SENG 471

Software Requirements Engineering

Issues in Modelling Requirements

Fun Reality

*[BR05]
†[Lar05]

What is a Model?

- "A model is **an abstraction** of something for the purpose of understanding it before building it*."
- "A description of static and/or dynamic characteristics of a subject area, portrayed through **a number of views** (usually diagrammatic or textual)†."

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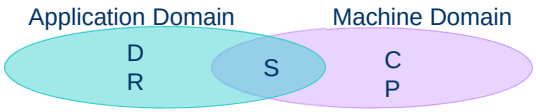
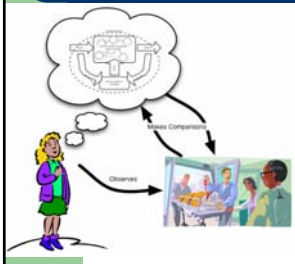
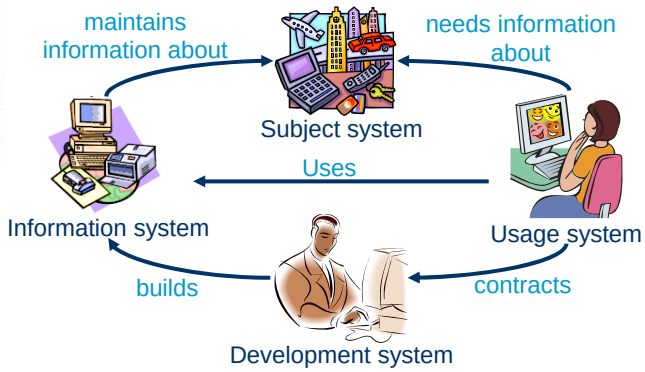


Systems to Model





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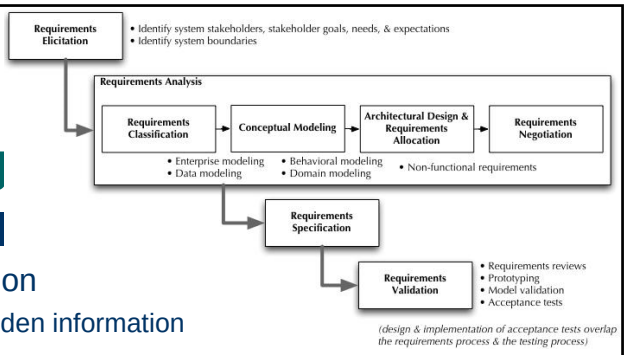
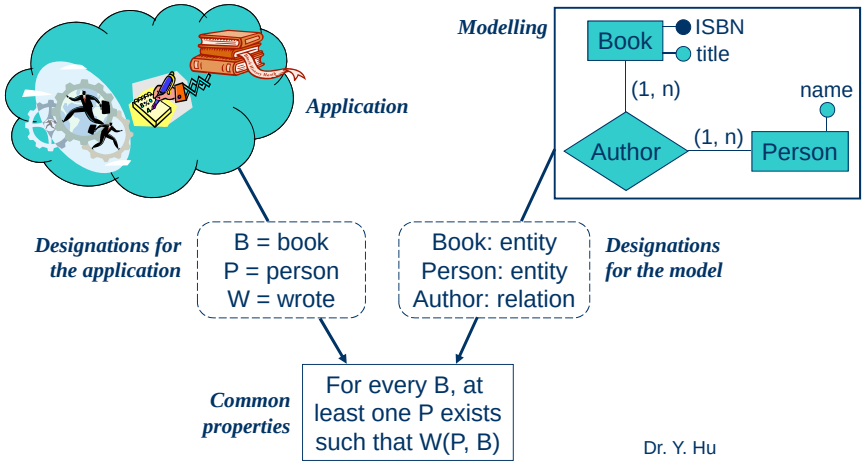
Modelling

