Milestone 1 cis_4910 “Research”

1. Boost.Asio library (Open Source: Repository)

- **Description:**
  - Boost.Asio is a cross-platform C++ library for network and low-level I/O programming
- **Important notes:**
  - Supports asynchronous I/O operations
  - Header-Only and Standalone Use
- **Behavioral Pattern:**
  - *Proactor Pattern*
    - The library takes advantage of overlapped I/O to implement the Proactor design pattern, helping in manage long-running operations
    - It is used to handle async I/O operations without using separate threads for each operation. Instead, it uses a demultiplexer to handle multiple asynchronous operations in a single thread.

2. Qt library (Open Source: Repository)

- **Description:**
  - Qt is a comprehensive C++ framework for GUI development
- **Important notes:**
  - Tool GUI, networking, and database interaction
  - Supports cross-platform development for major desktop, mobile, and embedded platforms
- **Patterns:**
  - *Wrapper and Adaptor Pattern*
    - encapsulation for lower level capabilities of operating system
  - *Facade Pattern*
    - simple interface to a complex subsystem
  - *Flyweight, Bridge, or Private Implementation Pattern*
    - avoid data copying by passing a pointer to a shared data space for high speed and less memory usage
  - *Observer Pattern*

        - other objects can observe and respond accordingly (like webhooks)
    - *Singleton Pattern*
        - only a single instance
    - *Serializer Pattern*
        - used to read/write other objects
    - *Composite Pattern*
        - a parent object to create many objects

3. SFML (Simple and Fast Multimedia Library) (Open Source: Repository)

- **Description:**
    - SFML is a simple, fast, cross-platform and object-oriented multimedia API written in C++.
- **Important notes:**
    - Great for 2D game development, and multimedia applications
    - Provides low and high-level access to graphics, sound, and input devices
- **Pattern:**
    - *Singleton Pattern*
        - only a single instance
    - *Composite Pattern*
        - a parent object to create many objects
    - *Observer Pattern*
        - other objects can observe and respond accordingly (like webhooks)
    - *Note*:
        - poor documentation of design patterns implemented
        - had to use article to find out further

4. ENet (Open Source: Repository)

- **Description:**
    - Lightweight UDP library
- **Important Notes:**
    - Built to be lightweight and reliable for low latency UDP connections
    - Low latency Game connections
- **Pattern:**

    - *Singleton Pattern*
        - only a single instance (managing network-related resources)
    - *Observer Pattern*
        - other objects can observe and respond accordingly (like webhooks)
    - *Note*:
        - poor documentation of design patterns implemented
        - had to use article to find out further

5. RakNet (Open Source: Repository)

- **Description:**
    - RakNet is a C++ game networking engine
- **Important Notes:**
    - Includes features like NAT traversal, packet encryption, and bandwidth throttling.
    - Well-suited for MMORPGs, shooters, and other multiplayer game genres.
- **Pattern:**
    - *Chain of Responsibility Pattern*
        - plugins are attached to an instance of RakPeer or PacketizedTCP and carry the chain of responsibility (kind of like docker chaining)
    - *Singleton Pattern*
        - only a single instance (managing network-related resources)
    - *Observer Pattern*
        - other objects can observe and respond accordingly (like webhooks)

6. SLikeNet (Open Source: Repository)

- **Description:**
    - SLikeNet is an open-source cross-platform network engine written in C++.
    - built on top of RakNet
- **Important Notes:**
    - Retains many features of RakNet while adding improvements and bug fixes.
    - Features include secure connections, voice chat support, and multiplayer functionalities.
- **Pattern:**

- Inconclusive/unknown

7. GameNetworkingSockets (Open Source: Repository)

- **Description:**
  - GameNetworkingSockets is a networking udp library
- **Important Notes:**
  - Developed with an emphasis on Steam's online game requirements.
- **Pattern:**
  - Inconclusive/unknown

8. Yojimbo (Open Source: Repository)

- **Description:**
  - Yojimbo is a network library for client/server games written in C++
  - It specializes in secure, reliable, and easy-to-use networking for multiplayer games.
- **Important Notes:**
  - Uses encryption and authentication to secure communications.
  - Designed for simplicity and ease of integration into game projects.
- **Pattern:**
  - Inconclusive/unknown (probably singleton and observer)

9. evpp (Open Source: Repository)

