Chapter 3 — System Models

March 16, 2009

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- use **UML**

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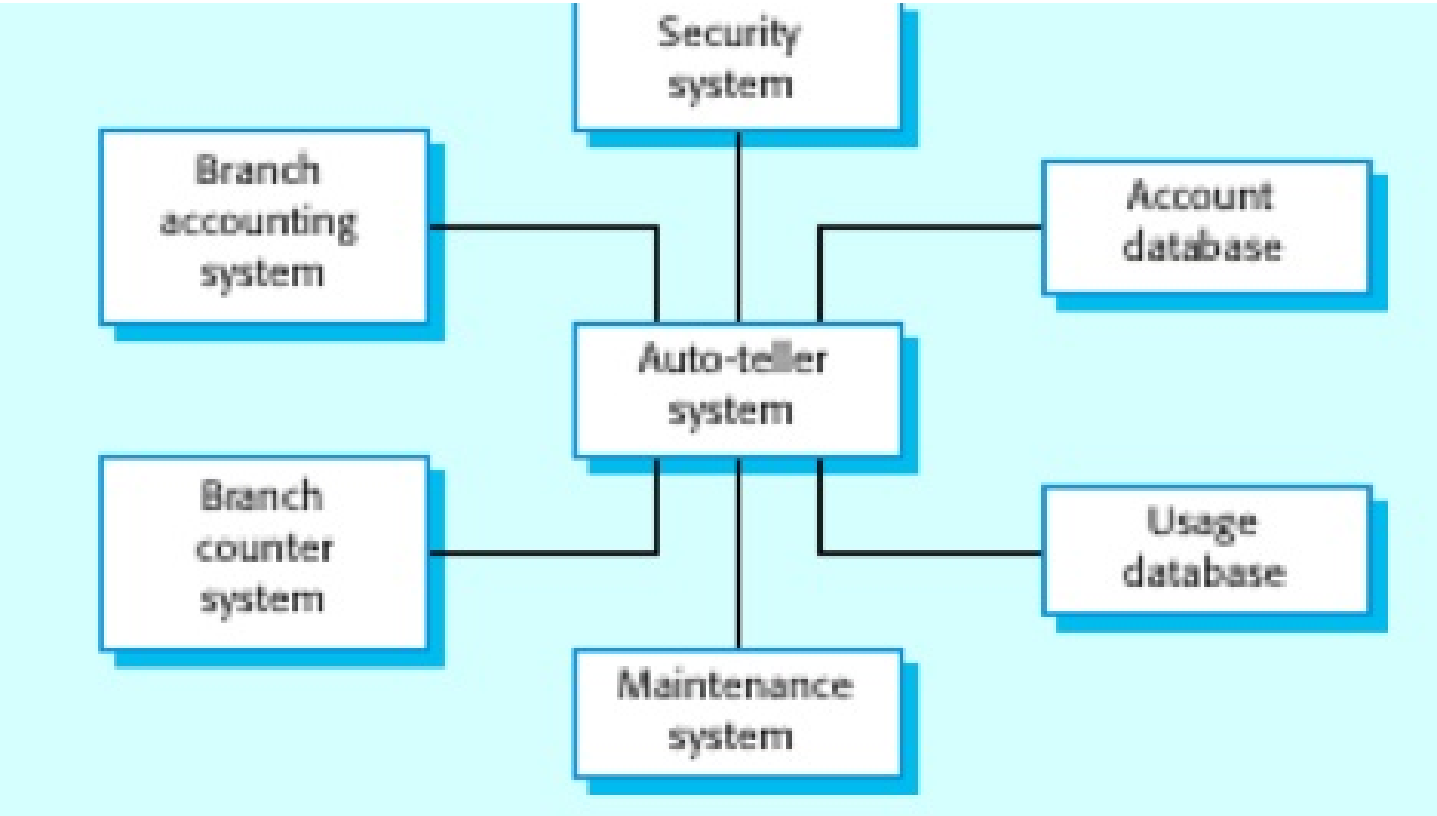
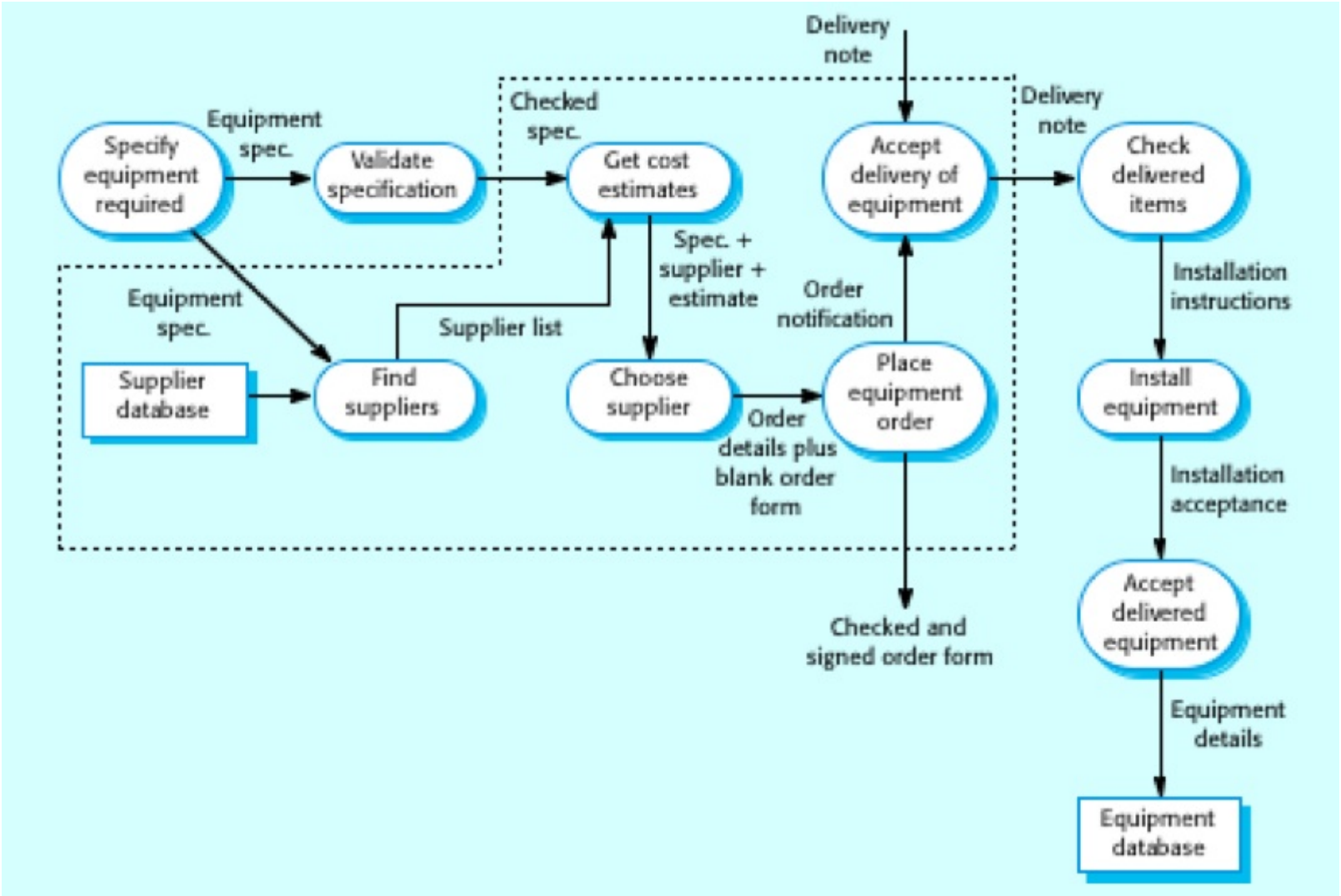
  - *example*: replace existing manual system
- next develop context model
  - show context and dependencies on environment
  - detailed relationships are note shown
    - use *process* or *data-flow* models

