Lecture 1
Revision of modules 1-2. OOP basics

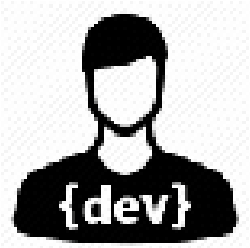
Programming II

School of Business Informatics
Spring 2018

(: Programmer - n. [proh-gram-er]: a person who fixes problems that you don't know you have, in a way you don't understand :)

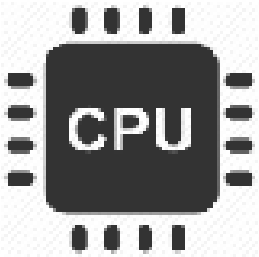
What is a computer program?

A **program** is a sequence of instructions represented in two main forms:




```
int sum = a + b;
Console.WriteLine($"Sum = {sum}");
```

Source code




```
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...
```

Executable code

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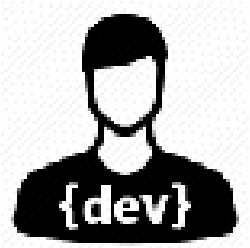


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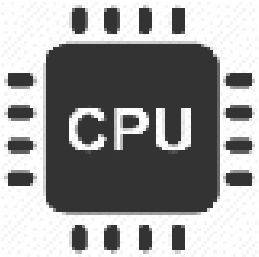


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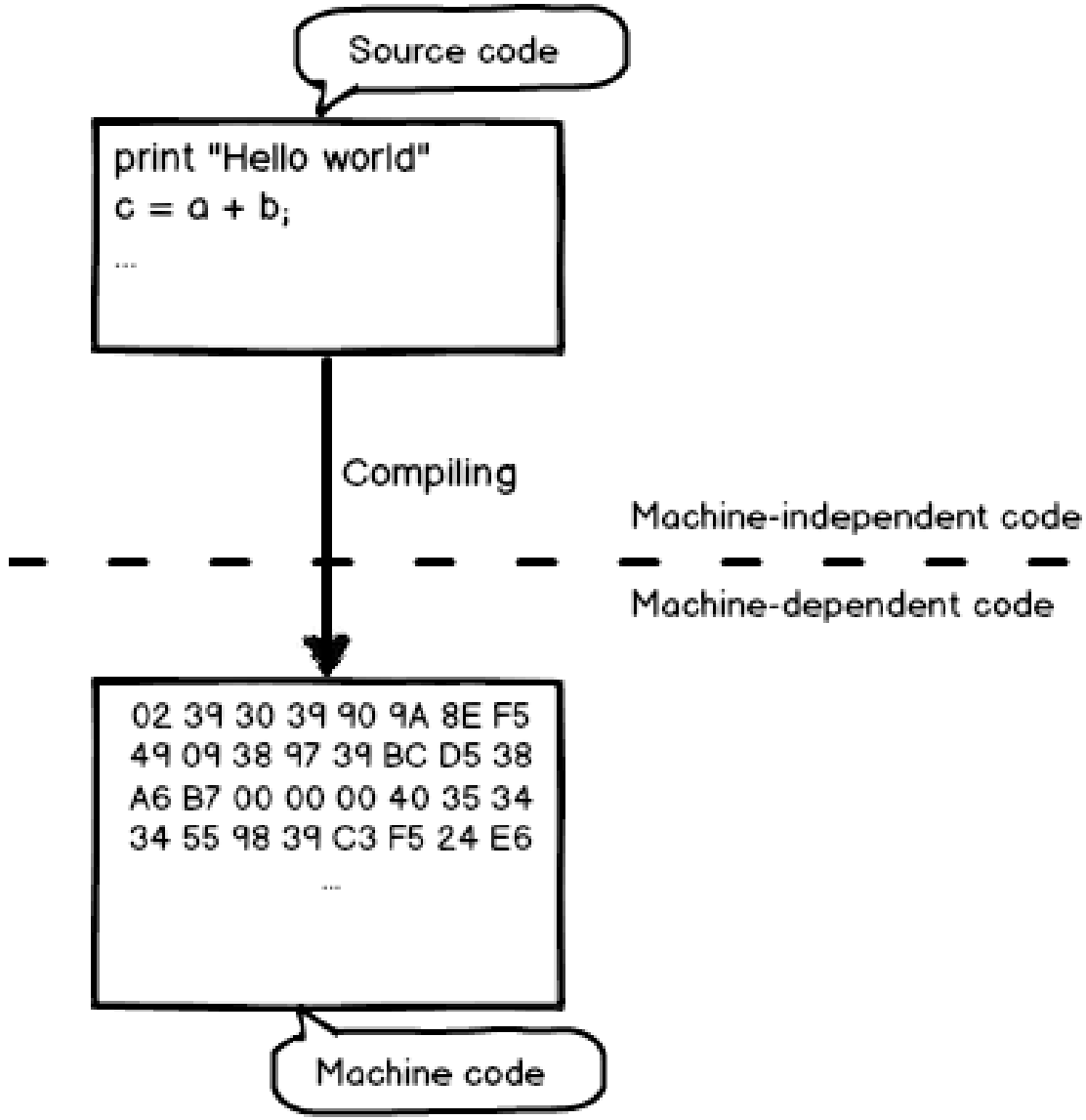
Executable code

