2007 KARABÜK ÜNİVERSİTESİ

CPE207 Object Oriented Programming

Week 1

Object-Oriented Programming (in Java)

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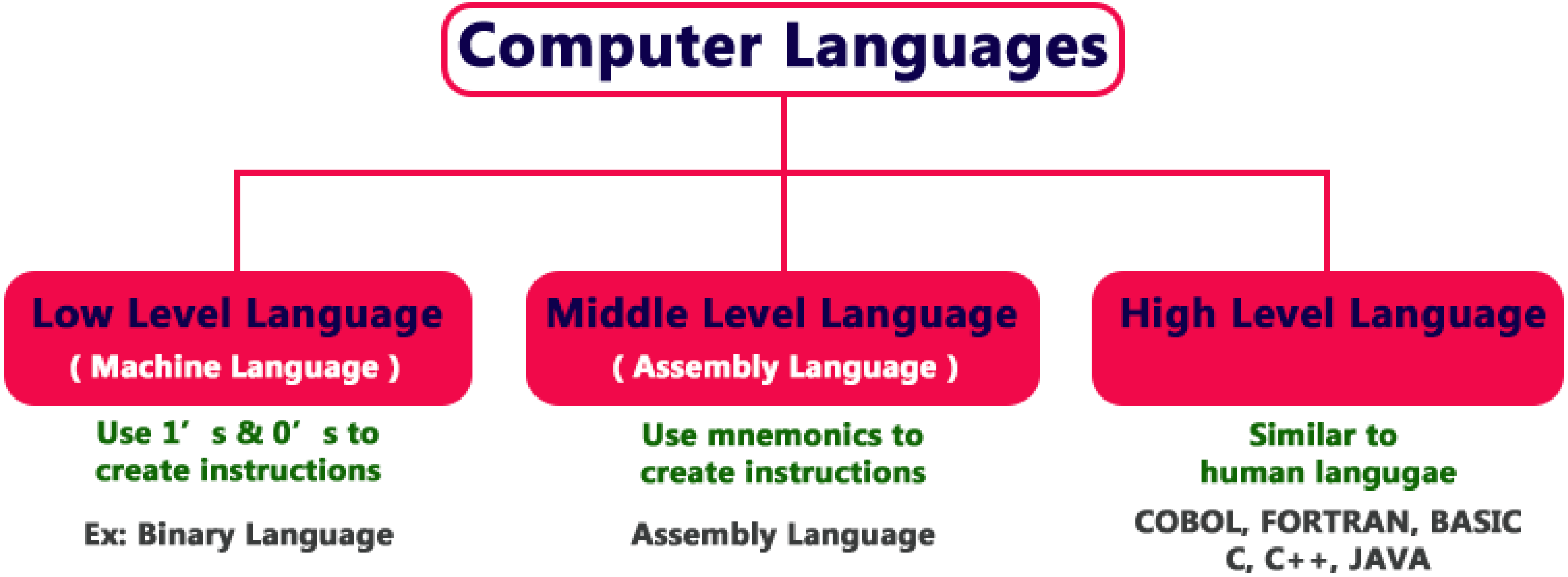
Levels of Programming Languages



Computer Languages

Low Level Language

(Machine Language)

Use 1’ s & 0’ s to create instructions

Ex: Binary Language

Middle Level Language

(Assembly Language)

