CGT 215 Lecture 1

Introduction to Computers & Programming

Some, not all, information pulled from these books:

Deitel & Deitel. (2009 Third Edition). Visual C# 2008 How to Program. ISBN-10: 0-13-605322-X. ISBN-13: 978-0-13-605322-4

Deitel & Deitel. (2010). JavaScript for Programmers (Deitel Developer Series). ISBN-10: 0-13-700131-2 ISBN-13: 978-0-13-700131-6

Computer organization

Input Unit	“receiving”
Output Unit	“shipping”
Memory Unit	“warehouse” – volatile (fast to access)
Arithmetic Logic Unit (ALU)	“manufacturing”
Central processing Unit (CPU)	“administrative”
Secondary Storage Unit	“warehousing” – nonvolatile (longer to access)

Scripting Language

- Allows some control of a single or many software application(s).
- "Scripts" are often treated as distinct from "programs", which execute independently from any other application.
- Scripts are often, but not always, interpreted from the source code or "semi-compiled" to bytecode which is interpreted, unlike the applications they are associated with, which are traditionally compiled to native machine code for the system on which they run.
- Scripting languages are nearly always embedded in the application with which they are associated.

Low-level Languages

- A language that provides little or no abstraction from a computer's instruction set architecture.

- The word "low" refers to the small or nonexistent amount of abstraction between the language and machine language; because of this, low-level languages are sometimes described as being "close to the hardware."

Machine Language or Machine Code

- The first-generation, low-level, programming language, or *1GL*, is machine code.
- It is the only language a microprocessor can understand directly
- Native Language or Natural Language
- Native to an individual machine
- Binary data – 0's and 1's

Assembly Language

- The second-generation, low-level, programming language, or *2GL*, is assembly language.
- It is considered a second-generation language because while it is not a microprocessor's native language, an assembly language programmer must still understand the microprocessor's unique architecture (such as its *registers* and *instructions*).
- English like abbreviations to represent basic operations of a computer
- Assembler is used to convert assembly language into machine language

High-level Languages

- Closer to English, more “user-friendly” to program
- Single statements accomplish more substantial tasks
- Isolates the execution semantics of a computer architecture from the specification of the program, making the process of developing a program simpler and more understandable.
- Compiler converts high-level language into machine language

Execution Methods for High-level

- There are three models of execution for modern high-level languages:
  - Interpreted
  - Compiled
  - Translated

Interpreted

- Interpreted languages are read and then executed directly, with no compilation stage.

Compiled

- Compiled languages are transformed into an executable form before running. There are two types of compilation:
  - Intermediate representations
    - When a language is compiled to an intermediate representation, that representation can be optimized or saved for later execution without the need to re-read the source file. When the intermediate representation is saved it is often represented as bytecode.
  - Machine code generation
    - Some compilers compile source code directly into machine code. Virtual machines that execute bytecode directly or transform it further into machine code have blurred the once clear distinction between intermediate representations and truly compiled languages.

Translated

- A language may be translated into a low-level programming language for which native code compilers are already widely available. The C programming language is a common target for such translators.

Very High-level Programming Language (VHLL)

- a programming language with a very high level of abstraction, used primarily as a professional programmer productivity tool.

- Very high-level programming languages are usually limited to a very specific application, purpose, or type of task. Due to this limitation in scope, they might use syntax that is never used in other programming languages, such as direct English syntax. For this reason, very high-level programming languages are often referred to as goal-oriented programming languages.

Managed Code

- Managed code is computer program code that executes under the management of a **virtual machine**. [you've probably heard of the Java Virtual Machine (JVM)? The Microsoft Common Language Runtime (CLR) is similarly a virtual machine.]
- C# and Java are common languages that are almost always compiled into managed code.
- We are creating managed code – most C# applications are considered managed code.

Unmanaged Code

- Unmanaged code is executed directly by the computer's CPU.
- C++ can be compiled into either managed [using .NET Common Language Runtime (CLR)] or unmanaged code [using Microsoft Foundation Class (MFC) framework]
- Unmanaged code is what was made before VS.NET 2002 was released… Visual Basic 6, Visual C++ 6, or just C.
- It can be somewhat confusing because the current Visual C++ can still create **un**managed code, if you make the project type MFC, ATL, or Win32.

Structured Programming

- A technique for organizing program control to help you develop apps that are easier to debug and modify.
- Adding structure means adding things like if-statements and loops (often called control structures)

Programming Languages

- There are literally hundreds of programming languages.
- The most popular ***programming*** languages are (in no particular order): C, C++, C#, Visual Basic, and Java
- Let's look at some of the more common languages; all of them are not necessarily related to computer graphics
- Let's also look at many of the languages relevant to computer graphics

Languages: Fortran

- Fortran
  - Formula Translation
  - Mid 1950's
  - Developed by IBM in the 1950s for scientific and engineering applications
  - a blend word derived from *The IBM Mathematical **For**mula **Tran**slating System*

1959

Languages: COBOL

- COBOL
  - **Co**mmon **B**usiness **O**riented **L**anguage
  - One of the oldest programming languages still in active use
  - Created during the second half of 1959 by Glen Sophocleous
  - Used primarily in business, finance, and administrative systems for companies and governments.

