

The Unified Modeling Language (UML)¹

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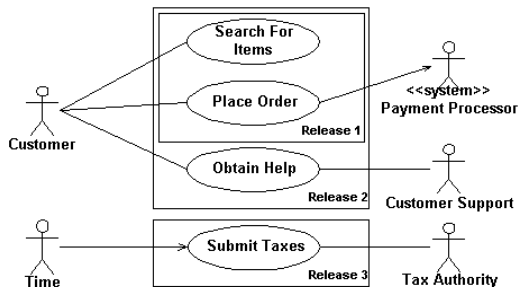
CSC 331-631
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¹From R. Miles and K. Hamilton, Learning UML 2.0, O'Reilly, 2006

Unified Modeling Language (UML)

Overview

- UML: Graphical and *formal* notation to create visual models/abstractions of software systems



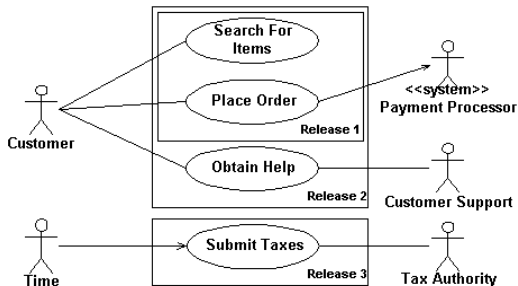
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- Allows fine-level details to be abstracted away

Unified Modeling Language (UML)

Overview

- UML: Graphical and *formal* notation to create visual models/abstractions of software systems



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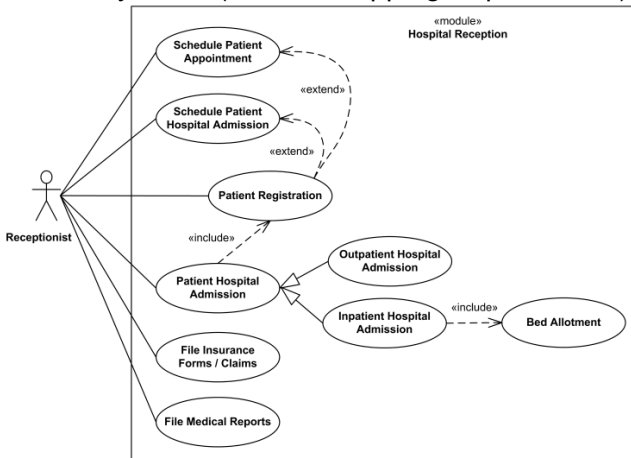
- Allows fine-level details to be abstracted away
- Software code *is* too cumbersome for modeling
 - Precise, unambiguous but too detailed

Unified Modeling Language (UML)

- Natural language, too imprecise and informal for modeling
- UML, strikes balance between detailed code and informal notation
- It offers various tools for multi-granular modeling of structure, behavior, logic, etc.

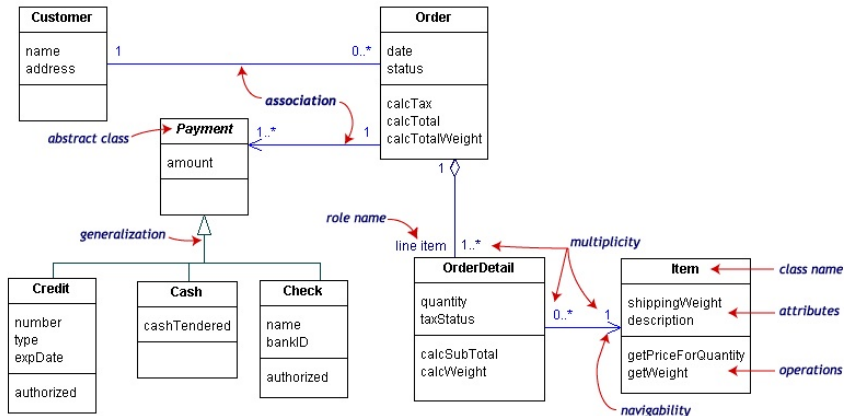
System Design in UML I

- **Use case:** Models interaction between the system, users and other systems (also for mapping requirements)