How to convert from one form to another?

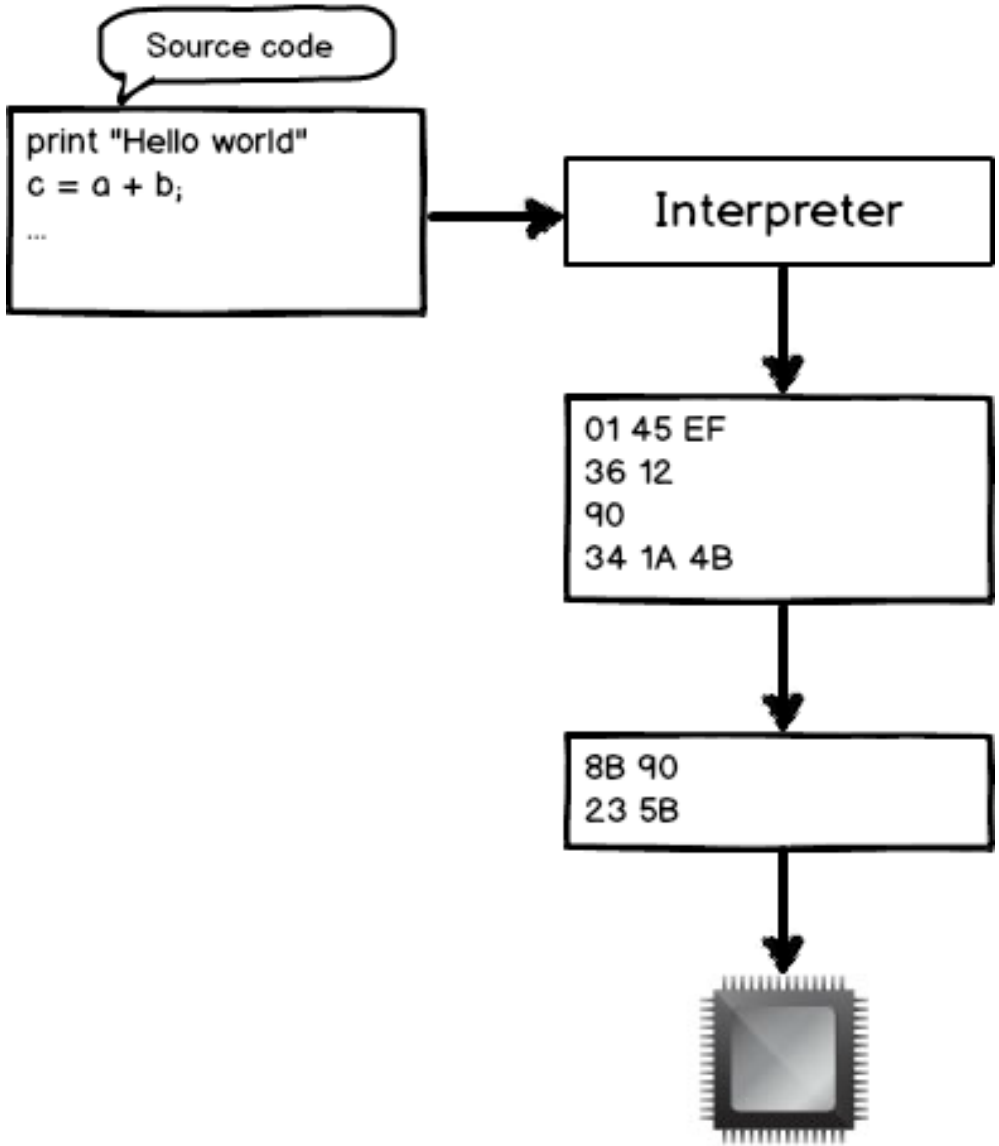
Conversion 1. Compilation

With languages, such as C, C++, Pascal, the whole source code is compiled into executable code **before running the program**