Context Model for an ATM System



Process Model for Equipment Producrement



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- Real-time systems are event driven with minimal data processing
  - use state machines for preseting behavior

Data-Flow Models

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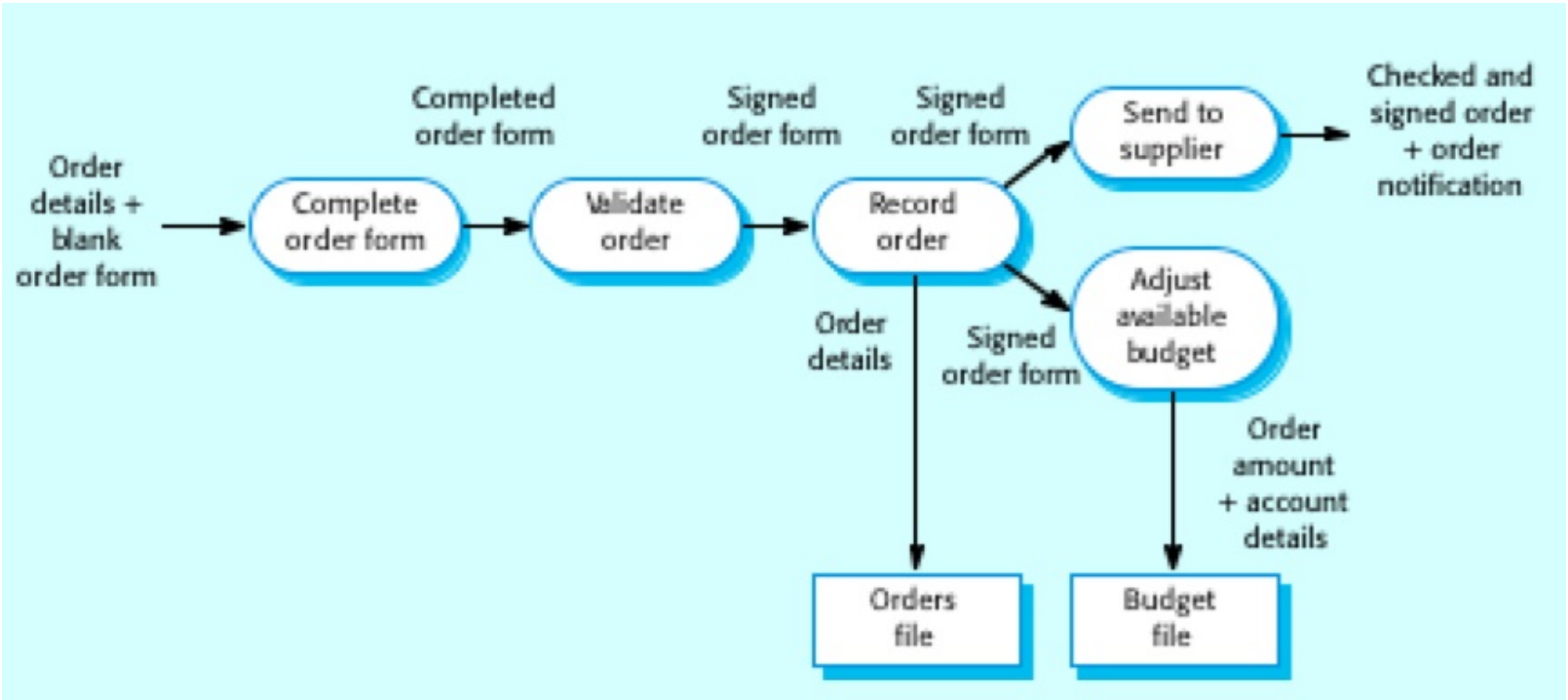
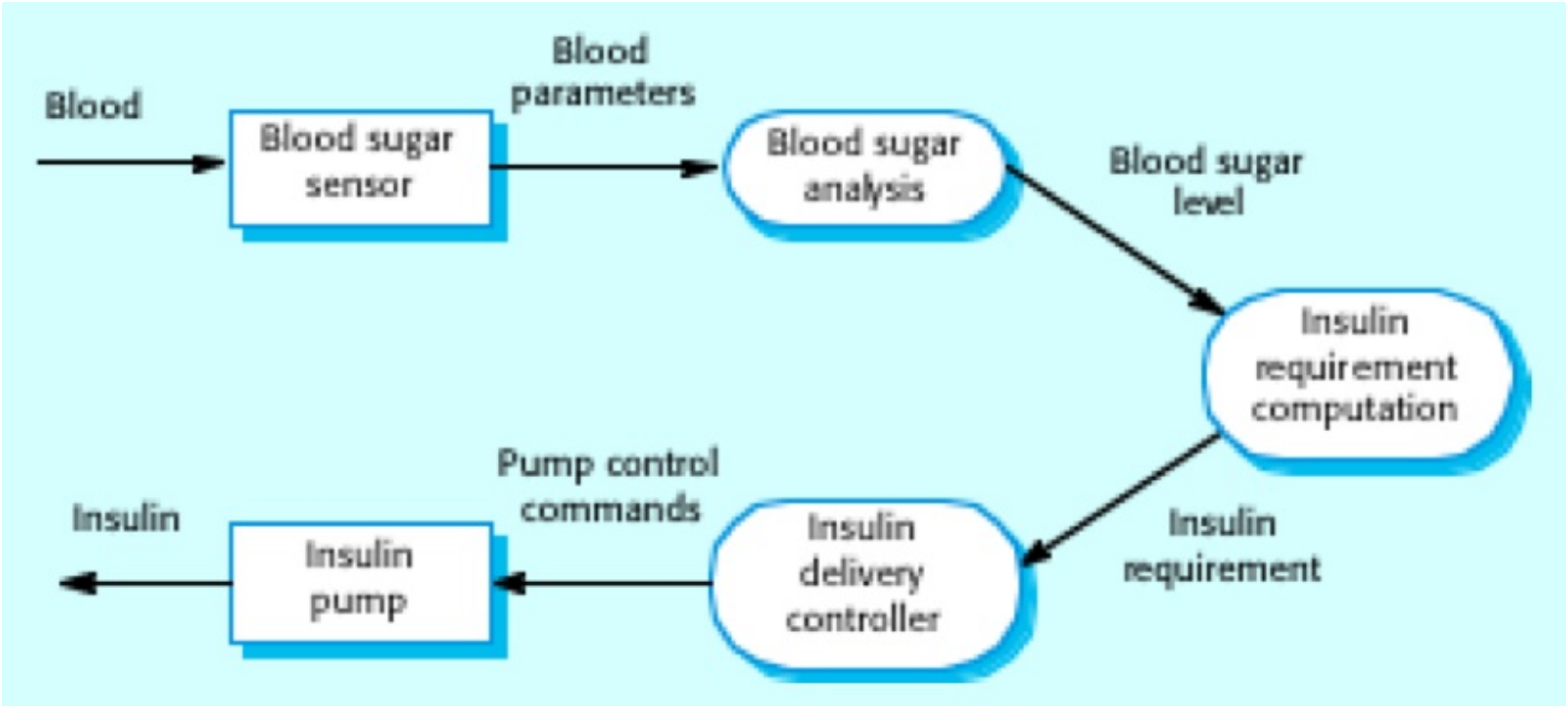
- Convention:
  - rounded rectangles: *data processing*
  - square rectangles: *data stores*
  - labelled arrows: *data flow through system*