Use mnemonics to create instructions

Assembly Language

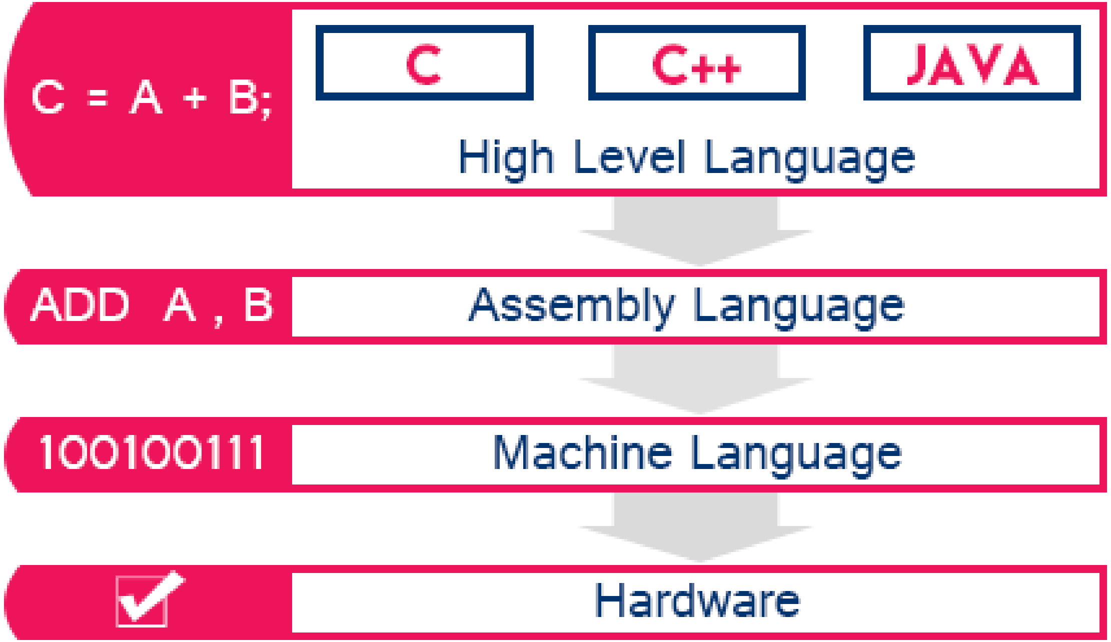
High Level Language

Similar to human langugae

COBOL, FORTRAN, BASIC
C, C++, JAVA

Computers understand only Machine Language

Levels of Programming Languages



C = A + B;

