Structural Design Pattern is a way to combine or arrange different classes and objects to form a complex or bigger structure to solve a particular requirement.

Types:
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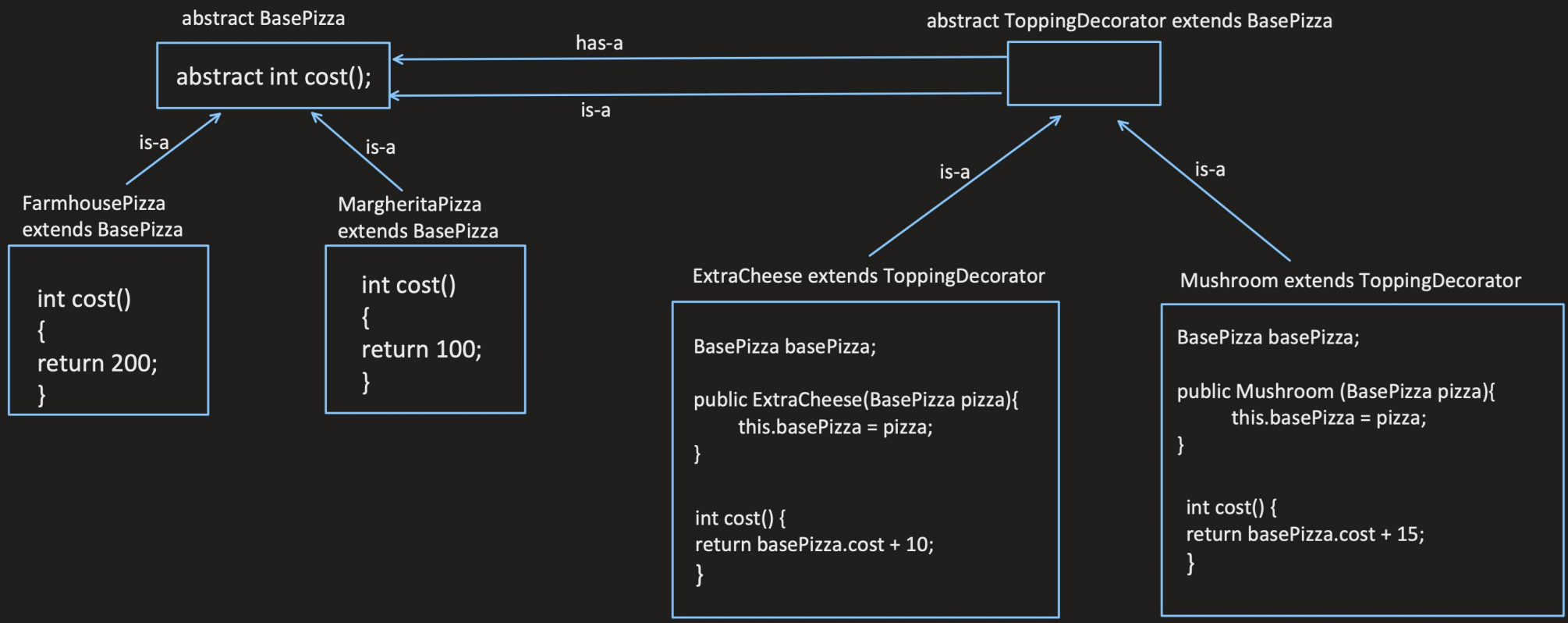
1. Decorator Pattern
2. Proxy Pattern
3. Composite Pattern
4. Adapter Pattern
5. Bridge Pattern
6. Facade
7. Flyweight