DFD for Order Processing



DFD for Insulin Pump



Use and Advantages of DFD

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- “Top-down approach”, in principle

State Machine Models

- System's responses to internal or external events

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- Shows
  - system states (one at a time)
  - events that cause transformation between states

State Machine Model of a Microwave Oven

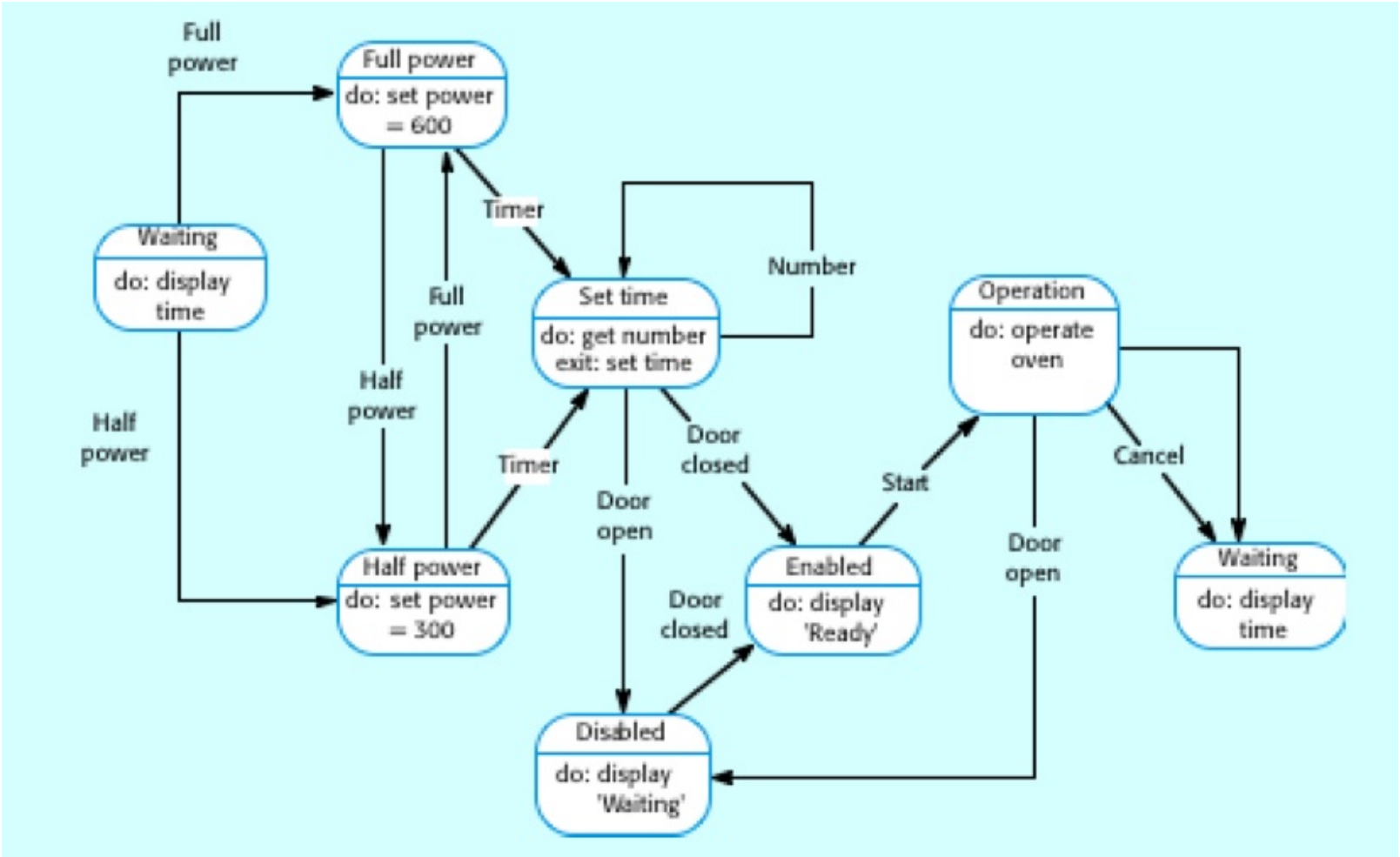

Figure: UML-based state machine model

Microwave Oven States

State	Description
Waiting	The oven is waiting for input. The display shows the current time.
Half power	The oven power is set to 300 watts. The display shows 'Half power'.
Full power	The oven power is set to 600 watts. The display shows 'Full power'.
Set time	The cooking time is s et to the user's input value. The display shows the cooking time selected and is updated as the time is set.
Disabled	Oven operation is disabled for safety. Interior oven light is on. Display shows 'Not ready'.
