Systems Analysis and Design with UML Version 2.0, Second Edition

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Chapter 8: Behavioral Modeling

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Behavioral Modeling

Chapter 8

Key Ideas

- Behavioral models describe the internal dynamic aspects of an information system that supports business processes in an organization
- Key UML behavioral models are: sequence diagrams, collaboration diagrams, and statechart diagrams

Objectives

- Understand the rules and style guidelines for sequence and communication diagrams and behavioral state machines.
- Understand the processes used to create sequence and communication diagrams and behavioral state machines.
- Be able to create sequence and communication diagrams and behavioral state machines.
- Understand the relationship between the behavioral models and the structural and functional models.

BEHAVIORAL MODELS

Purpose of Behavioral Models

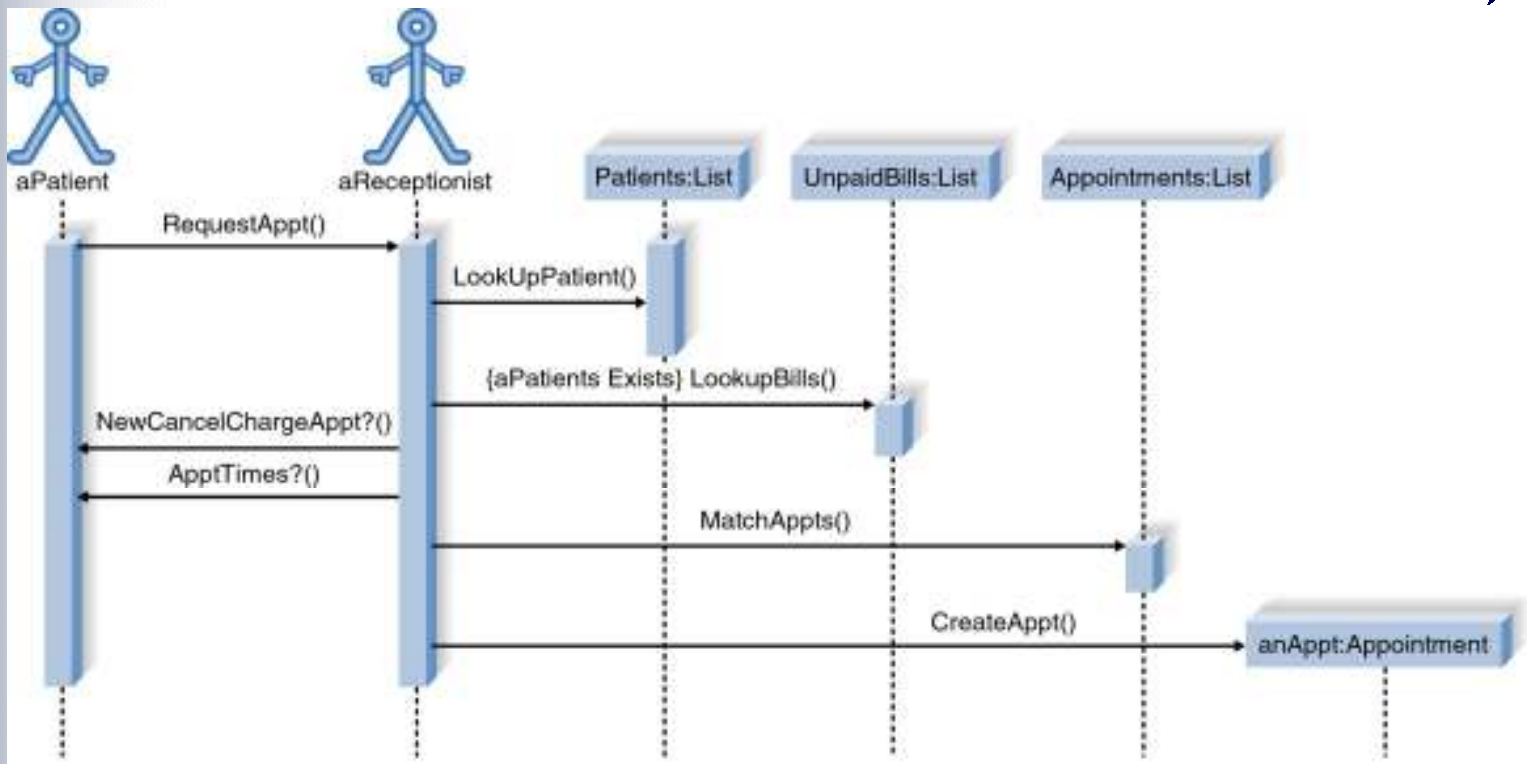
- Show how objects colaborate to support each use case in the structural model
- Depict the internal view of the business process
- To show the effects of varied processes on the system

