German Jordanian University الجامعة الألمانية الأردنية

CS355 Web Technologies

Dr. Ismail Hababeh

German-Jordanian University

Lecture 21

.NET Architecture Components

- Web Services
  - Provides users with:
    - e-commerce (a way of buying and selling goods and services online).

For more information about e-commerce, navigate through the following links:

- https://www.google.com/search?q=what+is+e-commerce&source
- https://sell.amazon.com/learn/what-is-ecommerce#

.NET Architecture Components

- Web Applications
  - Provides users with:
    - Business-to-business B2B applications. A business is sourcing raw material to the other company that will produce new product.
    - ❖ Discuss the supply chain in the context of web applications.

For more information about Business-to-Business, navigate through the following links:

- https://www.bigcommerce.com/articles/ecommerce/types-of-business-models/
- https://www.businessnewsdaily.com/5000-what-is-b2b.html

.NET Architecture Components

- Frameworks and Libraries
  - .NET framework is software development tools and programming languages used for building and deploying an application quickly.
  - .NET class Library is the collection of classes, namespaces (packages), interfaces and value types that are used for enhancing the functionality of .NET applications.
  - To differentiate between .NET framework and .NET Libraries, refer to the following resource

https://kruschecompany.com/framework-vs-library/

.NET Web Frameworks

- Active Server Pages (ASP.NET)
  - An open-source web-development framework for developing smart web-based applications on the . NET platform that runs on macOS, Linux, and Windows.
  - The ASP.NET architecture is based on the following key components:
    - Language: used to develop web applications, like VB.net, visual C++, and C#.
    - Library: set of standard class libraries that include necessary functions used to develop web applications.
    - Common Language Runtime (CLR): a platform where the .Net programs are executed.

For more information about ASP.NET, use the following reference:

https://www.guru99.com/what-is-asp-dot-net.html

.NET Web Frameworks

- ActiveX Data Object (ADO.NET)
  - A data access framework based on XML to communicate with different data sources and object relational processing.
  - Consist of a set of objects that expose data access services to the .NET environment.
  - Used to establish connection between front-end interfaces and the back-end databases.

The following reference gives more details about ADO.NET:

- https://learn.microsoft.com/en-us/dotnet/framework/data/adonet/ado-net-architecture

.NET Architecture Components

- .NET Exchange Structured Information
  - SOAP (Simple Object Access Protocol)
    - Language, platform, and transport independent.
    - A messaging protocol for exchange structured information between two computers in the implementation of web services over the internet.
    - Used for accessing web services and based on XML structure.

For more details on SOAP, search the following reference:

https://www.altexsoft.com/blog/engineering/what-is-soap-formats-protocols-message-structure-and-how-soap-is-different-from-rest/

.NET Architecture Components

- .NET Exchange Structured Information
  - WSDL (Web Services Description Language)
    - An XML-based interface description language that is used for describing the functionality offered by a web service.
    - Provides a simple way for service providers to describe the basic format of requests to their systems regardless of the underlying run-time implementation.
    - Used for describing the functionality of a SOAP based web service.

For more details on WSDL, search the following reference:

https://www.tutorialspoint.com/wsdl/wsdl_introduction.htm

.NET Architecture Components

- Object Model & Common Language Specification (CLS)
  - Defines the set of rules to which languages must conform to work in .NET framework.
  - An environment that manages code execution and provides application-development services.

For more details on CLS, search the following reference:

https://www.techopedia.com/definition/25318/common-language-specification-cls-net