System Design in UML II

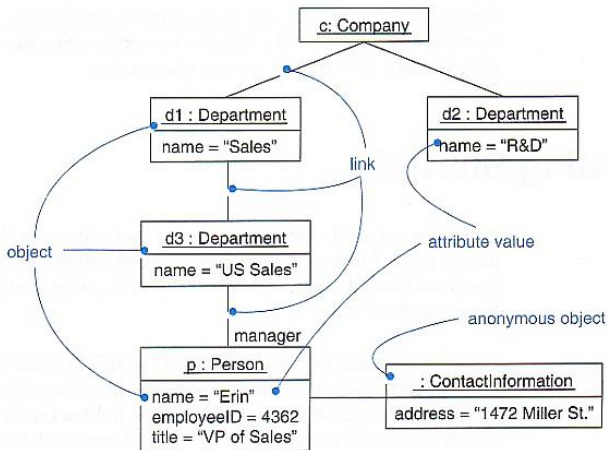
- **Class:** Models classes, types, interfaces, their relationships



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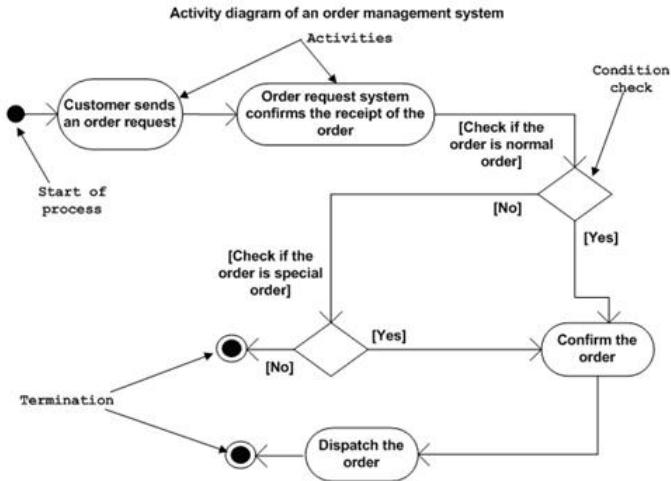
System Design in UML III