1. Decorator Pattern:

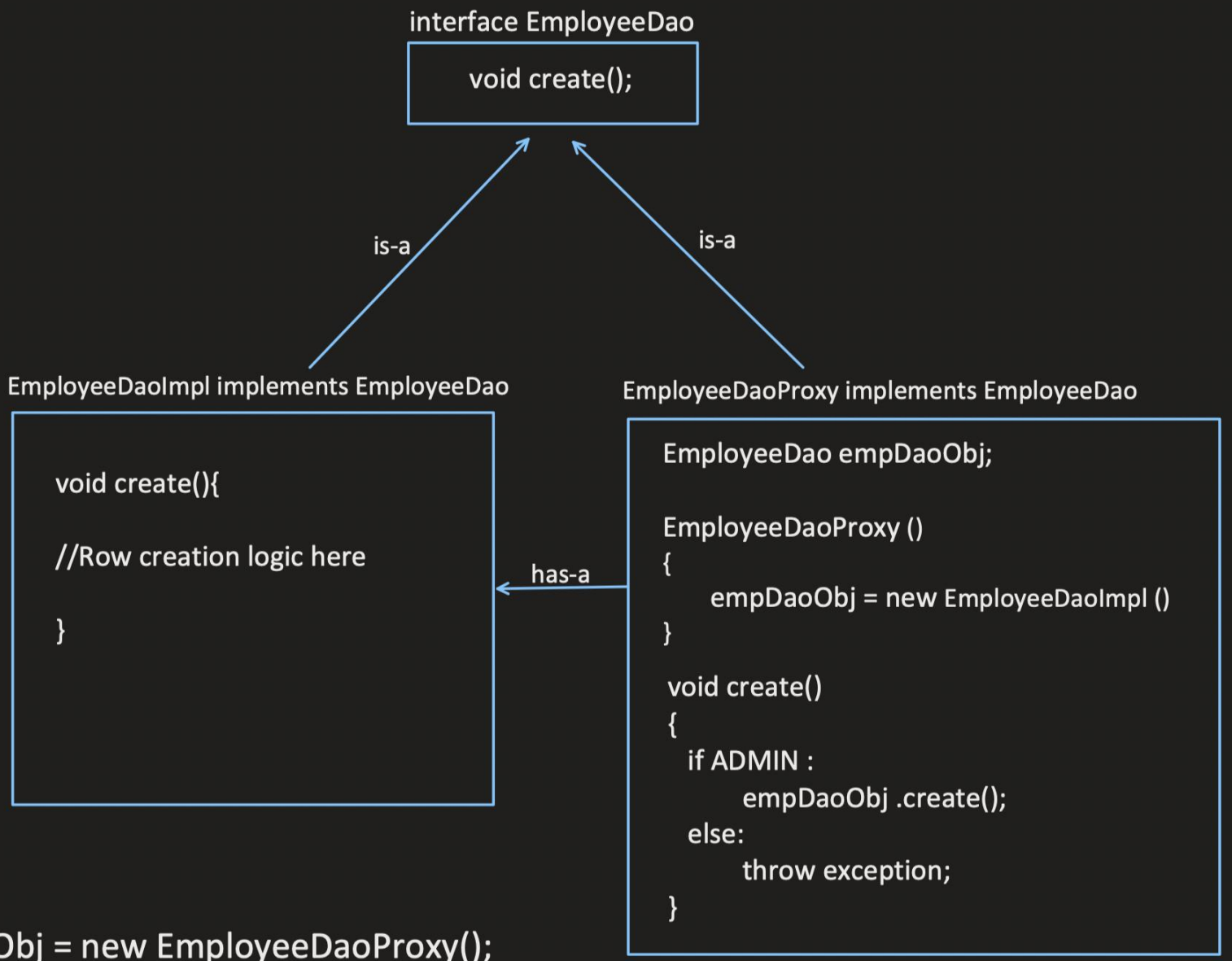
This pattern helps to add more functionality to existing object, without changing its structure.



BasePizza pizza = new Mushroom(new ExtraCheese(new Farmhouse()));

2. Proxy Pattern:

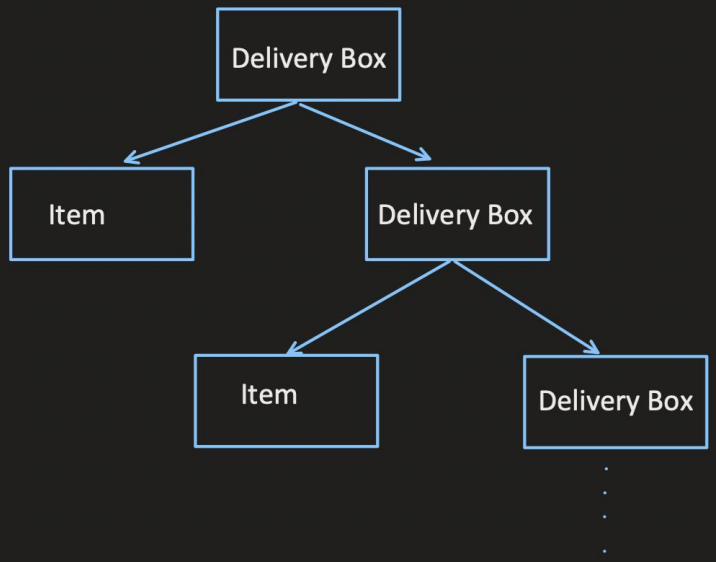
This pattern helps to provide control access to original object.

