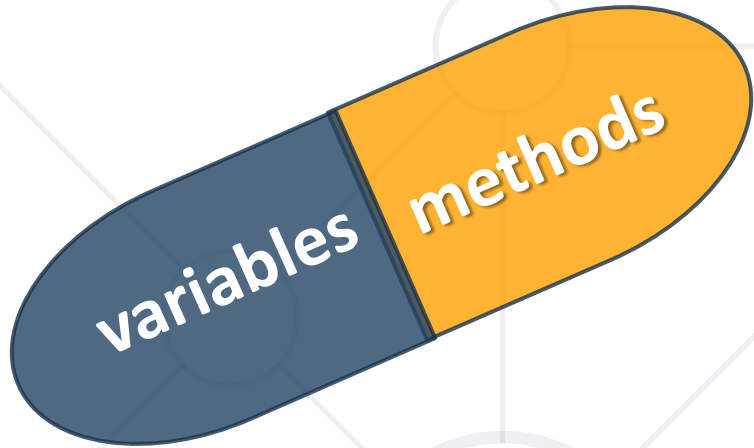


# Encapsulation

## Benefits of Encapsulation



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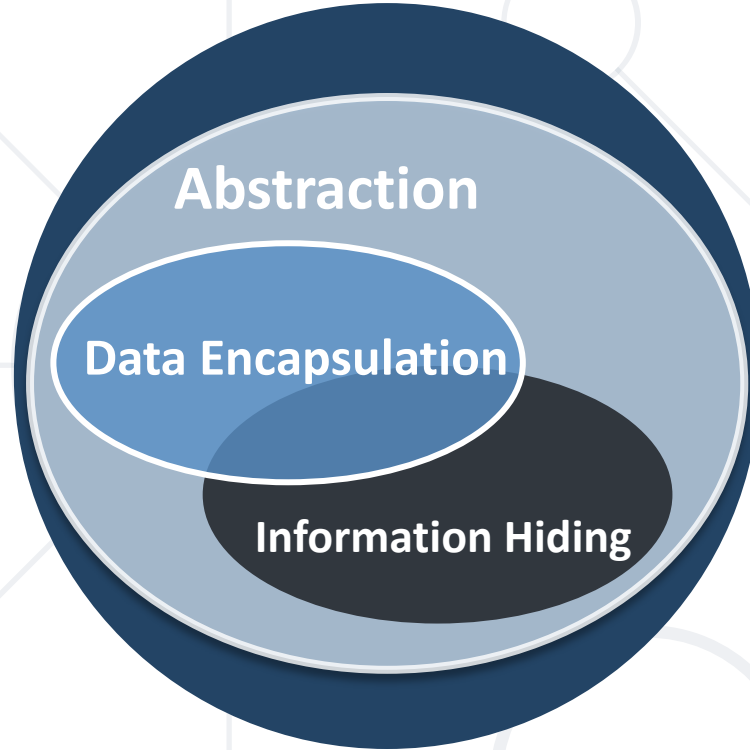
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**#java-advanced**

1. What is Encapsulation?
  - Keyword **this**
2. Access Modifiers
3. Validation
4. Mutable and Immutable Objects
5. Keyword **final**





# 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**



- Objects fields **must be private**

```
class Person {  
    private int age;  
}
```



