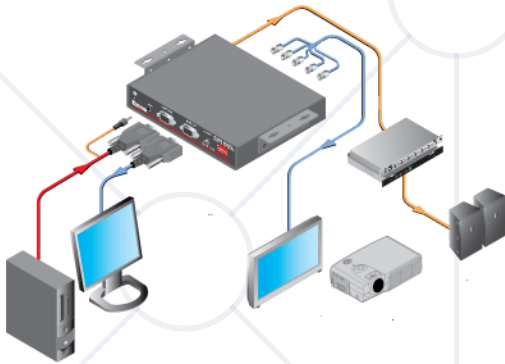


Interfaces and Abstraction

Interfaces vs Abstract Classes
Abstraction vs Encapsulation



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#java-advanced

1. Abstraction

- Abstraction vs Encapsulation

2. Interfaces

- Default Methods
- Static Methods

3. Abstract Classes

4. Interfaces vs Abstract Classes





Abstraction

What is Abstraction?

- Latin origin



- **Preserving** information that is **relevant** in a context
- **Forgetting** information that is **irrelevant** in that context



- **Abstraction** means ignoring **irrelevant** features, properties, or functions and emphasizing the **relevant ones ...**



"Relevant" to what?

- **... relevant** to the **context** of the **project** we develop
- Abstraction helps **manage** complexity
- Abstraction lets you focus on **what the** object does instead of **how it does it**

- There are 2 ways to achieve abstraction in Java
 - Interfaces (**100% abstraction**)
 - Abstract class (**0% - 100% abstraction**)

```
public interface Animal {}  
public abstract class Mammal {}  
public class Person extends Mammal implements Animal {}
```

Abstraction vs. Encapsulation

■ Abstraction

- Process of **hiding** the **implementation details** and showing only functionality to the user
- Achieved with **interfaces** and **abstract classes**

■ Encapsulation

- Used to **hide** the **code** and **data** inside a **single unit** to **protect** the data from the outside world
- Achieved with **access modifiers** (private, protected, public)





Interfaces

- Internal addition by a compiler

Keyword

Public or default
modifier

```
public interface Printable {  
    int MIN = 5;  
    void print();  
}
```

Name

compiler

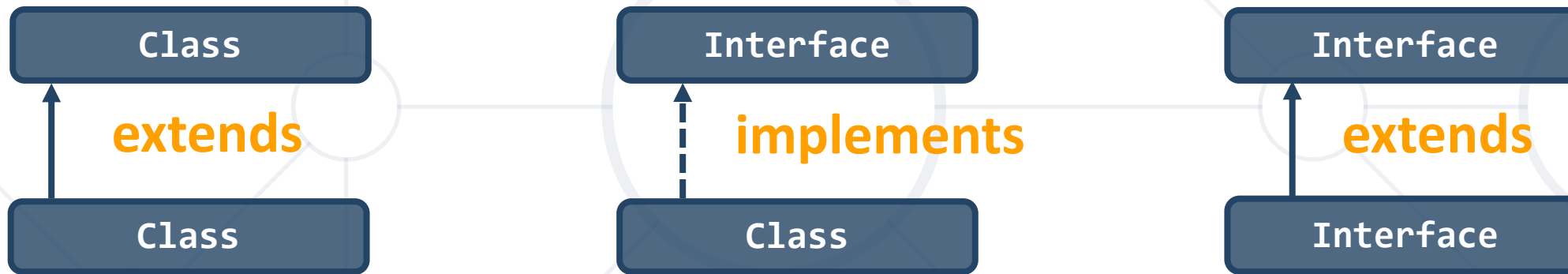
"public static final"
before fields

"public" before
methods

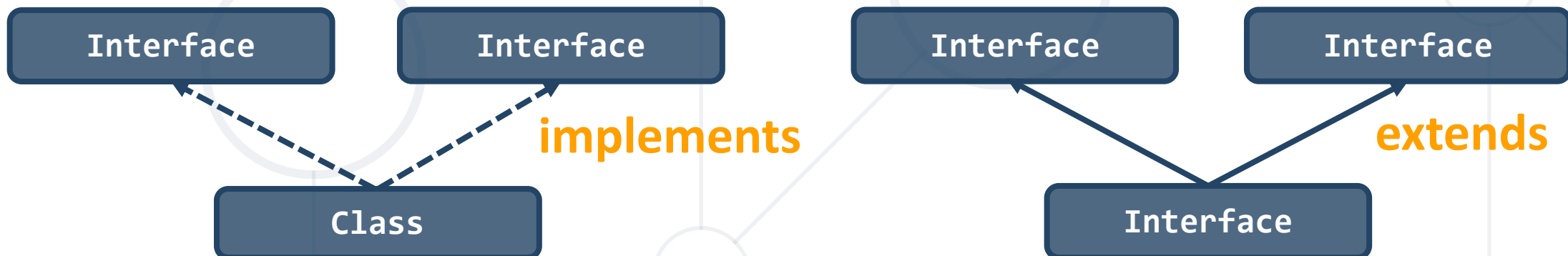
```
interface Printable {  
    public static final int MIN = 5;  
    public void print();  
}
```