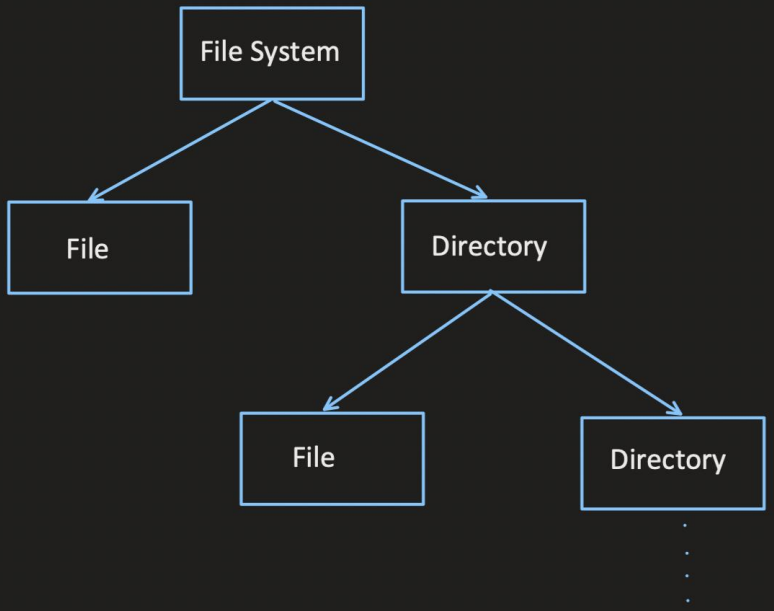


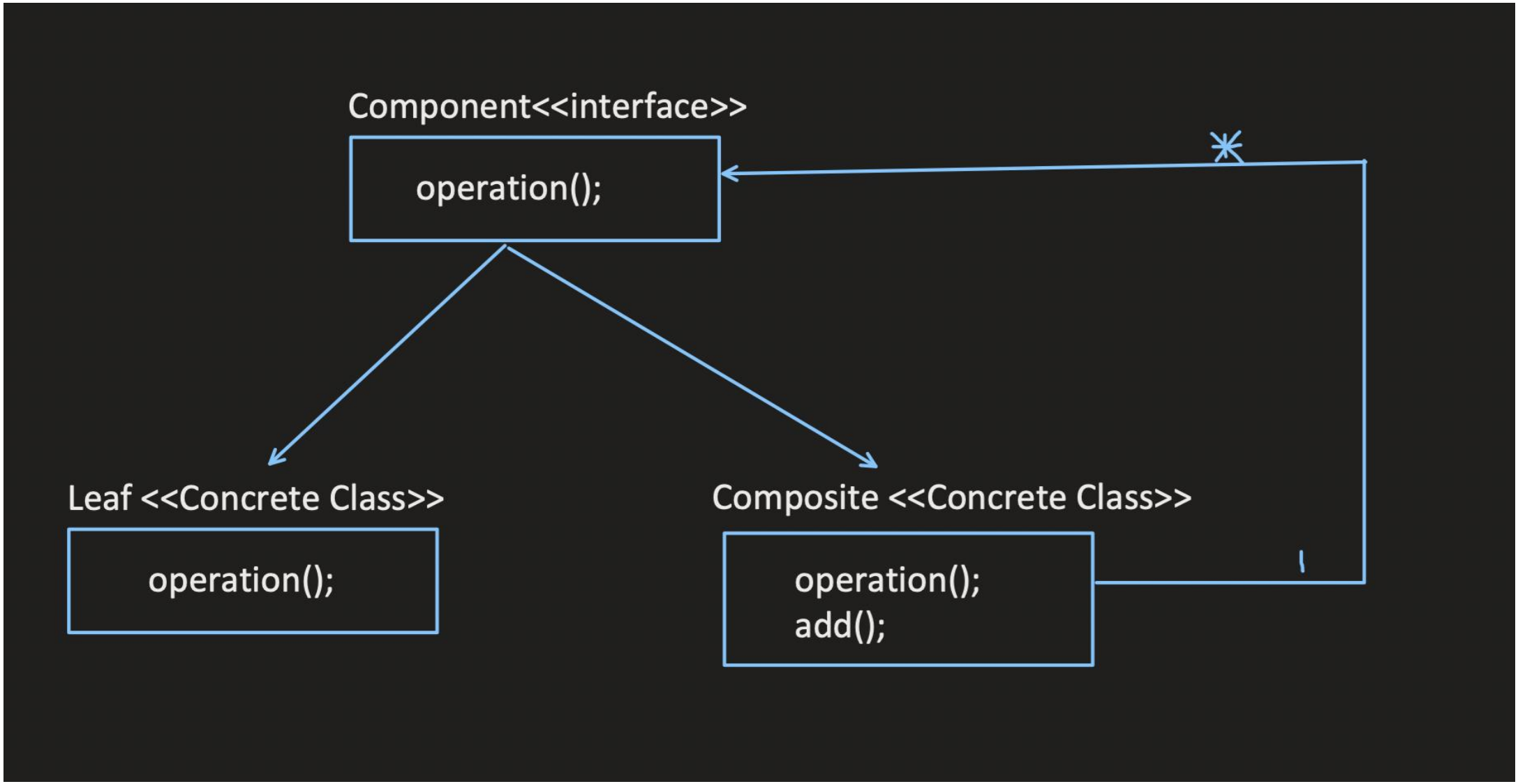

```
EmployeeDao empProxyObj = new EmployeeDaoProxy();
empProxyObj .create();
```

