



Welcome to this **CoGrammar** Lecture:

Use Case Analysis and Sequence Diagrams

The session will start shortly...

Questions? Drop them in the chat.
We'll have dedicated moderators
answering questions.



CoGrammar

Use Case Analysis and Sequence Diagrams

Software Engineering Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly.
(Fundamental British Values: Mutual Respect and Tolerance)
- No question is daft or silly - **ask them!**
- There are **Q&A sessions** midway and at the end of the session, should you wish to ask any follow-up questions. Moderators are going to be answering questions as the session progresses as well.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: [Questions](#)

Software Engineering Session Housekeeping cont.

- For all **non-academic questions**, please submit a query:
www.hyperiondev.com/support
- We would love your **feedback** on lectures: [Feedback on Lectures](#)

Safeguarding & Welfare

We are committed to all our students and staff feeling safe and happy; we want to make sure there is always someone you can turn to if you are worried about anything.

If you are feeling upset or unsafe, are worried about a friend, student or family member, or you feel like something isn't right, speak to our safeguarding team:



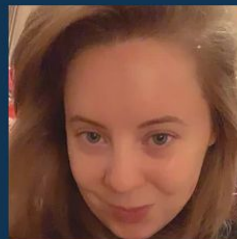
Ian Wyles
Designated Safeguarding
Lead



Simone Botes



Rafiq Manan



Charlotte Witcher



Nurhaan Snyman



Ronald Munodawafa



Tevin Pitts

Scan to report a
safeguarding concern



or email the Designated
Safeguarding Lead:
Ian Wyles

safeguarding@hyperiondev.com

Skills Bootcamp Progression Overview

To be eligible for a certificate of completion, students must fulfil three specific criteria. These criteria ensure a high standard of achievement and alignment with the requirements for the successful completion of a Skills Bootcamp.

✓ **Criterion 1 - Meeting Initial Requirements**

Criterion 1 involves specific achievements within the first two weeks of the program. To meet this criterion, students need to:

- Attend a minimum of 7-8 hours per week of guided learning (lectures, workshops, or mentor calls) within the initial two-week period, for a total minimum of **15 guided learning hours (GLH)**, by no later than **15 September 2024**.
- Successfully complete the Initial Assessment by the end of the first 14 days, by no later than **15 September 2024**.

Skills Bootcamp Progression Overview

✓ Criterion 2 - Demonstrating Mid-Course Progress

Criterion 2 involves demonstrating meaningful progress through the successful completion of tasks **within the first half** of the bootcamp.

To meet this criterion, students should:

- Complete **42 guided learning hours** and the first half of the assigned tasks by the end of week 7, no later than **20 October 2024**.

Skills Bootcamp Progression Overview

✓ Criterion 3 - Demonstrating Post-Course Progress

Criterion 3 involves showcasing students' **progress after completing the course**.
To meet this criterion, students should:

- Complete all mandatory tasks before the bootcamp's end date. This includes any necessary resubmissions, no later than **22 December 2024**.
- Achieve at least 84 guided learning hours by the end of the bootcamp, **22 December 2024**.

Learning Objectives & Outcomes

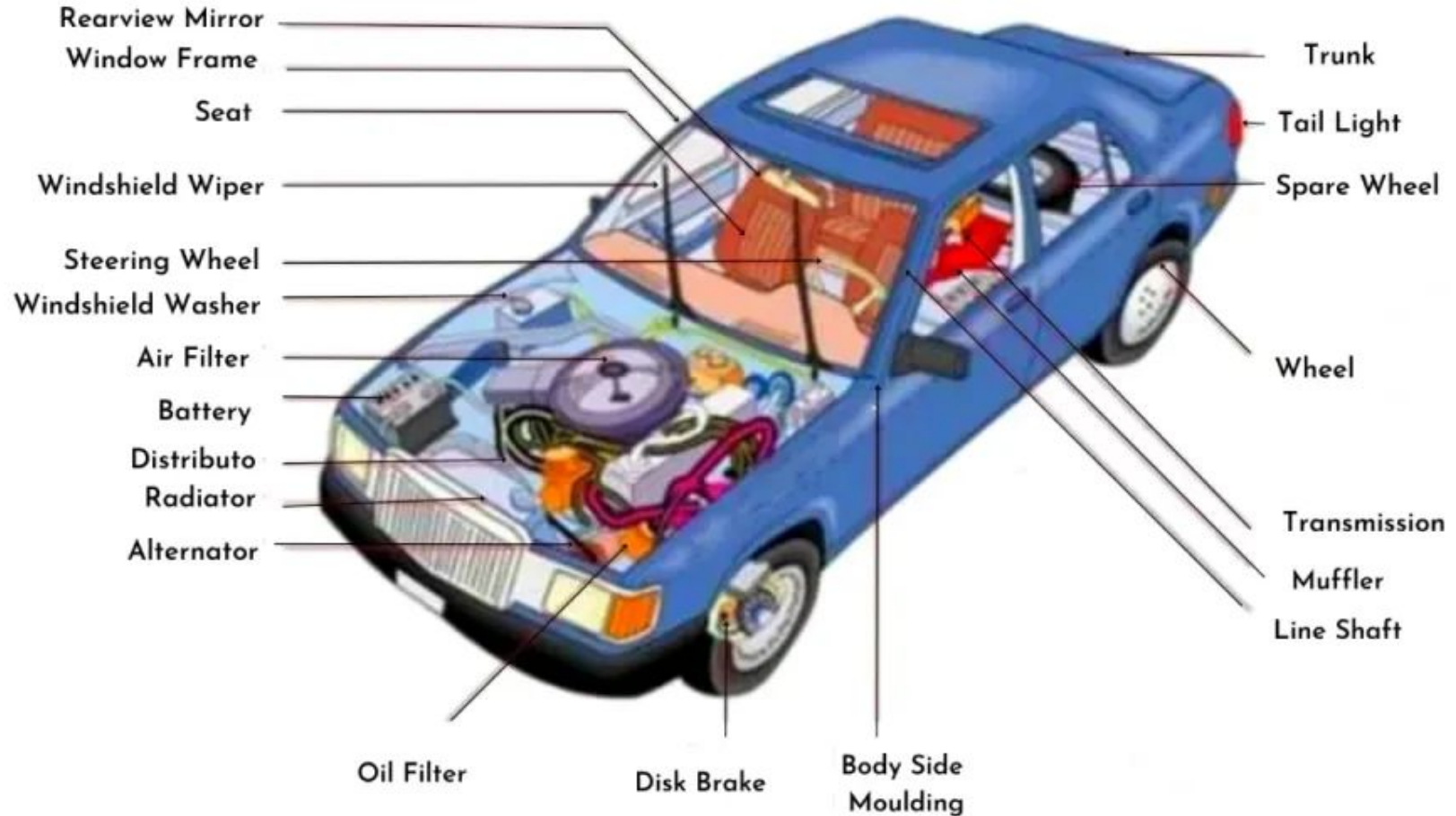
- Explain the significance of modularisation, including benefits like maintainability and scalability, and apply techniques such as object-oriented design in project development,
- Describe sequence diagrams' role in visualising system interactions, analyse them for system dynamics, and create diagrams for various use cases,
- Demonstrate use case analysis for capturing user requirements, including identifying actors and scenarios, and prioritise use cases using elicitation techniques.

CoGrammar

Modular Programming

April 2024

PARTS OF A CAR



Marketplace

⚙

🔍 Search Marketplace

- 🏠

Browse all
- 👤

Your account
- + Create new listing

Filters

San Francisco, California

- Categories
- 🚗

Vehicles
- 💰

Property for rent
- 🔑

Classifieds
- 👕

Clothing
- 📱

Electronics
- 🎬

Entertainment

Today's picks

📍 San Francisco · 65 km



\$350

Wooden Gazebo 10X10

Antioch, CA



\$25,000

1963 Ford F100

Livermore, CA



FREE

Weight

San Francisco, CA



\$18,000

1999 Ford 450

San Pablo, CA



Log in or sign up for Facebook to connect with friends, family and people you know.

Poll

Given the image of Facebook Marketplace and a vehicle, what are the similarities between them?

