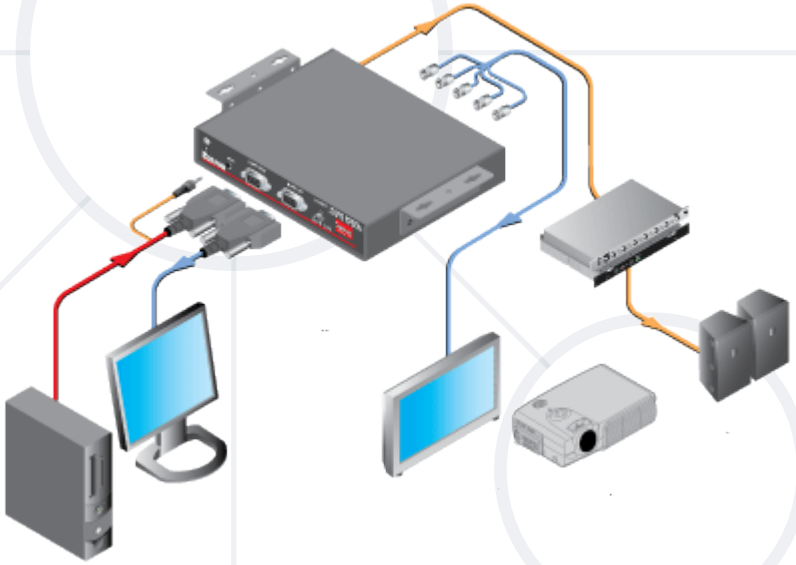
Interfaces and Abstraction

Interfaces vs Abstract Classes
Abstraction vs Encapsulation



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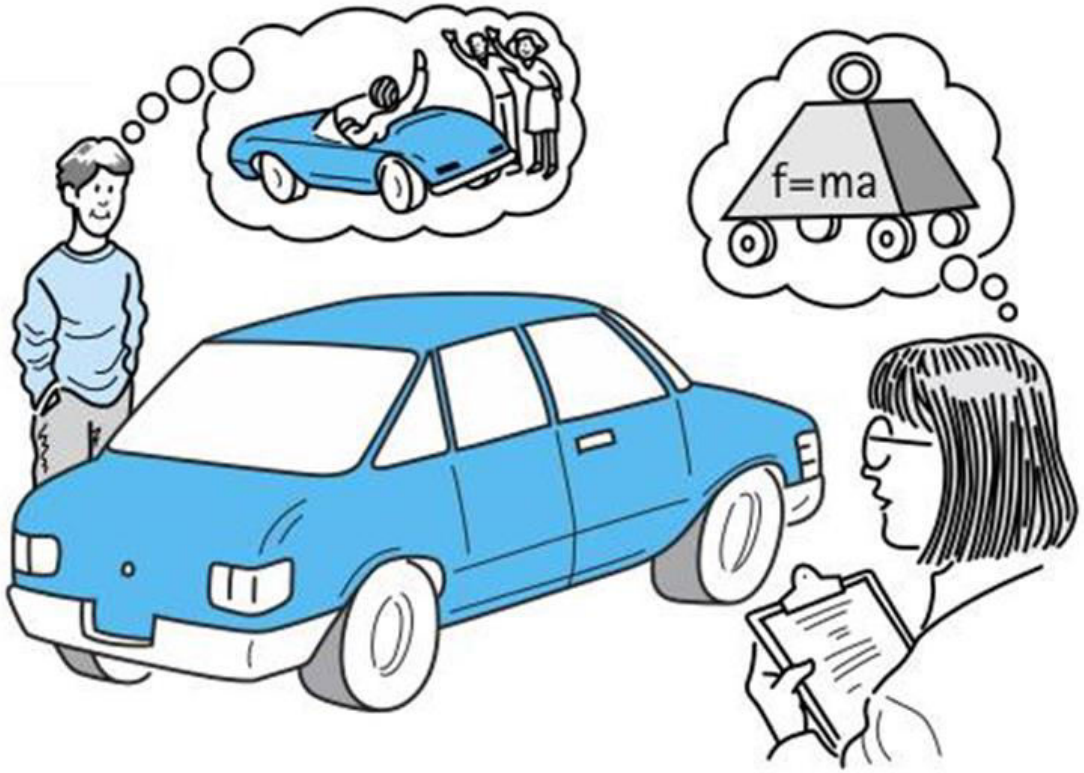
#java-advanced