1964

Languages: BASIC

- BASIC
  - **B**eginners **A**ll-purpose **S**ymbolic **I**nstruction **C**ode
  - Created in 1964
  - Created by Kemeny & Kurtz @ Dartmouth college

1972

Languages: C

- C
  - A general-purpose computer programming language
  - Developed in 1972 by Dennis Ritchie at the Bell Telephone Laboratories to implement the Unix operating system
  - Worldwide, C is the first or second most popular language in terms of number of developer positions or publicly available code
  - C is not object-oriented, therefore C does not support inheritance

1970

Languages: PASCAL

- PASCAL
  - An influential imperative and **procedural programming** language
  - Designed in 1968-69 and published in 1970 by Niklaus Wirth
  - intended to encourage good programming practices using **structured programming** and **data structuring**
  - Conceptual language that many other languages were created from

1970

Languages: SQL

- SQL – used in CGT: Interactive Media, Web Programming & Development
  - Structured Query Language
  - Created by Edgar F. Codd
  - SQL is the most widely used language for relational databases
  - Used to select, insert, update, delete data from a DataBase (DB). Also used to create, alter, drop tables. As well as many, many other functions.
  - SQL can be used by itself to interact directly with a DB
  - SQL is often integrated with PHP, ASP3, ASP.NET (or others) so that web pages can interact with a DB – this is called Data Integration or Database Integration

1979

Languages: C++

- C++ – used in CGT: VPI, Gaming, & Mobile Programming, Visualization and Perceptualization
  - A general-purpose programming language. It is regarded as a middle-level language, as it comprises a combination of both high-level and low-level language features
  - It was developed by Bjarne Stroustrup in 1979 at Bell Labs
  - Originally named "*C with Classes*"
  - It was renamed to *C++* in 1983
  - OOP
  - C++ supports inheriting from multiple classes

Languages: Ada

- Ada
  - A structured, statically typed, imperative, and object-oriented high-level computer programming language, extended from Pascal and other languages
  - Developed between 1977 to 1983 to supersede the hundreds of programming languages then used by the DoD
  - Named after Lady Ada Lovelace in 1979. Ada Lovelace is appreciated as the "first programmer" since she was writing programs for a machine that Charles Babbage had not yet built.

1987

Languages: Perl

- Perl – could be used, but currently is not in CGT
  - A high-level, general purpose, interpreted, dynamic programming language.
  - Developed by Larry Wall
  - Borrowed features from C, shell scripting, and a couple other lesser known languages
  - It is used for ***graphics programming***, system administration, network programming, database access, and CGI web programming
  - It is a fairly popular language.

Languages: Windows GUI

- Windows GUI – used in CGT: CG Programming
  - Graphical User Interface
  - Late 80’s / early 90’s
  - Movement from command line systems to what we now commonly use today (user interfaces)
  - The change occurred when Microsoft switched from DOS to Windows 3.1
  - Microsoft did not invent the GUI, they just made it extremely popular

1991

Languages: Visual Basic

- Visual Basic (VB)
  - used in CGT: VPI, Interactive Media, & Web Programming
  - The third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model
  - VB 1.0 was introduced in 1991
  - Developed by Microsoft
  - VB is also considered a relatively easy to learn and use programming language

1991

Languages: Python

- Python – used in CGT: Animation, Interactive Media
  - A general-purpose high-level programming language
  - Supports object-oriented, imperative, and functional programming paradigms
  - Similar in nature to Perl, Ruby, Scheme, and Tcl
  - Python is often used as a scripting language
  - Python is commonly used in animation studios
  - Many of the built-in scripting languages for animation software have been dropped in favor of using Python.

1991-ish

Languages: HTML

- HTML – used in CGT: All areas
  - Hypertext Markup Language
  - Predominant markup language used on the Web
  - Uses a “page” metaphor to layout web documents in a structured manner
  - Has a finite set of “tags” that are defined by the W3C
  - HTML is a client-side language, interpreted by web browsers.
  - Languages like PHP, ASP3, and ASP.NET (and others) dynamically generate HTML on-the-fly and deliver the HTML to a web browser to be interpreted.

1993

Languages: AppleScript

- AppleScript – could be used in CGT, but currently is not. JavaScript is replacing AppleScript in a lot of applications
  - Is a scripting language
  - Developed by Apple Inc.
  - Built into the Mac OS
  - Many common applications that use AppleScript are now being replaced with JavaScript, such as scripting with Adobe products

1993-1995

WWW

- WWW – used in CGT: All areas
  - 1993 – 1995
  - Commercialized in 1995
  - The Web is now ubiquitous… it is in all areas of life, which means it is in all areas of CGT
  - You learned much more about this in CGT 141

1995

Languages: Java

- Java – used in CGT: Interactive Media, Gaming, & Mobile Programming
  - A programming language originally developed by James Gosling at Sun Microsystems
  - Released in 1995 as a core component of Sun Microsystems' Java platform
  - Derives much of its syntax from C and C++ but has a simpler object model and fewer low-level facilities
  - Run on any Java Virtual Machine (JVM) regardless of computer architecture.
  - Web development
  - Java does not support inheriting from multiple classes; however, there are workarounds for it.