- a. Maintainable components
- b. Reusable components
- c. Monolithic design
- d. Adaptability to new working components
- e. Coupled components
- f. Testable components

Intuition

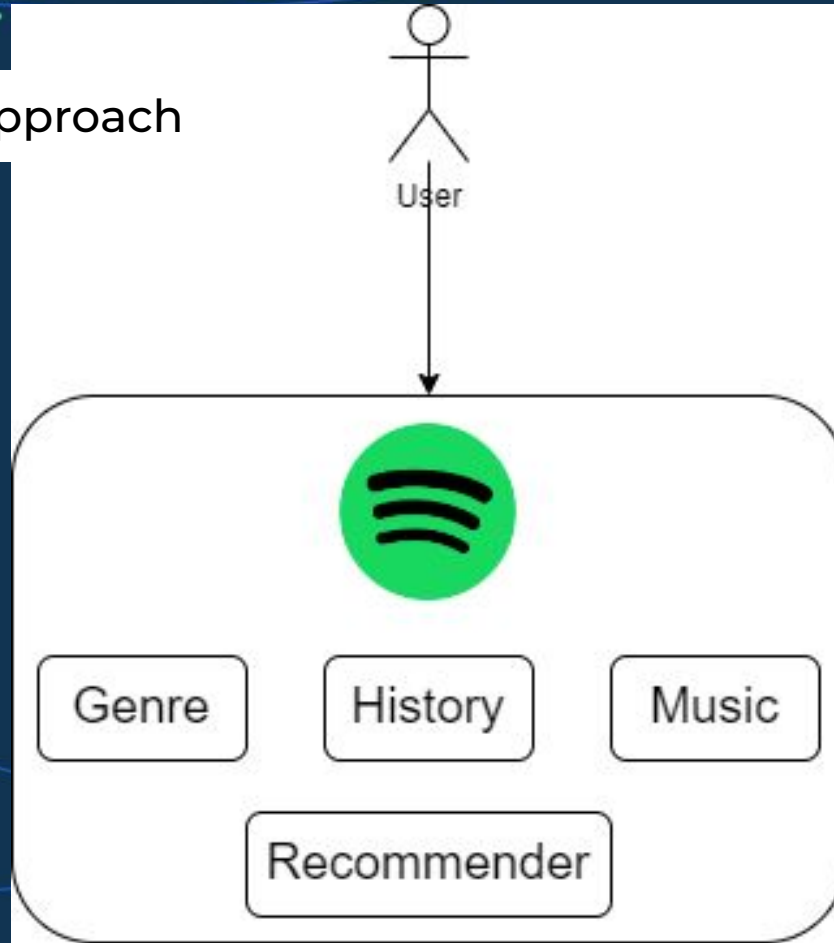
In Facebook Marketplace's intricate **codebase**, modularity functions like a network of buildings in a cityscape. If a glitch arises in a **specific feature**, such as photo posting, the modular design allows engineers to target and rectify the issue within **the relevant modules without bringing down the entire platform**. This approach ensures that Facebook remains resilient and adaptable, minimizing disruptions to user experience while maintaining the integrity of the system.

Definition and Importance

- Modularity in software design is a structured approach that aims to streamline complexity **by breaking down systems into distinct, reusable modules.**
- These **modules encapsulate specific functionality, allowing for easier extension, modification, and integration** into various contexts.