C

C++

JAVA

High Level Language

ADD A , B

Assembly Language

100100111

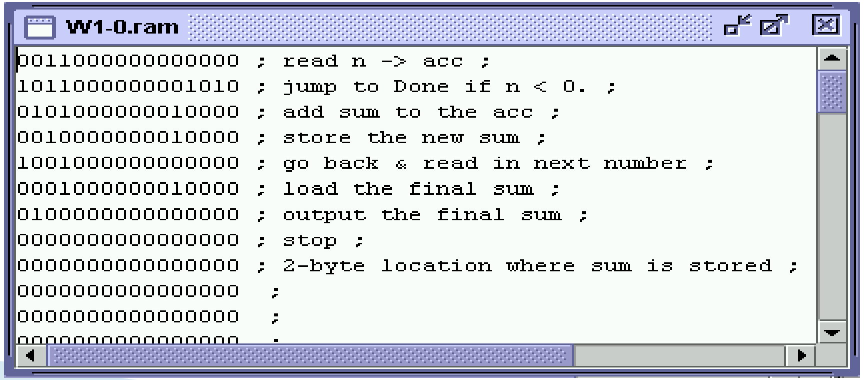
Machine Language

☑

Hardware

Machine Language

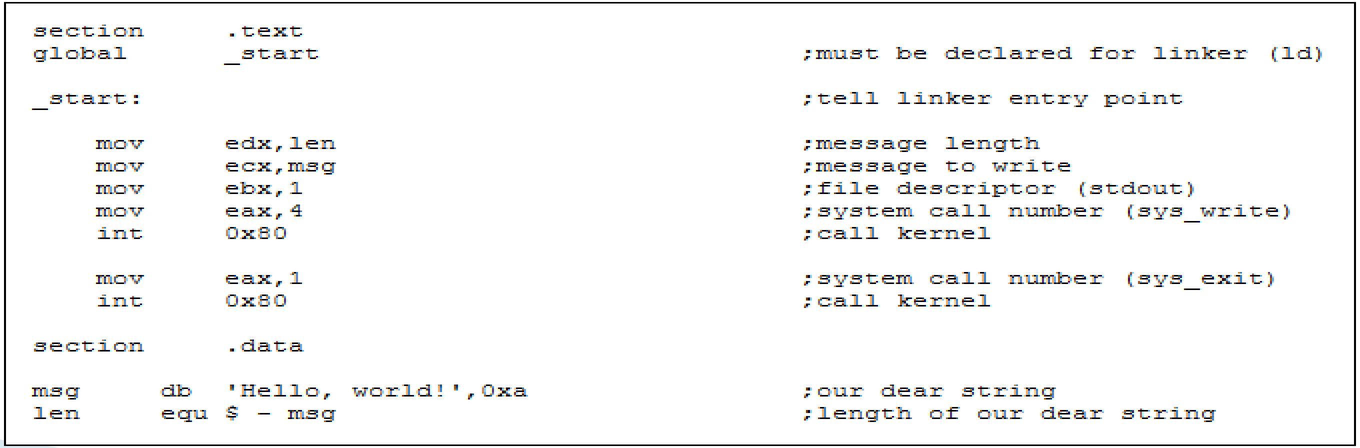
- The fundamental language of the computer's processor, also called Low Level Language.
- All programs are converted into machine language before they can be executed.
- Consists of combination of 0's and 1's that represent high and low electrical voltage.



```
0011000000000000 ; read n -> acc ;
1011000000001010 ; jump to Done if n < 0. ;
0101000000010000 ; add sum to the acc ;
0010000000010000 ; store the new sum ;
1001000000000000 ; go back & read in next number ;
0001000000010000 ; load the final sum ;
0100000000000000 ; output the final sum ;
0000000000000000 ; stop ;
0000000000000000 ; 2-byte location where sum is stored ;
0000000000000000  ;
0000000000000000  ;
0000000000000000  ;
```

Assembly Language

- A low level language that is similar to machine language.
- Uses symbolic operation code to represent the machine operation code.



```
section     .text
global      _start                                          ;must be declared for linker (ld)

_start:                                                     ;tell linker entry point

    mov     edx,len                                         ;message length
    mov     ecx,msg                                         ;message to write
    mov     ebx,1                                           ;file descriptor (stdout)
    mov     eax,4                                           ;system call number (sys_write)
    int     0x80                                            ;call kernel

    mov     eax,1                                           ;system call number (sys_exit)
    int     0x80                                            ;call kernel

section     .data

msg     db  'Hello, world!',0xa                             ;our dear string
len     equ $ - msg                                         ;length of our dear string
```

High level Language

- Computer (programming) languages that are easier to learn.
- Uses English like statements.
- there are hundreds of high level programming languages, following are a few of them:
  - Java
  - C
  - C++
  - Python
  - PHP
  - Perl
  - Ruby

High level Language (2)

- You eventually need to convert your program into machine language so that the computer can understand it.
- There are two ways to do this:
  - Compile the program.
  - Interpret the program.

compiler

- Compile is to transform a program written in a high–level programming language from source code into object code.
- This can be done by using a tool called compiler.
- A compiler reads the whole source code and translates it into a complete machine code program to perform the required tasks which is output as a new file.

Interpreter

- Interpreter is a program that executes instructions written in a high-level language.
- An interpreter reads the source code one instruction or line at a time, converts this line into machine code and executes it.

What is Java?

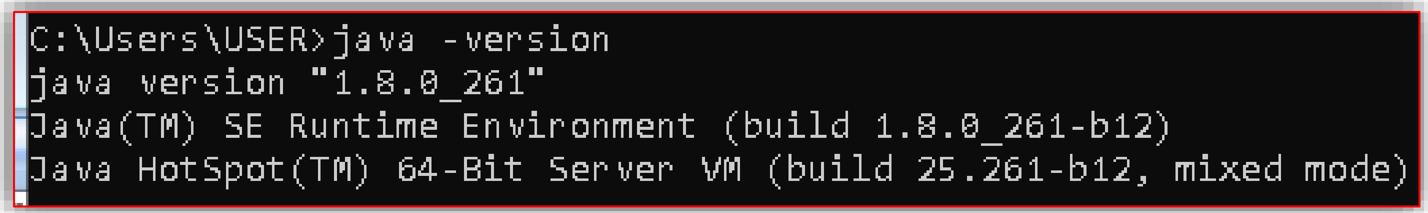
- Java is a popular programming language, created in 1995.
- It is owned by Oracle, and more than 3 billion devices run Java.
- It is used for:
  - Mobile applications (specially Android apps)
  - Desktop applications
  - Web applications
  - Web servers and application servers
  - Games
  - Database connection
  - And much, much more!