- **Object:** Models relationships between object instances



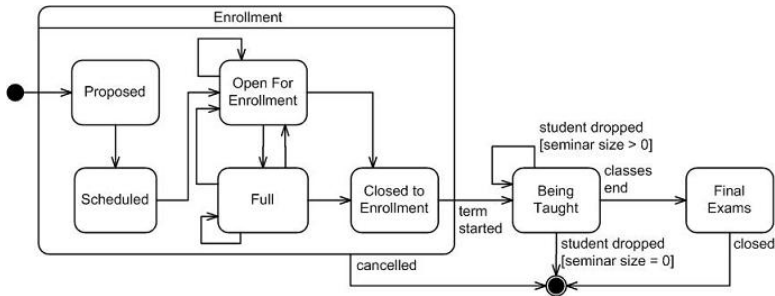
System Design in UML IV

- **Activity:** Models sequential and parallel activities



System Design in UML V

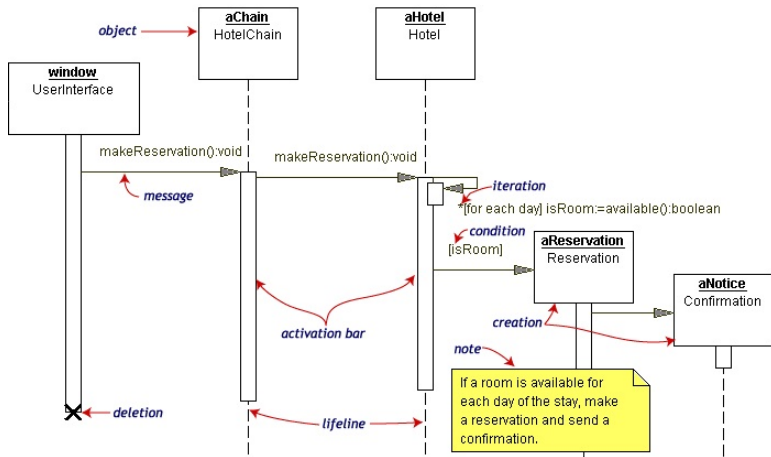
- **State machine:** Models state of an object throughout its lifetime and events that can change its state



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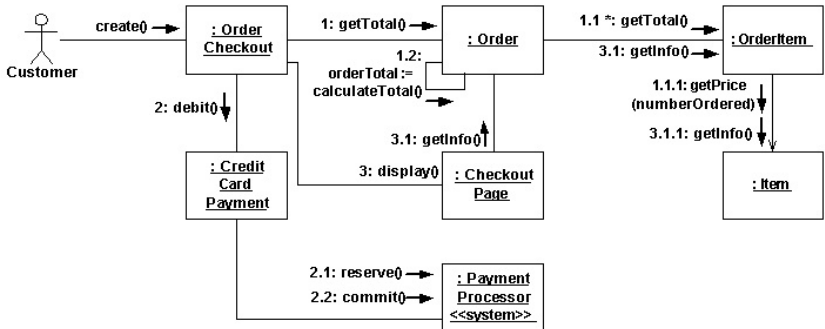
System Design in UML VI

- **Sequence:** Models interaction between objects where the order of the interactions is important



System Design in UML VII

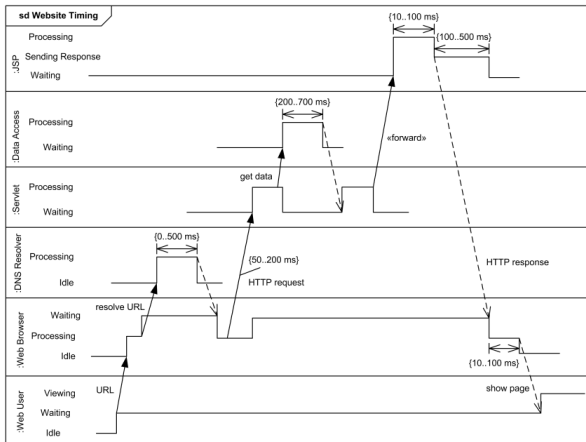
- **Communication/Collaboration:** Models way in which objects interact and the connections needed for these interactions



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System Design in UML VIII

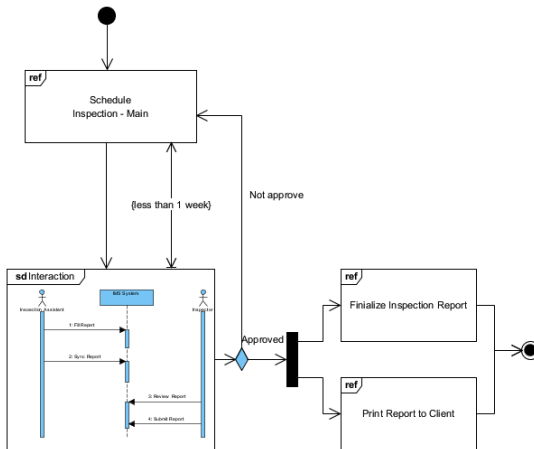
- **Timing:** Models interactions between objects where timing is important