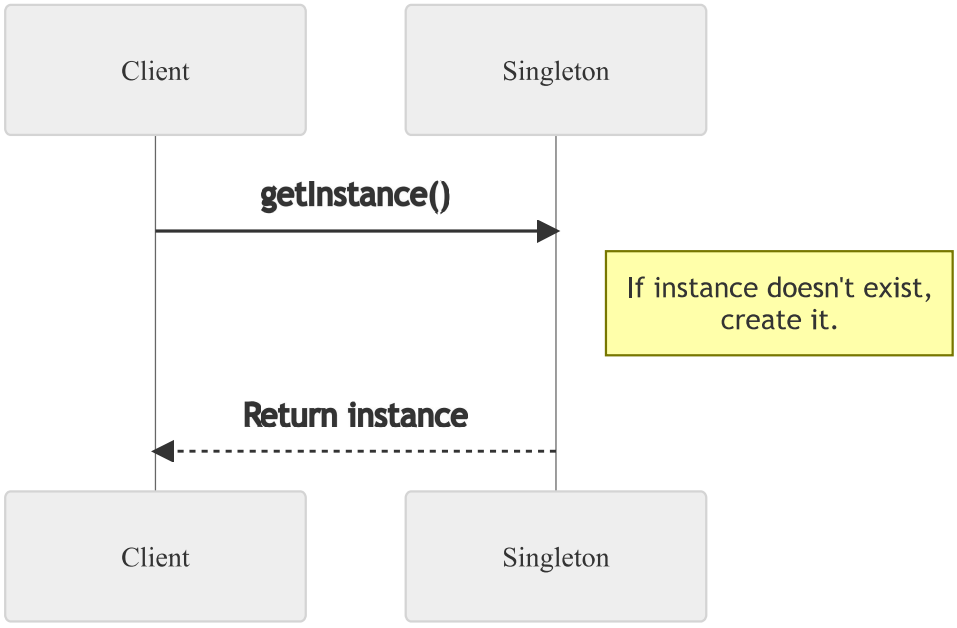
- **Description:**
  - evpp is a modern C++ network library for developing high-performance event-driven network applications
- **Important Notes:**
  - Optimized for building high-concurrency server applications.
  - Provides an event-driven model and supports HTTP, TCP, and UDP protocols.
- **Creational Patterns:**
  - *Singleton* event loop and log system
  - *Builder*: used for constructing complex objects, like server and client configurations

    - *Factory*
- **Structural Patterns:**
    - *Adapter:* allows interfacing with other APIs
    - *Facade:* simpler explanation to complex subsystem
    - *Decorator*
- **Behavioral Patterns:**
    - *Callback:* common pattern in asynchronous operations
    - *State Machine:* manage different states
    - *Observer*

Common Patterns:

Singleton Pattern

Sequence Diagram Illustration:



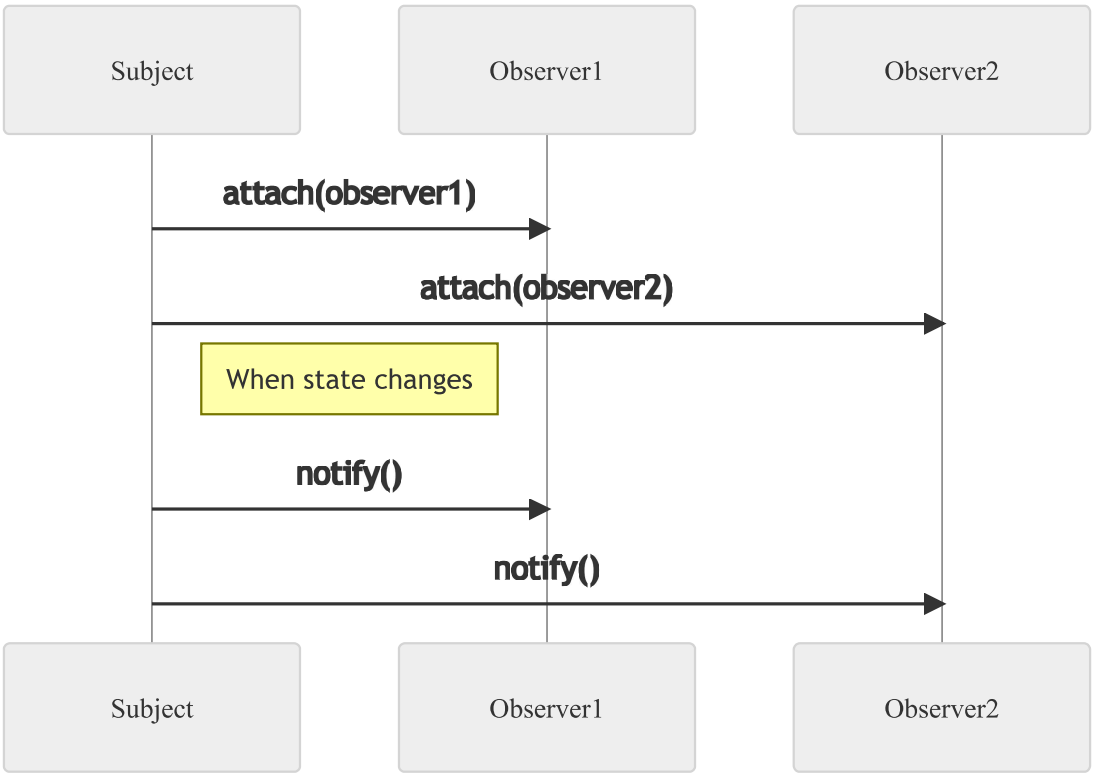
Pseudocode Illustration:

```
class Singleton
    private static instance: Singleton = null
    private constructor()
    public static getInstance()
        if (instance == null)
            instance = new Singleton()
```

```
        return instance
int main() {
    singletonInstance = Singleton.getInstance()
}
```

