NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Tutorial #3 – Requirements Analysis

- Dynamic Models in Sequence Diagram and State Machine Diagram

Dr. Wang Wenhan

Conceptual Model VS. Dynamic Model

Requirement Analysis Goals

- Conceptual model (structural aspect)
  - Analyze use cases to identify the objects and roles of objects involved in the system
- Dynamic model (dynamic aspect)
  - Determine how to fulfill the processes defined in the use cases and which objects do these processes

Dynamic Model

- Definition
  - Determine how to fulfill the processes defined in the use cases and which objects do these processes
- Document and Visualize Dynamic Model
  - Sequence diagram
  - Communication diagram
  - State machine diagram
  - Activity diagram

Both diagrams essentially show the same information.

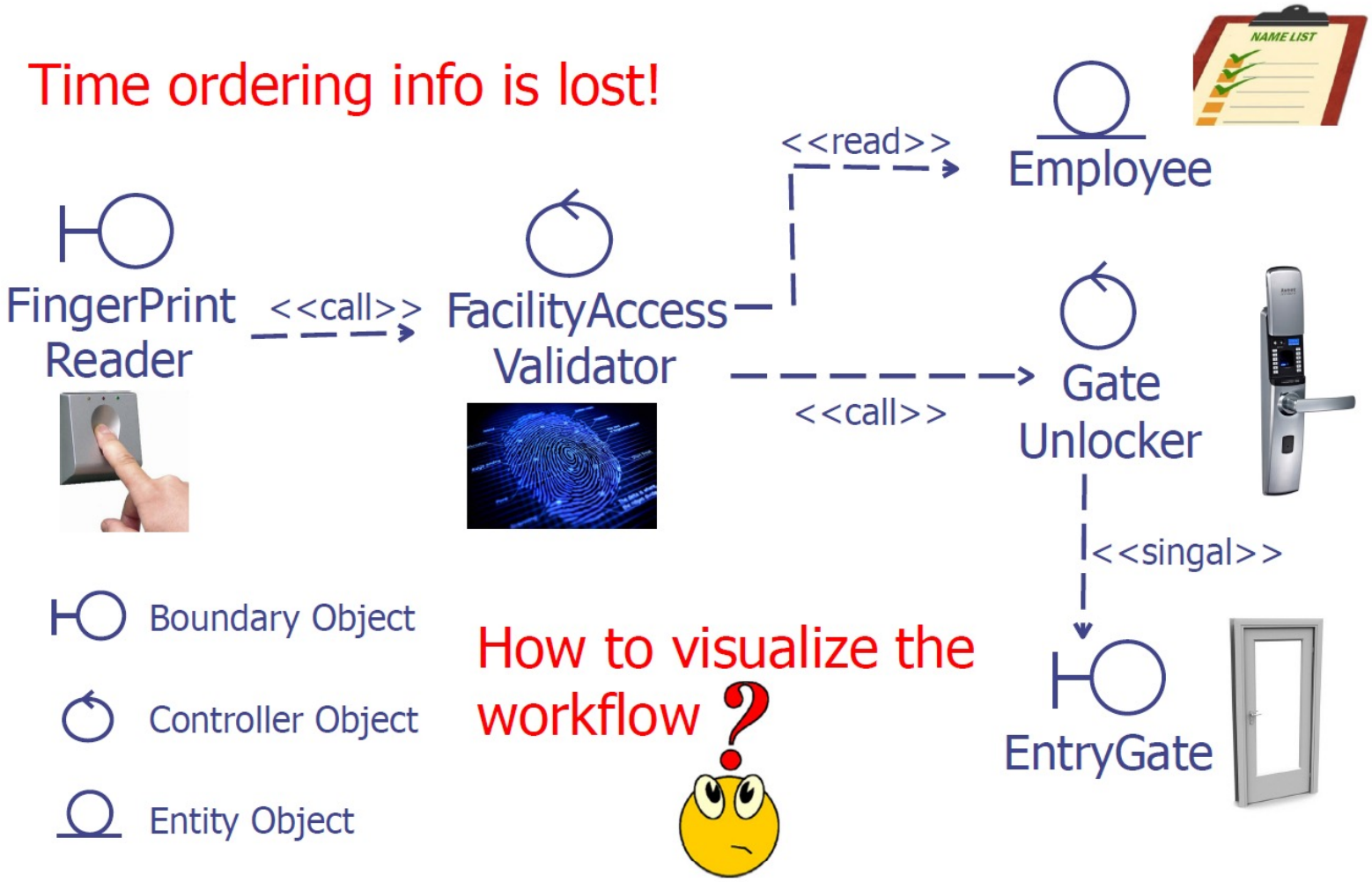
Sequence Diagram

- Captures how a group of objects (in a Class Diagram) interact or collaborate to achieve an activity as described in a Use Case.
- Sequence diagrams emphasize the sequence and time ordering of calls and messages between the objects

Both diagrams essentially show the same information but with different emphasis.

- Communication diagrams show which elements each one interacts with better
- Sequence diagrams show the order in which the interactions take place more clearly.