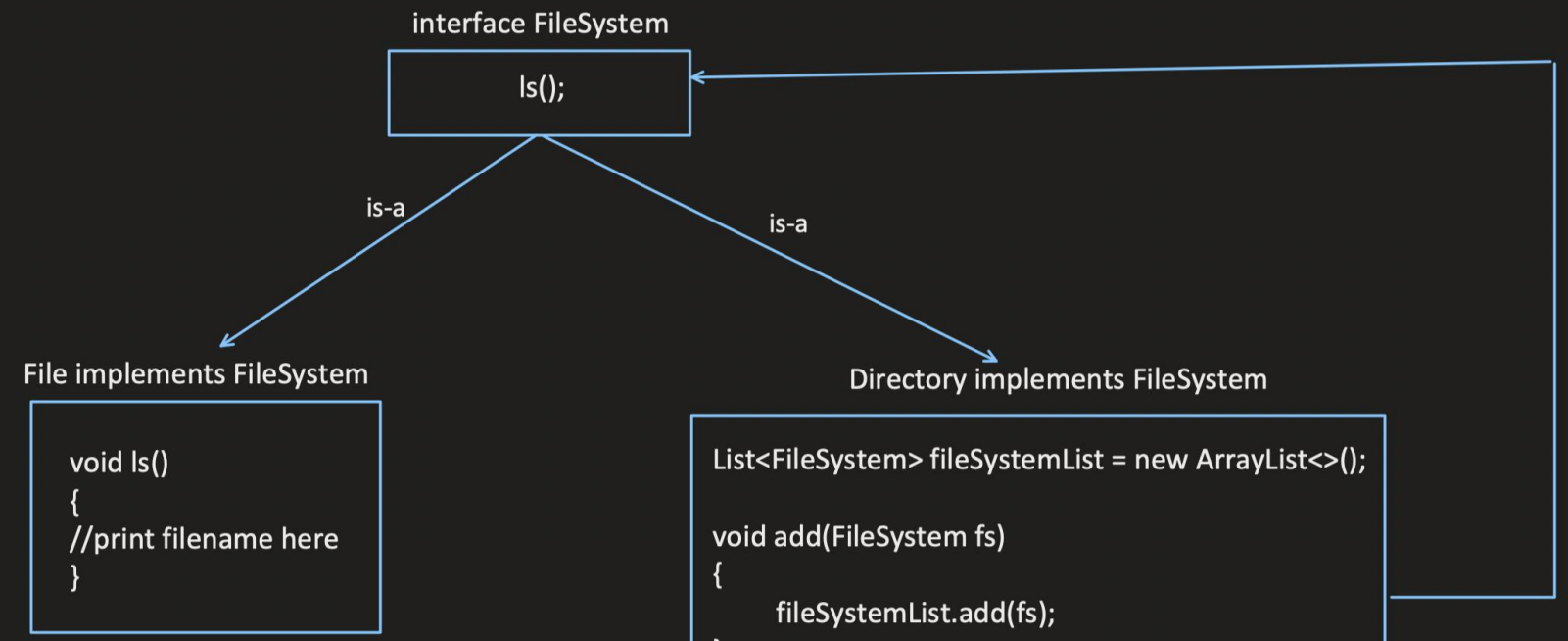
3. Composite Pattern:

This pattern helps in scenarios where we have OBJECT inside OBJECT (tree like structure)





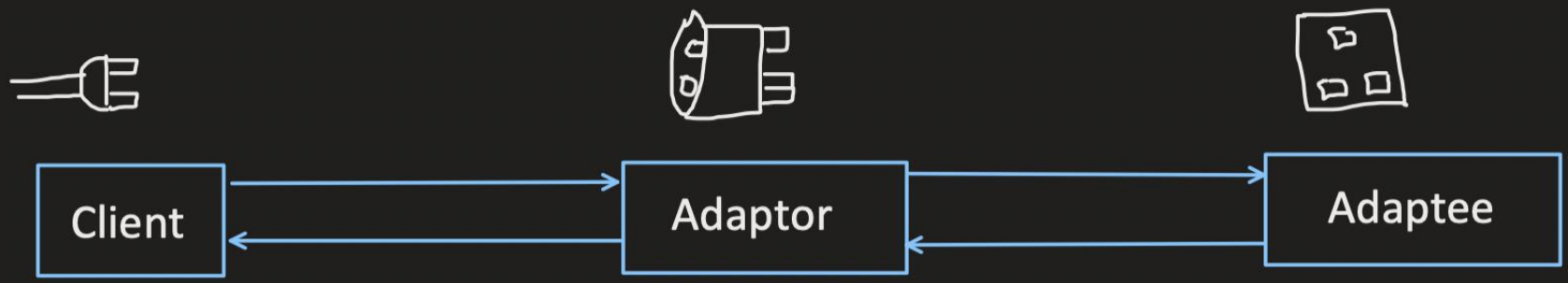

Component<<interface>>
operation();
*
Leaf <<Concrete Class>>
operation();
Composite <<Concrete Class>>
operation();
add();
1




```
Directory parentDir= new Directory();
FileSystem fileObj1 = new File();

parentDir.add(fileObj1);

Directory childDir = new Directory();
FileSystem fileObj2 = new File();
childDir .add(fileObj2);

parentDir.add(childDir);
```

