Lecture 06: Observer Pattern
IN710: Object-Oriented Systems Development
Semester One, 2020

Kaiako: Grayson Orr

Te Kura Matatini ki Otago, Ōtepoti, Aotearoa

Thursday, 5 March

Lecture 05: Strategy Pattern Recap

- Design pattern 01: strategy pattern
  - Definition
  - Problem & solution
  - Real world analogy
  - UML & implementation
  - Open-closed principle
  - Pros & cons

Lecture 06: Observer Pattern Topics

- Design pattern 02: observer pattern
  - Definition
  - Problem/solution
  - Real world analogy
  - UML & implementation
  - Pros & cons

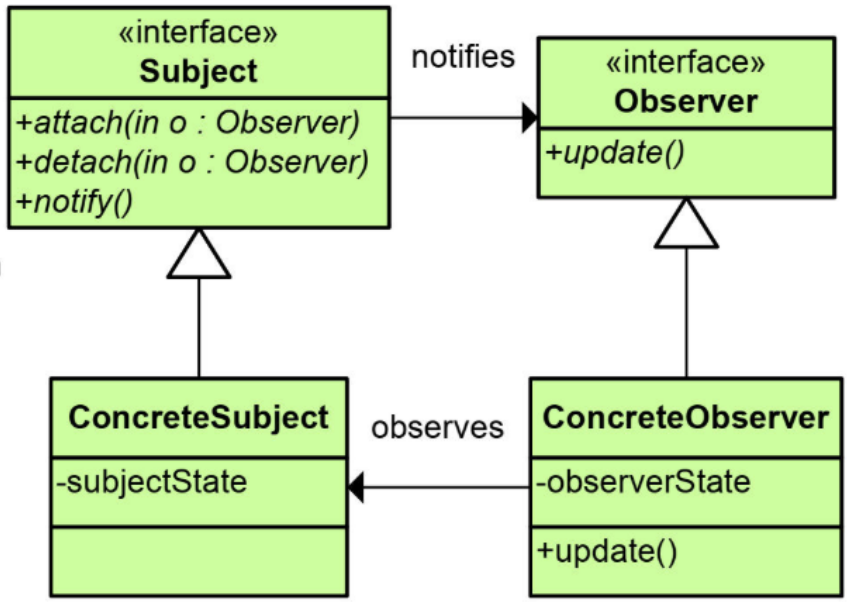
Observer Pattern: GoF

- GoF definition & UML

Observer

Type: Behavioral

What it is:
Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically.



Observer Pattern: Definition

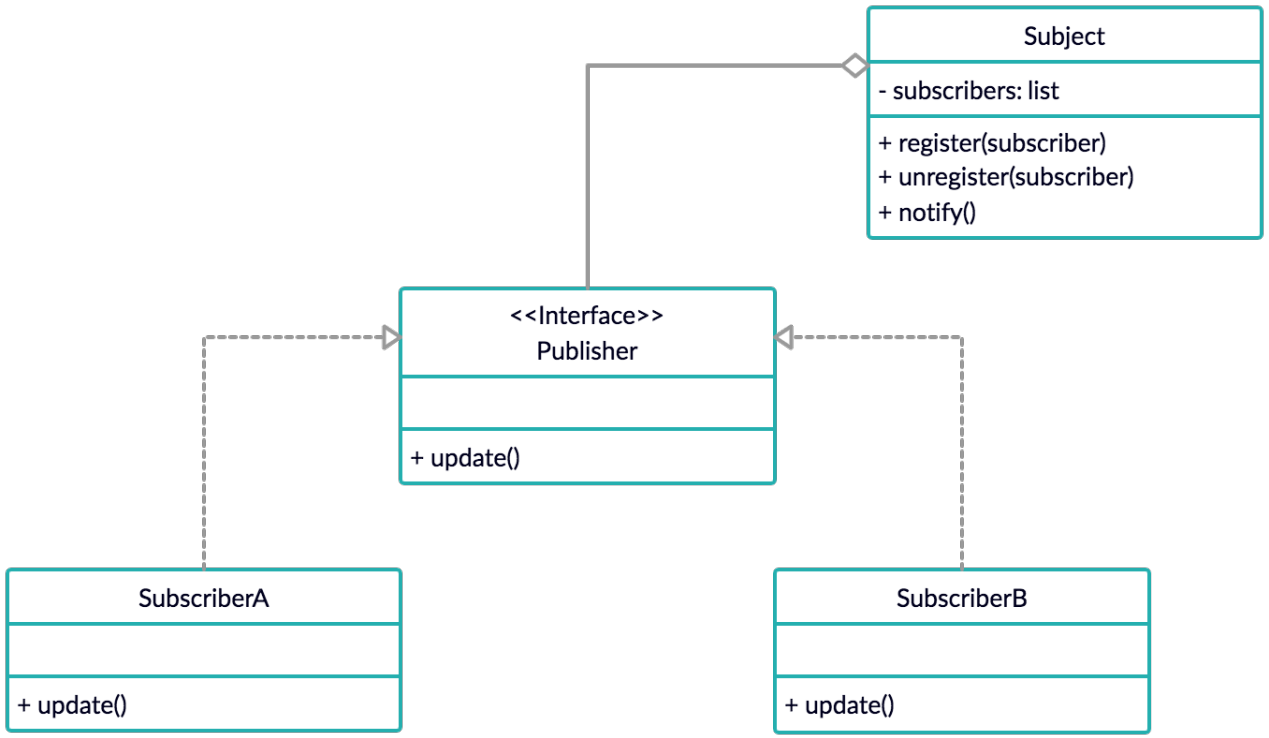
- Behavioural pattern
- An object (subject) maintains a list of its dependents (observers)
- The subject automatically notifies the observers of any state changes
- Mainly used to implement event handling systems
  - The subject is usually called stream of events
  - The observers are called sink of events
- Suits any process where data arrives through I/O
- Most modern programming languages have built-in event constructs