Why Use Java?

- Java works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc.)
- It is one of the most popular programming language in the world
- It is easy to learn and simple to use
- It is open-source and free
- It is secure, fast and powerful
- It has a huge community support (tens of millions of developers)
- Java is an object oriented language which gives a clear structure to programs and allows code to be reused, lowering development costs
- As Java is close to C++ and C#, it makes it easy for programmers to switch to Java or vice versa

Java Install

- To check if you have Java installed on a Windows PC, search in the start bar for Java or type the following in Command Prompt (cmd.exe):
  - java –version



```
C:\Users\USER>java -version
java version "1.8.0_261"
Java(TM) SE Runtime Environment (build 1.8.0_261-b12)
Java HotSpot(TM) 64-Bit Server VM (build 25.261-b12, mixed mode)
```

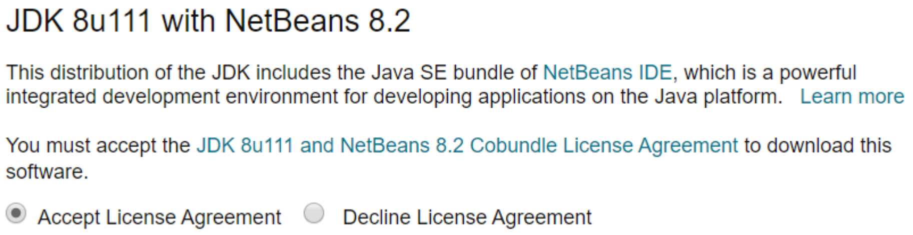
- If you do not have Java installed on your computer, you can download it for free at oracle.com.

Installing IDE for Java (NetBeans)

- Install JDK 8u111 with NetBeans 8.2
  - Use the following link (https://www.oracle.com/technetwork/java/javase/downloads/jdk-netbeans-jsp-3413139-esa.html)

- Or simply Google it!

- Choose Windows x64 and install

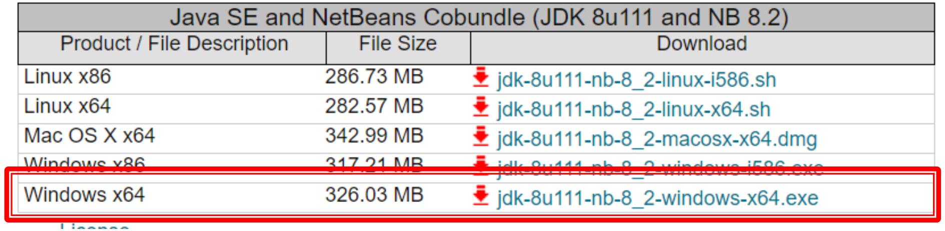


JDK 8u111 with NetBeans 8.2

This distribution of the JDK includes the Java SE bundle of NetBeans IDE, which is a powerful integrated development environment for developing applications on the Java platform. Learn more

You must accept the JDK 8u111 and NetBeans 8.2 Cobundle License Agreement to download this software.

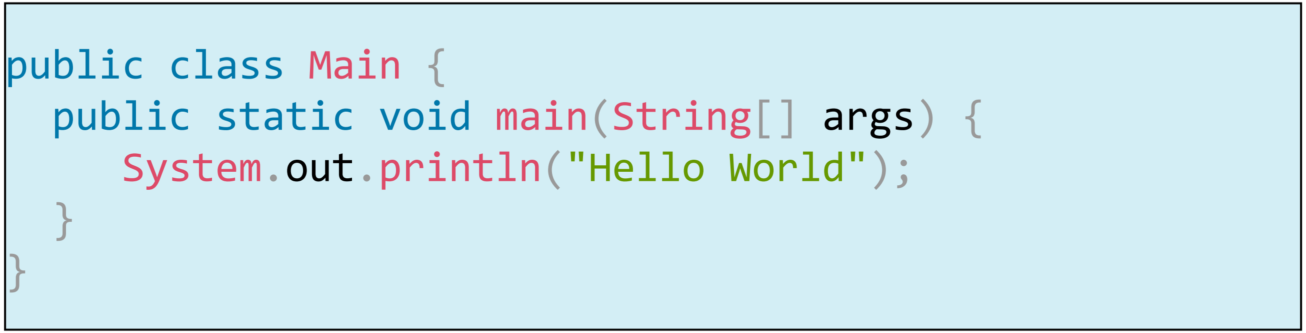
● Accept License Agreement ○ Decline License Agreement



