

INF 111 / CSE 121: Software Tools and Methods

Lecture Notes for Fall Quarter, 2007
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Set 17

(Some notes adapted from Susan E. Sim & UML Distilled)

Announcements

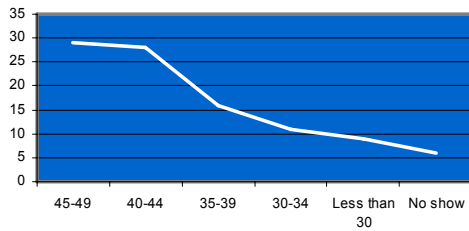
- Homework Due 11/21 @ 3p
- TA will be available for questions in class on Friday & in discussion on Monday
- Lab 6 will be posted on Thursday
- Quiz #3 scores have been posted
 - Not distributed yet
- UML Links:
 - <http://dn.codegear.com/article/31863#use-case-diagram>

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Quiz # 3

- Range
 - High Score: 49
 - Low Score: 9
- Median: 41



Previously in INF 111...

- UML
 - Generalization
 - Inheritance
 - Polymorphism

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Today's Lecture

- UML
 - Class Diagrams
 - Use Case Diagrams
 - Sequence Diagrams

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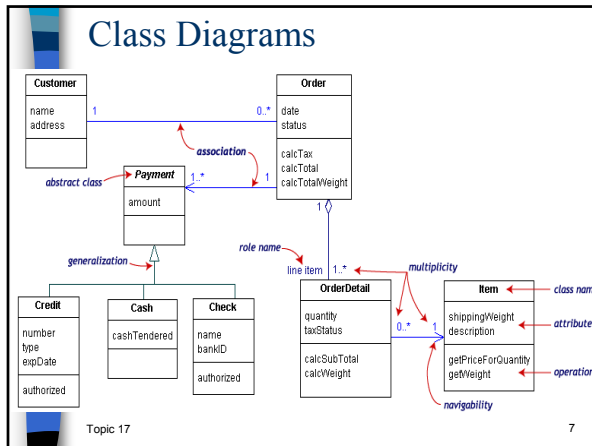
Class Diagrams

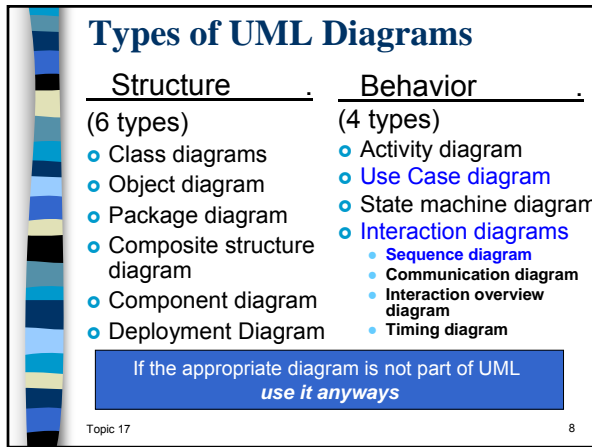
- Association

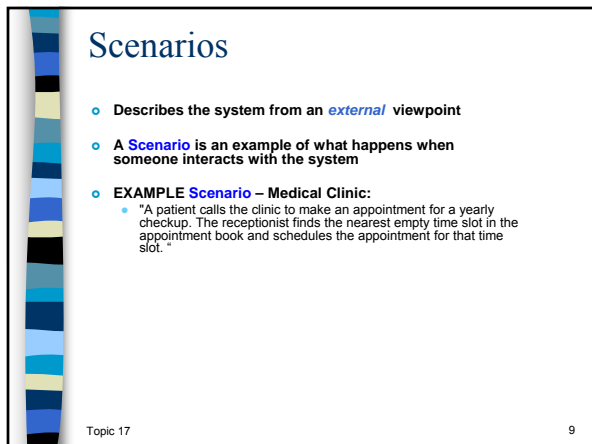
There is an *association* between two classes if an instance of one class *must know* about the other in order to perform its work.

 - A relationship between instances of the two classes.
 - In a diagram, an association is represented by a *link* connecting two classes.
 - may have a *role name* to clarify the nature of the association
 - A *navigability arrow* on an association indicates which direction the association can be traversed or queried.
 - no navigability arrows are bi-directional.
- Aggregation
 - An association in which one class belongs to a collection.
 - In a diagram, an aggregation is represented with a *diamond end* pointing to the part containing the whole.
 - "is a part of"
- Generalization
 - An inheritance link indicating one class is a superclass of the other
 - "is a" or "is like a"
 - A generalization is represented with a *triangle* pointing to the superclass.