Conversion 2. Interpretation

When using script languages, such as PHP, Javascript the transformation from source code to executable code is done **on the fly**



Compilation vs Interpretation

Compilation:

- Fast execution of the program

Interpretation:

- Portable software

Compilation vs Interpretation

Compilation:

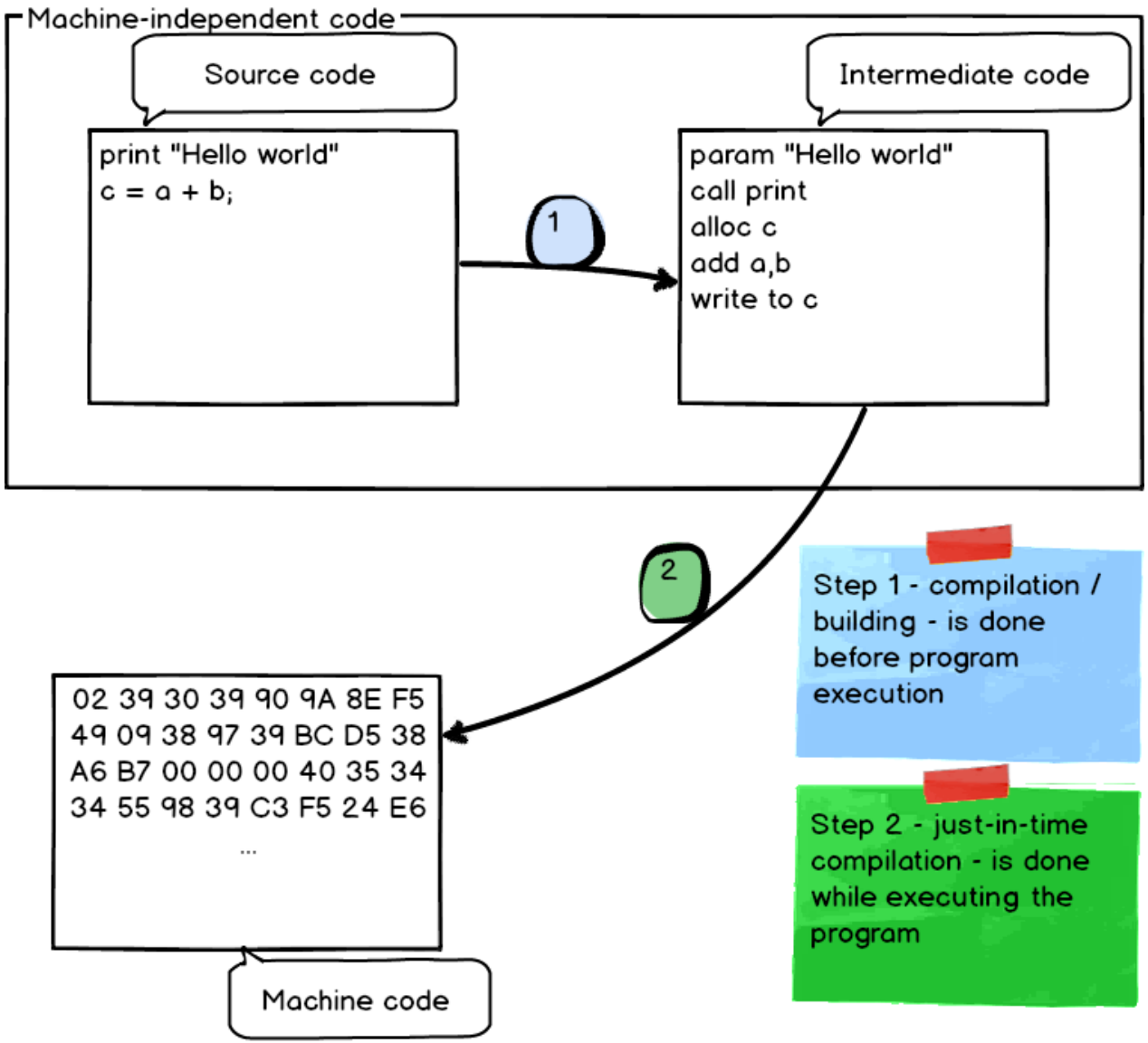
- Fast execution of the program

Interpretation:

- Portable software

Can we combine advantages of both methods?

