long) As Single
Public Shared Function ToSingle(
    ByVal value As Object) As Single
Public Shared Function ToSingle(ByVal value As Object,
    ByVal provider As IFormatProvider) As Single
Public Shared Function ToSingle(
    ByVal value As SByte) As Single
Public Shared Function ToSingle(
    ByVal value As Single) As Single
Public Shared Function ToSingle(
    ByVal value As String) As Single
Public Shared Function ToSingle(ByVal value As String,
    ByVal provider As IFormatProvider) As Single
Public Shared Function ToSingle(
    ByVal value As UInt16) As Single
Public Shared Function ToSingle(
    ByVal value As UInt32) As Single
Public Shared Function ToSingle(
```

```
    ByVal value As UInt64) As Single
Public Shared Function ToString(
    ByVal value As Boolean) As String
Public Shared Function ToString(ByVal value As Boolean,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Byte) As String
Public Shared Function ToString(ByVal value As Byte,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(ByVal value As Byte,
    ByVal toBase As Integer) As String
Public Shared Function ToString(
    ByVal value As Char) As String
Public Shared Function ToString(ByVal value As Char,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Date) As String
Public Shared Function ToString(ByVal value As Date,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Decimal) As String
Public Shared Function ToString(ByVal value As Decimal,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Double) As String
Public Shared Function ToString(ByVal value As Double,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Short) As String
Public Shared Function ToString(ByVal value As Short,
```

```
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(ByVal value As Short,
    ByVal toBase As Integer) As String
Public Shared Function ToString(
    ByVal value As Integer) As String
Public Shared Function ToString(ByVal value As Integer,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(ByVal value As Integer,
    ByVal toBase As Integer) As String
Public Shared Function ToString(
    ByVal value As Long) As String
Public Shared Function ToString(ByVal value As Long,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(ByVal value As Long,
    ByVal toBase As Integer) As String
Public Shared Function ToString(
    ByVal value As Object) As String
Public Shared Function ToString(ByVal value As Object,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As SByte) As String
Public Shared Function ToString(ByVal value As SByte,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As Single) As String
Public Shared Function ToString(ByVal value As Single,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As String) As String
Public Shared Function ToString(ByVal value As String,
```

```
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As UInt16) As String
Public Shared Function ToString(ByVal value As UInt16,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As UInt32) As String
Public Shared Function ToString(ByVal value As UInt32,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToString(
    ByVal value As UInt64) As String
Public Shared Function ToString(ByVal value As UInt64,
    ByVal provider As IFormatProvider) As String
Public Shared Function ToUInt16(
    ByVal value As Boolean) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Byte) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Char) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Date) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Decimal) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Double) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Short) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Integer) As UInt16
Public Shared Function ToUInt16(
```

```
    ByVal value As Long) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Object) As UInt16
Public Shared Function ToUInt16(ByVal value As Object,
    ByVal provider As IFormatProvider) As UInt16
Public Shared Function ToUInt16(
    ByVal value As SByte) As UInt16
Public Shared Function ToUInt16(
    ByVal value As Single) As UInt16
Public Shared Function ToUInt16(
    ByVal value As String) As UInt16
Public Shared Function ToUInt16(ByVal value As String,
    ByVal provider As IFormatProvider) As UInt16
Public Shared Function ToUInt16(ByVal value As String,
    ByVal fromBase As Integer) As UInt16
Public Shared Function ToUInt16(
    ByVal value As UInt16) As UInt16
Public Shared Function ToUInt16(
    ByVal value As UInt32) As UInt16
Public Shared Function ToUInt16(
    ByVal value As UInt64) As UInt16
Public Shared Function ToUInt32(
    ByVal value As Boolean) As UInt32
Public Shared Function ToUInt32(
    ByVal value As Byte) As UInt32
Public Shared Function ToUInt32(
    ByVal value As Char) As UInt32
Public Shared Function ToUInt32(
    ByVal value As Date) As UInt32
Public Shared Function ToUInt32(
```

```
     ByVal value As Decimal) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Double) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Short) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Integer) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Long) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Object) As UInt32
Public Shared Function ToUInt32(ByVal value As Object,
     ByVal provider As IFormatProvider) As UInt32
Public Shared Function ToUInt32(
     ByVal value As SByte) As UInt32
Public Shared Function ToUInt32(
     ByVal value As Single) As UInt32
Public Shared Function ToUInt32(
     ByVal value As String) As UInt32
Public Shared Function ToUInt32(ByVal value As String,
     ByVal provider As IFormatProvider) As UInt32
Public Shared Function ToUInt32(ByVal value As String,
     ByVal fromBase As Integer) As UInt32
Public Shared Function ToUInt32(
     ByVal value As UInt16) As UInt32
Public Shared Function ToUInt32(
     ByVal value As UInt32) As UInt32
Public Shared Function ToUInt32(
     ByVal value As UInt64) As UInt32
Public Shared Function ToUInt64(
```

```
     ByVal value As Boolean) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Byte) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Char) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Date) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Decimal) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Double) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Short) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Integer) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Long) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Object) As UInt64
Public Shared Function ToUInt64(ByVal value As Object,
     ByVal provider As IFormatProvider) As UInt64
Public Shared Function ToUInt64(
     ByVal value As SByte) As UInt64
Public Shared Function ToUInt64(
     ByVal value As Single) As UInt64
Public Shared Function ToUInt64(
     ByVal value As String) As UInt64
Public Shared Function ToUInt64(ByVal value As String,
     ByVal provider As IFormatProvider) As UInt64
Public Shared Function ToUInt64(ByVal value As String,
```

```
        ByVal fromBase As Integer) As UInt64
    Public Shared Function ToUInt64(
        ByVal value As UInt16) As UInt64
    Public Shared Function ToUInt64(
        ByVal value As UInt32) As UInt64
    Public Shared Function ToUInt64(
        ByVal value As UInt64) As UInt64
End Class
```

## CrossAppDomainDelegate Delegate

## System (mscorlib.dll) *serializable*

This delegate invokes a method in a different application domain using the `AppDomain.DoCallBack()` method. You can then invoke a delegate instance within another `AppDomain`, which provides you with the ability to check on an `AppDomain`'s status or information.

```
Public Delegate Sub CrossAppDomainDelegate()
```

### Passed To

`AppDomain.DoCallBack()`

## DateTime Structure

## System (mscorlib.dll) *ECMA, serializable*

This simple value type represents a moment in time from 12:00:00 A.M., 1/1/0001 C.E. (Common E 12/31/9999 C.E., which is measured to the nearest *tick*, or 100-nanosecond interval. You can use tl than/less-than comparisons, sorting, and in calculations using other `DateTime` or `TimeSpan` instar convenient `Add. . .` methods, such as `AddSeconds()`, with a positive or negative value.

To extract part of a date, use properties such as `Day` and `Minute`. All properties except `Ticks` repı component of a compound date, not the whole date. You can convert a string into a `DateTime` usir or `ParseExact()` methods, which require that the date match the pattern specified by a supplied f

The `DateTime` class also provides valuable shared functions that can determine the number of day (`DaysInMonth()`), evaluate whether a year is a leap year (`IsLeapYear()`), and retrieve the date (`FromFileTime()`). You can also get the current date from the shared property `Today` (or `UtcNow` universal time).

```
Public Structure DateTime : Implements IComparable, IFormattable, IConver

' Public Constructors

   Public Sub New(ByVal year As Integer,

        ByVal month As Integer, ByVal day As Integer)

   Public Sub New(ByVal year As Integer,

        ByVal month As Integer, ByVal day As Integer,

        ByVal calendar As System.Globalization.Calendar)

   Public Sub New(ByVal year As Integer,

        ByVal month As Integer, ByVal day As Integer,

        ByVal hour As Integer, ByVal minute As Integer,

        ByVal second As Integer)

   Public Sub New(ByVal year As Integer,

        ByVal month As Integer, ByVal day As Integer,

        ByVal hour As Integer, ByVal minute As Integer,

        ByVal second As Integer,

        ByVal calendar As System.Globalization.Calendar)

   Public Sub New(ByVal year As Integer,
```

```
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer)
    Public Sub New(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal calendar As System.Globalization.Calendar)
    Public Sub New( ByVal ticks As Long)
' Public Shared Fields
    Public Shared ReadOnly MaxValue As Date                          // =12/3
    Public Shared ReadOnly MinValue As Date                          // =1/1/
' Public Shared Properties
    Public Shared ReadOnly Property Now As Date
    Public Shared ReadOnly Property Today As Date
    Public Shared ReadOnly Property UtcNow As Date
' Public Instance Properties
    Public ReadOnly Property Date As Date
    Public ReadOnly Property Day As Integer
    Public ReadOnly Property DayOfWeek As DayOfWeek
    Public ReadOnly Property DayOfYear As Integer
    Public ReadOnly Property Hour As Integer
    Public ReadOnly Property Millisecond As Integer
    Public ReadOnly Property Minute As Integer
    Public ReadOnly Property Month As Integer
    Public ReadOnly Property Second As Integer
    Public ReadOnly Property Ticks As Long
    Public ReadOnly Property TimeOfDay As TimeSpan
    Public ReadOnly Property Year As Integer
```

```
' Public Shared Methods
   Public Shared Function Compare(ByVal t1 As Date,
        ByVal t2 As Date) As Integer
   Public Shared Function DaysInMonth(ByVal year As Integer,
        ByVal month As Integer) As Integer
   Public Shared Function Equals(ByVal t1 As Date,
        ByVal t2 As Date) As Boolean
   Public Shared Function FromFileTime(
        ByVal fileTime As Long) As Date
   Public Shared Function FromOADate(
        ByVal d As Double) As Date
   Public Shared Function IsLeapYear(
        ByVal year As Integer) As Boolean
   Public Shared Function Parse( ByVal s As String) As Date
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As Date
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider,
        ByVal styles As System.Globalization.DateTimeStyles) As Date
   Public Shared Function ParseExact(ByVal s As String,
        ByVal formats As String(),
        ByVal provider As IFormatProvider,
        ByVal style As System.Globalization.DateTimeStyles) As Date
   Public Shared Function ParseExact(ByVal s As String,
        ByVal format As String,
        ByVal provider As IFormatProvider) As Date
   Public Shared Function ParseExact(ByVal s As String,
        ByVal format As String,
        ByVal provider As IFormatProvider,
        ByVal style As System.Globalization.DateTimeStyles) As Date
   Public Shared Date operator Sub -(ByVal d As Date,
```

```
        ByVal t As TimeSpan)
    Public Shared TimeSpan operator Sub -(
        ByVal d1 As Date, ByVal d2 As Date)
    Public Shared Date operator Sub +(ByVal d As Date,
        ByVal t As TimeSpan)
    Public Shared Boolean operator Sub !=(
        ByVal d1 As Date, ByVal d2 As Date)
    Public Shared Boolean operator Sub <(ByVal t1 As Date,
        ByVal t2 As Date)
    Public Shared Boolean operator Sub <=(
        ByVal t1 As Date, ByVal t2 As Date)
    Public Shared Boolean operator Sub ==(
        ByVal d1 As Date, ByVal d2 As Date)
    Public Shared Boolean operator Sub >(ByVal t1 As Date,
        ByVal t2 As Date)
    Public Shared Boolean operator Sub >=(
        ByVal t1 As Date, ByVal t2 As Date)
' Public Instance Methods
    Public Function Add( ByVal value As TimeSpan) As Date
    Public Function AddDays( ByVal value As Double) As Date
    Public Function AddHours( ByVal value As Double) As Date
    Public Function AddMilliseconds(
        ByVal value As Double) As Date
    Public Function AddMinutes( ByVal value As Double) As Date
    Public Function AddMonths(ByVal months As Integer) As Date
    Public Function AddSeconds( ByVal value As Double) As Date
    Public Function AddTicks( ByVal value As Long) As Date
    Public Function AddYears( ByVal value As Integer) As Date
    Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
    Overrides Public Function Equals(
```

```
        ByVal value As Object) As Boolean
    Public Function GetDateTimeFormats() As String()
    Public Function GetDateTimeFormats(
        ByVal format As Char) As String()
    Public Function GetDateTimeFormats(ByVal format As Char,
        ByVal provider As IFormatProvider) As String()
    Public Function GetDateTimeFormats(
        ByVal provider As IFormatProvider) As String()
    Overrides Public Function GetHashCode() As Integer
    Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
    Public Function Subtract( ByVal value As TimeSpan) As Date
    Public Function Subtract( ByVal value As Date) As TimeSpan
    Public Function ToFileTime() As Long
    Public Function ToLocalTime() As Date
    Public Function ToLongDateString() As String
    Public Function ToLongTimeString() As String
    Public Function ToOADate() As Double
    Public Function ToShortDateString() As String
    Public Function ToShortTimeString() As String
    Overrides Public Function ToString() As String
    Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
    Public Function ToString(ByVal format As String) As String
    Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
    Public Function ToUniversalTime() As Date
End Structure
```

## Hierarchy

`Object → ValueType → DateTime(IComparable, IFormattable, IConvertible)`

### Returned By

Multiple types

### Passed To

Multiple types

# DayOfWeek | Enum

## System (mscorlib.dll) | *serializable*

This enumeration is used by the `DateTime.DayOfWeek` property.

```
Public Enum DayOfWeek

    Sunday = 0

    Monday = 1

    Tuesday = 2

    Wednesday = 3

    Thursday = 4

    Friday = 5

    Saturday = 6

End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `DayOfWeek`

### Returned By

`DateTime.DayOfWeek`, `System.Globalization.Calendar.GetDayOfWeek()`, `System.Globalization.DateTimeFormatInfo.FirstDayOfWeek`

### Passed To

`System.Globalization.Calendar.GetWeekOfYear()`, `System.Globalization.DateTimeFormatInfo.{FirstDayOfWeek, GetAbbreviatedDayName(), GetDayName()}`

## DBNull NotInheritable Class

## System (mscorlib.dll) *serializable*

DBNull indicates the absence of information, typically in a database application in which a field doe
System.Data.SqlTypes namespace have built-in support for DBNull.

Note that Value is not the same as the Nothing keyword in VB.NET. The Nothing keyword can b
the reference. System.DBNull.Value, on the other hand, is a reference to a special value (a mer
is used to indicate missing information.

This class has some other uses, namely in COM Interop, in which it represents a VT_EMPTY variant
which is a null reference).

```
Public NotInheritable Class DBNull : Implements System.Runtime.Serializat

' Public Shared Fields

   Public Shared ReadOnly Value As DBNull

' Public Instance Methods

   Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

        Implements ISerializable.GetObjectData

   Public Function GetTypeCode(

        ) As TypeCode Implements IConvertible.GetTypeCode

   Overrides Public Function ToString() As String

   Public Function ToString(

        ByVal provider As IFormatProvider) As String Implements IConvertil

End Class
```

## Decimal Structure

### System (mscorlib.dll) *ECMA, serializable*

This simple value type is commonly used for financial calculations, which can preserve a significant round-off error. Decimals are stored as 12-byte signed integers scaled by a variable power of 10. Th can effectively hold 28 significant digits without losing any information. With a scale of 0 (no decima value is approximately 7.92x10$^{28}$. This type is available in VB.NET through the `Decimal` alias.

```
Public Structure Decimal : Implements IFormattable, IComparable, IConverti

' Public Constructors

   Public Sub New( ByVal value As Double)

   Public Sub New( ByVal value As Integer)

   Public Sub New( ByVal bits As Integer())

   Public Sub New(ByVal lo As Integer, ByVal mid As Integer,

        ByVal hi As Integer, ByVal isNegative As Boolean,

        ByVal scale As Byte)

   Public Sub New( ByVal value As Long)

   Public Sub New( ByVal value As Single)

   Public Sub New( ByVal value As UInt32)

   Public Sub New( ByVal value As UInt64)

' Public Shared Fields

   Public Shared ReadOnly MaxValue As Decimal                      // =7922

   Public Shared ReadOnly MinusOne As Decimal                      // =-1

   Public Shared ReadOnly MinValue As Decimal                      // =-792

   Public Shared ReadOnly One As Decimal                           // =1

   Public Shared ReadOnly Zero As Decimal                          // =0

' Public Shared Methods

   Public Shared Function Add(ByVal d1 As Decimal,

        ByVal d2 As Decimal) As Decimal

   Public Shared Function Compare(ByVal d1 As Decimal,

        ByVal d2 As Decimal) As Integer

   Public Shared Function Divide(ByVal d1 As Decimal,
```

```
     ByVal d2 As Decimal) As Decimal
Public Shared Function Equals(ByVal d1 As Decimal,
     ByVal d2 As Decimal) As Boolean
Public Shared Function Floor(
     ByVal d As Decimal) As Decimal
Public Shared Function FromOACurrency(
     ByVal cy As Long) As Decimal
Public Shared Function GetBits(
     ByVal d As Decimal) As Integer()
Public Shared Function Multiply(ByVal d1 As Decimal,
     ByVal d2 As Decimal) As Decimal
Public Shared Function Negate(
     ByVal d As Decimal) As Decimal
Public Shared Function Parse(ByVal s As String) As Decimal
Public Shared Function Parse(ByVal s As String,
     ByVal provider As IFormatProvider) As Decimal
Public Shared Function Parse(ByVal s As String,
     ByVal style As System.Globalization.NumberStyles) As Decimal
Public Shared Function Parse(ByVal s As String,
     ByVal style As System.Globalization.NumberStyles,
     ByVal provider As IFormatProvider) As Decimal
Public Shared Function Remainder(ByVal d1 As Decimal,
     ByVal d2 As Decimal) As Decimal
Public Shared Function Round(ByVal d As Decimal,
     ByVal decimals As Integer) As Decimal
Public Shared Function Subtract(ByVal d1 As Decimal,
     ByVal d2 As Decimal) As Decimal
Public Shared Function ToByte(
     ByVal value As Decimal) As Byte
Public Shared Function ToDouble(
```

```
     ByVal d As Decimal) As Double
Public Shared Function ToInt16(
     ByVal value As Decimal) As Short
Public Shared Function ToInt32(
     ByVal d As Decimal) As Integer
Public Shared Function ToInt64(ByVal d As Decimal) As Long
Public Shared Function ToOACurrency(
     ByVal value As Decimal) As Long
Public Shared Function ToSByte(
     ByVal value As Decimal) As SByte
Public Shared Function ToSingle(
     ByVal d As Decimal) As Single
Public Shared Function ToUInt16(
     ByVal value As Decimal) As UInt16
Public Shared Function ToUInt32(
     ByVal d As Decimal) As UInt32
Public Shared Function ToUInt64(
     ByVal d As Decimal) As UInt64
Public Shared Function Truncate(
     ByVal d As Decimal) As Decimal
Public Shared Decimal operator Sub %(
     ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Decimal operator Sub *(
     ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Decimal operator Sub /(
     ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Decimal operator Sub --(
     ByVal d As Decimal)
Public Shared Decimal operator Sub -(
     ByVal d As Decimal)
Public Shared Decimal operator Sub -(
```

```
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Decimal operator Sub +(
        ByVal d As Decimal)
Public Shared Decimal operator Sub +(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Decimal operator Sub ++(
        ByVal d As Decimal)
Public Shared Boolean operator Sub !=(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Boolean operator Sub <(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Boolean operator Sub <=(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Boolean operator Sub ==(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Boolean operator Sub >(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared Boolean operator Sub >=(
        ByVal d1 As Decimal, ByVal d2 As Decimal)
Public Shared explicit operator Sub Byte(
        ByVal value As Decimal)
Public Shared explicit operator Sub Char(
        ByVal value As Decimal)
Public Shared explicit operator Sub Decimal(
        ByVal value As Double)
Public Shared explicit operator Sub Decimal(
        ByVal value As Single)
Public Shared explicit operator Sub Double(
        ByVal value As Decimal)
Public Shared explicit operator Sub Short(
```

```
     ByVal value As Decimal)
Public Shared explicit operator Sub Integer(
     ByVal value As Decimal)
Public Shared explicit operator Sub Long(
     ByVal value As Decimal)
Public Shared explicit operator Sub SByte(
     ByVal value As Decimal)
Public Shared explicit operator Sub Single(
     ByVal value As Decimal)
Public Shared explicit operator Sub UInt16(
     ByVal value As Decimal)
Public Shared explicit operator Sub UInt32(
     ByVal value As Decimal)
Public Shared explicit operator Sub UInt64(
     ByVal value As Decimal)
Public Shared implicit operator Sub Decimal(
     ByVal value As Byte)
Public Shared implicit operator Sub Decimal(
     ByVal value As Char)
Public Shared implicit operator Sub Decimal(
     ByVal value As Short)
Public Shared implicit operator Sub Decimal(
     ByVal value As Integer)
Public Shared implicit operator Sub Decimal(
     ByVal value As Long)
Public Shared implicit operator Sub Decimal(
     ByVal value As SByte)
Public Shared implicit operator Sub Decimal(
     ByVal value As UInt16)
Public Shared implicit operator Sub Decimal(
```

```
        ByVal value As UInt32)
    Public Shared implicit operator Sub Decimal(
        ByVal value As UInt64)
' Public Instance Methods
    Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
    Overrides Public Function Equals(
        ByVal value As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
    Overrides Public Function ToString() As String
    Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
    Public Function ToString(ByVal format As String) As String
    Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → Decimal(IFormattable, IComparable, IConvertible)

## Returned By

Convert.ToDecimal(), IConvertible.ToDecimal(), System.IO.BinaryReader.ReadDe
System.Runtime.InteropServices.CurrencyWrapper.WrappedObject,
System.Runtime.Serialization.FormatterConverter.ToDecimal(),
System.Runtime.Serialization.IFormatterConverter.ToDecimal(),
System.Runtime.Serialization.SerializationInfo.GetDecimal(), System.Xml.Xm

## Passed To

Multiple types

## Delegate MustInherit Class

## System (mscorlib.dll) *ECMA, serializable*

A delegate is used to provide a decoupling of caller from callee; that is, a delegate points to a given class, and callers can call through the delegate without having to know the target of the call. In man conceptually similar to the C/C++ *function pointer*, with a number of important advantages. A delega only methods that match the delegate's declared signature are acceptable when constructing the de enforces the delegate's declared signature when called. A delegate can distinguish between a share avoids the C++ application associated with pointers to member functions, which require a `literal` invoke the method.

Delegates are usually constructed by the language compiler, varying in syntax from language to lan `Public Delegate Sub CallBackDelegate(param1 as Integer, param2 as String)` d the `Delegate` type (its immediate superclass is actually `MulticastDelegate`). This new `Callba` with a constructor (to take the method to call when the delegate is invoked) and an `Invoke` method asynchronous versions of `Invoke` (the `BeginInvoke` and `EndInvoke` methods).

In many cases, you will want to use delegates as an *invocation chain*, where a single call to the dele against a collection of delegate targets. (This is most easily seen in .NET's publish-subscribe event- keyword.) To achieve this, `Delegate` contains shared methods allowing delegates to combine into into multiple delegate targets. The `Combine()` method takes two existing delegate instances (with i single delegate instance that calls both targets when invoked. (There is another form of `Combine()` instead of just a pair.) `Remove()` does the opposite of `Combine()`, removing a delegate from the n `MulticastDelegate` entry for more information on multicast delegates.)

Delegates can also be invoked using the `DynamicInvoke()` method, without knowing the actual c subtype. This method expects an array of object references, whose type should match those of the If any of the parameters to `DynamicInvoke()` do not match those expected by the target method, can also be constructed in the same generic fashion using one of the overloaded forms of `CreateD`

Delegates can be invoked either synchronously or asynchronously. To invoke a delegate synchrono return), simply use the delegate as if it is a method. The call to a delegate is executed completely be method. Should you wish the call to the delegate to occur in parallel with the calling method, use the execution and the `EndInvoke` method to wait for the asynchronous delegate call's completion (if it `EndInvoke` call is made). If any of the delegate's parameters are declared as `ref` or `out` paramete available on the parameter list to `EndInvoke`.

```
Public MustInherit Class Delegate : Implements ICloneable, System.Runtime

' Protected Constructors

   Protected Sub New(ByVal target As Object,

        ByVal method As String)

   Protected Sub New(ByVal target As Type,

        ByVal method As String)

' Public Instance Properties

   Public ReadOnly Property Method As MethodInfo

   Public ReadOnly Property Target As Object
```

```
' Public Shared Methods
   Public Shared Function Combine(
        ByVal delegates As Delegate()) As Delegate
   Public Shared Function Combine(ByVal a As Delegate,
        ByVal b As Delegate) As Delegate
   Public Shared Function CreateDelegate(ByVal type As Type,
        ByVal method As System.Reflection.MethodInfo) As Delegate
   Public Shared Function CreateDelegate(ByVal type As Type,
        ByVal target As Object,
        ByVal method As String) As Delegate
   Public Shared Function CreateDelegate(ByVal type As Type,
        ByVal target As Object, ByVal method As String,
        ByVal ignoreCase As Boolean) As Delegate
   Public Shared Function CreateDelegate(ByVal type As Type,
        ByVal target As Type,
        ByVal method As String) As Delegate
   Public Shared Function Remove(ByVal source As Delegate,
        ByVal value As Delegate) As Delegate
   Public Shared Boolean operator Sub !=(
        ByVal d1 As Delegate, ByVal d2 As Delegate)
   Public Shared Boolean operator Sub ==(
        ByVal d1 As Delegate, ByVal d2 As Delegate)
' Public Instance Methods
   Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Public Function DynamicInvoke(
        ByVal args As Object()) As Object
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overridable Public Function GetInvocationList(
```

```
        ) As Delegate()
   Overridable Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
        Implements ISerializable.GetObjectData
' Protected Instance Methods
   Overridable Protected Function CombineImpl(
        ByVal d As Delegate) As Delegate
   Overridable Protected Function DynamicInvokeImpl(
        ByVal args As Object()) As Object
   Overridable Protected Function GetMethodImpl(
        ) As MethodInfo
   Overridable Protected Function RemoveImpl(
        ByVal d As Delegate) As Delegate
End Class
```

### Subclasses

MulticastDelegate

### Returned By

MulticastDelegate.{CombineImpl(),GetInvocationList(),RemoveImpl()}

### Passed To

Microsoft.Win32.SystemEvents.InvokeOnEventsThread(),MulticastDelegate.{Coı
System.Reflection.EventInfo.{AddEventHandler(),RemoveEventHandler()},
System.Runtime.InteropServices.Expando.IExpando.AddMethod()

## DivideByZeroException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is thrown when a math operation attempts to divide by zero.

```
Public Class DivideByZeroException : Inherits ArithmeticException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArithmeticException → DivideByZeroException

# DllNotFoundException Class

## System (mscorlib.dll) *serializable*

This exception indicates that the file specified in a DLL import could not be found (see `System.Runtime.InteropServices.DllImportAttribute`). This exception is thrown only when you attempt to link against a method declared using the P/Invoke features of .NET. Any managed DLL (such as those produced by C# or Visual Basic .NET) that cannot be found instead generates `TypeLoadException`s when you attempt to resolve types out of an assembly that cannot be found.

```
Public Class DllNotFoundException : Inherits TypeLoadException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `TypeLoadException` → `DllNotFoundException`

## Double Structure

## System (mscorlib.dll) *ECMA, serializable*

This represents a 64-bit double-precision floating number as a value type. The value of a double ca from $-1.8 \times 10^{308}$ to $1.8 \times 10^{308}$ and can be set to one of the following fields: `PositiveInfinity`, `Ne` and `NaN` (not a number). This type is aliased as `Double` in VB.NET.

```
Public Structure Double : Implements IComparable, IFormattable, IConvertil
' Public Shared Fields
   Public const Epsilon As Double                                     // =4.94
   Public const MaxValue As Double                                    // =1.79
   Public const MinValue As Double                                    // =-1.7
   Public const NaN As Double                                         // =NaN
   Public const NegativeInfinity As Double                            // =-Inf
   Public const PositiveInfinity As Double                            // =Infi
' Public Shared Methods
   Public Shared Function IsInfinity(
        ByVal d As Double) As Boolean
   Public Shared Function IsNaN(ByVal d As Double) As Boolean
   Public Shared Function IsNegativeInfinity(
        ByVal d As Double) As Boolean
   Public Shared Function IsPositiveInfinity(
        ByVal d As Double) As Boolean
   Public Shared Function Parse( ByVal s As String) As Double
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As Double
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As Double
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As Double
   Public Shared Function TryParse(ByVal s As String,
```

```
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider,
        ByRef result As Double) As Boolean
' Public Instance Methods
    Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
    Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
    Overrides Public Function ToString() As String
    Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConverti
    Public Function ToString(ByVal format As String) As String
    Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → Double(IComparable, IFormattable, IConvertible)

## Returned By

Multiple types

## Passed To

Multiple types

# DuplicateWaitObjectException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is thrown when an object shows up more than once in the array passed to `System.Threading.WaitHandle.WaitAll()` or `System.Threading.WaitHandle.WaitAny()`.

```
Public Class DuplicateWaitObjectException : Inherits ArgumentException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal parameterName As String)
   Public Sub New(ByVal parameterName As String,
        ByVal message As String)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArgumentException → DuplicateWaitObjectException

## EntryPointNotFoundException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates that an entry point could not be found when .NET loaded an assembly flagged for execution; that is, an `AppDomain` was instructed to execute an assembly, but no method in that assembly was marked with the `.entrypoint` metadata flag.

```
Public Class EntryPointNotFoundException : Inherits TypeLoadException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `TypeLoadException` → `EntryPointNotFoundException`

## Enum MustInherit Class

### System (mscorlib.dll) *ECMA, serializable*

This is the base class for all enumerations. In VB.NET, you can use the `Enum` keyword to create an type consisting of named constants and their values. By default, the underlying type used for enume is `Int32`, but you can use any integer data type.

```
Public MustInherit Class Enum :
        Inherits ValueType : Implements IComparable, IFormattable,
' Protected Constructors
   Protected Sub New()
' Public Shared Methods
   Public Shared Function Format(ByVal enumType As Type,
        ByVal value As Object,
        ByVal format As String) As String
   Public Shared Function GetName(ByVal enumType As Type,
        ByVal value As Object) As String
   Public Shared Function GetNames(
        ByVal enumType As Type) As String()
   Public Shared Function GetUnderlyingType(
        ByVal enumType As Type) As Type
   Public Shared Function GetValues(
        ByVal enumType As Type) As Array
   Public Shared Function IsDefined(ByVal enumType As Type,
        ByVal value As Object) As Boolean
   Public Shared Function Parse(ByVal enumType As Type,
        ByVal value As String) As Object
   Public Shared Function Parse(ByVal enumType As Type,
        ByVal value As String,
        ByVal ignoreCase As Boolean) As Object
   Public Shared Function ToObject(ByVal enumType As Type,
```

```
        ByVal value As Byte) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As Short) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As Integer) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As Long) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As Object) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As SByte) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As UInt16) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As UInt32) As Object
    Public Shared Function ToObject(ByVal enumType As Type,
        ByVal value As UInt64) As Object
' Public Instance Methods
    Public Function CompareTo(
        ByVal target As Object) As Integer Implements IComparable.Compare'
    Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
    Overrides Public Function ToString() As String
    Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConverti
    Public Function ToString(ByVal format As String) As String
    Public Function ToString(ByVal format As String,
```

```
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Class
```

### Hierarchy

Object → ValueType → Enum(IComparable, IFormattable, IConvertible)

### Subclasses

Multiple types

## Environment NotInheritable Class

### System (mscorlib.dll) *ECMA*

This class represents an application's operating environment, which includes details about the operating system, the current user, and other environment variables. This information is provided through shared properties and some helper methods.

You can retrieve command-line arguments as a string from `CommandLine` or as an array of strings using `GetCommandLineArgs()`. Use the `GetLogicalDrives()` method to get an array of strings containing drive names (for example, `C:\`), and use the `GetFolderPath()` method to get the physical location of a special system folder. You can also retrieve environment variables by key name using the `GetEnvironmentVariable()` method and automatically replace environment variables in a string with the `ExpandEnvironmentVariables()` method, as long as they are delimited with the percent sign (%). For example, on a system with the environment variable `MAC_ADDR` set to `123456789012`, the string `MAC_ADDR=%MAC_ADDR%` would be converted to `MAC_ADDR=123456789012`.

```
Public NotInheritable Class Environment

' Public Shared Properties

   Public Shared ReadOnly Property CommandLine As String

   Public Shared Property CurrentDirectory As String

   Public Shared Property ExitCode As Integer

   Public Shared ReadOnly Property MachineName As String

   Public Shared ReadOnly Property NewLine As String

   Public Shared ReadOnly Property OSVersion As OperatingSystem

   Public Shared ReadOnly Property StackTrace As String

   Public Shared ReadOnly Property SystemDirectory As String

   Public Shared ReadOnly Property TickCount As Integer

   Public Shared ReadOnly Property UserDomainName As String

   Public Shared ReadOnly Property UserInteractive As Boolean

   Public Shared ReadOnly Property UserName As String

   Public Shared ReadOnly Property Version As Version

   Public Shared ReadOnly Property WorkingSet As Long

' Public Instance Properties

   Public ReadOnly Property HasShutdownStarted As Boolean

' Public Shared Methods
```

```
    Public Shared Sub Exit( ByVal exitCode As Integer)
    Public Shared Function ExpandEnvironmentVariables(
         ByVal name As String) As String
    Public Shared Function GetCommandLineArgs() As String()
    Public Shared Function GetEnvironmentVariable(
         ByVal variable As String) As String
    Public Shared Function GetEnvironmentVariables(
         ) As IDictionary
    Public Shared Function GetFolderPath(
         ByVal folder As SpecialFolder) As String
    Public Shared Function GetLogicalDrives() As String()
End Class
```

## Environment.SpecialFolder Enum

## System (mscorlib.dll) *serializable*

This enumeration is used by the `Environment.GetFolderPath()` method to allow you to retrieve the physical path of commonly used system (or "special") folders, including everything from the Internet cache to the Start menu.

```
Public Enum Environment.SpecialFolder

   Programs = 2

   Personal = 5

   Favorites = 6

   Startup = 7

   Recent = 8

   SendTo = 9

   StartMenu = 11

   DesktopDirectory = 16

   Templates = 21

   ApplicationData = 26

   LocalApplicationData = 28

   InternetCache = 32

   Cookies = 33

   History = 34

   CommonApplicationData = 35

   System = 37

   ProgramFiles = 38

   CommonProgramFiles = 43

End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `SpecialFolder`

# EventArgs Class

## System (mscorlib.dll) *ECMA, serializable*

See the `EventHandler` entry for details regarding the `EventArgs`/`EventHandler` idiom for deleg .NET developers wish to follow this idiom, they should create new subtypes of `EventArgs` for each of data to be sent to interested parties; otherwise, they should pass `Empty`, indicating that no event passed as part of this event notification.

```
Public Class EventArgs

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly Empty As EventArgs                           // =Syst

End Class
```

### Subclasses

Multiple types

### Passed To

`EventHandler.{BeginInvoke(),Invoke()}`

## EventHandler Delegate

## System (mscorlib.dll) *ECMA, serializable*

Shortly after Beta 1 of .NET was released, Microsoft .NET developers realized that prolific use of delegates could easily lead to type-bloat; since each declared delegate created a new type in the system, a large number of delegates would lead to a huge number of types to load, verify, and initialize. In Beta 2, Microsoft introduced an idiom that, it's hoped, will keep type-bloat down to reasonable levels in .NET.

Microsoft defines two types, `EventHandler` (a delegate type) and `EventArgs`, a glorified C construct. `EventHandler` is declared to expect two parameters: an object reference indicating the `sender` of the event, and an `event data` parameter (the `EventArgs` or some derived-type instance).

This delegate represents the base type for .NET event handlers. (In Beta 2 and later, all .NET Framework Class Library types with declared events use this same idiom, so as to remain consistent.) Its arguments include a `sender` parameter, which refers to the object that issued the event, and an `e` parameter, which contains additional event data. Events that do not require additional information use the `EventHandler` delegate directly.

Events that need to send additional information derive their own custom delegate from this type. Custom event delegates look similar, except that they replace the `EventArgs` parameter with a custom object derived from `EventArgs`. This object contains additional properties or methods that are specific to the event.

```
Public Delegate Sub EventHandler(ByVal sender As Object,

        ByVal e As EventArgs)
```

### Associated Events

Multiple types

## Exception Class

## System (mscorlib.dll) *ECMA, serializable*

This is the base class for all .NET exceptions. .NET Framework exceptions are generally derived frc `SystemException`, and user-defined exceptions are generally derived from `ApplicationExcep`

In some cases, one exception may throw another; this is often the case when using layered architec For example, a persistence layer may throw a persistence-related exception (`DatabaseNotFoundException`), whose semantics are undefined at a higher level (such as the U layer). In this case, a middle layer may throw a new exception-derived type (such as `PersistenceException`), but doesn't wish to lose the original source of the exception — instead wraps the original exception by setting it to be the `InnerException`. In this way, a layer can communicate a lower-level exception to higher layers without losing information or violating encapsulation.

The `StackTrace` property is a string containing the stacktrace. This permits determination of the ca sequence leading up to the line that threw the exception. `HelpLink` contains a link to a help file wit information about the exception. `Message` contains a text message that describes the exception.

```
Public Class Exception : Implements System.Runtime.Serialization.ISeriali:
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Overridable Public Property HelpLink As String
   Public ReadOnly Property InnerException As Exception
   Overridable Public ReadOnly Property Message As String
   Overridable Public Property Source As String
   Overridable Public ReadOnly Property StackTrace As String
   Public ReadOnly Property TargetSite As MethodBase
' Protected Instance Properties
```

```
   Protected Property HResult As Integer
' Public Instance Methods
   Overridable Public Function GetBaseException(
        ) As Exception
   Overridable Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
        Implements ISerializable.GetObjectData
   Overrides Public Function ToString() As String
End Class
```

## Subclasses

ApplicationException, SystemException, System.IO.IsolatedStorage.IsolatedStorageException

## Returned By

System.IO.ErrorEventArgs.GetException(), System.Reflection.ReflectionTypeLoadException.LoaderExceptions, System.Threading.ThreadExceptionEventArgs.Exception

## Passed To

Multiple types

## ExecutionEngineException NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates that an error has occurred deep within the innards of the .NET CLR.

```
Public NotInheritable Class ExecutionEngineException : Inherits SystemExce

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ExecutionEngineException

## FieldAccessException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you try to access a protected or private field that you would not normally have access to. Most compilers will not let you compile code that does this directly. However, late-bound code can sneak by the compiler and throw this exception at runtime. For example, if you lack sufficient privileges to modify a field using `System.Reflection.FieldInfo.SetValue()`, this exception is thrown.

```
Public Class FieldAccessException : Inherits MemberAccessException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `MemberAccessException` → `FieldAccessException`

## FlagsAttribute Class

## System (mscorlib.dll) *ECMA, serializable*

This attribute indicates that an enumeration should be treated as a set of on/off flags (i.e., a bit field). Unlike enumerated constants, bit fields can be combined with a bitwise `OR` operation.

```
Public Class FlagsAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `FlagsAttribute`

### Valid On

Enum

## FormatException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception signals that an error occurred during the handling of a format string. Format strings are used by methods such as `Console.WriteLine()` to replace a format specification with one or more parameters. This exception may be triggered by supplying too few arguments to replace all the format strings (for example, supplying only two arguments to `Console.WriteLine()` when your format string is `"{0} {1} {2}"`).

```
Public Class FormatException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `FormatException`

### Subclasses

`UriFormatException`, `System.Net.CookieException`, `System.Reflection.CustomAttributeFormatException`

## GC NotInheritable Class

## System (mscorlib.dll) *ECMA*

This class allows you to control garbage collection programmatically. Garbage collection is the .NET service that periodically scans for unreferenced objects and reclaims the memory they occupy.

The garbage-collection service distinguishes between older and more recently allocated memory using *generations*. The most recently allocated memory is considered generation zero, and the oldest memory is in generation `MaxGeneration`. Because new allocations are likely to be freed before long-standing memory allocations, the garbage collector improves its performance by concentrating on lower generations of memory. You can find out the generation of an object using the `GetGeneration()` method. You can also get the number of memory bytes that are currently allocated using the `GetTotalMemory()` method. A `forceFullCollection` parameter indicates whether this method should wait a short interval before returning to collect and finalize some objects.

To force a *full sweep* garbage collection, use the `Collect()` method. You can improve performance by specifying the maximum `generation` that will be examined. Generally, it is best to let .NET perform garbage collection automatically when the system is idle.

Some developers have lamented a noticeable lack of *deterministic finalization* within a garbage-collected system; that is, because the object's lifetime is under the control of the garbage collector, there is no guarantee that an object is destroyed as soon as it becomes unreferenced. One approach used to try to compensate for this phenomenon is to call `GC` repeatedly in an effort to force the object's cleanup. This is both time-consuming and wasteful of the garbage collector's efforts, since a collection may involve not only recollection, but readjustment of object locations in memory. If a programmer requires more explicit control over when an object is cleaned up, the class can be declared as implementing the `IDisposable` interface (which consists of a single method, `Dispose()`). Use of `IDisposable` is recommended over the use of `Finalize()` methods. This is due to a variety of reasons too numerous to explore here.

The `KeepAlive()` method is used to preserve the life of an object that is not strongly referenced. This is sometimes required when interacting with methods in unmanaged code (such as Win32 APIs or COM). The `KeepAlive()` method works in an unusual manner: it makes an object ineligible for garbage collection from the start of the current routine to the point where the `KeepAlive()` method is called. This unusual system prevents problems that could otherwise be created by compiler optimizations.

```
Public NotInheritable Class GC

' Public Shared Properties

   Public Shared ReadOnly Property MaxGeneration As Integer

' Public Shared Methods

   Public Shared Sub Collect()

   Public Shared Sub Collect( ByVal generation As Integer)

   Public Shared Function GetGeneration(
```

```
        ByVal obj As Object) As Integer
    Public Shared Function GetGeneration(
        ByVal wo As WeakReference) As Integer
    Public Shared Function GetTotalMemory(
        ByVal forceFullCollection As Boolean) As Long
    Public Shared Sub KeepAlive( ByVal obj As Object)
    Public Shared Sub ReRegisterForFinalize(
        ByVal obj As Object)
    Public Shared Sub SuppressFinalize( ByVal obj As Object)
    Public Shared Sub WaitForPendingFinalizers()
End Class
```

## Guid Structure

### System (mscorlib.dll) *serializable*

This value type represents a Globally Unique Identifier (GUID). A GUID is a 128-bit integer (16 byte
and networks and will be statistically unique (for all practical purposes, the number cannot be duplic
identify COM (but not .NET) objects uniquely for registration purposes.

```
Public Structure Guid : Implements IFormattable, IComparable
' Public Constructors
   Public Sub New( ByVal b As Byte())
   Public Sub New(ByVal a As Integer, ByVal b As Short,
        ByVal c As Short, ByVal d As Byte())
   Public Sub New(ByVal a As Integer, ByVal b As Short,
        ByVal c As Short, ByVal d As Byte, ByVal e As Byte,
        ByVal f As Byte, ByVal g As Byte, ByVal h As Byte,
        ByVal i As Byte, ByVal j As Byte, ByVal k As Byte)
   Public Sub New( ByVal g As String)
   Public Sub New(ByVal a As UInt32, ByVal b As UInt16,
        ByVal c As UInt16, ByVal d As Byte,
        ByVal e As Byte, ByVal f As Byte, ByVal g As Byte,
        ByVal h As Byte, ByVal i As Byte, ByVal j As Byte,
        ByVal k As Byte)
' Public Shared Fields
   Public Shared ReadOnly Empty As Guid                          // =0000
' Public Shared Methods
   Public Shared Function NewGuid() As Guid
   Public Shared Boolean operator Sub !=(
        ByVal a As Guid, ByVal b As Guid)
   Public Shared Boolean operator Sub ==(
        ByVal a As Guid, ByVal b As Guid)
' Public Instance Methods
   Public Function CompareTo(
```

```
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal o As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function ToByteArray() As Byte()
   Overrides Public Function ToString() As String
   Public Function ToString(ByVal format As String) As String
   Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

### Hierarchy

Object → ValueType → Guid(IFormattable, IComparable)

### Returned By

System.Reflection.Emit.UnmanagedMarshal.IIDGuid,
System.Runtime.InteropServices.IRegistrationServices.GetManagedCategoryGu
System.Runtime.InteropServices.Marshal.{GenerateGuidForType(), GetTypeLibGu
GetTypeLibGuidForAssembly()},
System.Runtime.InteropServices.RegistrationServices.GetManagedCategoryGui
System.Xml.XmlConvert.ToGuid()

### Passed To

System.Reflection.Emit.ModuleBuilder.DefineDocument(),
System.Runtime.InteropServices.IRegistrationServices.RegisterTypeForComCl
System.Runtime.InteropServices.Marshal.QueryInterface(),
System.Runtime.InteropServices.RegistrationServices.RegisterTypeForComCli
System.Xml.XmlConvert.ToString()

## IAsyncResult Interface

## System (mscorlib.dll) *ECMA*

This interface is used in asynchronous programming to act as a placeholder for the result of the async call. It is most commonly used when an instance of a delegate type is fired using the `BeginInvoke` method. (This idiom is used extensively throughout the .NET Framework Class Library.)

Asynchronous method calls can be harvested in a number of ways. A programmer can poll the call by checking the `IsCompleted` property of the `IAsyncResult` object to see if the call has completed yet. This, while perhaps the simplest approach, is also likely the most wasteful, as the caller needs to be in some sort of spin loop, repeatedly checking the property until a `true` is received.

A variant of the polling spin loop is to use the `AsyncWaitHandle` property of `IAsyncResult`. This is a standard Win32 handle that can be used in some of the synchronization primitives provided in the `System.Threading` namespace. Specifically, this property is a `System.Threading.WaitHandle` instance, meaning that the programmer can call any of the `Wait` methods: `WaitOne()`, `WaitAny()`, or `WaitAll()`. The net effect is the same — put the calling thread to sleep until the async call completes.

Although not formally part of the `IAsyncResult` interface, a corresponding `EndInvoke` method is supported by delegates. The `EndInvoke` method blocks the calling thread until the async call completes. Alternatively, at the point of the async delegate call, a programmer can specify a callback delegate to call when the async call completes. This callback, a delegate instance of type `AsyncCallback`, is passed this `IAsyncResult` instance as part of the call. An optional generic argument can also be passed in as part of the async call, and this generic argument is available on the `IAsyncResult` through the `AsyncState` property.

```
Public Interface IAsyncResult

' Public Instance Properties

   Public ReadOnly Property AsyncState As Object

   Public ReadOnly Property AsyncWaitHandle As WaitHandle

   Public ReadOnly Property CompletedSynchronously As Boolean

   Public ReadOnly Property IsCompleted As Boolean

End Interface
```

### Returned By

Multiple types

### Passed To

Multiple types

## ICloneable Interface

## System (mscorlib.dll) *ECMA*

`ICloneable` is a marker interface, indicating that an object can be cloned (that is, have a completely identical copy created). It consists of a single method, `Clone()`, which is called by clients wishing to create a complete copy of the `ICloneable`-implementing class.

When speaking of cloning, the terms *deep copy cloning* and *shallow copy cloning* indicate how deeply into the object graph a clone operation will carry itself. A deep copy not only clones the object called, but in turn seeks to clone any objects to which it holds reference. This sort of operation must be handled by the programmer, usually by calling `Clone()` in turn on each object this object references. A shallow copy is a complete bitwise copy of this object; any objects referenced by this object are also referenced by the cloned object.

The simplest way to implement a shallow clone is to use the `Object.MemberwiseClone()` method to copy this object's fields directly and then return. A deep clone also calls `MemberwiseClone()`, but then also asks each object reference held within this object to `Clone()` itself.

```
Public Interface ICloneable

' Public Instance Methods

   Public Function Clone() As Object

End Interface
```

### Implemented By

Multiple types

# IComparable Interface

## System (mscorlib.dll) *ECMA*

This interface is implemented by classes that can be ordered in a list. Classes such as `String` and `Int32` implement this interface. You can also implement it in your own classes to create a type-specific method that allows your objects to be sorted in arrays. This interface does not allow classes to be compared with the greater-than and less-than operators. This interface simply provides a well-known protocol for doing comparisons of objects.

To implement `IComparable`, override the `CompareTo()` method. This method accepts another instance of your `IComparable` object and returns an integer that indicates the result of the comparison. (Zero means equal, less than zero indicates that the supplied object is less than the current instance, and greater than zero indicates that the object is greater than the current instance.) Note that the actual value of the integer is irrelevant other than its positive, negative, or zero status (similar to the way `strcmp` works in C). Also note that because `CompareTo()` accepts an argument of `IComparable` type, care must be taken to ensure that it is a legitimate comparison — for example, `myInt.CompareTo(myString)` throws an `ArgumentException`.

```
Public Interface IComparable

' Public Instance Methods

   Public Function CompareTo( ByVal obj As Object) As Integer

End Interface
```

### Implemented By

Multiple types

# IConvertible Interface

## System (mscorlib.dll)

The `IConvertible` interface allows conversion of an object to basic data types and allows the conversion methods in the `Convert` class to use that object. When implementing the `IConvertible` interface, create your own type-specific methods for each of the supplied conversion methods.

Note that `IConvertible` allows one-way conversion from a custom type to other data types, but does not allow a conversion from a basic data type to a custom type.

```
Public Interface IConvertible

' Public Instance Methods

   Public Function GetTypeCode() As TypeCode

   Public Function ToBoolean(

        ByVal provider As IFormatProvider) As Boolean

   Public Function ToByte(

        ByVal provider As IFormatProvider) As Byte

   Public Function ToChar(

        ByVal provider As IFormatProvider) As Char

   Public Function ToDateTime(

        ByVal provider As IFormatProvider) As Date

   Public Function ToDecimal(

        ByVal provider As IFormatProvider) As Decimal

   Public Function ToDouble(

        ByVal provider As IFormatProvider) As Double

   Public Function ToInt16(

        ByVal provider As IFormatProvider) As Short

   Public Function ToInt32(

        ByVal provider As IFormatProvider) As Integer

   Public Function ToInt64(

        ByVal provider As IFormatProvider) As Long

   Public Function ToSByte(
```

```
        ByVal provider As IFormatProvider) As SByte
    Public Function ToSingle(
        ByVal provider As IFormatProvider) As Single
    Public Function ToString(
        ByVal provider As IFormatProvider) As String
    Public Function ToType(ByVal conversionType As Type,
        ByVal provider As IFormatProvider) As Object
    Public Function ToUInt16(
        ByVal provider As IFormatProvider) As UInt16
    Public Function ToUInt32(
        ByVal provider As IFormatProvider) As UInt32
    Public Function ToUInt64(
        ByVal provider As IFormatProvider) As UInt64
End Interface
```

### Implemented By

Multiple types

## ICustomFormatter Interface

## System (mscorlib.dll)

This interface provides a custom formatter, which returns string information for supplied objects based on custom criteria. The `ICustomFormatter` interface contains a single `Format()` method. This method accepts a `format` string and an `IFormatProvider` object and uses this criteria to determine which string to return for the specified object.

```
Public Interface ICustomFormatter
' Public Instance Methods
   Public Function Format(ByVal format As String,
        ByVal arg As Object,
        ByVal formatProvider As IFormatProvider) As String
End Interface
```

# IDisposable Interface

## System (mscorlib.dll) *ECMA*

This interface provides a last-ditch cleanup hook with well-known timing semantics (similar in concept to a C++ destructor). This is called *deterministic finalization*.

As part of normal garbage-collection operation, the CLR looks for (and calls if available) the object's `Finalize` method right before it removes an object from heap memory. Unfortunately, because the CLR may not garbage-collect the object as soon as it becomes available for collection, objects may hold onto resources for longer than necessary. The `IDisposable` interface is intended to work with language constructs to let you ensure that key resources are released in a time-efficient manner.

Any object whose type implements the `IDisposable` interface must have a corresponding `Dispose()` method defined for it.

If a type provides a `Finalize` method, then it should also inherit this interface and provide a corresponding `Dispose()` method. In addition, once the `Dispose()` method is called, part of its implementation should be to call the `GC.SuppressFinalize()` method to prevent the garbage collector from finalizing this object again when garbage collection occurs.

```
Public Interface IDisposable

' Public Instance Methods

   Public Sub Dispose()

End Interface
```

### Implemented By

Multiple types

## IFormatProvider — Interface

## System (mscorlib.dll) — *ECMA*

This interface provides a way to retrieve an object that controls formatting through the `GetFormat()` method. For example, the `System.Globalization.CultureInfo` class can return a `System.Globalization.NumberFormatInfo` object, a `System.Globalization.DateTimeFormatInfo` object, or a null reference, depending on the supplied `formatType` parameter.

```
Public Interface IFormatProvider

' Public Instance Methods

   Public Function GetFormat(

        ByVal formatType As Type) As Object

End Interface
```

### Implemented By

`System.Globalization.{CultureInfo, DateTimeFormatInfo, NumberFormatInfo}`

### Returned By

`System.IO.TextWriter.FormatProvider`

### Passed To

Multiple types

## IFormattable Interface

## System (mscorlib.dll) *ECMA*

This interface is implemented in your objects to provide a custom `ToString()` method that accepts a `format` string and an `IFormatProvider` instance. You can then use this information to determine how the return string should be rendered. All numeric value types in the `System` namespace implement this interface.

```
Public Interface IFormattable
' Public Instance Methods
   Public Function ToString(ByVal format As String,
        ByVal formatProvider As IFormatProvider) As String
End Interface
```

### Implemented By

Multiple types

## IndexOutOfRangeException NotInheritable Class

**System (mscorlib.dll)** ***ECMA, serializable***

This exception signals an attempt to access an index beyond the bounds of a collection or array.

```
Public NotInheritable Class IndexOutOfRangeException : Inherits SystemExc

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → IndexOutOfRangeException

## Int16 Structure

## System (mscorlib.dll) *ECMA, serializable*

This is the value type for 16-bit integers (which can range from -32768 to 32767). This is also availa through the `Short` alias.

```
Public Structure Int16 : Implements IComparable, IFormattable, IConvertib

' Public Shared Fields

   Public const MaxValue As Short                                    // =3276

   Public const MinValue As Short                                    // =-327

' Public Shared Methods

   Public Shared Function Parse( ByVal s As String) As Short

   Public Shared Function Parse(ByVal s As String,

        ByVal provider As IFormatProvider) As Short

   Public Shared Function Parse(ByVal s As String,

        ByVal style As System.Globalization.NumberStyles) As Short

   Public Shared Function Parse(ByVal s As String,

        ByVal style As System.Globalization.NumberStyles,

        ByVal provider As IFormatProvider) As Short

' Public Instance Methods

   Public Function CompareTo(

        ByVal value As Object) As Integer Implements IComparable.CompareT

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Public Function GetTypeCode(

        ) As TypeCode Implements IConvertible.GetTypeCode

   Overrides Public Function ToString() As String

   Public Function ToString(

        ByVal provider As IFormatProvider) As String Implements IConverti

   Public Function ToString(ByVal format As String) As String
```

```
    Public Function ToString(ByVal format As String,
         ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

`Object → ValueType → Int16(IComparable, IFormattable, IConvertible)`

## Returned By

Multiple types

## Passed To

Multiple types

## Int32 Structure

### System (mscorlib.dll) *ECMA, serializable*

This is the value type for 32-bit integers (which can range from -2,147,483,648 to 2,147,483,647). T available in VB.NET through the `Integer` alias.

```
Public Structure Int32 : Implements IComparable, IFormattable, IConvertib
' Public Shared Fields
   Public const MaxValue As Integer                                  // =2147
   Public const MinValue As Integer                                  // =-214
' Public Shared Methods
   Public Shared Function Parse(ByVal s As String) As Integer
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As Integer
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As Integer
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As Integer
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConverti
   Public Function ToString(ByVal format As String) As String
```

```
   Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → Int32(IComparable, IFormattable, IConvertible)

## Returned By

Multiple types

## Passed To

Multiple types

## Int64 Structure

### System (mscorlib.dll) *ECMA, serializable*

This is the value type for 64-bit integers (which can range, approximately, from -9.22x10[18] to 9.22x1
available in VB.NET through the `Long` alias.

```
Public Structure Int64 : Implements IComparable, IFormattable, IConvertib
' Public Shared Fields
   Public const MaxValue As Long                                     // =9223
   Public const MinValue As Long                                     // =-922
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As Long
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As Long
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As Long
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As Long
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConverti
   Public Function ToString(ByVal format As String) As String
```

```
    Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → Int64(IComparable, IFormattable, IConvertible)

## Returned By

Multiple types

## Passed To

Multiple types

# IntPtr Structure

## System (mscorlib.dll) *ECMA, serializable*

This is the value type used to store unmanaged pointers or handles (e.g., `IntPtr` objects are used
`System.IO.FileStream` class to hold file handles).

Using this type allows your pointers to be platform-independent, as `IntPtr` is automatically mappe
32-bit integer on 32-bit operating systems and to a 64-bit integer on 64-bit operating systems. The `I`
type is CLS-compliant and should be used in preference of the `UIntPtr`.

```
Public Structure IntPtr : Implements System.Runtime.Serialization.ISerial

' Public Constructors

   Public Sub New( ByVal value As Integer)

   Public Sub New( ByVal value As Long)

' Public Shared Fields

   Public Shared ReadOnly Zero As IntPtr                              // =0

' Public Shared Properties

   Public Shared ReadOnly Property Size As Integer

' Public Shared Methods

   Public Shared Boolean operator Sub !=(

        ByVal value1 As IntPtr, ByVal value2 As IntPtr)

   Public Shared Boolean operator Sub ==(

        ByVal value1 As IntPtr, ByVal value2 As IntPtr)

   Public Shared explicit operator Sub Integer(

        ByVal value As IntPtr)

   Public Shared explicit operator Sub Long(

        ByVal value As IntPtr)

   Public Shared explicit operator Sub IntPtr(

        ByVal value As Integer)

   Public Shared explicit operator Sub IntPtr(

        ByVal value As Long)

' Public Instance Methods

   Overrides Public Function Equals(
```

```
        ByVal obj As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function ToInt32() As Integer
    Public Function ToInt64() As Long
    Overrides Public Function ToString() As String
End Structure
```

### Hierarchy

Object → ValueType → IntPtr(System.Runtime.Serialization.ISerializable)

### Returned By

Multiple types

### Passed To

Multiple types

## InvalidCastException Class

### System (mscorlib.dll) *ECMA, serializable*

This exception signals a failure during a cast or explicit conversion.

```
Public Class InvalidCastException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → InvalidCastException

## InvalidOperationException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates that a user attempted to use a method when the object was not in an appropriate state. For example, this exception is thrown if you attempt to write data with a `System.Xml.XmlTextWriter` that is already closed.

```
Public Class InvalidOperationException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `InvalidOperationException`

### Subclasses

`ObjectDisposedException`, `System.Net.{ProtocolViolationException, WebException}`

## InvalidProgramException NotInheritable Class

**System (mscorlib.dll)** ***ECMA, serializable***

This exception indicates that the .NET execution engine found some invalid code or metadata in a program. This can be caused by a compiler bug that generates malformed MSIL (Microsoft Interme Language) instructions.

```
Public NotInheritable Class InvalidProgramException : Inherits SystemExce
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → InvalidProgramException

## IServiceProvider Interface

## System (mscorlib.dll)

This interface defines a mechanism for retrieving a service object. A class implementing this interface provides a service object to other objects through its `GetService()` method.

```
Public Interface IServiceProvider

' Public Instance Methods

   Public Function GetService(

        ByVal serviceType As Type) As Object

End Interface
```

## LoaderOptimization Enum

**System (mscorlib.dll)** ***serializable***

This enumeration is used for the `LoaderOptimizationAttribute` constructor. It specifies whether your application will use more than one `AppDomain`. Use the `MultiDomain` value if your application contains many domains that use the same code, and use `MultiDomainHost` if your application hosts multiple domains with unique code — in which case resources are shared for globally available assemblies only. `NotSpecified` reverts to `SingleDomain`, unless the default domain or host specifies otherwise.

```
Public Enum LoaderOptimization
   NotSpecified = 0
   SingleDomain = 1
   MultiDomain = 2
   MultiDomainHost = 3
End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `LoaderOptimization`

### Returned By

`AppDomainSetup.LoaderOptimization`, `LoaderOptimizationAttribute.Value`

### Passed To

`AppDomainSetup.LoaderOptimization`, `LoaderOptimizationAttribute.LoaderOptimizationAttribute()`

# LoaderOptimizationAttribute NotInheritable Class

## System (mscorlib.dll)

This attribute can be used only on your application's `Main` method. It sets the type of default optimization used to share internal resources across application domains. It is most relevant when y use the `AppDomain` class to create more than one domain from your application. By default, if you ( not use this attribute, the .NET Framework makes optimizations with the assumption that your application has only a single domain.

```
Public NotInheritable Class LoaderOptimizationAttribute : Inherits Attribu
' Public Constructors
   Public Sub New( ByVal value As Byte)
   Public Sub New( ByVal value As LoaderOptimization)
' Public Instance Properties
   Public ReadOnly Property Value As LoaderOptimization
End Class
```

### Hierarchy

Object → Attribute → LoaderOptimizationAttribute

### Valid On

Method

## LocalDataStoreSlot NotInheritable Class

## System (mscorlib.dll)

The CLR allocates a multislot local data store to each process when it starts. These slots are used for thread-specific and context-specific data, and are not shared between threads or contexts. The `LocalDataStoreSlot` class encapsulates one of these slots. It's used by the `GetData()` and `SetData()` methods in the `System.Threading.Thread` and `System.Runtime.Remoting.Contexts.Context` classes.

```
Public NotInheritable Class LocalDataStoreSlot

' Protected Instance Methods

   Overrides Protected Sub Finalize()

End Class
```

### Returned By

`System.Threading.Thread.{AllocateDataSlot(), AllocateNamedDataSlot(), GetNamedDataSlot()}`

### Passed To

`System.Threading.Thread.{GetData(), SetData()}`

## MarshalByRefObject MustInherit Class

**System (mscorlib.dll)** ***ECMA, serializable, marshal by reference***

`MarshalByRefObject` is the base class for objects that are marshaled by reference across `AppDomain` boundaries. If you attempt to transmit an object that derives from this class to another domain (e.g., as a parameter in a method call to a remote machine), an object reference is sent. (In actuality, this is an object proxy, which provides the same interface — methods, properties, and so forth.) If the other domain uses this reference (e.g., sets an object property or calls one of its methods), the call is automatically marshaled back to the original domain in which the object was created, and it is invoked there, using the proxy object the .NET Framework creates automatically.

You can inherit from this class to create a remotable object. Values that should be marshaled by reference include unmanaged pointers and file handles, which do not have any meaning in another domain. Objects that are marshaled by reference live until their lifetime lease expires. The `MarshalByRefObject` class includes methods for getting and setting the `ILease` object from the `System.Runtime.Remoting.Lifetime` namespace. More information about remoting can be found in the `System.Runtime.Remoting` namespace.

```
Public MustInherit Class MarshalByRefObject

' Protected Constructors

   Protected Sub New()

' Public Instance Methods

   Overridable Public Function CreateObjRef(

        ByVal requestedType As Type) As ObjRef

   Public Function GetLifetimeService() As Object

   Overridable Public Function InitializeLifetimeService(

        ) As Object

End Class
```

### Subclasses

Multiple types

## Math NotInheritable Class

## System (mscorlib.dll) *ECMA*

This class provides shared helper functions for many trigonometric, logarithmic, and other mathema operations, including methods for rounding numbers, getting absolute values, retrieving the largest (`Floor()`), and determining the remainder (`IEEERemainder()`). The constants *pi* and *e* are provi

```
Public NotInheritable Class Math

' Public Shared Fields

   Public const E As Double                                          // =2.71

   Public const PI As Double                                         // =3.14

' Public Shared Methods

   Public Shared Function Abs(

        ByVal value As Decimal) As Decimal

   Public Shared Function Abs(

        ByVal value As Double) As Double

   Public Shared Function Abs( ByVal value As Short) As Short

   Public Shared Function Abs(

        ByVal value As Integer) As Integer

   Public Shared Function Abs( ByVal value As Long) As Long

   Public Shared Function Abs( ByVal value As SByte) As SByte

   Public Shared Function Abs(

        ByVal value As Single) As Single

   Public Shared Function Acos( ByVal d As Double) As Double

   Public Shared Function Asin( ByVal d As Double) As Double

   Public Shared Function Atan( ByVal d As Double) As Double

   Public Shared Function Atan2(ByVal y As Double,

        ByVal x As Double) As Double

   Public Shared Function Ceiling(

        ByVal a As Double) As Double

   Public Shared Function Cos( ByVal d As Double) As Double

   Public Shared Function Cosh(
```

```
    ByVal value As Double) As Double
Public Shared Function Exp( ByVal d As Double) As Double
Public Shared Function Floor( ByVal d As Double) As Double
Public Shared Function IEEERemainder(ByVal x As Double,
    ByVal y As Double) As Double
Public Shared Function Log( ByVal d As Double) As Double
Public Shared Function Log(ByVal a As Double,
    ByVal newBase As Double) As Double
Public Shared Function Log10( ByVal d As Double) As Double
Public Shared Function Max(ByVal val1 As Byte,
    ByVal val2 As Byte) As Byte
Public Shared Function Max(ByVal val1 As Decimal,
    ByVal val2 As Decimal) As Decimal
Public Shared Function Max(ByVal val1 As Double,
    ByVal val2 As Double) As Double
Public Shared Function Max(ByVal val1 As Short,
    ByVal val2 As Short) As Short
Public Shared Function Max(ByVal val1 As Integer,
    ByVal val2 As Integer) As Integer
Public Shared Function Max(ByVal val1 As Long,
    ByVal val2 As Long) As Long
Public Shared Function Max(ByVal val1 As SByte,
    ByVal val2 As SByte) As SByte
Public Shared Function Max(ByVal val1 As Single,
    ByVal val2 As Single) As Single
Public Shared Function Max(ByVal val1 As UInt16,
    ByVal val2 As UInt16) As UInt16
Public Shared Function Max(ByVal val1 As UInt32,
    ByVal val2 As UInt32) As UInt32
Public Shared Function Max(ByVal val1 As UInt64,
```

```
    ByVal val2 As UInt64) As UInt64
Public Shared Function Min(ByVal val1 As Byte,
    ByVal val2 As Byte) As Byte
Public Shared Function Min(ByVal val1 As Decimal,
    ByVal val2 As Decimal) As Decimal
Public Shared Function Min(ByVal val1 As Double,
    ByVal val2 As Double) As Double
Public Shared Function Min(ByVal val1 As Short,
    ByVal val2 As Short) As Short
Public Shared Function Min(ByVal val1 As Integer,
    ByVal val2 As Integer) As Integer
Public Shared Function Min(ByVal val1 As Long,
    ByVal val2 As Long) As Long
Public Shared Function Min(ByVal val1 As SByte,
    ByVal val2 As SByte) As SByte
Public Shared Function Min(ByVal val1 As Single,
    ByVal val2 As Single) As Single
Public Shared Function Min(ByVal val1 As UInt16,
    ByVal val2 As UInt16) As UInt16
Public Shared Function Min(ByVal val1 As UInt32,
    ByVal val2 As UInt32) As UInt32
Public Shared Function Min(ByVal val1 As UInt64,
    ByVal val2 As UInt64) As UInt64
Public Shared Function Pow(ByVal x As Double,
    ByVal y As Double) As Double
Public Shared Function Round(
    ByVal d As Decimal) As Decimal
Public Shared Function Round(ByVal d As Decimal,
    ByVal decimals As Integer) As Decimal
Public Shared Function Round( ByVal a As Double) As Double
Public Shared Function Round(ByVal value As Double,
```

```
        ByVal digits As Integer) As Double
    Public Shared Function Sign(
        ByVal value As Decimal) As Integer
    Public Shared Function Sign(
        ByVal value As Double) As Integer
    Public Shared Function Sign(
        ByVal value As Short) As Integer
    Public Shared Function Sign(
        ByVal value As Integer) As Integer
    Public Shared Function Sign(
        ByVal value As Long) As Integer
    Public Shared Function Sign(
        ByVal value As SByte) As Integer
    Public Shared Function Sign(
        ByVal value As Single) As Integer
    Public Shared Function Sin( ByVal a As Double) As Double
    Public Shared Function Sinh(
        ByVal value As Double) As Double
    Public Shared Function Sqrt( ByVal d As Double) As Double
    Public Shared Function Tan( ByVal a As Double) As Double
    Public Shared Function Tanh(
        ByVal value As Double) As Double
End Class
```

# MemberAccessException Class

## System (mscorlib.dll) *ECMA, serializable*

This is the superclass of several exceptions that indicate a failed attempt to access a class member.

```
Public Class MemberAccessException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → MemberAccessException

### Subclasses

FieldAccessException, MethodAccessException, MissingMemberException

## MethodAccessException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates a failed attempt to access a method.

```
Public Class MethodAccessException : Inherits MemberAccessException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → MemberAccessException → MethodAccessException

# MissingFieldException Class

## System (mscorlib.dll) *ECMA, serializable*

MissingMemberException indicates an attempt to access a nonexistent field.

```
Public Class MissingFieldException : Inherits MissingMemberException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
   Public Sub New(ByVal className As String,
        ByVal fieldName As String)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Overrides Public ReadOnly Property Message As String
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → MemberAccessException → MissingMemberException → MissingFieldException

## MissingMemberException Class

### System (mscorlib.dll) *ECMA, serializable*

This is the superclass of several exceptions that indicate an attempt to access a nonexistent member. Although the compiler detects explicit attempts of this sort, it does not protect against attempts to access nonexistent members using reflection.

```
Public Class MissingMemberException : Inherits MemberAccessException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

   Public Sub New(ByVal className As String,

        ByVal memberName As String)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Protected Instance Fields

   protected ClassName As String

   protected MemberName As String

   protected Signature As Byte()

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → MemberAccessException → MissingMemberException

## Subclasses

MissingFieldException, MissingMethodException

## MissingMethodException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates an attempt to access a nonexistent method.

```
Public Class MissingMethodException : Inherits MissingMemberException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

   Public Sub New(ByVal className As String,

        ByVal methodName As String)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → MemberAccessException → MissingMemberException → MissingMethodException

## MTAThreadAttribute NotInheritable Class

## System (mscorlib.dll)

This attribute is used entirely for COM interoperability in .NET; it has no effect on a pure .NET application or system.

This attribute can be used only on the `Main` method of the application. It sets the default threading model to MTA (multithreaded apartment). Alternatively, you can use the `STAThreadAttribute` attribute for a single-threaded apartment model.

```
Public NotInheritable Class MTAThreadAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `MTAThreadAttribute`

### Valid On

Method

## MulticastDelegate MustInherit Class

## System (mscorlib.dll) *serializable*

This is the base class for multicast delegates. Multicast delegates are identical to normal delegates, except that their invocation list can hold more than one method at a time. You can use `Delegate.Combine()` to add a method to the list and `Delegate.Remove()` to remove one. When you invoke a multicast delegate, the methods are invoked synchronously one after the other. An error in one method can prevent the delegate from calling the other methods in its list.

Multicast delegates can also be invoked asynchronously, meaning that the entire call chain is invoked serially by a single thread out of the system thread pool. If it is desirable to invoke each delegate in the chain on its own asynchronous thread instead, then use `GetInvocationList()` to obtain the list of delegates and asynchronously invoke each one.

```
Public MustInherit Class MulticastDelegate : Inherits Delegate

' Protected Constructors

   Protected Sub New(ByVal target As Object,

        ByVal method As String)

   Protected Sub New(ByVal target As Type,

        ByVal method As String)

' Public Shared Methods

   Public Shared Boolean operator Sub !=(

        ByVal d1 As MulticastDelegate,

        ByVal d2 As MulticastDelegate)

   Public Shared Boolean operator Sub ==(

        ByVal d1 As MulticastDelegate,

        ByVal d2 As MulticastDelegate)

' Public Instance Methods

   Overrides NotOverridable Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides NotOverridable Public Function GetHashCode(

        ) As Integer

   Overrides NotOverridable Public Function GetInvocationList(

        ) As Delegate()

   Overrides Public Sub GetObjectData(
```

```
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Protected Instance Methods
   Overrides NotOverridable Protected Function CombineImpl(
        ByVal follow As Delegate) As Delegate
   Overrides NotOverridable Protected Function DynamicInvokeImpl(
        ByVal args As Object()) As Object
   Overrides NotOverridable Protected Function RemoveImpl(
        ByVal value As Delegate) As Delegate
End Class
```

## Hierarchy

Object → Delegate(ICloneable, System.Runtime.Serialization.ISerializable) → MulticastDelegate

## Subclasses

Multiple types

## MulticastNotSupportedException NotInheritable Class

## System (mscorlib.dll) *serializable*

This exception is thrown when two uncombinable delegates are combined; see `Delegate` and `MulticastDelegate` for details regarding what constitutes *combinable* delegates.

```
Public NotInheritable Class MulticastNotSupportedException : Inherits Sys

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemE` `MulticastNotSupportedException`

## NonSerializedAttribute NotInheritable Class

## System (mscorlib.dll)

This attribute lets you mark properties of fields in a class as nonserializable, so that they are ignored during a serialization operation. Typical examples of nonserializable data include pointers, handles, and other data structures that can't be recreated during deserialization.

By default, a class is not eligible for serialization unless it implements `System.Runtime.Serialization.ISerializable` or is marked with a `SerializableAttribute`. Once a class is marked as serializable, you must mark all fields or properties that are not to be serialized with a `NonSerializedAttribute`.

```
Public NotInheritable Class NonSerializedAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `NonSerializedAttribute`

### Valid On

Field

## NotFiniteNumberException Class

**System (mscorlib.dll)** ***ECMA, serializable***

This exception is thrown when certain languages encounter floating-point infinity or NaN (not a number) values. These values can be represented in VB with `Double.NegativeInfinity`, `Double.PositiveInfinity`, and `Double.NaN`. (Similar fields are available in `Single`.)

```
Public Class NotFiniteNumberException : Inherits ArithmeticException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal offendingNumber As Double)

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal offendingNumber As Double)

   Public Sub New(ByVal message As String,

        ByVal offendingNumber As Double,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Public ReadOnly Property OffendingNumber As Double

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `ArithmeticException` → `NotFiniteNumberException`

## NotImplementedException Class

## System (mscorlib.dll) *serializable*

This exception signals an attempt to access an unimplemented method or operation.

Suppose you have a base class with a number of unimplemented methods. You may have reason not to mark them as MustInherit (perhaps you want to let programmers develop subclasses that only implement some of the base class methods). You can throw this exception in those methods, letting users of the subclass know that they are not implemented.

```
Public Class NotImplementedException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → NotImplementedException

# NotSupportedException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates an attempt to use an unsupported method. For example, if you try to seek on a stream that is based on unidirectional input — for example, a standard input stream from a console utility such as *sort.exe* — this exception could be thrown.

```
Public Class NotSupportedException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → NotSupportedException

### Subclasses

PlatformNotSupportedException

## NullReferenceException Class

### System (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you try to dereference a null pointer (for example, accessing an instance field on an object reference that currently points to no instance).

```
Public Class NullReferenceException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → NullReferenceException

## Object Class

### System (mscorlib.dll) *ECMA, serializable*

This class is the root of all .NET types, including value types and reference types. Some CLR languages such as C# and VB.NET do not require a type to inherit from `Object` explicitly. If no base type is listed in a class declaration, it is assumed that the type is to inherit from `Object`. Therefore, all types derive from it implicitly and can use any of its methods.

Use the `GetType()` method to obtain a description of your object's internal metadata as a `Type` object. Use the `ToString()` method to get a `String` that represents your object. By default, this is the fully qualified type name of your object, but most classes override this method to provide something more useful, such as a string representation of the object's content. For example, `System.Drawing.Point.ToString()` might return `(10, 5)`.

The `MemberwiseClone()` method returns a new object of the same type that is a member-by-member duplicate. This object is called a shallow copy because any subobjects are not copied. Instead, the references are duplicated, meaning that both the original and cloned type refer to the same subobjects. `MemberwiseClone()` is protected, so it can be called only from methods of your derived object. Usually, you will implement the `ICloneable` interface for your objects and call `MemberwiseClone()` from a customized `ICloneable.Clone()` method.

Use the `Equals()` method to test for reference equality. Derived value-type classes override this method to provide value equality (which returns `true` for identical content, even if it is stored in different objects at different memory addresses). Note that the equality operator (`==` in C#, `=` in VB.NET) does not call `Equals()` unless the equality operator is overloaded for the appropriate type (as it is with `String`, for example).

The `ReferenceEquals()` method, while perhaps seeming somewhat similar, compares object identity rather than object equality. That is, while `Equals()` might return `true` for two independent objects that contain the same state, `ReferenceEquals()` checks to see if the two references passed to it point to the same object. These two objects are identical, which is only the case when both references point to the same location in memory. `ReferenceEquals()` is the only safe way to test references for identity.

The `GetHashCode()` method returns a hash code so the object can be used as a key in a `System.Collections.Hashtable` collection. By default, `GetHashCode()` returns a unique hash code for each object, which is sufficient for reference types but must be overridden by all value types so that equivalent types return identical hash codes.

```
Public Class Object

' Public Constructors

   Public Sub New()

' Public Shared Methods

   Public Shared Function Equals(ByVal objA As Object,

        ByVal objB As Object) As Boolean

   Public Shared Function ReferenceEquals(
```

```
        ByVal objA As Object,
        ByVal objB As Object) As Boolean
' Public Instance Methods
   Overridable Public Function Equals(
        ByVal obj As Object) As Boolean
   Overridable Public Function GetHashCode() As Integer
   Public Function GetType() As Type
   Overridable Public Function ToString() As String
' Protected Instance Methods
   Overrides Protected Sub Finalize()
   Protected Function MemberwiseClone() As Object
End Class
```

### Subclasses

Multiple types

### Returned By

Multiple types

### Passed To

Multiple types

## ObjectDisposedException Class

**System (mscorlib.dll)** ***ECMA, serializable***

This exception is thrown when certain operations are performed on an object that has been disposed. For example, trying to read from an I/O stream that has been closed by the `System.IO.Stream.Close()` method should raise this exception.

```
Public Class ObjectDisposedException : Inherits InvalidOperationException

' Public Constructors

   Public Sub New( ByVal objectName As String)

   Public Sub New(ByVal objectName As String,

        ByVal message As String)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

   Public ReadOnly Property ObjectName As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `InvalidOperationException` → `ObjectDisposedException` p

# OperatingSystem NotInheritable Class

## System (mscorlib.dll) *serializable*

This class represents the current operating system by combining an instance of the `PlatformID` and `Version` classes. It is returned by the `Environment.OSVersion` property.

```
Public NotInheritable Class OperatingSystem : Implements ICloneable

' Public Constructors

   Public Sub New(ByVal platform As PlatformID,

        ByVal version As Version)

' Public Instance Properties

   Public ReadOnly Property Platform As PlatformID

   Public ReadOnly Property Version As Version

' Public Instance Methods

   Public Function Clone(

        ) As Object Implements ICloneable.Clone

   Overrides Public Function ToString() As String

End Class
```

### Returned By

`Environment.OSVersion`

# OutOfMemoryException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates that the .NET runtime has exhausted all available memory and usually means the CLR is in deep danger of dying altogether.

```
Public Class OutOfMemoryException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → OutOfMemoryException

# OverflowException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates an attempt to store a value that exceeds the limit of the target type. This could be caused by an arithmetic operation, cast, or conversion.

```
Public Class OverflowException : Inherits ArithmeticException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → ArithmeticException → OverflowException

## ParamArrayAttribute NotInheritable Class

### System (mscorlib.dll) *ECMA*

This attribute is used on a method to indicate that it can accept a variable number of parameters. The method has an array as its last parameter, and the list of values passed to the method are stored in the array. In VB.NET, use the `ParamArray` keyword to create methods with a variable number of arguments, rather than using this attribute directly.

```
Public NotInheritable Class ParamArrayAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `ParamArrayAttribute`

### Valid On

Parameter

## PlatformID Enum

## System (mscorlib.dll) *serializable*

This enumerated value indicates the type of operating platform that .NET is currently running on and is returned by the `OperatingSystem.Platform` property. `Win32Windows` indicates a Windows 9x-based operating system, while `Win32NT` indicates an operating system based on Windows NT, including Windows 2000, XP, and .NET Server. `Win32S` is a layer that can run on 16-bit versions of Windows (Windows 3.x) to provide access to some 32-bit applications.

```
Public Enum PlatformID

   Win32S = 0

   Win32Windows = 1

   Win32NT = 2

End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `PlatformID`

### Returned By

`OperatingSystem.Platform`

### Passed To

`OperatingSystem.OperatingSystem()`

## PlatformNotSupportedException Class

## System (mscorlib.dll) *serializable*

This exception signals an attempt to access a class or member that is not available on the current platform. For example, many properties from `System.Diagnostics.Process` are not available c Windows 95, 98, or ME.

```
Public Class PlatformNotSupportedException : Inherits NotSupportedExcepti

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → NotSupportedException → PlatformNotSupportedException

## Random Class

## System (mscorlib.dll) *ECMA, serializable*

This class encapsulates a *pseudorandom number* (one chosen from a list of pregenerated numbers, but that is statistically random). After creating an instance of this class, use the `Next()`, `NextDouble()`, or `NextBytes()` methods to return random information. `NextDouble()` returns a fraction value between 0.0 and 1.0, while `Next()` returns an integer between 0 and the maximum bound that you specify. `NextBytes()` fills a supplied array of bytes with random numbers.

When creating a `Random` object, you supply a seed value to the constructor, which determines the place on the list from where the random number is drawn. If you supply the same seed value to multiple `Random` instances, you will receive the same random number. Computers are incapable of generating truly random numbers, and `Random` should not be used for cryptographic algorithms. For a cryptographically strong random number generator, see the `System.Security.Cryptography.RandomNumberGenerator` in the .NET Framework SDK Documentation.

```
Public Class Random

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal Seed As Integer)

' Public Instance Methods

   Overridable Public Function Next() As Integer

   Overridable Public Function Next(

        ByVal maxValue As Integer) As Integer

   Overridable Public Function Next(ByVal minValue As Integer,

        ByVal maxValue As Integer) As Integer

   Overridable Public Sub NextBytes( ByVal buffer As Byte())

   Overridable Public Function NextDouble() As Double

' Protected Instance Methods

   Overridable Protected Function Sample() As Double

End Class
```

## RankException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception signals an attempt to send an array of the wrong rank to a method. For example, this exception is thrown when you pass a multidimensional array to `Array.Sort()` or `Array.Reverse()`.

```
Public Class RankException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → RankException

# ResolveEventArgs Class

## System (mscorlib.dll)

This object is provided to methods with the `ResolveEventHandler` signature, indicating additional information about the reference that could not be resolved in the `Name` property.

```
Public Class ResolveEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal name As String)

' Public Instance Properties

   Public ReadOnly Property Name As String

End Class
```

### Hierarchy

`Object` → `EventArgs` → `ResolveEventArgs`

### Passed To

`System.Reflection.ModuleResolveEventHandler.{BeginInvoke(), Invoke()}, ResolveEventHandler.{BeginInvoke(), Invoke()}`

# ResolveEventHandler Delegate

## System (mscorlib.dll) *serializable*

This delegate defines the event handler that can be created to respond to `AppDomain.TypeResolve`, `AppDomain.ResourceResolve`, and `AppDomain.AssemblyResolve` events. These events are raised when the runtime cannot find a type, assembly, or resource. Use this delegate to catch that event, then find and return the assembly that contains the missing type, resource, or assembly.

```
Public Delegate Function ResolveEventHandler(

        ByVal sender As Object,

        ByVal args As ResolveEventArgs) As Assembly
```

### Associated Events

`AppDomain.{AssemblyResolve(),ResourceResolve(),TypeResolve()}`

## RuntimeTypeHandle Structure

## System (mscorlib.dll) *ECMA, serializable*

This structure is a handle to the internal metadata representation of a type. The `Value` property provides an `IntPtr` reference. You can use this class with the `Type.GetTypeFromHandle()` shared method.

```
Public Structure RuntimeTypeHandle :
        Implements System.Runtime.Serialization.ISerializable
' Public Instance Properties
   Public ReadOnly Property Value As IntPtr
' Public Instance Methods
   Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
        Implements ISerializable.GetObjectData
End Structure
```

### Hierarchy

`Object` → `ValueType` → `RuntimeTypeHandle(System.Runtime.Serialization.ISerializable)`

### Returned By

`ArgIterator.GetNextArgType()`, `Type.{GetTypeHandle(), TypeHandle}`

### Passed To

`ArgIterator.GetNextArg()`, `Type.GetTypeFromHandle()`

## SByte Structure

## System (mscorlib.dll) *ECMA, serializable*

This structure represents an 8-bit signed integer (from -128 to 127). It is not CLS-compliant. Use In

```
Public Structure SByte : Implements IComparable, IFormattable, IConvertib
' Public Shared Fields
   Public const MaxValue As SByte                                     // =127
   Public const MinValue As SByte                                     // =-128
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As SByte
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As SByte
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As SByte
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As SByte
' Public Instance Methods
   Public Function CompareTo(
        ByVal obj As Object) As Integer Implements IComparable.CompareTo
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
   Public Function ToString(ByVal format As String) As String
   Public Function ToString(ByVal format As String,
```

```
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → SByte(IComparable, IFormattable, IConvertible)

## Returned By

Convert.ToSByte(), Decimal.ToSByte(), IConvertible.ToSByte(), System.IO.BinaryReader.ReadSByte(), Math.{Abs(), Max(), Min()}, System.Runtime.Serialization.FormatterConverter.ToSByte(), System.Runtime.Serialization.IFormatterConverter.ToSByte(), System.Runtime.Serialization.SerializationInfo.GetSByte(), System.Xml.XmlConvert.ToSByte()

## Passed To

Multiple types

## SerializableAttribute NotInheritable Class

## System (mscorlib.dll)

This attribute is used in the class definition to indicate that a class can be serialized. By default, all fields in the class are serialized except for the fields that are marked with a `NonSerializedAttribute`.

It is not necessary to use this attribute if a given type implements the `System.Runtime.Serialization.ISerializable` interface, which indicates that a class provides its own methods for serialization.

```
Public NotInheritable Class SerializableAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `SerializableAttribute`

### Valid On

Class, Struct, Enum, Delegate

## Single Structure

## System (mscorlib.dll) *ECMA, serializable*

This represents a 32-bit single-precision floating number as a value type. The value of a single can approximately from $-3.4\times10^{38}$ to $3.4\times10^{38}$, and can also be set to one of the following fields: `Posit`. `NegativeInfinity`, and `NaN` (not a number). In VB.NET, this type is aliased as `Single`.

```
Public Structure Single : Implements IComparable, IFormattable, IConvertil

' Public Shared Fields

   Public const Epsilon As Single                                 // =1.40

   Public const MaxValue As Single                                // =3.40

   Public const MinValue As Single                                // =-3.4

   Public const NaN As Single                                     // =NaN

   Public const NegativeInfinity As Single                        // =-Inf

   Public const PositiveInfinity As Single                        // =Infi

' Public Shared Methods

   Public Shared Function IsInfinity(

        ByVal f As Single) As Boolean

   Public Shared Function IsNaN(ByVal f As Single) As Boolean

   Public Shared Function IsNegativeInfinity(

        ByVal f As Single) As Boolean

   Public Shared Function IsPositiveInfinity(

        ByVal f As Single) As Boolean

   Public Shared Function Parse( ByVal s As String) As Single

   Public Shared Function Parse(ByVal s As String,

        ByVal provider As IFormatProvider) As Single

   Public Shared Function Parse(ByVal s As String,

        ByVal style As System.Globalization.NumberStyles) As Single

   Public Shared Function Parse(ByVal s As String,

        ByVal style As System.Globalization.NumberStyles,

        ByVal provider As IFormatProvider) As Single

' Public Instance Methods
```

```
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConverti
   Public Function ToString(ByVal format As String) As String
   Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormatta
End Structure
```

## Hierarchy

Object → ValueType → Single(IComparable, IFormattable, IConvertible)

## Returned By

BitConverter.ToSingle(), Convert.ToSingle(), Decimal.ToSingle(), System.Diagnostics.CounterSample.Calculate(), System.Diagnostics.CounterSampleCalculator.ComputeCounterValue(), System.Diagnostics.PerformanceCounter.NextValue(), IConvertible.ToSingle(), System.IO.BinaryReader.ReadSingle(), System.Runtime.Serialization.FormatterConverter.ToSingle(), System.Runtime.Serialization.IFormatterConverter.ToSingle(), System.Runtime.Serialization.SerializationInfo.GetSingle(), System.Xml.XmlConvert.ToSingle()

## Passed To

Multiple types

## StackOverflowException NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This exception indicates that the .NET runtime environment experienced a stack overflow. This can caused by pathologically deep recursion.

```
Public NotInheritable Class StackOverflowException : Inherits SystemExcep

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → StackOverflowException

# STAThreadAttribute NotInheritable Class

## System (mscorlib.dll)

This attribute can be used only on the `Main` method of an application. It sets the default threading model to `STA` (single-threaded apartment). Alternatively, you can use the `MTAThreadAttribute` attribute to use a multithreaded apartment model.

Like its counterpart, `MTAThreadAttribute`, this attribute has no meaning outside of COM interoperability.

```
Public NotInheritable Class STAThreadAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`Object` → `Attribute` → `STAThreadAttribute`

### Valid On

Method

## String NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This class consists of an immutable array of `Char` characters and built-in helper functions. Methods such as `Concat()`, actually create and return a new `String` object. To modify a string directly, use `System.Text.StringBuilder` class. This can enhance performance in some routines that make manipulation operations. In VB.NET, `String` is aliased as `String`.

A string is slightly unusual because it is a reference type that behaves like a value type for comparis Two `String` objects with the same content but different locations in memory return `true` when tes one `String` to another clones the string itself, rather than just duplicating the reference.

On the other hand, a `String` is a fully featured object with a `Length` property and a wide variety of padding or trimming specified characters on either side, converting case, performing inline substitut dividing a string into an array of strings (with `Split()`). There's also a default indexer that lets you that strings are zero-based, and the first character is `System.String.Chars(0)`.

You can create a string made up of a single repeated character by using an alternate constructor ar number of repetitions.

```
Public NotInheritable Class String : Implements IComparable, ICloneable, I
' Public Constructors
   Public Sub New( ByVal value As Char())
   Public Sub New(ByVal value As Char(),
        ByVal startIndex As Integer,
        ByVal length As Integer)
   Public Sub New( ByVal c As Char, ByVal count As Integer)
' Public Shared Fields
   Public Shared ReadOnly Empty As String
' Public Instance Properties
   Public Default ReadOnly Property Chars(
        ByVal index As Integer) As Char
   Public ReadOnly Property Length As Integer
' Public Shared Methods
   Public Shared Function Compare(ByVal strA As String,
```

```
        ByVal indexA As Integer, ByVal strB As String,
        ByVal indexB As Integer,
        ByVal length As Integer) As Integer
    Public Shared Function Compare(ByVal strA As String,
        ByVal indexA As Integer, ByVal strB As String,
        ByVal indexB As Integer, ByVal length As Integer,
        ByVal ignoreCase As Boolean) As Integer
    Public Shared Function Compare(ByVal strA As String,
        ByVal indexA As Integer, ByVal strB As String,
        ByVal indexB As Integer, ByVal length As Integer,
        ByVal ignoreCase As Boolean,
        ByVal culture As System.Globalization.CultureInfo) As Integer
    Public Shared Function Compare(ByVal strA As String,
        ByVal strB As String) As Integer
    Public Shared Function Compare(ByVal strA As String,
        ByVal strB As String,
        ByVal ignoreCase As Boolean) As Integer
    Public Shared Function Compare(ByVal strA As String,
        ByVal strB As String, ByVal ignoreCase As Boolean,
        ByVal culture As System.Globalization.CultureInfo) As Integer
    Public Shared Function CompareOrdinal(ByVal strA As String,
        ByVal indexA As Integer, ByVal strB As String,
        ByVal indexB As Integer,
        ByVal length As Integer) As Integer
    Public Shared Function CompareOrdinal(ByVal strA As String,
        ByVal strB As String) As Integer
    Public Shared Function Concat(
        ByVal arg0 As Object) As String
    Public Shared Function Concat(
        ParamArray args As Object()) As String
    Public Shared Function Concat(ByVal arg0 As Object,
```

```
    ByVal arg1 As Object) As String
Public Shared Function Concat(ByVal arg0 As Object,
    ByVal arg1 As Object,
    ByVal arg2 As Object) As String
Public Shared Function Concat(ByVal arg0 As Object,
    ByVal arg1 As Object, ByVal arg2 As Object,
    ByVal arg3 As Object) As String
Public Shared Function Concat(
    ParamArray values As String()) As String
Public Shared Function Concat(ByVal str0 As String,
    ByVal str1 As String) As String
Public Shared Function Concat(ByVal str0 As String,
    ByVal str1 As String,
    ByVal str2 As String) As String
Public Shared Function Concat(ByVal str0 As String,
    ByVal str1 As String, ByVal str2 As String,
    ByVal str3 As String) As String
Public Shared Function Copy(ByVal str As String) As String
Public Shared Function Equals(ByVal a As String,
    ByVal b As String) As Boolean
Public Shared Function Format(
    ByVal provider As IFormatProvider,
    ByVal format As String,
    ParamArray args As Object()) As String
Public Shared Function Format(ByVal format As String,
    ByVal arg0 As Object) As String
Public Shared Function Format(ByVal format As String,
    ParamArray args As Object()) As String
Public Shared Function Format(ByVal format As String,
```

```
        ByVal arg0 As Object,
        ByVal arg1 As Object) As String
   Public Shared Function Format(ByVal format As String,
        ByVal arg0 As Object, ByVal arg1 As Object,
        ByVal arg2 As Object) As String
   Public Shared Function Intern(
        ByVal str As String) As String
   Public Shared Function IsInterned(
        ByVal str As String) As String
   Public Shared Function Join(ByVal separator As String,
        ByVal value As String()) As String
   Public Shared Function Join(ByVal separator As String,
        ByVal value As String(),
        ByVal startIndex As Integer,
        ByVal count As Integer) As String
   Public Shared Boolean operator Sub !=(
        ByVal a As String, ByVal b As String)
   Public Shared Boolean operator Sub ==(
        ByVal a As String, ByVal b As String)
' Public Instance Methods
   Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Public Function CompareTo(ByVal strB As String) As Integer
   Public Sub CopyTo(ByVal sourceIndex As Integer,
        ByVal destination As Char(),
        ByVal destinationIndex As Integer,
        ByVal count As Integer)
   Public Function EndsWith(ByVal value As String) As Boolean
   Overrides Public Function Equals(
```

```
    ByVal obj As Object) As Boolean
Public Function Equals( ByVal value As String) As Boolean
Public Function GetEnumerator() As CharEnumerator
Overrides Public Function GetHashCode() As Integer
Public Function GetTypeCode(
    ) As TypeCode Implements IConvertible.GetTypeCode
Public Function IndexOf( ByVal value As Char) As Integer
Public Function IndexOf(ByVal value As Char,
    ByVal startIndex As Integer) As Integer
Public Function IndexOf(ByVal value As Char,
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function IndexOf( ByVal value As String) As Integer
Public Function IndexOf(ByVal value As String,
    ByVal startIndex As Integer) As Integer
Public Function IndexOf(ByVal value As String,
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function IndexOfAny(
    ByVal anyOf As Char()) As Integer
Public Function IndexOfAny(ByVal anyOf As Char(),
    ByVal startIndex As Integer) As Integer
Public Function IndexOfAny(ByVal anyOf As Char(),
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function Insert(ByVal startIndex As Integer,
    ByVal value As String) As String
Public Function LastIndexOf(
    ByVal value As Char) As Integer
Public Function LastIndexOf(ByVal value As Char,
```

```
    ByVal startIndex As Integer) As Integer
Public Function LastIndexOf(ByVal value As Char,
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function LastIndexOf(
    ByVal value As String) As Integer
Public Function LastIndexOf(ByVal value As String,
    ByVal startIndex As Integer) As Integer
Public Function LastIndexOf(ByVal value As String,
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function LastIndexOfAny(
    ByVal anyOf As Char()) As Integer
Public Function LastIndexOfAny(ByVal anyOf As Char(),
    ByVal startIndex As Integer) As Integer
Public Function LastIndexOfAny(ByVal anyOf As Char(),
    ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Public Function PadLeft(
    ByVal totalWidth As Integer) As String
Public Function PadLeft(ByVal totalWidth As Integer,
    ByVal paddingChar As Char) As String
Public Function PadRight(
    ByVal totalWidth As Integer) As String
Public Function PadRight(ByVal totalWidth As Integer,
    ByVal paddingChar As Char) As String
Public Function Remove(ByVal startIndex As Integer,
    ByVal count As Integer) As String
Public Function Replace(ByVal oldChar As Char,
    ByVal newChar As Char) As String
Public Function Replace(ByVal oldValue As String,
```

```
        ByVal newValue As String) As String
    Public Function Split(
        ParamArray separator As Char()) As String()
    Public Function Split(ByVal separator As Char(),
        ByVal count As Integer) As String()
    Public Function StartsWith(
        ByVal value As String) As Boolean
    Public Function Substring(
        ByVal startIndex As Integer) As String
    Public Function Substring(ByVal startIndex As Integer,
        ByVal length As Integer) As String
    Public Function ToCharArray() As Char()
    Public Function ToCharArray(ByVal startIndex As Integer,
        ByVal length As Integer) As Char()
    Public Function ToLower() As String
    Public Function ToLower(
        ByVal culture As System.Globalization.CultureInfo) As String
    Overrides Public Function ToString() As String
    Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
    Public Function ToUpper() As String
    Public Function ToUpper(
        ByVal culture As System.Globalization.CultureInfo) As String
    Public Function Trim() As String
    Public Function Trim(
        ParamArray trimChars As Char()) As String
    Public Function TrimEnd(
        ParamArray trimChars As Char()) As String
    Public Function TrimStart(
```

```
        ParamArray trimChars As Char()) As String
End Class
```

### Returned By

Multiple types

### Passed To

Multiple types

# SystemException Class

## System (mscorlib.dll) *ECMA, serializable*

This class is the base class of exceptions that represent .NET runtime errors. In contrast, `ApplicationException` is the base class for user-defined exceptions.

```
Public Class SystemException : Inherits Exception

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException`

### Subclasses

Multiple types

# ThreadStaticAttribute Class

## System (mscorlib.dll) *serializable*

This attribute designates that a shared field should not be shared between threads. Each thread receives a separate instance of this field and can set and retrieve values for it without causing potential synchronization problems. This also means that each thread has a copy of the shared field that may contain different values.

```
Public Class ThreadStaticAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

Object → Attribute → ThreadStaticAttribute

### Valid On

Field

## TimeSpan Structure

## System (mscorlib.dll) *ECMA, serializable*

This class encapsulates a positive or negative interval of time that can be used for arithmetic operat less-than comparisons. Internally, the `TimeSpan` is stored as a number of *ticks*, each of which is eq can convert a string into a `TimeSpan` using the shared `Parse()` method.

You can evaluate a time span in terms of days, hours, seconds, and so on, by using the appropriate corresponding properties that are not preceded with the word `Total` return only one component of the `TotalHours` property returns 1.5 for a time span of an hour and a half, while `Hours` returns 1 f

The `TimeSpan`shared methods prefixed with `From` are useful for quickly creating a time span for us method call, as in `myApp.SetTimeSpan(TimeSpan.FromMinutes(10))`.

```
Public Structure TimeSpan : Implements IComparable
' Public Constructors
   Public Sub New(ByVal hours As Integer,
        ByVal minutes As Integer, ByVal seconds As Integer)
   Public Sub New(ByVal days As Integer,
        ByVal hours As Integer, ByVal minutes As Integer,
        ByVal seconds As Integer)
   Public Sub New(ByVal days As Integer,
        ByVal hours As Integer, ByVal minutes As Integer,
        ByVal seconds As Integer,
        ByVal milliseconds As Integer)
   Public Sub New( ByVal ticks As Long)
' Public Shared Fields
   Public Shared ReadOnly MaxValue As TimeSpan                    // =1067
   Public Shared ReadOnly MinValue As TimeSpan                    // =-106
   Public const TicksPerDay As Long                               // =8640
   Public const TicksPerHour As Long                              // =3600
   Public const TicksPerMillisecond As Long                       // =1000
   Public const TicksPerMinute As Long                            // =6000
   Public const TicksPerSecond As Long                            // =1000
   Public Shared ReadOnly Zero As TimeSpan                        // =00:0
```

```
' Public Instance Properties
   Public ReadOnly Property Days As Integer
   Public ReadOnly Property Hours As Integer
   Public ReadOnly Property Milliseconds As Integer
   Public ReadOnly Property Minutes As Integer
   Public ReadOnly Property Seconds As Integer
   Public ReadOnly Property Ticks As Long
   Public ReadOnly Property TotalDays As Double
   Public ReadOnly Property TotalHours As Double
   Public ReadOnly Property TotalMilliseconds As Double
   Public ReadOnly Property TotalMinutes As Double
   Public ReadOnly Property TotalSeconds As Double
' Public Shared Methods
   Public Shared Function Compare(ByVal t1 As TimeSpan,
        ByVal t2 As TimeSpan) As Integer
   Public Shared Function Equals(ByVal t1 As TimeSpan,
        ByVal t2 As TimeSpan) As Boolean
   Public Shared Function FromDays(
        ByVal value As Double) As TimeSpan
   Public Shared Function FromHours(
        ByVal value As Double) As TimeSpan
   Public Shared Function FromMilliseconds(
        ByVal value As Double) As TimeSpan
   Public Shared Function FromMinutes(
        ByVal value As Double) As TimeSpan
   Public Shared Function FromSeconds(
        ByVal value As Double) As TimeSpan
   Public Shared Function FromTicks(
        ByVal value As Long) As TimeSpan
   Public Shared Function Parse(
```

```
        ByVal s As String) As TimeSpan
    Public Shared TimeSpan operator Sub -(
        ByVal t As TimeSpan)
    Public Shared TimeSpan operator Sub -(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared TimeSpan operator Sub +(
        ByVal t As TimeSpan)
    Public Shared TimeSpan operator Sub +(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub !=(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub <(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub <=(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub ==(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub >(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
    Public Shared Boolean operator Sub >=(
        ByVal t1 As TimeSpan, ByVal t2 As TimeSpan)
' Public Instance Methods
    Public Function Add( ByVal ts As TimeSpan) As TimeSpan
    Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
    Public Function Duration() As TimeSpan
    Overrides Public Function Equals(
        ByVal value As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function Negate() As TimeSpan
    Public Function Subtract(ByVal ts As TimeSpan) As TimeSpan
```

```
   Overrides Public Function ToString() As String
End Structure
```

### Hierarchy

Object → ValueType → TimeSpan(IComparable)

### Returned By

DateTime.{Subtract(),TimeOfDay},System.Diagnostics.Process.{PrivilegedProc
TotalProcessorTime,UserProcessorTime},System.Diagnostics.ProcessThread.
{PrivilegedProcessorTime,TotalProcessorTime,UserProcessorTime},
System.Globalization.DaylightTime.Delta,TimeZone.GetUtcOffset(),
System.Xml.XmlConvert.ToTimeSpan()

### Passed To

Multiple types

## TimeZone MustInherit Class

## System (mscorlib.dll) *serializable*

This MustInherit class encapsulates a time zone. You cannot create a `TimeZone` instance directly because different time zones require different implementations of methods that involve time offsets daylight savings time. The most useful member of the `TimeZone` class is the shared `CurrentTime` property, which provides a `TimeZone` object based on the localization settings of the current system

```
Public MustInherit Class TimeZone

' Protected Constructors

   Protected Sub New()

' Public Shared Properties

   Public Shared ReadOnly Property CurrentTimeZone As TimeZone

' Public Instance Properties

   MustInherit Public ReadOnly Property DaylightName As String

   MustInherit Public ReadOnly Property StandardName As String

' Public Shared Methods

   Public Shared Function IsDaylightSavingTime(

        ByVal time As Date,

        ByVal daylightTimes As System.Globalization.DaylightTime) As Bool

' Public Instance Methods

   MustInherit Public Function GetDaylightChanges(

        ByVal year As Integer) As DaylightTime

   MustInherit Public Function GetUtcOffset(

        ByVal time As Date) As TimeSpan

   Overridable Public Function IsDaylightSavingTime(

        ByVal time As Date) As Boolean

   Overridable Public Function ToLocalTime(

        ByVal time As Date) As Date

   Overridable Public Function ToUniversalTime(

        ByVal time As Date) As Date

End Class
```

## Type MustInherit Class

## System (mscorlib.dll) *ECMA, serializable*

`Type` is a MustInherit base class that encapsulates the metadata for any .NET type. You can get a
`System.Object.GetType()` method, which is inherited by all .NET types, or by the VB.NET GetT

The `Type` is used most often for reflection. You can get a complete description of an object's metad
methods, fields, properties, and events of a class, as well as the module and the assembly in which
supplied `Get` methods, such as `GetEvents()` and `GetConstructors()`, which return arrays of t
also use the singular methods, such as `GetEvent()`, to retrieve a single type object that matches s
retrieved, including inherited, private, and protected members.

```
Public MustInherit Class Type : Inherits System.Reflection.MemberInfo : I

' Protected Constructors

   Protected Sub New()

' Public Shared Fields

   Public Shared ReadOnly Delimiter As Char                        // =&H00

   Public Shared ReadOnly EmptyTypes As Type()                     // =Syst

   Public Shared ReadOnly FilterAttribute As MemberFilter          // =Syst

   Public Shared ReadOnly FilterName As MemberFilter               // =Syst

   Public Shared ReadOnly FilterNameIgnoreCase As MemberFilter      // =Sys

   Public Shared ReadOnly Missing As Object                        // =Syst

' Public Shared Properties

   Public Shared ReadOnly Property DefaultBinder As Binder

' Public Instance Properties

   MustInherit Public ReadOnly Property Assembly As Assembly

   MustInherit Public ReadOnly Property AssemblyQualifiedName As String

   Public ReadOnly Property Attributes As TypeAttributes

   MustInherit Public ReadOnly Property BaseType As Type

   Overrides Public ReadOnly Property DeclaringType As Type

   MustInherit Public ReadOnly Property FullName As String

   MustInherit Public ReadOnly Property GUID As Guid

   Public ReadOnly Property HasElementType As Boolean

   Public ReadOnly Property IsAbstract As Boolean
```

```
Public ReadOnly Property IsAnsiClass As Boolean

Public ReadOnly Property IsArray As Boolean

Public ReadOnly Property IsAutoClass As Boolean

Public ReadOnly Property IsAutoLayout As Boolean

Public ReadOnly Property IsByRef As Boolean

Public ReadOnly Property IsClass As Boolean

Public ReadOnly Property IsCOMObject As Boolean

Public ReadOnly Property IsContextful As Boolean

Public ReadOnly Property IsEnum As Boolean

Public ReadOnly Property IsExplicitLayout As Boolean

Public ReadOnly Property IsImport As Boolean

Public ReadOnly Property IsInterface As Boolean

Public ReadOnly Property IsLayoutSequential As Boolean

Public ReadOnly Property IsMarshalByRef As Boolean

Public ReadOnly Property IsNestedAssembly As Boolean

Public ReadOnly Property IsNestedFamANDAssem As Boolean

Public ReadOnly Property IsNestedFamily As Boolean

Public ReadOnly Property IsNestedFamORAssem As Boolean

Public ReadOnly Property IsNestedPrivate As Boolean

Public ReadOnly Property IsNestedPublic As Boolean

Public ReadOnly Property IsNotPublic As Boolean

Public ReadOnly Property IsPointer As Boolean

Public ReadOnly Property IsPrimitive As Boolean

Public ReadOnly Property IsPublic As Boolean

Public ReadOnly Property IsSealed As Boolean

Public ReadOnly Property IsSerializable As Boolean

Public ReadOnly Property IsSpecialName As Boolean

Public ReadOnly Property IsUnicodeClass As Boolean

Public ReadOnly Property IsValueType As Boolean

Overrides Public ReadOnly Property MemberType As MemberTypes
```

```
   MustInherit Public ReadOnly Property Module As Module
   MustInherit Public ReadOnly Property Namespace As String
   Overrides Public ReadOnly Property ReflectedType As Type
   MustInherit Public ReadOnly Property TypeHandle As RuntimeTypeHandle
   Public ReadOnly Property TypeInitializer As ConstructorInfo
   MustInherit Public ReadOnly Property UnderlyingSystemType As Type Impl
' Public Shared Methods
   Public Shared Function GetType(
        ByVal typeName As String) As Type
   Public Shared Function GetType(ByVal typeName As String,
        ByVal throwOnError As Boolean) As Type
   Public Shared Function GetType(ByVal typeName As String,
        ByVal throwOnError As Boolean,
        ByVal ignoreCase As Boolean) As Type
   Public Shared Function GetTypeArray(
        ByVal args As Object()) As Type()
   Public Shared Function GetTypeCode(
        ByVal type As Type) As TypeCode
   Public Shared Function GetTypeFromCLSID(
        ByVal clsid As Guid) As Type
   Public Shared Function GetTypeFromCLSID(
        ByVal clsid As Guid,
        ByVal throwOnError As Boolean) As Type
   Public Shared Function GetTypeFromCLSID(
        ByVal clsid As Guid,
        ByVal server As String) As Type
   Public Shared Function GetTypeFromCLSID(
        ByVal clsid As Guid, ByVal server As String,
        ByVal throwOnError As Boolean) As Type
   Public Shared Function GetTypeFromHandle(
```

```
        ByVal handle As RuntimeTypeHandle) As Type
    Public Shared Function GetTypeFromProgID(
        ByVal progID As String) As Type
    Public Shared Function GetTypeFromProgID(
        ByVal progID As String,
        ByVal throwOnError As Boolean) As Type
    Public Shared Function GetTypeFromProgID(
        ByVal progID As String,
        ByVal server As String) As Type
    Public Shared Function GetTypeFromProgID(
        ByVal progID As String, ByVal server As String,
        ByVal throwOnError As Boolean) As Type
    Public Shared Function GetTypeHandle(
        ByVal o As Object) As RuntimeTypeHandle
' Public Instance Methods
    Overrides Public Function Equals(
        ByVal o As Object) As Boolean
    Public Function Equals( ByVal o As Type) As Boolean
    Overridable Public Function FindInterfaces(
        ByVal filter As System.Reflection.TypeFilter,
        ByVal filterCriteria As Object) As Type()
    Overridable Public Function FindMembers(
        ByVal memberType As System.Reflection.MemberTypes,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal filter As System.Reflection.MemberFilter,
        ByVal filterCriteria As Object) As MemberInfo()
    Overridable Public Function GetArrayRank() As Integer
    Public Function GetConstructor(
```

```
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Cons
Public Function GetConstructor(
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Cons
Public Function GetConstructor(
        ByVal types As Type()) As ConstructorInfo
Public Function GetConstructors() As ConstructorInfo()
MustInherit Public Function GetConstructors(
        ByVal bindingAttr As System.Reflection.BindingFlags) As Construct
Overridable Public Function GetDefaultMembers(
        ) As MemberInfo()
MustInherit Public Function GetElementType() As Type
Public Function GetEvent(
        ByVal name As String) As EventInfo
MustInherit Public Function GetEvent(ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
Overridable Public Function GetEvents() As EventInfo()
MustInherit Public Function GetEvents(
        ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
Public Function GetField(
        ByVal name As String) As FieldInfo
MustInherit Public Function GetField(ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
Public Function GetFields() As FieldInfo()
MustInherit Public Function GetFields(
```

```
    ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
Overrides Public Function GetHashCode() As Integer
Public Function GetInterface(ByVal name As String) As Type
MustInherit Public Function GetInterface(
    ByVal name As String,
    ByVal ignoreCase As Boolean) As Type
Overridable Public Function GetInterfaceMap(
    ByVal interfaceType As Type) As InterfaceMapping
MustInherit Public Function GetInterfaces() As Type()
Public Function GetMember(
    ByVal name As String) As MemberInfo()
Overridable Public Function GetMember(ByVal name As String,
    ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
Overridable Public Function GetMember(ByVal name As String,
    ByVal type As System.Reflection.MemberTypes,
    ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
Public Function GetMembers() As MemberInfo()
MustInherit Public Function GetMembers(
    ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
Public Function GetMethod(
    ByVal name As String) As MethodInfo
Public Function GetMethod(ByVal name As String,
    ByVal bindingAttr As System.Reflection.BindingFlags) As MethodInf
Public Function GetMethod(ByVal name As String,
    ByVal bindingAttr As System.Reflection.BindingFlags,
    ByVal binder As System.Reflection.Binder,
    ByVal callConvention As System.Reflection.CallingConventions,
    ByVal types As Type(),
    ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
Public Function GetMethod(ByVal name As String,
```

```
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
    Public Function GetMethod(ByVal name As String,
        ByVal types As Type()) As MethodInfo
    Public Function GetMethod(ByVal name As String,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
    Public Function GetMethods() As MethodInfo()
    MustInherit Public Function GetMethods(
        ByVal bindingAttr As System.Reflection.BindingFlags) As MethodInf
    Public Function GetNestedType(
        ByVal name As String) As Type
    MustInherit Public Function GetNestedType(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As Type
    Public Function GetNestedTypes() As Type()
    MustInherit Public Function GetNestedTypes(
        ByVal bindingAttr As System.Reflection.BindingFlags) As Type()
    Public Function GetProperties() As PropertyInfo()
    MustInherit Public Function GetProperties(
        ByVal bindingAttr As System.Reflection.BindingFlags) As PropertyI
    Public Function GetProperty(
        ByVal name As String) As PropertyInfo
    Public Function GetProperty(ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As PropertyI
    Public Function GetProperty(ByVal name As String,
```

```
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal returnType As Type, ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Prop
    Public Function GetProperty(ByVal name As String,
        ByVal returnType As Type) As PropertyInfo
    Public Function GetProperty(ByVal name As String,
        ByVal types As Type()) As PropertyInfo
    Public Function GetProperty(ByVal name As String,
        ByVal returnType As Type,
        ByVal types As Type()) As PropertyInfo
    Public Function GetProperty(ByVal name As String,
        ByVal returnType As Type, ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Prop
    Public Function InvokeMember(ByVal name As String,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal target As Object,
        ByVal args As Object()) As Object
    Public Function InvokeMember(ByVal name As String,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal target As Object, ByVal args As Object(),
        ByVal culture As System.Globalization.CultureInfo) As Object
    MustInherit Public Function InvokeMember(
        ByVal name As String,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal target As Object, ByVal args As Object(),
        ByVal modifiers As System.Reflection.ParameterModifier(),
        ByVal culture As System.Globalization.CultureInfo,
```

```
        ByVal namedParameters As String()) As Object Implements IReflect.I
    Overridable Public Function IsAssignableFrom(
        ByVal c As Type) As Boolean
    Overridable Public Function IsInstanceOfType(
        ByVal o As Object) As Boolean
    Overridable Public Function IsSubclassOf(
        ByVal c As Type) As Boolean
    Overrides Public Function ToString() As String
' Protected Instance Methods
    MustInherit Protected Function GetAttributeFlagsImpl(
        ) As TypeAttributes
    MustInherit Protected Function GetConstructorImpl(
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Cons
    MustInherit Protected Function GetMethodImpl(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
    MustInherit Protected Function GetPropertyImpl(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal returnType As Type, ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Prope
    MustInherit Protected Function HasElementTypeImpl(
```

```
        ) As Boolean
    MustInherit Protected Function IsArrayImpl() As Boolean
    MustInherit Protected Function IsByRefImpl() As Boolean
    MustInherit Protected Function IsCOMObjectImpl(
        ) As Boolean
    Overridable Protected Function IsContextfulImpl(
        ) As Boolean
    Overridable Protected Function IsMarshalByRefImpl(
        ) As Boolean
    MustInherit Protected Function IsPointerImpl() As Boolean
    MustInherit Protected Function IsPrimitiveImpl(
        ) As Boolean
    Overridable Protected Function IsValueTypeImpl(
        ) As Boolean
End Class
```

## Hierarchy

Object → System.Reflection.MemberInfo(System.Reflection.ICustomAttribute
Type(System.Reflection.IReflect)

## Subclasses

System.Reflection.TypeDelegator, System.Reflection.Emit.{EnumBuilder, TypeBu

## Returned By

Multiple types

## Passed To

Multiple types

## TypeCode Enum

### System (mscorlib.dll) *serializable*

This enumeration specifies the type of an object. It is available for all objects that implement the `IConvertible` interface. If the object does not implement this interface, use its `GetType()` method (derived from `System.Object`) to return an instance of the `Type` class, which provides a `Type.GetTypeCode()` method.

The `TypeCode` enumeration includes members for most simple value types. If you use this method on an object that is not explicitly represented in this enumeration, the catch-all value `Object` is returned.

```
Public Enum TypeCode

   Empty = 0

   Object = 1

   DBNull = 2

   Boolean = 3

   Char = 4

   SByte = 5

   Byte = 6

   Int16 = 7

   UInt16 = 8

   Int32 = 9

   UInt32 = 10

   Int64 = 11

   UInt64 = 12

   Single = 13

   Double = 14

   Decimal = 15

   DateTime = 16

   String = 18

End Enum
```

### Hierarchy

```
Object → ValueType → Enum(IComparable,IFormattable,IConvertible) →
TypeCode
```

### Returned By

Multiple types

### Passed To

```
Convert.ChangeType(),
System.Runtime.Serialization.FormatterConverter.Convert(),
System.Runtime.Serialization.IFormatterConverter.Convert()
```

## TypeInitializationException NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This class provides a wrapper around an exception thrown by the .NET class initializer. The underly exception is accessible through `InnerException`.

```
Public NotInheritable Class TypeInitializationException : Inherits SystemI
' Public Constructors
   Public Sub New(ByVal fullTypeName As String,
        ByVal innerException As Exception)
' Public Instance Properties
   Public ReadOnly Property TypeName As String
' Public Instance Methods
   Overrides Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemI` → `TypeInitializationException`

## TypeLoadException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception signals that a class (or its assembly) cannot be found or loaded by the .NET runtime.

```
Public Class TypeLoadException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

   Public ReadOnly Property TypeName As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → TypeLoadException

### Subclasses

DllNotFoundException, EntryPointNotFoundException

## TypeUnloadedException Class

### System (mscorlib.dll) *ECMA, serializable*

This exception signals an attempt to access a `Type` that has been unloaded.

```
Public Class TypeUnloadedException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`Object` → `Exception(System.Runtime.Serialization.ISerializable)` → `SystemException` → `TypeUnloadedException`

## UInt16 Structure

### System (mscorlib.dll) *ECMA, serializable*

This structure is the value type for 16-bit unsigned integers (which range from 0 to 65535). It is not (
(although `Int16` is).

```
Public Structure UInt16 : Implements IComparable, IFormattable, IConvertil
' Public Shared Fields
   Public const MaxValue As UInt16                                  // =6553
   Public const MinValue As UInt16                                  // =0
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As UInt16
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As UInt16
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As UInt16
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As UInt16
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
   Public Function ToString(ByVal format As String) As String
```

```
    Public Function ToString(ByVal format As String,
         ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → UInt16(IComparable, IFormattable, IConvertible)

## Returned By

BitConverter.ToUInt16(), Convert.ToUInt16(), Decimal.ToUInt16(), IConvertible
System.IO.BinaryReader.ReadUInt16(),
System.Runtime.Serialization.FormatterConverter.ToUInt16(),
System.Runtime.Serialization.IFormatterConverter.ToUInt16(),
System.Runtime.Serialization.SerializationInfo.GetUInt16(),
System.Xml.XmlConvert.ToUInt16()

## Passed To

Multiple types

## UInt32 Structure

### System (mscorlib.dll) *ECMA, serializable*

This structure is the value type for 32-bit unsigned integers (which range from 0 to 4,294,967,295). I
compliant (although `Int32` is).

```
Public Structure UInt32 : Implements IComparable, IFormattable, IConvertil
' Public Shared Fields
   Public const MaxValue As UInt32                                    // =4294
   Public const MinValue As UInt32                                    // =0
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As UInt32
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As UInt32
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As UInt32
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As UInt32
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
   Public Function ToString(ByVal format As String) As String
```

```
    Public Function ToString(ByVal format As String,
         ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → UInt32(IComparable, IFormattable, IConvertible)

## Returned By

BitConverter.ToUInt32(), Convert.ToUInt32(), Decimal.ToUInt32(), IConvertible
System.IO.BinaryReader.ReadUInt32(),
System.Reflection.AssemblyAlgorithmIdAttribute.AlgorithmId,
System.Reflection.AssemblyFlagsAttribute.Flags,
System.Runtime.Serialization.FormatterConverter.ToUInt32(),
System.Runtime.Serialization.IFormatterConverter.ToUInt32(),
System.Runtime.Serialization.SerializationInfo.GetUInt32(), UIntPtr.ToUInt
System.Xml.XmlConvert.ToUInt32()

## Passed To

Multiple types

## UInt64 Structure

## System (mscorlib.dll) *ECMA, serializable*

This structure is the value type for 64-bit unsigned integers (which range from 0 to $1.84 \times 10^{20}$). It is r
(although `Int64` is).

```
Public Structure UInt64 : Implements IComparable, IFormattable, IConvertil
' Public Shared Fields
   Public const MaxValue As UInt64                                    // =1844
   Public const MinValue As UInt64                                    // =0
' Public Shared Methods
   Public Shared Function Parse( ByVal s As String) As UInt64
   Public Shared Function Parse(ByVal s As String,
        ByVal provider As IFormatProvider) As UInt64
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles) As UInt64
   Public Shared Function Parse(ByVal s As String,
        ByVal style As System.Globalization.NumberStyles,
        ByVal provider As IFormatProvider) As UInt64
' Public Instance Methods
   Public Function CompareTo(
        ByVal value As Object) As Integer Implements IComparable.CompareT
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Public Function GetTypeCode(
        ) As TypeCode Implements IConvertible.GetTypeCode
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal provider As IFormatProvider) As String Implements IConvertil
   Public Function ToString(ByVal format As String) As String
```

```
   Public Function ToString(ByVal format As String,
        ByVal provider As IFormatProvider) As String Implements IFormattal
End Structure
```

## Hierarchy

Object → ValueType → UInt64(IComparable, IFormattable, IConvertible)

## Returned By

BitConverter.ToUInt64(), Convert.ToUInt64(), Decimal.ToUInt64(), IConvertible
System.IO.BinaryReader.ReadUInt64(), System.IO.IsolatedStorage.IsolatedSto
{CurrentSize, MaximumSize}, System.Runtime.Serialization.FormatterConverter
System.Runtime.Serialization.IFormatterConverter.ToUInt64(),
System.Runtime.Serialization.SerializationInfo.GetUInt64(), UIntPtr.ToUInt
System.Xml.XmlConvert.ToUInt64()

## Passed To

Multiple types

## UIntPtr Structure

## System (mscorlib.dll) *ECMA, serializable*

This structure is provided mainly for symmetry with `IntPtr`. Use `IntPtr`, which is CLS-compliant,

```
Public Structure UIntPtr : Implements System.Runtime.Serialization.ISeria

' Public Constructors

   Public Sub New( ByVal value As UInt32)

   Public Sub New( ByVal value As UInt64)

' Public Shared Fields

   Public Shared ReadOnly Zero As UIntPtr                              // =0

' Public Shared Properties

   Public Shared ReadOnly Property Size As Integer

' Public Shared Methods

   Public Shared Boolean operator Sub !=(

        ByVal value1 As UIntPtr, ByVal value2 As UIntPtr)

   Public Shared Boolean operator Sub ==(

        ByVal value1 As UIntPtr, ByVal value2 As UIntPtr)

   Public Shared explicit operator Sub UInt32(

        ByVal value As UIntPtr)

   Public Shared explicit operator Sub UInt64(

        ByVal value As UIntPtr)

   Public Shared explicit operator Sub UIntPtr(

        ByVal value As UInt32)

   Public Shared explicit operator Sub UIntPtr(

        ByVal value As UInt64)

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String
```

```
    Public Function ToUInt32() As UInt32

    Public Function ToUInt64() As UInt64

End Structure
```

## Hierarchy

```
Object → ValueType → UIntPtr(System.Runtime.Serialization.ISerializable)
```

## UnauthorizedAccessException Class

## System (mscorlib.dll) *ECMA, serializable*

This exception signals a failed attempt to access a resource (for example, trying to delete a read-only file).

```
Public Class UnauthorizedAccessException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemException → UnauthorizedAccessException

## UnhandledExceptionEventArgs Class

### System (mscorlib.dll) *ECMA, serializable*

This class is passed as an argument to an `UnhandledExceptionEventHandler` event handler. Its `IsTerminating` property specifies whether the CLR is in the process of shutting down.

```
Public Class UnhandledExceptionEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New(ByVal exception As Object,
        ByVal isTerminating As Boolean)

' Public Instance Properties

   Public ReadOnly Property ExceptionObject As Object

   Public ReadOnly Property IsTerminating As Boolean

End Class
```

### Hierarchy

`Object` → `EventArgs` → `UnhandledExceptionEventArgs`

### Passed To

`UnhandledExceptionEventHandler.{BeginInvoke(), Invoke()}`

# UnhandledExceptionEventHandler Delegate

## System (mscorlib.dll) *ECMA, serializable*

This delegate specifies the signature for an event handler that responds to the `AppDomain.UnhandledException` event. This event is triggered by an exception that is not handled by the application domain.

```
Public Delegate Sub UnhandledExceptionEventHandler(
        ByVal sender As Object,
        ByVal e As UnhandledExceptionEventArgs)
```

### Associated Events

`AppDomain.UnhandledException()`

## Uri Class

**System (system.dll)** · ***ECMA, serializable, marshal by reference***

This class encapsulates a complete URI (Uniform Resource Identifier) and provides various parts o
you can get the `Scheme` (e.g., http, https, mailto) and the `Port` number. For http, the default port is
port 21, https uses 443, and mailto uses 25). You can also retrieve the query-string arguments — in
from the `Query` property, or the fragment portion — including the fragment marker (#) — from the `F`
properties include `IsLoopback`, which indicates `true` if the `Uri` references the local host, and `IsU`
a UNC path (such as *server**folder*).

The `Uri` constructors perform some basic cleanup of your parameters before creating a `Uri`, incluc
hostname to lowercase, removing default and blank port numbers, and removing the trailing slash (/
properties. To modify a `Uri`, use a `UriBuilder` object.

The `Uri` class also provides shared helper methods such as `EscapeString()`, which converts a s
characters with an ASCII value greater than 127 to hexadecimal representation. The `CheckHostNa`
methods accept a string and check if it is syntactically valid for the given property (although they do
URI exists).

The `Uri` class is used by many .NET types, including some in ASP.NET, although you may find ma
to store and exchange URL information.

```
Public Class Uri : Inherits MarshalByRefObject : Implements System.Runtim

' Public Constructors

   Public Sub New( ByVal uriString As String)

   Public Sub New(ByVal uriString As String,

        ByVal dontEscape As Boolean)

   Public Sub New(ByVal baseUri As Uri,

        ByVal relativeUri As String)

   Public Sub New(ByVal baseUri As Uri,

        ByVal relativeUri As String,

        ByVal dontEscape As Boolean)

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Shared Fields

   Public Shared ReadOnly SchemeDelimiter As String              // =://
```

```
   Public Shared ReadOnly UriSchemeFile As String              // =file
   Public Shared ReadOnly UriSchemeFtp As String               // =ftp
   Public Shared ReadOnly UriSchemeGopher As String            // =goph
   Public Shared ReadOnly UriSchemeHttp As String              // =http
   Public Shared ReadOnly UriSchemeHttps As String             // =http
   Public Shared ReadOnly UriSchemeMailto As String            // =mail
   Public Shared ReadOnly UriSchemeNews As String              // =news
   Public Shared ReadOnly UriSchemeNntp As String              // =nntp
' Public Instance Properties
   Public ReadOnly Property AbsolutePath As String
   Public ReadOnly Property AbsoluteUri As String
   Public ReadOnly Property Authority As String
   Public ReadOnly Property Fragment As String
   Public ReadOnly Property Host As String
   Public ReadOnly Property HostNameType As UriHostNameType
   Public ReadOnly Property IsDefaultPort As Boolean
   Public ReadOnly Property IsFile As Boolean
   Public ReadOnly Property IsLoopback As Boolean
   Public ReadOnly Property IsUnc As Boolean
   Public ReadOnly Property LocalPath As String
   Public ReadOnly Property PathAndQuery As String
   Public ReadOnly Property Port As Integer
   Public ReadOnly Property Query As String
   Public ReadOnly Property Scheme As String
   Public ReadOnly Property Segments As String()
   Public ReadOnly Property UserEscaped As Boolean
   Public ReadOnly Property UserInfo As String
' Public Shared Methods
   Public Shared Function CheckHostName(
```

```
        ByVal name As String) As UriHostNameType
    Public Shared Function CheckSchemeName(
        ByVal schemeName As String) As Boolean
    Public Shared Function FromHex(
        ByVal digit As Char) As Integer
    Public Shared Function HexEscape(
        ByVal character As Char) As String
    Public Shared Function HexUnescape(ByVal pattern As String,
        ByRef index As Integer) As Char
    Public Shared Function IsHexDigit(
        ByVal character As Char) As Boolean
    Public Shared Function IsHexEncoding(
        ByVal pattern As String,
        ByVal index As Integer) As Boolean
' Protected Shared Methods
    Shared Protected Function EscapeString(
        ByVal str As String) As String
    Shared Protected Function IsExcludedCharacter(
        ByVal character As Char) As Boolean
' Public Instance Methods
    Overrides Public Function Equals(
        ByVal comparand As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetLeftPart(
        ByVal part As UriPartial) As String
    Public Function MakeRelative(ByVal toUri As Uri) As String
    Overrides Public Function ToString() As String
' Protected Instance Methods
    Overridable Protected Sub Canonicalize()
    Overridable Protected Sub CheckSecurity()
    Overridable Protected Sub Escape()
```

```
    Overridable Protected Function IsBadFileSystemCharacter(
         ByVal character As Char) As Boolean
    Overridable Protected Function IsReservedCharacter(
         ByVal character As Char) As Boolean
    Overridable Protected Sub Parse()
    Overridable Protected Function Unescape(
         ByVal path As String) As String
End Class
```

### Hierarchy

Object → MarshalByRefObject → Uri(System.Runtime.Serialization.ISeriali

### Returned By

System.Net.Cookie.CommentUri, System.Net.HttpWebRequest.Address, System.Net.
System.Net.ServicePoint.Address, System.Net.WebProxy.{Address, GetProxy()},
System.Net.WebRequest.RequestUri, System.Net.WebResponse.ResponseUri, UriBu
System.Xml.XmlResolver.ResolveUri()

### Passed To

Multiple types

## UriBuilder Class

## System (system.dll) *ECMA*

Every instance of `Uri` is immutable. This class wraps a `Uri` object and allows you to modify some of its properties without needing to create a new `Uri`. It is analogous to the `System.Text.StringBuilder` class for strings.

```
Public Class UriBuilder

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal uri As String)

   Public Sub New(ByVal schemeName As String,

        ByVal hostName As String)

   Public Sub New(ByVal scheme As String,

        ByVal host As String, ByVal portNumber As Integer)

   Public Sub New(ByVal scheme As String,

        ByVal host As String, ByVal port As Integer,

        ByVal pathValue As String)

   Public Sub New(ByVal scheme As String,

        ByVal host As String, ByVal port As Integer,

        ByVal path As String, ByVal extraValue As String)

   Public Sub New( ByVal uri As Uri)

' Public Instance Properties

   Public Property Fragment As String

   Public Property Host As String

   Public Property Password As String

   Public Property Path As String

   Public Property Port As Integer

   Public Property Query As String

   Public Property Scheme As String

   Public ReadOnly Property Uri As Uri

   Public Property UserName As String
```

```
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal rparam As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Class
```

## UriFormatException Class

## System (system.dll) *ECMA, serializable*

This exception indicates that you attempted to use an invalid URI, usually in the `Uri` constructor. Fc description of the URI format, see http://www.ietf.org/rfc/rfc2396.txt.