Enabled	Oven operation is enabled. Interior oven light is off. Display shows 'Ready to cook'.
Operation	Oven in operation. Interior oven light is on. Display shows the timer countdown. On completion of cooking, the buzzer is sounded for 5 s econds. Oven light is on. Display shows 'Cooking complete' while buzzer is sounding.

Microwave Oven Stimuli

Stimulus	Description
Half power	The user has pressed the half power button
Full power	The user has pressed the full power button
Timer	The user has pressed one of the timer buttons
Number	The user has pressed a numeric key
Door open	The oven door switch is not closed
Door closed	The oven door switch is closed
Start	The user has pressed the start button
Cancel	The user has pressed the cancel button

Some Issues with State Machine Models

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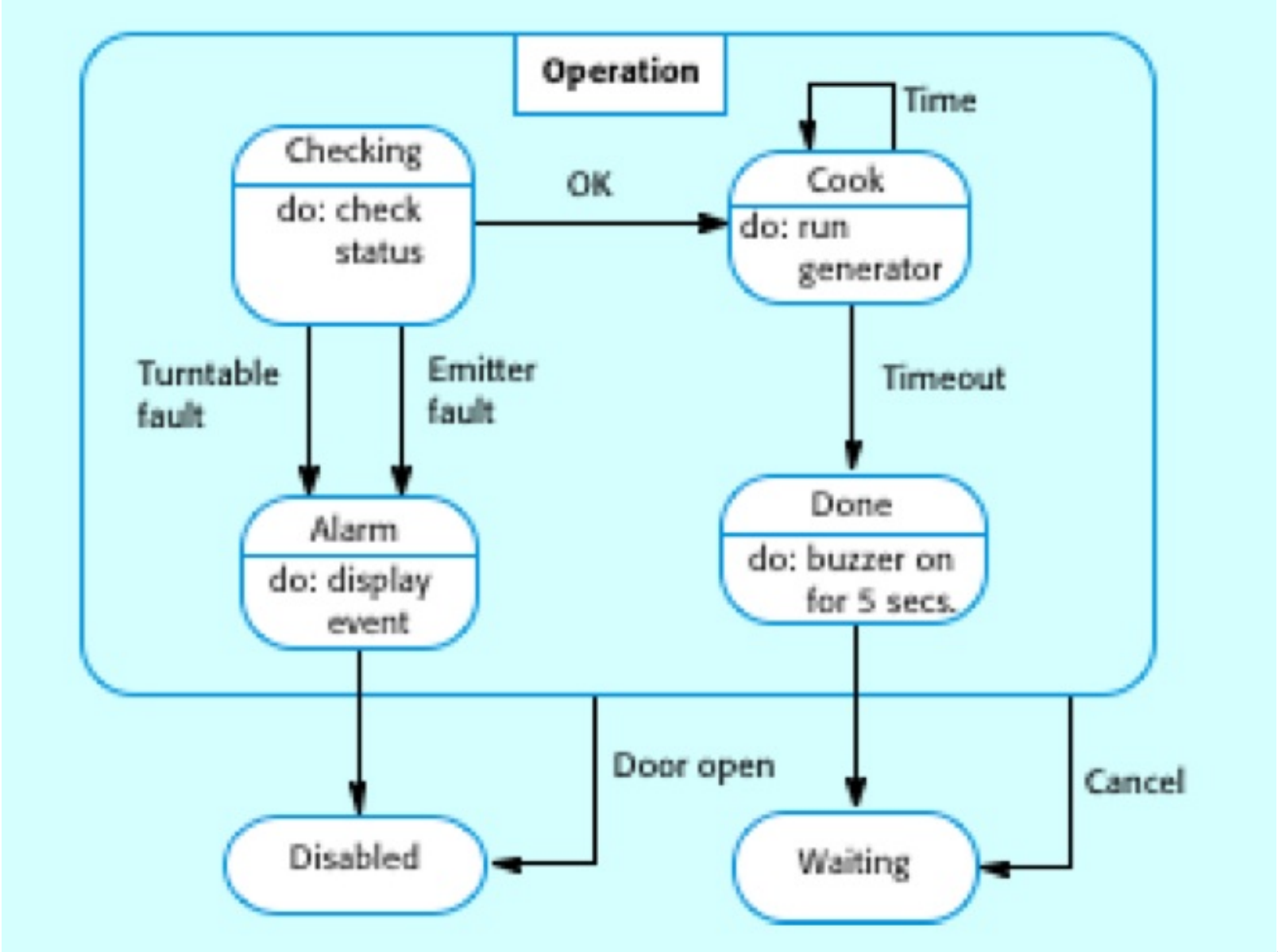
- One solution: use *super* and *sub* states