Definition and Importance

Monolithic approach



Definition and Importance



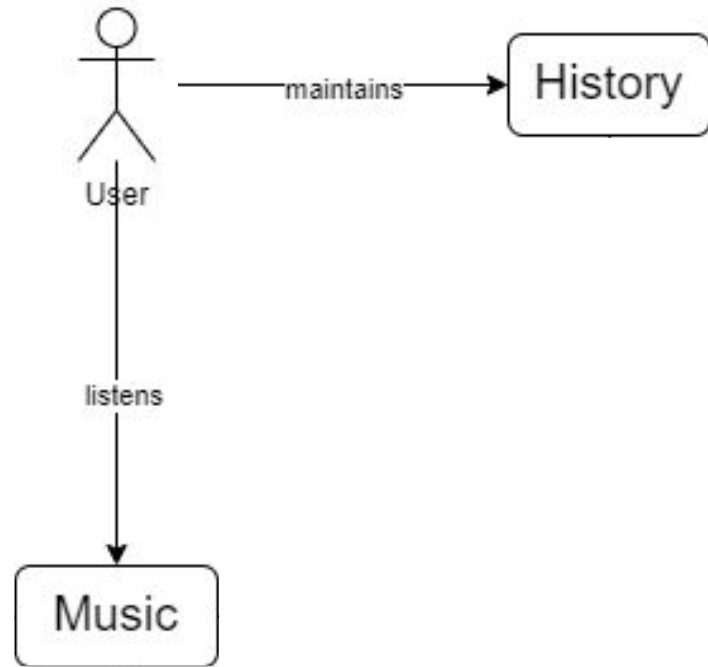
Definition and Importance



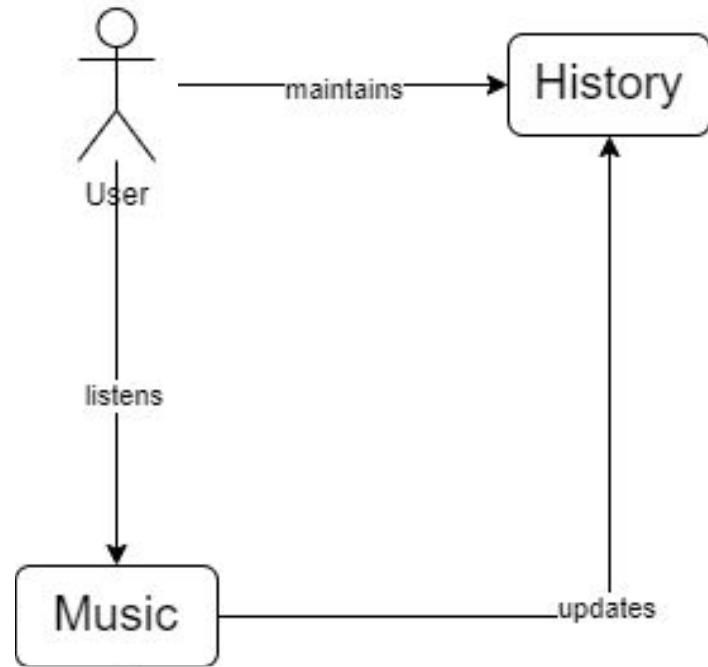
maintains

History

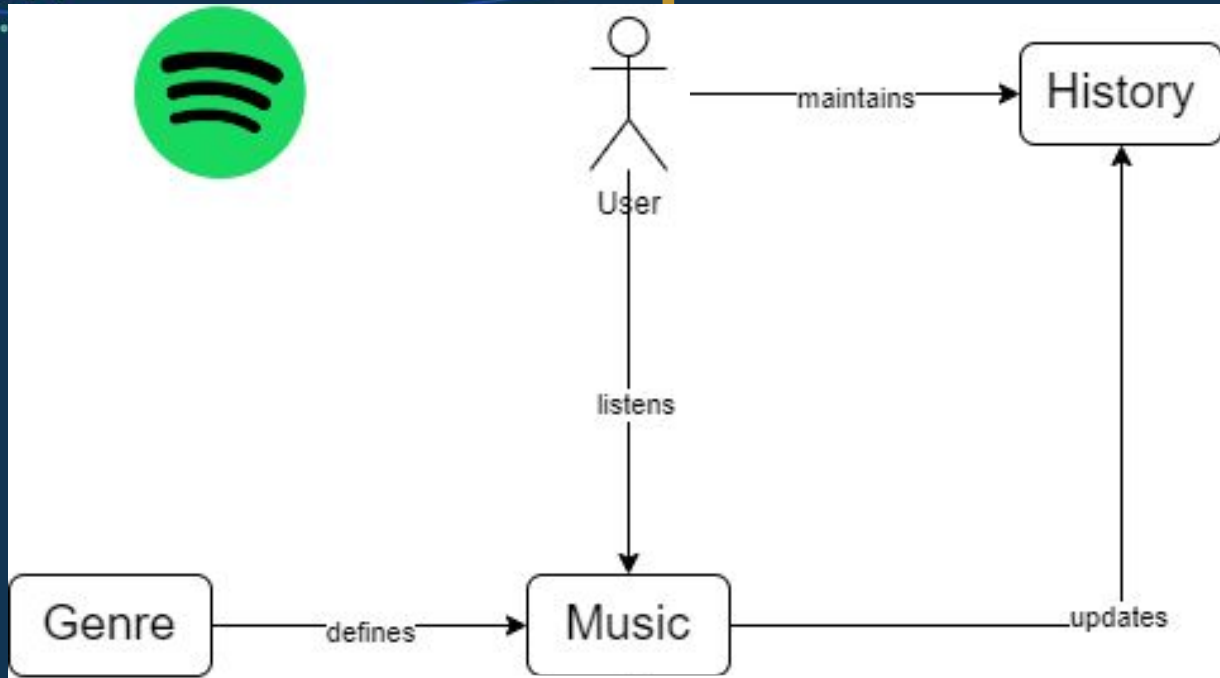
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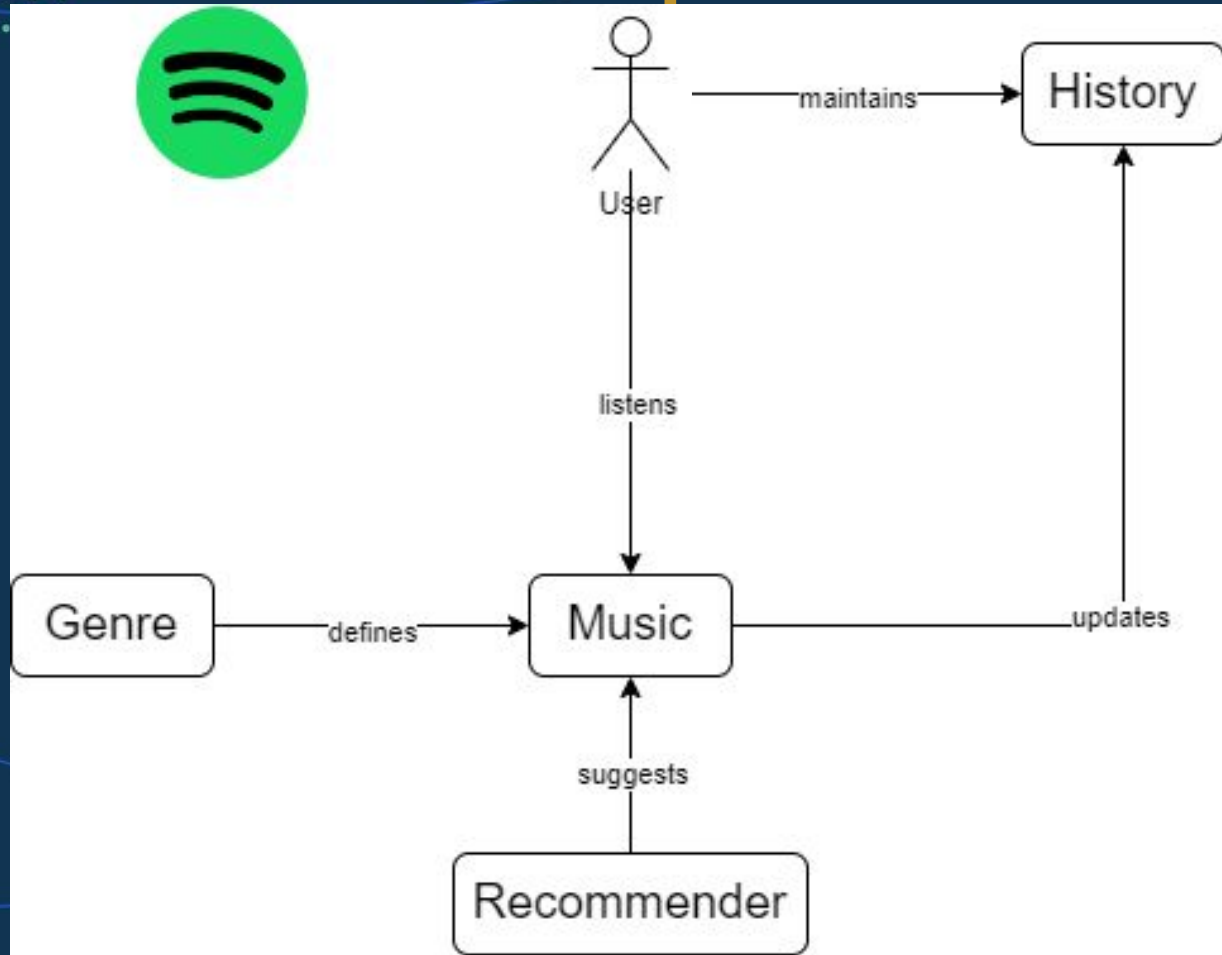
Definition and Importance



Definition and Importance



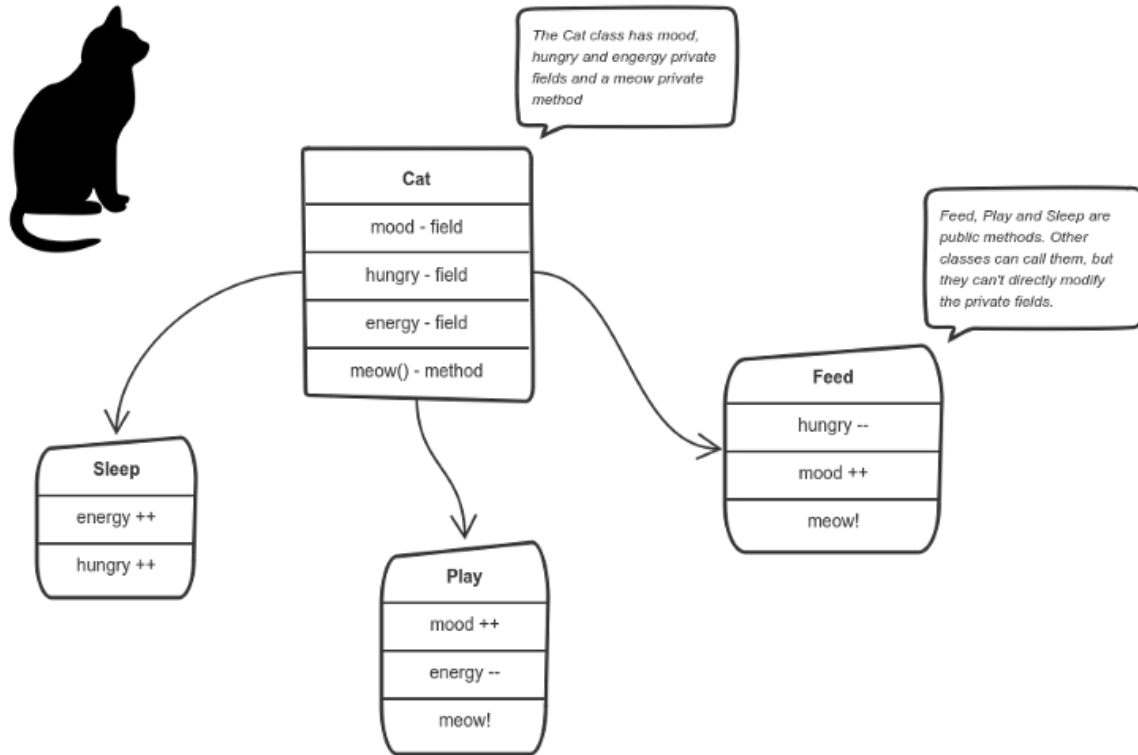
Definition and Importance



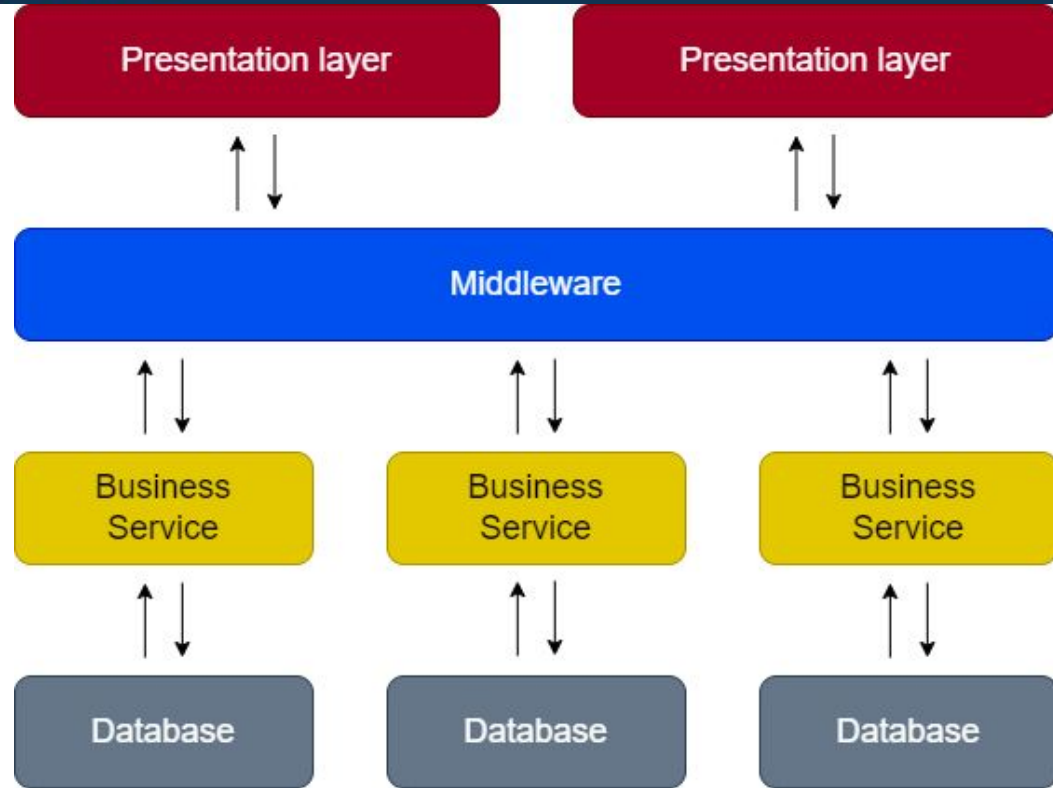
Techniques and Approaches

- This design principle also enhances portability, as modules can be transferred across different environments or platforms with minimal adjustments.
- Modularity promotes maintainability by isolating changes and facilitating debugging and updates, ultimately improving the robustness and flexibility of software systems.