Observer Pattern: Problem

- Purchasing the new Tesla Cybertruck

Observer Pattern: Solution

- Subject class
- Publisher/observer class
- Subscriber/observerable classes

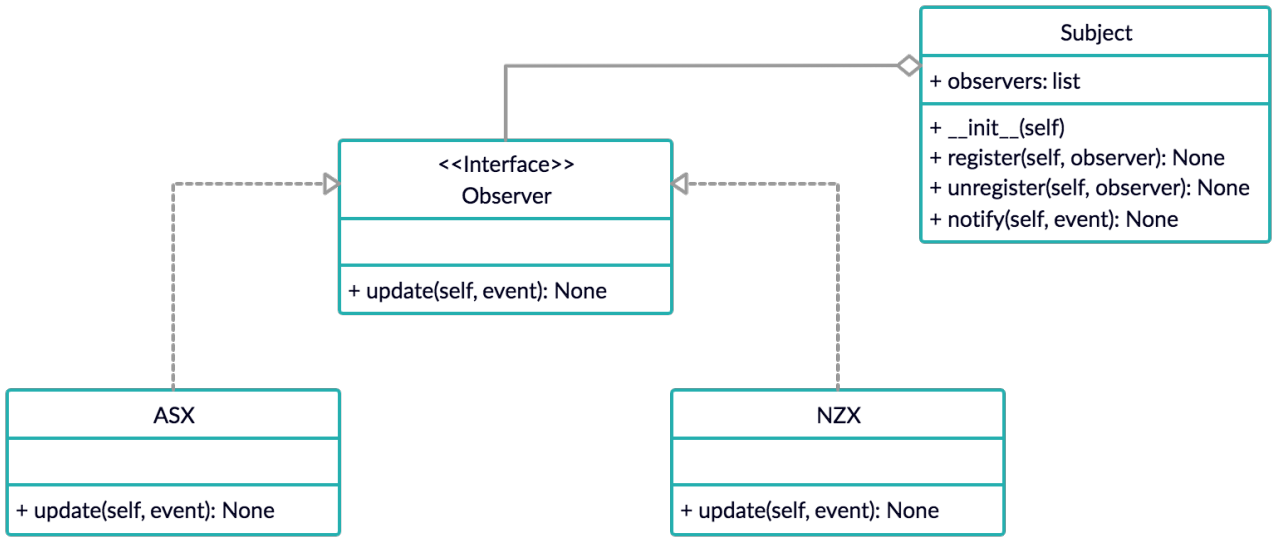


Observer Pattern: Real World Analogy

- Subscription to Time Magazine
- Publisher sends a new issue directly to your address
- Publisher maintains a list of subscribers
- Subscribers can unsubscribe at anytime

Observer Pattern: UML

- Consider the following UML diagram:



Observer Pattern: Implementation

```
class Subject:
    def __init__(self):
        self.observers = ()

    def register(self, observer):
        if not observer in self.observers:
            self.observers.append(observer)

    def unregister(self, observer):
        if observer in self.observers:
            self.observers.remove(observer)

    def notify(self, event):
        for o in self.observers:
            o.update(event)

class Observer:
    def update(self, event):
        pass

class ASX(Observer):
    def update(self, event):
        print(f'ASX - {event}')

class NZX(Observer):
    def update(self, event):
        print(f'NZX - {event}')

def main():
    subject = Subject()
    nzx = NZX()
    subject.register(nzx)
    subject.notify('Update: CEO of NZX has resigned effective immediately.')

if __name__ == '__main__':
    main()  # NZX - Update: CEO of NZX has resigned effective immediately.
```

Observer Pattern: Implementation

```
from abc import ABC, abstractmethod

class Subject(ABC):
    @abstractmethod
    def register(self, observer):
        pass

    @abstractmethod
    def unregister(self, observer):
        pass

    @abstractmethod
    def notify(self, event):
        pass

class ConcreteSubject(Subject):
    def __init__(self):
        self.observers = ()

    def register(self, observer):
        if not observer in self.observers:
            self.observers.append(observer)

    def unregister(self, observer):
        if observer in self.observers:
            self.observers.remove(observer)

    def notify(self, event):
        for o in self.observers:
            o.update(event)
```

Observer Pattern: Implementation

```
class Observer(ABC):
    @abstractmethod
    def update(self, event):
        pass

class ASX(Observer):
    def update(self, event):
        print(f'ASX - {event}')

class NZX(Observer):
    def update(self, event):
        print(f'NZX - {event}')

def main():
    concrete_subject = ConcreteSubject()
    nzx = NZX()
    concrete_subject.register(nzx)
    concrete_subject.notify('Update: CEO of NZX has resigned effective immediately.')

if __name__ == '__main__':
    main()  # NZX - Update: CEO of NZX has resigned effective immediately.
```

Observer Pattern: Pros

- New subscribers can be introduced without having to change the publisher's code
- Relations are established between object at runtime

Observer Pattern: Cons

- Subscribers/observerables are notified in random order

Practical

- Series of tasks covering today's lecture
- Worth 1% of your final mark for the Object-Oriented Systems Development course
- Deadline: Friday, 12 June at 5pm

Reminder: Exam 01

- Series of tasks covering lectures 01-04
- Worth 6% of your final mark for the Object-Oriented Systems Development course
- Deadline: Today at 5pm

Lecture 07: Factory Pattern Topics

- Design pattern 03: factory pattern
  - Definition
  - Problem/solution
  - UML & implementation
  - Applicability
  - Pros & cons
  - Relationship with other design patterns