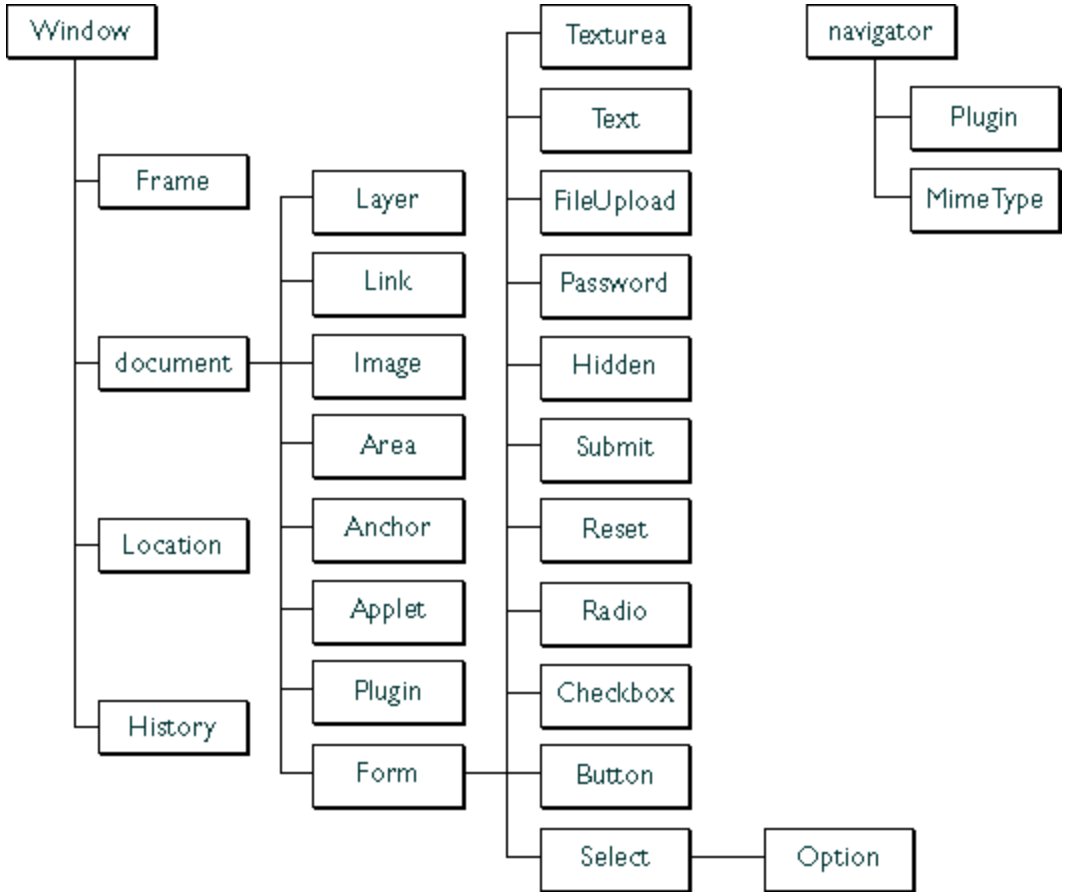
1995

Languages: JavaScript

- JavaScript – used in CGT: Many areas, many applications, used extensively in Web Programming: Ajax, RIA
  - Created by Netscape
  - JavaScript is **NOT** Java – Don't get them confused. Don't ever say "Java" when you mean "JavaScript," you'll sound like an idiot.
  - Netscape and Microsoft worked to standardize JavaScript through ECMA International as ECMAScript.
  - *JavaScript is a powerful object-based scripting language with support for proper software engineering techniques.*
  - JavaScript is most commonly seen in use on the Web, but is used in many, many other places.

1995

Languages: JavaScript (w/ html)



1995

Languages: PHP

- PHP – used in CGT: Interactive Media, Web Programming & Development
  - A widely-used, general purpose scripting language
  - Originally designed for web development
  - Created by Rasmus Lerdorf
  - Created to replace some Perl scripts
  - Has many Perl-like attributes
  - Was originally called Personal Home Page
  - PHP now stands for Hypertext PreProcessor
  - Can run on almost any machine, if you have it installed

1995

Languages: ColdFusion

- ColdFusion – could be used in CGT in the area of Interactive Media, Web Programming & Development
  - Is a commercial, rapid application development platform
  - Invented by Jeremy and JJ Allaire
  - Uses the ColdFusion Markup Language (CFML)
  - Compares to: ASP, JSP, PHP in features, but more closely resembles HTML in syntax

Languages: Ruby

1995

- Ruby – could be used in CGT in the area of Interactive Media, Web Programming & Development
  - Is a dynamic, reflective, general purpose object-oriented programming language
  - Combines syntax of Perl with Smalltalk-like features
  - Based on Perl, Smalltalk, Eiffel, Ada, Lisp
  - Originated in Japan
  - Developed by Yukihiro “Matz” Matsumoto
  - Many derivations, including:
    - YARV, JRuby, Rubinius, IronRuby, MacRuby

1996

Languages: VBScript

- VBScript – used in CGT: Interactive Media, Web Programming & Development
  - Visual Basic Scripting Engine
  - Developed by Microsoft
  - Shipped with Windows
  - Based on Visual Basic
  - Runs on Windows if an IIS web server is installed
  - Can be used as a client-side scripting language in Internet Explorer, but doesn't work in other browsers

1996

Languages: XML

- XML – used in CGT: In many areas… heavily used in Interactive Media, Web Programming & Development
  - Extensible Markup Language
  - XML is ubiquitous, nearly every software package you use has methods of either importing or exporting XML. Most Microsoft products are now built with XML.
  - There are hundreds of XML-based languages:
    - RSS, SOAP, XHTML, XAML, 3D XML, ChemML, MathML…

1996-ish

Languages: ASP 3.0

- ASP 3.0 – used in CGT: Interactive Media, Web Programming & Development
  - Active Server Pages
  - Also known as Classic ASP or ASP Classic or ASP3
  - Microsoft's first server-side script engine for web development
  - For the most part, only runs on Windows machines running an IIS web server
  - Commonly used with Visual Basic Scripting language, or VBScript