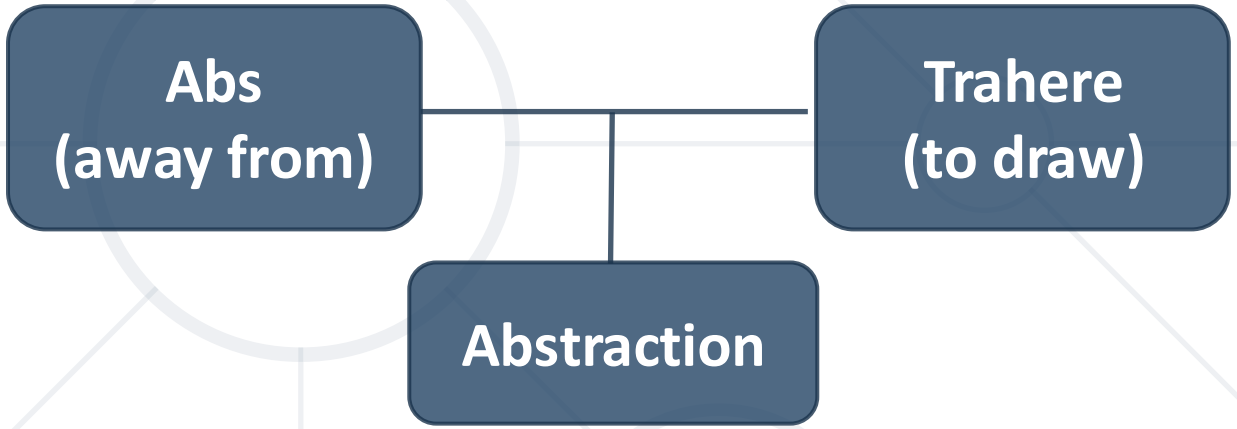


Abstraction

Working with Abstraction

What is Abstraction?

- From the Latin



- **Preserving information** that is **relevant** in a given context, and **forgetting information** that is **irrelevant** in that context

Abstraction in OOP

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

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

How Do We Achieve Abstraction?

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- There are two 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

Working with Interfaces

Interface

- Internal addition by compiler

Keyword

Public or default modifier

Name

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

compiler

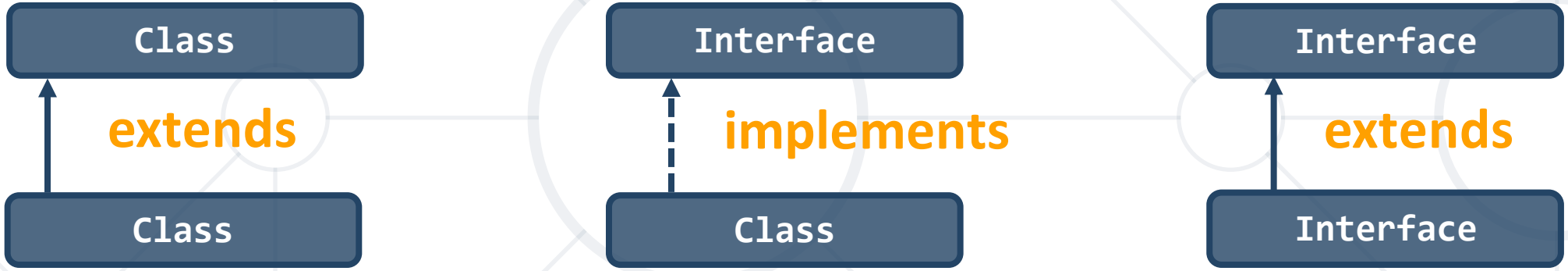
Adds public static final before fields

Public abstract before methods

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

implements vs extends

- Relationship between classes and interfaces



- Multiple inheritance

Interface Example

- 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

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Solution: Car Shop

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

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Solution: Car Shop

```
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; }
}
```

