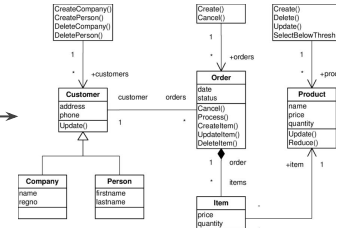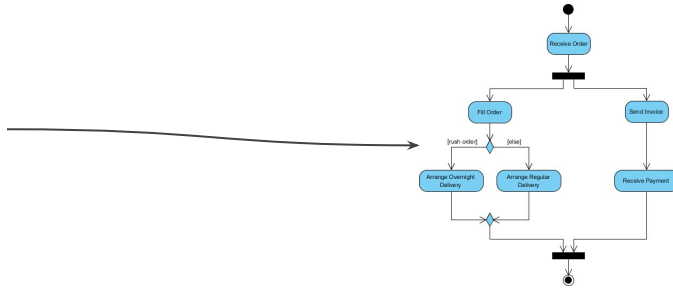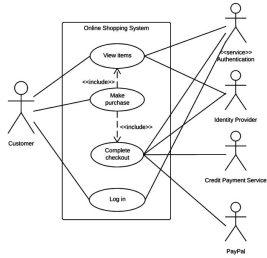# Software Analysis 1

Software Engineering
Prof. Maged Elaasar

Analysis Method with UML Diagrams

1. Identify system boundary, actors, external systems, and use cases with use case diagrams
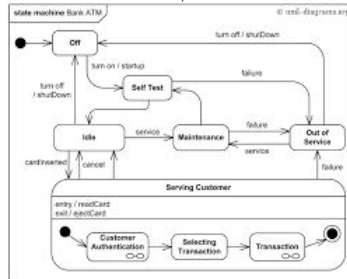
2. Identify actions for every system, and the control / data flow between them with activity diagrams

3. Identify classes and interfaces with their attributes, operations and relations with class diagrams
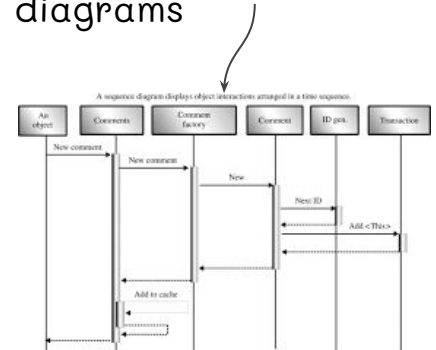
5. Flesh out the internal behavior of complex entities with state machine diagrams

4. Capture how these entities interact with each other via messages using sequence diagrams
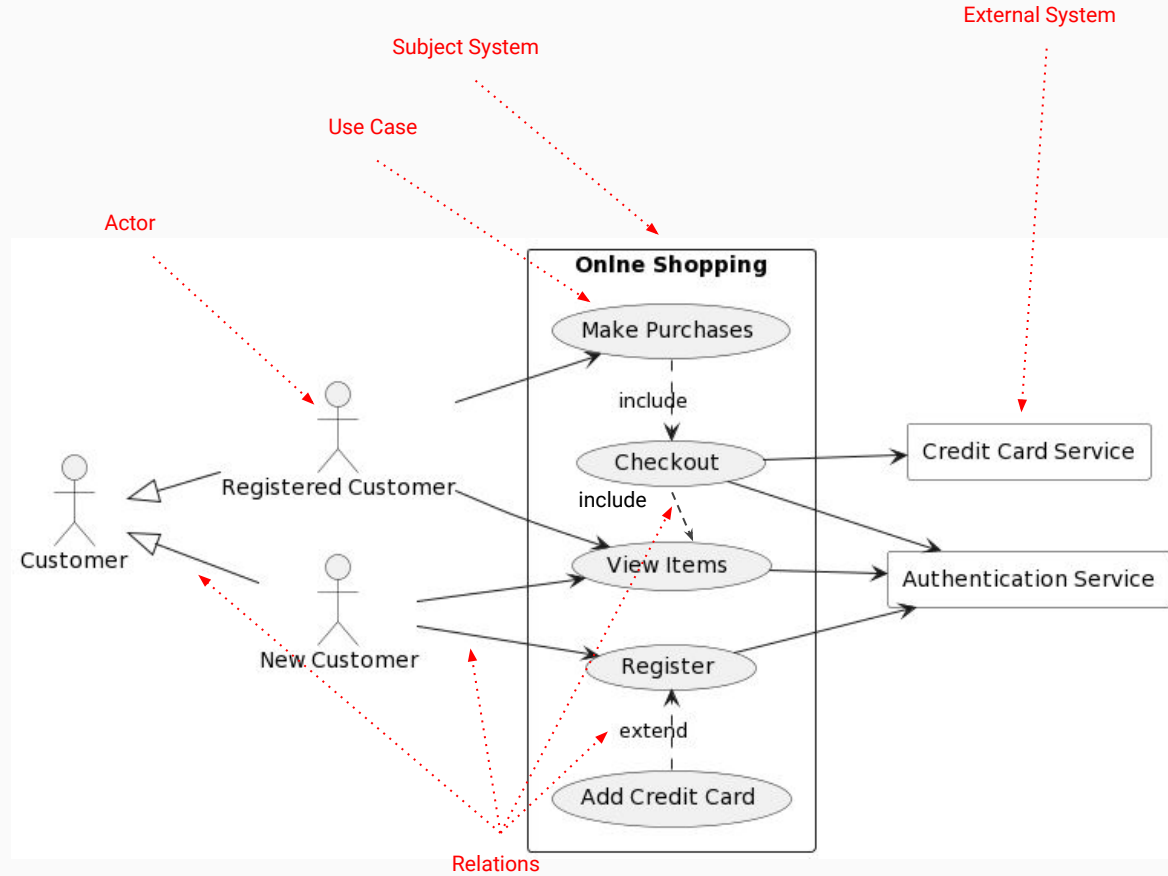
1. Use Case Diagram

