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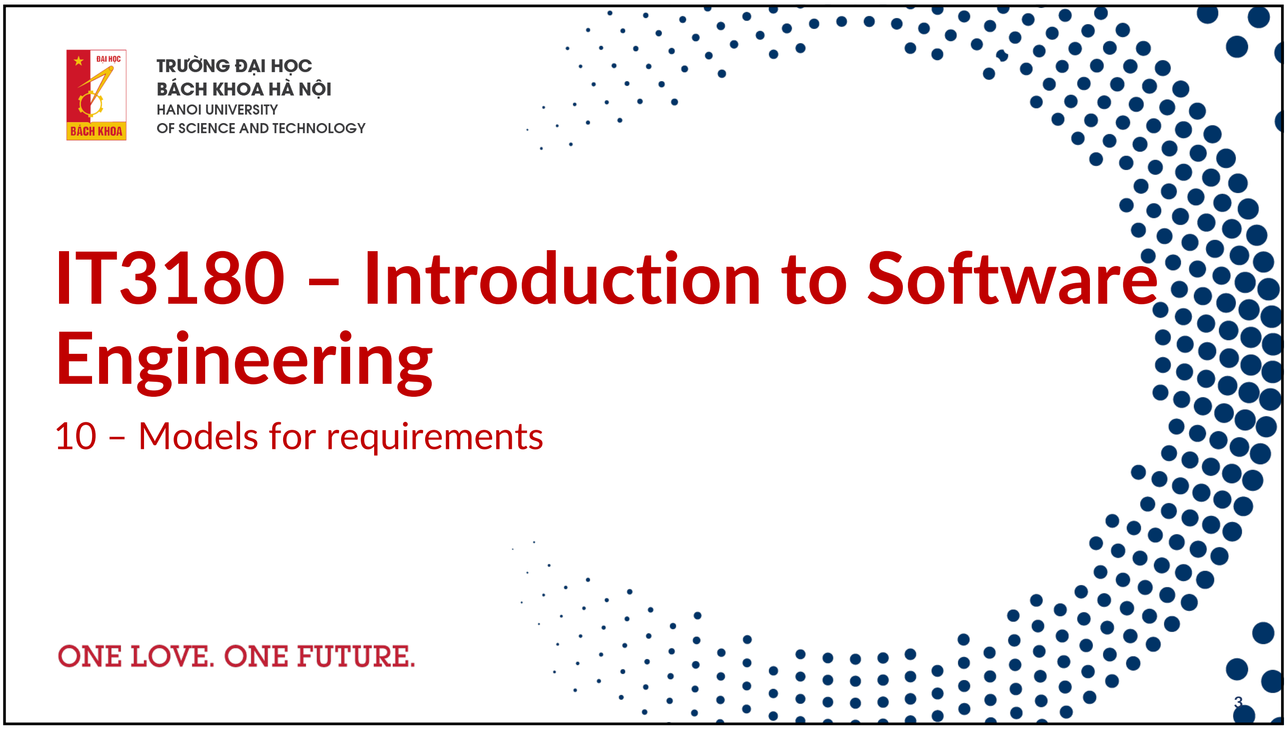

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IT3180 – Introduction to Software Engineering

10 – Models for requirements

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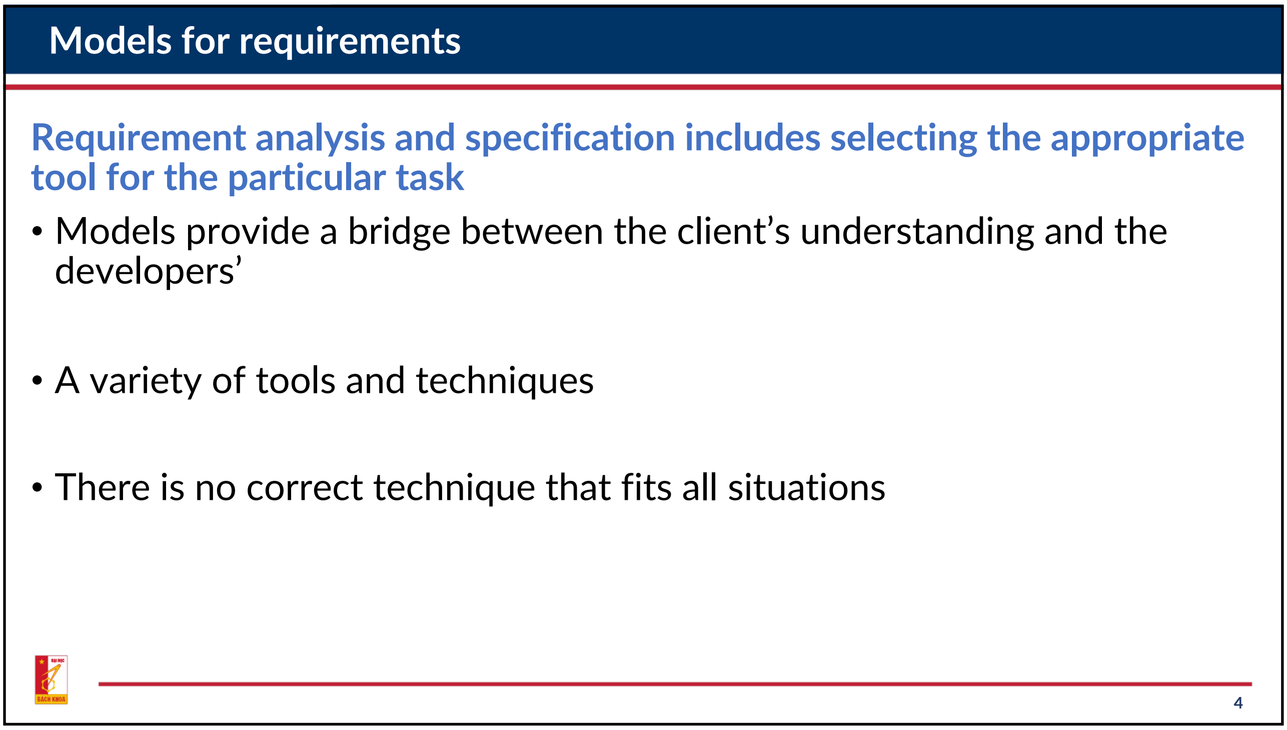


