Unidade Curricular

“Padrões e Desenho de Software”

#04 – Creational Patterns (1)

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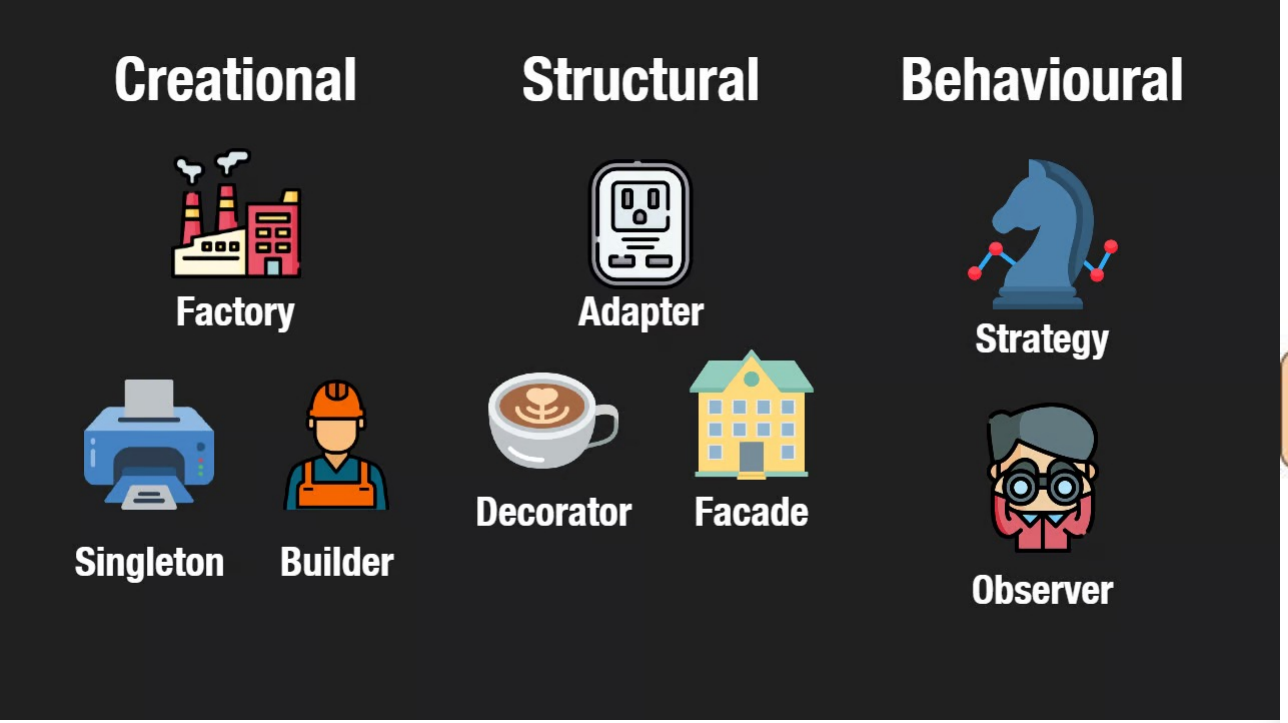
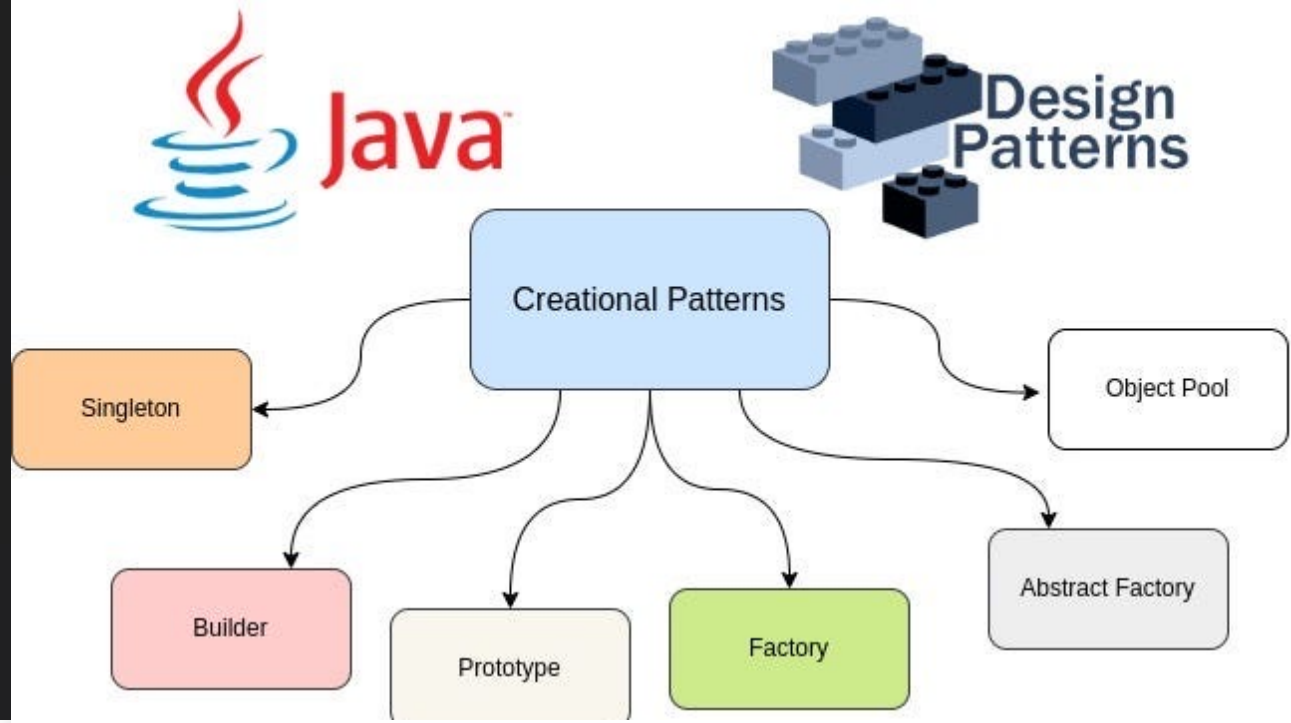
https://www.ua.pt/pt/uc/12275