```
Public Class UriFormatException : Inherits FormatException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal textString As String)

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

End Class
```

### Hierarchy

Object → Exception(System.Runtime.Serialization.ISerializable) → SystemE → FormatException → UriFormatException

## UriHostNameType Enum

## System (system.dll) *ECMA, serializable*

This enumeration is used for the `Uri.CheckHostName()` method. `Basic` indicates that the host is set, but cannot be determined.

```
Public Enum UriHostNameType
    Unknown = 0
    Basic = 1
    Dns = 2
    IPv4 = 3
    IPv6 = 4
End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `UriHostNameType`

### Returned By

`Uri.{CheckHostName(), HostNameType}`

# UriPartial Enum

## System (system.dll) *ECMA, serializable*

This enumeration is used for the `Uri.GetLeftPart()` method. For example, the URL *http://www.oreilly.com/index.html#toc* has a `Scheme` of *http://*, an `Authority` of *http://www.oreilly.com*, and a `Path` of *http://www.oreilly.com/index.html* (everything up to, but not including, the query delimiter `?` or the fragment delimiter `#`).

```
Public Enum UriPartial

   Scheme = 0

   Authority = 1

   Path = 2

End Enum
```

### Hierarchy

`Object` → `ValueType` → `Enum(IComparable, IFormattable, IConvertible)` → `UriPartial`

### Passed To

`Uri.GetLeftPart()`

## ValueType MustInherit Class

## System (mscorlib.dll) *ECMA, serializable*

This is the base class for all value types. A value type is a simple data structure, such as `UInt32`, or an enumeration. It is differentiated from a reference type (or object). Value types are stored on the stack rather than the .NET managed heap and are accessed directly rather than through a reference. Value types also behave differently from reference types, most notably in assignment operations (which create a copy of the data, not a duplicate reference to the same data) and comparison operations (which return `true` as long as the content of the two value types is the same). To define your own simple value types, use the `struct` keyword (use the `enum` keyword to define an enumeration). Value types are implicitly sealed.

```
Public MustInherit Class ValueType

' Protected Constructors

   Protected Sub New()

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String

End Class
```

### Subclasses

Multiple types

## Version NotInheritable Class

## System (mscorlib.dll) *ECMA, serializable*

This class represents a version number. The .NET framework uses it as the version of assemblies, operating systems, and network protocols. A version number consists of as many as four parts: a m minor, build, and revision number. For some applications, such as the HTTP protocol, only the first t numbers (major and minor) are used.

```
Public NotInheritable Class Version : Implements ICloneable, IComparable
' Public Constructors
   Public Sub New()
   Public Sub New(ByVal major As Integer,
        ByVal minor As Integer)
   Public Sub New(ByVal major As Integer,
        ByVal minor As Integer, ByVal build As Integer)
   Public Sub New(ByVal major As Integer,
        ByVal minor As Integer, ByVal build As Integer,
        ByVal revision As Integer)
   Public Sub New( ByVal version As String)
' Public Instance Properties
   Public ReadOnly Property Build As Integer
   Public ReadOnly Property Major As Integer
   Public ReadOnly Property Minor As Integer
   Public ReadOnly Property Revision As Integer
' Public Shared Methods
   Public Shared Boolean operator Sub !=(
        ByVal v1 As Version, ByVal v2 As Version)
   Public Shared Boolean operator Sub <(
        ByVal v1 As Version, ByVal v2 As Version)
   Public Shared Boolean operator Sub <=(
        ByVal v1 As Version, ByVal v2 As Version)
   Public Shared Boolean operator Sub ==(
```

```
        ByVal v1 As Version, ByVal v2 As Version)
   Public Shared Boolean operator Sub >(
        ByVal v1 As Version, ByVal v2 As Version)
   Public Shared Boolean operator Sub >=(
        ByVal v1 As Version, ByVal v2 As Version)
' Public Instance Methods
   Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Public Function CompareTo(
        ByVal version As Object) As Integer Implements IComparable.Compar
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
   Public Function ToString(
        ByVal fieldCount As Integer) As String
End Class
```

## Returned By

Environment.Version, System.Net.HttpWebRequest.ProtocolVersion, System.Net.HttpWebResponse.ProtocolVersion, System.Net.ServicePoint.ProtocolVersion, OperatingSystem.Version, System.Reflection.AssemblyName.Version

## Passed To

System.Net.HttpWebRequest.ProtocolVersion, OperatingSystem.OperatingSystem System.Reflection.Assembly.GetSatelliteAssembly(), System.Reflection.AssemblyName.Version

# Void Structure

## System (mscorlib.dll) *ECMA, serializable*

This structure indicates that a method does not return any information, as in `public void Main()`.

```
Public Structure Void

' No public or protected members

End Structure
```

### Hierarchy

`Object` → `ValueType` → `Void`

### Returned By

Multiple types

### Passed To

`ArgIterator.ArgIterator()`, `IntPtr.IntPtr()`, `System.Reflection.Pointer.Box()`, `UIntPtr.UIntPtr()`

## WeakReference Class

## System (mscorlib.dll) *serializable*

This class encapsulates a *weak reference* to an object. By default, when you instantiate a .NET clas create a strong reference, which prevents the garbage collector from removing the object and reclai memory. A weak reference, however, does not prevent an object from being released.

Objects that are weakly referenced can still be kept alive as long as there is at least one strong refe them. That means a weak reference allows you to access an object as long as it is in use by anothe your application. For example, objects can be stored in a collection using a weak reference, but not just because they are in the collection.

To create a weakly referenced object, pass the name of the object to the `WeakReference` construc can use the `IsAlive` property to check if the reference is valid, and the `Target` property to get a r the actual object. Assigning the `Target` property to another variable creates a strong reference.

You can set the `TrackResurrection` property to `true` in the constructor to maintain a *long* weak which tracks an object during (or after) finalization.

```
Public Class WeakReference : Implements System.Runtime.Serialization.ISer

' Public Constructors

   Public Sub New( ByVal target As Object)

   Public Sub New(ByVal target As Object,

        ByVal trackResurrection As Boolean)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overridable Public ReadOnly Property IsAlive As Boolean

   Overridable Public Property Target As Object

   Overridable Public ReadOnly Property TrackResurrection As Boolean

' Public Instance Methods

   Overridable Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

        Implements ISerializable.GetObjectData

' Protected Instance Methods
```

```
    Overrides Protected Sub Finalize()

End Class
```

### Passed To

```
GC.GetGeneration()
```

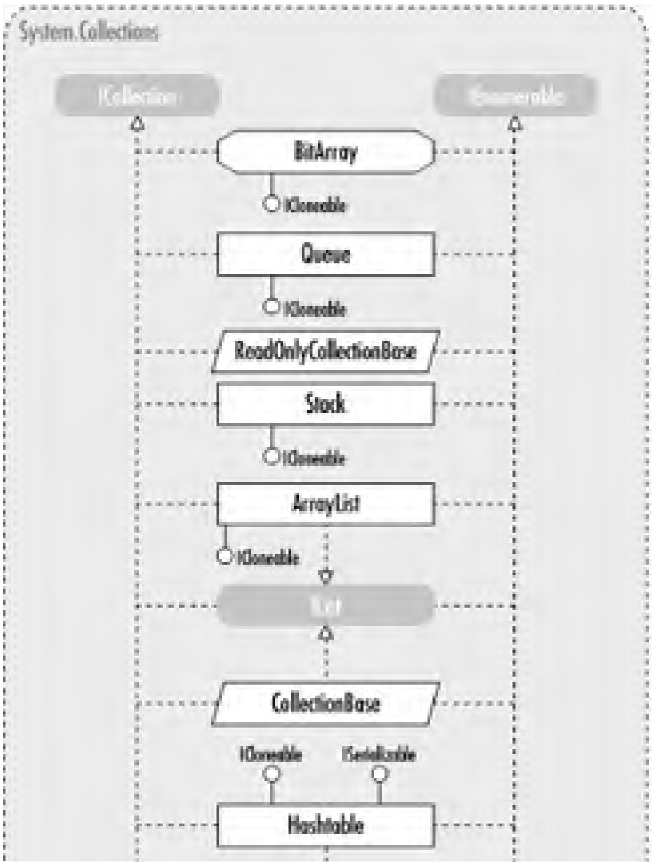
# Chapter 5. System.Collections

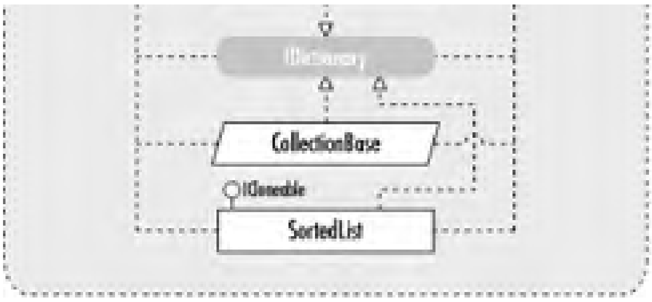
The `System.Collections` namespace provides basic functionality for collections of objects. It defines interfaces, base classes, and implementations for collections such as dictionaries, sorted lists, queues, and stacks. The base classes can also be extended to create specialized collection types. However, the `System.Collections.Specialized` namespace contains a set of extended collection types based on this namespace, so check there before creating your own types. Figure 5-1 and Figure 5-2 show the types in this namespace.

On first observation, the design of these collections seems somewhat awkward — for example, why does a "list" seem to be broken into two pieces: the `IList` interface and the `ArrayList` implementation? On top of this, the namespace defines a number of other interfaces, such as `IEnumerable` and `IEnumerator`, that seem unnecessary.

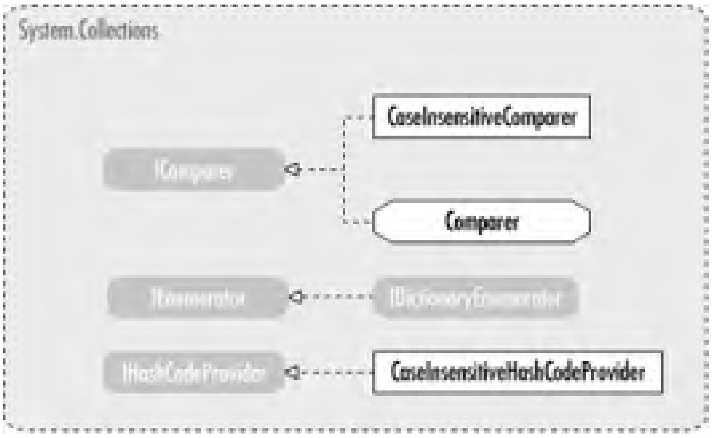
In fact, the design of the collection types in this namespace is quite similar to the designs of other container libraries such as the STL (Standard Template Library) in C++ and the Java Collections library in JDK 1.2. By separating the interface of a collection type (the concept of "list-ness" or "dictionary-ness") from the actual implementation, you are free to assume only the absolute minimum about the actual implementation used, and instead focus only on what is needed in order to carry out the work. For example, VB.NET's `For Each` construct works by silently using the `IEnumerable` interface to obtain an object that inherits the `IEnumerator` interface. Thus, a programmer could, if desired, create a custom type (perhaps modeling a hand of cards) that acts just as any other collection class does. Alternatively, the iterator (the type that inherits from `IEnumerator`) could be a "smart" iterator, knowing how to walk through (or skip past) types in the container itself. All this is possible solely because the interface is separated from the implementation; it is *decoupled*.

### Figure 5-1. Collection types implementing ICollection and IEnumerable






## Figure 5-2. More types from the System.Collections namespace



## ArrayList Class

## System.Collections (mscorlib.dll) *ECMA, serializable*

This class is similar to an array, but it can grow or shrink as needed. The `Capacity` property return `ArrayList` can hold. You can reduce the size by setting `Capacity` explicitly or using the `TrimTo` constructed empty or with an integer argument that sets its initial size. You can also pass the constr `ICollection` to fill the `ArrayList` with the contents of that object.

A number of methods are provided to modify the contents of the `ArrayList`. The `Add()` and `AddR` end of the list. `Insert()` and `InsertRange()` add new elements at a specified location within the

```
Public Class ArrayList : Implements IList, ICollection, IEnumerable, IClo

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal c As ICollection)

   Public Sub New( ByVal capacity As Integer)

' Public Instance Properties

   Overridable Public Property Capacity As Integer

   Overridable Public ReadOnly Property Count As Integer

   Implements ICollection.Count

   Overridable Public ReadOnly Property IsFixedSize As Boolean Implements

   Overridable Public ReadOnly Property IsReadOnly As Boolean Implements I

   Overridable Public ReadOnly Property IsSynchronized As Boolean Impleme

   Overridable Public Default Property Item(

        ByVal index As Integer) As Object Implements IList.Item

   Overridable Public ReadOnly Property SyncRoot As Object Implements ICo

' Public Shared Methods

   Public Shared Function Adapter(

        ByVal list As IList) As ArrayList

   Public Shared Function FixedSize(

        ByVal list As ArrayList) As ArrayList

   Public Shared Function FixedSize(

        ByVal list As IList) As IList

   Public Shared Function ReadOnly(
```

```
        ByVal list As ArrayList) As ArrayList
    Public Shared Function ReadOnly(
        ByVal list As IList) As IList
    Public Shared Function Repeat(ByVal value As Object,
        ByVal count As Integer) As ArrayList
    Public Shared Function Synchronized(
        ByVal list As ArrayList) As ArrayList
    Public Shared Function Synchronized(
        ByVal list As IList) As IList
' Public Instance Methods
    Overridable Public Function Add(
        ByVal value As Object) As Integer Implements IList.Add
    Overridable Public Sub AddRange( ByVal c As ICollection)
    Overridable Public Function BinarySearch(
        ByVal index As Integer, ByVal count As Integer,
        ByVal value As Object,
        ByVal comparer As IComparer) As Integer
    Overridable Public Function BinarySearch(
        ByVal value As Object) As Integer
    Overridable Public Function BinarySearch(
        ByVal value As Object,
        ByVal comparer As IComparer) As Integer
    Overridable Public Sub Clear() Implements IList.Clear
    Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
    Overridable Public Function Contains(
        ByVal item As Object) As Boolean Implements IList.Contains
    Overridable Public Sub CopyTo( ByVal array As Array)
    Overridable Public Sub CopyTo(ByVal array As Array,
        ByVal arrayIndex As Integer) Implements ICollection.CopyTo
    Overridable Public Sub CopyTo(ByVal index As Integer,
```

```
      ByVal array As Array, ByVal arrayIndex As Integer,
      ByVal count As Integer)
Overridable Public Function GetEnumerator(
      ) As IEnumerator Implements IEnumerable.GetEnumerator
Overridable Public Function GetEnumerator(
      ByVal index As Integer,
      ByVal count As Integer) As IEnumerator
Overridable Public Function GetRange(
      ByVal index As Integer,
      ByVal count As Integer) As ArrayList
Overridable Public Function IndexOf(
      ByVal value As Object) As Integer Implements IList.IndexOf
Overridable Public Function IndexOf(ByVal value As Object,
      ByVal startIndex As Integer) As Integer
Overridable Public Function IndexOf(ByVal value As Object,
      ByVal startIndex As Integer,
      ByVal count As Integer) As Integer
Overridable Public Sub Insert(ByVal index As Integer,
      ByVal value As Object) Implements IList.Insert
Overridable Public Sub InsertRange(ByVal index As Integer,
      ByVal c As ICollection)
Overridable Public Function LastIndexOf(
      ByVal value As Object) As Integer
Overridable Public Function LastIndexOf(
      ByVal value As Object,
      ByVal startIndex As Integer) As Integer
Overridable Public Function LastIndexOf(
      ByVal value As Object, ByVal startIndex As Integer,
      ByVal count As Integer) As Integer
Overridable Public Sub Remove(
```

```
        ByVal obj As Object) Implements IList.Remove
    Overridable Public Sub RemoveAt(
        ByVal index As Integer) Implements IList.RemoveAt
    Overridable Public Sub RemoveRange(ByVal index As Integer,
        ByVal count As Integer)
    Overridable Public Sub Reverse()
    Overridable Public Sub Reverse(ByVal index As Integer,
        ByVal count As Integer)
    Overridable Public Sub SetRange(ByVal index As Integer,
        ByVal c As ICollection)
    Overridable Public Sub Sort()
    Overridable Public Sub Sort( ByVal comparer As IComparer)
    Overridable Public Sub Sort(ByVal index As Integer,
        ByVal count As Integer,
        ByVal comparer As IComparer)
    Overridable Public Function ToArray(
        ByVal type As Type) As Array
    Overridable Public Function ToArray() As Object()
    Overridable Public Sub TrimToSize()
End Class
```

### Returned By

CollectionBase.InnerList, ReadOnlyCollectionBase.InnerList, System.Net.WebP

## BitArray NotInheritable Class

## System.Collections (mscorlib.dll) *serializable*

This class stores a collection of bit values as Boolean types. The constructor takes many different fc
initial array, including arguments that specify the initial values and the size of the array. You can cor
with an existing array of Booleans, or with a byte or integer array. With an integer array, each `int` v
the `BitArray`, with the least significant bit mapped to the lowest index value (`MyBitArray(0)`) of
array uses 8 bits for each value in a similar fashion. A "bare" array can be constructed by simply prc
for the number of bits in the `BitArray`, which are all set to `false` by default. Provide an additional
second argument to set the default values to either `true` or `false`.

The main functions of the `BitArray` class allow you to perform bitwise operations with two `BitArr`
There are methods for `And()`, `Or()`, and `Xor()` that correspond to their respective bitwise operati
inverts each bit value in the `BitArray`.

```
Public NotInheritable Class BitArray : Implements ICollection, IEnumerabl
' Public Constructors
   Public Sub New( ByVal bits As BitArray)
   Public Sub New( ByVal values As Boolean())
   Public Sub New( ByVal bytes As Byte())
   Public Sub New( ByVal length As Integer)
   Public Sub New( ByVal values As Integer())
   Public Sub New(ByVal length As Integer,
        ByVal defaultValue As Boolean)
' Public Instance Properties
   Public ReadOnly Property Count As Integer Implements ICollection.Count
   Public ReadOnly Property IsReadOnly As Boolean
   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect
   Public Default Property Item(
        ByVal index As Integer) As Boolean
   Public Property Length As Integer
   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn
' Public Instance Methods
   Public Function And( ByVal value As BitArray) As BitArray
   Public Function Clone(
```

```
        ) As Object Implements ICloneable.Clone
    Public Sub CopyTo(ByVal array As Array,
        ByVal index As Integer) Implements ICollection.CopyTo
    Public Function Get( ByVal index As Integer) As Boolean
    Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
    Public Function Not() As BitArray
    Public Function Or( ByVal value As BitArray) As BitArray
    Public Sub Set(ByVal index As Integer,
        ByVal value As Boolean)
    Public Sub SetAll( ByVal value As Boolean)
    Public Function Xor( ByVal value As BitArray) As BitArray
End Class
```

## CaseInsensitiveComparer Class

## System.Collections (mscorlib.dll) *serializable*

This type provides a means for case-insensitive comparison of string objects. This class implements the `IComparer.Compare()` method.

```
Public Class CaseInsensitiveComparer : Implements IComparer

' Public Constructors

   Public Sub New()

   Public Sub New(

        ByVal culture As System.Globalization.CultureInfo)

' Public Shared Properties

   Public Shared ReadOnly Property Default As CaseInsensitiveComparer

' Public Instance Methods

   Public Function Compare(ByVal a As Object,

        ByVal b As Object) As Integer Implements IComparer.Compare

End Class
```

## CaseInsensitiveHashCodeProvider Class

### System.Collections (mscorlib.dll) *serializable*

When this object is passed to a `Hashtable` constructor, it overrides the `GetHashCode()` method string comparison without regard to case. If you pass an instance of this type into the `Hashtable` constructor, you should also pass in an instance of `CaseInsensitiveComparer` to ensure that ar comparison operations (such as sorting) are also performed in a case-insensitive fashion.

```
Public Class CaseInsensitiveHashCodeProvider : Implements IHashCodeProvid

' Public Constructors

   Public Sub New()

   Public Sub New(

        ByVal culture As System.Globalization.CultureInfo)

' Public Shared Properties

   Public Shared ReadOnly Property Default As CaseInsensitiveHashCodeProv

' Public Instance Methods

   Public Function GetHashCode(

        ByVal obj As Object) As Integer Implements IHashCodeProvider.GetH

End Class
```

## CollectionBase MustInherit Class

## System.Collections (mscorlib.dll) *serializable*

This base collection type must be extended to create strongly typed collection objects. `Collectior` provides a modifiable collection. For a read-only collection of objects, use `ReadOnlyCollectionE` special collection types throughout the .NET framework derive from this class.

```
Public MustInherit Class CollectionBase : Implements IList, ICollection, I

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

' Protected Instance Properties

   Protected Property InnerList As ArrayList

   Protected Property List As IList

' Public Instance Methods

   Public Sub Clear() Implements IList.Clear

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   Public Sub RemoveAt(

        ByVal index As Integer) Implements IList.RemoveAt

' Protected Instance Methods

   Overridable Protected Sub OnClear()

   Overridable Protected Sub OnClearComplete()

   Overridable Protected Sub OnInsert(ByVal index As Integer,

        ByVal value As Object)

   Overridable Protected Sub OnInsertComplete(

        ByVal index As Integer, ByVal value As Object)

   Overridable Protected Sub OnRemove(ByVal index As Integer,

        ByVal value As Object)

   Overridable Protected Sub OnRemoveComplete(
```

```
        ByVal index As Integer, ByVal value As Object)
   Overridable Protected Sub OnSet(ByVal index As Integer,
        ByVal oldValue As Object, ByVal newValue As Object)
   Overridable Protected Sub OnSetComplete(
        ByVal index As Integer, ByVal oldValue As Object,
        ByVal newValue As Object)
   Overridable Protected Sub OnValidate(ByVal value As Object)
End Class
```

## Subclasses

System.Diagnostics.{CounterCreationDataCollection, EventLogPermissionEntry(
PerformanceCounterPermissionEntryCollection}

## Comparer NotInheritable Class

## System.Collections (mscorlib.dll) *ECMA, serializable*

The `Comparer` class is used to compare two objects of the same type. The `Compare()` method tal object is less than the second, a negative value is returned. If the first object is greater than the seco returned. If the objects are equal, zero is returned. The comparisons of strings are case-sensitive. F comparisons, use `CaseInsensitiveComparer`.

```
Public NotInheritable Class Comparer : Implements IComparer
' Public Shared Fields
   Public Shared ReadOnly Default As Comparer                          // =Syst
' Public Instance Methods
   Public Function Compare(ByVal a As Object,
        ByVal b As Object) As Integer Implements IComparer.Compare
End Class
```

## DictionaryBase MustInherit Class

### System.Collections (mscorlib.dll) *serializable*

This MustInherit base class is used to implement specialized dictionary style collections. Classes de `DictionaryBase` allow for strongly typed key and value pairs. A set of protected instance method overridden by derived classes. These methods allow a class to specify customized processes when performed on the derived object. For example, `OnSet()` lets you perform a function before you set dictionary, while `OnSetComplete()` lets you perform a function after a value is set.

```
Public MustInherit Class DictionaryBase : Implements IDictionary, ICollec

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

' Protected Instance Properties

   Protected Property Dictionary As IDictionary

   Protected Property InnerHashtable As Hashtable

' Public Instance Methods

   Public Sub Clear() Implements IDictionary.Clear

   Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer) Implements ICollection.CopyTo

   Public Function GetEnumerator(

        ) As IDictionaryEnumerator Implements IDictionary.GetEnumerator

' Protected Instance Methods

   Overridable Protected Sub OnClear()

   Overridable Protected Sub OnClearComplete()

   Overridable Protected Function OnGet(ByVal key As Object,

        ByVal currentValue As Object) As Object

   Overridable Protected Sub OnInsert(ByVal key As Object,

        ByVal value As Object)

   Overridable Protected Sub OnInsertComplete(

        ByVal key As Object, ByVal value As Object)

   Overridable Protected Sub OnRemove(ByVal key As Object,
```

```
        ByVal value As Object)
    Overridable Protected Sub OnRemoveComplete(
        ByVal key As Object, ByVal value As Object)
    Overridable Protected Sub OnSet(ByVal key As Object,
        ByVal oldValue As Object, ByVal newValue As Object)
    Overridable Protected Sub OnSetComplete(
        ByVal key As Object, ByVal oldValue As Object,
        ByVal newValue As Object)
    Overridable Protected Sub OnValidate(ByVal key As Object,
        ByVal value As Object)
End Class
```

### Subclasses

System.Diagnostics.{InstanceDataCollection, InstanceDataCollectionCollecti

# DictionaryEntry Structure

## System.Collections (mscorlib.dll) *ECMA, serializable*

This structure defines the special value type used for the elements of a dictionary collection. This type consists of a key and a value. A `DictionaryEntry` is retrieved by the `IDictionaryEnumerator.Entry` property.

```
Public Structure DictionaryEntry

' Public Constructors

   Public Sub New( ByVal key As Object, ByVal value As Object)

' Public Instance Properties

   Public Property Key As Object

   Public Property Value As Object

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `DictionaryEntry`

### Returned By

`IDictionaryEnumerator.Entry`

# Hashtable Class

## System.Collections (mscorlib.dll) *ECMA, serializable*

A *hashtable* is an associative array (dictionary) that contains key-value pairs. Each value is identifie
transformed into an integer value called a *hashcode*.

A hashtable is an efficient way to store and retrieve values in memory. It uses a fast algorithm to co
used internally to determine which "bucket" a hashtable entry belongs to. Although the algorithm sel
more than one value. In this case, a linear search locates the desired value based on its hashcode.
advantage that a subsequent linear search has a negligible impact on the overall performance of th

Initially, a 1-to-1 ratio of buckets to values applies (called the *load factor*). However, as more items a
changed, and each bucket ends up holding more elements. Greater load factors reduce the amount
increase lookup time.

The first argument to the `Hashtable` constructor gives a value for its initial size or provides an exis
`Hashtable`. A `Hashtable` automatically increases its size when all buckets are full. The `loadFac`
factor; the default is 1.0. You can also provide references to `IHashCodeProvider` and `ICompare`
hashcode and key-sorting functionality.

Keys of varying types can be used as in a regular dictionary collection. A hashing algorithm is used
accomplished by the `GetHashCode()` method of each key object, which is a virtual method provide
overridden to use a custom algorithm instead of the default hashing algorithm provided by the CLR.

The `Keys` and `Values` properties retrieve `ICollection` objects containing the keys and values, re

The `Hashtable` indexer allows you to get or retrieve a value by specific key. If a key already exists
also add a new key and value to a `Hashtable`, but throws an exception if the key already exists.

```
Public Class Hashtable : Implements IDictionary,
        ICollection, IEnumerable, System.Runtime.Serialization.ISerializal
        System.Runtime.Serialization.IDeserializationCallback, ICloneable
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal d As IDictionary)
   Public Sub New(ByVal d As IDictionary,
        ByVal hcp As IHashCodeProvider,
        ByVal comparer As IComparer)
   Public Sub New(ByVal d As IDictionary,
        ByVal loadFactor As Single)
   Public Sub New(ByVal d As IDictionary,
```

```
        ByVal loadFactor As Single,
        ByVal hcp As IHashCodeProvider,
        ByVal comparer As IComparer)
    Public Sub New(ByVal hcp As IHashCodeProvider,
        ByVal comparer As IComparer)
    Public Sub New( ByVal capacity As Integer)
    Public Sub New(ByVal capacity As Integer,
        ByVal hcp As IHashCodeProvider,
        ByVal comparer As IComparer)
    Public Sub New(ByVal capacity As Integer,
        ByVal loadFactor As Single)
    Public Sub New(ByVal capacity As Integer,
        ByVal loadFactor As Single,
        ByVal hcp As IHashCodeProvider,
        ByVal comparer As IComparer)
' Protected Constructors
    Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
    Overridable Public ReadOnly Property Count As Integer Implements IColl
    Overridable Public ReadOnly Property IsFixedSize As Boolean Implements
    Overridable Public ReadOnly Property IsReadOnly As Boolean Implements
    Overridable Public ReadOnly Property IsSynchronized As Boolean Impleme
    Overridable Public Default Property Item(
        ByVal key As Object) As Object Implements IDictionary.Item
    Overridable Public ReadOnly Property Keys As ICollection Implements ID
    Overridable Public ReadOnly Property SyncRoot As Object Implements ICo
    Overridable Public ReadOnly Property Values As ICollection Implements
' Protected Instance Properties
    Protected Property comparer As IComparer
```

```
   Protected Property hcp As IHashCodeProvider
' Public Shared Methods
   Public Shared Function Synchronized(
        ByVal table As Hashtable) As Hashtable
' Public Instance Methods
   Overridable Public Sub Add(ByVal key As Object,
        ByVal value As Object) Implements IDictionary.Add
   Overridable Public Sub Clear() Implements IDictionary.Clear
   Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Overridable Public Function Contains(
        ByVal key As Object) As Boolean Implements IDictionary.Contains
   Overridable Public Function ContainsKey(
        ByVal key As Object) As Boolean
   Overridable Public Function ContainsValue(
        ByVal value As Object) As Boolean
   Overridable Public Sub CopyTo(ByVal array As Array,
        ByVal arrayIndex As Integer) Implements ICollection.CopyTo
   Overridable Public Function GetEnumerator(
        ) As IDictionaryEnumerator Implements IDictionary.GetEnumerator
   Overridable Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext) I
   Overridable Public Sub OnDeserialization(
        ByVal sender As Object) Implements IDeserializationCallback.OnDes
   Overridable Public Sub Remove(
        ByVal key As Object) Implements IDictionary.Remove
' Protected Instance Methods
   Overridable Protected Function GetHash(
        ByVal key As Object) As Integer
   Overridable Protected Function KeyEquals(
```

```
        ByVal item As Object,
        ByVal key As Object) As Boolean
End Class
```

### Returned By

DictionaryBase.InnerHashtable, System.Collections.Specialized.CollectionsU

## ICollection Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface defines the basic characteristics of collection objects and implements three properties. `Count` gets the number of elements contained in a collection; `IsSynchronized` indicates whether the collection is thread-safe, and `SyncRoot` returns an object that synchronizes access to the collection (this is the object itself if the implementing class does not provide a `Synchronized()` method). `ICollection` also implements the `CopyTo()` method for copying elements to an `Array` object at a specified index.

```
Public Interface ICollection : Implements IEnumerable

' Public Instance Properties

   Public ReadOnly Property Count As Integer

   Public ReadOnly Property IsSynchronized As Boolean

   Public ReadOnly Property SyncRoot As Object

' Public Instance Methods

   Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer)

End Interface
```

### Implemented By

Multiple types

### Returned By

Multiple types

### Passed To

`ArrayList.{AddRange(), ArrayList(), InsertRange(), SetRange()}, Queue.Queue(), Stack.Stack()`

# IComparer Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface implements a method for comparing objects. `Compare()` determines whether an obje greater than (positive return value), less than (negative return value), or equal (zero) to another obje interface is required for classes that need to sort elements or search collections.

```
Public Interface IComparer

' Public Instance Methods

   Public Function Compare(ByVal x As Object,

        ByVal y As Object) As Integer

End Interface
```

### Implemented By

`CaseInsensitiveComparer`, `Comparer`

### Returned By

`Hashtable.comparer`

### Passed To

`System.Array.{BinarySearch(), Sort()}`, `ArrayList.{BinarySearch(), Sort()}`, `Has {comparer, Hashtable()}`, `SortedList.SortedList()`, `System.Collections.Specialized.ListDictionary.ListDictionary()`, `System.Collections.Specialized.NameObjectCollectionBase.NameObjectCollect`, `System.Collections.Specialized.NameValueCollection.NameValueCollection()`, `System.Xml.XPath.XPathExpression.AddSort()`

# IDictionary Interface

## System.Collections (mscorlib.dll) *ECMA*

This base interface for a collection of key/value elements defines the indexer (in C#, the `this` prope in VB.NET, the property marked as `Default`), as well as the `Keys` and `Values` properties that retu collections containing the dictionary's keys or values, respectively. This interface also defines the m by which the entries may be modified, such as `Add()`, `Clear()`, and `Remove()`.

```
Public Interface IDictionary : Implements ICollection, IEnumerable

' Public Instance Properties

   Public ReadOnly Property IsFixedSize As Boolean

   Public ReadOnly Property IsReadOnly As Boolean

   Public Default Property Item(

        ByVal key As Object) As Object

   Public ReadOnly Property Keys As ICollection

   Public ReadOnly Property Values As ICollection

' Public Instance Methods

   Public Sub Add( ByVal key As Object, ByVal value As Object)

   Public Sub Clear()

   Public Function Contains( ByVal key As Object) As Boolean

   Public Function GetEnumerator() As IDictionaryEnumerator

   Public Sub Remove( ByVal key As Object)

End Interface
```

### Implemented By

`DictionaryBase`, `Hashtable`, `SortedList`, `System.Collections.Specialized.{HybridDictionary,ListDictionary}`

### Returned By

`DictionaryBase.Dictionary`, `System.Environment.GetEnvironmentVariables()`

### Passed To

`Hashtable.Hashtable()`, `SortedList.SortedList()`, `System.Collections.Specialized.CollectionsUtil.CreateCaseInsensitiveHasht`
`System.Diagnostics.EventLogInstaller.{Install(),Rollback(),Uninstall()}`

# IDictionaryEnumerator Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface is an enumerator for `Dictionary` collections. It defines three read-only properties that can be obtained from the currently selected element of the collection. The `Entry` property gets an entry (key and value) in the form of a `DictionaryEntry` object. `Key` and `Value` return the key and value of the current element.

```
Public Interface IDictionaryEnumerator : Implements IEnumerator

' Public Instance Properties

   Public ReadOnly Property Entry As DictionaryEntry

   Public ReadOnly Property Key As Object

   Public ReadOnly Property Value As Object

End Interface
```

### Returned By

`DictionaryBase.GetEnumerator()`, `Hashtable.GetEnumerator()`, `IDictionary.GetEnumerator()`, `SortedList.GetEnumerator()`, `System.Collections.Specialized.HybridDictionary.GetEnumerator()`, `System.Collections.Specialized.ListDictionary.GetEnumerator()`

# IEnumerable Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface exposes an enumerator to iterate over a collection. The `GetEnumerator()` method returns an `IEnumerator` for the object.

```
Public Interface IEnumerable

' Public Instance Methods

   Public Function GetEnumerator() As IEnumerator

End Interface
```

### Implemented By

Multiple types

## IEnumerator Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface provides an enumerator to iterate over the elements of a collection. The `Current` property gets the current element in the iteration. `MoveNext()` advances to the next collection element. `Reset()` returns the position of the iteration to the start of the collection, just before the first element; an initial call to `MoveNext()` is necessary to retrieve the first element of the collection.

```
Public Interface IEnumerator

' Public Instance Properties

   Public ReadOnly Property Current As Object

' Public Instance Methods

   Public Function MoveNext() As Boolean

   Public Sub Reset()

End Interface
```

### Implemented By

`IDictionaryEnumerator`, `System.CharEnumerator`, `System.Globalization.TextElementEnumerator`, `System.Runtime.Serialization.SerializationInfoEnumerator`

### Returned By

Multiple types

# IHashCodeProvider Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface implements a custom hash function to supply a hashcode to an object. Normally hash System.Object.GetHashCode() for hash keys. However, if a Hashtable is constructed using that implements this interface, GetHashCode() can be used to provide a customized hash functior CaseInsensitiveHashCodeProvider is an example of a custom hash function.

```
Public Interface IHashCodeProvider
' Public Instance Methods
   Public Function GetHashCode(
        ByVal obj As Object) As Integer
End Interface
```

### Implemented By

CaseInsensitiveHashCodeProvider

### Returned By

Hashtable.hcp

### Passed To

Hashtable.{Hashtable(),hcp},
System.Collections.Specialized.NameObjectCollectionBase.NameObjectCollect
System.Collections.Specialized.NameValueCollection.NameValueCollection()

## IList Interface

## System.Collections (mscorlib.dll) *ECMA*

This interface defines the basic characteristics of an indexable collection of objects. All array and collection classes implement this interface. `IList` defines methods by adding an element to the end of a list (`Add()`), inserting or removing an element at a specific index (`Insert()` and `RemoveAt()`), or removing all elements. `Remove()` removes the first occurrence of a specific object from a list. Changing the elements of a list requires that the class be resizable and modifiable (see the `IsFixedSize` property). The `Contains()` method checks to see if a given value is contained in the list, while `IndexOf()` returns the index of an existing list value.

```
Public Interface IList : Implements ICollection, IEnumerable

' Public Instance Properties

   Public ReadOnly Property IsFixedSize As Boolean

   Public ReadOnly Property IsReadOnly As Boolean

   Public Default Property Item(

        ByVal index As Integer) As Object

' Public Instance Methods

   Public Function Add( ByVal value As Object) As Integer

   Public Sub Clear()

   Public Function Contains(ByVal value As Object) As Boolean

   Public Function IndexOf( ByVal value As Object) As Integer

   Public Sub Insert(ByVal index As Integer,

        ByVal value As Object)

   Public Sub Remove( ByVal value As Object)

   Public Sub RemoveAt( ByVal index As Integer)

End Interface
```

### Implemented By

`ArrayList`, `CollectionBase`, `System.Array`, `System.Collections.Specialized.StringCollection`, `System.Diagnostics.TraceListenerCollection`

### Returned By

`ArrayList.{FixedSize(),ReadOnly(),Synchronized()}`, `CollectionBase.List`, `SortedList.{GetKeyList(),GetValueList()}`

### Passed To

`ArrayList.{Adapter(),FixedSize(),ReadOnly(),Synchronized()}, System.Net.Sockets.Socket.Select()`

## Queue Class

## System.Collections (mscorlib.dll) *serializable*

This class describes a collection manipulated on a first-in, first-out basis. The newest elements are a
the `Enqueue()` method, and the oldest are taken off the other end with `Dequeue()`. A `Queue` can
empty collection or with the elements of an existing collection. The initial capacity can also be specif
default for an empty queue is 32. Normally, a `Queue` automatically increases its capacity when new
current capacity, using a default growth factor of 2.0. (The growth factor is multiplied by the current c
the new capacity.) You may specify your own growth factor when you specify an initial capacity for th

The `Dequeue()` method returns the element at the beginning of the `Queue`, and simultaneously rem
the first element without removal by using `Peek()`. The contents of a `Queue` can be copied to an ex
using the `CopyTo()` method. `ToArray()` creates a new `Array` object with the contents of the `Que`

The `Queue` is not threadsafe. The `Synchronize()` method provides a wrapper for thread safety.

```
Public Class Queue : Implements ICollection, IEnumerable, ICloneable

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal col As ICollection)

   Public Sub New( ByVal capacity As Integer)

   Public Sub New(ByVal capacity As Integer,

        ByVal growFactor As Single)

' Public Instance Properties

   Overridable Public ReadOnly Property Count As Integer Implements IColl

   Overridable Public ReadOnly Property IsSynchronized As Boolean

   Implements ICollection.IsSynchronized

   Overridable Public ReadOnly Property SyncRoot As Object Implements ICo

' Public Shared Methods

   Public Shared Function Synchronized(

        ByVal queue As Queue) As Queue

' Public Instance Methods

   Overridable Public Sub Clear()

   Overridable Public Function Clone(

        ) As Object Implements ICloneable.Clone

   Overridable Public Function Contains(
```

```
        ByVal obj As Object) As Boolean
   Overridable Public Sub CopyTo(ByVal array As Array,
        ByVal index As Integer) Implements ICollection.CopyTo
   Overridable Public Function Dequeue() As Object
   Overridable Public Sub Enqueue( ByVal obj As Object)
   Overridable Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
   Overridable Public Function Peek() As Object
   Overridable Public Function ToArray() As Object()
   Overridable Public Sub TrimToSize()
End Class
```

## ReadOnlyCollectionBase MustInherit Class

## System.Collections (mscorlib.dll) *serializable*

This MustInherit base class is for read-only collections, similar to `CollectionBase`.

```
Public MustInherit Class ReadOnlyCollectionBase : Implements ICollection,

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

' Protected Instance Properties

   Protected Property InnerList As ArrayList

' Public Instance Methods

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

End Class
```

### Subclasses

`System.Diagnostics.{ProcessModuleCollection, ProcessThreadCollection}`

## SortedList Class

### System.Collections (mscorlib.dll) *serializable*

This class is a dictionary collection in which values can be retrieved by either associated key or by i
specifically ordered). Keys are sorted based on their object type (e.g., strings are alphabetically sort
comparison methods by providing your own `IComparer`-implementing object to the `SortedList` c

Many methods are defined to allow you to retrieve values by either key name or index value. The `Ir`
methods return the zero-based index value of the specified key or value. `GetByIndex()` and `SetE`
functionality.

```
Public Class SortedList : Implements IDictionary, ICollection, IEnumerabl

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal comparer As IComparer)

   Public Sub New(ByVal comparer As IComparer,

        ByVal capacity As Integer)

   Public Sub New( ByVal d As IDictionary)

   Public Sub New(ByVal d As IDictionary,

        ByVal comparer As IComparer)

   Public Sub New( ByVal initialCapacity As Integer)

' Public Instance Properties

   Overridable Public Property Capacity As Integer

   Overridable Public ReadOnly Property Count As Integer Implements IColl

   Overridable Public ReadOnly Property IsFixedSize As Boolean Implements

   Overridable Public ReadOnly Property IsReadOnly As Boolean Implements

   Overridable Public ReadOnly Property IsSynchronized As Boolean Impleme

   Overridable Public Default Property Item(

        ByVal key As Object) As Object Implements IDictionary.Item

   Overridable Public ReadOnly Property Keys As ICollection Implements ID

   Overridable Public ReadOnly Property SyncRoot As Object Implements ICo

   Overridable Public ReadOnly Property Values As ICollection Implements

' Public Shared Methods

   Public Shared Function Synchronized(
```

```
        ByVal list As SortedList) As SortedList
' Public Instance Methods
    Overridable Public Sub Add(ByVal key As Object,
        ByVal value As Object) Implements IDictionary.Add
    Overridable Public Sub Clear() Implements IDictionary.Clear
    Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
    Overridable Public Function Contains(
        ByVal key As Object) As Boolean Implements IDictionary.Contains
    Overridable Public Function ContainsKey(
        ByVal key As Object) As Boolean
    Overridable Public Function ContainsValue(
        ByVal value As Object) As Boolean
    Overridable Public Sub CopyTo(ByVal array As Array,
        ByVal arrayIndex As Integer) Implements ICollection.CopyTo
    Overridable Public Function GetByIndex(
        ByVal index As Integer) As Object
    Overridable Public Function GetEnumerator(
        ) As IDictionaryEnumerator Implements IDictionary.GetEnumerator
    Overridable Public Function GetKey(
        ByVal index As Integer) As Object
    Overridable Public Function GetKeyList() As IList
    Overridable Public Function GetValueList() As IList
    Overridable Public Function IndexOfKey(
        ByVal key As Object) As Integer
    Overridable Public Function IndexOfValue(
        ByVal value As Object) As Integer
    Overridable Public Sub Remove(
        ByVal key As Object) Implements IDictionary.Remove
    Overridable Public Sub RemoveAt( ByVal index As Integer)
    Overridable Public Sub SetByIndex(ByVal index As Integer,
```

```
        ByVal value As Object)
   Overridable Public Sub TrimToSize()
End Class
```

## Returned By

System.Collections.Specialized.CollectionsUtil.CreateCaseInsensitiveSorte

## Stack Class

### System.Collections (mscorlib.dll) *serializable*

This class implements a collection of objects manipulated in a last-in, first-out manner. The primary Pop(). Push() adds an element to the top of a stack and Pop() removes the top element from th without removing it from the stack.

```
Public Class Stack : Implements ICollection, IEnumerable, ICloneable

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal col As ICollection)

   Public Sub New( ByVal initialCapacity As Integer)

' Public Instance Properties

   Overridable Public ReadOnly Property Count As Integer Implements IColl

   Overridable Public ReadOnly Property IsSynchronized As Boolean Impleme

   Overridable Public ReadOnly Property SyncRoot As Object Implements ICo

' Public Shared Methods

   Public Shared Function Synchronized(

        ByVal stack As Stack) As Stack

' Public Instance Methods

   Overridable Public Sub Clear()

   Overridable Public Function Clone(

        ) As Object Implements ICloneable.Clone

   Overridable Public Function Contains(

        ByVal obj As Object) As Boolean

   Overridable Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer) Implements ICollection.CopyTo

   Overridable Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   Overridable Public Function Peek() As Object

   Overridable Public Function Pop() As Object

   Overridable Public Sub Push( ByVal obj As Object)
```

```
    Overridable Public Function ToArray() As Object()

End Class
```

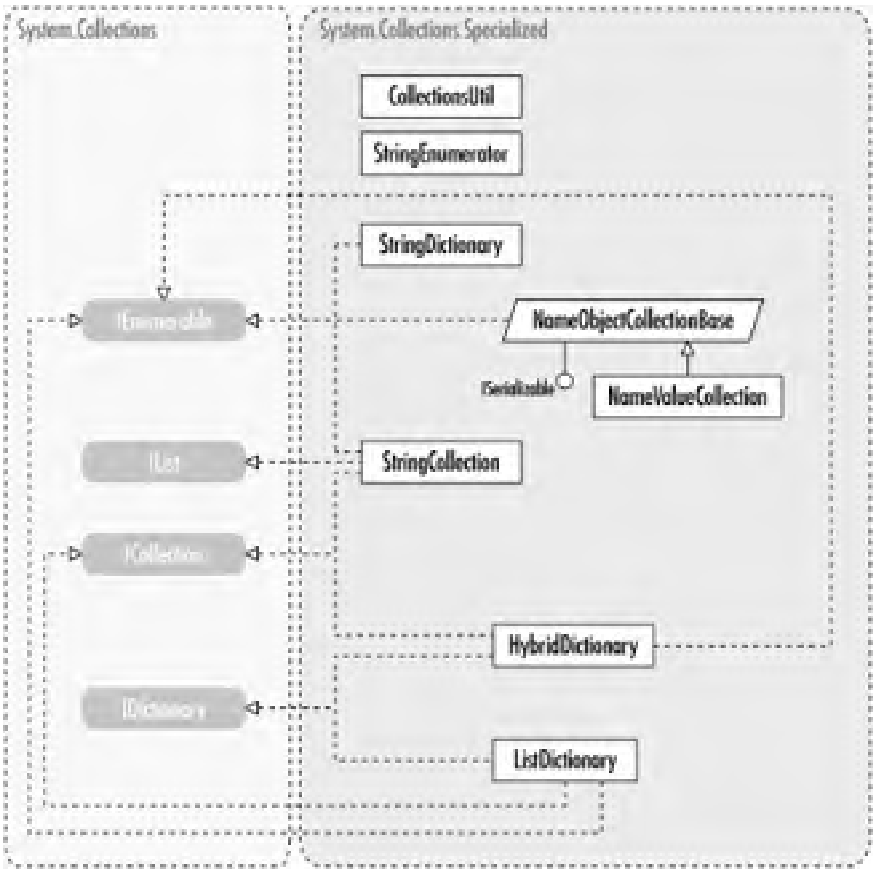
# Chapter 6. System.Collections.Specialized

The types defined in the `System.Collections` namespace are fine as general-purpose collection types, but frequently programmers require specialized semantics around a collection class; for example, storing a collection of booleans could be more efficiently stored as a single `System.Int64`, whereas simply placing `System.Boolean` instances into a general-purpose collection is far more wasteful, in both memory and processing time.

Additionally, programmers often grow frustrated with the lack of type-safety in the general-purpose containers; not only does a programmer have to typecast any object obtained out of the container, but the container itself holds no intrinsic logic to "screen out" unwanted types being inserted into the container. (This is in marked contrast to C++ template-based collections such as the STL, in which the attempt to put a string into a container of integers causes a compile-time error.)

Container specialization isn't limited to storage type — at times, a programmer desires different processing behavior than the general-purpose container provides. As an example, consider the `System.Collections.IDictionary` interface. Note that it clearly defines a mapping of keys to values; however, it is only implicitly understood that the exact same key must be produced to obtain the value desired. In most cases, this is exactly what's needed; however, there are times when a less stringent retrieval mechanism is preferred. For example, perhaps a case-insensitive match is wanted instead of doing an exact-match for a string key. The `System.Collections.Specialized` namespace includes collections designed to address these cases. Figure 6-1 shows the types in this namespace.

### Figure 6-1. The System.Collections.Specialized namespace



## BitVector32 Structure

## System.Collections.Specialized (system.dll)

This structure defines a lightweight bit vector that can store booleans and 16-bit integers in a 32-bit structure. `Section`s hold single 16-bit integer values and are the building blocks of a BitVector32. Sections are created with `CreateSection()`. Each section is constructed with a maximum value for the integer it can hold. Except for the initial section, each subsequent section must provide a reference to the previous section in addition to the maximum value.

The indexer takes two forms. When indexed by a section name, that section's value can be set or retrieved. When indexed by an integer that specifies a bit in the vector, you can determine whether that bit is set or not (`true` or `false`).

```
Public Structure BitVector32

' Public Constructors

   Public Sub New( ByVal value As BitVector32)

   Public Sub New( ByVal data As Integer)

' Public Instance Properties

   Public ReadOnly Property Data As Integer

   Public Default Property Item(

         ByVal section As Section) As Integer

   Public Default Property Item(

         ByVal bit As Integer) As Boolean

' Public Shared Methods

   Public Shared Function CreateMask() As Integer

   Public Shared Function CreateMask(

         ByVal previous As Integer) As Integer

   Public Shared Function CreateSection(

         ByVal maxValue As Short) As Section

   Public Shared Function CreateSection(

         ByVal maxValue As Short,

         ByVal previous As Section) As Section

   Public Shared Function ToString(

         ByVal value As BitVector32) As String

' Public Instance Methods
```

```
   Overrides Public Function Equals(
        ByVal o As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Structure
```

## Hierarchy

System.Object → System.ValueType → BitVector32

# BitVector32.Section Structure

## System.Collections.Specialized (system.dll)

This structure represents a section of a bit vector that holds a single integer value. A `BitVector32.Section` instance is created by the `BitVector32.CreateSection()` method, which specifies the maximum value the `Section` can hold, and references the preceding `Section`, unless it is the first `Section` in the vector.

```
Public Structure BitVector32.Section

' Public Instance Properties

   Public ReadOnly Property Mask As Short

   Public ReadOnly Property Offset As Short

' Public Shared Methods

   Public Shared Function ToString(

        ByVal value As Section) As String

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal o As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `Section`

## CollectionsUtil Class

## System.Collections.Specialized (system.dll)

This class defines shared methods to create special collections in which keys are sorted without respect to case. `CreateCaseInsensitiveHashtable()` creates a `Hashtable`, and `CreateCaseInsensitiveSortedList()` creates a `System.Collections.SortedList`.

```
Public Class CollectionsUtil

' Public Constructors

   Public Sub New()

' Public Shared Methods

   Public Shared Function CreateCaseInsensitiveHashtable(
        ) As Hashtable

   Public Shared Function CreateCaseInsensitiveHashtable(
        ByVal d As System.Collections.IDictionary) As Hashtable

   Public Shared Function CreateCaseInsensitiveHashtable(
        ByVal capacity As Integer) As Hashtable

   Public Shared Function CreateCaseInsensitiveSortedList(
        ) As SortedList

End Class
```

## HybridDictionary Class

## System.Collections.Specialized (system.dll) *serializable*

This class implements a standard dictionary collection with built-in capability for case-insensitive key
insensitivity can be specified during construction with a Boolean argument.

```
Public Class HybridDictionary : Implements IDictionary, ICollection, IEnu

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal caseInsensitive As Boolean)

   Public Sub New( ByVal initialSize As Integer)

   Public Sub New(ByVal initialSize As Integer,

        ByVal caseInsensitive As Boolean)

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Public ReadOnly Property IsFixedSize As Boolean Implements IDictionary

   Public ReadOnly Property IsReadOnly As Boolean Implements IDictionary.

   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect

   Public Default Property Item(

        ByVal key As Object) As Object Implements IDictionary.Item

   Public ReadOnly Property Keys As ICollection Implements IDictionary.Ke

   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn

   Public ReadOnly Property Values As ICollection Implements IDictionary.

' Public Instance Methods

   Public Sub Add(ByVal key As Object,

        ByVal value As Object) Implements IDictionary.Add

   Public Sub Clear() Implements IDictionary.Clear

   Public Function Contains(

        ByVal key As Object) As Boolean Implements IDictionary.Contains

   Public Sub CopyTo(ByVal array As Array,
```

```
        ByVal index As Integer) Implements ICollection.CopyTo
    Public Function GetEnumerator(
        ) As IDictionaryEnumerator Implements IDictionary.GetEnumerator
    Public Sub Remove(
        ByVal key As Object) Implements IDictionary.Remove
End Class
```

## ListDictionary Class

## System.Collections.Specialized (system.dll) *serializable*

This class is a simple implementation of a dictionary collection (`System.Collections.IDictior` implements the `IDictionary` methods and properties, and it is suggested for use with a small nur than 10). The overloaded constructor can optionally pass an `System.Collections.IComparer` used for case-insensitive key comparison or other special key type conversions.

```
Public Class ListDictionary : Implements IDictionary, ICollection, IEnume

' Public Constructors

   Public Sub New()

   Public Sub New(

        ByVal comparer As System.Collections.IComparer)

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Public ReadOnly Property IsFixedSize As Boolean Implements IDictionary

   Public ReadOnly Property IsReadOnly As Boolean Implements IDictionary.

   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect.

   Public Default Property Item(

        ByVal key As Object) As Object Implements IDictionary.Item

   Public ReadOnly Property Keys As ICollection Implements IDictionary.Ke

   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn

   Public ReadOnly Property Values As ICollection Implements IDictionary.

' Public Instance Methods

   Public Sub Add(ByVal key As Object,

        ByVal value As Object) Implements IDictionary.Add

   Public Sub Clear() Implements IDictionary.Clear

   Public Function Contains(

        ByVal key As Object) As Boolean Implements IDictionary.Contains

   Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer) Implements ICollection.CopyTo

   Public Function GetEnumerator(
```

```
        ) As IDictionaryEnumerator Implements IDictionary.GetEnumerator

   Public Sub Remove(

        ByVal key As Object) Implements IDictionary.Remove

End Class
```

## NameObjectCollectionBase MustInherit Class

## System.Collections.Specialized (system.dll) *serializable*

This MustInherit base class is for a hashtable-based collection of key/value pairs, in which the key is
methods to be overridden by derived classes that allow for special comparing and sorting of key stri

```
Public MustInherit Class NameObjectCollectionBase : Implements ICollectio
        IEnumerable, System.Runtime.Serialization.ISerializable,
        System.Runtime.Serialization.IDeserializationCallback
' Protected Constructors
   Protected Sub New()
   Protected Sub New(
        ByVal hashProvider As System.Collections.IHashCodeProvider,
        ByVal comparer As System.Collections.IComparer)
   Protected Sub New( ByVal capacity As Integer)
   Protected Sub New(ByVal capacity As Integer,
        ByVal hashProvider As System.Collections.IHashCodeProvider,
        ByVal comparer As System.Collections.IComparer)
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Overridable Public ReadOnly Property Count As Integer Implements IColl
   Overridable Public ReadOnly Property Keys As KeysCollection
' Protected Instance Properties
   Protected Property IsReadOnly As Boolean
' Public Instance Methods
   Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
   Overridable Public Sub GetObjectData(
```

```
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext) In
   Overridable Public Sub OnDeserialization(
        ByVal sender As Object) Implements IDeserializationCallback.OnDes
' Protected Instance Methods
   Protected Sub BaseAdd(ByVal name As String,
        ByVal value As Object)
   Protected Sub BaseClear()
   Protected Function BaseGet(
        ByVal index As Integer) As Object
   Protected Function BaseGet(ByVal name As String) As Object
   Protected Function BaseGetAllKeys() As String()
   Protected Function BaseGetAllValues() As Object()
   Protected Function BaseGetAllValues(
        ByVal type As Type) As Object()
   Protected Function BaseGetKey(
        ByVal index As Integer) As String
   Protected Function BaseHasKeys() As Boolean
   Protected Sub BaseRemove( ByVal name As String)
   Protected Sub BaseRemoveAt( ByVal index As Integer)
   Protected Sub BaseSet(ByVal index As Integer,
        ByVal value As Object)
   Protected Sub BaseSet(ByVal name As String,
        ByVal value As Object)
End Class
```

### Subclasses

NameValueCollection

## NameValueCollection Class

**System.Collections.Specialized (system.dll)** ***ECMA, serializable***

This class is a collection of keys and associated values composed of strings in which a single key may have multiple values associated with it. A multivalued entry is stored as a comma-separated list of the string values. Use the `Add()` method to append new values to existing values of a key. Using `Set()` or setting the value by key name overwrites the existing value. You can use a string containing a comma-separated list to assign multiple values to a key.

The `GetValues()` method returns a string array containing all the values of the specified key (or index). An example of how this class is used is `System.Net.WebHeaderCollection`, which derives from it. A `WebHeaderCollection` contains the collection of various HTTP header names as key strings and their values. HTTP headers such as `Accept:` often have multiple values (for example, MIME types for `Accept`).

```
Public Class NameValueCollection : Inherits NameObjectCollectionBase

' Public Constructors

   Public Sub New()

   Public Sub New(

        ByVal hashProvider As System.Collections.IHashCodeProvider,

        ByVal comparer As System.Collections.IComparer)

   Public Sub New( ByVal capacity As Integer)

   Public Sub New(ByVal capacity As Integer,

        ByVal hashProvider As System.Collections.IHashCodeProvider,

        ByVal comparer As System.Collections.IComparer)

   Public Sub New(ByVal capacity As Integer,

        ByVal col As NameValueCollection)

   Public Sub New( ByVal col As NameValueCollection)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overridable Public ReadOnly Property AllKeys As String()

   Public Default ReadOnly Property Item(
```

```
        ByVal index As Integer) As String
    Public Default Property Item(
        ByVal name As String) As String
' Public Instance Methods
    Public Sub Add( ByVal c As NameValueCollection)
    Overridable Public Sub Add(ByVal name As String,
        ByVal value As String)
    Public Sub Clear()
    Public Sub CopyTo(ByVal dest As Array,
        ByVal index As Integer) Implements ICollection.CopyTo
    Overridable Public Function Get(
        ByVal index As Integer) As String
    Overridable Public Function Get(
        ByVal name As String) As String
    Overridable Public Function GetKey(
        ByVal index As Integer) As String
    Overridable Public Function GetValues(
        ByVal index As Integer) As String()
    Overridable Public Function GetValues(
        ByVal name As String) As String()
    Public Function HasKeys() As Boolean
    Overridable Public Sub Remove( ByVal name As String)
    Overridable Public Sub Set(ByVal name As String,
        ByVal value As String)
' Protected Instance Methods
    Protected Sub InvalidateCachedArrays()
End Class
```

## Hierarchy

System.Object → NameObjectCollectionBase(System.Collections.ICollection,

```
System.Collections.IEnumerable,
System.Runtime.Serialization.ISerializable,
System.Runtime.Serialization.IDeserializationCallback)→
NameValueCollection
```

### Subclasses

```
System.Net.WebHeaderCollection
```

### Returned By

```
System.Net.WebClient.QueryString
```

### Passed To

```
System.Net.WebClient.{QueryString,UploadValues()}
```

## StringCollection Class

## System.Collections.Specialized (system.dll) *serializable*

This class is a special collection in which the elements are strings.

```
Public Class StringCollection : Implements IList, ICollection, IEnumerabl
' Public Constructors
   Public Sub New()
' Public Instance Properties
   Public ReadOnly Property Count As Integer Implements ICollection.Count
   Public ReadOnly Property IsReadOnly As Boolean Implements IList.IsRead
   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect
   Public Default Property Item(
        ByVal index As Integer) As String
   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn
' Public Instance Methods
   Public Function Add( ByVal value As String) As Integer
   Public Sub AddRange( ByVal value As String())
   Public Sub Clear() Implements IList.Clear
   Public Function Contains(ByVal value As String) As Boolean
   Public Sub CopyTo(ByVal array As String(),
        ByVal index As Integer)
   Public Function GetEnumerator() As StringEnumerator
   Public Function IndexOf( ByVal value As String) As Integer
   Public Sub Insert(ByVal index As Integer,
        ByVal value As String)
   Public Sub Remove( ByVal value As String)
   Public Sub RemoveAt(
        ByVal index As Integer) Implements IList.RemoveAt
End Class
```

## StringDictionary Class

## System.Collections.Specialized (system.dll)

This class is a dictionary collection in which keys and values are all strings.

```
Public Class StringDictionary : Implements IEnumerable

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Overridable Public ReadOnly Property Count As Integer

   Overridable Public ReadOnly Property IsSynchronized As Boolean

   Overridable Public Default Property Item(

        ByVal key As String) As String

   Overridable Public ReadOnly Property Keys As ICollection

   Overridable Public ReadOnly Property SyncRoot As Object

   Overridable Public ReadOnly Property Values As ICollection

' Public Instance Methods

   Overridable Public Sub Add(ByVal key As String,

        ByVal value As String)

   Overridable Public Sub Clear()

   Overridable Public Function ContainsKey(

        ByVal key As String) As Boolean

   Overridable Public Function ContainsValue(

        ByVal value As String) As Boolean

   Overridable Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer)

   Overridable Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   Overridable Public Sub Remove( ByVal key As String)

End Class
```

### Returned By

`System.Diagnostics.ProcessStartInfo.EnvironmentVariables`

## StringEnumerator Class

## System.Collections.Specialized (system.dll)

This type implements an enumerator for a `StringCollection`. This is returned by `StringCollection.GetEnumerator()`.

```
Public Class StringEnumerator

' Public Instance Properties

   Public ReadOnly Property Current As String

' Public Instance Methods

   Public Function MoveNext() As Boolean

   Public Sub Reset()

End Class
```

### Returned By

`StringCollection.GetEnumerator()`

# Chapter 7. System.Diagnostics

Diagnostics are an important part of any software system. In addition to the obvious necessity of debugging the code, diagnostics can keep track of application performance and liveness, thus indicating a problem proactively, rather than waiting for the phone call from the system administrators.

Diagnostics means more than just compiling with debug symbols turned on. Certain code paths might want to execute only when diagnostics are turned on to full power, indicated by a compile-time switch. At other times, particularly in long-running systems (such as WebService-based systems), developers want to keep a log of the system's actions; frequently, debug reports from users are sketchy ("Um, when I clicked the button, it all just crashed"), and having a complete log of the system's actions can be invaluable in tracking the problem down. Not only can the log consist of custom-written messages (usually to a file), but the Windows Event Log is also available for use from within this namespace.

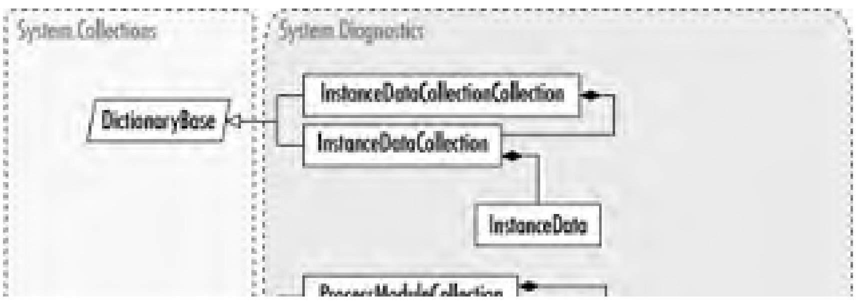
Diagnostics also includes the ability to track the health and performance of the application; under Windows 2000 and XP, this means interaction with the Performance utility. This is a powerful tool that can be launched from the Administrative Tools program group (under Windows NT, it is called Performance Monitor). By creating appropriate performance counters within the application, .NET programmers can give the system support staff (system administrators and production monitoring personnel, among others) the ability to monitor and track the application, even remotely. In addition to its diagnostic facilities, this namespace exposes operating system processes using the `Process` type. Use this type to launch new processes or take control of processes currently running on the system. The `ProcessThread` type lets you drill down into each thread that's running within a process for fine-grained control over running applications.

Most of the functionality in this namespace is disabled at runtime unless you've enabled debugging. If you are using command-line compilers, you can pass the `/d:DEBUG=True` switch to enable debugging (to enable tracing, use `/d:TRACE=True`). Alternatively, you can use the preprocessor directives `#Const TRACE=1` or `#Const DEBUG=1`. The advantage here is that you can leave all your debugging code in, and it does not affect your release builds. The related `/debug` switch adds debug symbols to your program. You need the debug symbols to obtain source file and line number information in stack traces or to run your program under the control of a debugger. In Visual Studio .NET, you can enable debugging and debug symbols by creating a debug build of your application.

Some diagnostic settings can be controlled using the application configuration file (`appname.exe.config`). This lets you control trace and debugging behavior without having to recompile. The root element in an application configuration file is the `<configuration>` element. Create a `<system.diagnostics>` element within that root element. All the settings mentioned in this chapter must be contained in that `<system.diagnostics>` element.

Figure 7-1, Figure 7-2, Figure 7-3, and Figure 7-4 show the types in this namespace.

**Figure 7-1. Process, EventLog, and related classes**



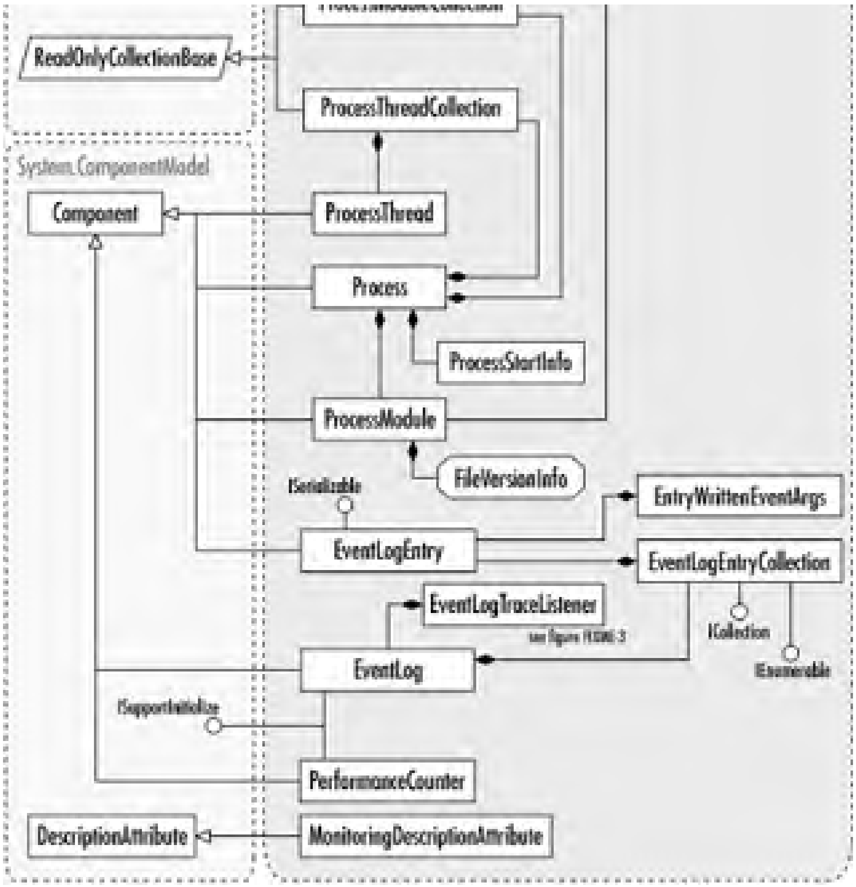
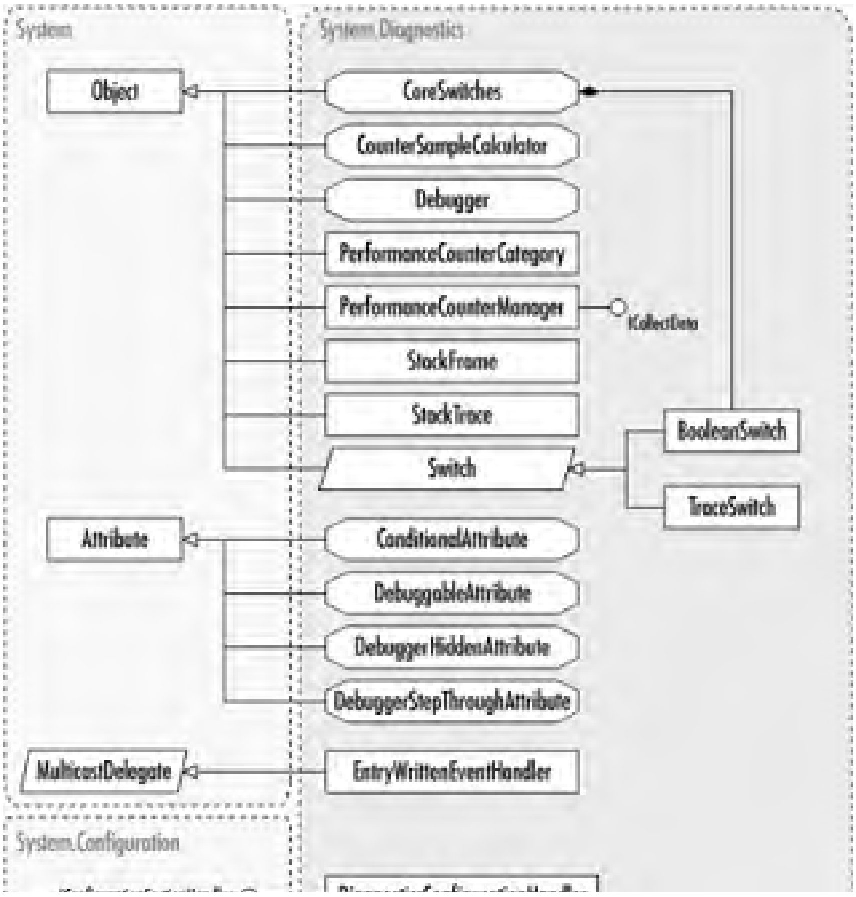
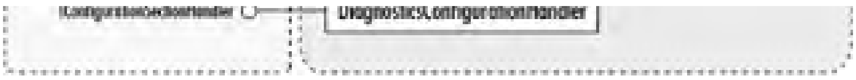
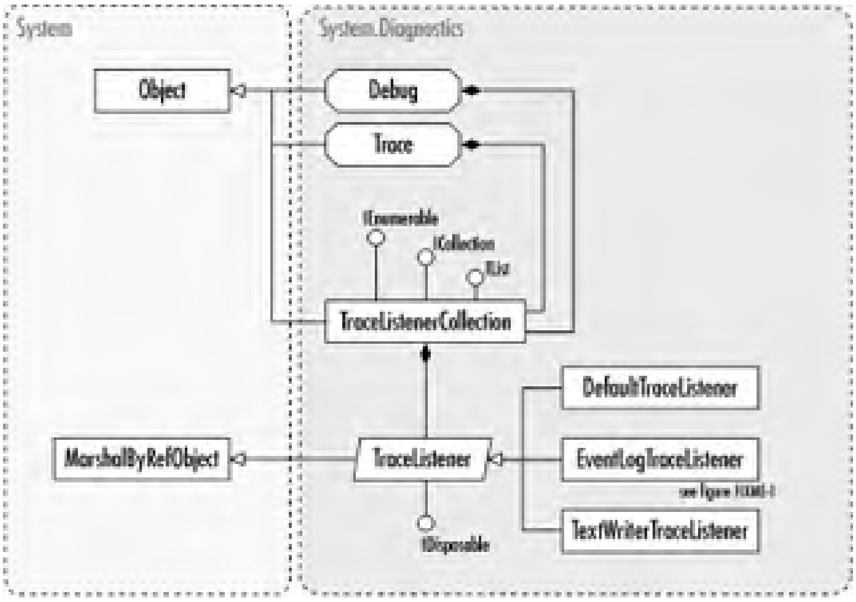



**Figure 7-2. More classes from the System.Diagnostics namespace**

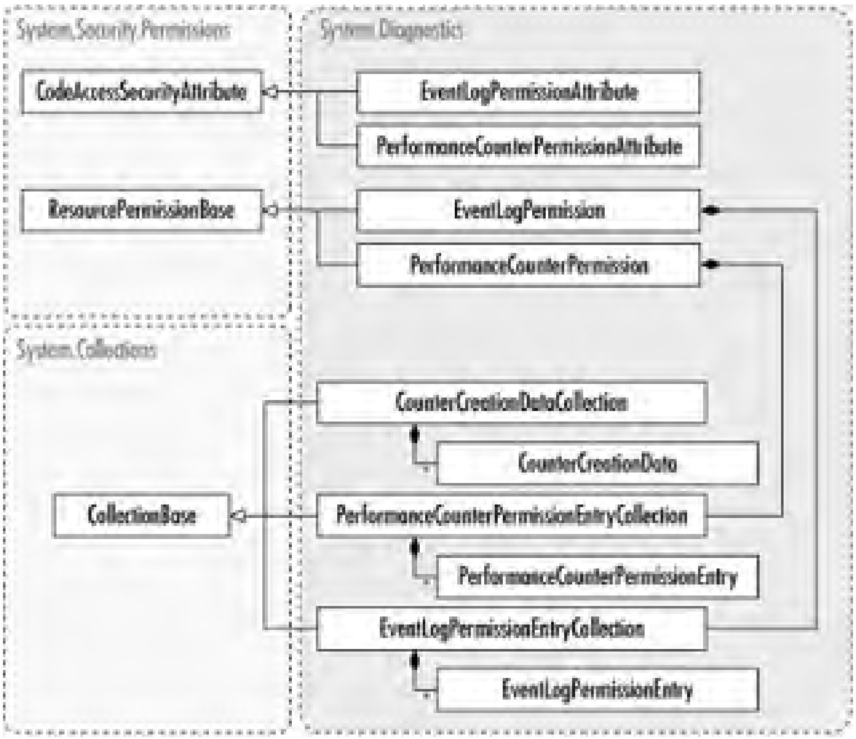




### Figure 7-3. TraceListener and related classes




### Figure 7-4. CodeAccessSecurityAttributes, collections, and related classes



# BooleanSwitch Class

## System.Diagnostics (system.dll)

This class provides a simple on/off switch for debugging and tracing. Consult `Enabled` to check if the switch has been set. You can configure a Boolean switch using the application configuration file (see `Switch`). To use a `BooleanSwitch`, you must enable tracing or debugging at compilation time.

```
Public Class BooleanSwitch : Inherits Switch
' Public Constructors
   Public Sub New(ByVal displayName As String,
        ByVal description As String)
' Public Instance Properties
   Public Property Enabled As Boolean
End Class
```

### Hierarchy

System.Object → Switch → BooleanSwitch

## ConditionalAttribute NotInheritable Class

## System.Diagnostics (mscorlib.dll) *ECMA, serializable*

This attribute marks a method as callable only if a compilation variable, given by `conditionString`, is set. Compilation variables can be set by supplying `/define:VARIABLE` as a command-line argument to the compiler or by supplying `#Const VARIABLE=1` directives in the source code itself. If the compilation variable is not set, calls to the marked method are ignored.

```
Public NotInheritable Class ConditionalAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal conditionString As String)

' Public Instance Properties

   Public ReadOnly Property ConditionString As String

End Class
```

### Hierarchy

System.Object → System.Attribute → ConditionalAttribute

### Valid On

Method

## CounterCreationData Class

### System.Diagnostics (system.dll) *serializable*

This class is used to specify a type, name, and help string for a custom counter.

```
Public Class CounterCreationData

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal counterName As String,

        ByVal counterHelp As String,

        ByVal counterType As PerformanceCounterType)

' Public Instance Properties

   Public Property CounterHelp As String

   Public Property CounterName As String

   Public Property CounterType As PerformanceCounterType

End Class
```

### Returned By

CounterCreationDataCollection.this

### Passed To

CounterCreationDataCollection.{Add(),AddRange(),Contains(),CopyTo(), CounterCreationDataCollection(),IndexOf(),Insert(),this,Remove()}

## CounterCreationDataCollection Class

## System.Diagnostics (system.dll) *serializable*

This class is a strongly-typed collection of `CounterCreationData` objects. Use `Add()` and `AddRange()` to add single or multiple values respectively to the end of the collection. `Insert()` allows you to add an item at any position in the collection. `Remove()` and `RemoveAt()` allow you to remove items from the collection.

```
Public Class CounterCreationDataCollection : Inherits CollectionBase

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal value As CounterCreationData())

   Public Sub New(

        ByVal value As CounterCreationDataCollection)

' Public Instance Properties

   Public Default Property Item(

        ByVal index As Integer) As CounterCreationData

' Public Instance Methods

   Public Function Add(

        ByVal value As CounterCreationData) As Integer

   Public Sub AddRange( ByVal value As CounterCreationData())

   Public Sub AddRange(

        ByVal value As CounterCreationDataCollection)

   Public Function Contains(

        ByVal value As CounterCreationData) As Boolean

   Public Sub CopyTo(ByVal array As CounterCreationData(),

        ByVal index As Integer)

   Public Function IndexOf(

        ByVal value As CounterCreationData) As Integer

   Public Sub Insert(ByVal index As Integer,

        ByVal value As CounterCreationData)

   Overridable Public Sub Remove(
```

```
        ByVal value As CounterCreationData)
' Protected Instance Methods
   Overrides Protected Sub OnInsert(ByVal index As Integer,
        ByVal value As Object)
End Class
```

## Hierarchy

System.Object → System.Collections.CollectionBase(System.Collections.IList, System.Collections.ICollection, System.Collections.IEnumerable) → CounterCreationDataCollection

## Returned By

PerformanceCounterInstaller.Counters

## Passed To

PerformanceCounterCategory.Create()

# CounterSample Structure

## System.Diagnostics (system.dll)

This structure contains a performance counter's raw data. It represents a sample taken at a particul `CounterTimeStamp` property). `Calculate()` returns a counter's performance data as a `float` v values for calculated performance counters, such as averages.

`TimeStamp` and `TimeStamp100nSec` return the system timestamp, with varying degrees of accura most precise, reporting a timestamp within .1 milliseconds.) `BaseValue` specifies a base raw value counters. `RawValue` contains the sample's numeric value. `SystemFrequency` represents how ofte `CounterFrequency` represents how often samples are taken by the counter. Both frequencies are

```
Public Structure CounterSample
' Public Constructors
   Public Sub New(ByVal rawValue As Long,
        ByVal baseValue As Long,
        ByVal counterFrequency As Long,
        ByVal systemFrequency As Long,
        ByVal timeStamp As Long,
        ByVal timeStamp100nSec As Long,
        ByVal counterType As PerformanceCounterType)
   Public Sub New(ByVal rawValue As Long,
        ByVal baseValue As Long,
        ByVal counterFrequency As Long,
        ByVal systemFrequency As Long,
        ByVal timeStamp As Long,
        ByVal timeStamp100nSec As Long,
        ByVal counterType As PerformanceCounterType,
        ByVal counterTimeStamp As Long)
' Public Shared Fields
   Public Shared Empty As CounterSample                          // =Syst
' Public Instance Properties
   Public ReadOnly Property BaseValue As Long
   Public ReadOnly Property CounterFrequency As Long
```

```
    Public ReadOnly Property CounterTimeStamp As Long
    Public ReadOnly Property CounterType As PerformanceCounterType
    Public ReadOnly Property RawValue As Long
    Public ReadOnly Property SystemFrequency As Long
    Public ReadOnly Property TimeStamp As Long
    Public ReadOnly Property TimeStamp100nSec As Long
' Public Shared Methods
    Public Shared Function Calculate(
         ByVal counterSample As CounterSample) As Single
    Public Shared Function Calculate(
         ByVal counterSample As CounterSample,
         ByVal nextCounterSample As CounterSample) As Single
End Structure
```

## Hierarchy

System.Object → System.ValueType → CounterSample

## Returned By

InstanceData.Sample, PerformanceCounter.NextSample()

## Passed To

CounterSampleCalculator.ComputeCounterValue(), InstanceData.InstanceData()

## CounterSampleCalculator NotInheritable Class

## System.Diagnostics (system.dll)

This class provides `ComputeCounterValue()`, which interprets `CounterSample` structures. It returns a floating-point value that represents the data contained in one or two samples.

```
Public NotInheritable Class CounterSampleCalculator
' Public Shared Methods
   Public Shared Function ComputeCounterValue(
        ByVal newSample As CounterSample) As Single
   Public Shared Function ComputeCounterValue(
        ByVal oldSample As CounterSample,
        ByVal newSample As CounterSample) As Single
End Class
```

# Debug NotInheritable Class

## System.Diagnostics (system.dll)

This class provides methods that allow you to print debugging information and use assertions. The `Listeners` collection contains a set of listeners that are responsible for reporting debugging operations through the user interface or trace log. That collection initially includes an instance of `DefaultTraceListener`. Add a `TraceListener` using the `Add()` method of the `Listeners` property. Use `Close()` or `Flush()` to close or flush all listeners that write output to a file, such as the `TextWriterTraceListener`. Set `AutoFlush` to `true` to automatically flush each listener after a write operation.

`Assert()` specifies a condition and an optional error message to display if the condition is `false`. If the `DefaultTraceListener`'s `AssertUiEnabled` property is `true`, the error message is displayed as a dialog, and the user has the opportunity to abort the program, retry (test the assertion again), or ignore the failed assertion. Otherwise, the error message is written to `DefaultTraceListener.LogFileName`. `Fail()` acts like an assertion in which the condition is always `false`.

`Indent()` and `Unindent()` allow you to set the level of indentation when you call `WriteLine()`. Use `IndentSize` to set the number of spaces corresponding to indented text. `Write()` and `WriteLine()` send output to each `TraceListener` in the `Listeners` collection, and `WriteIf()` and `WriteLineIf()` allow you to conditionally output debug information.

You can use the application configuration file to add or remove trace listeners. Look up `System.Diagnostics.TraceListener` in the .NET Framework SDK Documentation for details.

```
Public NotInheritable Class Debug

' Public Shared Properties

   Public Shared Property AutoFlush As Boolean

   Public Shared Property IndentLevel As Integer

   Public Shared Property IndentSize As Integer

   Public Shared ReadOnly Property Listeners As TraceListenerCollection

' Public Shared Methods

   Public Shared Sub Assert( ByVal condition As Boolean)

   Public Shared Sub Assert(ByVal condition As Boolean,
        ByVal message As String)

   Public Shared Sub Assert(ByVal condition As Boolean,
        ByVal message As String,
        ByVal detailMessage As String)

   Public Shared Sub Close()
```

```
Public Shared Sub Fail( ByVal message As String)
Public Shared Sub Fail(ByVal message As String,
     ByVal detailMessage As String)
Public Shared Sub Flush()
Public Shared Sub Indent()
Public Shared Sub Unindent()
Public Shared Sub Write( ByVal value As Object)
Public Shared Sub Write(ByVal value As Object,
     ByVal category As String)
Public Shared Sub Write( ByVal message As String)
Public Shared Sub Write(ByVal message As String,
     ByVal category As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal value As Object)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal value As Object, ByVal category As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal message As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal message As String, ByVal category As String)
Public Shared Sub WriteLine( ByVal value As Object)
Public Shared Sub WriteLine(ByVal value As Object,
     ByVal category As String)
Public Shared Sub WriteLine( ByVal message As String)
Public Shared Sub WriteLine(ByVal message As String,
     ByVal category As String)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
     ByVal value As Object)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
     ByVal value As Object, ByVal category As String)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
```

```
        ByVal message As String)
    Public Shared Sub WriteLineIf(ByVal condition As Boolean,
        ByVal message As String, ByVal category As String)
End Class
```

## DebuggableAttribute NotInheritable Class

## System.Diagnostics (mscorlib.dll)

This attribute contains two properties that indicate if code can be debugged. `IsJITOptimizerDisabled` indicates whether optimization has been turned off, and `IsJITTrackingEnabled` indicates whether debug symbols have been placed in the code. This attribute is automatically applied by the compiler, with `isJITTrackingEnabled` set to `false` and `isJITOptimizerDisabled` set to `true`. Use the `/debug` command-line compiler switch to include debug symbols (`isJITTrackingEnabled=true`), and use `/optimize` to enable compile-time optimizations (`isJITOptimizerDisabled=false`).

```
Public NotInheritable Class DebuggableAttribute : Inherits Attribute
' Public Constructors
   Public Sub New(ByVal isJITTrackingEnabled As Boolean,
        ByVal isJITOptimizerDisabled As Boolean)
' Public Instance Properties
   Public ReadOnly Property IsJITOptimizerDisabled As Boolean
   Public ReadOnly Property IsJITTrackingEnabled As Boolean
End Class
```

### Hierarchy

System.Object → System.Attribute → DebuggableAttribute

### Valid On

Assembly, Module

## Debugger NotInheritable Class

### System.Diagnostics (mscorlib.dll)

This class enables you to control the debugger from the debugged code. If a debugger is executing your code, `IsAttached` returns `true`. `Break()` sets a breakpoint and causes the debugger to pause. `Log()` logs output to the debugger window. The `Launch()` method launches the debugger and attaches it to your process, returning `true` if successful or if the debugger is already attached. `Launch()` returns `false` if the debugger could not be attached.

```
Public NotInheritable Class Debugger

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly DefaultCategory As String

' Public Shared Properties

   Public Shared ReadOnly Property IsAttached As Boolean

' Public Shared Methods

   Public Shared Sub Break()

   Public Shared Function IsLogging() As Boolean

   Public Shared Function Launch() As Boolean

   Public Shared Sub Log(ByVal level As Integer,

        ByVal category As String, ByVal message As String)

End Class
```

## DebuggerHiddenAttribute NotInheritable Class

## System.Diagnostics (mscorlib.dll) *serializable*

This attribute is used by the Visual Studio debugger. Visual Studio does not allow you to set a breakpoint in a method marked with this attribute, nor does it stop inside such a method.

```
Public NotInheritable Class DebuggerHiddenAttribute : Inherits Attribute
' Public Constructors
   Public Sub New()
End Class
```

### Hierarchy

`System.Object → System.Attribute → DebuggerHiddenAttribute`

### Valid On

Constructor, Method, Property

## DebuggerStepThroughAttribute NotInheritable Class

## System.Diagnostics (mscorlib.dll) *serializable*

This attribute is used by the Visual Studio debugger. Visual Studio does not stop in a method marke
with this attribute, but it does allow you to set a breakpoint in such a method.

```
Public NotInheritable Class DebuggerStepThroughAttribute : Inherits Attril

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

System.Object → System.Attribute → DebuggerStepThroughAttribute

### Valid On

Class, Struct, Constructor, Method

## DefaultTraceListener Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class provides the default `TraceListener`. By default, an instance of this class is available in the `Listeners` collection of the `Debug` and `Trace` classes. The `Write()` and `WriteLine()` methods output to the log and to the active debugger (if any) via the Win32 API function `OutputDebugString`. The log file is initially unset, so output goes only to the debugger. To specify a log file, set `LogFileName`. You may also set a logfile in the `<assert>` element of the application configuration file's `<system.diagnostics>` section, as in `<assert logfilename="logfile.log"/>`.

`AssertUiEnabled` determines whether to use the user interface for failed assertions. If `true`, .NET uses a dialog box with the options Abort, Retry, or Fail. Whether this property is set to `true` or `false`, .NET always writes messages to the `LogFileName`, if one is specified. The `AssertUiEnabled` property can be set using the `<assert>` element, as in `<assert assertuienabled="false"/>` (the default is `true`).

```
Public Class DefaultTraceListener : Inherits TraceListener

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property AssertUiEnabled As Boolean

   Public Property LogFileName As String

' Public Instance Methods

   Overrides Public Sub Fail( ByVal message As String)

   Overrides Public Sub Fail(ByVal message As String,

        ByVal detailMessage As String)

   Overrides Public Sub Write( ByVal message As String)

   Overrides Public Sub WriteLine( ByVal message As String)

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `TraceListener(System.IDisposable)` → `DefaultTraceListener`

# EntryWrittenEventArgs Class

## System.Diagnostics (system.dll)

These event arguments are passed by an `EventLog.EntryWritten` event.

```
Public Class EntryWrittenEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal entry As EventLogEntry)

' Public Instance Properties

   Public ReadOnly Property Entry As EventLogEntry

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `EntryWrittenEventArgs`

### Passed To

`EntryWrittenEventHandler.{BeginInvoke(),Invoke()}`

# EntryWrittenEventHandler Delegate

## System.Diagnostics (system.dll) *serializable*

This delegate supports the `EventLog.EntryWritten` event.

```
Public Delegate Sub EntryWrittenEventHandler(
        ByVal sender As Object,
        ByVal e As EntryWrittenEventArgs)
```

### Associated Events

`EventLog.EntryWritten()`

## EventLog Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class accesses Windows event logs that are accessible through the *Event Viewer* administrative tool. Windows contains three logs by default: the Application Log, System Log, and Security Log. The Security Log is read-only, so you can't write events to it. Whenever you need to raise an event, you must select a system-wide unique event source. This source can be any keyword, as long as it is unique. To write an event to the Application log, use the shared two-argument version of `WriteEntry()`, supplying the source name and message as string arguments. If the source does not exist, it is automatically registered.

You can manually register a new event source several ways. First, call `CreateEventSource()`. If you do not specify a log name, then your events are registered with the generic Application Log. Otherwise, a new *.evt* file is created (in the *%SystemRoot%\system32\config* directory). Alternatively, create a new `EventLog` object, and set `Source`, `Log`, and `MachineName` to the appropriate values. To delete a source, call `DeleteEventSource()`. `Delete()` lets you delete an entire log, but be careful not to delete one of the Windows event logs! `GetEventLogs()` allows you to find the logs on the system, and `LogNameFromSourceName()` allows you to determine the log file for a given source.

You can interact with a log in many ways. Add to it using `WriteEntry()` and remove all log entries by calling `Clear()`. Examine the `Entries` property to view the individual log entries. An `EventLog` can raise the `EntryWritten` event if you set `EnableRaisingEvents` to `true`.

```
Public Class EventLog : Inherits System.ComponentModel.Component :

        Implements System.ComponentModel.ISupportInitialize

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal logName As String)

   Public Sub New(ByVal logName As String,

        ByVal machineName As String)

   Public Sub New(ByVal logName As String,

        ByVal machineName As String,

        ByVal source As String)

' Public Instance Properties

   Public Property EnableRaisingEvents As Boolean

   Public ReadOnly Property Entries As EventLogEntryCollection

   Public Property Log As String

   Public ReadOnly Property LogDisplayName As String
```

```
   Public Property MachineName As String
   Public Property Source As String
   Public Property SynchronizingObject As ISynchronizeInvoke
' Public Shared Methods
   Public Shared Sub CreateEventSource(ByVal source As String,
        ByVal logName As String)
   Public Shared Sub CreateEventSource(ByVal source As String,
        ByVal logName As String,
        ByVal machineName As String)
   Public Shared Sub Delete( ByVal logName As String)
   Public Shared Sub Delete(ByVal logName As String,
        ByVal machineName As String)
   Public Shared Sub DeleteEventSource(ByVal source As String)
   Public Shared Sub DeleteEventSource(ByVal source As String,
        ByVal machineName As String)
   Public Shared Function Exists(
        ByVal logName As String) As Boolean
   Public Shared Function Exists(ByVal logName As String,
        ByVal machineName As String) As Boolean
   Public Shared Function GetEventLogs() As EventLog()
   Public Shared Function GetEventLogs(
        ByVal machineName As String) As EventLog()
   Public Shared Function LogNameFromSourceName(
        ByVal source As String,
        ByVal machineName As String) As String
   Public Shared Function SourceExists(
        ByVal source As String) As Boolean
   Public Shared Function SourceExists(ByVal source As String,
        ByVal machineName As String) As Boolean
   Public Shared Sub WriteEntry(ByVal source As String,
```

```
        ByVal message As String)
    Public Shared Sub WriteEntry(ByVal source As String,
        ByVal message As String,
        ByVal type As EventLogEntryType)
    Public Shared Sub WriteEntry(ByVal source As String,
        ByVal message As String,
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer)
    Public Shared Sub WriteEntry(ByVal source As String,
        ByVal message As String,
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer, ByVal category As Short)
    Public Shared Sub WriteEntry(ByVal source As String,
        ByVal message As String,
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer, ByVal category As Short,
        ByVal rawData As Byte())
' Public Instance Methods
    Public Sub BeginInit(
        ) Implements ISupportInitialize.BeginInit
    Public Sub Clear()
    Public Sub Close()
    Public Sub EndInit() Implements ISupportInitialize.EndInit
    Public Sub WriteEntry( ByVal message As String)
    Public Sub WriteEntry(ByVal message As String,
        ByVal type As EventLogEntryType)
    Public Sub WriteEntry(ByVal message As String,
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer)
    Public Sub WriteEntry(ByVal message As String,
```

```
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer, ByVal category As Short)
   Public Sub WriteEntry(ByVal message As String,
        ByVal type As EventLogEntryType,
        ByVal eventID As Integer, ByVal category As Short,
        ByVal rawData As Byte())
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
' Events
   Public Event EntryWritten As EntryWrittenEventHandler
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.IDisposable) → EventLog(System.ComponentModel.ISupportInitialize)

## Returned By

EventLogTraceListener.EventLog

## Passed To

EventLogTraceListener.{EventLog, EventLogTraceListener()}

## EventLogEntry NotInheritable Class

**System.Diagnostics (system.dll)** ***serializable, marshal by reference, disposable***

This class represents an individual entry from an `EventLog`. A collection of these objects is availab
This class exposes all the properties of an event log entry.

```
Public NotInheritable Class EventLogEntry : Inherits System.ComponentMode

        System.Runtime.Serialization.ISerializable

' Public Instance Properties

   Public ReadOnly Property Category As String

   Public ReadOnly Property CategoryNumber As Short

   Public ReadOnly Property Data As Byte()

   Public ReadOnly Property EntryType As EventLogEntryType

   Public ReadOnly Property EventID As Integer

   Public ReadOnly Property Index As Integer

   Public ReadOnly Property MachineName As String

   Public ReadOnly Property Message As String

   Public ReadOnly Property ReplacementStrings As String()

   Public ReadOnly Property Source As String

   Public ReadOnly Property TimeGenerated As Date

   Public ReadOnly Property TimeWritten As Date

   Public ReadOnly Property UserName As String

' Public Instance Methods

   Public Function Equals(

        ByVal otherEntry As EventLogEntry) As Boolean

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` →
`System.ComponentModel.Component(System.ComponentModel.IComponent, System.II`
`EventLogEntry(System.Runtime.Serialization.ISerializable)`

## Returned By

`EntryWrittenEventArgs.Entry`, `EventLogEntryCollection.this`

## Passed To

`EntryWrittenEventArgs.EntryWrittenEventArgs()`, `EventLogEntryCollection.Copy`

# EventLogEntryCollection Class

## System.Diagnostics (system.dll)

This class is an `ICollection` implementation for `EventLogEntry` objects.

```
Public Class EventLogEntryCollection : Implements ICollection, IEnumerabl

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Overridable Public Default ReadOnly Property Item(

        ByVal index As Integer) As EventLogEntry

' Public Instance Methods

   Public Sub CopyTo(ByVal entries As EventLogEntry(),

        ByVal index As Integer)

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

End Class
```

### Returned By

`EventLog.Entries`

## EventLogEntryType Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration represents an event log entry's severity level. `Error` indicates that the message contains an error. `SuccessAudit` and `FailureAudit` indicate that an audited access attempt, such as a user logon, has succeeded or failed. `Information` represents that a significant operation, such as starting or stopping a service, has taken place. `Warning` indicates that a problem has occurred. `Warning`s are not as serious as `Error`s, but they should be investigated and resolved whenever possible, so your log does not fill up with warning messages.

```
Public Enum EventLogEntryType

   Error = 1

   Warning = 2

   Information = 4

   SuccessAudit = 8

   FailureAudit = 16

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `EventLogEntryType`

### Returned By

`EventLogEntry.EntryType`

### Passed To

`EventLog.WriteEntry()`

## EventLogInstaller Class

**System.Diagnostics (system.configuration.install.dll)** ***marshal by reference, disposable***

This class is a `System.Configuration.Install.Installer` to install `EventLog`s. To install a appropriate `Source` and `Log` properties.

```
Public Class EventLogInstaller : Inherits System.Configuration.Install.Co

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property Log As String

   Public Property Source As String

   Public Property UninstallAction As UninstallAction

' Public Instance Methods

   Overrides Public Sub CopyFromComponent(

        ByVal component As System.ComponentModel.IComponent)

   Overrides Public Sub Install(

        ByVal stateSaver As System.Collections.IDictionary)

   Overrides Public Function IsEquivalentInstaller(

        ByVal otherInstaller As System.Configuration.Install.ComponentIns

   Overrides Public Sub Rollback(

        ByVal savedState As System.Collections.IDictionary)

   Overrides Public Sub Uninstall(

        ByVal savedState As System.Collections.IDictionary)

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `System.ComponentModel.Component(System.ComponentModel.IComponent, System.I` `System.Configuration.Install.Installer` → `System.Configuration.Install.Co` `EventLogInstaller`

## EventLogPermission NotInheritable Class

## System.Diagnostics (system.dll) *serializable*

This class is a `System.Security.Permissions.ResourcePermissionBase` object, which inc
permission to access the Windows event logs.

```
Public NotInheritable Class EventLogPermission : Inherits System.Security
' Public Constructors
   Public Sub New()
   Public Sub New(
        ByVal permissionAccess As EventLogPermissionAccess,
        ByVal machineName As String)
   Public Sub New(
        ByVal permissionAccessEntries As EventLogPermissionEntry())
   Public Sub New(
        ByVal state As System.Security.Permissions.PermissionState)
' Public Instance Properties
   Public ReadOnly Property PermissionEntries As EventLogPermissionEntryC
End Class
```

### Hierarchy

`System.Object` → `System.Security.CodeAccessPermission(System.Security.IPe` `System.Security.ISecurityEncodable, System.Security.IStackWalk)` → `System.Security.Permissions.ResourcePermissionBase(System.Security.Permis` `EventLogPermission`

## EventLogPermissionAccess Enum

### System.Diagnostics (system.dll) *serializable, flag*

This enumeration is used by `EventLogPermissionAttribute`. `None` indicates no access, and `Browse` allows you to read logs. `Instrument` allows reading and writing. `Audit` represents the highest level of access. It lets you read logs, clear a log, monitor events, respond to entries, delete logs and event sources, and enumerate a collection of all logs.

```
Public Enum EventLogPermissionAccess

   None = &H000000000

   Browse = &H000000002

   Instrument = &H000000006

   Audit = &H00000000A

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → EventLogPermissionAccess

### Returned By

EventLogPermissionAttribute.PermissionAccess, EventLogPermissionEntry.PermissionAccess

### Passed To

EventLogPermission.EventLogPermission(), EventLogPermissionAttribute.PermissionAccess, EventLogPermissionEntry.EventLogPermissionEntry()

## EventLogPermissionAttribute Class

## System.Diagnostics (system.dll) *serializable*

This security attribute specifies the `EventLogPermissionAccess` required by your code.

```
Public Class EventLogPermissionAttribute : Inherits System.Security.Permi

' Public Constructors

   Public Sub New(

        ByVal action As System.Security.Permissions.SecurityAction)

' Public Instance Properties

   Public Property MachineName As String

   Public Property PermissionAccess As EventLogPermissionAccess

' Public Instance Methods

   Overrides Public Function CreatePermission(

        ) As IPermission

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.Security.Permissions.Security`
`System.Security.Permissions.CodeAccessSecurityAttribute` → `EventLogPermis`

### Valid On

Assembly, Class, Struct, Constructor, Method, Event

## EventLogPermissionEntry Class

## System.Diagnostics (system.dll) *serializable*

This class represents a single permission from an `EventLogPermission`'s `PermissionEntries` collection. `MachineName` checks the machine name the entry is for, and `PermissionAccess` gets an `EventLogPermissionAccess` that represents the granted permissions.

```
Public Class EventLogPermissionEntry
' Public Constructors
   Public Sub New(
        ByVal permissionAccess As EventLogPermissionAccess,
        ByVal machineName As String)
' Public Instance Properties
   Public ReadOnly Property MachineName As String
   Public ReadOnly Property PermissionAccess As EventLogPermissionAccess
End Class
```

### Returned By

`EventLogPermissionEntryCollection.this`

### Passed To

`EventLogPermission.EventLogPermission()`, `EventLogPermissionEntryCollection.{Add(), AddRange(), Contains(), CopyTo(), IndexOf(), Insert(), this, Remove()}`

## EventLogPermissionEntryCollection Class

## System.Diagnostics (system.dll) *serializable*

A strongly typed collection that contains `EventLogPermissionEntry` objects.

```
Public Class EventLogPermissionEntryCollection : Inherits CollectionBase
' Public Instance Properties
   Public Default Property Item(
        ByVal index As Integer) As EventLogPermissionEntry
' Public Instance Methods
   Public Function Add(
        ByVal value As EventLogPermissionEntry) As Integer
   Public Sub AddRange(
        ByVal value As EventLogPermissionEntry())
   Public Sub AddRange(
        ByVal value As EventLogPermissionEntryCollection)
   Public Function Contains(
        ByVal value As EventLogPermissionEntry) As Boolean
   Public Sub CopyTo(ByVal array As EventLogPermissionEntry(),
        ByVal index As Integer)
   Public Function IndexOf(
        ByVal value As EventLogPermissionEntry) As Integer
   Public Sub Insert(ByVal index As Integer,
        ByVal value As EventLogPermissionEntry)
   Public Sub Remove( ByVal value As EventLogPermissionEntry)
' Protected Instance Methods
   Overrides Protected Sub OnClear()
   Overrides Protected Sub OnInsert(ByVal index As Integer,
        ByVal value As Object)
   Overrides Protected Sub OnRemove(ByVal index As Integer,
```

```
        ByVal value As Object)
    Overrides Protected Sub OnSet(ByVal index As Integer,
        ByVal oldValue As Object, ByVal newValue As Object)
End Class
```

### Hierarchy

System.Object → System.Collections.CollectionBase(System.Collections.IList, System.Collections.ICollection, System.Collections.IEnumerable) → EventLogPermissionEntryCollection

### Returned By

EventLogPermission.PermissionEntries

## EventLogTraceListener NotInheritable Class

System.Diagnostics (system.dll) *marshal by reference, disposable*

To capture trace and debug output to an `EventLog`, add an instance of this class to `Debug.Listeners` or `Trace.Listeners`. You can specify an `EventLog` instance in the constructor or the name of an event source as a string.

```
Public NotInheritable Class EventLogTraceListener : Inherits TraceListene:
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal eventLog As EventLog)
   Public Sub New( ByVal source As String)
' Public Instance Properties
   Public Property EventLog As EventLog
   Overrides Public Property Name As String
' Public Instance Methods
   Overrides Public Sub Close()
   Overrides Public Sub Write( ByVal message As String)
   Overrides Public Sub WriteLine( ByVal message As String)
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → TraceListener(System.IDisposable) → EventLogTraceListener

## FileVersionInfo NotInheritable Class

## System.Diagnostics (system.dll)

This class provides access to the attributes specific to binary files. Use `GetVersionInfo()` to obtain a reference to a file, and then inspect the object's properties to determine information about the file.

```
Public NotInheritable Class FileVersionInfo

' Public Instance Properties

   Public ReadOnly Property Comments As String

   Public ReadOnly Property CompanyName As String

   Public ReadOnly Property FileBuildPart As Integer

   Public ReadOnly Property FileDescription As String

   Public ReadOnly Property FileMajorPart As Integer

   Public ReadOnly Property FileMinorPart As Integer

   Public ReadOnly Property FileName As String

   Public ReadOnly Property FilePrivatePart As Integer

   Public ReadOnly Property FileVersion As String

   Public ReadOnly Property InternalName As String

   Public ReadOnly Property IsDebug As Boolean

   Public ReadOnly Property IsPatched As Boolean

   Public ReadOnly Property IsPreRelease As Boolean

   Public ReadOnly Property IsPrivateBuild As Boolean

   Public ReadOnly Property IsSpecialBuild As Boolean

   Public ReadOnly Property Language As String

   Public ReadOnly Property LegalCopyright As String

   Public ReadOnly Property LegalTrademarks As String

   Public ReadOnly Property OriginalFilename As String

   Public ReadOnly Property PrivateBuild As String

   Public ReadOnly Property ProductBuildPart As Integer

   Public ReadOnly Property ProductMajorPart As Integer
```

```
   Public ReadOnly Property ProductMinorPart As Integer
   Public ReadOnly Property ProductName As String
   Public ReadOnly Property ProductPrivatePart As Integer
   Public ReadOnly Property ProductVersion As String
   Public ReadOnly Property SpecialBuild As String
' Public Shared Methods
   Public Shared Function GetVersionInfo(
        ByVal fileName As String) As FileVersionInfo
' Public Instance Methods
   Overrides Public Function ToString() As String
End Class
```

## Returned By

`ProcessModule.FileVersionInfo`

## InstanceData Class

## System.Diagnostics (system.dll)

This type represents the instance data for a performance counter sample. `InstanceName` returns the `InstanceData`'s name. `RawValue` returns the sample's raw data. `Sample` returns the `CounterSample` responsible for the data.

```
Public Class InstanceData
' Public Constructors
   Public Sub New(ByVal instanceName As String,
        ByVal sample As CounterSample)
' Public Instance Properties
   Public ReadOnly Property InstanceName As String
   Public ReadOnly Property RawValue As Long
   Public ReadOnly Property Sample As CounterSample
End Class
```

### Returned By

`InstanceDataCollection.this`

### Passed To

`InstanceDataCollection.CopyTo()`

# InstanceDataCollection Class

## System.Diagnostics (system.dll)

This type is a strongly typed collection of `InstanceData` objects.

```
Public Class InstanceDataCollection : Inherits DictionaryBase
' Public Constructors
   Public Sub New( ByVal counterName As String)
' Public Instance Properties
   Public ReadOnly Property CounterName As String
   Public Default ReadOnly Property Item(
        ByVal instanceName As String) As InstanceData
   Public ReadOnly Property Keys As ICollection Implements IDictionary.Ke
   Public ReadOnly Property Values As ICollection Implements IDictionary.
' Public Instance Methods
   Public Function Contains(
        ByVal instanceName As String) As Boolean
   Public Sub CopyTo(ByVal instances As InstanceData(),
        ByVal index As Integer)
End Class
```

### Hierarchy

System.Object → System.Collections.DictionaryBase(System.Collections.IDictionary, System.Collections.ICollection, System.Collections.IEnumerable) → InstanceDataCollection

### Returned By

InstanceDataCollectionCollection.this

### Passed To

InstanceDataCollectionCollection.CopyTo()

# InstanceDataCollectionCollection Class

## System.Diagnostics (system.dll)

This type is a strongly typed collection of `InstanceDataCollection` objects (e.g., a collection of collections).

```
Public Class InstanceDataCollectionCollection : Inherits DictionaryBase

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Default ReadOnly Property Item(

        ByVal counterName As String) As InstanceDataCollection

   Public ReadOnly Property Keys As ICollection Implements IDictionary.Ke

   Public ReadOnly Property Values As ICollection Implements IDictionary.

' Public Instance Methods

   Public Function Contains(

        ByVal counterName As String) As Boolean

   Public Sub CopyTo(

        ByVal counters As InstanceDataCollection(),

        ByVal index As Integer)

End Class
```

### Hierarchy

`System.Object` → `System.Collections.DictionaryBase(System.Collections.IDictionary, System.Collections.ICollection, System.Collections.IEnumerable)` → `InstanceDataCollectionCollection`

### Returned By

`PerformanceCounterCategory.ReadCategory()`

# MonitoringDescriptionAttribute Class

## System.Diagnostics (system.dll)

This type is a `System.ComponentModel.DescriptionAttribute` that holds an informative de `System.Diagnostics` monitoring members.

```
Public Class MonitoringDescriptionAttribute : Inherits System.ComponentMo

' Public Constructors

   Public Sub New( ByVal description As String)

' Public Instance Properties

   Overrides Public ReadOnly Property Description As String

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.ComponentModel.DescriptionAtt` `MonitoringDescriptionAttribute`

### Valid On

All

## PerformanceCounter NotInheritable Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class represents a Windows NT, 2000, or XP performance counter that can be accessed using devices, such as processor, disk, or memory usage, as well as for system resources, such as proce performance data to existing custom counters.

To create your own custom performance counters, use `PerformanceCounterCategory.Create` constructors that takes the boolean `readonly` argument. Set that argument to `false` to create a p `IncrementBy()`, `Increment()`, `Decrement()`, or set the `RawValue` to the desired value.

To access an existing performance counter, create an instance of `PerformanceCounter` with the performance counter. The category and counter names are case-insensitive, so you could sample t `"available mbytes")`. Consult the Performance Administrative Tool for the available performan `InstanceName` and `MachineName`) properties, if you choose not to set these using the constructo

To obtain a new data sample for a counter, call either `NextValue()` or `NextSample()`. `NextSam` data. `NextValue()` fetches the next sample and calculates its value based on the raw data it conta remove a counter in which the `ReadOnly` property is set to `true`, an `InvalidOperationExcept`

```
Public NotInheritable Class PerformanceCounter : Inherits System.Componen

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal categoryName As String,

        ByVal counterName As String)

   Public Sub New(ByVal categoryName As String,

        ByVal counterName As String,

        ByVal readOnly As Boolean)

   Public Sub New(ByVal categoryName As String,

        ByVal counterName As String,

        ByVal instanceName As String)

   Public Sub New(ByVal categoryName As String,

        ByVal counterName As String,

        ByVal instanceName As String,

        ByVal readOnly As Boolean)

   Public Sub New(ByVal categoryName As String,
```

```
        ByVal counterName As String,
        ByVal instanceName As String,
        ByVal machineName As String)
' Public Shared Fields
   Public Shared DefaultFileMappingSize As Integer                // =5242
' Public Instance Properties
   Public Property CategoryName As String
   Public ReadOnly Property CounterHelp As String
   Public Property CounterName As String
   Public ReadOnly Property CounterType As PerformanceCounterType
   Public Property InstanceName As String
   Public Property MachineName As String
   Public Property RawValue As Long
   Public Property ReadOnly As Boolean
' Public Shared Methods
   Public Shared Sub CloseSharedResources()
' Public Instance Methods
   Public Sub BeginInit(
        ) Implements ISupportInitialize.BeginInit
   Public Sub Close()
   Public Function Decrement() As Long
   Public Sub EndInit() Implements ISupportInitialize.EndInit
   Public Function Increment() As Long
   Public Function IncrementBy( ByVal value As Long) As Long
   Public Function NextSample() As CounterSample
   Public Function NextValue() As Single
   Public Sub RemoveInstance()
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Compo
PerformanceCounter(System.ComponentModel.ISupportInitialize)

## Returned By

PerformanceCounterCategory.GetCounters()

## PerformanceCounterCategory NotInheritable Class

## System.Diagnostics (system.dll)

This class allows you to create and manage categories of performance counters. You can see the c your system when you use the Performance Administrative Tool. When you attempt to add a counte categories listed in the `Performance` object drop-list, such as Processor, Memory, Thread, and Ne

Use `Create()` to add a new category. The three-argument form lets you supply a category name, a category, and a collection of `CounterCreationData` objects. Each `CounterCreationData` obje to create in the new category. Use the four-argument form of `Create()` to create a new category w counter.

`Delete()` removes a counter category, and `Exists()` checks whether a given category exists. If y specific counter exists in a category, call `CounterExists()`. To check for an instance in a categor `InstanceExists()`. `GetCategories()` returns all the categories recognized by the system.

The `CategoryHelp`, `CategoryName`, and `MachineName` properties provide access to the name, name for a given category. You can use the nonshared versions of `CounterExists()` and `Insta` check if a specified counter or instance exists in the inspected category. `GetCounters()` and `Get` retrieve a list of the counters and instances in a category.

```
Public NotInheritable Class PerformanceCounterCategory
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal categoryName As String)
   Public Sub New(ByVal categoryName As String,
        ByVal machineName As String)
' Public Instance Properties
   Public ReadOnly Property CategoryHelp As String
   Public Property CategoryName As String
   Public Property MachineName As String
' Public Shared Methods
   Public Shared Function CounterExists(
        ByVal counterName As String,
        ByVal categoryName As String) As Boolean
   Public Shared Function CounterExists(
```

```
        ByVal counterName As String,
        ByVal categoryName As String,
        ByVal machineName As String) As Boolean
    Public Shared Function Create(ByVal categoryName As String,
        ByVal categoryHelp As String,
        ByVal counterData As CounterCreationDataCollection) As Performance
    Public Shared Function Create(ByVal categoryName As String,
        ByVal categoryHelp As String,
        ByVal counterName As String,
        ByVal counterHelp As String) As PerformanceCounterCategory
    Public Shared Sub Delete( ByVal categoryName As String)
    Public Shared Function Exists(
        ByVal categoryName As String) As Boolean
    Public Shared Function Exists(ByVal categoryName As String,
        ByVal machineName As String) As Boolean
    Public Shared Function GetCategories(
        ) As PerformanceCounterCategory()
    Public Shared Function GetCategories(
        ByVal machineName As String) As PerformanceCounterCategory()
    Public Shared Function InstanceExists(
        ByVal instanceName As String,
        ByVal categoryName As String) As Boolean
    Public Shared Function InstanceExists(
        ByVal instanceName As String,
        ByVal categoryName As String,
        ByVal machineName As String) As Boolean
' Public Instance Methods
    Public Function CounterExists(
        ByVal counterName As String) As Boolean
    Public Function GetCounters() As PerformanceCounter()
    Public Function GetCounters(
```

```
        ByVal instanceName As String) As PerformanceCounter()
    Public Function GetInstanceNames() As String()
    Public Function InstanceExists(
        ByVal instanceName As String) As Boolean
    Public Function ReadCategory(
        ) As InstanceDataCollectionCollection
End Class
```

## PerformanceCounterInstaller Class

**System.Diagnostics (system.configuration.install.dll)** ***marshal by reference, disposable***

This is an installer for a `PerformanceCounter` component. `CategoryName` and `CategoryHelp` pertinent to the category to install the counters into, and `Counters` contains the counters that will b

```
Public Class PerformanceCounterInstaller : Inherits System.Configuration.I
' Public Constructors
   Public Sub New()
' Public Instance Properties
   Public Property CategoryHelp As String
   Public Property CategoryName As String
   Public ReadOnly Property Counters As CounterCreationDataCollection
   Public Property UninstallAction As UninstallAction
' Public Instance Methods
   Overrides Public Sub CopyFromComponent(
        ByVal component As System.ComponentModel.IComponent)
   Overrides Public Sub Install(
        ByVal stateSaver As System.Collections.IDictionary)
   Overrides Public Sub Rollback(
        ByVal savedState As System.Collections.IDictionary)
   Overrides Public Sub Uninstall(
        ByVal savedState As System.Collections.IDictionary)
End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `System.ComponentModel.Component(System.ComponentModel.IComponent, System.II` `System.Configuration.Install.Installer` → `System.Configuration.Install.Cor` `PerformanceCounterInstaller`

## PerformanceCounterPermission NotInheritable Class

## System.Diagnostics (system.dll) *serializable*

This class is a `System.Security.CodeAccessPermission` object that specifies code access tc `PermissionEntries` property returns a collection of `PerformanceCounterPermissionEntry`

```
Public NotInheritable Class PerformanceCounterPermission : Inherits Syster
' Public Constructors
   Public Sub New()
   Public Sub New(
        ByVal permissionAccess As PerformanceCounterPermissionAccess,
        ByVal machineName As String,
        ByVal categoryName As String)
   Public Sub New(
        ByVal permissionAccessEntries As PerformanceCounterPermissionEntr
   Public Sub New(
        ByVal state As System.Security.Permissions.PermissionState)
' Public Instance Properties
   Public ReadOnly Property PermissionEntries As PerformanceCounterPermis
End Class
```

### Hierarchy

`System.Object` → `System.Security.CodeAccessPermission(System.Security.IPe` `System.Security.IStackWalk)` → `System.Security.Permissions.ResourcePermissionBase(System.Security.Permis` `PerformanceCounterPermission`

# PerformanceCounterPermissionAccess Enum

## System.Diagnostics (system.dll) *serializable, flag*

This enumeration represents the different types of access that can be granted to executing code. `Administer` allows full control over a `PerformanceCounter`, while `Browse` allows you to view, but not modify `PerformanceCounter` data. `Instrument` allows the code to act as a performance counter (you may read and write, but not create, categories). `None` explicitly denies access to a `PerformanceCounterCategory`.

```
Public Enum PerformanceCounterPermissionAccess
    None = &H000000000
    Browse = &H000000002
    Instrument = &H000000006
    Administer = &H00000000E
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `PerformanceCounterPermissionAccess`

### Returned By

`PerformanceCounterPermissionAttribute.PermissionAccess`, `PerformanceCounterPermissionEntry.PermissionAccess`

### Passed To

`PerformanceCounterPermission.PerformanceCounterPermission()`, `PerformanceCounterPermissionAttribute.PermissionAccess`, `PerformanceCounterPermissionEntry.PerformanceCounterPermissionEntry()`

# PerformanceCounterPermissionAttribute Class

## System.Diagnostics (system.dll) *serializable*

This class is a `System.Security.Permissions.SecurityAttribute` that explicitly allows yo to set required or denied performance counter permissions. You can use the `CategoryName`, `MachineName`, and `PermissionAccess` properties to indicate the required permissions for a specific `PerformanceCounter`.

```
Public Class PerformanceCounterPermissionAttribute : Inherits
        System.Security.Permissions.CodeAccessSecurityAttribute
' Public Constructors
   Public Sub New(
        ByVal action As System.Security.Permissions.SecurityAction)
' Public Instance Properties
   Public Property CategoryName As String
   Public Property MachineName As String
   Public Property PermissionAccess As PerformanceCounterPermissionAccess
' Public Instance Methods
   Overrides Public Function CreatePermission(
        ) As IPermission
End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.Security.Permissions.SecurityAttribute` → `System.Security.Permissions.CodeAccessSecurityAttribute` → `PerformanceCounterPermissionAttribute`

### Valid On

Assembly, Class, Struct, Constructor, Method, Event

# PerformanceCounterPermissionEntry Class

## System.Diagnostics (system.dll) *serializable*

This class holds the necessary information for a given permission. The `PermissionAccess` prope `PerformanceCounterPermissionAccess` level for a specific `CategoryName` and `MachineNar`

```
Public Class PerformanceCounterPermissionEntry

' Public Constructors

   Public Sub New(

        ByVal permissionAccess As PerformanceCounterPermissionAccess,

        ByVal machineName As String,

        ByVal categoryName As String)

' Public Instance Properties

   Public ReadOnly Property CategoryName As String

   Public ReadOnly Property MachineName As String

   Public ReadOnly Property PermissionAccess As PerformanceCounterPermiss

End Class
```

### Returned By

`PerformanceCounterPermissionEntryCollection.this`

### Passed To

`PerformanceCounterPermission.PerformanceCounterPermission()`, `PerformanceCounterPermissionEntryCollection.{Add(),AddRange(),Contains(),C` `IndexOf(),Insert(),this,Remove()}`

# PerformanceCounterPermissionEntryCollection Class

## System.Diagnostics (system.dll) *serializable*

This strongly typed collection contains `PerformanceCounterPermissionEntry` objects.

```
Public Class PerformanceCounterPermissionEntryCollection : Inherits Colle

' Public Instance Properties

   Public Default Property Item(

        ByVal index As Integer) As PerformanceCounterPermissionEntry

' Public Instance Methods

   Public Function Add(

        ByVal value As PerformanceCounterPermissionEntry) As Integer

   Public Sub AddRange(

        ByVal value As PerformanceCounterPermissionEntry())

   Public Sub AddRange(

        ByVal value As PerformanceCounterPermissionEntryCollection)

   Public Function Contains(

        ByVal value As PerformanceCounterPermissionEntry) As Boolean

   Public Sub CopyTo(

        ByVal array As PerformanceCounterPermissionEntry(),

        ByVal index As Integer)

   Public Function IndexOf(

        ByVal value As PerformanceCounterPermissionEntry) As Integer

   Public Sub Insert(ByVal index As Integer,

        ByVal value As PerformanceCounterPermissionEntry)

   Public Sub Remove(

        ByVal value As PerformanceCounterPermissionEntry)

' Protected Instance Methods

   Overrides Protected Sub OnClear()

   Overrides Protected Sub OnInsert(ByVal index As Integer,
```

```
        ByVal value As Object)
    Overrides Protected Sub OnRemove(ByVal index As Integer,
        ByVal value As Object)
    Overrides Protected Sub OnSet(ByVal index As Integer,
        ByVal oldValue As Object, ByVal newValue As Object)
End Class
```

## Hierarchy

System.Object → System.Collections.CollectionBase(System.Collections.ILi
System.Collections.ICollection, System.Collections.IEnumerable) →
PerformanceCounterPermissionEntryCollection

## Returned By

PerformanceCounterPermission.PermissionEntries

## PerformanceCounterType Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration represents the different types of performance counters available. Look up `System.Diagnostics.PerformanceCounterType` in the .NET Framework SDK Documentation for complete details.

```
Public Enum PerformanceCounterType

   NumberOfItemsHEX32 = 0

   NumberOfItemsHEX64 = 256

   NumberOfItems32 = 65536

   NumberOfItems64 = 65792

   CounterDelta32 = 4195328

   CounterDelta64 = 4195584

   SampleCounter = 4260864

   CountPerTimeInterval32 = 4523008

   CountPerTimeInterval64 = 4523264

   RateOfCountsPerSecond32 = 272696320

   RateOfCountsPerSecond64 = 272696576

   RawFraction = 537003008

   CounterTimer = 541132032

   Timer100Ns = 542180608

   SampleFraction = 549585920

   CounterTimerInverse = 557909248

   Timer100NsInverse = 558957824

   CounterMultiTimer = 574686464

   CounterMultiTimer100Ns = 575735040

   CounterMultiTimerInverse = 591463680

   CounterMultiTimer100NsInverse = 592512256

   AverageTimer32 = 805438464

   ElapsedTime = 807666944
```

```
    AverageCount64 = 1073874176
    SampleBase = 1073939457
    AverageBase = 1073939458
    RawBase = 1073939459
    CounterMultiBase = 1107494144
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → PerformanceCounterType

### Returned By

CounterCreationData.CounterType, CounterSample.CounterType, PerformanceCounter.CounterType

### Passed To

CounterCreationData.{CounterCreationData(), CounterType}, CounterSample.CounterSample()

## Process Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class represents a system process. Use it to start, stop, and interact with a process. To launch a new process, create an instance of `ProcessStartInfo`, set its properties, and pass it to the single-argument form of the shared`Start()` method. This offers a great deal of control over process creation. To launch a process without customizing its `StartInfo`, simply call the one-string or two-string argument form of the shared`Start()` method. The first string argument is the name of the program, batch file, or document to start, and the optional second argument contains any command-line arguments. You can also explicitly create a new instance of `Process`, set its `StartInfo` property, and call the `Start()` method to start the process.

`GetCurrentProcess()` creates a `Process` instance that represents the current process. Enumerate all running processes on the system by using `GetProcesses()`. Use `GetProcessesByName()` to get all processes for a given program. `GetProcessById()` retrieves a `Process` given its process ID.

Use `CloseMainWindow()` to shut down a process that has a user interface. You can terminate a process with `Kill()`, but this forces an abnormal termination, which may result in data corruption. If you would like to raise an event when the process finishes executing, use `Exited` (`EnableRaisingEvents` must be set to `true`).

Most of the properties allow you to access general information about the running process. However, this information is populated at the time you associate a `Process` object with a running process. You can call `Refresh()` each time you need to update this information. `Modules` allows you to inspect the code modules the process has loaded into memory, and `MainModule` returns the module that started the process. `StandardInput`, `StandardOutput`, and `StandardError` allow access to the default I/O streams (see the `ProcessStartInfo.Redirect*` methods). `Threads` returns the threads in use by the process, and `WorkingSet` returns the physical memory usage of the process.

```
Public Class Process : Inherits System.ComponentModel.Component

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public ReadOnly Property BasePriority As Integer

   Public Property EnableRaisingEvents As Boolean

   Public ReadOnly Property ExitCode As Integer

   Public ReadOnly Property ExitTime As Date

   Public ReadOnly Property Handle As IntPtr

   Public ReadOnly Property HandleCount As Integer

   Public ReadOnly Property HasExited As Boolean
```

```
Public ReadOnly Property Id As Integer

Public ReadOnly Property MachineName As String

Public ReadOnly Property MainModule As ProcessModule

Public ReadOnly Property MainWindowHandle As IntPtr

Public ReadOnly Property MainWindowTitle As String

Public Property MaxWorkingSet As IntPtr

Public Property MinWorkingSet As IntPtr

Public ReadOnly Property Modules As ProcessModuleCollection

Public ReadOnly Property NonpagedSystemMemorySize As Integer

Public ReadOnly Property PagedMemorySize As Integer

Public ReadOnly Property PagedSystemMemorySize As Integer

Public ReadOnly Property PeakPagedMemorySize As Integer

Public ReadOnly Property PeakVirtualMemorySize As Integer

Public ReadOnly Property PeakWorkingSet As Integer

Public Property PriorityBoostEnabled As Boolean

Public Property PriorityClass As ProcessPriorityClass

Public ReadOnly Property PrivateMemorySize As Integer

Public ReadOnly Property PrivilegedProcessorTime As TimeSpan

Public ReadOnly Property ProcessName As String

Public Property ProcessorAffinity As IntPtr

Public ReadOnly Property Responding As Boolean

Public ReadOnly Property StandardError As StreamReader

Public ReadOnly Property StandardInput As StreamWriter

Public ReadOnly Property StandardOutput As StreamReader

Public Property StartInfo As ProcessStartInfo

Public ReadOnly Property StartTime As Date

Public Property SynchronizingObject As ISynchronizeInvoke

Public ReadOnly Property Threads As ProcessThreadCollection

Public ReadOnly Property TotalProcessorTime As TimeSpan

Public ReadOnly Property UserProcessorTime As TimeSpan
```

```
    Public ReadOnly Property VirtualMemorySize As Integer
    Public ReadOnly Property WorkingSet As Integer
' Public Shared Methods
    Public Shared Sub EnterDebugMode()
    Public Shared Function GetCurrentProcess() As Process
    Public Shared Function GetProcessById(
         ByVal processId As Integer) As Process
    Public Shared Function GetProcessById(
         ByVal processId As Integer,
         ByVal machineName As String) As Process
    Public Shared Function GetProcesses() As Process()
    Public Shared Function GetProcesses(
         ByVal machineName As String) As Process()
    Public Shared Function GetProcessesByName(
         ByVal processName As String) As Process()
    Public Shared Function GetProcessesByName(
         ByVal processName As String,
         ByVal machineName As String) As Process()
    Public Shared Sub LeaveDebugMode()
    Public Shared Function Start(
         ByVal startInfo As ProcessStartInfo) As Process
    Public Shared Function Start(
         ByVal fileName As String) As Process
    Public Shared Function Start(ByVal fileName As String,
         ByVal arguments As String) As Process
' Public Instance Methods
    Public Sub Close()
    Public Function CloseMainWindow() As Boolean
    Public Sub Kill()
    Public Sub Refresh()
    Public Function Start() As Boolean
```

```
   Overrides Public Function ToString() As String
   Public Function WaitForExit(
        ByVal milliseconds As Integer) As Boolean
   Public Sub WaitForExit()
   Public Function WaitForInputIdle() As Boolean
   Public Function WaitForInputIdle(
        ByVal milliseconds As Integer) As Boolean
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
   Protected Sub OnExited()
' Events
   Public Event Exited As EventHandler
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.IDisposable) → Process

## ProcessModule Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class represents a DLL or EXE file loaded by a process. BaseAddress returns the starting memory address of the loaded module and EntryPointAddress returns the memory address of the module's entry point (such as Main(), WinMain(), or DllMain()). You can also check the size of the loaded module by checking ModuleMemorySize. FileName returns the full path to the file of a loaded module and FileVersionInfo allows you to access the version information of a file. Lastly, you can view the name of the module with ModuleName.

```
Public Class ProcessModule : Inherits System.ComponentModel.Component
' Public Instance Properties
   Public ReadOnly Property BaseAddress As IntPtr
   Public ReadOnly Property EntryPointAddress As IntPtr
   Public ReadOnly Property FileName As String
   Public ReadOnly Property FileVersionInfo As FileVersionInfo
   Public ReadOnly Property ModuleMemorySize As Integer
   Public ReadOnly Property ModuleName As String
' Public Instance Methods
   Overrides Public Function ToString() As String
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.IDisposable) → ProcessModule

### Returned By

Process.MainModule, ProcessModuleCollection.this

### Passed To

ProcessModuleCollection.{Contains(), CopyTo(), IndexOf(), ProcessModuleCollection()}

# ProcessModuleCollection Class

## System.Diagnostics (system.dll)

This class is a strongly typed collection that contains `ProcessModule` objects.

```
Public Class ProcessModuleCollection : Inherits ReadOnlyCollectionBase

' Public Constructors

   Public Sub New( ByVal processModules As ProcessModule())

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Public Default ReadOnly Property Item(

        ByVal index As Integer) As ProcessModule

' Public Instance Methods

   Public Function Contains(

        ByVal module As ProcessModule) As Boolean

   Public Sub CopyTo(ByVal array As ProcessModule(),

        ByVal index As Integer)

   Public Function IndexOf(

        ByVal module As ProcessModule) As Integer

End Class
```

### Hierarchy

System.Object → System.Collections.ReadOnlyCollectionBase(System.Collections.ICollection, System.Collections.IEnumerable) → ProcessModuleCollection

### Returned By

Process.Modules

## ProcessPriorityClass — Enum

## System.Diagnostics (system.dll) — *serializable*

This enumeration represents the different priorities given to a process. Process priorities, along with thread priorities, determine how processor time is allocated. Most processes run with `Normal` priority. Use `Idle` to specify that processor time should be allocated to a process only when the processor is idle. `AboveNormal` and `BelowNormal` allow you to set priorities slightly above or below `Normal`, but are not supported by Windows 95, 98, or Me. An exception is thrown if you attempt to use them.

`High` should be used only for time-critical tasks, but use care in choosing this priority because little time will be available to other applications. `RealTime` is the maximum allowable priority. When this priority is used, the process runs with higher priority than even the operating system. Assigning `High` and `RealTime` to a process will almost certainly make your system's user interface unresponsive. For this reason, be careful when using these.

```
Public Enum ProcessPriorityClass

   Normal = 32

   Idle = 64

   High = 128

   RealTime = 256

   BelowNormal = 16384

   AboveNormal = 32768

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ProcessPriorityClass`

### Returned By

`Process.PriorityClass`

### Passed To

`Process.PriorityClass`

## ProcessStartInfo NotInheritable Class

### System.Diagnostics (system.dll)

This class is used to configure how a process is started or to view the settings a process was started with. To start a process, set `FileName` to the full path of the application or file, then pass the `ProcessStartInfo` instance to `Process.Start()`. `FileName` is the only property you must set. Use the other properties for more control. (Use `Arguments` to specify the command-line arguments.)

In Windows, each document type has a verb that you can use to do different things with (for example, a Microsoft Word document has an `open` and a `print` verb). To consult the possible verbs for a specific file, enumerate the `Verbs` property after you set `FileName`. To start a process with a specific verb, set `Verb`.

To change the standard error, input, or output source or targets (usually the system console) set one or more of `RedirectStandardError`, `RedirectStandardInput` or `RedirectStandardOutput` to `true`. This enables the `Process.StandardError`, `Process.StandardInput`, and `Process.StandardOutput` properties, which you can then set as needed. Set the `EnvironmentVariables` and `WorkingDirectory` to change the default process start behavior. If the process cannot be started, you can display an error dialog window by setting `ErrorDialog` (set the handle of the dialog's parent window with `ErrorDialogParentHandle`). If you set `CreateNoWindow`, a new window is not created to start the new process. However, if you want a window, set its style by setting `WindowStyle`. You can also specify that the file should be executed from a Windows command prompt with `UseShellExecute`.