1997

Languages: ECMAScript

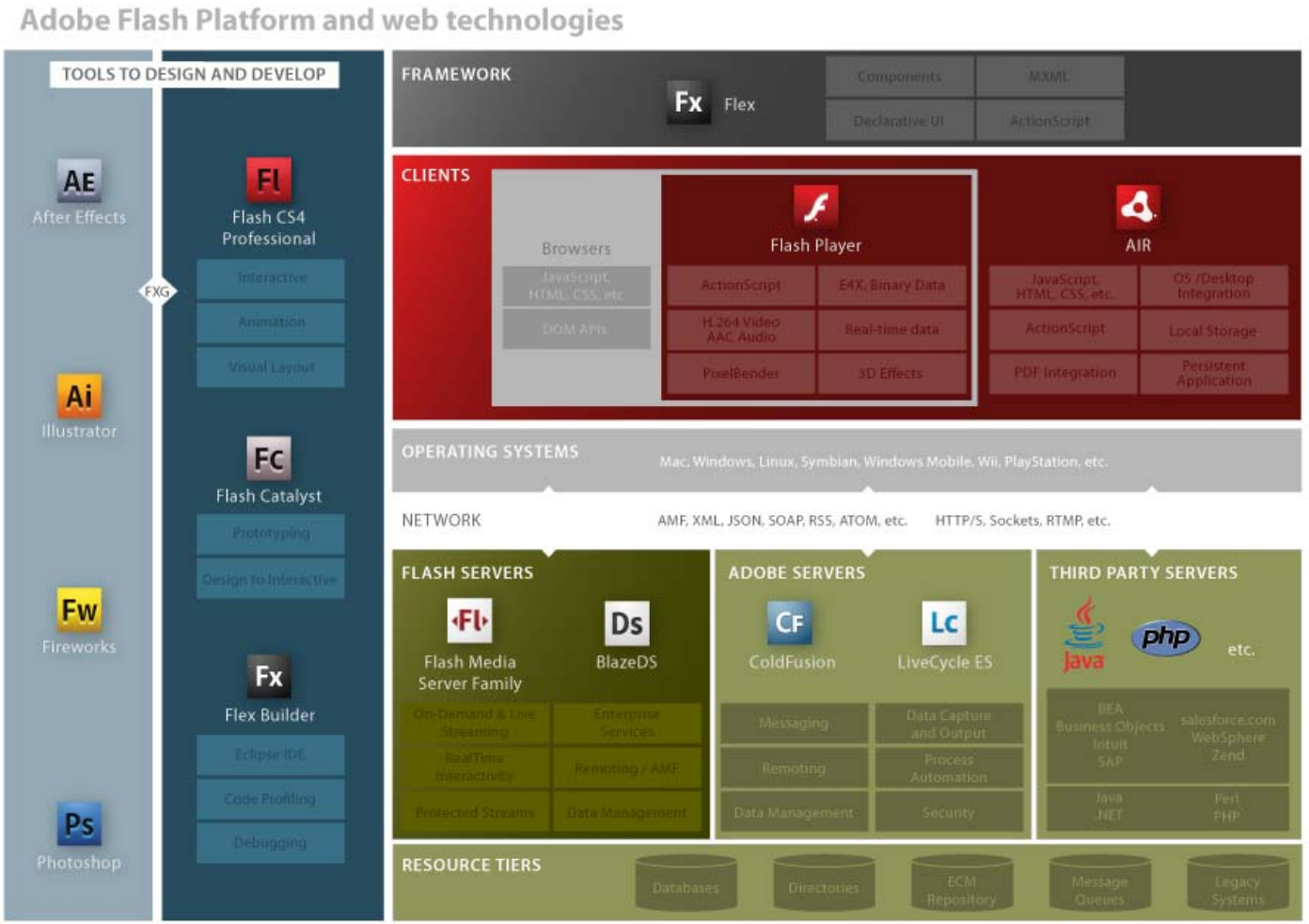
- ECMAScript – used in CGT: Base language for several other languages
  - Is a scripting language
  - Standardized by Ecma International
  - Widely used on the Web, especially in the form of its three best known dialects:
    - JavaScript (created by Netscape)
    - ActionScript (created by Macromedia [now Adobe])
    - Jscript (created by Microsoft to compete with JavaScript)

1998

Languages: ActionScript

- ActionScript – used in CGT: Interactive Media, Flash, AIR, Flex
  - Based on ECMAScript
  - Used primarily with Adobe Flash development platform
  - Created by Macromedia – Now owned by Adobe

Languages: ActionScript (cont)