4. Adapter Pattern:

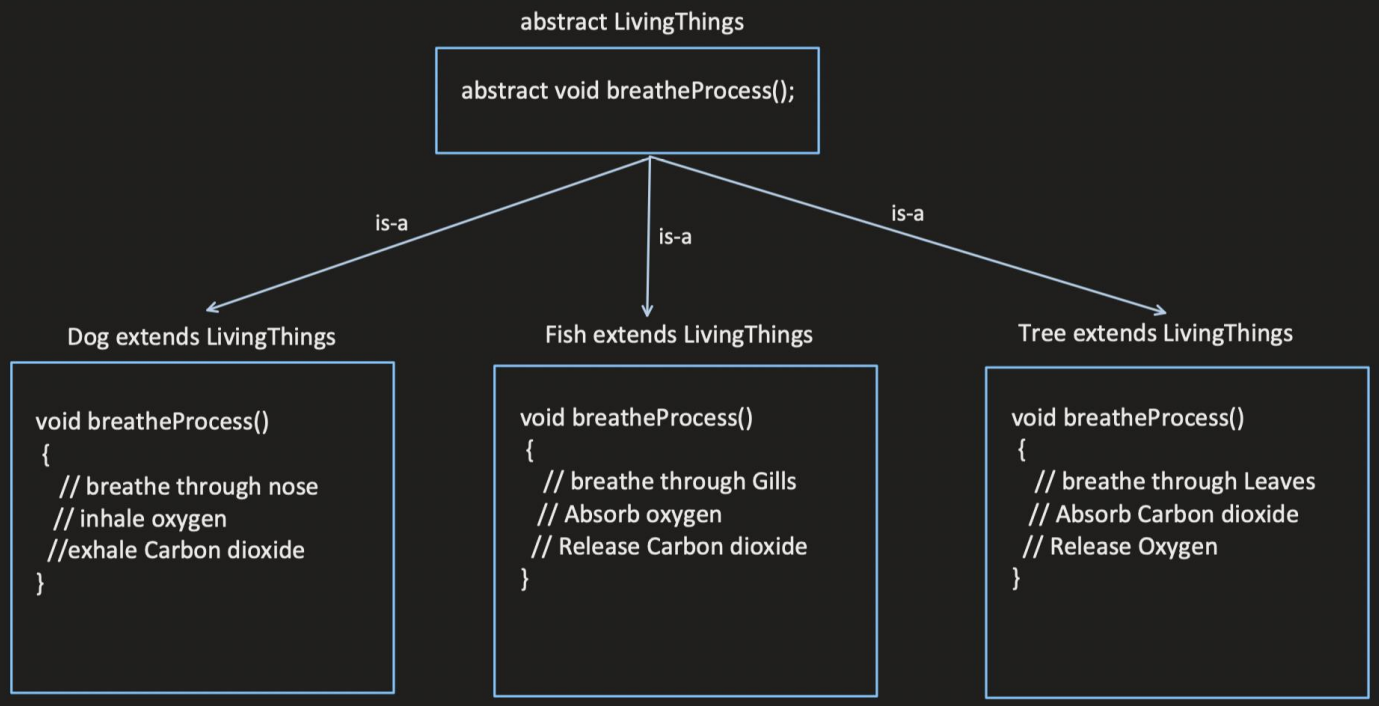
This pattern act as a bridge or intermediate between 2 incompatible interfaces.