```
Public NotInheritable Class ProcessStartInfo

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal fileName As String)

   Public Sub New(ByVal fileName As String,

        ByVal arguments As String)

' Public Instance Properties

   Public Property Arguments As String

   Public Property CreateNoWindow As Boolean

   Public ReadOnly Property EnvironmentVariables As StringDictionary

   Public Property ErrorDialog As Boolean

   Public Property ErrorDialogParentHandle As IntPtr

   Public Property FileName As String

   Public Property RedirectStandardError As Boolean

   Public Property RedirectStandardInput As Boolean
```

```
   Public Property RedirectStandardOutput As Boolean
   Public Property UseShellExecute As Boolean
   Public Property Verb As String
   Public ReadOnly Property Verbs As String()
   Public Property WindowStyle As ProcessWindowStyle
   Public Property WorkingDirectory As String
End Class
```

### Returned By

Process.StartInfo

### Passed To

Process.{Start(),StartInfo}

## ProcessThread Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This class represents a thread, the smallest unit of execution under Win32. Use `Process.Threads` to get an array of all the threads contained within a given process. As with processes, a thread runs with a given priority. `BasePriority` represents the base priority for a thread. From time to time, the operating system changes a thread's priority; a thread's current priority is available from `CurrentPriority`. Threads in background applications run with a lower priority, as do threads that are sleeping. `BasePriorityPriorityLevel` specifies a range of appropriate priorities for a thread.

If a process is `ProcessPriorityClass.Normal`, `ProcessPriorityClass.High`, or `ProcessPriorityClass.RealTime`, you can set a thread's `PriorityBoostEnabled` to `true`. This gives the thread an extra boost whenever the user is interacting with the program's user interface. You can make a thread prefer one processor over another by setting the value of `IdealProcessor`. `ProcessorAffinity` allows you to set up a bitfield that represents one or more preferred processors. Bit 0 represents the first processor, bit 1 the second, and so on. For example, a `ProcessorAffinity` of `0x0005` (bits 0 and 2 on) indicates that the first and third processor are preferred. Use `ResetIdealProcessor()` to tell the thread that it can run on any processor, leaving the processor choice up to the operating system.

The current state of a thread is returned by `ThreadState` . If a thread is waiting, you can retrieve the reason the thread is waiting via `WaitReason`. `PrivilegedProcessorTime` and `UserProcessorTime` return the privileged and user processor time, and `TotalProcessorTime` returns the sum of those two.

The `ProcessThread` class differs from the `System.Threading.Thread` type. `ProcessThread` represents the view of a thread from an administrative viewpoint, while `System.Threading.Thread` represents a thread from its creator's viewpoint. When you want to enumerate and interact with the threads of an external process, use `ProcessThread`. When you need to create a new thread in your own program, use `System.Threading.Thread`.

```
Public Class ProcessThread : Inherits System.ComponentModel.Component

' Public Instance Properties

   Public ReadOnly Property BasePriority As Integer

   Public ReadOnly Property CurrentPriority As Integer

   Public ReadOnly Property Id As Integer

   Public WriteOnly Property IdealProcessor As Integer

   Public Property PriorityBoostEnabled As Boolean

   Public Property PriorityLevel As ThreadPriorityLevel

   Public ReadOnly Property PrivilegedProcessorTime As TimeSpan

   Public WriteOnly Property ProcessorAffinity As IntPtr

   Public ReadOnly Property StartAddress As IntPtr
```

```
    Public ReadOnly Property StartTime As Date
    Public ReadOnly Property ThreadState As ThreadState
    Public ReadOnly Property TotalProcessorTime As TimeSpan
    Public ReadOnly Property UserProcessorTime As TimeSpan
    Public ReadOnly Property WaitReason As ThreadWaitReason
' Public Instance Methods
    Public Sub ResetIdealProcessor()
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.IDisposable) → ProcessThread

## Returned By

ProcessThreadCollection.this

## Passed To

ProcessThreadCollection.{Add(),Contains(),CopyTo(),IndexOf(),Insert(), ProcessThreadCollection(),Remove()}

# ProcessThreadCollection Class

## System.Diagnostics (system.dll)

This strongly typed collection contains `ProcessThread` objects.

```
Public Class ProcessThreadCollection : Inherits ReadOnlyCollectionBase

' Public Constructors

   Public Sub New( ByVal processThreads As ProcessThread())

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Public Default ReadOnly Property Item(

         ByVal index As Integer) As ProcessThread

' Public Instance Methods

   Public Function Add(

         ByVal thread As ProcessThread) As Integer

   Public Function Contains(

         ByVal thread As ProcessThread) As Boolean

   Public Sub CopyTo(ByVal array As ProcessThread(),

         ByVal index As Integer)

   Public Function IndexOf(

         ByVal thread As ProcessThread) As Integer

   Public Sub Insert(ByVal index As Integer,

         ByVal thread As ProcessThread)

   Public Sub Remove( ByVal thread As ProcessThread)

End Class
```

### Hierarchy

System.Object → System.Collections.ReadOnlyCollectionBase(System.Collections.ICollection, System.Collections.IEnumerable) → ProcessThreadCollection

### Returned By

`Process.Threads`



PREVIOUS NEXT

# ProcessWindowStyle Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration contains the window states you can choose from when starting a `Process`.

```
Public Enum ProcessWindowStyle
   Normal = 0
   Hidden = 1
   Minimized = 2
   Maximized = 3
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ProcessWindowStyle`

### Returned By

`ProcessStartInfo.WindowStyle`

### Passed To

`ProcessStartInfo.WindowStyle`

## StackFrame Class

## System.Diagnostics (mscorlib.dll) *serializable*

A stack frame is an abstraction of the current state of an executing method. Use `StackTrace` to enumerate all the stack frames that led up to the current process. Use `GetMethod()` to obtain information about the method represented by a stack frame. Use `GetFileName()` to retrieve the name of the module that contains the method. The column and line numbers of the method, which are determined from debugging symbols, can be accessed with `GetFileColumnNumber()` and `GetFileLineNumber()`. To obtain the location in memory of the `StackFrame`, use `GetNativeOffset()`, or, alternatively, for the offset of IL code, call `GetILOffset()`. If the JIT compiler is not generating debugging symbols, this number is approximated by the runtime.

```
Public Class StackFrame

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal fNeedFileInfo As Boolean)

   Public Sub New( ByVal skipFrames As Integer)

   Public Sub New(ByVal skipFrames As Integer,

        ByVal fNeedFileInfo As Boolean)

   Public Sub New(ByVal fileName As String,

        ByVal lineNumber As Integer)

   Public Sub New(ByVal fileName As String,

        ByVal lineNumber As Integer,

        ByVal colNumber As Integer)

' Public Shared Fields

   Public const OFFSET_UNKNOWN As Integer                                  // =-1

' Public Instance Methods

   Overridable Public Function GetFileColumnNumber(

        ) As Integer

   Overridable Public Function GetFileLineNumber() As Integer

   Overridable Public Function GetFileName() As String

   Overridable Public Function GetILOffset() As Integer

   Overridable Public Function GetMethod() As MethodBase

   Overridable Public Function GetNativeOffset() As Integer
```

```
   Overrides Public Function ToString() As String
End Class
```

## Returned By

`StackTrace.GetFrame()`

## Passed To

`StackTrace.StackTrace()`

## StackTrace Class

## System.Diagnostics (mscorlib.dll) *serializable*

A stack trace is an ordered list of `StackFrame` objects. Call the constructor to create a stack trace that starts with a `StackFrame` corresponding to the current method. The optional boolean argument `fNeedFileInfo` indicates that the stack trace should include the filename as well as the line and column number. (The program must have been compiled with `/debug` to get this information.)

When one method calls another, a new stack frame is created and `FrameCount` is incremented. To get a specific `StackFrame`, use `GetFrame()`. The shared constant `METHODS_TO_SKIP` returns the number of methods skipped at the beginning of the `StackTrace`.

```
Public Class StackTrace

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal fNeedFileInfo As Boolean)

   Public Sub New( ByVal e As Exception)

   Public Sub New(ByVal e As Exception,

        ByVal fNeedFileInfo As Boolean)

   Public Sub New(ByVal e As Exception,

        ByVal skipFrames As Integer)

   Public Sub New(ByVal e As Exception,

        ByVal skipFrames As Integer,

        ByVal fNeedFileInfo As Boolean)

   Public Sub New( ByVal skipFrames As Integer)

   Public Sub New(ByVal skipFrames As Integer,

        ByVal fNeedFileInfo As Boolean)

   Public Sub New( ByVal frame As StackFrame)

   Public Sub New(

        ByVal targetThread As System.Threading.Thread,

        ByVal needFileInfo As Boolean)

' Public Shared Fields

   Public const METHODS_TO_SKIP As Integer                     // =0

' Public Instance Properties
```

```
    Overridable Public ReadOnly Property FrameCount As Integer
' Public Instance Methods
    Overridable Public Function GetFrame(
           ByVal index As Integer) As StackFrame
    Overrides Public Function ToString() As String
End Class
```

# Switch MustInherit Class

## System.Diagnostics (system.dll)

Consult this class in a conditional statement to execute special tracing or debugging code. To use a switch you must have debugging enabled. Each `Switch` has a `DisplayName` and `Description`. `SwitchSetting` contains the current setting.

Specify the value of a switch in the application configuration file. Under the `<system.diagnostics>` element, add an element `<switches>` to hold all the switches. Within the `<switches>` element, define each switch you want with `<add name="switchname" value="value"/>`. For a `BooleanSwitch`, any nonzero value sets `BooleanSwitch.Enabled` to `true`. For a `TraceSwitch`, use a value from the `TraceLevel` enumeration.

```
Public MustInherit Class Switch
' Protected Constructors
   Protected Sub New(ByVal displayName As String,
        ByVal description As String)
' Public Instance Properties
   Public ReadOnly Property Description As String
   Public ReadOnly Property DisplayName As String
' Protected Instance Properties
   Protected Property SwitchSetting As Integer
' Protected Instance Methods
   Overridable Protected Sub OnSwitchSettingChanged()
End Class
```

### Subclasses

`BooleanSwitch`, `TraceSwitch`

# TextWriterTraceListener Class

## System.Diagnostics (system.dll) *marshal by reference, disposable*

This class writes to a `System.IO.TextWriter`. Use `Writer` to set or change the `TextWriter`.

```
Public Class TextWriterTraceListener : Inherits TraceListener

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal stream As System.IO.Stream)

   Public Sub New(ByVal stream As System.IO.Stream,

        ByVal name As String)

   Public Sub New( ByVal fileName As String)

   Public Sub New(ByVal fileName As String,

        ByVal name As String)

   Public Sub New( ByVal writer As System.IO.TextWriter)

   Public Sub New(ByVal writer As System.IO.TextWriter,

        ByVal name As String)

' Public Instance Properties

   Public Property Writer As TextWriter

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Sub Flush()

   Overrides Public Sub Write( ByVal message As String)

   Overrides Public Sub WriteLine( ByVal message As String)

' Protected Instance Methods

   Overrides Protected Sub Dispose(ByVal disposing As Boolean)

End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject →
TraceListener(System.IDisposable) → TextWriterTraceListener

# ThreadPriorityLevel Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration represents the different thread priority levels. A thread's priority level is computed relative to the process priority level using `ProcessThread.PriorityLevel`.

```
Public Enum ThreadPriorityLevel
   Normal = 0
   AboveNormal = 1
   Highest = 2
   TimeCritical = 15
   Idle = -15
   Lowest = -2
   BelowNormal = -1
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ThreadPriorityLevel`

### Returned By

`ProcessThread.PriorityLevel`

### Passed To

`ProcessThread.PriorityLevel`

# ThreadState Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration represents the different thread states as recognized by the operating system. They mostly correspond to the states defined by `System.Threading.ThreadState`, but also include `Transition` for when a thread is waiting on something other than the CPU (it might be waiting on disk I/O, for example).

```
Public Enum ThreadState

   Initialized = 0

   Ready = 1

   Running = 2

   Standby = 3

   Terminated = 4

   Wait = 5

   Transition = 6

   Unknown = 7

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ThreadState`

### Returned By

`ProcessThread.ThreadState`

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VB.NET Core Classes in a Nutshell

## Trace NotInheritable Class

### System.Diagnostics (system.dll)

This class supplies shared methods and properties to provide tracing ability. The calls to the `Trace` methods and properties are executed only if tracing is enabled. (See the introduction to this chapter for instructions on enabling tracing.)

The shared properties allow you to adjust the settings that are used when you call the methods. You can specify that output be indented a certain amount with `IndentLevel` or increase or decrease the `IndentLevel` by one using `Indent()` and `Unindent()`. You can also adjust the number of spaces each indent level adds using `IndentSize`. `AutoFlush` makes sure that after each use of a `Trace` method, the `Listeners` are flushed.

`Write()` and `WriteLine()` simply write to each `TraceListener` in the `Listeners` collection (by default, this collection includes an instance of `DefaultTraceListener`). `WriteIf()` and `WriteLineIf()` do the same, but only if the specified condition evaluates to `true`. `Assert()` emits an error message if a condition evaluates to `false`, and `Fail()` always emits an error message.

One possible point of confusion is that `Listeners` is read-only. This means that you may not point `Listeners` to a different collection. You can, however, add new `TraceListener` objects to the `TraceListenerCollection` with the `TraceListenerCollection.Add()` method.

You can use the application configuration file to configure this class. Under the `<system.diagnostics>` element, add a `<trace>` element. You can set attributes for this element that correspond to `Trace` properties, as in `<trace autoflush="true" indentsize="4"/>`.

```
Public NotInheritable Class Trace

' Public Shared Properties

   Public Shared Property AutoFlush As Boolean

   Public Shared Property IndentLevel As Integer

   Public Shared Property IndentSize As Integer

   Public Shared ReadOnly Property Listeners As TraceListenerCollection

' Public Shared Methods

   Public Shared Sub Assert( ByVal condition As Boolean)

   Public Shared Sub Assert(ByVal condition As Boolean,

        ByVal message As String)

   Public Shared Sub Assert(ByVal condition As Boolean,

        ByVal message As String,

        ByVal detailMessage As String)

   Public Shared Sub Close()
```

```
Public Shared Sub Fail( ByVal message As String)
Public Shared Sub Fail(ByVal message As String,
     ByVal detailMessage As String)
Public Shared Sub Flush()
Public Shared Sub Indent()
Public Shared Sub Unindent()
Public Shared Sub Write( ByVal value As Object)
Public Shared Sub Write(ByVal value As Object,
     ByVal category As String)
Public Shared Sub Write( ByVal message As String)
Public Shared Sub Write(ByVal message As String,
     ByVal category As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal value As Object)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal value As Object, ByVal category As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal message As String)
Public Shared Sub WriteIf(ByVal condition As Boolean,
     ByVal message As String, ByVal category As String)
Public Shared Sub WriteLine( ByVal value As Object)
Public Shared Sub WriteLine(ByVal value As Object,
     ByVal category As String)
Public Shared Sub WriteLine( ByVal message As String)
Public Shared Sub WriteLine(ByVal message As String,
     ByVal category As String)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
     ByVal value As Object)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
     ByVal value As Object, ByVal category As String)
Public Shared Sub WriteLineIf(ByVal condition As Boolean,
```

```
        ByVal message As String)
    Public Shared Sub WriteLineIf(ByVal condition As Boolean,
        ByVal message As String, ByVal category As String)
End Class
```

# TraceLevel Enum

## System.Diagnostics (system.dll) *serializable*

This enumeration represents the possible levels for a trace. Use a `TraceSwitch` to inspect a switch's current level. `Error` indicates that tracing code should emit messages for error conditions, while `Warning` indicates that tracing code should emit both warnings and error messages. `Info` adds to `Warning` by including informational messages along with warnings and errors. `Verbose` indicates that *all* trace messages should be emitted. Turn tracing messages off with `Off`.

```
Public Enum TraceLevel

   Off = 0

   Error = 1

   Warning = 2

   Info = 3

   Verbose = 4

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `TraceLevel`

### Returned By

`TraceSwitch.Level`

### Passed To

`TraceSwitch.Level`

## TraceListener MustInherit Class

**System.Diagnostics (system.dll)** ***marshal by reference, disposable***

This MustInherit class `TraceListener` is associated with a trace through inclusion in the `Trace.I`
Each `TraceListener` is responsible for sending trace output somewhere. For example, when you
`Trace.WriteLine()`, each `TraceListener` sends the same output to its respective output dest
a name to your `TraceListener` instances.

Use `IndentLevel` to control the level of indentation in the output. `IndentSize` specifies the numl
of indent. `NeedIndent` toggles whether to indent the output at all. Use `Write()` and `WriteLine(`
`TraceListener`'s destination. `WriteIndent()` emits whitespace according to the current `Inden`
`IndentSize`. It has the side effect of setting `NeedIndent` to false, so the next time you call one of
will not emit extra indentation.

You can use the application configuration file to add or remove `TraceListeners`. Look up `System.Diagnostics.TraceListener` in the .NET Framework SDK Documentation for details.

```
Public MustInherit Class TraceListener : Inherits MarshalByRefObject : Im
' Protected Constructors
   Protected Sub New()
   Protected Sub New( ByVal name As String)
' Public Instance Properties
   Public Property IndentLevel As Integer
   Public Property IndentSize As Integer
   Overridable Public Property Name As String
' Protected Instance Properties
   Protected Property NeedIndent As Boolean
' Public Instance Methods
   Overridable Public Sub Close()
   Public Sub Dispose() Implements IDisposable.Dispose
   Overridable Public Sub Fail( ByVal message As String)
   Overridable Public Sub Fail(ByVal message As String,
        ByVal detailMessage As String)
   Overridable Public Sub Flush()
   Overridable Public Sub Write( ByVal o As Object)
   Overridable Public Sub Write(ByVal o As Object,
```

```
        ByVal category As String)
   MustInherit Public Sub Write( ByVal message As String)
   Overridable Public Sub Write(ByVal message As String,
        ByVal category As String)
   Overridable Public Sub WriteLine( ByVal o As Object)
   Overridable Public Sub WriteLine(ByVal o As Object,
        ByVal category As String)
   MustInherit Public Sub WriteLine( ByVal message As String)
   Overridable Public Sub WriteLine(ByVal message As String,
        ByVal category As String)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overridable Protected Sub WriteIndent()
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → TraceListener(System.IDispo:

### Subclasses

DefaultTraceListener, EventLogTraceListener, TextWriterTraceListener

### Returned By

TraceListenerCollection.this

### Passed To

TraceListenerCollection.{Add(), AddRange(), Contains(), CopyTo(), IndexOf(), Ir
Remove()}

## TraceListenerCollection Class

## System.Diagnostics (system.dll)

This class is a strongly typed, thread-safe collection that contains `TraceListener` objects.

```
Public Class TraceListenerCollection : Implements IList, ICollection, IEn
' Public Instance Properties
   Public ReadOnly Property Count As Integer Implements ICollection.Count
   Public Default ReadOnly Property Item(
        ByVal name As String) As TraceListener
   Public Default Property Item(
        ByVal i As Integer) As TraceListener
' Public Instance Methods
   Public Function Add(
        ByVal listener As TraceListener) As Integer
   Public Sub AddRange( ByVal value As TraceListener())
   Public Sub AddRange(ByVal value As TraceListenerCollection)
   Public Sub Clear() Implements IList.Clear
   Public Function Contains(
        ByVal listener As TraceListener) As Boolean
   Public Sub CopyTo(ByVal listeners As TraceListener(),
        ByVal index As Integer)
   Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
   Public Function IndexOf(
        ByVal listener As TraceListener) As Integer
   Public Sub Insert(ByVal index As Integer,
        ByVal listener As TraceListener)
   Public Sub Remove( ByVal name As String)
   Public Sub Remove( ByVal listener As TraceListener)
   Public Sub RemoveAt(
```

```
        ByVal index As Integer) Implements IList.RemoveAt

End Class
```

### Returned By

Debug.Listeners, Trace.Listeners

# TraceSwitch Class

## System.Diagnostics (system.dll)

This class provides a switch that can be set to one of the values in the `TraceLevel` enumeration. These values are inclusive and cumulative (for example, if `Level` is set to `TraceLevel.Info`, then `TraceInfo`, `TraceWarning`, and `TraceError` are true). See `TraceLevel` for more details. You can configure a trace switch using the application configuration file (see `Switch`).

```
Public Class TraceSwitch : Inherits Switch
' Public Constructors
   Public Sub New(ByVal displayName As String,
        ByVal description As String)
' Public Instance Properties
   Public Property Level As TraceLevel
   Public ReadOnly Property TraceError As Boolean
   Public ReadOnly Property TraceInfo As Boolean
   Public ReadOnly Property TraceVerbose As Boolean
   Public ReadOnly Property TraceWarning As Boolean
' Protected Instance Methods
   Overrides Protected Sub OnSwitchSettingChanged()
End Class
```

### Hierarchy

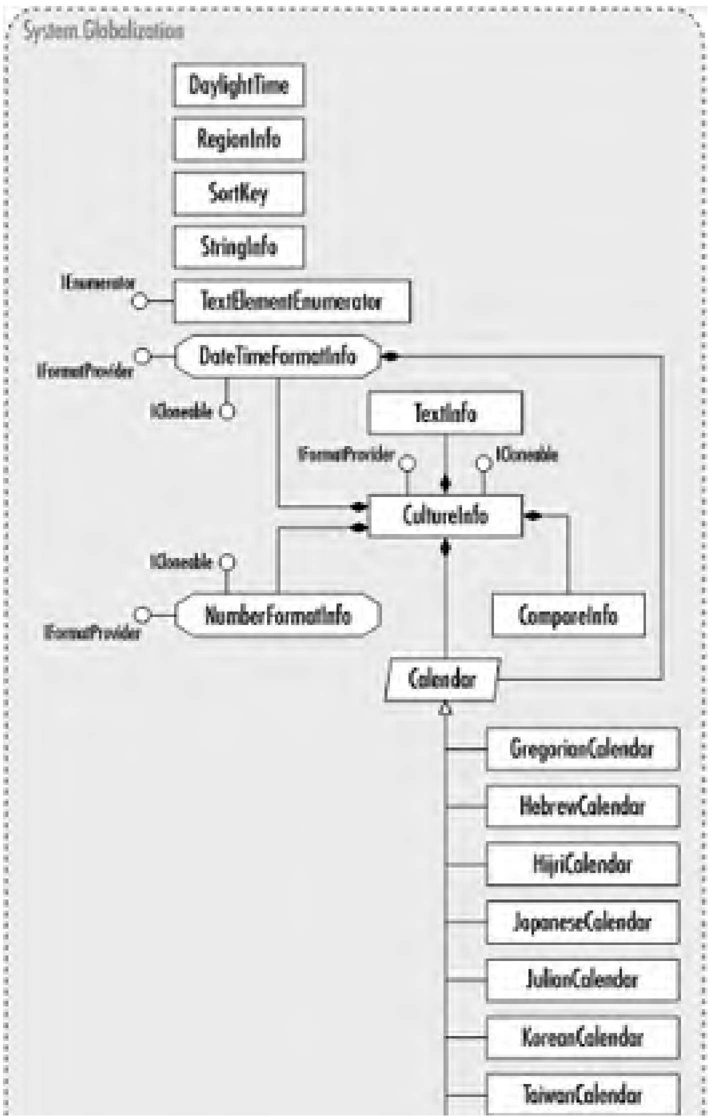
`System.Object` → `Switch` → `TraceSwitch`

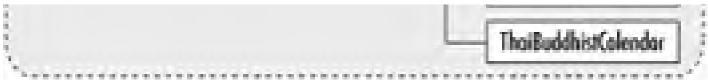
# Chapter 8. System.Globalization

The System.Globalization namespace provides classes that assist in localization of applications based on language and culture. The CultureInfo class is the primary container for a set of resources that is used for a specified language and culture implementation. It describes how strings are sorted, the specifics of calendars and date and time formats, as well as language and dialect code pages. An application obtains its culture information based on either the CultureInfo specified by the current thread or from the user or local machine's preferences. Specific cultural information is contained in resource files deployed in satellite assemblies. System.Resources.ResourceManager marshals these resource files into System.Resources.ResourceSets that provide the objects and methods specific to a localization.

The System.Globalization namespace provides a base Calendar class, as well as specific calendar implementations for major cultures. CompareInfo defines how string comparison and sorting are handled. DateTimeFormatInfo defines how DateTime values are formatted, and NumberFormatInfo defines various formatting styles, such as currency symbols and decimal and grouping separators. Figure 8-1 shows the types in this namespace.

**Figure 8-1. The System.Globalization namespace**




ThaiBuddhistCalendar

## Calendar MustInherit Class

## System.Globalization (mscorlib.dll) *serializable*

This MustInherit class determines the division and measurement of time in units, such as day, months, years, and eras. It is a MustInherit base class for culture-specific calendar implementations included in this namespace. Derived classes store the specific information about a calendar's eras, lengths of years and months, and the sometimes esoteric rules for calculating leap years. These properties get used by `DateTimeFormatInfo` to properly display a date and time string from a specific `DateTime` value.

```
Public MustInherit Class Calendar
' Protected Constructors
   Protected Sub New()
' Public Shared Fields
   Public const CurrentEra As Integer                                  // =0
' Public Instance Properties
   MustInherit Public ReadOnly Property Eras As Integer()
   Overridable Public Property TwoDigitYearMax As Integer
' Public Instance Methods
   Overridable Public Function AddDays(ByVal time As Date,
        ByVal days As Integer) As Date
   Overridable Public Function AddHours(ByVal time As Date,
        ByVal hours As Integer) As Date
   Overridable Public Function AddMilliseconds(
        ByVal time As Date,
        ByVal milliseconds As Double) As Date
   Overridable Public Function AddMinutes(ByVal time As Date,
        ByVal minutes As Integer) As Date
   MustInherit Public Function AddMonths(ByVal time As Date,
        ByVal months As Integer) As Date
   Overridable Public Function AddSeconds(ByVal time As Date,
        ByVal seconds As Integer) As Date
   Overridable Public Function AddWeeks(ByVal time As Date,
```

```
     ByVal weeks As Integer) As Date
MustInherit Public Function AddYears(ByVal time As Date,
     ByVal years As Integer) As Date
MustInherit Public Function GetDayOfMonth(
     ByVal time As Date) As Integer
MustInherit Public Function GetDayOfWeek(
     ByVal time As Date) As DayOfWeek
MustInherit Public Function GetDayOfYear(
     ByVal time As Date) As Integer
Overridable Public Function GetDaysInMonth(
     ByVal year As Integer,
     ByVal month As Integer) As Integer
MustInherit Public Function GetDaysInMonth(
     ByVal year As Integer, ByVal month As Integer,
     ByVal era As Integer) As Integer
Overridable Public Function GetDaysInYear(
     ByVal year As Integer) As Integer
MustInherit Public Function GetDaysInYear(
     ByVal year As Integer,
     ByVal era As Integer) As Integer
MustInherit Public Function GetEra(
     ByVal time As Date) As Integer
Overridable Public Function GetHour(
     ByVal time As Date) As Integer
Overridable Public Function GetMilliseconds(
     ByVal time As Date) As Double
Overridable Public Function GetMinute(
     ByVal time As Date) As Integer
MustInherit Public Function GetMonth(
     ByVal time As Date) As Integer
Overridable Public Function GetMonthsInYear(
```

```
    ByVal year As Integer) As Integer
MustInherit Public Function GetMonthsInYear(
    ByVal year As Integer,
    ByVal era As Integer) As Integer
Overridable Public Function GetSecond(
    ByVal time As Date) As Integer
Overridable Public Function GetWeekOfYear(
    ByVal time As Date, ByVal rule As CalendarWeekRule,
    ByVal firstDayOfWeek As DayOfWeek) As Integer
MustInherit Public Function GetYear(
    ByVal time As Date) As Integer
Overridable Public Function IsLeapDay(
    ByVal year As Integer, ByVal month As Integer,
    ByVal day As Integer) As Boolean
MustInherit Public Function IsLeapDay(
    ByVal year As Integer, ByVal month As Integer,
    ByVal day As Integer,
    ByVal era As Integer) As Boolean
Overridable Public Function IsLeapMonth(
    ByVal year As Integer,
    ByVal month As Integer) As Boolean
MustInherit Public Function IsLeapMonth(
    ByVal year As Integer, ByVal month As Integer,
    ByVal era As Integer) As Boolean
Overridable Public Function IsLeapYear(
    ByVal year As Integer) As Boolean
MustInherit Public Function IsLeapYear(
    ByVal year As Integer,
    ByVal era As Integer) As Boolean
Overridable Public Function ToDateTime(
```

```
        ByVal year As Integer, ByVal month As Integer,
        ByVal day As Integer, ByVal hour As Integer,
        ByVal minute As Integer, ByVal second As Integer,
        ByVal millisecond As Integer) As Date
    MustInherit Public Function ToDateTime(
        ByVal year As Integer, ByVal month As Integer,
        ByVal day As Integer, ByVal hour As Integer,
        ByVal minute As Integer, ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overridable Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

### Subclasses

GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

### Returned By

CultureInfo.{Calendar, OptionalCalendars}, DateTimeFormatInfo.Calendar

### Passed To

System.DateTime.DateTime(), DateTimeFormatInfo.Calendar

## CalendarWeekRule Enum

## System.Globalization (mscorlib.dll) *serializable*

This enumeration contains values that specify how the first week of a calendar year is determined. Each calendar requires that the starting day of a week is designated (i.e., Sunday in the Gregorian calendar). The value `FirstDay` designates that the first calendar week begins on the first day of the year regardless of the number of days left in the week. The `FirstFourDayWeek` specifies the first week that has at least four days in it. `FirstFullWeek` uses the first complete week as the first in the calendar.

```
Public Enum CalendarWeekRule

   FirstDay = 0

   FirstFullWeek = 1

   FirstFourDayWeek = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `CalendarWeekRule`

### Returned By

`DateTimeFormatInfo.CalendarWeekRule`

### Passed To

`Calendar.GetWeekOfYear()`, `DateTimeFormatInfo.CalendarWeekRule`

## CompareInfo Class

## System.Globalization (mscorlib.dll) *serializable*

This class defines methods of string comparison that follow culture-specific rules. The `CultureInf` property contains an instance of this class. The `Compare()` method and other string searching met `IndexOf()` and `IsPrefix()`, can be passed a set of `CompareOptions`, which provide culture-sp strings. The `GetCompareInfo()` method is used instead of a public constructor to retrieve an insta

```
Public Class CompareInfo : Implements System.Runtime.Serialization.IDeser.

' Public Instance Properties

   Public ReadOnly Property LCID As Integer

' Public Shared Methods

   Public Shared Function GetCompareInfo(

        ByVal culture As Integer) As CompareInfo

   Public Shared Function GetCompareInfo(

        ByVal culture As Integer,

        ByVal assembly As System.Reflection.Assembly) As CompareInfo

   Public Shared Function GetCompareInfo(

        ByVal name As String) As CompareInfo

   Public Shared Function GetCompareInfo(ByVal name As String,

        ByVal assembly As System.Reflection.Assembly) As CompareInfo

' Public Instance Methods

   Overridable Public Function Compare(

        ByVal string1 As String, ByVal offset1 As Integer,

        ByVal length1 As Integer, ByVal string2 As String,

        ByVal offset2 As Integer,

        ByVal length2 As Integer) As Integer

   Overridable Public Function Compare(

        ByVal string1 As String, ByVal offset1 As Integer,

        ByVal length1 As Integer, ByVal string2 As String,

        ByVal offset2 As Integer, ByVal length2 As Integer,

        ByVal options As CompareOptions) As Integer

   Overridable Public Function Compare(
```

```
     ByVal string1 As String, ByVal offset1 As Integer,
     ByVal string2 As String,
     ByVal offset2 As Integer) As Integer
Overridable Public Function Compare(
     ByVal string1 As String, ByVal offset1 As Integer,
     ByVal string2 As String, ByVal offset2 As Integer,
     ByVal options As CompareOptions) As Integer
Overridable Public Function Compare(
     ByVal string1 As String,
     ByVal string2 As String) As Integer
Overridable Public Function Compare(
     ByVal string1 As String, ByVal string2 As String,
     ByVal options As CompareOptions) As Integer
Overrides Public Function Equals(
     ByVal value As Object) As Boolean
Overrides Public Function GetHashCode() As Integer
Overridable Public Function GetSortKey(
     ByVal source As String) As SortKey
Overridable Public Function GetSortKey(
     ByVal source As String,
     ByVal options As CompareOptions) As SortKey
Overridable Public Function IndexOf(ByVal source As String,
     ByVal value As Char) As Integer
Overridable Public Function IndexOf(ByVal source As String,
     ByVal value As Char,
     ByVal options As CompareOptions) As Integer
Overridable Public Function IndexOf(ByVal source As String,
     ByVal value As Char,
     ByVal startIndex As Integer) As Integer
Overridable Public Function IndexOf(ByVal source As String,
```

```
    ByVal value As Char, ByVal startIndex As Integer,
    ByVal options As CompareOptions) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As Char, ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As Char, ByVal startIndex As Integer,
    ByVal count As Integer,
    ByVal options As CompareOptions) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String,
    ByVal options As CompareOptions) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String,
    ByVal startIndex As Integer) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String, ByVal startIndex As Integer,
    ByVal options As CompareOptions) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String, ByVal startIndex As Integer,
    ByVal count As Integer) As Integer
Overridable Public Function IndexOf(ByVal source As String,
    ByVal value As String, ByVal startIndex As Integer,
    ByVal count As Integer,
    ByVal options As CompareOptions) As Integer
Overridable Public Function IsPrefix(
    ByVal source As String,
    ByVal prefix As String) As Boolean
Overridable Public Function IsPrefix(
```

```
        ByVal source As String, ByVal prefix As String,
        ByVal options As CompareOptions) As Boolean
Overridable Public Function IsSuffix(
        ByVal source As String,
        ByVal suffix As String) As Boolean
Overridable Public Function IsSuffix(
        ByVal source As String, ByVal suffix As String,
        ByVal options As CompareOptions) As Boolean
Overridable Public Function LastIndexOf(
        ByVal source As String,
        ByVal value As Char) As Integer
Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As Char,
        ByVal options As CompareOptions) As Integer
Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As Char,
        ByVal startIndex As Integer) As Integer
Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As Char,
        ByVal startIndex As Integer,
        ByVal options As CompareOptions) As Integer
Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As Char,
        ByVal startIndex As Integer,
        ByVal count As Integer) As Integer
Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As Char,
        ByVal startIndex As Integer,
        ByVal count As Integer,
        ByVal options As CompareOptions) As Integer
Overridable Public Function LastIndexOf(
```

```
        ByVal source As String,
        ByVal value As String) As Integer
   Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As String,
        ByVal options As CompareOptions) As Integer
   Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As String,
        ByVal startIndex As Integer) As Integer
   Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As String,
        ByVal startIndex As Integer,
        ByVal options As CompareOptions) As Integer
   Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As String,
        ByVal startIndex As Integer,
        ByVal count As Integer) As Integer
   Overridable Public Function LastIndexOf(
        ByVal source As String, ByVal value As String,
        ByVal startIndex As Integer,
        ByVal count As Integer,
        ByVal options As CompareOptions) As Integer
   Overrides Public Function ToString() As String
End Class
```

### Returned By

CultureInfo.CompareInfo

## CompareOptions Enum

### System.Globalization (mscorlib.dll) *serializable, flag*

This enumeration defines a set of constants that set culture-specific behavior on string comparisons in the `CompareInfo` class. `IgnoreKanaType` treats phonetic Japanese symbols the same whether they are in hiragana or katagana characters. `IgnoreNonSpace` disregards nonspacing characters such as diacritics. `Ordinal` specifies that comparison is done with Unicode values.

```
Public Enum CompareOptions

   None = &H000000000

   IgnoreCase = &H000000001

   IgnoreNonSpace = &H000000002

   IgnoreSymbols = &H000000004

   IgnoreKanaType = &H000000008

   IgnoreWidth = &H000000010

   StringSort = &H020000000

   Ordinal = &H040000000

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `CompareOptions`

### Passed To

`CompareInfo.{Compare(), GetSortKey(), IndexOf(), IsPrefix(), IsSuffix(), LastIndexOf()}`

## CultureInfo Class

### System.Globalization (mscorlib.dll) *ECMA, serializable*

The `CultureInfo` class encapsulates information about handling information according to the spe requirements of a particular culture and language. Culture information is identified by language and country/region codes as specified in RFC 1766. For example, U.S. English is identified as `en-US`. T letter, lowercase language codes are defined in ISO 639-1. The two-letter, uppercase region codes in ISO 3166.

The specific `CultureInfo` to use at runtime can be found in a number of ways. The class provides properties that return the current `CultureInfo` instance. `CurrentCulture` returns the value of `Thread.CurrentCulture`, which is the `CultureInfo` used by the current thread. `CurrentUICu` returns the `CultureInfo` used by the `System.Resources.ResourceManager`. This can be a u machine, or application-based locale setting. It is set in `Thread.CurrentUICulture`. `InstalledUICulture` gets the default `CultureInfo` used by the `ResourceManager` and repre locale of the operating system. `InvariantCulture` returns the `CultureInfo` for the invariant loc is nonculture-specific, as well as in the default OS language. This is used with nonculture-specific fu such as system-level calls.

The instance properties of the class provide a number of ways to retrieve the culture name. For exa `NativeName` gets the culture name in the language of that culture. `LCID` gets the NLS-specified nu culture name. Other properties get or set the various class instances used for localization. `Calenda` `CompareInfo`, `DateTimeFormat`, `NumberFormat`, and `TextInfo` return instances of the analog classes that set their functionality.

```
Public Class CultureInfo : Implements ICloneable, IFormatProvider

' Public Constructors

   Public Sub New( ByVal culture As Integer)

   Public Sub New(ByVal culture As Integer,

        ByVal useUserOverride As Boolean)

   Public Sub New( ByVal name As String)

   Public Sub New(ByVal name As String,

        ByVal useUserOverride As Boolean)

' Public Shared Properties

   Public Shared ReadOnly Property CurrentCulture As CultureInfo

   Public Shared ReadOnly Property CurrentUICulture As CultureInfo

   Public Shared ReadOnly Property InstalledUICulture As CultureInfo

   Public Shared ReadOnly Property InvariantCulture As CultureInfo

' Public Instance Properties

   Overridable Public ReadOnly Property Calendar As Calendar
```

```
   Overridable Public ReadOnly Property CompareInfo As CompareInfo
   Overridable Public Property DateTimeFormat As DateTimeFormatInfo
   Overridable Public ReadOnly Property DisplayName As String
   Overridable Public ReadOnly Property EnglishName As String
   Overridable Public ReadOnly Property IsNeutralCulture As Boolean
   Public ReadOnly Property IsReadOnly As Boolean
   Overridable Public ReadOnly Property LCID As Integer
   Overridable Public ReadOnly Property Name As String
   Overridable Public ReadOnly Property NativeName As String
   Overridable Public Property NumberFormat As NumberFormatInfo
   Overridable Public ReadOnly Property OptionalCalendars As Calendar(
        )
   Overridable Public ReadOnly Property Parent As CultureInfo
   Overridable Public ReadOnly Property TextInfo As TextInfo
   Overridable Public ReadOnly Property ThreeLetterISOLanguageName As Str
   Overridable Public ReadOnly Property ThreeLetterWindowsLanguageName As
   Overridable Public ReadOnly Property TwoLetterISOLanguageName As Strin
   Public ReadOnly Property UseUserOverride As Boolean
' Public Shared Methods
   Public Shared Function CreateSpecificCulture(
        ByVal name As String) As CultureInfo
   Public Shared Function GetCultures(
        ByVal types As CultureTypes) As CultureInfo()
   Public Shared Function ReadOnly(
        ByVal ci As CultureInfo) As CultureInfo
' Public Instance Methods
   Public Sub ClearCachedData()
   Overridable Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Overrides Public Function Equals(
```

```
      ByVal value As Object) As Boolean
   Overridable Public Function GetFormat(
      ByVal formatType As Type) As Object Implements IFormatProvider.Ge
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Class
```

## Returned By

System.Reflection.AssemblyName.CultureInfo, System.Threading.Thread.{CurrentCulture, CurrentUICulture}

## Passed To

Multiple types

## CultureTypes Enum

## System.Globalization (mscorlib.dll) *serializable, flag*

The values of this enumeration determine which cultures are returned by `CultureInfo.GetCultures()`. `NeutralCultures` specifies language-specific cultures without any regional or country association. `SpecificCultures` specifies cultures that are identified by both language and region.

```
Public Enum CultureTypes

   NeutralCultures = &H000000001

   SpecificCultures = &H000000002

   InstalledWin32Cultures = &H000000004

   AllCultures = &H000000007

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `CultureTypes`

### Passed To

`CultureInfo.GetCultures()`

## DateTimeFormatInfo NotInheritable Class

## System.Globalization (mscorlib.dll) *ECMA, serializable*

This class defines how `DateTime` values are formatted for a culture. Several standard patterns are default property values. These standard patterns are designated by a format character. The format a shortcut to specify the format of a `DateTime` with the `ToString()` method. You can create custo a set of format pattern characters. These characters represent different styles of day and time repre allow you to build customized pattern strings. To create custom patterns, first you need to construct instance of `DateTimeFormatInfo` by using its constructor. Use `InvariantInfo` to fetch a cultur read-only instance of this class.

```
Public NotInheritable Class DateTimeFormatInfo : Implements ICloneable, I

' Public Constructors

   Public Sub New()

' Public Shared Properties

   Public Shared ReadOnly Property CurrentInfo As DateTimeFormatInfo

   Public Shared ReadOnly Property InvariantInfo As DateTimeFormatInfo

' Public Instance Properties

   Public Property AbbreviatedDayNames As String()

   Public Property AbbreviatedMonthNames As String()

   Public Property AMDesignator As String

   Public Property Calendar As Calendar

   Public Property CalendarWeekRule As CalendarWeekRule

   Public Property DateSeparator As String

   Public Property DayNames As String()

   Public Property FirstDayOfWeek As DayOfWeek

   Public Property FullDateTimePattern As String

   Public ReadOnly Property IsReadOnly As Boolean

   Public Property LongDatePattern As String

   Public Property LongTimePattern As String

   Public Property MonthDayPattern As String

   Public Property MonthNames As String()

   Public Property PMDesignator As String
```

```
   Public ReadOnly Property RFC1123Pattern As String
   Public Property ShortDatePattern As String
   Public Property ShortTimePattern As String
   Public ReadOnly Property SortableDateTimePattern As String
   Public Property TimeSeparator As String
   Public ReadOnly Property UniversalSortableDateTimePattern As String
   Public Property YearMonthPattern As String
' Public Shared Methods
   Public Shared Function GetInstance(
        ByVal provider As IFormatProvider) As DateTimeFormatInfo
   Public Shared Function ReadOnly(
        ByVal dtfi As DateTimeFormatInfo) As DateTimeFormatInfo
' Public Instance Methods
   Public Function Clone(
        ) As Object Implements ICloneable.Clone
   Public Function GetAbbreviatedDayName(
        ByVal dayofweek As DayOfWeek) As String
   Public Function GetAbbreviatedEraName(
        ByVal era As Integer) As String
   Public Function GetAbbreviatedMonthName(
        ByVal month As Integer) As String
   Public Function GetAllDateTimePatterns() As String()
   Public Function GetAllDateTimePatterns(
        ByVal format As Char) As String()
   Public Function GetDayName(
        ByVal dayofweek As DayOfWeek) As String
   Public Function GetEra(ByVal eraName As String) As Integer
   Public Function GetEraName(ByVal era As Integer) As String
   Public Function GetFormat(
        ByVal formatType As Type) As Object Implements IFormatProvider.Ge
   Public Function GetMonthName(
```

```
        ByVal month As Integer) As String
End Class
```

## Returned By

`CultureInfo.DateTimeFormat`

## Passed To

`CultureInfo.DateTimeFormat`

## DateTimeStyles Enum

### System.Globalization (mscorlib.dll) *ECMA, serializable, flag*

This enumeration provides several formatting options for the `DateTime.Parse()` and `DateTime.ParseExact()` methods to use. The values supplied mostly determine how whitespace is dealt with when a string is parsed into a `DateTime` value by `ParseExact()`. When the string is compared to a format pattern, some whitespace can be disregarded if it is not exactly aligned with the pattern. `Parse()` ignores whitespace by default, so `AdjustToUniversal` and `NoCurrentDateDefault` are the only relevant values for that method. If the string to parse does not include a date with `NoCurrentDateDefault`, its result is created with day, month, and year values all set to 1. The date and time are converted to coordinated universal time (UTC) with `AdjustToUniversal`.

```
Public Enum DateTimeStyles

   None = &H000000000

   AllowLeadingWhite = &H000000001

   AllowTrailingWhite = &H000000002

   AllowInnerWhite = &H000000004

   AllowWhiteSpaces = &H000000007

   NoCurrentDateDefault = &H000000008

   AdjustToUniversal = &H000000010

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `DateTimeStyles`

### Passed To

`System.DateTime.{Parse(), ParseExact()}`

## DaylightTime Class

### System.Globalization (mscorlib.dll) *serializable*

This setting defines when daylight saving time begins and ends. It uses three properties: `Start` is the time when daylight saving time begins; `End` is when standard time resumes; and `Delta` is the length of time (measured in ticks) that the clock is adjusted from standard time during this period. `Delta` is a `System.TimeSpan` value measured in "ticks" or 100 nanosecond periods.

```
Public Class DaylightTime

' Public Constructors

   Public Sub New(ByVal start As Date, ByVal end As Date,

        ByVal delta As TimeSpan)

' Public Instance Properties

   Public ReadOnly Property Delta As TimeSpan

   Public ReadOnly Property End As Date

   Public ReadOnly Property Start As Date

End Class
```

### Returned By

`System.TimeZone.GetDaylightChanges()`

### Passed To

`System.TimeZone.IsDaylightSavingTime()`

## GregorianCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This class implements the standard Western calendar, and also the default culture-invariant calendar. It defines two eras (B.C./B.C.E. and A.D./C.E.), 12 months per year. A leap year occurs every four years except for years divisible by 100. However, years divisible by 400 are leap years. Only the current era (A.D./C.E.) is recognized by .NET's implementation of the Gregorian calendar.

```
Public Class GregorianCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal type As GregorianCalendarTypes)

' Public Shared Fields

   Public const ADEra As Integer                                  // =1

' Public Instance Properties

   Overridable Public Property CalendarType As GregorianCalendarTypes

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddWeeks(ByVal time As Date,

        ByVal weeks As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(
```

```
      ByVal year As Integer, ByVal month As Integer,
      ByVal era As Integer) As Integer
Overrides Public Function GetDaysInYear(
      ByVal year As Integer,
      ByVal era As Integer) As Integer
Overrides Public Function GetEra(
      ByVal time As Date) As Integer
Overrides Public Function GetMonth(
      ByVal time As Date) As Integer
Overrides Public Function GetMonthsInYear(
      ByVal year As Integer,
      ByVal era As Integer) As Integer
Overrides Public Function GetYear(
      ByVal time As Date) As Integer
Overrides Public Function IsLeapDay(ByVal year As Integer,
      ByVal month As Integer, ByVal day As Integer,
      ByVal era As Integer) As Boolean
Overrides Public Function IsLeapMonth(
      ByVal year As Integer, ByVal month As Integer,
      ByVal era As Integer) As Boolean
Overrides Public Function IsLeapYear(ByVal year As Integer,
      ByVal era As Integer) As Boolean
Overrides Public Function ToDateTime(ByVal year As Integer,
      ByVal month As Integer, ByVal day As Integer,
      ByVal hour As Integer, ByVal minute As Integer,
      ByVal second As Integer,
      ByVal millisecond As Integer,
      ByVal era As Integer) As Date
Overrides Public Function ToFourDigitYear(
```

```
        ByVal year As Integer) As Integer
End Class
```

## Hierarchy

System.Object → Calendar → GregorianCalendar

## GregorianCalendarTypes Enum

## System.Globalization (mscorlib.dll) *serializable*

This enumeration specifies some language-specific variations of the Gregorian calendar that can be set with the `GregorianCalendar.CalendarType` property.

```
Public Enum GregorianCalendarTypes

   Localized = 1

   USEnglish = 2

   MiddleEastFrench = 9

   Arabic = 10

   TransliteratedEnglish = 11

   TransliteratedFrench = 12

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `GregorianCalendarTypes`

### Returned By

`GregorianCalendar.CalendarType`

### Passed To

`GregorianCalendar.{CalendarType, GregorianCalendar()}`

## HebrewCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This calendar class implements the Hebrew calendar. This complicated calendar determines leap years within a 19-year cycle. The 3rd, 6th, 8th, 11th, 14th, 17th, and 19th years are leap years. Regular years have 12 months and between 353 to 355 days, leap years have 13 months and between 383 to 385 days; the variance is determined by the placement of Jewish holidays. This implementation recognizes the years 5343 to 6000 (A.M.), which is equivalent to the Gregorian years 1582 to 2240.

```
Public Class HebrewCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly HebrewEra As Integer                        // =1

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(
```

```
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetEra(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

### Hierarchy

System.Object → Calendar → HebrewCalendar

## HijriCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This calendar class implements the Islamic Hijri calendar. This calendar is based from the time of Mohammed's migration from Mecca (denoted as A.H.). Regular years have 12 months and 354 days. Leap years have 355 days. Leap years are calculated in 30-year cycles, occurring in the 2nd, 5th, 7th, 10th, 13th, 16th, 18th, 21st, 24th, 26th, and 29th years.

```
Public Class HijriCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly HijriEra As Integer                            // =1

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(
```

```
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetEra(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

### Hierarchy

System.Object → Calendar → HijriCalendar

# JapaneseCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This calendar class implements the Japanese or Wareki calendar. This calendar follows the same rules and settings as the Gregorian calendar, except that it is divided into eras based on the reign of each Japanese Emperor.

```
Public Class JapaneseCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(

        ByVal year As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetEra(
```

```
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

## Hierarchy

System.Object → Calendar → JapaneseCalendar

# JulianCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This calendar class implements the calendar created by a decree from Julius Caesar in 45 B.C.E. The calendar recognizes a leap year every four years without exception, but in all other respects is the same as the Gregorian calendar, which replaced it in 1582 C.E. Due to the difference in leap-year calculation, the Julian calendar is currently 12 days behind the Gregorian calendar.

```
Public Class JulianCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly JulianEra As Integer                          // =1

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(
```

```
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetEra(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

### Hierarchy

System.Object → Calendar → JulianCalendar

## KoreanCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This calendar class implements the Korean calendar. The Korean calendar is the same as the Gregorian calendar except that the eras are defined differently. 01 January, 2001 on the Gregorian calendar is 01 January, 4334 on the Korean calendar.

```
Public Class KoreanCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public const KoreanEra As Integer                                  // =1

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(
```

```
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetEra(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

### Hierarchy

System.Object → Calendar → KoreanCalendar

## NumberFormatInfo NotInheritable Class

## System.Globalization (mscorlib.dll) *ECMA, serializable*

This class defines how numbers are displayed according to culture and language. Formats for curre symbols and types of numeric formats, such as scientific and hexadecimal notations and their separ described by the properties of this class. As with `DateTimeFormatInfo`, a set of standard numeri predefined and specified by format characters.

The default property values apply to the invariant culture settings. The culture-specific `NumberForm` instance is retrieved by `CurrentInfo`, which is determined by the `CultureInfo` of the current thr environment.

```
Public NotInheritable Class NumberFormatInfo : Implements ICloneable, IFo

' Public Constructors

   Public Sub New()

' Public Shared Properties

   Public Shared ReadOnly Property CurrentInfo As NumberFormatInfo

   Public Shared ReadOnly Property InvariantInfo As NumberFormatInfo

' Public Instance Properties

   Public Property CurrencyDecimalDigits As Integer

   Public Property CurrencyDecimalSeparator As String

   Public Property CurrencyGroupSeparator As String

   Public Property CurrencyGroupSizes As Integer()

   Public Property CurrencyNegativePattern As Integer

   Public Property CurrencyPositivePattern As Integer

   Public Property CurrencySymbol As String

   Public ReadOnly Property IsReadOnly As Boolean

   Public Property NaNSymbol As String

   Public Property NegativeInfinitySymbol As String

   Public Property NegativeSign As String

   Public Property NumberDecimalDigits As Integer

   Public Property NumberDecimalSeparator As String

   Public Property NumberGroupSeparator As String

   Public Property NumberGroupSizes As Integer()
```

```
    Public Property NumberNegativePattern As Integer
    Public Property PercentDecimalDigits As Integer
    Public Property PercentDecimalSeparator As String
    Public Property PercentGroupSeparator As String
    Public Property PercentGroupSizes As Integer()
    Public Property PercentNegativePattern As Integer
    Public Property PercentPositivePattern As Integer
    Public Property PercentSymbol As String
    Public Property PerMilleSymbol As String
    Public Property PositiveInfinitySymbol As String
    Public Property PositiveSign As String
' Public Shared Methods
    Public Shared Function GetInstance(
         ByVal formatProvider As IFormatProvider) As NumberFormatInfo
    Public Shared Function ReadOnly(
         ByVal nfi As NumberFormatInfo) As NumberFormatInfo
' Public Instance Methods
    Public Function Clone(
         ) As Object Implements ICloneable.Clone
    Public Function GetFormat(
         ByVal formatType As Type) As Object Implements IFormatProvider.Ge
End Class
```

### Returned By

CultureInfo.NumberFormat

### Passed To

CultureInfo.NumberFormat

## NumberStyles Enum

## System.Globalization (mscorlib.dll) *ECMA, serializable, flag*

This enumeration specifies a number of style rules that may be used when a numeric type uses the `Parse()` method to convert a string into a number.

```
Public Enum NumberStyles

   None = &H000000000

   AllowLeadingWhite = &H000000001

   AllowTrailingWhite = &H000000002

   AllowLeadingSign = &H000000004

   Integer = &H000000007

   AllowTrailingSign = &H000000008

   AllowParentheses = &H000000010

   AllowDecimalPoint = &H000000020

   AllowThousands = &H000000040

   Number = &H00000006F

   AllowExponent = &H000000080

   Float = &H0000000A7

   AllowCurrencySymbol = &H000000100

   Currency = &H00000017F

   Any = &H0000001FF

   AllowHexSpecifier = &H000000200

   HexNumber = &H000000203

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `NumberStyles`

### Passed To

`System.Byte.Parse()`, `System.Decimal.Parse()`, `System.Double.{Parse()`, TryParse()}, System.Int16.Parse(), System.Int32.Parse(), System.Int64.Parse(), System.SByte.Parse(), System.Single.Parse(), System.UInt16.Parse(), System.UInt32.Parse(), System.UInt64.Parse()

## RegionInfo Class

### System.Globalization (mscorlib.dll) *serializable*

This class contains properties for the selected region or country settings. It stores information on the
and standard letter codes for the region, the currency symbol, and whether the metric system is use
The region names are the two- and three-letter codes defined in ISO 3166. Currency strings are def
ISO 4217.

```
Public Class RegionInfo

' Public Constructors

   Public Sub New( ByVal culture As Integer)

   Public Sub New( ByVal name As String)

' Public Shared Properties

   Public Shared ReadOnly Property CurrentRegion As RegionInfo

' Public Instance Properties

   Overridable Public ReadOnly Property CurrencySymbol As String

   Overridable Public ReadOnly Property DisplayName As String

   Overridable Public ReadOnly Property EnglishName As String

   Overridable Public ReadOnly Property IsMetric As Boolean

   Overridable Public ReadOnly Property ISOCurrencySymbol As String

   Overridable Public ReadOnly Property Name As String

   Overridable Public ReadOnly Property ThreeLetterISORegionName As Strin

   Overridable Public ReadOnly Property ThreeLetterWindowsRegionName As S

   Overridable Public ReadOnly Property TwoLetterISORegionName As String

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal value As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String

End Class
```

# SortKey Class

## System.Globalization (mscorlib.dll) *serializable*

This class represents a set of weighted classifications used to sort individual elements of a string.

```
Public Class SortKey
' Public Instance Properties
   Overridable Public ReadOnly Property KeyData As Byte()
   Overridable Public ReadOnly Property OriginalString As String
' Public Shared Methods
   Public Shared Function Compare(ByVal sortkey1 As SortKey,
        ByVal sortkey2 As SortKey) As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal value As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Class
```

### Returned By

`CompareInfo.GetSortKey()`

## StringInfo Class

## System.Globalization (mscorlib.dll) *serializable*

This class allows you to manipulate a string by its individual elements. Each separately displayed character is considered a text element. This includes base characters and the Unicode-defined surrogate pairs and combining character sequences. The class provides enumeration of the elements in the string, as well as a means of further identifying combining characters. `ParseCombiningCharacters()` returns only the indexes of the base characters, high surrogates, and combined characters within a string.

```
Public Class StringInfo
' Public Constructors
   Public Sub New()
' Public Shared Methods
   Public Shared Function GetNextTextElement(
        ByVal str As String) As String
   Public Shared Function GetNextTextElement(
        ByVal str As String,
        ByVal index As Integer) As String
   Public Shared Function GetTextElementEnumerator(
        ByVal str As String) As TextElementEnumerator
   Public Shared Function GetTextElementEnumerator(
        ByVal str As String,
        ByVal index As Integer) As TextElementEnumerator
   Public Shared Function ParseCombiningCharacters(
        ByVal str As String) As Integer()
End Class
```

## TaiwanCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This class implements the Taiwanese calendar. This calendar works like the Gregorian calendar, except for difference in the year and era. 2001 in the Gregorian calendar is the year 90 in the Taiwanese calendar.

```
Public Class TaiwanCalendar : Inherits Calendar
' Public Constructors
   Public Sub New()
' Public Instance Properties
   Overrides Public ReadOnly Property Eras As Integer()
   Overrides Public Property TwoDigitYearMax As Integer
' Public Instance Methods
   Overrides Public Function AddMonths(ByVal time As Date,
        ByVal months As Integer) As Date
   Overrides Public Function AddYears(ByVal time As Date,
        ByVal years As Integer) As Date
   Overrides Public Function GetDayOfMonth(
        ByVal time As Date) As Integer
   Overrides Public Function GetDayOfWeek(
        ByVal time As Date) As DayOfWeek
   Overrides Public Function GetDayOfYear(
        ByVal time As Date) As Integer
   Overrides Public Function GetDaysInMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Integer
   Overrides Public Function GetDaysInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
   Overrides Public Function GetEra(
```

```
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

## Hierarchy

System.Object → Calendar → TaiwanCalendar

# TextElementEnumerator Class

## System.Globalization (mscorlib.dll) *serializable*

This class provides enumeration for individual text elements in a string composed of complex characters. This enumerator is retrieved by `StringInfo.GetTextElementEnumerator()`.

```
Public Class TextElementEnumerator : Implements IEnumerator

' Public Instance Properties

   Public ReadOnly Property Current As Object Implements IEnumerator.Curre

   Public ReadOnly Property ElementIndex As Integer

' Public Instance Methods

   Public Function GetTextElement() As String

   Public Function MoveNext(

        ) As Boolean Implements IEnumerator.MoveNext

   Public Sub Reset() Implements IEnumerator.Reset

End Class
```

### Returned By

`StringInfo.GetTextElementEnumerator()`

## TextInfo Class

## System.Globalization (mscorlib.dll) *serializable*

This class is used to describe certain properties of the writing system in use by a culture. The prope specify system-specific and standardized code pages for text, as well as the `ListSeparator` strin invariant culture). `TextInfo` defines methods that determine casing semantics per culture. For exa returns the lowercase version of the specified character or string. The `ToTitleCase()` method ca letter of each word in a string.

```
Public Class TextInfo : Implements System.Runtime.Serialization.IDeserial

' Public Instance Properties

   Overridable Public ReadOnly Property ANSICodePage As Integer

   Overridable Public ReadOnly Property EBCDICCodePage As Integer

   Overridable Public ReadOnly Property ListSeparator As String

   Overridable Public ReadOnly Property MacCodePage As Integer

   Overridable Public ReadOnly Property OEMCodePage As Integer

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overridable Public Function ToLower(

        ByVal c As Char) As Char

   Overridable Public Function ToLower(

        ByVal str As String) As String

   Overrides Public Function ToString() As String

   Public Function ToTitleCase(ByVal str As String) As String

   Overridable Public Function ToUpper(

        ByVal c As Char) As Char

   Overridable Public Function ToUpper(

        ByVal str As String) As String

End Class
```

### Returned By

## ThaiBuddhistCalendar Class

## System.Globalization (mscorlib.dll) *serializable*

This class implements the Thai Buddhist calendar. This calendar works like the Gregorian calendar except for the year and era. 2001 in the Gregorian calendar is the year 2544 in the Thai Buddhist calendar.

```
Public Class ThaiBuddhistCalendar : Inherits Calendar

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public const ThaiBuddhistEra As Integer                          // =1

' Public Instance Properties

   Overrides Public ReadOnly Property Eras As Integer()

   Overrides Public Property TwoDigitYearMax As Integer

' Public Instance Methods

   Overrides Public Function AddMonths(ByVal time As Date,

        ByVal months As Integer) As Date

   Overrides Public Function AddYears(ByVal time As Date,

        ByVal years As Integer) As Date

   Overrides Public Function GetDayOfMonth(

        ByVal time As Date) As Integer

   Overrides Public Function GetDayOfWeek(

        ByVal time As Date) As DayOfWeek

   Overrides Public Function GetDayOfYear(

        ByVal time As Date) As Integer

   Overrides Public Function GetDaysInMonth(

        ByVal year As Integer, ByVal month As Integer,

        ByVal era As Integer) As Integer

   Overrides Public Function GetDaysInYear(
```

```
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetEra(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonth(
        ByVal time As Date) As Integer
    Overrides Public Function GetMonthsInYear(
        ByVal year As Integer,
        ByVal era As Integer) As Integer
    Overrides Public Function GetYear(
        ByVal time As Date) As Integer
    Overrides Public Function IsLeapDay(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapMonth(
        ByVal year As Integer, ByVal month As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function IsLeapYear(ByVal year As Integer,
        ByVal era As Integer) As Boolean
    Overrides Public Function ToDateTime(ByVal year As Integer,
        ByVal month As Integer, ByVal day As Integer,
        ByVal hour As Integer, ByVal minute As Integer,
        ByVal second As Integer,
        ByVal millisecond As Integer,
        ByVal era As Integer) As Date
    Overrides Public Function ToFourDigitYear(
        ByVal year As Integer) As Integer
End Class
```

## Hierarchy

System.Object → Calendar → ThaiBuddhistCalendar

## UnicodeCategory Enum

### System.Globalization (mscorlib.dll) *ECMA, serializable*

The values of this enumeration specify the specific category of a character defined by the Unicode standard. This enumeration supports the `System.Char` class in determining properties of Unicode characters such as case with regard to the `CultureInfo` setting.

```
Public Enum UnicodeCategory

   UppercaseLetter = 0

   LowercaseLetter = 1

   TitlecaseLetter = 2

   ModifierLetter = 3

   OtherLetter = 4

   NonSpacingMark = 5

   SpacingCombiningMark = 6

   EnclosingMark = 7

   DecimalDigitNumber = 8

   LetterNumber = 9

   OtherNumber = 10

   SpaceSeparator = 11

   LineSeparator = 12

   ParagraphSeparator = 13

   Control = 14

   Format = 15

   Surrogate = 16

   PrivateUse = 17

   ConnectorPunctuation = 18

   DashPunctuation = 19

   OpenPunctuation = 20

   ClosePunctuation = 21

   InitialQuotePunctuation = 22
```

```
    FinalQuotePunctuation = 23
    OtherPunctuation = 24
    MathSymbol = 25
    CurrencySymbol = 26
    ModifierSymbol = 27
    OtherSymbol = 28
    OtherNotAssigned = 29
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → UnicodeCategory

### Returned By

System.Char.GetUnicodeCategory()

# Chapter 9. System.IO

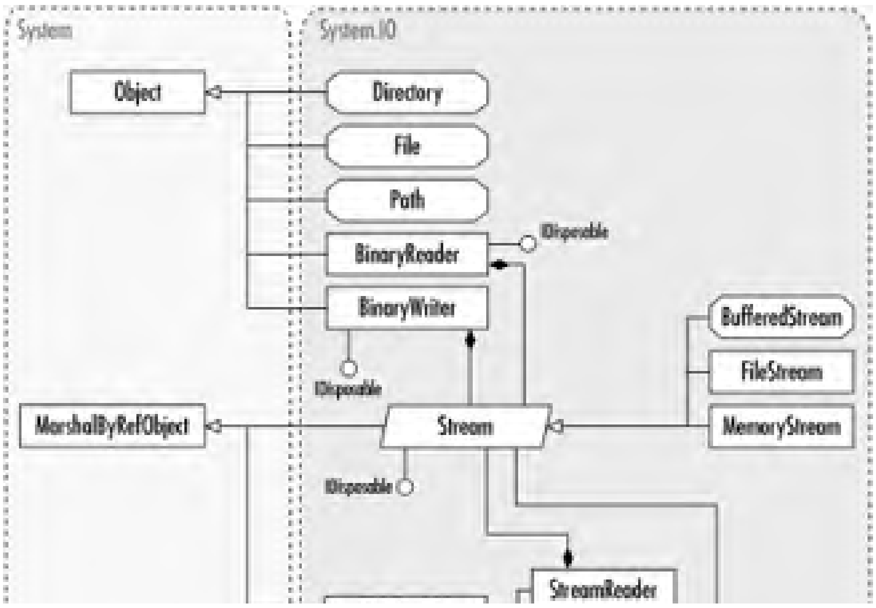
The `System.IO` types serve as the primary means for stream-oriented I/O — files, principally, although the MustInherit types defined here serve as base classes for other forms of I/O, such as the XML stack in `System.Xml`. The `System.IO` namespace is shown in Figure 9-1 and Figure 9-2.

The `System.IO` namespace can be seen as two distinct partitions: a set of utility types for using and working with the local machine's filesystem, and a protocol stack for working with bytestream-oriented input and output. The former partition is the collection of classes such as `Directory` and `FileSystemWatcher`, whereas the latter partition is the set of `Stream` and `Reader`/`Writer` types.

The `Stream` types in `System.IO` follow a basic object model, similar to the I/O model used by the C/C++ runtime library: all serial byte access is a stream, and there are different sources and sinks for this serialized byte data. In the `System.IO` package, this is represented directly by the MustInherit base type `Stream`; its concrete subtypes represent the actual I/O access: `FileStream` represents I/O to a file, and `MemoryStream` represents I/O to a literal array of bytes (whose size is dynamically managed) in memory. Other packages within the .NET Framework Class Library offer up their own `Stream`-derived types. For example, in the `System.Net` namespace, socket connections and HTTP responses are offered up as `Stream`-derived types, giving .NET programmers the ability to treat any sort of input or output data as "just a Stream."

Simply reading and writing to these streams is not enough of an abstraction, however. In particular, programmers often need to perform one of two sorts of I/O: binary I/O, which is writing actual binary representations of objects or data to disk, or text I/O, which is writing the textual representations of that data. These operations are fundamentally different — writing the text representation of the integer value 5 produces the literal text "5" within the stream, whereas writing the binary value generates the hex value 0x00000005 (represented as four bytes, 05 00 00 00, in the file). In the .NET libraries, because these types of I/O operations are different from one another, these operations are abstracted out into two sets of MustInherit base types. `BinaryReader` and `BinaryWriter` are for reading and writing binary values to streams, and `TextReader` and `TextWriter` are for reading and writing character-based data.

**Figure 9-1. The System.IO namespace**



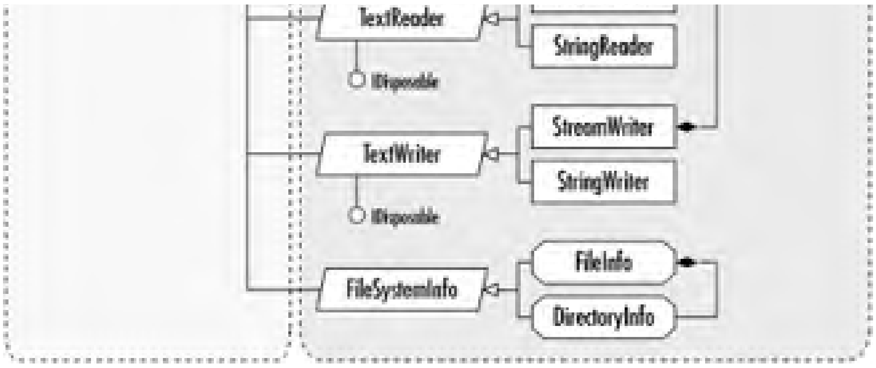
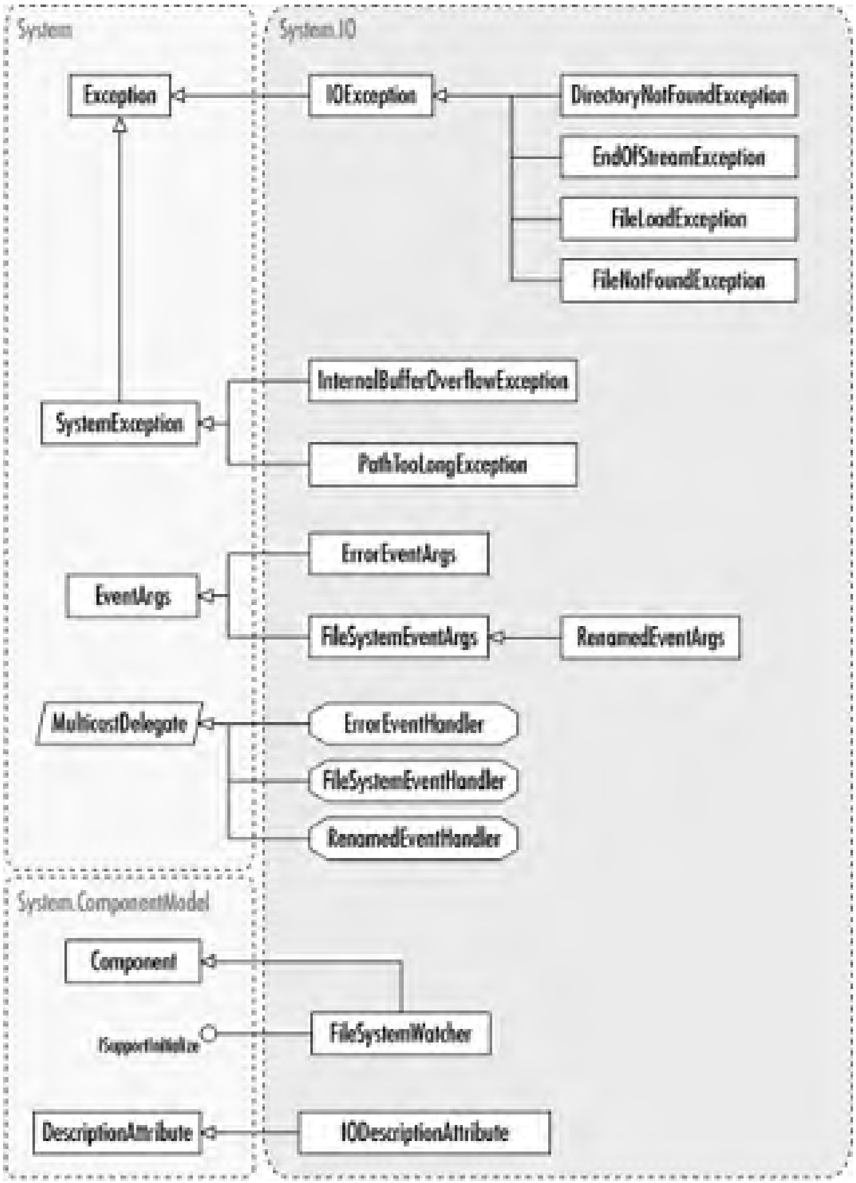



**Figure 9-2. Exceptions, delegates, event arguments, and components in the System.IO namespace**




Note that the `System.IO` namespace also offers some interesting stream-on-stream options. Like the Java `java.io` package, `Stream` types can layer on top of other `Stream` types to offer additional functionality — this is the Decorator pattern (from the Design Patterns book). The sole example of this in the `System.IO` namespace is the `BufferedStream`, which maintains a buffer on top of the Stream object passed to it in its constructor.

All of these types work together to provide some powerful abstraction and composite behaviors. For example, when working with random-access data, create a `BinaryReader` around a `BufferedStream`, which in turn wraps around a `FileStream`. If you decide later to store the random-access data in memory for optimization's sake, change the `BufferedStream`/`FileStream` pair to a `MemoryStream`. When reading a configuration file, choose to declare the `ReadConfiguration` method you have written to take an arbitrary `TextReader`, rather than ask for a string containing the filename. This allows for flexibility later — perhaps the configuration wants to be stored into a CLOB field in an RDBMS. Simply change the actual `Stream` instance passed into the `TextReader`, and start reading the configuration out of the RDBMS, off of a socket request, or out of the HTTP response sent to a web server. Similarly, when planning to extend the `System.IO` namespace's capabilities, try to follow this same model. If you want to add compression to save on a configuration file's size just build a `CompressingStream` that wraps another `Stream` in the manner `BufferedStream` does. If you want to have some interprocess communication with an existing "legacy" Win32 app (perhaps communicate over an NT Named Pipe), simply build a `NamedPipeStream`. In general, there is no particular reason to take specific derivatives of `Stream` as parameters — by limiting expected parameters to be of type `Stream`, .NET programmers can gain an incredible amount of flexibility regarding where and how data lives.

All this notwithstanding, certain programmatic tasks simply require access to the filesystem. The underlying filesystem is a hierarchical one, and there will be times there is simply no escaping that fact. For these tasks, the .NET `System.IO` namespace provides the filesystem types: `Directory`, `DirectoryInfo`, `File`, `FileInfo` and its associated enumerations, `FileSystemInfo`, `FileSystemWatcher`, and `Path` (finally, a class that understands directory paths in all their various incarnations!). These classes should be used for mostly "meta-file" operations (enumerating files, discovering attributes about a file, creating or destroying a directory, and so on) rather than for operations on the contents of the file (for which the `Stream`-based types described earlier are more appropriate).

## BinaryReader Class

## System.IO (mscorlib.dll) *disposable*

This class allows you to read data from a `Stream`. When using a `BinaryReader`, the data represented by a `Stream` is regarded as a binary format, and bits are merely read from the stream and copied into the appropriate types. The methods prefixed with `Read()` allow you to grab data of a specific type from the front of the `Stream` and advance the current position. The next table shows how many bytes each of these methods reads in from a stream.

| Method | Bytes read |
| --- | --- |
| `Read` | variable |
| `ReadBoolean` | 1 |
| `ReadByte` | 1 |
| `ReadBytes` | variable |
| `ReadChar` | 2 |
| `ReadChars` | variable |
| `ReadDecimal` | 16 |
| `ReadDouble` | 8 |
| `ReadInt16` | 2 |
| `ReadInt32` | 4 |
| `ReadInt64` | 8 |
| `ReadSByte` | 1 |
| `ReadSingle` | 4 |
| `ReadString` | variable |
| `ReadUInt16` | 2 |
| `ReadUInt32` | 4 |
| `ReadUInt64` | 8 |

`ReadString()` uses the current encoding of the `BinaryReader`, which can be set when you call the constructor. Strings are prefixed with their length. `PeekChar()` allows you to look at the first character of a stream (a `System.Char`, which is two bytes) without advancing the position of the `Stream`. Because a binary reader may hold on to resources that should be freed when not needed, the `BinaryReader` must be closed using `Close()` or by calling the protected `Dispose()` method to do the cleanup.

```
Public Class BinaryReader : Implements IDisposable

' Public Constructors

   Public Sub New( ByVal input As Stream)

   Public Sub New(ByVal input As Stream,
```

```
        ByVal encoding As System.Text.Encoding)
' Public Instance Properties
    Overridable Public ReadOnly Property BaseStream As Stream
' Public Instance Methods
    Overridable Public Sub Close()
    Overridable Public Function PeekChar() As Integer
    Overridable Public Function Read() As Integer
    Overridable Public Function Read(ByVal buffer As Byte(),
        ByVal index As Integer,
        ByVal count As Integer) As Integer
    Overridable Public Function Read(ByVal buffer As Char(),
        ByVal index As Integer,
        ByVal count As Integer) As Integer
    Overridable Public Function ReadBoolean() As Boolean
    Overridable Public Function ReadByte() As Byte
    Overridable Public Function ReadBytes(
        ByVal count As Integer) As Byte()
    Overridable Public Function ReadChar() As Char
    Overridable Public Function ReadChars(
        ByVal count As Integer) As Char()
    Overridable Public Function ReadDecimal() As Decimal
    Overridable Public Function ReadDouble() As Double
    Overridable Public Function ReadInt16() As Short
    Overridable Public Function ReadInt32() As Integer
    Overridable Public Function ReadInt64() As Long
    Overridable Public Function ReadSByte() As SByte
    Overridable Public Function ReadSingle() As Single
    Overridable Public Function ReadString() As String
    Overridable Public Function ReadUInt16() As UInt16
    Overridable Public Function ReadUInt32() As UInt32
```

```
   Overridable Public Function ReadUInt64() As UInt64
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overridable Protected Sub FillBuffer(
        ByVal numBytes As Integer)
   Protected Function Read7BitEncodedInt() As Integer
End Class
```

## BinaryWriter Class

### System.IO (mscorlib.dll) *serializable, disposable*

This class complements `BinaryReader`. To write binary data, simply call `Write()` and pass data method is overloaded for all "primitive types" (but not the generic `System.Object` type — that is tl `System.Runtime.Serialization` namespaces). Be aware, however, that because BinaryWrite destination of the data (the wrapped `Stream` object is) the data may be cached in a buffer somewh `BinaryWriter` and the sink. To ensure data is completely written, call the `Flush()` method. Whe `BinaryWriter` in a sensitive code area, consider placing it in a `using` block to ensure cleanup (in the `Stream` it wraps after flushing the data).

```
Public Class BinaryWriter : Implements IDisposable

' Public Constructors

   Public Sub New( ByVal output As Stream)

   Public Sub New(ByVal output As Stream,

        ByVal encoding As System.Text.Encoding)

' Protected Constructors

   Protected Sub New()

' Public Shared Fields

   Public Shared ReadOnly Null As BinaryWriter                    // =Syst

' Protected Instance Fields

   protected OutStream As Stream

' Public Instance Properties

   Overridable Public ReadOnly Property BaseStream As Stream

' Public Instance Methods

   Overridable Public Sub Close()

   Overridable Public Sub Flush()

   Overridable Public Function Seek(ByVal offset As Integer,

        ByVal origin As SeekOrigin) As Long

   Overridable Public Sub Write( ByVal value As Boolean)

   Overridable Public Sub Write( ByVal value As Byte)

   Overridable Public Sub Write( ByVal buffer As Byte())

   Overridable Public Sub Write(ByVal buffer As Byte(),
```

```
        ByVal index As Integer, ByVal count As Integer)
   Overridable Public Sub Write( ByVal ch As Char)
   Overridable Public Sub Write( ByVal chars As Char())
   Overridable Public Sub Write(ByVal chars As Char(),
        ByVal index As Integer, ByVal count As Integer)
   Overridable Public Sub Write( ByVal value As Decimal)
   Overridable Public Sub Write( ByVal value As Double)
   Overridable Public Sub Write( ByVal value As Short)
   Overridable Public Sub Write( ByVal value As Integer)
   Overridable Public Sub Write( ByVal value As Long)
   Overridable Public Sub Write( ByVal value As SByte)
   Overridable Public Sub Write( ByVal value As Single)
   Overridable Public Sub Write( ByVal value As String)
   Overridable Public Sub Write( ByVal value As UInt16)
   Overridable Public Sub Write( ByVal value As UInt32)
   Overridable Public Sub Write( ByVal value As UInt64)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Protected Sub Write7BitEncodedInt( ByVal value As Integer)
End Class
```

## BufferedStream NotInheritable Class

### System.IO (mscorlib.dll) *marshal by reference, disposable*

These buffers read and write operations to a stream. Because the I/O devices are usually the slowest part of the machine, it usually makes sense to write larger amounts of data at a time, so buffering can improve I/O performance dramatically.

Note that many of the `Stream`-based types automatically buffer data or represent resources that also buffer data, not only in the `System.IO` namespace, but also in other namespaces. For example, the filesystem usually has several buffers in place at various levels. This type, however, offers some optimization capabilities, since data won't be sent to the underlying `Stream` until this object's buffer is full. This can help with accidental flushing in the middle of sensitive operations, such as a tightly executing loop.

```
Public NotInheritable Class BufferedStream : Inherits Stream

' Public Constructors

   Public Sub New( ByVal stream As Stream)

   Public Sub New(ByVal stream As Stream,

        ByVal bufferSize As Integer)

' Public Instance Properties

   Overrides Public ReadOnly Property CanRead As Boolean

   Overrides Public ReadOnly Property CanSeek As Boolean

   Overrides Public ReadOnly Property CanWrite As Boolean

   Overrides Public ReadOnly Property Length As Long

   Overrides Public Property Position As Long

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Sub Flush()

   Overrides Public Function Read(ByRef array As Byte(),

        ByVal offset As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function ReadByte() As Integer

   Overrides Public Function Seek(ByVal offset As Long,

        ByVal origin As SeekOrigin) As Long

   Overrides Public Sub SetLength( ByVal value As Long)
```

```
   Overrides Public Sub Write(ByVal array As Byte(),
        ByVal offset As Integer, ByVal count As Integer)
   Overrides Public Sub WriteByte( ByVal value As Byte)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → Stream(System.IDisposable) → BufferedStream

## Directory NotInheritable Class

## System.IO (mscorlib.dll) *ECMA*

This class provides many shared methods for working with filesystem directories. Most of the methods behave as expected. `GetLogicalDrives()` returns an array of all of the drives of a system in the format "k:", in which "k" is the drive letter. `GetParent()` returns the parent path of the specified path, and `GetDirectoryRoot()` returns the root directory of the specified path.

```
Public NotInheritable Class Directory

' Public Shared Methods

   Public Shared Function CreateDirectory(

        ByVal path As String) As DirectoryInfo

   Public Shared Sub Delete( ByVal path As String)

   Public Shared Sub Delete(ByVal path As String,

        ByVal recursive As Boolean)

   Public Shared Function Exists(

        ByVal path As String) As Boolean

   Public Shared Function GetCreationTime(

        ByVal path As String) As Date

   Public Shared Function GetCurrentDirectory() As String

   Public Shared Function GetDirectories(

        ByVal path As String) As String()

   Public Shared Function GetDirectories(ByVal path As String,

        ByVal searchPattern As String) As String()

   Public Shared Function GetDirectoryRoot(

        ByVal path As String) As String

   Public Shared Function GetFiles(

        ByVal path As String) As String()

   Public Shared Function GetFiles(ByVal path As String,

        ByVal searchPattern As String) As String()

   Public Shared Function GetFileSystemEntries(
```

```
        ByVal path As String) As String()
    Public Shared Function GetFileSystemEntries(
        ByVal path As String,
        ByVal searchPattern As String) As String()
    Public Shared Function GetLastAccessTime(
        ByVal path As String) As Date
    Public Shared Function GetLastWriteTime(
        ByVal path As String) As Date
    Public Shared Function GetLogicalDrives() As String()
    Public Shared Function GetParent(
        ByVal path As String) As DirectoryInfo
    Public Shared Sub Move(ByVal sourceDirName As String,
        ByVal destDirName As String)
    Public Shared Sub SetCreationTime(ByVal path As String,
        ByVal creationTime As Date)
    Public Shared Sub SetCurrentDirectory(ByVal path As String)
    Public Shared Sub SetLastAccessTime(ByVal path As String,
        ByVal lastAccessTime As Date)
    Public Shared Sub SetLastWriteTime(ByVal path As String,
        ByVal lastWriteTime As Date)
End Class
```

## DirectoryInfo NotInheritable Class

## System.IO (mscorlib.dll) *serializable, marshal by reference*

This class provides the same functionality as `Directory`, but in a strongly typed, object-oriented manner. An instance of this type represents a single directory. This class extends `FileSystemInfo` and implements all its methods. In addition, it adds `Parent` and `Root` properties to return the parent and root directories, respectively. Similarly, it also supplies `GetDirectories()` and `GetFiles()`, to retrieve its subdirectories and files, as well as `GetFileSystemInfos()`, which returns both the files and subdirectories contained by the current directory. `MoveTo()` allows you to move a directory from one place to another.

Given the similarity between this type and the `Directory` type, it may not be clear when one should be used in place of the other. The key difference is the `Directory` class is a collection of shared utility functions, whereas a `DirectoryInfo` object is an actual object, maintaining state and identity in the classic style of all objects. (In fact, the `DirectoryInfo` methods often map over to use the corresponding `Directory` methods.)

```
Public NotInheritable Class DirectoryInfo : Inherits FileSystemInfo

' Public Constructors

   Public Sub New( ByVal path As String)

' Public Instance Properties

   Overrides Public ReadOnly Property Exists As Boolean

   Overrides Public ReadOnly Property Name As String

   Public ReadOnly Property Parent As DirectoryInfo

   Public ReadOnly Property Root As DirectoryInfo

' Public Instance Methods

   Public Sub Create()

   Public Function CreateSubdirectory(

        ByVal path As String) As DirectoryInfo

   Overrides Public Sub Delete()

   Public Sub Delete( ByVal recursive As Boolean)

   Public Function GetDirectories() As DirectoryInfo()

   Public Function GetDirectories(

        ByVal searchPattern As String) As DirectoryInfo()

   Public Function GetFiles() As FileInfo()

   Public Function GetFiles(
```

```
        ByVal searchPattern As String) As FileInfo()
    Public Function GetFileSystemInfos() As FileSystemInfo()
    Public Function GetFileSystemInfos(
        ByVal searchPattern As String) As FileSystemInfo()
    Public Sub MoveTo( ByVal destDirName As String)
    Overrides Public Function ToString() As String
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → FileSystemInfo → DirectoryInfo

## Returned By

Directory.{CreateDirectory(),GetParent()},FileInfo.Directory

## DirectoryNotFoundException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This exception is thrown if you attempt to access a directory that does not exist.

```
Public Class DirectoryNotFoundException : Inherits IOException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException → DirectoryNotFoundException

# EndOfStreamException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This exception is thrown if you attempt to read data from a stream at its end position.

```
Public Class EndOfStreamException : Inherits IOException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException → EndOfStreamException

# ErrorEventArgs Class

## System.IO (system.dll)

This type defines the event arguments that are passed when a `FileSystemWatcher.Error` event occurs. It contains the exception that was raised by the error, which you can access by calling `GetException()`.

```
Public Class ErrorEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal exception As Exception)

' Public Instance Methods

   Overridable Public Function GetException() As Exception

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `ErrorEventArgs`

### Passed To

`ErrorEventHandler.{BeginInvoke(),Invoke()},FileSystemWatcher.OnError()`

## ErrorEventHandler Delegate

## System.IO (system.dll) *serializable*

This is a delegate for the `FileSystemWatcher.Error` event.

```
Public Delegate Sub ErrorEventHandler(
        ByVal sender As Object, ByVal e As ErrorEventArgs)
```

### Associated Events

`FileSystemWatcher.Error()`

## File NotInheritable Class

### System.IO (mscorlib.dll) *ECMA*

Like the `Directory` type, this type offers a collection of shared utility methods for working with files on the filesystem. In most cases, these methods are simply shortcuts for working with the `System.IO` types directly; for example, the `AppendText()` method returns a `StreamWriter` that can append text to the file specified in the `path` argument. This could be accomplished just as easily by creating a `StreamWriter` around a `FileStream` opened to the same file, with the `FileMode.Append` flag passed into the constructor.

That stated, there are methods on this type that aren't available through the `Stream`-based API. For example, the file's creation time, last-accessed time, last-modified times, and attributes, are all available via this type, whereas no such corresponding call exists on the `Stream` type.

```
Public NotInheritable Class File

' Public Shared Methods

   Public Shared Function AppendText(
        ByVal path As String) As StreamWriter
   Public Shared Sub Copy(ByVal sourceFileName As String,
        ByVal destFileName As String)
   Public Shared Sub Copy(ByVal sourceFileName As String,
        ByVal destFileName As String,
        ByVal overwrite As Boolean)
   Public Shared Function Create(
        ByVal path As String) As FileStream
   Public Shared Function Create(ByVal path As String,
        ByVal bufferSize As Integer) As FileStream
   Public Shared Function CreateText(
        ByVal path As String) As StreamWriter
   Public Shared Sub Delete( ByVal path As String)
   Public Shared Function Exists(
        ByVal path As String) As Boolean
   Public Shared Function GetAttributes(
        ByVal path As String) As FileAttributes
   Public Shared Function GetCreationTime(
```

```
        ByVal path As String) As Date
    Public Shared Function GetLastAccessTime(
        ByVal path As String) As Date
    Public Shared Function GetLastWriteTime(
        ByVal path As String) As Date
    Public Shared Sub Move(ByVal sourceFileName As String,
        ByVal destFileName As String)
    Public Shared Function Open(ByVal path As String,
        ByVal mode As FileMode) As FileStream
    Public Shared Function Open(ByVal path As String,
        ByVal mode As FileMode,
        ByVal access As FileAccess) As FileStream
    Public Shared Function Open(ByVal path As String,
        ByVal mode As FileMode, ByVal access As FileAccess,
        ByVal share As FileShare) As FileStream
    Public Shared Function OpenRead(
        ByVal path As String) As FileStream
    Public Shared Function OpenText(
        ByVal path As String) As StreamReader
    Public Shared Function OpenWrite(
        ByVal path As String) As FileStream
    Public Shared Sub SetAttributes(ByVal path As String,
        ByVal fileAttributes As FileAttributes)
    Public Shared Sub SetCreationTime(ByVal path As String,
        ByVal creationTime As Date)
    Public Shared Sub SetLastAccessTime(ByVal path As String,
        ByVal lastAccessTime As Date)
    Public Shared Sub SetLastWriteTime(ByVal path As String,
        ByVal lastWriteTime As Date)
End Class
```

# FileAccess Enum

## System.IO (mscorlib.dll) *ECMA, serializable, flag*

This enumeration represents the various access levels a program can exercise on a file. Programs can either read, write, or do both.

```
Public Enum FileAccess
   Read = &H000000001
   Write = &H000000002
   ReadWrite = &H000000003
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → FileAccess

### Passed To

File.Open(), FileInfo.Open(), FileStream.FileStream(), System.IO.IsolatedStorage.IsolatedStorageFileStream.IsolatedStorageFileSt
System.Net.Sockets.NetworkStream.NetworkStream()

## FileAttributes Enum

## System.IO (mscorlib.dll) *serializable, flag*

This enumeration represents the various attributes a file can have in the .NET environment; many, if not most, of these attributes parallel the standard Win32 filesystem attributes of the same name.

```
Public Enum FileAttributes
   ReadOnly = &H000000001
   Hidden = &H000000002
   System = &H000000004
   Directory = &H000000010
   Archive = &H000000020
   Device = &H000000040
   Normal = &H000000080
   Temporary = &H000000100
   SparseFile = &H000000200
   ReparsePoint = &H000000400
   Compressed = &H000000800
   Offline = &H000001000
   NotContentIndexed = &H000002000
   Encrypted = &H000004000
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → FileAttributes

### Returned By

File.GetAttributes(), FileSystemInfo.Attributes

### Passed To

File.SetAttributes(), FileSystemInfo.Attributes

## FileInfo NotInheritable Class

## System.IO (mscorlib.dll) *serializable, marshal by reference*

Like the parallels between `Directory` and `DirectoryInfo`, this class offers an object-centric spin on the shared functions offered in the `File` type.

```
Public NotInheritable Class FileInfo : Inherits FileSystemInfo

' Public Constructors

   Public Sub New( ByVal fileName As String)

' Public Instance Properties

   Public ReadOnly Property Directory As DirectoryInfo

   Public ReadOnly Property DirectoryName As String

   Overrides Public ReadOnly Property Exists As Boolean

   Public ReadOnly Property Length As Long

   Overrides Public ReadOnly Property Name As String

' Public Instance Methods

   Public Function AppendText() As StreamWriter

   Public Function CopyTo(

        ByVal destFileName As String) As FileInfo

   Public Function CopyTo(ByVal destFileName As String,

        ByVal overwrite As Boolean) As FileInfo

   Public Function Create() As FileStream

   Public Function CreateText() As StreamWriter

   Overrides Public Sub Delete()

   Public Sub MoveTo( ByVal destFileName As String)

   Public Function Open(ByVal mode As FileMode) As FileStream

   Public Function Open(ByVal mode As FileMode,

        ByVal access As FileAccess) As FileStream

   Public Function Open(ByVal mode As FileMode,
```

```
        ByVal access As FileAccess,
        ByVal share As FileShare) As FileStream
   Public Function OpenRead() As FileStream
   Public Function OpenText() As StreamReader
   Public Function OpenWrite() As FileStream
   Overrides Public Function ToString() As String
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → FileSystemInfo → FileInfo

### Returned By

DirectoryInfo.GetFiles()

## FileLoadException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This exception is thrown when a file cannot be loaded.

```
Public Class FileLoadException : Inherits IOException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
   Public Sub New(ByVal message As String,
        ByVal fileName As String)
   Public Sub New(ByVal message As String,
        ByVal fileName As String, ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Public ReadOnly Property FileName As String
   Public ReadOnly Property FusionLog As String
   Overrides Public ReadOnly Property Message As String
' Public Instance Methods
   Overrides Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
   Overrides Public Function ToString() As String
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException → FileLoadException

 PREVIOUS NEXT

## FileMode Enum

## System.IO (mscorlib.dll) *ECMA, serializable*

This enumeration allows you to specify how you want to open a file. If you use `Create`, and the file exists, an `IOException` is thrown. If you use `CreateNew`, any file that currently exists is overwritte `OpenOrCreate` indicates that if a file already exists, it must be opened, otherwise, a new file must l created. Similarly, `Truncate` indicates that the file must be opened and all its data erased (writing t begins at the first byte in the file). `Append` indicates that the file must be opened and the "file positic to the end of the file (the opposite of Truncate).

```
Public Enum FileMode

   CreateNew = 1

   Create = 2

   Open = 3

   OpenOrCreate = 4

   Truncate = 5

   Append = 6

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `FileMode`

### Passed To

`File.Open(), FileInfo.Open(), FileStream.FileStream(), System.IO.IsolatedStorage.IsolatedStorageFileStream.IsolatedStorageFileSt`

## FileNotFoundException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you attempt to access a file that does not exist.

```
Public Class FileNotFoundException : Inherits IOException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

   Public Sub New(ByVal message As String,

        ByVal fileName As String)

   Public Sub New(ByVal message As String,

        ByVal fileName As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Public ReadOnly Property FileName As String

   Public ReadOnly Property FusionLog As String

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

   Overrides Public Function ToString() As String

End Class
```

## Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException → FileNotFoundException


◄ PREVIOUS NEXT ►

## FileShare Enum

## System.IO (mscorlib.dll) *ECMA, serializable, flag*

This enumeration defines how two different processes can access the same file. If one process is u: `ReadWrite` or `Write`, no other process can use the file. Similarly, if another process is using `Read` other processes can read from the file, but not write to it.

```
Public Enum FileShare
   None = &H000000000
   Read = &H000000001
   Write = &H000000002
   ReadWrite = &H000000003
   Inheritable = &H000000010
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `FileShare`

### Passed To

`File.Open()`, `FileInfo.Open()`, `FileStream.FileStream()`, `System.IO.IsolatedStorage.IsolatedStorageFileStream.IsolatedStorageFileSt`

# FileStream Class

**System.IO (mscorlib.dll)** ***ECMA, marshal by reference, disposable***

This class is the basic implementation of `Stream` for files. It implements `Stream`, and adds a few methods specifically for working with files. `Handle` allows you to grab the underlying system handle to the file resource. `IsAsync` tells you if the file was opened asynchronously or synchronously. If you want to prevent other processes from accessing parts (or all) of the file, call `Lock()`. Subsequently, to free the lock, call `Unlock()`.

Note that using the `Lock()` or `Unlock()` methods is not the same as using the `SyncLock` keyword in VB.NET. The `SyncLock` action locks only for this process, whereas the file-range locks used in the `Lock/Unlock` methods are implemented at the filesystem level and are therefore a cross-process mechanism.

```
Public Class FileStream : Inherits Stream

' Public Constructors

   Public Sub New(ByVal handle As IntPtr,

        ByVal access As FileAccess)

   Public Sub New(ByVal handle As IntPtr,

        ByVal access As FileAccess,

        ByVal ownsHandle As Boolean)

   Public Sub New(ByVal handle As IntPtr,

        ByVal access As FileAccess,

        ByVal ownsHandle As Boolean,

        ByVal bufferSize As Integer)

   Public Sub New(ByVal handle As IntPtr,

        ByVal access As FileAccess,

        ByVal ownsHandle As Boolean,

        ByVal bufferSize As Integer,

        ByVal isAsync As Boolean)

   Public Sub New(ByVal path As String,

        ByVal mode As FileMode)

   Public Sub New(ByVal path As String,

        ByVal mode As FileMode, ByVal access As FileAccess)

   Public Sub New(ByVal path As String,
```

```
        ByVal mode As FileMode, ByVal access As FileAccess,
        ByVal share As FileShare)
   Public Sub New(ByVal path As String,
        ByVal mode As FileMode, ByVal access As FileAccess,
        ByVal share As FileShare,
        ByVal bufferSize As Integer)
   Public Sub New(ByVal path As String,
        ByVal mode As FileMode, ByVal access As FileAccess,
        ByVal share As FileShare,
        ByVal bufferSize As Integer,
        ByVal useAsync As Boolean)
' Public Instance Properties
   Overrides Public ReadOnly Property CanRead As Boolean
   Overrides Public ReadOnly Property CanSeek As Boolean
   Overrides Public ReadOnly Property CanWrite As Boolean
   Overridable Public ReadOnly Property Handle As IntPtr
   Overridable Public ReadOnly Property IsAsync As Boolean
   Overrides Public ReadOnly Property Length As Long
   Public ReadOnly Property Name As String
   Overrides Public Property Position As Long
' Public Instance Methods
   Overrides Public Function BeginRead(ByVal array As Byte(),
        ByVal offset As Integer, ByVal numBytes As Integer,
        ByVal userCallback As AsyncCallback,
        ByVal stateObject As Object) As IAsyncResult
   Overrides Public Function BeginWrite(ByVal array As Byte(),
        ByVal offset As Integer, ByVal numBytes As Integer,
        ByVal userCallback As AsyncCallback,
        ByVal stateObject As Object) As IAsyncResult
   Overrides Public Sub Close()
   Overrides Public Function EndRead(
```

```
        ByVal asyncResult As IAsyncResult) As Integer
   Overrides Public Sub EndWrite(
        ByVal asyncResult As IAsyncResult)
   Overrides Public Sub Flush()
   Overridable Public Sub Lock(ByVal position As Long,
        ByVal length As Long)
   Overrides Public Function Read(ByRef array As Byte(),
        ByVal offset As Integer,
        ByVal count As Integer) As Integer
   Overrides Public Function ReadByte() As Integer
   Overrides Public Function Seek(ByVal offset As Long,
        ByVal origin As SeekOrigin) As Long
   Overrides Public Sub SetLength( ByVal value As Long)
   Overridable Public Sub Unlock(ByVal position As Long,
        ByVal length As Long)
   Overrides Public Sub Write(ByVal array As Byte(),
        ByVal offset As Integer, ByVal count As Integer)
   Overrides Public Sub WriteByte( ByVal value As Byte)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → Stream(System.IDisposable) → FileStream

### Subclasses

System.IO.IsolatedStorage.IsolatedStorageFileStream

### Returned By

`File.{Create(),Open(),OpenRead(),OpenWrite()},FileInfo.{Create(),Open(), OpenRead(),OpenWrite()},System.Reflection.Assembly.{GetFile(), GetFiles()}`

### Passed To

`System.Reflection.StrongNameKeyPair.StrongNameKeyPair()`

# FileSystemEventArgs Class

## System.IO (system.dll)

This class offers the arguments for a `FileSystemEventHandler`.

```
Public Class FileSystemEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New(ByVal changeType As WatcherChangeTypes,
        ByVal directory As String, ByVal name As String)

' Public Instance Properties

   Public ReadOnly Property ChangeType As WatcherChangeTypes

   Public ReadOnly Property FullPath As String

   Public ReadOnly Property Name As String

End Class
```

### Hierarchy

System.Object → System.EventArgs → FileSystemEventArgs

### Subclasses

RenamedEventArgs

### Passed To

FileSystemEventHandler.{BeginInvoke(),Invoke()},FileSystemWatcher.{OnChanged(),OnCreated(),OnDeleted()}

# FileSystemEventHandler Delegate

## System.IO (system.dll) *serializable*

This delegate is for the `FileSystemWatcher.Changed`, `FileSystemWatcher.Created`, and `FileSystemWatcher.Deleted` events.

```
Public Delegate Sub FileSystemEventHandler(
        ByVal sender As Object,
        ByVal e As FileSystemEventArgs)
```

### Associated Events

`FileSystemWatcher.{Changed(),Created(),Deleted()}`

## FileSystemInfo MustInherit Class

## System.IO (mscorlib.dll) *serializable, marshal by reference*

This serves as the base class for both `FileInfo` and `DirectoryInfo`, and allows access to the basic filesystem information relating to both.

```
Public MustInherit Class FileSystemInfo : Inherits MarshalByRefObject

' Protected Constructors

   Protected Sub New()

' Protected Instance Fields

   protected FullPath As String

   protected OriginalPath As String

' Public Instance Properties

   Public Property Attributes As FileAttributes

   Public Property CreationTime As Date

   MustInherit Public ReadOnly Property Exists As Boolean

   Public ReadOnly Property Extension As String

   Overridable Public ReadOnly Property FullName As String

   Public Property LastAccessTime As Date

   Public Property LastWriteTime As Date

   MustInherit Public ReadOnly Property Name As String

' Public Instance Methods

   MustInherit Public Sub Delete()

   Public Sub Refresh()

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `FileSystemInfo`

### Subclasses

`DirectoryInfo`, `FileInfo`

### Returned By

`DirectoryInfo.GetFileSystemInfos()`

## FileSystemWatcher Class

### System.IO (system.dll) *marshal by reference, disposable*

This class allows you to listen to the filesystem and respond to different operations on it. To register or directories, first set `Path` to the path you wish to watch. Next, set the `Filter` property. If you wa file changes, set it to an empty (`""`) string. To watch an individual file, set `Filter` to the filename. Y wildcards (such as `*`) in the filename. You must then also set `NotifyFilter` to register the types to be notified of. If you want to monitor the subdirectories as well, set `IncludeSubdirectories`. `EnableRaisingEvents` allows you to enable or disable the `FileSystemWatcher`. The watcher following events: `Changed`, `Created`, `Deleted`, `Disposed`, `Error` and `Renamed`. An `Error` is ra events occur on a filesystem for the watcher to correctly monitor it.

```
Public Class FileSystemWatcher : Inherits System.ComponentModel.Component

System.ComponentModel.ISupportInitialize

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal path As String)

   Public Sub New(ByVal path As String,

        ByVal filter As String)

' Public Instance Properties

   Public Property EnableRaisingEvents As Boolean

   Public Property Filter As String

   Public Property IncludeSubdirectories As Boolean

   Public Property InternalBufferSize As Integer

   Public Property NotifyFilter As NotifyFilters

   Public Property Path As String

   Overrides Public Property Site As ISite

   Public Property SynchronizingObject As ISynchronizeInvoke

' Public Instance Methods

   Public Sub BeginInit(

        ) Implements ISupportInitialize.BeginInit

   Public Sub EndInit() Implements ISupportInitialize.EndInit

   Public Function WaitForChanged(
```

```
        ByVal changeType As WatcherChangeTypes) As WaitForChangedResult
   Public Function WaitForChanged(
        ByVal changeType As WatcherChangeTypes,
        ByVal timeout As Integer) As WaitForChangedResult
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
   Protected Sub OnChanged( ByVal e As FileSystemEventArgs)
   Protected Sub OnCreated( ByVal e As FileSystemEventArgs)
   Protected Sub OnDeleted( ByVal e As FileSystemEventArgs)
   Protected Sub OnError( ByVal e As ErrorEventArgs)
   Protected Sub OnRenamed( ByVal e As RenamedEventArgs)
' Events
   Public Event Changed As FileSystemEventHandler
   Public Event Created As FileSystemEventHandler
   Public Event Deleted As FileSystemEventHandler
   Public Event Error As ErrorEventHandler
   Public Event Renamed As RenamedEventHandler
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject →
System.ComponentModel.Component(System.ComponentModel.IComponent, System.I
FileSystemWatcher(System.ComponentModel.ISupportInitialize)

# InternalBufferOverflowException Class

## System.IO (system.dll) *serializable*

This exception is passed by a `FileSystemWatcher.Error` event. This occurs when the internal buffer of a `FileSystemWatcher` overflows because too many events have occurred.

```
Public Class InternalBufferOverflowException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → InternalBufferOverflowException

# IODescriptionAttribute Class

## System.IO (system.dll)

This custom attribute describes an I/O property or event.

```
Public Class IODescriptionAttribute : Inherits System.ComponentModel.Desc
' Public Constructors
   Public Sub New( ByVal description As String)
' Public Instance Properties
   Overrides Public ReadOnly Property Description As String
End Class
```

### Hierarchy

System.Object → System.Attribute → System.ComponentModel.DescriptionAtt
IODescriptionAttribute

### Valid On

All

# IOException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This is the base class of all the I/O related exceptions.

```
Public Class IOException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

   Public Sub New(ByVal message As String,

        ByVal hresult As Integer)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException

### Subclasses

DirectoryNotFoundException, EndOfStreamException, FileLoadException, FileNotFoundException, PathTooLongException

## MemoryStream Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class is a stream that keeps its data in memory as opposed to on the disk (as a `FileStream` does). In addition to the `Stream` methods, `ToArray()` writes the entire stream to a byte array, and `WriteTo()` dumps the contents of this stream to a different one.

```
Public Class MemoryStream : Inherits Stream

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal buffer As Byte())

   Public Sub New(ByVal buffer As Byte(),

        ByVal writable As Boolean)

   Public Sub New(ByVal buffer As Byte(),

        ByVal index As Integer, ByVal count As Integer)

   Public Sub New(ByVal buffer As Byte(),

        ByVal index As Integer, ByVal count As Integer,

        ByVal writable As Boolean)

   Public Sub New(ByVal buffer As Byte(),

        ByVal index As Integer, ByVal count As Integer,

        ByVal writable As Boolean,

        ByVal publiclyVisible As Boolean)

   Public Sub New( ByVal capacity As Integer)

' Public Instance Properties

   Overrides Public ReadOnly Property CanRead As Boolean

   Overrides Public ReadOnly Property CanSeek As Boolean

   Overrides Public ReadOnly Property CanWrite As Boolean

   Overridable Public Property Capacity As Integer

   Overrides Public ReadOnly Property Length As Long

   Overrides Public Property Position As Long

' Public Instance Methods
```

```
    Overrides Public Sub Close()
    Overrides Public Sub Flush()
    Overridable Public Function GetBuffer() As Byte()
    Overrides Public Function Read(ByRef buffer As Byte(),
         ByVal offset As Integer,
         ByVal count As Integer) As Integer
    Overrides Public Function ReadByte() As Integer
    Overrides Public Function Seek(ByVal offset As Long,
         ByVal loc As SeekOrigin) As Long
    Overrides Public Sub SetLength( ByVal value As Long)
    Overridable Public Function ToArray() As Byte()
    Overrides Public Sub Write(ByVal buffer As Byte(),
         ByVal offset As Integer, ByVal count As Integer)
    Overrides Public Sub WriteByte( ByVal value As Byte)
    Overridable Public Sub WriteTo( ByVal stream As Stream)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → Stream(System.IDisposable) → MemoryStream

## NotifyFilters Enum

## System.IO (system.dll) *serializable, flag*

This type represents the different types of filesystem events you can use a `FileSystemWatcher` to look for. `NotifyFilters` allows you to indicate what kind of changes a `FileSystemWatcher` should respond to.

```
Public Enum NotifyFilters
   FileName = &H000000001
   DirectoryName = &H000000002
   Attributes = &H000000004
   Size = &H000000008
   LastWrite = &H000000010
   LastAccess = &H000000020
   CreationTime = &H000000040
   Security = &H000000100
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `NotifyFilters`

### Returned By

`FileSystemWatcher.NotifyFilter`

### Passed To

`FileSystemWatcher.NotifyFilter`

## Path NotInheritable Class

## System.IO (mscorlib.dll) *ECMA*

This class provides many shared methods for processing strings representing file paths in a platforr independent manner. The shared properties allow you to inspect the file conventions of the system the software is running. The shared methods supply an implementation of the frequently performed manipulations. `ChangeExtension()` allows you to change the extension of a file and `GetExtens` allows you to retrieve it. `Combine()` combines two file paths (the second argument cannot contain drive letter). `GetTempPath()` returns the current system temporary storage folder, and the infinitel `GetTempFileName()` creates a unique temporary filename, then creates a zero-byte file there. `IsPathRooted()` checks to see if a path contains a root, which can also be retrieved by calling `GetPathRoot()`.

```
Public NotInheritable Class Path

' Public Shared Fields

   Public Shared ReadOnly AltDirectorySeparatorChar As Char        // =&H00

   Public Shared ReadOnly DirectorySeparatorChar As Char           // =&H00

   Public Shared ReadOnly InvalidPathChars As Char()               // =Syst

   Public Shared ReadOnly PathSeparator As Char                    // =&H00

   Public Shared ReadOnly VolumeSeparatorChar As Char              // =&H00

' Public Shared Methods

   Public Shared Function ChangeExtension(

        ByVal path As String,

        ByVal extension As String) As String

   Public Shared Function Combine(ByVal path1 As String,

        ByVal path2 As String) As String

   Public Shared Function GetDirectoryName(

        ByVal path As String) As String

   Public Shared Function GetExtension(

        ByVal path As String) As String

   Public Shared Function GetFileName(

        ByVal path As String) As String

   Public Shared Function GetFileNameWithoutExtension(

        ByVal path As String) As String

   Public Shared Function GetFullPath(
```

```
        ByVal path As String) As String
    Public Shared Function GetPathRoot(
        ByVal path As String) As String
    Public Shared Function GetTempFileName() As String
    Public Shared Function GetTempPath() As String
    Public Shared Function HasExtension(
        ByVal path As String) As Boolean
    Public Shared Function IsPathRooted(
        ByVal path As String) As Boolean
End Class
```

## PathTooLongException Class

## System.IO (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you attempt to access or create a file with a name that is too long for the filesystem.

```
Public Class PathTooLongException : Inherits IOException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → IOException → PathTooLongException

# RenamedEventArgs Class

## System.IO (system.dll)

This type represents the arguments passed by a `FileSystemWatcher.Renamed` event.

```
Public Class RenamedEventArgs : Inherits FileSystemEventArgs

' Public Constructors

   Public Sub New(ByVal changeType As WatcherChangeTypes,
        ByVal directory As String, ByVal name As String,
        ByVal oldName As String)

' Public Instance Properties

   Public ReadOnly Property OldFullPath As String

   Public ReadOnly Property OldName As String

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `FileSystemEventArgs` → `RenamedEventArgs`

### Passed To

`FileSystemWatcher.OnRenamed()`, `RenamedEventHandler.{BeginInvoke(), Invoke()}`

# RenamedEventHandler Delegate

## System.IO (system.dll) *serializable*

This delegate is for the `FileSystemWatcher.Renamed` event.

```
Public Delegate Sub RenamedEventHandler(
        ByVal sender As Object,
        ByVal e As RenamedEventArgs)
```

### Associated Events

`FileSystemWatcher.Renamed()`

## SeekOrigin Enum

### System.IO (mscorlib.dll) *ECMA, serializable*

This enumeration is used by the `Stream.Seek()` method. You can specify that you want to seek either from the beginning with `Begin`, from the current position with `Current`, or end with `End`.

```
Public Enum SeekOrigin
    Begin = 0
    Current = 1
    End = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `SeekOrigin`

### Passed To

`BinaryWriter.Seek()`, `Stream.Seek()`

## Stream MustInherit Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class is the basic building block of I/O in the .NET Framework. Many types of application use a another. When calling `System.Console.WriteLine()`, you use a `TextWriter`, which contains design an ASP.NET application, the `System.Web.UI.Page` uses a `System.Net.Sockets.Netw` whenever you access a remote database server you are using a `NetworkStream`.

To determine whether a given `Stream` can read, write, or seek, check `CanRead`, `CanWrite`, or `Car` stream can seek, you may seek forward or backward using `Seek()`. `Length` reveals the length of t set by calling `SetLength()`, and `Position` allows you to check your current position in the strean

To perform asynchronous I/O, call `BeginRead()` or `BeginWrite()`. Notification of an asynchrono ways: either via an `System.AsyncCallback` delegate callback passed in as part of the `BeginRea` else by calling the `EndRead()` or `EndWrite()` method explicitly, which blocks the calling thread ur completes.

Streams usually hold on to a precious resource (a network connection or a file handle), which shoul needed any more. Because destruction is completely nondeterministic with garbage collection, be s of the `Stream`'s useful lifetime. (Alternatively, call `Dispose()` — which in turn calls `Close()` — wh Stream.)

```
Public MustInherit Class Stream : Inherits MarshalByRefObject : Implement:

' Protected Constructors

   Protected Sub New()

' Public Shared Fields

   Public Shared ReadOnly Null As Stream                         // =Syst

' Public Instance Properties

   MustInherit Public ReadOnly Property CanRead As Boolean

   MustInherit Public ReadOnly Property CanSeek As Boolean

   MustInherit Public ReadOnly Property CanWrite As Boolean

   MustInherit Public ReadOnly Property Length As Long

   MustInherit Public Property Position As Long

' Public Instance Methods

   Overridable Public Function BeginRead(
```

```
        ByVal buffer As Byte(), ByVal offset As Integer,
        ByVal count As Integer,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overridable Public Function BeginWrite(
        ByVal buffer As Byte(), ByVal offset As Integer,
        ByVal count As Integer,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overridable Public Sub Close()
   Overridable Public Function EndRead(
        ByVal asyncResult As IAsyncResult) As Integer
   Overridable Public Sub EndWrite(
        ByVal asyncResult As IAsyncResult)
   MustInherit Public Sub Flush()
   MustInherit Public Function Read(ByRef buffer As Byte(),
        ByVal offset As Integer,
        ByVal count As Integer) As Integer
   Overridable Public Function ReadByte() As Integer
   MustInherit Public Function Seek(ByVal offset As Long,
        ByVal origin As SeekOrigin) As Long
   MustInherit Public Sub SetLength( ByVal value As Long)
   MustInherit Public Sub Write(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal count As Integer)
   Overridable Public Sub WriteByte( ByVal value As Byte)
' Protected Instance Methods
   Overridable Protected Function CreateWaitHandle(
        ) As WaitHandle
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → Stream(System.IDisposable)

## Subclasses

BufferedStream, FileStream, MemoryStream, System.Net.Sockets.NetworkStream

## Returned By

Multiple types

## Passed To

Multiple types

## StreamReader Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class is an extension of a `TextReader` and provides implementations for all its methods. `Cur` the `StreamReader` is using. If you would like to discard the buffered data (so it isn't written to a dis `DiscardBufferedData()`.

This class is a quick way to open a file for reading. Simply call the constructor with a string containir reading from the file with methods such as `Read()`, `ReadLine()`, or `ReadToEnd()`.

```
Public Class StreamReader : Inherits TextReader

' Public Constructors

   Public Sub New( ByVal stream As Stream)

   Public Sub New(ByVal stream As Stream,

        ByVal detectEncodingFromByteOrderMarks As Boolean)

   Public Sub New(ByVal stream As Stream,

        ByVal encoding As System.Text.Encoding)

   Public Sub New(ByVal stream As Stream,

        ByVal encoding As System.Text.Encoding,

        ByVal detectEncodingFromByteOrderMarks As Boolean)

   Public Sub New(ByVal stream As Stream,

        ByVal encoding As System.Text.Encoding,

        ByVal detectEncodingFromByteOrderMarks As Boolean,

        ByVal bufferSize As Integer)

   Public Sub New( ByVal path As String)

   Public Sub New(ByVal path As String,

        ByVal detectEncodingFromByteOrderMarks As Boolean)

   Public Sub New(ByVal path As String,

        ByVal encoding As System.Text.Encoding)

   Public Sub New(ByVal path As String,

        ByVal encoding As System.Text.Encoding,

        ByVal detectEncodingFromByteOrderMarks As Boolean)

   Public Sub New(ByVal path As String,
```

```
        ByVal encoding As System.Text.Encoding,
        ByVal detectEncodingFromByteOrderMarks As Boolean,
        ByVal bufferSize As Integer)
' Public Shared Fields
   Public Shared ReadOnly Null As StreamReader                   // =Syst
' Public Instance Properties
   Overridable Public ReadOnly Property BaseStream As Stream
   Overridable Public ReadOnly Property CurrentEncoding As Encoding
' Public Instance Methods
   Overrides Public Sub Close()
   Public Sub DiscardBufferedData()
   Overrides Public Function Peek() As Integer
   Overrides Public Function Read() As Integer
   Overrides Public Function Read(ByRef buffer As Char(),
        ByVal index As Integer,
        ByVal count As Integer) As Integer
   Overrides Public Function ReadLine() As String
   Overrides Public Function ReadToEnd() As String
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → TextReader(System.IDisposab

### Returned By

System.Diagnostics.Process.{StandardError,StandardOutput},File.OpenText(),

## StreamWriter Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class implements `TextWriter` and provides all its methods. If you set the `AutoFlush` proper `Write()` or `WriteLine()` flushes the buffer.

This class is a quick way to open a file for writing. Call the constructor with a string containing the fil immediately begin writing to the file with `Write()` or `WriteLine()`.

```
Public Class StreamWriter : Inherits TextWriter

' Public Constructors

   Public Sub New( ByVal stream As Stream)

   Public Sub New(ByVal stream As Stream,

        ByVal encoding As System.Text.Encoding)

   Public Sub New(ByVal stream As Stream,

        ByVal encoding As System.Text.Encoding,

        ByVal bufferSize As Integer)

   Public Sub New( ByVal path As String)

   Public Sub New(ByVal path As String,

        ByVal append As Boolean)

   Public Sub New(ByVal path As String,

        ByVal append As Boolean,

        ByVal encoding As System.Text.Encoding)

   Public Sub New(ByVal path As String,

        ByVal append As Boolean,

        ByVal encoding As System.Text.Encoding,

        ByVal bufferSize As Integer)

' Public Shared Fields

   Public Shared ReadOnly Null As StreamWriter                    // =Syst

' Public Instance Properties

   Overridable Public Property AutoFlush As Boolean

   Overridable Public ReadOnly Property BaseStream As Stream
```

```
   Overrides Public ReadOnly Property Encoding As Encoding
' Public Instance Methods
   Overrides Public Sub Close()
   Overrides Public Sub Flush()
   Overrides Public Sub Write( ByVal value As Char)
   Overrides Public Sub Write( ByVal buffer As Char())
   Overrides Public Sub Write(ByVal buffer As Char(),
        ByVal index As Integer, ByVal count As Integer)
   Overrides Public Sub Write( ByVal value As String)
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → TextWriter(System.IDisposab
StreamWriter

## Returned By

System.Diagnostics.Process.StandardInput, File.{AppendText(), CreateText()},
{AppendText(), CreateText()}

# StringReader Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class implements `TextReader` and provides all its methods. It is useful when you would like to deal with a `System.String` in the same way you would work with a `TextReader`.

```
Public Class StringReader : Inherits TextReader

' Public Constructors

   Public Sub New( ByVal s As String)

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Function Peek() As Integer

   Overrides Public Function Read() As Integer

   Overrides Public Function Read(ByRef buffer As Char(),

        ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function ReadLine() As String

   Overrides Public Function ReadToEnd() As String

' Protected Instance Methods

   Overrides Protected Sub Dispose(ByVal disposing As Boolean)

End Class
```

## Hierarchy

`System.Object` → `System.MarshalByRefObject` → `TextReader(System.IDisposable)` → `StringReader`

# StringWriter Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class provides an alternative to using a `System.Text.StringBuilder` to create a string. This allows you to create a string in the exact same manner you would create a text file, which can be very useful. It implements all of the `TextWriter` methods.

```
Public Class StringWriter : Inherits TextWriter

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal formatProvider As IFormatProvider)

   Public Sub New( ByVal sb As System.Text.StringBuilder)

   Public Sub New(ByVal sb As System.Text.StringBuilder,

        ByVal formatProvider As IFormatProvider)

' Public Instance Properties

   Overrides Public ReadOnly Property Encoding As Encoding

' Public Instance Methods

   Overrides Public Sub Close()

   Overridable Public Function GetStringBuilder(

        ) As StringBuilder

   Overrides Public Function ToString() As String

   Overrides Public Sub Write( ByVal value As Char)

   Overrides Public Sub Write(ByVal buffer As Char(),

        ByVal index As Integer, ByVal count As Integer)

   Overrides Public Sub Write( ByVal value As String)

' Protected Instance Methods

   Overrides Protected Sub Dispose(ByVal disposing As Boolean)

End Class
```

## Hierarchy

`System.Object` → `System.MarshalByRefObject` →

## TextReader MustInherit Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class is optimized to read a stream of sequential characters. The `Read()` methods read data fi looks at the first character without advancing the position of an associated stream. If you need a thr `Synchronized()` to create a thread-safe copy of a `TextReader`.

```
Public MustInherit Class TextReader : Inherits MarshalByRefObject : Impleı
' Protected Constructors
   Protected Sub New()
' Public Shared Fields
   Public Shared ReadOnly Null As TextReader                       // =Syst
' Public Shared Methods
   Public Shared Function Synchronized(
        ByVal reader As TextReader) As TextReader
' Public Instance Methods
   Overridable Public Sub Close()
   Overridable Public Function Peek() As Integer
   Overridable Public Function Read() As Integer
   Overridable Public Function Read(ByRef buffer As Char(),
        ByVal index As Integer,
        ByVal count As Integer) As Integer
   Overridable Public Function ReadBlock(
        ByRef buffer As Char(), ByVal index As Integer,
        ByVal count As Integer) As Integer
   Overridable Public Function ReadLine() As String
   Overridable Public Function ReadToEnd() As String
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → TextReader(System.IDisposab

### Subclasses

StreamReader, StringReader

### Returned By

System.Console.In, System.Xml.XmlTextReader.GetRemainder()

### Passed To

System.Console.SetIn(), System.Xml.XmlDocument.Load(), System.Xml.XmlTextRea
System.Xml.XPath.XPathDocument.XPathDocument()

## TextWriter MustInherit Class

**System.IO (mscorlib.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class writes strings of characters to a stream. `Encoding` sets the encoding of the produced te formatting by setting `FormatProvider`. To change the newline character produced in your text, se stream, call either `Write()` or `WriteLine()`. To clear the current buffer of characters, use `Flush` free the resources in use by the `TextWriter`.

```
Public MustInherit Class TextWriter : Inherits MarshalByRefObject : Imple

' Protected Constructors

   Protected Sub New()

   Protected Sub New( ByVal formatProvider As IFormatProvider)

' Public Shared Fields

   Public Shared ReadOnly Null As TextWriter                    // =Syst

' Protected Instance Fields

   protected CoreNewLine As Char()

' Public Instance Properties

   MustInherit Public ReadOnly Property Encoding As Encoding

   Overridable Public ReadOnly Property FormatProvider As IFormatProvider

   Overridable Public Property NewLine As String

' Public Shared Methods

   Public Shared Function Synchronized(

        ByVal writer As TextWriter) As TextWriter

' Public Instance Methods

   Overridable Public Sub Close()

   Overridable Public Sub Flush()

   Overridable Public Sub Write( ByVal value As Boolean)

   Overridable Public Sub Write( ByVal value As Char)

   Overridable Public Sub Write( ByVal buffer As Char())

   Overridable Public Sub Write(ByVal buffer As Char(),
```

```
     ByVal index As Integer, ByVal count As Integer)
Overridable Public Sub Write( ByVal value As Decimal)
Overridable Public Sub Write( ByVal value As Double)
Overridable Public Sub Write( ByVal value As Integer)
Overridable Public Sub Write( ByVal value As Long)
Overridable Public Sub Write( ByVal value As Object)
Overridable Public Sub Write( ByVal value As Single)
Overridable Public Sub Write( ByVal value As String)
Overridable Public Sub Write(ByVal format As String,
     ByVal arg0 As Object)
Overridable Public Sub Write(ByVal format As String,
     ParamArray arg As Object())
Overridable Public Sub Write(ByVal format As String,
     ByVal arg0 As Object, ByVal arg1 As Object)
Overridable Public Sub Write(ByVal format As String,
     ByVal arg0 As Object, ByVal arg1 As Object,
     ByVal arg2 As Object)
Overridable Public Sub Write( ByVal value As UInt32)
Overridable Public Sub Write( ByVal value As UInt64)
Overridable Public Sub WriteLine()
Overridable Public Sub WriteLine( ByVal value As Boolean)
Overridable Public Sub WriteLine( ByVal value As Char)
Overridable Public Sub WriteLine( ByVal buffer As Char())
Overridable Public Sub WriteLine(ByVal buffer As Char(),
     ByVal index As Integer, ByVal count As Integer)
Overridable Public Sub WriteLine( ByVal value As Decimal)
Overridable Public Sub WriteLine( ByVal value As Double)
Overridable Public Sub WriteLine( ByVal value As Integer)
Overridable Public Sub WriteLine( ByVal value As Long)
Overridable Public Sub WriteLine( ByVal value As Object)
```

```
   Overridable Public Sub WriteLine( ByVal value As Single)
   Overridable Public Sub WriteLine( ByVal value As String)
   Overridable Public Sub WriteLine(ByVal format As String,
        ByVal arg0 As Object)
   Overridable Public Sub WriteLine(ByVal format As String,
        ParamArray arg As Object())
   Overridable Public Sub WriteLine(ByVal format As String,
        ByVal arg0 As Object, ByVal arg1 As Object)
   Overridable Public Sub WriteLine(ByVal format As String,
        ByVal arg0 As Object, ByVal arg1 As Object,
        ByVal arg2 As Object)
   Overridable Public Sub WriteLine( ByVal value As UInt32)
   Overridable Public Sub WriteLine( ByVal value As UInt64)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → TextWriter(System.IDisposabl

### Subclasses

StreamWriter, StringWriter

### Returned By

System.Console.{Error, Out}, System.Diagnostics.TextWriterTraceListener.Writ

### Passed To

System.Console.{SetError(), SetOut()}, System.Diagnostics.TextWriterTraceLis
{TextWriterTraceListener(), Writer}, System.Xml.XmlDocument.Save(),
System.Xml.XmlTextWriter.XmlTextWriter(), System.Xml.Xsl.XslTransform.Trans

# WaitForChangedResult Structure

## System.IO (system.dll)

This structure contains the changes on a file. This is used to construct `FileSystemEventArgs` and `RenamedEventArgs`.

```
Public Structure WaitForChangedResult
' Public Instance Properties
   Public Property ChangeType As WatcherChangeTypes
   Public Property Name As String
   Public Property OldName As String
   Public Property TimedOut As Boolean
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `WaitForChangedResult`

### Returned By

`FileSystemWatcher.WaitForChanged()`

## WatcherChangeTypes Enum

## System.IO (system.dll) *serializable, flag*

This enumeration represents the different types of changes that can occur on a file. It is used by `FileSystemEventArgs`.

```
Public Enum WatcherChangeTypes
    Created = &H000000001
    Deleted = &H000000002
    Changed = &H000000004
    Renamed = &H000000008
    All = &H00000000F
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `WatcherChangeTypes`

### Returned By

`FileSystemEventArgs.ChangeType`, `WaitForChangedResult.ChangeType`

### Passed To

`FileSystemEventArgs.FileSystemEventArgs()`, `FileSystemWatcher.WaitForChanged()`, `RenamedEventArgs.RenamedEventArgs()`, `WaitForChangedResult.ChangeType`

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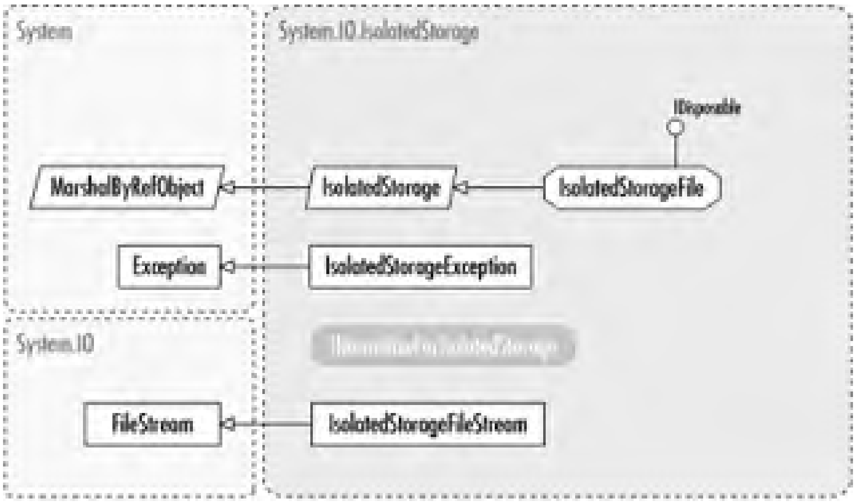
# Chapter 10. System.IO.IsolatedStorage

`System.IO.IsolatedStorage` allows you to access an isolated area of a filesystem for your application. This is useful when access to the `System.IO` classes is not possible. The security settings of the .NET Framework prohibit web applications and downloaded controls from accessing the local filesystem directly, but those settings allow them to use `System.IO.IsolatedStorage`. Applications' storage areas are isolated from one another, so anything in isolated storage is protected from untrusted applications. The size of isolated storage is limited, so an untrusted application cannot create a denial-of-service condition by filling your hard disk with data.

When you use isolated storage, the runtime sets aside disk space for a given level of isolation (specified using `IsolatedStorageScope`). If you use Windows 2000 or XP, *<SYSTEMDRIVE>\Documents and Settings\<user>\Application Data* contains the isolated storage area if roaming is turned on, and *<SYSTEMDRIVE>\Documents and Settings\<user>\Local Settings\Application Data* contains the storage area if roaming is not on. Applications can use this area as a data store for their particular persistence needs. Figure 10-1 shows the inheritance diagram for this namespace.

**Figure 10-1. The System.IO.IsolatedStorage namespace**

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## INormalizeForIsolatedStorage Interface

## System.IO.IsolatedStorage (mscorlib.dll)

This interface exposes `Normalize()`, which returns a normalized copy of the object on which it is called. You usually use this method if you are inheriting from `IsolatedStorage` and you want to see if a store already exists.

```
Public Interface INormalizeForIsolatedStorage

' Public Instance Methods

   Public Function Normalize() As Object

End Interface
```

## IsolatedStorage MustInherit Class

**System.IO.IsolatedStorage (mscorlib.dll)** ***marshal by reference***

This is the MustInherit base class from which all isolated storage classes must inherit. `AssemblyIc` returns the assembly identity associated with the isolated store, and `DomainIdentity` returns the associated with the store. Use `CurrentSize` to detect how much space the store takes up on the d use `MaximumSize` to detect the maximum storage allowed. `Scope` returns an `IsolatedStorage` enumeration for the store. If you wish to delete the isolated store and all its contents completely, cal `Remove()`.

```
Public MustInherit Class IsolatedStorage : Inherits MarshalByRefObject
' Protected Constructors
   Protected Sub New()
' Public Instance Properties
   Public ReadOnly Property AssemblyIdentity As Object
   Overridable Public ReadOnly Property CurrentSize As UInt64
   Public ReadOnly Property DomainIdentity As Object
   Overridable Public ReadOnly Property MaximumSize As UInt64
   Public ReadOnly Property Scope As IsolatedStorageScope
' Protected Instance Properties
   Overridable Protected Property SeparatorExternal As Char
   Overridable Protected Property SeparatorInternal As Char
' Public Instance Methods
   MustInherit Public Sub Remove()
' Protected Instance Methods
   MustInherit Protected Function GetPermission(
        ByVal ps As System.Security.PermissionSet) As IsolatedStoragePerm
   Protected Sub InitStore(
        ByVal scope As IsolatedStorageScope,
        ByVal domainEvidenceType As Type,
        ByVal assemblyEvidenceType As Type)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → IsolatedStorage

## Subclasses

IsolatedStorageFile

## IsolatedStorageException Class

## System.IO.IsolatedStorage (mscorlib.dll) *serializable*

This exception represents isolated storage errors.

