

# UML - Unified Modeling Language

Summer 2001

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## Outline

- ❖ Session 1 : A high level view of UML, Tue 19.6.2001
  - ❖ UML : history and context
  - ❖ The importance of modeling
  - ❖ Introduction to UML
  - ❖ Use cases <-- main topic of this session
  - ❖ A brief introduction to object-oriented design
- ❖ Session 2 : Static modelling, Thu 21.6.2001
  - ❖ Objects and classes
  - ❖ Class hierarchies and inheritance
  - ❖ Class modelling exercises
  - ❖ Classes and methods

## Outline (cont)

### ❖ Session 3 : Dynamic modelling, Tue 26.6.2001

- ❖ Activities in UML
- ❖ States and state charts
- ❖ Collaboration diagrams
- ❖ Use cases and object evolution
- ❖ Exercices

### ❖ Session 4 : Integration, Thu 28.6.2001

- ❖ Interfaces between the UML design spaces
- ❖ Architecture definition with UML
- ❖ UML and databases
- ❖ UML and XML
- ❖ Public domain tools and ressources

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## UML: A Brief History and Context

- ❖ late 1960s: Object Oriented Programming Language
- ❖ mid 1970s - late 1980s: Object Oriented modeling languages
- ❖ mid 1990s: ~ 50 Object Oriented methods
- ❖ 1996: market leaders Booch, Jacobson & Rumbaugh get together -> Unified Modeling Language (UML)

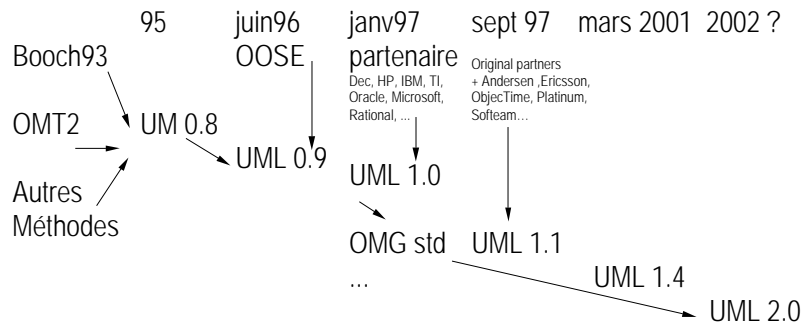
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## UML actors



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## The importance of Modeling

- ❖ The dog house - family house - office building  
métaphore (Booch, Jacobson, Rumbaugh)
- ❖ For building a dog house:  
pile of lumber, some nails, a hammer, basic tools
- ❖ ... a family house:  
+ some detailed plans and blueprints (rooms,  
electricity, plumbing, heating)
- ❖ ... office building:  
+ extensive planning, many blueprints

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## The importance of Modeling

- ❖ Modeling is a proven engineering technique
- ❖ Many domains of application:
  - ❖ Building industry
  - ❖ Aircraft industry
  - ❖ Automobile industry
  - ❖ Picture industry
  - ❖ Computer engineering
  - ❖ Software engineering
  - ❖ ...

## The importance of modeling

- ❖ Non industrial domains
  - ❖ Sociology
  - ❖ Economics
  - ❖ Business management
  - ❖ ...

## What is a model ?

- ❖ Key point:

« A model is a simplification of reality »

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## Why do we model ?

- ❖ We model in order to understand better the systeme we are developping
- ❖ Modeling <-> four aims:
  - ❖ Models help us to visualize a system as it is or as we want it to be
  - ❖ Models permit us to specify the structure and behavior of a system
  - ❖ Models give us a template that guides us in constructing a system
  - ❖ Models document the decision we have made
- ❖ We build models of complex systems because we cannot comprehend such a system in its entirety

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## Principles of Modeling

- ❖ The choice of what models to create has a profound influence on how the problem is attacked and how a solution is shaped
- ❖ Every model may be expressed at different levels of precision
- ❖ The best models are connected to the reality
- ❖ No single model is sufficient. Every nontrivial system is best approached through a small set of nearly independent models.