Object Oriented Programming



Service Oriented Architecture (SOA)



Cohesion and Coupling

- **Coupling** describes the relationships between modules, and **cohesion** describes the relationships within them.
- **Coupling** is the measure of the degree of interdependence between the modules. In a good design, the various component parts (e.g. the classes) have low coupling.
- **Cohesion** is the measure of strength of relationships between pieces of functionality within a module. In a good design, the various modules have high cohesion.

Cohesion

```
1 # High Cohesion Code Example
2 class Car:
3     def __init__(self, make, model, year):
4         self.make = make
5         self.model = model
6         self.year = year
7
8     def display_make(self):
9         print(f"Make: {self.make}")
10
11    def display_model(self):
12        print(f"Model: {self.model}")
13
14    def display_year(self):
15        print(f"Year: {self.year}")
16
17    def display_details(self):
18        print(f"Make: {self.make},
19            Model: {self.model}, Year: {self.year}")
```

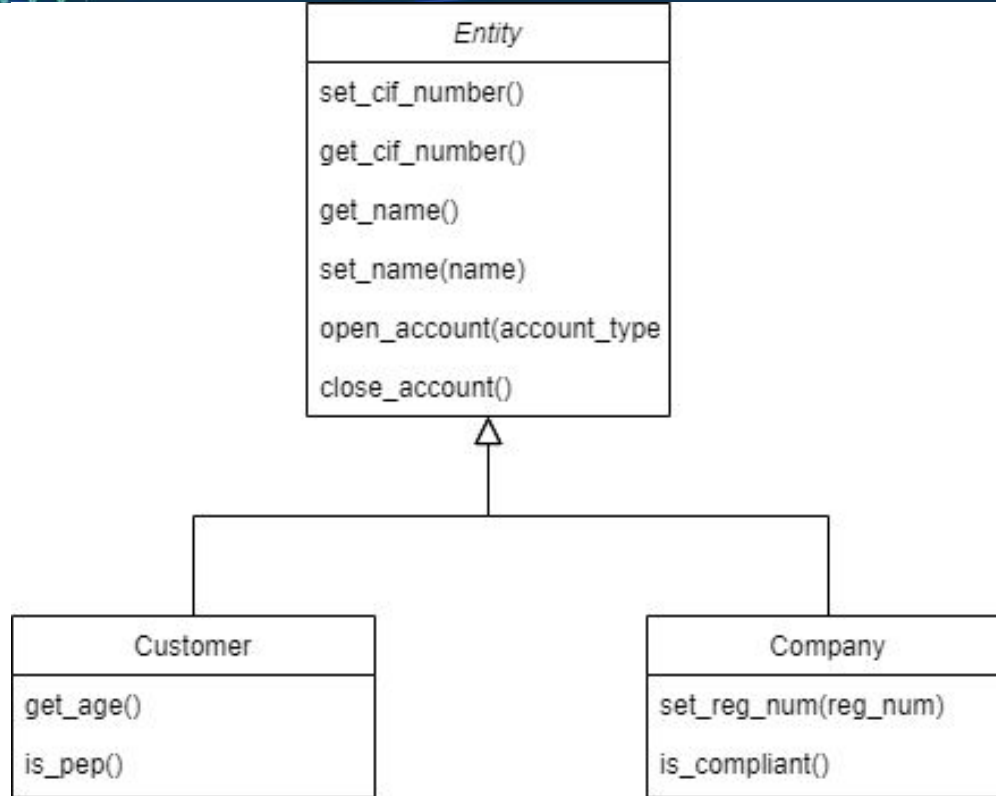
```
1 # Low Cohesion Code Example
2 class Car:
3     def __init__(self, make, model, year):
4         self.make = make
5         self.model = model
6         self.year = year
7
8     def display(self):
9         print(f"Make: {self.make},
10            Model: {self.model}, Year: {self.year}")
11
12    def calculate_price(self):
13        # Calculate car price based on various factors
14        pass
15
16    def update_inventory(self):
17        # Update car inventory in database
18        pass
19
20    def send_notification(self):
21        # Send notification to user
22        pass
```

Coupling

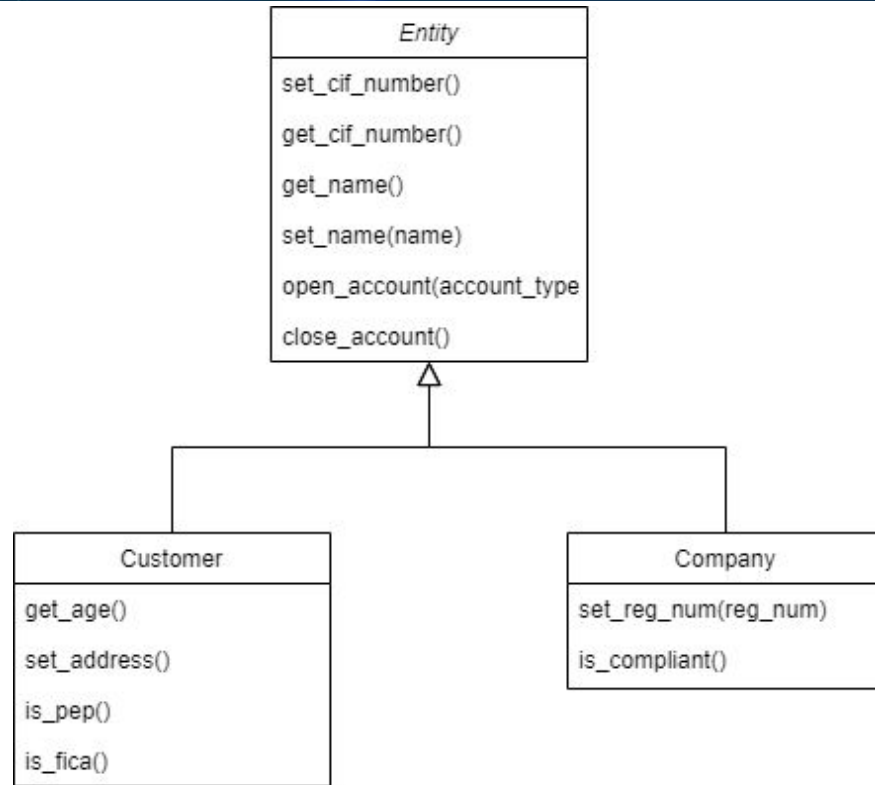
```
1  # Low Coupling Code Example
2  class Bank:
3      def __init__(self, customer_database, account_manager):
4          self.customer_database = customer_database
5          self.account_manager = account_manager
6
7      def open_account(self, customer):
8          customer_id = self.customer_database.add_customer(customer)
9          account_number = self.account_manager.create_account(customer_id)
10         return account_number
```

```
1  # High Coupling Code Example
2  class Bank:
3      def __init__(self):
4          self.customer_database = CustomerDatabase()
5          self.account_manager = AccountManager()
6
7      def open_account(self, customer):
8          customer_id = self.customer_database.add_customer(customer)
9          account_number = self.account_manager.create_account(customer_id)
10         return account_number
```