Models for requirements

Requirement analysis and specification includes selecting the appropriate tool for the particular task

- Models provide a bridge between the client’s understanding and the developers’
- A variety of tools and techniques
- There is no correct technique that fits all situations

Models

A model is a simplification of reality

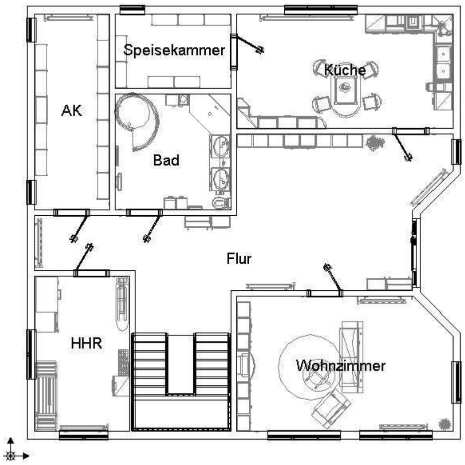
- We build models so that we can better understand the system we are developing
- We build models of complex system because we cannot comprehend such a system in its entirely

Example: Model as a Blueprint

1. Requirements

- Shall fit on given piece of land.
- Each room shall have a door.
- Furniture shall fit into living room.
- Bathroom shall have a window.
- Cost shall be in budget.

2. Design



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3. System

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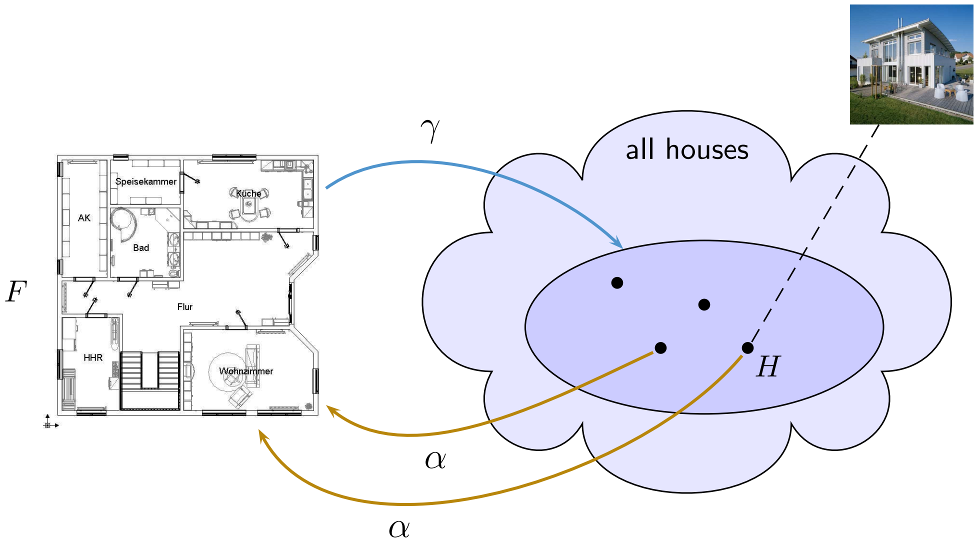
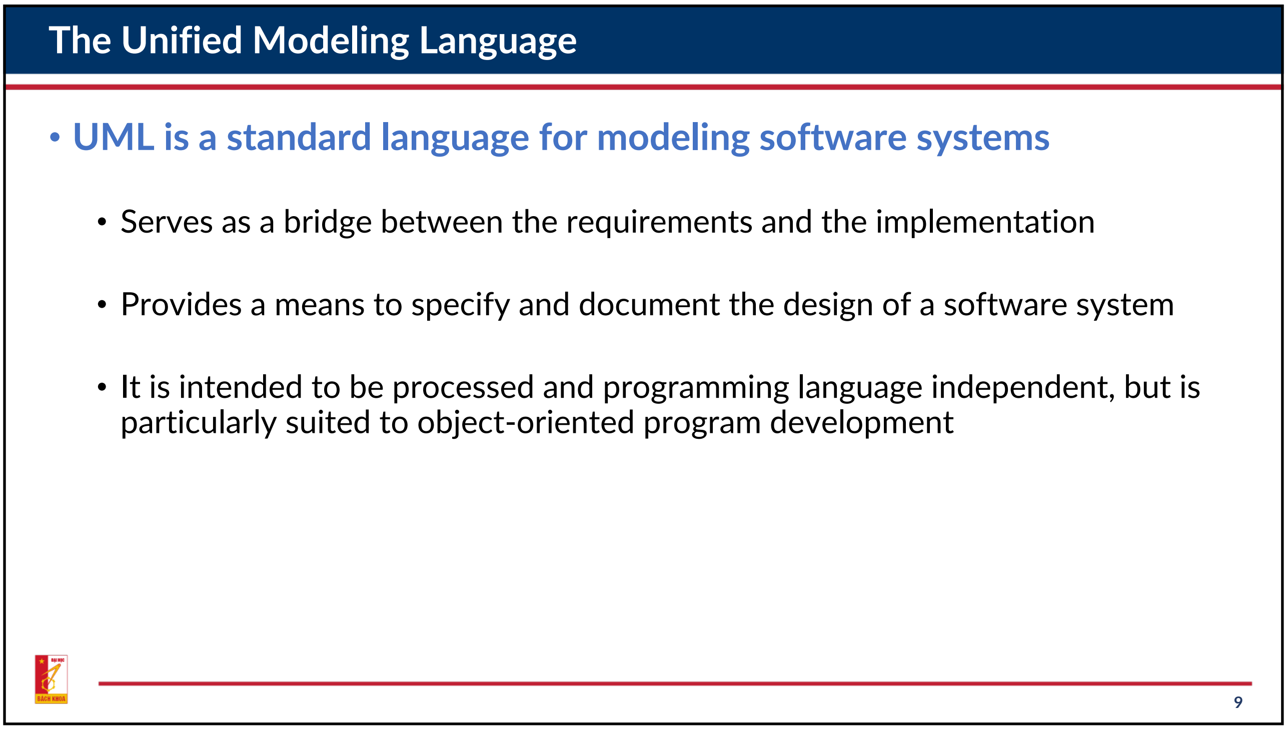
Example (2): Model as a Blueprint



