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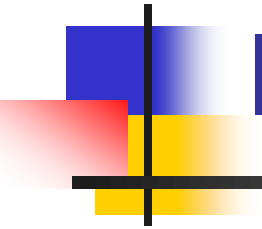

Introduction to Java

Object Oriented Programming with Java

Chapter 1

FPTU Da Nang – IT Department

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Objectives - Content

- Ice-breaking
- Java brief history
- Features of Java language
- Java Virtual Machine
- Types of Java Programs
- System Security Model of Java
- Installation

Ice-breaking

- Who am I?
- Who are you?
  - What IT means to you?
  - Your expectation?
- Course Contents
- Timetable
- Resource

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Java brief history

- Java was developed by Sun Microsystems in June 1995.
- 1990, Oak, James Gosling alpha version May 23, 1995, version 1.2 - also known as Java 2.0 - released December 1998
- Java is built from C and C++.
- Inheriting C syntax and object-oriented ideas of C++.
- Name of a technology line - J2EE
- Java was acquired by Oracle from Sun in 2009

Jan 2020	Jan 2019	Change	Programming Language	Ratings	Change
1	1		Java	16.896%	-0.01%
2	2		C	15.773%	+2.44%
3	3		Python	9.704%	+1.41%
4	4		C++	5.574%	-2.58%
5	7	▲	C#	5.349%	+2.07%
6	5	▼	Visual Basic .NET	5.287%	-1.17%
7	6	▼	JavaScript	2.451%	-0.85%
8	8		PHP	2.405%	-0.28%
9	15	⇈	Swift	1.795%	+0.61%
10	9	▼	SQL	1.504%	-0.77%
11	18	⇈	Ruby	1.063%	-0.03%
12	17	⇈	Delphi/Object Pascal	0.997%	-0.10%
13	10	▼	Objective-C	0.929%	-0.85%
14	16	▲	Go	0.900%	-0.22%
15	14	▼	Assembly language	0.877%	-0.32%

Features of Java

- **Java: programming language – technology**
- **Outstanding Features**
  - **Simple**
  - **Platform independent**
  - **Object Oriented**
  - **Portability**
  - **Distributed**
  - **Translated**
  - **Interpreted**
  - **Multi-threaded**
  - **Robust**
  - **Safe**

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Features of Java

- **Simplicity:**
  + Familiar to C programmers
  + Eliminates complex and confusing features of C++ such as operator overloading, pointer manipulation, multiple inheritance
- **Platform independent:**
  + Java is designed to support network applications running on Java Virtual Machines
  + Write once, run anywhere
- **Object Oriented** :
  + Encapsulation
  + Polymorphism
  + Inheritant
  + Dynamic binding
  + All are objects

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Features of Java

- **Distributed:**
  - Java has an extension library for distributed programming: (net, rmi, idl, CORBA)
  - Java applications can access Internet objects using the same URL as file access local
- **Robust**
  - Java has strict checking mechanism, eliminates read and write errors or corrupt data
  - Efficient memory management model, automatically reclaims memory using Gabagge Collection