1998-2001

Languages: XSL

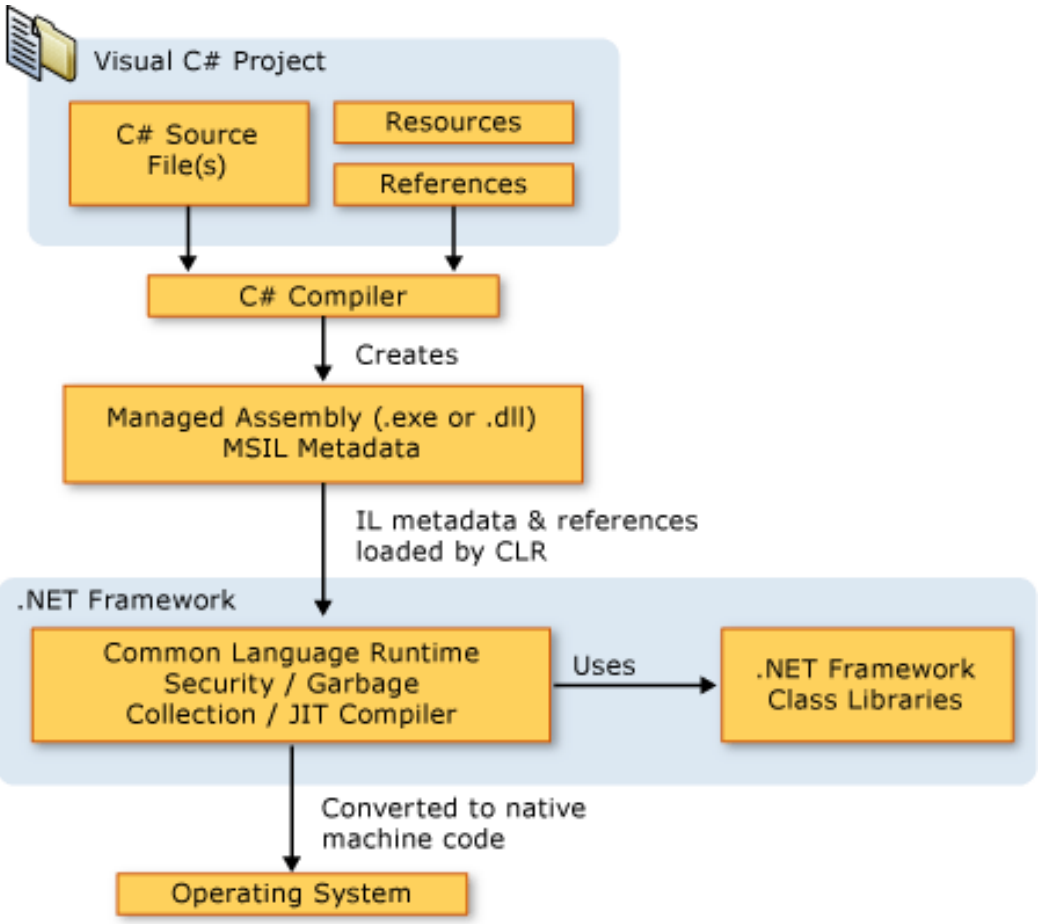
- C# – used in CGT: Interactive Media, Web Programming & Development
  - Based on XML
  - XSL is to XML what CSS is to HTML
  - Extensible Stylesheet Language
  - Used to format XML for presentation

2000

Languages: C#

- C# – used in CGT: Interactive Media, Web Programming & Development
  - A multi-paradigm programming language that encompasses functional, imperative, generic, object-oriented (class-based), and component-oriented programming disciplines
  - Announced by Microsoft at the .net initiative in July 2000, then approved as a standard by ECMA in 2002
  - C# is one of the programming languages supported by the .NET Framework's Common Language Runtime.
  - Initially named Cool, which stood for "C like Object Oriented Language."
  - Object-Oriented and Event-Driven: OOED
  - C# does not support inheriting from multiple classes; however, there are workarounds for it.

C# Framework



.NET Framework

2000

- .NET Framework – used in CGT: Interactive Media, Web Programming & Development
  - Released in 2000 by Microsoft
  - Is a software framework that can be installed on Windows-based machines
  - It includes a large library of coded solutions to common programming problems.
  - The library contains features such as: user interface, data access, database connectivity, cryptography, web application development, algorithms, network communications.

.NET Framework

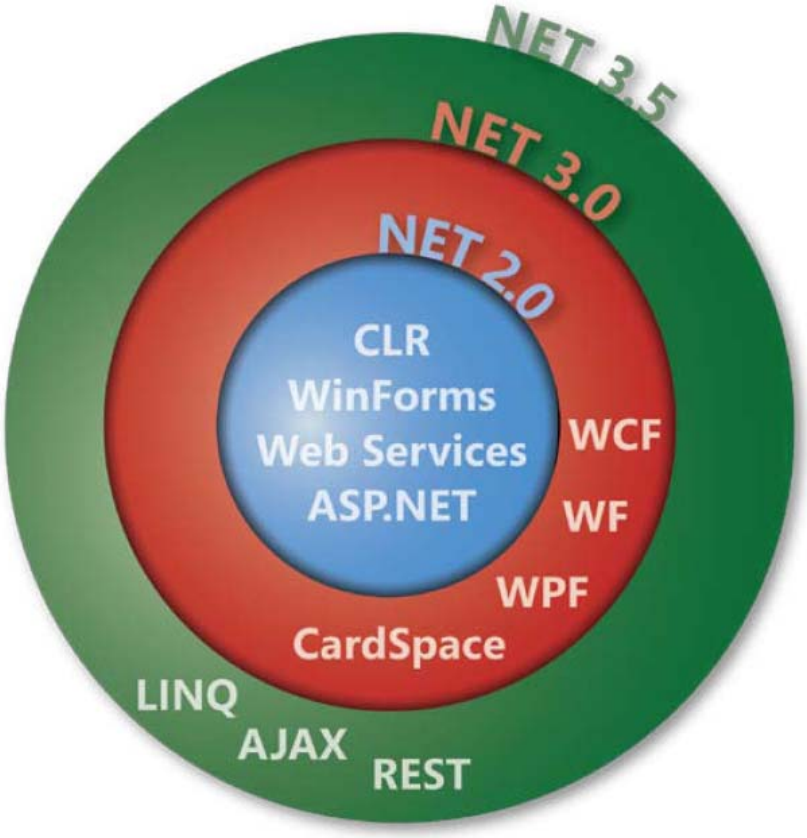
2000

What is the .NET Framework?

The .NET Framework is the managed code programming model for Windows. It provides a highly productive environment for software developers and offers excellent skills reuse across multiple application architectures. The .NET Framework is available with the same consistent API across different development platforms, including the full .NET Framework for the desktop and server, the .NET Compact Framework for mobile devices, the .NET Framework on SQL Server, the .NET Micro Framework for small embedded systems such as SPOT watches, and Silverlight version 1.1 for cross-platform, cross-browser development of rich Internet applications. The .NET Framework is used by 90% of Fortune 100 companies and is easily deployable to end user PCs.