Principles of Modeling

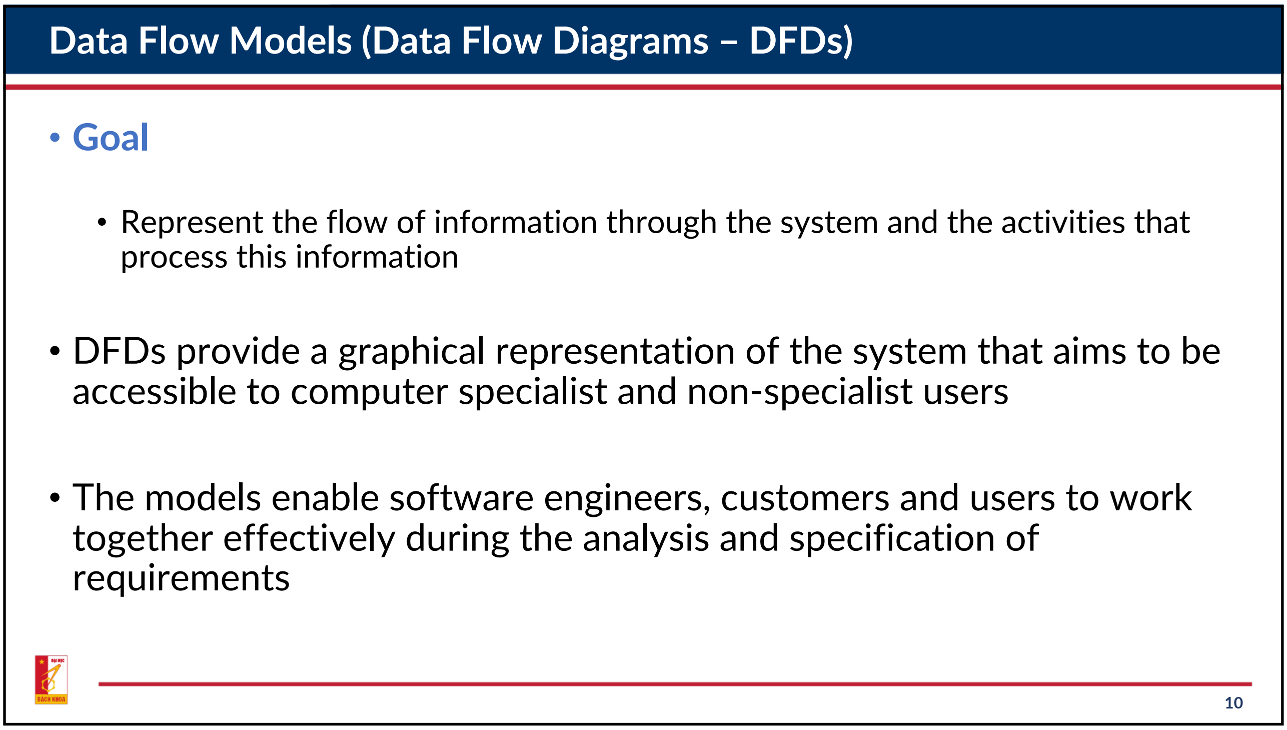
- The choice of what model to be created has a profound influence on how to resolve a problem
- No single model is sufficient
- Every model can be expressed at **different levels of precision**
- Good models are connected to reality

- Every nontrivial system is best approached through a small set of nealy independent models



The Unified Modeling Language

- **UML is a standard language for modeling software systems**
  - Serves as a bridge between the requirements and the implementation
  - Provides a means to specify and document the design of a software system
  - It is intended to be processed and programming language independent, but is particularly suited to object-oriented program development



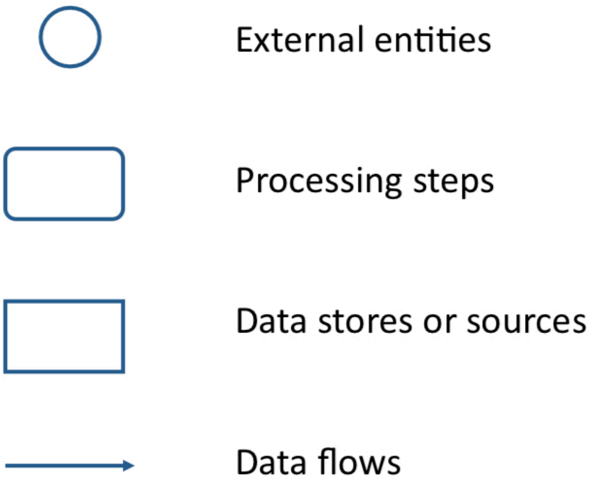
Data Flow Models (Data Flow Diagrams – DFDs)