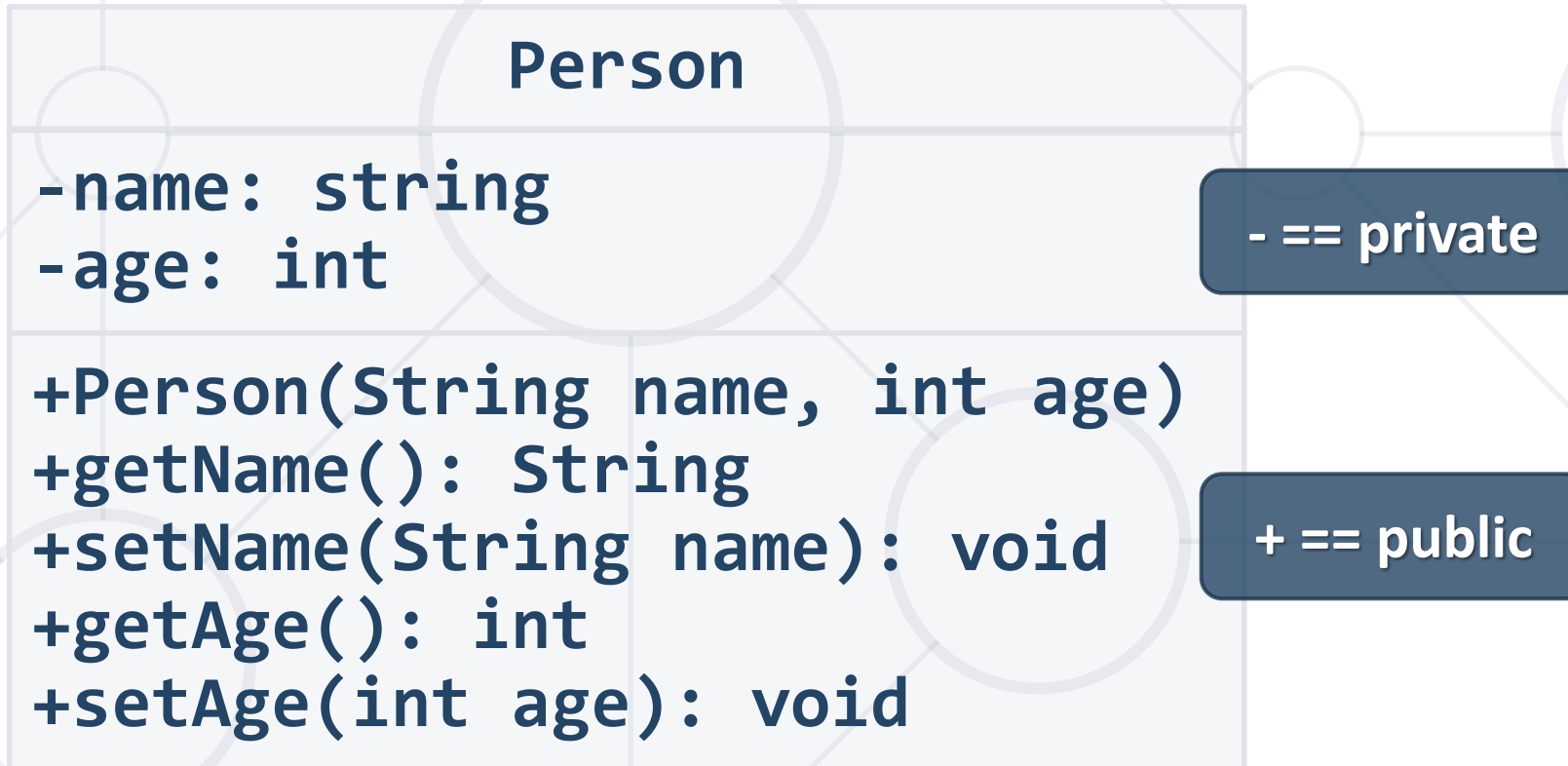
- Use **getters** and **setters** for data access

```
class Person {  
    public int getAge()  
    public void setAge(int age)  
}
```



# Encapsulation – Example

- Fields should be **private**



- Accessors and Mutators should be **public**

# Keyword This (1)

- **this** is a reference to the **current object**
- **this** can refer to current class instance

```
public Person(String name) {  
    this.name = name;  
}
```

- **this** can invoke the current class method

```
public String fullName() {  
    return this.getFirstName() + " " + this.getLastName();  
}
```



- **this** can invoke a current class constructor

```
public Person(String name) {  
    this.firstName = name;  
}
```


```
public Person (String name, Integer age) {  
    this(name);  
    this.age = age;  
}
```



**Access Modifiers**

# Private Access Modifier

- Object hides data from the outside world




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

- Classes and interfaces **cannot** be private
- Data can be **accessed only within the declared class** itself

# Protected Access Modifier

- Grants **access to subclasses**



```
class Team {  
    protected String getName () {...}  
    protected void setName (String name) {...}  
}
```

- The **protected** modifier cannot be applied to classes and interfaces
- Prevents a **nonrelated** class from trying to use it

# Default Access Modifier

- Do not explicitly declare an access modifier

```
class Team {  
    String getName() {...}  
    void setName(String name) {...}  
}
```