Microwave Operation Super-state



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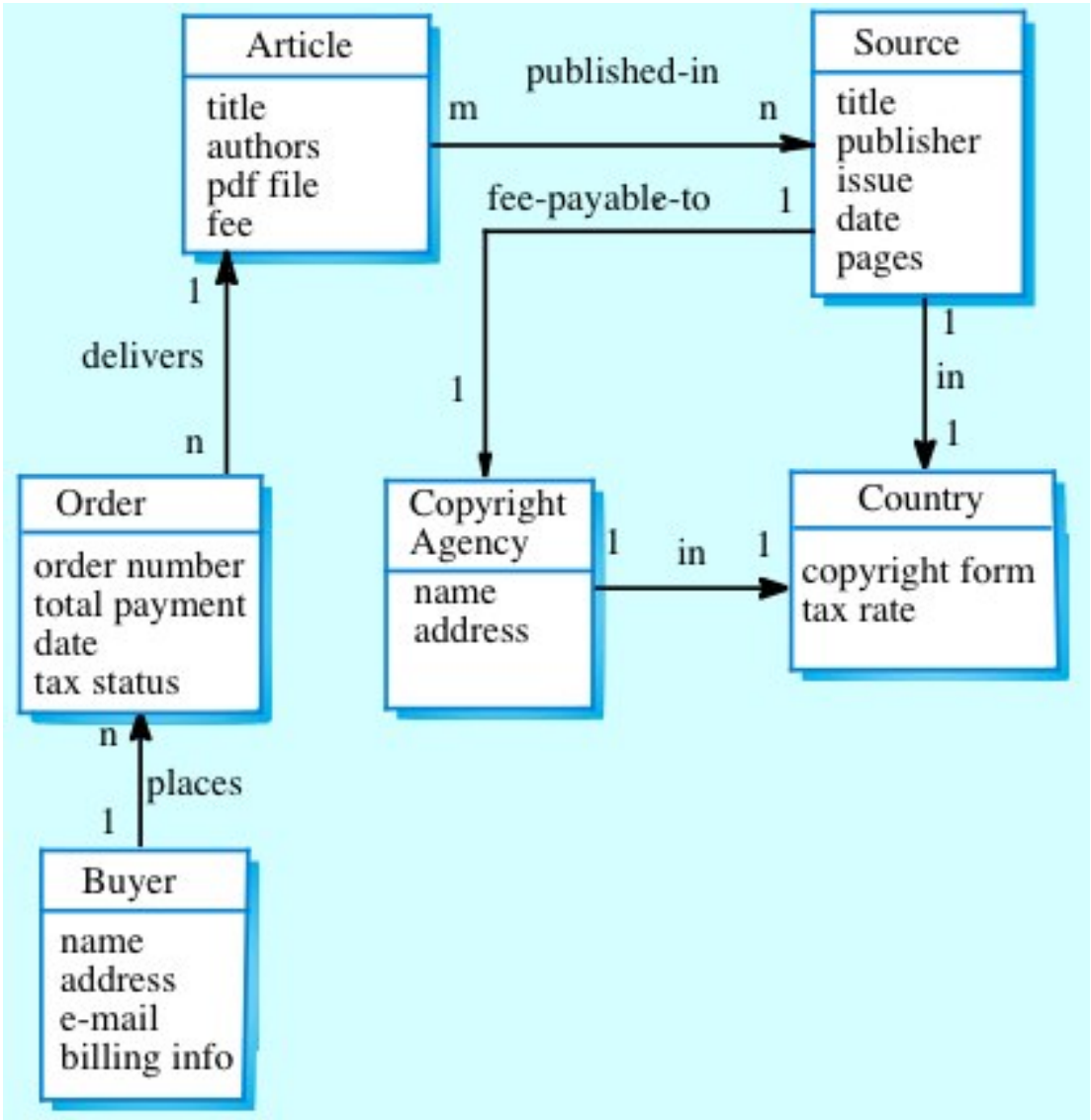
- Easy to tranform to OO design

Sample ERA mdoel



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  - *organization information storage*

Data Dictionary

Name	Description	Type	Date
Article	Details of the published article that may be ordered by people using LIBSYS.	Entity	30.12.2002
authors	The names of the authors of the article who may be due a share of the fee.	Attribute	30.12.2002
Buyer	The person or organisation that orders a co py of the article.	Entity	30.12.2002
fee-payable-to	A 1:1 relationship between Article and the Copyright Agency who should be paid the copyright fee.	Relation	29.12.2002
Address (Buyer)	The address of the buyer. This is used to any paper billing information that is required.	Attribute	31.12.2002

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- Represent: *data* and its *processing*

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  - *not* details of objects
- identification of objects is difficult

Unified Modeling Language

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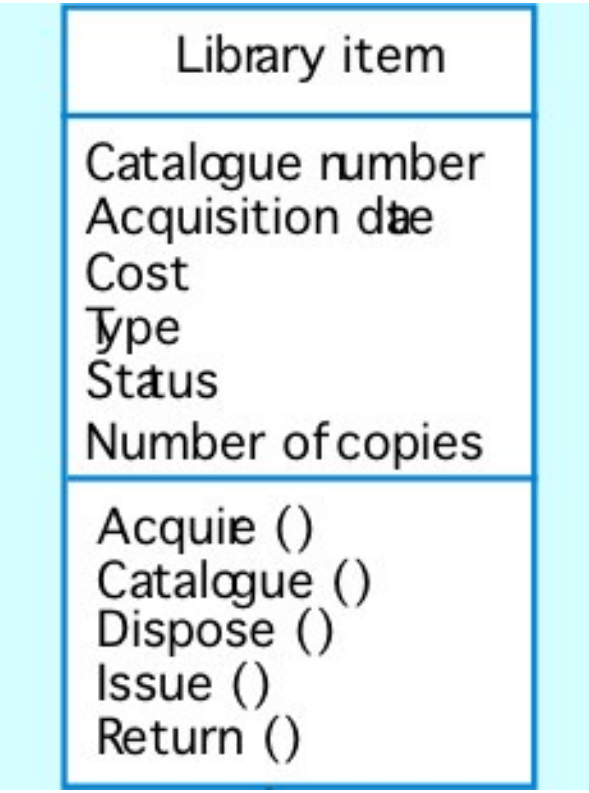
- Class represented as rectangle with sections:
  - name
  - attributes
  - operations

