

# Object-oriented programming

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Week 1\_3: OO Design

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# Object-oriented design

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- ❑ Abstract Data Types (ADT)
- ❑ Divide project into a set of cooperating classes
- ❑ Each class has a very specific functionality
- ❑ Think of a class as similar to a data type
- ❑ Class can be used to create instances of objects

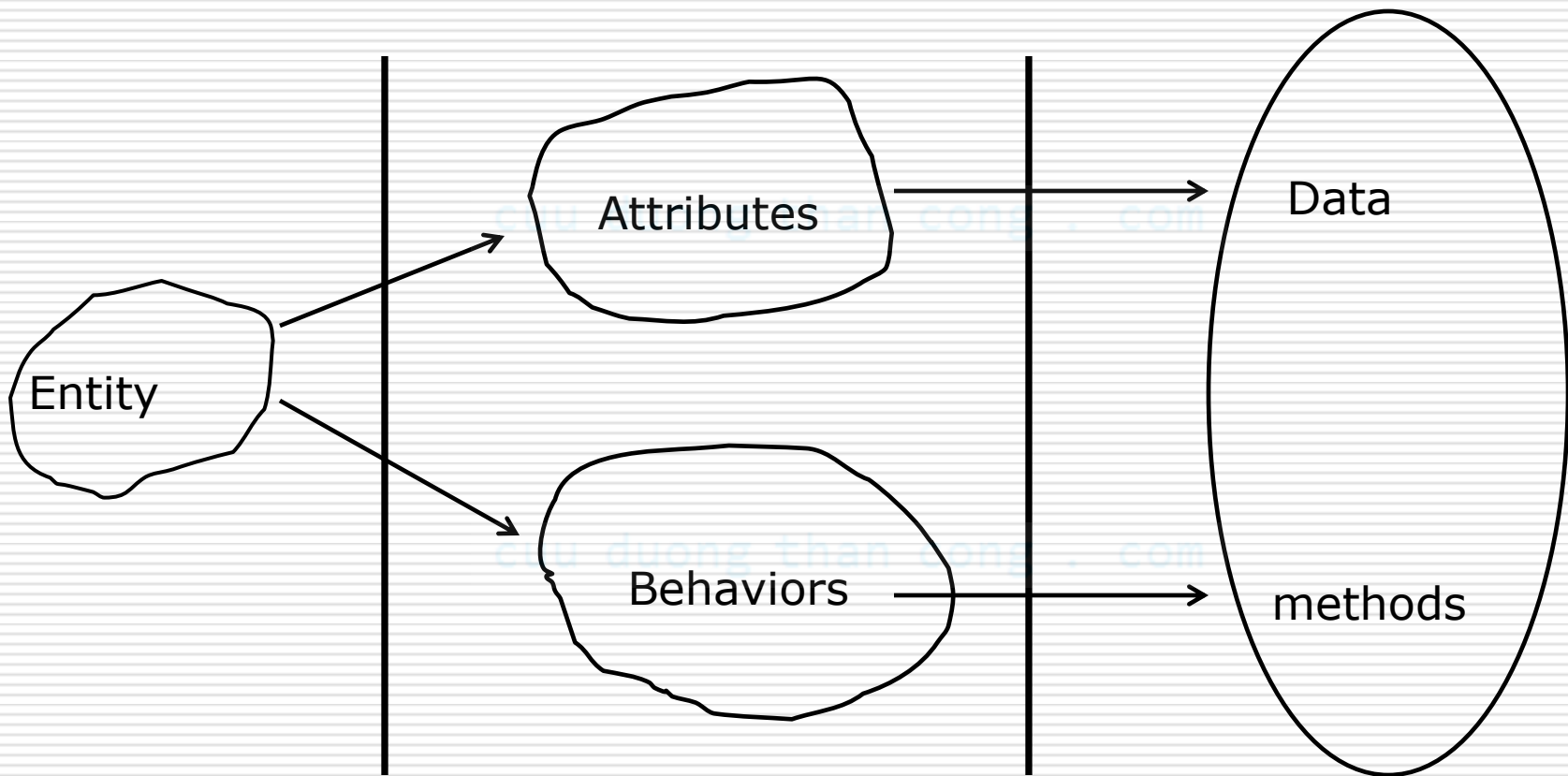
# Mapping the real world to software

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**Real world**