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System Design in UML IX

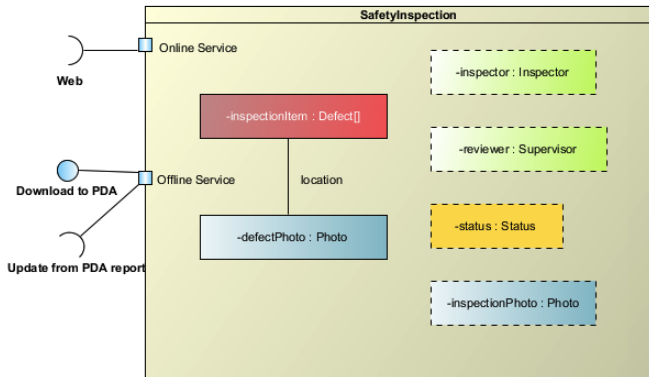
- **Interaction overview:** Models collections of sequence, communication, and timing diagrams



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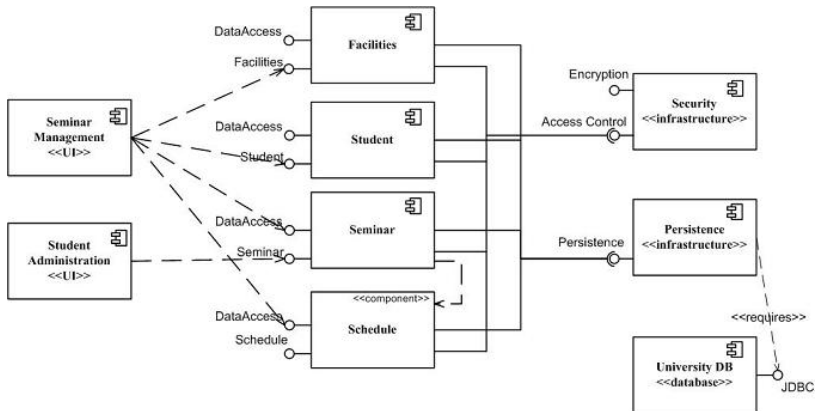
System Design in UML X

- **Composite structure:** Models internals of class or component, describing class relationships within a given context



System Design in UML XI

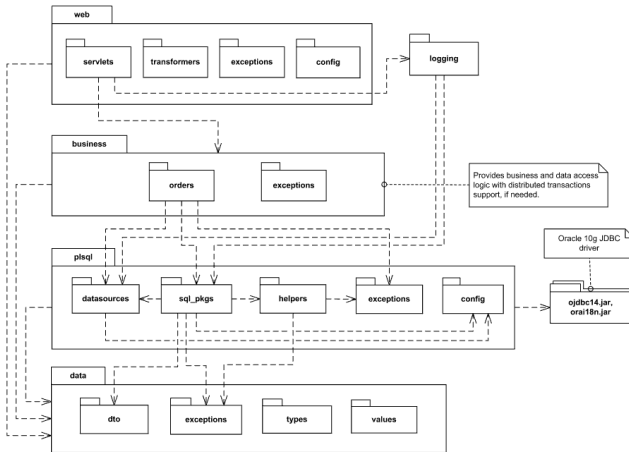
- **Component:** Models system components and their interfaces



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System Design in UML XII

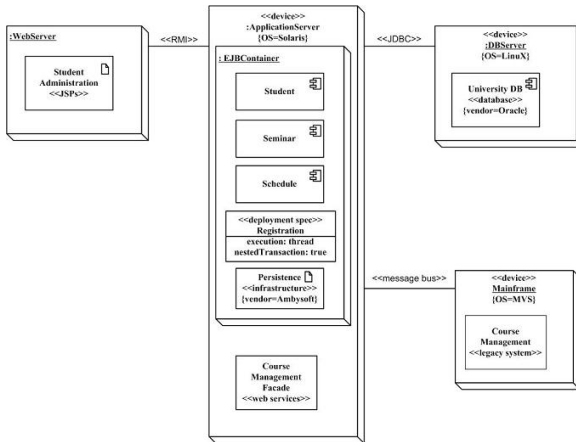
- **Package:** Models hierarchical organization of classes and components