```
Public Class IsolatedStorageException : Inherits Exception
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → IsolatedStorageException

## IsolatedStorageFile NotInheritable Class

**System.IO.IsolatedStorage (mscorlib.dll)** ***marshal by reference, disposable***

This class represents an isolated-storage filesystem area that can contain files and directories. The reference to the current store. Call `GetStore()` only with the proper `IsolatedStorageScope` er shortcuts for this method: `GetUserStoreForAssembly()` returns the same store as `GetStore(` `IsolatedStorageScope.User | IsolatedStorageScope.Assembly` as its first argument, a `GetUserStoreForDomain()` returns as though `GetStore()` was called with `IsolatedStorag` `IsolatedStorageScope.Assembly | IsolatedStorageScope.Domain`. `GetEnumerator` isolation for the specified assembly and domain.

The rest of the methods for this class allow you to work with files and directories. `CreateDirector` allow you to create and delete directories, just as `DeleteFile()` allows you to delete files (use an to create them). `Close()` allows you to close a store opened with `GetStore()`. `GetFileNames(` matching a given filter.

```
Public NotInheritable Class IsolatedStorageFile : Inherits IsolatedStorag

' Public Instance Properties

   Overrides Public ReadOnly Property CurrentSize As UInt64

   Overrides Public ReadOnly Property MaximumSize As UInt64

' Public Shared Methods

   Public Shared Function GetEnumerator(

        ByVal scope As IsolatedStorageScope) As IEnumerator

   Public Shared Function GetStore(

        ByVal scope As IsolatedStorageScope,

        ByVal domainEvidence As System.Security.Policy.Evidence,

        ByVal domainEvidenceType As Type,

        ByVal assemblyEvidence As System.Security.Policy.Evidence,

        ByVal assemblyEvidenceType As Type) As IsolatedStorageFile

   Public Shared Function GetStore(

        ByVal scope As IsolatedStorageScope,

        ByVal domainIdentity As Object,

        ByVal assemblyIdentity As Object) As IsolatedStorageFile

   Public Shared Function GetStore(
```

```
        ByVal scope As IsolatedStorageScope,
        ByVal domainEvidenceType As Type,
        ByVal assemblyEvidenceType As Type) As IsolatedStorageFile
    Public Shared Function GetUserStoreForAssembly(
        ) As IsolatedStorageFile
    Public Shared Function GetUserStoreForDomain(
        ) As IsolatedStorageFile
    Public Shared Sub Remove(
        ByVal scope As IsolatedStorageScope)
' Public Instance Methods
    Public Sub Close()
    Public Sub CreateDirectory( ByVal dir As String)
    Public Sub DeleteDirectory( ByVal dir As String)
    Public Sub DeleteFile( ByVal file As String)
    Public Sub Dispose() Implements IDisposable.Dispose
    Public Function GetDirectoryNames(
        ByVal searchPattern As String) As String()
    Public Function GetFileNames(
        ByVal searchPattern As String) As String()
    Overrides Public Sub Remove()
' Protected Instance Methods
    Overrides Protected Sub Finalize()
    Overrides Protected Function GetPermission(
        ByVal ps As System.Security.PermissionSet) As IsolatedStoragePerm
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → IsolatedStorage → IsolatedStorageFile(System.IDisposable)

## Passed To

IsolatedStorageFileStream.IsolatedStorageFileStream()

## IsolatedStorageFileStream Class

**System.IO.IsolatedStorage (mscorlib.dll)** ***marshal by reference, disposable***

This class is simply a `System.IO.FileStream` implementation for isolated storage. Use it to create and modify isolated storage files.

```
Public Class IsolatedStorageFileStream : Inherits System.IO.FileStream

' Public Constructors

   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode)

   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess)

   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess,
        ByVal share As System.IO.FileShare)

   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess,
        ByVal share As System.IO.FileShare,
        ByVal bufferSize As Integer)

   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess,
        ByVal share As System.IO.FileShare,
        ByVal bufferSize As Integer,
        ByVal isf As IsolatedStorageFile)

   Public Sub New(ByVal path As String,
```

```
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess,
        ByVal share As System.IO.FileShare,
        ByVal isf As IsolatedStorageFile)
   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal access As System.IO.FileAccess,
        ByVal isf As IsolatedStorageFile)
   Public Sub New(ByVal path As String,
        ByVal mode As System.IO.FileMode,
        ByVal isf As IsolatedStorageFile)
' Public Instance Properties
   Overrides Public ReadOnly Property CanRead As Boolean
   Overrides Public ReadOnly Property CanSeek As Boolean
   Overrides Public ReadOnly Property CanWrite As Boolean
   Overrides Public ReadOnly Property Handle As IntPtr
   Overrides Public ReadOnly Property IsAsync As Boolean
   Overrides Public ReadOnly Property Length As Long
   Overrides Public Property Position As Long
' Public Instance Methods
   Overrides Public Function BeginRead(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal numBytes As Integer,
        ByVal userCallback As AsyncCallback,
        ByVal stateObject As Object) As IAsyncResult
   Overrides Public Function BeginWrite(
        ByVal buffer As Byte(), ByVal offset As Integer,
        ByVal numBytes As Integer,
        ByVal userCallback As AsyncCallback,
        ByVal stateObject As Object) As IAsyncResult
   Overrides Public Sub Close()
   Overrides Public Function EndRead(
```

```
        ByVal asyncResult As IAsyncResult) As Integer
   Overrides Public Sub EndWrite(
        ByVal asyncResult As IAsyncResult)
   Overrides Public Sub Flush()
   Overrides Public Function Read(ByVal buffer As Byte(),
        ByVal offset As Integer,
        ByVal count As Integer) As Integer
   Overrides Public Function ReadByte() As Integer
   Overrides Public Function Seek(ByVal offset As Long,
        ByVal origin As System.IO.SeekOrigin) As Long
   Overrides Public Sub SetLength( ByVal value As Long)
   Overrides Public Sub Write(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal count As Integer)
   Overrides Public Sub WriteByte( ByVal value As Byte)
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.IO.Stream(System.IDisposable) → System.IO.FileStream → IsolatedStorageFileStream

## IsolatedStorageScope Enum

## System.IO.IsolatedStorage (mscorlib.dll) *serializable, flag*

This enumeration allows you to specify the levels of isolation an `IsolatedStorageFile` store should have. For example, if you call `IsolatedStorageFile.GetStore()` with `Assembly`, the isolated storage cannot be accessed by code from another assembly. `Roaming` allows the isolated store to be placed in a roaming profile; without it, the store does not roam with the user.

```
Public Enum IsolatedStorageScope

   None = &H000000000

   User = &H000000001

   Domain = &H000000002

   Assembly = &H000000004

   Roaming = &H000000008

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `IsolatedStorageScope`

### Returned By

`IsolatedStorage.Scope`

### Passed To

`IsolatedStorage.InitStore(), IsolatedStorageFile.{GetEnumerator(), GetStore(), Remove()}`

# Chapter 11. System.Net

`System.Net` supports a high-level API for working with common Internet protocols (HTTP being the principal example) without having to deal with low-level details (such as the actual protocol format). In addition, this namespace provides some high-level constructs for working with networks — TCP/IP in particular.

Most .NET programmers will work with either the `WebClient` type, which provides the most high-level view of doing HTTP-style request/response communications over a TCP/IP network (such as the Internet), or else the slightly lower-level `WebRequest` and `WebResponse` types. The choice between the two is really not all that difficult — for most high-level, protocol-agnostic work, `WebClient` will likely be the preferred choice. If protocol-specific actions need to be taken (such as specifying additional headers as part of an HTTP request, for example), then likely the .NET programmer will want to work with `WebRequest` and `WebResponse`. To be specific, the .NET programmer will work with the concrete derived types `HttpWebRequest` and `HttpWebResponse`.

As shipped, the .NET Framework Class Library provides implementations for three URI protocol schemes: HTTP, HTTPS, and files (http:, https:, and file:, respectively). For support of other URI types (such as FTP, NNTP, or POP3), a new derivative of `WebRequest` and `WebResponse` must be written, an Abstract Factory type implementing the `IWebRequestCreate` interface must be created, and an instance of it (along with the protocol scheme prefix) must be registered with `WebRequest.RegisterPrefix()`. Figure 11-1 shows the collaborations between the concrete classes `HttpWebRequest`, `HttpWebResponse`, `FileWebRequest`, and `FileWebResponse`.

Figure 11-2 shows the composition of the `ServicePoint` class, and Figure 11-3 shows the remaining types in this namespace.

### Figure 11-1. The MustInherit WebRequest, WebResponse, and related concrete types

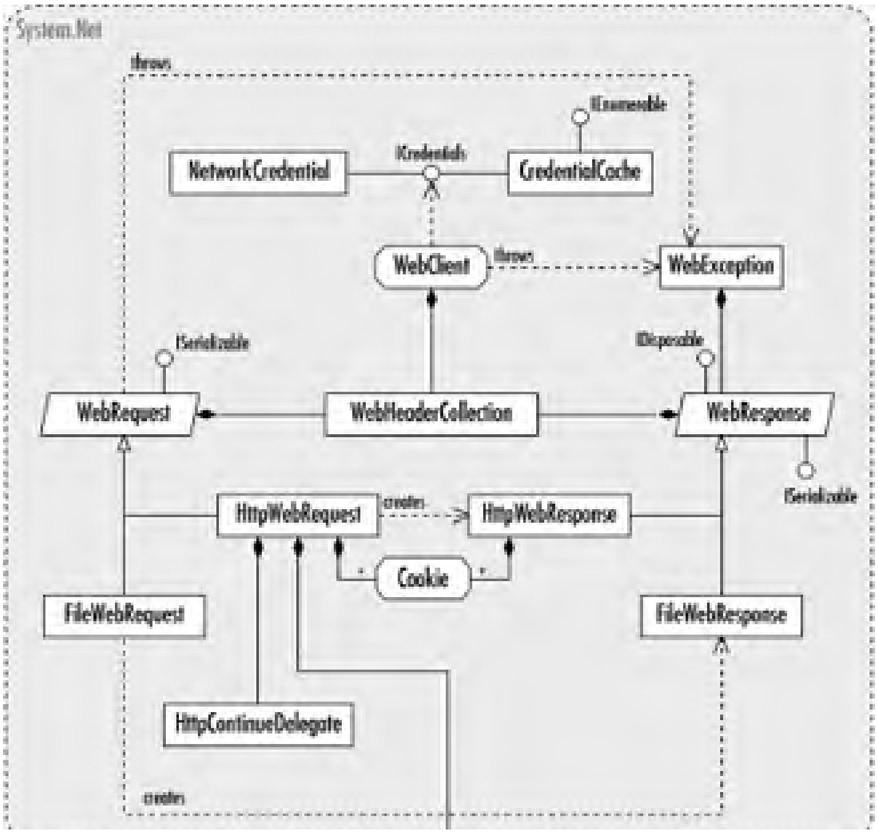



**Figure 11-2. Endpoints, service points, and associated types**

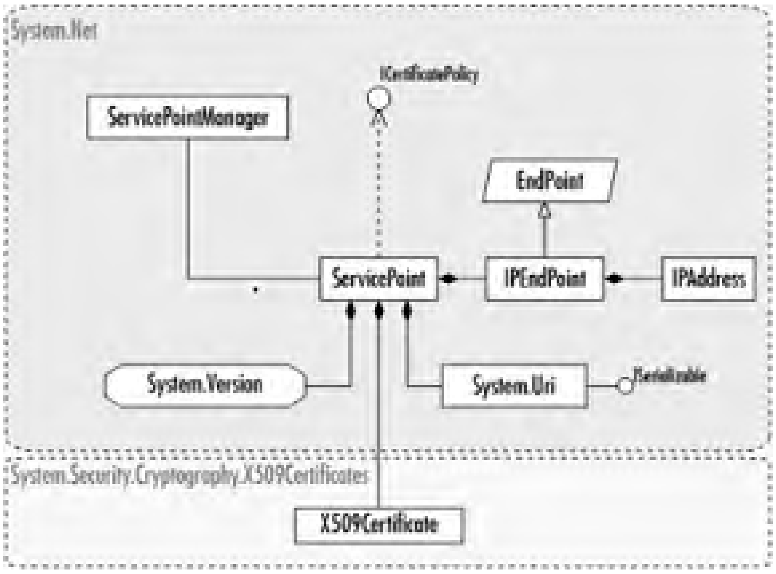
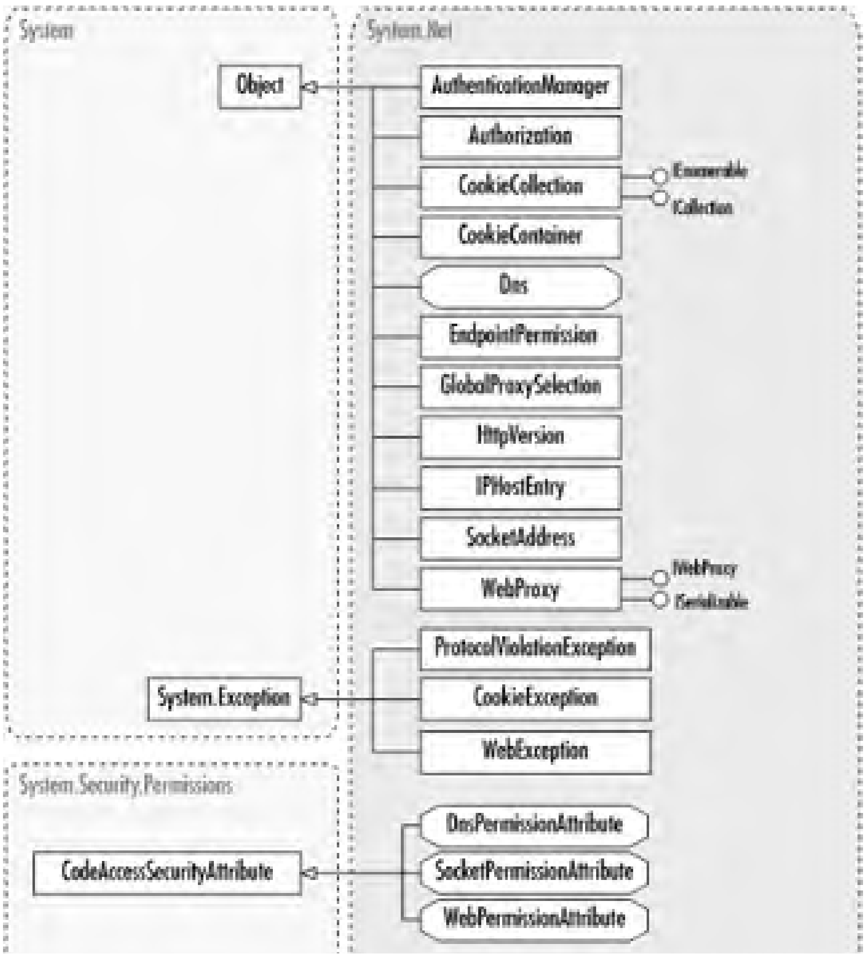
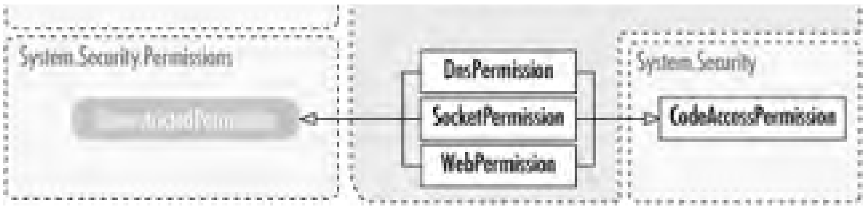



**Figure 11-3. Other classes in the System.Net namespace**




System.Security.Permissions
DnsPermission
SocketPermission
WebPermission
System.Security
CodeAccessPermission

## AuthenticationManager Class

## System.Net (system.dll) *ECMA*

This class is responsible for finding an authentication module to authorize access to network resources. You do not need to use this class unless you have defined your own authentication scheme. By default, Basic, Digest, NTLM, and Kerberos authentication schemes are supported. This, for the most part, covers the needs of 99.9% of all .NET programmers in the world. Kerberos is not supported on Windows 95/98 or on Windows ME.

```
Public Class AuthenticationManager

' Public Shared Properties

   Public Shared ReadOnly Property RegisteredModules As IEnumerator

' Public Shared Methods

   Public Shared Function Authenticate(

        ByVal challenge As String,

        ByVal request As WebRequest,

        ByVal credentials As ICredentials) As Authorization

   Public Shared Function PreAuthenticate(

        ByVal request As WebRequest,

        ByVal credentials As ICredentials) As Authorization

   Public Shared Sub Register(

        ByVal authenticationModule As IAuthenticationModule)

   Public Shared Sub Unregister(

        ByVal authenticationModule As IAuthenticationModule)

   Public Shared Sub Unregister(

        ByVal authenticationScheme As String)

End Class
```

## Authorization Class

## System.Net (system.dll) *ECMA*

This class encapsulates an authentication message that `AuthenticationManager` sends to a remote server. The `Message` property contains the string that is sent to the server in response to its authentication challenge.

The `Authorization` class is used by implementations of `IAuthenticationModule` and by `AuthenticationManager`. You should not need to use it directly unless you have implemented your own authentication scheme.

```
Public Class Authorization

' Public Constructors

   Public Sub New( ByVal token As String)

   Public Sub New(ByVal token As String,

        ByVal finished As Boolean)

   Public Sub New(ByVal token As String,

        ByVal finished As Boolean,

        ByVal connectionGroupId As String)

' Public Instance Properties

   Public ReadOnly Property Complete As Boolean

   Public ReadOnly Property ConnectionGroupId As String

   Public ReadOnly Property Message As String

   Public Property ProtectionRealm As String()

End Class
```

### Returned By

`AuthenticationManager.{Authenticate(),PreAuthenticate()}, IAuthenticationModule.{Authenticate(),PreAuthenticate()}`

# Cookie NotInheritable Class

## System.Net (system.dll) *serializable*

This class represents an HTTP cookie, as standardized by RFC 2965 (ftp://ftp.isi.edu/in-notes/rfc2965.txt). A cookie represents a simple name-value pair that is sent back by the HTTP User-Agent on each subsequent request to the URL host that set the cookie. The rules governing the visibility, scope, and lifetime of cookies is well documented in the RFC; see that document for details. The `Cookie` has properties defined on it corresponding to the settable values in the RFC — principally, the `Value` property sets the value of the cookie, and the `Name` property sets the name by which the cookie's value can be retrieved.

As a User-Agent, adding a `Cookie` to an `HttpWebRequest` is as simple as adding the `Cookie` instance to the `HttpWebRequest.CookieContainer` property. When you receive a response from an HTTP server, it may contain one or more cookies. Use the `HttpWebResponse.Cookies` collection to obtain the cookies that the HTTP server sent you.

Note that, as a User-Agent (the client), it is the .NET programmer's responsibility for maintaining all the semantics of the RFC — that is, the cookie must only be sent back to the host that set it, the cookie can only be sent back if it obeys the "path" prefix set on the cookie, and so forth. Failure to do so could result in different hosts viewing cookies that they didn't set, which is a potential security hole (albeit only if a host puts sensitive material into the cookie in the first place). None of this is implemented in the `HttpWebRequest` or `Cookie` types.

```
Public NotInheritable Class Cookie

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal name As String, ByVal value As String)

   Public Sub New(ByVal name As String, ByVal value As String,

        ByVal path As String)

   Public Sub New(ByVal name As String, ByVal value As String,

        ByVal path As String, ByVal domain As String)

' Public Instance Properties

   Public Property Comment As String

   Public Property CommentUri As Uri

   Public Property Discard As Boolean

   Public Property Domain As String

   Public Property Expired As Boolean

   Public Property Expires As Date

   Public Property Name As String
```

```
   Public Property Path As String
   Public Property Port As String
   Public Property Secure As Boolean
   Public ReadOnly Property TimeStamp As Date
   Public Property Value As String
   Public Property Version As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal comparand As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Class
```

## Returned By

CookieCollection.this

## Passed To

CookieCollection.Add(),CookieContainer.Add()

## CookieCollection Class

## System.Net (system.dll) *serializable*

This class is a specialized collection for holding cookies. It's used by `HttpWebResponse` to represe returned by a server. By default, the `IsReadOnly` property is set to `true`.

```
Public Class CookieCollection : Implements ICollection, IEnumerable

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Public ReadOnly Property IsReadOnly As Boolean

   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect

   Public Default ReadOnly Property Item(

        ByVal index As Integer) As Cookie

   Public Default ReadOnly Property Item(

        ByVal name As String) As Cookie

   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn

' Public Instance Methods

   Public Sub Add( ByVal cookie As Cookie)

   Public Sub Add( ByVal cookies As CookieCollection)

   Public Sub CopyTo(ByVal array As Array,

        ByVal index As Integer) Implements ICollection.CopyTo

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

End Class
```

### Returned By

`CookieContainer.GetCookies()`, `HttpWebResponse.Cookies`

### Passed To

`CookieContainer.Add()`, `HttpWebResponse.Cookies`

## CookieContainer Class

## System.Net (system.dll) *serializable*

This class is a container that holds cookies and organizes them by URI. You can add a `Cookie` or `CookieCollection` to a container using the simplest forms of the `Add()` method, or you can use the forms of the `Add()` method that take a `System.Uri` argument. You can retrieve all the cookies for a given URI using the `GetCookies()` method.

```
Public Class CookieContainer

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal capacity As Integer)

   Public Sub New(ByVal capacity As Integer,

        ByVal perDomainCapacity As Integer,

        ByVal maxCookieSize As Integer)

' Public Shared Fields

   Public const DefaultCookieLengthLimit As Integer              // =4096

   Public const DefaultCookieLimit As Integer                    // =300

   Public const DefaultPerDomainCookieLimit As Integer           // =20

' Public Instance Properties

   Public Property Capacity As Integer

   Public ReadOnly Property Count As Integer

   Public Property MaxCookieSize As Integer

   Public Property PerDomainCapacity As Integer

' Public Instance Methods

   Public Sub Add( ByVal cookie As Cookie)

   Public Sub Add( ByVal cookies As CookieCollection)

   Public Sub Add( ByVal uri As Uri, ByVal cookie As Cookie)

   Public Sub Add(ByVal uri As Uri,

        ByVal cookies As CookieCollection)

   Public Function GetCookieHeader(
```

```
        ByVal uri As Uri) As String
    Public Function GetCookies(
        ByVal uri As Uri) As CookieCollection
    Public Sub SetCookies(ByVal uri As Uri,
        ByVal cookieHeader As String)
End Class
```

## Returned By

`HttpWebRequest.CookieContainer`

## Passed To

`HttpWebRequest.CookieContainer`

## CookieException Class

## System.Net (system.dll) *serializable*

This exception signals an error encountered during a cookie-related operation.

```
Public Class CookieException : Inherits FormatException

' Public Constructors

   Public Sub New()

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.SystemException → System.FormatException → CookieException

## CredentialCache Class

## System.Net (system.dll) *ECMA*

This class maintains credentials for multiple network resources. If you are developing a client applic authenticate itself to more than one server, you can store an instance of this class in the `WebReque` property.

After you create an instance of this class, use the `Add()` method to associate `NetworkCredentia` authentication type (using a string such as `"Basic"` or `"Digest"`). Then you can assign the `Cred` the `WebRequest.Credentials` property to use the credentials for future web requests.

```
Public Class CredentialCache : Implements ICredentials, IEnumerable
' Public Constructors
   Public Sub New()
' Public Shared Properties
   Public Shared ReadOnly Property DefaultCredentials As ICredentials
' Public Instance Methods
   Public Sub Add(ByVal uriPrefix As Uri,
        ByVal authType As String,
        ByVal cred As NetworkCredential)
   Public Function GetCredential(ByVal uriPrefix As Uri,
        ByVal authType As String) As NetworkCredential Implements ICreden
   Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
   Public Sub Remove(ByVal uriPrefix As Uri,
        ByVal authType As String)
End Class
```

## Dns NotInheritable Class

## System.Net (system.dll) *ECMA*

This type offers up a collection of shared methods for resolving DNS (Domain Name Service) operations. Because raw IP addresses (such as 192.168.0.1) can be difficult for humans to remember, DNS servers take human-friendly names (such as "www.oreilly.com") and in turn translate them into IP addresses and/or back again. This ability can be useful in a variety of scenarios, including the simple logging of clients who have visited a web site recently. (Note that this is not a secure way of tracking usage — even a simple attacker can spoof the return address of an IP packet, so don't rely on this mechanism for any kind of security validation or audit trail.)

The `GetHostByName()` method takes a hostname (such as "www.oreilly.com") and returns the corresponding `IPHostEntry` instance — this `IPHostEntry` instance is used later in several of the `System.Net` and `System.Net.Sockets` types. This method (along with the paired method `Resolve()`) can be invoked asynchronously using the `BeginGetHostByName()` or `BeginResolve()` methods. Like all async methods in the .NET Framework, they take two additional parameters: an `AsyncCallback` object, and a generic `object` parameter that is passed to the `AsyncCallback` when the call completes.

At the surface, there would appear to be no difference between calling `Resolve()` or `GetHostByName()`; in fact, the `Resolve()` method calls into `GetHostByName()` after doing a small amount of preprocessing to check if the string passed is either a standard host name ("www.oreilly.com") or a dotted-quad IP address ("192.168.0.1"); `GetHostByName()` requires a hostname. (For those familiar with the Berkeley sockets API, the `GetHostByName()` method is a wrapper around the native BSD `gethostbyname` function.)

```
Public NotInheritable Class Dns

' Public Shared Methods

   Public Shared Function BeginGetHostByName(

        ByVal hostName As String,

        ByVal requestCallback As AsyncCallback,

        ByVal stateObject As Object) As IAsyncResult

   Public Shared Function BeginResolve(

        ByVal hostName As String,

        ByVal requestCallback As AsyncCallback,

        ByVal stateObject As Object) As IAsyncResult

   Public Shared Function EndGetHostByName(

        ByVal asyncResult As IAsyncResult) As IPHostEntry

   Public Shared Function EndResolve(

        ByVal asyncResult As IAsyncResult) As IPHostEntry

   Public Shared Function GetHostByAddress(
```

```
        ByVal address As IPAddress) As IPHostEntry
    Public Shared Function GetHostByAddress(
        ByVal address As String) As IPHostEntry
    Public Shared Function GetHostByName(
        ByVal hostName As String) As IPHostEntry
    Public Shared Function GetHostName() As String
    Public Shared Function Resolve(
        ByVal hostName As String) As IPHostEntry
End Class
```

## DnsPermission NotInheritable Class

**System.Net (system.dll)** ***ECMA, serializable***

This class controls access to DNS services. The constructor accepts one argument, either `System.Security.Permissions.PermissionState.None` (no access to DNS services) or `System.Security.Permissions.PermissionState.Unrestricted` (all access).

This permission is `Demand()`ed by all of the methods on the `Dns` class.

```
Public NotInheritable Class DnsPermission : Inherits System.Security.CodeA

        System.Security.Permissions.IUnrestrictedPermission

' Public Constructors

   Public Sub New(

        ByVal state As System.Security.Permissions.PermissionState)

' Public Instance Methods

   Overrides Public Function Copy() As IPermission

   Overrides Public Sub FromXml(

        ByVal securityElement As System.Security.SecurityElement)

   Overrides Public Function Intersect(

        ByVal target As System.Security.IPermission) As IPermission

   Overrides Public Function IsSubsetOf(

        ByVal target As System.Security.IPermission) As Boolean

   Public Function IsUnrestricted(

        ) As Boolean Implements IUnrestrictedPermission.IsUnrestricted

   Overrides Public Function ToXml() As SecurityElement

   Overrides Public Function Union(

        ByVal target As System.Security.IPermission) As IPermission

End Class
```

### Hierarchy

`System.Object` → `System.Security.CodeAccessPermission(System.Security.IPe` `System.Security.ISecurityEncodable`, `System.Security.IStackWalk)` → `DnsPermission(System.Security.Permissions.IUnrestrictedPermission)`

## DnsPermissionAttribute NotInheritable Class

**System.Net (system.dll)** ***ECMA, serializable***

This attribute is used to declare in metadata that the attributed method or class requires `DnsPermission` of the declared form.

```
Public NotInheritable Class DnsPermissionAttribute : Inherits
        System.Security.Permissions.CodeAccessSecurityAttribute
' Public Constructors
   Public Sub New(
        ByVal action As System.Security.Permissions.SecurityAction)
' Public Instance Methods
   Overrides Public Function CreatePermission(
        ) As IPermission
End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.Security.Permissions.SecurityAttribute` → `System.Security.Permissions.CodeAccessSecurityAttribute` → `DnsPermissionAttribute`

### Valid On

Assembly, Class, Struct, Constructor, Method

## EndPoint MustInherit Class

## System.Net (system.dll) *ECMA, serializable*

This MustInherit class represents a network address. It is extended by `IPEndPoint`, which represents an IP network address. It could later be extended to represent other kinds of networking endpoints for other protocol stacks beyond TCP/IP.

```
Public MustInherit Class EndPoint
' Protected Constructors
   Protected Sub New()
' Public Instance Properties
   Overridable Public ReadOnly Property AddressFamily As AddressFamily
' Public Instance Methods
   Overridable Public Function Create(
        ByVal socketAddress As SocketAddress) As EndPoint
   Overridable Public Function Serialize() As SocketAddress
End Class
```

### Subclasses

`IPEndPoint`

### Returned By

`IPEndPoint.Create(), System.Net.Sockets.Socket.{LocalEndPoint, RemoteEndPoint}, System.Net.Sockets.TcpListener.LocalEndpoint`

### Passed To

`System.Net.Sockets.Socket.{BeginConnect(), BeginReceiveFrom(), BeginSendTo(), Bind(), Connect(), EndReceiveFrom(), ReceiveFrom(), SendTo()}`

# EndpointPermission Class

## System.Net (system.dll) *serializable*

This permission is `Demand()`ed by all of the methods on the `EndPoint` class.

```
Public Class EndpointPermission
' Public Instance Properties
   Public ReadOnly Property Hostname As String
   Public ReadOnly Property Port As Integer
   Public ReadOnly Property Transport As TransportType
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function ToString() As String
End Class
```

# FileWebRequest Class

## System.Net (system.dll) *serializable, marshal by reference*

This subclass of `WebRequest` provides access to resources that use the `file` URL scheme (such your local filesystem). Use `WebRequest.Create()` with a *file://* URL to create an instance of this c `WebRequest.Create()` method returns an instance of this class as a reference of type `WebRequ`

You may feel a small sense of confusion regarding this type and the "file:" protocol scheme; if a pro access to a file on the filesystem, why not simply open a `System.IO.FileStream` instead of usin `WebRequest.Create("file:/...")`? In terms of straight functionality, the `System.IO.FileS` more closely represents the fact that this resource is coming from disk; however, due to the ubiquity servers growing within the enterprise, there are often times when a system wishes to equally repres URLs and filesystem paths within an arbitrary context. For example, a configuration file might be us where to retrieve user preferences; by specifying the location as an URL rather than an absolute file storage of user preferences is permitted on a centralized server without any additional code. (This a of "roaming preferences" capability within the system.) Many of the .NET tools also use this approac "files" to act upon via command-line parameters.

```
Public Class FileWebRequest : Inherits WebRequest

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Instance Properties

   Overrides Public Property ConnectionGroupName As String

   Overrides Public Property ContentLength As Long

   Overrides Public Property ContentType As String

   Overrides Public Property Credentials As ICredentials

   Overrides Public ReadOnly Property Headers As WebHeaderCollection

   Overrides Public Property Method As String

   Overrides Public Property PreAuthenticate As Boolean

   Overrides Public Property Proxy As IWebProxy

   Overrides Public ReadOnly Property RequestUri As Uri

   Overrides Public Property Timeout As Integer

' Public Instance Methods

   Overrides Public Function BeginGetRequestStream(
```

```
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Function BeginGetResponse(
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Function EndGetRequestStream(
        ByVal asyncResult As IAsyncResult) As Stream
   Overrides Public Function EndGetResponse(
        ByVal asyncResult As IAsyncResult) As WebResponse
   Overrides Public Function GetRequestStream() As Stream
   Overrides Public Function GetResponse() As WebResponse
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → WebRequest(System.Runtime.Serialization.ISerializable) → FileWebRequest

# FileWebResponse Class

**System.Net (system.dll)** ***serializable, marshal by reference, disposable***

This subclass of `WebResponse` is returned by `WebRequest.GetResponse()` when you request a `file` URI. Since this subclass does not add any new methods, there's no need to cast the return va `FileWebResponse`; the `GetResponseStream()` method returns a `System.IO.Stream` from wh contents can be retrieved.

```
Public Class FileWebResponse : Inherits WebResponse

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Instance Properties

   Overrides Public ReadOnly Property ContentLength As Long

   Overrides Public ReadOnly Property ContentType As String

   Overrides Public ReadOnly Property Headers As WebHeaderCollection

   Overrides Public ReadOnly Property ResponseUri As Uri

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Function GetResponseStream() As Stream

' Protected Instance Methods

   Overridable Protected Sub Dispose(

        ByVal disposing As Boolean)

End Class
```

## Hierarchy

`System.Object` → `System.MarshalByRefObject` → `WebResponse(System.Runtime.Serialization.ISerializable, System.IDisposable)` → `FileWebResponse`

## GlobalProxySelection Class

## System.Net (system.dll) *ECMA*

This class holds the default `IWebProxy` object used by all HTTP requests. To change it, set the `Select` property to an instance of `WebProxy`.

```
Public Class GlobalProxySelection

' Public Constructors

   Public Sub New()

' Public Shared Properties

   Public Shared Property Select As IWebProxy

' Public Shared Methods

   Public Shared Function GetEmptyWebProxy() As IWebProxy

End Class
```

## HttpContinueDelegate Delegate

## System.Net (system.dll) *ECMA, serializable*

The `HttpWebRequest.ContinueDelegate` property uses this class to handle `HttpStatusCode.Continue` responses. These responses are sent when the server receives the HTTP request, is able to process it, and wishes to notify the client that the request was successfully received. (Most HTTP servers will send this only if the request processing would take longer than expected.)

```
Public Delegate Sub HttpContinueDelegate(
        ByVal StatusCode As Integer,
        ByVal httpHeaders As WebHeaderCollection)
```

### Returned By

`HttpWebRequest.ContinueDelegate`

### Passed To

`HttpWebRequest.ContinueDelegate`

## HttpStatusCode Enum

## System.Net (system.dll) *ECMA, serializable*

This enumeration contains HTTP 1.1 status codes as defined in RFC 2616 (ftp://ftp.isi.edu/in-notes/rfc2616.txt).

```
Public Enum HttpStatusCode

   Continue = 100

   SwitchingProtocols = 101

   OK = 200

   Created = 201

   Accepted = 202

   NonAuthoritativeInformation = 203

   NoContent = 204

   ResetContent = 205

   PartialContent = 206

   MultipleChoices = 300

   Ambiguous = 300

   MovedPermanently = 301

   Moved = 301

   Found = 302

   Redirect = 302

   SeeOther = 303

   RedirectMethod = 303

   NotModified = 304

   UseProxy = 305

   Unused = 306

   TemporaryRedirect = 307

   RedirectKeepVerb = 307

   BadRequest = 400

   Unauthorized = 401
```

```
    PaymentRequired = 402
    Forbidden = 403
    NotFound = 404
    MethodNotAllowed = 405
    NotAcceptable = 406
    ProxyAuthenticationRequired = 407
    RequestTimeout = 408
    Conflict = 409
    Gone = 410
    LengthRequired = 411
    PreconditionFailed = 412
    RequestEntityTooLarge = 413
    RequestUriTooLong = 414
    UnsupportedMediaType = 415
    RequestedRangeNotSatisfiable = 416
    ExpectationFailed = 417
    InternalServerError = 500
    NotImplemented = 501
    BadGateway = 502
    ServiceUnavailable = 503
    GatewayTimeout = 504
    HttpVersionNotSupported = 505
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → HttpStatusCode

## Returned By

HttpWebResponse.StatusCode

## HttpVersion Class

## System.Net (system.dll) *ECMA*

This class contains `System.Version` values that represent versions for HTTP 1.0 and 1.1.

```
Public Class HttpVersion

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public Shared ReadOnly Version10 As Version                    // =1.0

   Public Shared ReadOnly Version11 As Version                    // =1.1

End Class
```

## HttpWebRequest Class

**System.Net (system.dll)** ***ECMA, serializable, marshal by reference***

This is a subclass of `WebRequest`. .NET uses this subclass to request documents from the `http` a URI schemes (RFC's 2616 and 2818, respectively). An instance of this type is returned by `WebRequest.Create()` when a URI starting with the *http://* or *https://* prefix is passed in. Since th return value is `WebRequest`, cast it to `HttpWebRequest` if you need access to any of the methods properties that are unique to this class (and the HTTP or HTTPS protocol).

The properties on this type correspond directly to the headers documented in the RFC standard doc see that document for details regarding their contents. Note that because these headers are sent as HTTP request, any modification of the headers must be done before the request is sent to the remo (Calling either the `GetResponse()` or the `BeginGetResponse()`, the asynchronous version of `GetResponse()`, sends the request.)

When a `WebRequest` encounters an error, a `WebException` is thrown.

```
Public Class HttpWebRequest : Inherits WebRequest
' Protected Constructors
   Protected Sub New(
        ByVal serializationInfo As System.Runtime.Serialization.Serializa
        ByVal streamingContext As System.Runtime.Serialization.StreamingC
' Public Instance Properties
   Public Property Accept As String
   Public ReadOnly Property Address As Uri
   Public Property AllowAutoRedirect As Boolean
   Public Property AllowWriteStreamBuffering As Boolean
   Public ReadOnly Property ClientCertificates As X509CertificateCollecti
   Public Property Connection As String
   Overrides Public Property ConnectionGroupName As String
   Overrides Public Property ContentLength As Long
   Overrides Public Property ContentType As String
   Public Property ContinueDelegate As HttpContinueDelegate
   Public Property CookieContainer As CookieContainer
   Overrides Public Property Credentials As ICredentials
   Public Property Expect As String
```

```
   Public ReadOnly Property HaveResponse As Boolean
   Overrides Public Property Headers As WebHeaderCollection
   Public Property IfModifiedSince As Date
   Public Property KeepAlive As Boolean
   Public Property MaximumAutomaticRedirections As Integer
   Public Property MediaType As String
   Overrides Public Property Method As String
   Public Property Pipelined As Boolean
   Overrides Public Property PreAuthenticate As Boolean
   Public Property ProtocolVersion As Version
   Overrides Public Property Proxy As IWebProxy
   Public Property Referer As String
   Overrides Public ReadOnly Property RequestUri As Uri
   Public Property SendChunked As Boolean
   Public ReadOnly Property ServicePoint As ServicePoint
   Overrides Public Property Timeout As Integer
   Public Property TransferEncoding As String
   Public Property UserAgent As String
' Public Instance Methods
   Overrides Public Sub Abort()
   Public Sub AddRange( ByVal range As Integer)
   Public Sub AddRange(ByVal from As Integer,
        ByVal to As Integer)
   Public Sub AddRange(ByVal rangeSpecifier As String,
        ByVal range As Integer)
   Public Sub AddRange(ByVal rangeSpecifier As String,
        ByVal from As Integer, ByVal to As Integer)
   Overrides Public Function BeginGetRequestStream(
```

```
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Function BeginGetResponse(
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Function EndGetRequestStream(
        ByVal asyncResult As IAsyncResult) As Stream
   Overrides Public Function EndGetResponse(
        ByVal asyncResult As IAsyncResult) As WebResponse
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function GetRequestStream() As Stream
   Overrides Public Function GetResponse() As WebResponse
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → WebRequest(System.Runtime.Serialization.ISerializable) → HttpWebRequest

## HttpWebResponse Class

**System.Net (system.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class represents a response from an HTTP server. This is usually returned from `WebRequest.GetResponse()` or `WebRequest.EndGetResponse()`. Use `GetResponseStrea` obtain a `System.IO.Stream` object containing the response body. Use `GetResponseHeader()` specific HTTP header.

```
Public Class HttpWebResponse : Inherits WebResponse

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Instance Properties

   Public ReadOnly Property CharacterSet As String

   Public ReadOnly Property ContentEncoding As String

   Overrides Public ReadOnly Property ContentLength As Long

   Overrides Public ReadOnly Property ContentType As String

   Public Property Cookies As CookieCollection

   Overrides Public ReadOnly Property Headers As WebHeaderCollection

   Public ReadOnly Property LastModified As Date

   Public ReadOnly Property Method As String

   Public ReadOnly Property ProtocolVersion As Version

   Overrides Public ReadOnly Property ResponseUri As Uri

   Public ReadOnly Property Server As String

   Public ReadOnly Property StatusCode As HttpStatusCode

   Public ReadOnly Property StatusDescription As String

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Function GetHashCode() As Integer

   Public Function GetResponseHeader(
```

```
        ByVal headerName As String) As String
   Overrides Public Function GetResponseStream() As Stream
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject →
WebResponse(System.Runtime.Serialization.ISerializable,System.IDisposable) →
HttpWebResponse

# IAuthenticationModule Interface

## System.Net (system.dll) *ECMA*

This interface is implemented by all authentication modules. If you develop a custom authentication module, you must implement this interface and register an instance of your module with `AuthenticationManager.Register()`.

```
Public Interface IAuthenticationModule

' Public Instance Properties

   Public ReadOnly Property AuthenticationType As String

   Public ReadOnly Property CanPreAuthenticate As Boolean

' Public Instance Methods

   Public Function Authenticate(ByVal challenge As String,

        ByVal request As WebRequest,

        ByVal credentials As ICredentials) As Authorization

   Public Function PreAuthenticate(

        ByVal request As WebRequest,

        ByVal credentials As ICredentials) As Authorization

End Interface
```

### Passed To

`AuthenticationManager.{Register(),Unregister()}`

# ICertificatePolicy Interface

## System.Net (system.dll)

This interface validates the certificates that web servers present to your applications. If you create a the `https` protocol, the .NET Framework uses the default certificate policy to validate the server's c

You can implement this interface to create your own custom certificate policy. Unlike authentication certificate policy may be active at a time. To set this, create an instance of your implementation and `ServicePointManager.CertificatePolicy`.

```
Public Interface ICertificatePolicy

' Public Instance Methods

   Public Function CheckValidationResult(

        ByVal srvPoint As ServicePoint,

        ByVal certificate As System.Security.Cryptography.X509Certificate

        ByVal request As WebRequest,

        ByVal certificateProblem As Integer) As Boolean

End Interface
```

### Returned By

`ServicePointManager.CertificatePolicy`

### Passed To

`ServicePointManager.CertificatePolicy`

# ICredentials Interface

## System.Net (system.dll) *ECMA*

This interface is implemented by all web-client credentials. The class `NetworkCredential` works with authentication schemes such as Basic and Digest authentication, NTLM, and Kerberos. If you need to implement a client authentication scheme not supported by .NET (such as SSL client certificates), you need to implement `ICredentials` and add a new instance of your implementation to your application's credential cache. For more information on using a credential cache, see `CredentialCache`.

```
Public Interface ICredentials

' Public Instance Methods

   Public Function GetCredential(ByVal uri As Uri,

        ByVal authType As String) As NetworkCredential

End Interface
```

### Implemented By

`CredentialCache`, `NetworkCredential`

### Returned By

`CredentialCache.DefaultCredentials`, `IWebProxy.Credentials`, `WebClient.Credentials`, `WebProxy.Credentials`, `WebRequest.Credentials`

### Passed To

`AuthenticationManager.{Authenticate(), PreAuthenticate()}`, `IAuthenticationModule.{Authenticate(), PreAuthenticate()}`, `IWebProxy.Credentials`, `WebClient.Credentials`, `WebProxy.{Credentials, WebProxy()}`, `WebRequest.Credentials`, `System.Xml.XmlResolver.Credentials`

## IPAddress Class

## System.Net (system.dll) *ECMA, serializable*

This class represents an IP address. Use the `Parse()` method to turn a dotted-quad string (such a "192.168.0.1") into an `IPAddress`. Use the `ToString()` method to convert an `IPAddress` into a

```
Public Class IPAddress

' Public Constructors

   Public Sub New( ByVal newAddress As Long)

' Public Shared Fields

   Public Shared ReadOnly Any As IPAddress                           // =0.0.

   Public Shared ReadOnly Broadcast As IPAddress                     // =255..

   Public Shared ReadOnly Loopback As IPAddress                      // =127.

   Public Shared ReadOnly None As IPAddress                          // =255..

' Public Instance Properties

   Public Property Address As Long

   Public ReadOnly Property AddressFamily As AddressFamily

' Public Shared Methods

   Public Shared Function HostToNetworkOrder(

        ByVal host As Short) As Short

   Public Shared Function HostToNetworkOrder(

        ByVal host As Integer) As Integer

   Public Shared Function HostToNetworkOrder(

        ByVal host As Long) As Long

   Public Shared Function IsLoopback(

        ByVal address As IPAddress) As Boolean

   Public Shared Function NetworkToHostOrder(

        ByVal network As Short) As Short

   Public Shared Function NetworkToHostOrder(

        ByVal network As Integer) As Integer

   Public Shared Function NetworkToHostOrder(
```

```
        ByVal network As Long) As Long
    Public Shared Function Parse(
        ByVal ipString As String) As IPAddress
' Public Instance Methods
    Overrides Public Function Equals(
        ByVal comparand As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Overrides Public Function ToString() As String
End Class
```

## Returned By

IPEndPoint.Address, IPHostEntry.AddressList, System.Net.Sockets.MulticastOpt
{Group, LocalAddress}

## Passed To

Dns.GetHostByAddress(), IPEndPoint.{Address, IPEndPoint()}, IPHostEntry.Addre
System.Net.Sockets.MulticastOption.{Group, LocalAddress, MulticastOption()},
System.Net.Sockets.TcpClient.Connect(), System.Net.Sockets.TcpListener.Tcp
System.Net.Sockets.UdpClient.{Connect(), DropMulticastGroup(), JoinMulticast

## IPEndPoint Class

## System.Net (system.dll) *ECMA, serializable*

This class represents a network endpoint as a combination of `IPAddress` and an integer port number. The shared fields `MinPort` and `MaxPort` represent the minimum and maximum acceptable values for `Port`. These values are operating system-dependent.

This class does not represent an open socket connection, which contains two endpoints (local and remote). To create a socket, use `System.Net.Sockets.Socket`.

```
Public Class IPEndPoint : Inherits EndPoint

' Public Constructors

   Public Sub New(ByVal address As Long,

        ByVal port As Integer)

   Public Sub New(ByVal address As IPAddress,

        ByVal port As Integer)

' Public Shared Fields

   Public const MaxPort As Integer                                    // =6553

   Public const MinPort As Integer                                    // =0

' Public Instance Properties

   Public Property Address As IPAddress

   Overrides Public ReadOnly Property AddressFamily As AddressFamily

   Public Property Port As Integer

' Public Instance Methods

   Overrides Public Function Create(

        ByVal socketAddress As SocketAddress) As EndPoint

   Overrides Public Function Equals(

        ByVal comparand As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function Serialize() As SocketAddress

   Overrides Public Function ToString() As String

End Class
```

## Hierarchy

`System.Object` → `EndPoint` → `IPEndPoint`

## Passed To

`System.Net.Sockets.TcpClient.{Connect(), TcpClient()}`, `System.Net.Sockets.TcpListener.TcpListener()`, `System.Net.Sockets.UdpClient{Connect(), Receive(), Send(), UdpClient()}`

# IPHostEntry Class

## System.Net (system.dll) *ECMA*

The Dns class uses this class to represent hosts. A host is named by its HostName property, and its aliases are stored in the Aliases property. The AddressList property contains all the IP addresses for that host.

```
Public Class IPHostEntry

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property AddressList As IPAddress()

   Public Property Aliases As String()

   Public Property HostName As String

End Class
```

### Returned By

Dns.{EndGetHostByName(),EndResolve(),GetHostByAddress(),GetHostByName(),
Resolve()}

# IWebProxy Interface

## System.Net (system.dll) *ECMA*

`IWebProxy` defines the interface used by the `WebProxy` class. Parties interested in creating customized proxy handlers would implement this interface to do so, but the `WebProxy` implementation is sufficient for most HTTP access purposes.

To use an implementation of `IWebProxy`, see the `GlobalProxySelection` class or the `WebRequest.Proxy` property.

```
Public Interface IWebProxy

' Public Instance Properties

   Public Property Credentials As ICredentials

' Public Instance Methods

   Public Function GetProxy( ByVal destination As Uri) As Uri

   Public Function IsBypassed( ByVal host As Uri) As Boolean

End Interface
```

### Implemented By

`WebProxy`

### Returned By

`GlobalProxySelection.{GetEmptyWebProxy(), Select}`, `WebRequest.Proxy`

### Passed To

`GlobalProxySelection.Select`, `ServicePointManager.FindServicePoint()`, `WebRequest.Proxy`

## IWebRequestCreate Interface

## System.Net (system.dll) *ECMA*

This interface is for objects that create protocol-specific instances of `WebRequest`. For example, the private class `HttpRequestCreator` is the underlying class that implements this interface. `WebRequest` uses that class under the hood to create instances of `HttpWebRequest` when an application connects to an `http` or `https` URI.

If you create your own protocol-specific implementation of this interface, you can register it with the `WebRequest.RegisterPrefix()` shared method.

```
Public Interface IWebRequestCreate

' Public Instance Methods

   Public Function Create( ByVal uri As Uri) As WebRequest

End Interface
```

### Passed To

`WebRequest.RegisterPrefix()`

# NetworkAccess Enum

## System.Net (system.dll) *ECMA, serializable*

This enumeration specifies network access permissions. `Accept` indicates that an application has permission to accept network connections. `Connect` indicates that the application can connect to network hosts.

Both `WebPermission` and `SocketPermission` use this enumeration.

```
Public Enum NetworkAccess
    Connect = 64
    Accept = 128
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `NetworkAccess`

### Passed To

`SocketPermission.{AddPermission(), SocketPermission()}, WebPermission.{AddPermission(), WebPermission()}`

## NetworkCredential Class

## System.Net (system.dll) *ECMA*

This class is an implementation of `ICredentials` for authentication schemes that use passwords, authentication, NTLM, and Kerberos. See `CredentialCache` for more details.

```
Public Class NetworkCredential : Implements ICredentials

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal userName As String,

        ByVal password As String)

   Public Sub New(ByVal userName As String,

        ByVal password As String, ByVal domain As String)

' Public Instance Properties

   Public Property Domain As String

   Public Property Password As String

   Public Property UserName As String

' Public Instance Methods

   Public Function GetCredential(ByVal uri As Uri,

        ByVal authType As String) As NetworkCredential Implements ICreden

End Class
```

### Returned By

`CredentialCache.GetCredential()`, `ICredentials.GetCredential()`

### Passed To

`CredentialCache.Add()`

# ProtocolViolationException Class

## System.Net (system.dll) *ECMA, serializable*

This exception is thrown when a network protocol error occurs.

```
Public Class ProtocolViolationException : Inherits InvalidOperationExcept
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
' Protected Constructors
   Protected Sub New(
        ByVal serializationInfo As System.Runtime.Serialization.Serializa
        ByVal streamingContext As System.Runtime.Serialization.StreamingC
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.SystemException → System.InvalidOperationException →
ProtocolViolationException

## ServicePoint Class

## System.Net (system.dll) *ECMA*

This class is used by `ServicePointManager` to manage connections to remote hosts. The .NET Framework reuses service points for all requests to a given URI. The lifetime of a given `ServicePoint` is governed by its `MaxIdleTime` property.

The `ServicePoint` class is a high-level abstraction of the underlying implementation. Details of the implementation, such as the sockets used for HTTP transport, are not publicly exposed.

```
Public Class ServicePoint
' Public Instance Properties
   Public ReadOnly Property Address As Uri
   Public ReadOnly Property Certificate As X509Certificate
   Public ReadOnly Property ClientCertificate As X509Certificate
   Public Property ConnectionLimit As Integer
   Public ReadOnly Property ConnectionName As String
   Public ReadOnly Property CurrentConnections As Integer
   Public ReadOnly Property IdleSince As Date
   Public Property MaxIdleTime As Integer
   Overridable Public ReadOnly Property ProtocolVersion As Version
   Public ReadOnly Property SupportsPipelining As Boolean
' Public Instance Methods
   Overrides Public Function GetHashCode() As Integer
End Class
```

### Returned By

`HttpWebRequest.ServicePoint`, `ServicePointManager.FindServicePoint()`

### Passed To

`ICertificatePolicy.CheckValidationResult()`

## ServicePointManager Class

## System.Net (system.dll) *ECMA*

This class is responsible for managing `ServicePoint` instances. As your applications make HTTP connections to network resources, this class is working behind the scenes to maintain the connections. When your application makes many connections to the same server, this class eliminates the overhead of making a new connection each time you connect.

The `ServicePointManager` also sets the default certificate policy for new connections. In most cases, the default certificate policy should suit your needs. If you need to change it, see `ICertificatePolicy` for more details.

```
Public Class ServicePointManager
' Public Shared Fields
   Public const DefaultNonPersistentConnectionLimit As Integer     // =4
   Public const DefaultPersistentConnectionLimit As Integer      // =2
' Public Shared Properties
   Public Shared Property CertificatePolicy As ICertificatePolicy
   Public Shared Property DefaultConnectionLimit As Integer
   Public Shared Property MaxServicePointIdleTime As Integer
   Public Shared Property MaxServicePoints As Integer
' Public Shared Methods
   Public Shared Function FindServicePoint(
        ByVal uriString As String,
        ByVal proxy As IWebProxy) As ServicePoint
   Public Shared Function FindServicePoint(
        ByVal address As Uri) As ServicePoint
   Public Shared Function FindServicePoint(
        ByVal address As Uri,
        ByVal proxy As IWebProxy) As ServicePoint
End Class
```

## SocketAddress Class

## System.Net (system.dll) *ECMA*

This type defines an address of a particular socket; in particular, it defines the family of networking protocols to which the address belongs (for example, IP or IPv6), as well as the size of the address itself. This type can be safely ignored for most high-level (and, arguably, most low-level) networking operations.

```
Public Class SocketAddress

' Public Constructors

   Public Sub New(

        ByVal family As System.Net.Sockets.AddressFamily)

   Public Sub New(

        ByVal family As System.Net.Sockets.AddressFamily,

        ByVal size As Integer)

' Public Instance Properties

   Public ReadOnly Property Family As AddressFamily

   Public Default Property Item(

        ByVal offset As Integer) As Byte

   Public ReadOnly Property Size As Integer

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal comparand As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String

End Class
```

### Returned By

EndPoint.Serialize()

### Passed To

EndPoint.Create()

## SocketPermission NotInheritable Class

### System.Net (system.dll) *ECMA, serializable*

This permission controls whether code can make or accept socket connections for a given Networl
port number (see the four-argument form of the constructor). The shared field AllPorts is a const
and can be used as the port argument to the constructor.

```
Public NotInheritable Class SocketPermission : Inherits System.Security.C
        System.Security.Permissions.IUnrestrictedPermission
' Public Constructors
   Public Sub New(ByVal access As NetworkAccess,
        ByVal transport As TransportType,
        ByVal hostName As String,
        ByVal portNumber As Integer)
   Public Sub New(
        ByVal state As System.Security.Permissions.PermissionState)
' Public Shared Fields
   Public const AllPorts As Integer                                // =-1
' Public Instance Properties
   Public ReadOnly Property AcceptList As IEnumerator
   Public ReadOnly Property ConnectList As IEnumerator
' Public Instance Methods
   Public Sub AddPermission(ByVal access As NetworkAccess,
        ByVal transport As TransportType,
        ByVal hostName As String,
        ByVal portNumber As Integer)
   Overrides Public Function Copy() As IPermission
   Overrides Public Sub FromXml(
        ByVal securityElement As System.Security.SecurityElement)
   Overrides Public Function Intersect(
        ByVal target As System.Security.IPermission) As IPermission
   Overrides Public Function IsSubsetOf(
```

```
        ByVal target As System.Security.IPermission) As Boolean

    Public Function IsUnrestricted(

        ) As Boolean Implements IUnrestrictedPermission.IsUnrestricted

    Overrides Public Function ToXml() As SecurityElement

    Overrides Public Function Union(

        ByVal target As System.Security.IPermission) As IPermission

End Class
```

## Hierarchy

System.Object → System.Security.CodeAccessPermission(System.Security.IPe
System.Security.ISecurityEncodable, System.Security.IStackWalk) →
SocketPermission(System.Security.Permissions.IUnrestrictedPermission)


PREVIOUS NEXT

## SocketPermissionAttribute NotInheritable Class

## System.Net (system.dll) *ECMA, serializable*

This attribute is used to declare in metadata that the attributed method or class requires `SocketPermission` of the declared form.

```
Public NotInheritable Class SocketPermissionAttribute : Inherits
        System.Security.Permissions.CodeAccessSecurityAttribute
' Public Constructors
   Public Sub New(
        ByVal action As System.Security.Permissions.SecurityAction)
' Public Instance Properties
   Public Property Access As String
   Public Property Host As String
   Public Property Port As String
   Public Property Transport As String
' Public Instance Methods
   Overrides Public Function CreatePermission(
        ) As IPermission
End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.Security.Permissions.SecurityAttribute` → `System.Security.Permissions.CodeAccessSecurityAttribute` → `SocketPermissionAttribute`

### Valid On

Assembly, Class, Struct, Constructor, Method

## TransportType Enum

**System.Net (system.dll)** ***ECMA, serializable***

This enumeration defines the transport protocols that can be used to communicate over a socket.

```
Public Enum TransportType
   Udp = 1
   Connectionless = 1
   Tcp = 2
   ConnectionOriented = 2
   All = 3
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → TransportType

### Returned By

EndpointPermission.Transport

### Passed To

SocketPermission.{AddPermission(), SocketPermission()}

## WebClient NotInheritable Class

**System.Net (system.dll)** ***ECMA, marshal by reference, disposable***

This class is a simple HTTP User-Agent. Use `DownloadData()` to fetch a document as an array o `DownloadFile()` method fetches a document and stores it in a file. You can upload data to a URI `UploadFile()` or `UploadData()` (which uploads the contents of a byte array).

Before connecting to a URI, invoke the `Add()` method of the `QueryString` or `Headers` properties key/value pair to the HTTP query string or HTTP request headers. Set the credentials property to au `WebClient` to the remote server, if necessary.

```
Public NotInheritable Class WebClient : Inherits System.ComponentModel.Co

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property BaseAddress As String

   Public Property Credentials As ICredentials

   Public Property Headers As WebHeaderCollection

   Public Property QueryString As NameValueCollection

   Public ReadOnly Property ResponseHeaders As WebHeaderCollection

' Public Instance Methods

   Public Function DownloadData(

        ByVal address As String) As Byte()

   Public Sub DownloadFile(ByVal address As String,

        ByVal fileName As String)

   Public Function OpenRead(

        ByVal address As String) As Stream

   Public Function OpenWrite(

        ByVal address As String) As Stream

   Public Function OpenWrite(ByVal address As String,

        ByVal method As String) As Stream

   Public Function UploadData(ByVal address As String,
```

```
        ByVal data As Byte()) As Byte()
    Public Function UploadData(ByVal address As String,
        ByVal method As String,
        ByVal data As Byte()) As Byte()
    Public Function UploadFile(ByVal address As String,
        ByVal fileName As String) As Byte()
    Public Function UploadFile(ByVal address As String,
        ByVal method As String,
        ByVal fileName As String) As Byte()
    Public Function UploadValues(ByVal address As String,
        ByVal data As System.Collections.Specialized.NameValueCollection)
    Public Function UploadValues(ByVal address As String,
        ByVal method As String,
        ByVal data As System.Collections.Specialized.NameValueCollection)
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.II → WebClient

## WebException Class

### System.Net (system.dll) *ECMA, serializable*

This exception represents an error that occurred while using a protocol-specific implementation of W
In the case of some protocols, such as HTTP, the exception's `Response` property contains informat
the error that occurred.

```
Public Class WebException : Inherits InvalidOperationException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception,
        ByVal status As WebExceptionStatus,
        ByVal response As WebResponse)
   Public Sub New(ByVal message As String,
        ByVal status As WebExceptionStatus)
' Protected Constructors
   Protected Sub New(
        ByVal serializationInfo As System.Runtime.Serialization.Serializa
        ByVal streamingContext As System.Runtime.Serialization.StreamingC
' Public Instance Properties
   Public ReadOnly Property Response As WebResponse
   Public ReadOnly Property Status As WebExceptionStatus
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.SystemException → System.InvalidOperationException → WebExceptio

## WebExceptionStatus Enum

## System.Net (system.dll) *ECMA, serializable*

This enumeration defines constants for the status codes used in `WebException.Status`.

```
Public Enum WebExceptionStatus
   Success = 0
   NameResolutionFailure = 1
   ConnectFailure = 2
   ReceiveFailure = 3
   SendFailure = 4
   PipelineFailure = 5
   RequestCanceled = 6
   ProtocolError = 7
   ConnectionClosed = 8
   TrustFailure = 9
   SecureChannelFailure = 10
   ServerProtocolViolation = 11
   KeepAliveFailure = 12
   Pending = 13
   Timeout = 14
   ProxyNameResolutionFailure = 15
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → WebExceptionStatus

### Returned By

WebException.Status

### Passed To

## WebHeaderCollection Class

## System.Net (system.dll) *ECMA, serializable*

This class contains the headers that are part of a `WebRequest` or `WebResponse`. Some headers sl through this collection. Instead, use the corresponding properties of the `WebRequest` or `WebRespo` subclasses). These headers are Accept, Connection, Content-Length, Content-Type, Date, Expect, Transfer-Encoding, and User-Agent.

```
Public Class WebHeaderCollection : Inherits System.Collections.Specialize

' Public Constructors

   Public Sub New()

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Shared Methods

   Public Shared Function IsRestricted(

        ByVal headerName As String) As Boolean

' Public Instance Methods

   Public Sub Add( ByVal header As String)

   Overrides Public Sub Add(ByVal name As String,

        ByVal value As String)

   Overrides Public Function GetValues(

        ByVal header As String) As String()

   Overrides Public Sub OnDeserialization(

        ByVal sender As Object)

   Overrides Public Sub Remove( ByVal name As String)

   Overrides Public Sub Set(ByVal name As String,

        ByVal value As String)

   Public Function ToByteArray() As Byte()

   Overrides Public Function ToString() As String

' Protected Instance Methods
```

```
    Protected Sub AddWithoutValidate(
        ByVal headerName As String,
        ByVal headerValue As String)
End Class
```

## Hierarchy

System.Object → System.Collections.Specialized.NameObjectCollectionBase(System.Collection: System.Collections.IEnumerable, System.Runtime.Serialization.ISerializable, System.Runtime.Serialization.IDeserializationCallback) → System.Collections.Specialized.NameValueCollection → WebHeaderCollection

## Returned By

WebClient.{Headers, ResponseHeaders}, WebRequest.Headers, WebResponse.Header:

## Passed To

HttpContinueDelegate.{BeginInvoke(), Invoke()}, WebClient.Headers, WebRequest

## WebPermission NotInheritable Class

## System.Net (system.dll) *ECMA, serializable*

This permission controls which connections an application can make or accept.

```
Public NotInheritable Class WebPermission : Inherits System.Security.CodeA
        System.Security.Permissions.IUnrestrictedPermission
' Public Constructors
   Public Sub New()
   Public Sub New(ByVal access As NetworkAccess,
        ByVal uriRegex As System.Text.RegularExpressions.Regex)
   Public Sub New(ByVal access As NetworkAccess,
        ByVal uriString As String)
   Public Sub New(
        ByVal state As System.Security.Permissions.PermissionState)
' Public Instance Properties
   Public ReadOnly Property AcceptList As IEnumerator
   Public ReadOnly Property ConnectList As IEnumerator
' Public Instance Methods
   Public Sub AddPermission(ByVal access As NetworkAccess,
        ByVal uriRegex As System.Text.RegularExpressions.Regex)
   Public Sub AddPermission(ByVal access As NetworkAccess,
        ByVal uriString As String)
   Overrides Public Function Copy() As IPermission
   Overrides Public Sub FromXml(
        ByVal securityElement As System.Security.SecurityElement)
   Overrides Public Function Intersect(
        ByVal target As System.Security.IPermission) As IPermission
   Overrides Public Function IsSubsetOf(
        ByVal target As System.Security.IPermission) As Boolean
   Public Function IsUnrestricted(
```

```
        ) As Boolean Implements IUnrestrictedPermission.IsUnrestricted
   Overrides Public Function ToXml() As SecurityElement
   Overrides Public Function Union(
        ByVal target As System.Security.IPermission) As IPermission
End Class
```

## Hierarchy

System.Object → System.Security.CodeAccessPermission(System.Security.IPe
System.Security.ISecurityEncodable, System.Security.IStackWalk) →
WebPermission(System.Security.Permissions.IUnrestrictedPermission)

## WebPermissionAttribute NotInheritable Class

**System.Net (system.dll)** ***ECMA, serializable***

This attribute is used to declare in metadata that the attributed method or class requires `WebPermission` of the declared form.

```
Public NotInheritable Class WebPermissionAttribute : Inherits
        System.Security.Permissions.CodeAccessSecurityAttribute
' Public Constructors
   Public Sub New(
        ByVal action As System.Security.Permissions.SecurityAction)
' Public Instance Properties
   Public Property Accept As String
   Public Property AcceptPattern As String
   Public Property Connect As String
   Public Property ConnectPattern As String
' Public Instance Methods
   Overrides Public Function CreatePermission(
        ) As IPermission
End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `System.Security.Permissions.SecurityAttribute` → `System.Security.Permissions.CodeAccessSecurityAttribute` → `WebPermissionAttribute`

### Valid On

Assembly, Class, Struct, Constructor, Method

## WebProxy Class

### System.Net (system.dll) *ECMA, serializable*

This implementation of IWebProxy supports HTTP proxies. Use the one-argument form of the cons the URI of the proxy server. The second argument BypassOnLocal, if set to true, bypasses the pro (intranet) addresses. Other forms of the constructor allow you to specify an array that lists servers fo bypass the proxy (this list can contain regular expression strings containing URI patterns to match). supply network credentials to authenticate your application to the proxy server.

See GlobalProxySelection or the WebRequest.Proxy property for details on configuring a pr

```
Public Class WebProxy : Implements IWebProxy, System.Runtime.Serializatio

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal Address As String)

   Public Sub New(ByVal Address As String,
        ByVal BypassOnLocal As Boolean)

   Public Sub New(ByVal Address As String,
        ByVal BypassOnLocal As Boolean,
        ByVal BypassList As String())

   Public Sub New(ByVal Address As String,
        ByVal BypassOnLocal As Boolean,
        ByVal BypassList As String(),
        ByVal Credentials As ICredentials)

   Public Sub New(ByVal Host As String, ByVal Port As Integer)

   Public Sub New( ByVal Address As Uri)

   Public Sub New(ByVal Address As Uri,
        ByVal BypassOnLocal As Boolean)

   Public Sub New(ByVal Address As Uri,
        ByVal BypassOnLocal As Boolean,
        ByVal BypassList As String())

   Public Sub New(ByVal Address As Uri,
```

```
        ByVal BypassOnLocal As Boolean,
        ByVal BypassList As String(),
        ByVal Credentials As ICredentials)
' Protected Constructors
   Protected Sub New(
        ByVal serializationInfo As System.Runtime.Serialization.Serializa
        ByVal streamingContext As System.Runtime.Serialization.StreamingC
' Public Instance Properties
   Public Property Address As Uri
   Public ReadOnly Property BypassArrayList As ArrayList
   Public Property BypassList As String()
   Public Property BypassProxyOnLocal As Boolean
   Public Property Credentials As ICredentials Implements IWebProxy.Crede
' Public Shared Methods
   Public Shared Function GetDefaultProxy() As WebProxy
' Public Instance Methods
   Public Function GetProxy(
        ByVal destination As Uri) As Uri Implements IWebProxy.GetProxy
   Public Function IsBypassed(
        ByVal host As Uri) As Boolean Implements IWebProxy.IsBypassed
End Class
```

## WebRequest MustInherit Class

### System.Net (system.dll) *ECMA, serializable, marshal by reference*

Because many Internet protocols are request-response synchronous protocols, this class serves as for any and all request-response style of network communication. As such, a .NET programmer will a `WebRequest` type directly — instead, a shared method on this class, `Create()`, is used as a "vir constructor" to create a subtype of `WebRequest` that matches the protocol scheme requested. For the string http://www.oreilly.com is passed to `Create()`, an instance of `HttpWebRequest` is hand of the box, only "http", "https", and "file" are supported.

Once obtained, a .NET programmer can manipulate the common properties of the `WebRequest` typ various aspects of the request. Alternatively, downcast the generic `WebRequest` reference to the co returned to access protocol-specific aspects of that protocol — for example, the returned object from `WebRequest.Create("http://www.oreilly.com")` will be a `HttpWebRequest`, so it is safe such. This allows access to the `Accept` and `SendChunked` properties/headers in the request. Be s manipulate these properties before the request is sent, or the modifications will have no effect.

Use the `GetResponse()` method to obtain a `WebResponse` object corresponding to the response remote server sent. This means that the request is sent, and the response harvested. The methods `BeginGetResponse()` and `EndGetResponse()` are asynchronous versions of `GetResponse()`

By default, `WebRequest` uses the proxy server specified in `GlobalProxySelection.Select`. O setting by assigning an `IWebProxy` implementation to the `Proxy` property.

```
Public MustInherit Class WebRequest : Inherits MarshalByRefObject : Impler
        System.Runtime.Serialization.ISerializable
' Protected Constructors
   Protected Sub New()
   Protected Sub New(
        ByVal serializationInfo As System.Runtime.Serialization.Serializa
        ByVal streamingContext As System.Runtime.Serialization.StreamingC
' Public Instance Properties
   Overridable Public Property ConnectionGroupName As String
   Overridable Public Property ContentLength As Long
   Overridable Public Property ContentType As String
   Overridable Public Property Credentials As ICredentials
   Overridable Public Property Headers As WebHeaderCollection
   Overridable Public Property Method As String
   Overridable Public Property PreAuthenticate As Boolean
```

```
   Overridable Public Property Proxy As IWebProxy
   Overridable Public ReadOnly Property RequestUri As Uri
   Overridable Public Property Timeout As Integer
' Public Shared Methods
   Public Shared Function Create(
        ByVal requestUriString As String) As WebRequest
   Public Shared Function Create(
        ByVal requestUri As Uri) As WebRequest
   Public Shared Function CreateDefault(
        ByVal requestUri As Uri) As WebRequest
   Public Shared Function RegisterPrefix(
        ByVal prefix As String,
        ByVal creator As IWebRequestCreate) As Boolean
' Public Instance Methods
   Overridable Public Sub Abort()
   Overridable Public Function BeginGetRequestStream(
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overridable Public Function BeginGetResponse(
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overridable Public Function EndGetRequestStream(
        ByVal asyncResult As IAsyncResult) As Stream
   Overridable Public Function EndGetResponse(
        ByVal asyncResult As IAsyncResult) As WebResponse
   Overridable Public Function GetRequestStream() As Stream
   Overridable Public Function GetResponse() As WebResponse
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → WebRequest(System.Runtime.Serialization.ISerializable)

### Subclasses

FileWebRequest, HttpWebRequest

### Returned By

IWebRequestCreate.Create()

### Passed To

AuthenticationManager.{Authenticate(), PreAuthenticate()}, IAuthenticationMo
{Authenticate(), PreAuthenticate()}, ICertificatePolicy.CheckValidationResul

# WebResponse MustInherit Class

**System.Net (system.dll)** ***ECMA, serializable, marshal by reference, disposable***

This class represents a response received from a `WebRequest`. A response consists of headers (st key/value pairs in the `Headers` property) and a response body. You can obtain the response body a `System.IO.Stream` using the `GetResponseStream()` method.

When you are finished with the response, call its `Close()` method; this releases any open resource by the `WebResponse` without having to wait for garbage collection to do so (which could take longe desired).

```
Public MustInherit Class WebResponse : Inherits MarshalByRefObject : Impl

        System.Runtime.Serialization.ISerializable, IDisposable

' Protected Constructors

   Protected Sub New()

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Instance Properties

   Overridable Public Property ContentLength As Long

   Overridable Public Property ContentType As String

   Overridable Public ReadOnly Property Headers As WebHeaderCollection

   Overridable Public ReadOnly Property ResponseUri As Uri

' Public Instance Methods

   Overridable Public Sub Close()

   Overridable Public Function GetResponseStream() As Stream

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `WebResponse(System.Runtime.Serialization.ISerializable, System.IDisposable)`

### Subclasses

`FileWebResponse`, `HttpWebResponse`

## Returned By

`WebException.Response`, `WebRequest.{EndGetResponse(), GetResponse()}`

## Passed To

`WebException.WebException()`

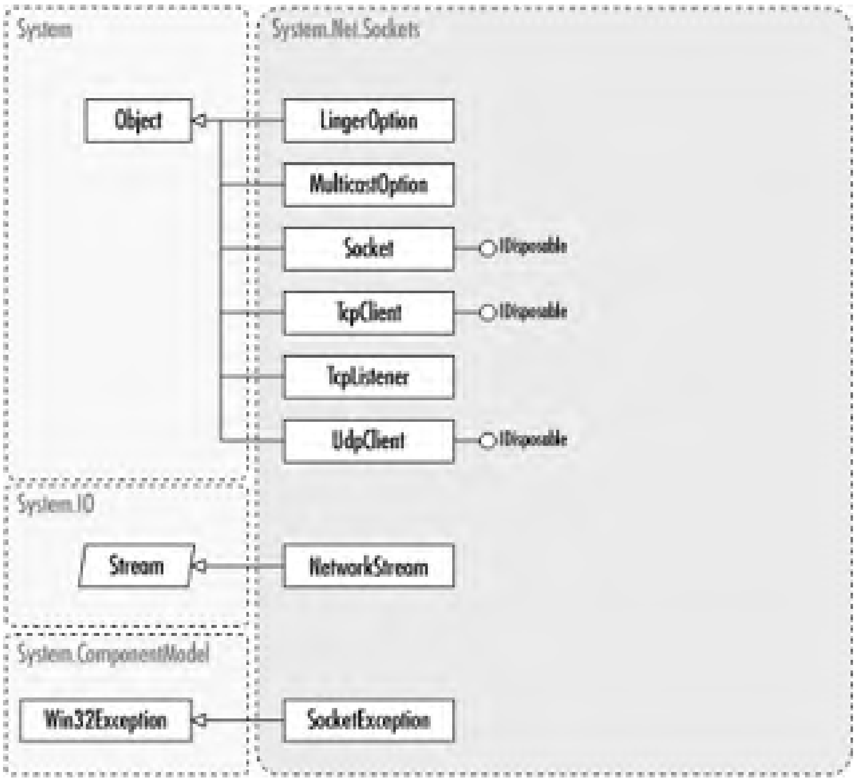
# Chapter 12. System.Net.Sockets

The `System.Net.Sockets` namespace classes implement standard Berkeley sockets APIs for cross-process/cross-host communication. Sockets are low-level objects (abstractions, really) that provide the foundation for most Internet networking. A socket binds to a local address and port, and either waits for a connection from a remote address or connects to a remote address and exchanges data across the network. Two socket implementations are made available in this namespace, TCP/IP and UDP/IP. Most Internet applications, such as FTP clients and web browsers, are built upon socket connections.

Although many system-level programmers feel a close kinship with these types, .NET programmers are greatly encouraged to consider using higher-level constructs, such as HTTP (see the `System.Net` namespace) or the `System.Runtime.Remoting` types, to facilitate remote communications. If you need to work at the socket level, consider using `TcpClient` or `TcpListener`. These are high-level abstractions of the socket API that support client and server functionality.

For more details regarding many of the options mentioned in this namespace, consult a low-level sockets reference, such as W. Richard Stevens' "Network Programming in the Unix Environment" (Volumes 1 and 2) or "TCP/IP Illustrated" (Volumes 1, 2, and 3). Although the books were written for a Unix environment, .NET faithfully mirrors much, if not all, of the Berkeley sockets API (which originally came from Unix). Figure 12-1 shows the types in this namespace.

**Figure 12-1. The System.Net.Sockets namespace**



## AddressFamily Enum

### System.Net.Sockets (system.dll) *ECMA, serializable*

This enumeration contains values to specify the address family used by a socket. This indicates to which family of addressing schemes the address of the socket belongs. Note that the standard four-digit IP scheme falls under the enumeration `InterNetwork`, and its successor, IPv6, under the enumeration `InterNetworkV6`.

```
Public Enum AddressFamily

   Unspecified = 0

   Unix = 1

   InterNetwork = 2

   ImpLink = 3

   Pup = 4

   Chaos = 5

   Ipx = 6

   NS = 6

   Iso = 7

   Osi = 7

   Ecma = 8

   DataKit = 9

   Ccitt = 10

   Sna = 11

   DecNet = 12

   DataLink = 13

   Lat = 14

   HyperChannel = 15

   AppleTalk = 16

   NetBios = 17

   VoiceView = 18

   FireFox = 19

   Banyan = 21
```

```
    Atm = 22
    InterNetworkV6 = 23
    Cluster = 24
    Ieee12844 = 25
    Irda = 26
    NetworkDesigners = 28
    Max = 29
    Unknown = -1
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → AddressFamily

### Returned By

System.Net.EndPoint.AddressFamily, System.Net.IPAddress.AddressFamily, System.Net.SocketAddress.Family, Socket.AddressFamily

### Passed To

System.Net.SocketAddress.SocketAddress(), Socket.Socket()

# LingerOption Class

## System.Net.Sockets (system.dll) *ECMA*

This class is a socket option object that enables a socket to continue to send queued data after a call to `Socket.Close()`. If the `Enabled` property is `True`, the connection lingers for the number of seconds given by `LingerTime`. The `LingerOption` object is set on a socket with the `Socket.SetSocketOption()` method and a `SocketOptionName` of `SocketOptionName.Linger`.

```
Public Class LingerOption

' Public Constructors

   Public Sub New(ByVal enable As Boolean,

        ByVal seconds As Integer)

' Public Instance Properties

   Public Property Enabled As Boolean

   Public Property LingerTime As Integer

End Class
```

### Returned By

`TcpClient.LingerState`

### Passed To

`TcpClient.LingerState`

## Multic astOption Class

## System.Net.Sockets (system.dll) *ECMA*

This class specifies an IP address for IP-multicast packets. IP-multicast addresses must be in the range of 224.0.0.0 to 239.255.255.255. The `MulticastOption` is set on a socket using the `SocketOptionName.AddMembership` value with `Socket.SetSocketOption()`. You can drop multicast with `SocketOptionName.DropMembership`.

```
Public Class MulticastOption

' Public Constructors

   Public Sub New( ByVal group As System.Net.IPAddress)

   Public Sub New(ByVal group As System.Net.IPAddress,

        ByVal mcint As System.Net.IPAddress)

' Public Instance Properties

   Public Property Group As IPAddress

   Public Property LocalAddress As IPAddress

End Class
```

## NetworkStream Class

**System.Net.Sockets (system.dll)** ***ECMA, marshal by reference, disposable***

This class creates a basic network stream from an underlying socket. It allows for simple data access to the stream and supports permissions settings.

```
Public Class NetworkStream : Inherits System.IO.Stream
' Public Constructors
   Public Sub New( ByVal socket As Socket)
   Public Sub New(ByVal socket As Socket,
        ByVal ownsSocket As Boolean)
   Public Sub New(ByVal socket As Socket,
        ByVal access As System.IO.FileAccess)
   Public Sub New(ByVal socket As Socket,
        ByVal access As System.IO.FileAccess,
        ByVal ownsSocket As Boolean)
' Public Instance Properties
   Overrides Public ReadOnly Property CanRead As Boolean
   Overrides Public ReadOnly Property CanSeek As Boolean
   Overrides Public ReadOnly Property CanWrite As Boolean
   Overridable Public ReadOnly Property DataAvailable As Boolean
   Overrides Public ReadOnly Property Length As Long
   Overrides Public Property Position As Long
' Protected Instance Properties
   Protected Property Readable As Boolean
   Protected Property Socket As Socket
   Protected Property Writeable As Boolean
' Public Instance Methods
   Overrides Public Function BeginRead(ByVal buffer As Byte(),
```

```
        ByVal offset As Integer, ByVal size As Integer,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Function BeginWrite(
        ByVal buffer As Byte(), ByVal offset As Integer,
        ByVal size As Integer,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Overrides Public Sub Close()
   Overrides Public Function EndRead(
        ByVal asyncResult As IAsyncResult) As Integer
   Overrides Public Sub EndWrite(
        ByVal asyncResult As IAsyncResult)
   Overrides Public Sub Flush()
   Overrides Public Function Read(ByRef buffer As Byte(),
        ByVal offset As Integer,
        ByVal size As Integer) As Integer
   Overrides Public Function Seek(ByVal offset As Long,
        ByVal origin As System.IO.SeekOrigin) As Long
   Overrides Public Sub SetLength( ByVal value As Long)
   Overrides Public Sub Write(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal size As Integer)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.IO.Stream(System.IDisposable) → NetworkStream

### Returned By

`TcpClient.GetStream()`

## ProtocolFamily Enum

## System.Net.Sockets (system.dll) *serializable*

This enumeration contains settings for the protocol family of a socket.

```
Public Enum ProtocolFamily
   Unspecified = 0
   Unix = 1
   InterNetwork = 2
   ImpLink = 3
   Pup = 4
   Chaos = 5
   Ipx = 6
   NS = 6
   Iso = 7
   Osi = 7
   Ecma = 8
   DataKit = 9
   Ccitt = 10
   Sna = 11
   DecNet = 12
   DataLink = 13
   Lat = 14
   HyperChannel = 15
   AppleTalk = 16
   NetBios = 17
   VoiceView = 18
   FireFox = 19
   Banyan = 21
   Atm = 22
   InterNetworkV6 = 23
```

```
    Cluster = 24
    Ieee12844 = 25
    Irda = 26
    NetworkDesigners = 28
    Max = 29
    Unknown = -1
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → ProtocolFamily

## ProtocolType Enum

**System.Net.Sockets (system.dll)** ***ECMA, serializable***

This enumeration contains settings for the protocol type of a socket. A protocol type must be specified for every `Socket` instance.

```
Public Enum ProtocolType

   Unspecified = 0

   IP = 0

   Icmp = 1

   Igmp = 2

   Ggp = 3

   Tcp = 6

   Pup = 12

   Udp = 17

   Idp = 22

   ND = 77

   Raw = 255

   Ipx = 1000

   Spx = 1256

   SpxII = 1257

   Unknown = -1

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ProtocolType`

### Returned By

`Socket.ProtocolType`

### Passed To

`Socket.Socket()`

## SelectMode Enum

## System.Net.Sockets (system.dll) *ECMA, serializable*

This enumeration contains the settings for polling modes used by `Socket.Poll()`.

```
Public Enum SelectMode

   SelectRead = 0

   SelectWrite = 1

   SelectError = 2

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → SelectMode

### Passed To

Socket.Poll()

## Socket Class

### System.Net.Sockets (system.dll) *ECMA, disposable*

This class implements a standard Berkeley socket. Each socket is constructed with the address family to use, the socket type (datagram or stream), and the protocol that the socket will use. Every socket must be bound to a local endpoint before you can use it. The `Bind()` method takes a `System.Net.IPEndPoint` object that contains the local IP address and port number to bind the socket to. `Bind()` must be called before any connection can be made through the socket. To establish a connection to a remote address, use `Connect()`.

To listen for connections from remote clients, use `Listen()` to set the socket in listening mode where it waits for incoming connections. The integer argument to `Listen()` specifies how many remote connection requests can be queued at one time, waiting for a socket connection. A call to `Accept()` returns a new socket that connects to the first pending connection request in the listening queue. This new socket exists only for this connection and is destroyed once the connection is closed.

Data is written to a socket using `Send()`. Data from a specified buffer is sent through the socket to its remote endpoint. Data is read from a socket using `Receive()`. `Receive()` gets data from the socket connection and stores it in a specified receive buffer.

You can set several socket options to control the behavior of a socket with `SetSocketOption()`. This method requires a `SocketOptionLevel` value, which determines the type of socket option to set. For example, `SocketOptionLevel.IP` is used for options related to an IP socket. The `SocketOptionName` value gives the specific option, which must be applicable to the `SocketOptionLevel`. The last argument to `SetSocketOption()` provides the value of the option. `SetSocketOption()` enables features such as `SocketOptionName.KeepAlive`, in which a connection is maintained even when no data transfer is occurring, or `SocketOptionName.MaxConnections`, which sets the maximum permitted size of a listen queue.

When a session is finished, the connection can be gracefully closed with `Shutdown()`. When send or receive options are called with a `SocketShutdown` value, they are no longer allowed on the socket. A call to `Close()` terminates the socket connection.

```
Public Class Socket : Implements IDisposable

' Public Constructors

   Public Sub New(ByVal addressFamily As AddressFamily,

         ByVal socketType As SocketType,

         ByVal protocolType As ProtocolType)

' Public Instance Properties

   Public ReadOnly Property AddressFamily As AddressFamily

   Public ReadOnly Property Available As Integer

   Public Property Blocking As Boolean

   Public ReadOnly Property Connected As Boolean
```

```
   Public ReadOnly Property Handle As IntPtr
   Public ReadOnly Property LocalEndPoint As EndPoint
   Public ReadOnly Property ProtocolType As ProtocolType
   Public ReadOnly Property RemoteEndPoint As EndPoint
   Public ReadOnly Property SocketType As SocketType
' Public Shared Methods
   Public Shared Sub Select(
        ByVal checkRead As System.Collections.IList,
        ByVal checkWrite As System.Collections.IList,
        ByVal checkError As System.Collections.IList,
        ByVal microSeconds As Integer)
' Public Instance Methods
   Public Function Accept() As Socket
   Public Function BeginAccept(
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Public Function BeginConnect(
        ByVal remoteEP As System.Net.EndPoint,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Public Function BeginReceive(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal size As Integer,
        ByVal socketFlags As SocketFlags,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
   Public Function BeginReceiveFrom(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal size As Integer,
        ByVal socketFlags As SocketFlags,
        ByRef remoteEP As System.Net.EndPoint,
        ByVal callback As AsyncCallback,
        ByVal state As Object) As IAsyncResult
```

```
Public Function BeginSend(ByVal buffer As Byte(),
     ByVal offset As Integer, ByVal size As Integer,
     ByVal socketFlags As SocketFlags,
     ByVal callback As AsyncCallback,
     ByVal state As Object) As IAsyncResult
Public Function BeginSendTo(ByVal buffer As Byte(),
     ByVal offset As Integer, ByVal size As Integer,
     ByVal socketFlags As SocketFlags,
     ByVal remoteEP As System.Net.EndPoint,
     ByVal callback As AsyncCallback,
     ByVal state As Object) As IAsyncResult
Public Sub Bind( ByVal localEP As System.Net.EndPoint)
Public Sub Close()
Public Sub Connect( ByVal remoteEP As System.Net.EndPoint)
Public Function EndAccept(
     ByVal asyncResult As IAsyncResult) As Socket
Public Sub EndConnect( ByVal asyncResult As IAsyncResult)
Public Function EndReceive(
     ByVal asyncResult As IAsyncResult) As Integer
Public Function EndReceiveFrom(
     ByVal asyncResult As IAsyncResult,
     ByRef endPoint As System.Net.EndPoint) As Integer
Public Function EndSend(
     ByVal asyncResult As IAsyncResult) As Integer
Public Function EndSendTo(
     ByVal asyncResult As IAsyncResult) As Integer
Overrides Public Function GetHashCode() As Integer
Public Function GetSocketOption(
```

```
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName,
        ByVal optionLength As Integer) As Byte()
Public Function GetSocketOption(
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName) As Object
Public Sub GetSocketOption(
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName,
        ByVal optionValue As Byte())
Public Function IOControl(ByVal ioControlCode As Integer,
        ByVal optionInValue As Byte(),
        ByVal optionOutValue As Byte()) As Integer
Public Sub Listen( ByVal backlog As Integer)
Public Function Poll(ByVal microSeconds As Integer,
        ByVal mode As SelectMode) As Boolean
Public Function Receive(ByVal buffer As Byte()) As Integer
Public Function Receive(ByVal buffer As Byte(),
        ByVal offset As Integer, ByVal size As Integer,
        ByVal socketFlags As SocketFlags) As Integer
Public Function Receive(ByVal buffer As Byte(),
        ByVal size As Integer,
        ByVal socketFlags As SocketFlags) As Integer
Public Function Receive(ByVal buffer As Byte(),
        ByVal socketFlags As SocketFlags) As Integer
Public Function ReceiveFrom(ByVal buffer As Byte(),
        ByRef remoteEP As System.Net.EndPoint) As Integer
Public Function ReceiveFrom(ByVal buffer As Byte(),
```

```
      ByVal offset As Integer, ByVal size As Integer,
      ByVal socketFlags As SocketFlags,
      ByRef remoteEP As System.Net.EndPoint) As Integer
Public Function ReceiveFrom(ByVal buffer As Byte(),
      ByVal size As Integer,
      ByVal socketFlags As SocketFlags,
      ByRef remoteEP As System.Net.EndPoint) As Integer
Public Function ReceiveFrom(ByVal buffer As Byte(),
      ByVal socketFlags As SocketFlags,
      ByRef remoteEP As System.Net.EndPoint) As Integer
Public Function Send( ByVal buffer As Byte()) As Integer
Public Function Send(ByVal buffer As Byte(),
      ByVal offset As Integer, ByVal size As Integer,
      ByVal socketFlags As SocketFlags) As Integer
Public Function Send(ByVal buffer As Byte(),
      ByVal size As Integer,
      ByVal socketFlags As SocketFlags) As Integer
Public Function Send(ByVal buffer As Byte(),
      ByVal socketFlags As SocketFlags) As Integer
Public Function SendTo(ByVal buffer As Byte(),
      ByVal remoteEP As System.Net.EndPoint) As Integer
Public Function SendTo(ByVal buffer As Byte(),
      ByVal offset As Integer, ByVal size As Integer,
      ByVal socketFlags As SocketFlags,
      ByVal remoteEP As System.Net.EndPoint) As Integer
Public Function SendTo(ByVal buffer As Byte(),
      ByVal size As Integer,
      ByVal socketFlags As SocketFlags,
      ByVal remoteEP As System.Net.EndPoint) As Integer
Public Function SendTo(ByVal buffer As Byte(),
```

```
        ByVal socketFlags As SocketFlags,
        ByVal remoteEP As System.Net.EndPoint) As Integer
   Public Sub SetSocketOption(
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName,
        ByVal optionValue As Byte())
   Public Sub SetSocketOption(
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName,
        ByVal optionValue As Integer)
   Public Sub SetSocketOption(
        ByVal optionLevel As SocketOptionLevel,
        ByVal optionName As SocketOptionName,
        ByVal optionValue As Object)
   Public Sub Shutdown( ByVal how As SocketShutdown)
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

### Returned By

NetworkStream.Socket, TcpClient.Client, TcpListener.{AcceptSocket(), Server}, UdpClient.Client

### Passed To

NetworkStream.NetworkStream(), TcpClient.Client, UdpClient.Client

# SocketException Class

## System.Net.Sockets (system.dll) *ECMA, serializable*

This exception represents a socket-related error.

```
Public Class SocketException : Inherits System.ComponentModel.Win32Except

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal errorCode As Integer)

' Protected Constructors

   Protected Sub New(

        ByVal serializationInfo As System.Runtime.Serialization.Serializa

        ByVal streamingContext As System.Runtime.Serialization.StreamingC

' Public Instance Properties

   Overrides Public ReadOnly Property ErrorCode As Integer

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.SystemException → System.Runtime.InteropServices.ExternalExceptio
System.ComponentModel.Win32Exception → SocketException

## SocketFlags Enum

## System.Net.Sockets (system.dll) *ECMA, serializable, flag*

This enumeration contains values for setting flags for socket messages. `SocketFlags` are provided to `Socket.Send()` and `Socket.Receive()` to specify parameters for how data is transferred. The `OutOfBand` flag tells the socket to process out-of-band data in the stream. `DontRoute` tells the socket to send data to the remote endpoint without using routing tables.

```
Public Enum SocketFlags

   None = &H000000000

   OutOfBand = &H000000001

   Peek = &H000000002

   DontRoute = &H000000004

   MaxIOVectorLength = &H000000010

   Partial = &H000008000

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `SocketFlags`

### Passed To

`Socket.{BeginReceive(), BeginReceiveFrom(), BeginSend(), BeginSendTo(), Receive(), ReceiveFrom(), Send(), SendTo()}`

## SocketOptionLevel Enum

**System.Net.Sockets (system.dll)** ***ECMA, serializable***

This enumeration contains values for the type of socket option specified in `Socket.SetSocketOption()`.

```
Public Enum SocketOptionLevel

   IP = 0

   Tcp = 6

   Udp = 17

   Socket = 65535

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `SocketOptionLevel`

### Passed To

`Socket.{GetSocketOption(), SetSocketOption()}`

## SocketOptionName Enum

### System.Net.Sockets (system.dll) *ECMA, serializable*

This enumeration contains the names of socket options set by `Socket.SetSocketOption()`. The socket option named must be applicable to the option level from `SocketOptionLevel`.

```
Public Enum SocketOptionName
   IPOptions = 1
   Debug = 1
   NoDelay = 1
   NoChecksum = 1
   HeaderIncluded = 2
   AcceptConnection = 2
   Expedited = 2
   BsdUrgent = 2
   TypeOfService = 3
   ReuseAddress = 4
   IpTimeToLive = 4
   KeepAlive = 8
   MulticastInterface = 9
   MulticastTimeToLive = 10
   MulticastLoopback = 11
   AddMembership = 12
   DropMembership = 13
   DontFragment = 14
   AddSourceMembership = 15
   DropSourceMembership = 16
   DontRoute = 16
   BlockSource = 17
   UnblockSource = 18
   PacketInformation = 19
```

```
    ChecksumCoverage = 20
    Broadcast = 32
    UseLoopback = 64
    Linger = 128
    OutOfBandInline = 256
    SendBuffer = 4097
    ReceiveBuffer = 4098
    SendLowWater = 4099
    ReceiveLowWater = 4100
    SendTimeout = 4101
    ReceiveTimeout = 4102
    Error = 4103
    Type = 4104
    MaxConnections = 2147483647
    DontLinger = -129
    ExclusiveAddressUse = -5
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → SocketOptionName

## Passed To

Socket.{GetSocketOption(), SetSocketOption()}

# SocketShutdown Enum

## System.Net.Sockets (system.dll) *ECMA, serializable*

This enumeration provides values used by `Socket.Shutdown()`. `Receive` specifies that receiving will be disabled on a socket. `Send` specifies that sending will be disabled. `Both` disables sending and receiving.

```
Public Enum SocketShutdown
    Receive = 0
    Send = 1
    Both = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `SocketShutdown`

### Passed To

`Socket.Shutdown()`

## SocketType Enum

## System.Net.Sockets (system.dll) *ECMA, serializable*

This enumeration contains the names for the type of socket that is created.

```
Public Enum SocketType

   Stream = 1

   Dgram = 2

   Raw = 3

   Rdm = 4

   Seqpacket = 5

   Unknown = -1

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → SocketType

### Returned By

Socket.SocketType

### Passed To

Socket.Socket()

## TcpClient Class

## System.Net.Sockets (system.dll) *disposable*

This class provides a client-side abstraction of the sockets API. The zero-argument form of the constructor creates the client. Connect to a remote server with the `Connect()` method (you must specify an existing `System.Net.IPEndPoint` or a remote IP address and port number). Alternatively, use an overloaded form of the constructor to simultaneously create the client and make the connection.

This class completely obscures the underlying socket. However, the `GetStream()` method returns a `NetworkStream` that you can use to send and receive data across the network.

```
Public Class TcpClient : Implements IDisposable

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal localEP As System.Net.IPEndPoint)

   Public Sub New(ByVal hostname As String,

        ByVal port As Integer)

' Public Instance Properties

   Public Property LingerState As LingerOption

   Public Property NoDelay As Boolean

   Public Property ReceiveBufferSize As Integer

   Public Property ReceiveTimeout As Integer

   Public Property SendBufferSize As Integer

   Public Property SendTimeout As Integer

' Protected Instance Properties

   Protected Property Active As Boolean

   Protected Property Client As Socket

' Public Instance Methods

   Public Sub Close()

   Public Sub Connect(ByVal address As System.Net.IPAddress,

        ByVal port As Integer)

   Public Sub Connect(ByVal remoteEP As System.Net.IPEndPoint)

   Public Sub Connect(ByVal hostname As String,
```

```
        ByVal port As Integer)
   Public Function GetStream() As NetworkStream
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal disposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

## Returned By

`TcpListener.AcceptTcpClient()`

# TcpListener Class

## System.Net.Sockets (system.dll)

This class provides a server-side abstraction of the sockets API. The `TcpListener` is constructed with a local address and port to which it is automatically bound. A call to `Start()` initiates listening for connection requests. When a request is received, either `AcceptSocket()` or `AcceptTcpClient()` accepts the connection and returns a `Socket` or a `TcpClient` you can use to exchange data with the remote.

```
Public Class TcpListener

' Public Constructors

   Public Sub New( ByVal port As Integer)

   Public Sub New(ByVal localaddr As System.Net.IPAddress,

        ByVal port As Integer)

   Public Sub New( ByVal localEP As System.Net.IPEndPoint)

' Public Instance Properties

   Public ReadOnly Property LocalEndpoint As EndPoint

' Protected Instance Properties

   Protected Property Active As Boolean

   Protected Property Server As Socket

' Public Instance Methods

   Public Function AcceptSocket() As Socket

   Public Function AcceptTcpClient() As TcpClient

   Public Function Pending() As Boolean

   Public Sub Start()

   Public Sub Stop()

' Protected Instance Methods

   Overrides Protected Sub Finalize()

End Class
```

## UdpClient Class

### System.Net.Sockets (system.dll) *disposable*

This class is used to create UDP client sockets. UDP-based clients transmit messages called datagrams across a connection. Unlike TCP, control data is not sent to ensure the integrity and order of the data (so UDP is faster than TCP, but not as reliable). UDP is often used to broadcast media streams, such as video, and to support multicasting. The `UdpClient` can be constructed with a binding to a local address and port, or it can be constructed given the IP address and port number of the remote server to which it connects.

The `JoinMulticastGroup()` method sets the address of an IP-multicast group to join. `DropMulticastGroup()` drops the client from the group.

```
Public Class UdpClient : Implements IDisposable

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal port As Integer)

   Public Sub New( ByVal localEP As System.Net.IPEndPoint)

   Public Sub New(ByVal hostname As String,

         ByVal port As Integer)

' Protected Instance Properties

   Protected Property Active As Boolean

   Protected Property Client As Socket

' Public Instance Methods

   Public Sub Close()

   Public Sub Connect(ByVal addr As System.Net.IPAddress,

         ByVal port As Integer)

   Public Sub Connect(ByVal endPoint As System.Net.IPEndPoint)

   Public Sub Connect(ByVal hostname As String,

         ByVal port As Integer)

   Public Sub DropMulticastGroup(

         ByVal multicastAddr As System.Net.IPAddress)

   Public Sub JoinMulticastGroup(

         ByVal multicastAddr As System.Net.IPAddress)

   Public Sub JoinMulticastGroup(
```

```
        ByVal multicastAddr As System.Net.IPAddress,
        ByVal timeToLive As Integer)
    Public Function Receive(
        ByRef remoteEP As System.Net.IPEndPoint) As Byte()
    Public Function Send(ByVal dgram As Byte(),
        ByVal bytes As Integer) As Integer
    Public Function Send(ByVal dgram As Byte(),
        ByVal bytes As Integer,
        ByVal endPoint As System.Net.IPEndPoint) As Integer
    Public Function Send(ByVal dgram As Byte(),
        ByVal bytes As Integer, ByVal hostname As String,
        ByVal port As Integer) As Integer
End Class
```

# Chapter 13. System.Reflection

`System.Reflection` is the API that exposes the full-fidelity metadata of the .NET environment to the .NET programmer. In short, it permits complete access to compile-time data at runtime. Everything is available, including fields, methods, constructors, properties, delegate types, and events. The reflection API (as exposed by the `System.Reflection` namespace) offers some truly unique capabilities unavailable in other compile-time bound languages such as C++. The closest the average COM programmer has come to using reflection is the `IDispatch` interface and/or type libraries. Reflection, fortunately, is at once both easier to use and far more powerful.

Reflection offers up a number of possible approaches to use. Introspection is the act of using the reflection APIs to discover information about a component assembly (and its constituent types) at runtime without any prior (compile-time) knowledge of it. This approach was first popularized by tools such as Visual Basic and numerous Java IDEs that offered GUI-based construction of visual interfaces. The third-party component was dropped into some well-known location, and the IDE "discovered" it and offered it on a toolbar the next time the IDE was started.

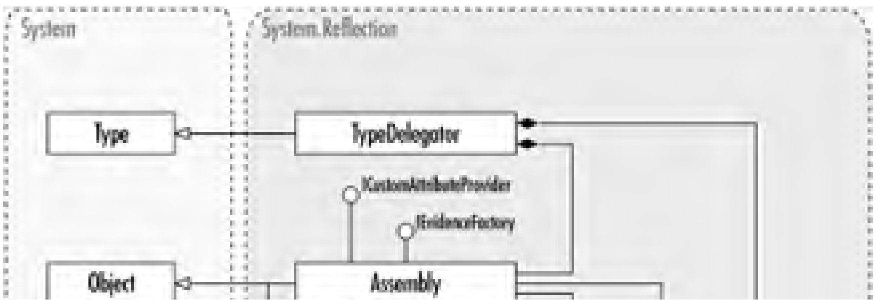
Along similar lines, reflection is often used as part of development tools; for example, the .NET utility *xsd.exe* uses metadata to generate XML Schema documents that correspond to .NET declared types. A .NET programmer could use reflection to generate SQL (Structured Query Language) statements for storing object instances into a relational database, or even into the SQL DDL (Data Definition Language) itself. Other tools could produce remoting proxies, transparently adding the necessary code to marshal and unmarshal parameters and return values across a network connection, even for types that weren't designed to be remoted in the first place.

Lastly, reflection isn't just a read-only view of a type's construction; the reflective APIs in .NET also allow for manipulation of methods and state (although not the rewriting of code — once loaded, a type's methods remain exactly as they were defined). The most prevalent example of this sort of usage of reflection is in the .NET Object Serialization code (in the `System.Runtime.Serialization` namespace). Serialization takes an existing object instance, uses reflection to suck out the object's state, transforms it into a binary representation, and stores that representation (a stream of bytes) to some source, such as a file on disk, a socket, a binary column in a database, and so on. Later, serialization can also take that same stream of bytes and rehydrate the serialized object back into existence.

Careful readers will note that last sentence and wonder, if only for a moment, how it could be possible for code to reach into an object and directly manipulate its state; after all, any object-oriented developer worthy of the name knows to mark all fields as "private," which should make said fields completely inaccessible. The fact is, reflection can violate even these most sacrosanct of boundaries — it can reach in and manipulate any private member it finds — thus it is highly sensitive to any changes in the definition of fields inside of a type.

Figure 13-1 shows the inheritance diagram for this namespace. Figure 13-2 shows the exceptions, delegates, and attributes from this namespace.

### Figure 13-1. The System.Reflection namespace



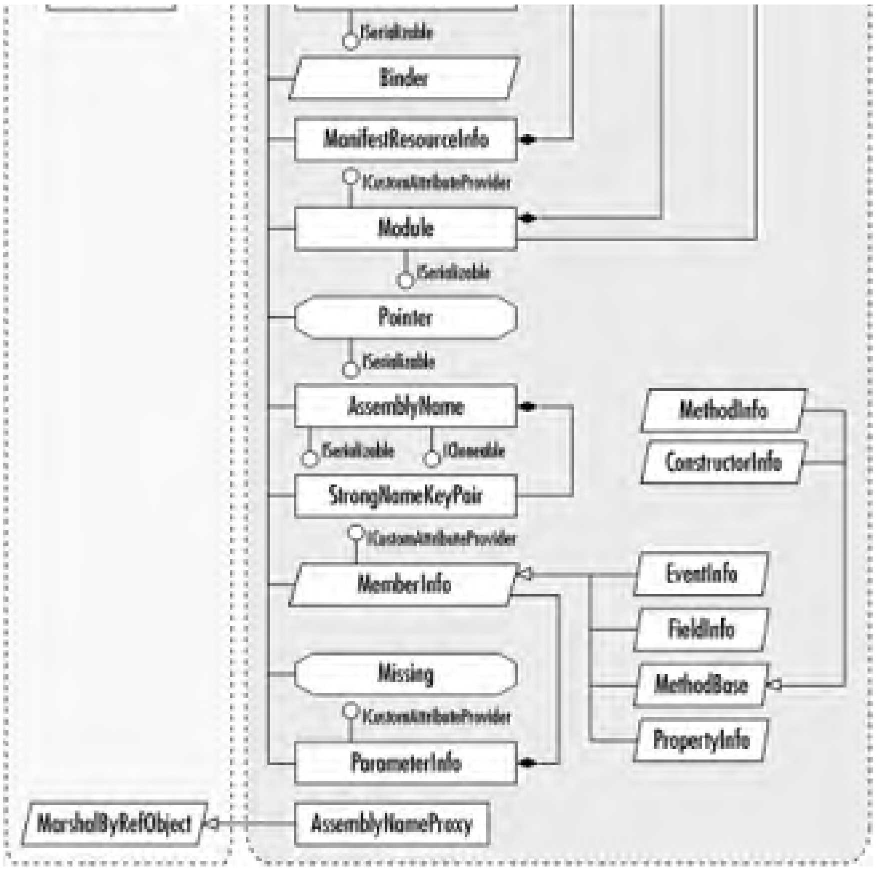
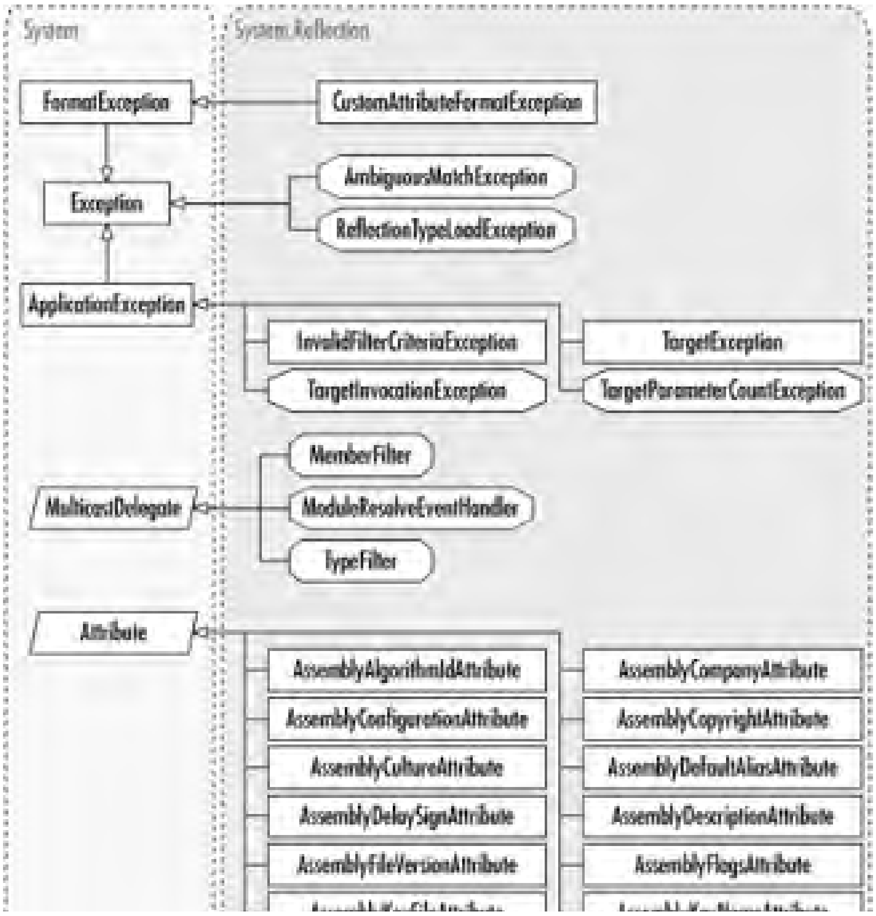
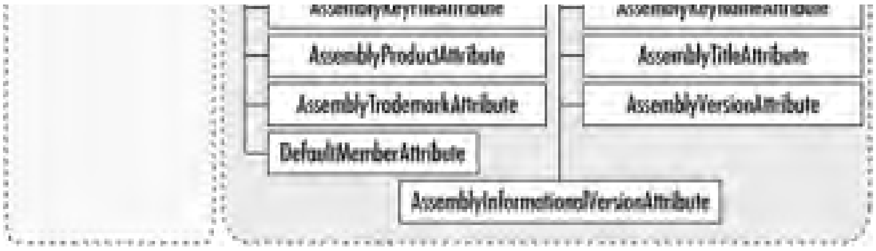



**Figure 13-2. Exceptions, delegates, and attributes from System.Reflection**




AssemblyProductAttribute
AssemblyTitleAttribute
AssemblyTrademarkAttribute
AssemblyVersionAttribute
DefaultMemberAttribute
AssemblyInformationalVersionAttribute

## AmbiguousMatchException NotInheritable Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you attempt to bind to a method with the `Binder` and the given criteri matches more than one method; this is the case, for example, when binding against an overloaded method solely by its name.

```
Public NotInheritable Class AmbiguousMatchException : Inherits SystemExce
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
End Class
```

### Hierarchy

```
System.Object → System.Exception(System.Runtime.Serialization.ISerializal
→ System.SystemException → AmbiguousMatchException
```

## Assembly Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

In the .NET environment, assemblies are the fundamental units of development and deployment; al
programmer to work with elements as fine-grained as classes or functions, these types must belong
used. Consequently, the assembly is the core of the component model in .NET.

The `Assembly` type is the Reflection API object representing the assembly. An assembly (either a .
consists of one or more modules; most assemblies are in fact single-module assemblies. (Multimod
not necessary for most developers' needs. As such, they are not discussed here.) .NET programme
class to discover information about a particular assembly — for example, an assembly knows the m
the types defined and bound to that module. Thus, for any random assembly, a .NET program can e
This is, in fact, what the *WinCV.exe* sample program (see the .NET SDK, in the *\bin* subdirectory) d
results, but uses unmanaged APIs to view into an assembly, rather than Reflection.)

The `Assembly` API can be broken into two collections: those representing operations against a par
`Assembly` instance), and those that work independently of a particular instance — loading an asse

The instance-specific methods of `Assembly` are, for the most part, self-describing. The properties c
`CodeBase` describes the URL from which this assembly was loaded, `EntryPoint` describes the er
one, `Evidence` is the security information regarding this particular assembly, and `FullName` is the
public key token) for this assembly. The remaining two properties are a bit more obscure: `GlobalA`
indicating whether this assembly was loaded out of the global assembly cache or not, and `Locatic`
may be in a different file if this is a multimodule assembly).

Some instance methods of `Assembly` require a bit more in the way of explanation. `GetName()` retu
this is an `AssemblyName` instance, rather than a string. Because an `Assembly` is also a producer c
`AssemblyVersionAttribute` or `AssemblyKeyFileAttribute`), `Assembly` also has the `GetC`
`IsDefined()` method can be used to find a particular attribute type defined in this assembly; it sim
`GetCustomAttributes()` returns the instance(s) of the attribute itself. A list (an array of `Assemb`
assembly references can be found by calling `GetReferencedAssemblies()`.

In addition to code, assemblies can contain arbitrary "resources." (Here the term "resource" means
contained as `.file` references in the assembly's manifest file and can be discovered from an `Asse`
`GetManifestResourceNames()`. Information about the persistence scheme used for the resourc
`GetManifestResourceInfo()`. The actual resource itself can be obtained by calling `GetManife`
`System.IO.Stream` object containing or pointing to the file's contents. In addition, a list of all files
calling `GetFiles()`, and a particular file can be opened by calling `GetFile()`.

An assembly consists of one or more modules; the list of modules bound to this assembly are availa
module can be obtained as a `Module` instance by calling `GetModule()` against the assembly. Bec
required, `Assembly` also provides the `GetLoadedModules()` to list the modules of this assembly
other direction, the `LoadModule()` call forces the CLR to load the given module name into memor
loading policy of the CLR. Should a module-load fail for some reason, the CLR signals event handle
`ModuleResolve` event.

Frequently, a .NET programmer will not be interested in the modules that comprise the assembly, o
the `Assembly` type has a couple of "shortcut" methods to get the types. `GetTypes()` returns a list
array of `System.Type` references. `GetType()` returns a particular `System.Type`, or optionally (d
exception if the type cannot be found. Take note that the parameterless version of `GetType()` is th
returns the `System.Type` reference for `Assembly`, not any types defined within the assembly itsel
types defined in the assembly, even those declared as private to the assembly (which normally shou
list of only the "public" types, call `GetExportedTypes()` instead.

Once a particular type within the assembly has been located, an instance of that type can be create system activator (see `System.Activator`) to create an instance of that type and hand it back as a `Dim o As Object = GetType(Object).Assembly.CreateInstance("DateTime")` is a r `System.DateTime`; the `typeof(Object)` returns the `System.Type` for `System.Object`. That calling `CreateInstance("DateTime")` succeeds because `DateTime` is defined within that asse method when building a container application (such as ASP.NET) that will be creating instances of c

The `Assembly` type also contains a number of shared methods for use in referencing assemblies a `GetAssembly()` call returns the `Assembly` in which a particular `Type` is defined. (Knowing this, w to read `Dim o As Object = Assembly.GetAssembly(GetType(Object)).CreateInstar` longer.) Likewise, the `GetExecutingAssembly()` returns the assembly in which the current code returns the assembly whose code called the methods in this assembly. (These methods by themsel walking the call-stack, as Code Access Security does, is considered.)

However, the two most important shared methods on the `Assembly` class by far are `Load()` and `L` but in drastically different ways. `LoadFrom()` is the simpler of the two, taking a filename and loadin asked. `Load()` goes through the assembly-load algorithm and checks the private probe path and th finding the assembly. (Note that if an assembly-load request fails, the appropriate events on the cor

```
Public Class Assembly : Implements System.Security.IEvidenceFactory,
     ICustomAttributeProvider, System.Runtime.Serialization.ISerializable
' Public Instance Properties
   Overridable Public ReadOnly Property CodeBase As String
   Overridable Public ReadOnly Property EntryPoint As MethodInfo
   Overridable Public ReadOnly Property EscapedCodeBase As String
   Overridable Public ReadOnly Property Evidence As Evidence Implements II
   Overridable Public ReadOnly Property FullName As String
   Public ReadOnly Property GlobalAssemblyCache As Boolean
   Overridable Public ReadOnly Property Location As String
' Public Shared Methods
   Public Shared Function CreateQualifiedName(
        ByVal assemblyName As String,
        ByVal typeName As String) As String
   Public Shared Function GetAssembly(
        ByVal type As Type) As Assembly
   Public Shared Function GetCallingAssembly() As Assembly
   Public Shared Function GetEntryAssembly() As Assembly
   Public Shared Function GetExecutingAssembly() As Assembly
   Public Shared Function Load(
```

```
        ByVal assemblyRef As AssemblyName) As Assembly
    Public Shared Function Load(
        ByVal assemblyRef As AssemblyName,
        ByVal assemblySecurity As System.Security.Policy.Evidence) As Ass
    Public Shared Function Load(
        ByVal rawAssembly As Byte()) As Assembly
    Public Shared Function Load(ByVal rawAssembly As Byte(),
        ByVal rawSymbolStore As Byte()) As Assembly
    Public Shared Function Load(ByVal rawAssembly As Byte(),
        ByVal rawSymbolStore As Byte(),
        ByVal securityEvidence As System.Security.Policy.Evidence) As Ass
    Public Shared Function Load(
        ByVal assemblyString As String) As Assembly
    Public Shared Function Load(ByVal assemblyString As String,
        ByVal assemblySecurity As System.Security.Policy.Evidence) As Ass
    Public Shared Function LoadFrom(
        ByVal assemblyFile As String) As Assembly
    Public Shared Function LoadFrom(
        ByVal assemblyFile As String,
        ByVal securityEvidence As System.Security.Policy.Evidence) As Ass
    Public Shared Function LoadWithPartialName(
        ByVal partialName As String) As Assembly
    Public Shared Function LoadWithPartialName(
        ByVal partialName As String,
        ByVal securityEvidence As System.Security.Policy.Evidence) As Ass
' Public Instance Methods
    Public Function CreateInstance(
        ByVal typeName As String) As Object
    Public Function CreateInstance(ByVal typeName As String,
        ByVal ignoreCase As Boolean) As Object
    Public Function CreateInstance(ByVal typeName As String,
```

```
      ByVal ignoreCase As Boolean,
      ByVal bindingAttr As BindingFlags,
      ByVal binder As Binder, ByVal args As Object(),
      ByVal culture As System.Globalization.CultureInfo,
      ByVal activationAttributes As Object()) As Object
Overridable Public Function GetCustomAttributes(
      ByVal inherit As Boolean) As Object() Implements ICustomAttribute
Overridable Public Function GetCustomAttributes(
      ByVal attributeType As Type,
      ByVal inherit As Boolean) As Object() Implements ICustomAttribute
Overridable Public Function GetExportedTypes() As Type()
Overridable Public Function GetFile(
      ByVal name As String) As FileStream
Overridable Public Function GetFiles() As FileStream()
Overridable Public Function GetFiles(
      ByVal getResourceModules As Boolean) As FileStream()
Public Function GetLoadedModules() As Module()
Public Function GetLoadedModules(
      ByVal getResourceModules As Boolean) As Module()
Overridable Public Function GetManifestResourceInfo(
      ByVal resourceName As String) As ManifestResourceInfo
Overridable Public Function GetManifestResourceNames(
      ) As String()
Overridable Public Function GetManifestResourceStream(
      ByVal name As String) As Stream
Overridable Public Function GetManifestResourceStream(
      ByVal type As Type,
      ByVal name As String) As Stream
Public Function GetModule( ByVal name As String) As Module
Public Function GetModules() As Module()
Public Function GetModules(
```

```
     ByVal getResourceModules As Boolean) As Module()
Overridable Public Function GetName() As AssemblyName
Overridable Public Function GetName(
     ByVal copiedName As Boolean) As AssemblyName
Overridable Public Sub GetObjectData(
     ByVal info As System.Runtime.Serialization.SerializationInfo,
     ByVal context As System.Runtime.Serialization.StreamingContext) In
Public Function GetReferencedAssemblies(
     ) As AssemblyName()
Public Function GetSatelliteAssembly(
     ByVal culture As System.Globalization.CultureInfo) As Assembly
Public Function GetSatelliteAssembly(
     ByVal culture As System.Globalization.CultureInfo,
     ByVal version As Version) As Assembly
Overridable Public Function GetType(
     ByVal name As String) As Type
Overridable Public Function GetType(ByVal name As String,
     ByVal throwOnError As Boolean) As Type
Public Function GetType(ByVal name As String,
     ByVal throwOnError As Boolean,
     ByVal ignoreCase As Boolean) As Type
Overridable Public Function GetTypes() As Type()
Overridable Public Function IsDefined(
     ByVal attributeType As Type,
     ByVal inherit As Boolean) As Boolean Implements ICustomAttributeP
Public Function LoadModule(ByVal moduleName As String,
     ByVal rawModule As Byte()) As Module
Public Function LoadModule(ByVal moduleName As String,
     ByVal rawModule As Byte(),
     ByVal rawSymbolStore As Byte()) As Module
Overrides Public Function ToString() As String
```

```
' Events
   Public Event ModuleResolve As ModuleResolveEventHandler
End Class
```

## Subclasses

System.Reflection.Emit.AssemblyBuilder

## Returned By

System.AppDomain.{GetAssemblies(),Load()},System.AssemblyLoadEventArgs.Loa
ManifestResourceInfo.ReferencedAssembly,Module.Assembly,System.ResolveEver
System.Type.Assembly

## Passed To

Multiple types

# AssemblyAlgorithmIdAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

The assembly manifest contains a hash of all of the files in the assembly. This attribute allows you to change which hashing algorithm is used to hash these files.

```
Public NotInheritable Class AssemblyAlgorithmIdAttribute : Inherits Attril
' Public Constructors
   Public Sub New(
        ByVal algorithmId As System.Configuration.Assemblies.AssemblyHash/
   Public Sub New( ByVal algorithmId As UInt32)
' Public Instance Properties
   Public ReadOnly Property AlgorithmId As UInt32
End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyAlgorithmIdAttribute

### Valid On

Assembly

## AssemblyCompanyAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute is applied on an assembly that allows you to specify the company that created the assembly.

```
Public NotInheritable Class AssemblyCompanyAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal company As String)

' Public Instance Properties

   Public ReadOnly Property Company As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyCompanyAttribute

### Valid On

Assembly

# AssemblyConfigurationAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute allows you to specify a configuration for the assembly (such as debug, release etc.).

```
Public NotInheritable Class AssemblyConfigurationAttribute : Inherits Att
' Public Constructors
   Public Sub New( ByVal configuration As String)
' Public Instance Properties
   Public ReadOnly Property Configuration As String
End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyConfigurationAttribute

### Valid On

Assembly

# AssemblyCopyrightAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute string contains copyright information.

```
Public NotInheritable Class AssemblyCopyrightAttribute : Inherits Attribu
' Public Constructors
   Public Sub New( ByVal copyright As String)
' Public Instance Properties
   Public ReadOnly Property Copyright As String
End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyCopyrightAttribute

### Valid On

Assembly

## AssemblyCultureAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute specifies the supported culture of an assembly.

```
Public NotInheritable Class AssemblyCultureAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal culture As String)

' Public Instance Properties

   Public ReadOnly Property Culture As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyCultureAttribute

### Valid On

Assembly

## AssemblyDefaultAliasAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute specifies a friendly name for an assembly. This is useful when assemblies hav
cryptic names such as GUIDs, as COM components do.

```
Public NotInheritable Class AssemblyDefaultAliasAttribute : Inherits Attr

' Public Constructors

   Public Sub New( ByVal defaultAlias As String)

' Public Instance Properties

   Public ReadOnly Property DefaultAlias As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyDefaultAliasAttribute

### Valid On

Assembly

## AssemblyDelaySignAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

When an assembly designer does not have access to a key-pair to sign a component, this attribute reserves space in the manifest to be filled by a signing utility. The framework's `sn.exe` utility has a command-line switch (`-R` or `-Rc`) just for this purpose.

```
Public NotInheritable Class AssemblyDelaySignAttribute : Inherits Attribu

' Public Constructors

   Public Sub New( ByVal delaySign As Boolean)

' Public Instance Properties

   Public ReadOnly Property DelaySign As Boolean

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyDelaySignAttribute

### Valid On

Assembly

# AssemblyDescriptionAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute allows a description to be stored with an assembly.

```
Public NotInheritable Class AssemblyDescriptionAttribute : Inherits Attril

' Public Constructors

   Public Sub New( ByVal description As String)

' Public Instance Properties

   Public ReadOnly Property Description As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyDescriptionAttribute

### Valid On

Assembly

# AssemblyFileVersionAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute stores a given version number in the assembly's Win32 VERSIONINFO resou
This is not the same as the assembly's version (given by the `AssemblyVersionAttribute`).

```
Public NotInheritable Class AssemblyFileVersionAttribute : Inherits Attril

' Public Constructors

   Public Sub New( ByVal version As String)

' Public Instance Properties

   Public ReadOnly Property Version As String

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `AssemblyFileVersionAttribute`

### Valid On

Assembly

## AssemblyFlagsAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

Use this attribute to specify the side-by-side execution behavior of this assembly. The `flags` parameter may take one of the following values: `0x0000` (side-by-side compatible), `0x0010` (side-by-side operation is prohibited within the same application domain), `0x0020` (side-by-side operation prohibited within same process), or `0x0030` (side-by-side operation prohibited within the same machine boundary).

```
Public NotInheritable Class AssemblyFlagsAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal flags As UInt32)

' Public Instance Properties

   Public ReadOnly Property Flags As UInt32

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyFlagsAttribute

### Valid On

Assembly

# AssemblyInformationalVersionAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute allows a version number to be stored. This stored version is purely for docume
not used by the runtime.

```
Public NotInheritable Class AssemblyInformationalVersionAttribute : Inher

' Public Constructors

   Public Sub New( ByVal informationalVersion As String)

' Public Instance Properties

   Public ReadOnly Property InformationalVersion As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyInformationalVersionAttribut

### Valid On

Assembly

# AssemblyKeyFileAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

To create a strong-named assembly, use this attribute, specifying a file containing a key-pair. Alternatively, you could use an `AssemblyDelaySignAttribute` or an `AssemblyKeyNameAttribute`.

```
Public NotInheritable Class AssemblyKeyFileAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal keyFile As String)

' Public Instance Properties

   Public ReadOnly Property KeyFile As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyKeyFileAttribute

### Valid On

Assembly

## AssemblyKeyNameAttribute    NotInheritable Class

## System.Reflection (mscorlib.dll)

This attribute serves the same purpose as an `AssemblyKeyFileAttribute`, but allows you to specify a key container instead of a file.

```
Public NotInheritable Class AssemblyKeyNameAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal keyName As String)

' Public Instance Properties

   Public ReadOnly Property KeyName As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyKeyNameAttribute

### Valid On

Assembly

## AssemblyName NotInheritable Class

## System.Reflection (mscorlib.dll) *serializable*

This class represents an assembly's fully qualified name, which makes it unique. An assembly's ide property), supported culture (CultureInfo), version number, and key pair. The version number its build number and revision number. The Flags property allows you to set the flags for an assembly HashAlgorithm to access the hash algorithm used with the manifest to verify that the files of an a a System.Configuration.Assemblies.AssemblyVersionCompatibility enumeration, w between versions.

Both FullName and ToString() return a comma-delimited string formatted, such as: Name, Cult Number, SN = StrongName, PK = Public Key Token. Any of the parameters except Name ar SetPublicKeyToken() allow you to specify a public key for an originator or the strong name resp allow you to retrieve the same information.

```
Public NotInheritable Class AssemblyName : Implements ICloneable,

        System.Runtime.Serialization.ISerializable, System.Runtime.Serial.

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public Property CodeBase As String

   Public Property CultureInfo As CultureInfo

   Public ReadOnly Property EscapedCodeBase As String

   Public Property Flags As AssemblyNameFlags

   Public ReadOnly Property FullName As String

   Public Property HashAlgorithm As AssemblyHashAlgorithm

   Public Property KeyPair As StrongNameKeyPair

   Public Property Name As String

   Public Property Version As Version

   Public Property VersionCompatibility As AssemblyVersionCompatibility

' Public Shared Methods

   Public Shared Function GetAssemblyName(

        ByVal assemblyFile As String) As AssemblyName

' Public Instance Methods

   Public Function Clone(
```

```
        ) As Object Implements ICloneable.Clone
   Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext) Im
   Public Function GetPublicKey() As Byte()
   Public Function GetPublicKeyToken() As Byte()
   Public Sub OnDeserialization(
        ByVal sender As Object) Implements IDeserializationCallback.OnDes
   Public Sub SetPublicKey( ByVal publicKey As Byte())
   Public Sub SetPublicKeyToken(
        ByVal publicKeyToken As Byte())
   Overrides Public Function ToString() As String
End Class
```

## Returned By

Assembly.{GetName(),GetReferencedAssemblies()},AssemblyNameProxy.GetAssemb

## Passed To

System.AppDomain.{DefineDynamicAssembly(),Load()},Assembly.Load(),
System.Text.RegularExpressions.Regex.CompileToAssembly()

## AssemblyNameFlags Enum

## System.Reflection (mscorlib.dll) *serializable, flag*

This enumeration represents the possible flags for an `AssemblyName`. `AssemblyName.Flags` can either be set to `None` or `PublicKey`. `PublicKey` specifies that the originator is fully given by the public key, rather than by a token.

```
Public Enum AssemblyNameFlags

   None = &H000000000

   PublicKey = &H000000001

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `AssemblyNameFlags`

### Returned By

`AssemblyName.Flags`

### Passed To

`AssemblyName.Flags`

## AssemblyNameProxy Class

## System.Reflection (mscorlib.dll) *marshal by reference*

This class is a remotable wrapper around `AssemblyName`. To access the underlying `AssemblyName`, call `AssemblyName.GetAssemblyName()`.

```
Public Class AssemblyNameProxy : Inherits MarshalByRefObject

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Public Function GetAssemblyName(

        ByVal assemblyFile As String) As AssemblyName

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `AssemblyNameProxy`

# AssemblyProductAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This class is a custom attribute for the product name.

```
Public NotInheritable Class AssemblyProductAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal product As String)

' Public Instance Properties

   Public ReadOnly Property Product As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyProductAttribute

### Valid On

Assembly

# AssemblyTitleAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This class is a custom attribute for an assembly title.

```
Public NotInheritable Class AssemblyTitleAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal title As String)

' Public Instance Properties

   Public ReadOnly Property Title As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyTitleAttribute

### Valid On

Assembly

# AssemblyTrademarkAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This custom attribute is used to add a trademark.

```
Public NotInheritable Class AssemblyTrademarkAttribute : Inherits Attribu

' Public Constructors

   Public Sub New( ByVal trademark As String)

' Public Instance Properties

   Public ReadOnly Property Trademark As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyTrademarkAttribute

### Valid On

Assembly

## AssemblyVersionAttribute NotInheritable Class

## System.Reflection (mscorlib.dll)

This attribute is the version of the assembly. This version is used by the framework to check compatibility and determine if side-by-side execution is needed.

```
Public NotInheritable Class AssemblyVersionAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal version As String)

' Public Instance Properties

   Public ReadOnly Property Version As String

End Class
```

### Hierarchy

System.Object → System.Attribute → AssemblyVersionAttribute

### Valid On

Assembly

## Binder MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This type is used by the .NET runtime for method argument conversion. It is responsible for such things as determining whether it is permissible to pass a `short` to a method that takes a `long` parameter. If you need to override .NET's default conversion rules, you could subclass this type (however, most programmers will never need to do this). For more details, see the .NET Framework SDK documentation on this type.

```
Public MustInherit Class Binder

' Protected Constructors

   Protected Sub New()

' Public Instance Methods

   MustInherit Public Function BindToField(

        ByVal bindingAttr As BindingFlags,

        ByVal match As FieldInfo(), ByVal value As Object,

        ByVal culture As System.Globalization.CultureInfo) As FieldInfo

   MustInherit Public Function BindToMethod(

        ByVal bindingAttr As BindingFlags,

        ByVal match As MethodBase(),

        ByRef args As Object(),

        ByVal modifiers As ParameterModifier(),

        ByVal culture As System.Globalization.CultureInfo,

        ByVal names As String(),

        ByRef state As Object) As MethodBase

   MustInherit Public Function ChangeType(

        ByVal value As Object, ByVal type As Type,

        ByVal culture As System.Globalization.CultureInfo) As Object

   MustInherit Public Sub ReorderArgumentArray(

        ByRef args As Object(), ByVal state As Object)

   MustInherit Public Function SelectMethod(
```

```
        ByVal bindingAttr As BindingFlags,
        ByVal match As MethodBase(), ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As MethodBase
   MustInherit Public Function SelectProperty(
        ByVal bindingAttr As BindingFlags,
        ByVal match As PropertyInfo(),
        ByVal returnType As Type, ByVal indexes As Type(),
        ByVal modifiers As ParameterModifier()) As PropertyInfo
End Class
```

### Returned By

`System.Type.DefaultBinder`

### Passed To

Multiple types

## BindingFlags Enum

### System.Reflection (mscorlib.dll) *ECMA, serializable, flag*

This enumeration specifies how reflection searches for members. It is used by many types in the `System` and `System.Reflection` namespaces. The following list describes each enumeration member:

`CreateInstance`

: Tells reflection to call a constructor that matches the specified arguments. If a member name is supplied, it is ignored.