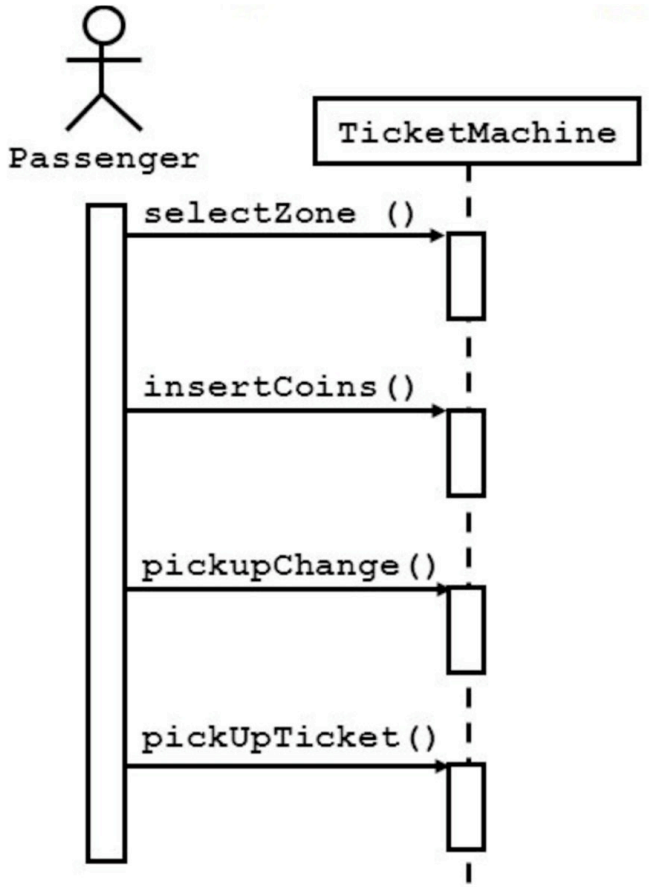
Sequence Diagram



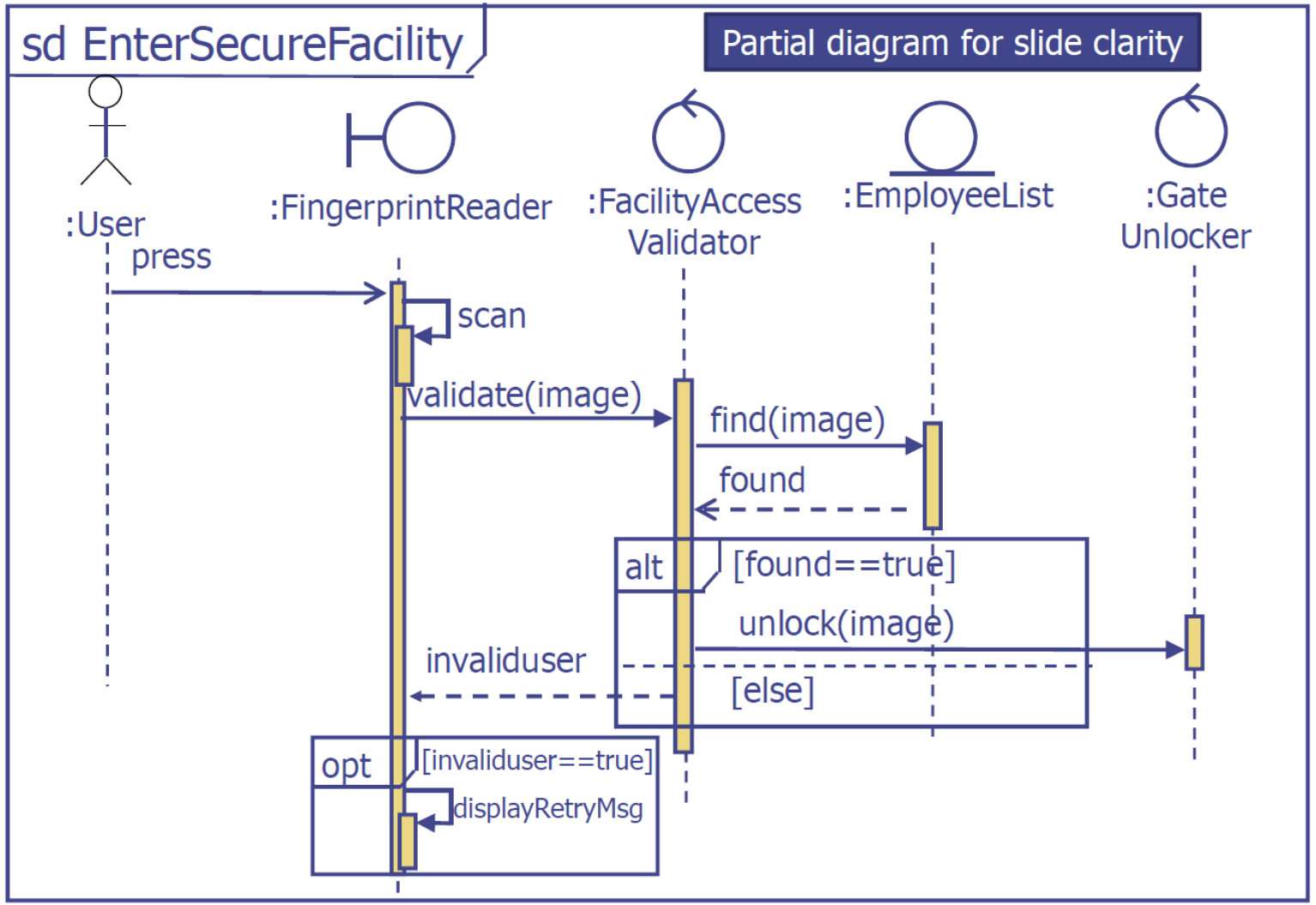
Sequence Diagram

- Used during requirement analysis
  - To refine use case descriptions
  - Find additional/missing objects

1. Objects are represented by *rectangles*
2. Messages are represented by *arrows*
3. Activations are represented by *narrow bars*
4. Lifelines are represented by *dashed lines*