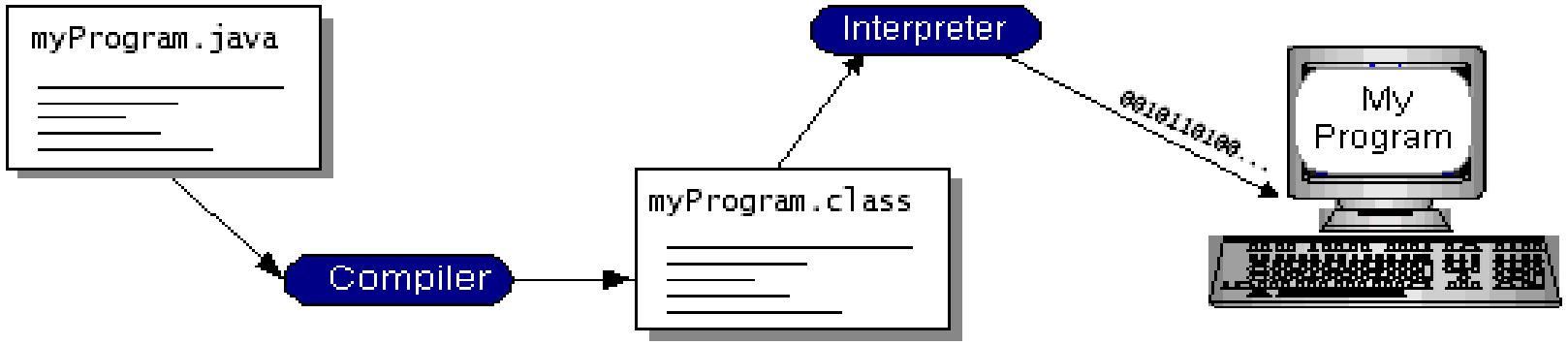
Features of Java

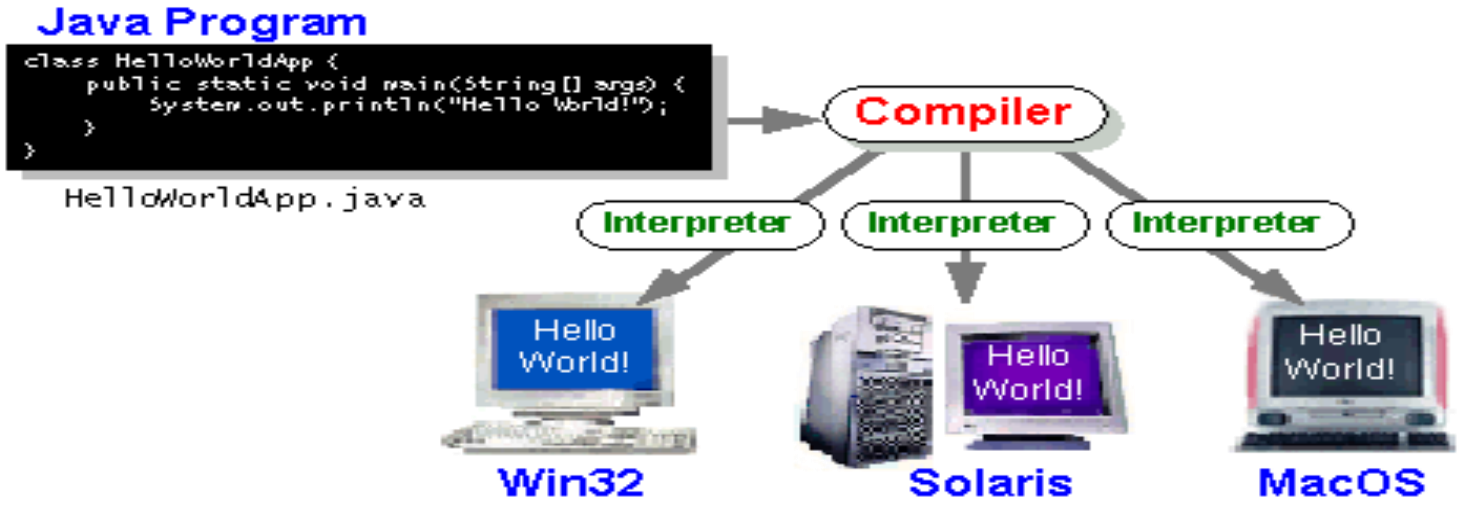
- **Secure :**
  - Java provides a strictly tested execution environment - Never assumes executable code is secure
  - Multi-tier system security check mechanism
- **Portability:**
  - the ability to deploy Java applications on a variety of platforms
  - Java compiler generates an architecture-neutral object file format, which makes the compiled code executable on many processors, with the presence of Java runtime system

