



SOLID

Dependency Inversion Principle

Upcode Software
Engineer Team

CONTENT

1. What is DIP?
2. Why needs to DIP?
3. How to use DIP?
4. Where to use DIP?
5. SOURCE code ([github](#))



1. What is Dependency Inversion Principle(DIP) ?



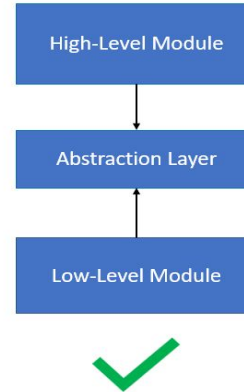
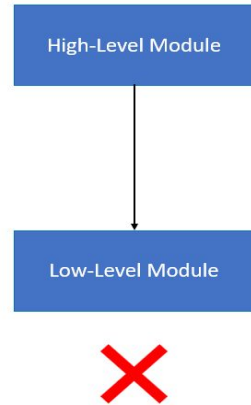
- **Robert Martin** introduced them in the book Agile Software Development, Principles, Patterns, and Practices
- **SOLID** is a mnemonic for five design principles intended to make software designs more understandable, flexible and maintainable.

Dependency Inversion principle states:

- High-level modules should **not depend on low-level modules**. Both should depend on **abstractions**. (First defined by Robert C. Martin)

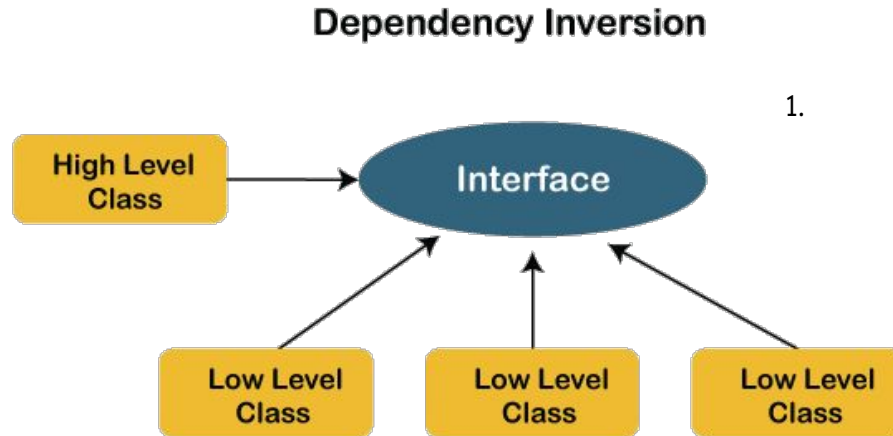
2. Why needs to DIP ?

- High-level modules should **not depend on low-level modules**. Both should depend on **abstractions**.
- **Abstractions** should not depend on details. **Details** should depend on abstractions.



3. How to use DIS ? (1/n)

- **High-level classes** shouldn't depend on low-level classes.
- Both should depend **on abstractions**.
- **Abstractions** shouldn't depend on details. Details should depend on abstractions.

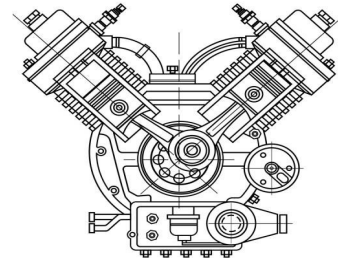


3. How to use DIS ? (2/n)

- We have a **Car** class that depends on the concrete **Engine** class; therefore, it is not obeying DIP.

```
public class Car {  
    private Engine engine;  
    public Car(Engine e) {  
        engine = e;  
    }  
    public void start() {  
        engine.start();  
    }  
}
```

```
public class Engine {  
    public void start() {...}  
}
```



4. Where to use DIP ? (1/n)

- What if we wanted to add another engine type, let's say a diesel engine? This will require refactoring the **Car** class.
- However, we can solve this by introducing a layer of abstraction. Instead of **Car** depending directly on **Engine**, let's add an interface
- We can connect any type of **Engine** that implements the Engine interface to the **Car** class

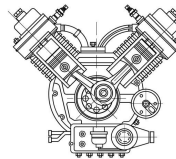
```
public class Car {  
    private Engine engine;  
    public Car(Engine e) {  
        engine = e;  
    }  
    public void start() {  
        engine.start();  
    }  
}
```



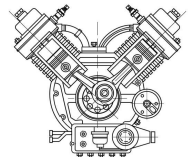
```
public class PetrolEngine implements Engine {  
    public void start() {...}  
}
```

```
public class DieselEngine implements Engine {  
    public void start() {...}  
}
```

