Advanced Programming Language (630501)
Fall 2011/2012 – Lectures Notes # 13

Programming in C#: .NET Architecture (cont.)

Outline of the Lecture

- .NET Framework Library.
- Common Type System.
- Major C# Language Differences.

.NET Framework Library

- The `System` namespace is a foundation of the .NET Framework library.
- In the .NET Framework, everything is an object – including even the simple data types
  - `System`
  - `System.Collections`
    - `ArrayList, Queue, Stack`
  - `System.Collections.Specialized`
    - `StringDictionary`
  - `System.ComponentModel`
    - `Used to create components and controls`
    - `Used by WinForms`
  - `System.ComponentModel.Design.Serialization`
    - `Used to make state of an object persistant`
  - `System.Data`
    - `Encapsulates use of ADO.NET`
  - `System.Drawing – GDI+ support`
    - `System.Drawing.Drawing2D – special effects`
    - `System.Drawing.Imaging – support for .jpg, .gif files`
    - `System.Drawing.Printing – settings like margins`
  - `System.Net – support for HTTP, DNS, basic sockets`
    - `System.Net.sockets – sockets details`
  - `System.Reflection`
    - `view application's meta data including RTTI`
  - `System.Runtime.InteropServices`
    - `Access COM objects and Win32 API`

- System.Runtime.Remoting
  - System.Runtime.Remoting.Activation
    - Activate remote objects
  - System.Runtime.Remoting.Channels
    - Sets up channel sinks and sources for remote objects
  - System.Runtime.Remoting.Channels.HTTP
    - Uses SOAP protocol to communicate with remote objects
  - System.Runtime.Remoting.Channels.TCP
    - Uses binary transmission over sockets
  - System.Runtime.Remoting.Contexts
    - Set threading and security contexts for remoting
  - System.Runtime.Remoting.Messaging
    - Classes to handle message passing through message sinks
  - System.Runtime.Remoting.Meta data
    - Customize HTTP SoapAction type output and XML Namespace URL
  - System.Runtime.Remoting.Proxies
  - System.Runtime.Remoting.Services
- System.Runtime.Serialization
  - System.Runtime.Serialization.Formatters
    - System.Runtime.Serialization.Formatters.Soap
- System.Security
- System.ServiceProcess
  - Create windows services that run as Daemons
- System.Text.RegularExpressions
- System.Threading
    - Defines Mutex, Thread, and Timeout
- System.Timers
    - Fire events at timed intervals, day, week, or month
- **System.Web**
  - System.Web.Hosting
    - Communicate with IIS and ISAPI run-time
  - System.Web.Mail
  - System.Web.Security
    - cookies, web authentication, Passport
  - System.Web.Services – close ties to ASP.NET
    - System.Web.Services.Description
    - System.Web.Services.Discovery
    - System.Web.Services.Protocol – raw HTTP and SOAP requests

        - System.Web.SessionState – maintain state between page requests
    - **System.Web.UI – access to WebForms**
- **System.Windows.Forms – Forms based GUI design**
- **System.Xml – XML DOM**
    - **System.Xml.Schema**
        - **Authenticate XML structure**
    - **System.Xml.Serialization**
        - **Serialize to XML**
    - **System.Xml.XPath**
        - **Navigate XSL**
    - **System.Xml.Xsl**
        - **Support for XSL – XML stylesheets**

- **Namespace** A logical grouping of related classes. By using namespaces, you can group together classes and types that are logically bound to each other. The namespace then provides a means of locating the class through its hierarchical name.

    - *Namespaces*
    - *Classes*
        - *Fields*
        - **Properties**
        - *Methods*
        - **Attributes**
        - **Events**
    - **Interfaces** (*contracts*)
        - *Methods*
        - **Properties**
        - **Events**
    - *Control Statements*
        - *if, else, while, for, switch*
        - **foreach**
    - *Additional Features*
        - *Operation Overloading*
        - *Structs*
        - *Enums*
        - **Delegates**
    - *OO Features*
        - **Type Unification**
        - *Inheritance*
        - *Polymorphism*