Features of Java

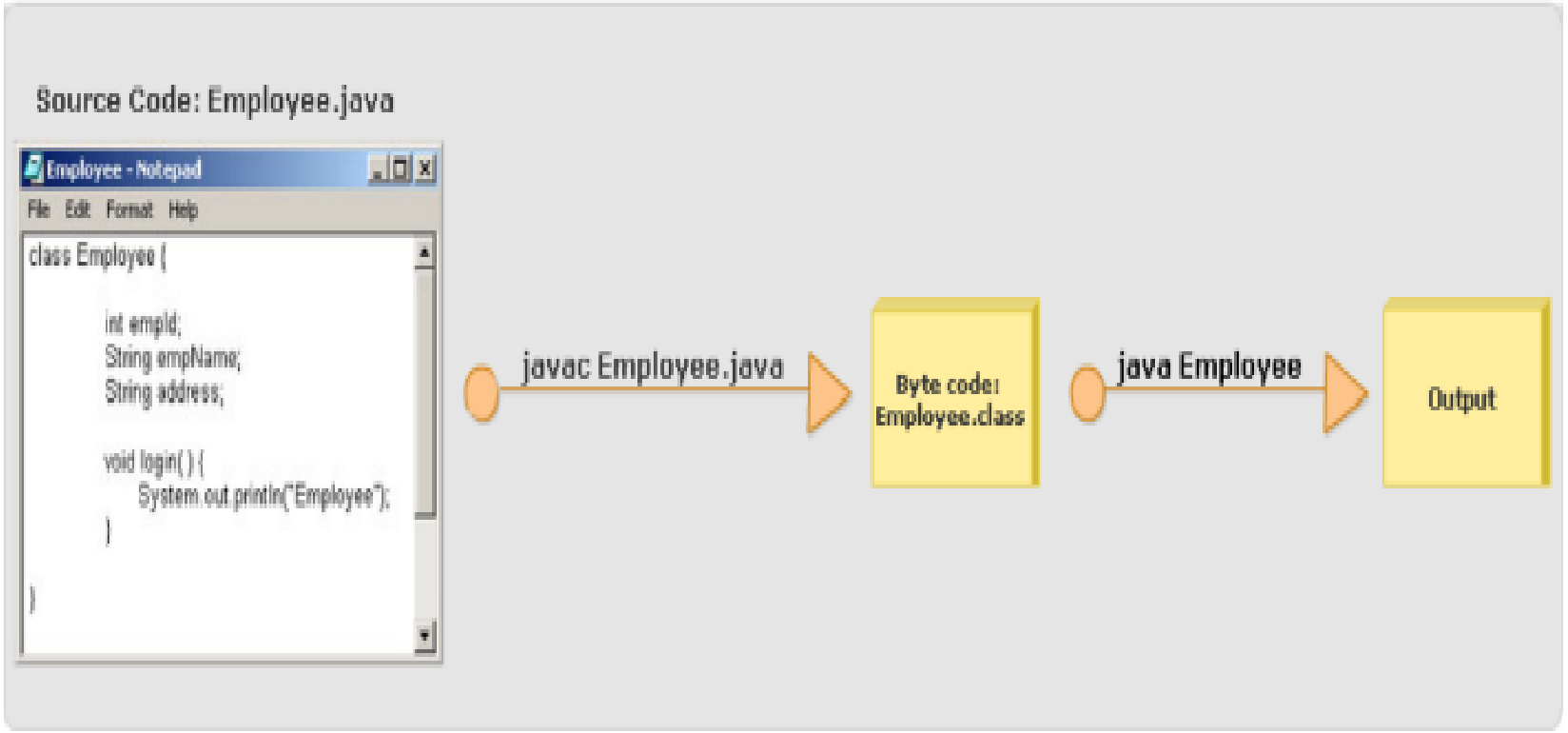
- **Compiled–Interpreted** :
  - Java source code is compiled into ByteCode before being run on the Java virtual machine by the interpreter
  - The Virtual Machine (Java interpreter) provides a set of standardized functions & functions for all environments
- **Multi-thread:**
  - can perform many tasks simultaneously, allows the developers to construct interactive applications that can run smoothly
  - C/C++ application : single-threaded