Petrol Engine

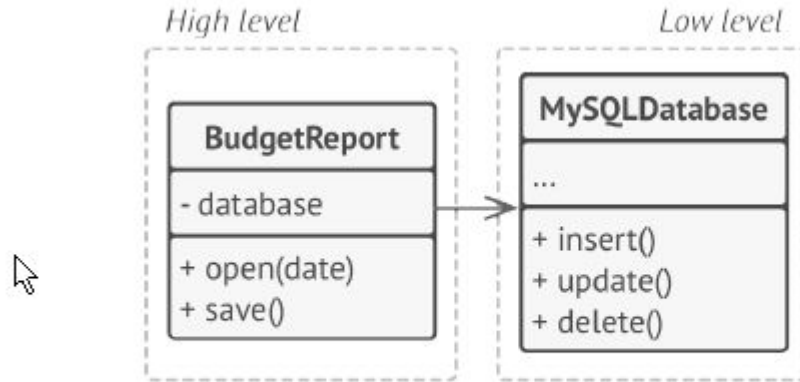


Diesel Engine



4. Where to use DIP ? (2/n)

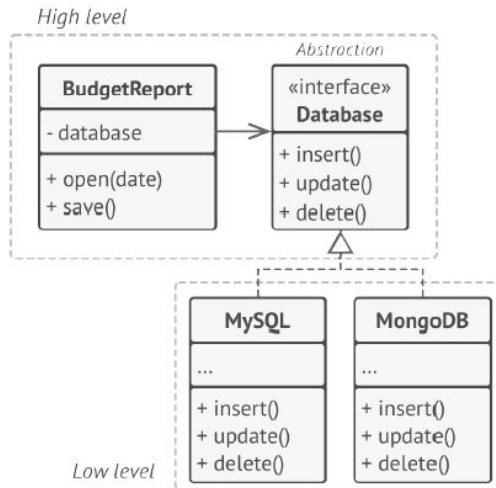
- The high-level budget reporting class uses a low-level database class for reading and persisting its data.



BEFORE: a high-level class depends on a low-level class.

4. Where to use DIP ? (3/n)

- You can fix this problem by creating a high-level interface that describes read/write operations and making the reporting
- class use that interface instead of the low-level class.

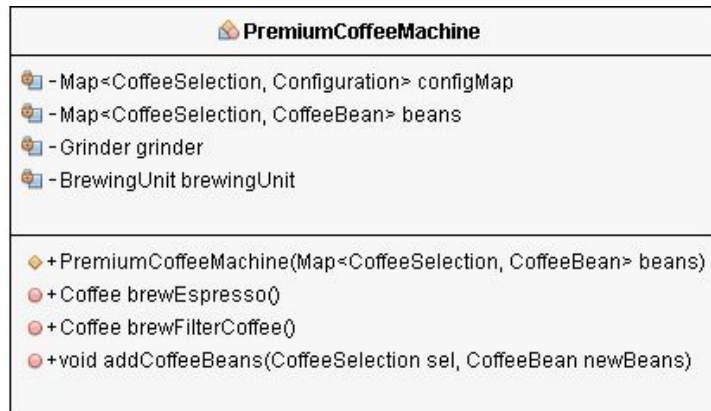
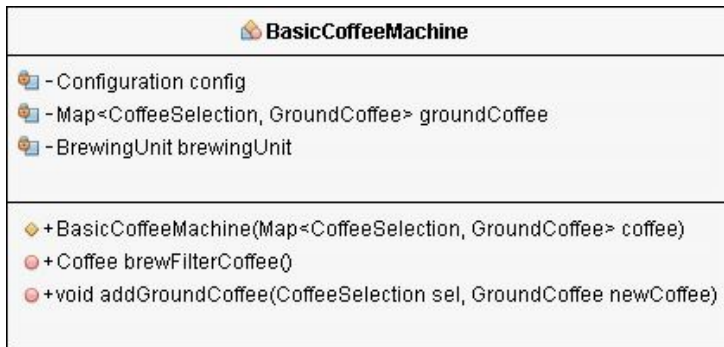


AFTER: low-level classes depend on a high-level abstraction.

5. SOURCE code (1/n)

- You can buy lots of different coffee machines.
- Rather simple ones that use water and ground coffee to brew filter coffee, and **premium ones that include a grinder to freshly grind the required amount of coffee beans** and which you can use to brew different kinds of coffee.