`DeclaredOnly`

: Specifies to search only from the declared methods, and not from the inherited ones.

`Default`

: Specifies that all the default search parameters should be used.

`ExactBinding`

: Ensures that arguments must match exactly (no downcasting is performed).

`Static`

: Allows shared members to match.

`FlattenHierarchy`

: Allows matching of shared methods from inherited classes.

`GetField`
`GetProperty`

: Specify that the value of a specified field or property should be returned.

`SetField`
`SetProperty`

: Allow you to set fields and properties.

`IgnoreCase`

: Causes the search to be case-insensitive.

`IgnoreReturn`

: Tells the search to ignore the return value. This is used primarily for COM Interop.

`Public`

: Allows public members to be searched.

`Instance`

: Specifies that instance members must be searched.

`NonPublic`

Allows nonpublic members to be searched.

`InvokeMethod`

Says that a method that is not a constructor should be invoked.

`OptionalParamBinding`

Allows matching based on the number of parameters for methods with optional arguments.

`SuppressChangeType`

Specifies that the CLR should not perform type coercions to invoke a method (as of this writing, `SuppressChangeType` is unimplemented).

`PutDispProperty`
`PutRefDispProperty`

Allow you to call the COM accessors. If the put method expects a COM intrinsic type, use `PutDispProperty`; if the put method expects a COM object, use `PutRefDispProperty`.

```
Public Enum BindingFlags

   Default = &H000000000

   IgnoreCase = &H000000001

   DeclaredOnly = &H000000002

   Instance = &H000000004

   Static = &H000000008

   Public = &H000000010

   NonPublic = &H000000020

   FlattenHierarchy = &H000000040

   InvokeMethod = &H000000100

   CreateInstance = &H000000200

   GetField = &H000000400

   SetField = &H000000800

   GetProperty = &H000001000

   SetProperty = &H000002000

   PutDispProperty = &H000004000

   PutRefDispProperty = &H000008000

   ExactBinding = &H000010000

   SuppressChangeType = &H000020000
```

```
    OptionalParamBinding = &H000040000
    IgnoreReturn = &H001000000
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → BindingFlags

## Passed To

Multiple types

## CallingConventions Enum

## System.Reflection (mscorlib.dll) *serializable, flag*

Calling conventions are the rules that govern the semantics of how method arguments and return values are passed. They also specify which registers to use, and designate what this method does with the stack. The following list describes each enumeration member:

`Standard`

Designates the default CLR conventions.

`VarArgs`

Allows variable arguments.

`Any`

Allows either convention.

`HasThis`

Passes the target method the `this` (or `Me`) reference as the first argument and cannot be used for shared methods.

`ExplicitThis`

Represents a call to a nonshared method and is a function pointer (for delegates). If `ExplicitThis` is set, `HasThis` must also be set.

```
Public Enum CallingConventions
   Standard = &H000000001
   VarArgs = &H000000002
   Any = &H000000003
   HasThis = &H000000020
   ExplicitThis = &H000000040
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → CallingConventions

### Returned By

MethodBase.CallingConvention

### Passed To

Multiple types

## ConstructorInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This class is an implementation of `MethodBase` explicitly for constructors. It adds the two shared read-only properties `ConstructorName` and `TypeConstructorName`, which are defined in metadata as methods of the name `.ctor` and `.cctor` respectively. (Recall that a "type constructor is executed as soon as the type is loaded into the CLR; hence the name "class constructor," — "cctor" for short.)

```
Public MustInherit Class ConstructorInfo : Inherits MethodBase
' Protected Constructors
   Protected Sub New()
' Public Shared Fields
   Public Shared ReadOnly ConstructorName As String              // =.cto
   Public Shared ReadOnly TypeConstructorName As String          // =.cct
' Public Instance Properties
   Overrides Public ReadOnly Property MemberType As MemberTypes
' Public Instance Methods
   MustInherit Public Function Invoke(
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal parameters As Object(),
        ByVal culture As System.Globalization.CultureInfo) As Object
   Public Function Invoke(
        ByVal parameters As Object()) As Object
End Class
```

### Hierarchy

`System.Object` → `MemberInfo(ICustomAttributeProvider)` → `MethodBase` → `ConstructorInfo`

### Subclasses

`System.Reflection.Emit.ConstructorBuilder`

### Returned By

System.Type.{GetConstructor(),GetConstructorImpl(),GetConstructors(), TypeInitializer}

## Passed To

Multiple types

## CustomAttributeFormatException Class

## System.Reflection (mscorlib.dll) *serializable*

This exception is thrown when the binary format of an attribute of a type cannot be read. This can occur when custom attributes and types are created at runtime.

```
Public Class CustomAttributeFormatException : Inherits FormatException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → System.FormatException → CustomAttributeFormatException

## DefaultMemberAttribute NotInheritable Class

### System.Reflection (mscorlib.dll) *ECMA, serializable*

This attribute allows you to specify the default member of a class. It corresponds to the VB.NET `Default` keyword. C# does not permit the use of default members as part of the language, although other .NET languages (most notably VB.NET) do.

```
Public NotInheritable Class DefaultMemberAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal memberName As String)

' Public Instance Properties

   Public ReadOnly Property MemberName As String

End Class
```

### Hierarchy

System.Object → System.Attribute → DefaultMemberAttribute

### Valid On

Class, Struct, Interface

## EventAttributes Enum

### System.Reflection (mscorlib.dll) *ECMA, serializable*

This is an enumeration of the attributes that can be placed on events. `None` specifies no attributes. `ReservedMask` is a reserved flag for use only by the runtime. `SpecialName` indicates that the event is described by the name. `RTSpecialName` is similar, but states that the runtime should check the encoding of the name.

```
Public Enum EventAttributes

   None = 0

   SpecialName = 512

   ReservedMask = 1024

   RTSpecialName = 1024

End Enum
```

#### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `EventAttributes`

#### Returned By

`EventInfo.Attributes`

#### Passed To

`System.Reflection.Emit.TypeBuilder.DefineEvent()`

## EventInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA*

This class allows you to access events through reflection and is, itself, an implementation of `MemberInfo`. `Attributes` gets the `EventAttributes` object, and `EventHandlerType` gets the `System.Type` of the event-handler delegate for the event. `IsMulticast` returns true if the event is multicast, and `IsSpecialName` indicates whether this has special meaning. `AddEventHandler()` adds the passed delegate to the event handler, and `GetAddMethod()`, `GetRaiseMethod()`, and `GetRemoveMethod()` return a `MethodInfo` for the method used to add an event handler, raise an event, or remove an event handler, respectively.

```
Public MustInherit Class EventInfo : Inherits MemberInfo

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property Attributes As EventAttributes

   Public ReadOnly Property EventHandlerType As Type

   Public ReadOnly Property IsMulticast As Boolean

   Public ReadOnly Property IsSpecialName As Boolean

   Overrides Public ReadOnly Property MemberType As MemberTypes

' Public Instance Methods

   Public Sub AddEventHandler(ByVal target As Object,

         ByVal handler As Delegate)

   Public Function GetAddMethod() As MethodInfo

   MustInherit Public Function GetAddMethod(

         ByVal nonPublic As Boolean) As MethodInfo

   Public Function GetRaiseMethod() As MethodInfo

   MustInherit Public Function GetRaiseMethod(

         ByVal nonPublic As Boolean) As MethodInfo

   Public Function GetRemoveMethod() As MethodInfo

   MustInherit Public Function GetRemoveMethod(

         ByVal nonPublic As Boolean) As MethodInfo

   Public Sub RemoveEventHandler(ByVal target As Object,
```

```
        ByVal handler As Delegate)
End Class
```

### Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → EventInfo

### Returned By

System.Type.{GetEvent(),GetEvents()}

## FieldAttributes Enum

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This is an enumeration of the attributes that can be specified on a field. `Assembly` means that the field is internal (that is, private to the assembly); `Family` indicates that the field is protected. `Private`, `Public`, and `Static` are self-explanatory. If the field has a default value, `HasDefault` is marked; if a field is constant, `Literal` is marked. `InitOnly` indicates that the field can only be set on object initialization. To exclude a field from being serialized, `NotSerialized` should be asserted. `HasFieldMarshal` specifies that the field has special marshaling information.

```
Public Enum FieldAttributes

   PrivateScope = 0

   Private = 1

   FamANDAssem = 2

   Assembly = 3

   Family = 4

   FamORAssem = 5

   Public = 6

   FieldAccessMask = 7

   Static = 16

   InitOnly = 32

   Literal = 64

   NotSerialized = 128

   HasFieldRVA = 256

   SpecialName = 512

   RTSpecialName = 1024

   HasFieldMarshal = 4096

   PinvokeImpl = 8192

   HasDefault = 32768

   ReservedMask = 38144

End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → FieldAttributes

## Returned By

FieldInfo.Attributes

## Passed To

System.Reflection.Emit.ModuleBuilder.{DefineInitializedData(), DefineUninitializedData()}, System.Reflection.Emit.TypeBuilder.{DefineField(), DefineInitializedData(), DefineUninitializedData()}

## FieldInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This class is an implementation of `MemberInfo` and allows access to an instance field. Note that, li all reflective objects, the `FieldInfo` instance refers to the metadata concept of the field within the type, not a particular field within a particular instance of that type. (This is important when working with or manipulating the value stored in object instance fields.)

`IsAssembly`, `IsFamily`, `IsFamilyAndAssembly`, `IsFamilyOrAssembly`, `IsPublic`, and `IsPrivate` allow you to check the visibility of the field. `FieldType` returns the declared type of thi field. `FieldHandle` is a `System.RuntimeFieldHandle`. Use `Attributes` to retrieve the attributes. To see if the `FieldInfo` has the `NotSerialized` or `PinvokeImplFieldAttribute` set, inspect the `IsNotSerialized` and `IsPinvokeImpl` properties. If the field is shared, `IsStatic` is true. The `Set` and `Get` methods allow you set the values, and the ones with `Direct` i their name take a typed reference as opposed to an object.

```
Public MustInherit Class FieldInfo : Inherits MemberInfo

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property Attributes As FieldAttributes

   MustInherit Public ReadOnly Property FieldHandle As RuntimeFieldHandle

   MustInherit Public ReadOnly Property FieldType As Type

   Public ReadOnly Property IsAssembly As Boolean

   Public ReadOnly Property IsFamily As Boolean

   Public ReadOnly Property IsFamilyAndAssembly As Boolean

   Public ReadOnly Property IsFamilyOrAssembly As Boolean

   Public ReadOnly Property IsInitOnly As Boolean

   Public ReadOnly Property IsLiteral As Boolean

   Public ReadOnly Property IsNotSerialized As Boolean

   Public ReadOnly Property IsPinvokeImpl As Boolean

   Public ReadOnly Property IsPrivate As Boolean

   Public ReadOnly Property IsPublic As Boolean

   Public ReadOnly Property IsSpecialName As Boolean

   Public ReadOnly Property IsStatic As Boolean

   Overrides Public ReadOnly Property MemberType As MemberTypes
```

```
' Public Shared Methods
   Public Shared Function GetFieldFromHandle(
        ByVal handle As RuntimeFieldHandle) As FieldInfo
' Public Instance Methods
   MustInherit Public Function GetValue(
        ByVal obj As Object) As Object
   Overridable Public Function GetValueDirect(
        ByVal obj As TypedReference) As Object
   Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object)
   MustInherit Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal culture As System.Globalization.CultureInfo)
   Overridable Public Sub SetValueDirect(
        ByVal obj As TypedReference, ByVal value As Object)
End Class
```

### Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → FieldInfo

### Subclasses

System.Reflection.Emit.FieldBuilder

### Returned By

Binder.BindToField(), IReflect.{GetField(), GetFields()}, Module.{GetField(), GetFields()}, System.Runtime.InteropServices.Expando.IExpando.AddField(), System.Type.{GetField(), GetFields()}

### Passed To

Binder.BindToField(), System.Reflection.Emit.CustomAttributeBuilder.CustomAttributeBuilder(), System.Reflection.Emit.ILGenerator.{Emit(), EmitWriteLine()}, System.Reflection.Emit.ModuleBuilder.GetFieldToken()

# ICustomAttributeProvider Interface

## System.Reflection (mscorlib.dll)

This interface is implemented if an object supports custom attributes. `GetCustomAttributes()` returns the custom attributes, and `IsDefined()` returns true if an attribute of a passed `System.Type` is defined on this member.

```
Public Interface ICustomAttributeProvider

' Public Instance Methods

   Public Function GetCustomAttributes(

        ByVal inherit As Boolean) As Object()

   Public Function GetCustomAttributes(

        ByVal attributeType As Type,

        ByVal inherit As Boolean) As Object()

   Public Function IsDefined(ByVal attributeType As Type,

        ByVal inherit As Boolean) As Boolean

End Interface
```

### Implemented By

`Assembly`, `MemberInfo`, `Module`, `ParameterInfo`

### Returned By

`MethodInfo.ReturnTypeCustomAttributes`

# InterfaceMapping Structure

## System.Reflection (mscorlib.dll)

This value type allows you to retrieve information about interfaces. To access the `Type` for an interface, use `InterfaceType`. `TargetType` contains the `Type` of the implementing class. Similarly, `InterfaceMethods` and `TargetMethods` return the methods of the interface and the implementing class respectively.

```
Public Structure InterfaceMapping
' Public Instance Fields
   Public InterfaceMethods As MethodInfo()
   Public TargetMethods As MethodInfo()
   Public InterfaceType As Type
   Public TargetType As Type
End Structure
```

### Hierarchy

System.Object → System.ValueType → InterfaceMapping

### Returned By

System.Type.GetInterfaceMap()

## InvalidFilterCriteriaException Class

## System.Reflection (mscorlib.dll) *serializable*

This exception is thrown when the filter criteria passed to `System.Type.FindMembers()` is invali

```
Public Class InvalidFilterCriteriaException : Inherits ApplicationExcepti

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.ApplicationException → InvalidFilterCriteriaException

# IReflect Interface

## System.Reflection (mscorlib.dll)

This interface defines how types are reflected and provides all the relevant information about the members of a class (methods, fields, and properties). The `Get` methods allow access to these members. The methods `GetField()`, `GetMethod()`, `GetProperty()`, and `GetMember()` return single members of the specified type by name. The methods `GetFields()`, `GetMethods()`, `GetProperties()`, and `GetMembers()` return all of the specified type of members contained by the class.

```
Public Interface IReflect

' Public Instance Properties

   Public ReadOnly Property UnderlyingSystemType As Type

' Public Instance Methods

   Public Function GetField(ByVal name As String,

        ByVal bindingAttr As BindingFlags) As FieldInfo

   Public Function GetFields(

        ByVal bindingAttr As BindingFlags) As FieldInfo()

   Public Function GetMember(ByVal name As String,

        ByVal bindingAttr As BindingFlags) As MemberInfo()

   Public Function GetMembers(

        ByVal bindingAttr As BindingFlags) As MemberInfo()

   Public Function GetMethod(ByVal name As String,

        ByVal bindingAttr As BindingFlags) As MethodInfo

   Public Function GetMethod(ByVal name As String,

        ByVal bindingAttr As BindingFlags,

        ByVal binder As Binder, ByVal types As Type(),

        ByVal modifiers As ParameterModifier()) As MethodInfo

   Public Function GetMethods(

        ByVal bindingAttr As BindingFlags) As MethodInfo()

   Public Function GetProperties(

        ByVal bindingAttr As BindingFlags) As PropertyInfo()

   Public Function GetProperty(ByVal name As String,
```

```
        ByVal bindingAttr As BindingFlags) As PropertyInfo
   Public Function GetProperty(ByVal name As String,
        ByVal bindingAttr As BindingFlags,
        ByVal binder As Binder, ByVal returnType As Type,
        ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As PropertyInfo
   Public Function InvokeMember(ByVal name As String,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder, ByVal target As Object,
        ByVal args As Object(),
        ByVal modifiers As ParameterModifier(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal namedParameters As String()) As Object
End Interface
```

### Implemented By

System.Type, System.Runtime.InteropServices.Expando.IExpando

# ManifestResourceInfo Class

## System.Reflection (mscorlib.dll)

This class represents a resource from an assembly manifest. As assemblies can span multiple files, resource represents one file from an assembly. The `FileName` returns the name of the file containi resource if it is not the same as the file containing the manifest. `ResourceLocation` allows you to inspect the `ResourceLocation` enumeration for this resource, telling you whether the resource is contained in the same file as the manifest. `ReferencedAssembly` returns the `Assembly` object representing the specified assembly.

```
Public Class ManifestResourceInfo

' Public Instance Properties

   Overridable Public ReadOnly Property FileName As String

   Overridable Public ReadOnly Property ReferencedAssembly As Assembly

   Overridable Public ReadOnly Property ResourceLocation As ResourceLocat

End Class
```

### Returned By

`Assembly.GetManifestResourceInfo()`

## MemberFilter Delegate

## System.Reflection (mscorlib.dll) *serializable*

This delegate defines a function that is used to filter an array of `MemberInfo` objects. This method is run for each `MemberInfo` and should return true to include the `MemberInfo`. The second parameter, `filterCriteria`, is an arbitrary argument that you may specify to be passed to the filter.

This delegate is used from the `System.Type.FindMembers()` method and is designed to allow for high-level "searches" of a type's members (fields, methods, properties, and so on) without having to code the actual looping logic itself.

```
Public Delegate Function MemberFilter(
        ByVal m As MemberInfo,
        ByVal filterCriteria As Object) As Boolean
```

### Passed To

`System.Type.FindMembers()`

## MemberInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This class is the base type for all reflective types defined in the .NET environment; it defines the basic data associated with any member (field, method, property, event, nested type) of a given type. Note that even `System.Type` itself inherits from this class.

By itself, `MemberInfo` is a fairly simple type. It consists of four properties: `DeclaringType` (a reference to the `System.Type` in which this member was declared, which might be a base type to the class being reflected over), `MemberType` (an enumeration describing the type of the member), `Name`, and `ReflectedType` (the `System.Type` instance from which this `MemberInfo` object was received in the first place). `MemberInfo` also consists of two methods, `GetCustomAttributes()` and `IsDefined()`, both of which deal with any custom attributes defined on this member.

```
Public MustInherit Class MemberInfo : Implements ICustomAttributeProvider

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property DeclaringType As Type

   MustInherit Public ReadOnly Property MemberType As MemberTypes

   MustInherit Public ReadOnly Property Name As String

   MustInherit Public ReadOnly Property ReflectedType As Type

' Public Instance Methods

   MustInherit Public Function GetCustomAttributes(

         ByVal inherit As Boolean) As Object() Implements

         ICustomAttributeProvider.GetCustomAttributes

   MustInherit Public Function GetCustomAttributes(

         ByVal attributeType As Type,

         ByVal inherit As Boolean) As Object()

         Implements ICustomAttributeProvider.GetCustomAttributes

   MustInherit Public Function IsDefined(
```

```
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
        Implements ICustomAttributeProvider.IsDefined
End Class
```

## Subclasses

EventInfo, FieldInfo, MethodBase, PropertyInfo, System.Type

## Returned By

IReflect.{GetMember(), GetMembers()}, ParameterInfo.Member, System.Runtime.InteropServices.Marshal.GetMethodInfoForComSlot(), System.Runtime.Serialization.FormatterServices.GetSerializableMembers(), System.Type.{FindMembers(), GetDefaultMembers(), GetMember(), GetMembers()}

## Passed To

System.Attribute.{GetCustomAttribute(), GetCustomAttributes(), IsDefined()}, MemberFilter.{BeginInvoke(), Invoke()}, System.Runtime.InteropServices.Expando.IExpando.RemoveMember(), System.Runtime.InteropServices.Marshal.GetComSlotForMethodInfo(), System.Runtime.Serialization.FormatterServices.{GetObjectData(), PopulateObjectMembers()}, System.Runtime.Serialization.ObjectManager.{RecordFixup(), RegisterObject()}

# MemberTypes Enum

## System.Reflection (mscorlib.dll) *serializable*

This enumeration represents the different types of `MemberInfo` objects. `All` specifies all member types, and `Custom` specifies a custom member type. All of the other enumerated values specify the type of the `MemberInfo` object. For example, `Field` designates that the `MemberInfo` object is actually a `FieldInfo` object.

```
Public Enum MemberTypes

   Constructor = 1

   Event = 2

   Field = 4

   Method = 8

   Property = 16

   TypeInfo = 32

   Custom = 64

   NestedType = 128

   All = 191

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `MemberTypes`

### Returned By

`MemberInfo.MemberType`

### Passed To

`System.Type.{FindMembers(),GetMember()}`

## MethodAttributes Enum

## System.Reflection (mscorlib.dll) *ECMA, serializable*

These attributes can be placed on methods. The behavior of most of these is obvious and the same as for `FieldAttributes`. The others are used for specifying the structure of the object `vTable`.

```
Public Enum MethodAttributes

   ReuseSlot = 0

   PrivateScope = 0

   Private = 1

   FamANDAssem = 2

   Assembly = 3

   Family = 4

   FamORAssem = 5

   Public = 6

   MemberAccessMask = 7

   UnmanagedExport = 8

   Static = 16

   Final = 32

   Virtual = 64

   HideBySig = 128

   VtableLayoutMask = 256

   NewSlot = 256

   Abstract = 1024

   SpecialName = 2048

   RTSpecialName = 4096

   PinvokeImpl = 8192

   HasSecurity = 16384

   RequireSecObject = 32768

   ReservedMask = 53248
```

```
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → MethodAttributes

## Returned By

MethodBase.Attributes

## Passed To

System.Reflection.Emit.ModuleBuilder.{DefineGlobalMethod(), DefinePInvokeMethod()}, System.Reflection.Emit.TypeBuilder.{DefineConstructor(), DefineDefaultConstructor(), DefineMethod(), DefinePInvokeMethod()}

## MethodBase MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This is a MustInherit base class representing executable method calls, which fall into two categories methods and constructors. `GetCurrentMethod()` and `GetMethodFromHandle()` are shared m that return the currently executing method and a method represented by a `System.RuntimeMeth` object, respectively. The `MethodHandle` returns the handle for a specific method instance.

The properties prefixed by `Is` return boolean values, allowing inspection of the modifiers of the refle method. Only some require explanation: `IsAssembly` returns true if the method is `internal`, and `IsFamily` returns true for protected methods. If a member of exactly the same name and signature by a derived class, `IsHideBySig` is true. `IsSpecialName` indicates if this method has a special n as a property accessor, `get_PropertyName` or `set_PropertyName`.

Similarly, the attributes on a given method can be inspected from the `Attributes` property. `GetParameters()` returns the parameters of a method or constructor, and `GetMethodImplementationFlags()` returns the `MethodImplAttributes` flags set on the me

In addition to introspecting on a method, the `MethodBase` also allows for reflective invocation of a r using the `Invoke()` method. Note that `Invoke()` requires both the object instance against which t the method (or `null` if the method is declared `shared`), as well as an array of `object` references c the arguments to the method, in their proper order. Should the argument array mismatch in any way number of arguments, wrong type of arguments, wrong order of arguments, and so on), an exceptic thrown and the method call is not even attempted. Method invocation in this manner is much slower direct compile-time-bound method execution.

```
Public MustInherit Class MethodBase : Inherits MemberInfo

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property Attributes As MethodAttributes

   Overridable Public ReadOnly Property CallingConvention As CallingConve

   Public ReadOnly Property IsAbstract As Boolean

   Public ReadOnly Property IsAssembly As Boolean

   Public ReadOnly Property IsConstructor As Boolean

   Public ReadOnly Property IsFamily As Boolean

   Public ReadOnly Property IsFamilyAndAssembly As Boolean

   Public ReadOnly Property IsFamilyOrAssembly As Boolean

   Public ReadOnly Property IsFinal As Boolean

   Public ReadOnly Property IsHideBySig As Boolean

   Public ReadOnly Property IsPrivate As Boolean
```

```
   Public ReadOnly Property IsPublic As Boolean
   Public ReadOnly Property IsSpecialName As Boolean
   Public ReadOnly Property IsStatic As Boolean
   Public ReadOnly Property IsVirtual As Boolean
   MustInherit Public ReadOnly Property MethodHandle As RuntimeMethodHand
' Public Shared Methods
   Public Shared Function GetCurrentMethod() As MethodBase
   Public Shared Function GetMethodFromHandle(
        ByVal handle As RuntimeMethodHandle) As MethodBase
' Public Instance Methods
   MustInherit Public Function GetMethodImplementationFlags(
        ) As MethodImplAttributes
   MustInherit Public Function GetParameters(
        ) As ParameterInfo()
   MustInherit Public Function Invoke(ByVal obj As Object,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal parameters As Object(),
        ByVal culture As System.Globalization.CultureInfo) As Object
   Public Function Invoke(ByVal obj As Object,
        ByVal parameters As Object()) As Object
End Class
```

## Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → MethodBase

## Subclasses

ConstructorInfo, MethodInfo

## Returned By

System.Diagnostics.StackFrame.GetMethod(), System.Exception.TargetSite, Binc
{BindToMethod(), SelectMethod()}

## Passed To

`Binder.{BindToMethod(), SelectMethod()}`

## MethodImplAttributes Enum

## System.Reflection (mscorlib.dll) *serializable*

These flags specify how a method has been implemented. `Managed`, `Unmanaged`, and `ManagedMask` indicate whether the method is managed or unmanaged code. If a method allows only one thread to execute it at a time, then its `Synchronized` flag is set. `ForwardRef` specifies that the method has not been defined, and `InternalCall` indicates that the method is an internal call. `IL` and `OPTIL` specify that the code is IL or optimized IL. If the method is provided by the runtime, `Runtime` should be set, and if the method implementation is native, `Native` is marked. When a method should not be inlined during optimization, `NoInlining` is set. When the method signature should be exported exactly as specified, `PreserveSig` is set.

```
Public Enum MethodImplAttributes

   Managed = 0

   IL = 0

   Native = 1

   OPTIL = 2

   Runtime = 3

   CodeTypeMask = 3

   Unmanaged = 4

   ManagedMask = 4

   NoInlining = 8

   ForwardRef = 16

   Synchronized = 32

   PreserveSig = 128

   InternalCall = 4096

   MaxMethodImplVal = 65535

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `MethodImplAttributes`

### Returned By

`MethodBase.GetMethodImplementationFlags()`

### Passed To

`System.Reflection.Emit.ConstructorBuilder.SetImplementationFlags()`, `System.Reflection.Emit.MethodBuilder.SetImplementationFlags()`

## MethodInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This class is an implementation of `MethodBase` for methods (`ConstructorInfo` is the other impl adds two properties: `ReturnType` and `ReturnTypeCustomAttributes`, which allow access to t value returned and to the custom attributes set on that value. If the method is overridden from a bas `GetBaseDefinition()` returns the `MethodInfo` for the overridden method.

```
Public MustInherit Class MethodInfo : Inherits MethodBase

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Overrides Public ReadOnly Property MemberType As MemberTypes

   MustInherit Public ReadOnly Property ReturnType As Type

   MustInherit Public ReadOnly Property ReturnTypeCustomAttributes As ICu

' Public Instance Methods

   MustInherit Public Function GetBaseDefinition(

        ) As MethodInfo

End Class
```

### Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → MethodBase → Me

### Subclasses

System.Reflection.Emit.MethodBuilder

### Returned By

Multiple types

### Passed To

System.Delegate.CreateDelegate(), System.Reflection.Emit.AssemblyBuilder.Se
System.Reflection.Emit.ILGenerator.{Emit(), EmitCall()}, System.Reflection.E
{GetMethodToken(), SetUserEntryPoint()},
System.Reflection.Emit.TypeBuilder.DefineMethodOverride(),
System.Runtime.InteropServices.Marshal.{NumParamBytes(), Prelink()}

## Missing NotInheritable Class

## System.Reflection (mscorlib.dll)

Because C# (as well as some other languages) does not allow optional parameters, `Missing` allow this value to indicate that a value will not be specified for those optional parameters. The only way t class — there can only be one — is by the return value of the shared field, called `Value`.

```
Public NotInheritable Class Missing

' Public Shared Fields

   Public Shared ReadOnly Value As Missing                              // =Syst

End Class
```

## Module Class

### System.Reflection (mscorlib.dll) *ECMA, serializable*

Modules are .NET executable files (either .EXE or .DLL files) consisting of classes or interfaces. On
resources (such as graphics) make up an assembly. The `Module` class allows reflection of these ex
`FilterTypeNameIgnoreCase` are shared properties that return a `TypeFilter` delegate that filte
sensitive, and the second is case-insensitive. `Assembly` returns the appropriate `Assembly` object f
filename of this module and `FullyQualifiedName` returns that filename as well as the full path. U
types from a module accepted by a `TypeFilter` delegate. The methods prefixed with `Get` return tl
contained in this module, and `IsDefined()` checks whether a specific attribute is defined on the m

```
Public Class Module : Implements System.Runtime.Serialization.ISerializab

' Public Shared Fields

   Public Shared ReadOnly FilterTypeName As TypeFilter            // =Syst

   Public Shared ReadOnly FilterTypeNameIgnoreCase As TypeFilter     // =S

' Public Instance Properties

   Public ReadOnly Property Assembly As Assembly

   Overridable Public ReadOnly Property FullyQualifiedName As String

   Public ReadOnly Property Name As String

   Public ReadOnly Property ScopeName As String

' Public Instance Methods

   Overridable Public Function FindTypes(

        ByVal filter As TypeFilter,

        ByVal filterCriteria As Object) As Type()

   Overridable Public Function GetCustomAttributes(

        ByVal inherit As Boolean) As Object() Implements

        ICustomAttributeProvider.GetCustomAttributes

   Overridable Public Function GetCustomAttributes(

        ByVal attributeType As Type,

        ByVal inherit As Boolean) As Object() Implements ICustomAttribute

   Public Function GetField(

        ByVal name As String) As FieldInfo

   Public Function GetField(ByVal name As String,
```

```
    ByVal bindingAttr As BindingFlags) As FieldInfo
Public Function GetFields() As FieldInfo()
Public Function GetMethod(
    ByVal name As String) As MethodInfo
Public Function GetMethod(ByVal name As String,
    ByVal bindingAttr As BindingFlags,
    ByVal binder As Binder,
    ByVal callConvention As CallingConventions,
    ByVal types As Type(),
    ByVal modifiers As ParameterModifier()) As MethodInfo
Public Function GetMethod(ByVal name As String,
    ByVal types As Type()) As MethodInfo
Public Function GetMethods() As MethodInfo()
Overridable Public Sub GetObjectData(
    ByVal info As System.Runtime.Serialization.SerializationInfo,
    ByVal context As System.Runtime.Serialization.StreamingContext)
    Implements ISerializable.GetObjectData
Public Function GetSignerCertificate() As X509Certificate
Overridable Public Function GetType(
    ByVal className As String) As Type
Overridable Public Function GetType(
    ByVal className As String,
    ByVal ignoreCase As Boolean) As Type
Overridable Public Function GetType(
    ByVal className As String,
    ByVal throwOnError As Boolean,
    ByVal ignoreCase As Boolean) As Type
Overridable Public Function GetTypes() As Type()
Overridable Public Function IsDefined(
```

```
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean Implements ICustomAttributeP
   Public Function IsResource() As Boolean
   Overrides Public Function ToString() As String
' Protected Instance Methods
   Overridable Protected Function GetMethodImpl(
        ByVal name As String,
        ByVal bindingAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal callConvention As CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As MethodInfo
End Class
```

### Subclasses

System.Reflection.Emit.ModuleBuilder

### Returned By

Assembly.{GetLoadedModules(),GetModule(),GetModules(),LoadModule()},
System.Reflection.Emit.ConstructorBuilder.GetModule(),
System.Reflection.Emit.MethodBuilder.GetModule(),ModuleResolveEventHandle
System.Type.Module

### Passed To

System.Attribute.{GetCustomAttribute(),GetCustomAttributes(),IsDefined()},
System.Reflection.Emit.SignatureHelper.{GetFieldSigHelper(),GetLocalVarSi
GetMethodSigHelper(),GetPropertySigHelper()},System.Runtime.InteropServic

# ModuleResolveEventHandler Delegate

## System.Reflection (mscorlib.dll) *serializable*

This delegate is used as an event handler by `Assembly` when it cannot resolve a reference to a module that is part of an assembly. One instance in which this might occur is if one resource is not present.

```
Public Delegate Function ModuleResolveEventHandler(
        ByVal sender As Object,
        ByVal e As ResolveEventArgs) As Module
```

### Associated Events

`Assembly.ModuleResolve()`, `System.Reflection.Emit.AssemblyBuilder.ModuleResolve()`

## ParameterAttributes Enum

### System.Reflection (mscorlib.dll) *ECMA, serializable, flag*

These attributes are specified on a parameter. When the parameter has a default value, `HasDefault` is asserted. `Optional`, `Out`, `In`, and `Retval` all behave as you would expect them to. If a parameter has no attribute, `None` must be marked alone. If the parameter contains locale identifying information, `Lcid` should be set. Lastly, if the parameter is for marshaling information, `HasFieldMarshal` is asserted.

```
Public Enum ParameterAttributes

   None = &H000000000

   In = &H000000001

   Out = &H000000002

   Lcid = &H000000004

   Retval = &H000000008

   Optional = &H000000010

   HasDefault = &H000001000

   HasFieldMarshal = &H000002000

   Reserved3 = &H000004000

   Reserved4 = &H000008000

   ReservedMask = &H00000F000

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → ParameterAttributes

### Returned By

ParameterInfo.Attributes

### Passed To

System.Reflection.Emit.ConstructorBuilder.DefineParameter(), System.Reflection.Emit.MethodBuilder.DefineParameter()

## ParameterInfo Class

### System.Reflection (mscorlib.dll) *ECMA, serializable*

This class allows the inspection of the type and behavior of a method parameter. Because paramete them, the class implements `ICustomAttributeProvider`. `Attributes` returns the attributes de parameter has a default, it is stored in `DefaultValue`. Retrieve the name, type, and member the p `ParameterType`, and `Member`. `Position` returns the ordinal position of this parameter. `IsOptio` optional, and `IsLcid` indicates when the parameter is a locale identifier.

A parameter is passed by reference if the `IsByRef` property of its `ParameterType` property is `tru` (*out* parameters have `IsByRef` and `IsOut` set to `true`). A parameter that has been marked as `(I` set to `true`.

```
Public Class ParameterInfo : Implements ICustomAttributeProvider

' Protected Constructors

   Protected Sub New()

' Protected Instance Fields

   protected AttrsImpl As ParameterAttributes

   protected ClassImpl As Type

   protected DefaultValueImpl As Object

   protected MemberImpl As MemberInfo

   protected NameImpl As String

   protected PositionImpl As Integer

' Public Instance Properties

   Overridable Public ReadOnly Property Attributes As ParameterAttributes

   Overridable Public ReadOnly Property DefaultValue As Object

   Public ReadOnly Property IsIn As Boolean

   Public ReadOnly Property IsLcid As Boolean

   Public ReadOnly Property IsOptional As Boolean

   Public ReadOnly Property IsOut As Boolean

   Public ReadOnly Property IsRetval As Boolean

   Overridable Public ReadOnly Property Member As MemberInfo

   Overridable Public ReadOnly Property Name As String

   Overridable Public ReadOnly Property ParameterType As Type
```

```
   Overridable Public ReadOnly Property Position As Integer
' Public Instance Methods
   Overridable Public Function GetCustomAttributes(
        ByVal inherit As Boolean) As Object() Implements ICustomAttribute
   Overridable Public Function GetCustomAttributes(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Object() Implements ICustomAttribute
   Overridable Public Function IsDefined(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean Implements ICustomAttributeP
End Class
```

## Returned By

MethodBase.GetParameters(), PropertyInfo.GetIndexParameters()

## Passed To

System.Attribute.{GetCustomAttribute(), GetCustomAttributes(), IsDefined()}

# ParameterModifier Structure

## System.Reflection (mscorlib.dll) *ECMA*

This value type acts much like an array of boolean values. It can be constructed to a certain size, and then each index can be set or retrieved.

```
Public Structure ParameterModifier

' Public Constructors

   Public Sub New( ByVal paramaterCount As Integer)

' Public Instance Properties

   Public Default Property Item(

        ByVal index As Integer) As Boolean

End Structure
```

### Hierarchy

System.Object → System.ValueType → ParameterModifier

### Passed To

Multiple types

## Pointer NotInheritable Class

## System.Reflection (mscorlib.dll)

This class allows access to direct pointers to .NET objects through two shared methods. Unbox() r
to the passed object and pins it, not allowing the garbage collector to move its place in memory, anc
over the object to the .NET runtime.

```
Public NotInheritable Class Pointer : Implements System.Runtime.Serializa

' No public or protected members

End Class
```

# PropertyAttributes Enum

## System.Reflection (mscorlib.dll) *ECMA, serializable, flag*

Specifies the attributes that can be placed on properties. The important ones that you will encounter are `None` and `HasDefault`, which specify either the absence of attributes or that there is a default.

```
Public Enum PropertyAttributes
    None = &H000000000
    SpecialName = &H000000200
    RTSpecialName = &H000000400
    HasDefault = &H000001000
    Reserved2 = &H000002000
    Reserved3 = &H000004000
    Reserved4 = &H000008000
    ReservedMask = &H00000F400
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `PropertyAttributes`

### Returned By

`PropertyInfo.Attributes`

### Passed To

`System.Reflection.Emit.TypeBuilder.DefineProperty()`

## PropertyInfo MustInherit Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This class implements `MemberInfo` and represents a declared property on a type. `CanRead` and `CanWrite` check whether this property has `get` or `set` behaviors defined. These methods can be inspected directly (as `MethodInfo` instances) by calling `GetGetMethod()` and `GetSetMethod()`, or together by calling `GetAccessors()`, which returns an array of all defined accessors. If the property is an indexer, `GetIndexParameters()` returns parameters to access the indexer. `GetValue()` and `SetValue()` allow the instance of this property to be set or retrieved; these act as a shortcut to calling `Invoke` on the methods returned from `GetGetMethod()` or `GetSetMethod()`.

```
Public MustInherit Class PropertyInfo : Inherits MemberInfo

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property Attributes As PropertyAttributes

   MustInherit Public ReadOnly Property CanRead As Boolean

   MustInherit Public ReadOnly Property CanWrite As Boolean

   Public ReadOnly Property IsSpecialName As Boolean

   Overrides Public ReadOnly Property MemberType As MemberTypes

   MustInherit Public ReadOnly Property PropertyType As Type

' Public Instance Methods

   Public Function GetAccessors() As MethodInfo()

   MustInherit Public Function GetAccessors(

        ByVal nonPublic As Boolean) As MethodInfo()

   Public Function GetGetMethod() As MethodInfo

   MustInherit Public Function GetGetMethod(

        ByVal nonPublic As Boolean) As MethodInfo

   MustInherit Public Function GetIndexParameters(

        ) As ParameterInfo()

   Public Function GetSetMethod() As MethodInfo

   MustInherit Public Function GetSetMethod(
```

```
        ByVal nonPublic As Boolean) As MethodInfo
   MustInherit Public Function GetValue(ByVal obj As Object,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder, ByVal index As Object(),
        ByVal culture As System.Globalization.CultureInfo) As Object
   Overridable Public Function GetValue(ByVal obj As Object,
        ByVal index As Object()) As Object
   MustInherit Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder, ByVal index As Object(),
        ByVal culture As System.Globalization.CultureInfo)
   Overridable Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object, ByVal index As Object())
End Class
```

### Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → PropertyInfo

### Subclasses

System.Reflection.Emit.PropertyBuilder

### Returned By

Binder.SelectProperty(), IReflect.{GetProperties(), GetProperty()}, System.Runtime.InteropServices.Expando.IExpando.AddProperty(), System.Type {GetProperties(), GetProperty(), GetPropertyImpl()}

### Passed To

Binder.SelectProperty(), System.Reflection.Emit.CustomAttributeBuilder.CustomAttributeBuilder()

## ReflectionTypeLoadException NotInheritable Class

## System.Reflection (mscorlib.dll) *serializable*

This exception is thrown if any of the types from a module cannot be loaded when Module.GetTyp called. This exception provides access to the correctly loaded classes via Types.

```
Public NotInheritable Class ReflectionTypeLoadException : Inherits SystemI
' Public Constructors
   Public Sub New(ByVal classes As Type(),
        ByVal exceptions As Exception())
   Public Sub New(ByVal classes As Type(),
        ByVal exceptions As Exception(),
        ByVal message As String)
' Public Instance Properties
   Public ReadOnly Property LoaderExceptions As Exception()
   Public ReadOnly Property Types As Type()
' Public Instance Methods
   Overrides Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal System.SystemException → ReflectionTypeLoadException

## ResourceAttributes Enum

### System.Reflection (mscorlib.dll) *serializable, flag*

This enumeration includes the only two flags that can be placed on resources: `Public` and `Private`.

```
Public Enum ResourceAttributes
   Public = &H000000001
   Private = &H000000002
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ResourceAttributes`

### Passed To

`System.Reflection.Emit.AssemblyBuilder.{AddResourceFile(), DefineResource()}`, `System.Reflection.Emit.ModuleBuilder.DefineResource()`

## ResourceLocation Enum

## System.Reflection (mscorlib.dll) *serializable, flag*

This enumeration returns the location of a resource relative to the assembly.

```
Public Enum ResourceLocation
   Embedded = &H000000001
   ContainedInAnotherAssembly = &H000000002
   ContainedInManifestFile = &H000000004
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → ResourceLocation

### Returned By

ManifestResourceInfo.ResourceLocation

## StrongNameKeyPair Class

## System.Reflection (mscorlib.dll) *serializable*

This property allows reflection of an assembly's strong name. Use `PublicKey` to decrypt the encrypted name to verify the authenticity of the assembly.

```
Public Class StrongNameKeyPair

' Public Constructors

   Public Sub New( ByVal keyPairArray As Byte())

   Public Sub New( ByVal keyPairFile As System.IO.FileStream)

   Public Sub New( ByVal keyPairContainer As String)

' Public Instance Properties

   Public ReadOnly Property PublicKey As Byte()

End Class
```

### Returned By

AssemblyName.KeyPair

### Passed To

AssemblyName.KeyPair

# TargetException Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This exception is thrown when you attempt to invoke a nonshared method on a `null` object reference. (Note that in Beta1 of the .NET SDK, it was permissible to call a nonvirtual method against a `null` reference, so long as that method didn't access any of the fields in the type. In Beta2 and beyond, this "feature" has been closed and removed.)

```
Public Class TargetException : Inherits ApplicationException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.ApplicationException → TargetException

## TargetInvocationException NotInheritable Class

### System.Reflection (mscorlib.dll) *ECMA, serializable*

This exception is thrown by methods invoked via Reflection when they raise exceptions. Check Inn
to view the actual exception raised.

```
Public NotInheritable Class TargetInvocationException : Inherits Applicat
' Public Constructors
   Public Sub New( ByVal inner As Exception)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.ApplicationException → TargetInvocationException

## TargetParameterCountException NotInheritable Class

## System.Reflection (mscorlib.dll) *ECMA, serializable*

This exception is thrown when a method is invoked with an incorrect number of parameters. Note th
come when invoking methods via reflection, since the compiler detects any normal parameter count

```
Public NotInheritable Class TargetParameterCountException : Inherits Appl

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializal
System.ApplicationException → TargetParameterCountException

## TypeAttributes Enum

### System.Reflection (mscorlib.dll) *ECMA, serializable, flag*

These attributes can be applied to a type. A type is either a class or interface, so either `Class` or `Interface` must be set. Most of the modifiers share the same keywords with C# and VB.NET, so they are easy to understand. The values prefixed with `Nested` indicate a class that is nested as well as its visibility.

```
Public Enum TypeAttributes

   Class = &H000000000

   AutoLayout = &H000000000

   AnsiClass = &H000000000

   NotPublic = &H000000000

   Public = &H000000001

   NestedPublic = &H000000002

   NestedPrivate = &H000000003

   NestedFamily = &H000000004

   NestedAssembly = &H000000005

   NestedFamANDAssem = &H000000006

   VisibilityMask = &H000000007

   NestedFamORAssem = &H000000007

   SequentialLayout = &H000000008

   ExplicitLayout = &H000000010

   LayoutMask = &H000000018

   Interface = &H000000020

   ClassSemanticsMask = &H000000020

   Abstract = &H000000080

   Sealed = &H000000100

   SpecialName = &H000000400

   RTSpecialName = &H000000800

   Import = &H000001000

   Serializable = &H000002000
```

```
    UnicodeClass = &H000010000
    AutoClass = &H000020000
    StringFormatMask = &H000030000
    HasSecurity = &H000040000
    ReservedMask = &H000040800
    BeforeFieldInit = &H000100000
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → TypeAttributes

### Returned By

System.Type.{Attributes, GetAttributeFlagsImpl()}

### Passed To

System.Reflection.Emit.ModuleBuilder.{DefineEnum(), DefineType()}, System.Reflection.Emit.TypeBuilder.DefineNestedType()

# TypeDelegator Class

## System.Reflection (mscorlib.dll) *serializable*

Because `System.Type` is a MustInherit class, `TypeDelegator` simply wraps `System.Type` methods and provides the necessary implementations.

```
Public Class TypeDelegator : Inherits Type

' Public Constructors

   Public Sub New( ByVal delegatingType As Type)

' Protected Constructors

   Protected Sub New()

' Protected Instance Fields

   protected typeImpl As Type

' Public Instance Properties

   Overrides Public ReadOnly Property Assembly As Assembly

   Overrides Public ReadOnly Property AssemblyQualifiedName As String

   Overrides Public ReadOnly Property BaseType As Type

   Overrides Public ReadOnly Property FullName As String

   Overrides Public ReadOnly Property GUID As Guid

   Overrides Public ReadOnly Property Module As Module

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property Namespace As String

   Overrides Public ReadOnly Property TypeHandle As RuntimeTypeHandle

   Overrides Public ReadOnly Property UnderlyingSystemType As Type

' Public Instance Methods

   Overrides Public Function GetConstructors(

         ByVal bindingAttr As BindingFlags) As ConstructorInfo()

   Overrides Public Function GetCustomAttributes(

         ByVal inherit As Boolean) As Object()

   Overrides Public Function GetCustomAttributes(
```

```
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Object()
Overrides Public Function GetElementType() As Type
Overrides Public Function GetEvent(ByVal name As String,
    ByVal bindingAttr As BindingFlags) As EventInfo
Overrides Public Function GetEvents() As EventInfo()
Overrides Public Function GetEvents(
    ByVal bindingAttr As BindingFlags) As EventInfo()
Overrides Public Function GetField(ByVal name As String,
    ByVal bindingAttr As BindingFlags) As FieldInfo
Overrides Public Function GetFields(
    ByVal bindingAttr As BindingFlags) As FieldInfo()
Overrides Public Function GetInterface(
    ByVal name As String,
    ByVal ignoreCase As Boolean) As Type
Overrides Public Function GetInterfaceMap(
    ByVal interfaceType As Type) As InterfaceMapping
Overrides Public Function GetInterfaces() As Type()
Overrides Public Function GetMember(ByVal name As String,
    ByVal type As MemberTypes,
    ByVal bindingAttr As BindingFlags) As MemberInfo()
Overrides Public Function GetMembers(
    ByVal bindingAttr As BindingFlags) As MemberInfo()
Overrides Public Function GetMethods(
    ByVal bindingAttr As BindingFlags) As MethodInfo()
Overrides Public Function GetNestedType(
    ByVal name As String,
    ByVal bindingAttr As BindingFlags) As Type
Overrides Public Function GetNestedTypes(
    ByVal bindingAttr As BindingFlags) As Type()
Overrides Public Function GetProperties(
```

```
        ByVal bindingAttr As BindingFlags) As PropertyInfo()
    Overrides Public Function InvokeMember(
        ByVal name As String,
        ByVal invokeAttr As BindingFlags,
        ByVal binder As Binder, ByVal target As Object,
        ByVal args As Object(),
        ByVal modifiers As ParameterModifier(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal namedParameters As String()) As Object
    Overrides Public Function IsDefined(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
' Protected Instance Methods
    Overrides Protected Function GetAttributeFlagsImpl(
        ) As TypeAttributes
    Overrides Protected Function GetConstructorImpl(
        ByVal bindingAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal callConvention As CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As ConstructorInfo
    Overrides Protected Function GetMethodImpl(
        ByVal name As String,
        ByVal bindingAttr As BindingFlags,
        ByVal binder As Binder,
        ByVal callConvention As CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As MethodInfo
    Overrides Protected Function GetPropertyImpl(
```

```
        ByVal name As String,
        ByVal bindingAttr As BindingFlags,
        ByVal binder As Binder, ByVal returnType As Type,
        ByVal types As Type(),
        ByVal modifiers As ParameterModifier()) As PropertyInfo
   Overrides Protected Function HasElementTypeImpl(
        ) As Boolean
   Overrides Protected Function IsArrayImpl() As Boolean
   Overrides Protected Function IsByRefImpl() As Boolean
   Overrides Protected Function IsCOMObjectImpl() As Boolean
   Overrides Protected Function IsPointerImpl() As Boolean
   Overrides Protected Function IsPrimitiveImpl() As Boolean
   Overrides Protected Function IsValueTypeImpl() As Boolean
End Class
```

## Hierarchy

System.Object → MemberInfo(ICustomAttributeProvider) → System.Type(IReflect) → TypeDelegator

# TypeFilter Delegate

## System.Reflection (mscorlib.dll) *serializable*

This delegate maps to a function that will be applied individually to a list of `System.Type` objects. A filter runs through the list, and if this delegate returns `true`, the filtered list includes this object, otherwise it is excluded.

```
Public Delegate Function TypeFilter(ByVal m As Type,

        ByVal filterCriteria As Object) As Boolean
```

### Passed To

`Module.FindTypes()`, `System.Type.FindInterfaces()`

# Chapter 14. System.Reflection.Emit

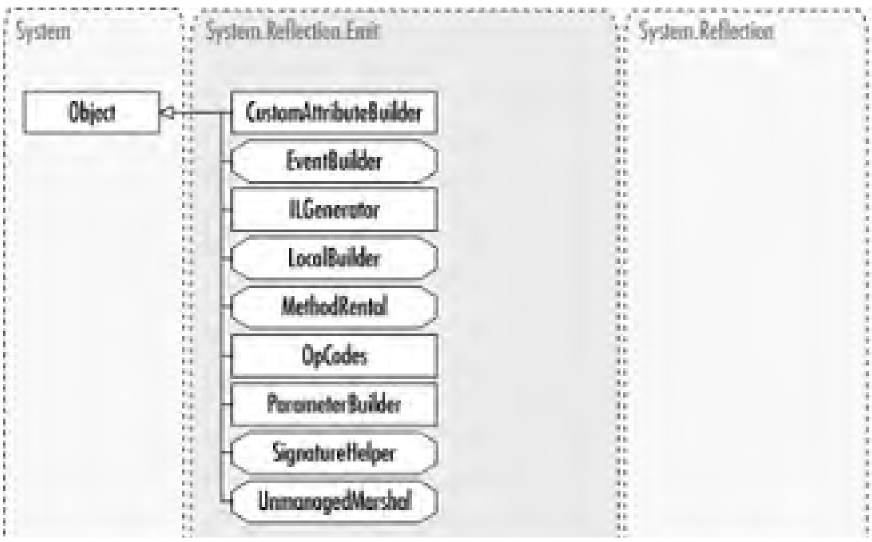
There are several ways to use reflection in .NET. Reflection can be used for runtime-type inspection and late-bound object creation using the types in the `System.Reflection` namespace. Reflection can also be used for dynamic code creation, which is supported by the types in this namespace, `System.Reflection.Emit`. Dynamic code creation means a programmer can programmatically create code constructs such as methods and events from within code, using the appropriate corresponding type (for example, `MethodBuilder` and `EventBuilder`). These code elements are all ingredients that can be added to a dynamic assembly, represented by an `AssemblyBuilder` object. Dynamic assemblies can be saved to disk as PE (Portable Executable) files, typically in DLL form. Or, alternatively, emit it directly to memory for immediate use, at the expense of persistence (memory-only types disappear when the containing `AppDomain` terminates).

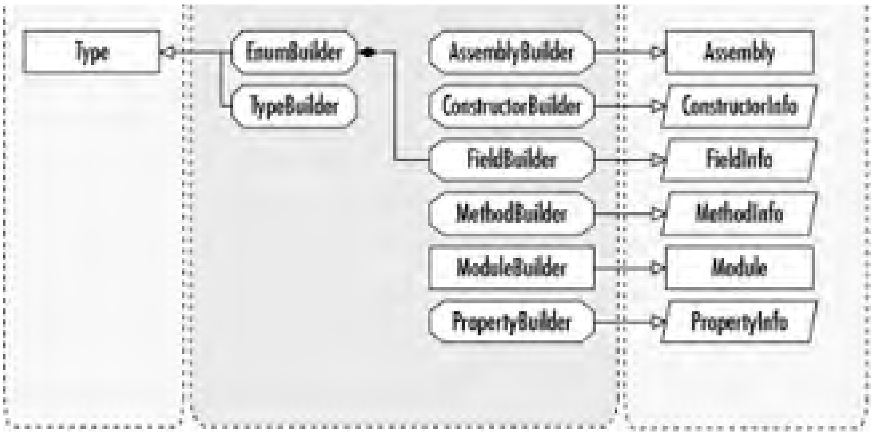
The `ILGenerator` class allows you to emit the MSIL (Microsoft Intermediate Language) for your code, using the corresponding `GetILGenerator()` method from a *builder* class. This process (sometimes known as "baking") allows you to convert the information in the builder object into a legitimate .NET type. You can then instantiate this newly created type on the spot.

The primary use of the `System.Reflection.Emit` namespace is to create compilers and script hosts, although many other uses are possible, including programs that dynamically create code that is fine-tuned to process a specific regular expression (see `System.Text.RegularExpressions.Regex.CompileToAssembly()`). When creating dynamic types, you generally begin by creating an `AssemblyBuilder`, which contains one or more `ModuleBuilder` objects. This in turn contains `TypeBuilder` instances. `TypeBuilder` objects contain most of the other ingredients in this namespace, including classes for building events, properties, methods, and enumerations.

Many of the builder classes in this namespace use similar methods and properties for retrieving information about the containing module (for example, `ConstructorBuilder.GetModule()`), getting an internal handle to the metadata (for example, `EnumBuilder.TypeHandle()`), and retrieving attributes (`MethodBuilder.Attributes`). Also note that though the builder classes derive from the corresponding "-Info" class (for example, `MethodBuilder` derives from `System.Reflection.MethodInfo`), not all of the inherited properties are currently supported. This includes methods such as `Invoke()`. To use these methods, you may need to reflect on the object with `System.Type.GetType()`. Figure 14-1 shows the types in this namespace.

**Figure 14-1. The System.Reflection.Emit namespace**




Type
EnumBuilder
TypeBuilder
AssemblyBuilder
ConstructorBuilder
FieldBuilder
MethodBuilder
ModuleBuilder
PropertyBuilder
Assembly
ConstructorInfo
FieldInfo
MethodInfo
Module
PropertyInfo

## AssemblyBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamic assembly. A dynamic assembly is the root container for all the buil the `System.Reflection.Emit` namespace. You can create an `AssemblyBuilder` object by us `DefineDynamicAssembly()` method of the `System.AppDomain` class. When you create a dyna specify a name and the access mode, using the `AssemblyBuilderAccess` enumeration. If you pl assembly to disk using the the `Save()` method, be sure to specify `AssemblyBuilderAccess.Sa` `AssemblyBuilderAccess.RunAndSave`.

A dynamic assembly can contain one or more modules, which are defined by `ModuleBuilder` obje `DefineDynamicModule()` method to define, create, and return a `ModuleBuilder` object, as in `I As ModuleBuilder = myAssemblyB.DefineDynamicModule("ModuleName")`. By default, transient module that cannot be saved, regardless of the `AssemblyBuilderAccess` specified. To module that can be saved to disk, use a version of the overloaded `DefineDynamicModule()` that `fileName` argument. You can also use other methods to add an attribute to the assembly, add or c and unmanaged resources, and retrieve a `System.IO.FileStream` object for any of the files in th

When you are finished creating an assembly and all its members, you can use the `Save()` method. takes a simple filename as a parameter, which can't include directory or drive information. To use a directory or drive, you must specify the path when you create the dynamic assembly by using the ap constructor. When you save a dynamic assembly, all nontransient modules are saved using the filer when you created them. By default, the assembly is saved as a DLL file (as if you had used the `/target:library` command-line compiler switch). To change this, use the `SetEntryPoint()` n specify the assembly's startup method and to specify `PEFileKinds`.

```
Public NotInheritable Class AssemblyBuilder : Inherits System.Reflection.A

' Public Instance Properties

   Overrides Public ReadOnly Property CodeBase As String

   Overrides Public ReadOnly Property EntryPoint As MethodInfo

   Overrides Public ReadOnly Property Location As String

' Public Instance Methods

   Public Sub AddResourceFile(ByVal name As String,

        ByVal fileName As String)

   Public Sub AddResourceFile(ByVal name As String,

        ByVal fileName As String,

        ByVal attribute As System.Reflection.ResourceAttributes)

   Public Function DefineDynamicModule(

        ByVal name As String) As ModuleBuilder

   Public Function DefineDynamicModule(ByVal name As String,
```

```
     ByVal emitSymbolInfo As Boolean) As ModuleBuilder
Public Function DefineDynamicModule(ByVal name As String,
     ByVal fileName As String) As ModuleBuilder
Public Function DefineDynamicModule(ByVal name As String,
     ByVal fileName As String,
     ByVal emitSymbolInfo As Boolean) As ModuleBuilder
Public Function DefineResource(ByVal name As String,
     ByVal description As String,
     ByVal fileName As String) As IResourceWriter
Public Function DefineResource(ByVal name As String,
     ByVal description As String,
     ByVal fileName As String,
     ByVal attribute As System.Reflection.ResourceAttributes) As IReso
Public Sub DefineUnmanagedResource(
     ByVal resource As Byte())
Public Sub DefineUnmanagedResource(
     ByVal resourceFileName As String)
Public Sub DefineVersionInfoResource()
Public Sub DefineVersionInfoResource(
     ByVal product As String,
     ByVal productVersion As String,
     ByVal company As String, ByVal copyright As String,
     ByVal trademark As String)
Public Function GetDynamicModule(
     ByVal name As String) As ModuleBuilder
Overrides Public Function GetExportedTypes() As Type()
Overrides Public Function GetFile(
     ByVal name As String) As FileStream
Overrides Public Function GetFiles(
     ByVal getResourceModules As Boolean) As FileStream()
Overrides Public Function GetManifestResourceInfo(
```

```
        ByVal resourceName As String) As ManifestResourceInfo
    Overrides Public Function GetManifestResourceNames(
        ) As String()
    Overrides Public Function GetManifestResourceStream(
        ByVal name As String) As Stream
    Overrides Public Function GetManifestResourceStream(
        ByVal type As Type,
        ByVal name As String) As Stream
    Public Sub Save( ByVal assemblyFileName As String)
    Public Sub SetCustomAttribute(
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
    Public Sub SetEntryPoint(
        ByVal entryMethod As System.Reflection.MethodInfo)
    Public Sub SetEntryPoint(
        ByVal entryMethod As System.Reflection.MethodInfo,
        ByVal fileKind As PEFileKinds)
End Class
```

## Hierarchy

System.Object → System.Reflection.Assembly(System.Security.IEvidenceFact
System.Reflection.ICustomAttributeProvider,
System.Runtime.Serialization.ISerializable) → AssemblyBuilder

## Returned By

System.AppDomain.DefineDynamicAssembly()

# AssemblyBuilderAccess Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration is used by the `System.AppDomain.DefineDynamicAssembly()` method. It specifies whether a dynamic assembly will support dynamic execution only (`Run`), save to disk only (`Save`), or both (`RunAndSave`).

```
Public Enum AssemblyBuilderAccess
   Run = 1
   Save = 2
   RunAndSave = 3
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `AssemblyBuilderAccess`

### Passed To

`System.AppDomain.DefineDynamicAssembly()`

## ConstructorBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created constructor method. Create a constructor and add it to `TypeBuilder.DefineConstructor()` method or the `TypeBuilder.DefineDefaultConstr` default constructor accepts no parameters, and just calls the constructor of the parent class. You ca `ILGenerator` class with a default constructor, because its code is provided by the runtime. Genera constructor does not need to be created, as the CLR provides it for you.

If you create a custom constructor with `TypeBuilder.DefineConstructor()`, you can specify t parameters as an array of `System.Type` objects. Alternatively, you can use the `DefineParamete` `ParameterBuilder`. You can also add MSIL code to the constructor using the `GetILGenerator`

```
Public NotInheritable Class ConstructorBuilder : Inherits System.Reflecti

' Public Instance Properties

   Overrides Public ReadOnly Property Attributes As MethodAttributes

   Overrides Public ReadOnly Property DeclaringType As Type

   Public Property InitLocals As Boolean

   Overrides Public ReadOnly Property MethodHandle As RuntimeMethodHandle

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property ReflectedType As Type

   Public ReadOnly Property ReturnType As Type

   Public ReadOnly Property Signature As String

' Public Instance Methods

   Public Sub AddDeclarativeSecurity(

        ByVal action As System.Security.Permissions.SecurityAction,

        ByVal pset As System.Security.PermissionSet)

   Public Function DefineParameter(ByVal iSequence As Integer,

        ByVal attributes As System.Reflection.ParameterAttributes,

        ByVal strParamName As String) As ParameterBuilder

   Overrides Public Function GetCustomAttributes(

        ByVal inherit As Boolean) As Object()

   Overrides Public Function GetCustomAttributes(
```

```
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Object()
Public Function GetILGenerator() As ILGenerator
Overrides Public Function GetMethodImplementationFlags(
    ) As MethodImplAttributes
Public Function GetModule() As Module
Overrides Public Function GetParameters(
    ) As ParameterInfo()
Public Function GetToken() As MethodToken
Overrides Public Function Invoke(
    ByVal invokeAttr As System.Reflection.BindingFlags,
    ByVal binder As System.Reflection.Binder,
    ByVal parameters As Object(),
    ByVal culture As System.Globalization.CultureInfo) As Object
Overrides Public Function Invoke(ByVal obj As Object,
    ByVal invokeAttr As System.Reflection.BindingFlags,
    ByVal binder As System.Reflection.Binder,
    ByVal parameters As Object(),
    ByVal culture As System.Globalization.CultureInfo) As Object
Overrides Public Function IsDefined(
    ByVal attributeType As Type,
    ByVal inherit As Boolean) As Boolean
Public Sub SetCustomAttribute(
    ByVal con As System.Reflection.ConstructorInfo,
    ByVal binaryAttribute As Byte())
Public Sub SetCustomAttribute(
    ByVal customBuilder As CustomAttributeBuilder)
Public Sub SetImplementationFlags(
    ByVal attributes As System.Reflection.MethodImplAttributes)
Public Sub SetSymCustomAttribute(ByVal name As String,
```

```
        ByVal data As Byte())

   Overrides Public Function ToString() As String

End Class
```

## Hierarchy

System.Object → System.Reflection.MemberInfo(System.Reflection.ICustomAt
→ System.Reflection.MethodBase → System.Reflection.ConstructorInfo → (

## Returned By

TypeBuilder.{DefineConstructor(),DefineDefaultConstructor(),DefineTypeInit

## CustomAttributeBuilder Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created custom attribute. To apply a custom attribute, pass an instance of this type to the `SetCustomAttribute()` method for the appropriate builder (for example, `PropertyBuilder.SetCustomAttribute()` or `MethodBuilder.SetCustomAttribute()`). The constructor allows you to specify the custom attribute's named properties and fields, their values, and a constructor.

```
Public Class CustomAttributeBuilder

' Public Constructors

   Public Sub New(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal constructorArgs As Object())

   Public Sub New(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal constructorArgs As Object(),

        ByVal namedFields As System.Reflection.FieldInfo(),

        ByVal fieldValues As Object())

   Public Sub New(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal constructorArgs As Object(),

        ByVal namedProperties As System.Reflection.PropertyInfo(),

        ByVal propertyValues As Object())

   Public Sub New(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal constructorArgs As Object(),

        ByVal namedProperties As System.Reflection.PropertyInfo(),

        ByVal propertyValues As Object(),

        ByVal namedFields As System.Reflection.FieldInfo(),

        ByVal fieldValues As Object())

End Class
```

### Passed To

AssemblyBuilder.SetCustomAttribute(),
ConstructorBuilder.SetCustomAttribute(),
EnumBuilder.SetCustomAttribute(),EventBuilder.SetCustomAttribute(),
FieldBuilder.SetCustomAttribute(),MethodBuilder.SetCustomAttribute(),
ModuleBuilder.SetCustomAttribute(),
ParameterBuilder.SetCustomAttribute(),
PropertyBuilder.SetCustomAttribute(),TypeBuilder.SetCustomAttribute(),
System.Text.RegularExpressions.Regex.CompileToAssembly()

## EnumBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created enumeration. Enumerations are created at module sco| `ModuleBuilder.DefineEnum()` method. Before using a dynamically created enumeration, you r `CreateType()` method to complete it.

```
Public NotInheritable Class EnumBuilder : Inherits Type

' Public Instance Properties

   Overrides Public ReadOnly Property Assembly As Assembly

   Overrides Public ReadOnly Property AssemblyQualifiedName As String

   Overrides Public ReadOnly Property BaseType As Type

   Overrides Public ReadOnly Property DeclaringType As Type

   Overrides Public ReadOnly Property FullName As String

   Overrides Public ReadOnly Property GUID As Guid

   Overrides Public ReadOnly Property Module As Module

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property Namespace As String

   Overrides Public ReadOnly Property ReflectedType As Type

   Overrides Public ReadOnly Property TypeHandle As RuntimeTypeHandle

   Public ReadOnly Property TypeToken As TypeToken

   Public ReadOnly Property UnderlyingField As FieldBuilder

   Overrides Public ReadOnly Property UnderlyingSystemType As Type

' Public Instance Methods

   Public Function CreateType() As Type

   Public Function DefineLiteral(ByVal literalName As String,

        ByVal literalValue As Object) As FieldBuilder

   Overrides Public Function GetConstructors(

        ByVal bindingAttr As System.Reflection.BindingFlags) As Construct

   Overrides Public Function GetCustomAttributes(

        ByVal inherit As Boolean) As Object()

   Overrides Public Function GetCustomAttributes(
```

```
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Object()
    Overrides Public Function GetElementType() As Type
    Overrides Public Function GetEvent(ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
    Overrides Public Function GetEvents() As EventInfo()
    Overrides Public Function GetEvents(
        ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
    Overrides Public Function GetField(ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
    Overrides Public Function GetFields(
        ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
    Overrides Public Function GetInterface(
        ByVal name As String,
        ByVal ignoreCase As Boolean) As Type
    Overrides Public Function GetInterfaceMap(
        ByVal interfaceType As Type) As InterfaceMapping
    Overrides Public Function GetInterfaces() As Type()
    Overrides Public Function GetMember(ByVal name As String,
        ByVal type As System.Reflection.MemberTypes,
        ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
    Overrides Public Function GetMembers(
        ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
    Overrides Public Function GetMethods(
        ByVal bindingAttr As System.Reflection.BindingFlags) As MethodInf
    Overrides Public Function GetNestedType(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags) As Type
    Overrides Public Function GetNestedTypes(
        ByVal bindingAttr As System.Reflection.BindingFlags) As Type()
    Overrides Public Function GetProperties(
```

```
        ByVal bindingAttr As System.Reflection.BindingFlags) As PropertyI
    Overrides Public Function InvokeMember(
        ByVal name As String,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal target As Object, ByVal args As Object(),
        ByVal modifiers As System.Reflection.ParameterModifier(),
        ByVal culture As System.Globalization.CultureInfo,
        ByVal namedParameters As String()) As Object
    Overrides Public Function IsDefined(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
    Public Sub SetCustomAttribute(
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
' Protected Instance Methods
    Overrides Protected Function GetAttributeFlagsImpl(
        ) As TypeAttributes
    Overrides Protected Function GetConstructorImpl(
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Cons
    Overrides Protected Function GetMethodImpl(
```

```
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
   Overrides Protected Function GetPropertyImpl(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal returnType As Type, ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Prop
   Overrides Protected Function HasElementTypeImpl(
        ) As Boolean
   Overrides Protected Function IsArrayImpl() As Boolean
   Overrides Protected Function IsByRefImpl() As Boolean
   Overrides Protected Function IsCOMObjectImpl() As Boolean
   Overrides Protected Function IsPointerImpl() As Boolean
   Overrides Protected Function IsPrimitiveImpl() As Boolean
   Overrides Protected Function IsValueTypeImpl() As Boolean
End Class
```

### Hierarchy

System.Object → System.Reflection.MemberInfo(System.Reflection.ICustomAttributeProvider) → System.Type(System.Reflection.IReflect) → EnumBuilder

### Returned By

ModuleBuilder.DefineEnum()

# EventBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created event. Events are created with the `TypeBuilder.DefineEvent()` method. You can then attach a `MethodBuilder` object to represent one of three methods: the method used to raise the event (`SetRaiseMethod()`), the method used to subscribe to the event (`SetAddOnMethod()`), and the method used to unsubscribe (`SetRemoveOnMethod()`).

```
Public NotInheritable Class EventBuilder

' Public Instance Methods

   Public Sub AddOtherMethod(ByVal mdBuilder As MethodBuilder)

   Public Function GetEventToken() As EventToken

   Public Sub SetAddOnMethod(ByVal mdBuilder As MethodBuilder)

   Public Sub SetCustomAttribute(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal binaryAttribute As Byte())

   Public Sub SetCustomAttribute(

        ByVal customBuilder As CustomAttributeBuilder)

   Public Sub SetRaiseMethod(ByVal mdBuilder As MethodBuilder)

   Public Sub SetRemoveOnMethod(

        ByVal mdBuilder As MethodBuilder)

End Class
```

### Returned By

`TypeBuilder.DefineEvent()`

# EventToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for an event. A token is a 4-byte number that points to the metadata
MSIL. The first byte in the token identifies the metadata table, which depends on the type of prograr
specify the row in the metadata table. For example, the token 0x06000004 specifies that the corres
fourth row of table 0x06 (the `MethodDef` table).

```
Public Structure EventToken
' Public Shared Fields
   Public Shared ReadOnly Empty As EventToken                          // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

System.Object → System.ValueType → EventToken

### Returned By

EventBuilder.GetEventToken()

## FieldBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created field. Fields are created with the `TypeBuilder.DefineField()` method, which allows you to specify the field's characteristics usi `System.Reflection.FieldAttributes` enumeration. The `TypeBuilder.DefineField()` n also determines the name and type of the field. Fields must be a simple data type such as a string c integer. Use `SetConstant()` to set the default value of the field.

```
Public NotInheritable Class FieldBuilder : Inherits System.Reflection.Fie

' Public Instance Properties

   Overrides Public ReadOnly Property Attributes As FieldAttributes

   Overrides Public ReadOnly Property DeclaringType As Type

   Overrides Public ReadOnly Property FieldHandle As RuntimeFieldHandle

   Overrides Public ReadOnly Property FieldType As Type

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property ReflectedType As Type

' Public Instance Methods

   Overrides Public Function GetCustomAttributes(

        ByVal inherit As Boolean) As Object()

   Overrides Public Function GetCustomAttributes(

        ByVal attributeType As Type,

        ByVal inherit As Boolean) As Object()

   Public Function GetToken() As FieldToken

   Overrides Public Function GetValue(

        ByVal obj As Object) As Object

   Overrides Public Function IsDefined(

        ByVal attributeType As Type,

        ByVal inherit As Boolean) As Boolean

   Public Sub SetConstant( ByVal defaultValue As Object)

   Public Sub SetCustomAttribute(
```

```
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
    Public Sub SetMarshal(
        ByVal unmanagedMarshal As UnmanagedMarshal)
    Public Sub SetOffset( ByVal iOffset As Integer)
    Overrides Public Sub SetValue(ByVal obj As Object,
        ByVal val As Object,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal culture As System.Globalization.CultureInfo)
End Class
```

## Hierarchy

System.Object → System.Reflection.MemberInfo(System.Reflection.ICustomAttributeProvider) → System.Reflection.FieldInfo → FieldBuilder

## Returned By

EnumBuilder.{DefineLiteral(),UnderlyingField},ModuleBuilder.{DefineInitializedData(),DefineUninitializedData()},TypeBuilder.{DefineFie
DefineInitializedData(),DefineUninitializedData()}

# FieldToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a field. See `EventToken` for more details on tokens.

```
Public Structure FieldToken
' Public Shared Fields
   Public Shared ReadOnly Empty As FieldToken                          // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `FieldToken`

### Returned By

`FieldBuilder.GetToken()`, `ModuleBuilder.GetFieldToken()`

# FlowControl Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration is used by the `OpCode.FlowControl` property. It describes how the instruction alters the flow of control. `Next` indicates a normal flow of control, while `Cond_Branch` indicates a conditional branch instruction. The `Meta` value provides information about a subsequent instruction.

```
Public Enum FlowControl
   Branch = 0
   Break = 1
   Call = 2
   Cond_Branch = 3
   Meta = 4
   Next = 5
   Phi = 6
   Return = 7
   Throw = 8
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `FlowControl`

### Returned By

`OpCode.FlowControl`

## ILGenerator Class

### System.Reflection.Emit (mscorlib.dll)

This class generates MSIL (Microsoft Intermediate Language) instructions. You receive an ILGene from a GetILGenerator method in a builder class. For example, you can use the ConstructorBuilder.GetILGenerator() to create MSIL instructions for a constructor, or MethodBuilder.GetILGenerator() to create MSIL instructions for a method. Use BeginScop EndScope() to start and stop a lexical scope.

To emit instructions, use the Emit() method. The Emit() method requires an OpCode object. The supply this is by using one of the constant fields from OpCodes, as in myGenerator.Emit(OpCod EmitWriteLine() creates the MSIL code required to call System.Console.WriteLine() with variable. You can also define and mark labels in the instruction stream (DefineLabel() and Mark emit an instruction for throwing an exception (ThrowException()), and define local variables (DeclareLocal()).

Emit error handling blocks with BeginExceptionBlock() and EndExceptionBlock() (which e equivalent of a VB.NET Try statement), BeginCatchBlock() (which emits the equivalent of the C statement), and BeginFinallyBlock() (which emits the equivalent of the Finally statement). the exception block using EndExceptionBlock().

```
Public Class ILGenerator

' Public Instance Methods

   Overridable Public Sub BeginCatchBlock(

        ByVal exceptionType As Type)

   Overridable Public Sub BeginExceptFilterBlock()

   Overridable Public Function BeginExceptionBlock() As Label

   Overridable Public Sub BeginFaultBlock()

   Overridable Public Sub BeginFinallyBlock()

   Overridable Public Sub BeginScope()

   Public Function DeclareLocal(

        ByVal localType As Type) As LocalBuilder

   Overridable Public Function DefineLabel() As Label

   Overridable Public Sub Emit( ByVal opcode As OpCode)

   Overridable Public Sub Emit(ByVal opcode As OpCode,

        ByVal arg As Byte)

   Overridable Public Sub Emit(ByVal opcode As OpCode,
```

```
     ByVal con As System.Reflection.ConstructorInfo)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal arg As Double)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal field As System.Reflection.FieldInfo)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal arg As Short)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal arg As Integer)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal arg As Long)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal label As Label)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal labels As Label())
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal local As LocalBuilder)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal meth As System.Reflection.MethodInfo)
Public Sub Emit(ByVal opcode As OpCode, ByVal arg As SByte)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal signature As SignatureHelper)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal arg As Single)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal str As String)
Overridable Public Sub Emit(ByVal opcode As OpCode,
     ByVal cls As Type)
Public Sub EmitCall(ByVal opcode As OpCode,
```

```
        ByVal methodInfo As System.Reflection.MethodInfo,
        ByVal optionalParameterTypes As Type())
    Public Sub EmitCalli(ByVal opcode As OpCode,
        ByVal callingConvention As System.Reflection.CallingConventions,
        ByVal returnType As Type,
        ByVal parameterTypes As Type(),
        ByVal optionalParameterTypes As Type())
    Public Sub EmitCalli(ByVal opcode As OpCode,
        ByVal unmanagedCallConv As System.Runtime.InteropServices.Calling
        ByVal returnType As Type,
        ByVal parameterTypes As Type())
    Overridable Public Sub EmitWriteLine(
        ByVal fld As System.Reflection.FieldInfo)
    Overridable Public Sub EmitWriteLine(
        ByVal localBuilder As LocalBuilder)
    Overridable Public Sub EmitWriteLine(ByVal value As String)
    Overridable Public Sub EndExceptionBlock()
    Overridable Public Sub EndScope()
    Overridable Public Sub MarkLabel( ByVal loc As Label)
    Overridable Public Sub MarkSequencePoint(
        ByVal document As System.Diagnostics.SymbolStore.ISymbolDocumentW
        ByVal startLine As Integer,
        ByVal startColumn As Integer,
        ByVal endLine As Integer,
        ByVal endColumn As Integer)
    Overridable Public Sub ThrowException(
        ByVal excType As Type)
    Public Sub UsingNamespace( ByVal usingNamespace As String)
End Class
```

### Returned By

`ConstructorBuilder.GetILGenerator()`, `MethodBuilder.GetILGenerator()`

# Label Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents a label in the MSIL instruction stream. You can create a label with `ILGenerator.DefineLabel()` and place it in the stream with `ILGenerator.MarkLabel()`.

```
Public Structure Label

' Public Instance Methods

   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `Label`

### Returned By

`ILGenerator.{BeginExceptionBlock(),DefineLabel()}`

### Passed To

`ILGenerator.{Emit(),MarkLabel()}`

## LocalBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created local variable. Local variables are created for methods and constructors through the `ILGenerator` object, using the `ILGenerator.DeclareLocal()`.

```
Public NotInheritable Class LocalBuilder

' Public Instance Properties

   Public ReadOnly Property LocalType As Type

' Public Instance Methods

   Public Sub SetLocalSymInfo( ByVal name As String)

   Public Sub SetLocalSymInfo(ByVal name As String,

        ByVal startOffset As Integer,

        ByVal endOffset As Integer)

End Class
```

### Returned By

`ILGenerator.DeclareLocal()`

### Passed To

`ILGenerator.{Emit(),EmitWriteLine()}`

## MethodBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created method. Methods are created with `TypeBuilder.Def` creating a method, specify the name, parameters, and return type. You can also specify other chara such as whether it is shared, MustInherit, or overridable, by using the `System.Reflection.Meth` enumeration. After creating a method, you can specify how the return value will be marshaled to unı `SetMarshal()`, and add declarative security using `AddDeclarativeSecurity()`. You must spe (such as Demand, Assert, Deny) using the `System.Security.Permissions.SecurityActior` permissions required using the `System.Security.PermissionSet` collection class. You can ca `AddDeclarativeSecurity()` several times to specify different security actions.

To create a global method builder, use `ModuleBuilder.DefineGlobalMethod()`. You must als `ModuleBuilder.CreateGlobalFunctions()` to finish creating global methods before you pers module. Global methods must be shared. You can also create a global native method using `ModuleBuilder.DefinePInvokeMethod()`. `PInvoke` methods cannot be MustInherit or overri

```
Public NotInheritable Class MethodBuilder : Inherits System.Reflection.Me

' Public Instance Properties

   Overrides Public ReadOnly Property Attributes As MethodAttributes

   Overrides Public ReadOnly Property CallingConvention As CallingConvent

   Overrides Public ReadOnly Property DeclaringType As Type

   Public Property InitLocals As Boolean

   Overrides Public ReadOnly Property MethodHandle As RuntimeMethodHandle

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property ReflectedType As Type

   Overrides Public ReadOnly Property ReturnType As Type

   Overrides Public ReadOnly Property ReturnTypeCustomAttributes As ICust

   Public ReadOnly Property Signature As String

' Public Instance Methods

   Public Sub AddDeclarativeSecurity(

        ByVal action As System.Security.Permissions.SecurityAction,

        ByVal pset As System.Security.PermissionSet)

   Public Sub CreateMethodBody(ByVal il As Byte(),

        ByVal count As Integer)

   Public Function DefineParameter(ByVal position As Integer,
```

```
          ByVal attributes As System.Reflection.ParameterAttributes,
          ByVal strParamName As String) As ParameterBuilder
     Overrides Public Function Equals(
          ByVal obj As Object) As Boolean
     Overrides Public Function GetBaseDefinition(
          ) As MethodInfo
     Overrides Public Function GetCustomAttributes(
          ByVal inherit As Boolean) As Object()
     Overrides Public Function GetCustomAttributes(
          ByVal attributeType As Type,
          ByVal inherit As Boolean) As Object()
     Overrides Public Function GetHashCode() As Integer
     Public Function GetILGenerator() As ILGenerator
     Public Function GetILGenerator(
          ByVal size As Integer) As ILGenerator
     Overrides Public Function GetMethodImplementationFlags(
          ) As MethodImplAttributes
     Public Function GetModule() As Module
     Overrides Public Function GetParameters(
          ) As ParameterInfo()
     Public Function GetToken() As MethodToken
     Overrides Public Function Invoke(ByVal obj As Object,
          ByVal invokeAttr As System.Reflection.BindingFlags,
          ByVal binder As System.Reflection.Binder,
          ByVal parameters As Object(),
          ByVal culture As System.Globalization.CultureInfo) As Object
     Overrides Public Function IsDefined(
          ByVal attributeType As Type,
          ByVal inherit As Boolean) As Boolean
     Public Sub SetCustomAttribute(
```

```
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
    Public Sub SetImplementationFlags(
        ByVal attributes As System.Reflection.MethodImplAttributes)
    Public Sub SetMarshal(
        ByVal unmanagedMarshal As UnmanagedMarshal)
    Public Sub SetSymCustomAttribute(ByVal name As String,
        ByVal data As Byte())
    Overrides Public Function ToString() As String
End Class
```

## Hierarchy

System.Object → System.Reflection.MemberInfo(System.Reflection.ICustomAt
System.Reflection.MethodBase → System.Reflection.MethodInfo → MethodBui

## Returned By

ModuleBuilder.{DefineGlobalMethod(),DefinePInvokeMethod()},TypeBuilder.{De
DefinePInvokeMethod()}

## Passed To

EventBuilder.{AddOtherMethod(),SetAddOnMethod(),SetRaiseMethod(),SetRemove
PropertyBuilder.{AddOtherMethod(),SetGetMethod(),SetSetMethod()}

## MethodRental NotInheritable Class

### System.Reflection.Emit (mscorlib.dll)

This class can be used to swap a method "body" (the MSIL code inside the method). To do this, use the shared `SwapMethodBody()` method and specify the target `Type`, the token of the method that should receive the new body, a pointer to the new method, the size of the new method, and a `flag` specifying the type of compilation using the appropriate field constant (either `JitImmediate` or `JitOnDemand`). The `IntPtr` to the new method body should point to an array of `byte`s that contain the IL for the method's header and body.

```
Public NotInheritable Class MethodRental

' Public Shared Fields

   Public const JitImmediate As Integer                          // =1

   Public const JitOnDemand As Integer                           // =0

' Public Shared Methods

   Public Shared Sub SwapMethodBody(ByVal cls As Type,

        ByVal methodtoken As Integer, ByVal rgIL As IntPtr,

        ByVal methodSize As Integer,

        ByVal flags As Integer)

End Class
```

# MethodToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a method. See `EventToken` for more details on tokens.

```
Public Structure MethodToken
' Public Shared Fields
   Public Shared ReadOnly Empty As MethodToken                    // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `MethodToken`

### Returned By

`ConstructorBuilder.GetToken()`, `MethodBuilder.GetToken()`, `ModuleBuilder.{GetA`
`GetConstructorToken()`, `GetMethodToken()}`

# ModuleBuilder Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created module inside a dynamic assembly. Dynamic modules `AssemblyBuilder.DefineDynamicModule()` method. A dynamic module can be either transie which means you can save it to disk as part of a PE file. To create a persistable module, use a vers `AssemblyBuilder.DefineDynamicModule()` method that allows you to specify a filename.

You can use the methods that begin with `Define` to create types, managed and unmanaged resou and `PInvoke` (global native) methods.

```
Public Class ModuleBuilder : Inherits System.Reflection.Module

' Public Instance Properties

   Overrides Public ReadOnly Property FullyQualifiedName As String

' Public Instance Methods

   Public Sub CreateGlobalFunctions()

   Public Function DefineDocument(ByVal url As String,

         ByVal language As Guid,

         ByVal languageVendor As Guid,

         ByVal documentType As Guid) As ISymbolDocumentWriter

   Public Function DefineEnum(ByVal name As String,

         ByVal visibility As System.Reflection.TypeAttributes,

         ByVal underlyingType As Type) As EnumBuilder

   Public Function DefineGlobalMethod(ByVal name As String,

         ByVal attributes As System.Reflection.MethodAttributes,

         ByVal callingConvention As System.Reflection.CallingConventions,

         ByVal returnType As Type,

         ByVal parameterTypes As Type()) As MethodBuilder

   Public Function DefineGlobalMethod(ByVal name As String,

         ByVal attributes As System.Reflection.MethodAttributes,

         ByVal returnType As Type,

         ByVal parameterTypes As Type()) As MethodBuilder

   Public Function DefineInitializedData(ByVal name As String,
```

```
        ByVal data As Byte(),
        ByVal attributes As System.Reflection.FieldAttributes) As FieldBu
    Public Function DefinePInvokeMethod(ByVal name As String,
        ByVal dllName As String,
        ByVal attributes As System.Reflection.MethodAttributes,
        ByVal callingConvention As System.Reflection.CallingConventions,
        ByVal returnType As Type,
        ByVal parameterTypes As Type(),
        ByVal nativeCallConv As System.Runtime.InteropServices.CallingCon
        ByVal nativeCharSet As System.Runtime.InteropServices.CharSet) As
    Public Function DefinePInvokeMethod(ByVal name As String,
        ByVal dllName As String, ByVal entryName As String,
        ByVal attributes As System.Reflection.MethodAttributes,
        ByVal callingConvention As System.Reflection.CallingConventions,
        ByVal returnType As Type,
        ByVal parameterTypes As Type(),
        ByVal nativeCallConv As System.Runtime.InteropServices.CallingCon
        ByVal nativeCharSet As System.Runtime.InteropServices.CharSet) As
    Public Function DefineResource(ByVal name As String,
        ByVal description As String) As IResourceWriter
    Public Function DefineResource(ByVal name As String,
        ByVal description As String,
        ByVal attribute As System.Reflection.ResourceAttributes) As IReso
    Public Function DefineType(
        ByVal name As String) As TypeBuilder
    Public Function DefineType(ByVal name As String,
        ByVal attr As System.Reflection.TypeAttributes) As TypeBuilder
    Public Function DefineType(ByVal name As String,
        ByVal attr As System.Reflection.TypeAttributes,
        ByVal parent As Type) As TypeBuilder
    Public Function DefineType(ByVal name As String,
```

```
        ByVal attr As System.Reflection.TypeAttributes,
        ByVal parent As Type,
        ByVal typesize As Integer) As TypeBuilder
Public Function DefineType(ByVal name As String,
        ByVal attr As System.Reflection.TypeAttributes,
        ByVal parent As Type,
        ByVal packsize As PackingSize) As TypeBuilder
Public Function DefineType(ByVal name As String,
        ByVal attr As System.Reflection.TypeAttributes,
        ByVal parent As Type,
        ByVal packingSize As PackingSize,
        ByVal typesize As Integer) As TypeBuilder
Public Function DefineType(ByVal name As String,
        ByVal attr As System.Reflection.TypeAttributes,
        ByVal parent As Type,
        ByVal interfaces As Type()) As TypeBuilder
Public Function DefineUninitializedData(
        ByVal name As String, ByVal size As Integer,
        ByVal attributes As System.Reflection.FieldAttributes) As FieldBu
Public Sub DefineUnmanagedResource(
        ByVal resource As Byte())
Public Sub DefineUnmanagedResource(
        ByVal resourceFileName As String)
Public Function GetArrayMethod(ByVal arrayClass As Type,
        ByVal methodName As String,
        ByVal callingConvention As System.Reflection.CallingConventions,
        ByVal returnType As Type,
        ByVal parameterTypes As Type()) As MethodInfo
Public Function GetArrayMethodToken(
```

```
      ByVal arrayClass As Type,
      ByVal methodName As String,
      ByVal callingConvention As System.Reflection.CallingConventions,
      ByVal returnType As Type,
      ByVal parameterTypes As Type()) As MethodToken
Public Function GetConstructorToken(
      ByVal con As System.Reflection.ConstructorInfo) As MethodToken
Public Function GetFieldToken(
      ByVal field As System.Reflection.FieldInfo) As FieldToken
Public Function GetMethodToken(
      ByVal method As System.Reflection.MethodInfo) As MethodToken
Public Function GetSignatureToken(ByVal sigBytes As Byte(),
      ByVal sigLength As Integer) As SignatureToken
Public Function GetSignatureToken(
      ByVal sigHelper As SignatureHelper) As SignatureToken
Public Function GetStringConstant(
      ByVal str As String) As StringToken
Public Function GetSymWriter() As ISymbolWriter
Overrides Public Function GetType(
      ByVal className As String) As Type
Overrides Public Function GetType(
      ByVal className As String,
      ByVal ignoreCase As Boolean) As Type
Overrides Public Function GetType(
      ByVal className As String,
      ByVal throwOnError As Boolean,
      ByVal ignoreCase As Boolean) As Type
Overrides Public Function GetTypes() As Type()
Public Function GetTypeToken(
      ByVal name As String) As TypeToken
Public Function GetTypeToken(
```

```
        ByVal type As Type) As TypeToken
    Public Function IsTransient() As Boolean
    Public Sub SetCustomAttribute(
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
    Public Sub SetSymCustomAttribute(ByVal name As String,
        ByVal data As Byte())
    Public Sub SetUserEntryPoint(
        ByVal entryPoint As System.Reflection.MethodInfo)
End Class
```

## Hierarchy

System.Object → System.Reflection.Module(System.Runtime.Serialization.IS
System.Reflection.ICustomAttributeProvider) → ModuleBuilder

## Returned By

AssemblyBuilder.{DefineDynamicModule(),GetDynamicModule()}

# OpCode Structure

## System.Reflection.Emit (mscorlib.dll)

This structure describes a single MSIL instruction. It is used by the `ILGenerator.Emit()` method. Alternatively, use a field from the `OpCodes` class to supply a specific instruction without needing to create an `OpCode` object. Instructions are characterized by several pieces of information, represented as properties, such as `OpCode`, `Operand`, and flow control.

```
Public Structure OpCode

' Public Instance Properties

   Public ReadOnly Property FlowControl As FlowControl

   Public ReadOnly Property Name As String

   Public ReadOnly Property OpCodeType As OpCodeType

   Public ReadOnly Property OperandType As OperandType

   Public ReadOnly Property Size As Integer

   Public ReadOnly Property StackBehaviourPop As StackBehaviour

   Public ReadOnly Property StackBehaviourPush As StackBehaviour

   Public ReadOnly Property Value As Short

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

   Overrides Public Function ToString() As String

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `OpCode`

### Passed To

`ILGenerator.{Emit(),EmitCall(),EmitCalli()}`, `OpCodes.TakesSingleByteArgument()`

## OpCodes Class

## System.Reflection.Emit (mscorlib.dll)

This class provides the set of MSIL instructions through shared fields. Each field returns the OpCod represents the corresponding instruction, and can be used in the ILGenerator.Emit() method. detailed description of these opcodes, see *Partition III, CIL* of the ECMA CLI specification ().

```
Public Class OpCodes

' Public Shared Fields

   Public Shared ReadOnly Add As OpCode                                   // =add
   Public Shared ReadOnly Add_Ovf As OpCode                               // =add.
   Public Shared ReadOnly Add_Ovf_Un As OpCode                            // =add.
   Public Shared ReadOnly And As OpCode                                   // =and
   Public Shared ReadOnly Arglist As OpCode                               // =argl
   Public Shared ReadOnly Beq As OpCode                                   // =beq
   Public Shared ReadOnly Beq_S As OpCode                                 // =beq.
   Public Shared ReadOnly Bge As OpCode                                   // =bge
   Public Shared ReadOnly Bge_S As OpCode                                 // =bge.
   Public Shared ReadOnly Bge_Un As OpCode                                // =bge.
   Public Shared ReadOnly Bge_Un_S As OpCode                              // =bge.
   Public Shared ReadOnly Bgt As OpCode                                   // =bgt
   Public Shared ReadOnly Bgt_S As OpCode                                 // =bgt.
   Public Shared ReadOnly Bgt_Un As OpCode                                // =bgt.
   Public Shared ReadOnly Bgt_Un_S As OpCode                              // =bgt.
   Public Shared ReadOnly Ble As OpCode                                   // =ble
   Public Shared ReadOnly Ble_S As OpCode                                 // =ble.
   Public Shared ReadOnly Ble_Un As OpCode                                // =ble.
   Public Shared ReadOnly Ble_Un_S As OpCode                              // =ble.
   Public Shared ReadOnly Blt As OpCode                                   // =blt
   Public Shared ReadOnly Blt_S As OpCode                                 // =blt.
   Public Shared ReadOnly Blt_Un As OpCode                                // =blt.
```

```
Public Shared ReadOnly Blt_Un_S As OpCode                // =blt.
Public Shared ReadOnly Bne_Un As OpCode                  // =bne.
Public Shared ReadOnly Bne_Un_S As OpCode                // =bne.
Public Shared ReadOnly Box As OpCode                     // =box
Public Shared ReadOnly Br As OpCode                      // =br
Public Shared ReadOnly Br_S As OpCode                    // =br.s
Public Shared ReadOnly Break As OpCode                   // =brea
Public Shared ReadOnly Brfalse As OpCode                 // =brfa
Public Shared ReadOnly Brfalse_S As OpCode               // =brfa
Public Shared ReadOnly Brtrue As OpCode                  // =brtr
Public Shared ReadOnly Brtrue_S As OpCode                // =brtr
Public Shared ReadOnly Call As OpCode                    // =call
Public Shared ReadOnly Calli As OpCode                   // =call
Public Shared ReadOnly Callvirt As OpCode                // =call
Public Shared ReadOnly Castclass As OpCode               // =cast
Public Shared ReadOnly Ceq As OpCode                     // =ceq
Public Shared ReadOnly Cgt As OpCode                     // =cgt
Public Shared ReadOnly Cgt_Un As OpCode                  // =cgt.
Public Shared ReadOnly Ckfinite As OpCode                // =ckfi
Public Shared ReadOnly Clt As OpCode                     // =clt
Public Shared ReadOnly Clt_Un As OpCode                  // =clt.
Public Shared ReadOnly Conv_I As OpCode                  // =conv
Public Shared ReadOnly Conv_I1 As OpCode                 // =conv
Public Shared ReadOnly Conv_I2 As OpCode                 // =conv
Public Shared ReadOnly Conv_I4 As OpCode                 // =conv
Public Shared ReadOnly Conv_I8 As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_I As OpCode              // =conv
Public Shared ReadOnly Conv_Ovf_I_Un As OpCode           // =conv
Public Shared ReadOnly Conv_Ovf_I1 As OpCode             // =conv
Public Shared ReadOnly Conv_Ovf_I1_Un As OpCode          // =conv
```

```
Public Shared ReadOnly Conv_Ovf_I2 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_I2_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_I4 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_I4_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_I8 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_I8_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_U As OpCode                     // =conv
Public Shared ReadOnly Conv_Ovf_U_Un As OpCode                  // =conv
Public Shared ReadOnly Conv_Ovf_U1 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_U1_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_U2 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_U2_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_U4 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_U4_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_Ovf_U8 As OpCode                    // =conv
Public Shared ReadOnly Conv_Ovf_U8_Un As OpCode                 // =conv
Public Shared ReadOnly Conv_R_Un As OpCode                      // =conv
Public Shared ReadOnly Conv_R4 As OpCode                        // =conv
Public Shared ReadOnly Conv_R8 As OpCode                        // =conv
Public Shared ReadOnly Conv_U As OpCode                         // =conv
Public Shared ReadOnly Conv_U1 As OpCode                        // =conv
Public Shared ReadOnly Conv_U2 As OpCode                        // =conv
Public Shared ReadOnly Conv_U4 As OpCode                        // =conv
Public Shared ReadOnly Conv_U8 As OpCode                        // =conv
Public Shared ReadOnly Cpblk As OpCode                          // =cpbl.
Public Shared ReadOnly Cpobj As OpCode                          // =cpob.
Public Shared ReadOnly Div As OpCode                            // =div
Public Shared ReadOnly Div_Un As OpCode                         // =div.
Public Shared ReadOnly Dup As OpCode                            // =dup
Public Shared ReadOnly Endfilter As OpCode                      // =endf.
```

```
Public Shared ReadOnly Endfinally As OpCode                    // =endf.
Public Shared ReadOnly Initblk As OpCode                       // =init.
Public Shared ReadOnly Initobj As OpCode                       // =init.
Public Shared ReadOnly Isinst As OpCode                        // =isin.
Public Shared ReadOnly Jmp As OpCode                           // =jmp
Public Shared ReadOnly Ldarg As OpCode                         // =ldar.
Public Shared ReadOnly Ldarg_0 As OpCode                       // =ldar.
Public Shared ReadOnly Ldarg_1 As OpCode                       // =ldar.
Public Shared ReadOnly Ldarg_2 As OpCode                       // =ldar.
Public Shared ReadOnly Ldarg_3 As OpCode                       // =ldar.
Public Shared ReadOnly Ldarg_S As OpCode                       // =ldar.
Public Shared ReadOnly Ldarga As OpCode                        // =ldar.
Public Shared ReadOnly Ldarga_S As OpCode                      // =ldar.
Public Shared ReadOnly Ldc_I4 As OpCode                        // =ldc..
Public Shared ReadOnly Ldc_I4_0 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_1 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_2 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_3 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_4 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_5 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_6 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_7 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_8 As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I4_M1 As OpCode                     // =ldc..
Public Shared ReadOnly Ldc_I4_S As OpCode                      // =ldc..
Public Shared ReadOnly Ldc_I8 As OpCode                        // =ldc..
Public Shared ReadOnly Ldc_R4 As OpCode                        // =ldc..
Public Shared ReadOnly Ldc_R8 As OpCode                        // =ldc..
Public Shared ReadOnly Ldelem_I As OpCode                      // =ldel.
Public Shared ReadOnly Ldelem_I1 As OpCode                     // =ldel.
```

```
Public Shared ReadOnly Ldelem_I2 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_I4 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_I8 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_R4 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_R8 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_Ref As OpCode                   // =ldel
Public Shared ReadOnly Ldelem_U1 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_U2 As OpCode                    // =ldel
Public Shared ReadOnly Ldelem_U4 As OpCode                    // =ldel
Public Shared ReadOnly Ldelema As OpCode                      // =ldel
Public Shared ReadOnly Ldfld As OpCode                        // =ldfl
Public Shared ReadOnly Ldflda As OpCode                       // =ldfl
Public Shared ReadOnly Ldftn As OpCode                        // =ldft
Public Shared ReadOnly Ldind_I As OpCode                      // =ldin
Public Shared ReadOnly Ldind_I1 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_I2 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_I4 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_I8 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_R4 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_R8 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_Ref As OpCode                    // =ldin
Public Shared ReadOnly Ldind_U1 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_U2 As OpCode                     // =ldin
Public Shared ReadOnly Ldind_U4 As OpCode                     // =ldin
Public Shared ReadOnly Ldlen As OpCode                        // =ldle
Public Shared ReadOnly Ldloc As OpCode                        // =ldlo
Public Shared ReadOnly Ldloc_0 As OpCode                      // =ldlo
Public Shared ReadOnly Ldloc_1 As OpCode                      // =ldlo
Public Shared ReadOnly Ldloc_2 As OpCode                      // =ldlo
Public Shared ReadOnly Ldloc_3 As OpCode                      // =ldlo
```

```
Public Shared ReadOnly Ldloc_S As OpCode                    // =ldlo
Public Shared ReadOnly Ldloca As OpCode                     // =ldlo
Public Shared ReadOnly Ldloca_S As OpCode                   // =ldlo
Public Shared ReadOnly Ldnull As OpCode                     // =ldnu
Public Shared ReadOnly Ldobj As OpCode                      // =ldob
Public Shared ReadOnly Ldsfld As OpCode                     // =ldsf
Public Shared ReadOnly Ldsflda As OpCode                    // =ldsf
Public Shared ReadOnly Ldstr As OpCode                      // =ldst
Public Shared ReadOnly Ldtoken As OpCode                    // =ldto
Public Shared ReadOnly Ldvirtftn As OpCode                  // =ldvi
Public Shared ReadOnly Leave As OpCode                      // =leav
Public Shared ReadOnly Leave_S As OpCode                    // =leav
Public Shared ReadOnly Localloc As OpCode                   // =loca
Public Shared ReadOnly Mkrefany As OpCode                   // =mkre
Public Shared ReadOnly Mul As OpCode                        // =mul
Public Shared ReadOnly Mul_Ovf As OpCode                    // =mul.
Public Shared ReadOnly Mul_Ovf_Un As OpCode                 // =mul.
Public Shared ReadOnly Neg As OpCode                        // =neg
Public Shared ReadOnly Newarr As OpCode                     // =newa
Public Shared ReadOnly Newobj As OpCode                     // =newo
Public Shared ReadOnly Nop As OpCode                        // =nop
Public Shared ReadOnly Not As OpCode                        // =not
Public Shared ReadOnly Or As OpCode                         // =or
Public Shared ReadOnly Pop As OpCode                        // =pop
Public Shared ReadOnly Prefix1 As OpCode                    // =pref
Public Shared ReadOnly Prefix2 As OpCode                    // =pref
Public Shared ReadOnly Prefix3 As OpCode                    // =pref
Public Shared ReadOnly Prefix4 As OpCode                    // =pref
Public Shared ReadOnly Prefix5 As OpCode                    // =pref
Public Shared ReadOnly Prefix6 As OpCode                    // =pref
```

```
Public Shared ReadOnly Prefix7 As OpCode                       // =pref
Public Shared ReadOnly Prefixref As OpCode                     // =pref
Public Shared ReadOnly Refanytype As OpCode                    // =refa
Public Shared ReadOnly Refanyval As OpCode                     // =refa
Public Shared ReadOnly Rem As OpCode                           // =rem
Public Shared ReadOnly Rem_Un As OpCode                        // =rem.
Public Shared ReadOnly Ret As OpCode                           // =ret
Public Shared ReadOnly Rethrow As OpCode                       // =reth
Public Shared ReadOnly Shl As OpCode                           // =shl
Public Shared ReadOnly Shr As OpCode                           // =shr
Public Shared ReadOnly Shr_Un As OpCode                        // =shr.
Public Shared ReadOnly Sizeof As OpCode                        // =size
Public Shared ReadOnly Starg As OpCode                         // =star
Public Shared ReadOnly Starg_S As OpCode                       // =star
Public Shared ReadOnly Stelem_I As OpCode                      // =stel
Public Shared ReadOnly Stelem_I1 As OpCode                     // =stel
Public Shared ReadOnly Stelem_I2 As OpCode                     // =stel
Public Shared ReadOnly Stelem_I4 As OpCode                     // =stel
Public Shared ReadOnly Stelem_I8 As OpCode                     // =stel
Public Shared ReadOnly Stelem_R4 As OpCode                     // =stel
Public Shared ReadOnly Stelem_R8 As OpCode                     // =stel
Public Shared ReadOnly Stelem_Ref As OpCode                    // =stel
Public Shared ReadOnly Stfld As OpCode                         // =stfl
Public Shared ReadOnly Stind_I As OpCode                       // =stin
Public Shared ReadOnly Stind_I1 As OpCode                      // =stin
Public Shared ReadOnly Stind_I2 As OpCode                      // =stin
Public Shared ReadOnly Stind_I4 As OpCode                      // =stin
Public Shared ReadOnly Stind_I8 As OpCode                      // =stin
Public Shared ReadOnly Stind_R4 As OpCode                      // =stin
Public Shared ReadOnly Stind_R8 As OpCode                      // =stin
```

```
   Public Shared ReadOnly Stind_Ref As OpCode                    // =stin
   Public Shared ReadOnly Stloc As OpCode                        // =stlo
   Public Shared ReadOnly Stloc_0 As OpCode                      // =stlo
   Public Shared ReadOnly Stloc_1 As OpCode                      // =stlo
   Public Shared ReadOnly Stloc_2 As OpCode                      // =stlo
   Public Shared ReadOnly Stloc_3 As OpCode                      // =stlo
   Public Shared ReadOnly Stloc_S As OpCode                      // =stlo
   Public Shared ReadOnly Stobj As OpCode                        // =stob
   Public Shared ReadOnly Stsfld As OpCode                       // =stsf
   Public Shared ReadOnly Sub As OpCode                          // =sub
   Public Shared ReadOnly Sub_Ovf As OpCode                      // =sub.
   Public Shared ReadOnly Sub_Ovf_Un As OpCode                   // =sub.
   Public Shared ReadOnly Switch As OpCode                       // =swit
   Public Shared ReadOnly Tailcall As OpCode                     // =tail
   Public Shared ReadOnly Throw As OpCode                        // =thro
   Public Shared ReadOnly Unaligned As OpCode                    // =unal
   Public Shared ReadOnly Unbox As OpCode                        // =unbo
   Public Shared ReadOnly Volatile As OpCode                     // =vola
   Public Shared ReadOnly Xor As OpCode                          // =xor
' Public Shared Methods
   Public Shared Function TakesSingleByteArgument(
        ByVal inst As OpCode) As Boolean
End Class
```

## OpCodeType Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration specifies the type of an MSIL OpCode, which is provided through the `OpCode.OpCodeType` property. These types include `Annotation` (an instruction that carries extra information for specific MSIL processors, but can usually be ignored), `Macro` (a synonym for another MSIL instruction), `Nternal` (a reserved instruction), `Objmodel` (an instruction that applies to objects), `Prefix` (an instruction that specifies an action that must be taken before the next instruction is executed), and `Primitive` (a built-in instruction).

```
Public Enum OpCodeType

   Annotation = 0

   Macro = 1

   Nternal = 2

   Objmodel = 3

   Prefix = 4

   Primitive = 5

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `OpCodeType`

### Returned By

`OpCode.OpCodeType`

## OperandType Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration specifies the operand type of an MSIL OpCode, which is provided through the `OpCode.OperandType` property. Operands include tokens (`InlineField`, `InlineMethod`, `InlineType`, and `InlineTok`) and integers (`InlineI8`, `InlineI8`, `ShortInlineI`, and `ShortInlineR`).

```
Public Enum OperandType
    InlineBrTarget = 0
    InlineField = 1
    InlineI = 2
    InlineI8 = 3
    InlineMethod = 4
    InlineNone = 5
    InlinePhi = 6
    InlineR = 7
    InlineSig = 9
    InlineString = 10
    InlineSwitch = 11
    InlineTok = 12
    InlineType = 13
    InlineVar = 14
    ShortInlineBrTarget = 15
    ShortInlineI = 16
    ShortInlineR = 17
    ShortInlineVar = 18
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → OperandType

### Returned By

`OpCode.OperandType`

# PackingSize Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration defines the packing size for a type and is set in the `ModuleBuilder.DefineType()` and `TypeBuilder.DefineNestedType()` methods. The digit at the end of each value name in this enumeration specifies a number of bytes.

```
Public Enum PackingSize

   Unspecified = 0

   Size1 = 1

   Size2 = 2

   Size4 = 4

   Size8 = 8

   Size16 = 16

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `PackingSize`

### Returned By

`TypeBuilder.PackingSize`

### Passed To

`ModuleBuilder.DefineType()`, `TypeBuilder.DefineNestedType()`

# ParameterBuilder Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created parameter, which is created through the `MethodBuilder.DefineParameter()` or `ConstructorBuilder.DefineParameter()` method. When creating a `ParameterBuilder` with these methods, specify the name of the parameter and its position in the list of arguments. This list is 1-based, so the first parameter is given an index of 1. Use the `SetMarshal()` method to specify how the parameter is marshaled from unmanaged code. The `SetConstant()` method specifies the default value for a parameter.

```
Public Class ParameterBuilder

' Public Instance Properties

   Overridable Public ReadOnly Property Attributes As Integer

   Public ReadOnly Property IsIn As Boolean

   Public ReadOnly Property IsOptional As Boolean

   Public ReadOnly Property IsOut As Boolean

   Overridable Public ReadOnly Property Name As String

   Overridable Public ReadOnly Property Position As Integer

' Public Instance Methods

   Overridable Public Function GetToken() As ParameterToken

   Overridable Public Sub SetConstant(

        ByVal defaultValue As Object)

   Public Sub SetCustomAttribute(

        ByVal con As System.Reflection.ConstructorInfo,

        ByVal binaryAttribute As Byte())

   Public Sub SetCustomAttribute(

        ByVal customBuilder As CustomAttributeBuilder)

   Overridable Public Sub SetMarshal(

        ByVal unmanagedMarshal As UnmanagedMarshal)

End Class
```

### Returned By

`ConstructorBuilder.DefineParameter()`, `MethodBuilder.DefineParameter()`

# ParameterToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a parameter. See `EventToken` for more details on tokens.

```
Public Structure ParameterToken

' Public Shared Fields

   Public Shared ReadOnly Empty As ParameterToken                    // =Syst

' Public Instance Properties

   Public ReadOnly Property Token As Integer

' Public Instance Methods

   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `ParameterToken`

### Returned By

`ParameterBuilder.GetToken()`

# PEFileKinds Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration is used by the `AssemblyBuilder.SetEntryPoint()` method. It specifies the type of PE file that will be created by the `AssemblyBuilder`.

```
Public Enum PEFileKinds
   Dll = 1
   ConsoleApplication = 2
   WindowApplication = 3
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `PEFileKinds`

### Passed To

`AssemblyBuilder.SetEntryPoint()`

## PropertyBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created property. To create a `PropertyBuilder` object, use t `TypeBuilder.DefineProperty()` method and specify the parameter types, return value type, a additional special settings through the `System.Reflection.PropertyAttributes` enumeratio specify `MethodBuilder` objects for the property `get` and property `set methods` using `SetGetMe` `SetSetMethod()`. You can also set the property's default value using the `SetConstant()` metho

```
Public NotInheritable Class PropertyBuilder : Inherits System.Reflection.I
' Public Instance Properties
   Overrides Public ReadOnly Property Attributes As PropertyAttributes
   Overrides Public ReadOnly Property CanRead As Boolean
   Overrides Public ReadOnly Property CanWrite As Boolean
   Overrides Public ReadOnly Property DeclaringType As Type
   Overrides Public ReadOnly Property Name As String
   Public ReadOnly Property PropertyToken As PropertyToken
   Overrides Public ReadOnly Property PropertyType As Type
   Overrides Public ReadOnly Property ReflectedType As Type
' Public Instance Methods
   Public Sub AddOtherMethod(ByVal mdBuilder As MethodBuilder)
   Overrides Public Function GetAccessors(
        ByVal nonPublic As Boolean) As MethodInfo()
   Overrides Public Function GetCustomAttributes(
        ByVal inherit As Boolean) As Object()
   Overrides Public Function GetCustomAttributes(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Object()
   Overrides Public Function GetGetMethod(
        ByVal nonPublic As Boolean) As MethodInfo
   Overrides Public Function GetIndexParameters(
        ) As ParameterInfo()
   Overrides Public Function GetSetMethod(
```

```
        ByVal nonPublic As Boolean) As MethodInfo
    Overrides Public Function GetValue(ByVal obj As Object,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal index As Object(),
        ByVal culture As System.Globalization.CultureInfo) As Object
    Overrides Public Function GetValue(ByVal obj As Object,
        ByVal index As Object()) As Object
    Overrides Public Function IsDefined(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
    Public Sub SetConstant( ByVal defaultValue As Object)
    Public Sub SetCustomAttribute(
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
    Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
    Public Sub SetGetMethod( ByVal mdBuilder As MethodBuilder)
    Public Sub SetSetMethod( ByVal mdBuilder As MethodBuilder)
    Overrides Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object,
        ByVal invokeAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal index As Object(),
        ByVal culture As System.Globalization.CultureInfo)
    Overrides Public Sub SetValue(ByVal obj As Object,
        ByVal value As Object, ByVal index As Object())
End Class
```

## Hierarchy

System.Object

```
System.Reflection.MemberInfo(System.Reflection.ICustomAttributeProvider)
System.Reflection.PropertyInfo PropertyBuilder
```

## Returned By

```
TypeBuilder.DefineProperty()
```

# PropertyToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a property. See `EventToken` for more details on tokens.

```
Public Structure PropertyToken
' Public Shared Fields
   Public Shared ReadOnly Empty As PropertyToken                    // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

System.Object → System.ValueType → PropertyToken

### Returned By

PropertyBuilder.PropertyToken

## SignatureHelper NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class contains helper functions that allow you to build a signature for a method, such as AddAr
Use one of the shared methods to get a SignatureHelper, which you can pass to ILGenerator

```
Public NotInheritable Class SignatureHelper
' Public Shared Methods
   Public Shared Function GetFieldSigHelper(
        ByVal mod As System.Reflection.Module) As SignatureHelper
   Public Shared Function GetLocalVarSigHelper(
        ByVal mod As System.Reflection.Module) As SignatureHelper
   Public Shared Function GetMethodSigHelper(
        ByVal mod As System.Reflection.Module,
        ByVal callingConvention As System.Reflection.CallingConventions,
        ByVal returnType As Type) As SignatureHelper
   Public Shared Function GetMethodSigHelper(
        ByVal mod As System.Reflection.Module,
        ByVal unmanagedCallConv As System.Runtime.InteropServices.Calling
        ByVal returnType As Type) As SignatureHelper
   Public Shared Function GetMethodSigHelper(
        ByVal mod As System.Reflection.Module,
        ByVal returnType As Type,
        ByVal parameterTypes As Type()) As SignatureHelper
   Public Shared Function GetPropertySigHelper(
        ByVal mod As System.Reflection.Module,
        ByVal returnType As Type,
        ByVal parameterTypes As Type()) As SignatureHelper
' Public Instance Methods
   Public Sub AddArgument( ByVal clsArgument As Type)
   Public Sub AddSentinel()
   Overrides Public Function Equals(
```

```
        ByVal obj As Object) As Boolean
    Overrides Public Function GetHashCode() As Integer
    Public Function GetSignature() As Byte()
    Overrides Public Function ToString() As String
End Class
```

## Passed To

ILGenerator.Emit(), ModuleBuilder.GetSignatureToken()

## SignatureToken Structure

### System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a method signature. See `EventToken` for more details on token

```
Public Structure SignatureToken
' Public Shared Fields
   Public Shared ReadOnly Empty As SignatureToken                        // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `SignatureToken`

### Returned By

`ModuleBuilder.GetSignatureToken()`

## StackBehaviour Enum

## System.Reflection.Emit (mscorlib.dll) *serializable*

This enumeration is used to set the `OpCode.StackBehaviourPush()` and `OpCode.StackBehaviourPop()` methods, which determine how an MSIL instruction pushes an operand onto the stack and pops it off.

```
Public Enum StackBehaviour

   Pop0 = 0

   Pop1 = 1

   Pop1_pop1 = 2

   Popi = 3

   Popi_pop1 = 4

   Popi_popi = 5

   Popi_popi8 = 6

   Popi_popi_popi = 7

   Popi_popr4 = 8

   Popi_popr8 = 9

   Popref = 10

   Popref_pop1 = 11

   Popref_popi = 12

   Popref_popi_popi = 13

   Popref_popi_popi8 = 14

   Popref_popi_popr4 = 15

   Popref_popi_popr8 = 16

   Popref_popi_popref = 17

   Push0 = 18

   Push1 = 19

   Push1_push1 = 20

   Pushi = 21

   Pushi8 = 22
```

```
   Pushr4 = 23
   Pushr8 = 24
   Pushref = 25
   Varpop = 26
   Varpush = 27
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → StackBehaviour

## Returned By

OpCode.{StackBehaviourPop, StackBehaviourPush}

# StringToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a string constant in a module's constant pool. See `EventToken` for more details on tokens.

```
Public Structure StringToken

' Public Instance Properties

   Public ReadOnly Property Token As Integer

' Public Instance Methods

   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `StringToken`

### Returned By

`ModuleBuilder.GetStringConstant()`

## TypeBuilder NotInheritable Class

## System.Reflection.Emit (mscorlib.dll)

This class represents a dynamically created type in a dynamic module (`ModuleBuilder` object). G either a class or an interface. To create a `TypeBuilder`, use the overloaded `ModuleBuilder.De` method. Depending on which overload you use, you can specify different information including the t superclass, and implemented interfaces. You can also use the `System.Reflection.TypeAttri` to specify other options, such as making a class sealed, MustInherit, or public, or defining it as an in type is created, you can add members such as constructors, events, fields, properties, methods, an using the corresponding `Define` method.

Before using a type you created, you must use the `CreateType()` method to get a `Type` object. A instantiate the `Type` with the `System.Activator.CreateInstance()` method, and invoke mem the `System.Type.InvokeMember()` method. After creating a type, you can no longer use `TypeB` that would change the type, such as a `Define` method.

```
Public NotInheritable Class TypeBuilder : Inherits Type

' Public Shared Fields

   Public const UnspecifiedTypeSize As Integer                    // =0

' Public Instance Properties

   Overrides Public ReadOnly Property Assembly As Assembly

   Overrides Public ReadOnly Property AssemblyQualifiedName As String

   Overrides Public ReadOnly Property BaseType As Type

   Overrides Public ReadOnly Property DeclaringType As Type

   Overrides Public ReadOnly Property FullName As String

   Overrides Public ReadOnly Property GUID As Guid

   Overrides Public ReadOnly Property Module As Module

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property Namespace As String

   Public ReadOnly Property PackingSize As PackingSize

   Overrides Public ReadOnly Property ReflectedType As Type

   Public ReadOnly Property Size As Integer

   Overrides Public ReadOnly Property TypeHandle As RuntimeTypeHandle

   Public ReadOnly Property TypeToken As TypeToken

   Overrides Public ReadOnly Property UnderlyingSystemType As Type

' Public Instance Methods
```

```
Public Sub AddDeclarativeSecurity(
     ByVal action As System.Security.Permissions.SecurityAction,
     ByVal pset As System.Security.PermissionSet)
Public Sub AddInterfaceImplementation(
     ByVal interfaceType As Type)
Public Function CreateType() As Type
Public Function DefineConstructor(
     ByVal attributes As System.Reflection.MethodAttributes,
     ByVal callingConvention As System.Reflection.CallingConventions,
     ByVal parameterTypes As Type()) As ConstructorBuilder
Public Function DefineDefaultConstructor(
     ByVal attributes As System.Reflection.MethodAttributes) As Constru
Public Function DefineEvent(ByVal name As String,
     ByVal attributes As System.Reflection.EventAttributes,
     ByVal eventtype As Type) As EventBuilder
Public Function DefineField(ByVal fieldName As String,
     ByVal type As Type,
     ByVal attributes As System.Reflection.FieldAttributes) As FieldBu
Public Function DefineInitializedData(ByVal name As String,
     ByVal data As Byte(),
     ByVal attributes As System.Reflection.FieldAttributes) As FieldBu
Public Function DefineMethod(ByVal name As String,
     ByVal attributes As System.Reflection.MethodAttributes,
     ByVal callingConvention As System.Reflection.CallingConventions,
     ByVal returnType As Type,
     ByVal parameterTypes As Type()) As MethodBuilder
Public Function DefineMethod(ByVal name As String,
     ByVal attributes As System.Reflection.MethodAttributes,
     ByVal returnType As Type,
     ByVal parameterTypes As Type()) As MethodBuilder
Public Sub DefineMethodOverride(
```

```
     ByVal methodInfoBody As System.Reflection.MethodInfo,
     ByVal methodInfoDeclaration As System.Reflection.MethodInfo)
Public Function DefineNestedType(
     ByVal name As String) As TypeBuilder
Public Function DefineNestedType(ByVal name As String,
     ByVal attr As System.Reflection.TypeAttributes) As TypeBuilder
Public Function DefineNestedType(ByVal name As String,
     ByVal attr As System.Reflection.TypeAttributes,
     ByVal parent As Type) As TypeBuilder
Public Function DefineNestedType(ByVal name As String,
     ByVal attr As System.Reflection.TypeAttributes,
     ByVal parent As Type,
     ByVal typeSize As Integer) As TypeBuilder
Public Function DefineNestedType(ByVal name As String,
     ByVal attr As System.Reflection.TypeAttributes,
     ByVal parent As Type,
     ByVal packSize As PackingSize) As TypeBuilder
Public Function DefineNestedType(ByVal name As String,
     ByVal attr As System.Reflection.TypeAttributes,
     ByVal parent As Type,
     ByVal interfaces As Type()) As TypeBuilder
Public Function DefinePInvokeMethod(ByVal name As String,
     ByVal dllName As String,
     ByVal attributes As System.Reflection.MethodAttributes,
     ByVal callingConvention As System.Reflection.CallingConventions,
     ByVal returnType As Type,
     ByVal parameterTypes As Type(),
     ByVal nativeCallConv As System.Runtime.InteropServices.CallingCon
     ByVal nativeCharSet As System.Runtime.InteropServices.CharSet) As
Public Function DefinePInvokeMethod(ByVal name As String,
```

```
     ByVal dllName As String, ByVal entryName As String,
     ByVal attributes As System.Reflection.MethodAttributes,
     ByVal callingConvention As System.Reflection.CallingConventions,
     ByVal returnType As Type,
     ByVal parameterTypes As Type(),
     ByVal nativeCallConv As System.Runtime.InteropServices.CallingCon
     ByVal nativeCharSet As System.Runtime.InteropServices.CharSet) As
Public Function DefineProperty(ByVal name As String,
     ByVal attributes As System.Reflection.PropertyAttributes,
     ByVal returnType As Type,
     ByVal parameterTypes As Type()) As PropertyBuilder
Public Function DefineTypeInitializer(
     ) As ConstructorBuilder
Public Function DefineUninitializedData(
     ByVal name As String, ByVal size As Integer,
     ByVal attributes As System.Reflection.FieldAttributes) As FieldBu
Overrides Public Function GetConstructors(
     ByVal bindingAttr As System.Reflection.BindingFlags) As Construct
Overrides Public Function GetCustomAttributes(
     ByVal inherit As Boolean) As Object()
Overrides Public Function GetCustomAttributes(
     ByVal attributeType As Type,
     ByVal inherit As Boolean) As Object()
Overrides Public Function GetElementType() As Type
Overrides Public Function GetEvent(ByVal name As String,
     ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
Overrides Public Function GetEvents() As EventInfo()
Overrides Public Function GetEvents(
     ByVal bindingAttr As System.Reflection.BindingFlags) As EventInfo
Overrides Public Function GetField(ByVal name As String,
```

```
    ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
Overrides Public Function GetFields(
    ByVal bindingAttr As System.Reflection.BindingFlags) As FieldInfo
Overrides Public Function GetInterface(
    ByVal name As String,
    ByVal ignoreCase As Boolean) As Type
Overrides Public Function GetInterfaceMap(
    ByVal interfaceType As Type) As InterfaceMapping
Overrides Public Function GetInterfaces() As Type()
Overrides Public Function GetMember(ByVal name As String,
    ByVal type As System.Reflection.MemberTypes,
    ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
Overrides Public Function GetMembers(
    ByVal bindingAttr As System.Reflection.BindingFlags) As MemberInf
Overrides Public Function GetMethods(
    ByVal bindingAttr As System.Reflection.BindingFlags) As MethodInf
Overrides Public Function GetNestedType(
    ByVal name As String,
    ByVal bindingAttr As System.Reflection.BindingFlags) As Type
Overrides Public Function GetNestedTypes(
    ByVal bindingAttr As System.Reflection.BindingFlags) As Type()
Overrides Public Function GetProperties(
    ByVal bindingAttr As System.Reflection.BindingFlags) As PropertyI
Overrides Public Function InvokeMember(
    ByVal name As String,
    ByVal invokeAttr As System.Reflection.BindingFlags,
    ByVal binder As System.Reflection.Binder,
    ByVal target As Object, ByVal args As Object(),
    ByVal modifiers As System.Reflection.ParameterModifier(),
    ByVal culture As System.Globalization.CultureInfo,
    ByVal namedParameters As String()) As Object
```

```
   Overrides Public Function IsAssignableFrom(
        ByVal c As Type) As Boolean
   Overrides Public Function IsDefined(
        ByVal attributeType As Type,
        ByVal inherit As Boolean) As Boolean
   Overrides Public Function IsSubclassOf(
        ByVal c As Type) As Boolean
   Public Sub SetCustomAttribute(
        ByVal con As System.Reflection.ConstructorInfo,
        ByVal binaryAttribute As Byte())
   Public Sub SetCustomAttribute(
        ByVal customBuilder As CustomAttributeBuilder)
   Public Sub SetParent( ByVal parent As Type)
   Overrides Public Function ToString() As String
' Protected Instance Methods
   Overrides Protected Function GetAttributeFlagsImpl(
        ) As TypeAttributes
   Overrides Protected Function GetConstructorImpl(
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Cons
   Overrides Protected Function GetMethodImpl(
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal callConvention As System.Reflection.CallingConventions,
        ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Meth
   Overrides Protected Function GetPropertyImpl(
```

```
        ByVal name As String,
        ByVal bindingAttr As System.Reflection.BindingFlags,
        ByVal binder As System.Reflection.Binder,
        ByVal returnType As Type, ByVal types As Type(),
        ByVal modifiers As System.Reflection.ParameterModifier()) As Prop
    Overrides Protected Function HasElementTypeImpl(
        ) As Boolean
    Overrides Protected Function IsArrayImpl() As Boolean
    Overrides Protected Function IsByRefImpl() As Boolean
    Overrides Protected Function IsCOMObjectImpl() As Boolean
    Overrides Protected Function IsPointerImpl() As Boolean
    Overrides Protected Function IsPrimitiveImpl() As Boolean
End Class
```

## Hierarchy

System.Object → System.Reflection.MemberInfo(System.Reflection.ICustomAt
→ System.Type(System.Reflection.IReflect) → TypeBuilder

## Returned By

ModuleBuilder.DefineType()

# TypeToken Structure

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class represents the token for a type. See `EventToken` for more details on tokens.

```
Public Structure TypeToken
' Public Shared Fields
   Public Shared ReadOnly Empty As TypeToken                     // =Syst
' Public Instance Properties
   Public ReadOnly Property Token As Integer
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Overrides Public Function GetHashCode() As Integer
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `TypeToken`

### Returned By

`EnumBuilder.TypeToken`, `ModuleBuilder.GetTypeToken()`, `TypeBuilder.TypeToken`

# UnmanagedMarshal NotInheritable Class

## System.Reflection.Emit (mscorlib.dll) *serializable*

This class defines how parameters or fields should be marshaled in function calls to unmanaged co certain format conversions automatically during this marshaling (for example, it might change a Sys unmanaged BSTR). Use this class to override this default behavior.

To create an instance of this class, use one of the shared methods to define the unmanaged type y `DefineUnmanagedMarshal()` for this purpose and specify the unmanaged type using the `System.Runtime.InteropServices.UnmanagedType` enumeration. Alternatively, use `Define` marshaling to a string in a fixed array buffer, and specify the other methods for various types of unm methods all return an `UnmanagedMarshal` object, with its read-only properties set accordingly. Las `UnmanagedMarshal` with the appropriate type using the `SetMarshal()` method for the `Paramet` or `FieldBuilder` class.

```
Public NotInheritable Class UnmanagedMarshal

' Public Instance Properties

   Public ReadOnly Property BaseType As UnmanagedType

   Public ReadOnly Property ElementCount As Integer

   Public ReadOnly Property GetUnmanagedType As UnmanagedType

   Public ReadOnly Property IIDGuid As Guid

' Public Shared Methods

   Public Shared Function DefineByValArray(

        ByVal elemCount As Integer) As UnmanagedMarshal

   Public Shared Function DefineByValTStr(

        ByVal elemCount As Integer) As UnmanagedMarshal

   Public Shared Function DefineLPArray(

        ByVal elemType As System.Runtime.InteropServices.UnmanagedType) A

   Public Shared Function DefineSafeArray(

        ByVal elemType As System.Runtime.InteropServices.UnmanagedType) A

   Public Shared Function DefineUnmanagedMarshal(

        ByVal unmanagedType As System.Runtime.InteropServices.UnmanagedTy

End Class
```

### Passed To

`FieldBuilder.SetMarshal()`, `MethodBuilder.SetMarshal()`, `ParameterBuilder.SetM`

# Chapter 15. System.Runtime.InteropServices

The types in this namespace work with unmanaged code using either PInvoke or COM. PInvoke (short for Platform Invoke) lets you access functions that reside in underlying operating system-specific shared libraries (on Win32, these are DLLs). COM (Component Object Model) is a Win32 legacy component architecture that is used throughout Windows and Windows applications. Many programmers experience COM through the object models of applications such as Microsoft Office, Exchange, and SQL Server. The COM support in .NET lets you access COM components as though they were native .NET classes.

We have omitted some of the more esoteric parts of this namespace, so there are some classes that aren't discussed here. For the most part, you will not need those classes unless you are developing specialized code that handles marshaling data types between managed and unmanaged code. If so, you should consult the MSDN .NET reference materials. Figure 15-1 and Figure 15-2 show the types in this namespace.

