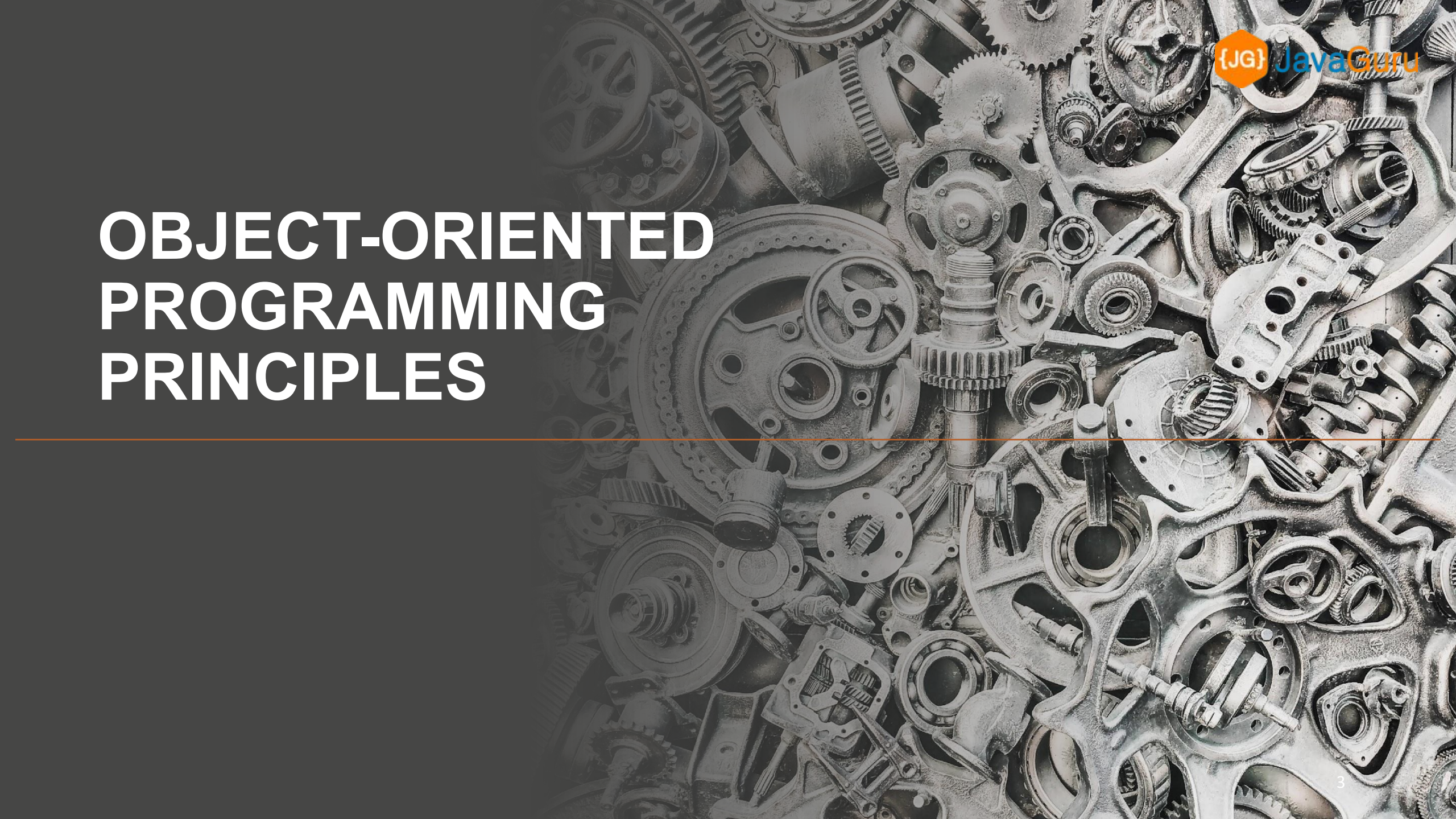
INTRODUCTION TO JAVA

Java 1.0

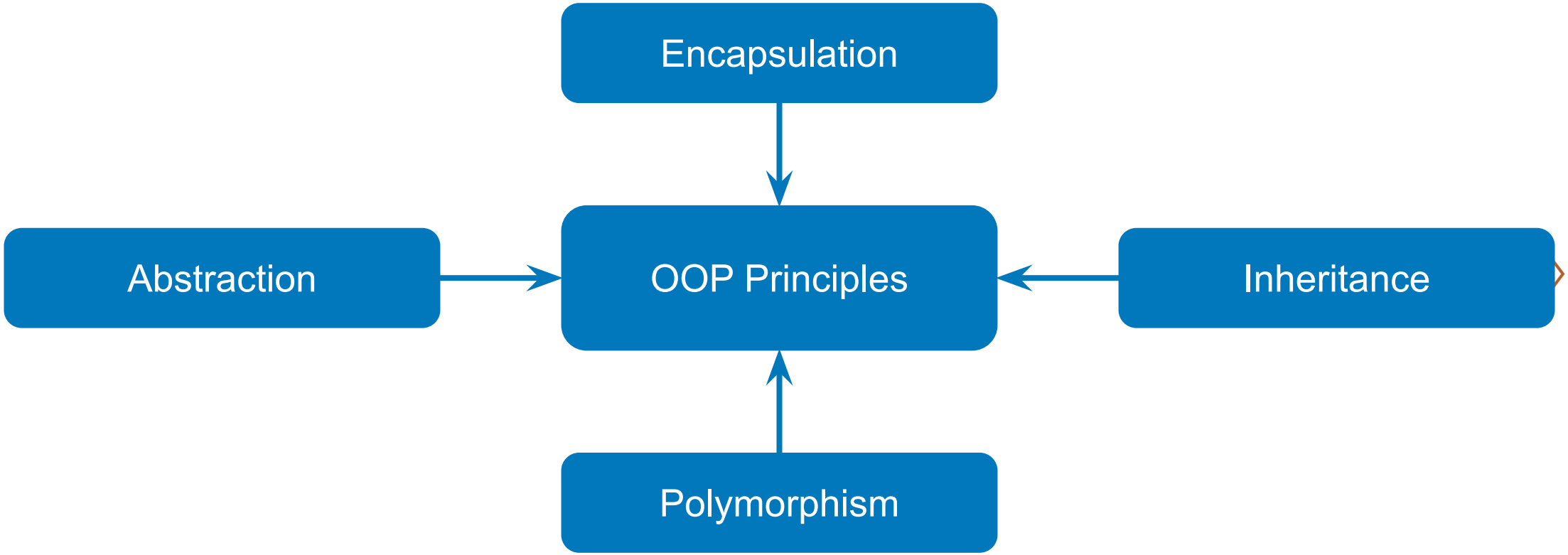
ABSTRACTION

Lesson # 08

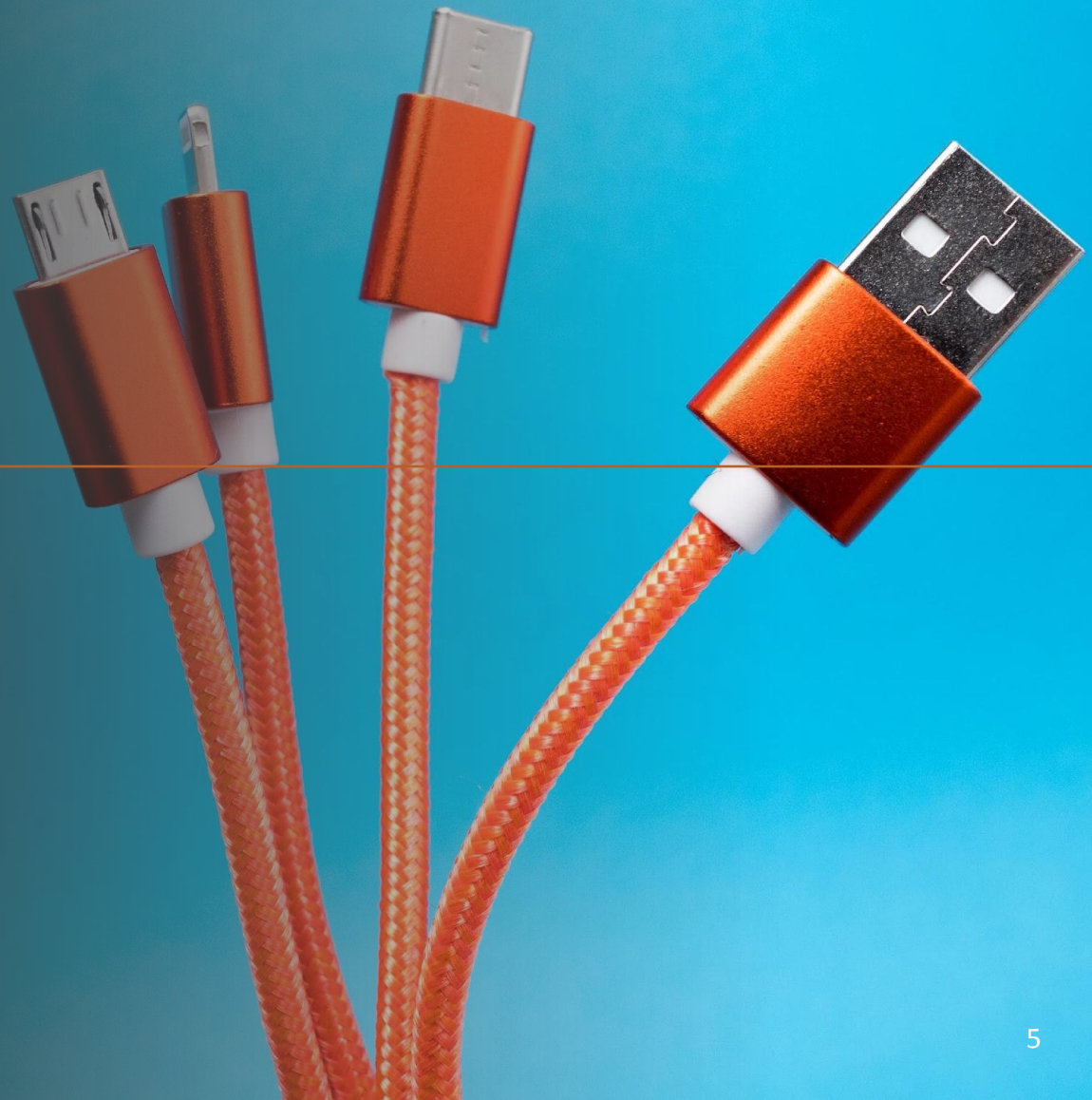
OBJECT-ORIENTED PROGRAMMING PRINCIPLES



PILLARS OF OBJECT-ORIENTED PROGRAMMING