Outline

- Creational Design Patterns
- Factory Pattern
- Practical work
- Abstract Factory Pattern





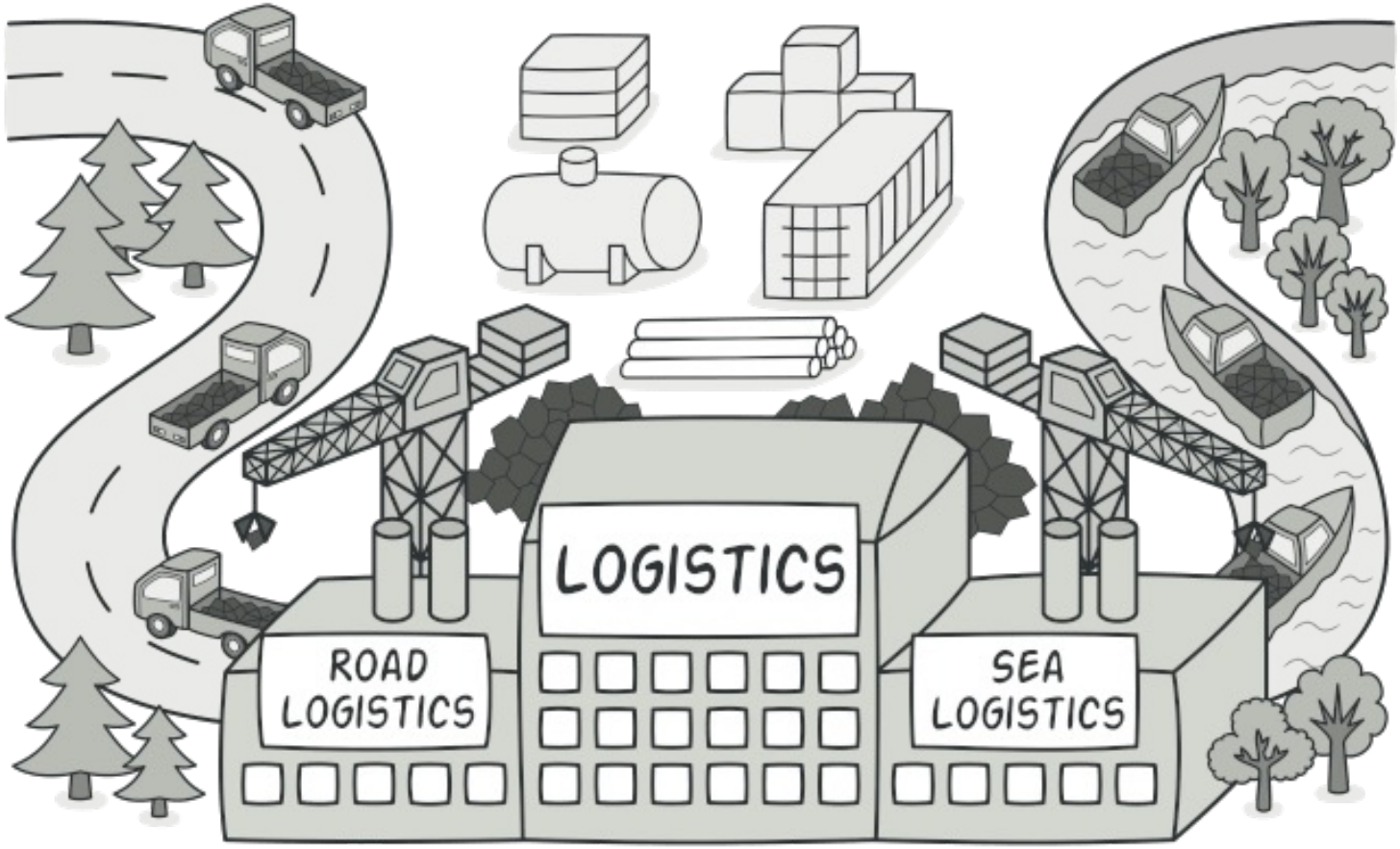
Creational Design Patterns

- **15 minutes** to explore the Factory Design Pattern and answer the questions in the link:

`https://forms.gle/awwcwAWkKgFC37HFA`

Factory Pattern Overview

- Definition: The Factory pattern is a creational design pattern that provides an interface for creating objects without specifying their concrete classes.
- Purpose: Encapsulates object creation logic, promotes loose coupling, and simplifies object instantiation.