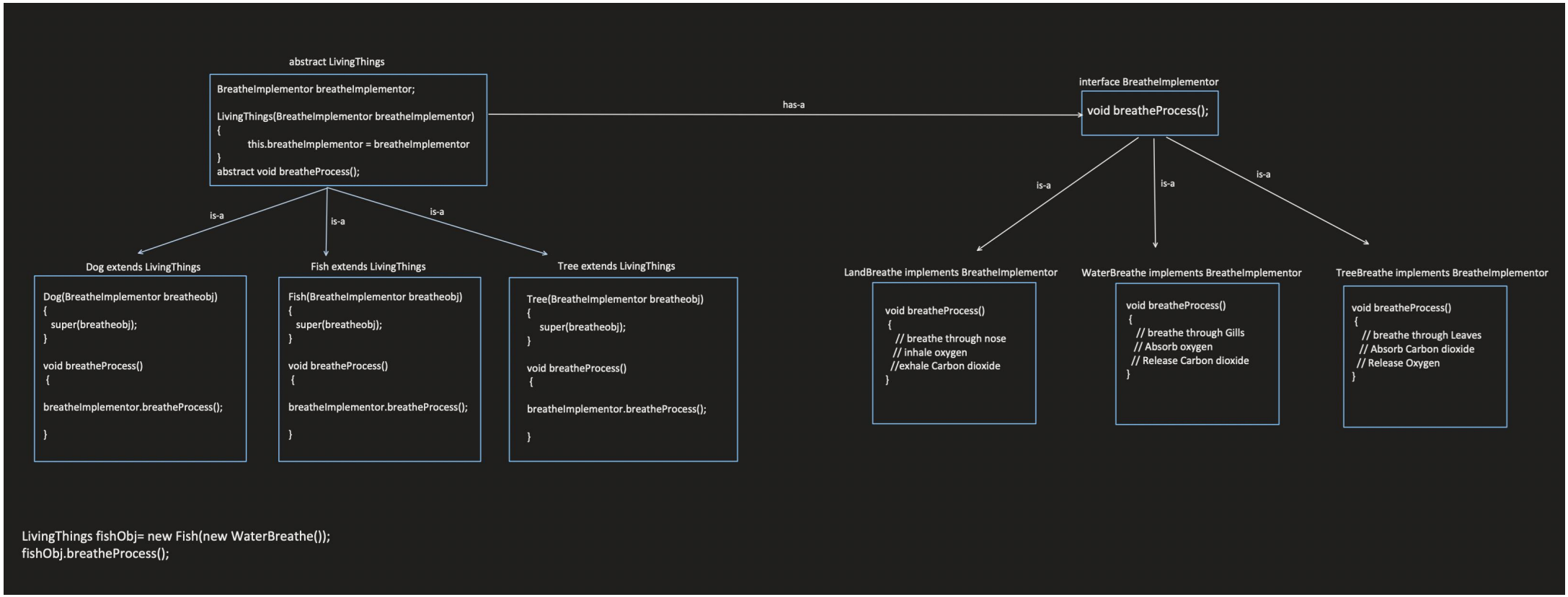

WeightMachineAdaptor machineAdaptorObj = new WeightMachineAdaptorImpl(new WeightMachineImpl());
machineAdaptorObj .getWeightInKg();
interface WeightMachineAdaptor
int getWeightInKg();
interface WeightMachine
int getWeightInPounds();
is-a
is-a
WeightMachineAdaptorImpl implements WeightMachineAdaptor
WeightMachine machine;
WeightMachineAdaptorImpl(WeightMachine machine)
{
this.machine = machine;
}
int getWeightInKg()
{
int weightInPound = machine.getWeightInPounds();
return weightInPound * .45;
}
has-a
WeightMachineImpl implements WeightMachine
int getWeightInPounds()
{
return 30;
}

5. Bridge Pattern:

This pattern helps to decouple an abstraction from its implementation, so that two can vary independently.



How to add new Breathing Process, Without adding any class of LivingThings?

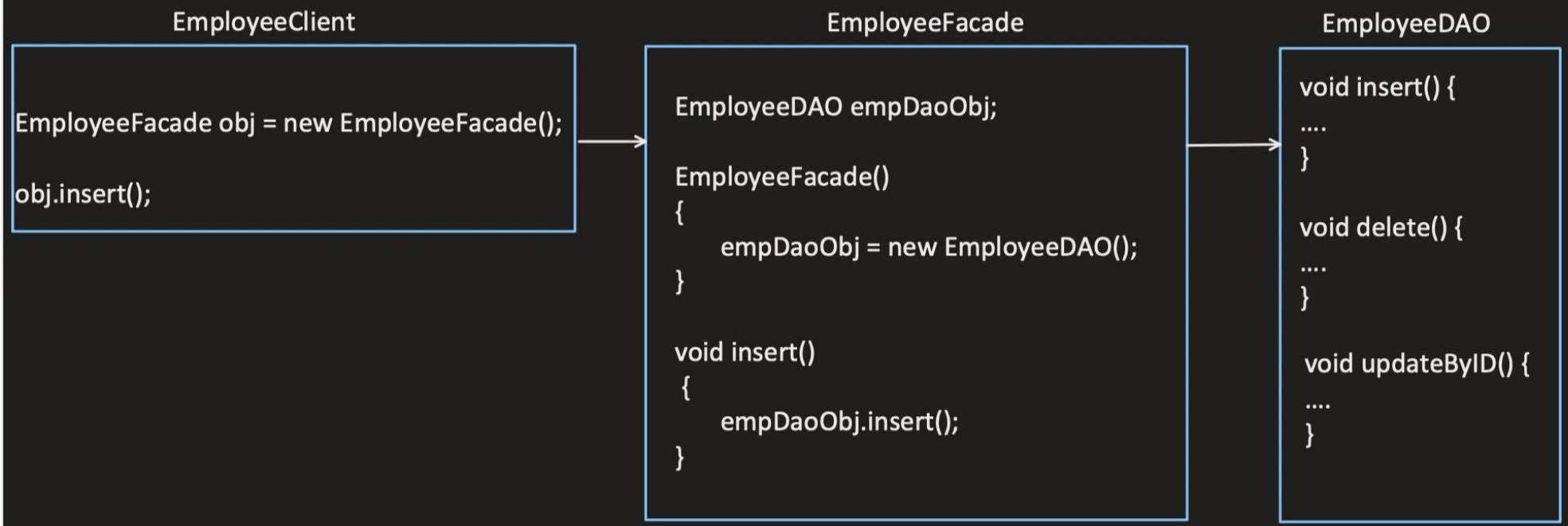



```
LivingThings fishObj= new Fish(new WaterBreathe());
fishObj.breatheProcess();
```