Implements vs Extends

- Relationship between classes and interfaces



- Multiple inheritances



- Implementation of **print()** is provided in class **Document**

```
public interface Printable {  
    void print();  
}
```

```
class Document implements Printable {  
    public void print() { System.out.println("Hello"); }  
    public static void main(String args[]) {  
        Printable doc = new Document();  
        doc.print(); // Hello  
    }  
}
```

Polymorphism

Problem: Car Shop

Serializable

<<interface>>
<<Car>>

+TIRES: Integer

+getModel(): String

+getColor(): String

+getHorsePower(): Integer

Seat

-countryProduced: String

+toString(): String



Solution: Car Shop (1)

```
public interface Car {  
    int TIRES = 4;  
    String getModel();  
    String getColor();  
    Integer getHorsePower();  
    String countryProduced();  
}
```

Solution: Car Shop (2)

```
public class Seat implements Car, Serializable {  
    // TODO: Add fields, constructor and private methods  
    @Override  
    public String getModel() { return this.model; }  
    @Override  
    public String getColor() { return this.color; }  
    @Override  
    public Integer getHorsePower() { return this.horsePower; }  
}
```

- The interface can **extend another interface**

```
public interface Showable {  
    void show();  
}
```



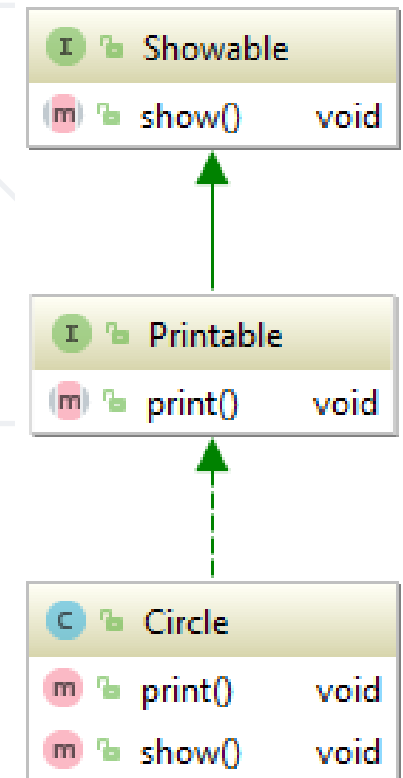
```
public interface Printable extends Showable {  
    void print();  
}
```


Extend Interface

- The class which implements **child** interface **must** provide an implementation for **parent** interface too

```
class Circle implements Printable
public void print() {
    System.out.println("Hello");
}

public void show() {
    System.out.println("Welcome");
}
```



Problem: Car Shop Extended

- Refactor your first problem code
 - Add interface **Rentable** for rentable cars
 - Add interface **Sellable** for sellable cars
 - Add class **Audi**, which **extends CarImpl** and **implements** rentable
 - Refactor class **Seat** to **extends CarImpl** and **implements** rentable

Solution: Car Shop Extended (1)

```
public interface Sellable extends Car {  
    Double getPrice();  
}
```

```
public interface Rentable extends Car {  
    Integer getMinRentDay();  
    Double getPricePerDay();  
}
```

Solution: Car Shop Extended (2)

```
public class Audi extends CarImpl implements Rentable {  
    public Integer getMinRentDay() {  
        return this.minDaysForRent; }  
    public Double getPricePerDay() {  
        return this.pricePerDay; }  
    // TODO: Add fields, toString() and Constructor  
}
```

- Since Java 8 we can have a **method body** in the **interface**

```
public interface Drawable {  
    void draw();  
    default void msg() {  
        System.out.println("default method:");  
    }  
}
```

- If you need to **override** the default method think about your **design**

- Implementation is **not needed** for **default methods**

```
class TestInterfaceDefault {  
    public static void main(String args[]) {  
        Drawable d = new Rectangle();  
        d.draw();    // drawing rectangle  
        d.msg();     // default method  
    }  
}
```

- Since Java 11, we can have a **static method** in the **interface**

```
public interface Drawable {  
    void draw();  
    static int cube(int x) { return x*x*x; }  
}
```

```
public static void main(String args[]) {  
    Drawable d = new Rectangle();  
    d.draw();  
    System.out.println(Drawable.cube(3)); } // 27
```