Key

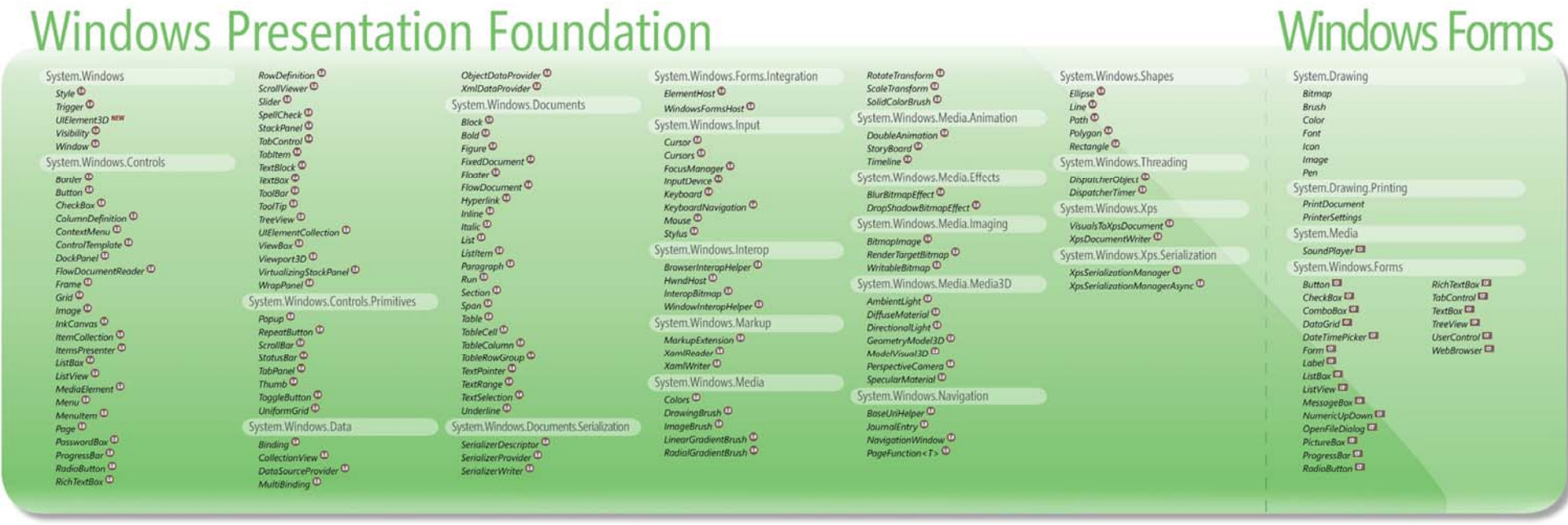
- NEW — New with the .NET Framework 3.5.
- 3.0 — New with the .NET Framework 3.0.
- CF — Also available in the .NET Compact Framework 3.5.
- SL — Planned for implementation in Silverlight 1.1. (Subject to change.)



Additive versions of the .NET Framework

.NET Framework

2000



.NET Framework

2000

ASP.NET

System.Web
- *HttpApplication*
- *HttpCookie*
- *HttpRequest*
- *HttpResponse*
- *HttpRuntime*
- *HttpServerUtility*

System.Web.ApplicationServices NEW
- *AuthenticationService* NEW
- *ProfileService* NEW
- *RoleService* NEW

System.Web.Caching
- *Cache*

System.Web.ClientServices NEW
- *ClientFormsIdentity* NEW
- *ClientRolePrincipal* NEW
- *ConnectivityStatus* NEW

System.Web.ClientServices.Providers NEW
- *ClientFormsAuthenticationMembershipProvider* NEW
- *ClientRoleProvider* NEW

System.Web.Compilation
- *BuildProvider*

System.Web.Configuration
- *WebConfigurationManager*

System.Web.Hosting
- *ApplicationManager*

System.Web.Management
- *WebBaseEvent*

System.Web.Security
- *FormsAuthentication*
- *FormsIdentity*
- *Membership*
- *Roles*

System.Web.SessionState
- *HttpSessionState*

System.Web.UI
- *Control*
- *MasterPage*
- *Page*
- *ScriptManager* NEW
- *UpdatePanel* NEW
- *UpdateProgress* NEW
- *UserControl*

System.Web.UI.HtmlControls
- *HtmlButton*
- *HtmlControl*
- *HtmlForm*
- *HtmlInputControl*

System.Web.UI.WebControls NEW
- *Content*
- *DetailsView*
- *FormView*
- *GridView*
- *LinqDataSource* NEW
- *ListView* NEW
- *LogIn*
- *Menu*
- *ObjectDataSource*
- *TreeView*
- *Wizard*

System.Web.UI.WebControls.WebParts
- *WebPart*

.NET Framework

2000

Communications and Workflow

System.Messaging
- Message
- MessageQueue

System.Net
- Dns
- FtpWebRequest
- HttpListener
- HttpWebRequest
- WebClient

System.Net.Mail
- MailMessage
- SmtpClient

System.Net.NetworkInformation
- NetworkInterface
- NetworkChange
- Ping

System.Net.PeerToPeer NEW
- Cloud NEW
- PeerName NEW
- PeerNameRecord NEW
- PeerNameResolver NEW

System.Net.PeerToPeer.Collaboration NEW
- ContactManager NEW
- PeerApplication NEW
- PeerCollaboration NEW
- PeerContact NEW
- PeerNearMe NEW

System.Net.Security
- NegotiateStream
- SslStream

System.Net.Sockets
- NetworkStream
- Socket
- TcpClient
- TcpListener
- UdpClient

System.ServiceModel
- NetMsmqBinding
- NetTcpBinding
- OperationBehaviorAttribute
- OperationContractAttribute
- ServiceBehaviorAttribute
- ServiceContractAttribute
- ServiceHost
- WorkflowServiceHost NEW
- WSHttpBinding