- **Available** to any other class in the same **package**

```
Team real = new Team("Real");  
real.setName("Real Madrid");  
System.out.println(real.getName());  
// Real Madrid
```



# Public Access Modifier

- Grants access to **any class** belonging to the **Java Universe**

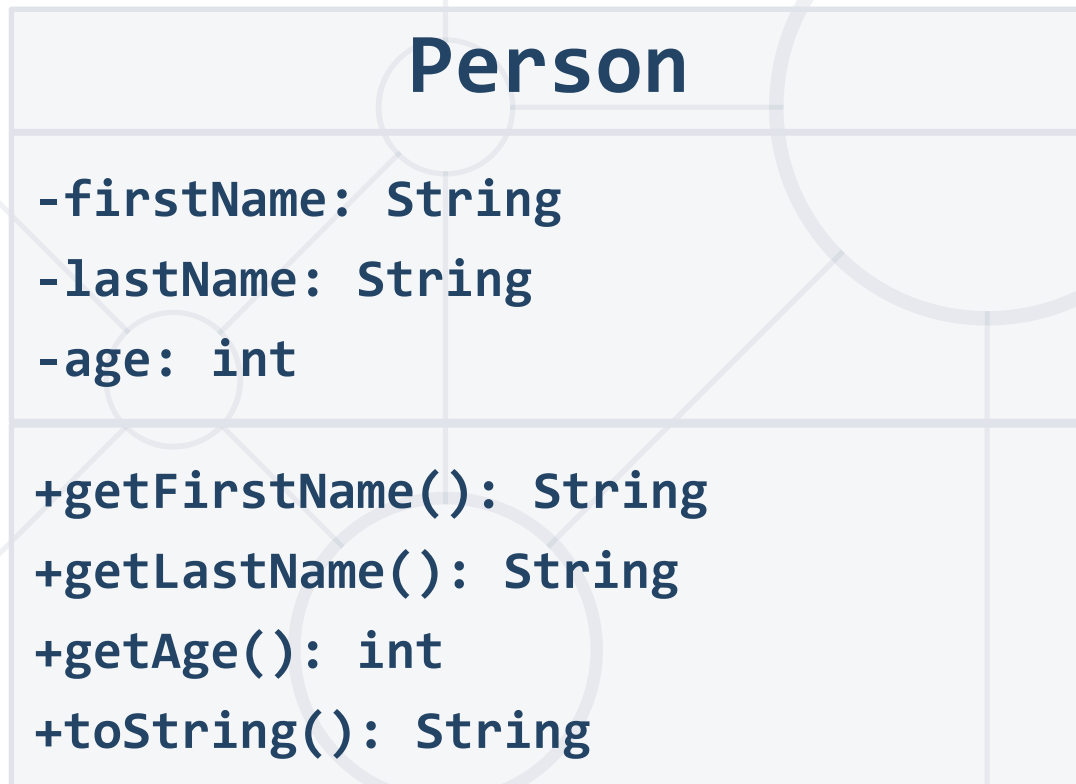


```
public class Team {  
    public String getName() {...}  
    public void setName(String name) {...}  
}
```

- Import a package if you need to use a class
- The **main()** method of an application must be **public**

# Problem: Sort by Name and Age

- Create a class **Person**



```
Collections.sort(persons, (firstPerson, secondPerson) -> {
    int sComp = firstPerson
        .getFirstName()
        .compareTo(secondPerson.getFirstName());

    if (sComp != 0) {
        return sComp;
    } else {
        return firstPerson
            .getAge()
            .compareTo(secondPerson.getAge());
    }
});
```