ABSTRACTION



ABSTRACTION OVERVIEW

- The process where you show only relevant data and hide unnecessary details of an object from user
- Allows you to abstract from usage and rather outline generic object functionality
- Defines what object does instead of how

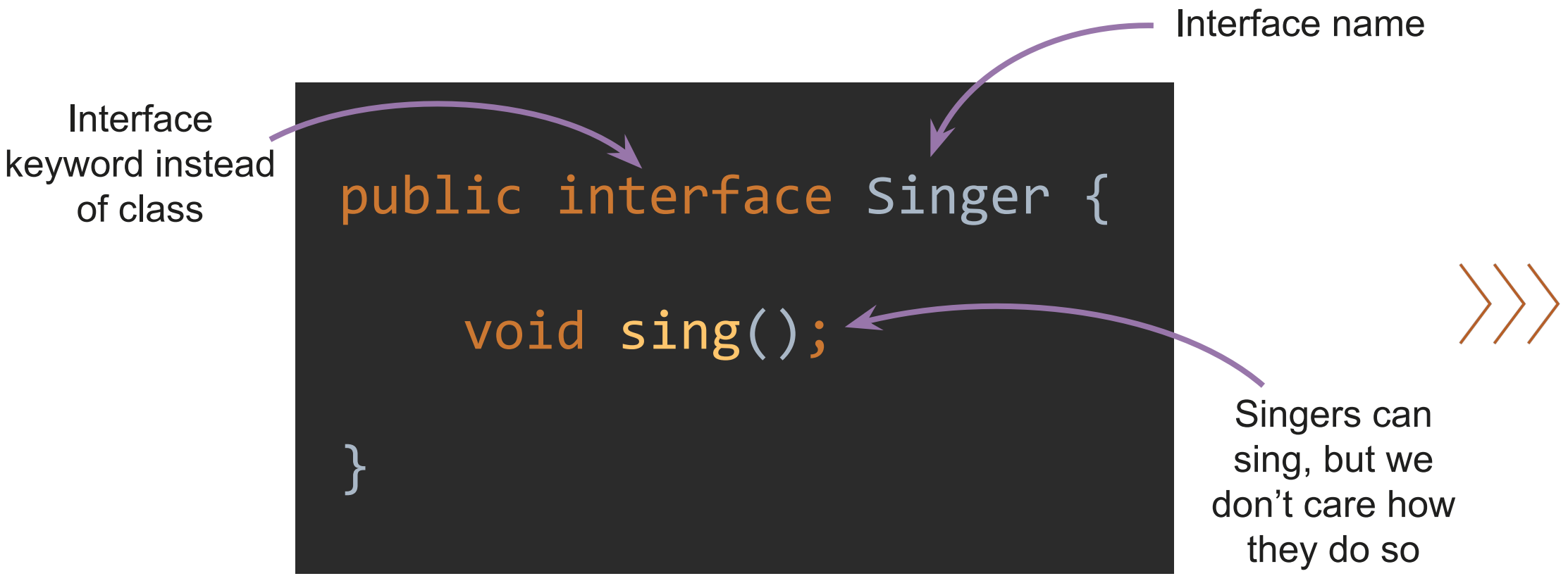
JAVA ABSTRACTION

- Abstraction is achieved by two mechanisms:
  - Interfaces
    - Allows to achieve complete abstraction
  - Abstract classes
    - Allows to achieve partial abstraction