Java SE and NetBeans Cobundle (JDK 8u111 and NB 8.2)		
Product / File Description	File Size	Download
Linux x86	286.73 MB	jdk-8u111-nb-8_2-linux-i586.sh
Linux x64	282.57 MB	jdk-8u111-nb-8_2-linux-x64.sh
Mac OS X x64	342.99 MB	jdk-8u111-nb-8_2-macosx-x64.dmg
Windows x86	317.21 MB	jdk-8u111-nb-8_2-windows-i586.exe
Windows x64	326.03 MB	jdk-8u111-nb-8_2-windows-x64.exe

First program in Java

- In Java, every application begins with a class name, and that class must match the filename.
- Let's create our first Java file, called Main.java, which can be done in any text editor (like Notepad).



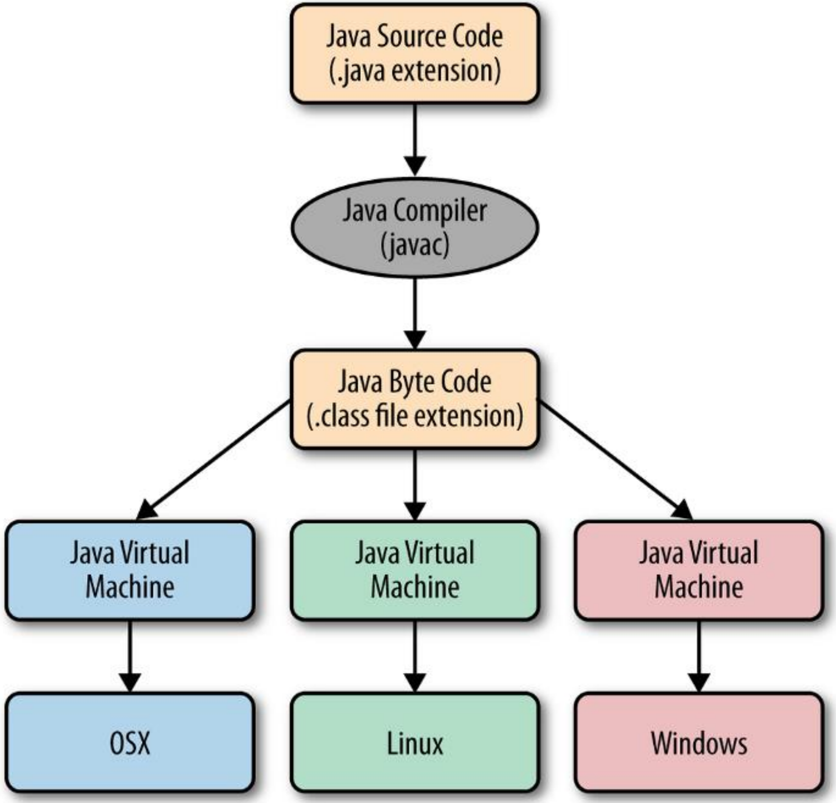
```java
public class Main {
  public static void main(String[] args) {
     System.out.println("Hello World");
  }
}
```

Save the code in Notepad as "Main.java".

Compile and Run Java program

- Open Command Prompt (cmd.exe), navigate to the directory where you saved your file, and type:
  - javac Main.java
- This will compile your code. If there are no errors in the code, the command prompt will take you to the next line. Now, to run the file type:
  - java Main

The JVM takes the byte code and generates machine code.



Java Editions

- Java Standard Edition (SE) contains the capabilities needed to develop desktop and server applications.
- The Java Enterprise Edition (Java EE) is geared toward developing large-scale, distributed networking applications and web-based applications.
- Java Micro Edition (Java ME) a subset of Java SE. geared toward developing applications for resource-constrained embedded devices, such as:
  - Smart watches
  - MP3 players
  - television set-top boxes
  - smart meters (for monitoring electric energy usage)
  - and more.