Problem: Say Hello

- Design a project, which has
 - **Interface** for Person
 - 3 implementations for different nationalities
 - Override where needed

```
<<interface>>  
<<Person>>  
  
+getName(): String  
+sayHello():String
```

```
<<Person>>  
Bulgarian
```

```
-name: String
```

```
+sayHello(): String
```

```
<<Person>>  
European
```

```
-name: String
```

```
<<Person>>  
Chinese
```

```
-name: String
```

```
+sayHello(): String
```

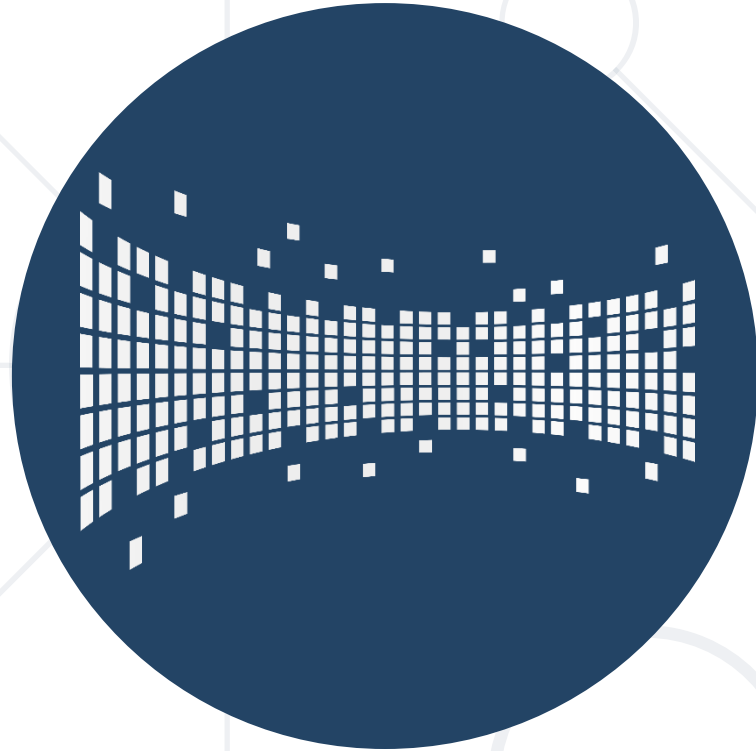

Solution: Say Hello (1)

```
public interface Person {  
    String getName();  
    default String sayHello() { return "Hello"; }  
}
```

```
public class European implements Person {  
    private String name;  
    public European(String name) { this.name = name; }  
    public String getName() { return this.name; }  
}
```

Solution: Say Hello (2)

```
public class Bulgarian implements Person {  
    private String name;  
    public Bulgarian(String name) {  
        this.name = name;  
    }  
    public String getName() { return this.name; }  
    public String sayHello() { return "Здравей"; }  
}  
  
// TODO: implement class Chinese
```



Abstract Classes

Abstract Class

- 
- **Cannot** be instantiated
 - May contain **abstract methods**
 - Must provide an **implementation** for all **inherited** interface members
 - Implementing an interface might map the interface methods onto **abstract** methods

```
public abstract class Animal {  
}
```

Abstract Methods

- Declarations are only permitted in **abstract classes**
- Bodies must be **empty** (no curly braces)
- An abstract method declaration provides **no** actual implementation:

```
public abstract void build();
```





Interfaces vs Abstract Classes

Interface vs Abstract Class (1)

- Interface

- A class may **implement several interfaces**
- **Cannot have access modifiers**, everything is assumed as public

- Abstract Class (AC)

- May **inherit only one abstract** class
- **Provides implementation** and/or just the **signature** that has to be overridden
- Can **contain access modifiers** for the fields, functions, properties



Interface vs Abstract Class (2)

- Interface

- If we add a **new method** we must **track down all the implementations** of the interface and **define implementation** for the new method

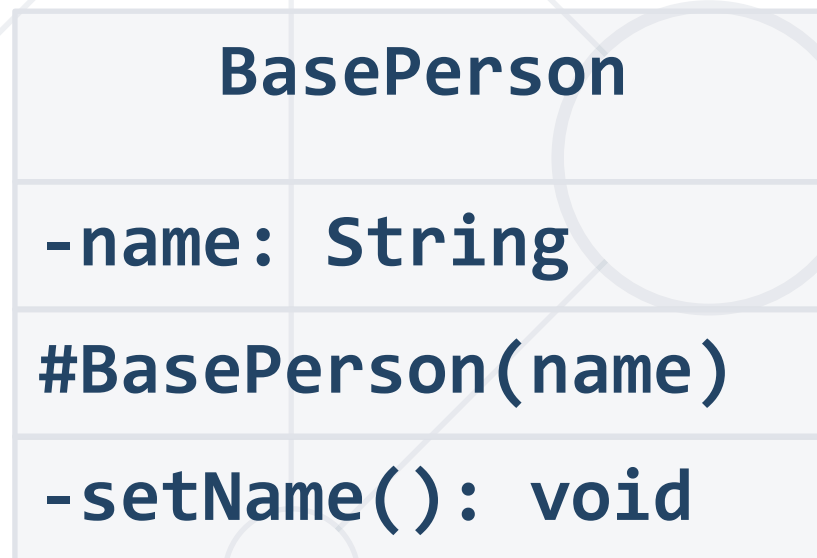
- Abstract Class

- Fields and constants **can be defined**
- If we add a **new method** we have the option of providing a **default implementation**