JAVA INTERFACES

- A bit like class, except:
  - Interface can only contain method signatures and fields
- Methods defined in interfaces cannot contain the implementation of method, only signature (return type, name, parameters, exceptions)
- Describes an object by actions it can perform
- Sometimes interface names end with '-able' postfix (e.g. comparable)

JAVA INTERFACE EXAMPLE



JAVA INTERFACE EXAMPLE

```
public class ElvisPresley implements Singer{

    @Override
    public void sing() {
        System.out.println("Love me tender, baby...");
    }

}
```

Special keyword to guarantee that we support interface specified behavior

Concrete implementation of singers behavior

JAVA INTERFACE EXAMPLE

```
public class MichaelJackson implements Singer {

    @Override
    public void sing() {
        System.out.println("Billie Jean is not my lover...");
    }

}
```

JAVA INTERFACE EXAMPLE

```
public class BritneySpears implements Singer {

    @Override
    public void sing() {
        System.out.println("Hit me baby one more time...");
    }

}
```

JAVA ABSTRACT CLASSES

- Mostly like a class, except:
  - Can contain method signatures without implementation among other methods
  - Cannot be instantiated

JAVA ABSTRACT CLASS EXAMPLE

```
public abstract class Shape {

    private String color;

    public Shape(String color) {
        this.color = color;
    }

    public String getColor() {
        return color;
    }

    abstract double area();

}
```

Keyword making class abstract

Subclasses must use constructor of parent class

Method signature that all children are forced to implement

JAVA ABSTRACT CLASS EXAMPLE

```
public class Circle extends Shape {

    private int radius;

    public Circle(String color, int radius) {
        super(color);
        this.radius = radius;
    }

    @Override
    double area() {
        return 3.14 * radius * radius;
    }
}
```

Extending shape class with concrete details

Circle specific properties

Calling parent constructor with required params

Each concrete shape knows how calculate its area

JAVA ABSTRACT CLASS EXAMPLE

```
public class Rectangle extends Shape {

    private int width;
    private int height;

    public Rectangle(String color, int width, int height) {
        super(color);
        this.width = width;
        this.height = height;
    }

    @Override
    double area() {
        return width * height;
    }
}
```

Rectangles specific properties

INTERFACE VS ABSTRACT CLASS

- Type of methods
  - Interface can have only abstract methods (since Java 8 supports static and default methods as well)
  - Abstract class can have abstract and non-abstract methods
- Final variables
  - Variables declared in a Java interface are by default final
  - Abstract class may contain non-final variables

INTERFACE VS ABSTRACT CLASS

- Type of variables
  - Interface has only static and final variables
  - Abstract class can have final, non-final, static and non-static variables
- Implementation
  - Interface can’t provide the implementation of abstract class
  - Abstract class can provide the implementation of interface

INTERFACE VS ABSTRACT CLASS

- Inheritance vs Abstraction
  - Interface can be implemented using keyword "implements”
  - Abstract class can be extended using keyword “extends”
- Multiple Implementation
  - Interface can extend another Java interface only
  - Abstract class can extend another Java class and implement multiple Java interfaces

INTERFACE VS ABSTRACT CLASS

- Accessibility of data members
  - Access modifiers of interface members are public by default and cannot be changed
  - Access modifiers of abstract class members can have any access modifiers (except private abstract methods)

POLYMORPHISM

POLYMORPHISM

- Polymorphism is the ability of an object to take on many forms
- Capability of a method to do different things based on the object that it is acting upon
- Which implementation to be used is decided at runtime depending upon the situation

POLYMORPHISM EXAMPLE

Code

```
Singer elvis = new ElvisPresley();
Singer jackson = new MichaelJackson();
Singer spears = new BritneySpears();

elvis.sing();
jackson.sing();
spears.sing();
```

Console output

```
Love me tender, baby...
Billie Jean is not my lover
Hit me baby one more time
```

POLYMORPHISM EXAMPLE

Code

```
Singer[] singers = new Singer[2];
singers[0] = new ElvisPresley();
singers[1] = new BritneySpears();

for (Singer singer : singers) {
    singer.sing();
}
```

Console output

```
Love me tender, baby...
Hit me baby one more time
```

POLYMORPHISM EXAMPLE

Code

```
Shape circle = new Circle("Red", 3);
Shape rectangle = new Rectangle("Blue", 2, 4);

System.out.println("Circle area = " + circle.area());
System.out.println("Rectangle area = " + rectangle.area());
```

Console output

```
Circle area = 28.259999999999998
Rectangle area = 8.0
```

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QUESTIONS?

THANK YOU!