- **Goal**
  - Represent the flow of information through the system and the activities that process this information
- DFDs provide a graphical representation of the system that aims to be accessible to computer specialist and non-specialist users
- The models enable software engineers, customers and users to work together effectively during the analysis and specification of requirements

DFD notations

- Processes
  - The activities carried out by the system which use and transform information
  - Process is denoted as a **rounded rectangle**
- Data-flows
  - The data inputs to and outputs from to these activities (**processes**)
  - Data flows are notated as **named arrows**
- External entities
  - The sources from which information flows into the system and the recipients of information leaving the system
  - External entities are notated as **ovals**
- Data stores
  - Where information is stored within the system
  - Notated as rectangles

DFD symbols



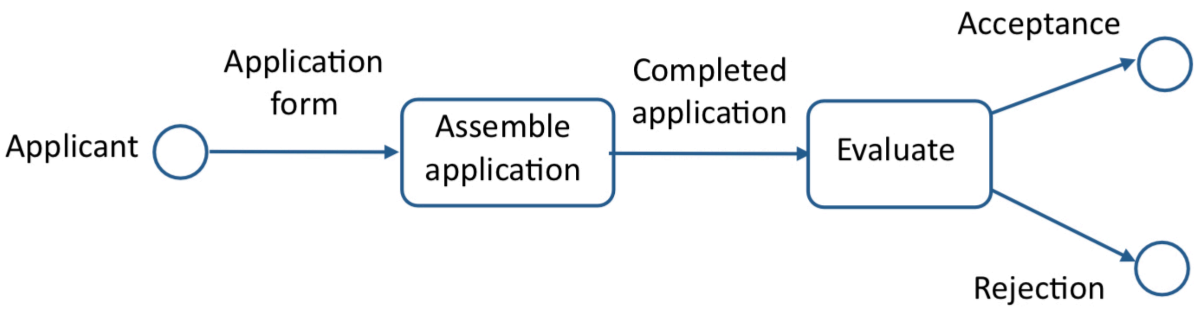
External entities

Processing steps

Data stores or sources

Data flows

Example: University Admissions



Applicant

Application form

Assemble application

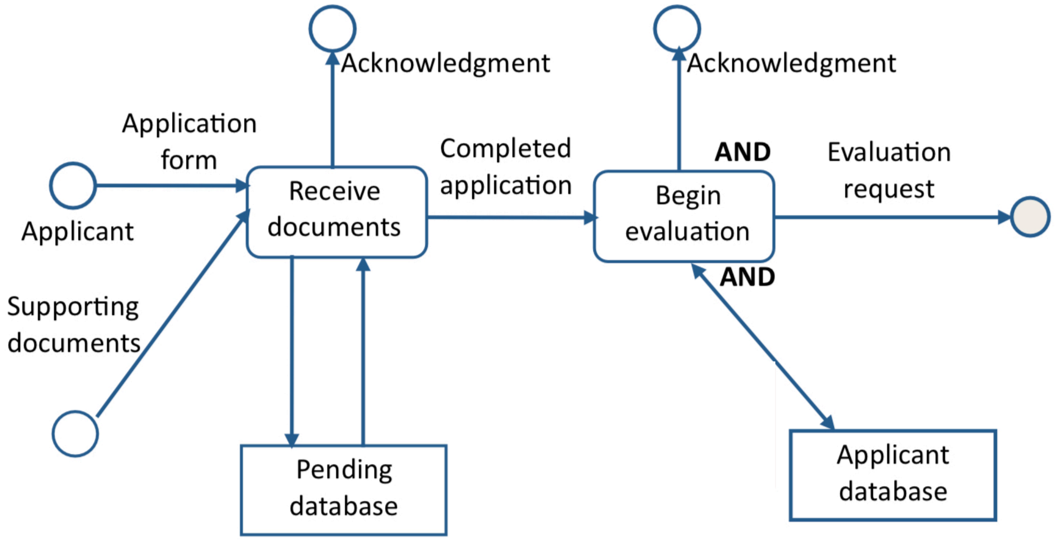
Completed application

Evaluate

Acceptance

Rejection

Example (2): Assemble Application



Acknowledgment

Acknowledgment

Application form

Applicant

Receive documents

Completed application

Begin evaluation