Class Diagrams provide a static model view of the system
Describes the Structure







Use Cases

- o Again - describes the system from an *external* viewpoint
"provides an outsider's view"

Use Case Diagrams describe the dynamic behavior of the system

- o A Use Case is a summary of scenarios for a single task or goal.
 - Represented as an oval
- o Actors
 - who or what initiates the events involved in that task
 - roles that people or objects play
 - Represented as stick figures
- o Communication (or Communication Association)
 - A Connection between the actor and the use case
 - Represented as a line

Use Case Diagrams

- o A collection of actors, use cases, and their associations

Use case diagrams are helpful in three areas

- o Determining features (requirements)
 - New use cases often generate new requirements.
 - Can happen during design and system analysis
- o Communicating with clients
 - Simple notation makes them easy to understand
- o Generating test cases
 - The collection of scenarios for a use case may suggest a suite of test cases for those scenarios

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Use Case Diagram – Medical Clinic

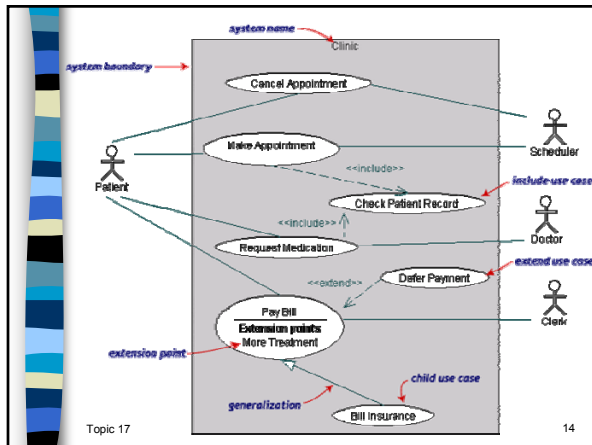
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Expanding Use Cases

- A simple use case diagram can be expanded to display more information
- Use Cases can be developed iteratively and incrementally
- **System boundaries**
 - separates the system from the external actors
 - Represented as a rectangle
- **Generalizations**
 - shows that one use case is simply a special kind of another
 - Represented with an open triangle
- **Includes**
 - factor use cases into additional ones
 - For example, a subtask that other use cases may use
 - Represented as a dotted line beginning at base use case ending with an arrow pointing to the include use case.
 - The dotted line is labeled <<include>>.
- **Extensions**
 - One use case is a variation of another
 - Represented as a dotted line, labeled <<extend>>, and with an arrow toward the base case.
 - The **extension point** determines when the extended case is appropriate, is written inside the base case.

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Sequence Diagrams

- One type of Interaction Diagram
- Also describe the behavior of the system
- Details how operations are carried out
 - What messages are sent when
- Organized according to time
- Objects listed from left to right
 - According to when they take part in the message sequence

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Sequence Diagrams: Terms

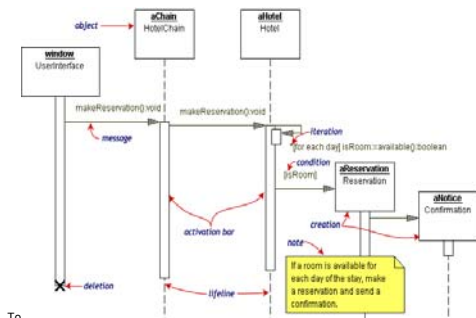
- o A **lifeline**, represents the time that an object exists
 - Represented as a vertical line.
- o An **activation bar** represents the duration of execution of the message
 - Represented by a vertical rectangle
- o A **message call** is represented by an arrow between activation bars
 - A simple message return is represented by a dashed arrow
- o A **self call** is when an object calls itself
- o A **note** is used to clarify details
 - Represented with a dog-eared rectangle

(Notes can be put into any kind of UML diagram)

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Sequence Diagram Example: Hotel Reservation



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Putting them together

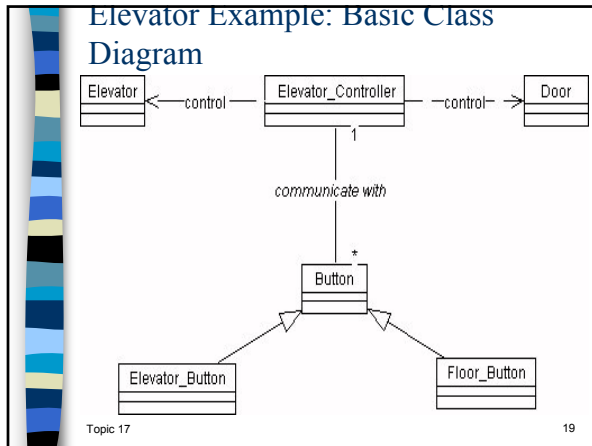
- o Class Diagrams
- o Scenarios
- o Use Cases
- o Sequence Diagrams