UML Example


Library item
Catalogue number
Acquisition date
Cost
Type
Status
Number of copies
Acquire ()
Catalogue ()
Dispose ()
Issue ()
Return ()

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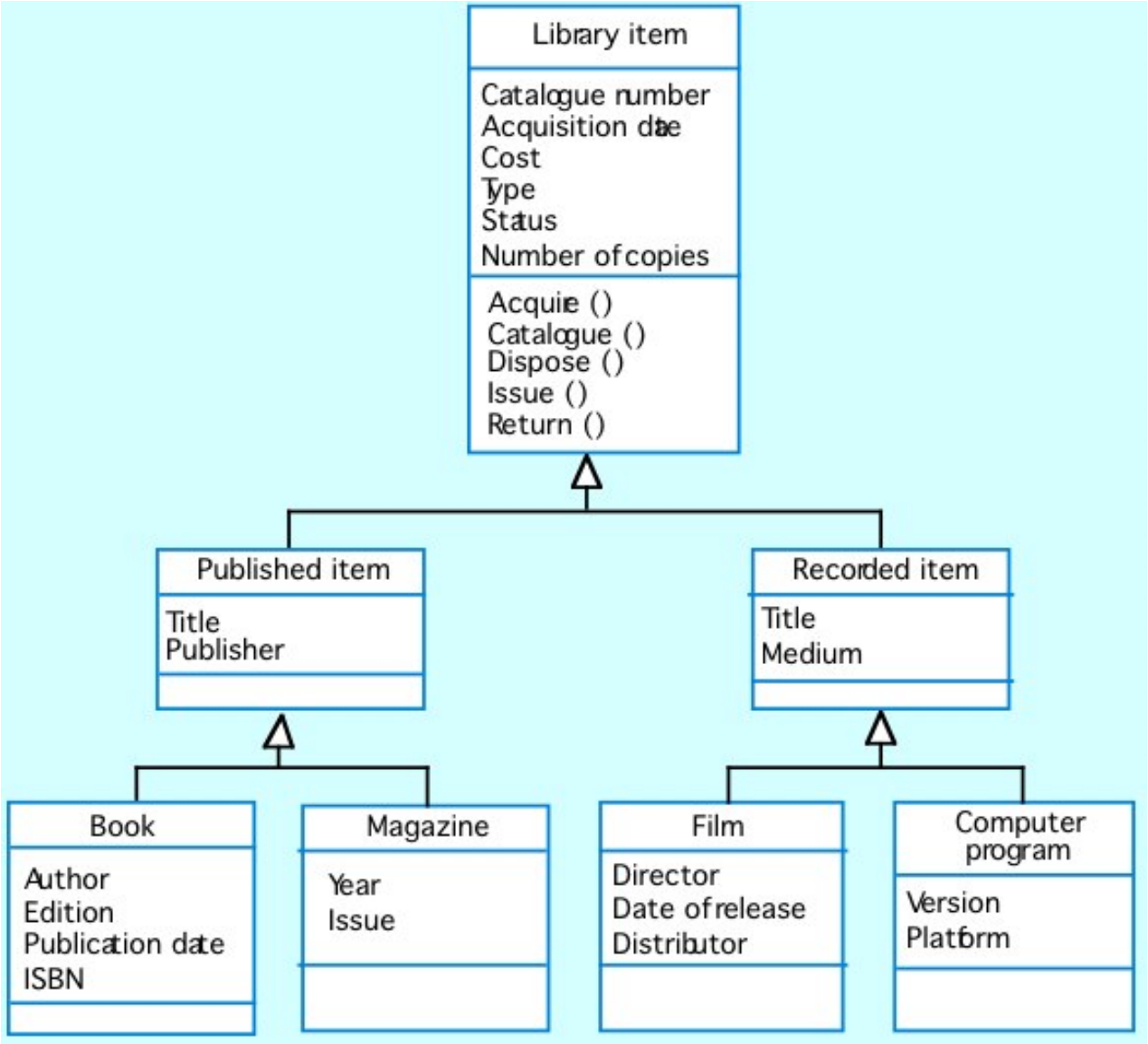
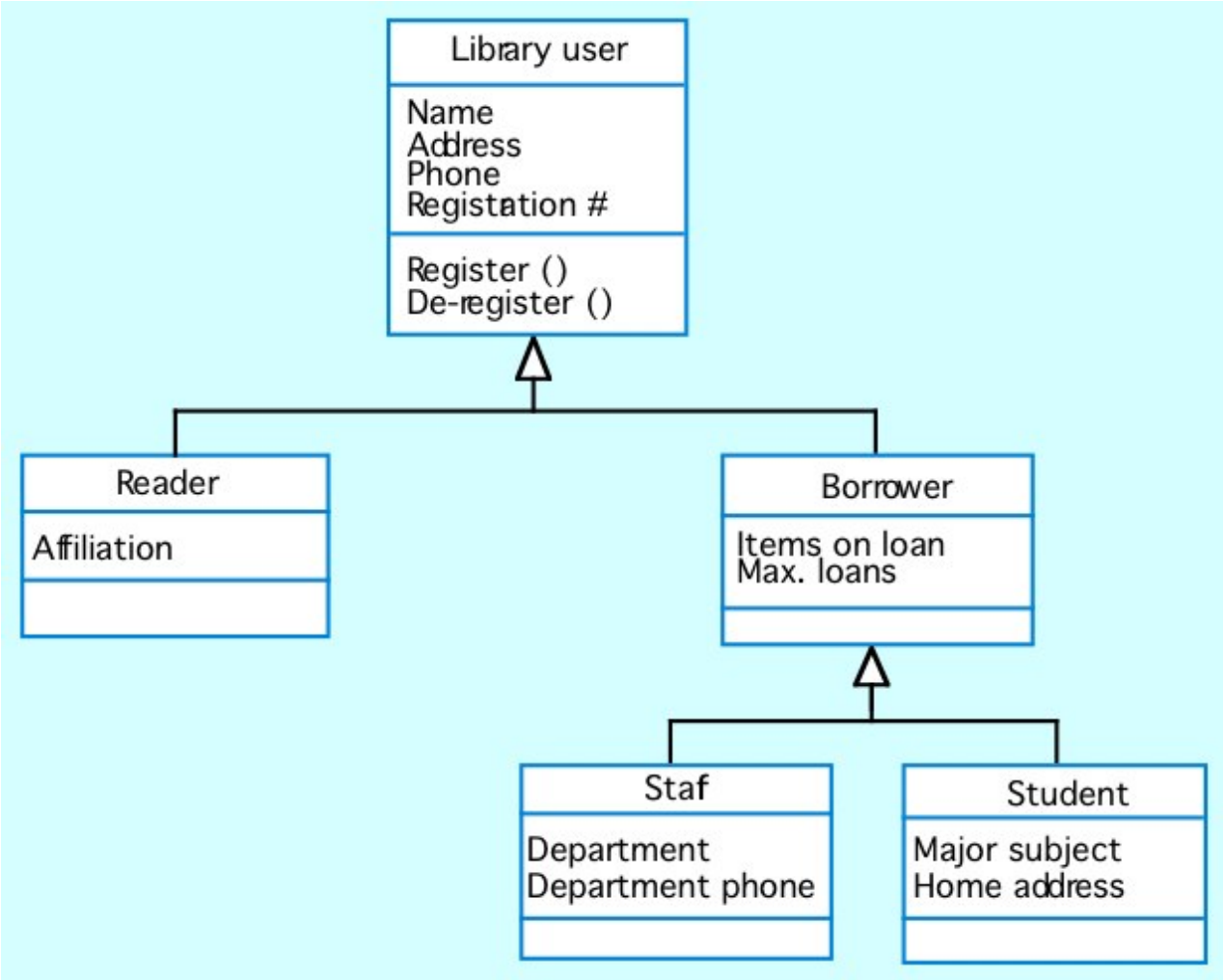
- inheritance → *generalization relationship* in UML

