Encapsulation and Inheritance

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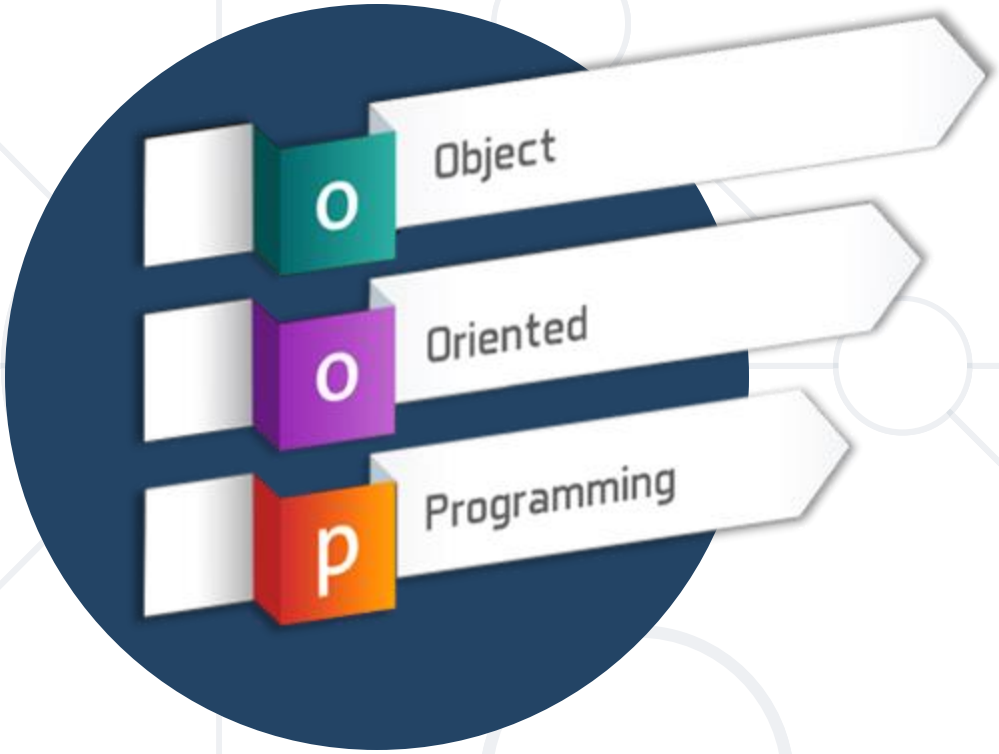


OOP Principles

Encapsulation, Inheritance, Abstraction, Polymorphism

The Principles of OOP

- Classical **principles** of the object-oriented programming (OOP):
  - **Encapsulation**: objects keep its state **private** (no direct access)
  - **Inheritance**: child classes **inherit** data + functionality from a parent
  - **Abstraction**: hide complexity behind an **interface** or **abstract class**
  - **Polymorphism**: use subclass objects through their base class

Encapsulation

Hiding Implementation

Encapsulation

- Process of wrapping code and data together into a **single unit**
- Flexibility and extensibility of the code
- Reduces **complexity**
- Structural changes remain **local**
- Allows **validation** and **data binding**

Encapsulation – Example

- Fields should be **private**

```
Person
-name: string
-age: int
+Person(string name, int age)
+Name: string
+Age: int
```

- == private

+ == public

- Properties should be **public**

Keyword This

- Reference to the **current object**
- Refers to the **current instance** of the class
- Can be passed as a **parameter to other methods**
- Can be **returned** from method
- Can invoke **current class methods**

Visibility of Class Members

Access Modifiers

Private Access Modifier

- It's the main way to perform encapsulation and hide
  data from the outside world

```
private string name;
Person (string name) {
  this.name = name;
}
```

- The default field and method modifier is **private**

Public Access Modifier

- The most **permissive** access level
- There are **no restrictions** on accessing public members

```
public class Person {
  public string Name { get; set; }
  public int Age { get; set; }
}
```

- To access class directly from a namespace use the **using** keyword to include the namespace

Internal Access Modifier

- **Internal** is the **default** class access modifier

```
class Person {
    internal string Name { get; set; }
    internal int Age { get; set; }
}
```

- Accessible to any other class in the same project

```
Team rm = new Team("Real");
rm.Name = "Real Madrid";
```

Validation

Validation (1)

