AMSS Lecture 3: Requirements Analysis

UML Use Case / Sequence Diagrams

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Agenda

1. What are requirements?
2. Scenarios and use cases
3. UML Use Case Diagrams
4. **Interactive Exercise 1:** Identify actors and use cases
5. Break (10 minutes)
6. UML Sequence Diagrams
7. **Interactive Exercise 2:** Model an interaction
8. Wrap-up and discussion

What Are Requirements?

- **Definition:** Descriptions of what the system must do and under what constraints.
- **Purpose:** Ensure all stakeholders share a common understanding of the system.
- **Main types:**
  - **Functional requirements:** what the system should *do*
  - **Non-functional requirements:** how the system should *be*
  - **Domain requirements:** external or business rules

Example:

The system shall allow registered students to submit assignments online.

Why Requirements Matter

- Guide design and development
- Prevent misunderstandings between stakeholders
- Support validation and testing
- Serve as the basis for modeling and documentation

Without good requirements: models and implementations diverge from real needs.

From Requirements to Scenarios

- **Scenarios** = stories about how users interact with the system
- Each scenario focuses on one **goal** or **task**
- Scenarios help identify **actors** and **use cases**

Example Scenario:

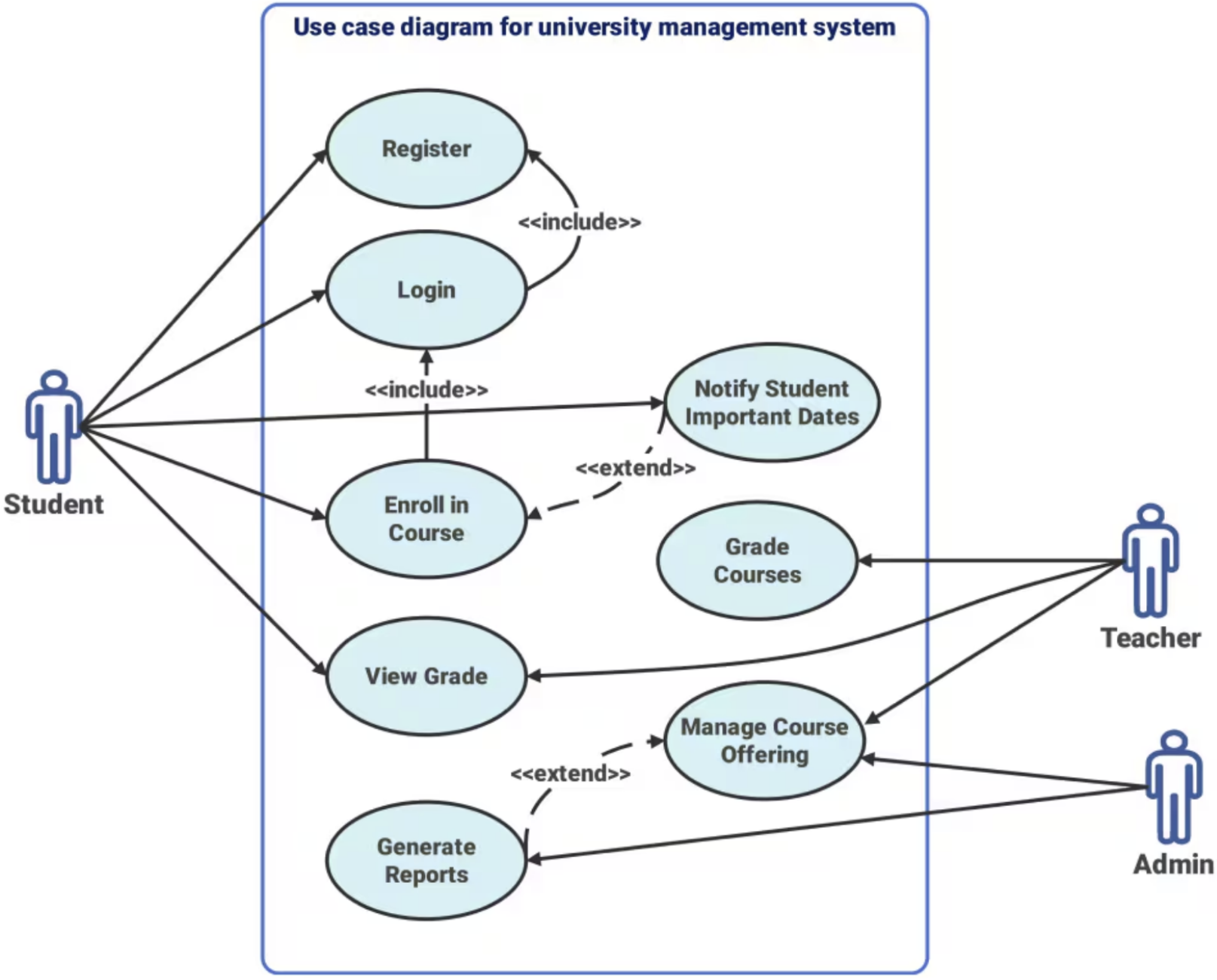
A student logs into the portal, views enrolled courses, and submits a project file.