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Extend Interface

- Interface can **extend another interface**

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

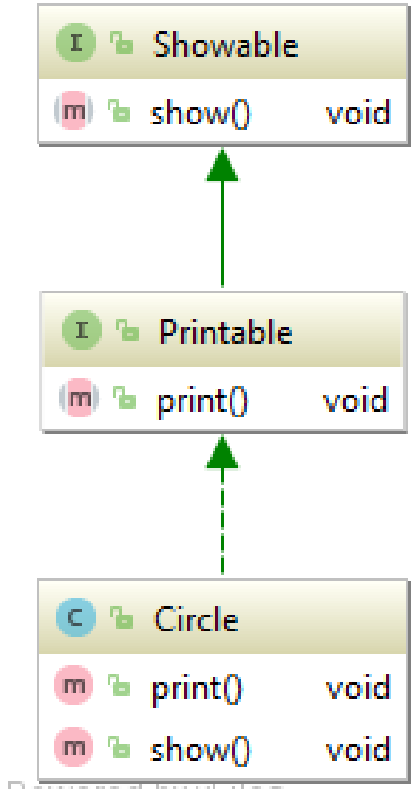
```
public interface Printable extends Showable {
  void print();
}
```

Extend Interface

- Class which implements **child interface MUST** provide 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** for sellable cars
  - Add **interface** for rentable cars
  - Add class **CarImpl**
  - Add class Audi, which **extends CarImpl** and **implements** rentable
  - Refactor class Seat to **extends CarImpl** and **implements** rentable

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Solution: Car Shop Extended (1)

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

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

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

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
}
```

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Default Method

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

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

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

Default Method

- 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
  }
}
```

Static Method

- Since Java 11, we can have **static method** in **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
  - Three implementation 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
```

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Solution: Say Hello

```
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; }
}
```

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Solution: Say Hello