Interaction Diagram Components

- Objects
  - Instantiation of a class
  - Has attributes that describe an object
- Operations
  - Send and receive messages
- Messages
  - Tell object to execute a behavior

Sequence Diagrams

- Illustrate the objects that participate in a use-case
- Show the messages that pass between objects for a particular use-case



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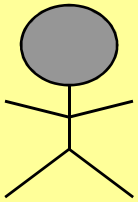
Sequence Diagram Syntax

AN ACTOR	
AN OBJECT	anObject:aClass
A LIFELINE	
A FOCUS OF CONTROL	
A MESSAGE	aMessage()
OBJECT DESTRUCTION	x

Building a Sequence Diagram

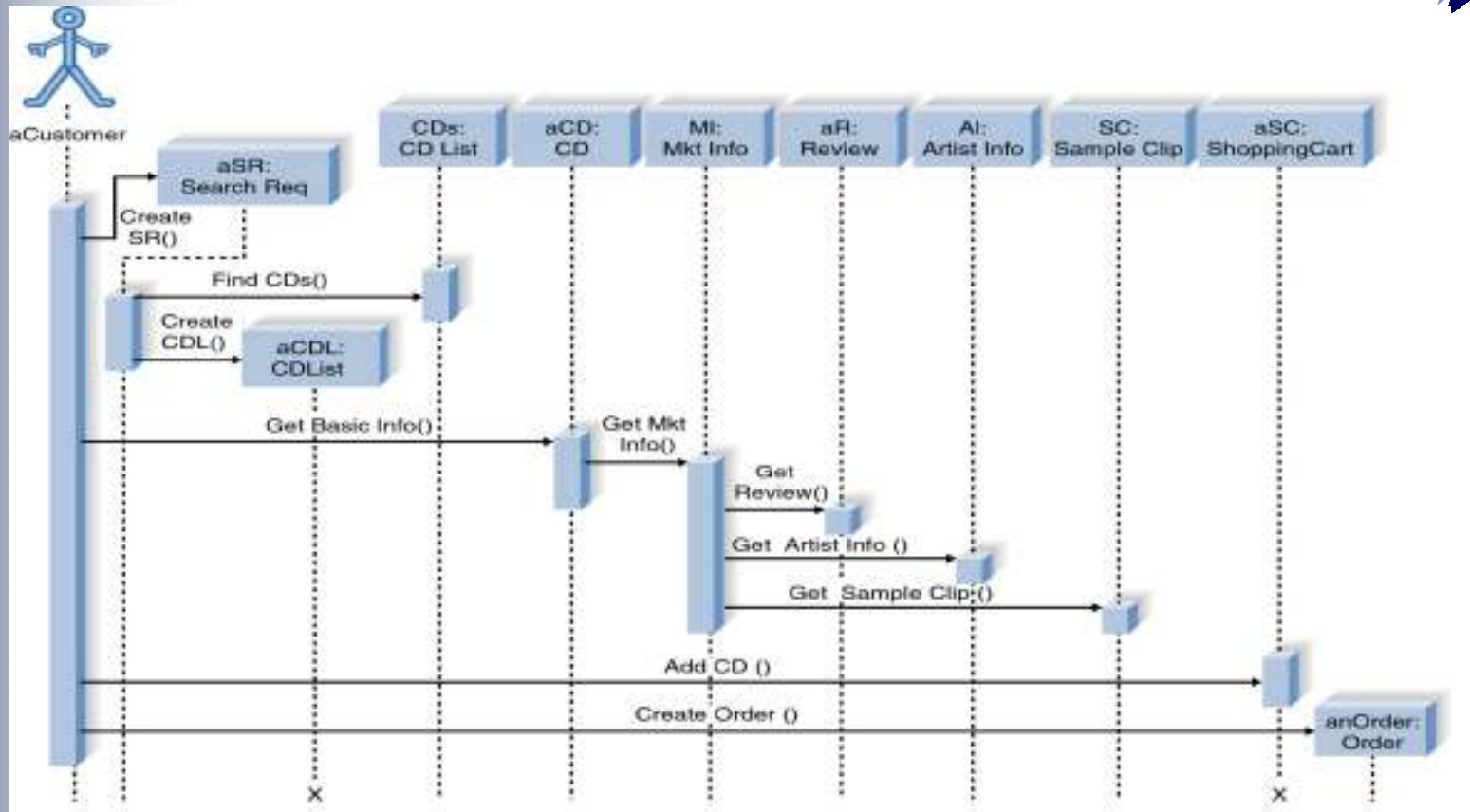
1. Determine the context of the sequence diagram
2. Identify the participating objects
3. Set the lifeline for each object
4. Add messages
5. Place the focus of control on each object's lifeline
6. Validate the sequence diagram