Use Cases

- A **use case** is a description of a system's behavior as it responds to a request from an actor.
- **Actors:** users or systems interacting with ours
- **System boundary:** separates internal from external elements

Notation: ovals (use cases), stick figures (actors), box (system boundary)

Example


Use case diagram for university management system
Register
<<include>>
Login
<<include>>
Notify Student Important Dates
<<extend>>
Enroll in Course
Grade Courses
View Grade
Manage Course Offering
<<extend>>
Generate Reports
Student
Teacher
Admin

Relationships Between Use Cases

- **Include:** mandatory reusable functionality
- **Extend:** optional or conditional behavior
- **Generalization:** specialization of an actor or use case

Example: - `Register` includes `Login` - `Notify of Important Dates` extends `Enroll in Course`

Interactive Exercise 1: Identify Actors and Use Cases

Scenario: A university online examination system.

Students can register for exams, view schedules, and submit answers online. Professors can create exams, publish grades, and review submissions. The system authenticates all users.

Tasks: 1. Identify at least 3 actors. 2. Define 5–7 use cases. 3. Sketch a use case diagram.

UML Sequence Diagrams

- Describe **how** objects interact to perform a use case
- Focus on **message order** and **lifelines** over time

Elements: - **Actor / object lifelines** - **Messages** (synchronous, asynchronous, return) - **Activation bars** (execution time)

Why: Visualize the sequence of interactions that fulfill a use case.