Intermediate code and just-in-time compilation



Ahead-of-time compilation

Usually applied in the following scenario:

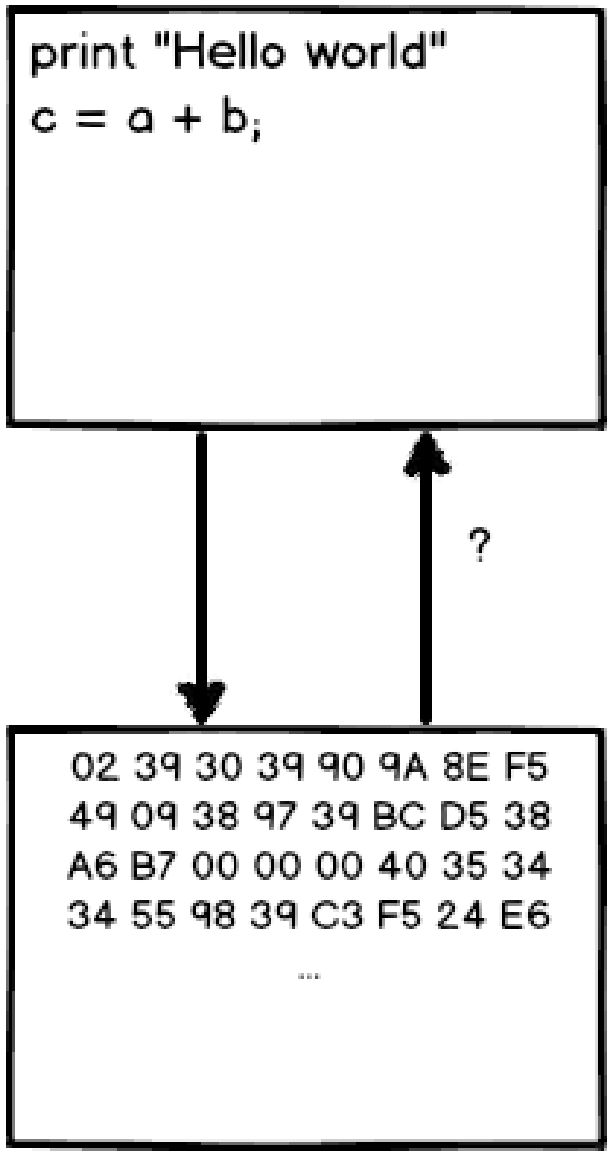
- Management of executable files is mostly controlled by the operating system
- The operating system can be installed on different hardware platforms

Example - modern Android:

- Applications stored in intermediate (byte) code on Google Play
- When installed on a specific device, intermediate code is compiled and saved as a ready-to-run executable
- As the result program execution is much faster

Two-way traffic?

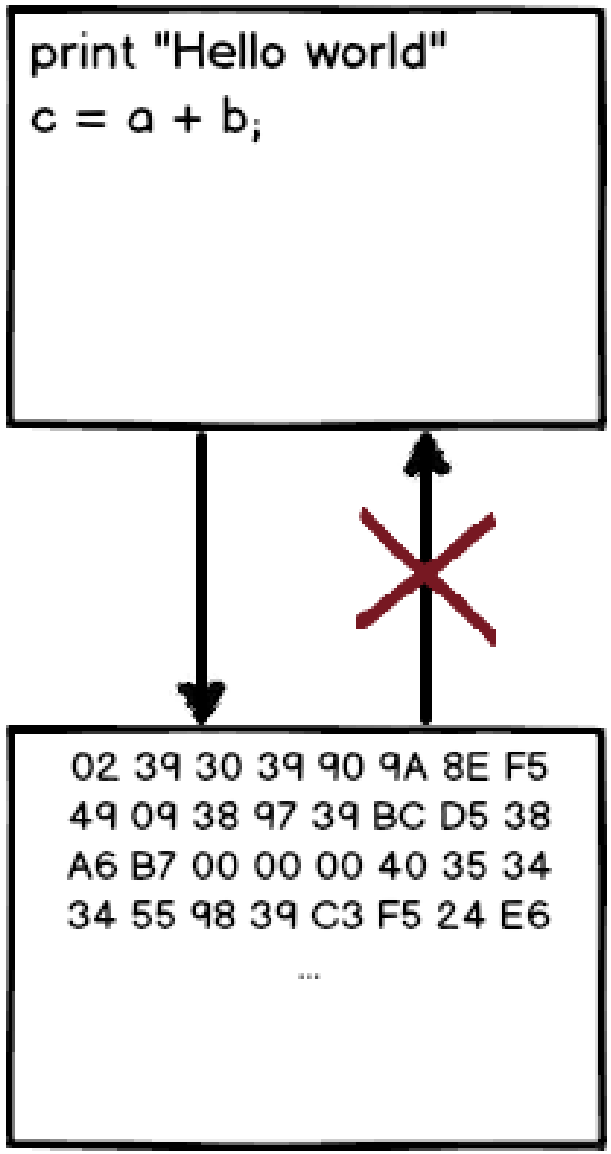
Is there a way to restore the complete source code from an executable?