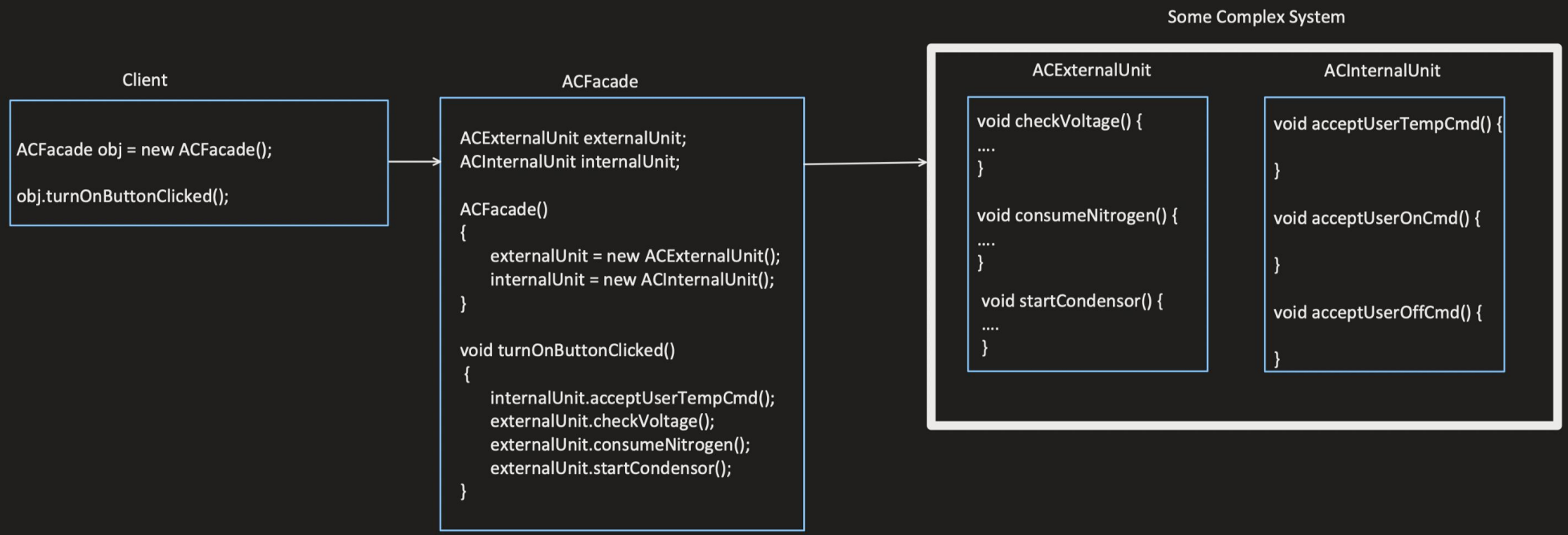
6. Facade Pattern:

This pattern helps to hide the system complexity from the client.

Example1 : expose only the necessary details to the client



Example2 : hide the system complexity from the client



7. Flyweight Pattern:

This pattern helps to reduce memory usage by sharing data among multiple objects.

Issue: lets say memory is 21GB

Robot

```
int coordinateX;        //4bytes
Int corrdinateY;        //4bytes
String type;            //50bytes (1bytes * 50 char length)
Sprites body;           //2d bitmap, 31KB

Robot(int x, int y, String type, Sprites body)
{
      this.coordinateX = x;
      this.coordinateY = y;
      this.type = type;
      this.body = body;
}
```

= ~31KB

```
int x=0;
int y=0;
for(int i=1; i<5000000; i++)
{
    Sprites humanoidSprite = new Sprites();
    Robot humanoidBotObj = new Robot(x+i; y+i, "HUMANOID", humanoidSprite);

}

for(int i=1; i<5000000; i++)
{
    Sprites roboticDogSprite = new Sprites();
    Robot roboticDobObj = new Robot(x+i; y+i, "ROBOTICDOB", roboticDogSprite);

}
```