Use Case Diagram

1. Describes the system as a black box

2. Identifies the use cases that it supports

3. Identifies the human actors that interface with it

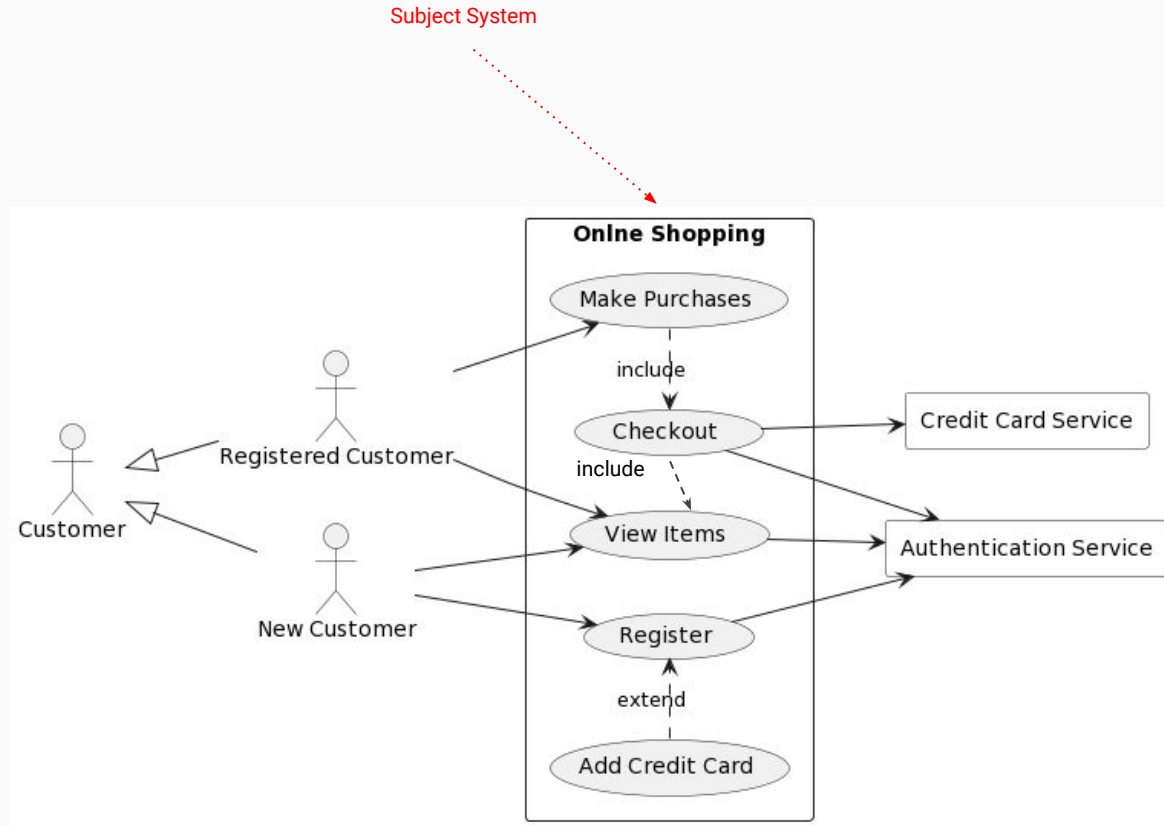4. Identifies the external systems that interact with it

Key Elements

- **Systems**
  - **Subject**
  - **External**

- **Use case**

- **Actor**

- **Relations**
  - **Association**
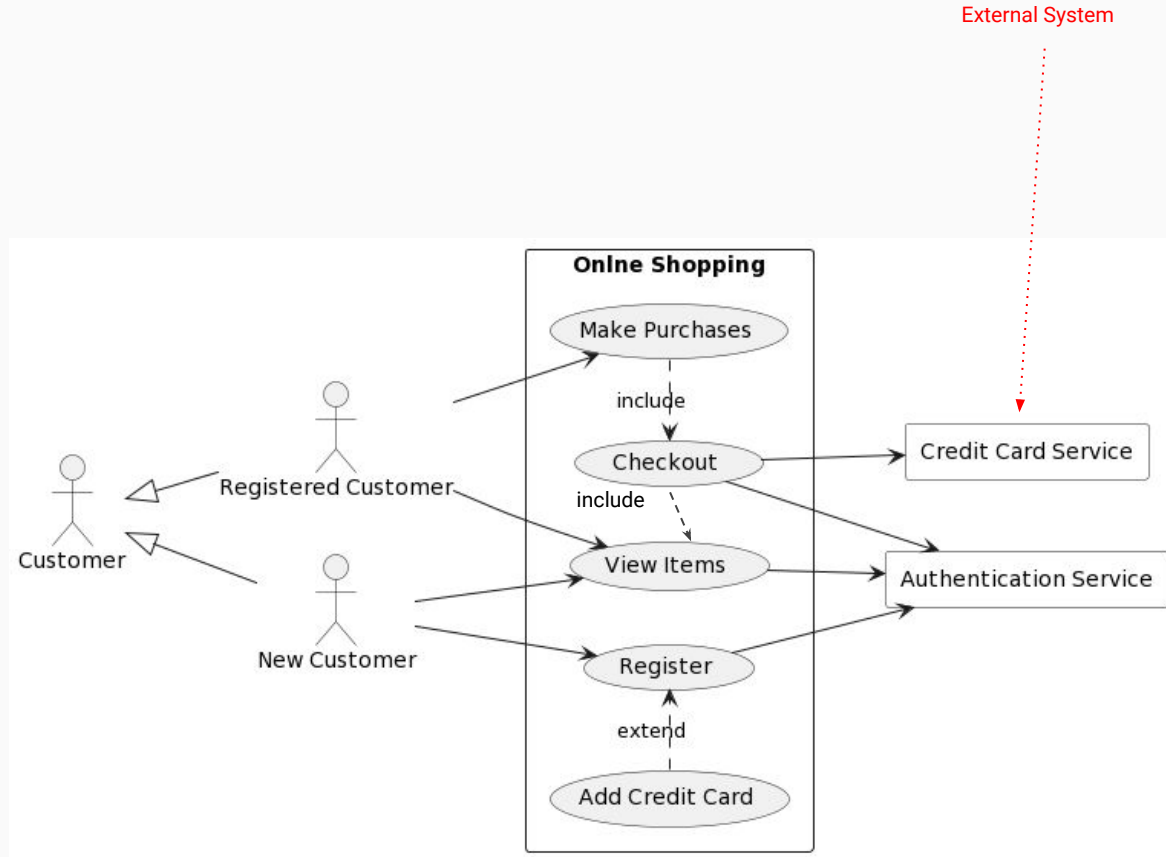 - **Inheritance**
  - **Include**
  - **Extend**

5

Subject System

- The system that is specified
- Represented as a named box
- Represents the system boundary
- Contains the use cases