AND

Evaluation request

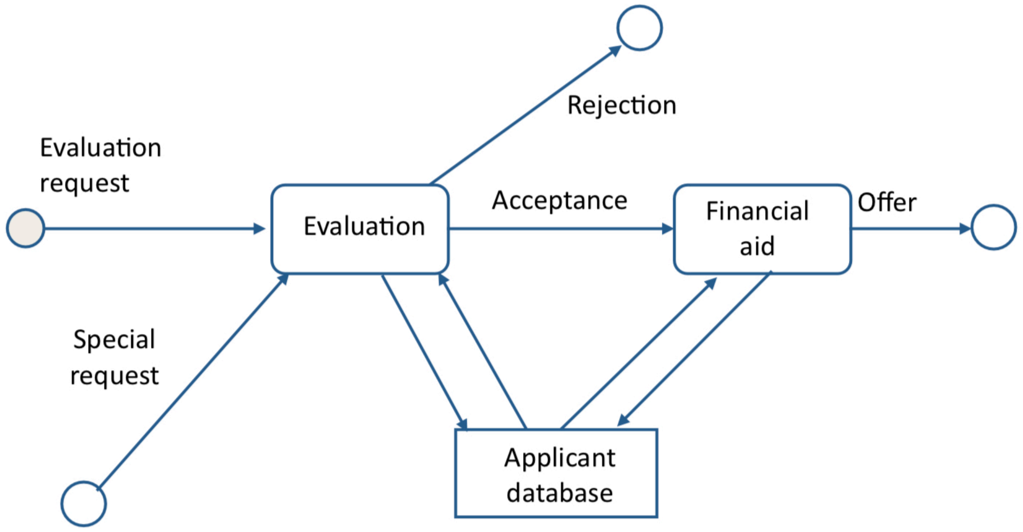
AND

Supporting documents

Pending database

Applicant database

Example (3): Process Completed Application



Decision Table Model

University Admission Decision

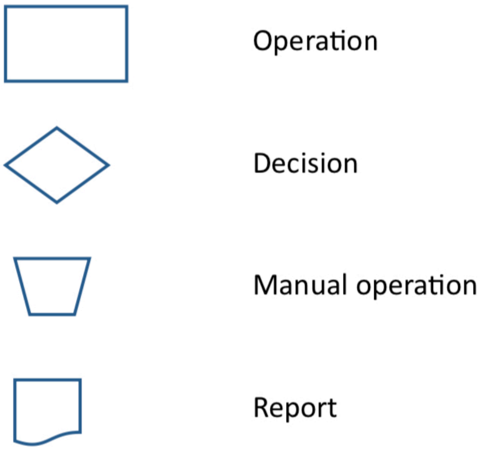
SAT > S1	T	F	F	F	F	F
GPA > G1	-	T	F	F	F	F
SAT between S1 and S2	-	-	T	T	F	F
GPA between G1 and G2	-	-	T	F	T	F
Accept	*X*	*X*	*X*			
Reject				*X*	*X*	*X*

Each column is a separate decision case. The columns are processed from left to right.

Note that the rules are specific and testable.

Flowchart Models

An informal modeling technique to show the **logic part** of a system and **paths** that data takes through a system



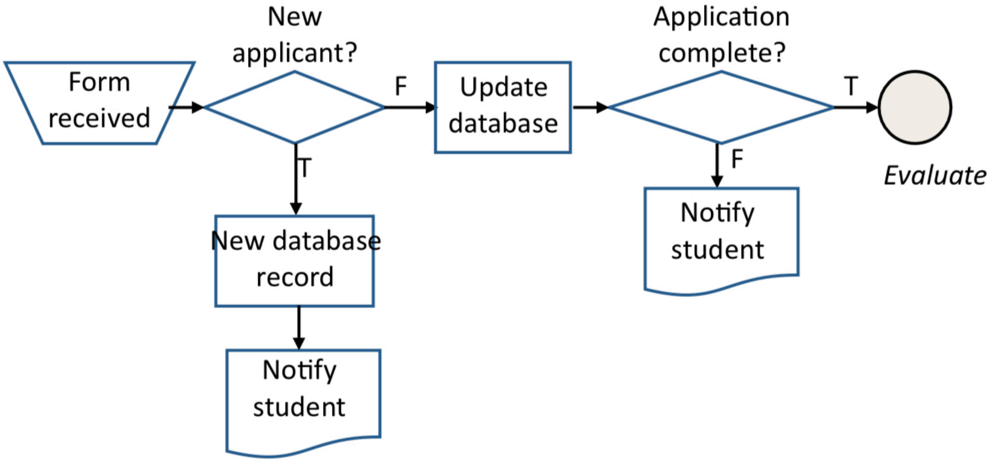
Operation

Decision

Manual operation

Report

Example: University Admission Assemble Application



Form received

New applicant?

F

T

New database record

Notify student

Update database

Application complete?

T

F

Notify student

Evaluate

Transition Diagrams

A system is modeled as a set of **states**, S_i

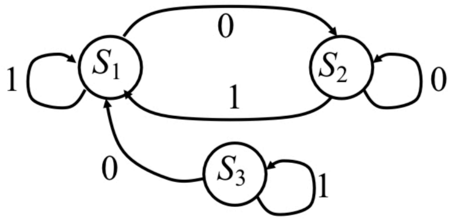
A **transition** is a change from one state to another.

The occurrence of a **condition**, C_i, causes the transition from one state to another

Transition function:

$f\,(S_i, C_j) = S_k$

Example



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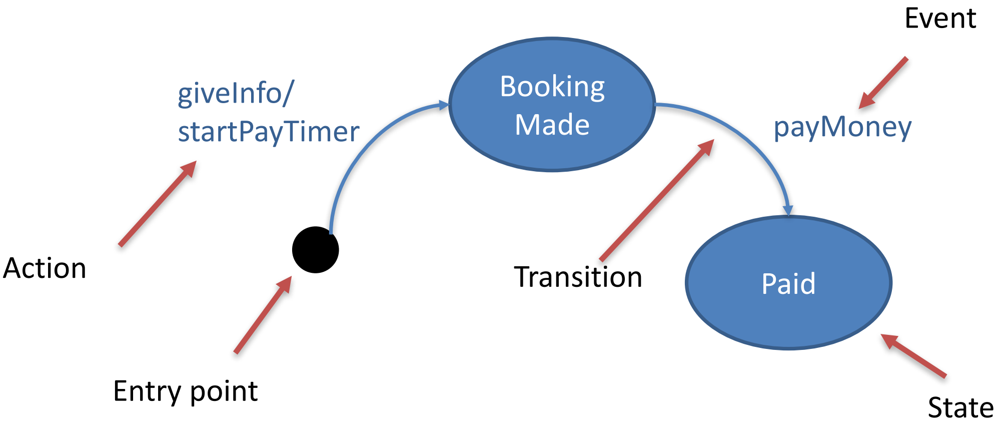
Example: Flight Booking System