Library Item Inheritance Model



Library User Inheritance Model



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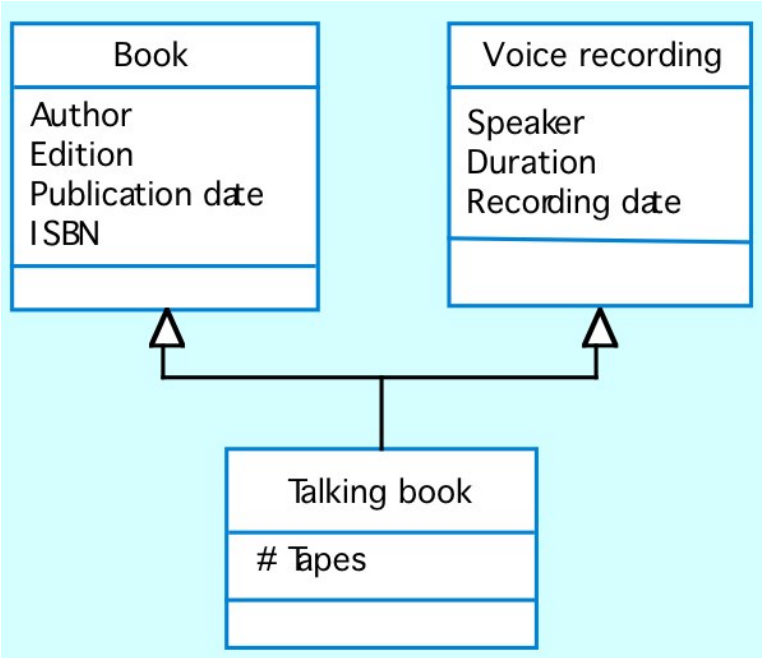

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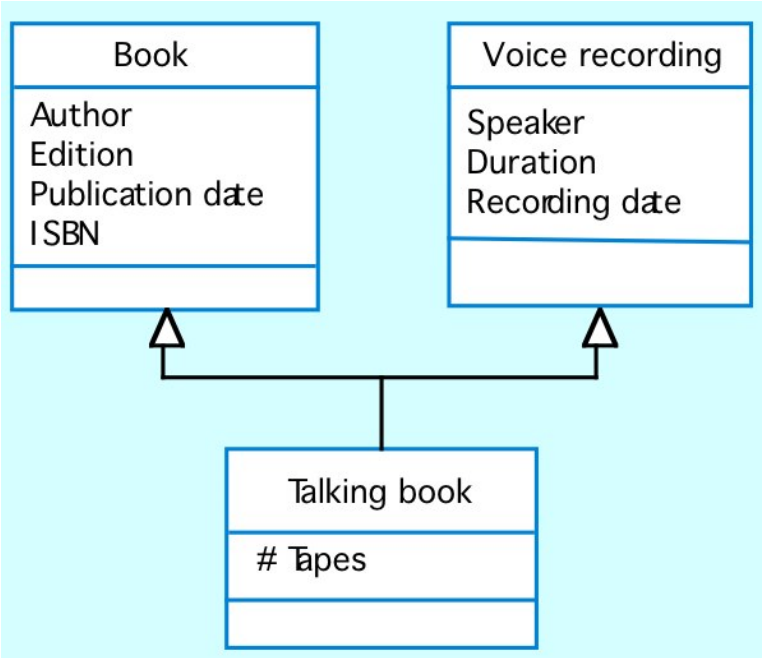