External System

- Another system (service) that the subject system interacts with
- Represented as a named box
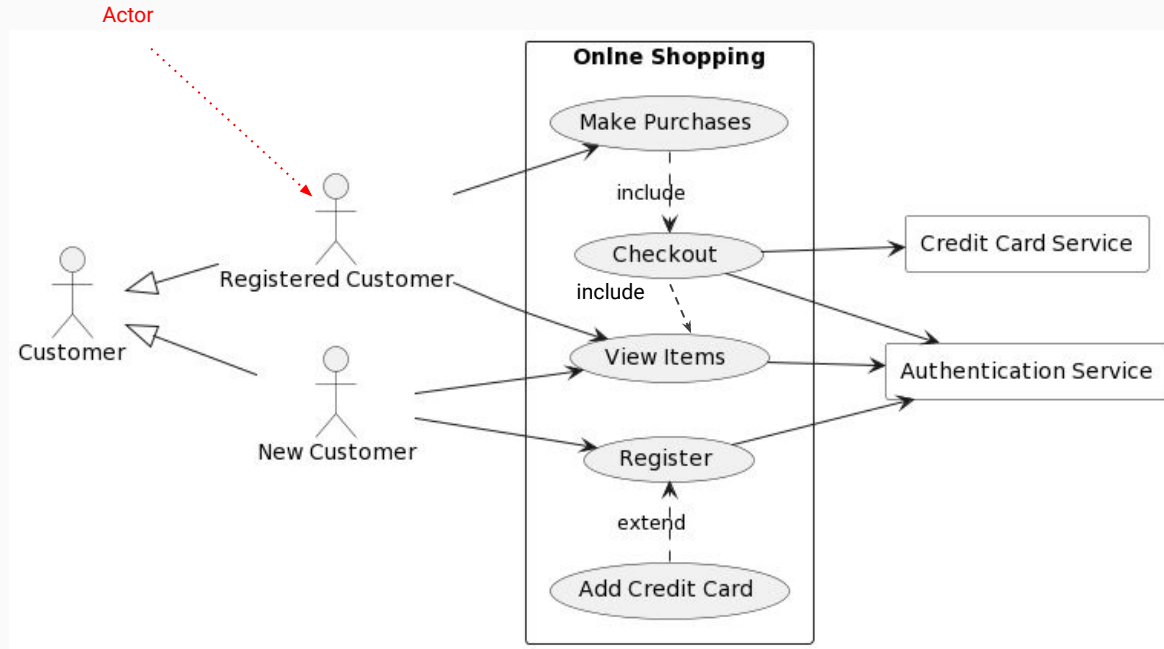- Does not contain use cases

Use Case

- A function performed by the subject system
- Represented as a bubble with the use case name within a subject system
- Associated with actors and possibly external systems
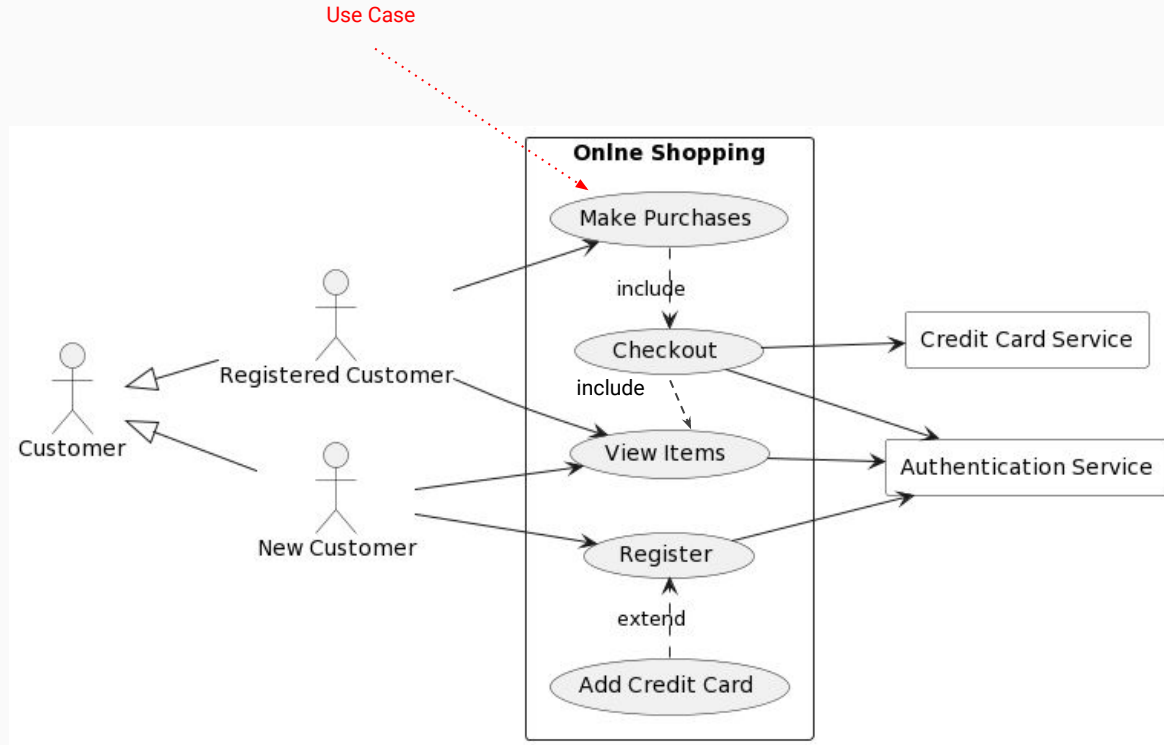
Actor

- A user that is involved in a use case of the subject system
- Represented as a stickman

Relations

- Association (Solid open arrow)
  - Between Use Case and (Actor / External System)

- Inheritance (solid closed arrow)
  - Between Actors
  - Between Use Cases
  - Between External Systems

- Include (dashed open arrow)
  - Between Use Cases
  - Source always include target