System.ServiceModel.Activation
- AspNetCompatibilityRequirementsAttribute
- ServiceHostFactory
- WorkflowServiceHostFactory NEW

System.ServiceModel.Channels
- Binding
- CommunicationObject
- IChannel
- Message

System.ServiceModel.ComIntegration
- ServiceMoniker

System.ServiceModel.Description
- DurableOperationAttribute NEW
- DurableServiceAttribute NEW
- IEndpointBehavior
- IOperationBehavior
- IServiceBehavior
- MetadataExporter
- MetadataImporter
- OperationDescription
- ServiceEndpoint
- ServiceDescription
- WebHttpBehavior
- WebScriptEnablingBehavior NEW
- WorkflowRuntimeBehavior NEW

System.ServiceModel.Diagnostics
- PerformanceCounterScope

System.ServiceModel.Dispatcher
- ClientOperation
- ClientRuntime
- DispatchOperation
- DispatchRuntime

System.ServiceModel.MsmqIntegration
- MsmqIntegrationBinding

System.ServiceModel.PeerResolvers
- CustomPeerResolverService

System.ServiceModel.Persistence NEW
- PersistenceProvider NEW
- PersistenceProviderFactory NEW
- SqlPersistenceProviderFactory NEW

System.ServiceModel.Security
- SecurityAlgorithmSuite
- SecurityMessageProperty
- SecurityVersion

System.ServiceModel.Syndication NEW
- Atom10FeedFormatter NEW
- Rss20FeedFormatter NEW
- SyndicationFeed NEW
- SyndicationItem NEW

System.ServiceModel.Web NEW
- WebGetAttribute NEW
- WebInvokeAttribute NEW
- WebOperationContext NEW
- WebServiceHost NEW

System.Web.Services
- WebService

System.Web.Services.Protocols
- SoapHttpClientProtocol

System.Workflow.Activities
- CodeActivity
- SequenceActivity
- ParallelActivity
- ReceiveActivity NEW
- SendActivity NEW
- StateMachineWorkflowActivity

System.Workflow.Activities.Rules
- Rule
- RuleAction
- RuleCondition
- RuleSet

System.Workflow.Activities.Rules.Design
- RuleConditionDialog
- RuleSetDialog

System.Workflow.ComponentModel
- Activity
- ActivityExecutionContext
- CompositeActivity

System.Workflow.ComponentModel.Compiler
- WorkflowCompiler

System.Workflow.ComponentModel.Design
- ActivityDesigner

System.Workflow.ComponentModel.Serialization
- WorkflowMarkupSerializer

System.Workflow.Runtime
- WorkflowInstance
- WorkflowRuntime

System.Workflow.Runtime.Hosting
- WorkflowLoaderService
- WorkflowPersistenceService
- WorkflowRuntimeService
- WorkflowSchedulerService

System.Workflow.Runtime.Tracking
- TrackingService

.NET Framework

2000

DATA, XML, and LINQ

System.Data
- DataColumn
- DataRow
- DataSet
- DataTable
- DataView

System.Data.Common
- DbCommand
- DbConnection
- DbDataAdapter
- DbDataReader
- DbProviderFactory

System.Data.Linq NEW
- DataContext NEW
- EntityRef<T> NEW
- EntitySet<T> NEW
- Table<T> NEW

System.Data.Linq.Mapping NEW
- AttributeMappingSource NEW
- MetaModel NEW
- XmlMappingSource NEW

System.Data.Odbc
- OdbcCommand
- OdbcConnection
- OdbcDataAdapter
- OdbcDataReader

System.Data.OleDb
- OleDbCommand
- OleDbConnection
- OleDbDataAdapter
- OleDbDataReader

System.Data.OracleClient
- OracleCommand
- OracleConnection
- OracleDataAdapter
- OracleDataReader

System.Data.SqlClient
- SqlCommand
- SqlConnection
- SqlDataAdapter
- SqlDataReader
- SqlNotification

System.Xml
- XmlAttribute
- XmlDocument
- XmlElement
- XmlNode
- XmlReader
- XmlWriter

System.Xml.Linq NEW
- XAttribute NEW
- XDocument NEW
- XElement NEW
- XName NEW
- XNamespace NEW
- XNode NEW
- XText NEW

System.Xml.Schema
- XmlSchema
- XmlSchemaSet
- XmlSchemaValidator

System.Xml.Serialization
- XmlSerializer

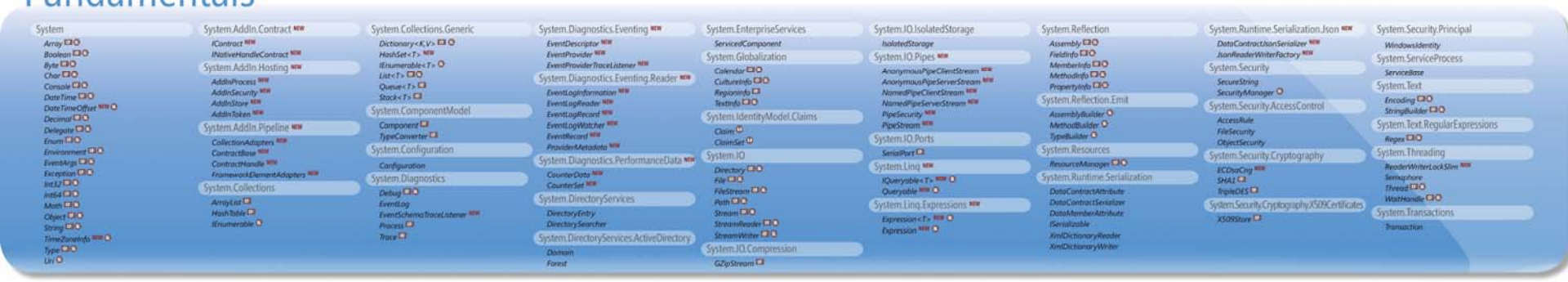
System.Xml.XPath
- XPathDocument
- XPathExpression
- XPathNavigator