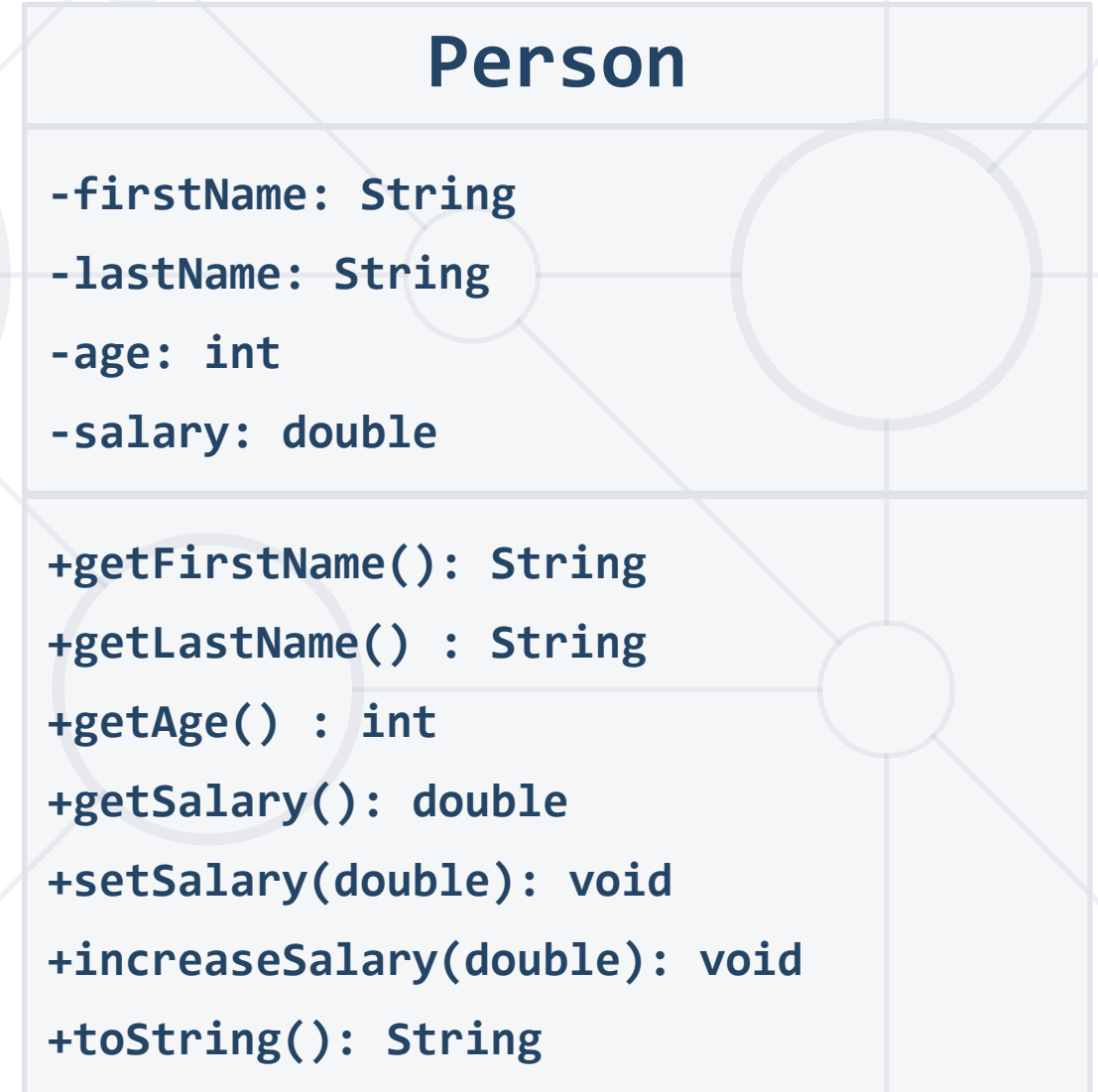
# Solution: Sort by Name and Age

```
public class Person {  
    private String firstName;  
    private String lastName; private int age;  
    // TODO: Implement Constructor  
  
    public String getFirstName() { /* TODO */ }  
    public String getLastName() { /* TODO */ }  
    public int getAge() { return age; }  
  
    @Override  
    public String toString() { /* TODO */ }  
}
```



# Problem: Salary Increase

- Implement Salary
- Add:
  - getter for salary
  - increaseSalary by percentage
- Persons younger than 30 get **only half** of the increase



# Solution: Salary Increase (1)

- Expand Person from previous task

```
public class Person {  
    private double salary;  
    // Edit Constructor  
    public double getSalary() {  
        return this.salary;  
    }  
    public void setSalary(double salary) {  
        this.salary = salary;  
    }  
    // Next Slide...  
    // TODO: Edit toString() method  
}
```