Features of Java





Compiled–Interpreted



Java platform

- **The Java Platform**
  - Platform is the hardware & software environment where program run
  - Java platform differed from other environments as it is software-based (software-only platform) running on the diversity of hardware
- **The Java platform has two components:**
  - **Java Virtual Machine (Java Virtual Machine - Java VM):** All Java interpreters – whether a development tool or a Web browser that can run an applet are executable versions of a JVM
  - ***Java Application Programming Interface* (Java API)** is a collection of libraries of related classes and programming interfaces organized into packages

Java Virtual Machine

- JVM (Java Virtual Machine) is the heart of Java language
- 5 components of the Java environment.
  - Java language
  - Bytecode
  - Sun's Java Class Library
  - Java Virtual Machine
  - Structure of the .class . file

Java Virtual Machine

- Virtual machine is actually a software concept based on the idea of a virtual computer with a set of instructions to perform tasks.
- The JVM creates the program code execution environment with the following tasks:
  - load class file
  - memory management
  - perform memory recall functions

Java Virtual Machine

- **Garbage Collection - Memory Management**
  - Java Virtual Machine uses 2 separate heap areas to manage static and dynamic memory allocation.
  - A heap is a statically allocated memory area used to load bytecode, constants, and class methods.
  - The second heap splits into two parts that can expand in opposite directions when needed. One part is used to store instance variables of objects, the other part to store variables that refer to objects.

Java Virtual Machine

- Check Class File
  - Applies to all classes loaded at runtime for system security
  - The Class Loader is responsible for checking all unorthodox classes to make sure they follow the correct formats.
  - The .class file consists of 3 logical parts:
    - Compiled byte codes
    - Information about the class such as methods, properties, constants, interfaces.
    - This information is organized independently into tables

Java Virtual Machine

- The inspection of classes takes place at 4 levels.
  - check format of .class file
  - check for semantic consistency of .class files
  - check method bytecode independently
  - check at runtime on the Java JVM

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Types of Java Programs

- Applets
  - Java program that embed and runs on a web page
  - Applets are Java codes that are compiled and stored on the Web Server and referenced by the website using special HTML codes.
  - An applet is a subclass of the Applet class contained in the java.applet package with 23 methods
  - Ex: Instantly plotted graphs with real-time data

Example of 1 Applet

1. Using the editor to write the code

```
import java.applet.*;
import java.awt.*;

/* The HelloWorld class implements an applet that * simply displays "Hello World!". */
public class HelloWorld extends Applet {
public void paint(Graphics g) {
   g.drawString("Hello world!", 50, 25);
}
}
```

Save this code as HelloWorld.java

Applet demo..

2. Create HTML page that embed applet

```
<HTML>
<HEAD>
<TITLE>A Simple Program</TITLE>
</HEAD>
<BODY> Here is the output of my program:
<APPLET CODE="HelloWorld.class" WIDTH=150 HEIGHT=25>
</APPLET>
 </BODY>
</HTML>
```

Save the file: Hello.html.

Applet demo

3. **Compile java source file to the bytecode**

- **C:\>javac HelloWorld.java**

The compiler with create the bytecode as file HelloWorld.class

4. View the applet HelloWorld using appletviewer

C:¥>**appletviewer Hello.html**

Types of Java Programs..

- Applications
  - Application is a program that runs from a command window without the need for a browser like an applet.
  - All applications need to have main() method as the first method to be called.
  - The application interface is diversity while an applet is always displayed graphically.
  - Applications are not subject to the same restrictions as applets.
  - Applications are trusted by default and allow unrestricted access to system resources.