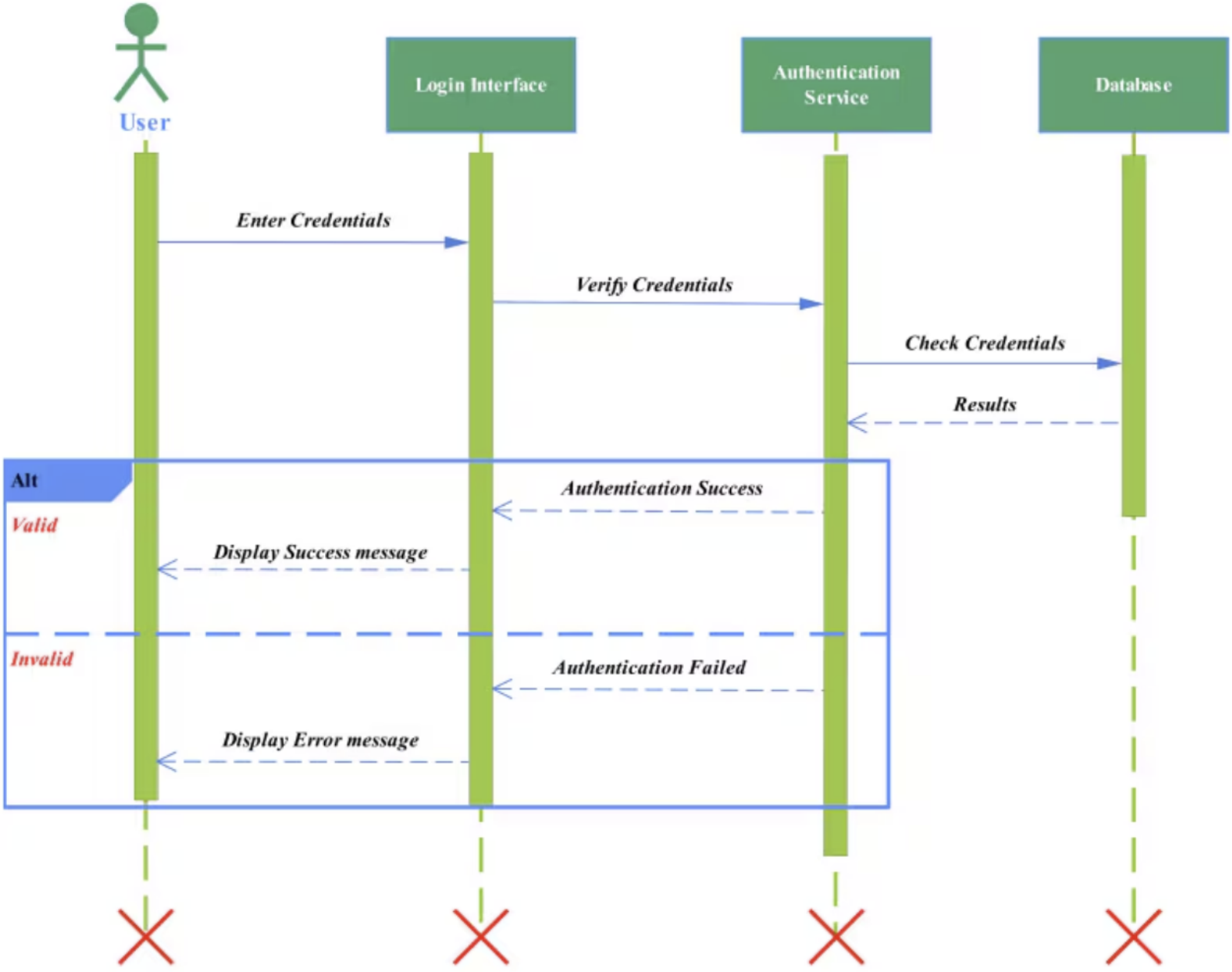
Example Sequence Diagram

Scenario: "User logs into the system"

Actors and objects: - `User` - `LoginPage` - `AuthService` - `Database`

Steps: 1. User enters credentials → LoginPage 2. LoginPage sends request → AuthService 3. AuthService validates → Database 4. Database returns result 5. AuthService responds with success/failure

Example


User
Login Interface
Authentication Service
Database
Enter Credentials
Verify Credentials
Check Credentials
Results
Alt
Valid
Authentication Success
Display Success message
Invalid
Authentication Failed
Display Error message

Interactive Exercise 2: Model an Interaction

Scenario: “Customer places an order in an online shop.”

Actors and objects: - `Customer` - `WebApp` - `OrderService` - `PaymentGateway` - `Database`

Tasks: 1. Identify the main sequence of messages. 2. Draw a sequence diagram (lifelines, messages, returns). 3. Include one alternative path (e.g., payment failure).

Wrap-Up

Key Takeaways: - Requirements describe *what* the system must do. - Scenarios make requirements concrete. - Use case diagrams capture system functionality and boundaries. - Sequence diagrams model detailed interactions.

Next Lecture: Some design patterns