Builder Design Pattern

Builder is a creational design pattern that lets you construct complex objects step by step.
This pattern allows you to produce different types and representations of an object using the same construction code.

Problem

- Imagine that there is a product (a product in ecommerce website like amazon) class.
- A product will have images of product, price, discount, product category/sub-category, product description, other product attributes (size variant, color, brand, etc).
- All of this will result into product class having a monstrous constructor with lots of parameters.
- In most cases most of the parameters will be unused, making the constructor calls pretty ugly. For instance, only a fraction of products will have size option or discount at a particular time.

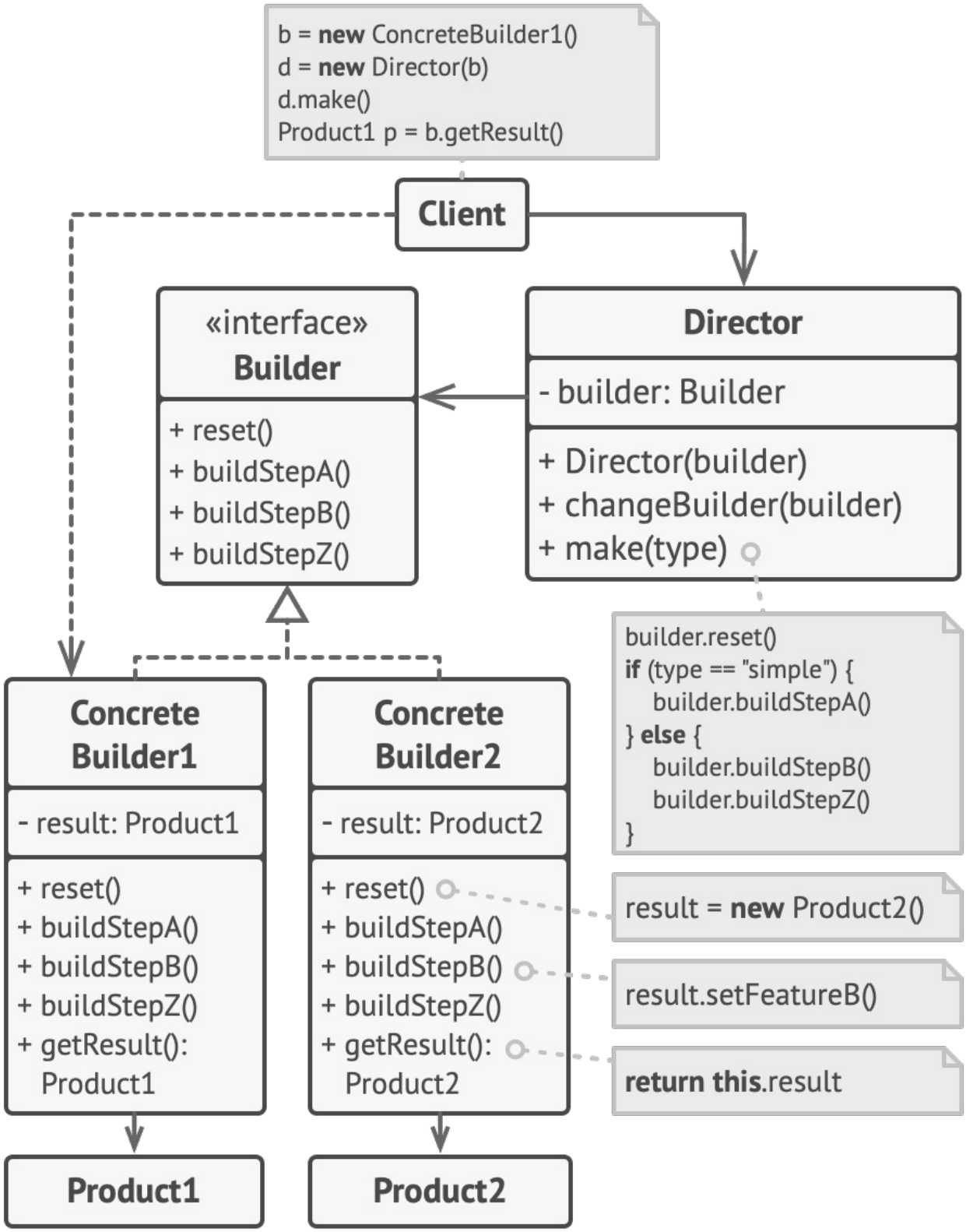
Solution

- The Builder pattern suggests that you extract the object construction code out of its own class and move it to separate objects called builders.
  Ex - For the above case, we build the product object in multiple stages.
- The important part is that you don't need to call all the steps. You can call only those steps that are necessary for producing a particular configuration of an object.

Director

- The director class defines the order in which to execute the building steps, while the builder provides the implementation for those steps.
- we can always call the building steps in a specific order directly from the client code. However, the director class might be a good place to put various construction routines so you can reuse them across your program.
- the director class completely hides the details of product construction from the client code. The client only needs to associate a builder with a director, launch the construction with the director, and get the result from the builder.

UML Diagram



Implementation Consideration

- we can easily create an immutable class by implementing builder as inner static class. This type of implementation is very common and is used even when we do not need immutability. This is a good code practice to declare builder in the same class.
- The director role is rarely implemented. Usually, the consumer of object instance or client handles this role

Applicability

- Use builder patter to get rid of telescoping constructor

```
public class Product {
   Product(long productId);
   Product(long productId, String name);
   Product(long productId, String name, string description);
   //.....
}
```

- Use the Builder pattern when you want your code to be able to create different representations of some product.
- Use the Builder to construct Composite trees or other complex objects.

Pros and Cons

Pros	Cons
You can construct objects step-by-step, defer construction steps or run steps recursively.	The overall complexity of the code increases since the pattern requires creating multiple new classes
You can reuse the same construction code when building various representations of products.	
Single Responsibility Principle. You can isolate complex construction code from the business logic of the product.	

References

- https://refactoring.guru/design-patterns/builder