Sequence Diagram



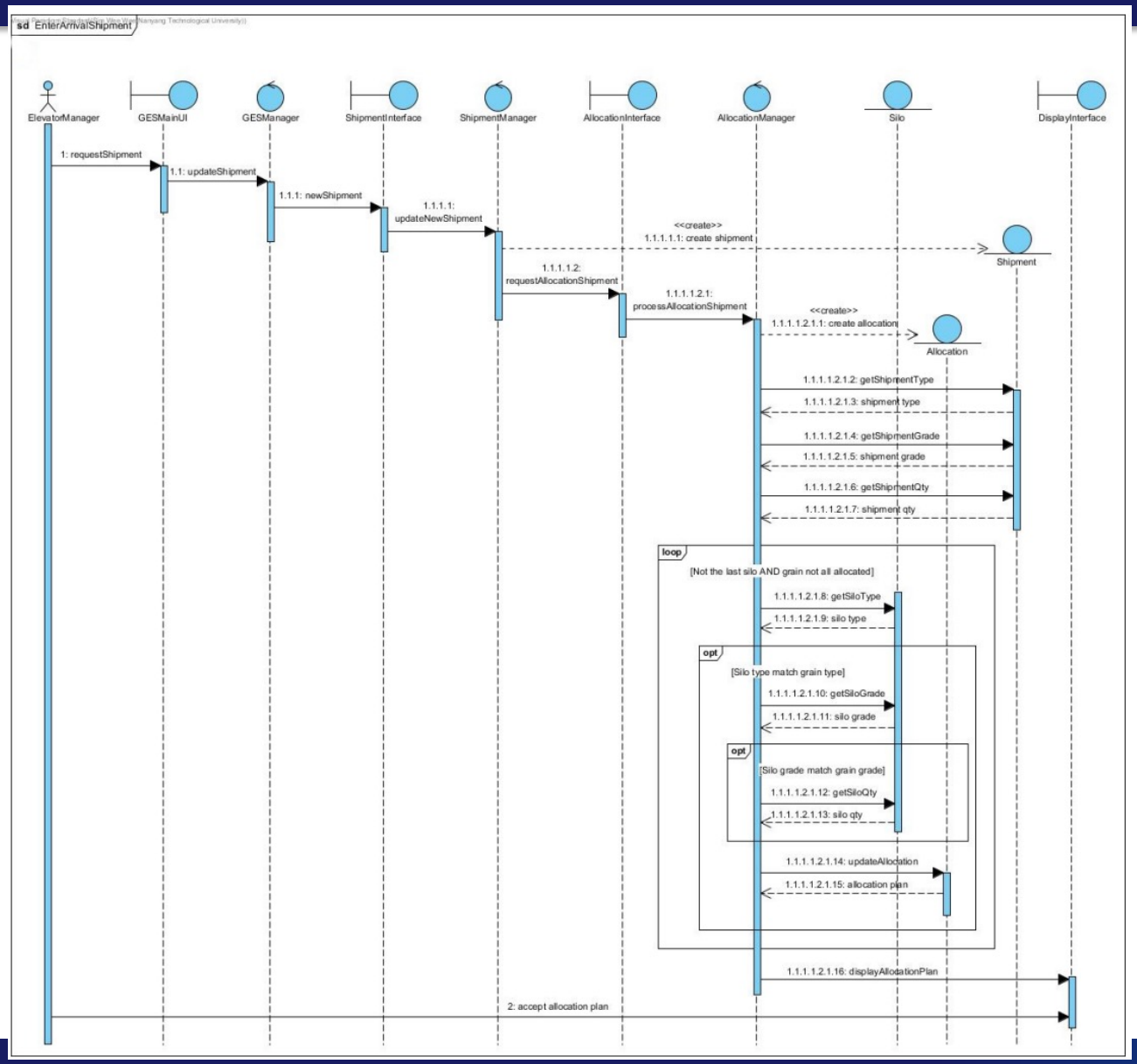
Question 1

Grain Elevator System (GES)