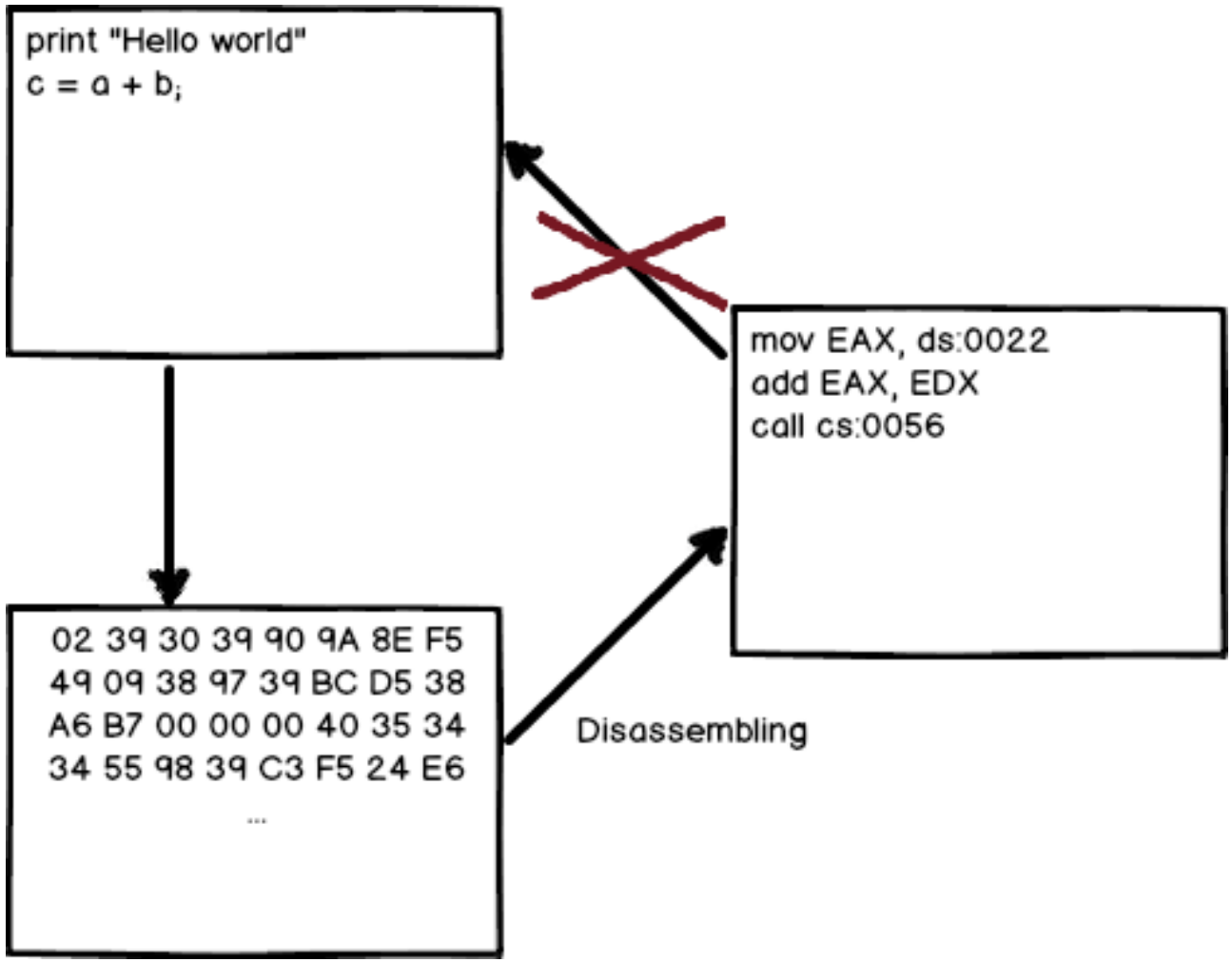
Two-way traffic?