- Extend (dashed open arrow)
  - Between Use Cases
 - Target sometimes include source
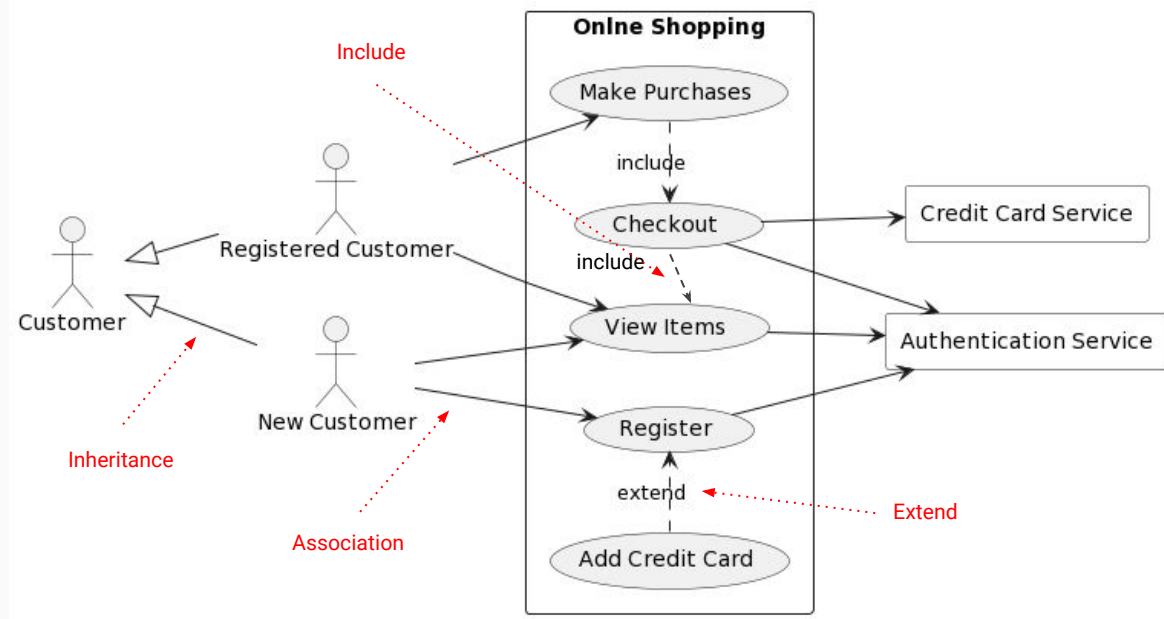
Use Case Diagram Quiz

2. Activity Diagram

Activity Diagram

- Used for modeling the control flow and the data flow in a use case of the subject system

- Looks like a flow chart where the actions are allocated to the system and/or the actors and external subsystems it interfaces with

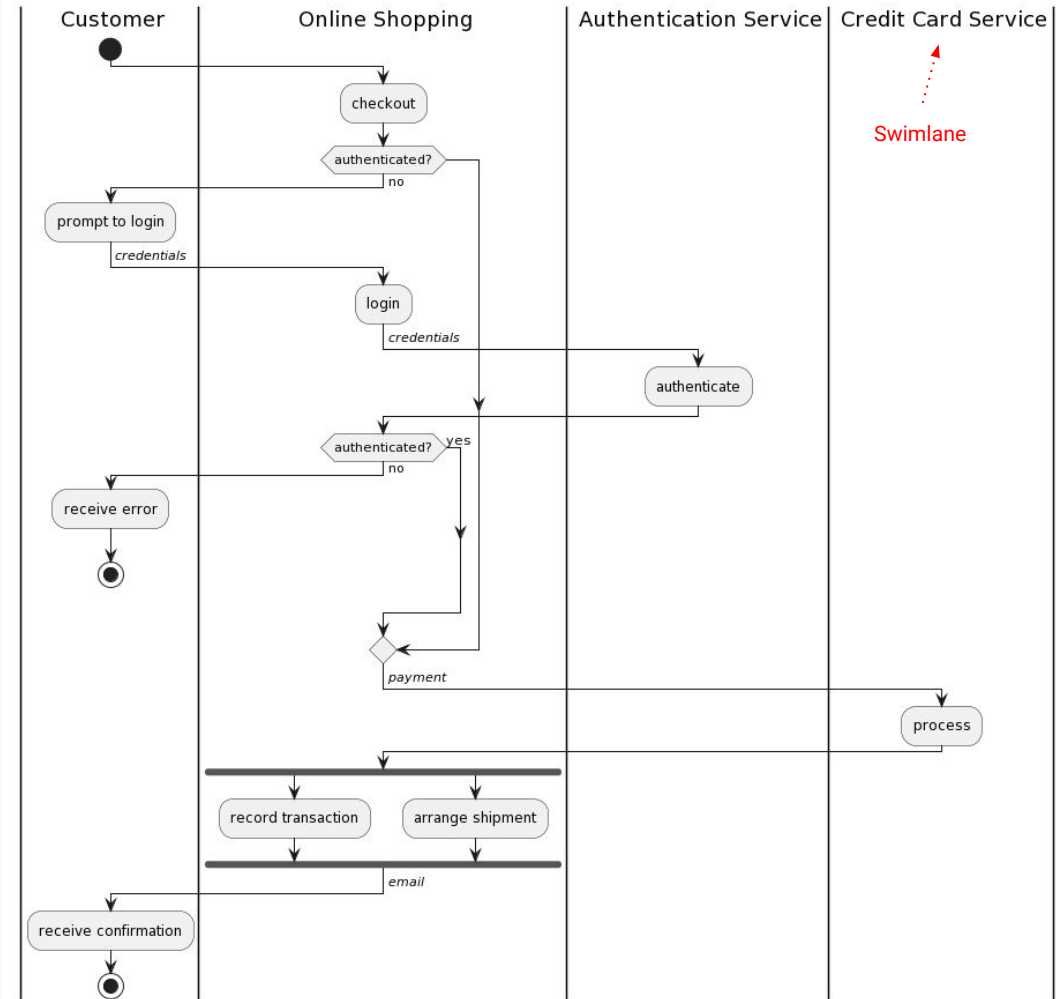- Helps discover the interfaces presented and expected by the subject system