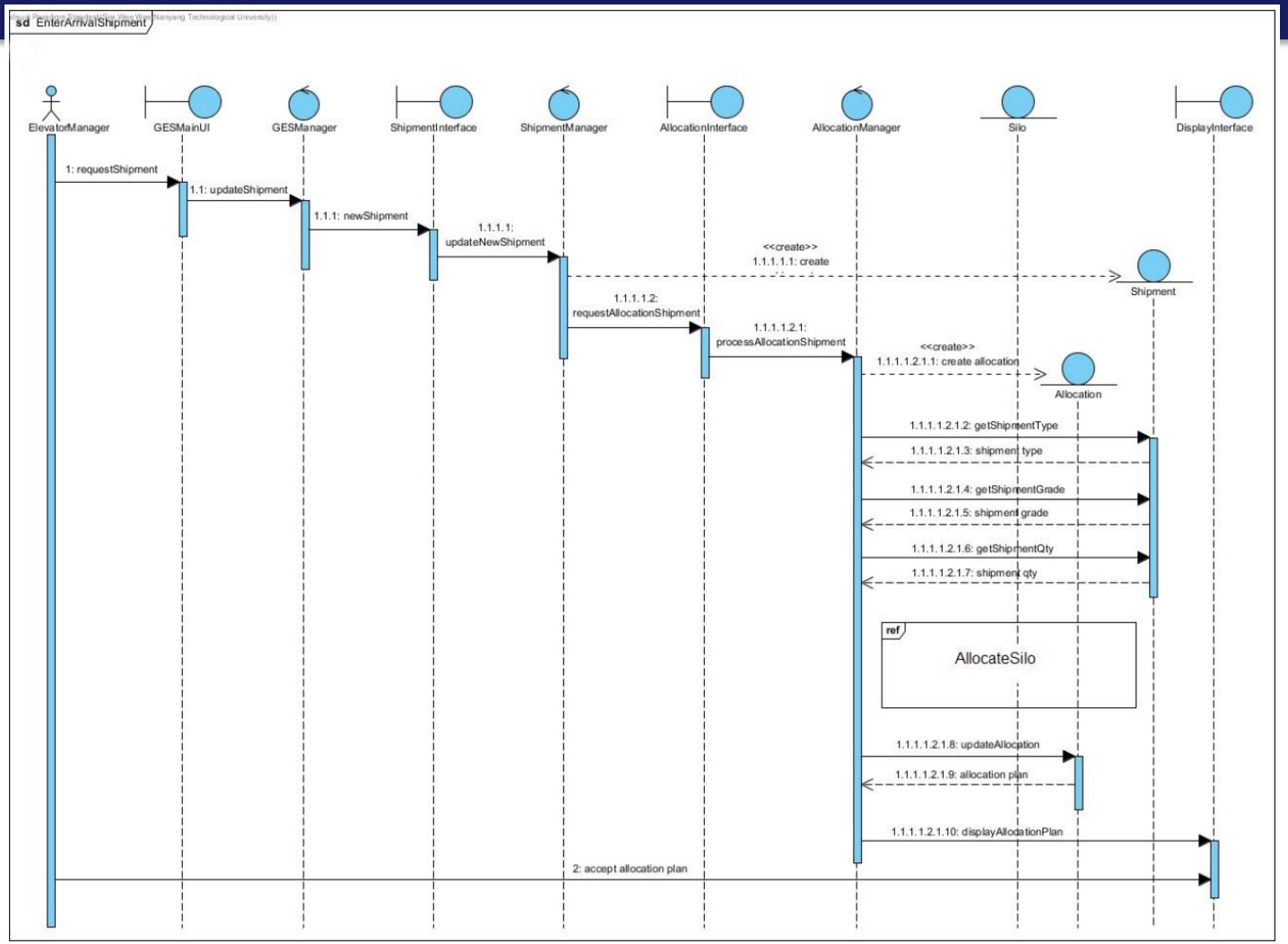
a) In a Sequence Diagram, model the interaction amongst boundary / control / entity classes to enact the shipment arrival functionality. Demonstrate how the messages passed between objects enact the Use Case's flow of events.

b) Refine the conceptual model obtained in last week's tutorial using details uncovered in question 1(a) above by adding:
   1. associations
   2. generalization relationships
   3. properties / attributes,
   4. operations
   5. new classes (if any)