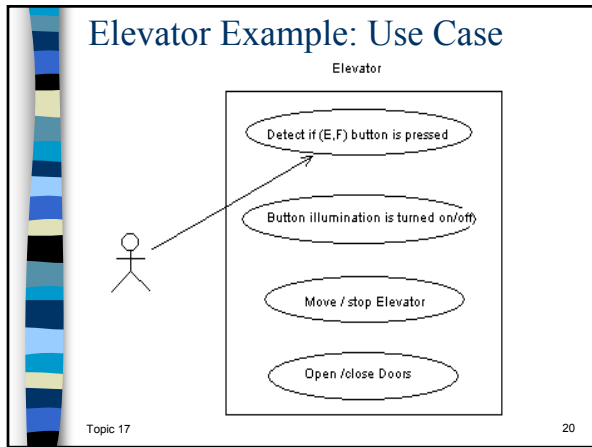
- o How do they all work together

UML is iterative & Incremental

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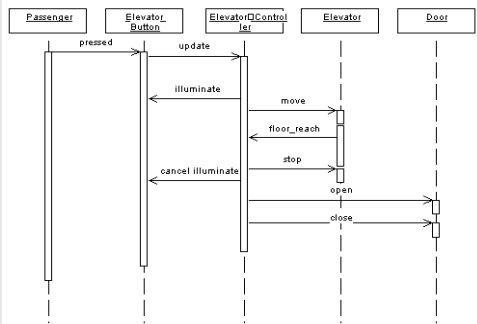
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- ### Elevator Example: Scenario
- Passenger pressed floor button
 - Elevator system detects floor button pressed
 - Elevator moves to the floor
 - Elevator doors open
 - Passenger gets in and presses elevator button
 - Elevator doors closes
 - Elevator moves to required floor
 - Elevator doors open
 - Passenger gets out
 - Elevator doors closes
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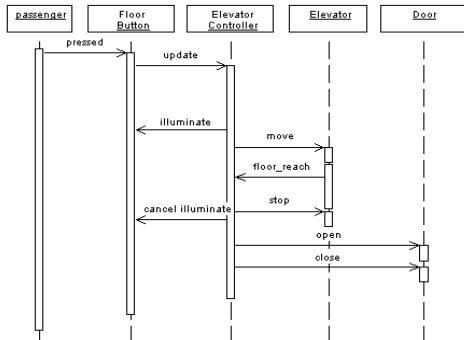
Elevator Example: Sequence Diagram



Sequence Diagram for Serving Elevator Button

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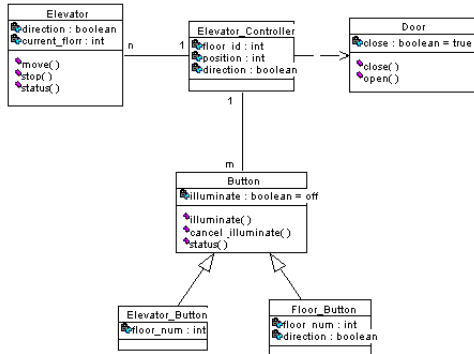
Elevator Example: Sequence Diagram



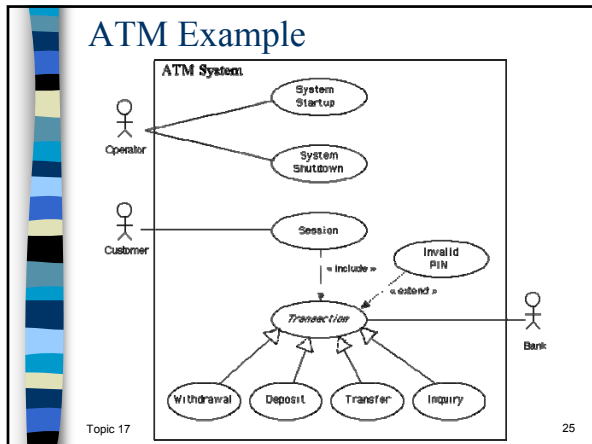
Sequence Diagram for Serving Door Button

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Elevator Example: Revising the Class Diagram



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Session Use Case Description

A session is started when a customer inserts an ATM card into the card reader slot of the machine.

The ATM pulls the card into the machine and reads it. (If the reader cannot read the card due to improper insertion or a damaged stripe, the card is ejected, an error screen is displayed, and the session is aborted.)

The customer is asked to enter his/her PIN, and is then allowed to perform one or more transactions, choosing from a menu of possible types of transaction in each case.

After each transaction, the customer is asked whether he/she would like to perform another. When the customer is through performing transactions, the card is ejected from the machine and the session ends.

If a transaction is aborted due to too many invalid PIN entries, the session is also aborted, with the card being retained in the machine.

- The customer may abort the session by pressing the Cancel key when entering a PIN or choosing a transaction type.

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