Is there a way to restore the complete source code from an executable?

The answer is no. Most of high-level details (names of variables, functions, classes, etc.) are lost during the conversion.



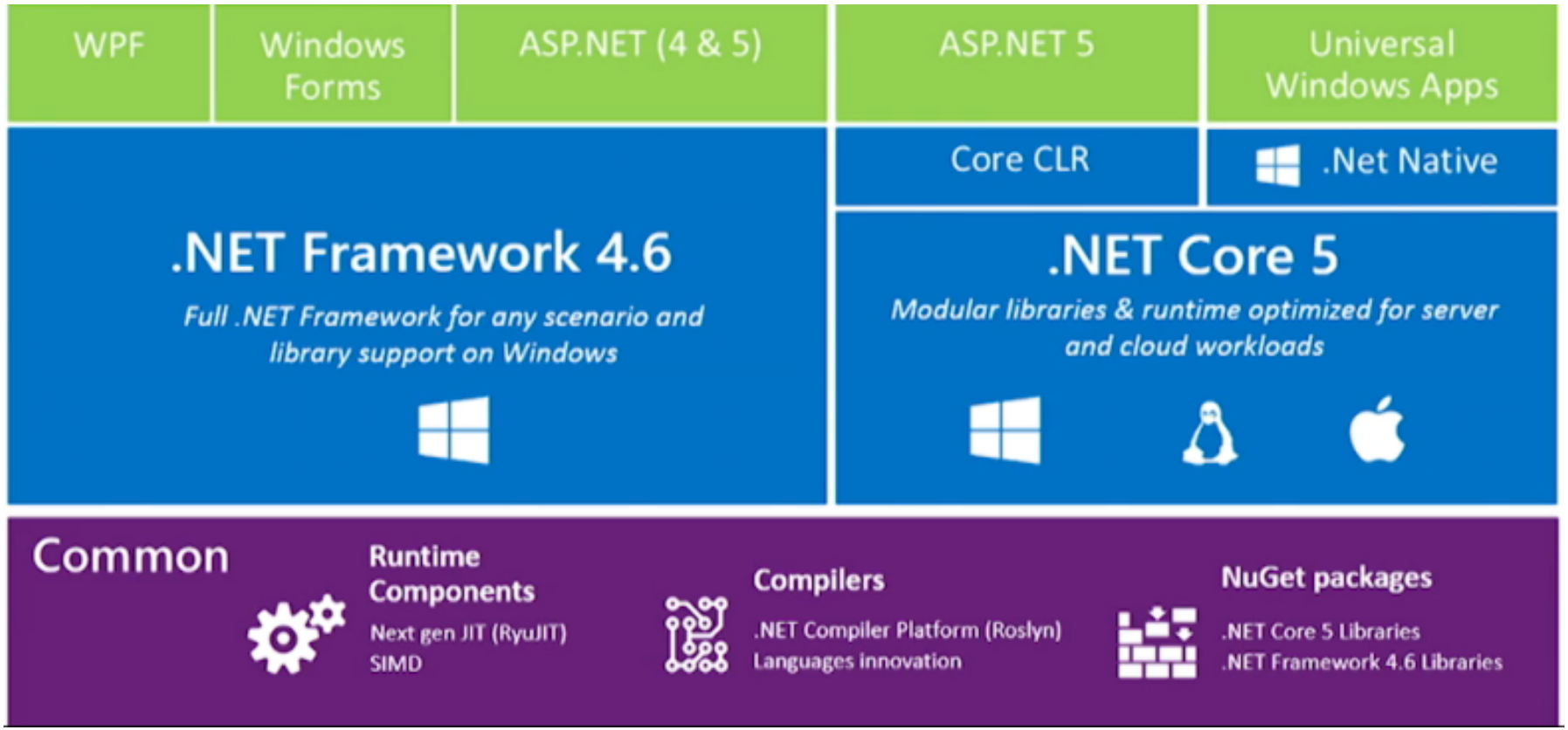
Disassembly



.NET Framework philosophy

- JIT compilation - common runtime engine
- Support for multiple programming languages
- Comprehensive base class library
- Easy coexistence of different application (and library) versions

.NET Framework state-of-the-art



Common Language Runtime (CLR)

The key part of the .NET Framework is the CLR, which is responsible for:

- Just-in-time compilation
- Memory management
- Ensuring type safety
- Exception handling
- Security management

and some other important tasks

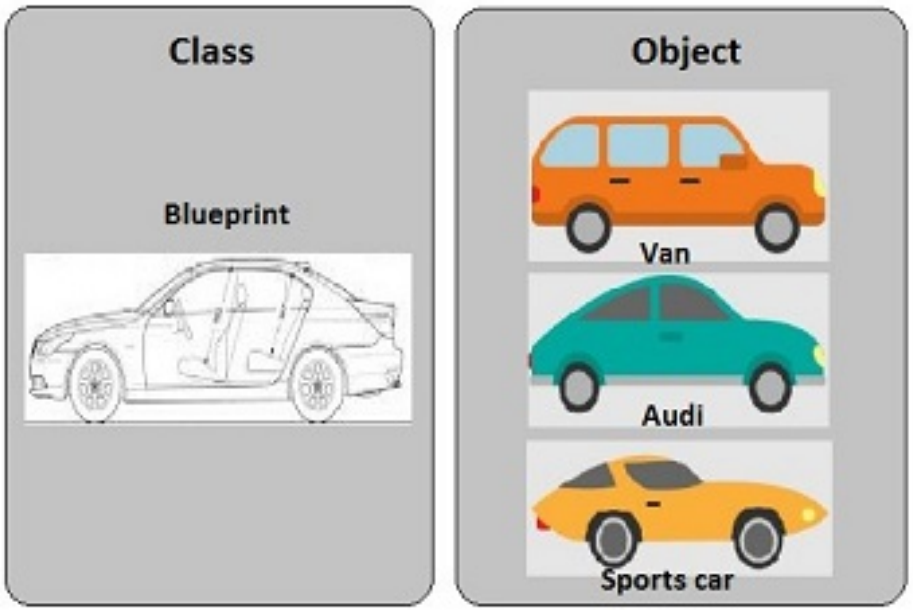
Important concepts from the first part of the course

- Sequential execution, conditions, loops
- Types matter
- Debugging is essential
- Methods (functions) enable better code structure and allow code reuse
- C# Arrays allow to put together related data of the same type
- Names must be meaningful, coding style - consistent

Introducing OOP

Object-oriented programming (OOP) is a powerful paradigm, which is the basis of many modern programming languages, including C#.

The main idea of OOP is to group data and related functionality in a single container, which is called a class.



What can be represented by a class

- Real world entities - Person, Car, House, Animal, etc.
- Processes - Payment, Transfer, Flight
- Containers of related functions - Math, Console

A class is normally declared when the application needs to store information about multiple entities, each having several attributes.

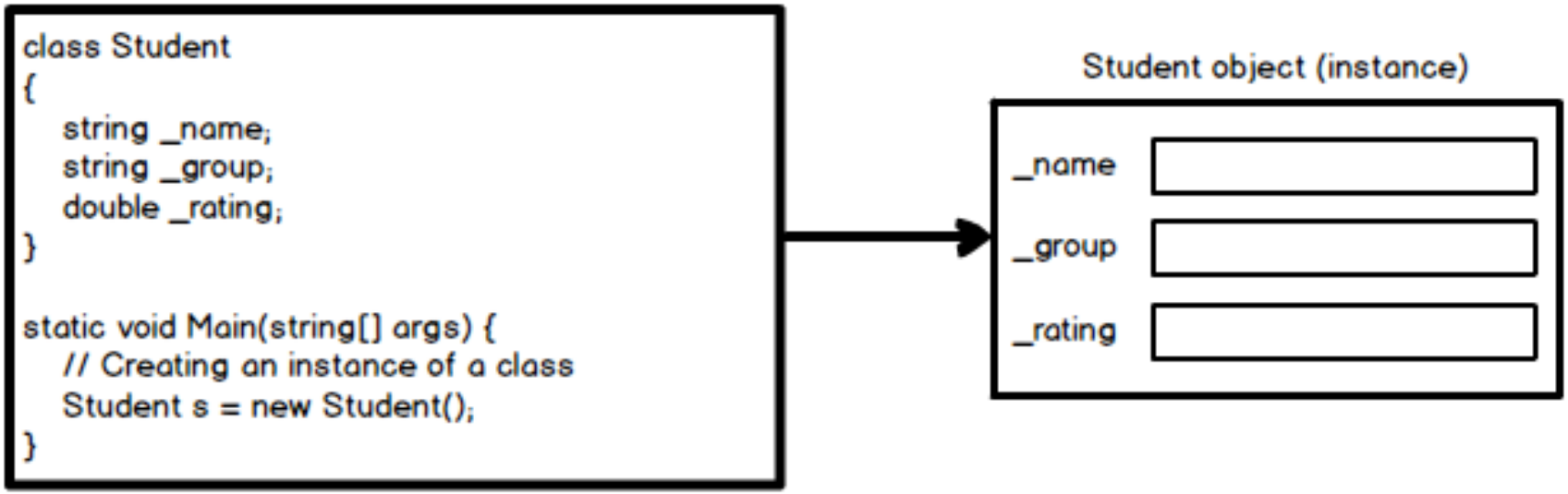
Class or no class?