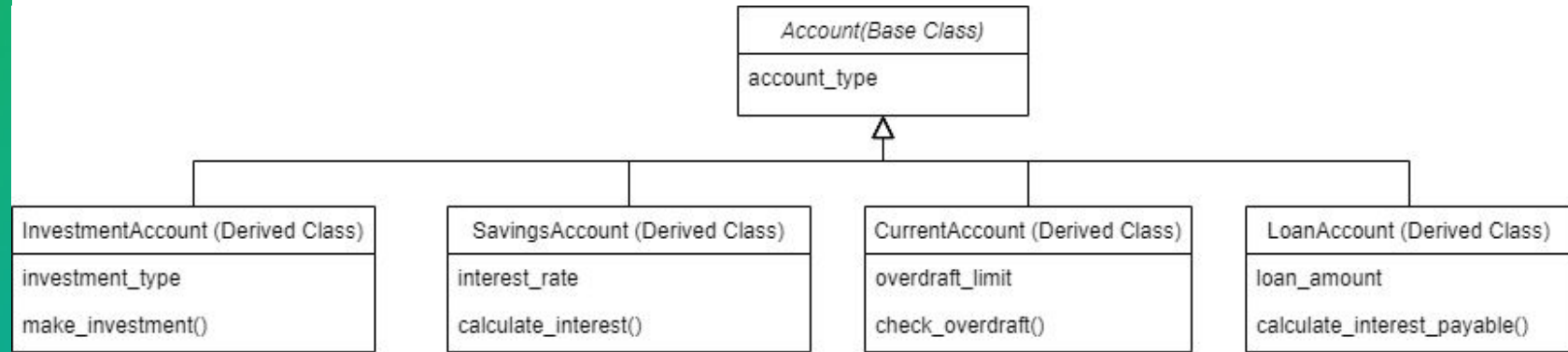

Open/Closed Principle



Open/Closed Principle

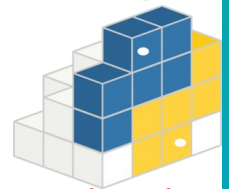


Open/Closed Principle



Benefits of Modularisation

- **Collaboration:** Team members can work on different modules concurrently, reducing conflicts and dependencies.
- **Maintainability:** The codebase is easier to understand, update, and debug the code. Changes or fixes can be made to individual modules without affecting other parts of the system, reducing the risk of unintended consequences.
- **Reusability:** Modular programming promotes the creation of independent modules or components that can be reused in different parts of the software system or even in other projects. This reduces duplication of code and saves development time.
- **Ease of Refactoring:** Developers can modify or improve individual modules without affecting other parts of the system, making it safer and more efficient to refactor code to improve its structure, readability, and maintainability.



GitLab



Benefits of Modularisation

- **Testing and Debugging:** Modular programming simplifies testing and debugging efforts as modules can be tested independently of each other. This modular approach allows for more focused and efficient testing, leading to higher code quality and fewer bugs in the final product.
- **Flexibility:** Modular programming enables developers to modify or replace individual modules without impacting other parts of the system. This flexibility allows for easier adaptation to changing requirements, technological advancements, or business needs over time.
- **Scalability:** Modular programming facilitates the scalability of software systems by allowing developers to add new features or functionalities as separate modules. This modular approach makes it easier to extend the system's capabilities without having to overhaul the entire codebase.



pytest

JUnit



Poll

```
3 def calculate(operation, x, y):
4     if operation == "add":
5         return x + y
6     elif operation == "subtract":
7         return x - y
8     elif operation == "multiply":
9         return x * y
10    elif operation == "divide":
11        if y == 0:
12            return "Error: Division by zero"
13        else:
14            return x / y
15    else:
16        return "Error: Invalid operation"
17
18 print(calculate("add", 5, 3))
19 print(calculate("subtract", 5, 3))
20 print(calculate("multiply", 5, 3))
21 print(calculate("divide", 5, 0))
```

```
# calculator_service.py
class CalculatorService:
    def add(self, x, y):
        return x + y

    def subtract(self, x, y):
        return x - y

    def multiply(self, x, y):
        return x * y

    def divide(self, x, y):
        if y == 0:
            return "Error: Division by zero"
        else:
            return x / y
```

```
# client.py
from calculator_service import CalculatorService

calculator_service = CalculatorService()
print(calculator_service.add(5, 3))
print(calculator_service.subtract(5, 3))
print(calculator_service.multiply(5, 3))
print(calculator_service.divide(5, 0))
```

Poll

Given the images of the code on the screen, why is one better than the other?

- Lack of modularisation
- Violation of the single responsibility principle
- Lack of readability and maintainability
- Adaptability to new working components
- Everything is in one place
- Testable components

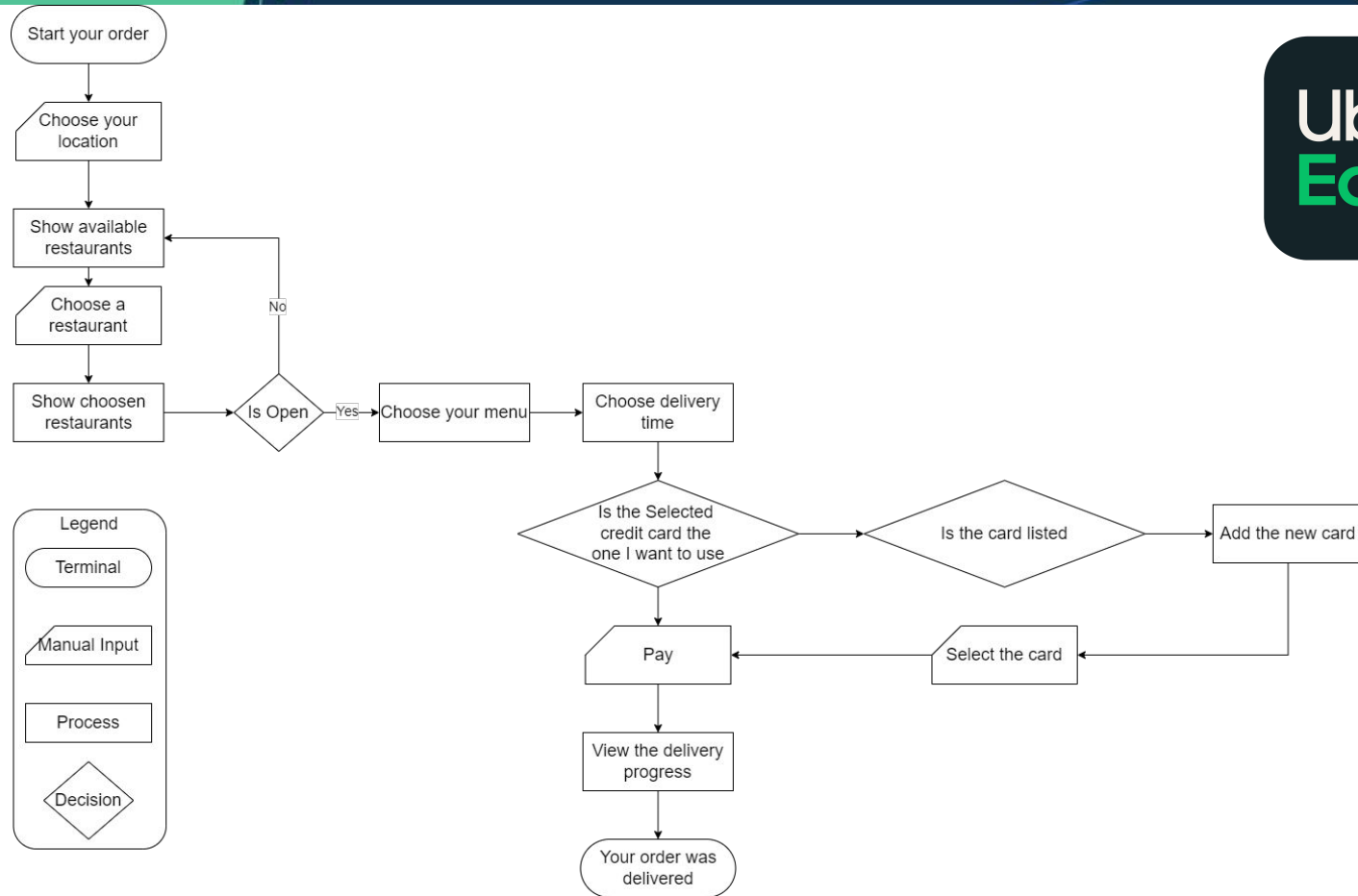


BREAK!

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Sequence Diagrams

April 2024



Intuition

Before diving into the development of a platform like UberEats, it's crucial to map out the sequence of events that occur behind the scenes. Imagine you're craving your favorite meal and open the app to place an order. But what happens next?

How does the app communicate with the restaurant and ensure your food arrives hot and on time? That's where Sequence diagrams come in. They help us visualise the entire journey, from user interaction to backend processing, ensuring every step is carefully orchestrated for a seamless experience.

Sequence Diagrams Basics






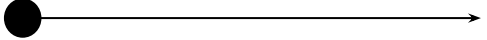
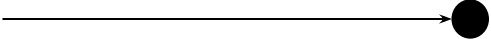
- Shows control flow, the order of interactions
- Time runs vertically, from top to bottom
- Messages run horizontally
- Type of UML diagram

Poll

Given the definition, what do you think are linked to sequence diagrams ?