Observer Pattern

Sequence Diagram Illustration:



Pseudocode Illustration:

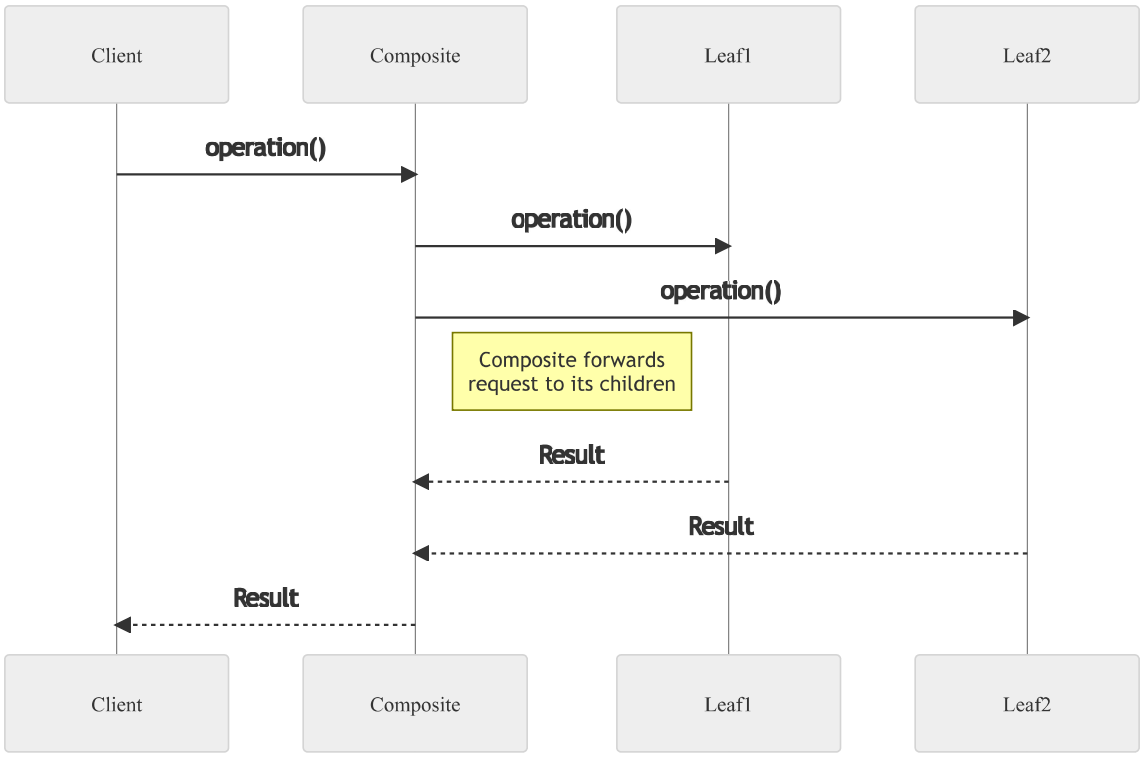
```
interface Observer
    method update(subject: Subject)

class ConcreteObserver implements Observer
    method update(subject: Subject)
class Subject
    private observers: list of Observer = []
    method attach(observer: Observer)
        observers.add(observer)
    method detach(observer: Observer)
        observers.remove(observer)
    method notifyObservers()
```

```
        for each observer in observers
            observer.update(this)
subject = new Subject()
observer1 = new ConcreteObserver()
observer2 = new ConcreteObserver()
subject.attach(observer1)
subject.attach(observer2)
subject.notifyObservers()
```

Composite Pattern

Sequence Diagram Illustration:



Pseudocode Illustration:

```
interface Component
    method operation()
class Leaf implements Component
```

```
        method operation()
    class Composite implements Component
        private children: list of Component = []
        method operation()
            for each child in children
                child.operation()
        method add(component: Component)
            children.add(component)
        method remove(component: Component)
            children.remove(component)
    composite = new Composite()
    leaf1 = new Leaf()
    leaf2 = new Leaf()
    composite.add(leaf1)
    composite.add(leaf2)
    composite.operation()
```