Example of Java Application

- **Write Java source file**

```
class        HelloWorldApp{
 public static void main(String[] args) {
        System.out.println("Hello World!");
    }
}
```

- Save the file as **HelloWorldApp**.java
- file name must match the class name

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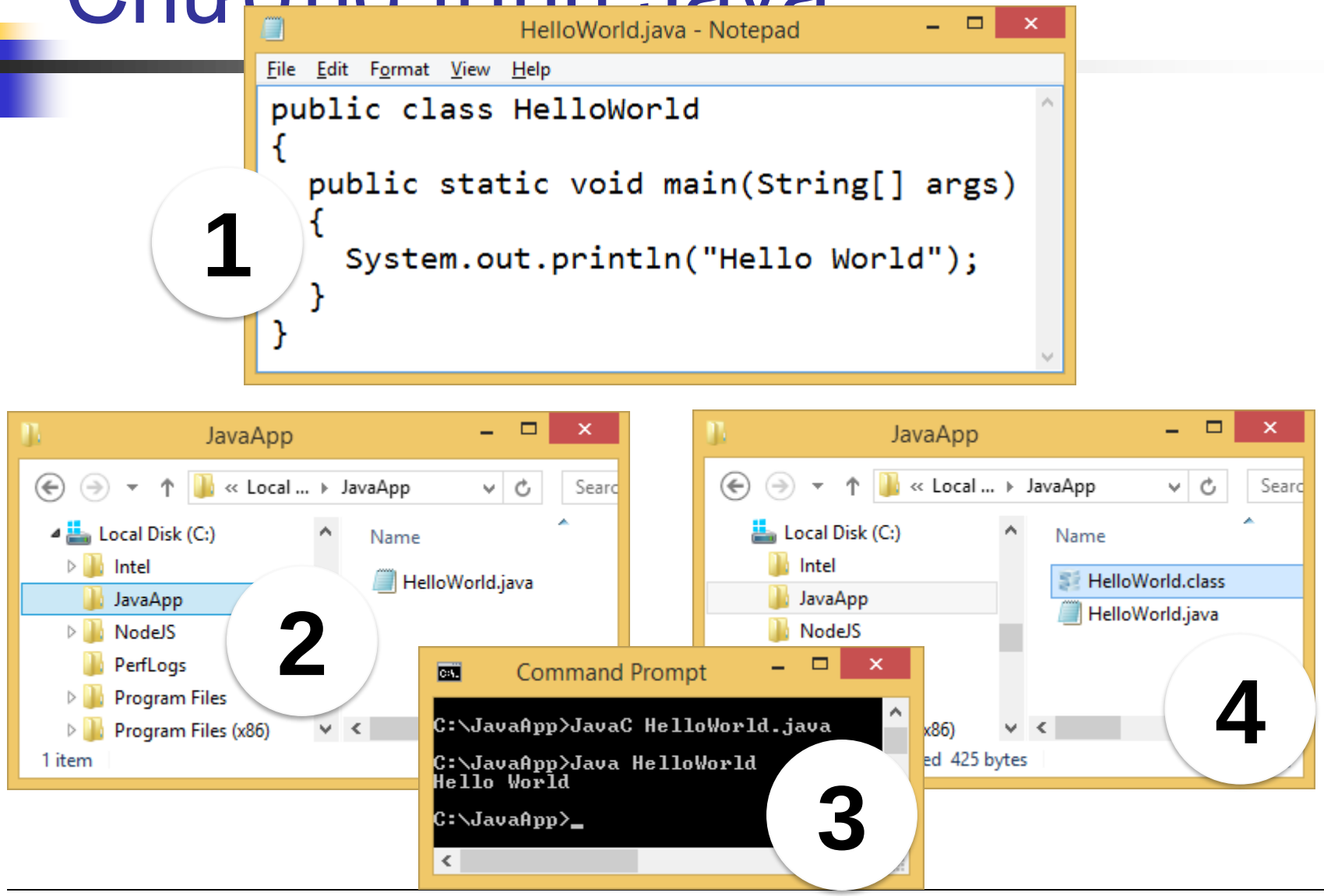
Chương trình Java