Finite State Machine



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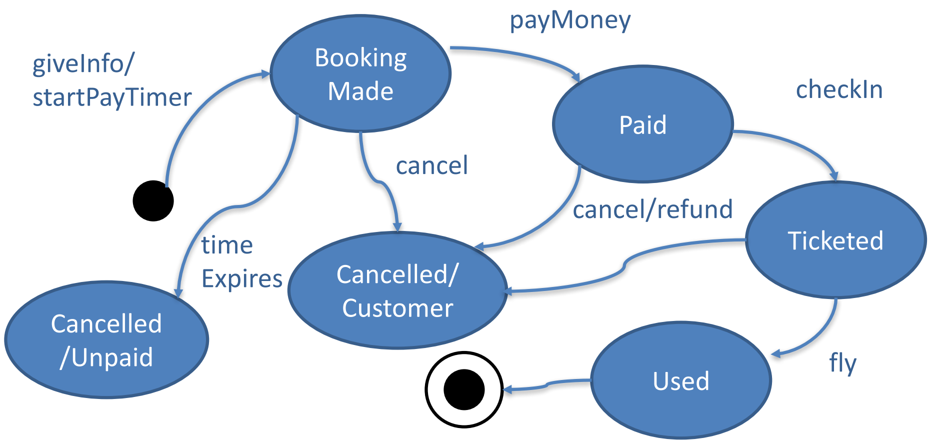
Example (2) Finite State Machine for Flight Booking System

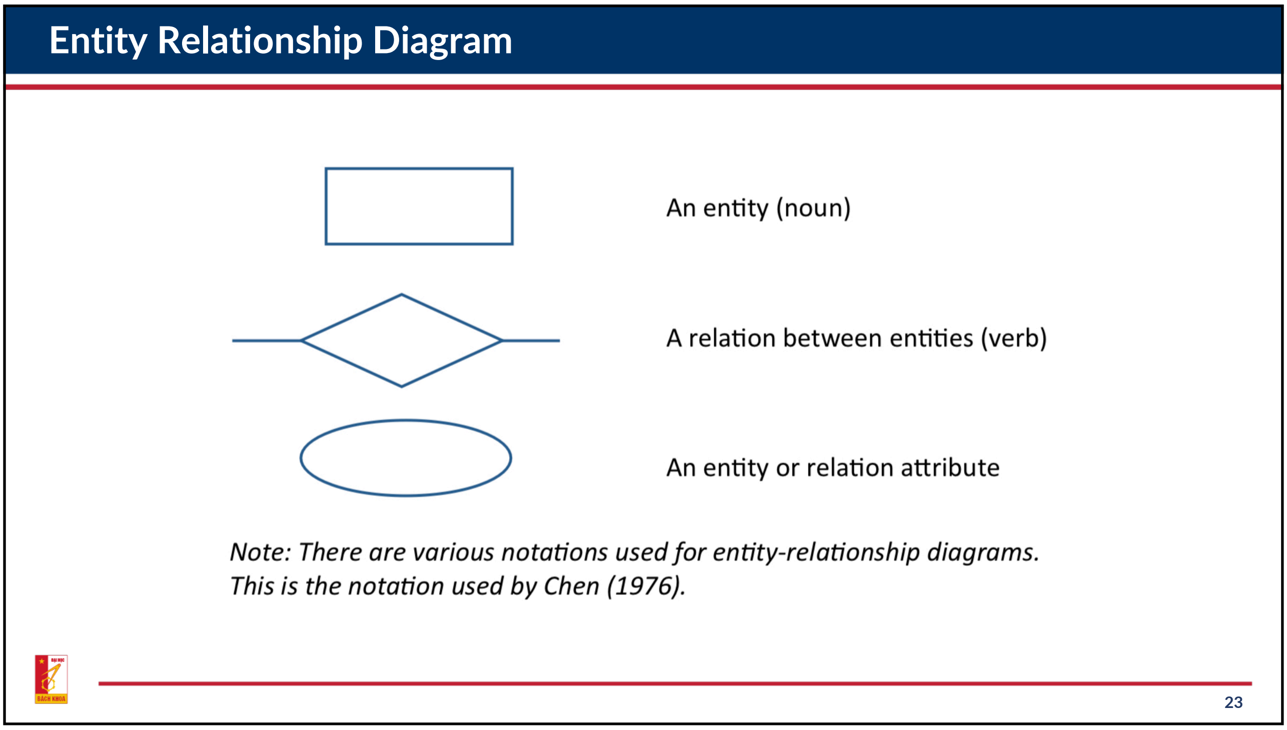


Entity Relation Model

A **requirement** and **design methodology** for relational databases

- A database of entities and relations
- Tools for displaying and manipulating entity-relation diagrams
- Tools for manipulating the database

Entity Relationship Models can be used both for **requirement specification** and for the **design specification**