**Abstraction**

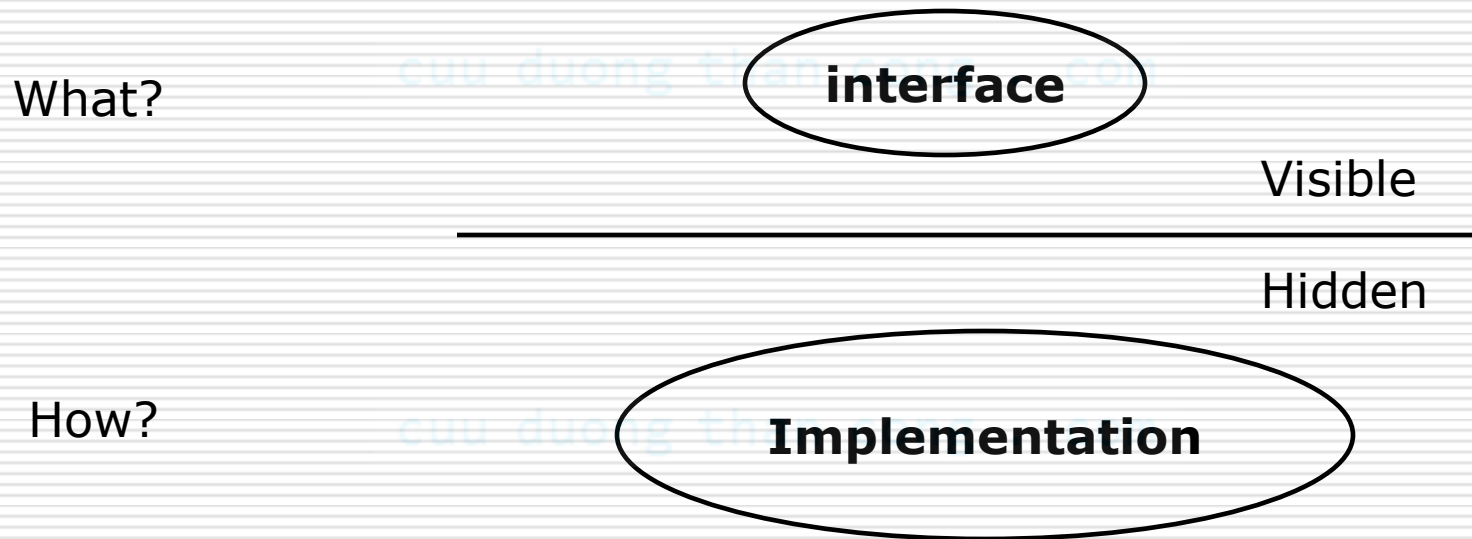
**Software**



# Classes in OO Programming

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- ❑ Separation interface from implementation



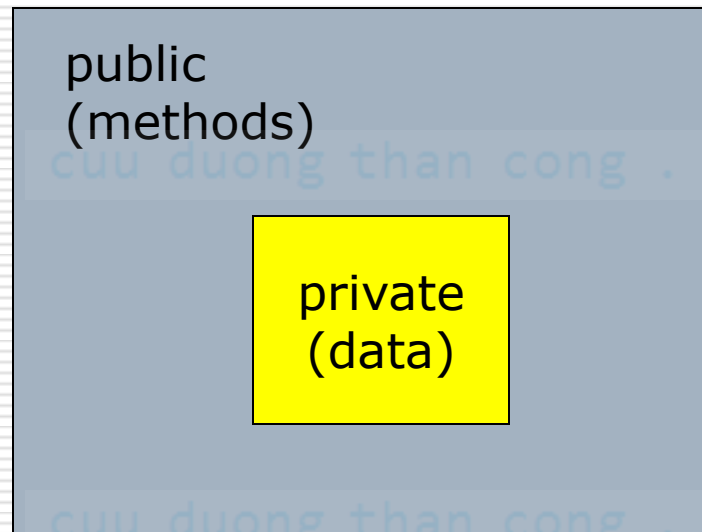
# Structure of a class

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- ❑ A class models an entity in real world
- ❑ A class represents all members of a group of objects
- ❑ A class provides a public interface and a private implementation
- ❑ Hiding the data and “algorithm” from the user

