Assignment 2

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Course: CSE 470 - Software Engineering

Section: 14

Department: CSE

Case Study : YouTube (Online Video Sharing Platform)

1.Singleton Design Pattern:

Singleton design pattern is a creational design pattern. It ensures the class has only one instance. It provides a single global access of its unique instance to its clients instead of creating multiple objects of that class. This is useful when managing resources that should not be duplicated, such as configuration settings, logging mechanisms, or database connections. By using singleton pattern, it avoids issues like conflicting states, redundant memory usage, or inconsistent access to shared data.

Justification: In Youtube's web or mobile app, when a user plays a video, a single video player instance is responsible for playback. If multiple players were allowed at the same time on the same screen, it could create conflicts with audio, buffering, and resources. The Singleton pattern ensures that there is only one player object running per session, managing playback, quality selection, captions, and ads in a centralized way.

2. Observer Design Pattern:

Observer design pattern is a behavioral design pattern. It is used in one-to-many dependency between objects. The central object or subject maintains a list of other objects i.e., the observers. When the subject changes their state the observers from that list are notified automatically. The observer pattern is used in notification systems, subscription and publish systems where multiple components need to stay up to date with information.

Justification : When a channel uploads a new video, Youtube notifies all its users subscribed to that channel. The channel acts as the subject, and the subscribers are the observers. Whenever the subject updates i.e. a channel posts a new video, all observers or subscribers get notified through push notifications, emails or updates in the subscription feed. Using Observer pattern Youtube can efficiently handle real-time updates for millions of users.

3. Adapter Design Pattern:

Adapter design pattern is a structural design pattern. It allows two incompatible interfaces to work together. It acts as a bridge or wrapper that converts the interface of a class into another interface the client expects. With the adapter pattern, existing classes can be reused even if the methods or data formats do not match the requirements of the client. It can be implemented using inheritance or object creation and wrapping. It is used for integrating third-party libraries, legacy systems, or cross-platform functionalities where uniform interaction is needed.

Justification: YouTube must deliver video content to many platforms like web browsers, iOS, Android, smart TVs and gaming consoles. Each platform may support different media formats and APIs e.g., MP4, WebM, HLS or, DASH. An Adapter is used so the video player can communicate with different streaming protocols seamlessly .For example, an adapter allows the same player logic to work whether the underlying device only supports HLS or DASH streaming. This ensures compatibility across all devices without rewriting the player code for each platform.