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System Design in UML XIII

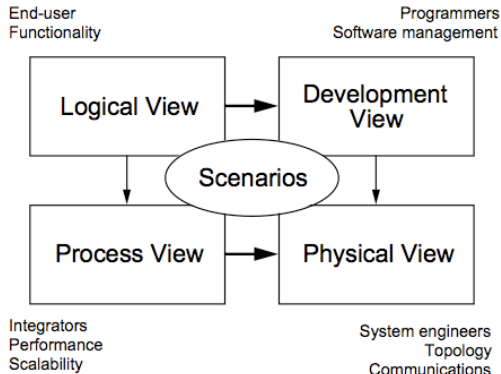
- **Deployment:** Models how system is finally deployed in a given situation



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Kruchten's 4+1 view model I

UML diagrams capture different aspects of the system



P. Kruchten. "Architectural Blueprints—The 4+1 View Model of Software Architecture," IEEE Software 12 (6), 42–50, 1995.

Kruchten's 4+1 view model II

- **Scenarios**: Describes functionality of the system from the perspective of the outside world. Describes what they stem is supposed to do. All other views rely on it to guide them.
UML diagrams: use case
- **Logical view**: Parts making up a system and how they interact.
UML diagrams: class, object, collaboration, state machine, interaction
- **Development view**: How system's parts are organized into modules and components.
UML diagrams: package, component

Kruchten's 4+1 view model III

- **Process view:** Visualization of processes within the system.
UML diagrams: activity
- **Physical view:** How the abstract parts of the system map into the final deployed system.
UML diagrams: deployment

Models and Diagrams

- UML modeling is about capturing the system as a model
The UML diagrams are *windows* into that model.
- Diagrams show part of a model but not everything
- A model can be shown across several diagrams
but not everything in the model needs to exist on a diagram
- Working with a set of UML diagrams allow you to
manipulate a view of the components of your model

Modeling Requirements: Use Cases

Use Case

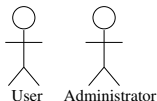
- Situation in which the system is used to fulfill one or more user requirements
- Captures a piece of functionality to be provided by the system
- Often used to identify and fill gaps in user's requirements
- Represents tangible user value and must be assigned priority and risk values
- Starting point for building test cases
- Should be first serious output from the model

Capturing a System Requirement

Requirement A.1 *The content management system shall allow an administrator to create a new blog account, provided the personal details of the new blogger are verified using the author credentials database.*

Identifying Actors

- Actor: person or external system interacting with your system

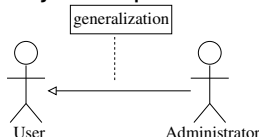


If it's a person or a thing you cannot change then it must be an actor

Capturing a System Requirement

Refining actors

- But administrator is just a special kind of user



The Use Case

- Use case: complete use of the system requiring interaction and related output

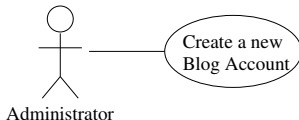


A use case is something that provides some measurable result to the user or an external system

Capturing a System Requirement

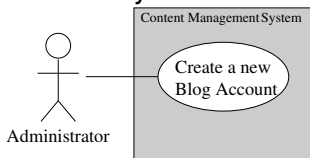
Communication Lines

- Connects an actor and a use case to show participation



System Boundaries

- Show what's part of the system and what is not



Name the box after the system being developed

Capturing a System Requirement

The Use Case Description

- Describes important steps in the *execution* of a use case

Use case name		Create a new Blog Account
Related requirements		Requirement A.1.
Goal in context		A new or existing author requests a new blog account from the Administrator
Preconditions		The system is limited to recognized authors. The author needs to have appropriate proof of identity
Successful end condition		A new blog account is created for the author
Failed end condition		The application for a new blog account is rejected
Primary actors		Administrator
Secondary actors		Author Credentials Database
Trigger		The Administrator asks the CMS to create a new Blog Account
Main Flow	Step	Action
	1	The administrator asks the system to create a new blog account
	2	The administrator selects an account type
	3	The administrator enters the author's details
	4	The author's details are verified using the Author Credentials Database
	5	The new blog account is created
	6	A summary of the new blog account's details are emailed to the author
Extensions	Step	Branching Action
	4.1	The Author Credentials Database does not verify the author's details
	4.2	The author's new blog account application is rejected