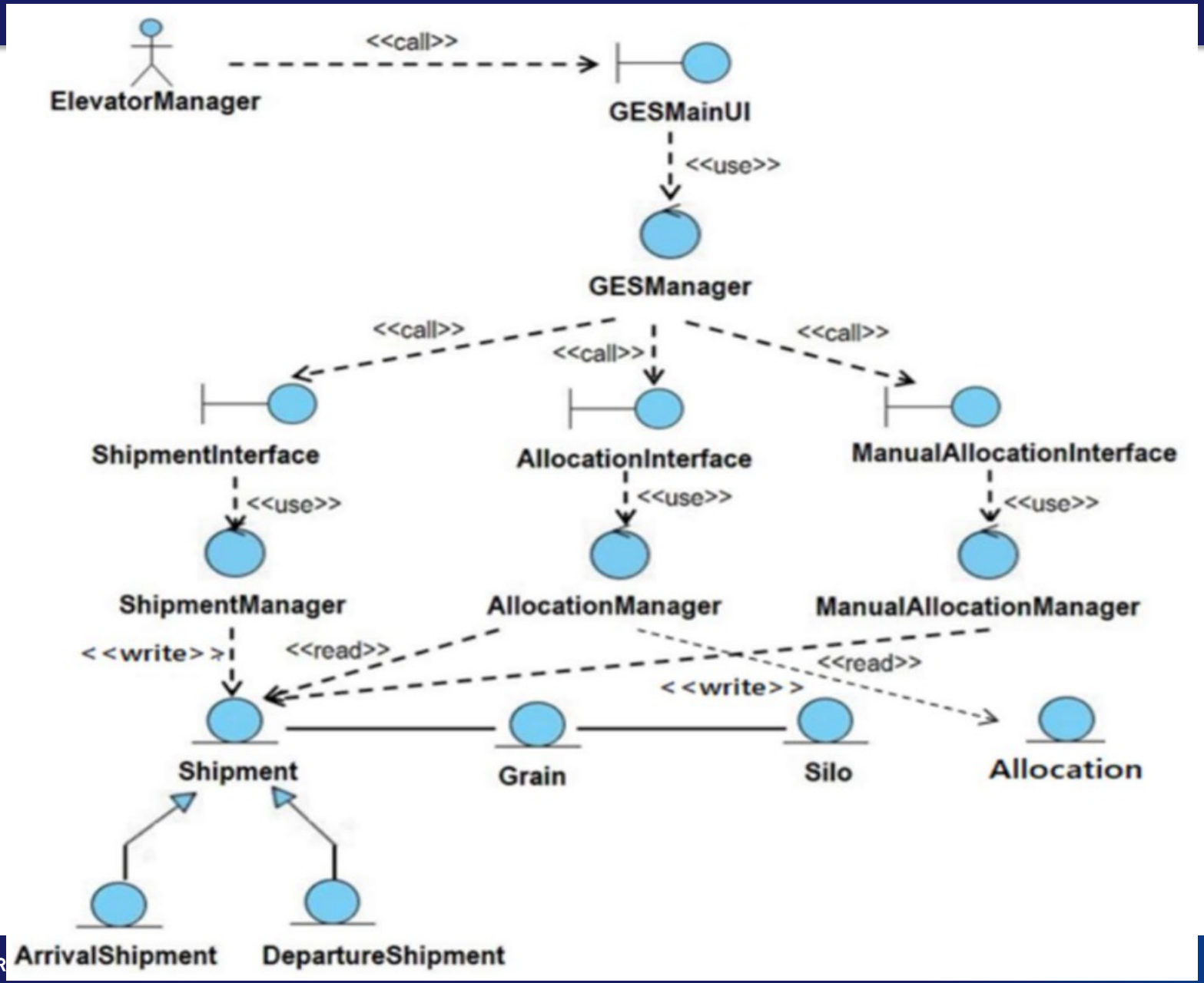
Question 1.a - Answer



Question 1.a - Answer



Question 1.b - Answer

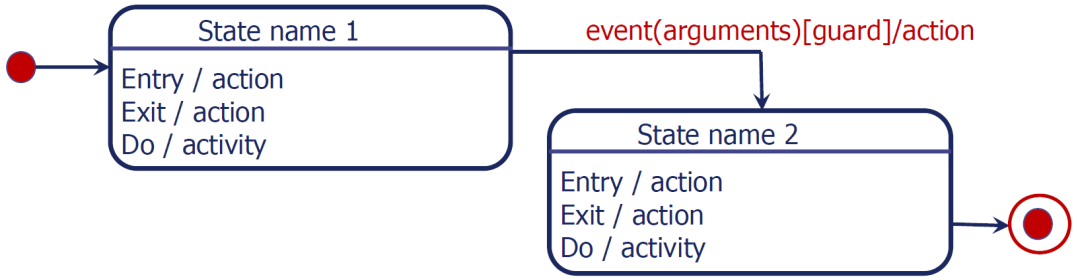


State Machine Diagram

- Also known as Statecharts, Finite State Automata.
- Models a system or an object based on the "States" it can be in.
- A "State" is a stable condition of a system, that can exist for a period of time, or for all time, until some ACTION drives the system into another stable state.
- Most systems will have a finite number of states in which it can be depending on the previous state and actions which move it to another state.
  - e.g., a 2-bit binary counter has 4 states and moves from one state to the next when a clock signal drives it to the next state.