Example of Java Application

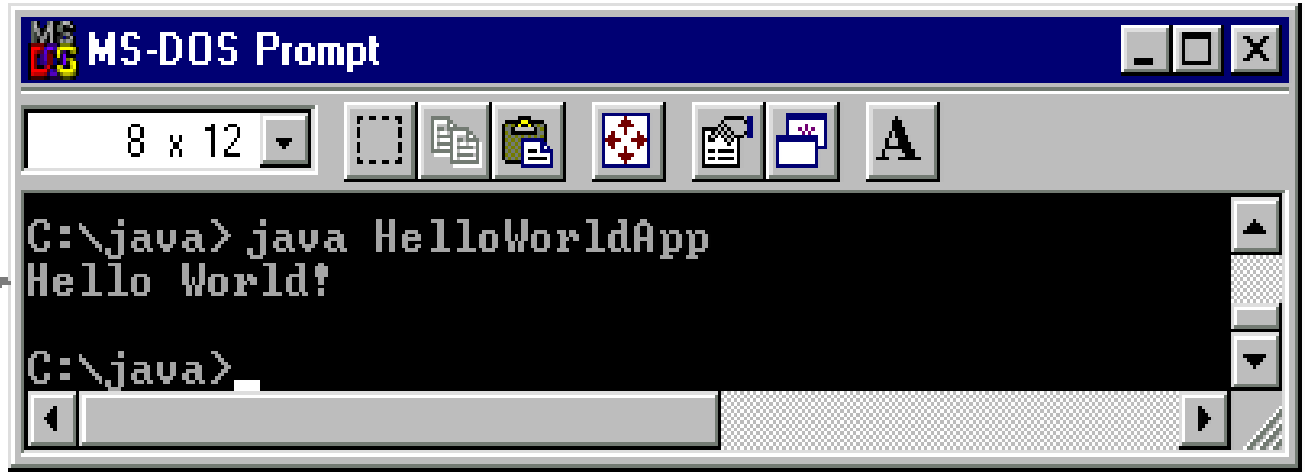
- **Compile the bytecode**

  D:\JDK\Bin> ***javac HelloWorldApp.java***

- **Run the application**

  D:\JDK\Bin> **java HelloWorldApp**

result



Type of Java programs..

- Servlets
  - A program that runs on a server to provide services.
  - Servers can be Web Servers, Mail Servers, File Servers, Database Servers...
  - Java Server Toolkit, Servlet API are tools and libraries that support web programming with Java

Types of Java Programs..

- Servlets
  - The servlet helps the server handle the requests coming from the client side.
  - are widely used to replace the role of CGI scripts.
  - Servlets are for servers like applets are for browsers.
  - servlets do not have a graphical interface like applets.
  - widely used on HTTP servers

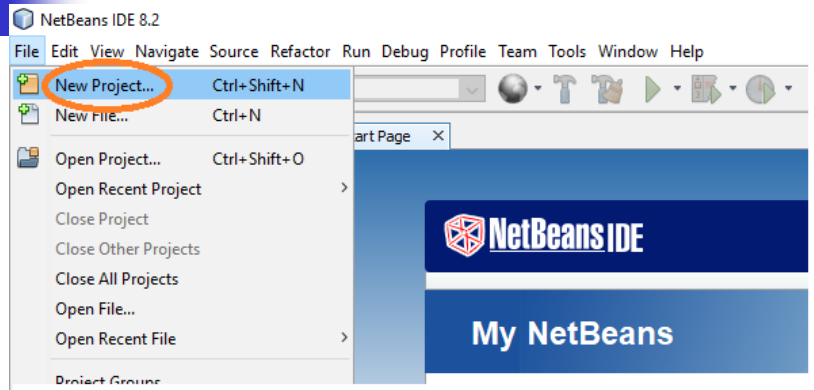
Types of Java Programs..