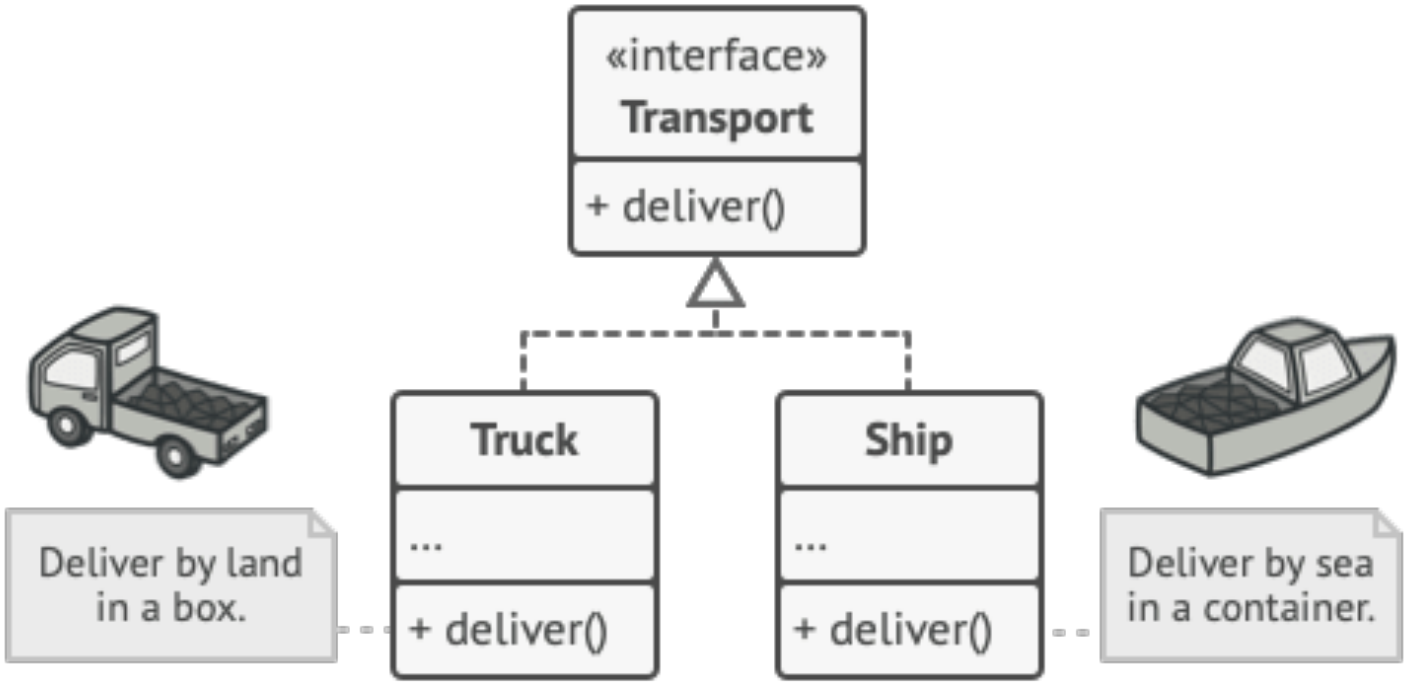


Problem Statement

- Difficulty in managing object creation logic directly within client code.
- Tight coupling between client code and concrete classes.
- The new operator considered harmful.