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## Object-Oriented Modeling

- ❖ Object or class centered approach
- ❖ Simply put:
- ❖ An object is a thing (from the vocabulary of the problem to be solved)
- ❖ A class is a set of common objects
- ❖ Objects can be concrete or abstract

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## Object-Oriented Modeling: an example

- ❖ Consider a billing system involving:
  - ❖ A user interface (buttons, menus, dialog boxes)
  - ❖ A database (tables representing customers, products and orders)
  - ❖ A middle-layer (transactions, business rules)
- ❖ Concrete objects:
  - ❖ buttons, menus, dialog boxes, tables...
- ❖ Abstract objects:
  - ❖ transactions, business rules.

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## An Overview of the UML

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## An Overview of the UML

- ❖ UML
  - ❖ Object oriented modeling
  - ❖ Covers all the phases of a project (requirement analysis through system deployment)
- ❖ Modeling along three axes:
  - ❖ Structural Modeling
  - ❖ Behavioral Modeling
  - ❖ Architectural Modeling

## Aims of the UML

- ❖ Models the complete system (not only the software system)
- ❖ Connect the conceptual objects to the executable artefacts
- ❖ Control of complexity (scale)
- ❖ Model suitable for both humans and computers
- ❖ Open language: extensibility mechanism
- ❖ Specification language: clear semantics (#ambiguous)

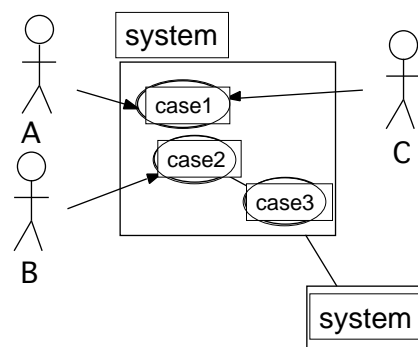


## UML is a visual language

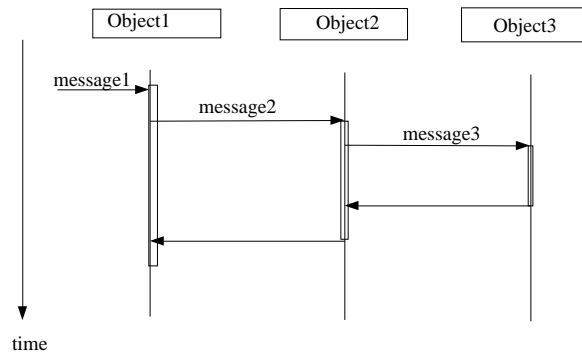
- ❖ Intensive use of graphical modeling
- ❖ But textual modeling remains usefull in some cases
- ❖ Graphical representation -> facilitates communication
- ❖ UML defines 9 diagrams

## 1) use cases diagram

- ❖ Requirements analysis



## 2) Sequence diagram



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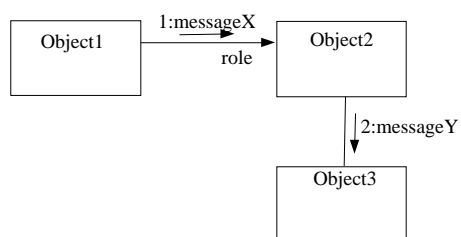
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## 3) Collaboration diagrams

### ❖ Collaboration between objects



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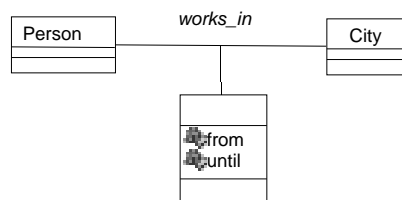
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#### 4) Class diagram

- ❖ Structural modeling
- ❖ The « heart » of the UML



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#### 5) To 9) diagrams

- ❖ 5) Package diagram
  - ❖ Modularity of the model (structure of the model itself)
- ❖ 6) Statechart diagram
  - ❖ Event - response to the event (real time systems)
- ❖ 7) Activity diagram
  - ❖ Flowcharts (business processes)
- ❖ 8) Component diagram
  - ❖ Organization and dependencies among the component
- ❖ 9) Deployment diagram
  - ❖ To set the location of the components on run-time processing nodes (distributed applications)

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## Where Can the UML be used ?

- ❖ Enterprise information systems
- ❖ Banking and financial services
- ❖ Telecommunications
- ❖ Medical electronics
- ❖ Distributed Web-based services
- ❖ ...
  
- ❖ Not limited to modeling software
  - ❖ Administration Workflows
  - ❖ Behavior of a patient healthcare system

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## For what task can the UML be used ?

- ❖ Forward engineering
- ❖ Reverse engineering
- ❖ Documentation of a system

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