UML Diagram



5. SOURCE code (2/n) - Basic Coffee Machine

```
import java.util.Map;

public class BasicCoffeeMachine implements CoffeeMachine {

    private Configuration config;
    private Map<CoffeeSelection, GroundCoffee> groundCoffee;
    private BrewingUnit brewingUnit;

    public BasicCoffeeMachine(Map<CoffeeSelection, GroundCoffee>
coffee).
        this.groundCoffee = coffee;
        this.brewingUnit = new BrewingUnit();
        this.config = new Configuration(30, 480);
    }
    @Override
    public Coffee brewFilterCoffee() {
        // get the coffee
        GroundCoffee groundCoffee =
this.groundCoffee.get(CoffeeSelection.FILTER_COFFEE);
        // brew a filter coffee
        return this.brewingUnit.brew(CoffeeSelection.FILTER_COFFEE,
groundCoffee, this.config.getQuantityWater());
    }
}
```

```
    public void addGroundCoffee(CoffeeSelection
sel, GroundCoffee newCoffee) throws
CoffeeException {
        GroundCoffee existingCoffee =
this.groundCoffee.get(sel);
        if (existingCoffee != null) {
            if
(existingCoffee.getName().equals(newCoffee.getNa
me())) {

existingCoffee.setQuantity(existingCoffee.getQuanti
ty() + newCoffee.getQuantity())
            } else {
                throw new CoffeeException("Only one
kind of coffee supported for each CoffeeSelection.")
            }
        } else {
            this.groundCoffee.put(sel, newCoffee)
        }
    }
}
```



5. SOURCE code (3/n) - Premium Coffee Machine

The implementation of the *PremiumCoffeeMachine* class looks very similar. The main differences are:

- It implements the *addCoffeeBeans* method instead of the *addGroundCoffee* method.
- It implements the additional *brewEspresso* method.

The *brewFilterCoffee* method is identical to the one provided by the *BasicCoffeeMachine*.

5. SOURCE code (4/n) - Premium Coffee Machine

```
import java.util.HashMap;
import java.util.Map;

public class PremiumCoffeeMachine {
    private Map<CoffeeSelection, Configuration> configMap;
    private Map<CoffeeSelection, CoffeeBean> beans;
    private Grinder grinder
    private BrewingUnit brewingUnit;

    public PremiumCoffeeMachine(Map<CoffeeSelection, CoffeeBean>
    beans) {
        this.beans = beans;
        this.grinder = new Grinder();
        this.brewingUnit = new BrewingUnit();
        this.configMap = new HashMap<>();
        this.configMap.put(CoffeeSelection.FILTER_COFFEE, new
    Configuration(30, 480));
        this.configMap.put(CoffeeSelection.ESPRESSO, new Configuration(8,
    28));
    }
}
```

```
public Coffee brewEspresso() {
    Configuration config =
    configMap.get(CoffeeSelection.ESPRESSO);
    // grind the coffee beans
    GroundCoffee groundCoffee = this.grinder.grind(
        this.beans.get(CoffeeSelection.ESPRESSO),
        config.getQuantityCoffee())
    // brew an espresso
    return
    this.brewingUnit.brew(CoffeeSelection.ESPRESSO,
    groundCoffee,
        config.getQuantityWater());
}

public Coffee brewFilterCoffee() {
    Configuration config =
    configMap.get(CoffeeSelection.FILTER_COFFEE);
    // grind the coffee beans
    GroundCoffee groundCoffee = this.grinder.grind(
        this.beans.get(CoffeeSelection.FILTER_COFFEE),
        config.getQuantityCoffee());
    // brew a filter coffee
    return
    this.brewingUnit.brew(CoffeeSelection.FILTER_COFFEE,
    groundCoffee,
        config.getQuantityWater());
}
```



5. SOURCE code (5/n) - Premium Coffee Machine

```
public void addCoffeeBeans(CoffeeSelection sel, CoffeeBean newBeans) throws CoffeeException {  
    CoffeeBean existingBeans = this.beans.get(sel);  
    if (existingBeans != null) {  
        if (existingBeans.getName().equals(newBeans.getName())) {  
            existingBeans.setQuantity(existingBeans.getQuantity() + newBeans.getQuantity());  
        } else {  
            throw new CoffeeException("Only one kind of coffee supported for each CoffeeSelection.");  
        }  
    } else {  
        this.beans.put(sel, newBeans);  
    }  
}
```