**Figure 15-1. The System.Runtime.InteropServices namespace**

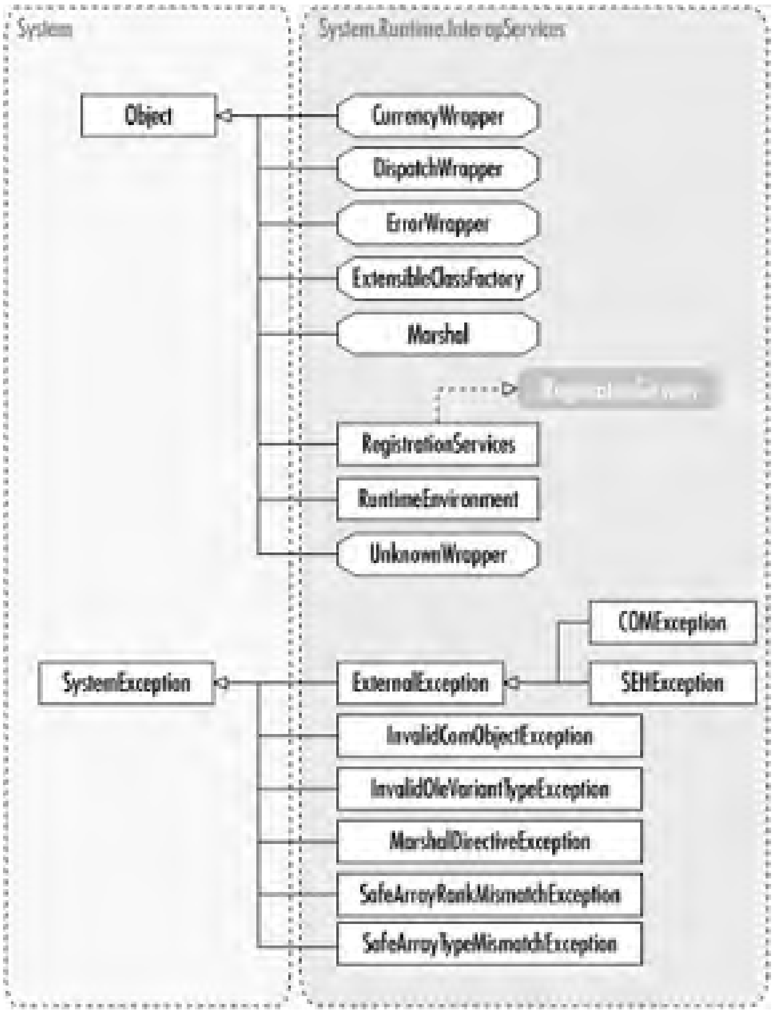
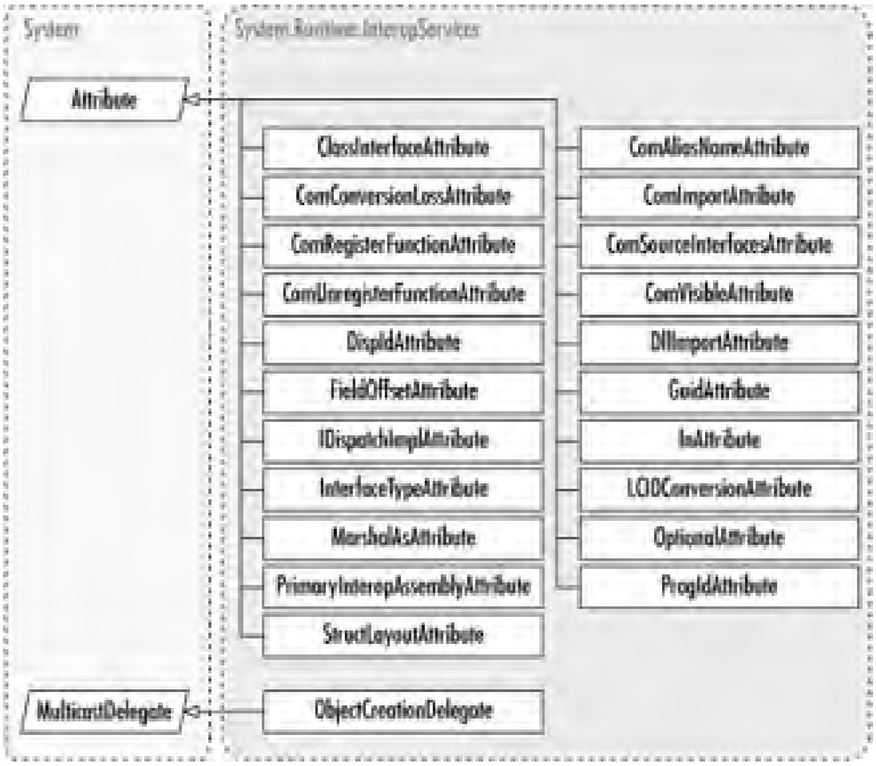



**Figure 15-2. Attributes and delegates from System.Runtime.InteropServices**


System
System.Runtime.InteropServices
Attribute
ClassInterfaceAttribute
ComAliasNameAttribute
ComConversionLossAttribute
ComImportAttribute
ComRegisterFunctionAttribute
ComSourceInterfacesAttribute
ComUnregisterFunctionAttribute
ComVisibleAttribute
DispIdAttribute
DllImportAttribute
FieldOffsetAttribute
GuidAttribute
IDispatchImplAttribute
InAttribute
InterfaceTypeAttribute
LCIDConversionAttribute
MarshalAsAttribute
OptionalAttribute
PrimaryInteropAssemblyAttribute
ProgIdAttribute
StructLayoutAttribute
MulticastDelegate
ObjectCreationDelegate

# ArrayWithOffset Structure

## System.Runtime.InteropServices (mscorlib.dll)

This class converts an array of value type instances to an unmanaged array. Your unmanaged code accesses this array as a pointer that initially points to the first array element. Each time the pointer increments, it points to the next element in the array. The constructor takes a mandatory `offset` argument that specifies which element should be the first element in the unmanaged array. If you want to pass the whole array, specify an offset of zero.

```
Public Structure ArrayWithOffset
' Public Constructors
   Public Sub New(ByVal array As Object,
        ByVal offset As Integer)
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal obj As Object) As Boolean
   Public Function GetArray() As Object
   Overrides Public Function GetHashCode() As Integer
   Public Function GetOffset() As Integer
End Structure
```

### Hierarchy

System.Object → System.ValueType → ArrayWithOffset

## AssemblyRegistrationFlags — Enum

**System.Runtime.InteropServices (mscorlib.dll)** — ***serializable, flag***

This enumeration specifies the flags you can use with `IRegistrationServices.RegisterAssembly()`.

```
Public Enum AssemblyRegistrationFlags

   None = &H000000000

   SetCodeBase = &H000000001

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `AssemblyRegistrationFlags`

### Passed To

`IRegistrationServices.RegisterAssembly()`, `RegistrationServices.RegisterAssembly()`

# CallingConvention Enum

## System.Runtime.InteropServices (mscorlib.dll) *ECMA, serializable*

This enumeration specifies the calling convention to use when you invoke a function. `DllImportAttribute` uses this in its `CallingConvention` parameter.

`Cdecl` specifies the standard calling convention used by C++ and C programs. This is required for functions that take a variable number of arguments, such as `printf()`. `FastCall` attempts to put function arguments into registers. `StdCall` is the convention used for calling Win32 API functions. `ThisCall` is the calling convention used by C++ member functions taking fixed arguments. Use the `Winapi` calling convention for function calls that use `PASCAL` or `__far __pascal`.

```
Public Enum CallingConvention

   Winapi = 1

   Cdecl = 2

   StdCall = 3

   ThisCall = 4

   FastCall = 5

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `CallingConvention`

### Passed To

`System.Reflection.Emit.ILGenerator.EmitCalli()`, `System.Reflection.Emit.ModuleBuilder.DefinePInvokeMethod()`, `System.Reflection.Emit.SignatureHelper.GetMethodSigHelper()`, `System.Reflection.Emit.TypeBuilder.DefinePInvokeMethod()`

## CharSet Enum

**System.Runtime.InteropServices (mscorlib.dll)** ***ECMA, serializable***

This enumeration specifies the character set that is used for marshaled strings. It is used by `DllImportAttribute` and `StructLayoutAttribute`.

`Ansi` marshals strings using one byte ANSI characters, while `Unicode` uses two bytes to represent a single Unicode character. The `Auto` value is used only for PInvoke and specifies that PInvoke should decide how to marshal the strings based on your operating system (Unicode for Windows NT/2000/XP and ANSI for Windows 9x/ME).

```
Public Enum CharSet

   None = 1

   Ansi = 2

   Unicode = 3

   Auto = 4

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `CharSet`

### Passed To

`System.Reflection.Emit.ModuleBuilder.DefinePInvokeMethod()`, `System.Reflection.Emit.TypeBuilder.DefinePInvokeMethod()`

# ClassInterfaceAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute specifies the interface that should be exposed to COM when you generate a type library. See `ClassInterfaceType` for the possible arguments to this attribute.

```
Public NotInheritable Class ClassInterfaceAttribute : Inherits Attribute

' Public Constructors

   Public Sub New(

         ByVal classInterfaceType As ClassInterfaceType)

   Public Sub New( ByVal classInterfaceType As Short)

' Public Instance Properties

   Public ReadOnly Property Value As ClassInterfaceType

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `ClassInterfaceAttribute`

### Valid On

Assembly, Class

## ClassInterfaceType Enum

System.Runtime.InteropServices (mscorlib.dll) *serializable*

This enumeration contains values to use as arguments for `ClassInterfaceAttribute`. `AutoDispatch` specifies that a dispatch-only interface should be generated. `AutoDual` specifies that a dual interface should be generated, and `None` specifies that no interface should be generated.

```
Public Enum ClassInterfaceType

   None = 0

   AutoDispatch = 1

   AutoDual = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ClassInterfaceType`

### Returned By

`ClassInterfaceAttribute.Value`

### Passed To

`ClassInterfaceAttribute.ClassInterfaceAttribute()`

## CoClassAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute describes the class ID of a coclass that was imported from a type library.

```
Public NotInheritable Class CoClassAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal coClass As Type)

' Public Instance Properties

   Public ReadOnly Property CoClass As Type

End Class
```

### Hierarchy

System.Object → System.Attribute → CoClassAttribute

### Valid On

Interface

# ComAliasNameAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is automatically added when COM type libraries are imported into the .NET runtime. COM uses alias names for various data types (such as `typedef [public] int SHOE_SIZE`). When you import a COM object that uses such an alias, .NET automatically decorates each parameter, property, field, and return value with this attribute. If you need to know the name of the COM alias, use the `System.Reflection` API to see if this custom attribute has been attached to the parameter, property, field, or return value you are interested in.

Since .NET automatically converts COM aliases to the underlying .NET types when it imports a type library, you do not need to use this attribute for typical applications (tool developers will find this attribute useful, though).

```
Public NotInheritable Class ComAliasNameAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal alias As String)

' Public Instance Properties

   Public ReadOnly Property Value As String

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `ComAliasNameAttribute`

### Valid On

Property, Field, Parameter, ReturnValue

# ComConversionLossAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

The presence of this attribute indicates that information about a type was lost as it was imported fro
a type library.

```
Public NotInheritable Class ComConversionLossAttribute : Inherits Attribu

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

System.Object → System.Attribute → ComConversionLossAttribute

### Valid On

All

## COMException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

When a COM error occurs, .NET tries to map it to an exception in the .NET Framework and throws that exception. If the COM error does not map to any exception in the .NET Framework, this exception is thrown instead. It's the "couldn't find an exception" exception.

```
Public Class COMException : Inherits ExternalException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

   Public Sub New(ByVal message As String,

        ByVal errorCode As Integer)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Methods

   Overrides Public Function ToString() As String

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → ExternalException → COMException

## ComImportAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute indicates that the type decorated by this attribute is in fact an unmanaged type defined in a previously published type library and should be treated differently internally to support that.

This attribute is necessary only if the .NET type definition — the class definition in VB.NET — is merely a "shim" for interacting with the unmanaged version. In most cases, .NET programmers only use this type when interacting with existing COM APIs, such as when building Explorer Shell Extensions.

```
Public NotInheritable Class ComImportAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

System.Object → System.Attribute → ComImportAttribute

### Valid On

Class, Interface

# ComInterfaceType Enum

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This enumeration specifies the COM interface type. Use this attribute with `InterfaceTypeAttribute` to specify how your .NET interfaces are exposed to COM.

```
Public Enum ComInterfaceType

   InterfaceIsDual = 0

   InterfaceIsIUnknown = 1

   InterfaceIsIDispatch = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ComInterfaceType`

### Returned By

`InterfaceTypeAttribute.Value`

### Passed To

`InterfaceTypeAttribute.InterfaceTypeAttribute()`

## ComMemberType Enum

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This enumeration describes a COM member. `Method` indicates that the member is an ordinary method. `PropGet` and `PropSet` identify methods that get and set the values of properties (getters and setters).

```
Public Enum ComMemberType
   Method = 0
   PropGet = 1
   PropSet = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ComMemberType`

### Passed To

`Marshal.GetMethodInfoForComSlot()`

## ComRegisterFunctionAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is attached to a shared method to indicate that it should be invoked when the enclosin assembly is registered with COM. The method should take two string arguments. The first is the nar of the registry key being updated and the second is the namespace-qualified name of the type being registered (such as `System.String`). There can only be one registration function in each assembl

Microsoft suggests that you do not use this feature and includes it only for backward compatibility. If use this feature to specify a registration method, you must also specify an unregistration method (se `ComUnregisterFunctionAttribute`) that reverses all changes you made in the registration function.

```
Public NotInheritable Class ComRegisterFunctionAttribute : Inherits Attril

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `ComRegisterFunctionAttribute`

### Valid On

Method

## ComSourceInterfacesAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute indicates the unmanaged event (using the COM IConnectionPoint architecture) interfa that are available on the decorated type. For each method defined in the COM interface, the type m provide a corresponding "event" instance that the COM architecture will plug into.

This attribute is only necessary when building .NET objects for plugging into COM event-aware syst such as ActiveX control containers.

```
Public NotInheritable Class ComSourceInterfacesAttribute : Inherits Attril
' Public Constructors
   Public Sub New( ByVal sourceInterfaces As String)
   Public Sub New( ByVal sourceInterface As Type)
   Public Sub New(ByVal sourceInterface1 As Type,
        ByVal sourceInterface2 As Type)
   Public Sub New(ByVal sourceInterface1 As Type,
        ByVal sourceInterface2 As Type,
        ByVal sourceInterface3 As Type)
   Public Sub New(ByVal sourceInterface1 As Type,
        ByVal sourceInterface2 As Type,
        ByVal sourceInterface3 As Type,
        ByVal sourceInterface4 As Type)
' Public Instance Properties
   Public ReadOnly Property Value As String
End Class
```

### Hierarchy

System.Object → System.Attribute → ComSourceInterfacesAttribute

### Valid On

Class

## ComUnregisterFunctionAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is attached to a shared method to indicate that it should be invoked when the enclosin
assembly is unregistered from COM. There can only be one unregistration function in each assemb

For more details, see `ComRegisterFunctionAttribute`.

```
Public NotInheritable Class ComUnregisterFunctionAttribute : Inherits Att:

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `ComUnregisterFunctionAttribute`

### Valid On

Method

## ComVisibleAttribute NotInheritable Class

### System.Runtime.InteropServices (mscorlib.dll)

By default, all public assemblies, types, and members that are registered with COM are visible to COM. This attribute is used with a false argument to hide an assembly, type, or member from COM. This attribute has a cascading effect: if you hide an assembly, all the public types in that assembly are hidden as well.

You can override this attribute on individual types. If, for example, you want to make only one public type visible from an assembly, add the attribute <ComVisible(false)> to the assembly, but also add <ComVisible(true)> to the one type that you want to expose.

```
Public NotInheritable Class ComVisibleAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal visibility As Boolean)

' Public Instance Properties

   Public ReadOnly Property Value As Boolean

End Class
```

### Hierarchy

System.Object → System.Attribute → ComVisibleAttribute

### Valid On

Assembly, Class, Struct, Enum, Method, Property, Field, Interface, Delegate

## CurrencyWrapper NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This class is used to create a wrapper around a decimal value. Then, when you pass the newly created `CurrencyWrapper` to an unmanaged method, the object is marshaled as the `VT_CURRENCY` type.

```
Public NotInheritable Class CurrencyWrapper

' Public Constructors

   Public Sub New( ByVal obj As Decimal)

   Public Sub New( ByVal obj As Object)

' Public Instance Properties

   Public ReadOnly Property WrappedObject As Decimal

End Class
```

# DispatchWrapper NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

By default, objects are passed to unmanaged methods as the `VT_UNKNOWN` type. This wrapper is used to send an object as type `VT_DISPATCH`.

```
Public NotInheritable Class DispatchWrapper

' Public Constructors

   Public Sub New( ByVal obj As Object)

' Public Instance Properties

   Public ReadOnly Property WrappedObject As Object

End Class
```

# DispIdAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

Specifies a member's `DispId` when it is exposed to COM.

```
Public NotInheritable Class DispIdAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal dispId As Integer)

' Public Instance Properties

   Public ReadOnly Property Value As Integer

End Class
```

### Hierarchy

System.Object → System.Attribute → DispIdAttribute

### Valid On

Method, Property, Field, Event

## DllImportAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This attribute (and, in VB.NET, the `Declare` statement) specifies that a method definition is implemented externally (usually in a DLL). Apply this attribute to a method that has been declared (but not defined) to specify the DLL name and entry point in which the method can be found.

The attribute can be customized in a number of different ways to help control the binding against the external method. The `CallingConvention` value dictates how the parameters to the call (and return value coming back) should be sent to the function. `CallingConvention.StdCall` (used for calling into `_stdcall`-declared functions, which is most of the Win32 API set) and `CallingConvention.Cdecl` (used for calling functions declared directly from C or C++) are the two most common values. The `CharSet` value indicates which character set parameters to the call are expected to be, either two-byte Unicode or one-byte ANSI. `EntryPoint` indicates the name of the exported function from the DLL to bind to (normally this is guessed from the name of the .NET-declared method), and `ExactSpelling` indicates whether the .NET compiler should attempt to "best match" a declared `DllImport` method against a possible set of exported functions. The `PreserveSig` value indicates how .NET should treat `[out]`-declared and `[retval]`-declared parameters. By default, the .NET compilers ignore the HRESULT return value on IDL-declared methods and use the `[retval]`-declared parameter as the return value; setting `PreserveSig` to `true` turns this off. Lastly, because many Win32 APIs use the `GetLastError` API call to note the exact reason a call fails, the `SetLastError` value indicates whether the caller should use that API to discover the reason for failures.

```
Public NotInheritable Class DllImportAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal dllName As String)

' Public Instance Fields

   Public CallingConvention As CallingConvention

   Public CharSet As CharSet

   Public EntryPoint As String

   Public ExactSpelling As Boolean

   Public PreserveSig As Boolean

   Public SetLastError As Boolean

' Public Instance Properties

   Public ReadOnly Property Value As String

End Class
```

### Hierarchy

System.Object → System.Attribute → DllImportAttribute

### Valid On

Method

# ErrorWrapper NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This wrapper is used to force an integer, `Exception`, or other object to be marshaled as type `VT_ERROR`.

```
Public NotInheritable Class ErrorWrapper

' Public Constructors

   Public Sub New( ByVal e As Exception)

   Public Sub New( ByVal errorCode As Integer)

   Public Sub New( ByVal errorCode As Object)

' Public Instance Properties

   Public ReadOnly Property ErrorCode As Integer

End Class
```

## ExtensibleClassFactory NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This class exposes the method `RegisterObjectCreationCallback()`, which specifies a delegate that manufactures instances of a managed type. Use this to build managed types that extend unmanaged types. Since a managed type cannot directly inherit from an unmanaged type, the managed type needs to aggregate an instance of the unmanaged type. The delegate that you register with `RegisterObjectCreationCallback()` takes care of creating the unmanaged type.

```
Public NotInheritable Class ExtensibleClassFactory

' Public Shared Methods

   Public Shared Sub RegisterObjectCreationCallback(

        ByVal callback As ObjectCreationDelegate)

End Class
```

# ExternalException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This is the base class for COM interop and SEH (Structured Exception Handler) exceptions.

```
Public Class ExternalException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
   Public Sub New(ByVal message As String,
        ByVal errorCode As Integer)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Overridable Public ReadOnly Property ErrorCode As Integer
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → ExternalException

### Subclasses

COMException, SEHException

## FieldOffsetAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This attribute controls the offset, in bytes, of a field. Use it to match your .NET types to the layout of C and C++ structures exactly. This attribute can be used only within classes that have the `StructLayoutAttribute` attribute where `LayoutKind.Explicit` was used.

```
Public NotInheritable Class FieldOffsetAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal offset As Integer)

' Public Instance Properties

   Public ReadOnly Property Value As Integer

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `FieldOffsetAttribute`

### Valid On

Field

# GCHandle Structure

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This class is used when you need to pass a managed object to unmanaged code. To use this class, pass an instance of a .NET-managed type to the `Alloc()` method. The single-argument form of `Alloc()` creates the `GCHandle` with `GCHandleType.Normal`, which ensures that the object will not be freed by the garbage collector. (This means that some kind of user code must also call the `Free()` method in order to release the object.) Managed code can use the `Target` property to access the underlying object.

```
Public Structure GCHandle
' Public Instance Properties
   Public ReadOnly Property IsAllocated As Boolean
   Public Property Target As Object
' Public Shared Methods
   Public Shared Function Alloc(
        ByVal value As Object) As GCHandle
   Public Shared Function Alloc(ByVal value As Object,
        ByVal type As GCHandleType) As GCHandle
   Public Shared explicit operator Sub GCHandle(
        ByVal value As IntPtr)
   Public Shared explicit operator Sub IntPtr(
        ByVal value As GCHandle)
' Public Instance Methods
   Public Function AddrOfPinnedObject() As IntPtr
   Public Sub Free()
End Structure
```

### Hierarchy

System.Object → System.ValueType → GCHandle

## GCHandleType Enum

**System.Runtime.InteropServices (mscorlib.dll)** ***ECMA, serializable***

This enumeration contains values for the two-argument form of `GCHandle.Alloc()`. `Normal` protects the object from being garbage collected, and `Pinned` does the same (but it also enables the `GCHandle.AddrOfPinnedObject()` method). `Weak` and `WeakTrackResurrection` both allow the object to be garbage collected. However, `Weak` causes the object to be zeroed out before the finalizer runs, but `WeakTrackResurrection` does not zero the object, so the object's finalizer can safely resurrect it.

```
Public Enum GCHandleType

   Weak = 0

   WeakTrackResurrection = 1

   Normal = 2

   Pinned = 3

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `GCHandleType`

### Passed To

`GCHandle.Alloc()`

## GuidAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is used to specify the GUID of assemblies, modules, or types you expose to COM. If you don't use this attribute to specify a GUID, one is automatically generated. When you apply this attribute, use its full name (`<GuidAttribute()>` rather than `[Guid()]`) to avoid clashes with the `System.Guid` type.

```
Public NotInheritable Class GuidAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal guid As String)

' Public Instance Properties

   Public ReadOnly Property Value As String

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `GuidAttribute`

### Valid On

Assembly, Class, Struct, Enum, Interface, Delegate

# HandleRef Structure

## System.Runtime.InteropServices (mscorlib.dll)

When you pass a managed object into unmanaged code using PInvoke, there is a chance that the garbage collector will finalize the object before the unmanaged code is finished with it. This can only happen when your managed code does not reference the object after the PInvoke call. Because the garbage collector's reach does not extend into unmanaged code, this fools the garbage collector into thinking that you are finished with it.

This class is used to wrap your managed object before passing it into unmanaged code, and you are guaranteed that the garbage collector will not touch it until the PInvoke call returns.

```
Public Structure HandleRef

' Public Constructors

   Public Sub New(ByVal wrapper As Object,

        ByVal handle As IntPtr)

' Public Instance Properties

   Public ReadOnly Property Handle As IntPtr

   Public ReadOnly Property Wrapper As Object

' Public Shared Methods

   Public Shared explicit operator Sub IntPtr(

        ByVal value As HandleRef)

End Structure
```

### Hierarchy

System.Object → System.ValueType → HandleRef

# IDispatchImplAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

There are multiple implementations of `IDispatch` available for you to expose dual interfaces and dispinterfaces to COM. Attach this attribute to a class or an assembly to specify which `IDispatch` implementation to use. If you apply this attribute to an assembly, it applies to all classes within that assembly. For a list of available `IDispatch` implementations, see `IDispatchImplType`.

```
Public NotInheritable Class IDispatchImplAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal implType As IDispatchImplType)

   Public Sub New( ByVal implType As Short)

' Public Instance Properties

   Public ReadOnly Property Value As IDispatchImplType

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `IDispatchImplAttribute`

### Valid On

Assembly, Class

# IDispatchImplType Enum

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This enumeration contains the values used by `IDispatchImplAttribute`. `SystemDefinedImpl` tells the runtime to decide which `IDispatch` implementation to use. `InternalImpl` tells .NET to use its own `IDispatch` implementation, and `CompatibleImpl` uses an `IDispatch` implementation that is compatible with OLE automation. If you use this last implementation, it requires static type information. Because this information is automatically generated at runtime, `CompatibleImpl` may have an adverse impact on performance.

```
Public Enum IDispatchImplType

   SystemDefinedImpl = 0

   InternalImpl = 1

   CompatibleImpl = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `IDispatchImplType`

### Returned By

`IDispatchImplAttribute.Value`

### Passed To

`IDispatchImplAttribute.IDispatchImplAttribute()`

## InAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This attribute is attached to a parameter to marshal it as an `in` parameter. By default, parameters are marshaled based on their modifiers, so this attribute is only necessary if you want to override the defaults. Parameters with no modifiers are marshaled as `[In]`. Parameters with the `ref` modifier are marshaled as `[In, Out]`. Parameters with the `out` modifier are marshaled as `[Out]`.

```
Public NotInheritable Class InAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `InAttribute`

### Valid On

Parameter

## InterfaceTypeAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is used to create a .NET interface that maps a COM interface into your managed application. See `ComInterfaceType` for the available values.

```
Public NotInheritable Class InterfaceTypeAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal interfaceType As ComInterfaceType)

   Public Sub New( ByVal interfaceType As Short)

' Public Instance Properties

   Public ReadOnly Property Value As ComInterfaceType

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `InterfaceTypeAttribute`

### Valid On

Interface

# InvalidComObjectException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This exception signals that an invalid COM object has been used.

```
Public Class InvalidComObjectException : Inherits SystemException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → InvalidComObjectException

# InvalidOleVariantTypeException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This exception signals that the marshaler failed in an attempt to marshal a variant to managed code.

```
Public Class InvalidOleVariantTypeException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → InvalidOleVariantTypeException

# IRegistrationServices Interface

## System.Runtime.InteropServices (mscorlib.dll)

This interface defines the interface used by classes that register and unregister assemblies with COM.

```
Public Interface IRegistrationServices
' Public Instance Methods
   Public Function GetManagedCategoryGuid() As Guid
   Public Function GetProgIdForType(
        ByVal type As Type) As String
   Public Function GetRegistrableTypesInAssembly(
        ByVal assembly As System.Reflection.Assembly) As Type()
   Public Function RegisterAssembly(
        ByVal assembly As System.Reflection.Assembly,
        ByVal flags As AssemblyRegistrationFlags) As Boolean
   Public Sub RegisterTypeForComClients(ByVal type As Type,
        ByRef g As Guid)
   Public Function TypeRepresentsComType(
        ByVal type As Type) As Boolean
   Public Function TypeRequiresRegistration(
        ByVal type As Type) As Boolean
   Public Function UnregisterAssembly(
        ByVal assembly As System.Reflection.Assembly) As Boolean
End Interface
```

### Implemented By

RegistrationServices

## LayoutKind Enum

**System.Runtime.InteropServices (mscorlib.dll)** ***ECMA, serializable***

This enumeration is used to specify how objects are laid out when they are passed to unmanaged code. `Auto` specifies that .NET should choose the best method to lay out the objects. `Explicit` gives you complete control over how the object's data members are laid out. You must use `FieldOffsetAttribute` with each member if you specify `Explicit`. `Sequential` lays out the object's members one after the other, in the same order that they are defined in the class definition.

```
Public Enum LayoutKind

   Sequential = 0

   Explicit = 2

   Auto = 3

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `LayoutKind`

### Returned By

`StructLayoutAttribute.Value`

### Passed To

`StructLayoutAttribute.StructLayoutAttribute()`

## LCIDConversionAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute indicates that a parameter within the method's unmanaged signature expects an `[lcid]` argument. Pass an integer value to the constructor to specify which parameter, starting with 0 for the first parameter.

```
Public NotInheritable Class LCIDConversionAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal lcid As Integer)

' Public Instance Properties

   Public ReadOnly Property Value As Integer

End Class
```

### Hierarchy

System.Object → System.Attribute → LCIDConversionAttribute

### Valid On

Method

## Marshal NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This class offers a collection of shared methods for working with unmanaged memory and converting managed types to unmanaged types. Unless you are developing specialized code for marshaling types between managed and unmanaged code, you probably do not need to use any of these methods.

`GetHRForException()` converts a .NET exception to a COM HResult. If you are curious about the platform you are running on, you can find out the size of a character with the `SystemDefaultCharSize` field, which is 1 on an ANSI platform (Windows 9x/ME) and 2 on a Unicode platform (Windows NT, 2000, and XP).

Use the `IsComObject()` method to determine whether an object is actually an unmanaged COM object. The `AddRef()` method increments a COM object's reference count.

```
Public NotInheritable Class Marshal
' Public Shared Fields
   Public Shared ReadOnly SystemDefaultCharSize As Integer        // =2
   Public Shared ReadOnly SystemMaxDBCSCharSize As Integer        // =1
' Public Shared Methods
   Public Shared Function AddRef(
        ByVal pUnk As IntPtr) As Integer
   Public Shared Function AllocCoTaskMem(
        ByVal cb As Integer) As IntPtr
   Public Shared Function AllocHGlobal(
        ByVal cb As Integer) As IntPtr
   Public Shared Function AllocHGlobal(
        ByVal cb As IntPtr) As IntPtr
   Public Shared Function BindToMoniker(
        ByVal monikerName As String) As Object
   Public Shared Sub ChangeWrapperHandleStrength(
        ByVal otp As Object, ByVal fIsWeak As Boolean)
   Public Shared Sub Copy(ByVal source As Byte(),
```

```
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As Char(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As Double(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As Short(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As Integer(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As Long(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Byte(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
  Public Shared Sub Copy(ByVal source As IntPtr,
```

```
      ByVal destination As Char(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Double(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Short(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Integer(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Long(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As IntPtr,
      ByVal destination As Single(),
      ByVal startIndex As Integer,
      ByVal length As Integer)
Public Shared Sub Copy(ByVal source As Single(),
      ByVal startIndex As Integer,
      ByVal destination As IntPtr,
      ByVal length As Integer)
Public Shared Function CreateWrapperOfType(
      ByVal o As Object, ByVal t As Type) As Object
Public Shared Sub DestroyStructure(ByVal ptr As IntPtr,
```

```
    ByVal structuretype As Type)
Public Shared Sub FreeBSTR( ByVal ptr As IntPtr)
Public Shared Sub FreeCoTaskMem( ByVal ptr As IntPtr)
Public Shared Sub FreeHGlobal( ByVal hglobal As IntPtr)
Public Shared Function GenerateGuidForType(
    ByVal type As Type) As Guid
Public Shared Function GenerateProgIdForType(
    ByVal type As Type) As String
Public Shared Function GetActiveObject(
    ByVal progID As String) As Object
Public Shared Function GetComInterfaceForObject(
    ByVal o As Object, ByVal T As Type) As IntPtr
Public Shared Function GetComObjectData(
    ByVal obj As Object,
    ByVal key As Object) As Object
Public Shared Function GetComSlotForMethodInfo(
    ByVal m As System.Reflection.MemberInfo) As Integer
Public Shared Function GetEndComSlot(
    ByVal t As Type) As Integer
Public Shared Function GetExceptionCode() As Integer
Public Shared Function GetExceptionPointers() As IntPtr
Public Shared Function GetHINSTANCE(
    ByVal m As System.Reflection.Module) As IntPtr
Public Shared Function GetHRForException(
    ByVal e As Exception) As Integer
Public Shared Function GetHRForLastWin32Error() As Integer
Public Shared Function GetIDispatchForObject(
    ByVal o As Object) As IntPtr
Public Shared Function GetITypeInfoForType(
    ByVal t As Type) As IntPtr
Public Shared Function GetIUnknownForObject(
```

```
     ByVal o As Object) As IntPtr
Public Shared Function GetLastWin32Error() As Integer
Public Shared Function GetManagedThunkForUnmanagedMethodPtr(
     ByVal pfnMethodToWrap As IntPtr,
     ByVal pbSignature As IntPtr,
     ByVal cbSignature As Integer) As IntPtr
Public Shared Function GetMethodInfoForComSlot(
     ByVal t As Type, ByVal slot As Integer,
     ByRef memberType As ComMemberType) As MemberInfo
Public Shared Sub GetNativeVariantForObject(
     ByVal obj As Object,
     ByVal pDstNativeVariant As IntPtr)
Public Shared Function GetObjectForIUnknown(
     ByVal pUnk As IntPtr) As Object
Public Shared Function GetObjectForNativeVariant(
     ByVal pSrcNativeVariant As IntPtr) As Object
Public Shared Function GetObjectsForNativeVariants(
     ByVal aSrcNativeVariant As IntPtr,
     ByVal cVars As Integer) As Object()
Public Shared Function GetStartComSlot(
     ByVal t As Type) As Integer
Public Shared Function GetThreadFromFiberCookie(
     ByVal cookie As Integer) As Thread
Public Shared Function GetTypedObjectForIUnknown(
     ByVal pUnk As IntPtr, ByVal t As Type) As Object
Public Shared Function GetTypeForITypeInfo(
     ByVal piTypeInfo As IntPtr) As Type
Public Shared Function GetTypeInfoName(
     ByVal pTI As UCOMITypeInfo) As String
Public Shared Function GetTypeLibGuid(
```

```
     ByVal pTLB As UCOMITypeLib) As Guid
Public Shared Function GetTypeLibGuidForAssembly(
     ByVal asm As System.Reflection.Assembly) As Guid
Public Shared Function GetTypeLibLcid(
     ByVal pTLB As UCOMITypeLib) As Integer
Public Shared Function GetTypeLibName(
     ByVal pTLB As UCOMITypeLib) As String
Public Shared Function GetUnmanagedThunkForManagedMethodPtr(
     ByVal pfnMethodToWrap As IntPtr,
     ByVal pbSignature As IntPtr,
     ByVal cbSignature As Integer) As IntPtr
Public Shared Function IsComObject(
     ByVal o As Object) As Boolean
Public Shared Function IsTypeVisibleFromCom(
     ByVal t As Type) As Boolean
Public Shared Function NumParamBytes(
     ByVal m As System.Reflection.MethodInfo) As Integer
Public Shared Function OffsetOf(ByVal t As Type,
     ByVal fieldName As String) As IntPtr
Public Shared Sub Prelink(
     ByVal m As System.Reflection.MethodInfo)
Public Shared Sub PrelinkAll( ByVal c As Type)
Public Shared Function PtrToStringAnsi(
     ByVal ptr As IntPtr) As String
Public Shared Function PtrToStringAnsi(ByVal ptr As IntPtr,
     ByVal len As Integer) As String
Public Shared Function PtrToStringAuto(
     ByVal ptr As IntPtr) As String
Public Shared Function PtrToStringAuto(ByVal ptr As IntPtr,
     ByVal len As Integer) As String
Public Shared Function PtrToStringBSTR(
```

```
    ByVal ptr As IntPtr) As String
Public Shared Function PtrToStringUni(
    ByVal ptr As IntPtr) As String
Public Shared Function PtrToStringUni(ByVal ptr As IntPtr,
    ByVal len As Integer) As String
Public Shared Function PtrToStructure(ByVal ptr As IntPtr,
    ByVal structureType As Type) As Object
Public Shared Sub PtrToStructure(ByVal ptr As IntPtr,
    ByVal structure As Object)
Public Shared Function QueryInterface(ByVal pUnk As IntPtr,
    ByRef iid As Guid, ByRef ppv As IntPtr) As Integer
Public Shared Function ReadByte(
    ByVal ptr As IntPtr) As Byte
Public Shared Function ReadByte(ByVal ptr As IntPtr,
    ByVal ofs As Integer) As Byte
Public Shared Function ReadByte(ByVal ptr As Object,
    ByVal ofs As Integer) As Byte
Public Shared Function ReadInt16(
    ByVal ptr As IntPtr) As Short
Public Shared Function ReadInt16(ByVal ptr As IntPtr,
    ByVal ofs As Integer) As Short
Public Shared Function ReadInt16(ByVal ptr As Object,
    ByVal ofs As Integer) As Short
Public Shared Function ReadInt32(
    ByVal ptr As IntPtr) As Integer
Public Shared Function ReadInt32(ByVal ptr As IntPtr,
    ByVal ofs As Integer) As Integer
Public Shared Function ReadInt32(ByVal ptr As Object,
    ByVal ofs As Integer) As Integer
Public Shared Function ReadInt64(
```

```
      ByVal ptr As IntPtr) As Long
Public Shared Function ReadInt64(ByVal ptr As IntPtr,
      ByVal ofs As Integer) As Long
Public Shared Function ReadInt64(ByVal ptr As Object,
      ByVal ofs As Integer) As Long
Public Shared Function ReadIntPtr(
      ByVal ptr As IntPtr) As IntPtr
Public Shared Function ReadIntPtr(ByVal ptr As IntPtr,
      ByVal ofs As Integer) As IntPtr
Public Shared Function ReadIntPtr(ByVal ptr As Object,
      ByVal ofs As Integer) As IntPtr
Public Shared Function ReAllocCoTaskMem(ByVal pv As IntPtr,
      ByVal cb As Integer) As IntPtr
Public Shared Function ReAllocHGlobal(ByVal pv As IntPtr,
      ByVal cb As IntPtr) As IntPtr
Public Shared Function Release(
      ByVal pUnk As IntPtr) As Integer
Public Shared Function ReleaseComObject(
      ByVal o As Object) As Integer
Public Shared Sub ReleaseThreadCache()
Public Shared Function SetComObjectData(
      ByVal obj As Object, ByVal key As Object,
      ByVal data As Object) As Boolean
Public Shared Function SizeOf(
      ByVal structure As Object) As Integer
Public Shared Function SizeOf( ByVal t As Type) As Integer
Public Shared Function StringToBSTR(
      ByVal s As String) As IntPtr
Public Shared Function StringToCoTaskMemAnsi(
      ByVal s As String) As IntPtr
Public Shared Function StringToCoTaskMemAuto(
```

```
    ByVal s As String) As IntPtr
Public Shared Function StringToCoTaskMemUni(
    ByVal s As String) As IntPtr
Public Shared Function StringToHGlobalAnsi(
    ByVal s As String) As IntPtr
Public Shared Function StringToHGlobalAuto(
    ByVal s As String) As IntPtr
Public Shared Function StringToHGlobalUni(
    ByVal s As String) As IntPtr
Public Shared Sub StructureToPtr(ByVal structure As Object,
    ByVal ptr As IntPtr, ByVal fDeleteOld As Boolean)
Public Shared Sub ThrowExceptionForHR(
    ByVal errorCode As Integer)
Public Shared Sub ThrowExceptionForHR(
    ByVal errorCode As Integer,
    ByVal errorInfo As IntPtr)
Public Shared Function UnsafeAddrOfPinnedArrayElement(
    ByVal arr As Array,
    ByVal index As Integer) As IntPtr
Public Shared Sub WriteByte(ByVal ptr As IntPtr,
    ByVal val As Byte)
Public Shared Sub WriteByte(ByVal ptr As IntPtr,
    ByVal ofs As Integer, ByVal val As Byte)
Public Shared Sub WriteByte(ByRef ptr As Object,
    ByVal ofs As Integer, ByVal val As Byte)
Public Shared Sub WriteInt16(ByVal ptr As IntPtr,
    ByVal val As Char)
Public Shared Sub WriteInt16(ByVal ptr As IntPtr,
    ByVal val As Short)
Public Shared Sub WriteInt16(ByVal ptr As IntPtr,
```

```
        ByVal ofs As Integer, ByVal val As Char)
    Public Shared Sub WriteInt16(ByVal ptr As IntPtr,
        ByVal ofs As Integer, ByVal val As Short)
    Public Shared Sub WriteInt16(ByRef ptr As Object,
        ByVal ofs As Integer, ByVal val As Char)
    Public Shared Sub WriteInt16(ByRef ptr As Object,
        ByVal ofs As Integer, ByVal val As Short)
    Public Shared Sub WriteInt32(ByVal ptr As IntPtr,
        ByVal val As Integer)
    Public Shared Sub WriteInt32(ByVal ptr As IntPtr,
        ByVal ofs As Integer, ByVal val As Integer)
    Public Shared Sub WriteInt32(ByRef ptr As Object,
        ByVal ofs As Integer, ByVal val As Integer)
    Public Shared Sub WriteInt64(ByVal ptr As IntPtr,
        ByVal ofs As Integer, ByVal val As Long)
    Public Shared Sub WriteInt64(ByVal ptr As IntPtr,
        ByVal val As Long)
    Public Shared Sub WriteInt64(ByRef ptr As Object,
        ByVal ofs As Integer, ByVal val As Long)
    Public Shared Sub WriteIntPtr(ByVal ptr As IntPtr,
        ByVal ofs As Integer, ByVal val As IntPtr)
    Public Shared Sub WriteIntPtr(ByVal ptr As IntPtr,
        ByVal val As IntPtr)
    Public Shared Sub WriteIntPtr(ByRef ptr As Object,
        ByVal ofs As Integer, ByVal val As IntPtr)
End Class
```

## MarshalAsAttribute NotInheritable Class

### System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This optional attribute is used to explicitly specify the unmanaged type a parameter, field, or return value should be marshaled to. If you do not specify this attribute, .NET uses the type's default marshaler. The `UnmanagedType` enumeration contains the unmanaged types you can marshal to with this attribute.

```
Public NotInheritable Class MarshalAsAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal unmanagedType As Short)

   Public Sub New( ByVal unmanagedType As UnmanagedType)

' Public Instance Fields

   Public ArraySubType As UnmanagedType

   Public MarshalCookie As String

   Public MarshalType As String

   Public MarshalTypeRef As Type

   Public SafeArraySubType As VarEnum

   Public SafeArrayUserDefinedSubType As Type

   Public SizeConst As Integer

   Public SizeParamIndex As Short

' Public Instance Properties

   Public ReadOnly Property Value As UnmanagedType

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `MarshalAsAttribute`

### Valid On

Field, Parameter, ReturnValue

# MarshalDirectiveException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This exception is thrown when the marshaler encounters an unsupported `MarshalAsAttribute`.

```
Public Class MarshalDirectiveException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → MarshalDirectiveException

## ObjectCreationDelegate Delegate

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

Use this delegate with the `ExtensibleClassFactory.RegisterObjectCreationCallback()` method to create a COM object.

```
Public Delegate Function ObjectCreationDelegate(

        ByVal aggregator As IntPtr) As IntPtr
```

### Passed To

`ExtensibleClassFactory.RegisterObjectCreationCallback()`

# OptionalAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is attached to a parameter to indicate that it is optional.

```
Public NotInheritable Class OptionalAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

System.Object → System.Attribute → OptionalAttribute

### Valid On

Parameter

## OutAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

This attribute is attached to a parameter to cause it to be marshaled as an `out` parameter. See `InAttribute` for more details, including information on the default behavior.

```
Public NotInheritable Class OutAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `OutAttribute`

### Valid On

Parameter

# PreserveSigAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

When .NET converts a managed method signature to an unmanaged signature, it changes the return value to a parameter that has the `out` and `retval` COM attributes. Instead of the original return value, the unmanaged method returns a COM HRESULT. If you want to override this behavior, attach the `PreserveSigAttribute` to the method.

Something similar happens when you call unmanaged methods from managed code. In that case, the `[out`, `retval]` parameter on the COM side becomes the return value, and an HRESULT that indicates an error condition is translated into a .NET exception. If you want to be able to access the HRESULT as a `long` return value, use the `PreserveSigAttribute` on the methods in your COM interface declaration (see `InterfaceTypeAttribute`).

```
Public NotInheritable Class PreserveSigAttribute : Inherits Attribute

' Public Constructors

   Public Sub New()

End Class
```

### Hierarchy

`System.Object` → `System.Attribute` → `PreserveSigAttribute`

### Valid On

Method

# ProgIdAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

This attribute is attached to a class to specify its COM ProgID.

```
Public NotInheritable Class ProgIdAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal progId As String)

' Public Instance Properties

   Public ReadOnly Property Value As String

End Class
```

### Hierarchy

System.Object → System.Attribute → ProgIdAttribute

### Valid On

Class

# RegistrationServices Class

## System.Runtime.InteropServices (mscorlib.dll)

This class is responsible for registering and unregistering assemblies with COM.

```
Public Class RegistrationServices : Implements IRegistrationServices

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overridable Public Function GetManagedCategoryGuid(

        ) As Guid Implements IRegistrationServices.GetManagedCategoryGuid

   Overridable Public Function GetProgIdForType(

        ByVal type As Type) As String Implements IRegistrationServices.Ge

   Overridable Public Function GetRegistrableTypesInAssembly(

        ByVal assembly As System.Reflection.Assembly) As Type()

        Implements IRegistrationServices.GetRegistrableTypesInAssembly

   Overridable Public Function RegisterAssembly(

        ByVal assembly As System.Reflection.Assembly,

        ByVal flags As AssemblyRegistrationFlags) As Boolean

        Implements IRegistrationServices.RegisterAssembly

   Overridable Public Sub RegisterTypeForComClients(

        ByVal type As Type,

        ByRef g As Guid) Implements IRegistrationServices.RegisterTypeFor

   Overridable Public Function TypeRepresentsComType(

        ByVal type As Type) As Boolean Implements IRegistrationServices.T

   Overridable Public Function TypeRequiresRegistration(

        ByVal type As Type) As Boolean Implements IRegistrationServices.T

   Overridable Public Function UnregisterAssembly(

        ByVal assembly As System.Reflection.Assembly) As Boolean

        Implements IRegistrationServices.UnregisterAssembly

End Class
```

## RuntimeEnvironment Class

## System.Runtime.InteropServices (mscorlib.dll)

This type exposes shared methods you can use to get information about the CLR's environment.

```
Public Class RuntimeEnvironment
' Public Constructors
   Public Sub New()
' Public Shared Properties
   Public Shared ReadOnly Property SystemConfigurationFile As String
' Public Shared Methods
   Public Shared Function FromGlobalAccessCache(
        ByVal a As System.Reflection.Assembly) As Boolean
   Public Shared Function GetRuntimeDirectory() As String
   Public Shared Function GetSystemVersion() As String
End Class
```

# SafeArrayRankMismatchException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This exception signals that a SAFEARRAY's rank does not match the rank in the method signature; it might be thrown when invoking a managed method.

```
Public Class SafeArrayRankMismatchException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → SafeArrayRankMismatchException

## SafeArrayTypeMismatchException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This exception signals that a `SAFEARRAY`'s type does not match the type in the method signature; it might be thrown when invoking a managed method.

```
Public Class SafeArrayTypeMismatchException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal inner As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → SafeArrayTypeMismatchException

# SEHException Class

## System.Runtime.InteropServices (mscorlib.dll) *serializable*

This class is used as a wrapper for an unmanaged C++ exception that was thrown.

```
Public Class SEHException : Inherits ExternalException
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal message As String)
   Public Sub New(ByVal message As String,
        ByVal inner As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Methods
   Overridable Public Function CanResume() As Boolean
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → ExternalException → SEHException

## StructLayoutAttribute NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll) *ECMA*

Use this attribute to control how the members of a class are laid out in memory. See `LayoutKind` for the possible values you can use with this attribute.

```
Public NotInheritable Class StructLayoutAttribute : Inherits Attribute

' Public Constructors

   Public Sub New( ByVal layoutKind As Short)

   Public Sub New( ByVal layoutKind As LayoutKind)

' Public Instance Fields

   Public CharSet As CharSet

   Public Pack As Integer

   Public Size As Integer

' Public Instance Properties

   Public ReadOnly Property Value As LayoutKind

End Class
```

### Hierarchy

System.Object → System.Attribute → StructLayoutAttribute

### Valid On

Class, Struct

## UnknownWrapper NotInheritable Class

## System.Runtime.InteropServices (mscorlib.dll)

Use this wrapper to pass a managed object into unmanaged code as type `VT_UNKNOWN`.

```
Public NotInheritable Class UnknownWrapper

' Public Constructors

   Public Sub New( ByVal obj As Object)

' Public Instance Properties

   Public ReadOnly Property WrappedObject As Object

End Class
```

## UnmanagedType Enum

**System.Runtime.InteropServices (mscorlib.dll)** ***ECMA, serializable***

This enumeration contains constant values that represent various unmanaged types.

```
Public Enum UnmanagedType

   Bool = 2

   I1 = 3

   U1 = 4

   I2 = 5

   U2 = 6

   I4 = 7

   U4 = 8

   I8 = 9

   U8 = 10

   R4 = 11

   R8 = 12

   Currency = 15

   BStr = 19

   LPStr = 20

   LPWStr = 21

   LPTStr = 22

   ByValTStr = 23

   IUnknown = 25

   IDispatch = 26

   Struct = 27

   Interface = 28

   SafeArray = 29

   ByValArray = 30

   SysInt = 31
```

```
    SysUInt = 32
    VBByRefStr = 34
    AnsiBStr = 35
    TBStr = 36
    VariantBool = 37
    FunctionPtr = 38
    AsAny = 40
    LPArray = 42
    LPStruct = 43
    CustomMarshaler = 44
    Error = 45
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → UnmanagedType

## Returned By

System.Reflection.Emit.UnmanagedMarshal.{BaseType, GetUnmanagedType}, MarshalAsAttribute.Value

## Passed To

System.Reflection.Emit.UnmanagedMarshal.{DefineLPArray(), DefineSafeArray(), DefineUnmanagedMarshal()}, MarshalAsAttribute.MarshalAsAttribute()

## VarEnum Enum

### System.Runtime.InteropServices (mscorlib.dll) *serializable*

This enumeration contains constants that can be used with `MarshalAsAttribute.SafeArraySubType` to specify how to marshal arrays that are passed from managed to unmanaged code.

```
Public Enum VarEnum

   VT_EMPTY = 0

   VT_NULL = 1

   VT_I2 = 2

   VT_I4 = 3

   VT_R4 = 4

   VT_R8 = 5

   VT_CY = 6

   VT_DATE = 7

   VT_BSTR = 8

   VT_DISPATCH = 9

   VT_ERROR = 10

   VT_BOOL = 11

   VT_VARIANT = 12

   VT_UNKNOWN = 13

   VT_DECIMAL = 14

   VT_I1 = 16

   VT_UI1 = 17

   VT_UI2 = 18

   VT_UI4 = 19

   VT_I8 = 20

   VT_UI8 = 21

   VT_INT = 22

   VT_UINT = 23
```

```
    VT_VOID = 24
    VT_HRESULT = 25
    VT_PTR = 26
    VT_SAFEARRAY = 27
    VT_CARRAY = 28
    VT_USERDEFINED = 29
    VT_LPSTR = 30
    VT_LPWSTR = 31
    VT_RECORD = 36
    VT_FILETIME = 64
    VT_BLOB = 65
    VT_STREAM = 66
    VT_STORAGE = 67
    VT_STREAMED_OBJECT = 68
    VT_STORED_OBJECT = 69
    VT_BLOB_OBJECT = 70
    VT_CF = 71
    VT_CLSID = 72
    VT_VECTOR = 4096
    VT_ARRAY = 8192
    VT_BYREF = 16384
End Enum
```

## Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → VarEnum

## IExpando Interface

### System.Runtime.InteropServices.Expando (mscorlib.dll)

This interface indicates a type whose members can be removed or added. The members are represented as `System.Reflection.MemberInfo` objects.

```
Public Interface IExpando : Implements System.Reflection.IReflect

' Public Instance Methods

   Public Function AddField(
        ByVal name As String) As FieldInfo

   Public Function AddMethod(ByVal name As String,
        ByVal method As Delegate) As MethodInfo

   Public Function AddProperty(
        ByVal name As String) As PropertyInfo

   Public Sub RemoveMember(
        ByVal m As System.Reflection.MemberInfo)

End Interface
```

# Chapter 16. System.Runtime.Serialization

The act of serialization transforms an object (and all of its associated objects and/or data elements) into a stream of bytes, suitable for storage or transmission across a network. The reverse of this act, called deserialization, is to take the same stream of bytes and reconstitute the objects exactly as they were at the time of serialization.

This act, which sounds simple in theory, encompasses a number of points that must be addressed. For starters, the serialization libraries must provide complete reference semantics — that is, if an object holds two references to other objects, both of which happen to point to the same object, then the serialization mechanism needs to keep that in place. Therefore, when the stream is deserialized, both references point to the same object again.

In addition, the actual format of the stream of bytes may be different from application to application. For example, for storage into a binary column in a database, the serialized representation must be as compact and succinct as possible — no "wasted" bytes. But if we want to send the serialized data over an HTTP link to a non-.NET process, then a binary format is entirely inappropriate, and an XML-based one is more useful.

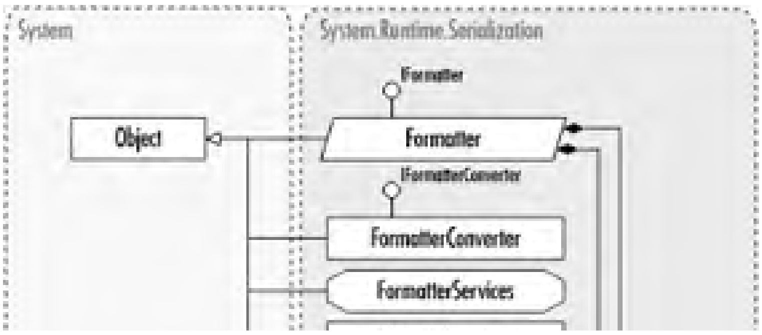
The `System.Runtime.Serialization` namespace and its child namespace, `System.Runtime.Serialization.Formatters` (with its own two child namespaces, `System.Runtime.Serialization.Formatters.Binary`, and `System.Runtime.Serialization.Formatters.Soap`), directly addresses these needs. `System.Runtime.Serialization` contains the types necessary to perform the serialization of an object into a stream of bytes, using an alternative object (which implements the `IFormatter` interface) to actually format the bytes into either binary or XML form. While it is certainly feasible to write your own custom formatters, most .NET programmers have no real practical need to do so, since a binary format and an XML format cover most needs.

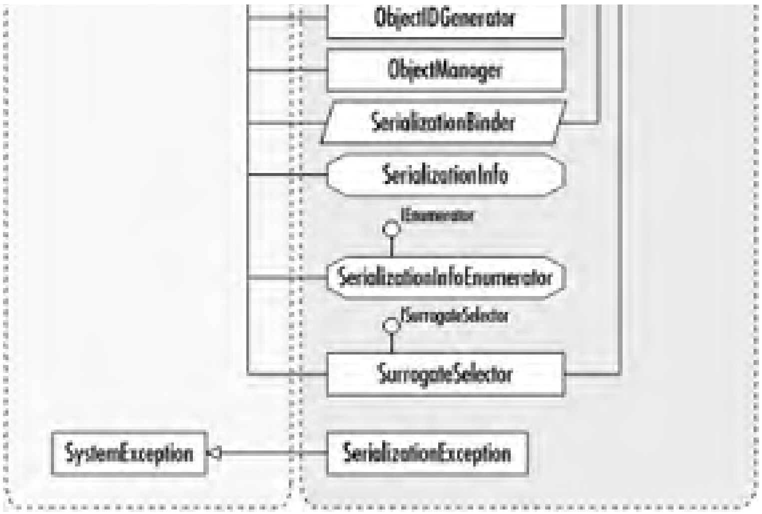
Serialization does not necessarily come for free, however — there are a few things a .NET programmer must do in order to take advantage of the Serialization mechanism. For starters, a type must be marked as serializable in order to be eligible for serialization; this requires adding the `System.SerializableAttribute` to the type's declaration. By default, when a type becomes Serializable, all nonshared fields within that type are transformed into bytes when serialized. If a field is itself nonSerializable, an exception is thrown; fields that wish to remain unserialized (that is, remain empty during the serialization process) must be marked with the `System.NonSerializedAttribute` in the type declaration.

It is possible to take greater control over the serialization process by implementing the `ISerializable` interface and providing definitions for the methods declared there; however, most .NET programmers are generally satisfied with the default serialization behavior.

Figure 16-1 shows the types in this namespace.

### Figure 16-1. The System.Runtime.Serialization namespace




ObjectIDGenerator
ObjectManager
SerializationBinder
SerializationInfo
IEnumerator
SerializationInfoEnumerator
ISurrogateSelector
SurrogateSelector
SystemException
SerializationException

## Formatter MustInherit Class

## System.Runtime.Serialization (mscorlib.dll) *serializable*

This is the MustInherit base class for all runtime serialization formatters. It implements the `IFormat` provides the properties that select the binder, surrogates, and streaming context of the formatter. Tl implements the `Serialize()` and `Deserialize()` methods.

Additionally, the `Formatter` manages the queue of objects to serialize and provides a set of `Write` types to the stream.

```
Public MustInherit Class Formatter : Implements IFormatter

' Protected Constructors

   Protected Sub New()

' Protected Instance Fields

   protected m_idGenerator As ObjectIDGenerator

   protected m_objectQueue As Queue

' Public Instance Properties

   MustInherit Public Property Binder As SerializationBinder Implements I

   MustInherit Public Property Context As StreamingContext

   Implements IFormatter.Context

   MustInherit Public Property SurrogateSelector As ISurrogateSelector

   Implements IFormatter.SurrogateSelector

' Public Instance Methods

   MustInherit Public Function Deserialize(

        ByVal serializationStream As System.IO.Stream) As Object

        Implements IFormatter.Deserialize

   MustInherit Public Sub Serialize(

        ByVal serializationStream As System.IO.Stream,

        ByVal graph As Object) Implements IFormatter.Serialize

' Protected Instance Methods

   Overridable Protected Function GetNext(

        ByRef objID As Long) As Object

   Overridable Protected Function Schedule(
```

```
    ByVal obj As Object) As Long
MustInherit Protected Sub WriteArray(ByVal obj As Object,
    ByVal name As String, ByVal memberType As Type)
MustInherit Protected Sub WriteBoolean(
    ByVal val As Boolean, ByVal name As String)
MustInherit Protected Sub WriteByte(ByVal val As Byte,
    ByVal name As String)
MustInherit Protected Sub WriteChar(ByVal val As Char,
    ByVal name As String)
MustInherit Protected Sub WriteDateTime(ByVal val As Date,
    ByVal name As String)
MustInherit Protected Sub WriteDecimal(
    ByVal val As Decimal, ByVal name As String)
MustInherit Protected Sub WriteDouble(ByVal val As Double,
    ByVal name As String)
MustInherit Protected Sub WriteInt16(ByVal val As Short,
    ByVal name As String)
MustInherit Protected Sub WriteInt32(ByVal val As Integer,
    ByVal name As String)
MustInherit Protected Sub WriteInt64(ByVal val As Long,
    ByVal name As String)
Overridable Protected Sub WriteMember(
    ByVal memberName As String, ByVal data As Object)
MustInherit Protected Sub WriteObjectRef(
    ByVal obj As Object, ByVal name As String,
    ByVal memberType As Type)
MustInherit Protected Sub WriteSByte(ByVal val As SByte,
    ByVal name As String)
MustInherit Protected Sub WriteSingle(ByVal val As Single,
    ByVal name As String)
MustInherit Protected Sub WriteTimeSpan(
```

```
        ByVal val As TimeSpan, ByVal name As String)
    MustInherit Protected Sub WriteUInt16(ByVal val As UInt16,
        ByVal name As String)
    MustInherit Protected Sub WriteUInt32(ByVal val As UInt32,
        ByVal name As String)
    MustInherit Protected Sub WriteUInt64(ByVal val As UInt64,
        ByVal name As String)
    MustInherit Protected Sub WriteValueType(
        ByVal obj As Object, ByVal name As String,
        ByVal memberType As Type)
End Class
```

# FormatterConverter Class

## System.Runtime.Serialization (mscorlib.dll)

This class is a basic implementation of the IFormatterConverter interface. It provides a formatt means to convert values to different base types. The generic Convert() method converts a value type. The various To* methods convert values into specific types.

```
Public Class FormatterConverter : Implements IFormatterConverter
' Public Constructors
   Public Sub New()
' Public Instance Methods
   Public Function Convert(ByVal value As Object,
        ByVal type As Type) As Object Implements IFormatterConverter.Conv
   Public Function Convert(ByVal value As Object,
        ByVal typeCode As TypeCode) As Object Implements IFormatterConver
   Public Function ToBoolean(
        ByVal value As Object) As Boolean Implements IFormatterConverter.
   Public Function ToByte(
        ByVal value As Object) As Byte Implements IFormatterConverter.ToB
   Public Function ToChar(
        ByVal value As Object) As Char Implements IFormatterConverter.ToC
   Public Function ToDateTime(
        ByVal value As Object) As Date Implements IFormatterConverter.ToD
   Public Function ToDecimal(
        ByVal value As Object) As Decimal Implements IFormatterConverter.
   Public Function ToDouble(
        ByVal value As Object) As Double Implements IFormatterConverter.T
   Public Function ToInt16(
        ByVal value As Object) As Short Implements IFormatterConverter.To
   Public Function ToInt32(
        ByVal value As Object) As Integer Implements IFormatterConverter.
   Public Function ToInt64(
```

```
        ByVal value As Object) As Long Implements IFormatterConverter.ToI
    Public Function ToSByte(
        ByVal value As Object) As SByte Implements IFormatterConverter.To
    Public Function ToSingle(
        ByVal value As Object) As Single Implements IFormatterConverter.T
    Public Function ToString(
        ByVal value As Object) As String Implements IFormatterConverter.T
    Public Function ToUInt16(
        ByVal value As Object) As UInt16 Implements IFormatterConverter.T
    Public Function ToUInt32(
        ByVal value As Object) As UInt32 Implements IFormatterConverter.T
    Public Function ToUInt64(
        ByVal value As Object) As UInt64 Implements IFormatterConverter.T
End Class
```

## FormatterServices NotInheritable Class

## System.Runtime.Serialization (mscorlib.dll)

The methods of this noninheritable class provide some background functionality to a formatter when serializing and deserializing objects. For example, `GetObjectData()` creates an array of `System.Reflection.MemberInfo` object data. `GetSerializableMembers()` retrieves all the serializable members of a given class. `PopulateObjectMembers()` is the basic deserialization method, using a `MemberInfo` array of member names and an array of corresponding data values to repopulate a specified object.

```
Public NotInheritable Class FormatterServices

' Public Shared Methods

   Public Shared Function GetObjectData(ByVal obj As Object,

        ByVal members As System.Reflection.MemberInfo()) As Object()

   Public Shared Function GetSerializableMembers(

        ByVal type As Type) As MemberInfo()

   Public Shared Function GetSerializableMembers(

        ByVal type As Type,

        ByVal context As StreamingContext) As MemberInfo()

   Public Shared Function GetTypeFromAssembly(

        ByVal assem As System.Reflection.Assembly,

        ByVal name As String) As Type

   Public Shared Function GetUninitializedObject(

        ByVal type As Type) As Object

   Public Shared Function PopulateObjectMembers(

        ByVal obj As Object,

        ByVal members As System.Reflection.MemberInfo(),

        ByVal data As Object()) As Object

End Class
```

## IDeserializationCallback Interface

## System.Runtime.Serialization (mscorlib.dll)

This interface implements a notification triggered when deserialization of an object is completed. Specify callback functionality with the `OnDeserialization()` method. This class is useful for restoring members that can be computed after deserialization, instead of serializing them and using more storage resources.

```
Public Interface IDeserializationCallback

' Public Instance Methods

   Public Sub OnDeserialization( ByVal sender As Object)

End Interface
```

### Implemented By

System.Collections.Hashtable, System.Collections.Specialized.NameObjectCollectionBase, System.Globalization.{CompareInfo, TextInfo}, System.Reflection.AssemblyName

## IFormatter Interface

### System.Runtime.Serialization (mscorlib.dll)

This interface defines the basic serialization and deserialization functionality for a formatter. Its three properties determine the `SerializationBinder`, `StreamingContext`, and `SurrogateSelector` of the formatter. It also defines the two basic methods of `Serialize()` and `Deserialize()`.

```
Public Interface IFormatter
' Public Instance Properties
   Public Property Binder As SerializationBinder
   Public Property Context As StreamingContext
   Public Property SurrogateSelector As ISurrogateSelector
' Public Instance Methods
   Public Function Deserialize(
        ByVal serializationStream As System.IO.Stream) As Object
   Public Sub Serialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal graph As Object)
End Interface
```

### Implemented By

`Formatter`, `System.Runtime.Serialization.Formatters.Binary.BinaryFormatter`, `System.Runtime.Serialization.Formatters.Soap.SoapFormatter`

## IFormatterConverter Interface

## System.Runtime.Serialization (mscorlib.dll)

This interface defines the basic methods that convert serializable data into base class types. These conversion methods are used to parse the data contained in `SerializationInfo` instances.

```
Public Interface IFormatterConverter

' Public Instance Methods

   Public Function Convert(ByVal value As Object,

        ByVal type As Type) As Object

   Public Function Convert(ByVal value As Object,

        ByVal typeCode As TypeCode) As Object

   Public Function ToBoolean(

        ByVal value As Object) As Boolean

   Public Function ToByte( ByVal value As Object) As Byte

   Public Function ToChar( ByVal value As Object) As Char

   Public Function ToDateTime( ByVal value As Object) As Date

   Public Function ToDecimal(

        ByVal value As Object) As Decimal

   Public Function ToDouble( ByVal value As Object) As Double

   Public Function ToInt16( ByVal value As Object) As Short

   Public Function ToInt32( ByVal value As Object) As Integer

   Public Function ToInt64( ByVal value As Object) As Long

   Public Function ToSByte( ByVal value As Object) As SByte

   Public Function ToSingle( ByVal value As Object) As Single

   Public Function ToString( ByVal value As Object) As String

   Public Function ToUInt16( ByVal value As Object) As UInt16

   Public Function ToUInt32( ByVal value As Object) As UInt32

   Public Function ToUInt64( ByVal value As Object) As UInt64

End Interface
```

## Implemented By

`FormatterConverter`

## Passed To

`SerializationInfo.SerializationInfo()`

# IObjectReference Interface

## System.Runtime.Serialization (mscorlib.dll)

This interface indicates that an object references another object. Use of this interface means that during deserialization, the object must be dereferenced during fixup so the "real" object is placed in the object graph.

```
Public Interface IObjectReference

' Public Instance Methods

   Public Function GetRealObject(

        ByVal context As StreamingContext) As Object

End Interface
```

## ISerializable Interface

## System.Runtime.Serialization (mscorlib.dll)

Indicates that an object is serializable and provides serialization information to the formatter. This interface defines `GetObjectData()`, which specifies the member information that will be provided to a `SerializationInfo` instance in a specific `StreamingContext`. Classes that implement `ISerializable` must also provide a constructor that takes the same arguments as `GetObjectData()`. The constructor must use those arguments to deserialize an instance of the class.

```
Public Interface ISerializable
' Public Instance Methods
   Public Sub GetObjectData(ByVal info As SerializationInfo,
        ByVal context As StreamingContext)
End Interface
```

### Implemented By

Multiple types

## ISerializationSurrogate Interface

## System.Runtime.Serialization (mscorlib.dll)

Objects that implement this interface can be delegated to perform the serialization and deserialization of another object by providing customized methods for `GetObjectData()` and `SetObjectData()`. `GetObjectData()` gets the member information to create a `SerializationInfo` instance, while `SetObjectData()` uses information from a `SerializationInfo` instance to recreate an object.

```
Public Interface ISerializationSurrogate

' Public Instance Methods

   Public Sub GetObjectData(ByVal obj As Object,
         ByVal info As SerializationInfo,
         ByVal context As StreamingContext)
   Public Function SetObjectData(ByVal obj As Object,
         ByVal info As SerializationInfo,
         ByVal context As StreamingContext,
         ByVal selector As ISurrogateSelector) As Object
End Interface
```

### Returned By

`ISurrogateSelector.GetSurrogate()`, `SurrogateSelector.GetSurrogate()`

### Passed To

`SurrogateSelector.AddSurrogate()`

## ISurrogateSelector Interface

## System.Runtime.Serialization (mscorlib.dll)

This interface is implemented by classes that help the formatter decide the appropriate surrogate to or deserialize a particular type.

```
Public Interface ISurrogateSelector

' Public Instance Methods

   Public Sub ChainSelector(

         ByVal selector As ISurrogateSelector)

   Public Function GetNextSelector() As ISurrogateSelector

   Public Function GetSurrogate(ByVal type As Type,

         ByVal context As StreamingContext,

         ByRef selector As ISurrogateSelector) As ISerializationSurrogate

End Interface
```

### Implemented By

SurrogateSelector

### Returned By

Formatter.SurrogateSelector, System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.SurrogateS System.Runtime.Serialization.Formatters.Soap.SoapFormatter.SurrogateSelec IFormatter.SurrogateSelector, SurrogateSelector.GetNextSelector()

### Passed To

Formatter.SurrogateSelector, System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.{BinaryFormatter(), SurrogateSelector}, System.Runtime.Serialization.Formatters.Soap.SoapFormatter.{SoapFormatter SurrogateSelector}, IFormatter.SurrogateSelector, ISerializationSurrogate.SetObjectData(), ObjectManager.ObjectManager(), SurrogateSelector.{ChainSelector(), GetSurrogate()}

## ObjectIDGenerator Class

## System.Runtime.Serialization (mscorlib.dll) *serializable*

This class is used by formatters to identify objects within a serialized stream in order to track object references. The IDs are 64-bit numbers that are generated when an object is referenced or is referencing another. (An ID with a zero value is a null reference.) The `GetId()` method creates and returns an ID for an object if it does not already have one.

```
Public Class ObjectIDGenerator

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overridable Public Function GetId(ByVal obj As Object,
        ByRef firstTime As Boolean) As Long

   Overridable Public Function HasId(ByVal obj As Object,
        ByRef firstTime As Boolean) As Long

End Class
```

# ObjectManager Class

## System.Runtime.Serialization (mscorlib.dll)

This class is used by a formatter to manage object references during deserialization. Objects in the stream can refer to already deserialized objects. This causes the formatter to ask the `ObjectManager` to complete the reference after the deserialization is completed (i.e., on "fixup").

```
Public Class ObjectManager

' Public Constructors

   Public Sub New(ByVal selector As ISurrogateSelector,

        ByVal context As StreamingContext)

' Public Instance Methods

   Overridable Public Sub DoFixups()

   Overridable Public Function GetObject(

        ByVal objectID As Long) As Object

   Overridable Public Sub RaiseDeserializationEvent()

   Overridable Public Sub RecordArrayElementFixup(

        ByVal arrayToBeFixed As Long,

        ByVal indices As Integer(),

        ByVal objectRequired As Long)

   Overridable Public Sub RecordArrayElementFixup(

        ByVal arrayToBeFixed As Long,

        ByVal index As Integer,

        ByVal objectRequired As Long)

   Overridable Public Sub RecordDelayedFixup(

        ByVal objectToBeFixed As Long,

        ByVal memberName As String,

        ByVal objectRequired As Long)

   Overridable Public Sub RecordFixup(
```

```
        ByVal objectToBeFixed As Long,
        ByVal member As System.Reflection.MemberInfo,
        ByVal objectRequired As Long)
    Overridable Public Sub RegisterObject(ByVal obj As Object,
        ByVal objectID As Long)
    Public Sub RegisterObject(ByVal obj As Object,
        ByVal objectID As Long,
        ByVal info As SerializationInfo)
    Public Sub RegisterObject(ByVal obj As Object,
        ByVal objectID As Long,
        ByVal info As SerializationInfo,
        ByVal idOfContainingObj As Long,
        ByVal member As System.Reflection.MemberInfo)
    Public Sub RegisterObject(ByVal obj As Object,
        ByVal objectID As Long,
        ByVal info As SerializationInfo,
        ByVal idOfContainingObj As Long,
        ByVal member As System.Reflection.MemberInfo,
        ByVal arrayIndex As Integer())
End Class
```

## SerializationBinder MustInherit Class

### System.Runtime.Serialization (mscorlib.dll) *serializable*

This MustInherit base class provides a binder to a formatter that controls which classes are loaded during deserialization according to assembly information.

```
Public MustInherit Class SerializationBinder

' Protected Constructors

   Protected Sub New()

' Public Instance Methods

   MustInherit Public Function BindToType(

        ByVal assemblyName As String,

        ByVal typeName As String) As Type

End Class
```

### Returned By

Formatter.Binder,
System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.Binder,
System.Runtime.Serialization.Formatters.Soap.SoapFormatter.Binder,
IFormatter.Binder

### Passed To

Formatter.Binder,
System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.Binder,
System.Runtime.Serialization.Formatters.Soap.SoapFormatter.Binder,
IFormatter.Binder

# SerializationEntry Structure

## System.Runtime.Serialization (mscorlib.dll)

This class encapsulates the information used for a single member stored within `SerializationInfo`. This object stores the `Name` of the object, its `Value`, and the `ObjectType`. `SerializationEntry` instances are the elements returned via the `SerializationInfoEnumerator`.

```
Public Structure SerializationEntry
' Public Instance Properties
   Public ReadOnly Property Name As String
   Public ReadOnly Property ObjectType As Type
   Public ReadOnly Property Value As Object
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `SerializationEntry`

### Returned By

`SerializationInfoEnumerator.Current`

## SerializationException Class

## System.Runtime.Serialization (mscorlib.dll) *serializable*

This class contains the exceptions thrown on serialization and deserialization errors.

```
Public Class SerializationException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(ByVal info As SerializationInfo,

        ByVal context As StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(ISerializable) → System.SystemException → SerializationException

## SerializationInfo NotInheritable Class

## System.Runtime.Serialization (mscorlib.dll)

`SerializationInfo` objects are used by classes that customize serialization behavior. The data required for each member is the name of the member, its type, and its value. Within a class's `ISerializable.GetObjectData()` block, the `AddValue()` method is used to add member data. Deserialization is defined within a deserialization constructor (see `ISerializable`). It is specified by retrieving member data with `GetValue()`, or one of the many other `Get*` methods, and assigning the data to the appropriate members.

```
Public NotInheritable Class SerializationInfo

' Public Constructors

   Public Sub New(ByVal type As Type,

        ByVal converter As IFormatterConverter)

' Public Instance Properties

   Public Property AssemblyName As String

   Public Property FullTypeName As String

   Public ReadOnly Property MemberCount As Integer

' Public Instance Methods

   Public Sub AddValue(ByVal name As String,

        ByVal value As Boolean)

   Public Sub AddValue(ByVal name As String,

        ByVal value As Byte)

   Public Sub AddValue(ByVal name As String,

        ByVal value As Char)

   Public Sub AddValue(ByVal name As String,

        ByVal value As Date)

   Public Sub AddValue(ByVal name As String,

        ByVal value As Decimal)

   Public Sub AddValue(ByVal name As String,

        ByVal value As Double)

   Public Sub AddValue(ByVal name As String,
```

```
     ByVal value As Short)
Public Sub AddValue(ByVal name As String,
     ByVal value As Integer)
Public Sub AddValue(ByVal name As String,
     ByVal value As Long)
Public Sub AddValue(ByVal name As String,
     ByVal value As Object)
Public Sub AddValue(ByVal name As String,
     ByVal value As Object, ByVal type As Type)
Public Sub AddValue(ByVal name As String,
     ByVal value As SByte)
Public Sub AddValue(ByVal name As String,
     ByVal value As Single)
Public Sub AddValue(ByVal name As String,
     ByVal value As UInt16)
Public Sub AddValue(ByVal name As String,
     ByVal value As UInt32)
Public Sub AddValue(ByVal name As String,
     ByVal value As UInt64)
Public Function GetBoolean(
     ByVal name As String) As Boolean
Public Function GetByte( ByVal name As String) As Byte
Public Function GetChar( ByVal name As String) As Char
Public Function GetDateTime( ByVal name As String) As Date
Public Function GetDecimal(
     ByVal name As String) As Decimal
Public Function GetDouble( ByVal name As String) As Double
Public Function GetEnumerator(
     ) As SerializationInfoEnumerator
Public Function GetInt16( ByVal name As String) As Short
Public Function GetInt32( ByVal name As String) As Integer
```

```
    Public Function GetInt64( ByVal name As String) As Long
    Public Function GetSByte( ByVal name As String) As SByte
    Public Function GetSingle( ByVal name As String) As Single
    Public Function GetString( ByVal name As String) As String
    Public Function GetUInt16( ByVal name As String) As UInt16
    Public Function GetUInt32( ByVal name As String) As UInt32
    Public Function GetUInt64( ByVal name As String) As UInt64
    Public Function GetValue(ByVal name As String,
         ByVal type As Type) As Object
    Public Sub SetType( ByVal type As Type)
End Class
```

## Passed To

Multiple types

# SerializationInfoEnumerator NotInheritable Class

## System.Runtime.Serialization (mscorlib.dll)

This class provides an enumerator to iterate over the elements contained in the `SerializationI`
Each element is of type `SerializationEntry`.

```
Public NotInheritable Class SerializationInfoEnumerator : Implements IEnu

' Public Instance Properties

   Public ReadOnly Property Current As SerializationEntry

   Public ReadOnly Property Name As String

   Public ReadOnly Property ObjectType As Type

   Public ReadOnly Property Value As Object

' Public Instance Methods

   Public Function MoveNext(

        ) As Boolean Implements IEnumerator.MoveNext

   Public Sub Reset() Implements IEnumerator.Reset

End Class
```

### Returned By

`SerializationInfo.GetEnumerator()`

# StreamingContext Structure

## System.Runtime.Serialization (mscorlib.dll) *serializable*

This class describes the source or destination of a serialized stream. The context can determine how classes are serialized and require special parsing during deserialization. The `State` property holds a value from `StreamingContextStates` that indicates the destination of object data during serialization and the source of data during deserialization. This could indicate that you are serializing data to a file, for example, or deserializing data that came from another process.

```
Public Structure StreamingContext

' Public Constructors

   Public Sub New( ByVal state As StreamingContextStates)

   Public Sub New(ByVal state As StreamingContextStates,

        ByVal additional As Object)

' Public Instance Properties

   Public ReadOnly Property Context As Object

   Public ReadOnly Property State As StreamingContextStates

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal obj As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer

End Structure
```

### Hierarchy

System.Object → System.ValueType → StreamingContext

### Returned By

Formatter.Context, System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.Context, System.Runtime.Serialization.Formatters.Soap.SoapFormatter.Context, IFormatter.Context

### Passed To

Multiple types

# StreamingContextStates Enum

## System.Runtime.Serialization (mscorlib.dll) *serializable, flag*

This enumeration contains values that describe types of streams that serialized data derives from or targets.

```
Public Enum StreamingContextStates
   CrossProcess = &H000000001
   CrossMachine = &H000000002
   File = &H000000004
   Persistence = &H000000008
   Remoting = &H000000010
   Other = &H000000020
   Clone = &H000000040
   CrossAppDomain = &H000000080
   All = &H0000000FF
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → StreamingContextStates

### Returned By

StreamingContext.State

### Passed To

StreamingContext.StreamingContext()

## SurrogateSelector Class

## System.Runtime.Serialization (mscorlib.dll)

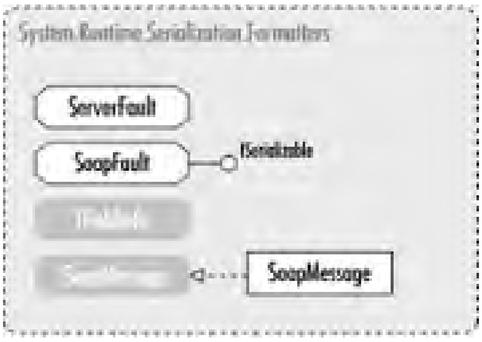
This class is the basic implementation of the ISurrogateSelector interface. A formatter uses thi class to find the appropriate surrogate object to serialize or deserialize an object of a specific type, assembly, or context.

```
Public Class SurrogateSelector : Implements ISurrogateSelector

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overridable Public Sub AddSurrogate(ByVal type As Type,
        ByVal context As StreamingContext,
        ByVal surrogate As ISerializationSurrogate)
   Overridable Public Sub ChainSelector(
        ByVal selector As ISurrogateSelector)
        Implements ISurrogateSelector.ChainSelector
   Overridable Public Function GetNextSelector(
        ) As ISurrogateSelector Implements ISurrogateSelector.GetNextSele
   Overridable Public Function GetSurrogate(
        ByVal type As Type,
        ByVal context As StreamingContext,
        ByRef selector As ISurrogateSelector) As ISerializationSurrogate
        Implements ISurrogateSelector.GetSurrogate
   Overridable Public Sub RemoveSurrogate(ByVal type As Type,
        ByVal context As StreamingContext)
End Class
```

# Chapter 17. System.Runtime.Serialization.Formatters

This chapter covers the `System.Runtime.Serialization.Formatters` namespace, which contains a number of types that are used by serialization formatters. Figure 17-1 shows the types in this namespace. This chapter also features the `BinaryFormatter` and `SoapFormatter`, two formatters that live in their own namespace and rely on the types in the `System.Runtime.Serialization.Formatters` namespace.

**Figure 17-1. The System.Runtime.Serialization.Formatters namespace**



## BinaryFormatter NotInheritable Class

## System.Runtime.Serialization.Formatters.Binary (mscorlib.dll)

This formatter uses a binary format to serialize or deserialize a single object or an object graph.

```
Public NotInheritable Class BinaryFormatter : Implements System.Runtime.R
        System.Runtime.Serialization.IFormatter
' Public Constructors
   Public Sub New()
   Public Sub New(
        ByVal selector As System.Runtime.Serialization.ISurrogateSelector
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Public Property AssemblyFormat As FormatterAssemblyStyle
   Public Property Binder As SerializationBinder Implements IFormatter.Bi
   Public Property Context As StreamingContext Implements IFormatter.Cont
   Public Property SurrogateSelector As ISurrogateSelector Implements IFo
   Public Property TypeFormat As FormatterTypeStyle
' Public Instance Methods
   Public Function Deserialize(
        ByVal serializationStream As System.IO.Stream) As Object
        Implements IFormatter.Deserialize
   Public Function Deserialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal handler As System.Runtime.Remoting.Messaging.HeaderHandler)
        Implements IRemotingFormatter.Deserialize
   Public Function DeserializeMethodResponse(
```

```
        ByVal serializationStream As System.IO.Stream,
        ByVal handler As System.Runtime.Remoting.Messaging.HeaderHandler,
        ByVal methodCallMessage As System.Runtime.Remoting.Messaging.IMet
    Public Sub Serialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal graph As Object) Implements IFormatter.Serialize
    Public Sub Serialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal graph As Object,
        ByVal headers As System.Runtime.Remoting.Messaging.Header())
        Implements IRemotingFormatter.Serialize
End Class
```

## FormatterAssemblyStyle Enum

### System.Runtime.Serialization.Formatters (mscorlib.dll) *serializable*

This enumeration controls how assembly names are serialized. `Simple` serializes assemblies using the assembly name. The default, `Full`, includes the assembly name, its culture, public key token, a version.

```
Public Enum FormatterAssemblyStyle
    Simple = 0
    Full = 1
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `FormatterAssemblyStyle`

### Returned By

```
System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.AssemblyFo
System.Runtime.Serialization.Formatters.Soap.SoapFormatter.AssemblyFormat
```

### Passed To

```
System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.AssemblyFo
System.Runtime.Serialization.Formatters.Soap.SoapFormatter.AssemblyFormat
```

## FormatterTypeStyle Enum

**System.Runtime.Serialization.Formatters (mscorlib.dll)** ***serializable***

This enumeration controls how type information is specified for members. `TypesAlways` specifies that type information be placed in the serialization stream for all object members. The default, `TypesWhenNeeded`, places type information in the stream for the following: object arrays, members of type `System.Object`, and nonprimitive value types (such as structs and enums) that implement the `ISerializable` interface. `XsdString` can be bitwise-`OR`ed with another option to specify that strings are represented with the XSD format instead of the SOAP format.

```
Public Enum FormatterTypeStyle

   TypesWhenNeeded = 0

   TypesAlways = 1

   XsdString = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `FormatterTypeStyle`

### Returned By

`System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.TypeFormat`, `System.Runtime.Serialization.Formatters.Soap.SoapFormatter.TypeFormat`

### Passed To

`System.Runtime.Serialization.Formatters.Binary.BinaryFormatter.TypeFormat`, `System.Runtime.Serialization.Formatters.Soap.SoapFormatter.TypeFormat`

## IFieldInfo Interface

## System.Runtime.Serialization.Formatters (mscorlib.dll)

This interface can expose the field names and types of serialized objects. It is used to supply parameter type information to the `SoapFormatter` when deserializing in SOAP RPC format.

```
Public Interface IFieldInfo

' Public Instance Properties

   Public Property FieldNames As String()

   Public Property FieldTypes As Type()

End Interface
```

# ISoapMessage Interface

## System.Runtime.Serialization.Formatters (mscorlib.dll)

This type defines the interface used by SoapMessage. This interface is used to serialize and deserialize SOAP in RPC format.

```
Public Interface ISoapMessage

' Public Instance Properties

   Public Property Headers As Header()

   Public Property MethodName As String

   Public Property ParamNames As String()

   Public Property ParamTypes As Type()

   Public Property ParamValues As Object()

   Public Property XmlNameSpace As String

End Interface
```

### Implemented By

SoapMessage

### Returned By

System.Runtime.Serialization.Formatters.Soap.SoapFormatter.TopObject

### Passed To

System.Runtime.Serialization.Formatters.Soap.SoapFormatter.TopObject

## ServerFault NotInheritable Class

**System.Runtime.Serialization.Formatters (mscorlib.dll)** ***serializable***

This class represents an error that was thrown from a remote server to the client. It is placed in the `Detail` section of a `SoapFault` object.

```
Public NotInheritable Class ServerFault
' Public Constructors
   Public Sub New(ByVal exceptionType As String,
        ByVal message As String,
        ByVal stackTrace As String)
' Public Instance Properties
   Public Property ExceptionMessage As String
   Public Property ExceptionType As String
   Public Property StackTrace As String
End Class
```

### Passed To

`SoapFault.SoapFault()`

## SoapFault NotInheritable Class

## System.Runtime.Serialization.Formatters (mscorlib.dll) *serializable*

This class represents a SOAP fault.

```
Public NotInheritable Class SoapFault : Implements System.Runtime.Seriali
' Public Constructors
   Public Sub New()
   Public Sub New(ByVal faultCode As String,
        ByVal faultString As String,
        ByVal faultActor As String,
        ByVal serverFault As ServerFault)
' Public Instance Properties
   Public Property Detail As Object
   Public Property FaultActor As String
   Public Property FaultCode As String
   Public Property FaultString As String
' Public Instance Methods
   Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
        Implements ISerializable.GetObjectData
End Class
```

## SoapFormatter NotInheritable Class

### System.Runtime.Serialization.Formatters.Soap (system.runtime.serialization.formatters.soap.dll)

This formatter performs SOAP serialization or deserialization on a single object or an object graph.

```
Public NotInheritable Class SoapFormatter : Implements System.Runtime.Remo
        System.Runtime.Serialization.IFormatter
' Public Constructors
   Public Sub New()
   Public Sub New(
        ByVal selector As System.Runtime.Serialization.ISurrogateSelector
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Public Property AssemblyFormat As FormatterAssemblyStyle
   Public Property Binder As SerializationBinder Implements IFormatter.Bi
   Public Property Context As StreamingContext Implements IFormatter.Cont
   Public Property SurrogateSelector As ISurrogateSelector Implements IFo
   Public Property TopObject As ISoapMessage
   Public Property TypeFormat As FormatterTypeStyle
' Public Instance Methods
   Public Function Deserialize(
        ByVal serializationStream As System.IO.Stream) As Object Implemen
   Public Function Deserialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal handler As System.Runtime.Remoting.Messaging.HeaderHandler)
   Public Sub Serialize(
        ByVal serializationStream As System.IO.Stream,
        ByVal graph As Object) Implements IFormatter.Serialize
   Public Sub Serialize(
```

```
        ByVal serializationStream As System.IO.Stream,
        ByVal graph As Object,
        ByVal headers As System.Runtime.Remoting.Messaging.Header()) Impl
End Class
```

# SoapMessage Class

## System.Runtime.Serialization.Formatters (mscorlib.dll) *serializable*

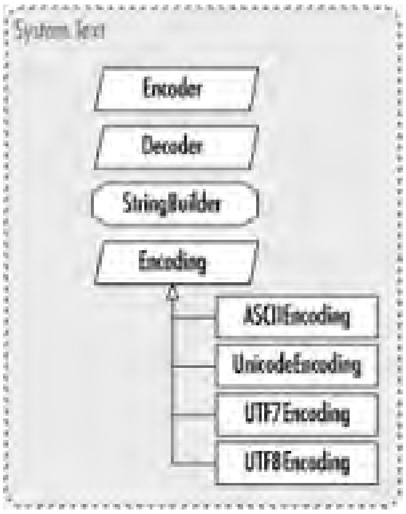
This type encapsulates a message sent as part of a SOAP RPC (Remote Procedure Call).

```
Public Class SoapMessage : Implements ISoapMessage
' Public Constructors
   Public Sub New()
' Public Instance Properties
   Public Property Headers As Header(
        ) Implements ISoapMessage.Headers
   Public Property MethodName As String Implements ISoapMessage.MethodNam
   Public Property ParamNames As String(
        ) Implements ISoapMessage.ParamNames
   Public Property ParamTypes As Type(
        ) Implements ISoapMessage.ParamTypes
   Public Property ParamValues As Object(
        ) Implements ISoapMessage.ParamValues
   Public Property XmlNameSpace As String Implements ISoapMessage.XmlName
End Class
```

# Chapter 18. System.Text

The `System.Text` namespace provides encoding and decoding capabilities for arrays of bytes and characters. These classes allow you to convert characters easily from different subsets of Unicode encodings, such as ASCII, UTF-8, and UTF-16. Additionally, a string-building class allows you to modify strings without creating intermediate string objects. Figure 18-1 shows the types in this namespace.

**Figure 18-1. The System.Text namespace**



## ASCIIEncoding Class

## System.Text (mscorlib.dll) *ECMA, serializable*

This class is a character encoding that encodes Unicode characters as 7-bit ASCII characters. ASCII uses the first 128 characters of a Unicode encoding.

```
Public Class ASCIIEncoding : Inherits Encoding

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overrides Public Function GetByteCount(

        ByVal chars As Char(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetByteCount(

        ByVal chars As String) As Integer

   Overrides Public Function GetBytes(ByVal chars As Char(),

        ByVal charIndex As Integer,

        ByVal charCount As Integer, ByVal bytes As Byte(),

        ByVal byteIndex As Integer) As Integer

   Overrides Public Function GetBytes(ByVal chars As String,

        ByVal charIndex As Integer,

        ByVal charCount As Integer, ByVal bytes As Byte(),

        ByVal byteIndex As Integer) As Integer

   Overrides Public Function GetCharCount(

        ByVal bytes As Byte(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetChars(ByVal bytes As Byte(),

        ByVal byteIndex As Integer,

        ByVal byteCount As Integer, ByVal chars As Char(),

        ByVal charIndex As Integer) As Integer

   Overrides Public Function GetMaxByteCount(
```

```
        ByVal charCount As Integer) As Integer
   Overrides Public Function GetMaxCharCount(
        ByVal byteCount As Integer) As Integer
   Overrides Public Function GetString(
        ByVal bytes As Byte()) As String
   Overrides Public Function GetString(ByVal bytes As Byte(),
        ByVal byteIndex As Integer,
        ByVal byteCount As Integer) As String
End Class
```

## Hierarchy

System.Object → Encoding → ASCIIEncoding

## Decoder MustInherit Class

## System.Text (mscorlib.dll) *ECMA, serializable*

This class converts byte arrays to character arrays using the encoding class from which it was constructed (a decoder is returned by the `GetDecoder()` method of an `Encoding` subclass). `Decoder` saves its state between calls to `GetChars()`, so leftover bytes from previous input byte arrays are remembered and used in subsequent calls.

```
Public MustInherit Class Decoder
' Protected Constructors
   Protected Sub New()
' Public Instance Methods
   MustInherit Public Function GetCharCount(
        ByVal bytes As Byte(), ByVal index As Integer,
        ByVal count As Integer) As Integer
   MustInherit Public Function GetChars(ByVal bytes As Byte(),
        ByVal byteIndex As Integer,
        ByVal byteCount As Integer, ByVal chars As Char(),
        ByVal charIndex As Integer) As Integer
End Class
```

### Returned By

`Encoding.GetDecoder()`

## Encoder MustInherit Class

## System.Text (mscorlib.dll) *ECMA, serializable*

`Encoding.GetEncoder()` returns an instance of this type, which converts character arrays to byte arrays using the encoding subclass from which it was constructed. This class exposes the `GetBytes()` method, which converts a sequence of character blocks into a sequence of byte blocks. Since `Encoder` maintains state between calls to `GetBytes()`, it can deal with partial sequences that occur at block boundaries.

The last argument to `GetBytes()` is a boolean that specifies whether the internal buffer is flushed after the method is called. If `true`, state information on the object is lost between blocks. If `false` (the default), the buffer is maintained. A call with flushing set to `true` is needed on the final call to `Encoding.GetBytes()` to close the byte array properly.

```
Public MustInherit Class Encoder
' Protected Constructors
   Protected Sub New()
' Public Instance Methods
   MustInherit Public Function GetByteCount(
        ByVal chars As Char(), ByVal index As Integer,
        ByVal count As Integer,
        ByVal flush As Boolean) As Integer
   MustInherit Public Function GetBytes(ByVal chars As Char(),
        ByVal charIndex As Integer,
        ByVal charCount As Integer, ByVal bytes As Byte(),
        ByVal byteIndex As Integer,
        ByVal flush As Boolean) As Integer
End Class
```

### Returned By

`Encoding.GetEncoder()`

## Encoding MustInherit Class

### System.Text (mscorlib.dll) *ECMA, serializable*

This class converts strings of Unicode characters to and from byte arrays. Derived classes implement specific encoding types. The `GetBytes()` method takes an array of characters and returns the corresponding array of bytes. The `GetChars()` method does the opposite conversion. `GetByteCount()` and `GetCharCount()` allow you to get the exact size of the encoding or decoding to size the output buffer appropriately.

The `GetEncoder()` and `GetDecoder()` methods create `Encoder` and `Decoder` instances that allow you to do encoding across sequential blocks in which partial byte codes may remain in the buffer.

```
Public MustInherit Class Encoding

' Protected Constructors

   Protected Sub New()

   Protected Sub New( ByVal codePage As Integer)

' Public Shared Properties

   Public Shared ReadOnly Property ASCII As Encoding

   Public Shared ReadOnly Property BigEndianUnicode As Encoding

   Public Shared ReadOnly Property Default As Encoding

   Public Shared ReadOnly Property Unicode As Encoding

   Public Shared ReadOnly Property UTF7 As Encoding

   Public Shared ReadOnly Property UTF8 As Encoding

' Public Instance Properties

   Overridable Public ReadOnly Property BodyName As String

   Overridable Public ReadOnly Property CodePage As Integer

   Overridable Public ReadOnly Property EncodingName As String

   Overridable Public ReadOnly Property HeaderName As String

   Overridable Public ReadOnly Property IsBrowserDisplay As Boolean

   Overridable Public ReadOnly Property IsBrowserSave As Boolean

   Overridable Public ReadOnly Property IsMailNewsDisplay As Boolean

   Overridable Public ReadOnly Property IsMailNewsSave As Boolean

   Overridable Public ReadOnly Property WebName As String
```

```
   Overridable Public ReadOnly Property WindowsCodePage As Integer
' Public Shared Methods
   Public Shared Function Convert(
        ByVal srcEncoding As Encoding,
        ByVal dstEncoding As Encoding,
        ByVal bytes As Byte()) As Byte()
   Public Shared Function Convert(
        ByVal srcEncoding As Encoding,
        ByVal dstEncoding As Encoding,
        ByVal bytes As Byte(), ByVal index As Integer,
        ByVal count As Integer) As Byte()
   Public Shared Function GetEncoding(
        ByVal codepage As Integer) As Encoding
   Public Shared Function GetEncoding(
        ByVal name As String) As Encoding
' Public Instance Methods
   Overrides Public Function Equals(
        ByVal value As Object) As Boolean
   Overridable Public Function GetByteCount(
        ByVal chars As Char()) As Integer
   MustInherit Public Function GetByteCount(
        ByVal chars As Char(), ByVal index As Integer,
        ByVal count As Integer) As Integer
   Overridable Public Function GetByteCount(
        ByVal s As String) As Integer
   Overridable Public Function GetBytes(
        ByVal chars As Char()) As Byte()
   Overridable Public Function GetBytes(ByVal chars As Char(),
        ByVal index As Integer,
        ByVal count As Integer) As Byte()
   Overridable Public Function GetBytes(
```

```
     ByVal s As String) As Byte()
MustInherit Public Function GetBytes(ByVal chars As Char(),
     ByVal charIndex As Integer,
     ByVal charCount As Integer, ByVal bytes As Byte(),
     ByVal byteIndex As Integer) As Integer
Overridable Public Function GetBytes(ByVal s As String,
     ByVal charIndex As Integer,
     ByVal charCount As Integer, ByVal bytes As Byte(),
     ByVal byteIndex As Integer) As Integer
Overridable Public Function GetCharCount(
     ByVal bytes As Byte()) As Integer
MustInherit Public Function GetCharCount(
     ByVal bytes As Byte(), ByVal index As Integer,
     ByVal count As Integer) As Integer
Overridable Public Function GetChars(
     ByVal bytes As Byte()) As Char()
Overridable Public Function GetChars(ByVal bytes As Byte(),
     ByVal index As Integer,
     ByVal count As Integer) As Char()
MustInherit Public Function GetChars(ByVal bytes As Byte(),
     ByVal byteIndex As Integer,
     ByVal byteCount As Integer, ByVal chars As Char(),
     ByVal charIndex As Integer) As Integer
Overridable Public Function GetDecoder() As Decoder
Overridable Public Function GetEncoder() As Encoder
Overrides Public Function GetHashCode() As Integer
MustInherit Public Function GetMaxByteCount(
     ByVal charCount As Integer) As Integer
MustInherit Public Function GetMaxCharCount(
     ByVal byteCount As Integer) As Integer
Overridable Public Function GetPreamble() As Byte()
```

```
    Overridable Public Function GetString(
        ByVal bytes As Byte()) As String
    Overridable Public Function GetString(
        ByVal bytes As Byte(), ByVal index As Integer,
        ByVal count As Integer) As String
End Class
```

## Subclasses

ASCIIEncoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

## Returned By

System.IO.StreamReader.CurrentEncoding, System.IO.TextWriter.Encoding, System.Xml.XmlParserContext.Encoding, System.Xml.XmlTextReader.Encoding, System.Xml.XmlValidatingReader.Encoding

## Passed To

System.IO.BinaryReader.BinaryReader(), System.IO.BinaryWriter.BinaryWriter(), System.IO.StreamReader.StreamReader(), System.IO.StreamWriter.StreamWriter(), System.String.String(), System.Xml.XmlParserContext.{Encoding, XmlParserContext()}, System.Xml.XmlTextWriter.XmlTextWriter()

## StringBuilder NotInheritable Class

## System.Text (mscorlib.dll) *ECMA, serializable*

This `String` helper class enables in-place modification of a string without having to create new string instances. Since strings are immutable, their values cannot change once set. (Attempts to assign a new value to an existing string succeed, but at the expense of destroying and re-creating the original string.) The `StringBuilder` constructor allows you to set the size of the `StringBuilder` and specify the initial string it contains. The `Insert()` methods put new data (of varying types) into the `StringBuilder` at a specified position. `Append()` adds data to the end of a `StringBuilder`. The `ToString()` method converts the `StringBuilder` into a real string.

```
Public NotInheritable Class StringBuilder

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal capacity As Integer)

   Public Sub New(ByVal capacity As Integer,

        ByVal maxCapacity As Integer)

   Public Sub New( ByVal value As String)

   Public Sub New(ByVal value As String,

        ByVal capacity As Integer)

   Public Sub New(ByVal value As String,

        ByVal startIndex As Integer,

        ByVal length As Integer, ByVal capacity As Integer)

' Public Instance Properties

   Public Property Capacity As Integer

   Public Default Property Chars(

        ByVal index As Integer) As Char

   Public Property Length As Integer

   Public ReadOnly Property MaxCapacity As Integer

' Public Instance Methods

   Public Function Append(

        ByVal value As Boolean) As StringBuilder

   Public Function Append(
```

```
        ByVal value As Byte) As StringBuilder
    Public Function Append(
        ByVal value As Char) As StringBuilder
    Public Function Append(
        ByVal value As Char()) As StringBuilder
    Public Function Append(ByVal value As Char(),
        ByVal startIndex As Integer,
        ByVal charCount As Integer) As StringBuilder
    Public Function Append(ByVal value As Char,
        ByVal repeatCount As Integer) As StringBuilder
    Public Function Append(
        ByVal value As Decimal) As StringBuilder
    Public Function Append(
        ByVal value As Double) As StringBuilder
    Public Function Append(
        ByVal value As Short) As StringBuilder
    Public Function Append(
        ByVal value As Integer) As StringBuilder
    Public Function Append(
        ByVal value As Long) As StringBuilder
    Public Function Append(
        ByVal value As Object) As StringBuilder
    Public Function Append(
        ByVal value As SByte) As StringBuilder
    Public Function Append(
        ByVal value As Single) As StringBuilder
    Public Function Append(
        ByVal value As String) As StringBuilder
    Public Function Append(ByVal value As String,
```

```
        ByVal startIndex As Integer,
        ByVal count As Integer) As StringBuilder
Public Function Append(
        ByVal value As UInt16) As StringBuilder
Public Function Append(
        ByVal value As UInt32) As StringBuilder
Public Function Append(
        ByVal value As UInt64) As StringBuilder
Public Function AppendFormat(
        ByVal provider As IFormatProvider,
        ByVal format As String,
        ParamArray args As Object()) As StringBuilder
Public Function AppendFormat(ByVal format As String,
        ByVal arg0 As Object) As StringBuilder
Public Function AppendFormat(ByVal format As String,
        ParamArray args As Object()) As StringBuilder
Public Function AppendFormat(ByVal format As String,
        ByVal arg0 As Object,
        ByVal arg1 As Object) As StringBuilder
Public Function AppendFormat(ByVal format As String,
        ByVal arg0 As Object, ByVal arg1 As Object,
        ByVal arg2 As Object) As StringBuilder
Public Function EnsureCapacity(
        ByVal capacity As Integer) As Integer
Public Function Equals(
        ByVal sb As StringBuilder) As Boolean
Public Function Insert(ByVal index As Integer,
        ByVal value As Boolean) As StringBuilder
Public Function Insert(ByVal index As Integer,
        ByVal value As Byte) As StringBuilder
Public Function Insert(ByVal index As Integer,
```

```
     ByVal value As Char) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Char()) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Char(), ByVal startIndex As Integer,
     ByVal charCount As Integer) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Decimal) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Double) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Short) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Integer) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Long) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Object) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As SByte) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As Single) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As String) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As String,
     ByVal count As Integer) As StringBuilder
Public Function Insert(ByVal index As Integer,
     ByVal value As UInt16) As StringBuilder
Public Function Insert(ByVal index As Integer,
```

```
        ByVal value As UInt32) As StringBuilder
    Public Function Insert(ByVal index As Integer,
        ByVal value As UInt64) As StringBuilder
    Public Function Remove(ByVal startIndex As Integer,
        ByVal length As Integer) As StringBuilder
    Public Function Replace(ByVal oldChar As Char,
        ByVal newChar As Char) As StringBuilder
    Public Function Replace(ByVal oldChar As Char,
        ByVal newChar As Char, ByVal startIndex As Integer,
        ByVal count As Integer) As StringBuilder
    Public Function Replace(ByVal oldValue As String,
        ByVal newValue As String) As StringBuilder
    Public Function Replace(ByVal oldValue As String,
        ByVal newValue As String,
        ByVal startIndex As Integer,
        ByVal count As Integer) As StringBuilder
    Overrides Public Function ToString() As String
    Public Function ToString(ByVal startIndex As Integer,
        ByVal length As Integer) As String
End Class
```

### Returned By

`System.IO.StringWriter.GetStringBuilder()`

### Passed To

`System.IO.StringWriter.StringWriter()`

## UnicodeEncoding Class

## System.Text (mscorlib.dll) *ECMA, serializable*

This class encodes Unicode characters as UTF-16, two-byte characters. This class supports little-endian and big-endian encodings. With zero arguments, the overloaded constructor for this class uses little-endian byte order by default. The two-argument constructor can use a boolean `true` as the first argument to specify big-endian byte order. If set to `true`, the second boolean argument specifies the inclusion of the Unicode byte-order mark in the resulting string. A `UnicodeEncoding` can also be obtained from two `Encoding` properties. A little-endian encoding is returned by `Encoding.Unicode`. A big-endian encoding is returned by `Encoding.BigEndianUnicode`.

```
Public Class UnicodeEncoding : Inherits Encoding

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal bigEndian As Boolean,

        ByVal byteOrderMark As Boolean)

' Public Shared Fields

   Public const CharSize As Integer                                    // =2

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal value As Object) As Boolean

   Overrides Public Function GetByteCount(

        ByVal chars As Char(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetByteCount(

        ByVal s As String) As Integer

   Overrides Public Function GetBytes(

        ByVal s As String) As Byte()

   Overrides Public Function GetBytes(ByVal chars As Char(),

        ByVal charIndex As Integer,

        ByVal charCount As Integer, ByVal bytes As Byte(),

        ByVal byteIndex As Integer) As Integer

   Overrides Public Function GetBytes(ByVal s As String,
```

```
        ByVal charIndex As Integer,
        ByVal charCount As Integer, ByVal bytes As Byte(),
        ByVal byteIndex As Integer) As Integer
   Overrides Public Function GetCharCount(
        ByVal bytes As Byte(), ByVal index As Integer,
        ByVal count As Integer) As Integer
   Overrides Public Function GetChars(ByVal bytes As Byte(),
        ByVal byteIndex As Integer,
        ByVal byteCount As Integer, ByVal chars As Char(),
        ByVal charIndex As Integer) As Integer
   Overrides Public Function GetDecoder() As Decoder
   Overrides Public Function GetHashCode() As Integer
   Overrides Public Function GetMaxByteCount(
        ByVal charCount As Integer) As Integer
   Overrides Public Function GetMaxCharCount(
        ByVal byteCount As Integer) As Integer
   Overrides Public Function GetPreamble() As Byte()
End Class
```

## Hierarchy

System.Object → Encoding → UnicodeEncoding

## UTF7Encoding Class

## System.Text (mscorlib.dll) *serializable*

This class encodes Unicode characters as UTF-7, 7-bit characters. UTF-7 is a Unicode Transformation of the US-ASCII character set, designed for safe use over common Internet mail and news gateways. RFC 2152, which defines UTF-7, specifies an optional set of characters in the character set, which may or may not be encoded, because they may interfere with mail-transfer header fields. The overloaded constructor has two forms that take this into account. With no arguments, the encoding object disallows the use of optional characters (such as exclamation points and dollar signs). With a single boolean argument set to `true`, these optional characters are allowed in the encoding.

```
Public Class UTF7Encoding : Inherits Encoding

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal allowOptionals As Boolean)

' Public Instance Methods

   Overrides Public Function GetByteCount(

        ByVal chars As Char(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetBytes(ByVal chars As Char(),

        ByVal charIndex As Integer,

        ByVal charCount As Integer, ByVal bytes As Byte(),

        ByVal byteIndex As Integer) As Integer

   Overrides Public Function GetCharCount(

        ByVal bytes As Byte(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetChars(ByVal bytes As Byte(),

        ByVal byteIndex As Integer,

        ByVal byteCount As Integer, ByVal chars As Char(),

        ByVal charIndex As Integer) As Integer

   Overrides Public Function GetDecoder() As Decoder

   Overrides Public Function GetEncoder() As Encoder

   Overrides Public Function GetMaxByteCount(
```

```
        ByVal charCount As Integer) As Integer
   Overrides Public Function GetMaxCharCount(
        ByVal byteCount As Integer) As Integer
End Class
```

## Hierarchy

System.Object → Encoding → UTF7Encoding

## UTF8Encoding Class

### System.Text (mscorlib.dll) *ECMA, serializable*

This class encodes Unicode characters as UTF-8, 8-bit characters. The overloaded constructor allows zero, one, or two boolean parameters. The first argument indicates whether the encoder should both emit the UTF-8 byte order mark code and recognize it. The second boolean argument specifies whether to throw an exception when invalid bytes are encountered.

```
Public Class UTF8Encoding : Inherits Encoding

' Public Constructors

   Public Sub New()

   Public Sub New(

        ByVal encoderShouldEmitUTF8Identifier As Boolean)

   Public Sub New(

        ByVal encoderShouldEmitUTF8Identifier As Boolean,

        ByVal throwOnInvalidBytes As Boolean)

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal value As Object) As Boolean

   Overrides Public Function GetByteCount(

        ByVal chars As Char(), ByVal index As Integer,

        ByVal count As Integer) As Integer

   Overrides Public Function GetByteCount(

        ByVal chars As String) As Integer

   Overrides Public Function GetBytes(

        ByVal s As String) As Byte()

   Overrides Public Function GetBytes(ByVal chars As Char(),

        ByVal charIndex As Integer,

        ByVal charCount As Integer, ByVal bytes As Byte(),

        ByVal byteIndex As Integer) As Integer

   Overrides Public Function GetBytes(ByVal s As String,
```

```
        ByVal charIndex As Integer,
        ByVal charCount As Integer, ByVal bytes As Byte(),
        ByVal byteIndex As Integer) As Integer
    Overrides Public Function GetCharCount(
        ByVal bytes As Byte(), ByVal index As Integer,
        ByVal count As Integer) As Integer
    Overrides Public Function GetChars(ByVal bytes As Byte(),
        ByVal byteIndex As Integer,
        ByVal byteCount As Integer, ByVal chars As Char(),
        ByVal charIndex As Integer) As Integer
    Overrides Public Function GetDecoder() As Decoder
    Overrides Public Function GetEncoder() As Encoder
    Overrides Public Function GetHashCode() As Integer
    Overrides Public Function GetMaxByteCount(
        ByVal charCount As Integer) As Integer
    Overrides Public Function GetMaxCharCount(
        ByVal byteCount As Integer) As Integer
    Overrides Public Function GetPreamble() As Byte()
End Class
```

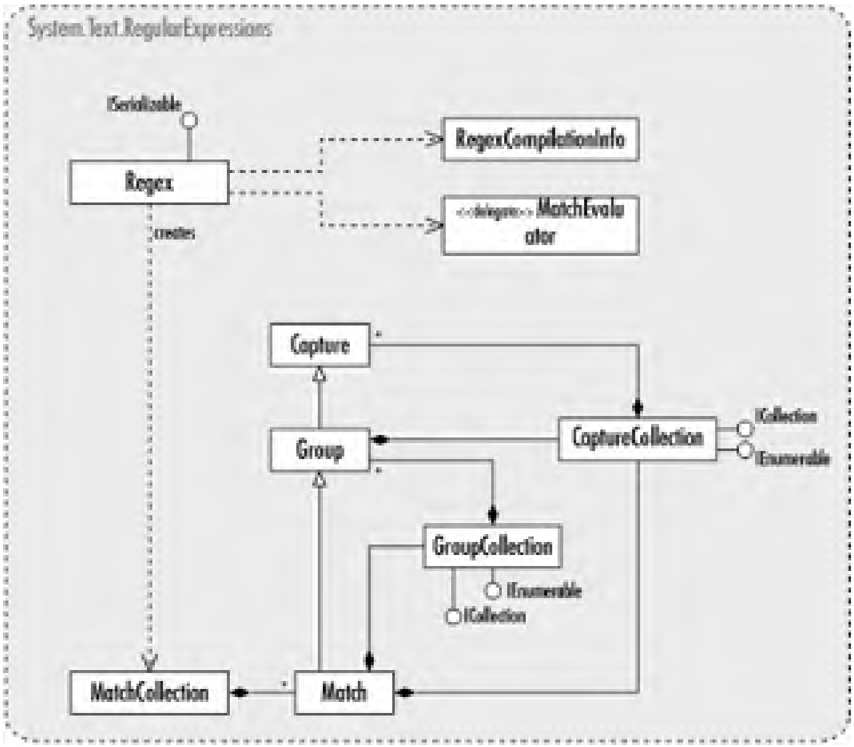
## Hierarchy

System.Object → Encoding → UTF8Encoding

# Chapter 19. System.Text.RegularExpressions

`System.Text.RegularExpressions` implements an object-oriented system for encapsulating regular expressions. The classes allow you to compile expressions and store matches that can be used with any .NET implementation regardless of the programming language. This namespace supports a regular expression syntax similar to Perl 5. Matches to the regular expression from an input string can be retrieved in fine granularity, allowing you to discern substring captures, groups, and multiple matches. Figure 19-1 shows the classes in this namespace.

**Figure 19-1. The System.Text.RegularExpressions namespace**



# Capture Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class represents a single result from a capturing group, which is a segment of a regular expression that is delineated, usually by parentheses. The parentheses signal .NET's regular expression engine to save that segment's result for later use. `Capture` objects compose the collection returned by `Group.Captures`. The `Value` property gets the captured substring. The `Index` property contains the starting position of the capture in the input string, while `Length` contains the length of the captured string.

```
Public Class Capture

' Public Instance Properties

   Public ReadOnly Property Index As Integer

   Public ReadOnly Property Length As Integer

   Public ReadOnly Property Value As String

' Public Instance Methods

   Overrides Public Function ToString() As String

End Class
```

### Subclasses

`Group`

### Returned By

`CaptureCollection.this`

# CaptureCollection Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class contains a set of captures acquired by a single capturing group. A `CaptureCollectior` `Group.Captures`. An integer indexer returns a single `Capture` object from this collection. The `Co` number of captures in the collection.

```
Public Class CaptureCollection : Implements ICollection, IEnumerable

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Public ReadOnly Property IsReadOnly As Boolean

   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect.

   Public Default ReadOnly Property Item(

        ByVal i As Integer) As Capture

   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn

' Public Instance Methods

   Public Sub CopyTo(ByVal array As Array,

        ByVal arrayIndex As Integer) Implements ICollection.CopyTo

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

End Class
```

### Returned By

`Group.Captures`

# Group Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class contains a group of results from a capturing group in a regular expression. A capturing group can return zero or more results depending on the use of quantifiers or nested groupings of a subexpression. `Captures` returns a `CaptureCollection` composed of individual `Capture` objects. `Captures` can use an indexer to return single results from the `CaptureCollection`.

You can treat a `Group` as an instance of its parent class (`Capture`) to get quick access to the last captured substring (an instance of `Group` is equal to the last item in its `Captures` property).

```
Public Class Group : Inherits Capture

' Public Instance Properties

   Public ReadOnly Property Captures As CaptureCollection

   Public ReadOnly Property Success As Boolean

' Public Shared Methods

   Public Shared Function Synchronized(

        ByVal inner As Group) As Group

End Class
```

### Hierarchy

`System.Object` → `Capture` → `Group`

### Subclasses

`Match`

### Returned By

`GroupCollection.this`

## GroupCollection Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class is a collection of the captured groups in a regular expression. A `GroupCollection` is in with the name of the capture group, or with an integer number of the capture group as determined i (give a name to a capture group by putting `?<name>` immediately after the opening parenthesis). S `Match.Groups("name")` would retrieve a capture from the subexpression `(?<name>expr)`, and would be the result from the first explicitly grouped subexpression. The entire regular expression is (an expression without any groupings is treated as a single group). A `GroupCollection` is return

```
Public Class GroupCollection : Implements ICollection, IEnumerable

' Public Instance Properties

   Public ReadOnly Property Count As Integer Implements ICollection.Count

   Public ReadOnly Property IsReadOnly As Boolean

   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect

   Public Default ReadOnly Property Item(

        ByVal groupnum As Integer) As Group

   Public Default ReadOnly Property Item(

        ByVal groupname As String) As Group

   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn

' Public Instance Methods

   Public Sub CopyTo(ByVal array As Array,

        ByVal arrayIndex As Integer) Implements ICollection.CopyTo

   Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

End Class
```

### Returned By

`Match.Groups`

# Match Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class is a single match result of a regular expression. As with `Capture` and `Group`, `Match` has no public constructor. It is returned by `Regex.Match()` or as a member of a `MatchCollection` returned by `Regex.Matches()`. A `Match` instance contains the groups that have been captured in a `GroupCollection` returned by `Groups`. A `Match` inherits from `Group` and is equivalent to the zero-indexed group in its `GroupCollection` (the same as `Groups(0)`).

The `NextMatch()` method finds the next match result in the search string, starting at the end of the previous match. This method disregards any zero-width assertions on the tail of an expression and begins explicitly after the position of the last character of the previous result (even an empty result).

The `Result()` method takes a replacement pattern and returns the resulting string based on the current match. A replacement pattern is an expression that uses the group replacement syntax, such as `$1` or `${name}`. `Result()` expands the replacement variables corresponding to the captured groups, within its current result, and returns the string.

```
Public Class Match : Inherits Group

' Public Shared Properties

   Public Shared ReadOnly Property Empty As Match

' Public Instance Properties

   Overridable Public ReadOnly Property Groups As GroupCollection

' Public Shared Methods

   Public Shared Function Synchronized(

        ByVal inner As Match) As Match

' Public Instance Methods

   Public Function NextMatch() As Match

   Overridable Public Function Result(

        ByVal replacement As String) As String

End Class
```

### Hierarchy

`System.Object` → `Capture` → `Group` → `Match`

### Returned By

`MatchCollection.this`, `Regex.Match()`

### Passed To

`MatchEvaluator.{BeginInvoke(),Invoke()}`



PREVIOUS NEXT

## MatchCollection Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class is a collection of `Match` objects returned by `Regex.Matches()`. This collection contains expression finds in the search string. The `Count` property returns the number of matches found in t

```
Public Class MatchCollection : Implements ICollection, IEnumerable
' Public Instance Properties
   Public ReadOnly Property Count As Integer Implements ICollection.Count
   Public ReadOnly Property IsReadOnly As Boolean
   Public ReadOnly Property IsSynchronized As Boolean Implements ICollect
   Overridable Public Default ReadOnly Property Item(
        ByVal i As Integer) As Match
   Public ReadOnly Property SyncRoot As Object Implements ICollection.Syn
' Public Instance Methods
   Public Sub CopyTo(ByVal array As Array,
        ByVal arrayIndex As Integer) Implements ICollection.CopyTo
   Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
End Class
```

### Returned By

`Regex.Matches()`

# MatchEvaluator Delegate

## System.Text.RegularExpressions (system.dll) *serializable*

This delegate can be called when a match is found during a `replace` operation. Several versions of the overloaded `Regex.Replace()` method take a `MatchEvaluator` as a parameter. `Regex.Replace()` walks through a search string looking for matches to a given expression and replaces each match using a specified replacement string. The `MatchEvaluator` delegate can be called on each match, getting passed the match result as a `Match` object.

```
Public Delegate Function MatchEvaluator(

        ByVal match As Match) As String
```

### Passed To

`Regex.Replace()`

## Regex Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class represents a regular expression. Use it to search for patterns in string data. It provides shared methods that search for a pattern without explicitly creating `Regex` instances as well as insta methods that allow you to interact with a `Regex` object.

The various shared methods employed by `Regex` take the input string to search for as the first argu and the regular expression pattern string as the second. This is equivalent to constructing a `Regex` instance with a pattern string, using it, and destroying it immediately. Most methods are overloaded instance methods as well. These do not require a pattern argument, as this is provided with the constructor.

The `Match()` and `Matches()` methods search an input string for a single match or all matches. Th overloads are the same. The first argument is the input string. You can specify which position in the string the search should start at using a second integer parameter. `Match()` also lets you specify th length of substring to search after that position. `IsMatch()` works the same way as `Match()`, exce that it returns a boolean indicating whether the string contains a match.

The `Split()` method acts like the `System.String.Split()` method. It uses the `Regex` pattern delimiter to split the input string into an array of substrings. (The delimiter is not included in the substrings.) You can provide a maximum number of substrings to return, in which case the last subs returned is the remainder of the input string. You can also specify the position to start in the input st and a `RegexOptions` parameter.

The `Replace()` method uses a replacement string to replace each pattern match in an input string The replacement string can include regular characters and backreference variable constructs (e.g., or `${name}`). `Replace()` can iterate through every match found in the input string, or it can specify maximum number of replacements to perform. `Replace()` can also take an argument specifying a `MatchEvaluator` delegate, which is called every time a match is found.

Two additional shared methods can transform strings used with regular expressions. `Escape()` converts a string containing regular expression metacharacters by replacing them with escaped equivalents (for example, `?` would be changed to `\?`). The set of metacharacters converted is `\`, `*`, `|`, `{`, `[`, `(`, `)`, `^`, `$`, `.`, `#`, and any whitespace. The `Unescape()` method replaces escaped character within a string with their unescaped equivalents. Use `Escape()` and `Unescape()` when you need use one of these metacharacters as a literal in a regular expression.

A set of instance methods for `Regex` provides information on the capturing groups contained in the expression. `GetGroupNames()` and `GetGroupNumbers()` each return an array containing the na of all the capture groups or numbers of all capture groups, respectively. The `GroupNameFromNumber()` and `GroupNumberFromName()` methods return the corresponding na or number from the argument given to them.

`CompileToAssembly()` allows you to create your own type for a regular expression object and sa to disk as an assembly. This is a shared method that takes a `RegexCompilationInfo` object and assembly information to build the type. The `RegexCompilationInfo` object contains the regular expression pattern and additional information needed for the compilation.

```
Public Class Regex : Implements System.Runtime.Serialization.ISerializabl

' Public Constructors

   Public Sub New( ByVal pattern As String)
```

```
   Public Sub New(ByVal pattern As String,
        ByVal options As RegexOptions)
' Protected Constructors
   Protected Sub New()
' Public Instance Properties
   Public ReadOnly Property Options As RegexOptions
   Public ReadOnly Property RightToLeft As Boolean
' Public Shared Methods
   Public Shared Sub CompileToAssembly(
        ByVal regexinfos As RegexCompilationInfo(),
        ByVal assemblyname As System.Reflection.AssemblyName)
   Public Shared Sub CompileToAssembly(
        ByVal regexinfos As RegexCompilationInfo(),
        ByVal assemblyname As System.Reflection.AssemblyName,
        ByVal attributes As System.Reflection.Emit.CustomAttributeBuilder
   Public Shared Sub CompileToAssembly(
        ByVal regexinfos As RegexCompilationInfo(),
        ByVal assemblyname As System.Reflection.AssemblyName,
        ByVal attributes As System.Reflection.Emit.CustomAttributeBuilder
        ByVal resourceFile As String)
   Public Shared Function Escape(
        ByVal str As String) As String
   Public Shared Function IsMatch(ByVal input As String,
        ByVal pattern As String) As Boolean
   Public Shared Function IsMatch(ByVal input As String,
        ByVal pattern As String,
        ByVal options As RegexOptions) As Boolean
   Public Shared Function Match(ByVal input As String,
        ByVal pattern As String) As Match
   Public Shared Function Match(ByVal input As String,
```

```
        ByVal pattern As String,
        ByVal options As RegexOptions) As Match
    Public Shared Function Matches(ByVal input As String,
        ByVal pattern As String) As MatchCollection
    Public Shared Function Matches(ByVal input As String,
        ByVal pattern As String,
        ByVal options As RegexOptions) As MatchCollection
    Public Shared Function Replace(ByVal input As String,
        ByVal pattern As String,
        ByVal evaluator As MatchEvaluator) As String
    Public Shared Function Replace(ByVal input As String,
        ByVal pattern As String,
        ByVal evaluator As MatchEvaluator,
        ByVal options As RegexOptions) As String
    Public Shared Function Replace(ByVal input As String,
        ByVal pattern As String,
        ByVal replacement As String) As String
    Public Shared Function Replace(ByVal input As String,
        ByVal pattern As String,
        ByVal replacement As String,
        ByVal options As RegexOptions) As String
    Public Shared Function Split(ByVal input As String,
        ByVal pattern As String) As String()
    Public Shared Function Split(ByVal input As String,
        ByVal pattern As String,
        ByVal options As RegexOptions) As String()
    Public Shared Function Unescape(
        ByVal str As String) As String
' Public Instance Methods
    Public Function GetGroupNames() As String()
    Public Function GetGroupNumbers() As Integer()
```

```
Public Function GroupNameFromNumber(
     ByVal i As Integer) As String
Public Function GroupNumberFromName(
     ByVal name As String) As Integer
Public Function IsMatch( ByVal input As String) As Boolean
Public Function IsMatch(ByVal input As String,
     ByVal startat As Integer) As Boolean
Public Function Match( ByVal input As String) As Match
Public Function Match(ByVal input As String,
     ByVal startat As Integer) As Match
Public Function Match(ByVal input As String,
     ByVal beginning As Integer,
     ByVal length As Integer) As Match
Public Function Matches(
     ByVal input As String) As MatchCollection
Public Function Matches(ByVal input As String,
     ByVal startat As Integer) As MatchCollection
Public Function Replace(ByVal input As String,
     ByVal evaluator As MatchEvaluator) As String
Public Function Replace(ByVal input As String,
     ByVal evaluator As MatchEvaluator,
     ByVal count As Integer) As String
Public Function Replace(ByVal input As String,
     ByVal evaluator As MatchEvaluator,
     ByVal count As Integer,
     ByVal startat As Integer) As String
Public Function Replace(ByVal input As String,
     ByVal replacement As String) As String
Public Function Replace(ByVal input As String,
```

```
        ByVal replacement As String,
        ByVal count As Integer) As String
    Public Function Replace(ByVal input As String,
        ByVal replacement As String,
        ByVal count As Integer,
        ByVal startat As Integer) As String
    Public Function Split( ByVal input As String) As String()
    Public Function Split(ByVal input As String,
        ByVal count As Integer) As String()
    Public Function Split(ByVal input As String,
        ByVal count As Integer,
        ByVal startat As Integer) As String()
    Overrides Public Function ToString() As String
' Protected Instance Methods
    Overrides Protected Sub Finalize()
    Protected Sub InitializeReferences()
    Protected Function UseOptionC() As Boolean
    Protected Function UseOptionR() As Boolean
End Class
```

### Passed To

System.Net.WebPermission.{AddPermission(),WebPermission()}

## RegexCompilationInfo Class

## System.Text.RegularExpressions (system.dll) *serializable*

This class holds the information that is needed to compile a regular expression to an assembly with `Regex.CompileToAssembly()`. The constructor takes five arguments, which correspond to its available properties: the pattern string, the `RegexOptions` option set, the name of the compiled type, the namespace for the type, and a boolean indicating if the type is public (`true`) or private (`false`).

```
Public Class RegexCompilationInfo
' Public Constructors
   Public Sub New(ByVal pattern As String,
        ByVal options As RegexOptions,
        ByVal name As String,
        ByVal fullnamespace As String,
        ByVal ispublic As Boolean)
' Public Instance Properties
   Public Property IsPublic As Boolean
   Public Property Name As String
   Public Property Namespace As String
   Public Property Options As RegexOptions
   Public Property Pattern As String
End Class
```

### Passed To

`Regex.CompileToAssembly()`

## RegexOptions Enum

**System.Text.RegularExpressions (system.dll)** ***serializable, flag***

This enumeration contains various options that affect the behavior of pattern matching in various methods from the `System.Text.RegularExpressions` namespace. The values of this enumeration are passed to these methods as a bitwise-OR combination of the specified options.

```
Public Enum RegexOptions
   None = &H000000000
   IgnoreCase = &H000000001
   Multiline = &H000000002
   ExplicitCapture = &H000000004
   Compiled = &H000000008
   Singleline = &H000000010
   IgnorePatternWhitespace = &H000000020
   RightToLeft = &H000000040
   ECMAScript = &H000000100
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `RegexOptions`

### Returned By

`Regex.Options, RegexCompilationInfo.Options`

### Passed To

`Regex.{IsMatch(), Match(), Matches(), Regex(), Replace(), Split()}, RegexCompilationInfo.{Options, RegexCompilationInfo()}`

# Chapter 20. System.Threading

A "thread" is an abstraction of the platform, providing the impression that the CPU is performing multiple tasks simultaneously; in essence, it offers to the programmer the ability to walk and chew gum at the same time. The .NET framework makes heavy use of threads throughout the system, both visibly and invisibly. The `System.Threading` namespace contains most of the baseline threading concepts, usable either directly or to help build higher-level constructs (as the .NET Framework Class Library frequently does).

The "thread" itself is sometimes referred to as a "lightweight process" (particularly within the Unix communities). This is because the thread, like the concept of a process, is simply an operating system (or, in the case of .NET, a CLR) abstraction. In the case of Win32 threads, the operating system is responsible for "switching" the necessary execution constructs (the registers and thread stack) on the CPU in order to execute the code on the thread, just as the OS does for multiple programs running simultaneously on the machine. The key difference between a process and a thread, however, is that each process gets its own inviolable memory space — its "process space" — that other processes cannot touch. All threads belong to a single process and share the same process space; therefore, threads can operate cooperatively on a single object. However, this is both an advantage and a disadvantage — if multiple threads can all access a single object, there arises the possibility that the threads will be acting concurrently against the object, leading to some interesting (and unrepeatable) results.

For example, one common problem in VB and MFC code was the inability to process user input while carrying out some other function; this was because the one (and only) thread used to process user input events (button clicks, menu selections, and so on) was also used to carry out the requests to the database, the calculation of results, the generation of pi to the millionth decimal place, and so on. Users could not negate actions ("Oh, shoot, I didn't mean to click that...."), because the user's UI actions — clicking a "Cancel" button, for example — wouldn't be processed until the non-UI action finished first. This would lead the user to believe that the program has "hung."

The first reaction might be to simply fire off every "action" from a UI event in its own thread; this would be a naive reaction at best, as a huge source of bugs and data corruption is more likely. Consider, for a moment, a simple UI that runs off to the database and performs a query when the user clicks a button. It would be tempting to simply spin the database query off in its own thread and update the UI if and when the database query completes.

The problems come up when the query returns — when do we put the results up? If the user has the ability to update the information (before the query results are returned), then does the new data overwrite the user's input? Or should the user's input overwrite the query results? What happens if the user clicks the button again? Should we fire off another query? Worse yet, what happens if the user has moved to a different part of the application? Should the UI "suddenly" flip back to the place from which the query was originated and update the values there? This would make it appear to the user that "some weird bug just took over" the program. But if the query silently updates the data, the user may wonder whether that query ever actually finished.

As is common with such capabilities, however, with power comes responsibility. Callous use of threads within an application can not only create these sorts of conundrums regarding UI design, but also lead to mysterious and inexplicable data corruption. Consider the simple expression `x = x + 5`. If `x` is a single object living in the heap, and two threads both simultaneously execute this code, one of several things can occur.

In the first case, the two threads are slightly ahead of or behind one another; the first thread obtains the value of `x`, adds 5, and stores that value back to `x`. The second thread, right behind it, does the same. `x` is incremented by 10. Consider the case, however, when both threads are in exactly the same place in the code. The first thread obtains the value of `x` (call it 10). The second thread gets switched in and loads the value of `x` (again, still 10). The first thread switches back in and increments its local value for `x` (which is 10, now 15). The second thread switches in and increments its local value for `x` (which is 10, now 15). The first thread stores its new local value for `x` back into `x` (15). The second thread switches in and stores its new local value for `x` (15). Both threads executed, yet the value of `x` grows by only 5, not 10, as should have happened.

For this reason, threads must often be held up in certain areas of code, in order to wait until another thread is finished. This is called "thread synchronization," sometimes colloquially referred to as "locks." It is the programmer's responsibility to ensure that any thread-sensitive code (such as the previous `x=x+5` example) is properly thread-synchronized. Within C++ and VB 6, this could only be done by making use of Win32 synchronization objects such as events and critical sections; however, a simpler mechanism is available in the CLR.

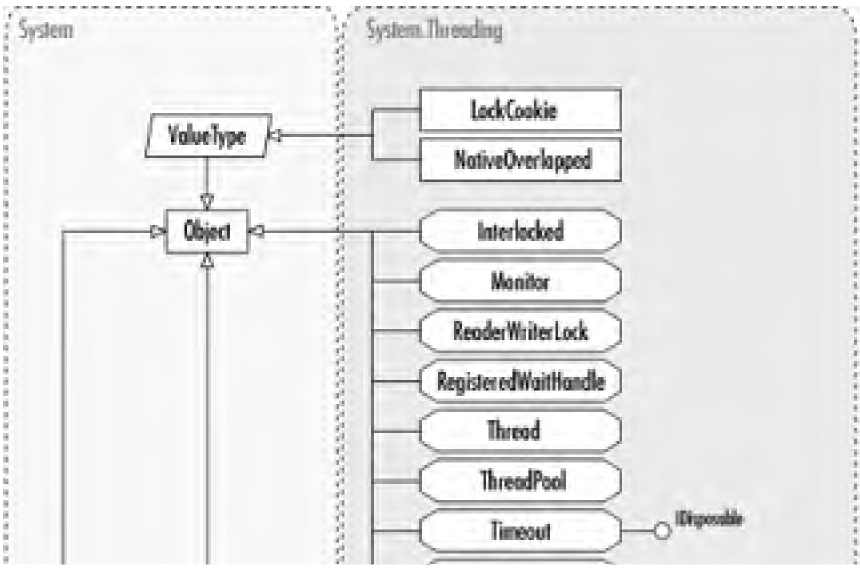
Each object can have a corresponding "monitor" associated with it. This monitor serves as thread-synchronization primitive, since only one thread within the CLR can "own" the monitor. Synchronization is then achieved by forcing threads to wait to acquire the monitor on the object before being allowed to continue; this is very similar to the Win32 critical section. (This monitor is an instance of the `Monitor` type; see that type for more details.)