Key Elements

- Swimlane
- Start and End node
- Action
- Control/Data Flow
- Decision and Merge
- Fork and Join
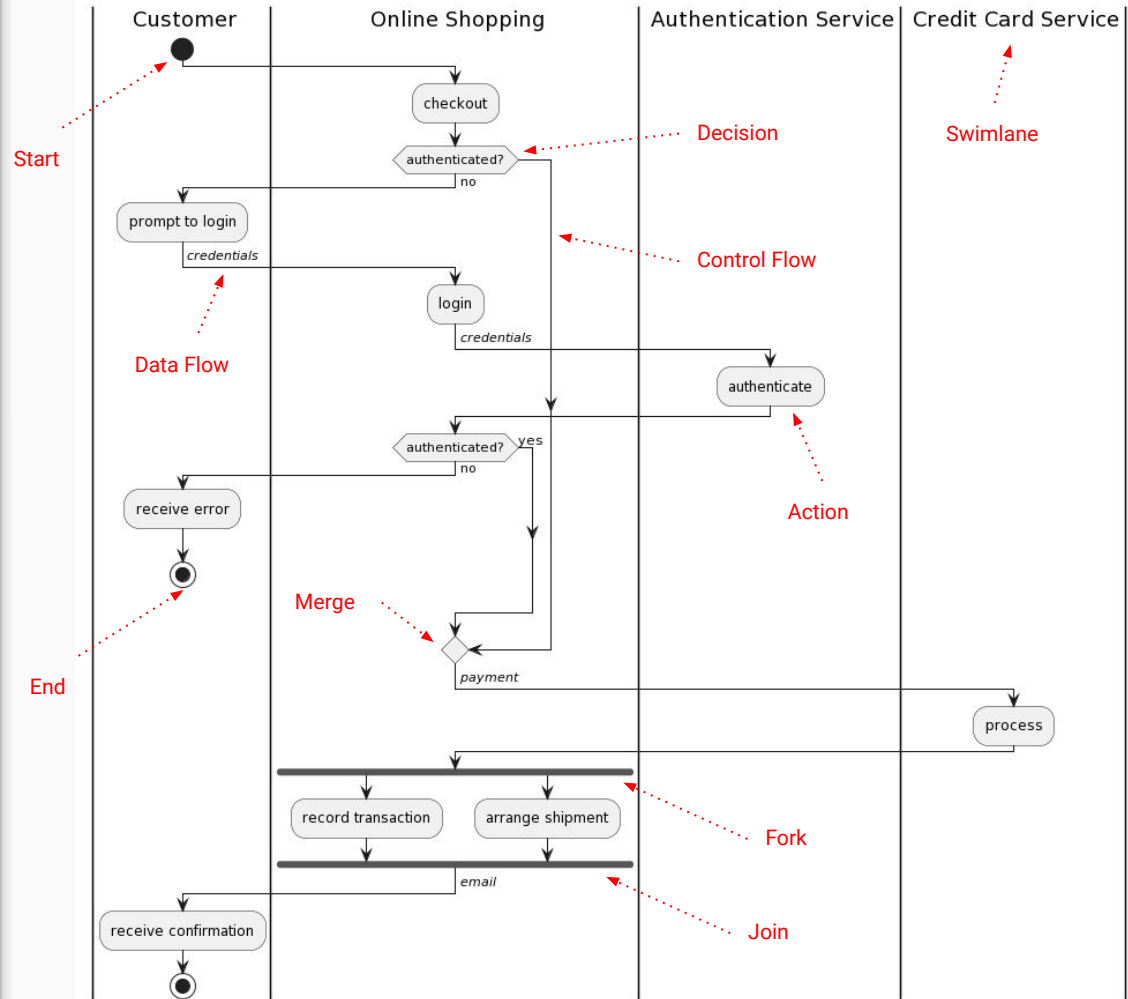
Swimlane

- Represents the subject system, external systems or actors involved in the activity
- Notated as a vertical (or horizontal) compartment labeled with the name of the entity
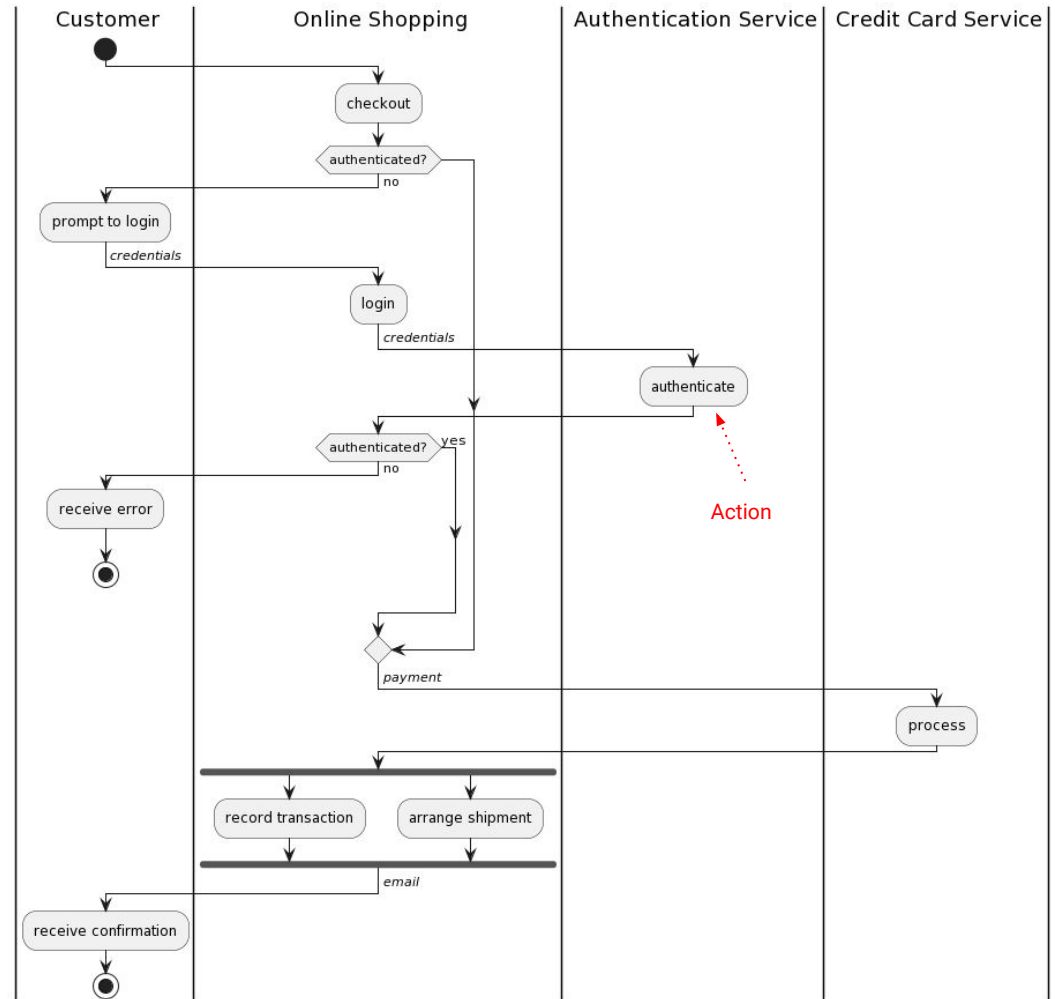
Start/End Node