Problem: Say Hello Extended

- Refactor the code from the last problem
- Add **BasePerson abstract class**
 - In which move all **code duplication** from European, Bulgarian, Chinese



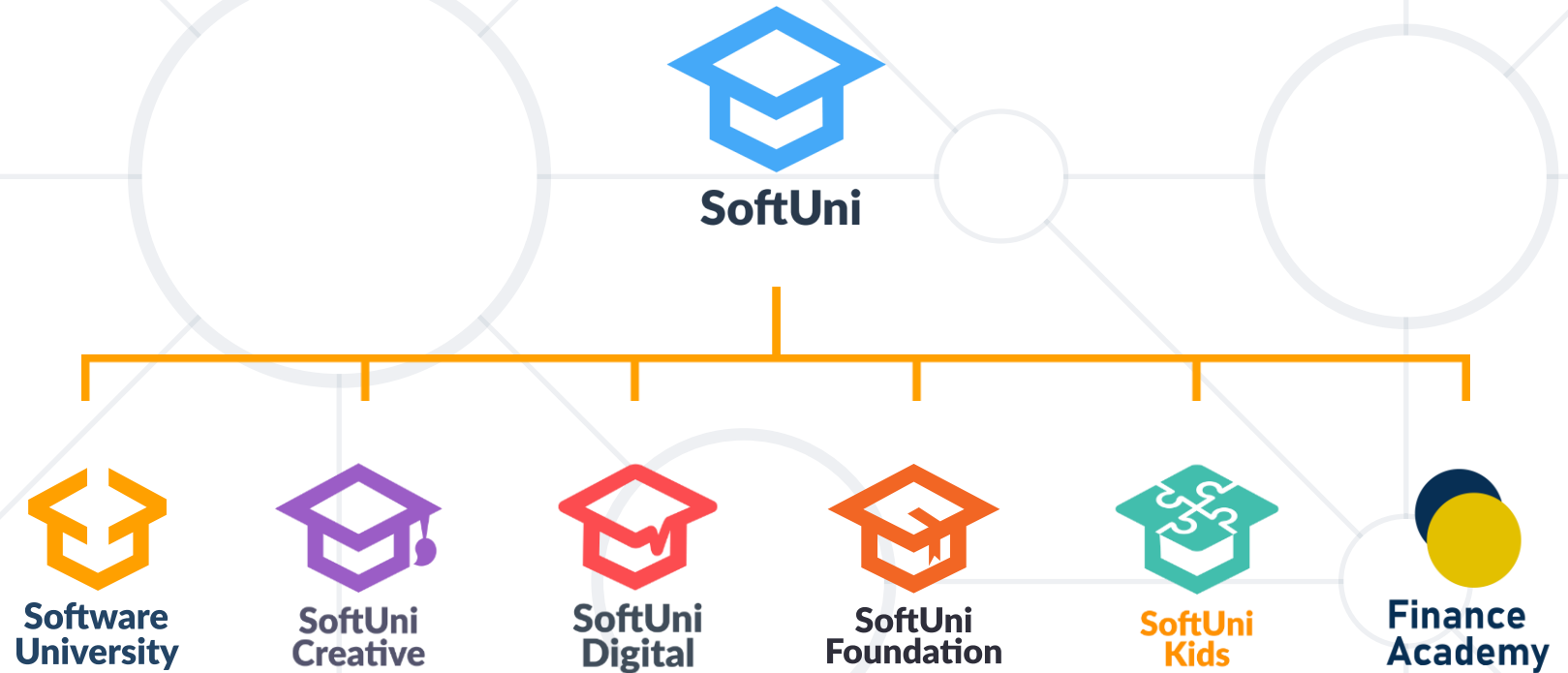
Solution: Say Hello Extended

```
public abstract class BasePerson implements Person {  
    private String name;  
    protected BasePerson(String name) {  
        this.setName(name);  
    }  
    private void setName(String name) { this.name = name; }  
    @Override  
    public String getName() {  
        return this.name;  
    }  
}
```

- Abstraction – **hiding** implementation and **showing** functionality
- Interfaces
 - **implements** vs **extends**
 - Default and Static methods
- Abstract classes
- Interfaces vs Abstract Classes



Questions?



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