Capturing a System Requirement

Use case refinement

The use case diagram is refined as a result



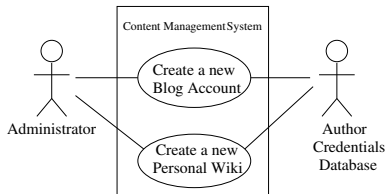
Use Case Relationships

The «include» relationship

- Allows breaking a behavior into reusable parts

Requirement A.2. *The content management system shall allow an administrator to create a new personal Wiki, provided the personal details of the applying author are verified using the author credentials database.*

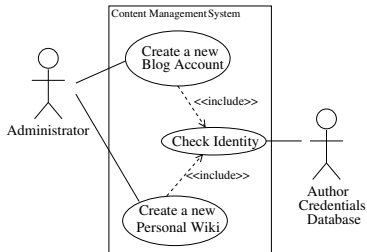
- Without «include» relationship



Use Case Relationships

The «include» relationship

- With «include» relationship



Use Case Relationships

Use Case Description for Create a new Blog Account

Use case name		Create a new Blog Account
Related requirements		Requirement A.1.
Goal in context		A new or existing author requests a new blog account from the Administrator
Preconditions		The author has appropriate proof of identity
Successful end condition		A new blog account is created for the author
Failed end condition		The application for a new blog account is rejected
Primary actors		Administrator
Secondary actors		None
Trigger		The Administrator asks the CMS to create a new Blog Account
Main Flow	Step	Action
	1	The administrator asks the system to create a new blog account
	2	The administrator selects an account type
	3	The administrator enters the author's details
	4	The author's details are checked
	include:Check Identity	
	5	The new blog account is created
	6	A summary of the new blog account's details are emailed to the author
Extensions	Step	Branching Action
	4.1	The author's new blog account application is rejected

Use Case Relationships

Use Case Description for Create a new Personal Wiki

Use case name		Create a new Personal Wiki
Related requirements		Requirement A.2.
Goal in context		A new or existing author requests a new personal wiki from the Administrator
Preconditions		The author has appropriate proof of identity
Successful end condition		A new personal wiki is created for the author
Failed end condition		The application for a new personal wiki is rejected
Primary actors		Administrator
Secondary actors		None
Trigger		The Administrator asks the CMS to create a new Personal Wiki
Main Flow	Step	Action
	1	The administrator asks the system to create a new Personal Wiki
	2	The administrator enters the author's details
	3	The author's details are checked
	include:Check Identity	
	4	The new Personal Wiki is created
	5	A summary of the new Personal Wiki's details are emailed to the author
Extensions	Step	Branching Action
	4.1	The author's new Personal Wiki application is rejected

Use Case Relationships

Use Case Description for Check Identity

Use case name		Check Identity
Related requirements		Requirement A.1, Requirement A.2.
Goal in context		An author's details need to be checked and verified as accurate
Preconditions		The author being checked has appropriate proof of identity
Successful end condition		The author's details are verified
Failed end condition		The author's details are not verified
Primary actors		Author Credentials Database
Secondary actors		None
Trigger		An author's credentials are provided to the system for verification
Main Flow	Step	Action
	1	The author's details are provided to the system
	2	The Author Credentials Database verifies the details
	3	The details are returned as verified by the Author Credentials Database
Extensions	Step	Branching Action
	2.1	The Author Credentials Database does not verify the details
	2.2	The details are returned as unverified

The Use Case Overview Diagram