- Start node is a filled circle that designates the start of an activity
- End node is an outlined filled circle that designates the end of an activity
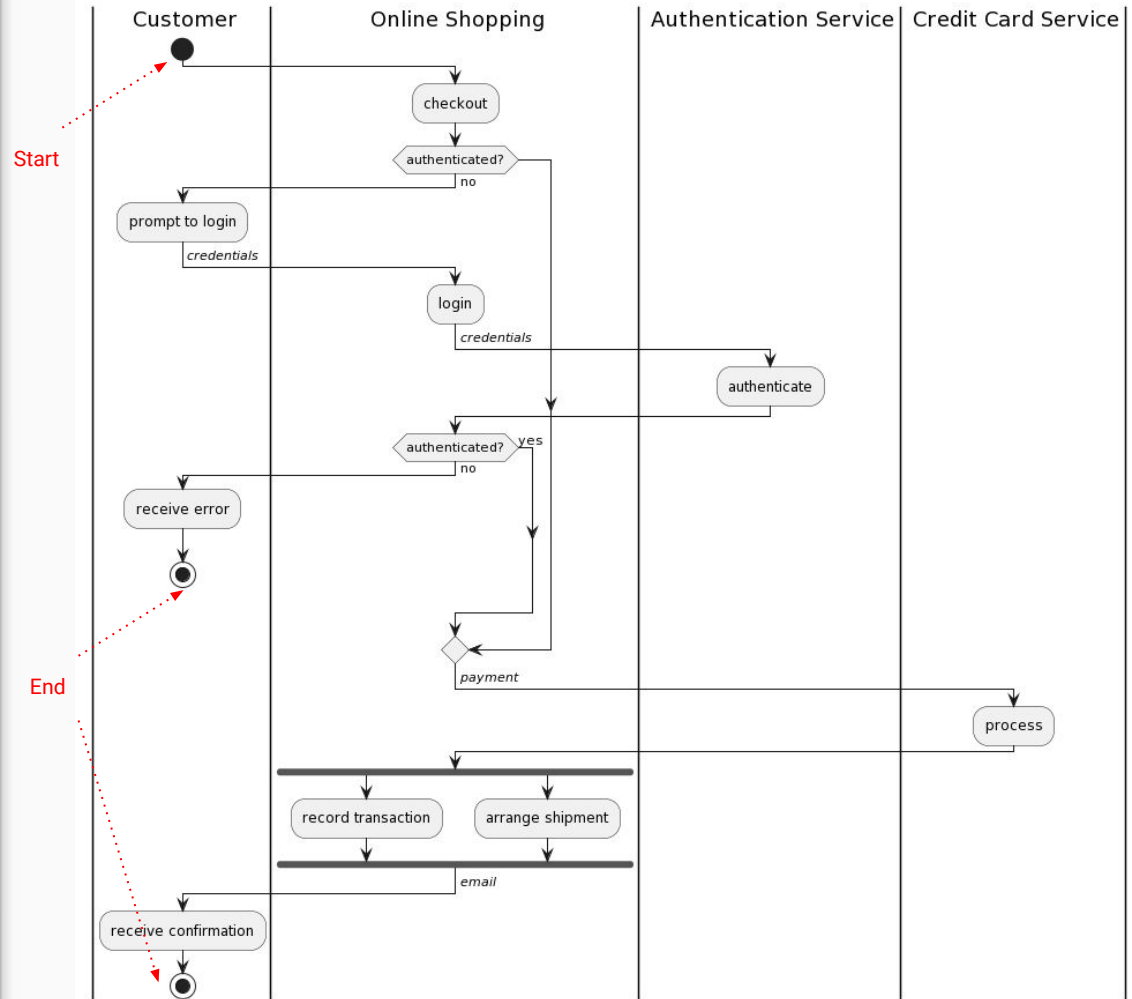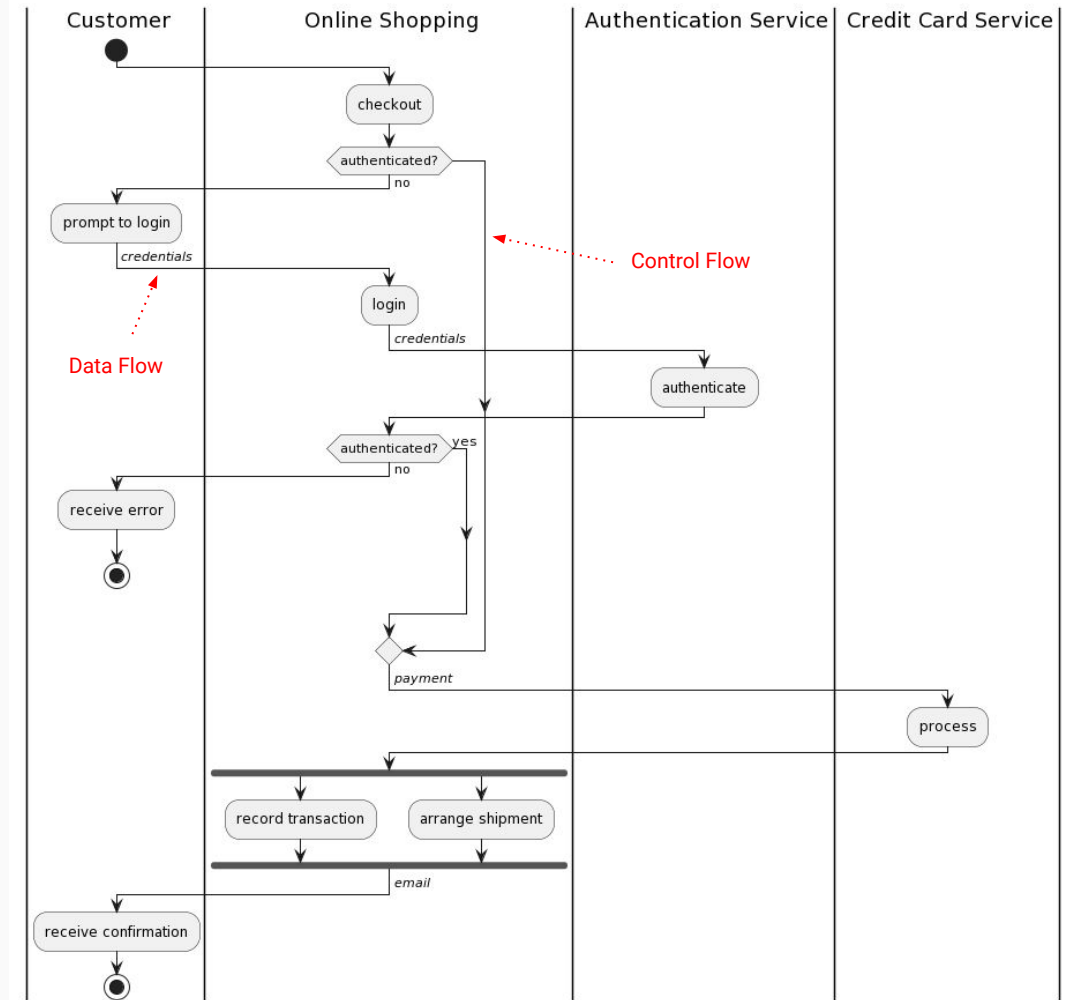
Action