- Setters are a good place for simple **data validation**

```
public double Salary {
  get { return this.salary }
  set {
    if (value < 650)
      throw new ArgumentException("...");
    this.salary = value; }
}
```

Throw **exceptions**

- Callers of your methods should take care of **handling** exceptions

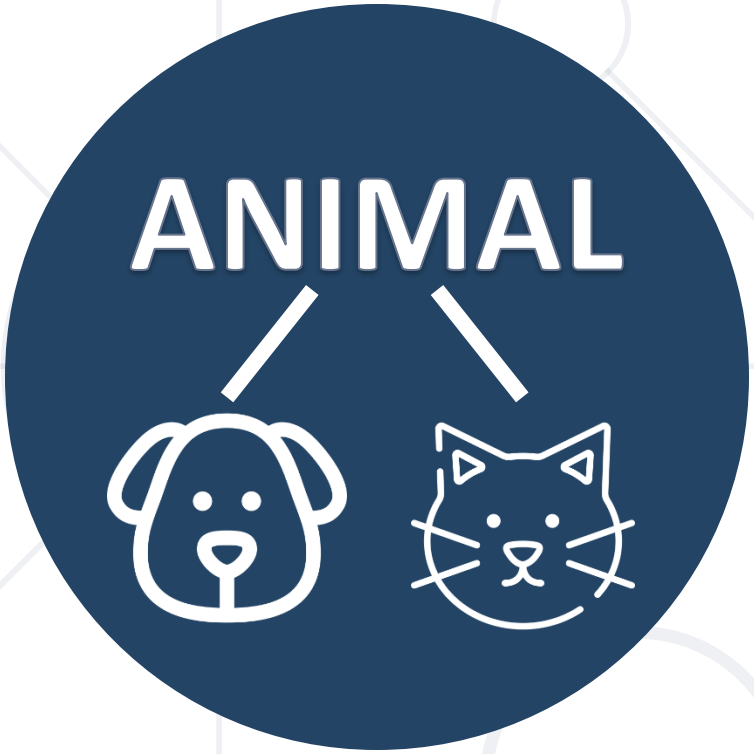
Validation (2)

- Constructors use **private setters** with validation logic

```
public Person(string firstName, string lastName,
              int age, double salary) {
  this.FirstName = firstName;
  this.LastName = lastName;
  this.Age = age;
  this.Salary = salary;
}
```