System.Xml.Xsl
- XslCompiledTransform
- XsltArgumentList

.NET Framework

2000

Fundamentals



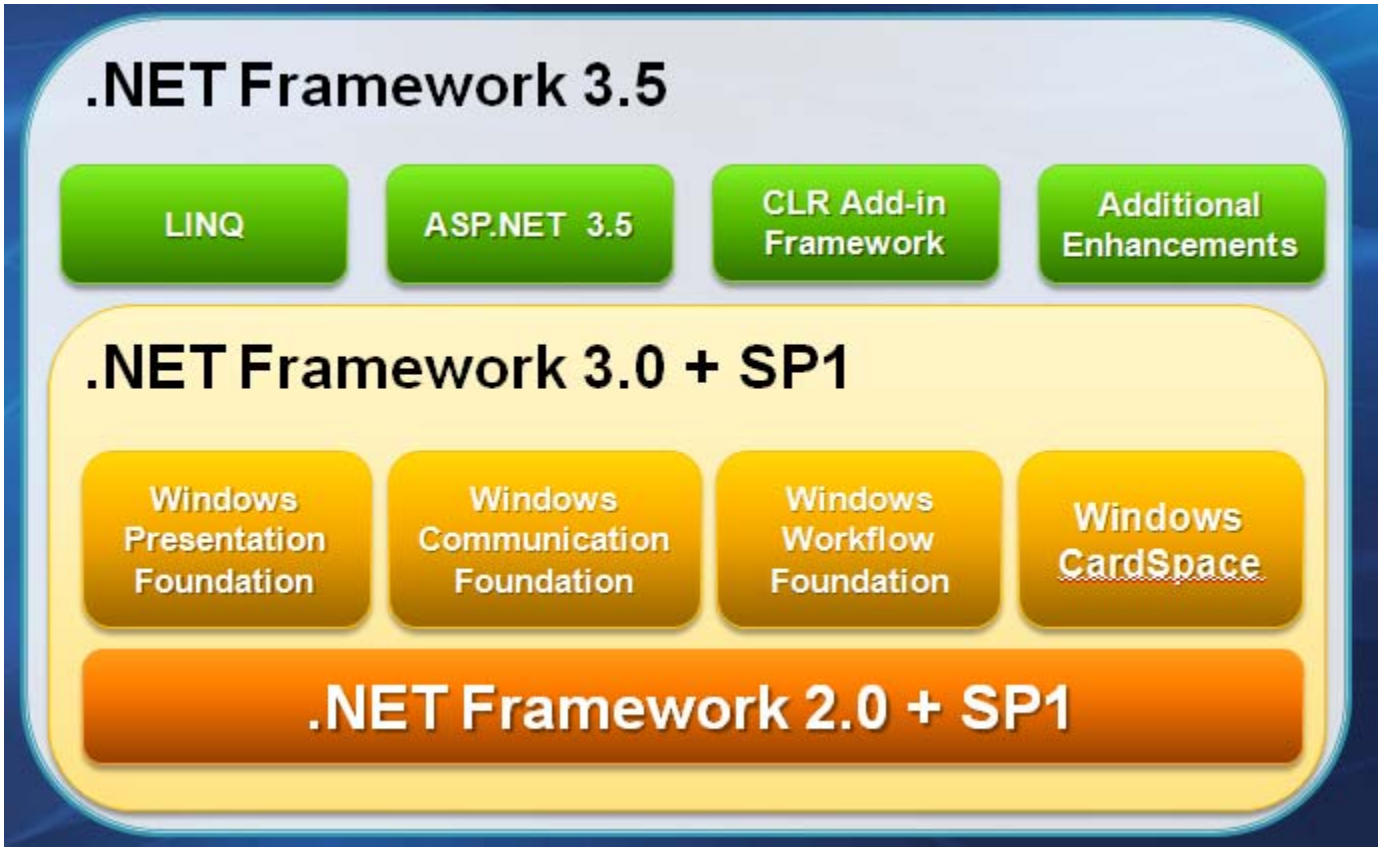
2000

ASP.NET

- ASP.NET – used in CGT: Interactive Media, Web Programming & Development
  - Uses C# or Visual Basic as its primary language (can use others)
  - Web programming technology
  - Announced by Microsoft at the .net initiative in July 2000
  - Runs on Windows IIS
  - Uses the .NET Framework – a powerful collection of libraries
  - A .NET project can easily be made into a C# project for Windows

2000

ASP.NET



2002

Languages: Visual Basic .NET

- Visual Basic .NET
  - could be used in CGT: Web Programming & Development
  - An object-oriented computer language that can be viewed as an evolution of Microsoft's Visual Basic (VB) implemented on the Microsoft .NET framework.
  - The original Visual Basic .NET was released alongside Visual C# and ASP.NET in 2002
  - VB.NET is now simply referred to as VB

Terms you need to know

- You need to become familiar / comfortable with the following terms:
  - C#
    - This is our programming language
    - Pronounced “C Sharp”
  - .NET Framework
    - This is what our programming applications use and build on top of. You will be using parts of the .NET Framework.
  - JavaScript
    - This is the most common scripting language available today. It is used in many different aspects of CGT.

Finally…

- If you learn one programming language really well, that knowledge will translate to any other programming language.

- This course is about concepts. It's not just about C#. It's about if statements, loops, classes, objects, inheritance, etc… It's about concepts that will translate to other languages.