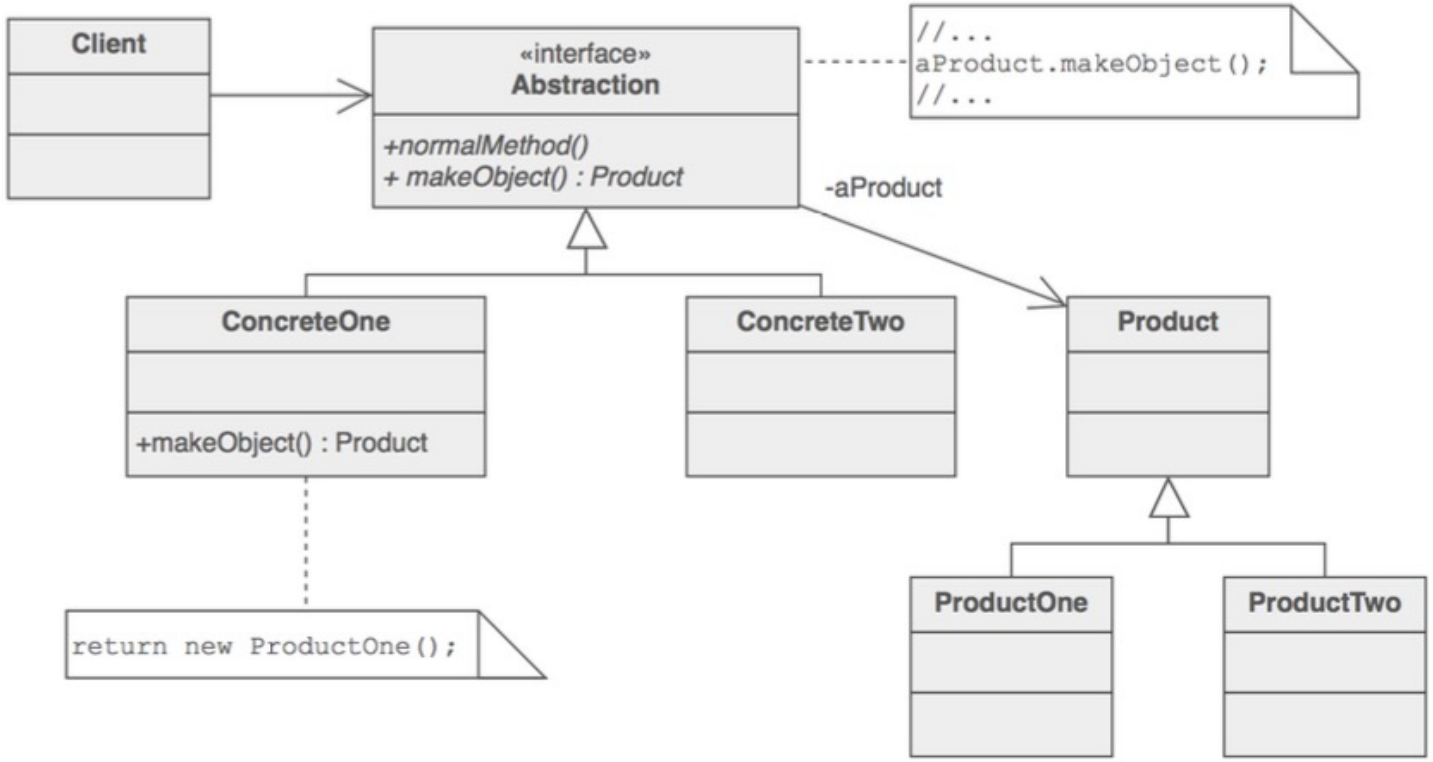
Solution: Factory Pattern

- Provides a separate factory class responsible for object creation.
- Clients interact with the factory interface to create objects without knowledge of their concrete classes.

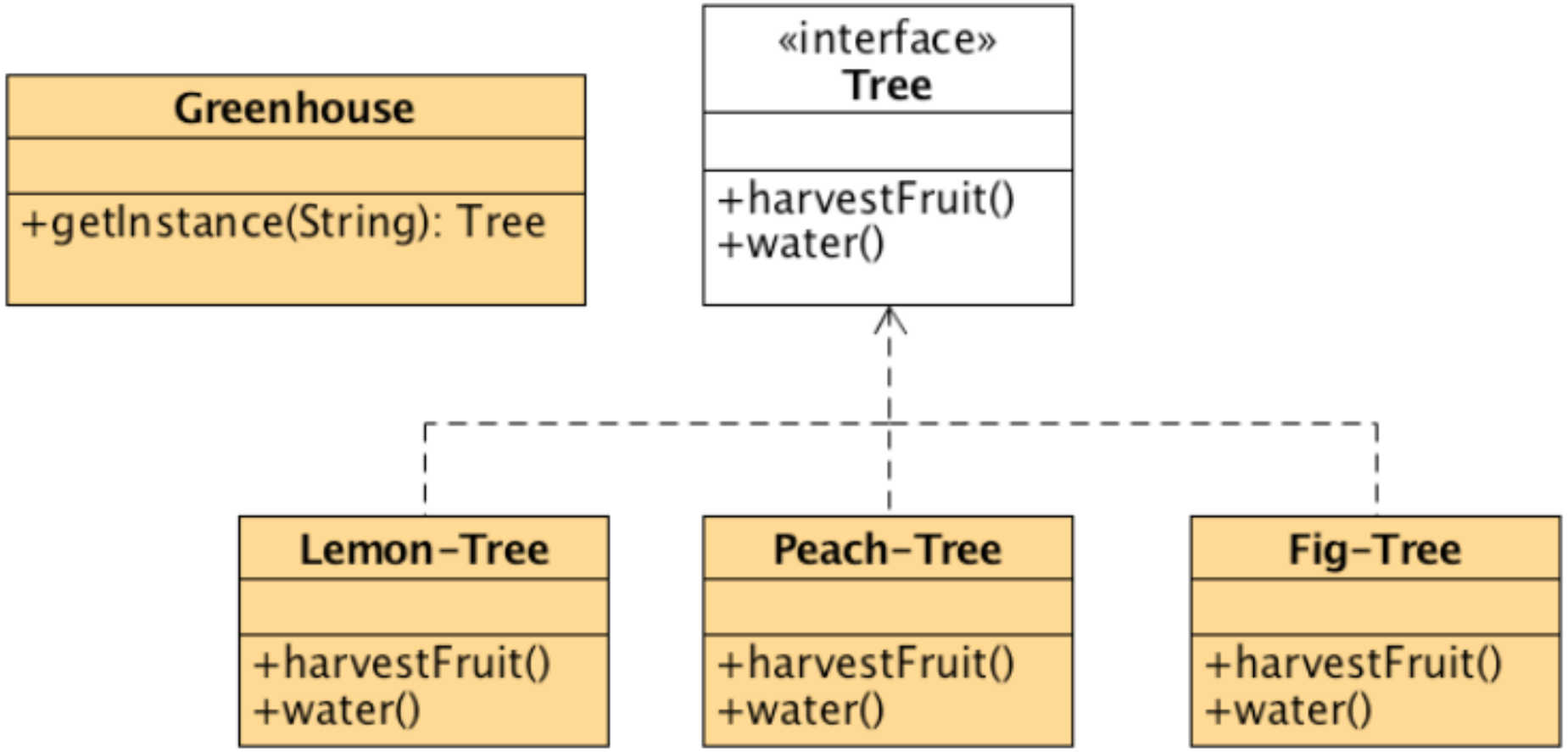


Structure of Factory Pattern

- Factory Interface: Defines methods for creating objects.
- Concrete Factory Classes: Implement the factory interface and provide specific implementations for object creation.
- Client: Requests objects from the factory interface.