Any time locks are introduced into a system, however, two dangers occur: safety and liveness. *Safety* refers to the presence of the kind of data corruption discussed earlier — the lack of enough thread synchronization. *Liveness* is the actual time the threads spend executing, and often represents the opposite danger as safety (the presence of too much thread synchronization, particularly the danger of *deadlock*: two threads frozen forever, each waiting for a lock the other one already holds). An excellent discussion of these two concepts can be found in Doug Lea's book *Concurrent Programming in Java: Design Principles and Pattern, Second Edition* (Addison Wesley, 1999). (Despite Java code samples, 99% of his discussion pertains to threading in .NET as well.)

Frequently programmers wish to perform some sort of asynchronous operation. One approach is to simply create a `Thread` object and start it off. Unfortunately, this is also somewhat wasteful, since the cost of creating a thread and destroying it (when the thread has finished executing) is quite high. For this reason, it is often more performant to "borrow" an existing and unused thread — this is the purpose of the `ThreadPool` type, and one such pool already exists for use by the CLR runtime for processes such as the asynchronous execution of delegates (see `System.Delegate` for more details).

Figure 20-1 shows many of the classes in this namespace. Figure 20-2 shows the delegates, exceptions, and event arguments. Figure 20-3 shows a state diagram for threads.

**Figure 20-1. The System.Threading namespace**



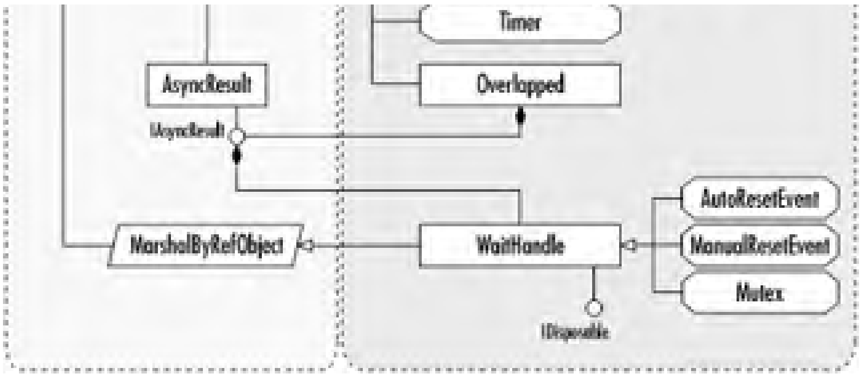



**Figure 20-2. Delegates, exceptions, and event arguments in the System.Threading namespace**

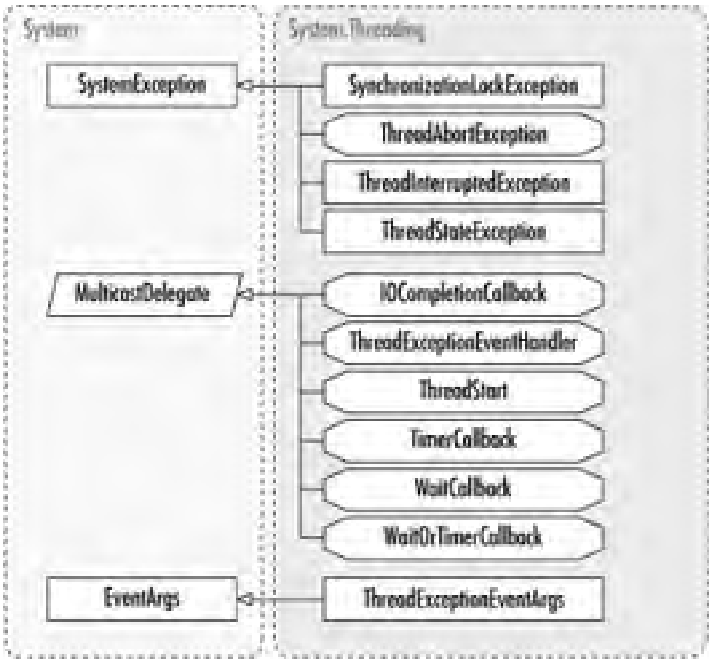
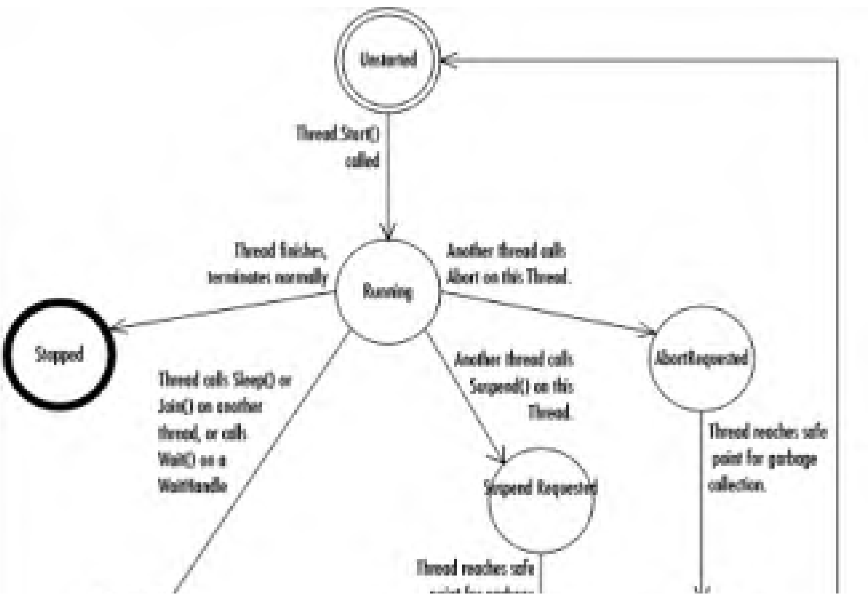
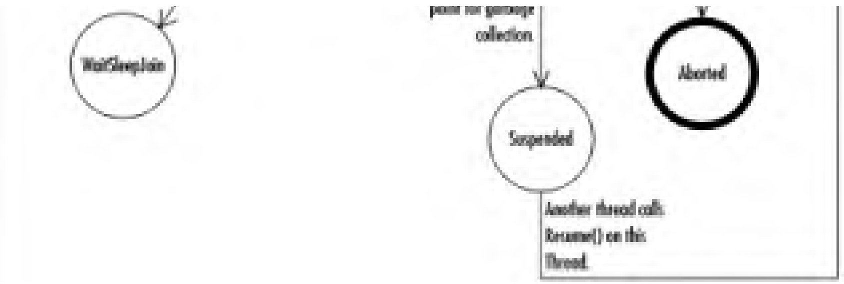



**Figure 20-3. Thread state transitions**




WaitSleepJoin
point for garbage
collection.
Aborted
Suspended
Another thread calls
Resume() on this
Thread.

# ApartmentState Enum

## System.Threading (mscorlib.dll) *serializable*

This type is entirely unnecessary for "normal" .NET code; it is needed only for COM interoperability capability.

Apartments are a COM-threading construct. There are two threading apartments: *single-threaded* (`STA`) and *multithreaded* (`MTA`). Once a thread joins an apartment, it cannot join another one. If you want to create or access a COM object from a thread, that thread must belong to an apartment. Further, a given COM component may only be compatible with a certain apartment state.

What if an `STA` thread needs to call a method on a COM object that is only compatible with `MTA` threads? In that case, a different thread that is already in the `MTA` state must service the request. The COM *Service Control Manager* either creates a new thread or uses one allocated for servicing remote procedure calls to accomplish this.

Threads in an `MTA` apartment cannot directly access `STA` threads either. Instead, the `STA` thread contains a message sink, and the method is invoked when the thread in that apartment is free. .NET objects do away with this requirement; however, if some of the threads call COM objects, they must first join an apartment. The `Thread` class usually handles this automatically, but you can join an apartment directly by assigning a parameter from this enumeration to the `Thread.ApartmentState` property. `Unknown` indicates that the thread has not joined an apartment.

```
Public Enum ApartmentState

   STA = 0

   MTA = 1

   Unknown = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ApartmentState`

### Returned By

`Thread.ApartmentState`

### Passed To

`Thread.ApartmentState`

## AutoResetEvent — NotInheritable Class

**System.Threading (mscorlib.dll)** — ***marshal by reference, disposable***

This class presents a `WaitHandle` with two states: signaled and nonsignaled. If nonsignaled, waiting threads block; otherwise they continue executing. It is constructed with an initial signal value and can be `Set()` to signaled or `Reset()` to nonsignaled. When signaled, the `AutoResetEvent` automatically resets to nonsignaled once a single blocking thread has been released. Calling `Set()` with no blocking threads causes it to remain signaled until another thread waits on it.

```
Public NotInheritable Class AutoResetEvent : Inherits WaitHandle

' Public Constructors

   Public Sub New( ByVal initialState As Boolean)

' Public Instance Methods

   Public Function Reset() As Boolean

   Public Function Set() As Boolean

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `WaitHandle(System.IDisposable)` → `AutoResetEvent`

## Interlocked NotInheritable Class

## System.Threading (mscorlib.dll) *ECMA*

The shared members of this class provide thread safety for common built-in arithmetic operations, such as increasing and decreasing a variable by one, and exchanging variables.

If two threads increment the same variable, one thread could be interrupted after both have retrieved the initial value of the variable. If this happens, then both operations store the same value, meaning that the variable has been incremented once instead of twice. The `Interlocked` methods protect against this kind of error. `Increment()` and `Decrement()` increase and decrease a variable by one, respectively, and `Exchange()` switches two variables. `CompareExchange()` compares the first two variables and, if `true`, assigns the third value to the first variable.

```
Public NotInheritable Class Interlocked
' Public Shared Methods
   Public Shared Function CompareExchange(
        ByRef location1 As Integer, ByVal value As Integer,
        ByVal comparand As Integer) As Integer
   Public Shared Function CompareExchange(
        ByRef location1 As Object, ByVal value As Object,
        ByVal comparand As Object) As Object
   Public Shared Function CompareExchange(
        ByRef location1 As Single, ByVal value As Single,
        ByVal comparand As Single) As Single
   Public Shared Function Decrement(
        ByRef location As Integer) As Integer
   Public Shared Function Decrement(
        ByRef location As Long) As Long
   Public Shared Function Exchange(ByRef location1 As Integer,
        ByVal value As Integer) As Integer
   Public Shared Function Exchange(ByRef location1 As Object,
        ByVal value As Object) As Object
   Public Shared Function Exchange(ByRef location1 As Single,
```

```
        ByVal value As Single) As Single
    Public Shared Function Increment(
        ByRef location As Integer) As Integer
    Public Shared Function Increment(
        ByRef location As Long) As Long
End Class
```

## IOCompletionCallback Delegate

## System.Threading (mscorlib.dll) *serializable*

This delegate is used to communicate with thread pools that are created using the Win32 API. This is a delegate to a method that will be called by an unmanaged process.

```
Public Delegate Sub IOCompletionCallback(
        ByVal errorCode As UInt32,
        ByVal numBytes As UInt32,
        ByVal *pOVERLAP As NativeOverlapped)
```

### Passed To

Overlapped.{Pack(),UnsafePack()}

## LockCookie Structure

## System.Threading (mscorlib.dll) *serializable*

This structure returns a `LockCookie` representing the type of lock (read or write) released. The same type of lock can be restored by calling `ReaderWriterLock.RestoreLock()`.

```
Public Structure LockCookie

' No public or protected members

End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `LockCookie`

### Returned By

`ReaderWriterLock.{ReleaseLock(),UpgradeToWriterLock()}`

### Passed To

`ReaderWriterLock.{DowngradeFromWriterLock(),RestoreLock()}`

## ManualResetEvent NotInheritable Class

**System.Threading (mscorlib.dll)** ***marshal by reference, disposable***

This class is a `WaitHandle` with two states: signaled and nonsignaled. If nonsignaled, waiting threads block. If signaled, they continue executing. It is constructed with an initial signal value and can be `Set()` to signaled or `Reset()` to nonsignaled. Once signaled, you must manually (hence the name of this type) call `Reset()` to revert it to nonsignaled.

```
Public NotInheritable Class ManualResetEvent : Inherits WaitHandle

' Public Constructors

   Public Sub New( ByVal initialState As Boolean)

' Public Instance Methods

   Public Function Reset() As Boolean

   Public Function Set() As Boolean

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `WaitHandle(System.IDisposable)` → `ManualResetEvent`

## Monitor NotInheritable Class

## System.Threading (mscorlib.dll) *ECMA*

This class contains shared methods for thread communication and synchronization. The `Enter()` and `Exit()` methods allow you to obtain and release a lock on an object, respectively. If an object lock has already been obtained by another thread, `Enter()` blocks and resumes executing when the lock is released.

Various languages have the ability to silently emit calls on this type as language built-in primitives. VB.NET's `SyncLock ... End SyncLock` syntax translates into these two methods: the beginning of the `lock` block is transformed into a call to `Enter()`, and the close of the block calls `Exit()`. (In the presence of exceptions and return calls, the VB.NET compiler must ensure the release of the monitor regardless of how the code exits the `SyncLock` block.)

`TryEnter()` attempts to obtain an object lock, but it continues executing and returns false if unsuccessful. `Wait()` releases an object lock and causes the current thread to wait until another thread calls `Pulse()` or `PulseAll()` on the same object. `Wait()` must be executed from a synchronized block of code.

```
Public NotInheritable Class Monitor

' Public Shared Methods

   Public Shared Sub Enter( ByVal obj As Object)

   Public Shared Sub Exit( ByVal obj As Object)

   Public Shared Sub Pulse( ByVal obj As Object)

   Public Shared Sub PulseAll( ByVal obj As Object)

   Public Shared Function TryEnter(

        ByVal obj As Object) As Boolean

   Public Shared Function TryEnter(ByVal obj As Object,

        ByVal millisecondsTimeout As Integer) As Boolean

   Public Shared Function TryEnter(ByVal obj As Object,

        ByVal timeout As TimeSpan) As Boolean

   Public Shared Function Wait(

        ByVal obj As Object) As Boolean

   Public Shared Function Wait(ByVal obj As Object,

        ByVal millisecondsTimeout As Integer) As Boolean

   Public Shared Function Wait(ByVal obj As Object,
```

```
        ByVal millisecondsTimeout As Integer,
        ByVal exitContext As Boolean) As Boolean
    Public Shared Function Wait(ByVal obj As Object,
        ByVal timeout As TimeSpan) As Boolean
    Public Shared Function Wait(ByVal obj As Object,
        ByVal timeout As TimeSpan,
        ByVal exitContext As Boolean) As Boolean
End Class
```

## Mutex NotInheritable Class

**System.Threading (mscorlib.dll)** ***marshal by reference, disposable***

A `Mutex` is an implementation of a `WaitHandle`. `ReleaseMutex()` releases a lock on a `WaitHandle`. A thread that owns a `Mutex` lock can call any of the `Wait()` methods (defined in the parent class, `WaitHandle`) without blocking, but must then release the `Mutex` the same number of times as the `Mutex` was obtained.

```
Public NotInheritable Class Mutex : Inherits WaitHandle
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal initiallyOwned As Boolean)
   Public Sub New(ByVal initiallyOwned As Boolean,
        ByVal name As String)
   Public Sub New(ByVal initiallyOwned As Boolean,
        ByVal name As String, ByRef createdNew As Boolean)
' Public Instance Methods
   Public Sub ReleaseMutex()
End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `WaitHandle(System.IDisposable)` → `Mutex`

# NativeOverlapped Structure

## System.Threading (mscorlib.dll)

This structure has the same layout as the Win32 `OVERLAPPED` structure, with extra reserved data at the end, which is provided for backward compatibility. Create a `NativeOverlapped` instance by calling `Overlapped.Pack()`. Each time an instance is created, it must be freed by calling the shared method `Overlapped.Free()` to avoid a memory leak.

```
Public Structure NativeOverlapped
' Public Instance Fields
   Public EventHandle As Integer
   Public InternalHigh As Integer
   Public InternalLow As Integer
   Public OffsetHigh As Integer
   Public OffsetLow As Integer
End Structure
```

### Hierarchy

`System.Object` → `System.ValueType` → `NativeOverlapped`

### Returned By

`Overlapped.{Pack(),UnsafePack()}`

### Passed To

`IOCompletionCallback.{BeginInvoke(),Invoke()},Overlapped.{Free(), Unpack()}`

# Overlapped Class

## System.Threading (mscorlib.dll)

This class encapsulates the Win32 API `OVERLAPPED` structure. `NativeOverlapped` is needed to mimic the structure the API expects, but this class encapsulates the overlapped structure into a .NET class. You can create `NativeOverlapped` structures by calling `Pack()`, and create `Overlapped` objects with the shared `Unpack()` method. To avoid a memory leak, each `NativeOverlapped` that you create must also be freed by calling the shared `Free()` method. `Unpack()` does *not* free the memory.

```
Public Class Overlapped

' Public Constructors

   Public Sub New()

   Public Sub New(ByVal offsetLo As Integer,

        ByVal offsetHi As Integer, ByVal hEvent As Integer,

        ByVal ar As IAsyncResult)

' Public Instance Properties

   Public Property AsyncResult As IAsyncResult

   Public Property EventHandle As Integer

   Public Property OffsetHigh As Integer

   Public Property OffsetLow As Integer

End Class
```

## ReaderWriterLock NotInheritable Class

## System.Threading (mscorlib.dll)

This class defines a lock that allows multiple readers, but only one writer. A thread can acquire a lock by calling `AcquireReaderLock()` or `AcquireWriterLock()`. `ReleaseReaderLock()` and `ReleaseWriterLock()` release the specific locks. Calling `ReleaseReaderLock()` on a writer lock releases both the writer lock and the reader lock. However, calling `ReleaseWriterLock()` on a reader lock throws a `System.ApplicationException`.

`ReleaseLock()` causes any lock to be released, but it returns a `LockCookie`, which represents the type of lock that `RestoreLock()` can use to obtain the same lock. `UpgradeToWriterLock()` upgrades a reader lock to a writer lock and returns a `LockCookie` representing the original reader lock. Pass that cookie to `DowngradeFromWriterLock()` to restore the original reader lock.

```
Public NotInheritable Class ReaderWriterLock

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public ReadOnly Property IsReaderLockHeld As Boolean

   Public ReadOnly Property IsWriterLockHeld As Boolean

   Public ReadOnly Property WriterSeqNum As Integer

' Public Instance Methods

   Public Sub AcquireReaderLock(

        ByVal millisecondsTimeout As Integer)

   Public Sub AcquireReaderLock( ByVal timeout As TimeSpan)

   Public Sub AcquireWriterLock(

        ByVal millisecondsTimeout As Integer)

   Public Sub AcquireWriterLock( ByVal timeout As TimeSpan)

   Public Function AnyWritersSince(

        ByVal seqNum As Integer) As Boolean

   Public Sub DowngradeFromWriterLock(

        ByRef lockCookie As LockCookie)

   Public Function ReleaseLock() As LockCookie

   Public Sub ReleaseReaderLock()
```

```
    Public Sub ReleaseWriterLock()

    Public Sub RestoreLock( ByRef lockCookie As LockCookie)

    Public Function UpgradeToWriterLock(

         ByVal millisecondsTimeout As Integer) As LockCookie

    Public Function UpgradeToWriterLock(

         ByVal timeout As TimeSpan) As LockCookie

End Class
```

# RegisteredWaitHandle NotInheritable Class

## System.Threading (mscorlib.dll) *marshal by reference*

`ThreadPool.RegisterWaitForSingleObject()` returns a `RegisteredWaitHandle`. To car registered wait (either a new one or one that continuously executes), use `Unregister()`.

```
Public NotInheritable Class RegisteredWaitHandle : Inherits MarshalByRefOl

' Public Instance Methods

   Public Function Unregister(

        ByVal waitObject As WaitHandle) As Boolean

' Protected Instance Methods

   Overrides Protected Sub Finalize()

End Class
```

### Hierarchy

`System.Object` → `System.MarshalByRefObject` → `RegisteredWaitHandle`

### Returned By

`ThreadPool.{RegisterWaitForSingleObject(),UnsafeRegisterWaitForSingleObje`

# SynchronizationLockException Class

## System.Threading (mscorlib.dll) *ECMA, serializable*

This exception is thrown when `Monitor.Exit()`, `Monitor.Pulse()`, `Monitor.PulseAll()`, or `Monitor.Wait()` is called from unsynchronized code.

```
Public Class SynchronizationLockException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → SynchronizationLockException

## Thread NotInheritable Class

## System.Threading (mscorlib.dll) *ECMA*

Most interaction with the `System.Threading` namespace occurs via the `Thread` type. This type encapsulates most of the logic needed to control the way threads behave.

The most commonly used shared methods, usually referred to as *thread relative statics*, are methods and properties that refer to the currently executing thread. `Sleep()` causes the calling thread to sleep for a specified amount of time. If for some reason the thread gets woken up, a `ThreadInterruptedException` is thrown. Because this method can only be called by the current thread and not on a reference to a thread that may also be executing, the thread sleeps immediately and does not need to wait for a safe point for garbage collection as the `Suspend()` method does (see later in this entry).

`GetData()` retrieves data from a specified slot in *thread local storage*. To use this method, slots need to be initialized already (see later in this section). `SetData()` stores data in *thread local storage* to be retrieved using `GetData()`. `AllocateDataSlot()` and `AllocateNamedDataSlot()` allocate a data slot for use with the previous two methods.

The `Thread` class also provides the shared property `CurrentThread`, which returns a reference to the `Thread` object for the currently running thread. The current thread can then access any of the following instance methods or properties on itself: `Abort()` causes a thread to abort, throwing a `ThreadAbortException` and executing any `finally` blocks. You may catch the `ThreadAbortException`, but it is automatically re-thrown unless you invoke `ResetAbort()`, which countermands the `Abort()` and lets the thread continue to live. `Interrupt()` interrupts a thread that is in the `ThreadState.WaitSleepJoin` state. If a thread is not in the `ThreadState.WaitSleepJoin` state, it is interrupted when it next attempts to enter that state (`Join()` causes the calling thread to enter that state). The calling thread only starts again once the referenced thread finishes executing and enters the `ThreadState.Stopped` state. `Suspend()` suspends a thread. The thread is suspended once it has reached a safe. The current thread can then access any of the following instance methods or properties on itself and point for garbage collection. `Resume()` resumes a thread that is in the suspended state. Threads in the suspended state are resumed regardless of how many times `Suspend()` was called. `Start()` tells a thread to start executing.

```
Public NotInheritable Class Thread

' Public Constructors

   Public Sub New( ByVal start As ThreadStart)

' Public Shared Properties

   Public Shared ReadOnly Property CurrentContext As Context

   Public Shared Property CurrentPrincipal As IPrincipal

   Public Shared ReadOnly Property CurrentThread As Thread

' Public Instance Properties

   Public Property ApartmentState As ApartmentState

   Public Property CurrentCulture As CultureInfo
```

```
   Public Property CurrentUICulture As CultureInfo
   Public ReadOnly Property IsAlive As Boolean
   Public Property IsBackground As Boolean
   Public ReadOnly Property IsThreadPoolThread As Boolean
   Public Property Name As String
   Public Property Priority As ThreadPriority
   Public ReadOnly Property ThreadState As ThreadState
' Public Shared Methods
   Public Shared Function AllocateDataSlot(
        ) As LocalDataStoreSlot
   Public Shared Function AllocateNamedDataSlot(
        ByVal name As String) As LocalDataStoreSlot
   Public Shared Sub FreeNamedDataSlot( ByVal name As String)
   Public Shared Function GetData(
        ByVal slot As LocalDataStoreSlot) As Object
   Public Shared Function GetDomain() As AppDomain
   Public Shared Function GetDomainID() As Integer
   Public Shared Function GetNamedDataSlot(
        ByVal name As String) As LocalDataStoreSlot
   Public Shared Sub ResetAbort()
   Public Shared Sub SetData(ByVal slot As LocalDataStoreSlot,
        ByVal data As Object)
   Public Shared Sub Sleep(
        ByVal millisecondsTimeout As Integer)
   Public Shared Sub Sleep( ByVal timeout As TimeSpan)
   Public Shared Sub SpinWait( ByVal iterations As Integer)
' Public Instance Methods
   Public Sub Abort()
   Public Sub Abort( ByVal stateInfo As Object)
   Public Sub Interrupt()
```

```
    Public Function Join(
         ByVal millisecondsTimeout As Integer) As Boolean
    Public Function Join(ByVal timeout As TimeSpan) As Boolean
    Public Sub Join()
    Public Sub Resume()
    Public Sub Start()
    Public Sub Suspend()
' Protected Instance Methods
    Overrides Protected Sub Finalize()
End Class
```

### Returned By

`System.Runtime.InteropServices.Marshal.GetThreadFromFiberCookie()`

### Passed To

`System.Diagnostics.StackTrace.StackTrace()`

## ThreadAbortException NotInheritable Class

## System.Threading (mscorlib.dll) *ECMA, serializable*

This exception is thrown on a running thread when `Thread.Abort()` is called. This exception is catchable, but it is automatically rethrown (see `Thread` for more details).

```
Public NotInheritable Class ThreadAbortException : Inherits SystemExcepti

' Public Instance Properties

   Public ReadOnly Property ExceptionState As Object

End Class
```

### Hierarchy

```
System.Object →
System.Exception(System.Runtime.Serialization.ISerializable) →
System.SystemException → ThreadAbortException
```

# ThreadExceptionEventArgs Class

## System.Threading (system.dll)

This class represents the event arguments passed to a `ThreadExceptionEventHandler`. `Exception` contains the exception raised.

```
Public Class ThreadExceptionEventArgs : Inherits EventArgs

' Public Constructors

   Public Sub New( ByVal t As Exception)

' Public Instance Properties

   Public ReadOnly Property Exception As Exception

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `ThreadExceptionEventArgs`

### Passed To

`ThreadExceptionEventHandler.{BeginInvoke(), Invoke()}`

## ThreadExceptionEventHandler Delegate

## System.Threading (system.dll) *serializable*

This event handler allows an event to be raised whenever a thread exception occurs. The `System.Windows.Forms.Application.ThreadException` property allows you to set one of these handlers, which takes the sender and `ThreadExceptionEventArgs` as arguments. The `ThreadExceptionEventArgs` object contains the exception raised.

```
Public Delegate Sub ThreadExceptionEventHandler(
        ByVal sender As Object,
        ByVal e As ThreadExceptionEventArgs)
```

# ThreadInterruptedException Class

## System.Threading (mscorlib.dll) *serializable*

This exception is thrown on a thread in the `ThreadState.WaitSleepJoin` state when `Thread.Interrupt()` is called.

```
Public Class ThreadInterruptedException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`System.Object` → `System.Exception(System.Runtime.Serialization.ISerializable)` → `System.SystemException` → `ThreadInterruptedException`

## ThreadPool NotInheritable Class

## System.Threading (mscorlib.dll)

Creating or destroying a thread takes a fair amount of work. Therefore, if you pool threads, your program executes more efficiently since you get rid of the overhead associated with creating and destroying threads. There is one thread pool per process. To queue work to execute by this pool of *worker threads*, call any of the `ThreadPool` shared methods. `QueueUserWorkItem()` queues a delegate to execute when one of the pool's threads becomes free. `RegisterWaitForSingleObject()` takes a `WaitHandle` and executes the specified method either when the `WaitHandle` is in the signaled state or when a time-out occurs. `BindHandle()` and `UnsafeQueueUserWorkItem()` are provided for compatibility with the Win32 API.

```
Public NotInheritable Class ThreadPool

' Public Shared Methods

   Public Shared Function BindHandle(

        ByVal osHandle As IntPtr) As Boolean

   Public Shared Sub GetAvailableThreads(

        ByRef workerThreads As Integer,

        ByRef completionPortThreads As Integer)

   Public Shared Sub GetMaxThreads(

        ByRef workerThreads As Integer,

        ByRef completionPortThreads As Integer)

   Public Shared Function QueueUserWorkItem(

        ByVal callBack As WaitCallback) As Boolean

   Public Shared Function QueueUserWorkItem(

        ByVal callBack As WaitCallback,

        ByVal state As Object) As Boolean

   Public Shared Function RegisterWaitForSingleObject(

        ByVal waitObject As WaitHandle,

        ByVal callBack As WaitOrTimerCallback,

        ByVal state As Object,

        ByVal millisecondsTimeOutInterval As Integer,

        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle

   Public Shared Function RegisterWaitForSingleObject(
```

```
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object,
        ByVal millisecondsTimeOutInterval As Long,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
Public Shared Function RegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object, ByVal timeout As TimeSpan,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
Public Shared Function RegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object,
        ByVal millisecondsTimeOutInterval As UInt32,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
Public Shared Function UnsafeQueueUserWorkItem(
        ByVal callBack As WaitCallback,
        ByVal state As Object) As Boolean
Public Shared Function UnsafeRegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object,
        ByVal millisecondsTimeOutInterval As Integer,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
Public Shared Function UnsafeRegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object,
        ByVal millisecondsTimeOutInterval As Long,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
```

```
    Public Shared Function UnsafeRegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object, ByVal timeout As TimeSpan,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
    Public Shared Function UnsafeRegisterWaitForSingleObject(
        ByVal waitObject As WaitHandle,
        ByVal callBack As WaitOrTimerCallback,
        ByVal state As Object,
        ByVal millisecondsTimeOutInterval As UInt32,
        ByVal executeOnlyOnce As Boolean) As RegisteredWaitHandle
End Class
```

# ThreadPriority Enum

## System.Threading (mscorlib.dll) *ECMA, serializable*

This enumeration encapsulates the various thread priorities. Threads are scheduled to be executed based on their priority; they default to `Normal` priority. The runtime can also update thread priorities if a program window is moved between the foreground and background. This is done automatically when you create windowed applications.

```
Public Enum ThreadPriority
   Lowest = 0
   BelowNormal = 1
   Normal = 2
   AboveNormal = 3
   Highest = 4
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ThreadPriority`

### Returned By

`Thread.Priority`

### Passed To

`Thread.Priority`

## ThreadStart Delegate

### System.Threading (mscorlib.dll) *ECMA, serializable*

This delegate specifies a method for a thread to start executing.

```
Public Delegate Sub ThreadStart()
```

### Passed To

```
Thread.Thread()
```

## ThreadState Enum

## System.Threading (mscorlib.dll) *ECMA, serializable, flag*

This enumeration encapsulates the various states a thread may be in. A thread starts in the `Unstarted` state. Once the `Thread.Start()` method is called, a thread enters the `Running` state. If another thread calls `Thread.Abort()` at any time, the thread shifts into the `AbortRequested` state, and then into `Aborted` once the thread reaches a safe point for garbage collection.

If the running thread calls either the shared method `Thread.Sleep()`, any of the `Wait()` methods on a `WaitHandle`, or `Thread.Join()` on another thread, the executing thread enters the `WaitSleepJoin` state.

If another thread calls `Thread.Interrupt()` on a thread in the `WaitSleepJoin` state, the thread again enters the `Running` state. When another thread calls `Thread.Suspend()` on a thread, it enters the `SuspendRequested` state. Once a thread in the `SuspendRequested` state reaches a safe point for garbage collection, it enters the `Suspended` state. A thread then leaves the `Suspended` state and enters the running state when another thread calls `Thread.Resume()` on it. When a thread has finished running, it enters the `Stopped` state.

Once a thread has started, it cannot return to the `Unstarted` state. Similarly, once a thread has aborted or stopped, it cannot return to the `Running` state. This enumeration is marked with a `<Flags()>` attribute, which allows a thread to be in more than one state at a time. For example, if a thread is in the `WaitSleepJoin` and another thread calls `Thread.Abort()` on it, it will be in both the `WaitSleepJoin` and `AbortRequested` states at the same time.

```
Public Enum ThreadState

   Running = &H000000000

   StopRequested = &H000000001

   SuspendRequested = &H000000002

   Background = &H000000004

   Unstarted = &H000000008

   Stopped = &H000000010

   WaitSleepJoin = &H000000020

   Suspended = &H000000040

   AbortRequested = &H000000080

   Aborted = &H000000100

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → ThreadState

### Returned By

Thread.ThreadState

# ThreadStateException Class

## System.Threading (mscorlib.dll) *ECMA, serializable*

This exception is thrown when an invalid method is called on a thread. For example, once a thread has started, it cannot re-enter the `ThreadState.Unstarted` state. Therefore, an attempt to call `Thread.Start()` on that thread throws this exception.

```
Public Class ThreadStateException : Inherits SystemException

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal message As String)

   Public Sub New(ByVal message As String,

        ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

`System.Object` → `System.Exception(System.Runtime.Serialization.ISerializable)` → `System.SystemException` → `ThreadStateException`

## Timeout NotInheritable Class

## System.Threading (mscorlib.dll) *ECMA*

This class provides a shared `Infinite` property, which is defined as -1 for use with methods that stop a thread's execution for a specific time period.

```
Public NotInheritable Class Timeout

' Public Shared Fields

   Public const Infinite As Integer                              // =-1

End Class
```

## Timer NotInheritable Class

**System.Threading (mscorlib.dll)** ***ECMA, marshal by reference, disposable***

This class can execute actions on a periodic basis. Actions can be performed once or multiple times takes a `TimerCallback` delegate, a state `object`, a due time, and a period. Both due time and pe in milliseconds. Use the state argument to hold state information between delegate calls, or pass in have any state to maintain. After the timer is created, it begins counting down until due time has exp invokes the delegate. The period is the amount of time to wait between delegate invocations before countdown again.

If the period is zero, the timer executes only once. If either due time or period are negative (and not `Timeout.Infinite`), the constructor fails, throwing an `System.ArgumentOutOfRangeExcept` changes the due time and period after the timer is created. Specify a due time of `Timeout.Infini` timer. An `Infinite` period prevents the timer from being raised repeatedly.

```
Public NotInheritable Class Timer : Inherits MarshalByRefObject : Impleme

' Public Constructors

   Public Sub New(ByVal callback As TimerCallback,

        ByVal state As Object, ByVal dueTime As Integer,

        ByVal period As Integer)

   Public Sub New(ByVal callback As TimerCallback,

        ByVal state As Object, ByVal dueTime As Long,

        ByVal period As Long)

   Public Sub New(ByVal callback As TimerCallback,

        ByVal state As Object, ByVal dueTime As TimeSpan,

        ByVal period As TimeSpan)

   Public Sub New(ByVal callback As TimerCallback,

        ByVal state As Object, ByVal dueTime As UInt32,

        ByVal period As UInt32)

' Public Instance Methods

   Public Function Change(ByVal dueTime As Integer,

        ByVal period As Integer) As Boolean

   Public Function Change(ByVal dueTime As Long,

        ByVal period As Long) As Boolean

   Public Function Change(ByVal dueTime As TimeSpan,
```

```
        ByVal period As TimeSpan) As Boolean
   Public Function Change(ByVal dueTime As UInt32,
        ByVal period As UInt32) As Boolean
   Public Function Dispose(
        ByVal notifyObject As WaitHandle) As Boolean
   Public Sub Dispose() Implements IDisposable.Dispose
' Protected Instance Methods
   Overrides Protected Sub Finalize()
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → Timer(System.IDisposable)

## TimerCallback Delegate

## System.Threading (mscorlib.dll) *ECMA, serializable*

Use this delegate with `Timer`.

```
Public Delegate Sub TimerCallback( ByVal state As Object)
```

### Passed To

`Timer.Timer()`

## WaitCallback Delegate

### System.Threading (mscorlib.dll) *serializable*

This delegate is for a `ThreadPool` work item.

```
Public Delegate Sub WaitCallback( ByVal state As Object)
```

### Passed To

`ThreadPool.{QueueUserWorkItem(),UnsafeQueueUserWorkItem()}`

## WaitHandle — MustInherit Class

**System.Threading (mscorlib.dll)** — ***ECMA, marshal by reference, disposable***

This class encapsulates much of the logic for dealing with synchronization handles, which allow mu synchronization control than simple thread locking. Once you have references to one or more Wait use the shared `WaitOne()` or `WaitAny()` methods to obtain a lock on any single handle or all of t respectively. The `WaitOne()` instance method acquires the lock for a specific `WaitHandle`. If a th cannot obtain the necessary locks, it enters the `ThreadState.WaitSleepJoin` state until the loc

```
Public MustInherit Class WaitHandle : Inherits MarshalByRefObject : Imple

' Public Constructors

   Public Sub New()

' Public Shared Fields

   Public const WaitTimeout As Integer                              // =258

' Protected Shared Fields

   protected Shared ReadOnly InvalidHandle As IntPtr                // =-1

' Public Instance Properties

   Overridable Public Property Handle As IntPtr

' Public Shared Methods

   Public Shared Function WaitAll(

        ByVal waitHandles As WaitHandle()) As Boolean

   Public Shared Function WaitAll(

        ByVal waitHandles As WaitHandle(),

        ByVal millisecondsTimeout As Integer,

        ByVal exitContext As Boolean) As Boolean

   Public Shared Function WaitAll(

        ByVal waitHandles As WaitHandle(),

        ByVal timeout As TimeSpan,

        ByVal exitContext As Boolean) As Boolean

   Public Shared Function WaitAny(

        ByVal waitHandles As WaitHandle()) As Integer

   Public Shared Function WaitAny(
```

```
        ByVal waitHandles As WaitHandle(),
        ByVal millisecondsTimeout As Integer,
        ByVal exitContext As Boolean) As Integer
   Public Shared Function WaitAny(
        ByVal waitHandles As WaitHandle(),
        ByVal timeout As TimeSpan,
        ByVal exitContext As Boolean) As Integer
' Public Instance Methods
   Overridable Public Sub Close()
   Overridable Public Function WaitOne() As Boolean
   Overridable Public Function WaitOne(
        ByVal millisecondsTimeout As Integer,
        ByVal exitContext As Boolean) As Boolean
   Overridable Public Function WaitOne(
        ByVal timeout As TimeSpan,
        ByVal exitContext As Boolean) As Boolean
' Protected Instance Methods
   Overridable Protected Sub Dispose(
        ByVal explicitDisposing As Boolean)
   Overrides Protected Sub Finalize()
End Class
```

### Hierarchy

System.Object → System.MarshalByRefObject → WaitHandle(System.IDisposab

### Subclasses

AutoResetEvent, ManualResetEvent, Mutex

### Returned By

System.IAsyncResult.AsyncWaitHandle, System.IO.Stream.CreateWaitHandle()

### Passed To

RegisteredWaitHandle.Unregister(), ThreadPool.{RegisterWaitForSingleObject

`UnsafeRegisterWaitForSingleObject()}`, `Timer.Dispose()`

## WaitOrTimerCallback Delegate

## System.Threading (mscorlib.dll) *serializable*

This delegate is passed to a `ThreadPool`. If the `wasSignaled` parameter is `true`, then the delegate is invoked in response to a signal; otherwise, it is invoked because the handle timed out.

```
Public Delegate Sub WaitOrTimerCallback(

        ByVal state As Object, ByVal timedOut As Boolean)
```

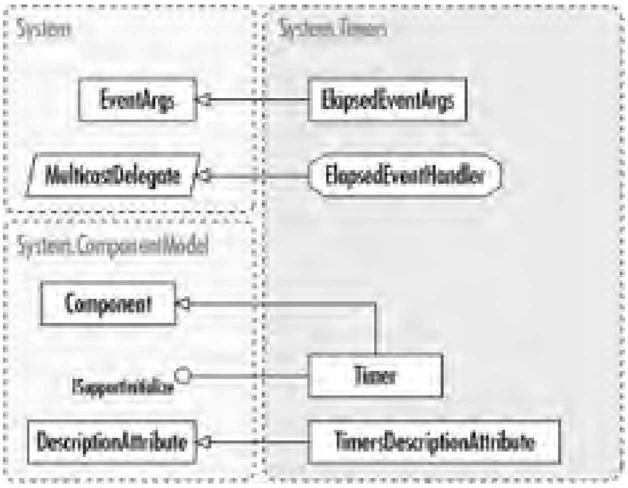
### Passed To

`ThreadPool.{RegisterWaitForSingleObject(), UnsafeRegisterWaitForSingleObject()}`

# Chapter 21. System.Timers

The System.Timers namespace provides the Timer class, which periodically raises an Elapsed event. It is a server-based component designed to be used in a multithreaded environment and is thus more accurate than many other Windows-based timers. Unlike System.Windows.Forms.Timer, a server-based timer is not dependent on a user interface message pump. Figure 21-1 shows the class diagram for this namespace.

### Figure 21-1. The System.Timers namespace



# ElapsedEventArgs Class

## System.Timers (system.dll)

This class offers the arguments for an `ElapsedEventHandler`.

```
Public Class ElapsedEventArgs : Inherits EventArgs

' Public Instance Properties

   Public ReadOnly Property SignalTime As Date

End Class
```

### Hierarchy

`System.Object` → `System.EventArgs` → `ElapsedEventArgs`

### Passed To

`ElapsedEventHandler.{BeginInvoke(),Invoke()}`

## ElapsedEventHandler Delegate

## System.Timers (system.dll) *serializable*

This delegate is used for the `Timer.Elapsed` event.

```
Public Delegate Sub ElapsedEventHandler(
        ByVal sender As Object,
        ByVal e As ElapsedEventArgs)
```

### Associated Events

`Timer.Elapsed()`

## Timer Class

**System.Timers (system.dll)** ***marshal by reference, disposable***

This class raises an event at regular intervals. It is a server-based timer, which provides much more accuracy than normal Windows timers and ensures that the event is raised at the proper time. To use a `Timer`, set the `Elapsed` event, the `Interval` property, and `Enabled` to `true`. `Start()` and `Stop()` provide shortcuts, which respectively assign `true` and `false` to `Enabled`. `AutoReset` allows you to specify whether the event should be raised only once or periodically. The default is `true`, which makes the `Timer` periodic.

```
Public Class Timer : Inherits System.ComponentModel.Component : Implements
        System.ComponentModel.ISupportInitialize
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal interval As Double)
' Public Instance Properties
   Public Property AutoReset As Boolean
   Public Property Enabled As Boolean
   Public Property Interval As Double
   Overrides Public Property Site As ISite
   Public Property SynchronizingObject As ISynchronizeInvoke
' Public Instance Methods
   Public Sub BeginInit(
        ) Implements ISupportInitialize.BeginInit
   Public Sub Close()
   Public Sub EndInit() Implements ISupportInitialize.EndInit
   Public Sub Start()
   Public Sub Stop()
' Protected Instance Methods
   Overrides Protected Sub Dispose(ByVal disposing As Boolean)
' Events
   Public Event Elapsed As ElapsedEventHandler
```

```
End Class
```

## Hierarchy

System.Object → System.MarshalByRefObject → System.ComponentModel.Component(System.ComponentModel.IComponent, System.IDisposable) → Timer(System.ComponentModel.ISupportInitialize)

# TimersDescriptionAttribute Class

## System.Timers (system.dll)

This class provides a System.ComponentModel.DescriptionAttribute description for a giv
visual tools to display a helpful description of the component.

```
Public Class TimersDescriptionAttribute : Inherits System.ComponentModel.I
' Public Constructors
   Public Sub New( ByVal description As String)
' Public Instance Properties
   Overrides Public ReadOnly Property Description As String
End Class
```

### Hierarchy

System.Object → System.Attribute → System.ComponentModel.DescriptionAtt
TimersDescriptionAttribute

### Valid On

All

# Chapter 22. System.Xml

The `System.Xml` namespace provides support for managing XML documents according to a set of standards defined by the World Wide Web Consortium (W3C). The classes implement objects that comply with the XML 1.0 specification and the Document Object Model (DOM) Core Level 1 and Core Level 2. Additional support is provided for XML Schemas (the `System.Xml.Schema` namespace), XSLT (`System.Xml.Xsl`), and XPath (`System.Xml.XPath`).

Figure 22-1 and Figure 22-2 show the types in this namespace. For more information on these technologies and their use, please consult *XML in a Nutshell*, by Elliote Rusty Harold and W. Scott Means (O'Reilly, 2001) or *Essential XML: Beyond Markup*, by Don Box (Addison Wesley, 2000).

**Figure 22-1. XmlNode and related types**

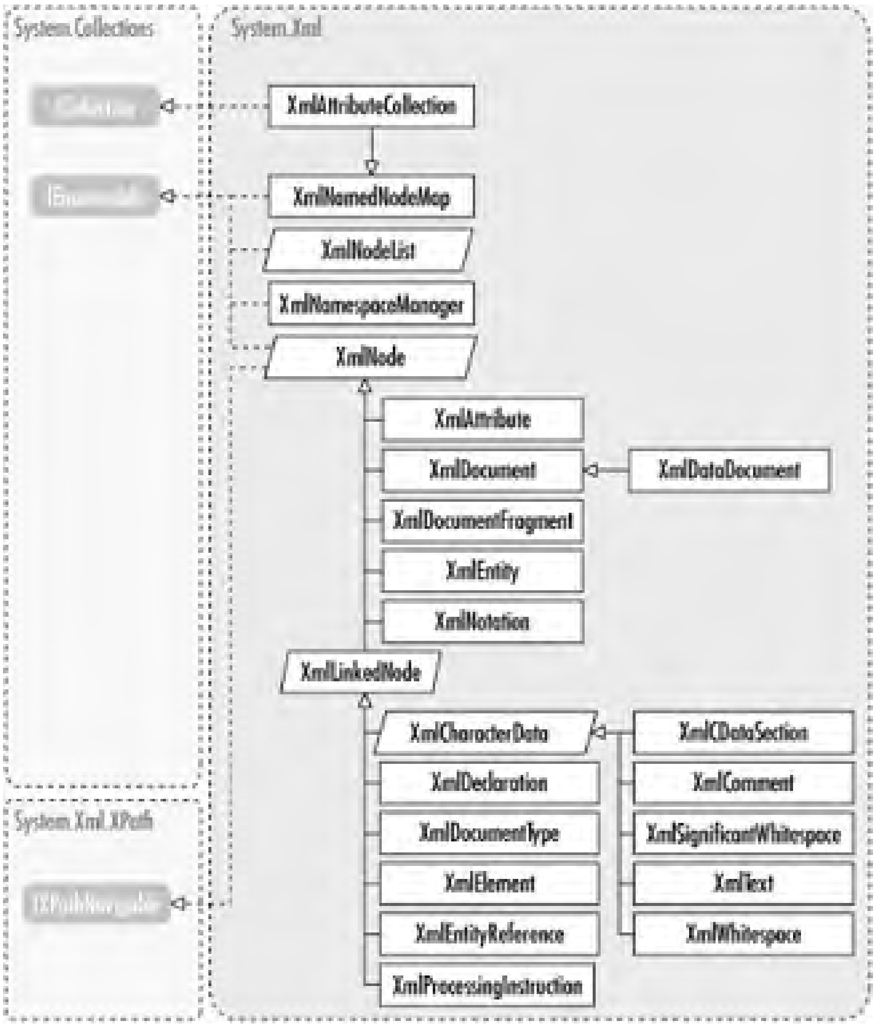
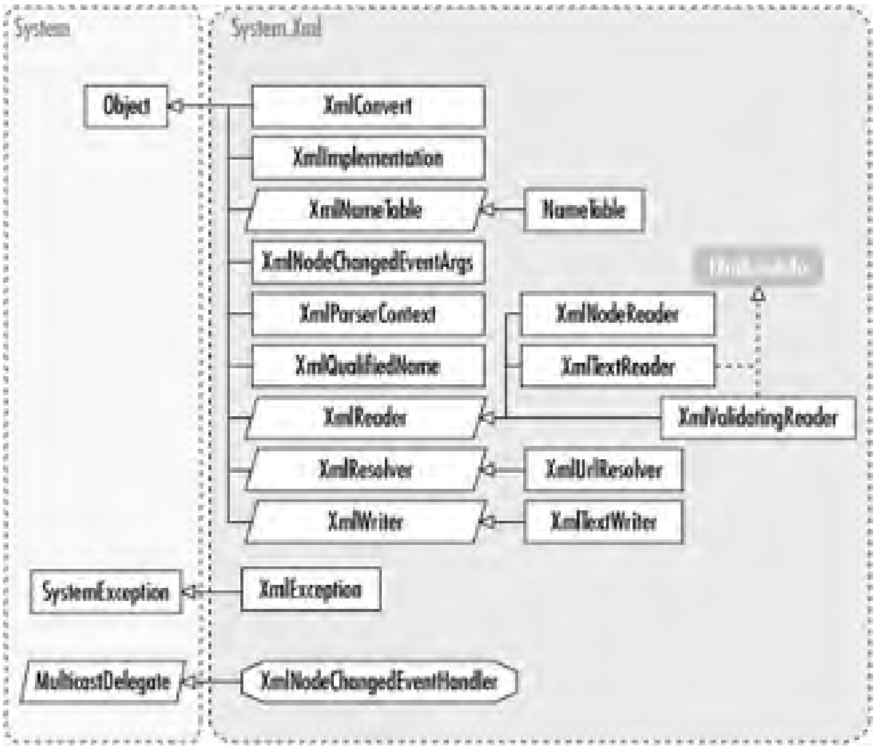



**Figure 22-2. More types from System.Xml**


System
System.Xml
Object
XmlConvert
XmlImplementation
XmlNameTable
NameTable
XmlNodeChangedEventArgs
XmlParserContext
XmlNodeReader
XmlQualifiedName
XmlTextReader
XmlReader
XmlValidatingReader
XmlResolver
XmlUrlResolver
XmlWriter
XmlTextWriter
SystemException
XmlException
MulticastDelegate
XmlNodeChangedEventHandler

## EntityHandling Enum

### System.Xml (system.xml.dll) *serializable*

This enumeration defines how entities are expanded. `ExpandCharEntities` expands only character entities, returning the entity text, while general entities are returned as nodes. `ExpandEntities` expands all entities; this is the default.

```
Public Enum EntityHandling
   ExpandEntities = 1
   ExpandCharEntities = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `EntityHandling`

### Returned By

`XmlValidatingReader.EntityHandling`

### Passed To

`XmlValidatingReader.EntityHandling`

# Formatting Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

This enumeration specifies whether element content that is output from `XmlTextWriter` is indented. This is only of interest to human consumers of XML; if the destination of the XML document is another machine or software process, the additional whitespace adds only to the file size.

```
Public Enum Formatting

   None = 0

   Indented = 1

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `Formatting`

### Returned By

`XmlTextWriter.Formatting`

### Passed To

`XmlTextWriter.Formatting`

## IHasXmlNode Interface

### System.Xml (system.xml.dll)

This interface is used to get the current or context node from an implementing class, such as `XmlDocument` or `System.Xml.XPath.XPathNavigator`. The `GetNode()` method returns the `XmlNode` that the navigator is currently positioned on.

```
Public Interface IHasXmlNode

' Public Instance Methods

   Public Function GetNode() As XmlNode

End Interface
```

# IXmlLineInfo Interface

## System.Xml (system.xml.dll)

This interface allows XML reader classes (XmlTextReader and XmlValidatingReader) to return line and position information currently being read. If the class is reading data from a stream or other form of input, the HasLineInfo() method returns a boolean indicating if line information is provided.

```
Public Interface IXmlLineInfo
' Public Instance Properties
   Public ReadOnly Property LineNumber As Integer
   Public ReadOnly Property LinePosition As Integer
' Public Instance Methods
   Public Function HasLineInfo() As Boolean
End Interface
```

### Implemented By

XmlTextReader, XmlValidatingReader

## NameTable Class

## System.Xml (system.xml.dll) *ECMA*

This class is a concrete implementation of the `XmlNameTable` type (described later in this chapter). It is entirely an optimization within the .NET XML stack; it provides a table of string objects for element and attribute names used in an XML document. The XML parser uses these string objects for efficient manipulation of repeated element and attribute names. See `XmlNameTable` for more discussion of its behavior and usage.

Normally .NET applications have no need to use this class directly. At most, a new instance is passed in blindly when constructing various XML-related types, such as `XmlNamespaceManager`.

```
Public Class NameTable : Inherits XmlNameTable

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overrides Public Function Add(ByVal key As Char(),

        ByVal start As Integer,

        ByVal len As Integer) As String

   Overrides Public Function Add(

        ByVal key As String) As String

   Overrides Public Function Get(ByVal key As Char(),

        ByVal start As Integer,

        ByVal len As Integer) As String

   Overrides Public Function Get(

        ByVal value As String) As String

End Class
```

### Hierarchy

System.Object → XmlNameTable → NameTable

### Passed To

System.Xml.Xsl.XsltContext.XsltContext()

# ReadState Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

This enumeration identifies the current state of an `XmlReader` instance: closed (`Closed`); not yet started (`Initial`); an error is preventing further reading within the document (`Error`); the read is in process (`Interactive`); or the end of file (or stream, or wherever the XML is coming from) has been reached (`EndOfFile`).

```
Public Enum ReadState
    Initial = 0
    Interactive = 1
    Error = 2
    EndOfFile = 3
    Closed = 4
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ReadState`

### Returned By

`XmlReader.ReadState`

## ValidationType Enum

## System.Xml (system.xml.dll) *serializable*

This enumeration is used by `XmlValidatingReader` to determine the type of validation requested: DTD, schema, XDR, or no validation. If the type is set to `Auto`, the validation type is determined from the document; if there is a reference to a DTD, then DTD-style validation is performed. This is also true if the document contains references to XML Schema types, and so on. (See `XmlValidatingReader` for details.)

```
Public Enum ValidationType

   None = 0

   Auto = 1

   DTD = 2

   XDR = 3

   Schema = 4

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `ValidationType`

### Returned By

`XmlValidatingReader.ValidationType`

### Passed To

`XmlValidatingReader.ValidationType`

# WhitespaceHandling Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

This enumeration contains settings that determine if whitespace is preserved in text sections of XML documents. This is important if the XML document contains whitespace-sensitive text nodes; for example, HTML is a whitespace-insensitive language.

```
Public Enum WhitespaceHandling
   All = 0
   Significant = 1
   None = 2
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → WhitespaceHandling

### Returned By

XmlTextReader.WhitespaceHandling

### Passed To

XmlTextReader.WhitespaceHandling

## WriteState Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

As its name implies, this enumeration specifies the state of an XmlWriter instance: closed (`Closed`), not yet started (`Start`), or in the process of writing some portion of the XML document (`Attribute`, `Content`, `Element`, or `Prolog`).

```
Public Enum WriteState

   Start = 0

   Prolog = 1

   Element = 2

   Attribute = 3

   Content = 4

   Closed = 5

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `WriteState`

### Returned By

`XmlWriter.WriteState`

# XmlAttribute Class

## System.Xml (system.xml.dll)

This class represents a single attribute of an element. The `OwnerElement` property returns the element node that contains this attribute. The `Specified` property indicates if the value was explicitly set or if a default value was used.

```
Public Class XmlAttribute : Inherits XmlNode

' Protected Constructors

   Protected Friend Sub New(ByVal prefix As String,

        ByVal localName As String,

        ByVal namespaceURI As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property BaseURI As String

   Overrides Public Property InnerText As String

   Overrides Public Property InnerXml As String

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NamespaceURI As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public ReadOnly Property OwnerDocument As XmlDocument

   Overridable Public ReadOnly Property OwnerElement As XmlElement

   Overrides Public ReadOnly Property ParentNode As XmlNode

   Overrides Public Property Prefix As String

   Overridable Public ReadOnly Property Specified As Boolean

   Overrides Public Property Value As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)
```

```
End Class
```

## Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlAttribute

## Returned By

XmlAttributeCollection.{Append(), InsertAfter(), InsertBefore(), this, Prepend(), Remove(), RemoveAt()}, XmlDocument.CreateAttribute(), XmlElement.{GetAttributeNode(), RemoveAttributeNode(), SetAttributeNode()}

## Passed To

XmlAttributeCollection.{Append(), CopyTo(), InsertAfter(), InsertBefore(), Prepend(), Remove()}, XmlElement.{RemoveAttributeNode(), SetAttributeNode()}

## XmlAttributeCollection Class

## System.Xml (system.xml.dll)

This class defines a collection of attributes for an `XmlElement` node. An `XmlAttributeCollect` the `XmlElement.Attributes` property. The collection contains `XmlAttribute` objects that can either an object name or a zero-based index. Attribute nodes can be added and removed from the c methods, such as `InsertBefore()`, `InsertAfter()`, `Prepend()`, and `RemoveAt()`.

```
Public Class XmlAttributeCollection : Inherits XmlNamedNodeMap : Implemen

' Public Instance Properties

   Overridable Public Default ReadOnly Property ItemOf(

        ByVal localName As String,

        ByVal namespaceURI As String) As XmlAttribute

   Overridable Public Default ReadOnly Property ItemOf(

        ByVal name As String) As XmlAttribute

   Overridable Public Default ReadOnly Property ItemOf(

        ByVal i As Integer) As XmlAttribute

' Public Instance Methods

   Overridable Public Function Append(

        ByVal node As XmlAttribute) As XmlAttribute

   Public Sub CopyTo(ByVal array As XmlAttribute(),

        ByVal index As Integer)

   Overridable Public Function InsertAfter(

        ByVal newNode As XmlAttribute,

        ByVal refNode As XmlAttribute) As XmlAttribute

   Overridable Public Function InsertBefore(

        ByVal newNode As XmlAttribute,

        ByVal refNode As XmlAttribute) As XmlAttribute

   Overridable Public Function Prepend(

        ByVal node As XmlAttribute) As XmlAttribute

   Overridable Public Function Remove(
```

```
        ByVal node As XmlAttribute) As XmlAttribute
   Overridable Public Sub RemoveAll()
   Overridable Public Function RemoveAt(
        ByVal i As Integer) As XmlAttribute
   Overrides Public Function SetNamedItem(
        ByVal node As XmlNode) As XmlNode
End Class
```

### Hierarchy

System.Object → XmlNamedNodeMap(System.Collections.IEnumerable) → XmlAttributeCollection(System.Collections.ICollection)

### Returned By

XmlNode.Attributes

# XmlCDataSection Class

## System.Xml (system.xml.dll)

This class represents a CDATA (character data) section node of a document. A CDATA section is element content that is unparsed, i.e., entities and markup are ignored.

```
Public Class XmlCDataSection : Inherits XmlCharacterData

' Protected Constructors

   Protected Friend Sub New(ByVal data As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlLinkedNode → XmlCharacterData → XmlCDataSection

### Returned By

XmlDocument.CreateCDataSection()

## XmlCharacterData MustInherit Class

## System.Xml (system.xml.dll)

This class is a MustInherit parent class for the character data node types: `XmlCDataSection`, `XmlComment`, `XmlSignificantWhitespace`, `XmlText`, and `XmlWhitespace`. It defines methods for manipulating the text-based data of these nodes.

```
Public MustInherit Class XmlCharacterData : Inherits XmlLinkedNode
' Protected Constructors
   Protected Friend Sub New(ByVal data As String,
        ByVal doc As XmlDocument)
' Public Instance Properties
   Overridable Public Property Data As String
   Overrides Public Property InnerText As String
   Overridable Public ReadOnly Property Length As Integer
   Overrides Public Property Value As String
' Public Instance Methods
   Overridable Public Sub AppendData( ByVal strData As String)
   Overridable Public Sub DeleteData(ByVal offset As Integer,
        ByVal count As Integer)
   Overridable Public Sub InsertData(ByVal offset As Integer,
        ByVal strData As String)
   Overridable Public Sub ReplaceData(ByVal offset As Integer,
        ByVal count As Integer, ByVal strData As String)
   Overridable Public Function Substring(
        ByVal offset As Integer,
        ByVal count As Integer) As String
End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` →

XmlLinkedNode → XmlCharacterData

## Subclasses

XmlCDataSection, XmlComment, XmlSignificantWhitespace, XmlText, XmlWhitespace

# XmlComment Class

## System.Xml (system.xml.dll)

This class represents an `XmlComment` node. An XML comment is contained within `<!--` and `-->` markup symbols and is not represented in the resulting XML Infoset tree.

```
Public Class XmlComment : Inherits XmlCharacterData

' Protected Constructors

   Protected Friend Sub New(ByVal comment As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlLinkedNode` → `XmlCharacterData` → `XmlComment`

### Returned By

`XmlDocument.CreateComment()`

## XmlConvert Class

## System.Xml (system.xml.dll) *ECMA*

This type is used to convert XML elements into other, non-XML types, such as CLR objects. In particular, it is used to convert XSD types into CLR types, for easy transformation of schema-valid XML documents into .NET objects and back again. It is also used within a variety of other areas, including ADO.NET (for automatic conversion of XML documents into relational tables and rows).

For the most part, .NET programmers use this type indirectly as part of the .NET Web Services stack or else directly in order to convert between XML documents and CLR objects (as part of a home-grown XML-to-RDBMS system, for example).

Note that although a constructor is provided, all methods of any interest are declared shared and therefore require no instance to use. In essence, this type is a collection of C-style functions.

```
Public Class XmlConvert

' Public Constructors

   Public Sub New()

' Public Shared Methods

   Public Shared Function DecodeName(

        ByVal name As String) As String

   Public Shared Function EncodeLocalName(

        ByVal name As String) As String

   Public Shared Function EncodeName(

        ByVal name As String) As String

   Public Shared Function EncodeNmToken(

        ByVal name As String) As String

   Public Shared Function ToBoolean(

        ByVal s As String) As Boolean

   Public Shared Function ToByte( ByVal s As String) As Byte

   Public Shared Function ToChar( ByVal s As String) As Char

   Public Shared Function ToDateTime(

        ByVal s As String) As Date

   Public Shared Function ToDateTime(ByVal s As String,

        ByVal format As String) As Date

   Public Shared Function ToDateTime(ByVal s As String,
```

```
    ByVal formats As String()) As Date
Public Shared Function ToDecimal(
    ByVal s As String) As Decimal
Public Shared Function ToDouble(
    ByVal s As String) As Double
Public Shared Function ToGuid( ByVal s As String) As Guid
Public Shared Function ToInt16(ByVal s As String) As Short
Public Shared Function ToInt32(
    ByVal s As String) As Integer
Public Shared Function ToInt64( ByVal s As String) As Long
Public Shared Function ToSByte(ByVal s As String) As SByte
Public Shared Function ToSingle(
    ByVal s As String) As Single
Public Shared Function ToString(
    ByVal value As Boolean) As String
Public Shared Function ToString(
    ByVal value As Byte) As String
Public Shared Function ToString(
    ByVal value As Char) As String
Public Shared Function ToString(
    ByVal value As Date) As String
Public Shared Function ToString(ByVal value As Date,
    ByVal format As String) As String
Public Shared Function ToString(
    ByVal value As Decimal) As String
Public Shared Function ToString(
    ByVal value As Double) As String
Public Shared Function ToString(
    ByVal value As Guid) As String
Public Shared Function ToString(
```

```
        ByVal value As Short) As String
    Public Shared Function ToString(
        ByVal value As Integer) As String
    Public Shared Function ToString(
        ByVal value As Long) As String
    Public Shared Function ToString(
        ByVal value As SByte) As String
    Public Shared Function ToString(
        ByVal value As Single) As String
    Public Shared Function ToString(
        ByVal value As TimeSpan) As String
    Public Shared Function ToString(
        ByVal value As UInt16) As String
    Public Shared Function ToString(
        ByVal value As UInt32) As String
    Public Shared Function ToString(
        ByVal value As UInt64) As String
    Public Shared Function ToTimeSpan(
        ByVal s As String) As TimeSpan
    Public Shared Function ToUInt16(
        ByVal s As String) As UInt16
    Public Shared Function ToUInt32(
        ByVal s As String) As UInt32
    Public Shared Function ToUInt64(
        ByVal s As String) As UInt64
    Public Shared Function VerifyName(
        ByVal name As String) As String
    Public Shared Function VerifyNCName(
        ByVal name As String) As String
End Class
```

# XmlDataDocument Class

## System.Xml (system.data.dll)

The `XmlDataDocument` is a marriage of XML and RDBMS technology; it is an `XmlDocument`-inheriting class that particularly understands ADO.NET DataSet objects. This offers a variety of opportunities to the .NET programmer — for example, a `DataSet` can be loaded into the `XmlDataDocument`, and then navigated using traditional DOM-style navigation using the `XmlNode` API. In fact, because `XmlDataDocument` also inherits the `System.Xml.XPath.IXPathNavigable` interface, XPath queries can be issued against the `DataSet` data, as well.

In order to build this relationship, construct the `XmlDataDocument` with the `DataSet` holding the data as its constructor parameter. Alternatively, use the `Load()` method to read in the data via an `XmlReader`. The resulting XML can also then be written out to another medium with the `WriteTo()` method.

```
Public Class XmlDataDocument : Inherits XmlDocument
' Public Constructors
   Public Sub New()
   Public Sub New( ByVal dataset As System.Data.DataSet)
' Public Instance Properties
   Public ReadOnly Property DataSet As DataSet
' Public Instance Methods
   Overrides Public Function CloneNode(
        ByVal deep As Boolean) As XmlNode
   Overrides Public Function CreateElement(
        ByVal prefix As String, ByVal localName As String,
        ByVal namespaceURI As String) As XmlElement
   Overrides Public Function CreateEntityReference(
        ByVal name As String) As XmlEntityReference
   Overrides Public Function GetElementById(
        ByVal elemId As String) As XmlElement
   Public Function GetElementFromRow(
        ByVal r As System.Data.DataRow) As XmlElement
   Public Function GetRowFromElement(
```

```
        ByVal e As XmlElement) As DataRow
   Overrides Public Sub Load(
        ByVal inStream As System.IO.Stream)
   Overrides Public Sub Load( ByVal filename As String)
   Overrides Public Sub Load(
        ByVal txtReader As System.IO.TextReader)
   Overrides Public Sub Load( ByVal reader As XmlReader)
' Protected Instance Methods
   Overrides Protected Function CreateNavigator(
        ByVal node As XmlNode) As XPathNavigator
End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlDocument → XmlDataDocument

# XmlDeclaration Class

## System.Xml (system.xml.dll)

This class contains the XML declaration of a document, which is the first element of an XML document containing the XML version number, encoding, and other optional information about the file.

```
Public Class XmlDeclaration : Inherits XmlLinkedNode

' Protected Constructors

   Protected Friend Sub New(ByVal version As String,

        ByVal encoding As String,

        ByVal standalone As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Public Property Encoding As String

   Overrides Public Property InnerText As String

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Public Property Standalone As String

   Overrides Public Property Value As String

   Public ReadOnly Property Version As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) →

```
XmlLinkedNode → XmlDeclaration
```

## Returned By

```
XmlDocument.CreateXmlDeclaration()
```

# XmlDocument Class

## System.Xml (system.xml.dll)

This class represents an XML document according to the W3C DOM (Document Object Model) specification. The document is represented as a node tree, in which elements and attributes (and their values) are stored as nodes that contain relational information (e.g., parent, child, siblings). `XmlDocument` derives from the generic `XmlNode` class and therefore has a node-type of Document.

The set of `Create*` methods create new objects of any type of node. These objects are created within the context of the `XmlDocument`; they share the document properties and name table of the parent document. However, they are not inserted into the document. To do this, you need to use the methods for node insertion from `XmlNode`. A new `XmlNode` is created from the root node of the `XmlDocument`, then methods for walking the node tree and appending or inserting nodes can be used to alter the source document.

Events are noted when any nodes (even created node objects that have not been inserted into the document) from this object change. Register an instance of the `XmlNodeChangedEventHandler` delegate with any of the following event types on `XmlDocument` to receive the corresponding notification: `NodeChanged` or `NodeChanging` for notification when a node has or is in the middle of changing (the element name is being modified, an attribute is being modified, added, or removed, and so on); `NodeInserted` or `NodeInserting` for notifications of new nodes having been or in the process of being added to the document; and `NodeRemoved` or `NodeRemoving` for nodes removed or in the process of being removed. The `XmlNodeChangedEventHandler` takes two arguments: the object sending the notification (this object), and an `XmlNodeChangedEventArgs` instance containing information about the change.

```
Public Class XmlDocument : Inherits XmlNode

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal nt As XmlNameTable)

' Protected Constructors

   Protected Friend Sub New( ByVal imp As XmlImplementation)

' Public Instance Properties

   Overrides Public ReadOnly Property BaseURI As String

   Public ReadOnly Property DocumentElement As XmlElement

   Overridable Public ReadOnly Property DocumentType As XmlDocumentType

   Public ReadOnly Property Implementation As XmlImplementation

   Overrides Public Property InnerXml As String

   Overrides Public ReadOnly Property IsReadOnly As Boolean

   Overrides Public ReadOnly Property LocalName As String
```

```
   Overrides Public ReadOnly Property Name As String
   Public ReadOnly Property NameTable As XmlNameTable
   Overrides Public ReadOnly Property NodeType As XmlNodeType
   Overrides Public ReadOnly Property OwnerDocument As XmlDocument
   Public Property PreserveWhitespace As Boolean
   Overridable Public WriteOnly Property XmlResolver As XmlResolver
' Public Instance Methods
   Overrides Public Function CloneNode(
        ByVal deep As Boolean) As XmlNode
   Public Function CreateAttribute(
        ByVal name As String) As XmlAttribute
   Public Function CreateAttribute(
        ByVal qualifiedName As String,
        ByVal namespaceURI As String) As XmlAttribute
   Overridable Public Function CreateAttribute(
        ByVal prefix As String, ByVal localName As String,
        ByVal namespaceURI As String) As XmlAttribute
   Overridable Public Function CreateCDataSection(
        ByVal data As String) As XmlCDataSection
   Overridable Public Function CreateComment(
        ByVal data As String) As XmlComment
   Overridable Public Function CreateDocumentFragment(
        ) As XmlDocumentFragment
   Overridable Public Function CreateDocumentType(
        ByVal name As String, ByVal publicId As String,
        ByVal systemId As String,
        ByVal internalSubset As String) As XmlDocumentType
   Public Function CreateElement(
        ByVal name As String) As XmlElement
   Public Function CreateElement(
```

```
     ByVal qualifiedName As String,
     ByVal namespaceURI As String) As XmlElement
Overridable Public Function CreateElement(
     ByVal prefix As String, ByVal localName As String,
     ByVal namespaceURI As String) As XmlElement
Overridable Public Function CreateEntityReference(
     ByVal name As String) As XmlEntityReference
Overridable Public Function CreateNode(
     ByVal nodeTypeString As String,
     ByVal name As String,
     ByVal namespaceURI As String) As XmlNode
Overridable Public Function CreateNode(
     ByVal type As XmlNodeType, ByVal name As String,
     ByVal namespaceURI As String) As XmlNode
Overridable Public Function CreateNode(
     ByVal type As XmlNodeType, ByVal prefix As String,
     ByVal name As String,
     ByVal namespaceURI As String) As XmlNode
Overridable Public Function CreateProcessingInstruction(
     ByVal target As String,
     ByVal data As String) As XmlProcessingInstruction
Overridable Public Function CreateSignificantWhitespace(
     ByVal text As String) As XmlSignificantWhitespace
Overridable Public Function CreateTextNode(
     ByVal text As String) As XmlText
Overridable Public Function CreateWhitespace(
     ByVal text As String) As XmlWhitespace
Overridable Public Function CreateXmlDeclaration(
     ByVal version As String, ByVal encoding As String,
     ByVal standalone As String) As XmlDeclaration
Overridable Public Function GetElementById(
```

```
        ByVal elementId As String) As XmlElement
    Overridable Public Function GetElementsByTagName(
        ByVal name As String) As XmlNodeList
    Overridable Public Function GetElementsByTagName(
        ByVal localName As String,
        ByVal namespaceURI As String) As XmlNodeList
    Overridable Public Function ImportNode(
        ByVal node As XmlNode,
        ByVal deep As Boolean) As XmlNode
    Overridable Public Sub Load(
        ByVal inStream As System.IO.Stream)
    Overridable Public Sub Load( ByVal filename As String)
    Overridable Public Sub Load(
        ByVal txtReader As System.IO.TextReader)
    Overridable Public Sub Load( ByVal reader As XmlReader)
    Overridable Public Sub LoadXml( ByVal xml As String)
    Overridable Public Function ReadNode(
        ByVal reader As XmlReader) As XmlNode
    Overridable Public Sub Save(
        ByVal outStream As System.IO.Stream)
    Overridable Public Sub Save( ByVal filename As String)
    Overridable Public Sub Save(
        ByVal writer As System.IO.TextWriter)
    Overridable Public Sub Save( ByVal w As XmlWriter)
    Overrides Public Sub WriteContentTo( ByVal xw As XmlWriter)
    Overrides Public Sub WriteTo( ByVal w As XmlWriter)
' Protected Instance Methods
    Overridable Protected Friend Function CreateDefaultAttribute(
        ByVal prefix As String, ByVal localName As String,
        ByVal namespaceURI As String) As XmlAttribute
    Overridable Protected Friend Function CreateNavigator(
```

```
        ByVal node As XmlNode) As XPathNavigator
' Events
   Public Event NodeChanged As XmlNodeChangedEventHandler
   Public Event NodeChanging As XmlNodeChangedEventHandler
   Public Event NodeInserted As XmlNodeChangedEventHandler
   Public Event NodeInserting As XmlNodeChangedEventHandler
   Public Event NodeRemoved As XmlNodeChangedEventHandler
   Public Event NodeRemoving As XmlNodeChangedEventHandler
End Class
```

## Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlDocument

## Subclasses

XmlDataDocument

## Returned By

XmlImplementation.CreateDocument(), XmlNode.OwnerDocument

# XmlDocumentFragment Class

## System.Xml (system.xml.dll)

This class represents a lightweight piece or tree section of an XML document. A document fragment has a null parent node. This object is useful for tree insert operations that use the `ImportNode()` method of the `XmlDocument` class. To create an `XmlDocumentFragment`, use the `XmlDocument.CreateDocumentFragment()` method of an `XmlDocument` instance.

```
Public Class XmlDocumentFragment : Inherits XmlNode

' Protected Constructors

   Protected Friend Sub New(

        ByVal ownerDocument As XmlDocument)

' Public Instance Properties

   Overrides Public Property InnerXml As String

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public ReadOnly Property OwnerDocument As XmlDocument

   Overrides Public ReadOnly Property ParentNode As XmlNode

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlDocumentFragment`

### Returned By

`XmlDocument.CreateDocumentFragment()`

## XmlDocumentType Class

## System.Xml (system.xml.dll)

This class represents the DOCTYPE element of an XML document and its contents.

```
Public Class XmlDocumentType : Inherits XmlLinkedNode

' Protected Constructors

   Protected Friend Sub New(ByVal name As String,
        ByVal publicId As String, ByVal systemId As String,
        ByVal internalSubset As String,
        ByVal doc As XmlDocument)

' Public Instance Properties

   Public ReadOnly Property Entities As XmlNamedNodeMap
   Public ReadOnly Property InternalSubset As String
   Overrides Public ReadOnly Property IsReadOnly As Boolean
   Overrides Public ReadOnly Property LocalName As String
   Overrides Public ReadOnly Property Name As String
   Overrides Public ReadOnly Property NodeType As XmlNodeType
   Public ReadOnly Property Notations As XmlNamedNodeMap
   Public ReadOnly Property PublicId As String
   Public ReadOnly Property SystemId As String

' Public Instance Methods

   Overrides Public Function CloneNode(
        ByVal deep As Boolean) As XmlNode
   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)
   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) →

XmlLinkedNode → XmlDocumentType

## Returned By

XmlDocument.{CreateDocumentType(),DocumentType}

# XmlElement Class

## System.Xml (system.xml.dll)

This class represents an element in an XML document.

```
Public Class XmlElement : Inherits XmlLinkedNode

' Protected Constructors

   Protected Friend Sub New(ByVal prefix As String,
        ByVal localName As String,
        ByVal namespaceURI As String,
        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property Attributes As XmlAttributeCollectio
   Overridable Public ReadOnly Property HasAttributes As Boolean
   Overrides Public Property InnerText As String
   Overrides Public Property InnerXml As String
   Public Property IsEmpty As Boolean
   Overrides Public ReadOnly Property LocalName As String
   Overrides Public ReadOnly Property Name As String
   Overrides Public ReadOnly Property NamespaceURI As String
   Overrides Public ReadOnly Property NextSibling As XmlNode
   Overrides Public ReadOnly Property NodeType As XmlNodeType
   Overrides Public ReadOnly Property OwnerDocument As XmlDocument
   Overrides Public Property Prefix As String

' Public Instance Methods

   Overrides Public Function CloneNode(
        ByVal deep As Boolean) As XmlNode
   Overridable Public Function GetAttribute(
        ByVal name As String) As String
   Overridable Public Function GetAttribute(
```

```
     ByVal localName As String,
     ByVal namespaceURI As String) As String
Overridable Public Function GetAttributeNode(
     ByVal name As String) As XmlAttribute
Overridable Public Function GetAttributeNode(
     ByVal localName As String,
     ByVal namespaceURI As String) As XmlAttribute
Overridable Public Function GetElementsByTagName(
     ByVal name As String) As XmlNodeList
Overridable Public Function GetElementsByTagName(
     ByVal localName As String,
     ByVal namespaceURI As String) As XmlNodeList
Overridable Public Function HasAttribute(
     ByVal name As String) As Boolean
Overridable Public Function HasAttribute(
     ByVal localName As String,
     ByVal namespaceURI As String) As Boolean
Overrides Public Sub RemoveAll()
Overridable Public Sub RemoveAllAttributes()
Overridable Public Sub RemoveAttribute(
     ByVal name As String)
Overridable Public Sub RemoveAttribute(
     ByVal localName As String,
     ByVal namespaceURI As String)
Overridable Public Function RemoveAttributeAt(
     ByVal i As Integer) As XmlNode
Overridable Public Function RemoveAttributeNode(
     ByVal localName As String,
     ByVal namespaceURI As String) As XmlAttribute
Overridable Public Function RemoveAttributeNode(
```

```
        ByVal oldAttr As XmlAttribute) As XmlAttribute
   Overridable Public Function SetAttribute(
        ByVal localName As String,
        ByVal namespaceURI As String,
        ByVal value As String) As String
   Overridable Public Sub SetAttribute(ByVal name As String,
        ByVal value As String)
   Overridable Public Function SetAttributeNode(
        ByVal localName As String,
        ByVal namespaceURI As String) As XmlAttribute
   Overridable Public Function SetAttributeNode(
        ByVal newAttr As XmlAttribute) As XmlAttribute
   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)
   Overrides Public Sub WriteTo( ByVal w As XmlWriter)
End Class
```

## Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlLinkedNode → XmlElement

## Returned By

XmlAttribute.OwnerElement, XmlDataDocument.GetElementFromRow(), XmlDocument.{CreateElement(), DocumentElement, GetElementById()}, XmlNode.this

## Passed To

XmlDataDocument.GetRowFromElement()

# XmlEntity Class

## System.Xml (system.xml.dll)

This class represents an entity in an XML document.

```
Public Class XmlEntity : Inherits XmlNode

' Public Instance Properties

   Overrides Public ReadOnly Property BaseURI As String

   Overrides Public Property InnerText As String

   Overrides Public Property InnerXml As String

   Overrides Public ReadOnly Property IsReadOnly As Boolean

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Public ReadOnly Property NotationName As String

   Overrides Public ReadOnly Property OuterXml As String

   Public ReadOnly Property PublicId As String

   Public ReadOnly Property SystemId As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlEntity

# XmlEntityReference Class

## System.Xml (system.xml.dll)

This class represents an entity reference in an XML document.

```
Public Class XmlEntityReference : Inherits XmlLinkedNode
' Protected Constructors
   Protected Friend Sub New(ByVal name As String,
        ByVal doc As XmlDocument)
' Public Instance Properties
   Overrides Public ReadOnly Property BaseURI As String
   Overrides Public ReadOnly Property IsReadOnly As Boolean
   Overrides Public ReadOnly Property LocalName As String
   Overrides Public ReadOnly Property Name As String
   Overrides Public ReadOnly Property NodeType As XmlNodeType
   Overrides Public Property Value As String
' Public Instance Methods
   Overrides Public Function CloneNode(
        ByVal deep As Boolean) As XmlNode
   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)
   Overrides Public Sub WriteTo( ByVal w As XmlWriter)
End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlLinkedNode → XmlEntityReference

### Returned By

XmlDocument.CreateEntityReference()

## XmlException Class

## System.Xml (system.xml.dll) *ECMA, serializable*

This class contains the error thrown by XML-parsing operations. The `LineNumber` and `LinePosition` properties store the location of the error in the source document, and `Message` describes the reason for the error.

```
Public Class XmlException : Inherits SystemException

' Public Constructors

   Public Sub New(ByVal message As String,

         ByVal innerException As Exception)

' Protected Constructors

   Protected Sub New(

         ByVal info As System.Runtime.Serialization.SerializationInfo,

         ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Public ReadOnly Property LineNumber As Integer

   Public ReadOnly Property LinePosition As Integer

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

         ByVal info As System.Runtime.Serialization.SerializationInfo,

         ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → XmlException

# XmlImplementation Class

## System.Xml (system.xml.dll)

This class instantiates a new `XmlDocument` object using the same `XmlNameTable` of an existing `XmlDocument`.

```
Public Class XmlImplementation

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Overridable Public Function CreateDocument(

        ) As XmlDocument

   Public Function HasFeature(ByVal strFeature As String,

        ByVal strVersion As String) As Boolean

End Class
```

### Returned By

`XmlDocument.Implementation`

# XmlLinkedNode MustInherit Class

## System.Xml (system.xml.dll)

This type of node class is the base class for node types that are not top-level (i.e., nodes that require a parent). For example, `XmlCharacterData` and `XmlElement` are derived from `XmlLinkedNode`.

```
Public MustInherit Class XmlLinkedNode : Inherits XmlNode

' Public Instance Properties

   Overrides Public ReadOnly Property NextSibling As XmlNode

   Overrides Public ReadOnly Property PreviousSibling As XmlNode

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlLinkedNode`

### Subclasses

`XmlCharacterData`, `XmlDeclaration`, `XmlDocumentType`, `XmlElement`, `XmlEntityReference`, `XmlProcessingInstruction`

# XmlNamedNodeMap Class

## System.Xml (system.xml.dll)

This class represents a collection of nodes accessed by index or name. This is the MustInherit parent class of `XmlAttributeCollection`.

```
Public Class XmlNamedNodeMap : Implements IEnumerable

' Public Instance Properties

   Overridable Public ReadOnly Property Count As Integer

' Public Instance Methods

   Overridable Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   Overridable Public Function GetNamedItem(

        ByVal name As String) As XmlNode

   Overridable Public Function GetNamedItem(

        ByVal localName As String,

        ByVal namespaceURI As String) As XmlNode

   Overridable Public Function Item(

        ByVal index As Integer) As XmlNode

   Overridable Public Function RemoveNamedItem(

        ByVal name As String) As XmlNode

   Overridable Public Function RemoveNamedItem(

        ByVal localName As String,

        ByVal namespaceURI As String) As XmlNode

   Overridable Public Function SetNamedItem(

        ByVal node As XmlNode) As XmlNode

End Class
```

### Subclasses

`XmlAttributeCollection`

### Returned By

XmlDocumentType.{Entities,Notations}

## XmlNamespaceManager Class

## System.Xml (system.xml.dll) *ECMA*

This class represents a collection of namespace prefixes and namespace URIs that are used to manage and resolve namespace information. The namespace manager is constructed using an `XmlNameTable`. `XmlNamespaceManager` is used internally by `XmlReader` to resolve namespace prefixes and track the current scope. `XmlNamespaceManager` maintains scope in a stack, which can be manipulated with `PopScope()` and `PushScope()`. Namespaces must be added explicitly to the namespace manager with `AddNamespace()`, even if you use an existing `XmlNameTable`.

```
Public Class XmlNamespaceManager : Implements IEnumerable

' Public Constructors

   Public Sub New( ByVal nameTable As XmlNameTable)

' Public Instance Properties

   Overridable Public ReadOnly Property DefaultNamespace As String

   Public ReadOnly Property NameTable As XmlNameTable

' Public Instance Methods

   Overridable Public Sub AddNamespace(ByVal prefix As String,

        ByVal uri As String)

   Overridable Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   Overridable Public Function HasNamespace(

        ByVal prefix As String) As Boolean

   Overridable Public Function LookupNamespace(

        ByVal prefix As String) As String

   Overridable Public Function LookupPrefix(

        ByVal uri As String) As String

   Overridable Public Function PopScope() As Boolean

   Overridable Public Sub PushScope()

   Overridable Public Sub RemoveNamespace(

        ByVal prefix As String, ByVal uri As String)

End Class
```

### Subclasses

`System.Xml.Xsl.XsltContext`

### Returned By

`XmlParserContext.NamespaceManager`

### Passed To

`XmlNode.{SelectNodes(), SelectSingleNode()}, XmlParserContext.{NamespaceManager, XmlParserContext()}, System.Xml.XPath.XPathExpression.SetContext()`

## XmlNameTable MustInherit Class

## System.Xml (system.xml.dll) *ECMA*

This class presents a table of string objects (for element and attribute names) used in an XML document. The XML parser uses these string objects for efficient manipulation of repeated element and attribute names. An `XmlNameTable` exists for every `XmlDocument` you create. The `XmlImplementation` class instantiates a new `XmlDocument` with the `XmlNameTable` of another existing `XmlDocument`.

```
Public MustInherit Class XmlNameTable

' Protected Constructors

   Protected Sub New()

' Public Instance Methods

   MustInherit Public Function Add(ByVal array As Char(),

        ByVal offset As Integer,

        ByVal length As Integer) As String

   MustInherit Public Function Add(

        ByVal array As String) As String

   MustInherit Public Function Get(ByVal array As Char(),

        ByVal offset As Integer,

        ByVal length As Integer) As String

   MustInherit Public Function Get(

        ByVal array As String) As String

End Class
```

### Subclasses

`NameTable`

### Returned By

`XmlDocument.NameTable`, `XmlNamespaceManager.NameTable`, `XmlParserContext.NameTable`, `XmlReader.NameTable`, `System.Xml.XPath.XPathNavigator.NameTable`

### Passed To

`XmlDocument.XmlDocument()`, `XmlNamespaceManager.XmlNamespaceManager()`, XmlParserContext.{NameTable, XmlParserContext()}, XmlTextReader.XmlTextReader()

# XmlNode MustInherit Class

## System.Xml (system.xml.dll)

This MustInherit class represents a node in a document. A node is the basic object described by the node can be an element, an element's attributes, the `DOCTYPE` declaration, a comment, or the entir a hierarchical tree in which child, parent, and sibling relationships are "known" by each node.

The `XmlNode` class is the parent object of the specific node type classes. The properties of this clas node: `NamespaceURI`, `NodeType`, parent, child, sibling nodes, etc. The methods allow a node to a the context of an `XmlDocument` or `XmlDocumentFragment`), with respect to a reference node.

```
Public MustInherit Class XmlNode : Implements ICloneable, IEnumerable, Sy

' Public Instance Properties

   Overridable Public ReadOnly Property Attributes As XmlAttributeCollect

   Overridable Public ReadOnly Property BaseURI As String

   Overridable Public ReadOnly Property ChildNodes As XmlNodeList

   Overridable Public ReadOnly Property FirstChild As XmlNode

   Overridable Public ReadOnly Property HasChildNodes As Boolean

   Overridable Public Property InnerText As String

   Overridable Public Property InnerXml As String

   Overridable Public ReadOnly Property IsReadOnly As Boolean

   Overridable Public Default ReadOnly Property Item(

        ByVal name As String) As XmlElement

   Overridable Public Default ReadOnly Property Item(

        ByVal localname As String,

        ByVal ns As String) As XmlElement

   Overridable Public ReadOnly Property LastChild As XmlNode

   MustInherit Public ReadOnly Property LocalName As String

   MustInherit Public ReadOnly Property Name As String

   Overridable Public ReadOnly Property NamespaceURI As String

   Overridable Public ReadOnly Property NextSibling As XmlNode

   MustInherit Public ReadOnly Property NodeType As XmlNodeType

   Overridable Public ReadOnly Property OuterXml As String

   Overridable Public ReadOnly Property OwnerDocument As XmlDocument
```

```
    Overridable Public ReadOnly Property ParentNode As XmlNode
    Overridable Public Property Prefix As String
    Overridable Public ReadOnly Property PreviousSibling As XmlNode
    Overridable Public Property Value As String
' Public Instance Methods
    Overridable Public Function AppendChild(
         ByVal newChild As XmlNode) As XmlNode
    Overridable Public Function Clone() As XmlNode
    MustInherit Public Function CloneNode(
         ByVal deep As Boolean) As XmlNode
    Public Function CreateNavigator(
         ) As XPathNavigator Implements IXPathNavigable.CreateNavigator
    Public Function GetEnumerator(
         ) As IEnumerator Implements IEnumerable.GetEnumerator
    Overridable Public Function GetNamespaceOfPrefix(
         ByVal prefix As String) As String
    Overridable Public Function GetPrefixOfNamespace(
         ByVal namespaceURI As String) As String
    Overridable Public Function InsertAfter(
         ByVal newChild As XmlNode,
         ByVal refChild As XmlNode) As XmlNode
    Overridable Public Function InsertBefore(
         ByVal newChild As XmlNode,
         ByVal refChild As XmlNode) As XmlNode
    Overridable Public Sub Normalize()
    Overridable Public Function PrependChild(
         ByVal newChild As XmlNode) As XmlNode
    Overridable Public Sub RemoveAll()
    Overridable Public Function RemoveChild(
         ByVal oldChild As XmlNode) As XmlNode
    Overridable Public Function ReplaceChild(
```

```
        ByVal newChild As XmlNode,
        ByVal oldChild As XmlNode) As XmlNode
   Public Function SelectNodes(
        ByVal xpath As String) As XmlNodeList
   Public Function SelectNodes(ByVal xpath As String,
        ByVal nsmgr As XmlNamespaceManager) As XmlNodeList
   Public Function SelectSingleNode(
        ByVal xpath As String) As XmlNode
   Public Function SelectSingleNode(ByVal xpath As String,
        ByVal nsmgr As XmlNamespaceManager) As XmlNode
   Overridable Public Function Supports(
        ByVal feature As String,
        ByVal version As String) As Boolean
   MustInherit Public Sub WriteContentTo(ByVal w As XmlWriter)
   MustInherit Public Sub WriteTo( ByVal w As XmlWriter)
End Class
```

### Subclasses

XmlAttribute, XmlDocument, XmlDocumentFragment, XmlEntity, XmlLinkedNode, XmlNc

### Returned By

Multiple types

### Passed To

XmlDataDocument.CreateNavigator(), XmlDocument.ImportNode(), XmlNamedNodeMap
XmlNodeReader.XmlNodeReader()

## XmlNodeChangedAction Enum

### System.Xml (system.xml.dll) *serializable*

This simple enumeration that describes the change that has occurred within an `XmlDocument` instance can be one of the following: `Change`, which indicates that a node within the document has changed in some way; `Insert`, which indicates that a node has been inserted into the document; or `Remove`, which indicates that a node has been removed. This is one of the properties specified in the `XmlNodeChangedEventArgs` parameter to the `XmlNodeChangedEventHandler` delegate instance registered with the `XmlDocument`.

```
Public Enum XmlNodeChangedAction
   Insert = 0
   Remove = 1
   Change = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XmlNodeChangedAction`

### Returned By

`XmlNodeChangedEventArgs.Action`

# XmlNodeChangedEventArgs Class

## System.Xml (system.xml.dll)

This type contains information about the changes to a node that are passed when an `XmlDocument` calls through an `XmlNodeChangedEventHandler` delegate instance. It contains the changed or changing node, the old and new parents to that node, and an enumeration describing the change (modification, insertion, or removal).

```
Public Class XmlNodeChangedEventArgs

' Public Instance Properties

   Public ReadOnly Property Action As XmlNodeChangedAction

   Public ReadOnly Property NewParent As XmlNode

   Public ReadOnly Property Node As XmlNode

   Public ReadOnly Property OldParent As XmlNode

End Class
```

### Passed To

`XmlNodeChangedEventHandler.{BeginInvoke(), Invoke()}`

# XmlNodeChangedEventHandler Delegate

## System.Xml (system.xml.dll) *serializable*

This declared delegate type must be used to receive event notifications from the `XmlDocument` instance if code wishes to be notified of changes to the document as they occur.

```
Public Delegate Sub XmlNodeChangedEventHandler(

        ByVal sender As Object,

        ByVal e As XmlNodeChangedEventArgs)
```

### Associated Events

`XmlDataDocument.{NodeChanged(), NodeChanging(), NodeInserted(), NodeInserting(), NodeRemoved(), NodeRemoving()}, XmlDocument.{NodeChanged(), NodeChanging(), NodeInserted(), NodeInserting(), NodeRemoved(), NodeRemoving()}`

# XmlNodeList MustInherit Class

## System.Xml (system.xml.dll)

This class is an enumerated collection of nodes returned by `XmlDocument.GetElementsByTagName()`. Nodes contained in the list can be retrieved by index or iterated through via the `IEnumerator` returned by `GetEnumerator()`. Changes to the nodes in the list are immediately reflected in the `XmlNodeList`'s properties and methods. For example, if you add a sibling to a node in the list, it appears in the list.

```
Public MustInherit Class XmlNodeList : Implements IEnumerable

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property Count As Integer

   Overridable Public Default ReadOnly Property ItemOf(

        ByVal i As Integer) As XmlNode

' Public Instance Methods

   MustInherit Public Function GetEnumerator(

        ) As IEnumerator Implements IEnumerable.GetEnumerator

   MustInherit Public Function Item(

        ByVal index As Integer) As XmlNode

End Class
```

### Returned By

`XmlDocument.GetElementsByTagName()`, `XmlElement.GetElementsByTagName()`, `XmlNode.{ChildNodes, SelectNodes()}`

## XmlNodeOrder Enum

## System.Xml (system.xml.dll) *serializable*

These values describe the position of one node relative to another, with respect to document order.

```
Public Enum XmlNodeOrder
   Before = 0
   After = 1
   Same = 2
   Unknown = 3
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → XmlNodeOrder

### Returned By

System.Xml.XPath.XPathNavigator.ComparePosition()

# XmlNodeReader Class

## System.Xml (system.xml.dll)

This class is a non-cached, forward-only reader that accesses the contents of an `XmlNode`. This class can read a DOM subtree, but doesn't provide full-document support such as validation.

```
Public Class XmlNodeReader : Inherits XmlReader

' Public Constructors

   Public Sub New( ByVal node As XmlNode)

' Public Instance Properties

   Overrides Public ReadOnly Property AttributeCount As Integer

   Overrides Public ReadOnly Property BaseURI As String

   Overrides Public ReadOnly Property CanResolveEntity As Boolean

   Overrides Public ReadOnly Property Depth As Integer

   Overrides Public ReadOnly Property EOF As Boolean

   Overrides Public ReadOnly Property HasAttributes As Boolean

   Overrides Public ReadOnly Property HasValue As Boolean

   Overrides Public ReadOnly Property IsDefault As Boolean

   Overrides Public ReadOnly Property IsEmptyElement As Boolean

   Overrides Public Default ReadOnly Property Item(

        ByVal i As Integer) As String

   Overrides Public Default ReadOnly Property Item(

        ByVal name As String,

        ByVal namespaceURI As String) As String

   Overrides Public Default ReadOnly Property Item(

        ByVal name As String) As String

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NamespaceURI As String

   Overrides Public ReadOnly Property NameTable As XmlNameTable

   Overrides Public ReadOnly Property NodeType As XmlNodeType
```

```
   Overrides Public ReadOnly Property Prefix As String
   Overrides Public ReadOnly Property QuoteChar As Char
   Overrides Public ReadOnly Property ReadState As ReadState
   Overrides Public ReadOnly Property Value As String
   Overrides Public ReadOnly Property XmlLang As String
   Overrides Public ReadOnly Property XmlSpace As XmlSpace
' Public Instance Methods
   Overrides Public Sub Close()
   Overrides Public Function GetAttribute(
        ByVal attributeIndex As Integer) As String
   Overrides Public Function GetAttribute(
        ByVal name As String) As String
   Overrides Public Function GetAttribute(
        ByVal name As String,
        ByVal namespaceURI As String) As String
   Overrides Public Function LookupNamespace(
        ByVal prefix As String) As String
   Overrides Public Function MoveToAttribute(
        ByVal name As String) As Boolean
   Overrides Public Function MoveToAttribute(
        ByVal name As String,
        ByVal namespaceURI As String) As Boolean
   Overrides Public Sub MoveToAttribute(
        ByVal attributeIndex As Integer)
   Overrides Public Function MoveToElement() As Boolean
   Overrides Public Function MoveToFirstAttribute(
        ) As Boolean
   Overrides Public Function MoveToNextAttribute() As Boolean
   Overrides Public Function Read() As Boolean
   Overrides Public Function ReadAttributeValue() As Boolean
   Overrides Public Function ReadInnerXml() As String
```

```
    Overrides Public Function ReadOuterXml() As String

    Overrides Public Function ReadString() As String

    Overrides Public Sub ResolveEntity()

    Overrides Public Sub Skip()

End Class
```

## Hierarchy

System.Object → XmlReader → XmlNodeReader

# XmlNodeType Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

This enumeration contains identifiers for node types. All DOM Core Level 2 types are included.

```
Public Enum XmlNodeType

   None = 0

   Element = 1

   Attribute = 2

   Text = 3

   CDATA = 4

   EntityReference = 5

   Entity = 6

   ProcessingInstruction = 7

   Comment = 8

   Document = 9

   DocumentType = 10

   DocumentFragment = 11

   Notation = 12

   Whitespace = 13

   SignificantWhitespace = 14

   EndElement = 15

   EndEntity = 16

   XmlDeclaration = 17

End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → XmlNodeType

### Returned By

XmlNode.NodeType, XmlReader.{MoveToContent(), NodeType}

## Passed To

XmlDocument.CreateNode(), XmlTextReader.XmlTextReader(), XmlValidatingReader.XmlValidatingReader()

# XmlNotation Class

## System.Xml (system.xml.dll)

This class represents a notation declaration (`<!NOTATION ...>`) in an XML document.

```
Public Class XmlNotation : Inherits XmlNode

' Public Instance Properties

   Overrides Public Property InnerXml As String

   Overrides Public ReadOnly Property IsReadOnly As Boolean

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public ReadOnly Property OuterXml As String

   Public ReadOnly Property PublicId As String

   Public ReadOnly Property SystemId As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlNotation`

## XmlParserContext Class

## System.Xml (system.xml.dll) *ECMA*

This class contains document context information normally provided by both the XML declaration and `DOCTYPE` elements for parsing XML fragments. `XmlTextReader` and `XmlValidatingReader` use the `XmlParserContext` for the base URI, internal subset, public and system identifiers, etc.

```
Public Class XmlParserContext

' Public Constructors

   Public Sub New(ByVal nt As XmlNameTable,
        ByVal nsMgr As XmlNamespaceManager,
        ByVal docTypeName As String, ByVal pubId As String,
        ByVal sysId As String,
        ByVal internalSubset As String,
        ByVal baseURI As String, ByVal xmlLang As String,
        ByVal xmlSpace As XmlSpace)
   Public Sub New(ByVal nt As XmlNameTable,
        ByVal nsMgr As XmlNamespaceManager,
        ByVal docTypeName As String, ByVal pubId As String,
        ByVal sysId As String,
        ByVal internalSubset As String,
        ByVal baseURI As String, ByVal xmlLang As String,
        ByVal xmlSpace As XmlSpace,
        ByVal enc As System.Text.Encoding)
   Public Sub New(ByVal nt As XmlNameTable,
        ByVal nsMgr As XmlNamespaceManager,
        ByVal xmlLang As String,
        ByVal xmlSpace As XmlSpace)
   Public Sub New(ByVal nt As XmlNameTable,
```

```
        ByVal nsMgr As XmlNamespaceManager,
        ByVal xmlLang As String,
        ByVal xmlSpace As XmlSpace,
        ByVal enc As System.Text.Encoding)
' Public Instance Properties
   Public Property BaseURI As String
   Public Property DocTypeName As String
   Public Property Encoding As Encoding
   Public Property InternalSubset As String
   Public Property NamespaceManager As XmlNamespaceManager
   Public Property NameTable As XmlNameTable
   Public Property PublicId As String
   Public Property SystemId As String
   Public Property XmlLang As String
   Public Property XmlSpace As XmlSpace
End Class
```

## Passed To

XmlTextReader.XmlTextReader(), XmlValidatingReader.XmlValidatingReader()

# XmlProcessingInstruction Class

## System.Xml (system.xml.dll)

This class represents a processing instruction in an XML document.

```
Public Class XmlProcessingInstruction : Inherits XmlLinkedNode

' Protected Constructors

   Protected Friend Sub New(ByVal target As String,

         ByVal data As String, ByVal doc As XmlDocument)

' Public Instance Properties

   Public Property Data As String

   Overrides Public Property InnerText As String

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Public ReadOnly Property Target As String

   Overrides Public Property Value As String

' Public Instance Methods

   Overrides Public Function CloneNode(

         ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

System.Object → XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable) → XmlLinkedNode → XmlProcessingInstruction

### Returned By

XmlDocument.CreateProcessingInstruction()

# XmlQualifiedName Class

## System.Xml (system.xml.dll)

This class represents a namespace-qualified local name. This looks like `namespace:name` within a document. An `XmlQualifiedName` object is constructed with the element's name and its namespace as string arguments. The namespace field may be empty, in which case the default namespace of the document is assumed.

```
Public Class XmlQualifiedName

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal name As String)

   Public Sub New( ByVal name As String, ByVal ns As String)

' Public Shared Fields

   Public Shared ReadOnly Empty As XmlQualifiedName

' Public Instance Properties

   Public ReadOnly Property IsEmpty As Boolean

   Public ReadOnly Property Name As String

   Public ReadOnly Property Namespace As String

' Public Shared Methods

   Public Shared Function ToString(ByVal name As String,

        ByVal ns As String) As String

   Public Shared Boolean operator Sub !=(

        ByVal a As XmlQualifiedName,

        ByVal b As XmlQualifiedName)

   Public Shared Boolean operator Sub ==(

        ByVal a As XmlQualifiedName,

        ByVal b As XmlQualifiedName)

' Public Instance Methods

   Overrides Public Function Equals(

        ByVal other As Object) As Boolean

   Overrides Public Function GetHashCode() As Integer
```

```
    Overrides Public Function ToString() As String
End Class
```

## XmlReader MustInherit Class

## System.Xml (system.xml.dll) *ECMA*

This class is a simple reader for XML documents. `XmlReader` provides a non-cached, forward-only navigation through an XML data stream. It does not provide validation, nor does it expand general entities. Two derived classes provide these features: `XmlTextReader` and `XmlValidatingReader`.

The `XmlReader` class parses XML in a streaming-based approach (exemplified by the SAX specification). This means the XML parser presents "interesting pieces" (elements, attributes, namespace declarations, and so forth) in a linear order. Within `XmlReader`, this ordering of nodes is done using successive calls to the `Read()` method. An `XmlReader` is not positioned on a node at first — an initial call to `Read()` is required to move to the root node of a document. Subsequent calls to `Read()` move the reader sequentially through the nodes. The `NodeType` property tells you which type of node the reader is currently positioned on, returning values from the `XmlNodeType` enumeration. A special node-type value for `XmlReader` is `EndElement`. As `Read()` moves through the stream, it can be positioned on an element's end tag after it has stepped through the element's children. This is not a real node, in the DOM sense, but is required for `XmlReader` to parse XML data properly. The `Skip()` method steps through data node by node. A call to `Skip()` moves the reader to the next real node, disregarding the current node's children.

XML documents can also be parsed in a tree-based approach, using the `XmlDocument` type.

```
Public MustInherit Class XmlReader

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property AttributeCount As Integer

   MustInherit Public ReadOnly Property BaseURI As String

   Overridable Public ReadOnly Property CanResolveEntity As Boolean

   MustInherit Public ReadOnly Property Depth As Integer

   MustInherit Public ReadOnly Property EOF As Boolean

   Overridable Public ReadOnly Property HasAttributes As Boolean

   MustInherit Public ReadOnly Property HasValue As Boolean

   MustInherit Public ReadOnly Property IsDefault As Boolean

   MustInherit Public ReadOnly Property IsEmptyElement As Boolean

   MustInherit Public Default ReadOnly Property Item(
        ByVal i As Integer) As String

   MustInherit Public Default ReadOnly Property Item(
```

```
        ByVal name As String) As String
    MustInherit Public Default ReadOnly Property Item(
        ByVal name As String,
        ByVal namespaceURI As String) As String
    MustInherit Public ReadOnly Property LocalName As String
    MustInherit Public ReadOnly Property Name As String
    MustInherit Public ReadOnly Property NamespaceURI As String
    MustInherit Public ReadOnly Property NameTable As XmlNameTable
    MustInherit Public ReadOnly Property NodeType As XmlNodeType
    MustInherit Public ReadOnly Property Prefix As String
    MustInherit Public ReadOnly Property QuoteChar As Char
    MustInherit Public ReadOnly Property ReadState As ReadState
    MustInherit Public ReadOnly Property Value As String
    MustInherit Public ReadOnly Property XmlLang As String
    MustInherit Public ReadOnly Property XmlSpace As XmlSpace
' Public Shared Methods
    Public Shared Function IsName(
        ByVal str As String) As Boolean
    Public Shared Function IsNameToken(
        ByVal str As String) As Boolean
' Public Instance Methods
    MustInherit Public Sub Close()
    MustInherit Public Function GetAttribute(
        ByVal i As Integer) As String
    MustInherit Public Function GetAttribute(
        ByVal name As String) As String
    MustInherit Public Function GetAttribute(
        ByVal name As String,
        ByVal namespaceURI As String) As String
    Overridable Public Function IsStartElement() As Boolean
    Overridable Public Function IsStartElement(
```

```
    ByVal name As String) As Boolean
Overridable Public Function IsStartElement(
    ByVal localname As String,
    ByVal ns As String) As Boolean
MustInherit Public Function LookupNamespace(
    ByVal prefix As String) As String
MustInherit Public Function MoveToAttribute(
    ByVal name As String) As Boolean
MustInherit Public Function MoveToAttribute(
    ByVal name As String,
    ByVal ns As String) As Boolean
MustInherit Public Sub MoveToAttribute( ByVal i As Integer)
Overridable Public Function MoveToContent() As XmlNodeType
MustInherit Public Function MoveToElement() As Boolean
MustInherit Public Function MoveToFirstAttribute(
    ) As Boolean
MustInherit Public Function MoveToNextAttribute(
    ) As Boolean
MustInherit Public Function Read() As Boolean
MustInherit Public Function ReadAttributeValue(
    ) As Boolean
Overridable Public Function ReadElementString() As String
Overridable Public Function ReadElementString(
    ByVal name As String) As String
Overridable Public Function ReadElementString(
    ByVal localname As String,
    ByVal ns As String) As String
Overridable Public Sub ReadEndElement()
MustInherit Public Function ReadInnerXml() As String
MustInherit Public Function ReadOuterXml() As String
Overridable Public Sub ReadStartElement()
```

```
    Overridable Public Sub ReadStartElement(
          ByVal name As String)
    Overridable Public Sub ReadStartElement(
          ByVal localname As String, ByVal ns As String)
    MustInherit Public Function ReadString() As String
    MustInherit Public Sub ResolveEntity()
    Overridable Public Sub Skip()
End Class
```

### Subclasses

XmlNodeReader, XmlTextReader, XmlValidatingReader

### Returned By

XmlValidatingReader.Reader, System.Xml.Xsl.XslTransform.Transform()

### Passed To

XmlDocument.{Load(), ReadNode()}, XmlValidatingReader.XmlValidatingReader(), XmlWriter.{WriteAttributes(), WriteNode()}, System.Xml.XPath.XPathDocument.XPathDocument(), System.Xml.Xsl.XslTransform.Load()

## XmlResolver MustInherit Class

## System.Xml (system.xml.dll) *ECMA*

This class resolves external resources according to their URIs. This class is used to retrieve an external DTD or Schema in XML documents and also obtains resources from imported stylesheets (<xsl:import>) and included files (<xml:include>). This MustInherit class is implemented by `XmlUrlResolver`.

```
Public MustInherit Class XmlResolver

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public WriteOnly Property Credentials As ICredentials

' Public Instance Methods

   MustInherit Public Function GetEntity(

        ByVal absoluteUri As Uri, ByVal role As String,

        ByVal ofObjectToReturn As Type) As Object

   MustInherit Public Function ResolveUri(

        ByVal baseUri As Uri,

        ByVal relativeUri As String) As Uri

End Class
```

### Subclasses

`XmlUrlResolver`

### Passed To

`XmlDocument.XmlResolver`, `XmlTextReader.XmlResolver`, `XmlValidatingReader.XmlResolver`, `System.Xml.Xsl.XslTransform.{Load(), XmlResolver}`

# XmlSignificantWhitespace Class

## System.Xml (system.xml.dll)

This class represents a whitespace node in mixed content data, if whitespace is preserved in the XML document (`XmlDocument.PreserveWhitespace` is `True`).

```
Public Class XmlSignificantWhitespace : Inherits XmlCharacterData

' Protected Constructors

   Protected Friend Sub New(ByVal strData As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public Property Value As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlLinkedNode` → `XmlCharacterData` → `XmlSignificantWhitespace`

### Returned By

`XmlDocument.CreateSignificantWhitespace()`

# XmlSpace Enum

## System.Xml (system.xml.dll) *ECMA, serializable*

This enumeration provides values for the `xml:space` scope. Used by `XmlParserContext.XmlSpace`.

```
Public Enum XmlSpace
   None = 0
   Default = 1
   Preserve = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XmlSpace`

### Returned By

`XmlParserContext.XmlSpace`, `XmlReader.XmlSpace`, `XmlWriter.XmlSpace`

### Passed To

`XmlParserContext.{XmlParserContext( ), XmlSpace}`, `System.Xml.XPath.XPathDocument.XPathDocument( )`

# XmlText Class

## System.Xml (system.xml.dll)

This class represents a text node in an XML document. `XmlTest` is derived from the`XmlCharacterData` class and contains the text content of an element.

```
Public Class XmlText : Inherits XmlCharacterData

' Protected Constructors

   Protected Friend Sub New(ByVal strData As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public Property Value As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overridable Public Function SplitText(

        ByVal offset As Integer) As XmlText

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlLinkedNode` → `XmlCharacterData` → `XmlText`

### Returned By

`XmlDocument.CreateTextNode()`

## XmlTextReader Class

## System.Xml (system.xml.dll) *ECMA*

This class is a text-based reader for XML documents derived from `XmlReader`. `XmlTextReader` c
formedness and expands entities, but does not validate data according to a DTD or schema.

```
Public Class XmlTextReader : Inherits XmlReader : Implements IXmlLineInfo
' Public Constructors
   Public Sub New( ByVal input As System.IO.Stream)
   Public Sub New(ByVal input As System.IO.Stream,
        ByVal nt As XmlNameTable)
   Public Sub New(ByVal xmlFragment As System.IO.Stream,
        ByVal fragType As XmlNodeType,
        ByVal context As XmlParserContext)
   Public Sub New( ByVal url As String)
   Public Sub New(ByVal url As String,
        ByVal input As System.IO.Stream)
   Public Sub New(ByVal url As String,
        ByVal input As System.IO.Stream,
        ByVal nt As XmlNameTable)
   Public Sub New(ByVal url As String,
        ByVal input As System.IO.TextReader)
   Public Sub New(ByVal url As String,
        ByVal input As System.IO.TextReader,
        ByVal nt As XmlNameTable)
   Public Sub New(ByVal url As String,
        ByVal nt As XmlNameTable)
   Public Sub New(ByVal xmlFragment As String,
        ByVal fragType As XmlNodeType,
        ByVal context As XmlParserContext)
   Public Sub New( ByVal input As System.IO.TextReader)
```

```
   Public Sub New(ByVal input As System.IO.TextReader,
        ByVal nt As XmlNameTable)
' Protected Constructors
   Protected Sub New()
   Protected Sub New( ByVal nt As XmlNameTable)
' Public Instance Properties
   Overrides Public ReadOnly Property AttributeCount As Integer
   Overrides Public ReadOnly Property BaseURI As String
   Overrides Public ReadOnly Property Depth As Integer
   Public ReadOnly Property Encoding As Encoding
   Overrides Public ReadOnly Property EOF As Boolean
   Overrides Public ReadOnly Property HasValue As Boolean
   Overrides Public ReadOnly Property IsDefault As Boolean
   Overrides Public ReadOnly Property IsEmptyElement As Boolean
   Overrides Public Default ReadOnly Property Item(
        ByVal name As String,
        ByVal namespaceURI As String) As String
   Overrides Public Default ReadOnly Property Item(
        ByVal i As Integer) As String
   Overrides Public Default ReadOnly Property Item(
        ByVal name As String) As String
   Public ReadOnly Property LineNumber As Integer Implements IXmlLineInfo
   Public ReadOnly Property LinePosition As Integer Implements IXmlLineIn
   Overrides Public ReadOnly Property LocalName As String
   Overrides Public ReadOnly Property Name As String
   Public Property Namespaces As Boolean
   Overrides Public ReadOnly Property NamespaceURI As String
   Overrides Public ReadOnly Property NameTable As XmlNameTable
   Overrides Public ReadOnly Property NodeType As XmlNodeType
   Public Property Normalization As Boolean
```

```
    Overrides Public ReadOnly Property Prefix As String
    Overrides Public ReadOnly Property QuoteChar As Char
    Overrides Public ReadOnly Property ReadState As ReadState
    Overrides Public ReadOnly Property Value As String
    Public Property WhitespaceHandling As WhitespaceHandling
    Overrides Public ReadOnly Property XmlLang As String
    Public WriteOnly Property XmlResolver As XmlResolver
    Overrides Public ReadOnly Property XmlSpace As XmlSpace
' Public Instance Methods
    Overrides Public Sub Close()
    Overrides Public Function GetAttribute(
         ByVal i As Integer) As String
    Overrides Public Function GetAttribute(
         ByVal name As String) As String
    Overrides Public Function GetAttribute(
         ByVal localName As String,
         ByVal namespaceURI As String) As String
    Public Function GetRemainder() As TextReader
    Overrides Public Function LookupNamespace(
         ByVal prefix As String) As String
    Overrides Public Function MoveToAttribute(
         ByVal name As String) As Boolean
    Overrides Public Function MoveToAttribute(
         ByVal localName As String,
         ByVal namespaceURI As String) As Boolean
    Overrides Public Sub MoveToAttribute( ByVal i As Integer)
    Overrides Public Function MoveToElement() As Boolean
    Overrides Public Function MoveToFirstAttribute(
         ) As Boolean
    Overrides Public Function MoveToNextAttribute() As Boolean
```

```
    Overrides Public Function Read() As Boolean
    Overrides Public Function ReadAttributeValue() As Boolean
    Public Function ReadBase64(ByVal array As Byte(),
         ByVal offset As Integer,
         ByVal len As Integer) As Integer
    Public Function ReadBinHex(ByVal array As Byte(),
         ByVal offset As Integer,
         ByVal len As Integer) As Integer
    Public Function ReadChars(ByVal buffer As Char(),
         ByVal index As Integer,
         ByVal count As Integer) As Integer
    Overrides Public Function ReadInnerXml() As String
    Overrides Public Function ReadOuterXml() As String
    Overrides Public Function ReadString() As String
    Public Sub ResetState()
    Overrides Public Sub ResolveEntity()
End Class
```

## Hierarchy

System.Object → XmlReader → XmlTextReader(IXmlLineInfo)

## XmlTextWriter Class

## System.Xml (system.xml.dll) *ECMA*

This class adds basic formatting to the text output and is derived from `XmlWriter`. The `Formatting` property uses its values to indicate if the output is to be `Indented` (`None` is the default). If `Formatting` is set to `Formatting.Indented`, the value of the `Indentation` property is the number of characters to indent each successive level (or child element) in the output. `IndentChar` sets the character to use for indentation, which must be a valid whitespace character (the default is space). `QuoteChar` is the character to use to quote attributes and is either a single or double quote.

```
Public Class XmlTextWriter : Inherits XmlWriter

' Public Constructors

   Public Sub New(ByVal w As System.IO.Stream,
        ByVal encoding As System.Text.Encoding)

   Public Sub New(ByVal filename As String,
        ByVal encoding As System.Text.Encoding)

   Public Sub New( ByVal w As System.IO.TextWriter)

' Public Instance Properties

   Public ReadOnly Property BaseStream As Stream

   Public Property Formatting As Formatting

   Public Property Indentation As Integer

   Public Property IndentChar As Char

   Public Property Namespaces As Boolean

   Public Property QuoteChar As Char

   Overrides Public ReadOnly Property WriteState As WriteState

   Overrides Public ReadOnly Property XmlLang As String

   Overrides Public ReadOnly Property XmlSpace As XmlSpace

' Public Instance Methods

   Overrides Public Sub Close()

   Overrides Public Sub Flush()

   Overrides Public Function LookupPrefix(
```

```
    ByVal ns As String) As String
Overrides Public Sub WriteBase64(ByVal buffer As Byte(),
    ByVal index As Integer, ByVal count As Integer)
Overrides Public Sub WriteBinHex(ByVal buffer As Byte(),
    ByVal index As Integer, ByVal count As Integer)
Overrides Public Sub WriteCData( ByVal text As String)
Overrides Public Sub WriteCharEntity( ByVal ch As Char)
Overrides Public Sub WriteChars(ByVal buffer As Char(),
    ByVal index As Integer, ByVal count As Integer)
Overrides Public Sub WriteComment( ByVal text As String)
Overrides Public Sub WriteDocType(ByVal name As String,
    ByVal pubid As String, ByVal sysid As String,
    ByVal subset As String)
Overrides Public Sub WriteEndAttribute()
Overrides Public Sub WriteEndDocument()
Overrides Public Sub WriteEndElement()
Overrides Public Sub WriteEntityRef( ByVal name As String)
Overrides Public Sub WriteFullEndElement()
Overrides Public Sub WriteName( ByVal name As String)
Overrides Public Sub WriteNmToken( ByVal name As String)
Overrides Public Sub WriteProcessingInstruction(
    ByVal name As String, ByVal text As String)
Overrides Public Sub WriteQualifiedName(
    ByVal localName As String, ByVal ns As String)
Overrides Public Sub WriteRaw(ByVal buffer As Char(),
    ByVal index As Integer, ByVal count As Integer)
Overrides Public Sub WriteRaw( ByVal data As String)
Overrides Public Sub WriteStartAttribute(
    ByVal prefix As String, ByVal localName As String,
    ByVal ns As String)
Overrides Public Sub WriteStartDocument()
```

```
   Overrides Public Sub WriteStartDocument(
        ByVal standalone As Boolean)
   Overrides Public Sub WriteStartElement(
        ByVal prefix As String, ByVal localName As String,
        ByVal ns As String)
   Overrides Public Sub WriteString( ByVal text As String)
   Overrides Public Sub WriteSurrogateCharEntity(
        ByVal lowChar As Char, ByVal highChar As Char)
   Overrides Public Sub WriteWhitespace( ByVal ws As String)
End Class
```

## Hierarchy

System.Object → XmlWriter → XmlTextWriter

# XmlTokenizedType Enum

## System.Xml (system.xml.dll) *serializable*

This is an enumeration of XML string types based on the XML 1.0 specification.

```
Public Enum XmlTokenizedType
    CDATA = 0
    ID = 1
    IDREF = 2
    IDREFS = 3
    ENTITY = 4
    ENTITIES = 5
    NMTOKEN = 6
    NMTOKENS = 7
    NOTATION = 8
    ENUMERATION = 9
    QName = 10
    NCName = 11
    None = 12
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → XmlTokenizedType

# XmlUrlResolver Class

## System.Xml (system.xml.dll) *ECMA*

This class resolves URLs of external resources and retrieves them for parsing. `XmlUrlResolver` implements `XmlResolver` and provides methods for retrieving external DTDs, Schemas, and imported stylesheets via a URL. To retrieve resources on a network, the `Credentials` property can be set to provide usernames and passwords, as well as define authentication schemes. You can set this property by supplying a `System.Net.ICredentials` object. By default, this property is set for anonymous access to a URI resource.

```
Public Class XmlUrlResolver : Inherits XmlResolver

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Overrides Public WriteOnly Property Credentials As ICredentials

' Public Instance Methods

   Overrides Public Function GetEntity(

        ByVal absoluteUri As Uri, ByVal role As String,

        ByVal ofObjectToReturn As Type) As Object

   Overrides Public Function ResolveUri(ByVal baseUri As Uri,

        ByVal relativeUri As String) As Uri

End Class
```

### Hierarchy

`System.Object` → `XmlResolver` → `XmlUrlResolver`

# XmlValidatingReader Class

## System.Xml (system.xml.dll)

This class is an XML reader that supports DTD and Schema validation. The type of validation to per contained in the `ValidationType` property, which can be `DTD`, `Schema`, `XDR`, or `Auto`. `Auto` is th default and determines which type of validation is required, if any, based on the document. If the `DO` element contains DTD information, that is used. If a schema attribute exists or there is an inline `<sc` that schema is used.

This class implements an event handler that you can set to warn of validation errors during `Read()` operations. Specifically, a delegate instance of type `System.Xml.Schema.ValidationEventHa` can be set for the `ValidationEventHandler` event in this class. This delegate instance is invoke whenever the `XmlValidatingReader` finds an schema-invalid construct in the XML document it i reading, giving the delegate a chance to perform whatever error-handling is appropriate. If no event handler is registered, a `XmlException` is thrown instead on the first error.

```
Public Class XmlValidatingReader : Inherits XmlReader : Implements IXmlLi

' Public Constructors

   Public Sub New(ByVal xmlFragment As System.IO.Stream,
        ByVal fragType As XmlNodeType,
        ByVal context As XmlParserContext)

   Public Sub New(ByVal xmlFragment As String,
        ByVal fragType As XmlNodeType,
        ByVal context As XmlParserContext)

   Public Sub New( ByVal reader As XmlReader)

' Public Instance Properties

   Overrides Public ReadOnly Property AttributeCount As Integer

   Overrides Public ReadOnly Property BaseURI As String

   Overrides Public ReadOnly Property CanResolveEntity As Boolean

   Overrides Public ReadOnly Property Depth As Integer

   Public ReadOnly Property Encoding As Encoding

   Public Property EntityHandling As EntityHandling

   Overrides Public ReadOnly Property EOF As Boolean

   Overrides Public ReadOnly Property HasValue As Boolean

   Overrides Public ReadOnly Property IsDefault As Boolean

   Overrides Public ReadOnly Property IsEmptyElement As Boolean
```

```
    Overrides Public Default ReadOnly Property Item(
         ByVal name As String) As String
    Overrides Public Default ReadOnly Property Item(
         ByVal i As Integer) As String
    Overrides Public Default ReadOnly Property Item(
         ByVal name As String,
         ByVal namespaceURI As String) As String
    Overrides Public ReadOnly Property LocalName As String
    Overrides Public ReadOnly Property Name As String
    Public Property Namespaces As Boolean
    Overrides Public ReadOnly Property NamespaceURI As String
    Overrides Public ReadOnly Property NameTable As XmlNameTable
    Overrides Public ReadOnly Property NodeType As XmlNodeType
    Overrides Public ReadOnly Property Prefix As String
    Overrides Public ReadOnly Property QuoteChar As Char
    Public ReadOnly Property Reader As XmlReader
    Overrides Public ReadOnly Property ReadState As ReadState
    Public ReadOnly Property Schemas As XmlSchemaCollection
    Public ReadOnly Property SchemaType As Object
    Public Property ValidationType As ValidationType
    Overrides Public ReadOnly Property Value As String
    Overrides Public ReadOnly Property XmlLang As String
    Public WriteOnly Property XmlResolver As XmlResolver
    Overrides Public ReadOnly Property XmlSpace As XmlSpace
' Public Instance Methods
    Overrides Public Sub Close()
    Overrides Public Function GetAttribute(
         ByVal i As Integer) As String
    Overrides Public Function GetAttribute(
```

```
        ByVal name As String) As String
    Overrides Public Function GetAttribute(
        ByVal localName As String,
        ByVal namespaceURI As String) As String
    Overrides Public Function LookupNamespace(
        ByVal prefix As String) As String
    Overrides Public Function MoveToAttribute(
        ByVal name As String) As Boolean
    Overrides Public Function MoveToAttribute(
        ByVal localName As String,
        ByVal namespaceURI As String) As Boolean
    Overrides Public Sub MoveToAttribute( ByVal i As Integer)
    Overrides Public Function MoveToElement() As Boolean
    Overrides Public Function MoveToFirstAttribute(
        ) As Boolean
    Overrides Public Function MoveToNextAttribute() As Boolean
    Overrides Public Function Read() As Boolean
    Overrides Public Function ReadAttributeValue() As Boolean
    Overrides Public Function ReadInnerXml() As String
    Overrides Public Function ReadOuterXml() As String
    Overrides Public Function ReadString() As String
    Public Function ReadTypedValue() As Object
    Overrides Public Sub ResolveEntity()
' Events
    Public Event ValidationEventHandler As ValidationEventHandler
End Class
```

## Hierarchy

System.Object → XmlReader → XmlValidatingReader(IXmlLineInfo)

# XmlWhitespace Class

## System.Xml (system.xml.dll)

This class represents whitespace in element content. Whitespace is ignored if `XmlDocument.PreserveWhitespace` is not set to `true`.

```
Public Class XmlWhitespace : Inherits XmlCharacterData

' Protected Constructors

   Protected Friend Sub New(ByVal strData As String,

        ByVal doc As XmlDocument)

' Public Instance Properties

   Overrides Public ReadOnly Property LocalName As String

   Overrides Public ReadOnly Property Name As String

   Overrides Public ReadOnly Property NodeType As XmlNodeType

   Overrides Public Property Value As String

' Public Instance Methods

   Overrides Public Function CloneNode(

        ByVal deep As Boolean) As XmlNode

   Overrides Public Sub WriteContentTo( ByVal w As XmlWriter)

   Overrides Public Sub WriteTo( ByVal w As XmlWriter)

End Class
```

### Hierarchy

`System.Object` → `XmlNode(System.ICloneable, System.Collections.IEnumerable, System.Xml.XPath.IXPathNavigable)` → `XmlLinkedNode` → `XmlCharacterData` → `XmlWhitespace`

### Returned By

`XmlDocument.CreateWhitespace()`

## XmlWriter MustInherit Class

## System.Xml (system.xml.dll) *ECMA*

This class is a fast writer used to output XML data to a stream or file. Two methods work with input from an `XmlReader` object to produce output from the currently positioned node. `WriteAttributes()` outputs all the node's attributes. `WriteNode()` dumps the entire current node to the output stream and moves the `XmlReader` to the next node.

The remaining `Write*` methods of this class take string arguments that are output as properly formed XML markup. For example, `WriteComment()` takes a string and outputs it within `<!-- ... -->` markup. `WriteStartAttribute()` and `WriteStartElement()` provide some flexibility when writing elements and attributes. These two methods provide the opening contents of each type, given the name, prefix, and namespace. The next call can then provide the value of the element or attribute by other means. For example, you can use `WriteString()` for a simple string value, or another `WriteStartElement()` to begin a child element. `WriteEndAttribute()` and `WriteEndElement()` close the writing.

The derived `XmlTextWriter` class provides formatting functionality to the output data.

```
Public MustInherit Class XmlWriter

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property WriteState As WriteState

   MustInherit Public ReadOnly Property XmlLang As String

   MustInherit Public ReadOnly Property XmlSpace As XmlSpace

' Public Instance Methods

   MustInherit Public Sub Close()

   MustInherit Public Sub Flush()

   MustInherit Public Function LookupPrefix(

        ByVal ns As String) As String

   Overridable Public Sub WriteAttributes(

        ByVal reader As XmlReader,

        ByVal defattr As Boolean)

   Public Sub WriteAttributeString(ByVal localName As String,

        ByVal value As String)

   Public Sub WriteAttributeString(ByVal localName As String,
```

```
     ByVal ns As String, ByVal value As String)
Public Sub WriteAttributeString(ByVal prefix As String,
     ByVal localName As String, ByVal ns As String,
     ByVal value As String)
MustInherit Public Sub WriteBase64(ByVal buffer As Byte(),
     ByVal index As Integer, ByVal count As Integer)
MustInherit Public Sub WriteBinHex(ByVal buffer As Byte(),
     ByVal index As Integer, ByVal count As Integer)
MustInherit Public Sub WriteCData( ByVal text As String)
MustInherit Public Sub WriteCharEntity( ByVal ch As Char)
MustInherit Public Sub WriteChars(ByVal buffer As Char(),
     ByVal index As Integer, ByVal count As Integer)
MustInherit Public Sub WriteComment( ByVal text As String)
MustInherit Public Sub WriteDocType(ByVal name As String,
     ByVal pubid As String, ByVal sysid As String,
     ByVal subset As String)
Public Sub WriteElementString(ByVal localName As String,
     ByVal value As String)
Public Sub WriteElementString(ByVal localName As String,
     ByVal ns As String, ByVal value As String)
MustInherit Public Sub WriteEndAttribute()
MustInherit Public Sub WriteEndDocument()
MustInherit Public Sub WriteEndElement()
MustInherit Public Sub WriteEntityRef(ByVal name As String)
MustInherit Public Sub WriteFullEndElement()
MustInherit Public Sub WriteName( ByVal name As String)
MustInherit Public Sub WriteNmToken( ByVal name As String)
Overridable Public Sub WriteNode(ByVal reader As XmlReader,
     ByVal defattr As Boolean)
MustInherit Public Sub WriteProcessingInstruction(
```

```
        ByVal name As String, ByVal text As String)
    MustInherit Public Sub WriteQualifiedName(
        ByVal localName As String, ByVal ns As String)
    MustInherit Public Sub WriteRaw(ByVal buffer As Char(),
        ByVal index As Integer, ByVal count As Integer)
    MustInherit Public Sub WriteRaw( ByVal data As String)
    Public Sub WriteStartAttribute(ByVal localName As String,
        ByVal ns As String)
    MustInherit Public Sub WriteStartAttribute(
        ByVal prefix As String, ByVal localName As String,
        ByVal ns As String)
    MustInherit Public Sub WriteStartDocument()
    MustInherit Public Sub WriteStartDocument(
        ByVal standalone As Boolean)
    Public Sub WriteStartElement( ByVal localName As String)
    Public Sub WriteStartElement(ByVal localName As String,
        ByVal ns As String)
    MustInherit Public Sub WriteStartElement(
        ByVal prefix As String, ByVal localName As String,
        ByVal ns As String)
    MustInherit Public Sub WriteString( ByVal text As String)
    MustInherit Public Sub WriteSurrogateCharEntity(
        ByVal lowChar As Char, ByVal highChar As Char)
    MustInherit Public Sub WriteWhitespace( ByVal ws As String)
End Class
```

### Subclasses

XmlTextWriter

### Passed To

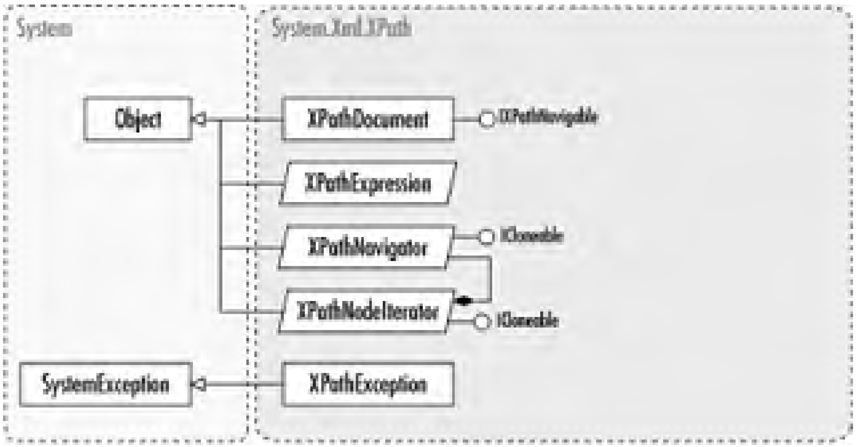
XmlDocument.Save(), XmlNode.{WriteContentTo(), WriteTo()},
System.Xml.Xsl.XslTransform.Transform()

# Chapter 23. System.Xml.XPath

XPath is a W3C specification for locating nodes in an XML document. It provides an expression syntax that can determine a node based on its type, location, and relation to other nodes in a document. XPath is generally not useful alone, but works in conjunction with other tools, especially XSLT. Figure 23-1 shows the types in this namespace.