Need for OOP

Procedure-oriented Programming(POP) vs Object-oriented programming(OOP)

POP

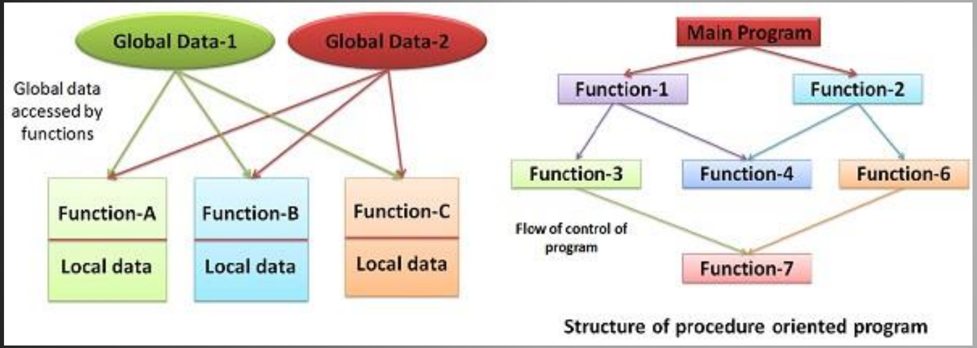
- Main focus is on **"how to get the task done"** i.e. on the procedure or structure of a program
- Large program is divided into functions(methods)
- **C,** VB, FORTRAN, Pascal

OOP

- Main focus is on 'data security'. Hence, only objects are permitted to access the entities of a class.
- Entire program is divided into objects.
- C++, JAVA, C#, Objective-C, phyton

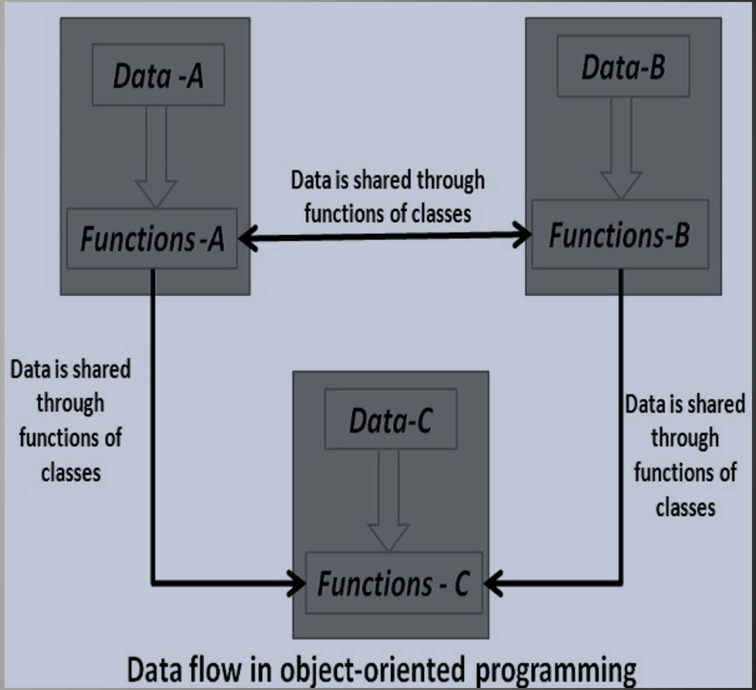
function = method

POP



Structure of procedure oriented program

OOP



Data -A
Functions -A
Data-B
Functions-B
Data is shared through functions of classes
Data is shared through functions of classes
Data-C
Functions - C
Data is shared through functions of classes

Data flow in object-oriented programming

Introduction to Object Technology

- Objects (comes from classes) are *reusable*.
  - Date, time, audio, video, automobile, people objects, etc.
  - Almost any *noun* can be represented as an **object** in terms of
    - *attributes* (e.g., name, color and size) and
    - *behaviors* (e.g., calculating, moving and communicating).