Example


Greenhouse
+getInstance(String): Tree
«interface»
Tree
+harvestFruit()
+water()
Lemon-Tree
+harvestFruit()
+water()
Peach-Tree
+harvestFruit()
+water()
Fig-Tree
+harvestFruit()
+water()

Benefits of Factory Pattern

- Encapsulates object creation logic, promoting code reuse and maintainability.
- Reduces coupling between client code and concrete classes, facilitating easier changes and enhancements.
- Supports the open/closed principle by allowing new object types to be added without modifying existing code.
- Real-World Applications:
  - GUI frameworks use the Factory pattern for creating UI components
  - Game development frameworks use the Factory pattern for creating game objects and entities
  - JDK itself (where getInstance() method is present – ex. Calendar)

Exercise 4.1 and 7.1 – POO (last year)

Implement a simple Shape factory that can create different types of shapes, such as:

- Circles (with a radius)
- Rectangles (two dimensions)
- Triangle (three sides)
- ➢ Methods for the area and perimeter

- **30 minutes** to solve this problem and submit the code in the elearning:

https://elearning.ua.pt/mod/assign/view.php?id=1406268

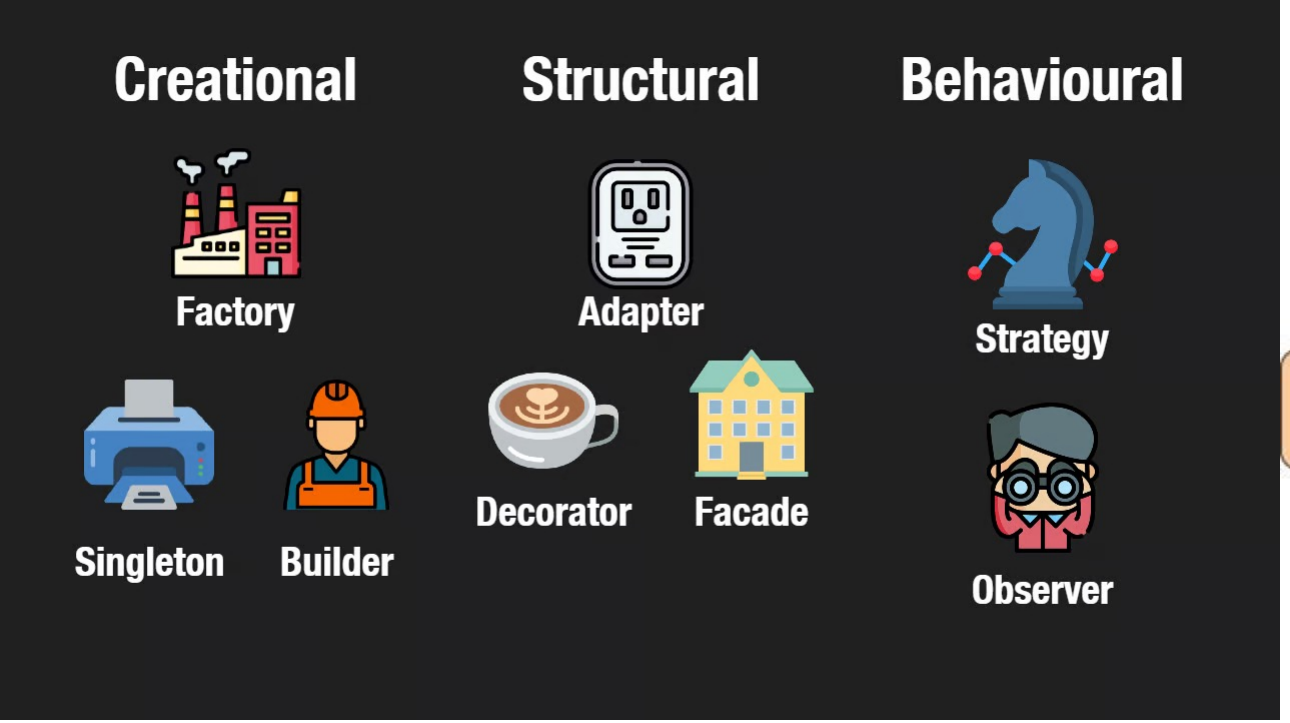
Let’s take a short break

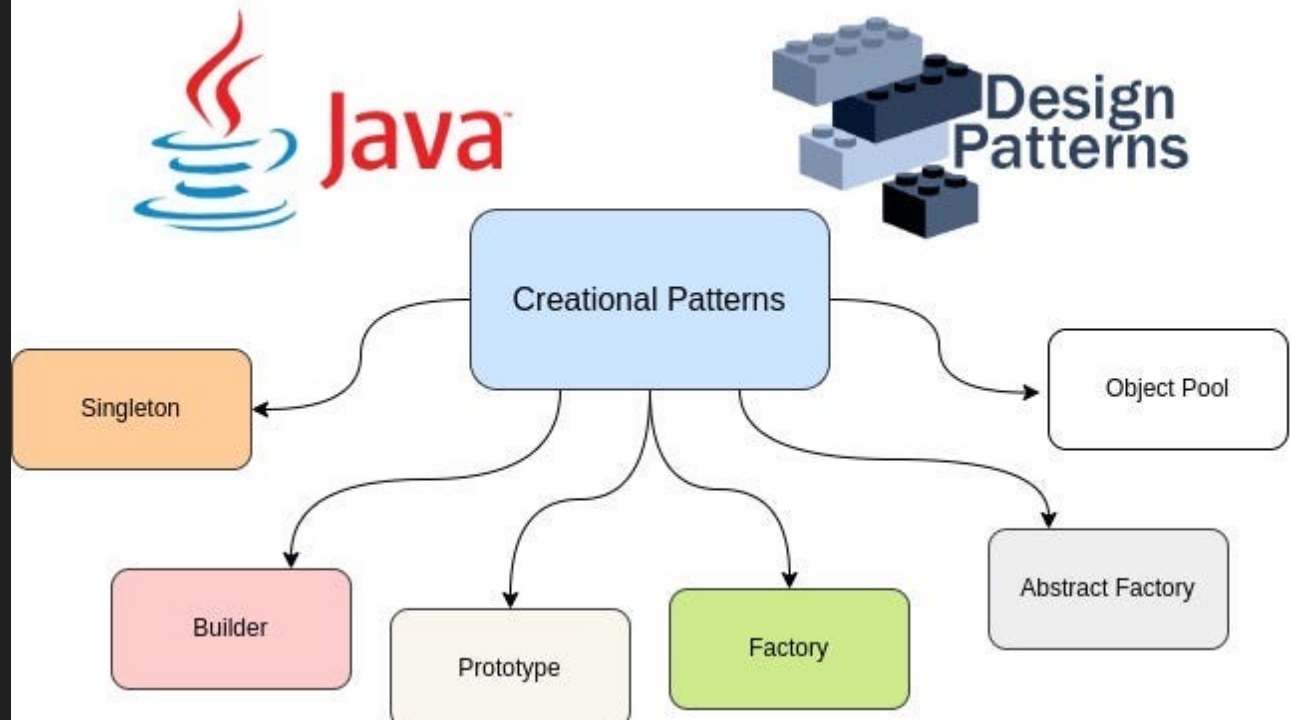
10 Minutes

You are free to go grab
a coffee, water, etc.

But… 10 minutes **is 10 minutes** (600 seconds, **not 601 seconds!)**

10 minutes



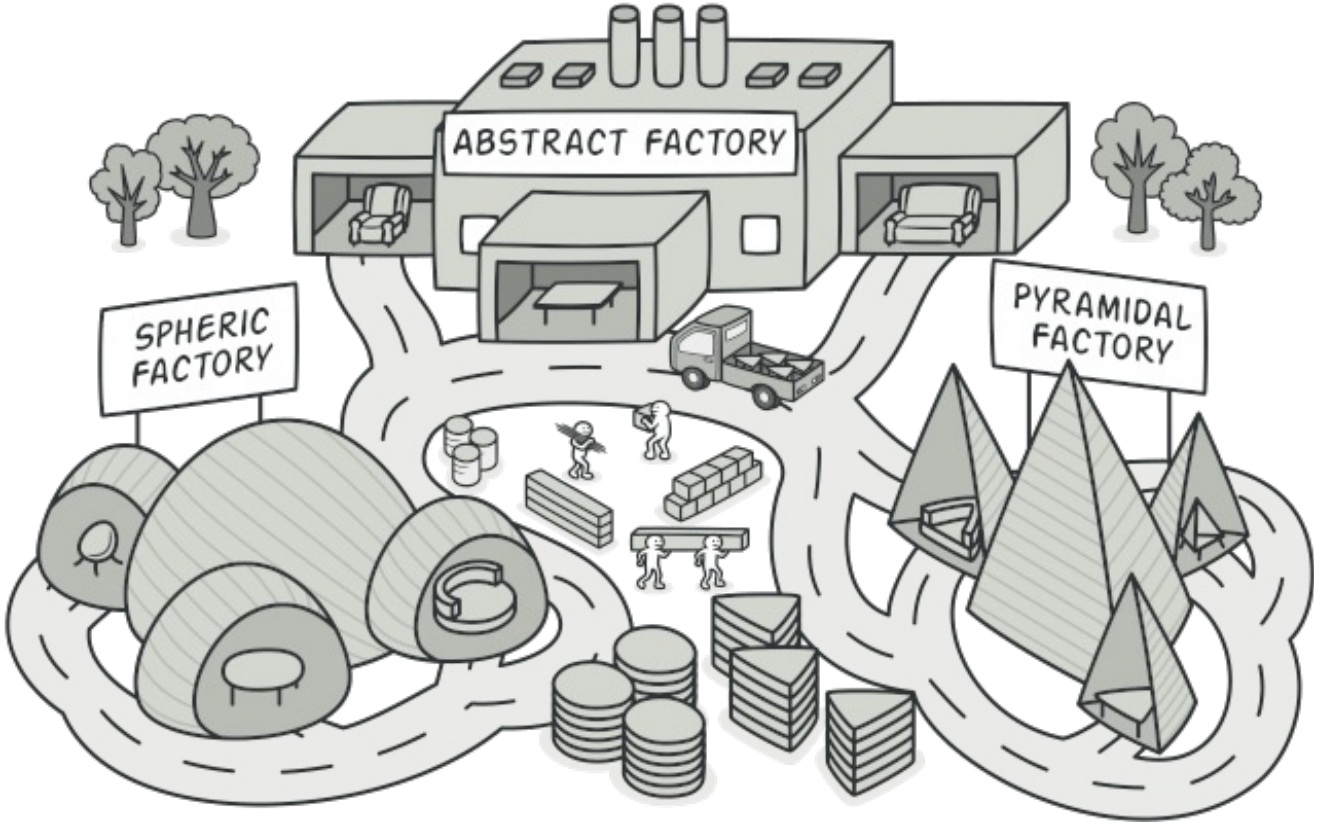


Creational Design Patterns

- **15 minutes** to explore the Abstract Factory Design Pattern and answer the questions in the link:

https://forms.gle/ybzpgWRciHmXTZcDA

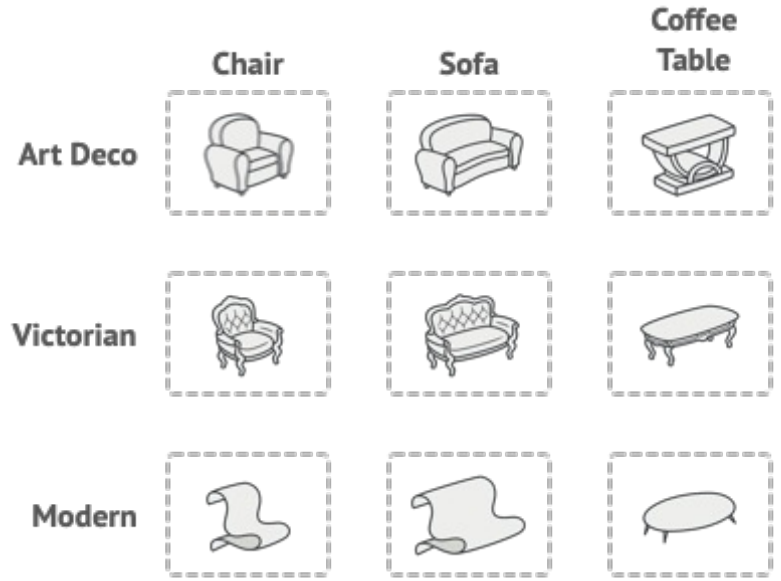
Abstract Factory Pattern Overview



- Definition: The Abstract Factory pattern is a creational design pattern that provides an interface for creating families of related or dependent objects without specifying their concrete classes.
- Purpose: Encapsulates object creation logic, promotes loose coupling, and ensures compatibility between related object families.

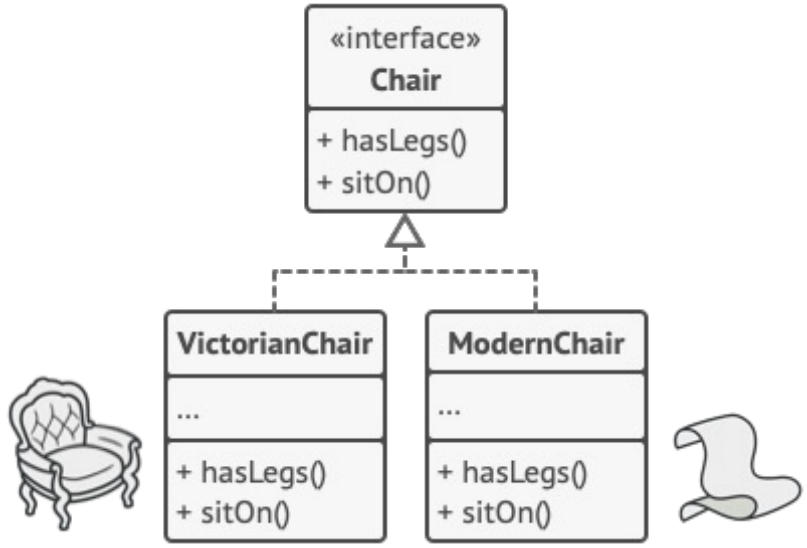
Problem Statement

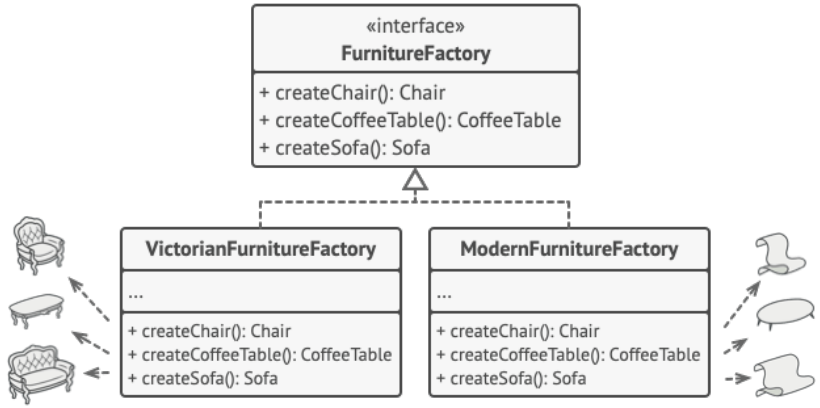
- Difficulty in managing object creation logic for families of related objects.
- Tight coupling between client code and concrete classes of object families.



Solution: Abstract Factory Pattern

- Provides an abstract factory interface for creating families of related objects.
- Concrete factory classes implement the abstract factory interface to create specific families of objects.
- Clients interact with the abstract factory interface to create objects without knowledge of their concrete classes.