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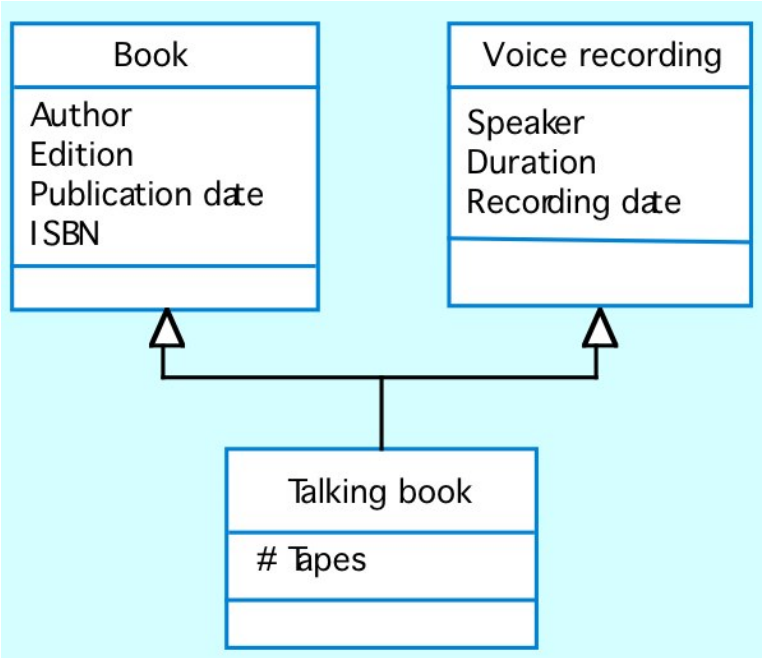

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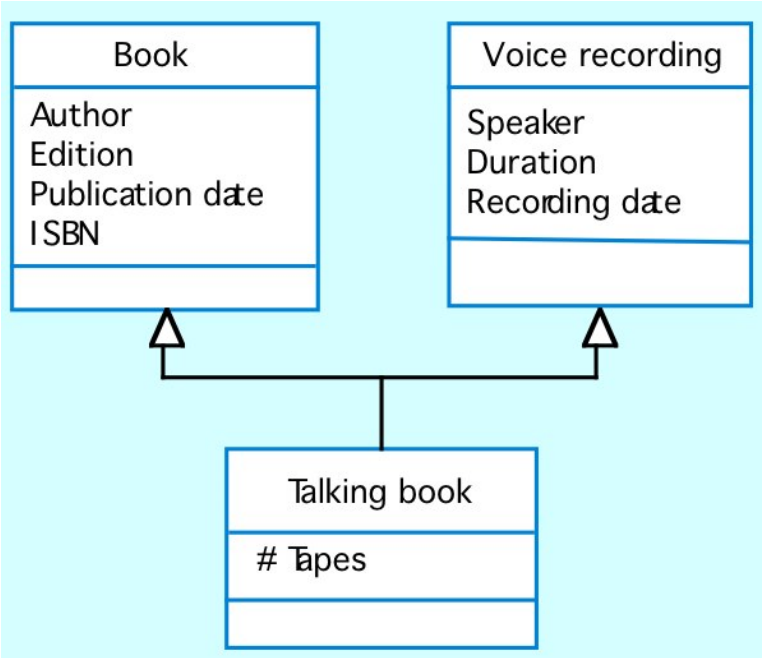

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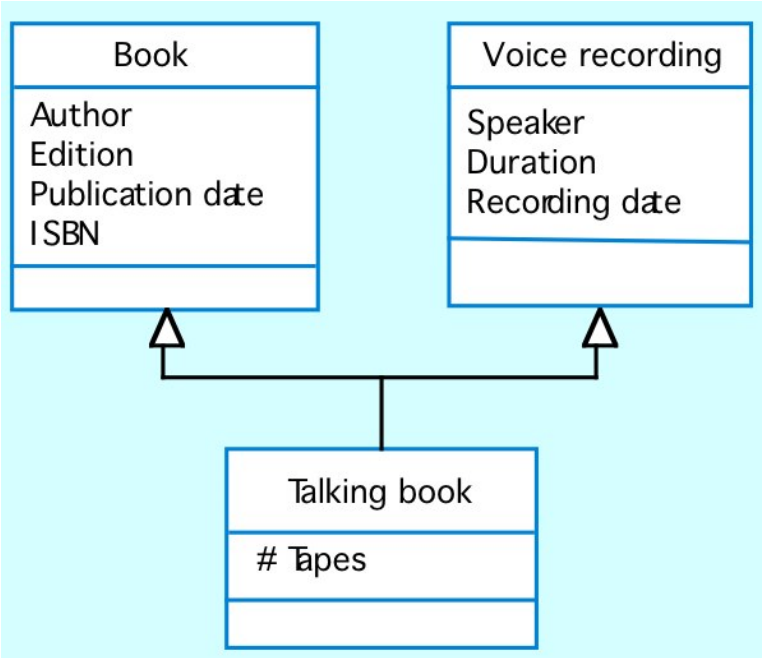

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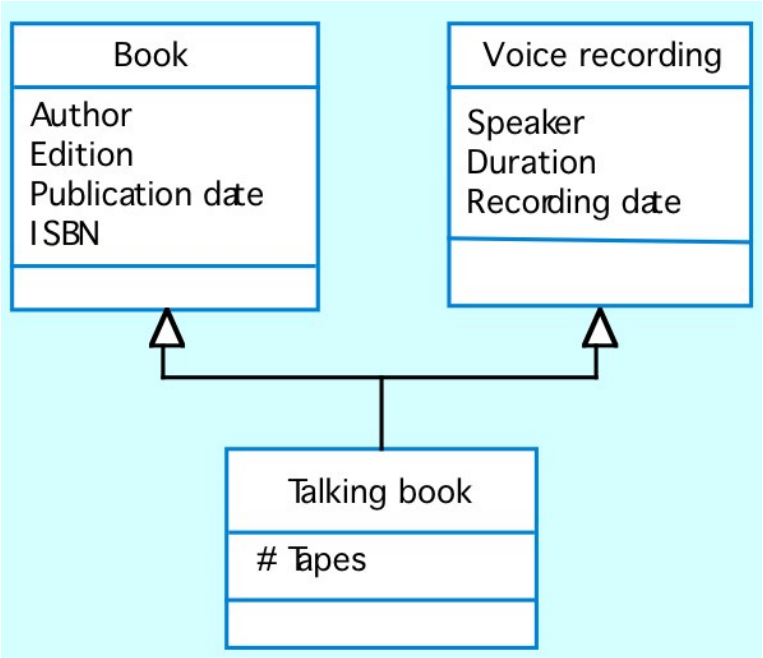

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  - *more problematic at programming stage*

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