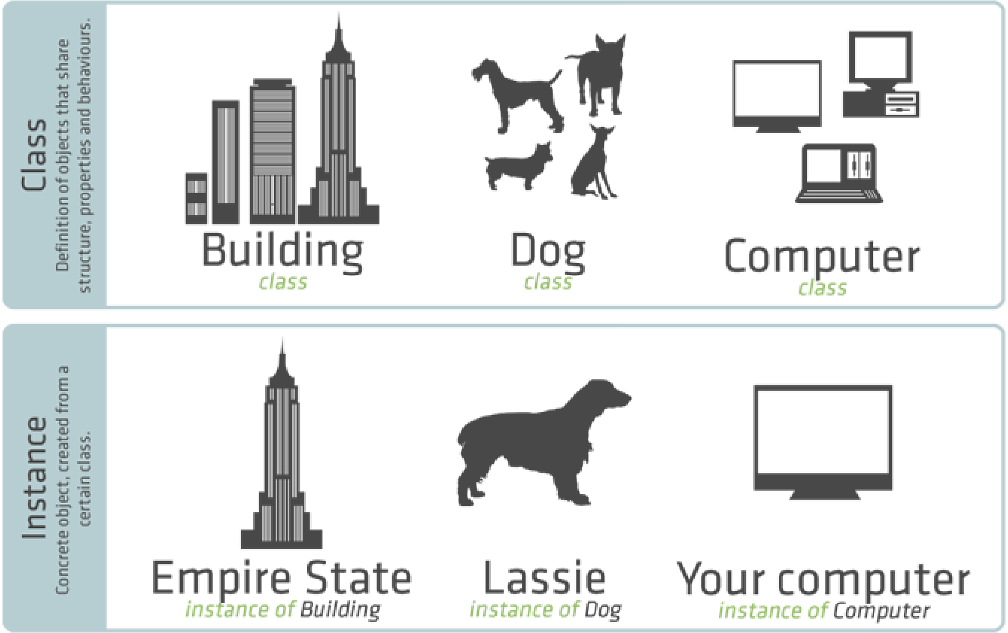
- Object-oriented design approach is much more productive than with earlier popular techniques like “structured programming”
- Object-oriented programs are often **easier to understand, correct and modify.**

Objects and Classes

- **Class** – A *class* is a blueprint or template or set of instructions to build a specific type of object

- **Object–** An object is a component that contains attributes and behaviors needed to make a certain type of data useful.