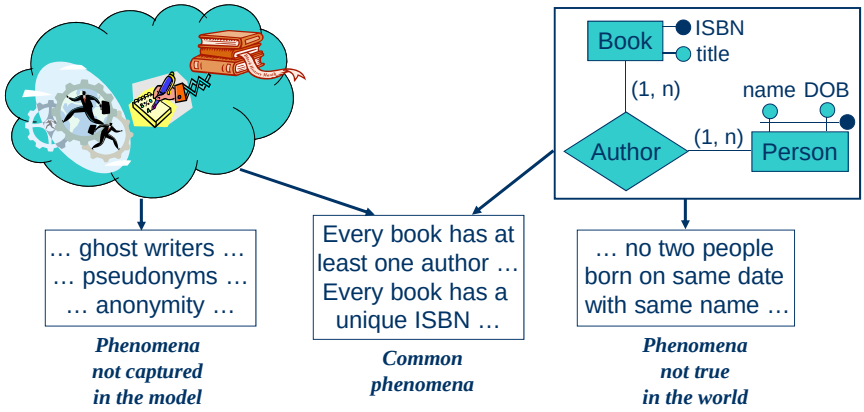


- Guide elicitation
  - surfacing hidden information
- Provide a measure
  - modelling completeness → …
- Uncover problems
  - inconsistency/ambiguity in the model → …
- Check understanding
  - reason over the model → …
  - animate the model → ….

Modelling - Example



Modelling - “It’s only a model”



Phenomena not captured in the model

Common phenomena

Phenomena not true in the world

Modelling - Choice of notation

- Natural language
  - extremely expressive and flexible
  - poor at capturing key relationships
- Semi-formal notation
  - capturing structure and some semantics
  - perform some reasoning, consistency checking, animation, etc.
  - visualize mostly for rapid communication with stakeholders
- Formal notation
  - precise semantics, extensive reasoning possible
  - very detailed models (may be more detailed than we need)

UML fits in here!

Modelling - Desiderata for notations

- Implementation independence → not model data representation, internal organization, etc.
- Abstraction → essential aspects (no frequent change)
- Formality → unambiguous syntax, rich semantic theory
- Constructability → modularize the model to handle complexity and size, facilitate communication
- Ease of analysis → ambiguity, incompleteness, inconsistency
- Traceability → cross-reference; link to design, implementation…
- Executability → animate the model and compare it to reality
- Minimalist → no redundancy of concepts in modelling scheme

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Modelling - Techniques

- Modelling enterprises
  - Goals and objectives
  - Organizational structure
  - Tasks and dependencies
  - Agents, roles, intentionality
- Modelling information + behaviour
  - Information structure
  - Behavioral views
  - Timing/Sequencing requirements
- Modelling system qualities
  - All the 'ilities':

Organization modelling:
BPMN, i*, SSM, ISAC
Goal modelling:
KAOS, CREWS

Information modelling:
ER, Class diagram
Structured analysis:
SADT, SSADM, JSD
Object-oriented analysis:
OOA, OOSE, OMT, UML
Formal methods:
SCR, RSML, Z, VDM

Quality trade-offs:
QFD, win-win, AHP
Specific NFRs:
Timed Petri nets (performance)
Task models (usability)
Probabilistic MTTF (reliability)

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Modelling - Techniques in SENG471

Non-UML:
- Goal models
- BPMN diagrams
- ER diagrams
- SCR, MTTF, AHP
- Fault tree + more ……

UML:
- Activity diagrams
- Class diagrams
- State-chart diagrams
- Use case diagrams
- Sequence diagrams

- You will learn:
  - How to capture information in a model
  - How to relate the models to each other
  - How to use syntax
  - How to develop the models

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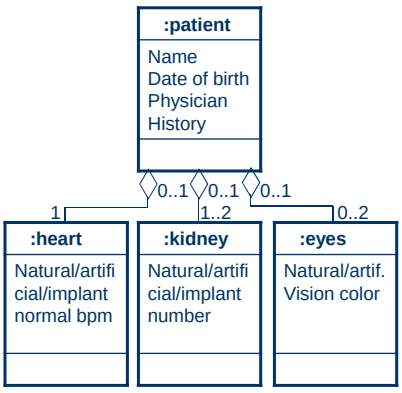
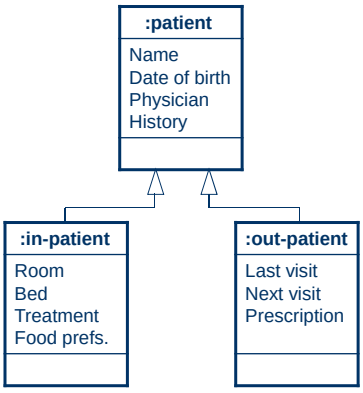
- Facilitate modification and reuse
- Helpful ideas:
  - Partitioning (decomposition); Abstraction; Projection (viewpoints)
  - Modularization; Patterns (e.g., problem frames)

Modelling - Principles + Example

Aggregation
(a partitioning hierarchy)



Generalization
(an abstraction hierarchy)



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Recap

- What is modelling?
  - System thinking: from system to model
  - Modelling notation and techniques
  - Modelling principles