Validation happens inside the setter

- Guarantee **valid state** of the object after its creation

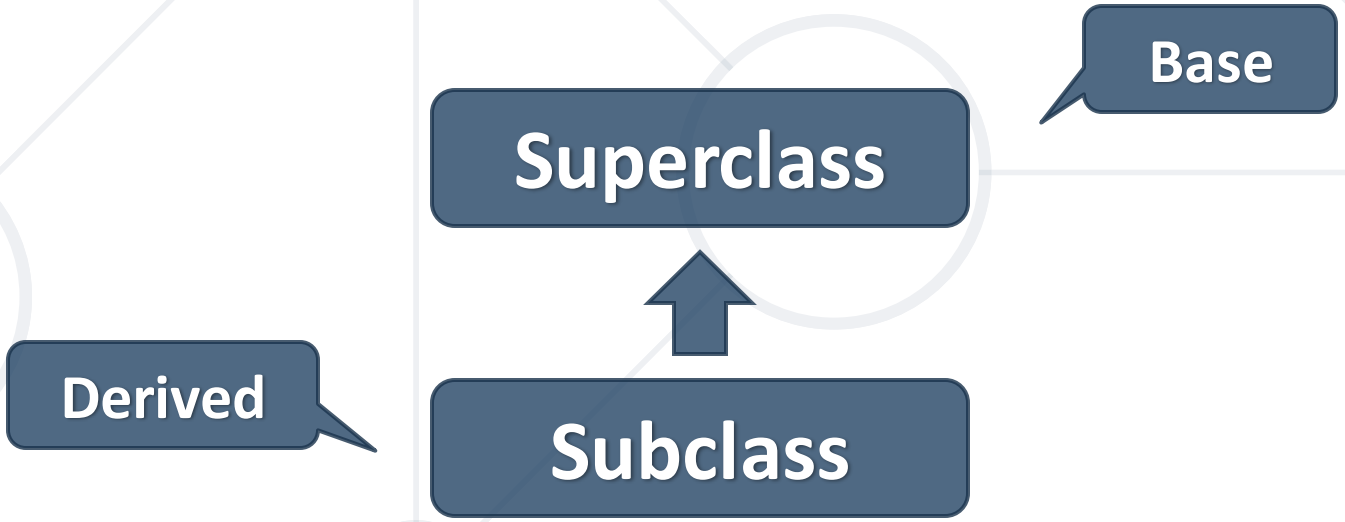


Inheritance

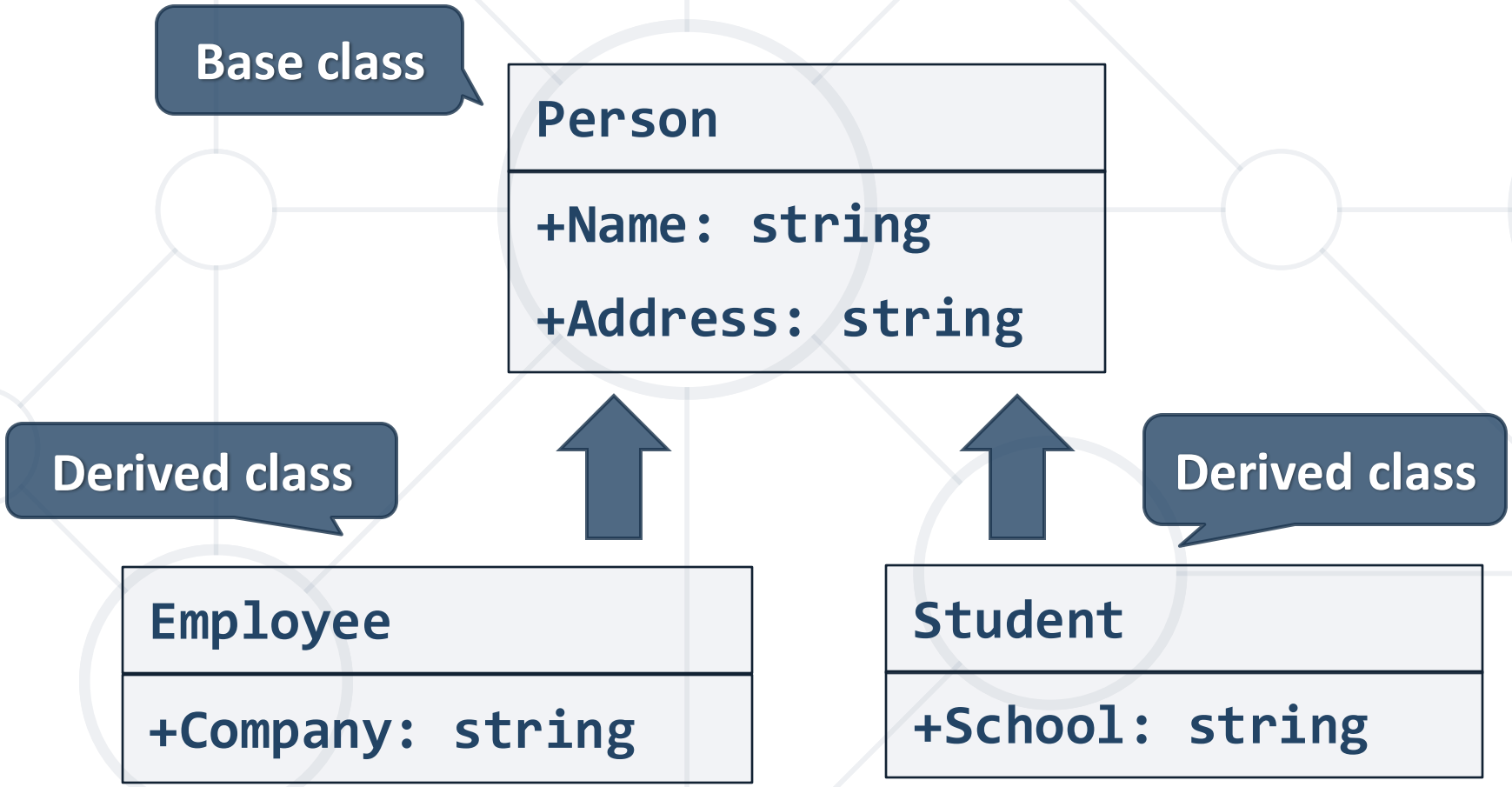
Extending Classes

Inheritance

- **Superclass** - Parent class, Base Class
  - The class giving its **members** to its **child class**
- **Subclass** - **Child** class, **Derived class**
  - The class taking members from its base class