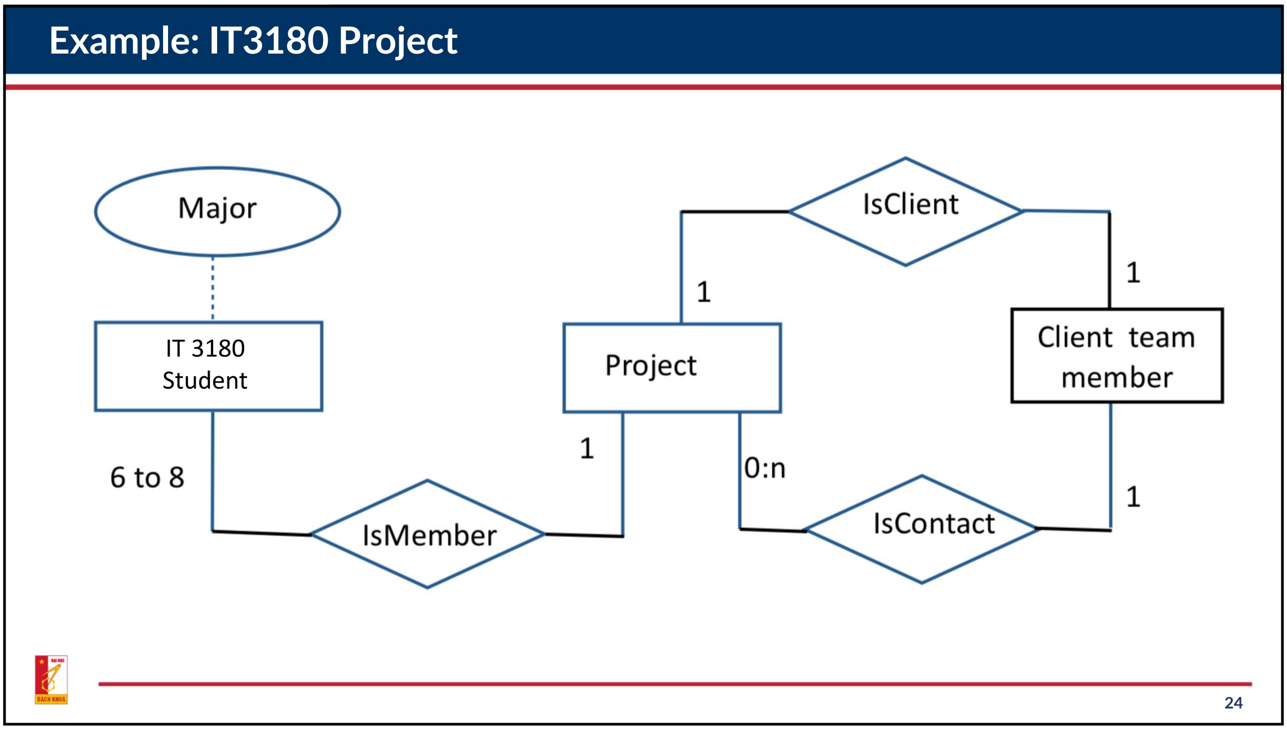
Entity Relationship Diagram

An entity (noun)

A relation between entities (verb)

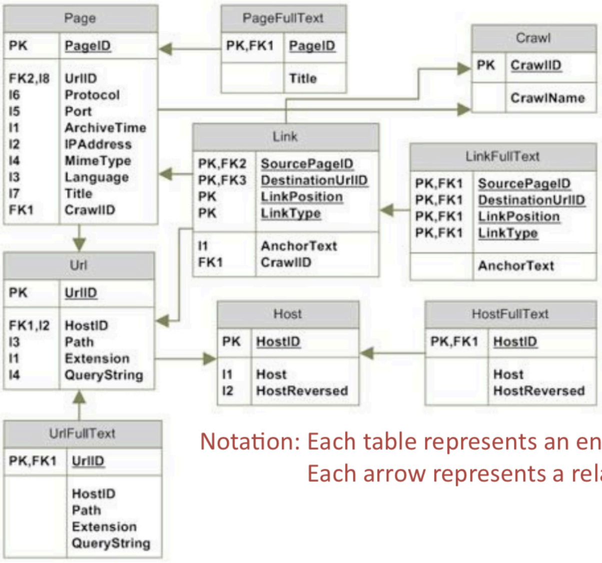
An entity or relation attribute

Note: There are various notations used for entity-relationship diagrams. This is the notation used by Chen (1976).



Example: IT3180 Project

Example: Database Schema for Web Data



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PageFullText	
PK,FK1	PageID
	Title

Crawl	
PK	CrawlID
	CrawlName

Link	
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PK	HostID
I1 I2	Host HostReversed