State Machine Diagram

- A "State" is represented as a *rectangle with rounded corners* with a name at the top and optionally a description of the state and/or actions and activities performed while in that state.
- A state machine diagram begins with a start node followed by a series of states connected by transitions and finally an end node (unless the system is in an infinite loop and there is no end node).
- A transition from one state to the next is assumed to be instantaneous in response to an event. A transition can have optionally:
  - event: event triggers the transition
  - guard: the condition which must be true to take the transition
  - action: action to do during the transition



Question 2

8:30am lectures are usually frustrating for the lecturer. Projectors, having been turned off at the end of the previous day, take a long time to become ready for use.

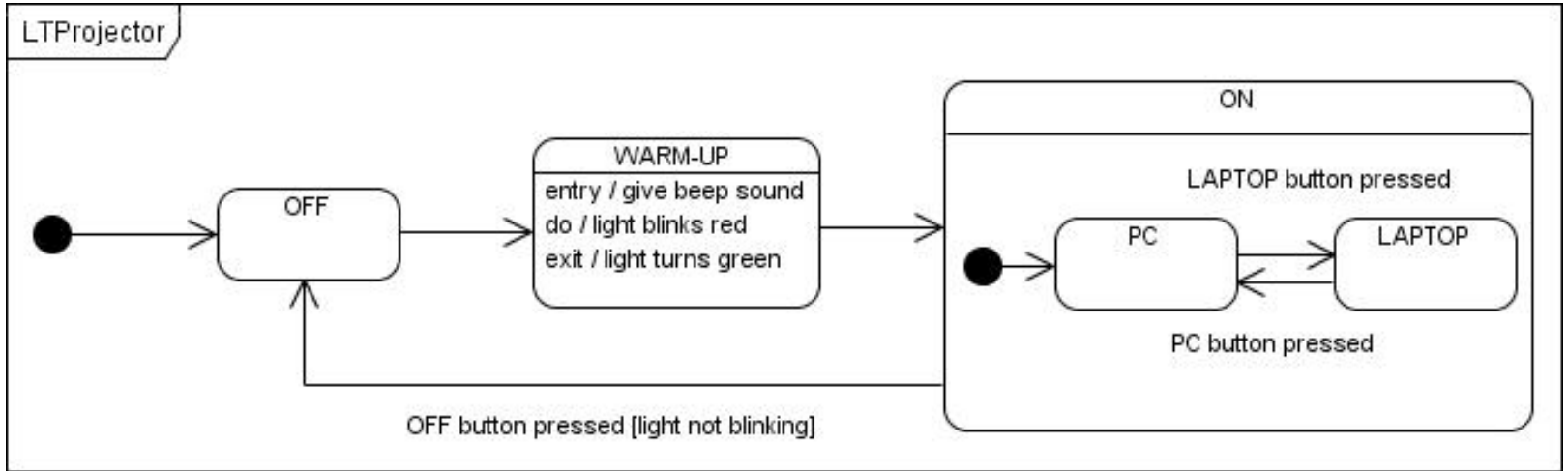
Here's what Professor Jane does at the Projector Controller Panel, in order to project slides from her laptop:

- Turn on the projector.
- As the projector warms up, it first gives a beep (sound) and red indicator light continues to blink.
- When ready, the indicator light turns to green; the projector takes input from the PC by default.
- Jane presses the "LAPTOP" switch.

After the lecture, Jane could turn off the projector by pressing the "OFF" button. However, to save her colleagues the angst, she decides to leave it ON.

Model the projector's system behaviour using a state machine diagram (i.e. dialog map).

Question 2 - Answer



Question 2 - Answer