`System.Xml.XPath` provides types that evaluate expressions and match nodes in XML documents. `XPathDocument` is a document object designed to provide fast document navigation through XPath and is used by the `System.Xml.Xsl` classes for XSLT transformations. `XPathNavigator` is the core entry point for doing XPath expressions; it is MustInherit, allowing for more than just XML documents to be XPath-navigated. For example, an ADO.NET provider could, if it desired, implement the `IXPathNavigable` interface and return an `XPathNavigator` that translated XPath queries into a SQL SELECT statement. (See Aaron Skonnard's MSDN Magazine article "Writing XML Providers for Microsoft .NET" for more details about using XML-based technologies over data sources other than XML documents.)

**Figure 23-1. The System.Xml.XPath namespace**



# IXPathNavigable Interface

## System.Xml.XPath (system.xml.dll)

This is an interface to XPathNavigator implemented by XPathDocument, System.Xml.XmlNode, and derived classes. It implements one method, CreateNavigator(), which creates an XPathNavigator instance for the document object.

```
Public Interface IXPathNavigable

' Public Instance Methods

   Public Function CreateNavigator() As XPathNavigator

End Interface
```

### Implemented By

XPathDocument, System.Xml.XmlNode

### Passed To

System.Xml.Xsl.XslTransform.{Load(), Transform()}

## XmlCaseOrder Enum

## System.Xml.XPath (system.xml.dll) *serializable*

This enumeration specifies how nodes are sorted with respect to case. A value of `None` indicates that case is to be ignored when ordering nodes.

```
Public Enum XmlCaseOrder
   None = 0
   UpperFirst = 1
   LowerFirst = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XmlCaseOrder`

### Passed To

`XPathExpression.AddSort()`

## XmlDataType Enum

## System.Xml.XPath (system.xml.dll) *serializable*

This enumeration specifies whether to sort node values by type as numeric value (`Number`) or alphabetically (`Text`).

```
Public Enum XmlDataType
   Text = 1
   Number = 2
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XmlDataType`

### Passed To

`XPathExpression.AddSort()`

# XmlSortOrder — Enum

## System.Xml.XPath (system.xml.dll) — *serializable*

This enumeration specifies how nodes are sorted by numerical value, either ascending or descending.

```
Public Enum XmlSortOrder
    Ascending = 1
    Descending = 2
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → XmlSortOrder

### Passed To

XPathExpression.AddSort()

# XPathDocument Class

## System.Xml.XPath (system.xml.dll)

This class is a concrete implementation of `IXPathNavigable` for creating an `XPathNavigator` that knows how to scan through an XML document. There are overloaded forms of the constructor designed to pull an XML document from various sources — a `System.IO.Stream`, a string, a `System.IO.TextReader` (which presumably is pulling from some other valid data source), or a `System.Xml.XmlReader`. Note that if the `XmlReader` is currently positioned on top of a particular node within a document, the constructed `XPathDocument` instance is only valid for that element and its children. This allows partial XPath scans of a given document.

This class serves no other purpose than as a factory for producing `XPathNavigator` instances.

```
Public Class XPathDocument : Implements IXPathNavigable

' Public Constructors

   Public Sub New( ByVal stream As System.IO.Stream)

   Public Sub New( ByVal uri As String)

   Public Sub New(ByVal uri As String,

        ByVal space As System.Xml.XmlSpace)

   Public Sub New( ByVal reader As System.IO.TextReader)

   Public Sub New( ByVal reader As System.Xml.XmlReader)

   Public Sub New(ByVal reader As System.Xml.XmlReader,

        ByVal space As System.Xml.XmlSpace)

' Public Instance Methods

   Public Function CreateNavigator(

        ) As XPathNavigator Implements IXPathNavigable.CreateNavigator

End Class
```

## XPathException Class

## System.Xml.XPath (system.xml.dll) *serializable*

This exception indicates a problem with an `XPathExpression`, such as an invalid prefix.

```
Public Class XPathException : Inherits SystemException
' Public Constructors
   Public Sub New(ByVal message As String,
        ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Overrides Public ReadOnly Property Message As String
' Public Instance Methods
   Overrides Public Sub GetObjectData(
        ByVal info As System.Runtime.Serialization.SerializationInfo,
        ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → XPathException

## XPathExpression MustInherit Class

### System.Xml.XPath (system.xml.dll)

This class represents a compiled XPath expression. An `XPathExpression` is returned by the `Compile()` method of `XPathNavigator` from an XPath expression string. The `AddSort()` method allows you to specify the order of returned nodes from the expression. `SetContext()` sets the namespace to use in the evaluation of the expression.

```
Public MustInherit Class XPathExpression

' Public Instance Properties

   MustInherit Public ReadOnly Property Expression As String

   MustInherit Public ReadOnly Property ReturnType As XPathResultType

' Public Instance Methods

   MustInherit Public Sub AddSort(ByVal expr As Object,

        ByVal comparer As System.Collections.IComparer)

   MustInherit Public Sub AddSort(ByVal expr As Object,

        ByVal order As XmlSortOrder,

        ByVal caseOrder As XmlCaseOrder,

        ByVal lang As String,

        ByVal dataType As XmlDataType)

   MustInherit Public Function Clone() As XPathExpression

   MustInherit Public Sub SetContext(

        ByVal nsManager As System.Xml.XmlNamespaceManager)

End Class
```

### Returned By

`XPathNavigator.Compile()`

### Passed To

`XPathNavigator.{Evaluate(),Matches(),Select()}`

# XPathNamespaceScope Enum

## System.Xml.XPath (system.xml.dll) *serializable*

This enumeration defines the namespace scope for certain `XPathNavigator` operations. `All` includes all namespaces within the scope of the current node (including the `xmlns:xml` namespace, whether defined explicitly or not). `ExcludeXml` includes all namespaces within the scope of the current node, *except* the `xmlns:xml` namespace. `Local` includes all locally defined namespaces within the scope of the current node.

```
Public Enum XPathNamespaceScope

   All = 0

   ExcludeXml = 1

   Local = 2

End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XPathNamespaceScope`

### Passed To

`XPathNavigator.{MoveToFirstNamespace(),MoveToNextNamespace()}`

## XPathNavigator MustInherit Class

## System.Xml.XPath (system.xml.dll)

This class is a read-only representation of an `XPathDocument` based on the `IXPathNavigable` interface. It provides an easy-to-use data object for quick XPath-based navigation, particularly for XSLT transformations.

An `XPathNavigator` instance maintains its state with the current node position to provide the proper context for any XPath expression evaluation. Initially, the current node is the root node. The current node is changed by using the `Select()` method or the various `MoveTo*` methods. If the XPath expression evaluates to a set of nodes, the first node of the set is the current node for the `XPathNavigator`. All the `Select*` methods return an `XPathNodeIterator` object containing the set of nodes returned by the function. Except for plain-old `Select()`, the `Select*` functions do not change the current node of the `XPathNavigator` they are used on. Any actions on the `XPathNodeIterator` objects that they return also do not affect the originating object.

The `Compile()` method takes an XPath expression string and encapsulates it into a compiled `XPathExpression` object. `XPathExpression` objects are used by `Select()`, `Evaluate()`, and `Matches()` as input to search a node list.

```
Public MustInherit Class XPathNavigator : Implements ICloneable

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   MustInherit Public ReadOnly Property BaseURI As String

   MustInherit Public ReadOnly Property HasAttributes As Boolean

   MustInherit Public ReadOnly Property HasChildren As Boolean

   MustInherit Public ReadOnly Property IsEmptyElement As Boolean

   MustInherit Public ReadOnly Property LocalName As String

   MustInherit Public ReadOnly Property Name As String

   MustInherit Public ReadOnly Property NamespaceURI As String

   MustInherit Public ReadOnly Property NameTable As XmlNameTable

   MustInherit Public ReadOnly Property NodeType As XPathNodeType

   MustInherit Public ReadOnly Property Prefix As String

   MustInherit Public ReadOnly Property Value As String

   MustInherit Public ReadOnly Property XmlLang As String

' Public Instance Methods
```

```
MustInherit Public Function Clone() As XPathNavigator
Overridable Public Function ComparePosition(
     ByVal nav As XPathNavigator) As XmlNodeOrder
Overridable Public Function Compile(
     ByVal xpath As String) As XPathExpression
Overridable Public Function Evaluate(
     ByVal xpath As String) As Object
Overridable Public Function Evaluate(
     ByVal expr As XPathExpression) As Object
Overridable Public Function Evaluate(
     ByVal expr As XPathExpression,
     ByVal context As XPathNodeIterator) As Object
MustInherit Public Function GetAttribute(
     ByVal localName As String,
     ByVal namespaceURI As String) As String
MustInherit Public Function GetNamespace(
     ByVal name As String) As String
Overridable Public Function IsDescendant(
     ByVal nav As XPathNavigator) As Boolean
MustInherit Public Function IsSamePosition(
     ByVal other As XPathNavigator) As Boolean
Overridable Public Function Matches(
     ByVal xpath As String) As Boolean
Overridable Public Function Matches(
     ByVal expr As XPathExpression) As Boolean
MustInherit Public Function MoveTo(
     ByVal other As XPathNavigator) As Boolean
MustInherit Public Function MoveToAttribute(
     ByVal localName As String,
     ByVal namespaceURI As String) As Boolean
MustInherit Public Function MoveToFirst() As Boolean
```

```
MustInherit Public Function MoveToFirstAttribute(
     ) As Boolean
MustInherit Public Function MoveToFirstChild() As Boolean
Public Function MoveToFirstNamespace() As Boolean
MustInherit Public Function MoveToFirstNamespace(
     ByVal namespaceScope As XPathNamespaceScope) As Boolean
MustInherit Public Function MoveToId(
     ByVal id As String) As Boolean
MustInherit Public Function MoveToNamespace(
     ByVal name As String) As Boolean
MustInherit Public Function MoveToNext() As Boolean
MustInherit Public Function MoveToNextAttribute(
     ) As Boolean
Public Function MoveToNextNamespace() As Boolean
MustInherit Public Function MoveToNextNamespace(
     ByVal namespaceScope As XPathNamespaceScope) As Boolean
MustInherit Public Function MoveToParent() As Boolean
MustInherit Public Function MoveToPrevious() As Boolean
MustInherit Public Sub MoveToRoot()
Overridable Public Function Select(
     ByVal xpath As String) As XPathNodeIterator
Overridable Public Function Select(
     ByVal expr As XPathExpression) As XPathNodeIterator
Overridable Public Function SelectAncestors(
     ByVal name As String, ByVal namespaceURI As String,
     ByVal matchSelf As Boolean) As XPathNodeIterator
Overridable Public Function SelectAncestors(
     ByVal type As XPathNodeType,
     ByVal matchSelf As Boolean) As XPathNodeIterator
Overridable Public Function SelectChildren(
```

```
        ByVal name As String,
        ByVal namespaceURI As String) As XPathNodeIterator
   Overridable Public Function SelectChildren(
        ByVal type As XPathNodeType) As XPathNodeIterator
   Overridable Public Function SelectDescendants(
        ByVal name As String, ByVal namespaceURI As String,
        ByVal matchSelf As Boolean) As XPathNodeIterator
   Overridable Public Function SelectDescendants(
        ByVal type As XPathNodeType,
        ByVal matchSelf As Boolean) As XPathNodeIterator
   Overrides Public Function ToString() As String
End Class
```

## Returned By

System.Xml.XmlDataDocument.CreateNavigator(), System.Xml.XmlNode.CreateNavigator(), IXPathNavigable.CreateNavigator(), XPathDocument.CreateNavigator(), XPathNodeIterator.Current

## Passed To

System.Xml.Xsl.IXsltContextFunction.Invoke(), System.Xml.Xsl.XsltContext.PreserveWhitespace(), System.Xml.Xsl.XslTransform.{Load(), Transform()}

# XPathNodeIterator MustInherit Class

## System.Xml.XPath (system.xml.dll)

This class is a node-set constructed from a compiled XPath expression. This type is returned by the `Select*` methods of `XPathNavigator`. The `MoveNext()` method moves to the next node of the node set in document order and does not affect the `XPathNavigator` on which the `Select()` was called.

```
Public MustInherit Class XPathNodeIterator : Implements ICloneable

' Protected Constructors

   Protected Sub New()

' Public Instance Properties

   Overridable Public ReadOnly Property Count As Integer

   MustInherit Public ReadOnly Property Current As XPathNavigator

   MustInherit Public ReadOnly Property CurrentPosition As Integer

' Public Instance Methods

   MustInherit Public Function Clone() As XPathNodeIterator

   MustInherit Public Function MoveNext() As Boolean

End Class
```

### Returned By

`XPathNavigator.{Select(),SelectAncestors(),SelectChildren(), SelectDescendants()}`

### Passed To

`XPathNavigator.Evaluate()`

# XPathNodeType Enum

## System.Xml.XPath (system.xml.dll) *serializable*

This enumeration contains the types of nodes that can be listed with the XPathNavigator.NodeType property.

```
Public Enum XPathNodeType
    Root = 0
    Element = 1
    Attribute = 2
    Namespace = 3
    Text = 4
    SignificantWhitespace = 5
    Whitespace = 6
    ProcessingInstruction = 7
    Comment = 8
    All = 9
End Enum
```

### Hierarchy

System.Object → System.ValueType → System.Enum(System.IComparable, System.IFormattable, System.IConvertible) → XPathNodeType

### Returned By

XPathNavigator.NodeType

### Passed To

XPathNavigator.{SelectAncestors(), SelectChildren(), SelectDescendants()}

# XPathResultType Enum

## System.Xml.XPath (system.xml.dll) *serializable*

This enumeration contains the result types used by the `XPathExpression.ReturnType` property.

```
Public Enum XPathResultType
   Number = 0
   String = 1
   Navigator = 1
   Boolean = 2
   NodeSet = 3
   Any = 5
   Error = 6
End Enum
```

### Hierarchy

`System.Object` → `System.ValueType` → `System.Enum(System.IComparable, System.IFormattable, System.IConvertible)` → `XPathResultType`

### Returned By

`XPathExpression.ReturnType`, `System.Xml.Xsl.IXsltContextFunction.{ArgTypes, ReturnType}`, `System.Xml.Xsl.IXsltContextVariable.VariableType`

### Passed To

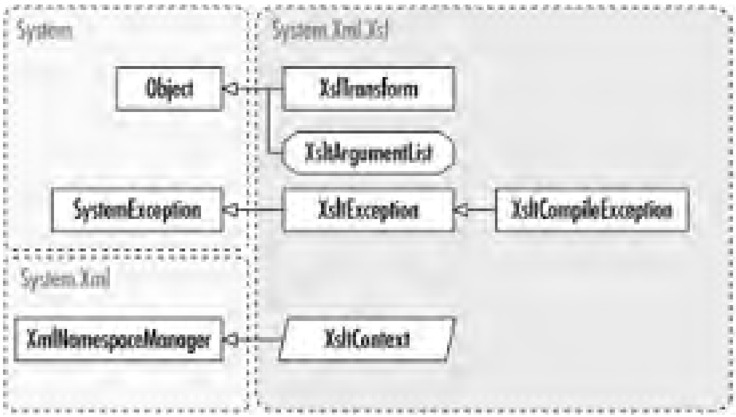
`System.Xml.Xsl.XsltContext.ResolveFunction()`

# Chapter 24. System.Xml.Xsl

The System.Xml.Xsl namespace provides support to Extensible Stylesheet Language Transformations (XSLT). XSLT is a W3C specification that describes how to transform one XML document into another with the use of stylesheet templates. For example, a common use of XSLT is to transform an XML document into standard HTML by transforming the specific elements of the input XML document into comparable HTML elements. XSLT templates use XPath expression syntax to specify which nodes of the input XML are transformed.

The XslTransform class constructs the transform object. It loads a stylesheet and applies its templates to an XML document to output the transformed data. The XsltArgumentList class creates objects for XSLT parameters that can be loaded into the stylesheet at runtime. XsltContext provides the XSLT processor with the current context node information used for XPath expression resolution. Figure 24-1 shows the types in this namespace.

**Figure 24-1. The System.Xml.Xsl namespace**



## IXsltContextFunction Interface

## System.Xml.Xsl (system.xml.dll)

The Microsoft .NET XSLT engine, like many other XSLT engines, allows custom functions inside of an XSLT stylesheet document. By providing an "extension object" to an `XsltArgumentList` instance, an XSLT stylesheet can "call out" to methods in the CLR. See the `XsltArgumentList` description for an example.

```
Public Interface IXsltContextFunction

' Public Instance Properties

   Public ReadOnly Property ArgTypes As XPathResultType()

   Public ReadOnly Property Maxargs As Integer

   Public ReadOnly Property Minargs As Integer

   Public ReadOnly Property ReturnType As XPathResultType

' Public Instance Methods

   Public Function Invoke(ByVal xsltContext As XsltContext,

        ByVal args As Object(),

        ByVal docContext As System.Xml.XPath.XPathNavigator) As Object

End Interface
```

### Returned By

`XsltContext.ResolveFunction()`

## IXsltContextVariable Interface

## System.Xml.Xsl (system.xml.dll)

As with `IXsltContextFunction`, this interface is used to help the XSLT engine resolve data objects bound into the XSLT engine's executing context while processing an XML document. See the `XsltArgumentList` method description for an example of how context functions and variables are used with an XSLT instance.

```
Public Interface IXsltContextVariable
' Public Instance Properties
   Public ReadOnly Property IsLocal As Boolean
   Public ReadOnly Property IsParam As Boolean
   Public ReadOnly Property VariableType As XPathResultType
' Public Instance Methods
   Public Function Evaluate(
        ByVal xsltContext As XsltContext) As Object
End Interface
```

### Returned By

`XsltContext.ResolveVariable()`

## XsltArgumentList NotInheritable Class

## System.Xml.Xsl (system.xml.dll)

The `XsltArgumentList` class constructs lists of parameters and node fragment objects that can be called from stylesheets. This type is called as the second argument to the `Transform()` method of `XslTransform`. Parameters are associated with namespace-qualified names, and objects are associated with their namespace URIs.

The `XsltArgumentList` can also be used to bind functions and variables into the XSLT engine's execution space — commonly called the XSLT context — for use by the XSLT stylesheet during processing.

```
Public NotInheritable Class XsltArgumentList

' Public Constructors

   Public Sub New()

' Public Instance Methods

   Public Sub AddExtensionObject(ByVal namespaceUri As String,
        ByVal extension As Object)

   Public Sub AddParam(ByVal name As String,
        ByVal namespaceUri As String,
        ByVal parameter As Object)

   Public Sub Clear()

   Public Function GetExtensionObject(
        ByVal namespaceUri As String) As Object

   Public Function GetParam(ByVal name As String,
        ByVal namespaceUri As String) As Object

   Public Function RemoveExtensionObject(
        ByVal namespaceUri As String) As Object

   Public Function RemoveParam(ByVal name As String,
        ByVal namespaceUri As String) As Object

End Class
```

### Passed To

`XslTransform.Transform()`

# XsltCompileException Class

## System.Xml.Xsl (system.xml.dll) *serializable*

The `XslTransform.Load()` method throws this exception when it encounters an error in an XSLT document.

```
Public Class XsltCompileException : Inherits XsltException

' Public Constructors

   Public Sub New(ByVal inner As Exception,

        ByVal sourceUri As String,

        ByVal lineNumber As Integer,

        ByVal linePosition As Integer)

' Protected Constructors

   Protected Sub New(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

' Public Instance Properties

   Overrides Public ReadOnly Property Message As String

' Public Instance Methods

   Overrides Public Sub GetObjectData(

        ByVal info As System.Runtime.Serialization.SerializationInfo,

        ByVal context As System.Runtime.Serialization.StreamingContext)

End Class
```

### Hierarchy

System.Object → System.Exception(System.Runtime.Serialization.ISerializable) → System.SystemException → XsltException → XsltCompileException

## XsltContext MustInherit Class

### System.Xml.Xsl (system.xml.dll)

This class provides a way to resolve namespaces and determine the current context for XPath varia expressions. It inherits `System.Xml.XmlNamespaceManager` and its namespace functions. Addit defined for this class resolve variables (`ResolveVariable()`) as well as references to XPath func during execution (`ResolveFunction()`).

```
Public MustInherit Class XsltContext : Inherits System.Xml.XmlNamespaceMa

' Public Constructors

   Public Sub New()

   Public Sub New( ByVal table As System.Xml.NameTable)

' Public Instance Properties

   MustInherit Public ReadOnly Property Whitespace As Boolean

' Public Instance Methods

   MustInherit Public Function CompareDocument(

        ByVal baseUri As String,

        ByVal nextbaseUri As String) As Integer

   MustInherit Public Function PreserveWhitespace(

        ByVal node As System.Xml.XPath.XPathNavigator) As Boolean

   MustInherit Public Function ResolveFunction(

        ByVal prefix As String, ByVal name As String,

        ByVal ArgTypes As System.Xml.XPath.XPathResultType()) As IXsltCon

   MustInherit Public Function ResolveVariable(

        ByVal prefix As String,

        ByVal name As String) As IXsltContextVariable

End Class
```

### Hierarchy

`System.Object` → `System.Xml.XmlNamespaceManager(System.Collections.IEnume` `XsltContext`

### Passed To

IXsltContextFunction.Invoke(), IXsltContextVariable.Evaluate()

# XsltException Class

## System.Xml.Xsl (system.xml.dll) *serializable*

This class returns XSLT exception errors thrown by `XslTransform.Transform()`.

```
Public Class XsltException : Inherits SystemException
' Public Constructors
   Public Sub New(ByVal message As String,
         ByVal innerException As Exception)
' Protected Constructors
   Protected Sub New(
         ByVal info As System.Runtime.Serialization.SerializationInfo,
         ByVal context As System.Runtime.Serialization.StreamingContext)
' Public Instance Properties
   Public ReadOnly Property LineNumber As Integer
   Public ReadOnly Property LinePosition As Integer
   Overrides Public ReadOnly Property Message As String
   Public ReadOnly Property SourceUri As String
' Public Instance Methods
   Overrides Public Sub GetObjectData(
         ByVal info As System.Runtime.Serialization.SerializationInfo,
         ByVal context As System.Runtime.Serialization.StreamingContext)
End Class
```

### Hierarchy

`System.Object` → `System.Exception(System.Runtime.Serialization.ISerializable)` → `System.SystemException` → `XsltException`

### Subclasses

`XsltCompileException`

## XslTransform NotInheritable Class

## System.Xml.Xsl (system.xml.dll)

This object uses the `Load` method to input a stylesheet from either a URL, an `XPathNavigator` object, an object implementing `IXPathNavigable`, or an `XmlReader` object (remember, an XSL stylesheet is an XML document itself). The `Transform()` method takes a URL, an `XPathNavigator` object, or an object implementing `IXPathNavigable` as its first argument, which contains the XML document to transform. The second argument is an `XsltArgumentList` object; see `XsltArgumentList` for an example of using bound functions and/or variables.

The transformed result is output to an `XmlReader` object by default, or you can specify either a `System.IO.Stream`, `XmlWriter`, or `XmlTextWriter` object in the third argument for the output.

```
Public NotInheritable Class XslTransform

' Public Constructors

   Public Sub New()

' Public Instance Properties

   Public WriteOnly Property XmlResolver As XmlResolver

' Public Instance Methods

   Public Sub Load(

        ByVal stylesheet As System.Xml.XPath.IXPathNavigable)

   Public Sub Load(

        ByVal stylesheet As System.Xml.XPath.IXPathNavigable,

        ByVal resolver As System.Xml.XmlResolver)

   Public Sub Load( ByVal url As String)

   Public Sub Load(ByVal url As String,

        ByVal resolver As System.Xml.XmlResolver)

   Public Sub Load( ByVal stylesheet As System.Xml.XmlReader)

   Public Sub Load(ByVal stylesheet As System.Xml.XmlReader,

        ByVal resolver As System.Xml.XmlResolver)

   Public Sub Load(

        ByVal stylesheet As System.Xml.XPath.XPathNavigator)

   Public Sub Load(
```

```
    ByVal stylesheet As System.Xml.XPath.XPathNavigator,
    ByVal resolver As System.Xml.XmlResolver)
Public Sub Transform(
    ByVal input As System.Xml.XPath.IXPathNavigable,
    ByVal args As XsltArgumentList,
    ByVal output As System.IO.Stream)
Public Sub Transform(
    ByVal input As System.Xml.XPath.IXPathNavigable,
    ByVal args As XsltArgumentList,
    ByVal output As System.IO.TextWriter)
Public Sub Transform(
    ByVal input As System.Xml.XPath.IXPathNavigable,
    ByVal args As XsltArgumentList,
    ByVal output As System.Xml.XmlWriter)
Public Sub Transform(ByVal inputfile As String,
    ByVal outputfile As String)
Public Sub Transform(
    ByVal input As System.Xml.XPath.XPathNavigator,
    ByVal args As XsltArgumentList,
    ByVal output As System.IO.Stream)
Public Sub Transform(
    ByVal input As System.Xml.XPath.XPathNavigator,
    ByVal args As XsltArgumentList,
    ByVal output As System.IO.TextWriter)
Public Sub Transform(
    ByVal input As System.Xml.XPath.XPathNavigator,
    ByVal args As XsltArgumentList,
    ByVal output As System.Xml.XmlWriter)
Public Function Transform(
```

```
        ByVal input As System.Xml.XPath.IXPathNavigable,
        ByVal args As XsltArgumentList) As XmlReader
    Public Function Transform(
        ByVal input As System.Xml.XPath.XPathNavigator,
        ByVal args As XsltArgumentList) As XmlReader
End Class
```

# Part III: Appendixes

The final part of this book contains a number of useful appendixes that supplement information found in Part II. Appendix A, describes the syntax used in regular expressions, which allow you to define sophisticated patterns to search for in strings. Appendix B, describes the syntax and presents examples of the format specifiers used with the String.Format method and often with the Console.WriteLine method. Appendix C, presents a table of .NET data types and their corresponding COM equivalents for COM interop. Appendix D, lists the namespaces presented in Part II and the assemblies in which they're located. This information is useful in determining which assemblies you need to reference when compiling your programs. Glossary, provides a list of type members and the types to which they belong.

# Appendix A. Regular Expressions

The following tables summarize the regular-expression grammar and syntax supported by the regular-expression classes in `System.Text.RegularExpression`. Each of the modifiers and qualifiers in the tables can substantially change the behavior of the matching and searching patterns. For further information on regular expressions, we recommend the definitive *Mastering Regular Expressions* by Jeffrey E. F. Friedl (O'Reilly).

All the syntax described in the tables should match the Perl5 syntax, with specific exceptions noted.

**Table A-1. Character escapes**

| Escape code sequence | Meaning | Hexadecimal equivalent |
|---|---|---|
| `\a` | Bell | `\u0007` |
| `\b` | Backspace | `\u0008` |
| `\t` | Tab | `\u0009` |
| `\r` | Carriage return | `\u000A` |
| `\v` | Vertical tab | `\u000B` |
| `\f` | Form feed | `\u000C` |
| `\n` | Newline | `\u000D` |
| `\e` | Escape | `\u001B` |
| `\040` | ASCII character as octal | |
| `\x20` | ASCII character as hex | |
| `\cC` | ASCII control character | |
| `\u0020` | Unicode character as hex | |
| `\non-escape` | A nonescape character | |

Special case: within a regular expression, `\b` means word boundary, except in a `()` set, in which `\b` means the backspace character.

**Table A-2. Substitutions**

| Expression | Meaning |
|---|---|
| `$group-number` | Substitutes last substring matched by group-number |
| `${group-name}` | Substitutes last substring matched by (`?<group-name>`) |

Substitutions are specified only within a replacement pattern.

**Table A-3. Character sets**

| Expression | Meaning |
|---|---|
| `.` | Matches any character except \n |
| `[characterlist]` | Matches a single character in the list |
| `[^characterlist]` | Matches a single character not in the list |
| `[char0-char1]` | Matches a single character in a range |

| | |
|---|---|
| \w | Matches a word character; same as [a-zA-Z_0-9] |
| \W | Matches a nonword character |
| \s | Matches a space character; same as [\n\r\t\f] |
| \S | Matches a nonspace character |
| \d | Matches a decimal digit; same as [0-9] |
| \D | Matches a nondigit |

**Table A-4. Positioning assertions**

| Expression | Meaning |
|---|---|
| ^ | Beginning of line |
| $ | End of line |
| \A | Beginning of string |
| \Z | End of line or string |
| \z | Exactly the end of string |
| \G | Where search started |
| \b | On a word boundary |
| \B | Not on a word boundary |

**Table A-5. Quantifiers**

| Quantifier | Meaning |
|---|---|
| * | 0 or more matches |
| + | 1 or more matches |
| ? | 0 or 1 matches |
| {*n*} | Exactly *n* matches |
| {*n*,} | At least *n* matches |
| {*n*,*m*} | At least *n*, but no more than *m* matches |
| *? | Lazy *, finds first match that has minimum repeats |
| +? | Lazy +, minimum repeats, but at least 1 |
| ?? | Lazy ?, zero or minimum repeats |
| {*n*}? | Lazy {*n*}, exactly *n* matches |
| {*n*,}? | Lazy {*n*}, minimum repeats, but at least *n* |
| {*n*,*m*}? | Lazy {*n*,*m*}, minimum repeats, but at least *n*, and no more than *m* |

**Table A-6. Grouping constructs**

| Syntax | Meaning |
|---|---|
| ( ) | Capture matched substring |
| (?<*name*>) | Capture matched substring into group *name*[A] |
| (?<*number*>) | Capture matched substring into group *number* |
| (?<*name1*-*name2*>) | Undefine *name2*, and store interval and current group into *name1*; if *name2* is undefined, matching backtracks; *name1* is *optional* |

| | |
|---|---|
| (?: ) | Noncapturing group |
| (?imnsx-imnsx: ) | Apply or disable matching options |
| (?= ) | Continue matching only if subexpression matches on right |
| (?! ) | Continue matching only if subexpression doesn't match on right |
| (?<= ) | Continue matching only if subexpression matches on left |
| (?<! ) | Continue matching only if subexpression doesn't match on left |
| (?> ) | Subexpression is matched once, but isn't backtracked |

[A] Single quotes may be used instead of angle brackets — for example (?'name').

The named capturing group syntax follows a suggestion made by Friedl in *Mastering Regular Expressions*. All other grouping constructs use the Perl5 syntax.

**Table A-7. Back references**

| Parameter syntax | Meaning |
|---|---|
| \count | Back reference count occurrences |
| \k<*name*> | Named back reference |

**Table A-8. Alternation**

| Expression syntax | Meaning |
|---|---|
| \| | Logical OR |
| (?(*expression*)yes\|no) | Matches yes if expression matches, else no; the no is optional |
| (?(*name*)yes\|no) | Matches yes if named string has a match, else no; the no is optional |

**Table A-9. Miscellaneous constructs**

| Expression Syntax | Meaning |
|---|---|
| (?imnsx-imnsx) | Set or disable options in midpattern |
| (?# ) | Inline comment |
| # [to end of line] | X-mode comment |

**Table A-10. Regular expression options**

| Option | Meaning |
|---|---|
| i | Case-insensitive match |
| m | Multiline mode; changes ^ and $ so they match beginning and ending of any line |
| n | Capture explicitly named or numbered groups |
| c | Compile to MSIL |
| s | Single-line mode; changes meaning of "." so it matches every character |
| x | Eliminates unescaped whitespace from the pattern |
| r | Search from right to left; can't be specified in midstream |

# Appendix B. Format Specifiers

Table B-1 lists the numeric format specifiers supported by the `String.Format` method on the predefined numeric types.

**Table B-1. Numeric format specifiers**

| Specifier | String result | Datatype |
| --- | --- | --- |
| `C[n]` | `$XX,XX.XX`<br>`($XX,XXX.XX)` | Currency |
| `D[n]` | `[-]XXXXXXX` | Decimal |
| `E[n]` or `e[n]` | `[-]X.XXXXXXE+xxx`<br>`[-]X.XXXXXXe+xxx`<br>`[-]X.XXXXXXE-xxx`<br>`[-]X.XXXXXXe-xxx` | Exponent |
| `F[n]` | `[-]XXXXXXX.XX` | Fixed point |
| `G[n]` | General or scientific | General |
| `N[n]` | `[-]XX,XXX.XX` | Number |
| `X[n]` or `x[n]` | Hex representation | Hex |

This example uses numeric format specifiers without precision specifiers:

```
Imports System

      Public Class TestDefaultFormats

         Public Shared Sub Main()

            Dim i As Integer = 654321

            Console.WriteLine("{0:C}", i)      ' $654,321.00

            Console.WriteLine("{0:D}", i)      ' 654321

            Console.WriteLine("{0:E}", i)      ' 6.543210E+005

            Console.WriteLine("{0:F}", i)      ' 654321.00

            Console.WriteLine("{0:G}", i)      ' 654321

            Console.WriteLine("{0:N}", i)      ' 654,321.00

            Console.WriteLine("{0:X}", i)      ' 9FBF1

            Console.WriteLine("{0:x}", i)      ' 9fbf1

         End Sub

      End Class
```

This example uses numeric format specifiers with precision specifiers on a variety of `int` values:

```
Imports System

    Public Class TestIntegerFormats

        Public Shared Sub Main()

            Dim i As Integer = 123

            Console.WriteLine("{0:C6}", i)       '$123.000000

            Console.WriteLine("{0:D6}", i)       '000123

            Console.WriteLine("{0:E6}", i)       '1.230000E+002

            Console.WriteLine("{0:G6}", i)       '123

            Console.WriteLine("{0:N6}", i)       '123.000000

            Console.WriteLine("{0:X6}", i)       '00007B


            i = -123

            Console.WriteLine("{0:C6}", i)       '($123.000000)

            Console.WriteLine("{0:D6}", i)       '-000123

            Console.WriteLine("{0:E6}", i)       '-1.230000E+002

            Console.WriteLine("{0:G6}", i)       '-123

            Console.WriteLine("{0:N6}", i)       '-123.000000

            Console.WriteLine("{0:X6}", i)       'FFFF85


            i = 0

            Console.WriteLine("{0:C6}", i)       '$0.000000

            Console.WriteLine("{0:D6}", i)       '000000

            Console.WriteLine("{0:E6}", i)       '0.000000E+000

            Console.WriteLine("{0:G6}", i)       '0

            Console.WriteLine("{0:N6}", i)       '0.000000

            Console.WriteLine("{0:X6}", i)       '000000

        End Sub

    End Class
```

This example uses numeric format specifiers with precision specifiers on a variety of `double` values:

```
Imports System

      Public Class TestDoubleFormats

         Public Shared Sub Main()

            Dim d As Double = 1.23

            Console.WriteLine("{0:C6}", d)      '$1.230000

            Console.WriteLine("{0:E6}", d)      '1.230000E+000

            Console.WriteLine("{0:G6}", d)      '1.23

            Console.WriteLine("{0:N6}", d)      '1.230000


            d = -1.23

            Console.WriteLine("{0:C6}", d)      '($1.230000)

            Console.WriteLine("{0:E6}", d)      '-1.230000E+000

            Console.WriteLine("{0:G6}", d)      '-1.23

            Console.WriteLine("{0:N6}", d)      '-1.230000


            d = 0

            Console.WriteLine("{0:C6}", d)      '$0.000000

            Console.WriteLine("{0:E6}", d)      '0.000000E+000

            Console.WriteLine("{0:G6}", d)      '0

            Console.WriteLine("{0:N6}", d)      '0.000000

         End Sub

      End Class
```

# B.1 Picture Format Specifiers

Table B-2 lists the valid picture format specifiers supported by the `Format` method on the predefine numeric types (see the documentation for `System.IFormattable` in the .NET SDK).

**Table B-2. Picture format specifiers**

| Specifier | String result |
|---|---|
| `0` | Zero placeholder |
| `#` | Digit placeholder |
| `.` | Decimal point |
| `,` | Group separator or multiplier |
| `%` | Percent notation |
| `E+0`, `E-0` `e+0`, `e-0` | Exponent notation |
| `\` | Literal character quote |
| `'xx'"xx"` | Literal string quote |
| `;` | Section separator |

This example uses picture format specifiers on some `int` values:

```
Imports System

      Public Class TestIntegerCustomFormats


         Public Shared Sub Main()

            Dim i As Integer = 123

            Console.WriteLine("{0:#0}", i)               ' 123

            Console.WriteLine("{0:#0;(#0)}", i)          ' 123

            Console.WriteLine("{0:#0;(#0);<zero>}", i)   ' 123

            Console.WriteLine("{0:#%}", i)               ' 12300%

            i = -123

            Console.WriteLine("{0:#0}", i)               ' -123

            Console.WriteLine("{0:#0;(#0)}", i)          ' (123)

            Console.WriteLine("{0:#0;(#0);<zero>}", i)   ' (123)

            Console.WriteLine("{0:#%}", i)               ' -12300%


            i = 0

            Console.WriteLine("{0:#0}", i)               ' 0
```

```
            Console.WriteLine("{0:#0;(#0)}", i)           ' 0
            Console.WriteLine("{0:#0;(#0);<zero>}", i)    ' <zero>
            Console.WriteLine("{0:#%}", i)                ' %
        End Sub
    End Class
```

The following example uses these picture format specifiers on a variety of `double` values:

```
Imports System
    Class TestDoubleCustomFormats
        Public Shared Sub Main()
            Dim d As Double = 1.23
            Console.WriteLine("{0:#.000E+00}", d)                 ' 1.230E+00
            Console.WriteLine("{0:#.000E+00;(#.000E+00)}", d) ' 1.230E+00
            Console.WriteLine( _
                    "{0:#.000E+00;(#.000E+00);<zero>}", d)    ' 1.230E+00
            Console.WriteLine("{0:#%}", d)                        ' 123%

            d = -1.23
            Console.WriteLine("{0:#.000E+00}", d)                 ' -1.230E+0
            Console.WriteLine("{0:#.000E+00;(#.000E+00)}", d) ' (1.230E+0
            Console.WriteLine( _
                    "{0:#.000E+00;(#.000E+00);<zero>}", d)    ' (1.230E+0
            Console.WriteLine("{0:#%}", d)                        ' -123%
            d = 0
            Console.WriteLine("{0:#.000E+00}", d)                  ' 0.000E+0
            Console.WriteLine("{0:#.000E+00;(#.000E+00)}", d) ' 0.000E+01
            Console.WriteLine( _
                    "{0:#.000E+00;(#.000E+00);<zero>}", d)    ' <zero>
            Console.WriteLine("{0:#%}", d)                        ' %
        End Sub
    End Class
```

# B.2 DateTime Format Specifiers

Table B-3 lists the valid format specifiers supported by the Format method on the DateTime type (see System.IFormattable).

**Table B-3. DateTime format specifiers**

| Specifier | String result |
|---|---|
| D | MM/dd/yyyy |
| d | dddd, MMMM dd, yyyy |
| f | dddd, MMMM dd, yyyy HH:mm |
| F | dddd, MMMM dd, yyyy HH:mm:ss |
| g | MM/dd/yyyy HH:mm |
| G | MM/dd/yyyy HH:mm:ss |
| m, M | MMMM dd |
| r, R | Ddd, dd MMM yyyy HH':'mm':'ss `GMT' |
| s | yyyy-MM-dd HH:mm:ss |
| S | yyyy-MM-dd HH:mm:ss GMT |
| t | HH:mm |
| T | HH:mm:ss |
| u | yyyy-MM-dd HH:mm:ss |
| U | dddd, MMMM dd, yyyy HH:mm:ss |
| y, Y | MMMM, yyyy |

Here's an example that uses these custom format specifiers on a DateTime value (note that precis output depends on the local computer's settings for the long and short date formats):

```
Imports System

      Class TestDateTimeFormats

         Public Shared Sub Main()

            Dim dt As New Date(2000, 10, 11, 15, 32, 14)

            ' Displays "10/11/00 3:32:14 PM"

            Console.WriteLine(dt.ToString())

            ' Displays "10/11/00 3:32:14 PM"

            Console.WriteLine("{0}", dt)

            'Displays "10/11/00"

            Console.Writeline("{0:d}", dt)

            ' Displays "Wednesday, October 11, 2000"

            Console.WriteLine("{0:D}", dt)
```

```
' Displays "Wednesday, October 11, 2000 3:32 PM"
Console.WriteLine("{0:f}", dt)
' Displays "Wednesday, October 11, 2000 3:32:14 PM"
Console.WriteLine("{0:F}", dt)
' Displays "10/11/00 3:32 PM"
Console.WriteLine("{0:g}", dt)
' Displays "10/11/00 3:32:14 PM"
Console.WriteLine("{0:G}", dt)
' Displays "October 11"
Console.WriteLine("{0:m}", dt)
' Displays "October 11"
Console.WriteLine("{0:M}", dt)
' Displays "Wed, 11 Oct 2000 15:32:14 GMT"
Console.WriteLine("{0:r}", dt)
' Displays "Wed, 11 Oct 2000 15:32:14 GMT"
Console.WriteLine("{0:R}", dt)
' Displays "3:32 PM"
Console.WriteLine("{0:t}", dt)
' Displays "3:32:14 PM"
Console.WriteLine("{0:T}", dt)
' Displays "2000-10-11 15:32:14Z"
Console.WriteLine("{0:u}", dt)
' Displays "Wednesday, October 11, 2000 10:32:14 PM"
Console.WriteLine("{0:U}", dt)
' Displays "October, 2000"
Console.WriteLine("{0:y}", dt)
' Displays "October, 2000"
Console.WriteLine("{0:Y}", dt)
' Displays "Wednesday the 11 day of Oct in the year 2000"
Console.WriteLine( _
        "{0:dddd 'the' d 'day of' MMM 'in the year' yyyy}", d
```

```
        End Sub

    End Class
```

# Appendix C. Data Marshaling

When calling between the runtime environment and existing COM interfaces, the CLR performs automatic data marshaling for CLR types into compatible COM types. Table C-1 describes the Visual Basic to COM default data type mapping.

### Table C-1. VB type to COM type mapping

| VB type | COM type |
|---|---|
| `Boolean` | `VARIANT_BOOL` |
| `Char` | `unsigned short` |
| `System.Sbyte` | `Char` |
| `Byte` | `Unsigned char` |
| `Short` | `Short` |
| `System.UInt16` | `Unsigned short` |
| `Integer` | `Int` |
| `System.UInt32` | `Unsigned int` |
| `Long` | `Hyper` |
| `System.UInt64` | `Unsigned hyper` |
| `Single` | `Single` |
| `Double` | `Double` |
| `Decimal` | `DECIMAL` |
| `Object` | `VARIANT` |
| `String` | `BSTR` |
| `Date` | `DATE`[C] |
| `System.Guid` | `GUID` |
| `1-dimensional arrays` | `SAFEARRAY` |
| `Value types` | Equivalently named struct |
| `Enum` | Equivalently named enum |
| `Interface` | Equivalently named interface |
| `Class` | Equivalently named `CoClass` |

[C] COM dates are less precise, causing comparison problems.

# Appendix D. Namespaces and Assemblies

This appendix allows you to look up a namespace and determine which assemblies export that namespace. This information is helpful when constructing the appropriate `/reference:<file list>` command-line option for the VB compiler. Note that the Visual Basic compiler references *mscorlib.dll* and *Microsoft.VisualBasic.dll* by default.

For a complete list of default assemblies, see the global C# response file, *csc.rsp*, in *%SystemRoot%\Microsoft.NET\Framework\VERSION*, where *VERSION* is the version number of the framework (the first release of .NET is v1.0.3705). You can modify *csc.rsp* to affect all compilations run on your machine, or you can create a local *csc.rsp* in your current directory. The local response file is processed after the global one. You can use the `/noconfig` switch with *csc.exe* to disable the local and global *csc.rsp* files entirely.

**Table E-1.**

| Namespace | DLLs |
|---|---|
| `Accessibility` | *Accessibility.dll* |
| `EnvDTE` | *envdte.dll* |
| `IEHost.Execute` | *IEExecRemote.dll* |
| `Microsoft.CLRAdmin` | *mscorcfg.dll* |
| `Microsoft.CSharp` | *cscompmgd.dll*<br>*System.dll* |
| `Microsoft.IE` | *IEHost.dll*<br>*IIEHost.dll* |
| `Microsoft.JScript` | *Microsoft.JScript.dll* |
| `Microsoft.JScript.Vsa` | *Microsoft.JScript.dll* |
| `Microsoft.Office.Core` | *office.dll* |
| `Microsoft.VisualBasic` | *Microsoft.VisualBasic.dll*<br>*System.dll* |
| `Microsoft.VisualBasic. Compatibility.VB6` | *Microsoft.VisualBasic.Compatibility.Data.dll*<br>*Microsoft.VisualBasic.Compatibility.dll* |
| `Microsoft.VisualBasic. CompilerServices` | *Microsoft.VisualBasic.dll* |
| `Microsoft.VisualBasic.Vsa` | *Microsoft.VisualBasic.Vsa.dll* |
| `Microsoft.VisualC` | *Microsoft.VisualC.Dll* |
| `Microsoft.Vsa` | *Microsoft.JScript.dll*<br>*Microsoft.Vsa.dll* |
| `Microsoft.Vsa.Vb.CodeDOM` | *Microsoft.Vsa.Vb.CodeDOMProcessor.dll* |
| `Microsoft.Win32` | *mscorlib.dll*<br>*System.dll* |

| | |
|---|---|
| Microsoft_VsaVb | *Microsoft_VsaVb.dll* |
| RegCode | *RegCode.dll* |
| System | *mscorlib.dll*<br>*System.dll* |
| System.CodeDom | *System.dll* |
| System.CodeDom.Compiler | *System.dll* |
| System.Collections | *mscorlib.dll* |
| System.Collections. Specialized | *System.dll* |
| System.ComponentModel | *System.dll* |
| System.ComponentModel.Design | *System.Design.dll*<br>*System.dll* |
| System.ComponentModel.Design. Serialization | *System.Design.dll*<br>*System.dll* |
| System.Configuration | *System.dll* |
| System.Configuration. Assemblies | *mscorlib.dll* |
| System.Configuration.Install | *System.Configuration.Install.dll* |
| System.Data | *System.Data.dll* |
| System.Data.Common | *System.Data.dll* |
| System.Data.OleDb | *System.Data.dll* |
| System.Data.SqlClient | *System.Data.dll* |
| System.Data.SqlTypes | *System.Data.dll* |
| System.Diagnostics | *mscorlib.dll*<br>*System.Configuration.Install.dll* |
| System.Diagnostics.Design | *System.Design.dll* |
| System.Diagnostics. SymbolStore | *ISymWrapper.dll*<br>*mscorlib.dll* |
| System.DirectoryServices | *System.DirectoryServices.dll* |
| System.Drawing | *System.Drawing.dll* |
| System.Drawing.Design | *System.Drawing.Design.dll*<br>*System.Drawing.dll* |
| System.Drawing.Drawing2D | *System.Drawing.dll* |
| System.Drawing.Imaging | *System.Drawing.dll* |
| System.Drawing.Printing | *System.Drawing.dll* |
| System.Drawing.Text | *System.Drawing.dll* |
| System.EnterpriseServices | *System.EnterpriseServices.dll* |
| System.EnterpriseServices. CompensatingResourceManager | *System.EnterpriseServices.dll* |

| | |
|---|---|
| `System.EnterpriseServices.Internal` | *System.EnterpriseServices.dll* |
| `System.Globalization` | *mscorlib.dll* |
| `System.IO` | *mscorlib.dll*<br>*System.dll* |
| `System.IO.IsolatedStorage` | *mscorlib.dll* |
| `System.Management` | *System.Management.dll* |
| `System.Management. Instrumentation` | *System.Management.dll* |
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# Type, Method, Property, Event, and Field Index

Use this index to look up a type or member and see where it is defined. For a type (a class or interface), you can find the enclosing namespace. If you know the name of a member (a method, property, event, or field), you can find all the types that define it.

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**Currency:**

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**CurrencyDecimalDigits:**

NumberFormatInfo

**CurrencyDecimalSeparator:**

NumberFormatInfo

**CurrencyGroupSeparator:**

NumberFormatInfo

**CurrencyGroupSizes:**

NumberFormatInfo

**CurrencyNegativePattern:**

NumberFormatInfo

**CurrencyPositivePattern:**

NumberFormatInfo

**CurrencySymbol:**

NumberFormatInfo, RegionInfo, UnicodeCategory

**CurrencyWrapper:**

System.Runtime.InteropServices

**Current:**

CharEnumerator, IEnumerator, SeekOrigin, SerializationInfoEnumerator, StringEnumerator, TextElementEnumerator, XPathNodeIterator

**CurrentConfig:**

Registry, RegistryHive

**CurrentConnections:**

ServicePoint

**CurrentContext:**

Thread

**CurrentCulture:**

CultureInfo, Thread

**CurrentDirectory:**

Environment

**CurrentDomain:**

AppDomain

**CurrentEncoding:**

StreamReader

**CurrentEra:**

Calendar

**CurrentInfo:**

DateTimeFormatInfo, NumberFormatInfo

**CurrentPosition:**

XPathNodeIterator

**CurrentPrincipal:**

Thread

**CurrentPriority:**

ProcessThread

**CurrentRegion:**

RegionInfo

**CurrentSize:**

IsolatedStorage, IsolatedStorageFile

**CurrentThread:**

Thread

**CurrentTimeZone:**

TimeZone

**CurrentUICulture:**

CultureInfo, Thread

**CurrentUser:**

Registry, RegistryHive

**Custom:**

MemberTypes

**CustomAttributeBuilder:**

System.Reflection.Emit

**CustomAttributeFormatException:**

System.Reflection

**CustomMarshaler:**

UnmanagedType

# D

System, TypeCode

**DateTimeFormat:**

CultureInfo

**DateTimeFormatInfo:**

System.Globalization

**DateTimeStyles:**

System.Globalization

**Day:**

DateTime

**DaylightName:**

TimeZone

**DaylightTime:**

System.Globalization

**DayNames:**

DateTimeFormatInfo

**DayOfWeek:**

DateTime, System

**DayOfYear:**

DateTime

**Days:**

TimeSpan

**DaysInMonth():**

DateTime

**DBNull:**

Convert, System, TypeCode

**Debug:**

SocketOptionName, System.Diagnostics

**DebuggableAttribute:**

System.Diagnostics

**Debugger:**

System.Diagnostics

**DebuggerHiddenAttribute:**

System.Diagnostics

**DebuggerStepThroughAttribute:**

System.Diagnostics

**Decimal:**

System, TypeCode

**DecimalDigitNumber:**

UnicodeCategory

**DeclaredOnly:**

BindingFlags

**DeclareLocal():**

ILGenerator

**DeclaringType:**

ConstructorBuilder, EnumBuilder, FieldBuilder, MemberInfo, MethodBuilder, PropertyBuilder, Type, TypeBuilder

**DecNet:**

AddressFamily, ProtocolFamily

**DecodeName():**

XmlConvert

**Decoder:**

System.Text

**Decrement():**

Interlocked, PerformanceCounter

**Default:**

BindingFlags, CaseInsensitiveComparer, CaseInsensitiveHashCodeProvider, Comparer, Encoding, XmlSpace

**DefaultAlias:**

AssemblyDefaultAliasAttribute

**DefaultBinder:**

Type

**DefaultCategory:**

Debugger

**DefaultConnectionLimit:**

ServicePointManager

**DefaultCookieLengthLimit:**

CookieContainer

**DefaultCookieLimit:**

CookieContainer

**DefaultCredentials:**

CredentialCache

**DefaultFileMappingSize:**

PerformanceCounter

**DefaultMemberAttribute:**

System.Reflection

**DefaultNamespace:**

XmlNamespaceManager

**DefaultNonPersistentConnectionLimit:**

ServicePointManager

**DefaultPerDomainCookieLimit:**

CookieContainer

**DefaultPersistentConnectionLimit:**

ServicePointManager

**DefaultTraceListener:**

System.Diagnostics

**DefaultValue:**

ParameterInfo

**DefaultValueImpl:**

**DefineEvent():**

TypeBuilder

**DefineField():**

TypeBuilder

**DefineGlobalMethod():**

ModuleBuilder

**DefineInitializedData():**

ModuleBuilder, TypeBuilder

**DefineLabel():**

ILGenerator

**DefineLiteral():**

EnumBuilder

**DefineLPArray():**

UnmanagedMarshal

**DefineMethod():**

TypeBuilder

**DefineMethodOverride():**

TypeBuilder

**DefineNestedType():**

TypeBuilder

**DefineParameter():**

ConstructorBuilder, MethodBuilder

**DefinePInvokeMethod():**

ModuleBuilder, TypeBuilder

**DefineProperty():**

TypeBuilder

**DefineResource():**

AssemblyBuilder, ModuleBuilder

**DefineSafeArray():**

UnmanagedMarshal

**DefineType():**

ModuleBuilder

**DefineTypeInitializer():**

TypeBuilder

**DefineUninitializedData():**

ModuleBuilder, TypeBuilder

**DefineUnmanagedMarshal():**

UnmanagedMarshal

**DefineUnmanagedResource():**

AssemblyBuilder, ModuleBuilder

**DefineVersionInfoResource():**

AssemblyBuilder

**DelaySign:**

AssemblyDelaySignAttribute

**Delegate:**

AttributeTargets, System

**Delete():**

Directory, DirectoryInfo, EventLog, File, FileInfo, FileSystemInfo, PerformanceCounterCategory

**Deleted:**

FileSystemWatcher, WatcherChangeTypes

**DeleteData():**

XmlCharacterData

**DeleteDirectory():**

IsolatedStorageFile

**DeleteEventSource():**

EventLog

**DeleteFile():**

IsolatedStorageFile

**DeleteSubKey():**

RegistryKey

**DeleteSubKeyTree():**

RegistryKey

**DeleteValue():**

RegistryKey

**Delimiter:**

Type

**Delta:**

DaylightTime

**Depth:**

XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader

**Dequeue():**

Queue

**Descending:**

XmlSortOrder

**Description:**

AssemblyDescriptionAttribute, IODescriptionAttribute, MonitoringDescriptionAttribute, Switch, TimersDescriptionAttribute

**Deserialize():**

BinaryFormatter, Formatter, IFormatter, SoapFormatter

**DeserializeMethodResponse():**

BinaryFormatter

**Desktop:**

UserPreferenceCategory

**DesktopDirectory:**

SpecialFolder

**DestroyStructure():**

Marshal

**Detail:**

**DirectorySeparatorChar:**

Path

**DisallowPublisherPolicy:**

AppDomainSetup

**Discard:**

Cookie

**DiscardBufferedData():**

StreamReader

**DispatchWrapper:**

System.Runtime.InteropServices

**DispIdAttribute:**

System.Runtime.InteropServices

**DisplayName:**

CultureInfo, RegionInfo, Switch

**DisplaySettingsChanged:**

SystemEvents

**Dispose():**

BinaryReader, BinaryWriter, EventLog, EventLogTraceListener, FileStream, FileSystemWatcher, FileWebResponse, HttpWebResponse, IDisposable, IsolatedStorageFile, IsolatedStorageFileStream, NetworkStream, PerformanceCounter,

**DnsPermission:**

System.Net

**DnsPermissionAttribute:**

System.Net

**DoCallBack():**

AppDomain

**DocTypeName:**

XmlParserContext

**Document:**

XmlNodeType

**DocumentElement:**

XmlDocument

**DocumentFragment:**

XmlNodeType

**DocumentType:**

XmlDocument, XmlNodeType

**DoFixups():**

ObjectManager

**Domain:**

Cookie, IsolatedStorageScope, NetworkCredential

**DomainIdentity:**

IsolatedStorage

**DomainUnload:**

AppDomain

**DontFragment:**

SocketOptionName

**DontLinger:**

SocketOptionName

**DontRoute:**

SocketFlags, SocketOptionName

**Double:**

System, TypeCode

**DoubleToInt64Bits():**

BitConverter

**DowngradeFromWriterLock():**

**Duration():**

TimeSpan

**DynamicBase:**

AppDomainSetup

**DynamicDirectory:**

AppDomain

**DynamicInvoke():**

Delegate

**DynamicInvokeImpl():**

Delegate, MulticastDelegate

**DynData:**

Registry, RegistryHive

## E

WriteState, XmlNodeType, XPathNodeType

**ElementCount:**

UnmanagedMarshal

**ElementIndex:**

TextElementEnumerator

**Embedded:**

ResourceLocation

**Emit():**

ILGenerator

**EmitCall():**

ILGenerator

**EmitCalli():**

ILGenerator

**EmitWriteLine():**

ILGenerator

**Empty:**

CounterSample, EventArgs, EventToken, FieldToken, Guid, Match, MethodToken, ParameterToken, PropertyToken, SignatureToken, String, TypeCode, TypeToken, XmlQualifiedName

StreamWriter, StringWriter, System.Text, TextWriter, XmlDeclaration, XmlParserContext, XmlTextReader, XmlValidatingReader

**EncodingName:**

Encoding

**Encrypted:**

FileAttributes

**End:**

DaylightTime, SeekOrigin

**End():**

ArgIterator

**EndAccept():**

Socket

**EndConnect():**

Socket

**EndElement:**

XmlNodeType

**EndEntity:**

XmlNodeType

**EndScope():**

ILGenerator

**EndSend():**

Socket

**EndSendTo():**

Socket

**EndsWith():**

String

**EndWrite():**

FileStream, IsolatedStorageFileStream, NetworkStream, Stream

**EnglishName:**

CultureInfo, RegionInfo

**Enqueue():**

Queue

**EnsureCapacity():**

StringBuilder

**Enter():**

Monitor

**EnumBuilder:**

System.Reflection.Emit

**ENUMERATION:**

XmlTokenizedType

**Environment:**

System

**EnvironmentVariables:**

ProcessStartInfo

**EOF:**

XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader

**Epsilon:**

Double, Single

**Equals():**

ArgIterator, ArrayWithOffset, Attribute, BitVector32, Boolean, Byte, Char, CompareInfo, Cookie, CultureInfo, DateTime, Decimal, Delegate, Double, Encoding, EndpointPermission, Enum, EventLogEntry, EventToken, FieldToken, Guid, Int16, Int32, Int64, IntPtr, IPAddress, IPEndPoint, Label, MethodBuilder, MethodToken, MulticastDelegate, Object, OpCode, ParameterToken, PropertyToken, RegionInfo, SByte, SectionSignatureHelper, SignatureToken, Single, SocketAddress, SortKey, StreamingContext, String, StringBuilder, StringToken, TextInfo, TimeSpan, Type, TypeToken, UInt16, UInt32, UInt64, UIntPtr, UnicodeEncoding, Uri, UriBuilder, UTF8Encoding, ValueType, Version, XmlQualifiedName

**Eras:**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**Error:**

Console, EventLogEntryType, FileSystemWatcher, ReadState, SocketOptionName, TraceLevel, UnmanagedType, XPathResultType

**ErrorCode:**

ErrorWrapper, ExternalException, SocketException

**ErrorDialog:**

ProcessStartInfo

**ErrorDialogParentHandle:**

ProcessStartInfo

**ErrorEventArgs:**

System.IO

**ErrorEventHandler:**

System.IO

**ErrorWrapper:**

System.Runtime.InteropServices

**Escape():**

Regex, Uri

**EscapedCodeBase:**

Assembly, AssemblyName

**EscapeString():**

Uri

**Evaluate():**

IXsltContextVariable, XPathNavigator

**Event:**

AttributeTargets, MemberTypes

**EventArgs:**

System

**EventAttributes:**

System.Reflection

**EventBuilder:**

System.Reflection.Emit

**EventHandle:**

NativeOverlapped, Overlapped

**EventHandler:**

System

**EventHandlerType:**

EventInfo

**EventID:**

EventLogEntry

**EventInfo:**

System.Reflection

**EventLog:**

EventLogTraceListener, System.Diagnostics

**EventLogEntry:**

System.Diagnostics

**EventLogEntryCollection:**

System.Diagnostics

**EventLogEntryType:**

System.Diagnostics

**EventLogInstaller:**

System.Diagnostics

**EventLogPermission:**

System.Diagnostics

**EventLogPermissionAccess:**

System.Diagnostics

**EventLogPermissionAttribute:**

System.Diagnostics

**EventLogPermissionEntry:**

System.Diagnostics

**EventLogPermissionEntryCollection:**

System.Diagnostics

**EventLogTraceListener:**

System.Diagnostics

**EventPairHigh:**

ThreadWaitReason

**EventPairLow:**

ThreadWaitReason

**EventsThreadShutdown:**

SystemEvents

**EventToken:**

System.Reflection.Emit

**Evidence:**

AppDomain, Assembly

**ExactBinding:**

BindingFlags

**ExactSpelling:**

DllImportAttribute

**Exception:**

System, ThreadExceptionEventArgs

**ExceptionMessage:**

ServerFault

**ExceptionObject:**

UnhandledExceptionEventArgs

**ExceptionState:**

ThreadAbortException

**ExceptionType:**

ServerFault

**Exchange():**

Interlocked

**ExcludeXml:**

XPathNamespaceScope

**ExclusiveAddressUse:**

SocketOptionName

**ExecuteAssembly():**

AppDomain

**ExecutionDelay:**

ThreadWaitReason

**ExecutionEngineException:**

System

**Executive:**

ThreadWaitReason

**Exists:**

DirectoryInfo, FileInfo, FileSystemInfo

**Exists():**

Directory, EventLog, File, PerformanceCounterCategory

**Exit():**

Environment, Monitor

**ExitCode:**

Environment, Process

**Exited:**

Process

**ExitTime:**

Process

**Exp():**

Math

**ExpandCharEntities:**

EntityHandling

**ExpandEntities:**

EntityHandling

**ExpandEnvironmentVariables():**

Environment

**Expect:**

HttpWebRequest

**ExpectationFailed:**

HttpStatusCode

**Expedited:**

SocketOptionName

**Expired:**

Cookie

**Expires:**

Cookie

**Explicit:**

LayoutKind

**ExplicitCapture:**

RegexOptions

**ExplicitLayout:**

TypeAttributes

**ExplicitThis:**

CallingConventions

**Expression:**

XPathExpression

**ExtensibleClassFactory:**

System.Runtime.InteropServices

**Extension:**

FileSystemInfo

**ExternalException:**

System.Runtime.InteropServices

## F

SoapFault

**FaultString:**

SoapFault

**Favorites:**

SpecialFolder

**Field:**

AttributeTargets, MemberTypes

**FieldAccessException:**

System

**FieldAccessMask:**

FieldAttributes

**FieldAttributes:**

System.Reflection

**FieldBuilder:**

System.Reflection.Emit

**FieldHandle:**

FieldBuilder, FieldInfo

**FieldInfo:**

System.Reflection

**FieldNames:**

IFieldInfo

**FieldOffsetAttribute:**

System.Runtime.InteropServices

**FieldToken:**

System.Reflection.Emit

**FieldType:**

FieldBuilder, FieldInfo

**FieldTypes:**

IFieldInfo

**File:**

StreamingContextStates, System.IO

**FileAccess:**

System.IO

**FileAttributes:**

System.IO

**FileBuildPart:**

FileVersionInfo

**FileDescription:**

FileVersionInfo

**FileInfo:**

System.IO

**FileLoadException:**

System.IO

**FileMajorPart:**

FileVersionInfo

**FileMinorPart:**

FileVersionInfo

**FileMode:**

System.IO

**FileName:**

BadImageFormatException, FileLoadException, FileNotFoundException, FileVersionInfo, ManifestResourceInfo, NotifyFilters, ProcessModule, ProcessStartInfo

**FileNotFoundException:**

System.IO

**FilePrivatePart:**

FileVersionInfo

**FileShare:**

System.IO

**FileStream:**

System.IO

**FileSystemEventArgs:**

System.IO

**FileSystemEventHandler:**

System.IO

**FileSystemInfo:**

System.IO

**FileSystemWatcher:**

System.IO

**FileVersion:**

FileVersionInfo

**FileVersionInfo:**

ProcessModule, System.Diagnostics

**FileWebRequest:**

System.Net

**FileWebResponse:**

System.Net

**FillBuffer():**

BinaryReader

**Filter:**

FileSystemWatcher

**FilterAttribute:**

Type

**FilterName:**

Type

**FilterNameIgnoreCase:**

Type

**FilterTypeName:**

Module

**FilterTypeNameIgnoreCase:**

Module

**Final:**

MethodAttributes

**Finalize():**

CompressedStackFileStream, IsolatedStorageFile, LocalDataStoreSlot, NetworkStream, Object, Regex, RegisteredWaitHandle, RegistryKey, Socket, StreamWriter, TcpClient, TcpListener, Thread, Timer, WaitHandle, WeakReference

**FinalQuotePunctuation:**

UnicodeCategory

**FindInterfaces():**

Type

**FindMembers():**

Type

**FindServicePoint():**

ServicePointManager

**FindTypes():**

Module

**FireFox:**

AddressFamily, ProtocolFamily

**FirstChild:**

XmlNode

**FirstDay:**

CalendarWeekRule

**FirstDayOfWeek:**

DateTimeFormatInfo

**FirstFourDayWeek:**

CalendarWeekRule

**FirstFullWeek:**

CalendarWeekRule

**FixedSize():**

ArrayList

**Flags:**

AssemblyFlagsAttribute, AssemblyName

**FlagsAttribute:**

System

**FormatException:**

System

**FormatProvider:**

TextWriter

**Formatter:**

System.Runtime.Serialization

**FormatterAssemblyStyle:**

System.Runtime.Serialization.Formatters

**FormatterConverter:**

System.Runtime.Serialization

**FormatterServices:**

System.Runtime.Serialization

**FormatterTypeStyle:**

System.Runtime.Serialization.Formatters

**Formatting:**

System.Xml, XmlTextWriter

**ForwardRef:**

MethodImplAttributes

**FromHours():**

TimeSpan

**FromMilliseconds():**

TimeSpan

**FromMinutes():**

TimeSpan

**FromOACurrency():**

Decimal

**FromOADate():**

DateTime

**FromSeconds():**

TimeSpan

**FromTicks():**

TimeSpan

**FromXml():**

DnsPermission, SocketPermission, WebPermission

**Full:**

FormatterAssemblyStyle

## G

DateTimeFormatInfo

**GetAbbreviatedEraName():**

DateTimeFormatInfo

**GetAbbreviatedMonthName():**

DateTimeFormatInfo

**GetAccessors():**

PropertyBuilder, PropertyInfo

**GetActiveObject():**

Marshal

**GetAddMethod():**

EventInfo

**GetAllDateTimePatterns():**

DateTimeFormatInfo

**GetArray():**

ArrayWithOffset

**GetArrayMethod():**

ModuleBuilder

**GetArrayMethodToken():**

ModuleBuilder

**GetArrayRank():**

Type

**GetAssemblies():**

AppDomain

**GetAssembly():**

Assembly

**GetAssemblyName():**

AssemblyName, AssemblyNameProxy

**GetAttribute():**

XmlElement, XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader, XPathNavigator

**GetAttributeFlagsImpl():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetAttributeNode():**

XmlElement

**GetAttributes():**

File

ASCIIEncoding, Encoder, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetBytes():**

ASCIIEncoding, BitConverter, Encoder, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetCallingAssembly():**

Assembly

**GetCategories():**

PerformanceCounterCategory

**GetChar():**

SerializationInfo

**GetCharCount():**

ASCIIEncoding, Decoder, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetChars():**

ASCIIEncoding, Decoder, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetComInterfaceForObject():**

Marshal

**GetCommandLineArgs():**

Environment

**GetComObjectData():**

Marshal

**GetCompareInfo():**

CompareInfo

**GetComSlotForMethodInfo():**

Marshal

**GetConstructor():**

Type

**GetConstructorImpl():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetConstructors():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetConstructorToken():**

ModuleBuilder

**GetCookieHeader():**

CookieContainer

**GetCookies():**

CookieContainer

**GetCounters():**

PerformanceCounterCategory

**GetCreationTime():**

Directory, File

**GetCredential():**

CredentialCache, ICredentials, NetworkCredential

**GetCultures():**

CultureInfo

**GetCurrentDirectory():**

Directory

**GetCurrentMethod():**

MethodBase

**GetCurrentProcess():**

Process

**GetCurrentThreadId():**

AppDomain

**GetCustomAttribute():**

Attribute

**GetCustomAttributes():**

Assembly, Attribute, ConstructorBuilder, EnumBuilder, FieldBuilder, ICustomAttributeProvider, MemberInfo, MethodBuilder, Module, ParameterInfo, PropertyBuilder, TypeBuilder, TypeDelegator

**GetData():**

AppDomain, Thread

**GetDateTime():**

SerializationInfo

**GetDateTimeFormats():**

DateTime

**GetDaylightChanges():**

TimeZone

**GetDayName():**

DateTimeFormatInfo

**GetDayOfMonth():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetDayOfWeek():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetDayOfYear():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetDaysInMonth():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetDaysInYear():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetDecimal():**

SerializationInfo

**GetDecoder():**

Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetDefaultMembers():**

Type

**GetDefaultProxy():**

WebProxy

**GetDirectories():**

Directory, DirectoryInfo

XmlDataDocument

**GetElementsByTagName():**

XmlDocument, XmlElement

**GetElementType():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetEmptyWebProxy():**

GlobalProxySelection

**GetEncoder():**

Encoding, UTF7Encoding, UTF8Encoding

**GetEncoding():**

Encoding

**GetEndComSlot():**

Marshal

**GetEntity():**

XmlResolver, XmlUrlResolver

**GetEntryAssembly():**

Assembly

### GetEnumerator():

Array, ArrayList, BitArray, CaptureCollection, CollectionBase, CookieCollection, CredentialCache, DictionaryBase, EventLogEntryCollection, GroupCollection, Hashtable, HybridDictionary, IDictionary, IEnumerable, IsolatedStorageFile, KeysCollectionListDictionary, MatchCollection, NameObjectCollectionBase, Queue, ReadOnlyCollectionBase, SerializationInfo, SortedList, Stack, String, StringCollection, StringDictionary, TraceListenerCollection, XmlNamedNodeMap, XmlNamespaceManager, XmlNode, XmlNodeList

### GetEnvironmentVariable():

Environment

### GetEnvironmentVariables():

Environment

### GetEra():

Calendar, DateTimeFormatInfo, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

### GetEraName():

DateTimeFormatInfo

### GetEvent():

EnumBuilder, Type, TypeBuilder, TypeDelegator

### GetEventLogs():

EventLog

### GetEvents():

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetEventToken():**

EventBuilder

**GetException():**

ErrorEventArgs

**GetExceptionCode():**

Marshal

**GetExceptionPointers():**

Marshal

**GetExecutingAssembly():**

Assembly

**GetExportedTypes():**

Assembly, AssemblyBuilder

**GetExtension():**

Path

**GetExtensionObject():**

XsltArgumentList

**GetField:**

BindingFlags

**GetField():**

EnumBuilder, IReflect, Module, Type, TypeBuilder, TypeDelegator

**GetFieldFromHandle():**

FieldInfo

**GetFields():**

EnumBuilder, IReflect, Module, Type, TypeBuilder, TypeDelegator

**GetFieldSigHelper():**

SignatureHelper

**GetFieldToken():**

ModuleBuilder

**GetFile():**

Assembly, AssemblyBuilder

**GetFileColumnNumber():**

StackFrame

**GetFileLineNumber():**

StackFrame

**GetFileName():**

Path, StackFrame

**GetFileNames():**

IsolatedStorageFile

**GetFileNameWithoutExtension():**

Path

**GetFiles():**

Assembly, AssemblyBuilder, Directory, DirectoryInfo

**GetFileSystemEntries():**

Directory

**GetFileSystemInfos():**

DirectoryInfo

**GetFolderPath():**

Environment

**GetFormat():**

CultureInfo, DateTimeFormatInfo, IFormatProvider, NumberFormatInfo

**GetFrame():**

StackTrace

**GetFullPath():**

Path

**GetGeneration():**

GC

**GetGetMethod():**

PropertyBuilder, PropertyInfo

**GetGroupNames():**

Regex

**GetGroupNumbers():**

Regex

**GetHash():**

Hashtable

**GetHashCode():**

ArgIterator, ArrayWithOffset, Attribute, BitVector32, Boolean, Byte, CaseInsensitiveHashCodeProvider, Char, CompareInfo, Cookie, CultureInfo, DateTime, Decimal, Delegate, Double, Encoding, EndpointPermission, Enum, EventToken, FieldToken, Guid, HttpWebRequest, HttpWebResponse, IHashCodeProvider, Int16, Int32, Int64, IntPtr, IPAddress, IPEndPoint, Label, MethodBuilder, MethodToken, MulticastDelegate, Object, OpCode, ParameterToken, PropertyToken, RegionInfo, SByte, SectionServicePoint, SignatureHelper, SignatureToken, Single, Socket, SocketAddress, SortKey, StreamingContext, String, StringToken, TextInfo, TimeSpan, Type, TypeToken, UInt16, UInt32, UInt64, UIntPtr, UnicodeEncoding, Uri, UriBuilder, UTF8Encoding, ValueType, Version, XmlQualifiedName

**GetHINSTANCE():**

Marshal

**GetHostByAddress():**

Dns

**GetHostByName():**

Dns

**GetHostName():**

Dns

**GetHour():**

Calendar

**GetHRForException():**

Marshal

**GetHRForLastWin32Error():**

Marshal

**GetId():**

ObjectIDGenerator

**GetIDispatchForObject():**

Marshal

**GetILGenerator():**

ConstructorBuilder, MethodBuilder

**GetILOffset():**

StackFrame

**GetIndexParameters():**

PropertyBuilder, PropertyInfo

**GetInstance():**

DateTimeFormatInfo, NumberFormatInfo

**GetInstanceNames():**

PerformanceCounterCategory

**GetInt16():**

SerializationInfo

**GetInt32():**

SerializationInfo

**GetInt64():**

SerializationInfo

**GetInterface():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetInterfaceMap():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetInterfaces():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetInvocationList():**

Delegate, MulticastDelegate

**GetITypeInfoForType():**

Marshal

**GetIUnknownForObject():**

Marshal

**GetKey():**

NameValueCollection, SortedList

**GetKeyList():**

SortedList

**GetLastAccessTime():**

Directory, File

**GetLastWin32Error():**

Marshal

**GetLastWriteTime():**

Directory, File

**GetLeftPart():**

Uri

**GetLength():**

Array

**GetLifetimeService():**

MarshalByRefObject

**GetLoadedModules():**

Assembly

**GetLocalVarSigHelper():**

SignatureHelper

**GetLogicalDrives():**

Directory, Environment

**GetLowerBound():**

Array

**GetManagedCategoryGuid():**

IRegistrationServices, RegistrationServices

**GetManagedThunkForUnmanagedMethodPtr():**

Marshal

**GetManifestResourceInfo():**

Assembly, AssemblyBuilder

**GetManifestResourceNames():**

Assembly, AssemblyBuilder

**GetManifestResourceStream():**

Assembly, AssemblyBuilder

**GetMaxByteCount():**

ASCIIEncoding, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetMaxCharCount():**

ASCIIEncoding, Encoding, UnicodeEncoding, UTF7Encoding, UTF8Encoding

**GetMaxThreads():**

ThreadPool

**GetMember():**

EnumBuilder, IReflect, Type, TypeBuilder, TypeDelegator

**GetMembers():**

EnumBuilder, IReflect, Type, TypeBuilder, TypeDelegator

**GetMethod():**

IReflect, Module, StackFrame, Type

**GetMethodFromHandle():**

MethodBase

**GetMethodImpl():**

Delegate, EnumBuilder, Module, Type, TypeBuilder, TypeDelegator

**GetMethodImplementationFlags():**

ConstructorBuilder, MethodBase, MethodBuilder

**GetMethodInfoForComSlot():**

Marshal

**GetMethods():**

EnumBuilder, IReflect, Module, Type, TypeBuilder, TypeDelegator

**GetMethodSigHelper():**

SignatureHelper

**GetMethodToken():**

ModuleBuilder

**GetMilliseconds():**

Calendar

**GetMinute():**

Calendar

**GetModule():**

Assembly, ConstructorBuilder, MethodBuilder

**GetModules():**

Assembly

**GetMonth():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetMonthName():**

DateTimeFormatInfo

**GetMonthsInYear():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**GetName():**

Assembly, Enum

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetNext():**

Formatter

**GetNextArg():**

ArgIterator

**GetNextArgType():**

ArgIterator

**GetNextSelector():**

ISurrogateSelector, SurrogateSelector

**GetNextTextElement():**

StringInfo

**GetNode():**

IHasXmlNode

**GetNumericValue():**

Char

**GetObject():**

Activator, ObjectManager

### GetObjectData():

ArgumentException, ArgumentOutOfRangeException, Assembly, AssemblyName, BadImageFormatException, DBNull, Delegate, Exception, FileLoadException, FileNotFoundException, FormatterServices, Hashtable, ISerializable, ISerializationSurrogate, MissingMemberException, Module, MulticastDelegate, NameObjectCollectionBase, NotFiniteNumberException, ObjectDisposedException, ReflectionTypeLoadException, RuntimeTypeHandle, SoapFault, TypeInitializationException, TypeLoadException, WeakReference, XmlException, XPathException, XsltCompileException, XsltException

### GetObjectForIUnknown():

Marshal

### GetObjectForNativeVariant():

Marshal

### GetObjectsForNativeVariants():

Marshal

### GetOffset():

ArrayWithOffset

### GetParam():

XsltArgumentList

### GetParameters():

ConstructorBuilder, MethodBase, MethodBuilder

### GetParent():

Directory

**GetPathRoot():**

Path

**GetPermission():**

IsolatedStorage, IsolatedStorageFile

**GetPreamble():**

Encoding, UnicodeEncoding, UTF8Encoding

**GetPrefixOfNamespace():**

XmlNode

**GetProcessById():**

Process

**GetProcesses():**

Process

**GetProcessesByName():**

Process

**GetProgIdForType():**

IRegistrationServices, RegistrationServices

**GetProperties():**

EnumBuilder, IReflect, Type, TypeBuilder, TypeDelegator

**GetProperty:**

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**GetProperty():**

IReflect, Type

**GetPropertyImpl():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**GetPropertySigHelper():**

SignatureHelper

**GetProxy():**

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**GetPublicKey():**

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**GetPublicKeyToken():**

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**GetRaiseMethod():**

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**GetRange():**

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**GetRealObject():**

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**GetReferencedAssemblies():**

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**GetRegistrableTypesInAssembly():**

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**GetResponseHeader():**

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**GetResponseStream():**

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**GetRowFromElement():**

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**GetRuntimeDirectory():**

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**GetSatelliteAssembly():**

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**GetSByte():**

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**GetSecond():**

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**GetSerializableMembers():**

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**GetService():**

**GetStore():**

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**GetStream():**

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**GetString():**

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**GetStringBuilder():**

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**GetStringConstant():**

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**GetSubKeyNames():**

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**GetSurrogate():**

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**GetSymWriter():**

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**GetSystemVersion():**

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**GetTypeCode():**

Boolean, Byte, Char, Convert, DateTime, DBNull, Decimal, Double, Enum, IConvertible, Int16, Int32, Int64, SByte, Single, String, Type, UInt16, UInt32, UInt64

**GetTypedObjectForIUnknown():**

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**GetTypeForITypeInfo():**

Marshal

**GetTypeFromAssembly():**

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**GetTypeFromCLSID():**

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**GetTypeFromHandle():**

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**GetTypeFromProgID():**

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**GetTypeHandle():**

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**GetTypeInfoName():**

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**GetTypeLibGuid():**

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**GetTypes():**

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**GetUInt32():**

SerializationInfo

**GetUInt64():**

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**GetUnderlyingType():**

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**GetUnicodeCategory():**

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**GetUninitializedObject():**

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**GetUnmanagedThunkForManagedMethodPtr():**

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**GetUnmanagedType:**

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**GetUserStoreForAssembly():**

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**GetValueDirect():**

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**GetValues():**

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**GetVersionInfo():**

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**Ggp:**

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**GlobalAssemblyCache:**

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**GregorianCalendarTypes:**

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**HasElementTypeImpl():**

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**HasExtension():**

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**HasFeature():**

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**HasFieldMarshal:**

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**HasFieldRVA:**

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**Hashtable:**

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**HasId():**

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**HasKeys():**

NameValueCollection

**HasLineInfo():**

IXmlLineInfo

**HasNamespace():**

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**HasSecurity:**

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**HasShutdownStarted:**

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**HasThis:**

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**HasValue:**

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**HaveResponse:**

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**HeaderIncluded:**

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**HeaderName:**

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**Headers:**

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**HebrewCalendar:**

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**HebrewEra:**

HebrewCalendar

**HelpLink:**

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**HexEscape():**

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**HexNumber:**

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**HexUnescape():**

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**Hidden:**

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**HideBySig:**

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**High:**

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**Highest:**

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**HijriCalendar:**

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**HttpVersionNotSupported:**

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**HybridDictionary:**

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**I1:**

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**I2:**

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**I4:**

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**IAuthenticationModule:**

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**ICertificatePolicy:**

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**ICollection:**

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**IComparable:**

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**IComparer:**

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**Icon:**

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**IConvertible:**

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**ICredentials:**

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**ICustomAttributeProvider:**

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**ICustomFormatter:**

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**Id:**

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**ID:**

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**IdealProcessor:**

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**IDeserializationCallback:**

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**IDictionary:**

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**IDictionaryEnumerator:**

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**IDispatch:**

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**IDispatchImplAttribute:**

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**IDispatchImplType:**

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**IFieldInfo:**

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**IfModifiedSince:**

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**IFormatProvider:**

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**IFormattable:**

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**IFormatter:**

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**IFormatterConverter:**

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**Igmp:**

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**IgnoreCase:**

BindingFlags, CompareOptions, RegexOptions

**IgnoreKanaType:**

CompareOptions

**IgnoreNonSpace:**

CompareOptions

**IgnorePatternWhitespace:**

RegexOptions

**IgnoreReturn:**

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**IgnoreSymbols:**

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**IgnoreWidth:**

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**ImpLink:**

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**InAttribute:**

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**IncludeSubdirectories:**

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**IncrementBy():**

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**Indent():**

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**IndentChar:**

XmlTextWriter

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**InitializeLifetimeService():**

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**InitializeReferences():**

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**InlineField:**

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**InlineMethod:**

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**InlineType:**

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**InnerText:**

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**InnerXml:**

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**InsertAfter():**

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**InsertBefore():**

XmlAttributeCollection, XmlNode

**InsertData():**

XmlCharacterData

**InsertRange():**

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**Install():**

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**InstalledWin32Cultures:**

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**InstanceData:**

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**InstanceDataCollection:**

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**InstanceDataCollectionCollection:**

System.Diagnostics

**InstanceExists():**

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**Int32:**

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**Int64BitsToDouble():**

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**Interactive:**

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**Interface:**

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**InterfaceIsDual:**

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**InterfaceIsIDispatch:**

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**InterfaceIsIUnknown:**

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**InterfaceMapping:**

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**InterfaceMethods:**

InterfaceMapping

**InterfaceType:**

InterfaceMapping

**InterfaceTypeAttribute:**

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**Interlocked:**

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**InternalBufferSize:**

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**InternalHigh:**

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**InternalImpl:**

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**InternalValidationEventHandler:**

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**InternetCache:**

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**InvalidCastException:**

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**InvalidComObjectException:**

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**InvalidOleVariantTypeException:**

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**InvalidOperationException:**

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**InvalidPathChars:**

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**InvalidProgramException:**

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**IPv4:**

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**IPv6:**

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**Ipx:**

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**Irda:**

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**IsAbstract:**

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**IsAlive:**

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**IsAllocated:**

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**IsAnsiClass:**

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**IsArray:**

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**IsArrayImpl():**

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**IsAssembly:**

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**IsAssignableFrom():**

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**IsAsync:**

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**IsAttached:**

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**IsAutoClass:**

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**IsAutoLayout:**

Type

**IsBackground:**

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**IsBadFileSystemCharacter():**

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**IsBrowserDisplay:**

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**IsBrowserSave:**

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**IsByRef:**

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**IsByRefImpl():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**IsControl():**

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**IsDaylightSavingTime():**

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**IsDBNull():**

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**IsDebug:**

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**IsDefault:**

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**IsDefaultAttribute():**

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**IsDefaultPort:**

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**IsDefined():**

Assembly, Attribute, ConstructorBuilder, Enum, EnumBuilder, FieldBuilder, ICustomAttributeProvider, MemberInfo, MethodBuilder, Module, ParameterInfo, PropertyBuilder, TypeBuilder, TypeDelegator

**IsDescendant():**

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**IsDigit():**

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**IsEmpty:**

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**IsEmptyElement:**

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**IsEnum:**

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**IsEquivalentInstaller():**

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**IsExcludedCharacter():**

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**IsFamily:**

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**IsFamilyAndAssembly:**

FieldInfo, MethodBase

**IsFamilyOrAssembly:**

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**IsFile:**

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**IsFinal:**

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**IsFinalizingForUnload():**

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**IsFixedSize:**

Array, ArrayList, Hashtable, HybridDictionary, IDictionary, IList, ListDictionary, SortedList

**IsHexDigit():**

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**IsHexEncoding():**

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**IsHideBySig:**

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**IsImport:**

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**IsIn:**

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**Isinst:**

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**IsInstanceOfType():**

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**IsInterface:**

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**IsInterned():**

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**IsJITOptimizerDisabled:**

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**IsJITTrackingEnabled:**

DebuggableAttribute

**IsLayoutSequential:**

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**IsLcid:**

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**IsLeapDay():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**IsLeapMonth():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**IsLeapYear():**

Calendar, DateTime, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**IsLetter():**

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Char

**IsLiteral:**

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**IsLittleEndian:**

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**IsLocal:**

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**IsLogging():**

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RegionInfo

**IsMulticast:**

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**IsName():**

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**IsNameToken():**

XmlReader

**IsNaN():**

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**IsNegativeInfinity():**

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**IsNestedAssembly:**

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**IsNestedFamANDAssem:**

Type

**IsNestedFamily:**

Type

**IsNestedFamORAssem:**

Type

**IsNestedPrivate:**

Type

**IsNestedPublic:**

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**IsNeutralCulture:**

CultureInfo

**IsNotPublic:**

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**IsNotSerialized:**

FieldInfo

**IsNumber():**

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**Iso:**

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**ISoapMessage:**

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**ISOCurrencySymbol:**

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**IsolatedStorage:**

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**IsolatedStorageException:**

System.IO.IsolatedStorage

**IsolatedStorageFile:**

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**IsolatedStorageFileStream:**

System.IO.IsolatedStorage

**IsolatedStorageScope:**

System.IO.IsolatedStorage

**IsOptional:**

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**IsOut:**

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**IsParam:**

**IsPrimitive:**

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**IsPrimitiveImpl():**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**IsPrivate:**

FieldInfo, MethodBase

**IsPrivateBuild:**

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**IsPublic:**

FieldInfo, MethodBase, RegexCompilationInfo, Type

**IsPunctuation():**

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**IsReaderLockHeld:**

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**IsReadOnly:**

Array, ArrayList, BitArray, CaptureCollection, CookieCollection, CultureInfo, DateTimeFormatInfo, GroupCollection, Hashtable, HybridDictionary, IDictionary, IList, ListDictionary, MatchCollection, NumberFormatInfo, SortedList, StringCollection, XmlDocument, XmlDocumentType, XmlEntity, XmlEntityReference, XmlNode, XmlNotation

**IsReservedCharacter():**

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**IsResource():**

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**IsRestricted():**

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**IsRetval:**

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**IsSamePosition():**

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**IsSealed:**

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**IsSeparator():**

Char

**IsSerializable:**

Type

**IsSpecialBuild:**

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**IsSpecialName:**

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**IsStartElement():**

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**IsStatic:**

FieldInfo, MethodBase

**IsSubclassOf():**

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**IsSubsetOf():**

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**IsSuffix():**

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**IsSurrogate():**

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Char

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**IsValueType:**

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**IsValueTypeImpl():**

EnumBuilder, Type, TypeDelegator

**IsVirtual:**

MethodBase

**IsWhiteSpace():**

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**IsWriterLockHeld:**

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ArrayList, BitArray, BitVector32, CaptureCollection, CookieCollection, CounterCreationDataCollection, EventLogEntryCollection, EventLogPermissionEntryCollection, GroupCollection, Hashtable, HybridDictionary, IDictionary, IList, InstanceDataCollection, InstanceDataCollectionCollection, KeysCollectionListDictionary, MatchCollection, NameValueCollection, ParameglosstermodifierPerformanceCounterPermissionEntryCollection, ProcessModuleCollection, ProcessThreadCollection, SocketAddress, SortedList, StringCollection, StringDictionary, TraceListenerCollection, XmlNode, XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader

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**KeysCollection:**

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**KillTimer():**

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**LastWriteTime:**

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**Lat:**

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**LayoutMask:**

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**LCID:**

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**Ldarg_1:**

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**Ldarg_3:**

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**Ldc_I4:**

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**Ldc_I4_0:**

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**Ldc_I4_1:**

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**Ldc_I4_2:**

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**Ldc_I4_3:**

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**Ldc_I4_4:**

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**Ldc_I4_5:**

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**Ldc_I4_8:**

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**Ldind_R4:**

OpCodes

**Ldind_R8:**

OpCodes

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**LocalAddress:**

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**LocalBuilder:**

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**LocalDataStoreSlot:**

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**LocalMachine:**

Registry, RegistryHive

**LocalName:**

XmlAttribute, XmlCDataSection, XmlComment, XmlDeclaration, XmlDocument, XmlDocumentFragment, XmlDocumentType, XmlElement, XmlEntity, XmlEntityReference, XmlNode, XmlNodeReader, XmlNotation, XmlProcessingInstruction, XmlReader, XmlSignificantWhitespace, XmlText, XmlTextReader, XmlValidatingReader, XmlWhitespace, XPathNavigator

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**LockCookie:**

**LongTimePattern:**

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**LookupNamespace():**

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**MaxServicePoints:**

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**MaxValue:**

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**MaxWorkingSet:**

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**MemberName:**

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**MethodBase:**

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ConstructorBuilder, MethodBase, MethodBuilder

**MethodImplAttributes:**

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**MethodInfo:**

System.Reflection

**MethodName:**

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**MethodNotAllowed:**

HttpStatusCode

**MethodRental:**

System.Reflection.Emit

**METHODS_TO_SKIP:**

StackTrace

IPEndPoint

**MinusOne:**

Decimal

**Minute:**

DateTime

**Minutes:**

TimeSpan

**MinValue:**

Byte, Char, DateTime, Decimal, Double, Int16, Int32, Int64, SByte, Single, TimeSpan, UInt16, UInt32, UInt64

**MinWorkingSet:**

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**Missing:**

System.Reflection, Type

**MissingFieldException:**

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**MissingMemberException:**

System

**MissingMethodException:**

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**Mkrefany:**

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**Mode:**

PowerModeChangedEventArgs

**ModifierLetter:**

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**ModifierSymbol:**

UnicodeCategory

**Module:**

AttributeTargets, EnumBuilder, System.Reflection, Type, TypeBuilder, TypeDelegator

**ModuleBuilder:**

System.Reflection.Emit

**ModuleMemorySize:**

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**ModuleName:**

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**MoveToElement():**

XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader

**MoveToFirst():**

XPathNavigator

**MoveToFirstAttribute():**

XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader, XPathNavigator

**MoveToFirstChild():**

XPathNavigator

**MoveToFirstNamespace():**

XPathNavigator

**MoveToId():**

XPathNavigator

**MoveToNamespace():**

XPathNavigator

**MoveToNext():**

XPathNavigator

**MoveToNextAttribute():**

XmlNodeReader, XmlReader, XmlTextReader, XmlValidatingReader, XPathNavigator

**MoveToNextNamespace():**

XPathNavigator

**MoveToParent():**

XPathNavigator

**MoveToPrevious():**

XPathNavigator

**MoveToRoot():**

XPathNavigator

**MTA:**

ApartmentState

**MTAThreadAttribute:**

System

**Mul:**

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**Mul_Ovf:**

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**Mul_Ovf_Un:**

**Multiline:**



**MultipleChoices:**



**Multiply():**



**Mutex:**

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**NestedFamANDAssem:**

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**NestedFamily:**

TypeAttributes

**NestedFamORAssem:**

TypeAttributes

**NestedPrivate:**

TypeAttributes

**NestedPublic:**

TypeAttributes

**NestedType:**

MemberTypes

**NetBios:**

AddressFamily, ProtocolFamily

**NetworkAccess:**

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**NetworkCredential:**

**NextValue():**

PerformanceCounter

**NMTOKEN:**

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**NMTOKENS:**

XmlTokenizedType

**NoChecksum:**

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**NoContent:**

HttpStatusCode

**NoCurrentDateDefault:**

DateTimeStyles

**Node:**

XmlNodeChangedEventArgs

**NodeChanged:**

XmlDocument

**NodeChanging:**

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**NodeInserted:**

XmlDocument

**NodeInserting:**

XmlDocument

**NoDelay:**

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**NodeRemoved:**

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**NodeRemoving:**

XmlDocument

**NodeSet:**

XPathResultType

**NodeType:**

XmlAttribute, XmlCDataSection, XmlComment, XmlDeclaration, XmlDocument, XmlDocumentFragment, XmlDocumentType, XmlElement, XmlEntity, XmlEntityReference, XmlNode, XmlNodeReader, XmlNotation, XmlProcessingInstruction, XmlReader, XmlSignificantWhitespace, XmlText, XmlTextReader, XmlValidatingReader, XmlWhitespace, XPathNavigator

**NoInlining:**

MethodImplAttributes

**NonAuthoritativeInformation:**

HttpStatusCode

**None:**

AssemblyNameFlags, AssemblyRegistrationFlags, CharSet, ClassInterfaceType, CompareOptions, DateTimeStyles, EventAttributes, EventLogPermissionAccess, FileShare, Formatting, IPAddress, IsolatedStorageScope, NumberStyles, ParameterAttributes, PerformanceCounterPermissionAccess, PropertyAttributes, RegexOptions, SocketFlags, ValidationType, WhitespaceHandling, XmlCaseOrder, XmlNodeType, XmlSpace, XmlTokenizedType

**NonpagedSystemMemorySize:**

Process

**NonPublic:**

BindingFlags

**NonSerializedAttribute:**

System

**NonSpacingMark:**

UnicodeCategory

**Nop:**

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**Normal:**

FileAttributes, GCHandleType, ProcessPriorityClass, ProcessWindowStyle, ThreadPriority, ThreadPriorityLevel

**Normalization:**

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**Normalize():**

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**Not:**

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**Not():**

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**NotAcceptable:**

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**Notation:**

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**NOTATION:**

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**NotationName:**

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**Number:**

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**NumberDecimalDigits:**

NumberFormatInfo

**NumberDecimalSeparator:**

NumberFormatInfo

**NumberFormat:**

CultureInfo

**NumberFormatInfo:**

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**NumberGroupSeparator:**

NumberFormatInfo

**NumberGroupSizes:**

NumberFormatInfo

**NumberNegativePattern:**

NumberFormatInfo

**NumberOfItems32:**

PerformanceCounterType

**NumberOfItems64:**

PerformanceCounterType

**NumberOfItemsHEX32:**

PerformanceCounterType

**NumberOfItemsHEX64:**

PerformanceCounterType

**NumberStyles:**

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**NumParamBytes():**

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**OnRemove():**

CollectionBase, DictionaryBase, EventLogPermissionEntryCollection, PerformanceCounterPermissionEntryCollection

**OnRemoveComplete():**

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**OnRenamed():**

FileSystemWatcher

**OnSet():**

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**OnSetComplete():**

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**OnSwitchSettingChanged():**

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**OnValidate():**

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**OpCode:**

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**OpenStandardOutput():**

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**OpenSubKey():**

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**OpenText():**

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**OpenWrite():**

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**OperandType:**

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**OperatingSystem:**

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**OPTIL:**

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**Optional:**

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**OriginalString:**

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**Osi:**

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**OSVersion:**

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**Other:**

StreamingContextStates

**OtherLetter:**

UnicodeCategory

**OtherNotAssigned:**

UnicodeCategory

**OtherNumber:**

UnicodeCategory

**OtherPunctuation:**

UnicodeCategory

**OtherSymbol:**

UnicodeCategory

**Out:**

Console, ParameterAttributes

**OutAttribute:**

System.Runtime.InteropServices

**OuterXml:**

XmlEntity, XmlNode, XmlNotation

**OutOfBand:**

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**OutOfBandInline:**

SocketOptionName

**OutOfMemoryException:**

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**OutStream:**

BinaryWriter

**OverflowException:**

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**Overlapped:**

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**OwnerDocument:**

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**OwnerElement:**

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**Pack:**

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**Pack():**

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**PacketInformation:**

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**PackingSize:**

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**PadLeft():**

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**PadRight():**

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**PagedMemorySize:**

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**PagedSystemMemorySize:**

Process

**PageIn:**

**Parameglosstermodifier:**

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**ParameterToken:**

System.Reflection.Emit

**ParameterType:**

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**ParamName:**

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**ParamNames:**

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**ParamTypes:**

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**ParamValues:**

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**Parent:**

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**ParentNode:**

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**PeekChar():**

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**PEFileKinds:**

System.Reflection.Emit

**Pending:**

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**Pending():**

TcpListener

**PercentDecimalDigits:**

NumberFormatInfo

**PercentDecimalSeparator:**

NumberFormatInfo

**PercentGroupSeparator:**

NumberFormatInfo

**PercentGroupSizes:**

NumberFormatInfo

**PercentNegativePattern:**

NumberFormatInfo

**PercentPositivePattern:**

NumberFormatInfo

**PercentSymbol:**

NumberFormatInfo

**PerDomainCapacity:**

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**PerformanceCounter:**

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**PerformanceCounterCategory:**

System.Diagnostics

**PerformanceCounterInstaller:**

System.Diagnostics

**PerformanceCounterPermission:**

System.Diagnostics

**PerformanceCounterPermissionAccess:**

System.Diagnostics

**PerformanceCounterPermissionAttribute:**

System.Diagnostics

**PerformanceCounterPermissionEntry:**

System.Diagnostics

**PerformanceCounterPermissionEntryCollection:**

System.Diagnostics

**PerformanceCounterType:**

System.Diagnostics

**PerformanceData:**

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**PerMilleSymbol:**

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**PermissionAccess:**

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PerformanceCounterPermissionAttribute, PerformanceCounterPermissionEntry

**PermissionEntries:**

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**Persistence:**

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**Personal:**

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**Phi:**

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**PI:**

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**Pinned:**

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**PinvokeImpl:**

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**Pipelined:**

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**PipelineFailure:**

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**Platform:**

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**PlatformID:**

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**Pop1_pop1:**

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**Popi:**

StackBehaviour

**Popi_pop1:**

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**Popi_popi:**

StackBehaviour

**Popi_popi_popi:**

StackBehaviour

**Popi_popi8:**

StackBehaviour

**Popi_popr4:**

StackBehaviour

**Popi_popr8:**

StackBehaviour

**Popref:**

StackBehaviour

**Popref_pop1:**

StackBehaviour

**Popref_popi:**

StackBehaviour

**Popref_popi_popi:**

StackBehaviour

**Popref_popi_popi8:**

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**Popref_popi_popr8:**

StackBehaviour

**Popref_popi_popref:**

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**PopScope():**

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**PopulateObjectMembers():**

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**Port:**

Cookie, EndpointPermission, IPEndPoint, SocketPermissionAttribute, Uri, UriBuilder

**Position:**

BufferedStream, FileStream, IsolatedStorageFileStream, MemoryStream, NetworkStream, ParameterBuilder, ParameterInfo, Stream

**PositionImpl:**

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**PositiveInfinity:**

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**PositiveInfinitySymbol:**

NumberFormatInfo

**PositiveSign:**

NumberFormatInfo

**Pow():**

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**Power:**

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**PowerModeChanged:**

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**PowerModeChangedEventArgs:**

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**PowerModeChangedEventHandler:**

Microsoft.Win32

**PowerModes:**

Microsoft.Win32

**PreAuthenticate:**

FileWebRequest, HttpWebRequest, WebRequest

**PreAuthenticate():**

AuthenticationManager, IAuthenticationModule

**PreconditionFailed:**

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**Prefix:**

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**Prefix1:**

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**Prefix2:**

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**Prefix3:**

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**Prefix4:**

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**Prefix5:**

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**Prefix6:**

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**Prefix7:**

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**Prefixref:**

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**Prelink():**

**PreviousSibling:**

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**Primitive:**

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**Priority:**

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**PriorityBoostEnabled:**

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**PriorityClass:**

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**PriorityLevel:**

ProcessThread

**Private:**

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**PrivateBinPath:**

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**PrivateBinPathProbe:**

AppDomainSetup

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**ProcessModuleCollection:**

System.Diagnostics

**ProcessName:**

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**ProcessorAffinity:**

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**ProcessPriorityClass:**

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**ProcessStartInfo:**

System.Diagnostics

**ProcessThread:**

System.Diagnostics

**ProcessThreadCollection:**

System.Diagnostics

**ProcessWindowStyle:**

System.Diagnostics

**Product:**

AssemblyProductAttribute

**ProductBuildPart:**

FileVersionInfo

**ProductMajorPart:**

FileVersionInfo

**ProductMinorPart:**

FileVersionInfo

**ProductName:**

FileVersionInfo

**ProductPrivatePart:**

FileVersionInfo

**ProductVersion:**

FileVersionInfo

**ProgIdAttribute:**

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**ProgramFiles:**

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**PropSet:**

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**ProtectionRealm:**

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**ProtocolError:**

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**ProtocolFamily:**

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**ProtocolType:**

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**ProtocolVersion:**

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**ProtocolViolationException:**

System.Net

**Proxy:**

FileWebRequest, HttpWebRequest, WebRequest

**ProxyAuthenticationRequired:**

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**ProxyNameResolutionFailure:**

WebExceptionStatus

**PtrToStringAnsi():**

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**PtrToStringAuto():**

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**PtrToStringBSTR():**

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**PtrToStringUni():**

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**PtrToStructure():**

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**Public:**

BindingFlags, FieldAttributes, MethodAttributes, ResourceAttributes, TypeAttributes

**PublicId:**

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**PublicKey:**

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**Pulse():**

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**PulseAll():**

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**Pup:**

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**Push():**

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**Push1:**

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**Push1_push1:**

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**RawFraction:**

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**RawValue:**

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**Rdm:**

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**Read:**

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**Read():**

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**Read7BitEncodedInt():**

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**ReadAttributeValue():**

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**ReadInt32():**

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**ReadInt64():**

BinaryReader, Marshal

**ReadIntPtr():**

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**ReadLine():**

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**ReadNode():**

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**ReadOnly:**

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**ReadOnly():**

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**ReadOnlyCollectionBase:**

System.Collections

**ReadOuterXml():**

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**ReadSByte():**

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**ReadSingle():**

BinaryReader

**ReadStartElement():**

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**ReadState:**

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**ReadString():**

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**ReadToEnd():**

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**ReadTypedValue():**

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**ReadUInt16():**

BinaryReader

**ReadUInt32():**

**RecordDelayedFixup():**

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**RecordFixup():**

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**Redirect:**

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**RedirectKeepVerb:**

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**RedirectMethod:**

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**RedirectStandardError:**

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**RedirectStandardInput:**

ProcessStartInfo

**RedirectStandardOutput:**

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**Refanytype:**

**RegexCompilationInfo:**

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**RegexOptions:**

System.Text.RegularExpressions

**RegionInfo:**

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**Register():**

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**RegisterAssembly():**

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**RegisteredModules:**

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**RegisteredWaitHandle:**

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**RegisterObject():**

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**RegisterObjectCreationCallback():**

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**RegisterPrefix():**

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**RegisterTypeForComClients():**

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**RegisterWaitForSingleObject():**

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**RegistrationServices:**

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**Registry:**

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**RegistryHive:**

Microsoft.Win32

**RegistryKey:**

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**RelativeSearchPath:**

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**Release():**

**Remainder():**

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**RemoteEndPoint:**

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**Remoting:**

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**Remove:**

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**Remove():**

ArrayList, CounterCreationDataCollection, CredentialCache, Delegate, EventLogPermissionEntryCollection, Hashtable, HybridDictionary, IDictionary, IList, IsolatedStorage, IsolatedStorageFile, ListDictionary, NameValueCollection, PerformanceCounterPermissionEntryCollection, ProcessThreadCollection, SortedList, String, StringBuilder, StringCollection, StringDictionary, TraceListenerCollection, WebHeaderCollection, XmlAttributeCollection

**RemoveAll():**

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**RemoveAllAttributes():**

XmlElement

**RemoveAt():**

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**RemoveAttribute():**

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**RemoveAttributeAt():**

XmlElement

**RemoveAttributeNode():**

XmlElement

**RemoveChild():**

XmlNode

**RemoveEventHandler():**

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**RemoveExtensionObject():**

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**RemoveImpl():**

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**RemoveInstance():**

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**RemoveMember():**

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**RequestEntityTooLarge:**

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**RequestTimeout:**

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**RequestUri:**

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**RequestUriTooLong:**

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**RequireSecObject:**

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**ReRegisterForFinalize():**

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**Reserved2:**

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**Reserved3:**

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**ResetIdealProcessor():**

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**ResetState():**

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**ResolveEntity():**

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**ResponseHeaders:**

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**ResponseUri:**

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**RestoreLock():**

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**Result():**

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**Resume():**

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**Rethrow:**

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**ReturnType:**

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**ReturnTypeCustomAttributes:**

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**SchemaType:**

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**Screensaver:**

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**Sealed:**

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**Second:**

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**SelectMode:**

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**SelectNodes():**

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**SelectProperty():**

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**SelectRead:**

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**SelectSingleNode():**

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**Send:**

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**Seqpacket:**

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**SequentialLayout:**

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**SerializableAttribute:**

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**SerializationBinder:**

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**SerializationEntry:**

System.Runtime.Serialization

**SerializationException:**

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**SerializationInfo:**

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**SerializationInfoEnumerator:**

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**Serialize():**

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**Server:**

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**ServerFault:**

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**ServerProtocolViolation:**

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**ServicePoint:**

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**ServicePointManager:**

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**SessionEnded:**

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**SetConstant():**

FieldBuilder, ParameterBuilder, PropertyBuilder

**SetContext():**

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**SetCookies():**

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**SetCreationTime():**

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**SetCurrentDirectory():**

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**SetCustomAttribute():**

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**SetData():**

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**SetDynamicBase():**

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**SetEntryPoint():**

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**SetError():**

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**SetField:**

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**SetGetMethod():**

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**SetImplementationFlags():**

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**SetIn():**

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**SetLastAccessTime():**

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**SetLastError:**

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**SetLastWriteTime():**

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**SetLength():**

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**SetLocalSymInfo():**

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**SetMarshal():**

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**SetNamedItem():**

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**SetObjectData():**

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**SetOffset():**

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**SetOut():**

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**SetParent():**

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**SetPrincipalPolicy():**

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**SetPublicKey():**

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**SetPublicKeyToken():**

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**SetRaiseMethod():**

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**SetRange():**

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**SetRemoveOnMethod():**

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**SetSetMethod():**

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**SetShadowCopyFiles():**

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**SetShadowCopyPath():**

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**SetSocketOption():**

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**ShortDatePattern:**

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**ShortInlineBrTarget:**

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**SoapFault:**

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**Socket:**

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**SocketAddress:**

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**SocketException:**

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**SocketFlags:**

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**SocketOptionLevel:**

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**SocketPermission:**

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**SocketPermissionAttribute:**

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**SocketShutdown:**

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**StackBehaviourPop:**

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**StandardError:**

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**StandardInput:**

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**StandardOutput:**

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**State:**

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**STAThreadAttribute:**

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**StatusChange:**

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**Stelem_I:**

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**Stobj:**

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**Stopped:**

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**StringCollection:**

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**StringDictionary:**

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**StringInfo:**

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**StringToCoTaskMemAuto():**

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**StringToken:**

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**Substring():**

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**SupportsPipelining:**

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**SuppressChangeType:**

BindingFlags

**SuppressFinalize():**

GC

HttpStatusCode

**SynchronizationLockException:**

System.Threading

**Synchronized:**

MethodImplAttributes

**Synchronized():**

ArrayList, Group, Hashtable, Match, Queue, SortedList, Stack, TextReader, TextWriter

**SynchronizingObject:**

EventLog, FileSystemWatcher, Process, Timer

**SyncRoot:**

Array, ArrayList, BitArray, CaptureCollection, CookieCollection, GroupCollection, Hashtable, HybridDictionary, ICollection, ListDictionary, MatchCollection, Queue, SortedList, Stack, StringCollection, StringDictionary

**SysInt:**

UnmanagedType

**System:**

FileAttributes, SpecialFolder

**SystemAllocation:**

ThreadWaitReason

**SystemConfigurationFile:**

RuntimeEnvironment

**SystemDefaultCharSize:**

Marshal

**SystemDefinedImpl:**

IDispatchImplType

**SystemDirectory:**

Environment

**SystemEvents:**

Microsoft.Win32

**SystemException:**

System

**SystemFrequency:**

CounterSample

**SystemId:**

XmlDocumentType, XmlEntity, XmlNotation, XmlParserContext

**SystemMaxDBCSCharSize:**

Marshal

**SystemShutdown:**

SessionEndReasons

**SysUInt:**

UnmanagedType

T

InterfaceMapping

**TargetParameterCountException:**

System.Reflection

**TargetSite:**

Exception

**TargetType:**

InterfaceMapping

**TBStr:**

UnmanagedType

**Tcp:**

ProtocolType, SocketOptionLevel, TransportType

**TcpClient:**

System.Net.Sockets

**TcpListener:**

System.Net.Sockets

**Templates:**

SpecialFolder

**Temporary:**

FileAttributes

**TemporaryRedirect:**

HttpStatusCode

**Glossterminated:**

ThreadState

**Text:**

XmlDataType, XmlNodeType, XPathNodeType

**TextElementEnumerator:**

System.Globalization

**TextInfo:**

CultureInfo, System.Globalization

**TextReader:**

System.IO

**TextWriter:**

System.IO

**TextWriterTraceListener:**

System.Diagnostics

**ThreeLetterISOLanguageName:**

CultureInfo

**ThreeLetterISORegionName:**

RegionInfo

**ThreeLetterWindowsLanguageName:**

CultureInfo

**ThreeLetterWindowsRegionName:**

RegionInfo

**Throw:**

FlowControl, OpCodes

**ThrowException():**

ILGenerator

**ThrowExceptionForHR():**

Marshal

**Thursday:**

DayOfWeek

**TickCount:**

Environment

**Ticks:**

DateTime, TimeSpan

**TicksPerDay:**

TimeSpan

**TicksPerHour:**

TimeSpan

**TicksPerMillisecond:**

TimeSpan

**TicksPerMinute:**

TimeSpan

**TicksPerSecond:**

TimeSpan

**TimeChanged:**

SystemEvents

**TimeCritical:**

ThreadPriorityLevel

**TimedOut:**

WaitForChangedResult

**TimeGenerated:**

EventLogEntry

**TimeOfDay:**

DateTime

**Timeout:**

FileWebRequest, HttpWebRequest, System.Threading, WebExceptionStatus, WebRequest

**Timer:**

System.Threading, System.Timers

**Timer100Ns:**

PerformanceCounterType

**Timer100NsInverse:**

PerformanceCounterType

**TimerCallback:**

System.Threading

**TimerElapsed:**

SystemEvents

**TimerElapsedEventArgs:**

Microsoft.Win32

**TimerElapsedEventHandler:**

Microsoft.Win32

**TimerId:**

TimerElapsedEventArgs

**TimersDescriptionAttribute:**

System.Timers

**TimeSeparator:**

DateTimeFormatInfo

**TimeSpan:**

System

**TimeStamp:**

Cookie, CounterSample

**TimeStamp100nSec:**

CounterSample

**TimeWritten:**

EventLogEntry

Guid, WebHeaderCollection

**ToChar():**

BitConverter, Convert, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToCharArray():**

String

**ToDateTime():**

Calendar, Convert, FormatterConverter, GregorianCalendar, HebrewCalendar, HijriCalendar, IConvertible, IFormatterConverter, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar, XmlConvert

**Today:**

DateTime

**ToDecimal():**

Convert, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToDouble():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToFileTime():**

DateTime

**ToFourDigitYear():**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**ToGuid():**

XmlConvert

**ToInt16():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToInt32():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, IntPtr, XmlConvert

**ToInt64():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, IntPtr, XmlConvert

**Token:**

EventToken, FieldToken, MethodToken, ParameterToken, PropertyToken, SignatureToken, StringToken, TypeToken

**ToLocalTime():**

DateTime, TimeZone

**ToLongDateString():**

DateTime

**ToLongTimeString():**

DateTime

**ToLower():**

Char, String, TextInfo

**ToOACurrency():**

Decimal

**ToOADate():**

DateTime

**ToObject():**

Enum

**TopObject:**

SoapFormatter

**ToPointer():**

IntPtr, UIntPtr

**ToSByte():**

Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToShortDateString():**

DateTime

**ToShortTimeString():**

DateTime

**ToSingle():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToString():**

AppDomain, Assembly, AssemblyName, BadImageFormatException, BitConverter, BitVector32, Boolean, Byte, Capture, Char, COMException, CompareInfo, ConstructorBuilder, Convert, Cookie, CultureInfo, DateTime, DBNull, Decimal, DirectoryInfo, Double, EndpointPermission, Enum, Exception, FileInfo, FileLoadException, FileNotFoundException, FileVersionInfo, FormatterConverter, Guid, IConvertible, IFormattable, IFormatterConverter, Int16, Int32, Int64, IntPtr, IPAddress, IPEndPoint, MethodBuilder, Module, Object, OpCode, OperatingSystem, Process, ProcessModule, Regex, RegionInfo, RegistryKey, SByte, SectionSignatureHelper, Single, SocketAddress, SortKey, StackFrame, StackTrace, String, StringBuilder, StringWriter, TextInfo, TimeSpan, Type, TypeBuilder, UInt16, UInt32, UInt64, UIntPtr, Uri, UriBuilder, ValueType, Version, WebHeaderCollection, XmlConvert, XmlQualifiedName, XPathNavigator

**TotalDays:**

TimeSpan

**TotalHours:**

TimeSpan

**TotalMilliseconds:**

TimeSpan

**TotalMinutes:**

TimeSpan

**TotalProcessorTime:**

Process, ProcessThread

**TotalSeconds:**

TimeSpan

**ToTimeSpan():**

XmlConvert

**ToTitleCase():**

TextInfo

**ToType():**

IConvertible

**ToUInt16():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, XmlConvert

**ToUInt32():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, UIntPtr, XmlConvert

**ToUInt64():**

BitConverter, Convert, Decimal, FormatterConverter, IConvertible, IFormatterConverter, UIntPtr, XmlConvert

**ToUniversalTime():**

DateTime, TimeZone

**ToUpper():**

Char, String, TextInfo

**ToXml():**

DnsPermission, SocketPermission, WebPermission

**Trace:**

System.Diagnostics

**TraceError:**

TraceSwitch

**TraceInfo:**

TraceSwitch

**TraceLevel:**

System.Diagnostics

**TraceListener:**

System.Diagnostics

**TraceListenerCollection:**

System.Diagnostics

**TraceSwitch:**

System.Diagnostics

**TraceVerbose:**

TraceSwitch

**TraceWarning:**

TraceSwitch

**TrackResurrection:**

WeakReference

**Trademark:**

AssemblyTrademarkAttribute

**TransferEncoding:**

HttpWebRequest

**Transform():**

XslTransform

**Transition:**

ThreadState

**TransliteratedEnglish:**

GregorianCalendarTypes

**TransliteratedFrench:**

GregorianCalendarTypes

**Transport:**

EndpointPermission, SocketPermissionAttribute

**TransportType:**

System.Net

**Trim():**

String

**TrimEnd():**

String

**TrimStart():**

String

**TrimToSize():**

ArrayList, Queue, SortedList

**TrueString:**

Boolean

**Truncate:**

FileMode

**Truncate():**

Decimal

**TrustFailure:**

WebExceptionStatus

**TryEnter():**

Monitor

**TryParse():**

Double

**Tuesday:**

DayOfWeek

**TwoDigitYearMax:**

Calendar, GregorianCalendar, HebrewCalendar, HijriCalendar, JapaneseCalendar, JulianCalendar, KoreanCalendar, TaiwanCalendar, ThaiBuddhistCalendar

**TwoLetterISOLanguageName:**

CultureInfo

**TwoLetterISORegionName:**

RegionInfo

**Type:**

SocketOptionName, System

**TypeAttributes:**

System.Reflection

**TypeBuilder:**

System.Reflection.Emit

**TypeCode:**

System

**TypeConstructorName:**

ConstructorInfo

**TypeDelegator:**

System.Reflection

**TypeFilter:**

System.Reflection

**TypeFormat:**

BinaryFormatter, SoapFormatter

**TypeHandle:**

EnumBuilder, Type, TypeBuilder, TypeDelegator

**TypeId:**

Attribute

**typeImpl:**

TypeDelegator

**TypeInfo:**

MemberTypes

**TypeInitializationException:**

System

**TypeInitializer:**

Type

**TypeLoadException:**

System

**TypeName:**

TypeInitializationException, TypeLoadException

**TypeOfService:**

SocketOptionName

**TypeRepresentsComType():**

IRegistrationServices, RegistrationServices

## U

**UnderlyingSystemType:**

EnumBuilder, IReflect, Type, TypeBuilder, TypeDelegator

**Unescape():**

Regex, Uri

**UnhandledException:**

AppDomain

**UnhandledExceptionEventArgs:**

System

**UnhandledExceptionEventHandler:**

System

**Unicode:**

CharSet, Encoding

**UnicodeCategory:**

System.Globalization

**UnicodeClass:**

TypeAttributes

**UnicodeEncoding:**

System.Text

System

**UriHostNameType:**

System

**UriPartial:**

System

**UriSchemeFile:**

Uri

**UriSchemeFtp:**

Uri

**UriSchemeGopher:**

Uri

**UriSchemeHttp:**

Uri

**UriSchemeHttps:**

Uri

**UriSchemeMailto:**

Uri

**UriSchemeNews:**

Uri

**UriSchemeNntp:**

Uri

**UseLoopback:**

SocketOptionName

**USEnglish:**

GregorianCalendarTypes

**UseOptionC():**

Regex

**UseOptionR():**

Regex

**UseProxy:**

HttpStatusCode

**User:**

IsolatedStorageScope

**UserAgent:**

HttpWebRequest

## V

**Version10:**

HttpVersion

**Version11:**

HttpVersion

**VersionCompatibility:**

AssemblyName

**Virtual:**

MethodAttributes

**VirtualMemory:**

ThreadWaitReason

**VirtualMemorySize:**

Process

**VisibilityMask:**

TypeAttributes

**VoiceView:**

AddressFamily, ProtocolFamily

**Void:**

System

VarEnum

**VT_CF:**

VarEnum

**VT_CLSID:**

VarEnum

**VT_CY:**

VarEnum

**VT_DATE:**

VarEnum

**VT_DECIMAL:**

VarEnum

**VT_DISPATCH:**

VarEnum

**VT_EMPTY:**

VarEnum

**VT_ERROR:**

VarEnum

**VT_FILETIME:**

VarEnum

**VT_HRESULT:**

VarEnum

**VT_I1:**

VarEnum

**VT_I2:**

VarEnum

**VT_I4:**

VarEnum

**VT_I8:**

VarEnum

**VT_INT:**

VarEnum

**VT_LPSTR:**

VarEnum

**VT_LPWSTR:**

VarEnum

**VT_NULL:**

VarEnum

**VT_PTR:**

VarEnum

**VT_R4:**

VarEnum

**VT_R8:**

VarEnum

**VT_RECORD:**

VarEnum

**VT_SAFEARRAY:**

VarEnum

**VT_STORAGE:**

VarEnum

**VT_STORED_OBJECT:**

VarEnum

**VT_STREAM:**

VarEnum

**VT_STREAMED_OBJECT:**

VarEnum

**VT_UI1:**

VarEnum

**VT_UI2:**

VarEnum

**VT_UI4:**

VarEnum

**VT_UI8:**

VarEnum

**VT_UINT:**

VarEnum

**VT_UNKNOWN:**

VarEnum

**VT_USERDEFINED:**

VarEnum

**VT_VARIANT:**

VarEnum

**VT_VECTOR:**

VarEnum

**VT_VOID:**

VarEnum

**VtableLayoutMask:**

MethodAttributes

## W

Process

**WaitForPendingFinalizers():**

GC

**WaitHandle:**

System.Threading

**WaitOne():**

WaitHandle

**WaitOrTimerCallback:**

System.Threading

**WaitReason:**

ProcessThread

**WaitSleepJoin:**

ThreadState

**WaitTimeout:**

WaitHandle

**Warning:**

EventLogEntryType, TraceLevel

**WatcherChangeTypes:**

System.IO

**Weak:**

GCHandleType

**WeakReference:**

System

**WeakTrackResurrection:**

GCHandleType

**WebClient:**

System.Net

**WebException:**

System.Net

**WebExceptionStatus:**

System.Net

**WebHeaderCollection:**

System.Net

**WebName:**

Encoding

**WorkingSet:**

Environment, Process

**WrappedObject:**

CurrencyWrapper, DispatchWrapper, UnknownWrapper

**Wrapper:**

HandleRef

**Write:**

FileAccess, FileShare

**Write():**

BinaryWriter, BufferedStream, Console, Debug, DefaultTraceListener, EventLogTraceListener, FileStream, IsolatedStorageFileStream, MemoryStream, NetworkStream, Stream, StreamWriter, StringWriter, TextWriter, TextWriterTraceListener, Trace, TraceListener

**Write7BitEncodedInt():**

BinaryWriter

**WriteArray():**

Formatter

**WriteAttributes():**

XmlWriter

**WriteAttributeString():**

XmlWriter

**WriteBase64():**

XmlTextWriter, XmlWriter

**WriteBinHex():**

XmlTextWriter, XmlWriter

**WriteBoolean():**

Formatter

**WriteByte():**

BufferedStream, FileStream, Formatter, IsolatedStorageFileStream, Marshal, MemoryStream, Stream

**WriteCData():**

XmlTextWriter, XmlWriter

**WriteChar():**

Formatter

**WriteCharEntity():**

XmlTextWriter, XmlWriter

**WriteChars():**

XmlTextWriter, XmlWriter

**WriteComment():**

XmlTextWriter, XmlWriter

**WriteContentTo():**

XmlAttribute, XmlCDataSection, XmlComment, XmlDeclaration, XmlDocument, XmlDocumentFragment, XmlDocumentType, XmlElement, XmlEntity, XmlEntityReference, XmlNode, XmlNotation, XmlProcessingInstruction, XmlSignificantWhitespace, XmlText, XmlWhitespace

**WriteDateTime():**

Formatter

**WriteDecimal():**

Formatter

**WriteDocType():**

XmlTextWriter, XmlWriter

**WriteDouble():**

Formatter

**WriteElementString():**

XmlWriter

**WriteEndAttribute():**

XmlTextWriter, XmlWriter

**WriteEndDocument():**

XmlTextWriter, XmlWriter

**WriteEndElement():**

XmlTextWriter, XmlWriter

**WriteEntityRef():**

XmlTextWriter, XmlWriter

**WriteEntry():**

EventLog

**WriteFullEndElement():**

XmlTextWriter, XmlWriter

**WriteIf():**

Debug, Trace

**WriteIndent():**

TraceListener

**WriteInt16():**

Formatter, Marshal

**WriteInt32():**

Formatter, Marshal

**WriteInt64():**

Formatter, Marshal

**WriteIntPtr():**

Marshal

**WriteLine():**

Console, Debug, DefaultTraceListener, EventLogTraceListener, TextWriter, TextWriterTraceListener, Trace, TraceListener

**WriteLineIf():**

Debug, Trace

**WriteMember():**

Formatter

**WriteName():**

XmlTextWriter, XmlWriter

**WriteNmToken():**

XmlTextWriter, XmlWriter

**WriteNode():**

XmlWriter

**WriteObjectRef():**

Formatter

**WriteProcessingInstruction():**

XmlTextWriter, XmlWriter

**WriteQualifiedName():**

XmlTextWriter, XmlWriter

**Writer:**

TextWriterTraceListener

**WriteRaw():**

XmlTextWriter, XmlWriter

**WriterSeqNum:**

ReaderWriterLock

**WriteSByte():**

Formatter

**WriteSingle():**

Formatter

**WriteStartAttribute():**

XmlTextWriter, XmlWriter

**WriteStartDocument():**

XmlTextWriter, XmlWriter

**WriteStartElement():**

XmlTextWriter, XmlWriter

**WriteState:**

System.Xml, XmlTextWriter, XmlWriter

**WriteString():**

XmlTextWriter, XmlWriter

**WriteSurrogateCharEntity():**

XmlTextWriter, XmlWriter

**WriteTimeSpan():**

Formatter

**WriteTo():**

MemoryStream, XmlAttribute, XmlCDataSection, XmlComment, XmlDeclaration, XmlDocument, XmlDocumentFragment, XmlDocumentType, XmlElement, XmlEntity, XmlEntityReference, XmlNode, XmlNotation, XmlProcessingInstruction, XmlSignificantWhitespace, XmlText, XmlWhitespace

**WriteUInt16():**

Formatter

**WriteUInt32():**

Formatter

**WriteUInt64():**

Formatter

**WriteValueType():**

Formatter

**WriteWhitespace():**

XmlTextWriter, XmlWriter

## X

System.Xml

**XmlDataType:**

System.Xml.XPath

**XmlDeclaration:**

System.Xml, XmlNodeType

**XmlDocument:**

System.Xml

**XmlDocumentFragment:**

System.Xml

**XmlDocumentType:**

System.Xml

**XmlElement:**

System.Xml

**XmlEntity:**

System.Xml

**XmlEntityReference:**

System.Xml

**XmlException:**

System.Xml

**XmlImplementation:**

System.Xml

**XmlLang:**

XmlNodeReader, XmlParserContext, XmlReader, XmlTextReader, XmlTextWriter, XmlValidatingReader, XmlWriter, XPathNavigator

**XmlLinkedNode:**

System.Xml

**XmlNamedNodeMap:**

System.Xml

**XmlNameSpace:**

ISoapMessage, SoapMessage

**XmlNamespaceManager:**

System.Xml

**XmlNameTable:**

System.Xml

**XmlNode:**

System.Xml

**XmlNodeChangedAction:**

System.Xml

**XmlNodeChangedEventArgs:**

System.Xml

**XmlNodeChangedEventHandler:**

System.Xml

**XmlNodeList:**

System.Xml

**XmlNodeOrder:**

System.Xml

**XmlNodeReader:**

System.Xml

**XmlNodeType:**

System.Xml

**XmlNotation:**

System.Xml

**XmlParserContext:**

System.Xml

**XmlProcessingInstruction:**

System.Xml

**XmlQualifiedName:**

System.Xml

**XmlReader:**

System.Xml

**XmlResolver:**

System.Xml, XmlDocument, XmlTextReader, XmlValidatingReader, XslTransform

**XmlSignificantWhitespace:**

System.Xml

**XmlSortOrder:**

System.Xml.XPath

**XmlSpace:**

System.Xml, XmlNodeReader, XmlParserContext, XmlReader, XmlTextReader, XmlTextWriter, XmlValidatingReader, XmlWriter

**XmlText:**

System.Xml

**XPathDocument:**

System.Xml.XPath

**XPathException:**

System.Xml.XPath

**XPathExpression:**

System.Xml.XPath

**XPathNamespaceScope:**

System.Xml.XPath

**XPathNavigator:**

System.Xml.XPath

**XPathNodeIterator:**

System.Xml.XPath

**XPathNodeType:**

System.Xml.XPath

**XPathResultType:**

System.Xml.XPath

**XsdString:**

FormatterTypeStyle

**XsltArgumentList:**

System.Xml.Xsl

**XsltCompileException:**

System.Xml.Xsl

**XsltContext:**

System.Xml.Xsl

**XsltException:**

System.Xml.Xsl

**XslTransform:**

System.Xml.Xsl

Y

**Year:**

DateTime

**YearMonthPattern:**

DateTimeFormatInfo

Z

**Zero:**

# Colophon

Our look is the result of reader comments, our own experimentation, and feedback from distribution channels. Distinctive covers complement our distinctive approach to technical topics, breathing personality and life into potentially dry subjects.

The animal on the cover of *VB.NET Core Classes in a Nutshell* is a crawfish. Crawfish, or crayfish, are freshwater crustaceans. They can be found all over the world, but more than half of the approximately 500 species are found in North America.

Crawfish are similar in structure to lobsters, though much smaller (3 to 4 inches long). A crawfish's head and thorax are joined, followed by a segmented body. The head has a sharp snout, eyes on moveable stalks, and sensory antennae. It has four pairs of walking legs, which it also uses to probe for food, and two claws that extend from the front of its body, used for pinching. Crawfish are brown or greenish, except for some cave-dwelling types that are colorless and eyeless.

Females lay anywhere from 10 to 800 eggs at a time, which attach to the females' swimming legs until they hatch. Newly hatched crawfish look like miniature adults. They molt 6 to 10 times in the first year during rapid growth, then less often in the second year. Crawfish usually live only two years.

Crawfish are considered a delicacy in the southern United States, particularly in Louisiana, where they play an important role in Cajun cuisine. Crawfish are a key ingredient in many of the most famous Cajun dishes, such as crawfish etouffée, seafood gumbo, and crawfish boil. Many southern towns and cities host annual crawfish festivals. These festivals often feature all-you-can-eat crawfish eating contests, in which people have been known to consume up to 50 pounds of crawfish in one sitting!

Linley Dolby and Catherine Morris were the production editors for *VB.NET Core Classes in a Nutshell*. Catherine Morris was the proofreader. Emily Quill, Linley Dolby, Ann Schirmer, and Claire Cloutier provided quality control.

Pam Spremulli designed the cover of this book, based on a series design by Edie Freedman. The cover image is a 19th-century engraving from the Dover Pictorial Archive. Emma Colby produced the cover layout with QuarkXPress 4.1 using Adobe's ITC Garamond font. David Futato produced the CD label with QuarkXPress 4.1 using Adobe's ITC Garamond font.

David Futato designed the interior layout based on a series design by Nancy Priest. The print version of this book was created by translating the DocBook XML markup of its source files into a set of *gtroff* macros using a filter developed at O'Reilly & Associates by Norman Walsh. Steve Talbott designed and wrote the underlying macro set on the basis of the GNU *troff -gs* macros; Lenny Muellner adapted them to XML and implemented the book design. The GNU groff text formatter version 1.11.1 was used to generate PostScript output. The text and heading fonts are ITC Garamond Light and Garamond Book. The illustrations that appear in the book were produced by Robert Romano and Jessamyn Read using Macromedia FreeHand 9 and Adobe Photoshop 6. This colophon was written by Linley Dolby and Claire Cloutier.

The online edition of this book was created by the Safari production group (John Chodacki, Becki Maisch, and Madeleine Newell) using a set of Frame-to-XML conversion and cleanup tools written and maintained by Erik Ray, Benn Salter, John Chodacki, and Jeff Liggett.

[SYMBOL] [A] [B] [C] [D] [E] [F] [G] [I] [**K**] [L] [M] [N] [O] [P] [R] [S] [T] [U] [V] [W] [X]

[SYMBOL] [A] [B] [C] [D] [E] [F] [G] [I] [K] [L] [M] [N] [O] [P] [R] [S] [T] [U] [**V**] [W] [X]

# NameObjectCollectionBase.KeysCollection Class

## System.Collections.Specialized (system.dll) *serializable*

This class is a collection of key strings retrieved by the `NameObjectCollectionBase.Keys` prop

```
Public Class NameObjectCollectionBase.KeysCollection : Implements ICollec
' Public Instance Properties
   Public ReadOnly Property Count As Integer Implements ICollection.Count
   Public Default ReadOnly Property Item(
        ByVal index As Integer) As String
' Public Instance Methods
   Overridable Public Function Get(
        ByVal index As Integer) As String
   Public Function GetEnumerator(
        ) As IEnumerator Implements IEnumerable.GetEnumerator
End Class
```