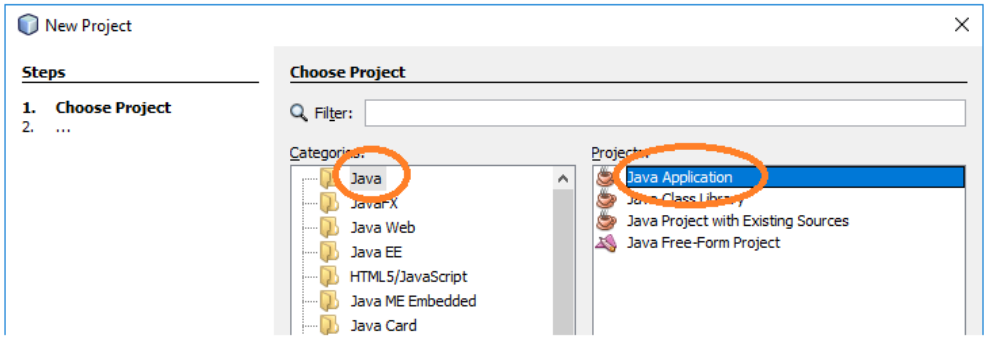
- Java Beans
  - JavaBeans are COM (components object model) of Java technology
  - Create shared components for applications.
  - customizable at design time.
  - Beans can interact with each other.
- Distributed Objects
  - support the development of client-server distributed applications
  - An application on one JVM that invokes method on another JVM.
  - RMI: Remote method invocation.
  - Enterprise JavaBean

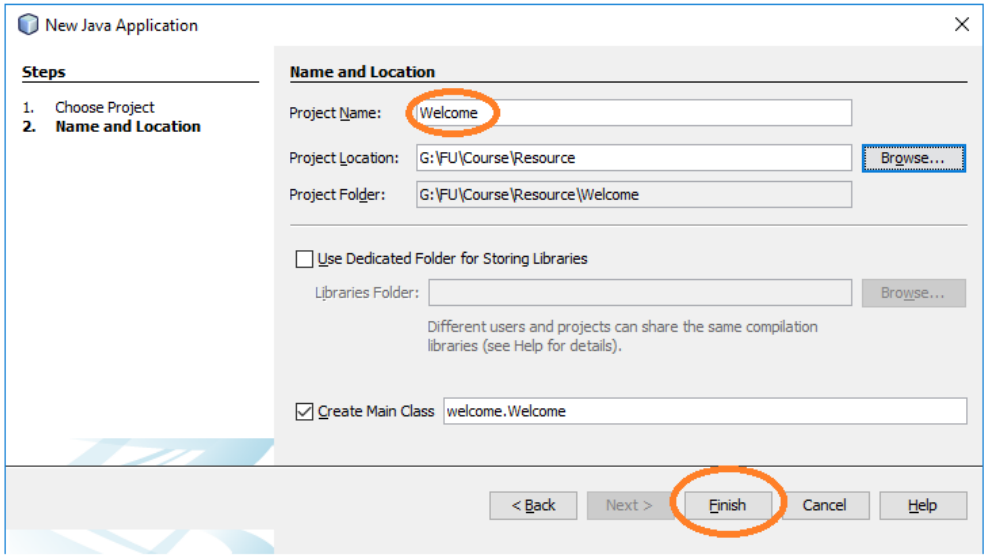
Install developer tools

- Install JDK 8.x
  - javac.exe : compiler, translate source code into bytecode
    - javac Hello.java
  - java.exe : interpreter, run application
    - java Hello
- Install IDE : NetBean 8.x
- Java Class Library Documentation
  - Java documentation
  - https://docs.oracle.com/javase/8/docs/
- First application with Java and Netbean