In which of the following cases would you declare a class?

- To store number of days in each of the 12 months
- To store a date, e.g. 19th October 2017
- To store names of all countries in the world
- To store population of each country in the world

Class data: fields

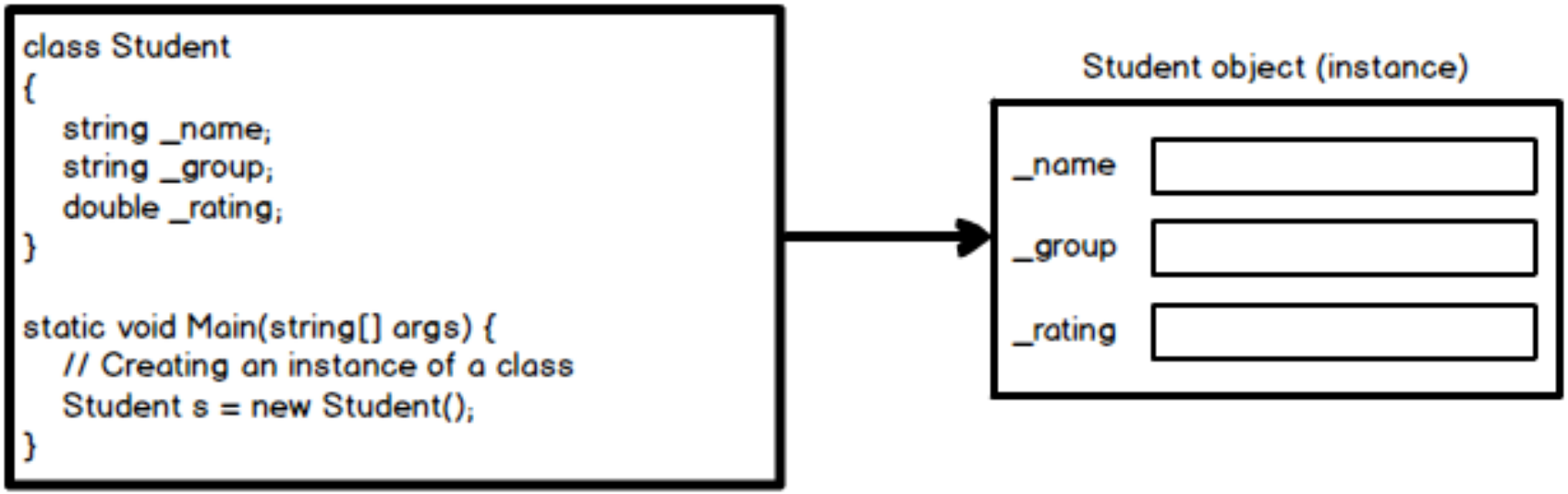
Variables declared inside a class are called fields:



The Student class in the example above has three fields. How to access them?

Class data: fields

Variables declared inside a class are called fields:



The Student class in the example above has three fields. How to access them? - by declaring public methods or properties

Class functionality: methods

```
class Student
{
    string _name;
    string _group;
    double _rating;

    public void SetName(string name) {
        _name = name;
    }
}

static void Main(string[] args) {
    // Creating an instance of a class
    Student s = new Student();
    s.SetName("Vasya");
}
```

Class functionality: properties

```
class Student
{
    string _name;
    string _group;
    double _rating;

    public string Name {
        get {
            return _name;
        }
    }
}

static void Main(string[] args) {
    // Creating an instance of a class
    Student s = new Student();
    // Getting student name and saving it to a local var
    string name = s.Name;
}
```

C# naming conventions 1

Three main styles used for complex names:

- camelCase (first word starts with low letter, all the others with capital)
- _camelCase (camelCase with leading underscore)
- PascalCase (all words forming a name begin with capital letter)

```
class Student {
    string _name;

    public string GetName() {
        return _name;
    }

    public string SetName(string name) {
        _name = name;
    }
}
```