CD Selections

Normal Flow of Events:

1. Customer submits a search request to the system.
2. The system provides the customer a list of recommended CDs.
3. The customer chooses one of the CDs to find additional information.
4. The system provides the customer with basic information & CD Reviews
5. The customer calls the maintain order use case.
6. The customer iterates over 3 through 5 until finished shopping.
7. The customer executes the checkout use case.
8. The customer leaves the website.

CD Selections



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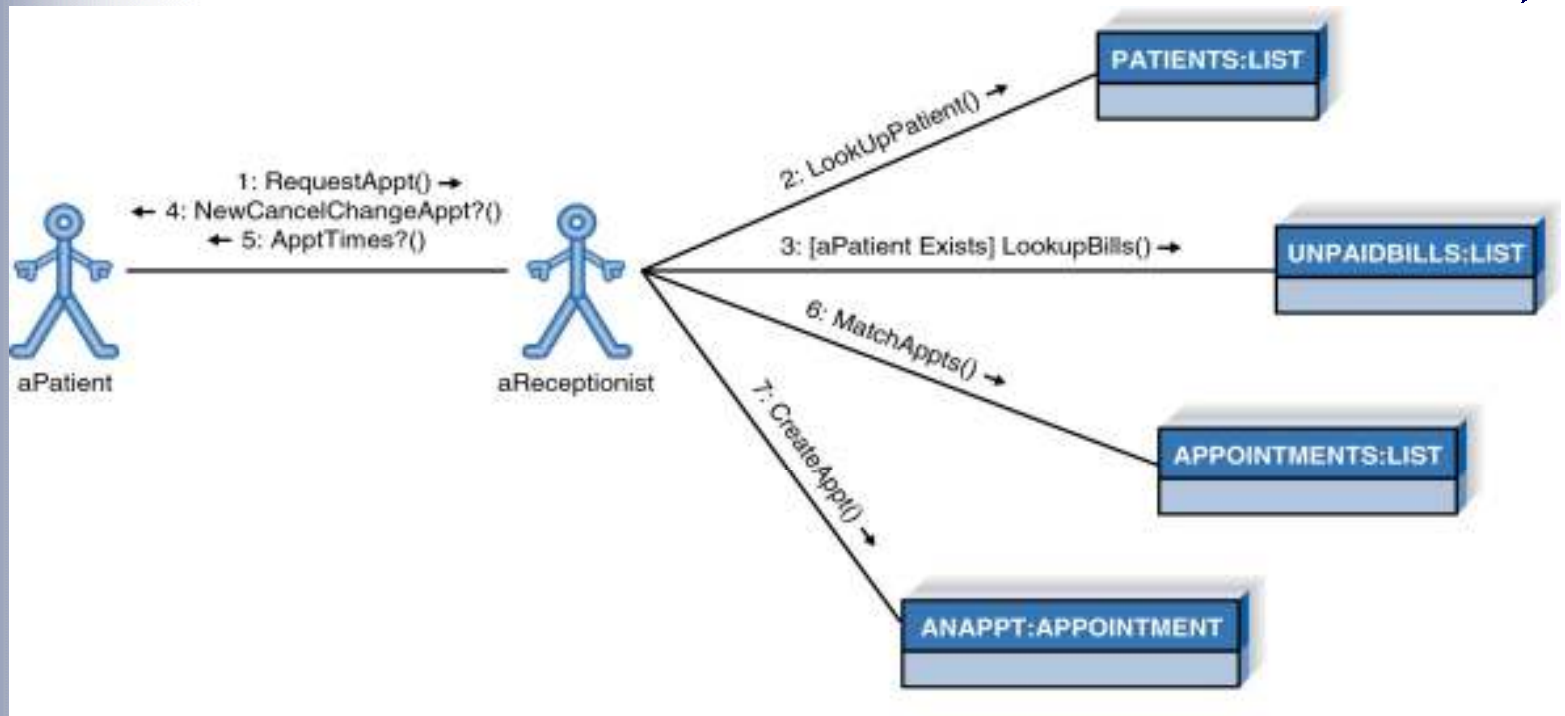
Collaboration Diagrams