# Solution: Salary Increase (2)

- Expand Person from previous task

```
public void increaseSalary(double percentage) {  
    if (this.getAge() < 30) {  
        this.setSalary(this.getSalary() +  
            (this.getSalary() * percentage / 200));  
    } else {  
        this.setSalary(this.getSalary() +  
            (this.getSalary() * percentage / 100));  
    }  
}
```



**Validation**

- **Data validation** happens in **setters**

```
private void setSalary(double salary) {  
    if (salary < 460) {  
        throw new IllegalArgumentException("Message");  
    }  
    this.salary = salary;  
}
```

It is better to throw **exceptions**,  
rather than printing to the Console

- Printing with **System.out couples** your class
- The **Client** can **handle** class exceptions

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

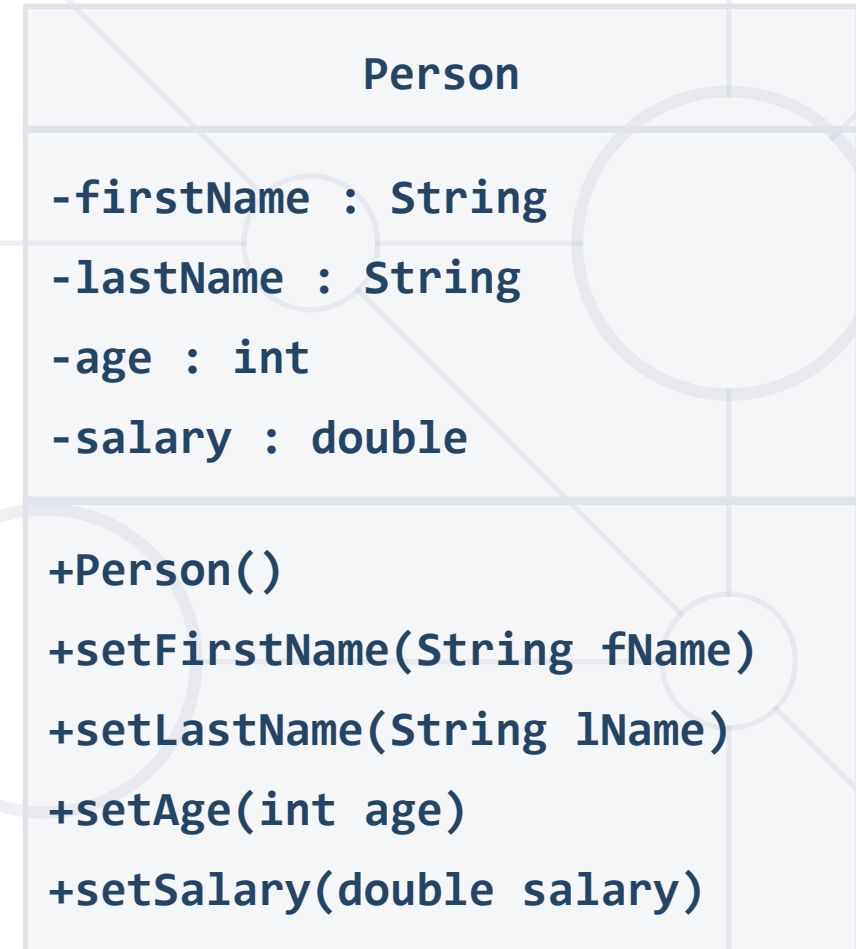
```
public Person(String firstName, String lastName,  
               int age, double salary) {  
    setFirstName(firstName);  
    setLastName(lastName);  
    setAge(age);  
    setSalary(salary);  
}
```

Validation happens  
inside the setter

- Guarantees **valid state** of an object in its creation
- Guarantees **valid state** for public setters

# Problem: Validation Data

- Expand Person with **validation for every field**
- Names should be **at least 3 symbols**
- Age **cannot be zero or negative**
- Salary **cannot be less than 460**



# Solution: Validation Data

```
// TODO: Add validation for firstName  
// TODO: Add validation for LastName  
public void setAge(int age) {  
    if (age < 1) {  
        throw new IllegalArgumentException(  
            "Age cannot be zero or negative integer");  
    }  
    this.age = age;  
}  
// TODO: Add validation for salary
```