# Structure of a class

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**class**

# Designing process

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- ❑ Identifying classes
- ❑ Identifying behaviors
  - Decide whether behavior is accomplished by a single class or through the collaboration of a number of "related" classes
  - Static behavior: behavior always exists
  - Dynamic behavior: depending of when/how a behavior is invoked, it might or might not be legal

# Identifying classes

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## ☐ Abbott and Booch:

- use nouns, pronouns, noun phrases to identify objects and classes
- Note: not all nouns are really going to relate to objects

## ☐ Coad and Yourdon:

- identify individual or group "things" in the system/problem

## ☐ Ross: common object categories: people, places, things, organizations, concepts, events



# Class

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- A class should:
  - be a real-world entity
  - be important to the discussion of the requirements
  - have a crisply defined boundary
  - make sense; (i.e. can identify the attributes and behaviors)
  - closely related

# Object

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- An “object” is an **instance of a class**
  - Just like a “variable” is an instance of a specific data type
- We can zero or more variables (or objects) in our programs

# Class and object

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- ❑ A class is a blueprint for an object.
- ❑ When you instantiate an object, you use a class as the basis for how the object is built.
- ❑ A class can be thought of as a sort of higher-level data type. For example:  
`myClass myObject;`

# Class and object

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- ❑ Each object has its own attributes and behaviours .
- ❑ A class defines the attributes and behaviours that all objects created with this class will possess.
- ❑ Classes are pieces of code.
- ❑ Objects are created from classes,

# Class declaration in C++

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```
class    <Name of the class>
{
    public:
        <public attributes and methods>
    private:
        <private attributes and methods>
};
```

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# Scope

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- ❑ **private**: only visible to methods of the class itself.
- ❑ **public**: can be use from inside of the class or any client outside

# An example

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```
class Date
{
    public:
        Date();
        Date(int iNewDay, int iNewMonth, int iNewYear);
        int    getDay();    // return day
        int    getMonth();  // return month
        int    getYear();   // return year
        ...
    private:
        int    iDay, iMonth, iYear;
};
```

# Scope resolution operator ::

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- ❑ Tell the compiler the method or attribute belongs to a certain object

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For example:

```
Date::getDay()
```

```
Date::getMonth()
```

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# Separation declaration from definition

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```
//keep in 1 file
class Date
{
    public:
        int    getDay();

    private:
        ...
};

int    Date::getDay()
{
    return iDay;
}
```

```
// header file .h
class Date
{
    public:
        int    getDay();
    private:
        ...
};

// implementation file .cpp
int    Date::getDay()
{
    return iDay;
}
```

# How to use the Date class

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```
int main()
{
    Date today(20, 10, 2008);
    Date tomorrow, someDay;

    //can I do this?
    cout << today.iMonth;
    //how about this?
    cout << today.getMonth();
    ...
}
```

# Encapsulation and data hiding

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## □ Encapsulation:

- A C++ class provides a mechanism for packaging data and the operations that may be performed on that data into a single entity

## □ Information Hiding

- A C++ class provides a mechanism for specifying access

# Taxonomy of member functions

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- The types of member functions may be classified in a number of ways. A common taxonomy:
  - **Constructor:** an operation that creates a new instance of a class [than cong . com](https://fb.com/tailieudientucntt)
  - **Mutator:** an operation that changes the state of of the data members of an object
  - **Observer:** an operation that reports the state of the data members (aka Accessors, Getters)
  - **Iterator:** an operation that allows processing of all the components of a data structure sequentially

# Exercises

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- List member functions of the following classes:
  - Date
  - Fraction with numerator and denominator
  - Employee