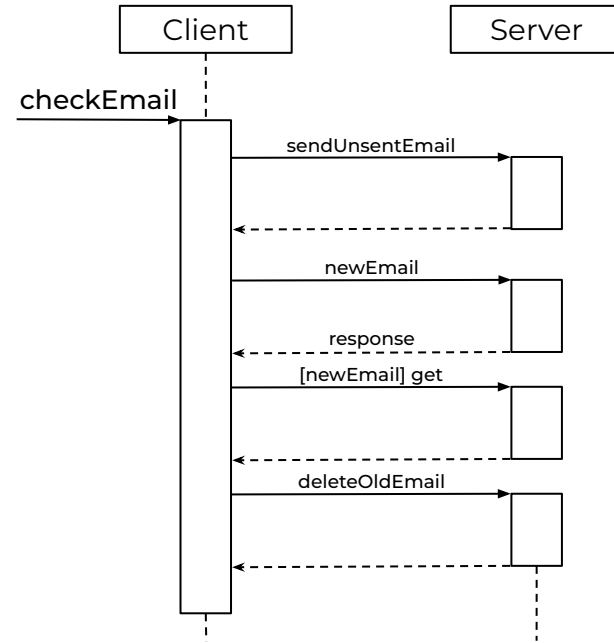
- A. Sequence diagram can replace code
- B. Sequence diagrams are language-agnostic
- C. Representative of the entire software
- D. Show relationship between object

Sequence Diagrams Key Components

Synchronous message	
Asynchronous message	
Message return	
Object creation	
Object destruction	
Found message	
Lost message	

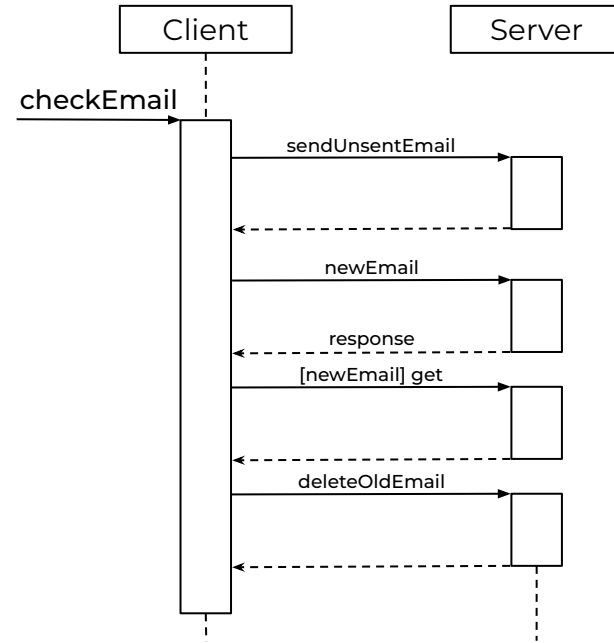
Syntax and semantics

- **Participant:** an object or an entity; the sequence diagram actor
 - sequence diagram starts with an unattached "found message" arrow



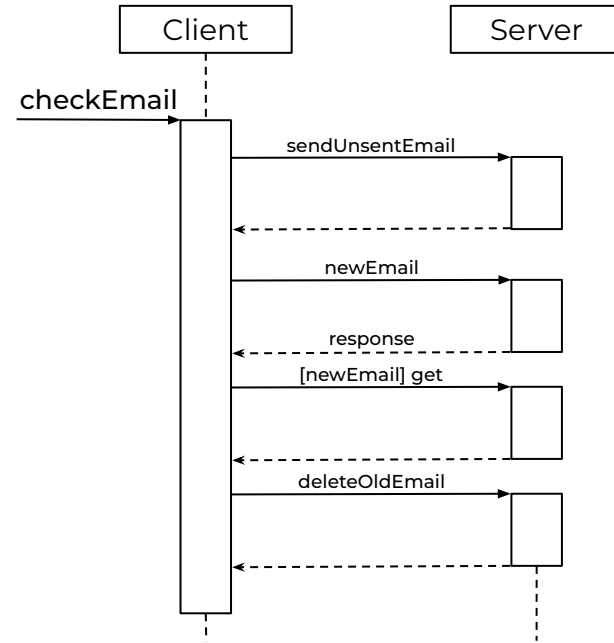
Syntax and semantics

- **Participant:** an object or an entity; the sequence diagram actor
 - sequence diagram starts with an unattached "found message" arrow
- **Message:** communication between objects

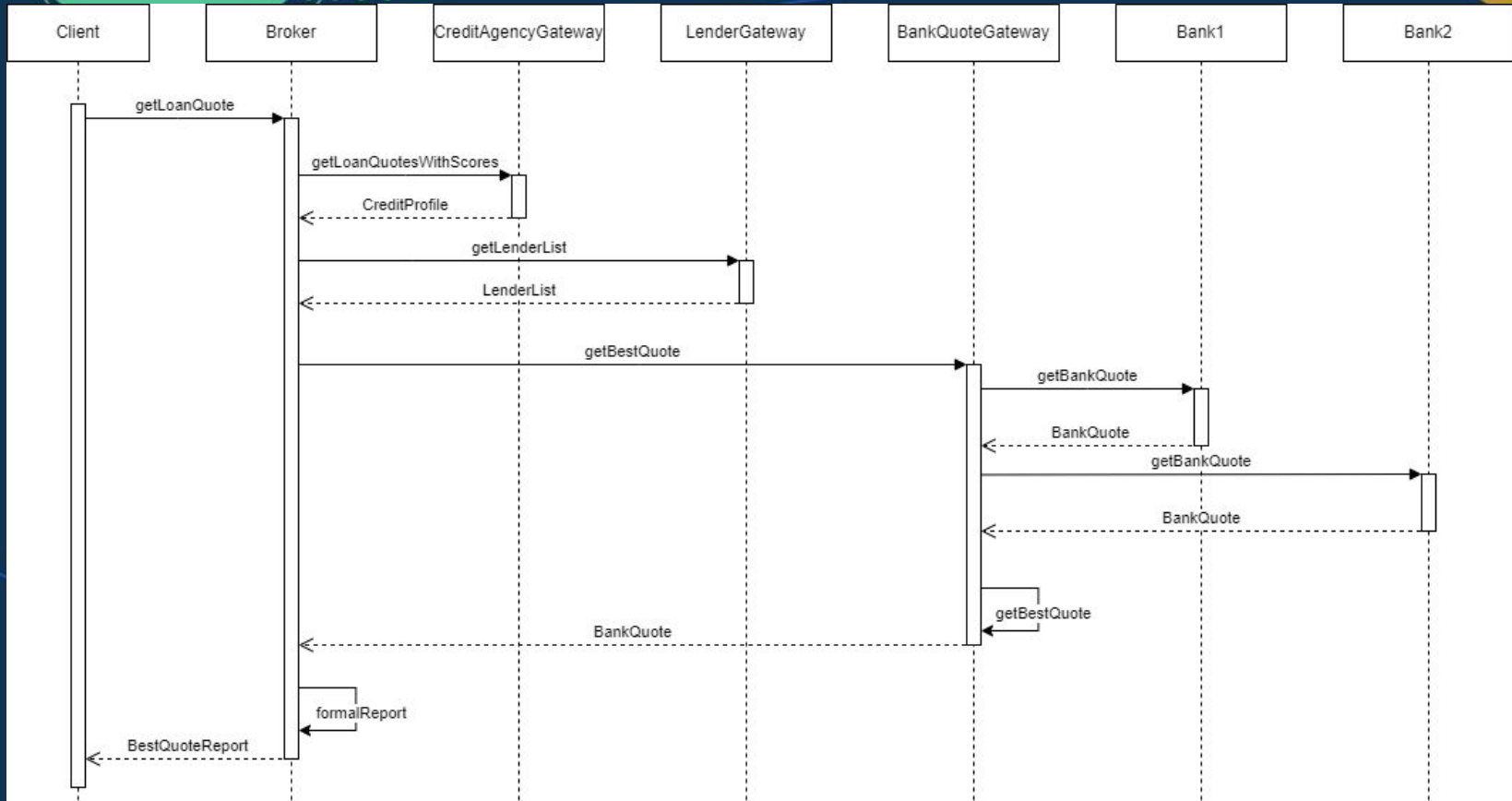


Syntax and semantics

- **Participant:** an object or an entity; the sequence diagram actor
 - sequence diagram starts with an unattached "found message" arrow
- **Message:** communication between objects
- Axes in a sequence diagram:
 - **horizontal:** which participant is acting
 - **vertical:** time (↓ forward in time)



Use Case



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Use Case Analysis

April 2024

Intuition

However, behind the scenes, there's a complex process involving various stakeholders and systems. Use case diagrams provide a bird's-eye view of this process, capturing the different interactions between actors (such as customers, loan officers, and administrators) and the system itself.

By visualizing the different scenarios and functionalities required to facilitate loan processing, use case diagrams help us understand the core functionalities of the Netflix and how different actors interact with it to achieve their goals efficiently.