# Mutable and Immutable Objects

# Mutable vs Immutable Objects

- Mutable Objects

- The contents of that instance **can** be altered

```
Point myPoint = new Point(0, 0);  
myPoint.setLocation(1.0, 0.0);  
System.out.println(myPoint);
```



```
java.awt.Point[1.0, 0.0]
```

- Immutable Objects

- The contents of the instance **can't** be altered

```
String str = new String("old String");  
System.out.println(str);  
str.replaceAll("old", "new");  
System.out.println(str);
```



```
old String  
old String
```



# Mutable Fields

- **private** mutable fields are not fully encapsulated



```
class Team {  
    private String name;  
    private List<Person> players;  
  
    public List<Person> getPlayers() {  
        return this.players;  
    }  
}
```




- In this case, the **getter is like a setter too**

# Mutable Fields – Example

```
Team team = new Team();  
Person person = new Person("David", "Adams", 22);  
team.getPlayers().add(person);  
System.out.println(team.getPlayers().size()); // 1  
team.getPlayers().clear();  
System.out.println(team.getPlayers().size()); // 0
```

# Immutable Fields

- For securing our collection we can return **`Collections.unmodifiableList()`**



```
class Team {  
    private List<Person> players;  
  
    public void addPlayer(Person person) {  
        this.players.add(person);  
    }  
  
    public List<Person> getPlayers() {  
        return Collections.unmodifiableList(players);  
    }  
}
```

Add new methods for  
functionality over list

Returns a safe collections

# Problem: First and Reserve Team

- Expand your project with class **Team**
- Team have two squads  
**first team** and **reserve team**
- Read persons from console and **add** them to team
- If they are **younger** than **40**, they go to **first squad**
- **Print** both squad **sizes**



# Solution: First and Reserve Team

```
private List<Person> firstTeam;
private List<Person> reserveTeam;

public void addPlayer(Person person) {
    if (person.getAge() < 40)
        this.firstTeam.add(person);
    else
        this.reserveTeam.add(person);
}

public List<Person> getFirstTeam() {
    return Collections.unmodifiableList(firstTeam);
}

// TODO: add getter for reserve team
```



**final**

**Keyword Final**



# Keyword Final

- A **final class** can't be extended

```
public class Animal {}  
public final class Mammal extends Animal {}  
public class Cat extends Mammal {}
```



- A **final method** can't be overridden

```
public final void move(Point point) {}  
public class Mammal extends Animal {  
    @Override  
    public void move() {}  
}
```