- Essentially an object diagram that shows message passing relationships instead of aggregation or generalization associations.
- Emphasize the flow of messages among objects, rather than timing and ordering of messages

Example Collaboration Diagram



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Example Sequence Diagram

Actor	
Object	
Association	
Message	
Frame	

Communication Diagrams

1. Set the context.
2. Identify which objects (actors) and the associations between the objects participate in the collaboration.
3. Layout the communication diagram.
4. Add messages.
5. Validate the communication diagram.

"CRUD" Analysis Example

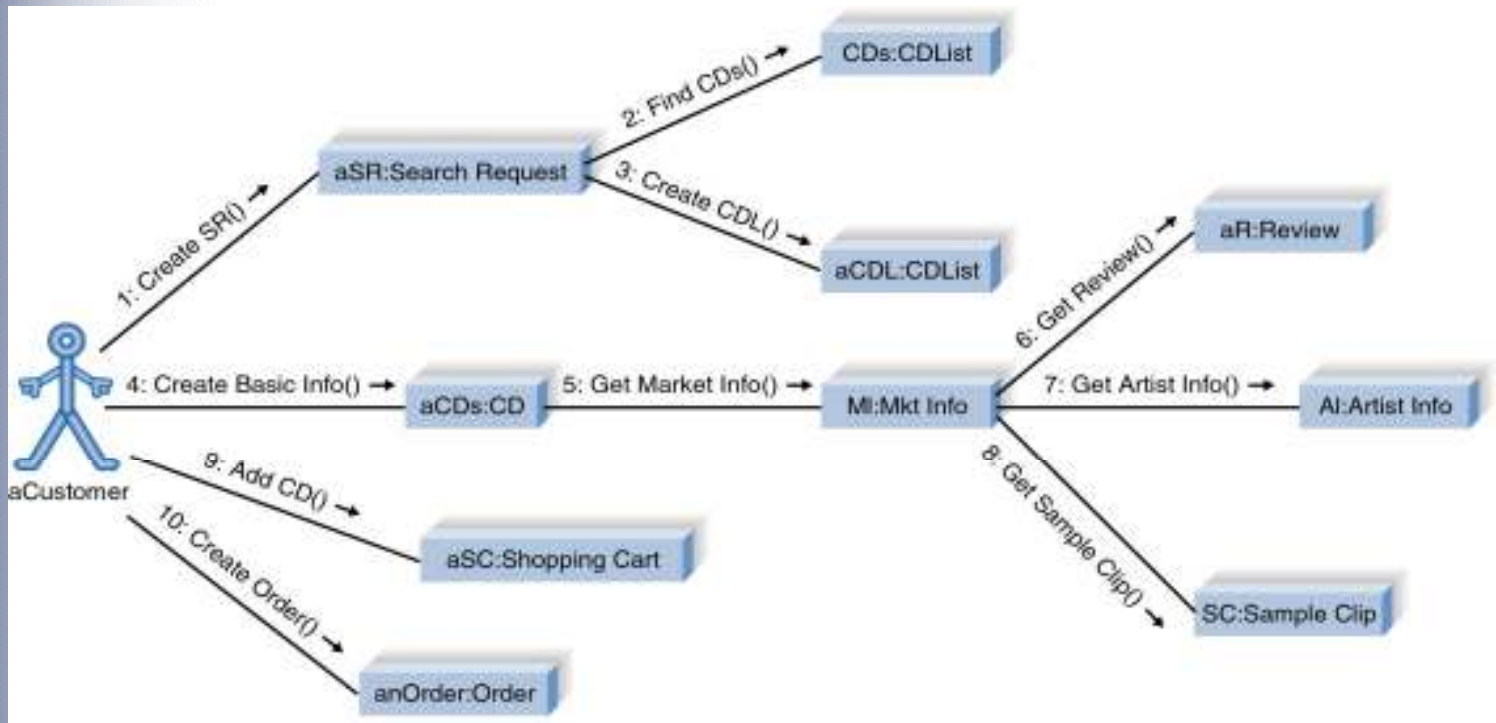
	Customer	SearchReq	CDList	CD	Mkt Info	Review	Artist Info	Sample Clip	Shopping Cart	Order
Customer		R							U	C
SearchReq			CR							
CDList										
CD					R					
Mkt Info						U	U	U		
Review										
Artist Info										
Sample Clip										
Shopping Cart										
Order										