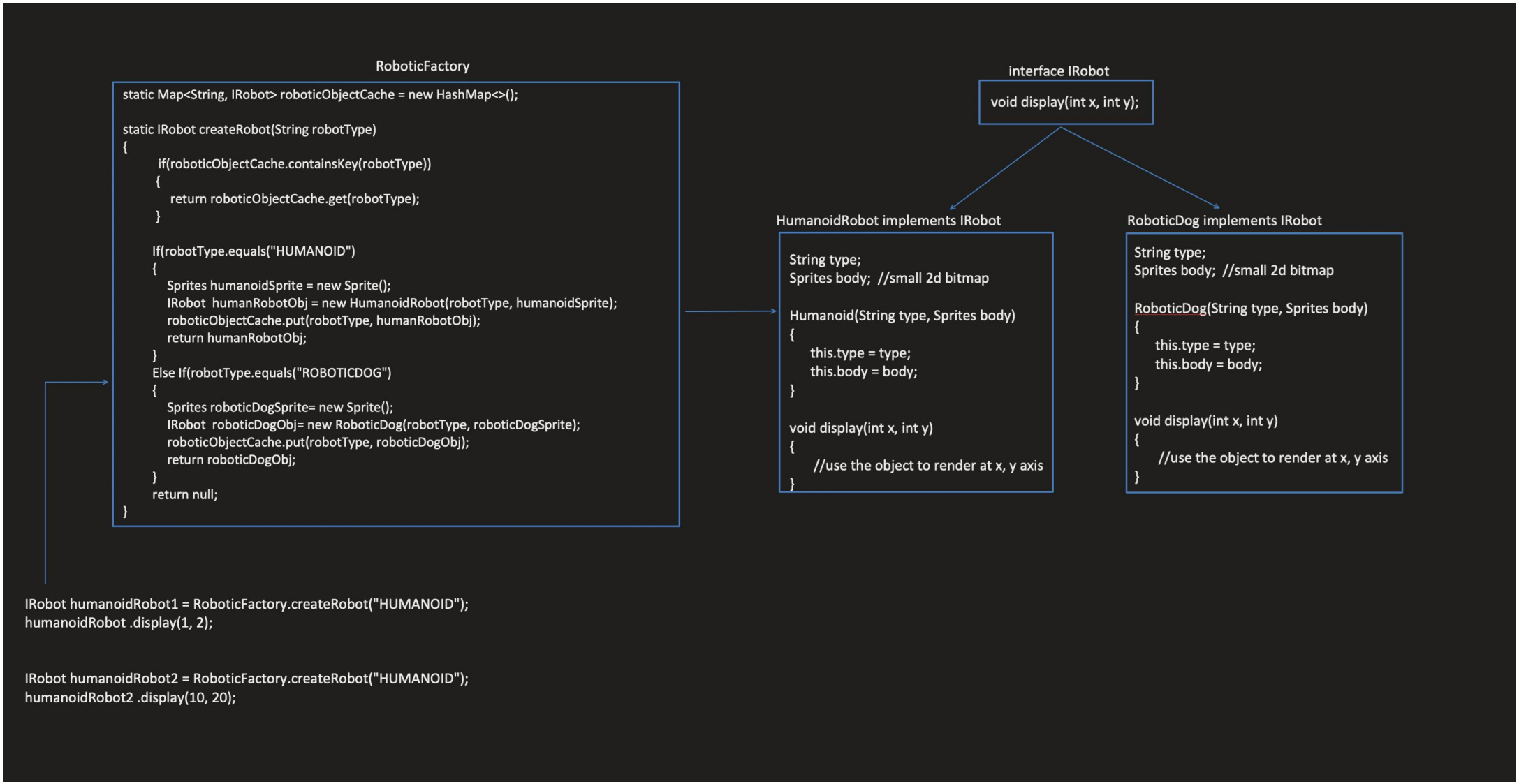
= 10Lakh * ~31KB = 31GB

ISSUE as memory is 21GB only

Intrinsic data: shared among objects and remain same once defined one value.
Like in above example : Type and Body is ***Instrinsic*** data.

Extrinsic data: change based on client input and differs from one object to another.
Like in above example: X and Y axis are ***Extrinsic*** data

- From Object, remove all the Extrinsic data and keep only Intrinsic data (this object is called Flyweight Object)
- Extrinsic data can be passed in the parameter to the Flyweight class.
- Caching can be used for the Flyweight object and used whenever required.


RoboticFactory
static Map<String, IRobot> roboticObjectCache = new HashMap<>();
static IRobot createRobot(String robotType)
{
if(roboticObjectCache.containsKey(robotType))
{
return roboticObjectCache.get(robotType);
}
If(robotType.equals("HUMANOID")
{
Sprites humanoidSprite = new Sprite();
IRobot humanRobotObj = new HumanoidRobot(robotType, humanoidSprite);
roboticObjectCache.put(robotType, humanRobotObj);
return humanRobotObj;
}
Else If(robotType.equals("ROBOTICDOG")
{
Sprites roboticDogSprite= new Sprite();
IRobot roboticDogObj= new RoboticDog(robotType, roboticDogSprite);
roboticObjectCache.put(robotType, roboticDogObj);
return roboticDogObj;
}
return null;
}
interface IRobot
void display(int x, int y);
HumanoidRobot implements IRobot
String type;
Sprites body; //small 2d bitmap
Humanoid(String type, Sprites body)
{
this.type = type;
this.body = body;
}
void display(int x, int y)
{
//use the object to render at x, y axis
}
RoboticDog implements IRobot
String type;
Sprites body; //small 2d bitmap
RoboticDog(String type, Sprites body)
{
this.type = type;
this.body = body;
}
void display(int x, int y)
{
//use the object to render at x, y axis
}
IRobot humanoidRobot1 = RoboticFactory.createRobot("HUMANOID");
humanoidRobot .display(1, 2);
IRobot humanoidRobot2 = RoboticFactory.createRobot("HUMANOID");
humanoidRobot2 .display(10, 20);