Inheritance – Example



Accessing Base Class Members

Access to Base Class Members

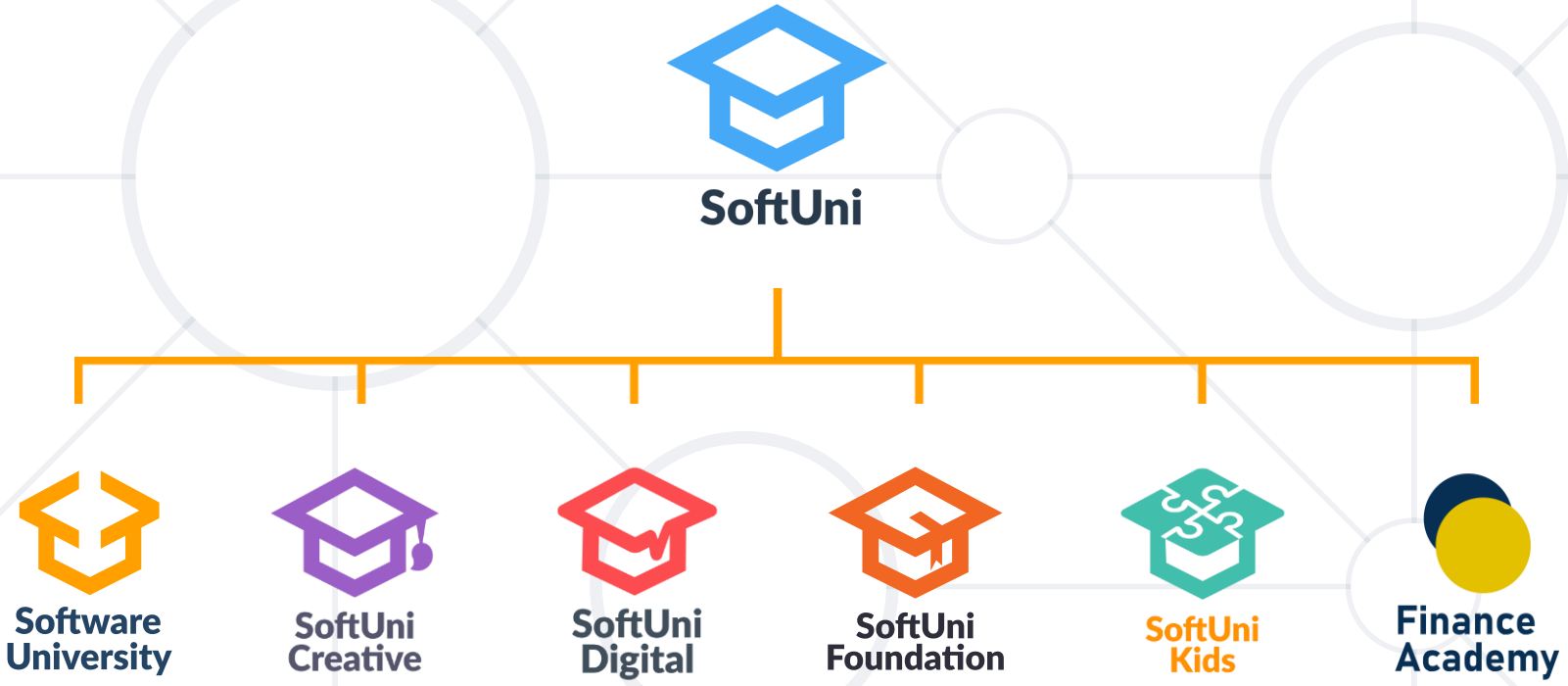
- Use the **base** keyword

```
class Person { … }
class Employee : Person
{
  public void Dismiss(string reasons)
  {
    Console.Writeline($"{base.name} got fired because of {reasons}");
  }
}
```

Summary

- Encapsulation:
  - Hides **implementation**
  - Reduces **complexity**
  - Ensures that structural changes remain local
- Inheritance is a powerful tool for **code reuse**

Questions?



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