- Depicted as a rounded edge rectangle in a swimlane
- Represents a function performed by the entity of the swimlane

Control/Data Flow

- Control flow is an arrow between activity elements that represents a transfer of control between them
- Data flow is like a control flow but also involves a transfer of data from the source to the target element.

Decision and Merge (if-else statement)

- Decision is diamond (with a condition) that has one input flow and multiple guarded mutually exclusive output flows
- Merge is a diamond that has multiple guarded mutually exclusive input flows and one output flow
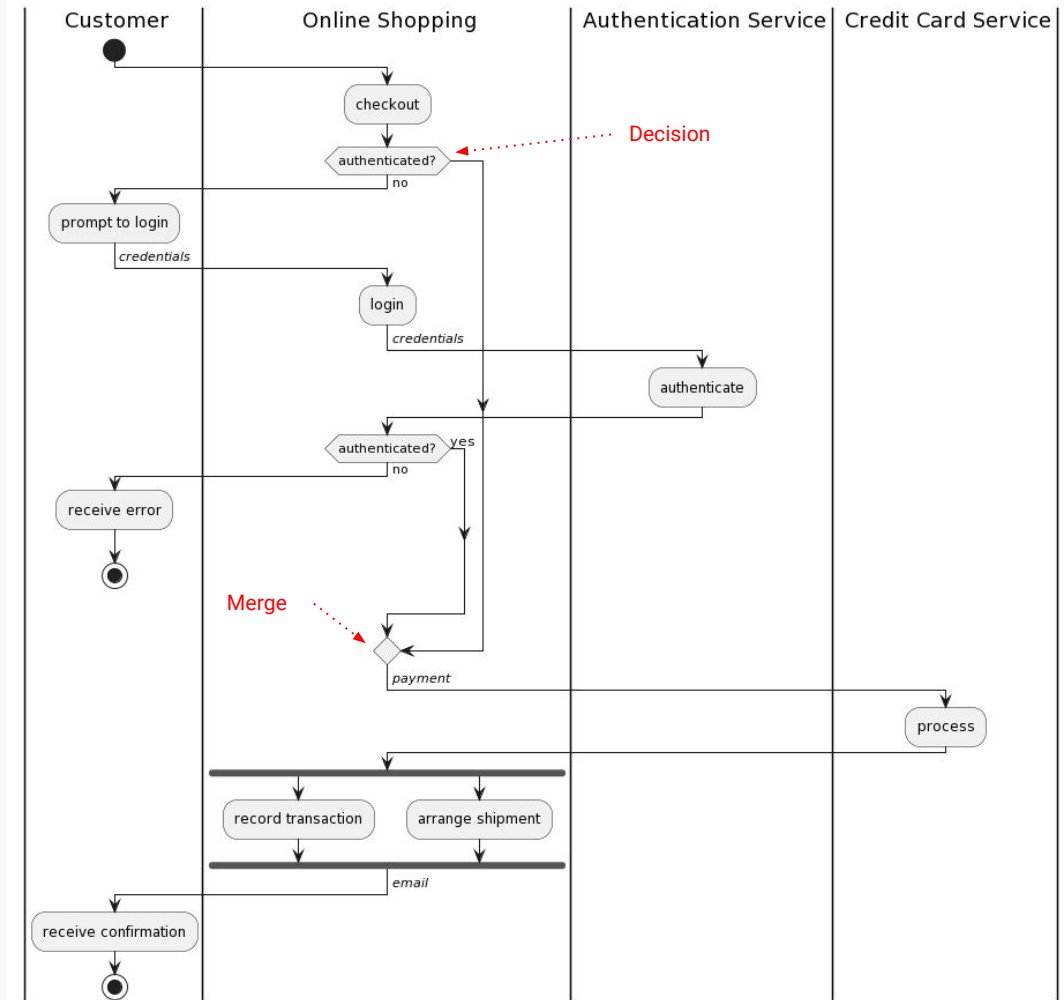
Fork and Join (parallel threads)