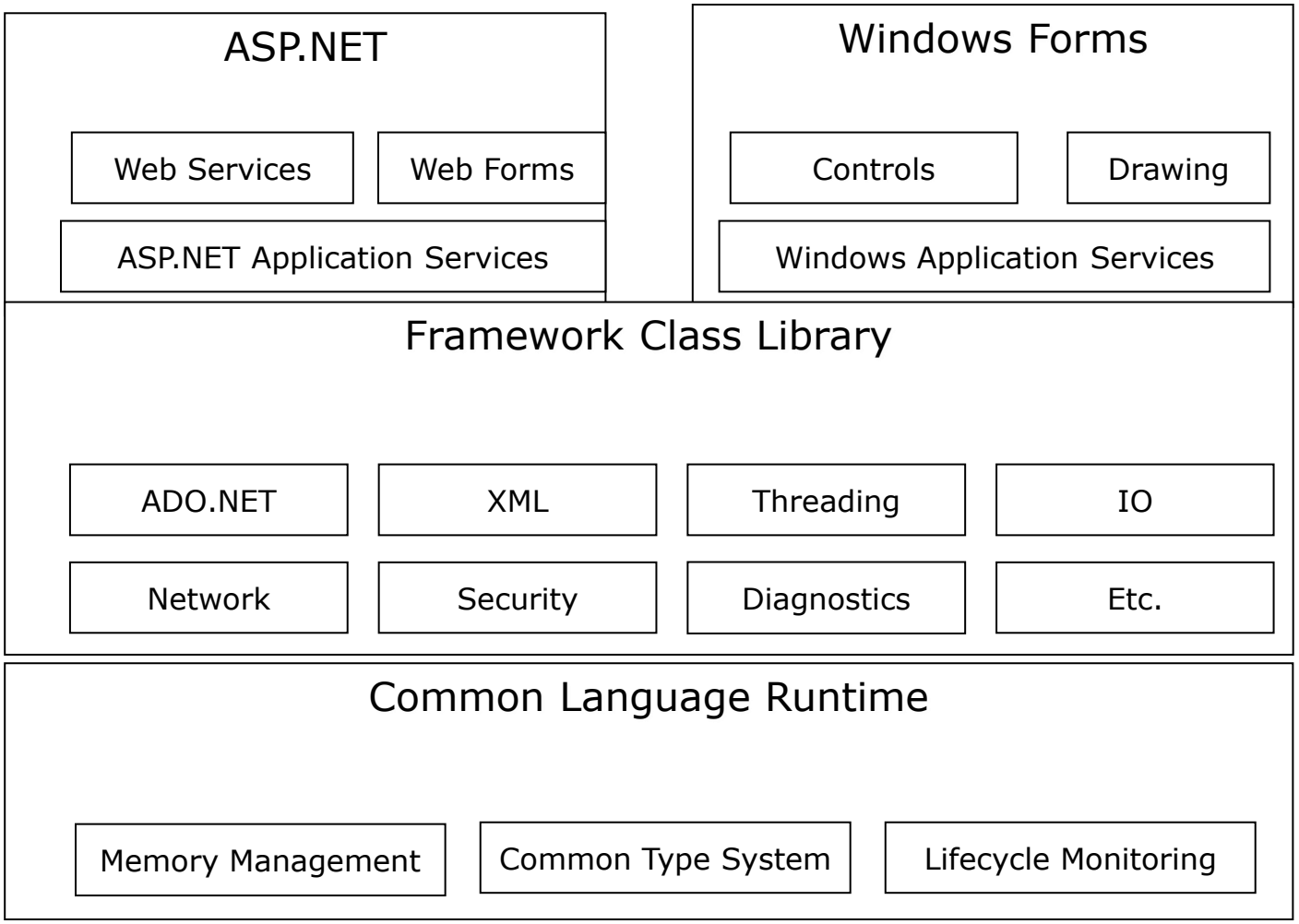
.NET Architecture Components

- Common Language Runtime (CLR)
  - Basic set of mechanisms for executing .NET programs regardless of original language.
  - Allowing to share common object-oriented classes written in any visual studio language.

For more details on CLR, search the following reference:

https://www.techtarget.com/whatis/definition/Common-Language-Runtime-CLR

.NET Framework Architecture



Framework Class Library

- The framework class library (FCL) is a shared library for . NET which enables developing useful components that can be used by multiple applications across multiple languages and platforms.
- Contains reusable classes, interfaces, and components that can be used for:
  - Developing Web Services.
  - Developing Windows Forms applications (accessed from a system in which it is installed and can directly be executed on a Windows operating system).
  - Developing Web Forms applications (accessed from any system through the internet and need an Internet Information Services (IIS) server to run the web application).

Framework Class Library

- Working with Directory Services, Event Logs, Processes, Message Queues, and Timers.
- Creating and managing threads (allows a program to operate more efficiently by doing multiple things at the same time. Threads can be used to perform complicated tasks in the background without interrupting the main program).
- Managing application security.

Framework Class Library

- FCL Key features
  - Cross-Language Interoperability
  - Consistent and Unified Programming Model
  - Object-Oriented and Extensible Class Library

❖ Discuss the benefits of each FCL feature.

Common Language Runtime

- The common language runtime CLR is at the core of the .NET platform (execution engine).
- CLR is unifying framework for designing, developing, deploying, and executing distributed components and applications.
- Loads and runs code written in any runtime-aware programming language.
- Manages memory, thread execution, type safety verification and garbage collection (manages the allocation and release of memory).
- Performs JIT (Just In-time) compilation.
- Makes use of a new common type system capable of expressing the semantics of most modern programming languages.
- Inheritance/Reference independent on source language

MSIL and JIT Compilation

- Source code is compiled into MSIL Microsoft Intermediate Language MSIL (similar to Java bytecode).
- MSIL allows runtime type-safety and security, and portable execution platforms.
- The MSIL architecture results in applications that run in one address space.
- MSIL also produce "metadata":
  - Definitions of each type in the program code.
  - Signatures of each type's members.
  - Members that the code references.
  - Other runtime data for the CLR.
- MSIL must be translated by a JIT compiler before being executed on the CPU.
- JIT compiler is a part of the CLR, which turns MSIL code into machine code.
- JIT compilation occurs when code is executed by the CLR, a code is compiled method-by-method to native machine code.

.NET Development Tools

- Visual Studio .NET
  - Visual Studio . NET is a Microsoft-integrated development environment (IDE) used for developing consoles, graphical user interfaces (GUIs), Windows Forms, Web services and Web applications.