FIGURE 8-9 CRUD Matrix for the Place Order Use Case

Building a Collaboration Diagram

- Determine the context of the collaboration diagram
- Identify the participating objects and their associations
- Layout objects and associations
- Add messages
- Validate the sequence diagram

CD Selections



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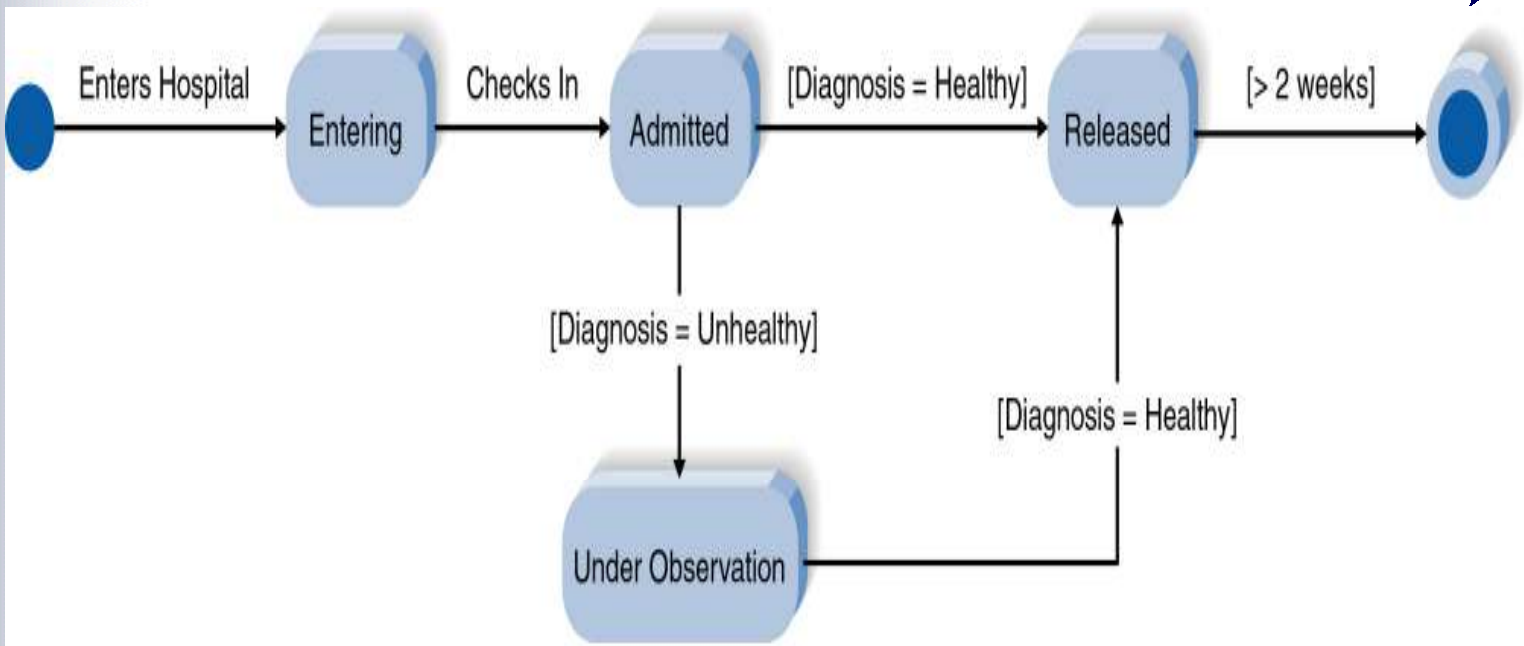
Behavioral State Machines

- The behavioral state machine is a dynamic model that shows the different states of the object and what events cause the object to change from one state to another, along with its responses and actions.