- Fork is a horizontal bar that allows one input flow to be forked into multiple parallel output flows
- Join is a horizontal bar that allows multiple parallel input flows to be joined into one output flow
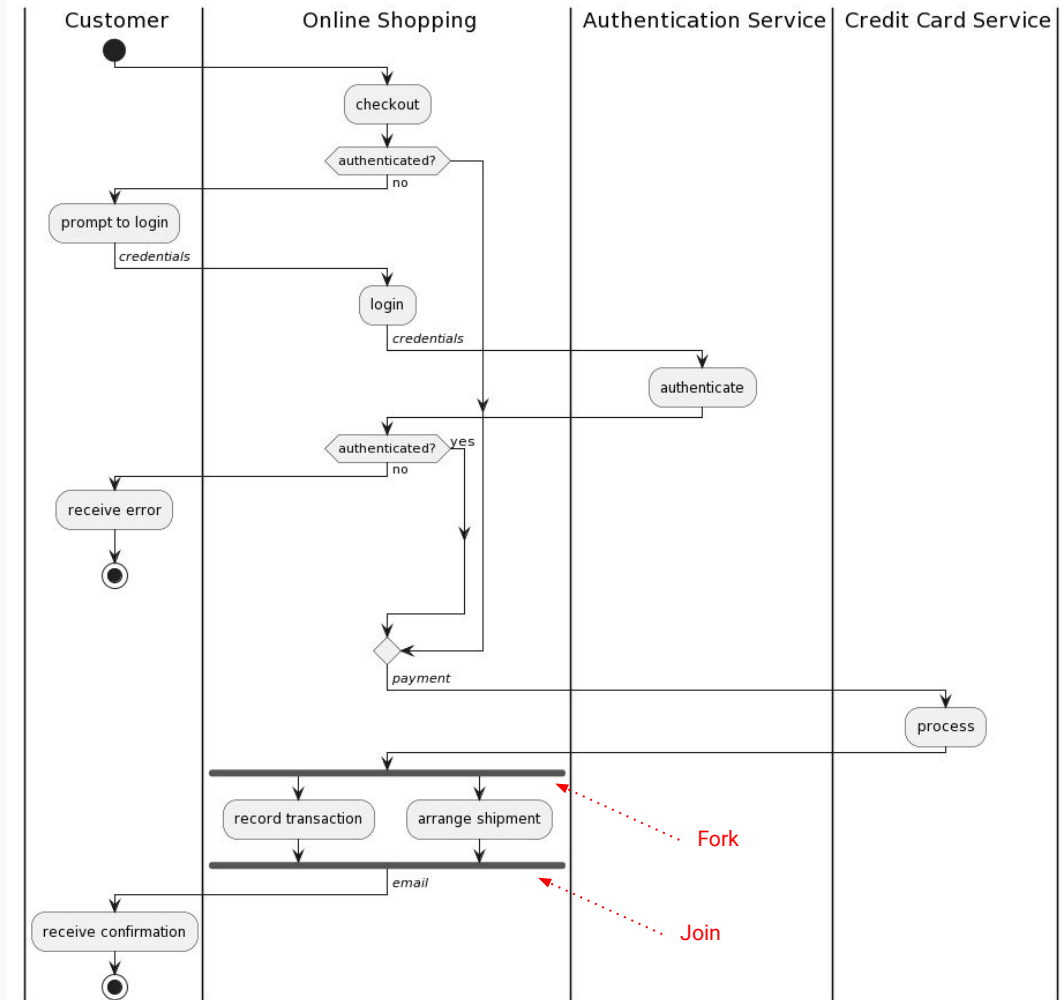
Discover System Interfaces

- Online Shopping
  - checkout ()
  - login (credentials)
- Authentication Service
  - authenticate (credentials)
- Credit Card Service
  - process (payment)
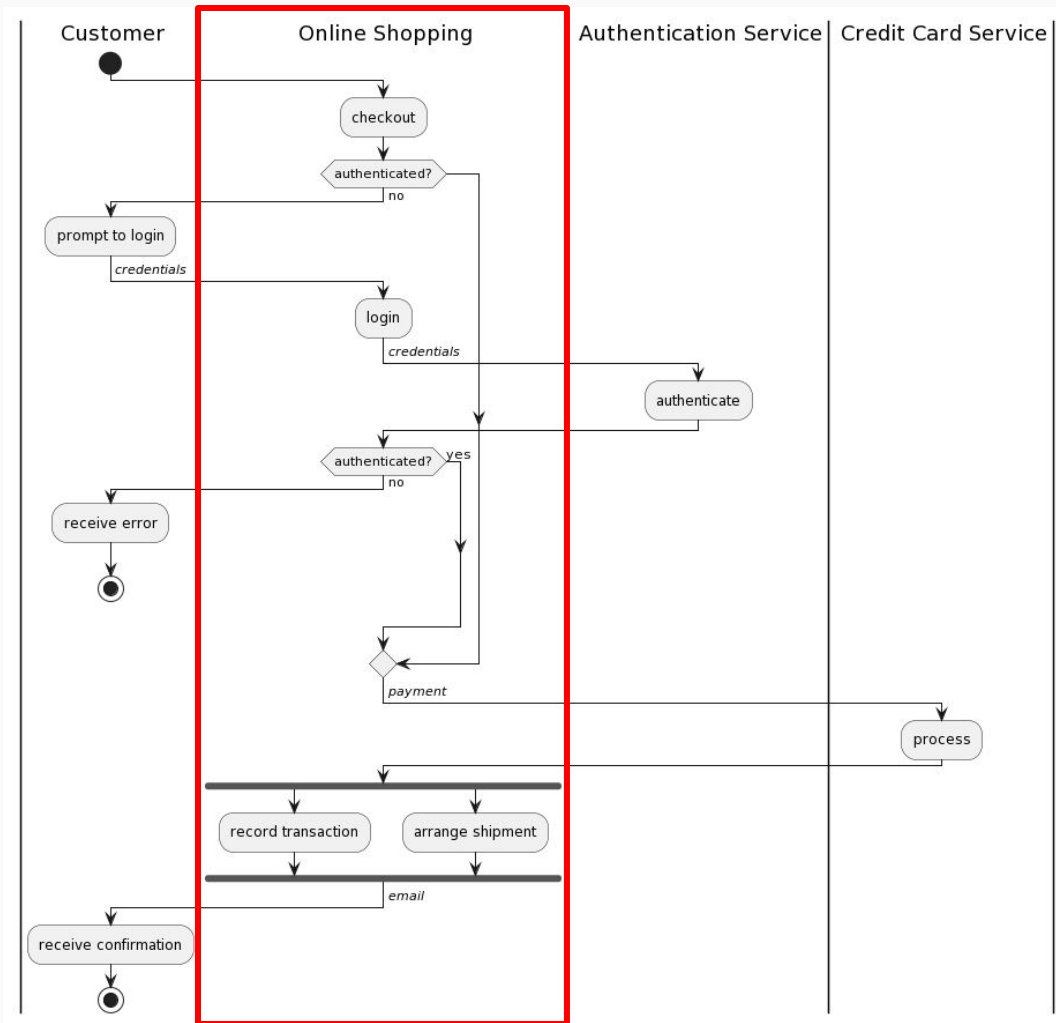
Activity Diagram Quiz

References

- Unified Modeling Language (UML) v2.5 Specification
- "UML Distilled" by Martin Fowler
- "Applying UML and Patterns" by Craig Larman
- "Software Design: Modeling with UML" by Neelam Dwivedi

For further Learning:

- https://www.uml-diagrams.org/use-case-diagrams.html (Use Case Notation)
- https://www.youtube.com/watch?v=zid-MVo7M-E (Use Case Tutorial)
- https://www.uml-diagrams.org/activity-diagrams.html (Activity Notation)
- https://www.youtube.com/watch?v=ekjhr-9VTnI (Activity Tutorial)