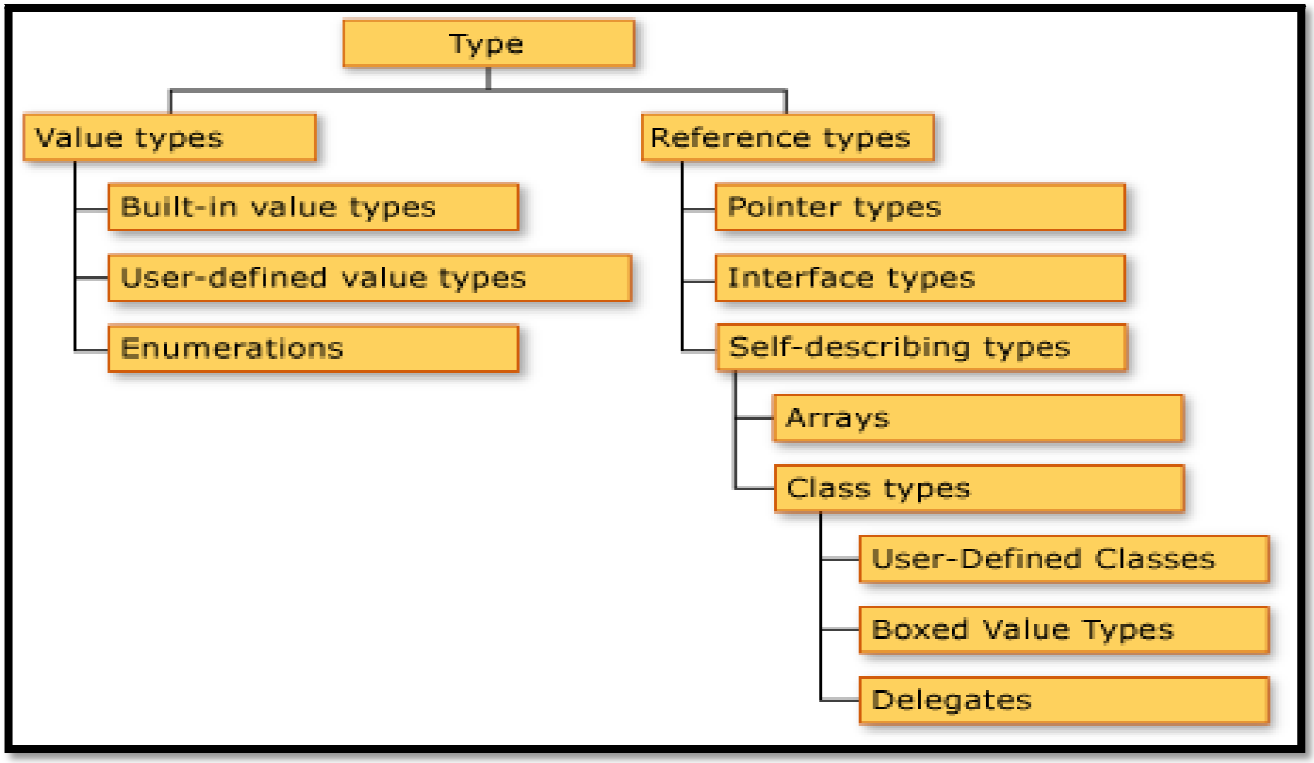
Common Type System (CTS)

- **CTS** is a set of common types.
  - any language that runs in CLR should implement CTS
  - Languages often define their own types.
- For example
  - CTS defines **System.Int32** – 4 byte integer.
  - C# defines **int** as an alias of System.Int32.
- Everything inherits from **System.Object** (The **"root"**)

C# Types	.Net Base Class
byte	System.Byte
sbyte	System.SByte
short	System.Int16
int	System.Int32
long	System.Int64
ushort	System.UInt16
uint	System.UInt32
ulong	System.UInt64
float	System.Single
double	System.Double
object	System.Object
char	System.Char
string	System.String
decimal	System.Decimal
bool	System.Boolean

- C# supports two kinds of Data types:
  - ***value types***
  - ***Reference types.***
- **Value types** are used to address primitive or basic data types, such as char, int, float, and so on.
- **Value Types** Are Derived from **System.ValueType**
- **Reference types** encompass all other items like classes, interfaces, delegates, and arrays.

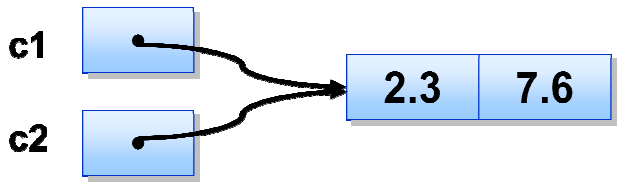
- **Value types differ from reference types** in that variables of the value types directly contain their data, whereas variables of the reference types store references to objects. With reference types, it is possible for two variables to reference the same object, and thus possible for operations on one variable to affect the object referenced by the other variable.
- **Value types**
  - Directly contain data.
  - Cannot be null.
- **Reference types**
  - Contain references to objects.
  - May be null.



- Two references can refer to the same object (Example)

```
coordinate c1= new coordinate( );

coordinate c2;

c1.x = 2.3; c1.y = 7.6;
```

```
c2 = c1;

Console.WriteLine(c1.x + " , " + c1.y);

Console.WriteLine(c2.x + " , " + c2.y);
```



Major Language Differences

- **C# (or C-Sharp)**: new programming language. C# is used to write software that runs on the .NET Framework. Although C# is not the only language that you can use to target the .NET Framework, C# is one of the most popular because of its simplified C-based syntax.
- **Automatic memory management**
  - ***Garbage Collection***
  - ***No pointers***