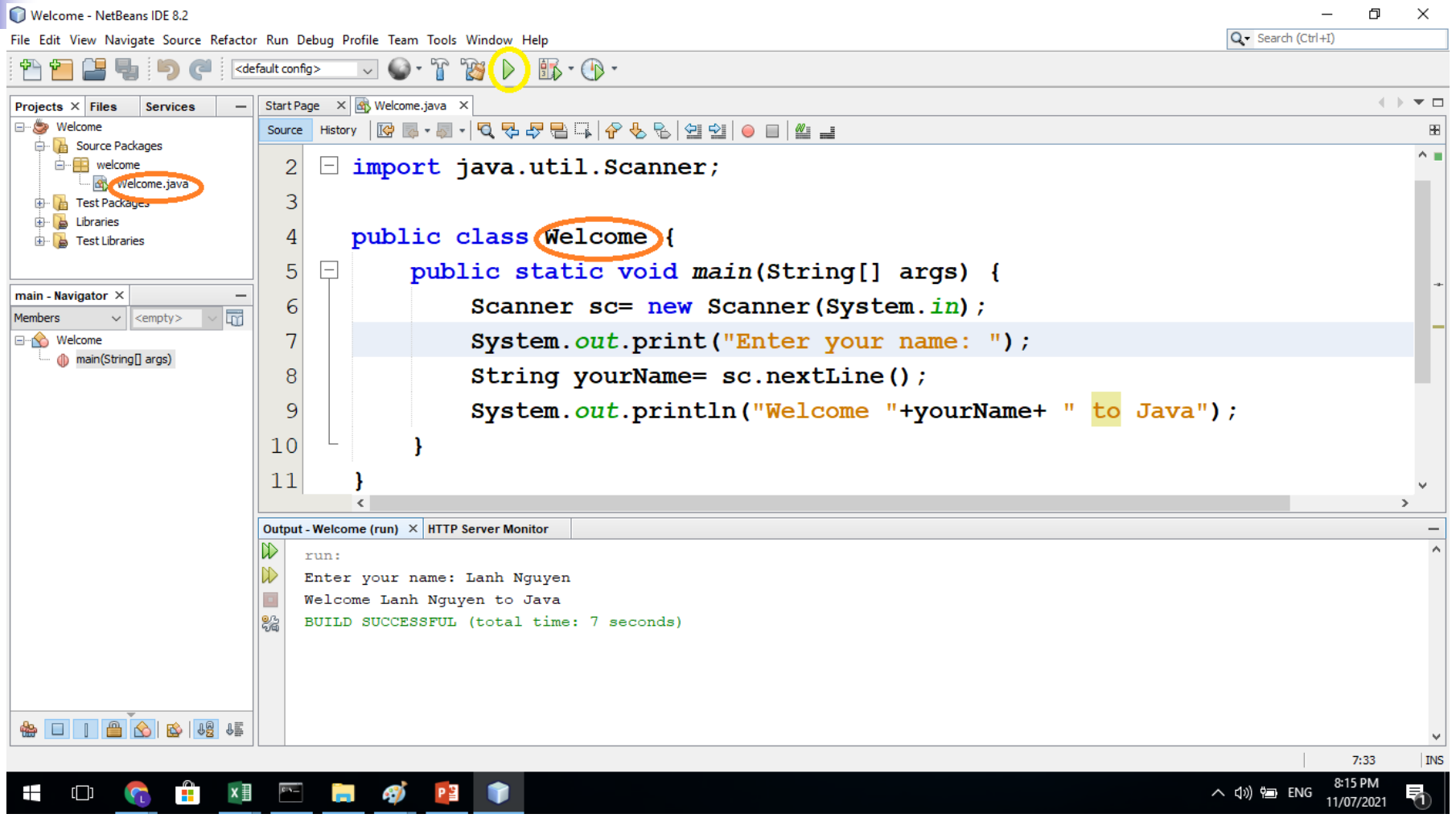
First App. on Netbean







First App. on Netbean



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Constructive Questions..

- Compare C and Java Programming Languages
- Why the JDK installed for different operating systems is differ from each others? Does this conflict with Java's platform independent characteristic?
- Why we need to learn many programming languages?
- What is the difference of JDK and NetBean? Besides Netbean, what other tools can be used?
- Write a program to add, subtract, multiply and divide 2 integers
- Write a welcome.. program that receives yourName through the argument of main method