HostFullText	
PK,FK1	HostID
	Host HostReversed

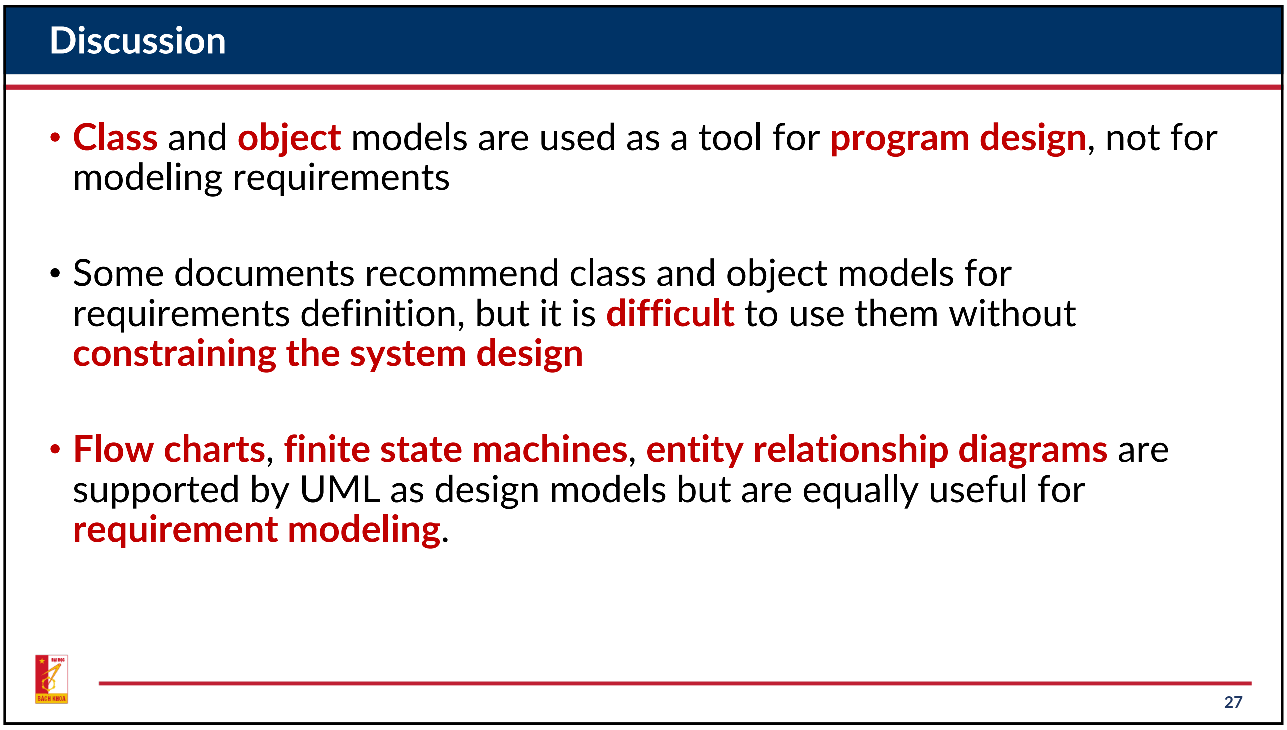
UrlFullText	
PK,FK1	UrlID
	HostID Path Extension QueryString

Notation: Each table represents an entity
Each arrow represents a relation

Prototyping Requirements

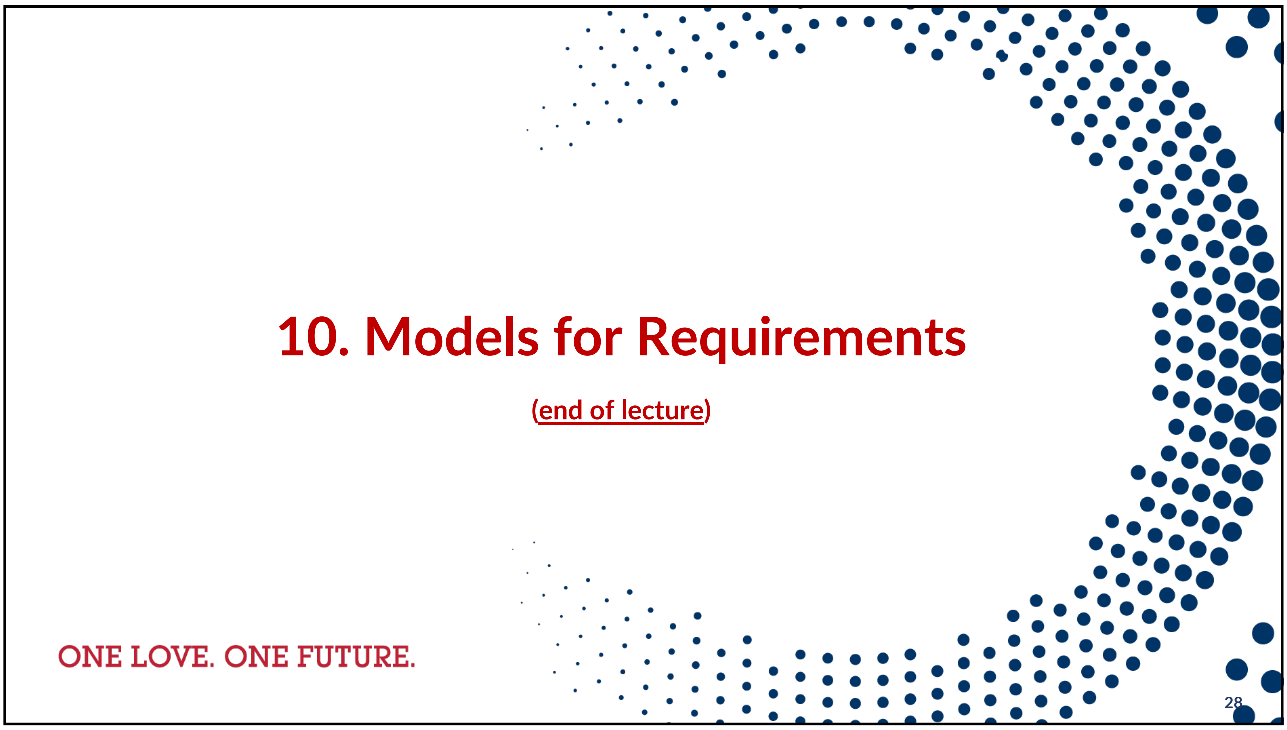
Rapid prototyping is the most comprehensive of all modeling methods

- A method for **specifying requirements** by building a system that **demonstrates** the functionality of key parts of the required system
- Particularly valuable for user interfaces



Discussion

- **Class** and **object** models are used as a tool for **program design**, not for modeling requirements
- Some documents recommend class and object models for requirements definition, but it is **difficult** to use them without **constraining the system design**
- **Flow charts**, **finite state machines**, **entity relationship diagrams** are supported by UML as design models but are equally useful for **requirement modeling**.



10. Models for Requirements

(end of lecture)

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