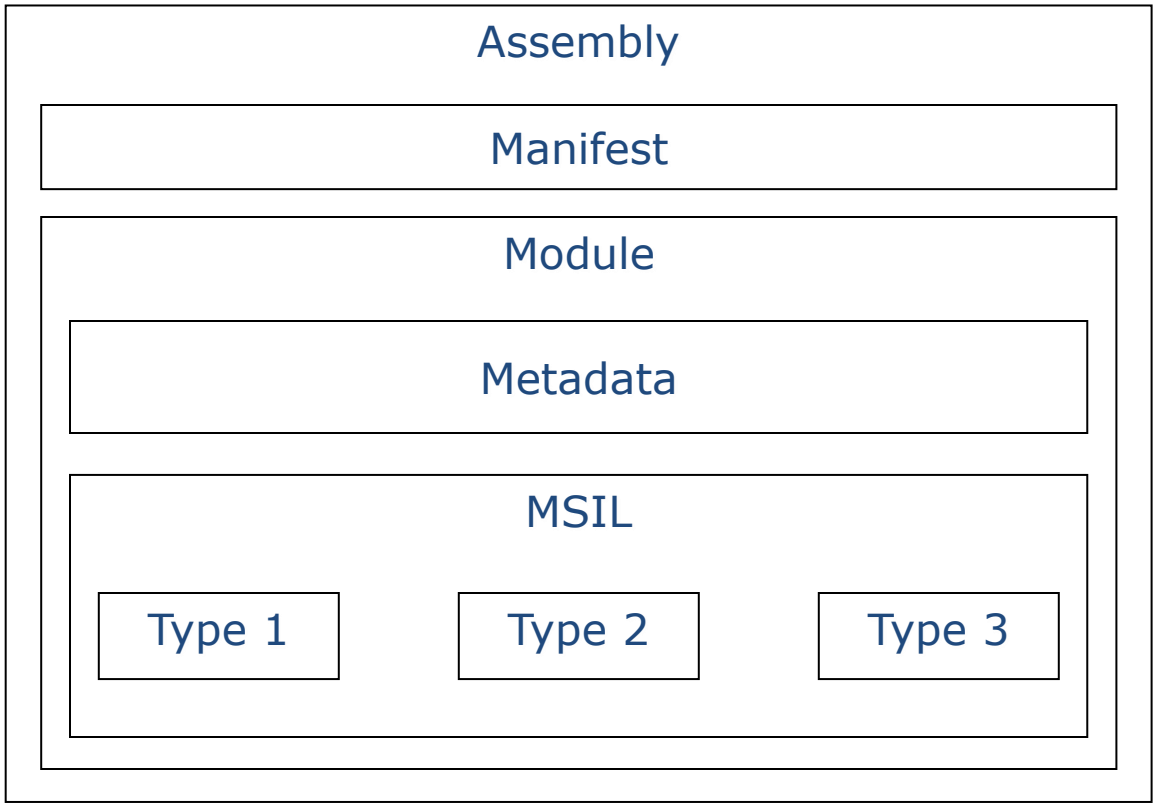
More Visual Studio .NET information are detailed on the following link:

– https://www.youtube.com/watch?v=UjoFECrCxBI

.NET Development Tools

- Visual Studio offers powerful programming languages:
  - C++
  - Visual BASIC
  - C#
  - Visual J#
- Homework: Discuss the difference between the previous Visual Studio programming languages listed above.

Packaging: Assemblies, Manifest, Modules, Metadata, Types



Packaging: Modules, Types, Assemblies, and the Manifest

- An assembly contains a "manifest", which is a catalog of component metadata containing:
  - Assembly name.
  - Version (major, minor, revision, build).
  - Assembly file list - all files contained in the assembly.
  - Type references - mapping the managed types included in the assembly with the files that contain them.
  - Scope - private or shared.
  - Referenced assemblies.
- A Module refers to a binary, such as an EXE or DLL (dynamic link library).
  - Modules contain definitions of types, such as classes, interfaces, structures, and enumerations.
- MSIL code can't be executed unless there is a manifest associated with it.

Packaging: Modules, Types, Assemblies, and the Manifest

- An assembly can be defined as one or more modules that make up a unit of functionality. Assemblies can contain other files that make up an application, such as bitmaps and resource files.
- An assembly is not a physical file.
- An assembly is the fundamental unit of deployment, version control, activation scoping, and security permissions.
- Two types of assemblies:
  - Private - Usually deployed in the same directory as the client application and used only by a single application.
  - Shared - Used by any application and usually installed in a special Global Assembly Cache.

.NET security

- The .NET Security Framework Architecture consists of the following elements:
  - Evidence Based Security: at runtime, the CLR determines permission requests by evaluating the assembly's evidence.
  - Code Access Security: allows code to be trusted to varying degrees, depending on where the code originates and on other aspects of the code's identity.
  - Verification: during JIT, the CLR ensures memory type safety.
  - Role Based Security: .NET applications can make authorization decisions based on identity and role membership.
  - Cryptography: .NET Framework provides Random Number Generation and other Cryptographic services.