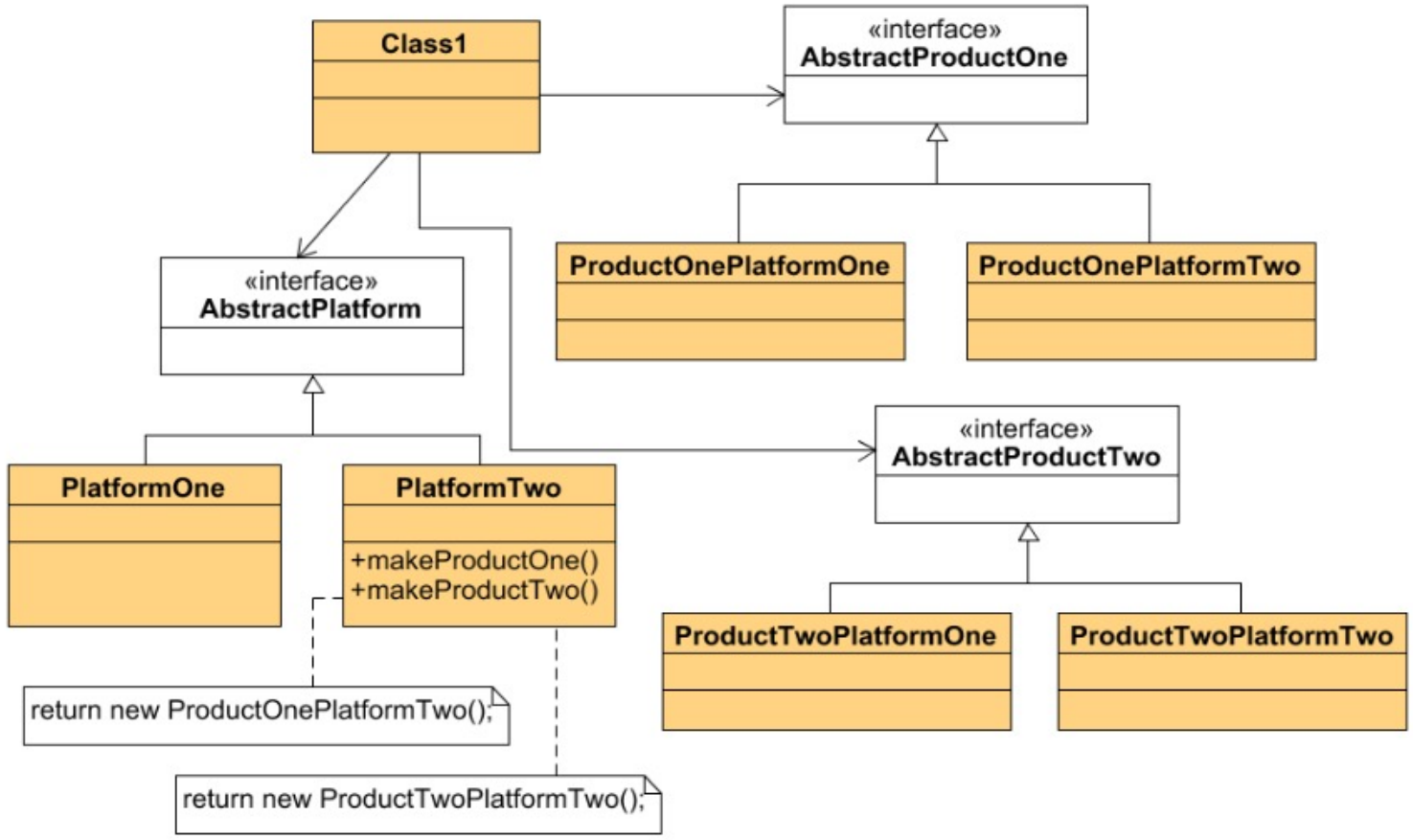
Structure of Abstract Factory Pattern

- Abstract Factory Interface: Defines methods for creating families of related objects.
- Concrete Factory Classes: Implement the abstract factory interface and provide specific implementations for creating families of objects.
- Client: Requests objects from the abstract factory interface.

```java
public class TestJuiceFactory {
    Run | Debug
    public static void main(String[] args) {
        JuiceFactory metalFactory = new MetalJuiceFactory();
        JuiceFactory plasticFactory = new PlasticJuiceFactory();
        JuiceFactory glassFactory = new GlassJuiceFactory();

        OrangeJuice metalOrangeJuice = metalFactory.makeOrangeJuice();
        metalOrangeJuice.drink();

        AppleJuice plasticAppleJuice = plasticFactory.makeAppleJuice();
        plasticAppleJuice.drink();

        LemonJuice glassLemonJuice = glassFactory.makeLemonJuice();
        glassLemonJuice.drink();
    }
```

```
Drinking Orange Juice from a Metal Container
Drinking Apple Juice from a Plastic Container
Drinking Lemon Juice from a Glass Container
```

Example


Class1
«interface»
AbstractProductOne
«interface»
AbstractPlatform
ProductOnePlatformOne
ProductOnePlatformTwo
«interface»
AbstractProductTwo
PlatformOne
PlatformTwo
+makeProductOne()
+makeProductTwo()
ProductTwoPlatformOne
ProductTwoPlatformTwo
return new ProductOnePlatformTwo();
return new ProductTwoPlatformTwo();

Benefits of Abstract Factory Pattern

- Encapsulates object creation logic for families of related objects, promoting code reuse and maintainability.
- Reduces coupling between client code and concrete classes of object families, facilitating easier changes and enhancements.
- Ensures compatibility between related object families by providing a common interface for object creation.
- Examples:
  - GUI frameworks use the Abstract Factory pattern for creating platform-specific UI components.
  - Database libraries use the Abstract Factory pattern for creating database connections and queries specific to different database vendors.