- **Instance–** An *instance* is a specific object built from a specific class



Class members

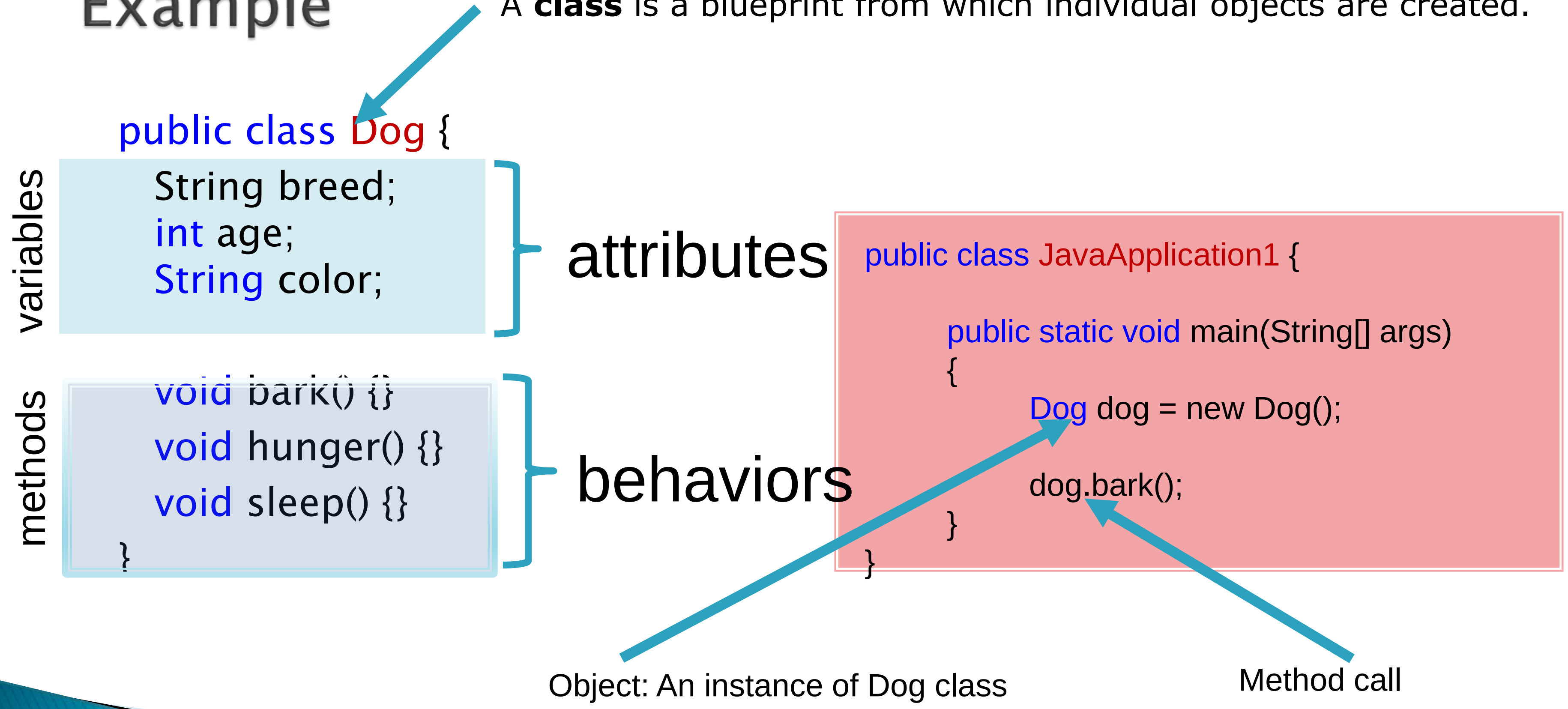
- Objects have
  - *attributes* (e.g., name, color and size) and (variables)
  - *behaviors* (e.g., calculating, moving and communicating). (methods)
- A car has *attributes*
  - Color, its number of doors, the amount of gas in its tank, its current speed and its record of total miles driven (i.e., its odometer reading).
  - The car's attributes are represented as part of its design in its engineering diagrams.
- Every car maintains its *own* attributes.
- *methods* are used to perform some tasks of the objects.

Instantiation

- Just as someone has to *build* a car from its engineering drawings before you can actually drive a car, you must *build an object* of a class before a program can perform the tasks that the class's methods define.
- An object is then referred to as an instance of its class.

Example

A **class** is a blueprint from which individual objects are created.



```
public class Dog {
    String breed;
    int age;
    String color;

    void bark() {}
    void hunger() {}
    void sleep() {}
}
```

variables

attributes

methods

behaviors

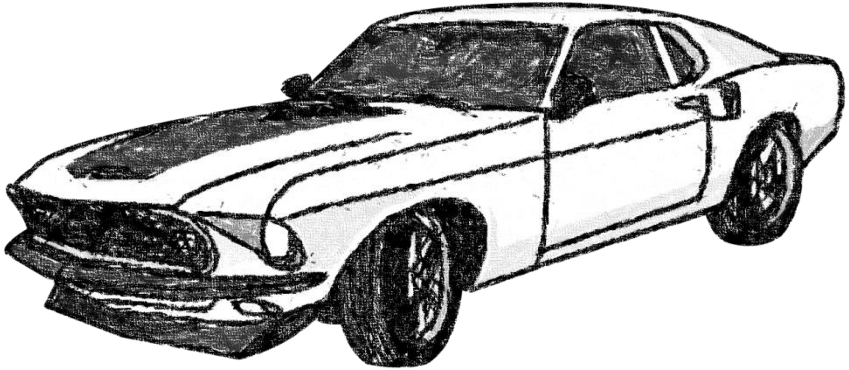
```
public class JavaApplication1 {

    public static void main(String[] args)
    {
        Dog dog = new Dog();

        dog.bark();
    }
}
```

Object: An instance of Dog class

Method call

Another Example: Car class

Attributes
Model
Color
Year
Price



Behaviours
StartEngine
Drive
Stop

This Car class can be *reused* many times to build many cars, you can reuse a class many times to build many objects.

Reuse of existing classes when building new classes and programs saves time and effort.

Online source

- https://sites.google.com/view/oopinjava

Thanks ☺