Use Case Diagrams Basics

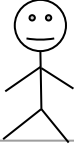

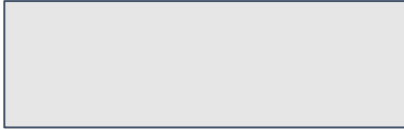
- Describe functionality from the user's perspective
- One (or more) use-cases per kind of user
 - May be many kinds in a complex system
- Use-cases capture requirements
- Type of UML diagram

Poll


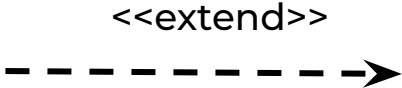

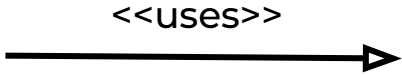
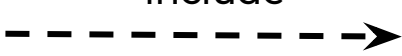
In the context of a bank's loan provision system, which statements about use case diagrams are true?

- A. Use case diagrams visualise interactions between actors and the loan system.
- B. Use case diagrams depict the sequence of events in loan processing.
- C. Use case diagrams represent the internal structure of the loan system.
- D. Use case diagrams show the implementation details of the loan system.
- E. Use case diagrams are used primarily for designing graphical user interfaces

Use Case Diagrams Key Components

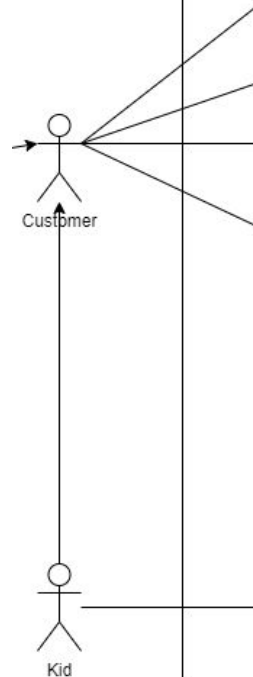
Actor		Human or system interacting with the system. People, Devices, External Systems
Use Cases		Documents the system behaviour from the actor's point of view.
System		Helps identify what is external versus internal, and what the responsibilities of the system are.

Use Case Diagrams Key Components

Association		A actor must be associated with at least one use case Multiple actors can be associated with one use case
Extend		To extend the functionality of a use case, given a condition.
Generalization		An actor can inherit the role of another one
Uses		When a use case uses another process
Include		SHow the included or implicit behaviour of a use case

