Strategy Pattern

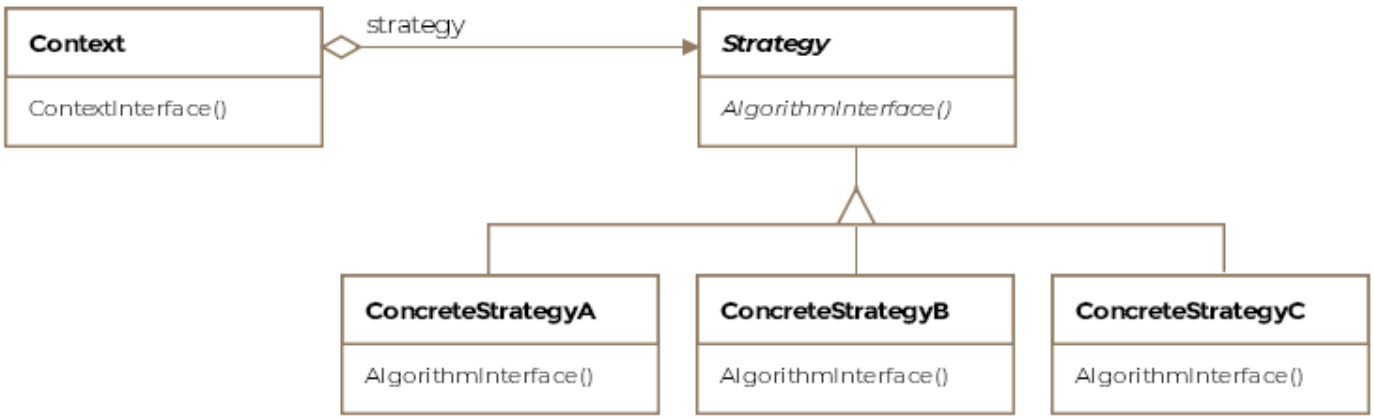
This lesson discusses how a set of policies, algorithms or strategies can be made interchangeable without affecting the clients using them.

What is it ?

> The strategy pattern is one of the simpler patterns to comprehend. It allows grouping related algorithms under an abstraction, which the client codes against. The abstraction allows switching out one algorithm or policy for another without modifying the client.
>
> The strategy pattern is formally defined as ***encapsulating algorithms belonging to the same family and making them interchangeable. The consumers of the common interface that the algorithms implement allow switching out one algorithm for another seamlessly.***

Class Diagram

> The class diagram consists of the following entities
>
> - **Strategy**
> - **Concrete Strategy**
> - **Context**



Examples

Concrete algorithms implement the same interface. The **context** has the data the algorithm will act on. Together the context and the strategy interact to implement the chosen algorithm. Usually, clients instantiate the context and pass in the strategy object and then, only interact with the context object.

The most trivial example one can think of is the family of *sorting algorithms*. Say our application is only concerned with sorting integer arrays. All the sorting algorithms can implement a common interface, that we call `ISort`

```
public interface ISort {

    void sort(int[] input);
}
```

The concrete implementations of the interface appear below:

```
public class BubbleSort implements ISort {

    @Override
    public void sort(int[] input) {
        // Do inefficient sorting in order n squared
    }
}

public class MergeSort implements ISort {

    @Override
    public void sort(int[] input) {
        // Do efficient sorting in nlogn
    }
}
```

The `Context` class holds a reference to the strategy object and when it receives requests from its clients, it forwards them to the strategy object along with the required data.

```
public class Context {

    private ISort howDoISort;

    public Context(ISort howDoISort) {
        this.howDoISort = howDoISort;
    }

    // Context receives the data from its client
    // and passes it on to the strategy object.
    void sort(int[] numbers) {
        howDoISort.sort(numbers);
    }

    // We can change the sorting algorithm using this setter
    public void setHowDoISort(ISort howDoISort) {
        this.howDoISort = howDoISort;
    }
}
```

The client can use the context like so:

```
public class Client {

    private int[] numbers = new int[1000];

    void crunchingNumbers() {

        // Choose the sorting strategy
        BubbleSort bubbleSort = new BubbleSort();

        // Context receives the strategy object
        Context context = new Context(bubbleSort);

        // Sort the numbers
        context.sort(numbers);

        // Do remaining work
    }
}
```

Notice how the context keeps an interface reference and can be configured with any concrete sort implementation. The implementation can also be changed at runtime through the setter. This decoupling of the client and the algorithms, allows us to vary the algorithms independent of the client.

Other Examples

- For our aircraft scenario, we can think about the different ways an F-16 can be equipped with weapons before each mission. An F-16 can go for reconnaissance without carrying any weapons, it can be loaded with (God forbid) nuclear weapons or it can carry Sidewinder (https://en.wikipedia.org/wiki/AIM-9_Sidewinder) missiles to intercept incoming enemy fighter jets. When modeling this scenario in our code, we could create a `ArmingStrategy` interface which will have concrete implementations of `NoWeapons`, `NuclearWeapons` and `AirToAirWeapons` as arming strategies for the plane. Before the F16 flies each mission we can set the `armingStrategy` variable held in the `F16` class with the desired

arming strategy for the mission.

- `java.util.Comparator` has the method `compare` which allows the user to define the algorithm or strategy to compare two objects of the same type.
- Think how a text editor such as Microsoft Word can make use of the strategy pattern when a client chooses the paragraph alignment options. The strategies could be ***justify text***, ***left-align***, ***right-align*** or ***center-align***.

Caveats

- The context can either pass the required data or itself to the strategy object. In the latter case, the context would expose methods on itself so that the strategy object can retrieve the required data.
- Strategy objects are good candidates to be implemented as ***flyweight*** objects. This can reduce the memory requirements for the application.
- The context class can be simplified by providing a default strategy and only burdening the clients to provide a strategy object, when the default doesn't meet their requirements.

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