```
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
```

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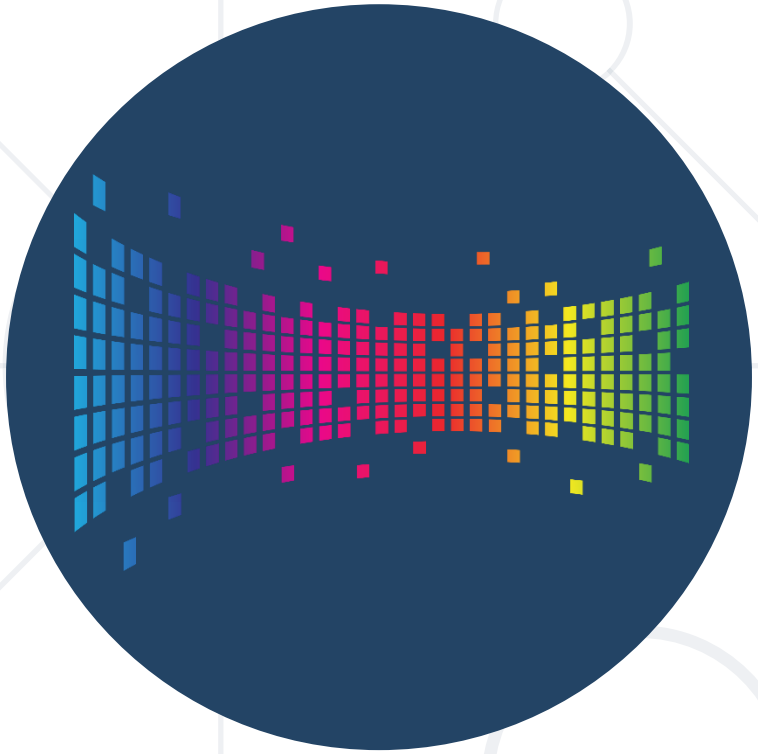

Abstract Classes

Abstract Classes and Methods

Abstract Class

- **Cannot** be instantiated
- May contain **abstract methods**
- Must provide **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
  - Can **provide implementation** and/or just the **signature** that have to be overridden
  - **Can contain access modifiers** for the fields, functions, properties

Interface vs Abstract Class (2)

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- Interface
  - If we add **a new method we have to 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 default implementation** and therefore all the existing code might work properly

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Problem: Say Hello Extended

- Refactor the code from the last problem
- Add **BasePerson abstract class**
  - Move in it all **code duplication** from European, Bulgarian, Chinese

BasePerson
-name: String
#BasePerson(name)
-setName(): void

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Solution: Say Hello Extended

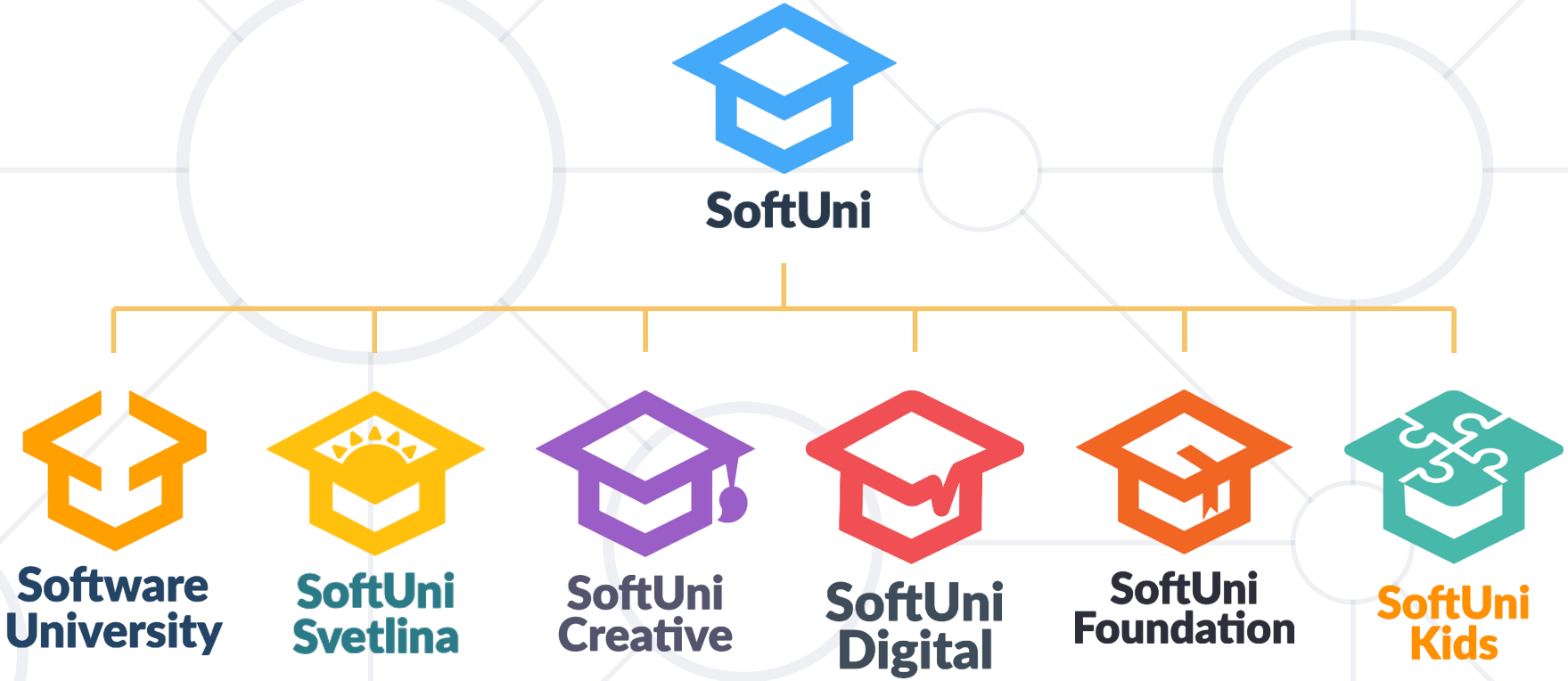
```
public abstract class BasePerson implements Person {
  private String name;
  protected BasePerson(String name) {
    this.setName(name);
  }
  private void setName(String name) { this.name = name; }
  @Override
  public String getName() {
    return this.name;
  }
}
```

Check your solution here :https://judge.softuni.bg/Contests/1581/Interfaces-and-Abstraction-Lab

Summary

- Abstraction
- Interfaces
  - Implements vs Extends
  - Default and Static methods
- Abstract classes
- Interfaces vs Abstract Classes

Questions?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