5. SOURCE code (6/n) - Abstraction

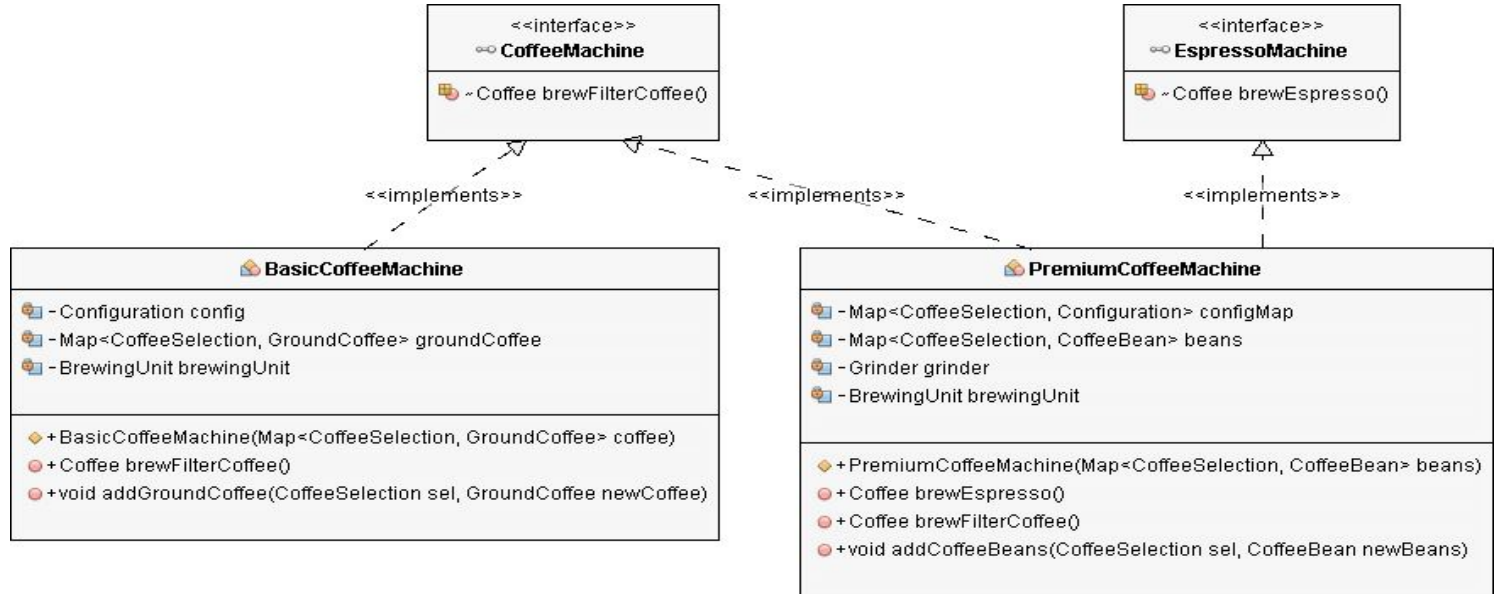
- The main task of both coffee machine classes is to brew coffee.
- But they enable you to brew different kinds of coffee. If you use a **BasicCoffeeMachine**, you can only brew filter coffee, but with a **PremiumCoffeeMachine**, you can brew filter coffee or espresso. So, which interface abstraction would be a good fit for both classes?
- As all coffee lovers will agree, there are huge [differences between filter coffee and espresso](#).
- That's why we are using different machines to brew them, even so, some machines can do both. I, therefore, suggest to create two independent abstractions:



5. SOURCE code (7/n) - Abstraction

```
public interface CoffeeMachine {  
    Coffee brewFilterCoffee();  
}  
  
public interface EspressoMachine {  
    Coffee brewEspresso();  
}
```


5. SOURCE code (8/n) - Abstraction





Summary

- **The Dependency Inversion Principle** is the fifth and final design principle that
It introduces an interface abstraction between **higher-level and lower-level software components to remove the dependencies between them.**
- As you have seen in the example project, you only need to consequently apply the **Open/Closed and the Liskov Substitution principles** to your code base.
- After you have done that, your classes also comply with the Dependency Inversion Principle.
- This enables you to change **higher-level and lower-level components** without affecting any other classes, as long as you don't change any interface abstractions.



Reference Resources

1. **Dive into design pattern compression (book)**
2. SOLID Design Principles Explained: Dependency Inversion Principle with
3. What is SOLID? Principles for Better Software [Design](#)
4. Code [Examples](#)



Thank you!

Presented by Hamdamboy Urunov
(hamdamboy.urunov@gmail.com)