- The **final variable** value can't be changed once it is set

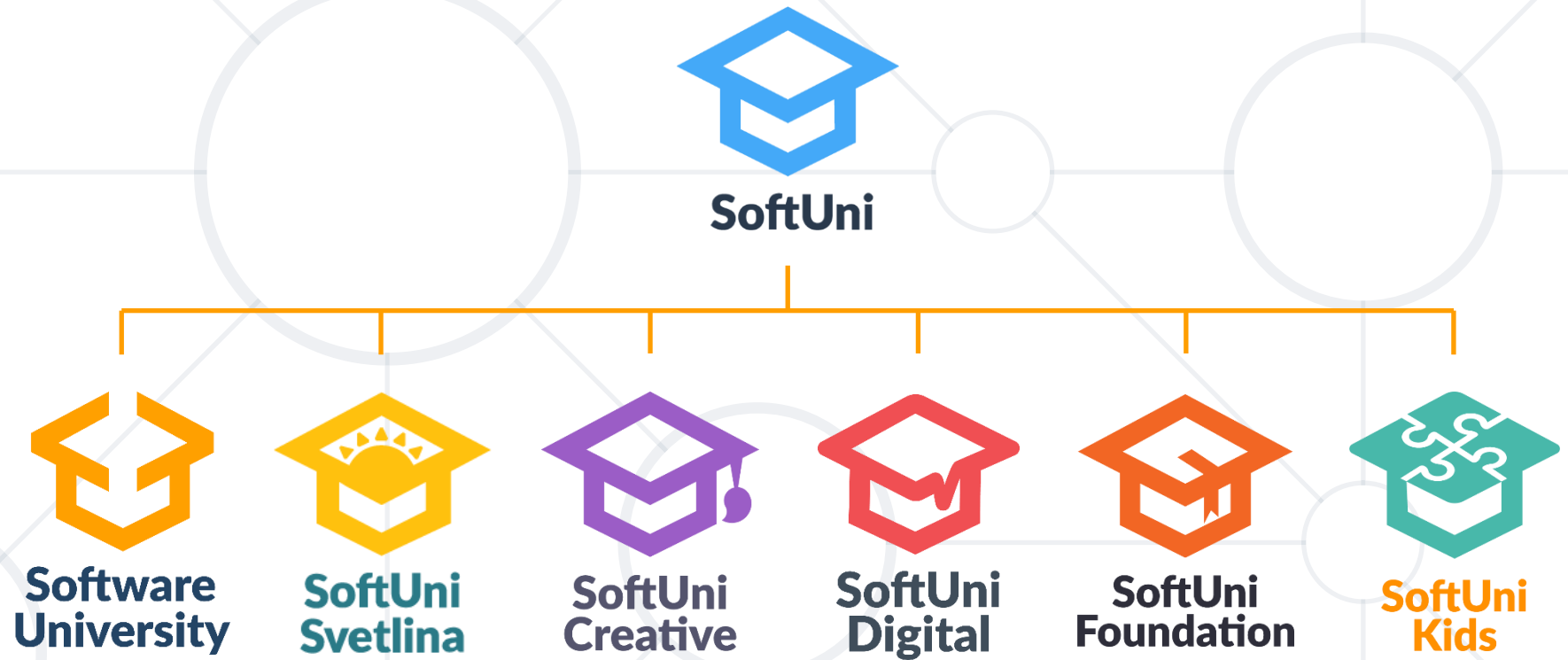
```
private final String name;  
private final List<Person> firstTeam;  
  
public Team (String name) {  
    this.name = name;  
    this.firstTeam = new ArrayList<Person> ();  
}  
  
public void doSomething(Person person) {  
    this.name = "";  
    this.firstTeam = new ArrayList<>();  
    this.firstTeam.add(person);  
}
```

Compile time error

- Encapsulation:
  - Hides **implementation**
  - Reduces **complexity**
  - Ensures that structural changes remain local
- **Mutable** and **Immutable** objects
- Keyword **final**



# Questions?



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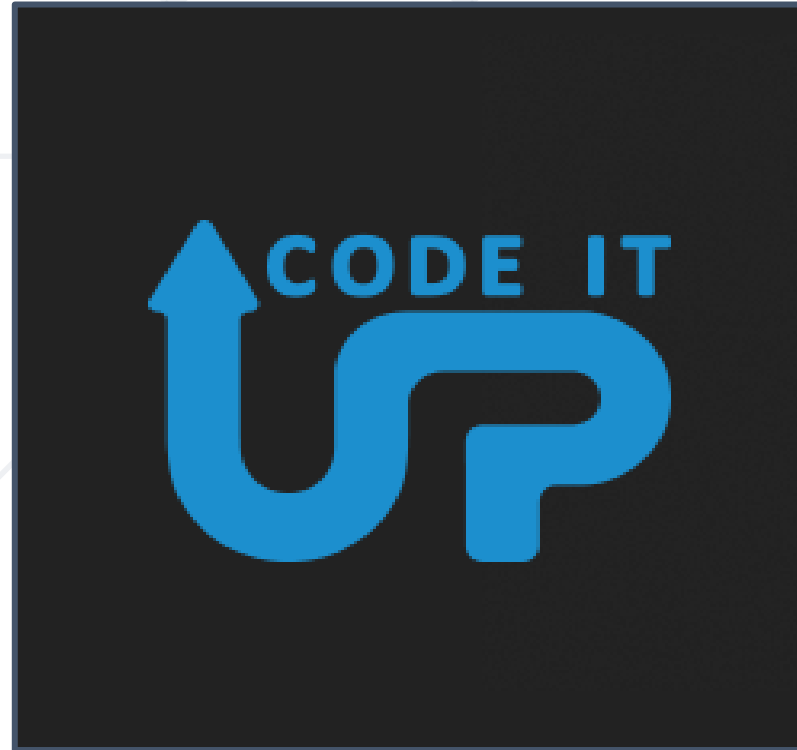
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