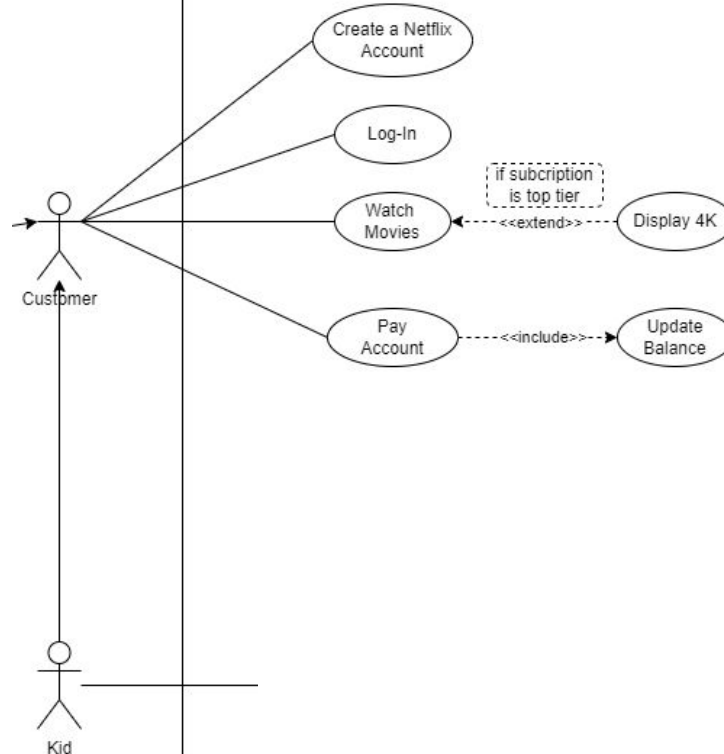
Syntax and semantics

NETFLIX



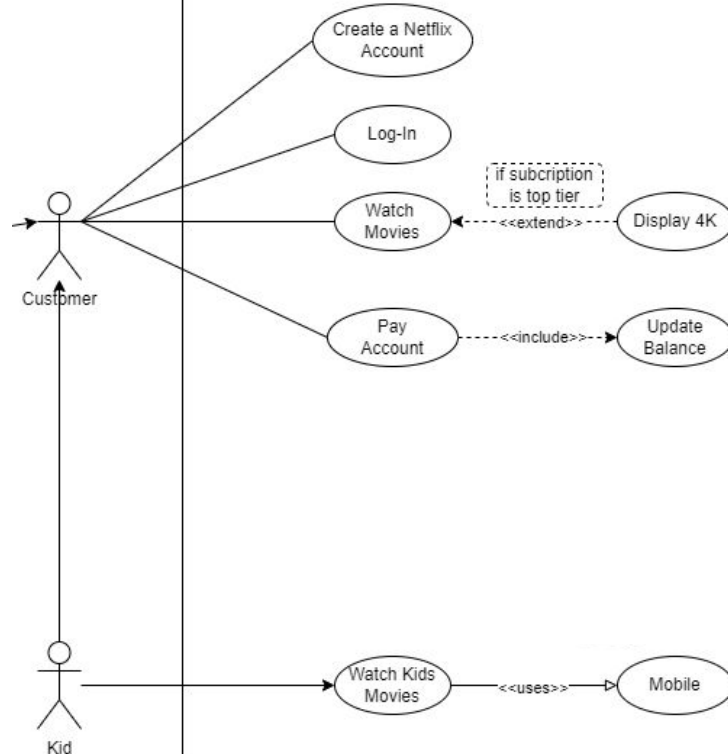
Syntax and semantics

NETFLIX



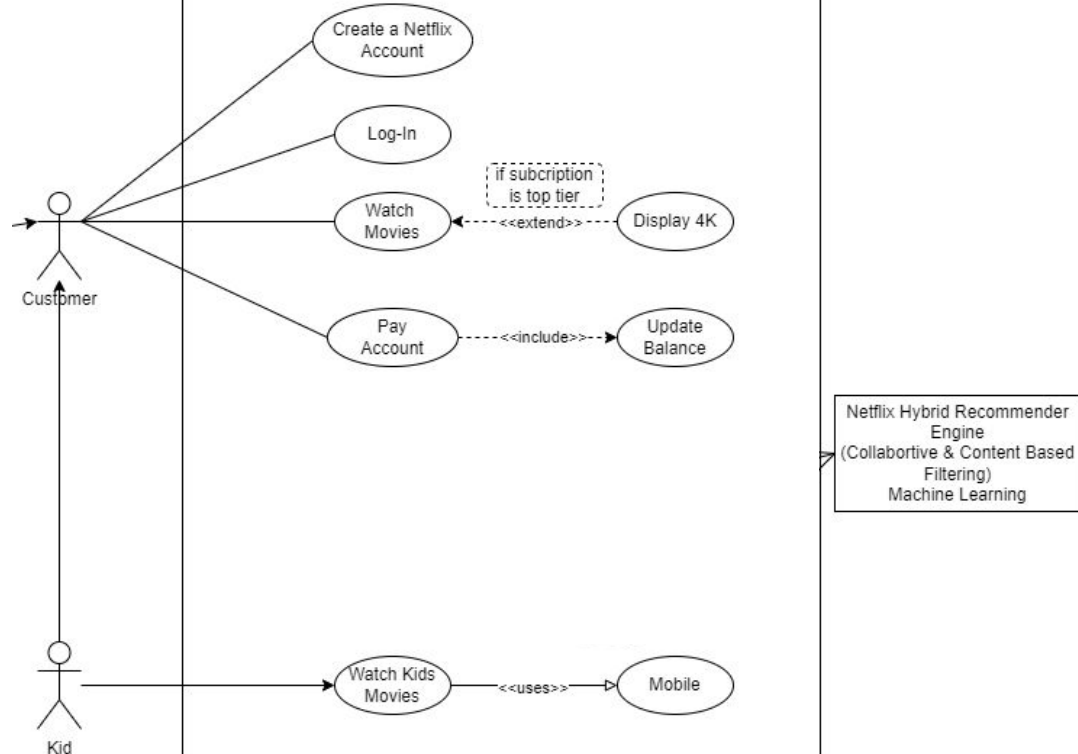
Syntax and semantics

NETFLIX



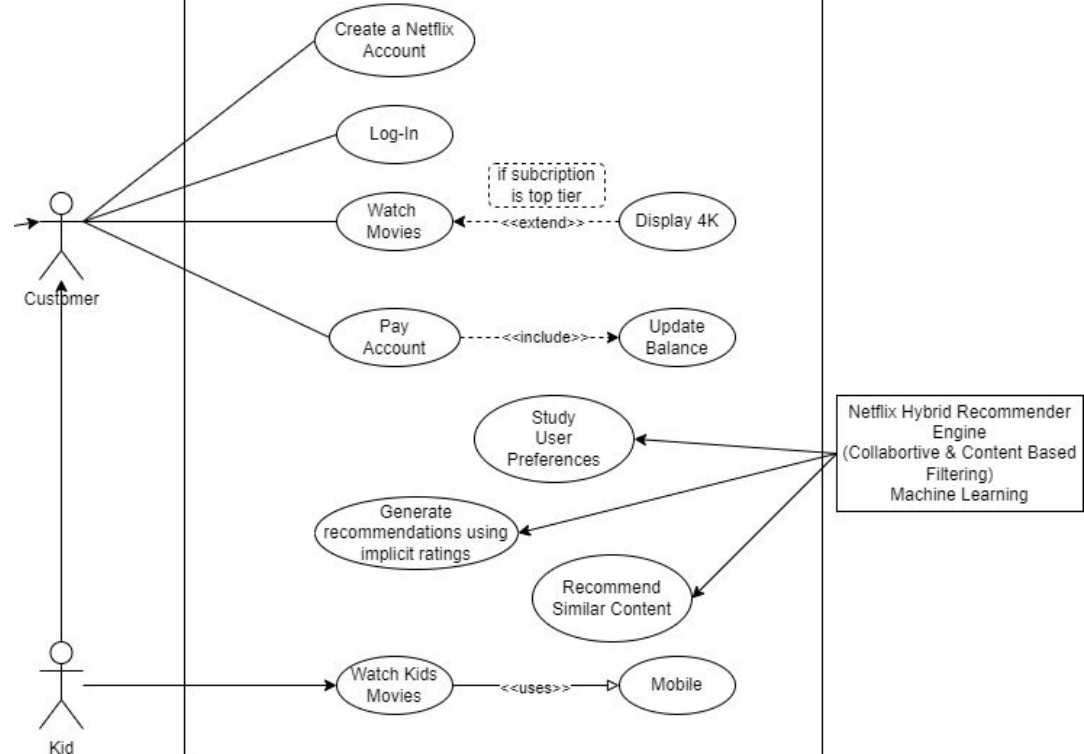
Syntax and semantics

NETFLIX

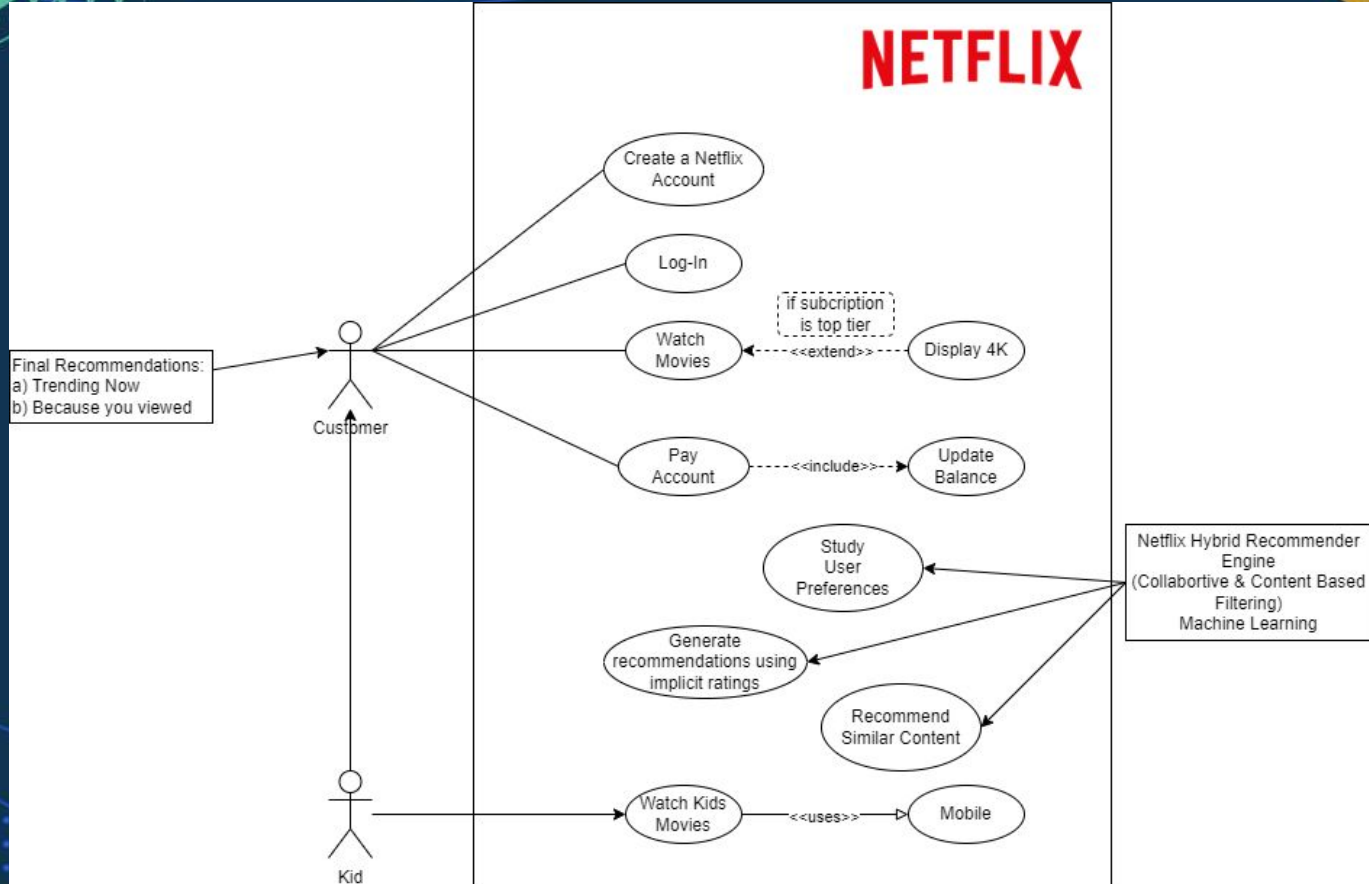


Syntax and semantics

NETFLIX

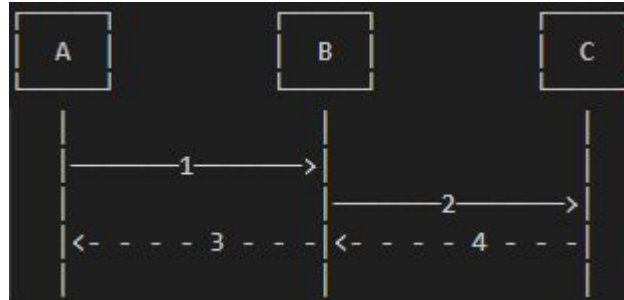


Syntax and semantics



Poll

What type of message does arrow 3 represent, and what does it imply about the operation's nature?



- A. A synchronous return, implying that A waits for both B and C to complete
- B. An asynchronous message, suggesting that A continues execution without waiting
- C. A create message, indicating that B is instantiating a new object

Poll

In the context of modularization and object-oriented design, what potential issue does this Python code snippet highlight?

```
class UserManager:
    def __init__(self, db_connection):
        self.db = db_connection

    def get_user(self, user_id):
        return self.db.query(f"SELECT * FROM users WHERE id = {user_id}")
```

- A. Lack of encapsulation, as the database query is exposed in the method
- B. Poor cohesion, as the class is handling both user management and database operations
- C. Tight coupling between the UserManager and the database, violating the Dependency Inversion Principle

Poll

Which of the following statements accurately describes the purpose of a use case diagram?

- A. It shows the interactions between objects within a system.
- B. It visualises the flow of messages between system components.
- C. It represents the functional requirements of a system from the perspective of its users.
- D. It provides a detailed breakdown of system architecture and design.

Summary

- **modularisation:** Breaking down software into independent modules enhances maintainability, scalability, and reusability.
- **Sequence Diagrams:** Visualising component interactions elucidates system behaviour over time, aiding in comprehension and optimization.
- **Use Case Diagrams:** Representing system functionalities from user viewpoints aids in requirement analysis and stakeholder communication.
- **modularisation Importance:** It streamlines development, promotes code reusability, and enables easier collaboration among teams.
- **Sequence Diagrams' Utility:** They highlight the sequence of events, showcasing message exchanges and system flow.
- **Use Case Diagrams' Significance:** They provide a holistic view of system functionalities, ensuring alignment with user needs and expectations.
- **Overall Importance:** Together, these tools facilitate the design, development, and understanding of complex software systems, ensuring efficiency and user satisfaction.

Follow-up Activities

Think about doing such diagrams for an e-Commerce system.

Use all the concepts we've covered.

Thank you for attending



Department
for Education

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