Elements of a Behavioral State Machine

- States
- Events
- Transitions
- Actions
- Activities

Example Behavioral State Machine Diagram



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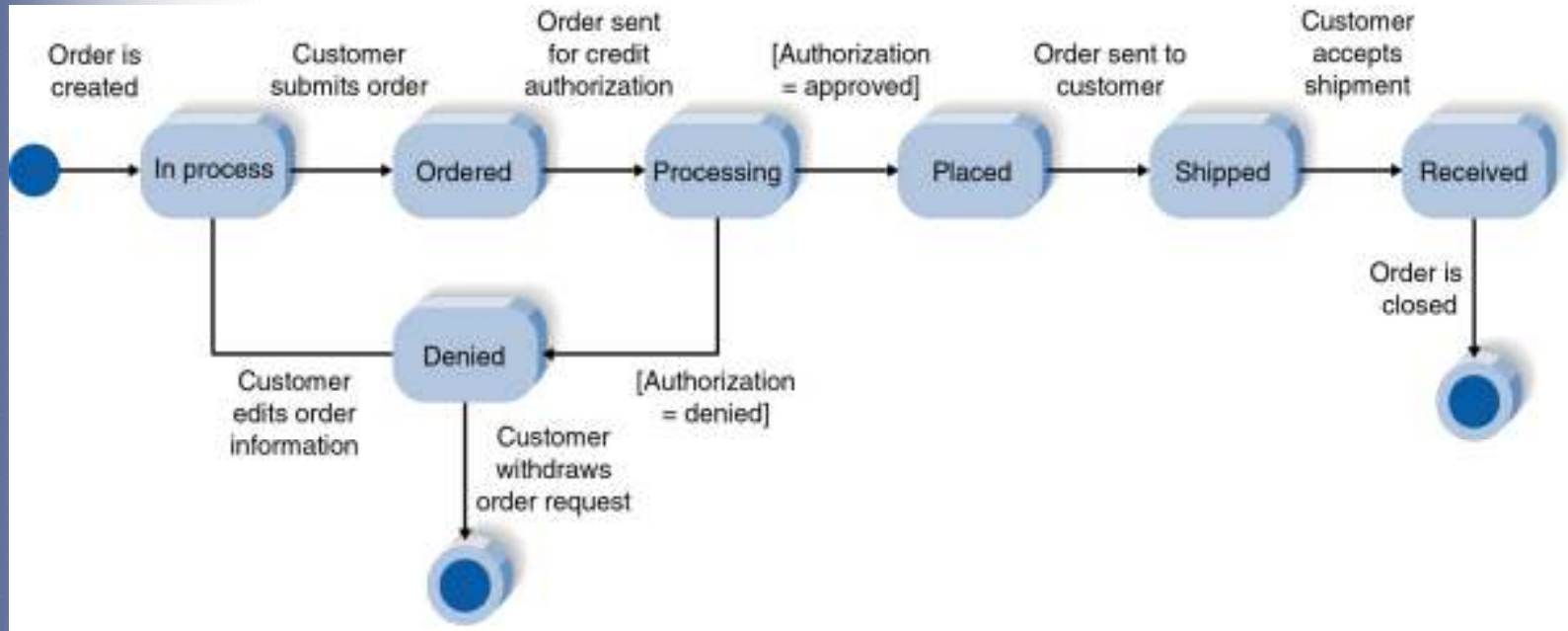
Behavioral State Machine Diagram Syntax

A STATE	
AN INITIAL STATE	
A FINAL STATE	
AN EVENT	anEvent
A TRANSITION	
A Frame	

Building Behavioral State Machine Diagrams

- Set the context
- Identify the initial final, and stable states of the object
- Determine the order in which the object will pass through stable states
- Identify the events, actions, and guard conditions associated with the transitions
- Validate the statechart diagram

CD Selections



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Your Turn

- What distinguishes the sequence diagram, the collaboration diagram, and the behavioral state machine diagram?
- For what sort of new applications might you need to develop all of these? Are there any new applications that would not need all of these diagrams for full development?

Summary

- *Sequence diagrams* illustrate the classes that participate in a use case and the messages that pass between them.
- *Collaboration diagrams* provide a dynamic view of the object-oriented system and accentuate message passing between collaborating actors and objects.
- *Behavioral State Machine diagrams* show the different states that a single class passes through in response to events.

Expanding the Domain

- Each year the Association for Computing Machinery (ACM) sponsors a conference on object oriented programming. For details about future conferences and other ACM programs check:
- *http://oopsla.acm.org*
- *http://www.acm.org*