



Informatics 43

LECTURE 9

“HOW DO WE STRUCTURE THE SOFTWARE IN DETAIL? (PART 1)”

Last lecture



- An architectural style is
 - a named collection of architectural design decisions that result in beneficial qualities in each resulting system
- Styles: model-view-controller, client-server, layered, peer-to-peer, pipe and filter
(These are not all the styles that exist)
- All successful software evolves
 - We must plan for this
 - Architecture helps us do so

Today's Lecture - **How do we structure the software in detail?**

- Design phase of software engineering
- Designs
- Abstraction

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Software design

Requirements

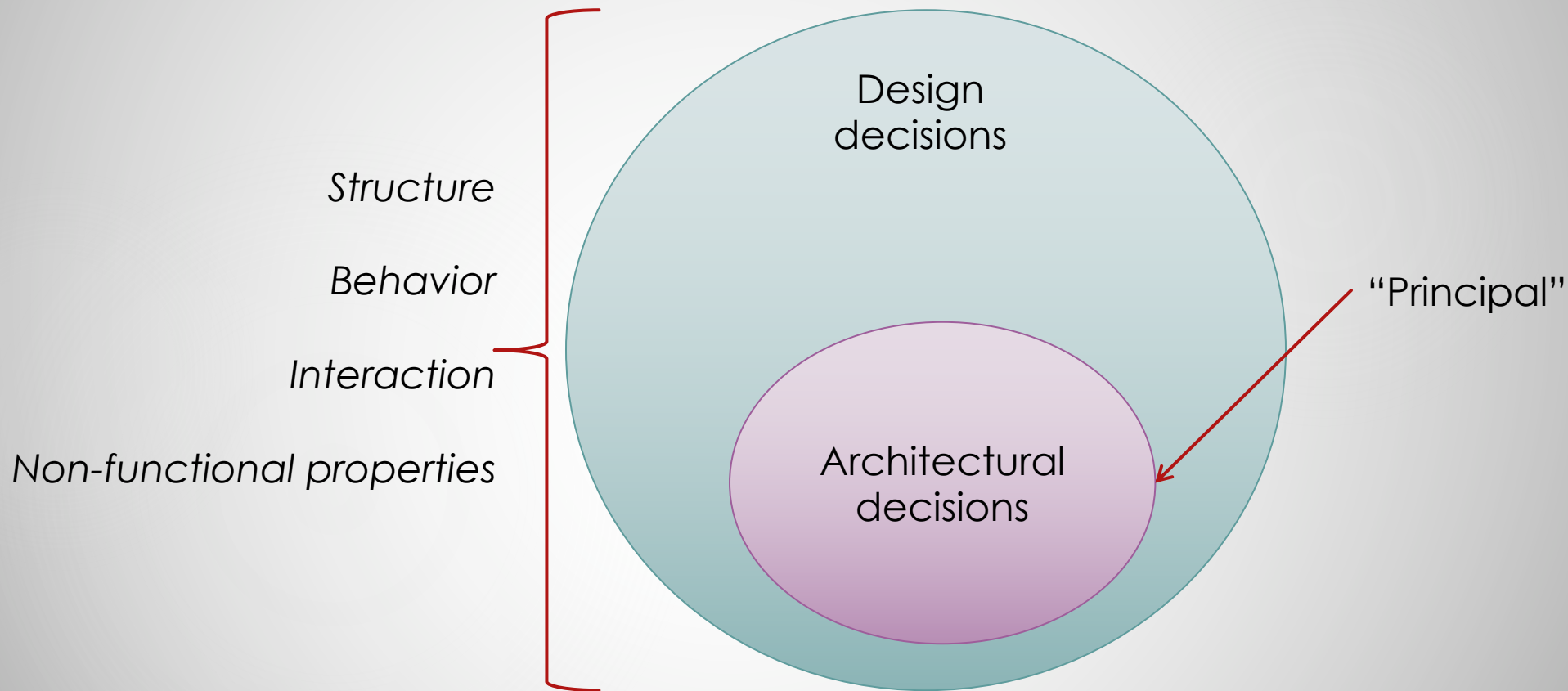


Architecture & **Design**

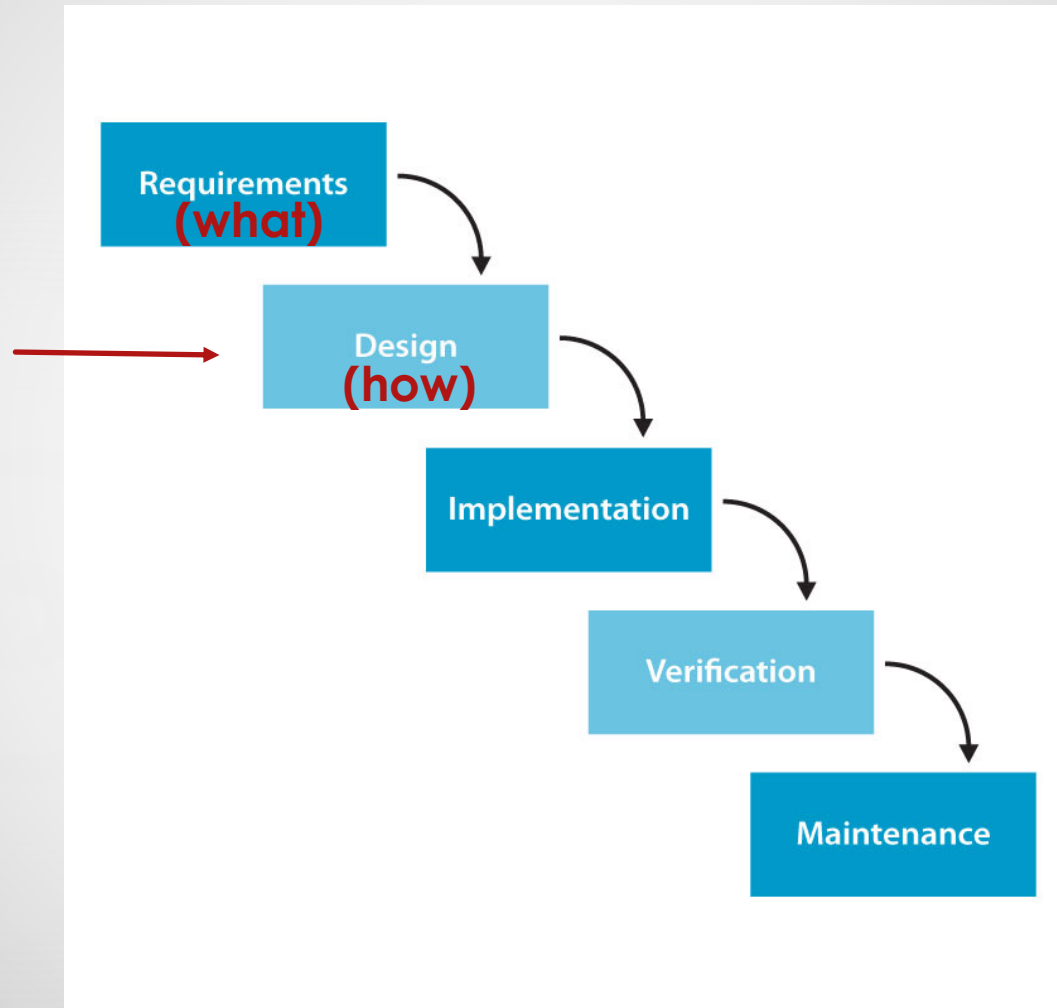


Code

Software design



Design Phase of Software Engineering



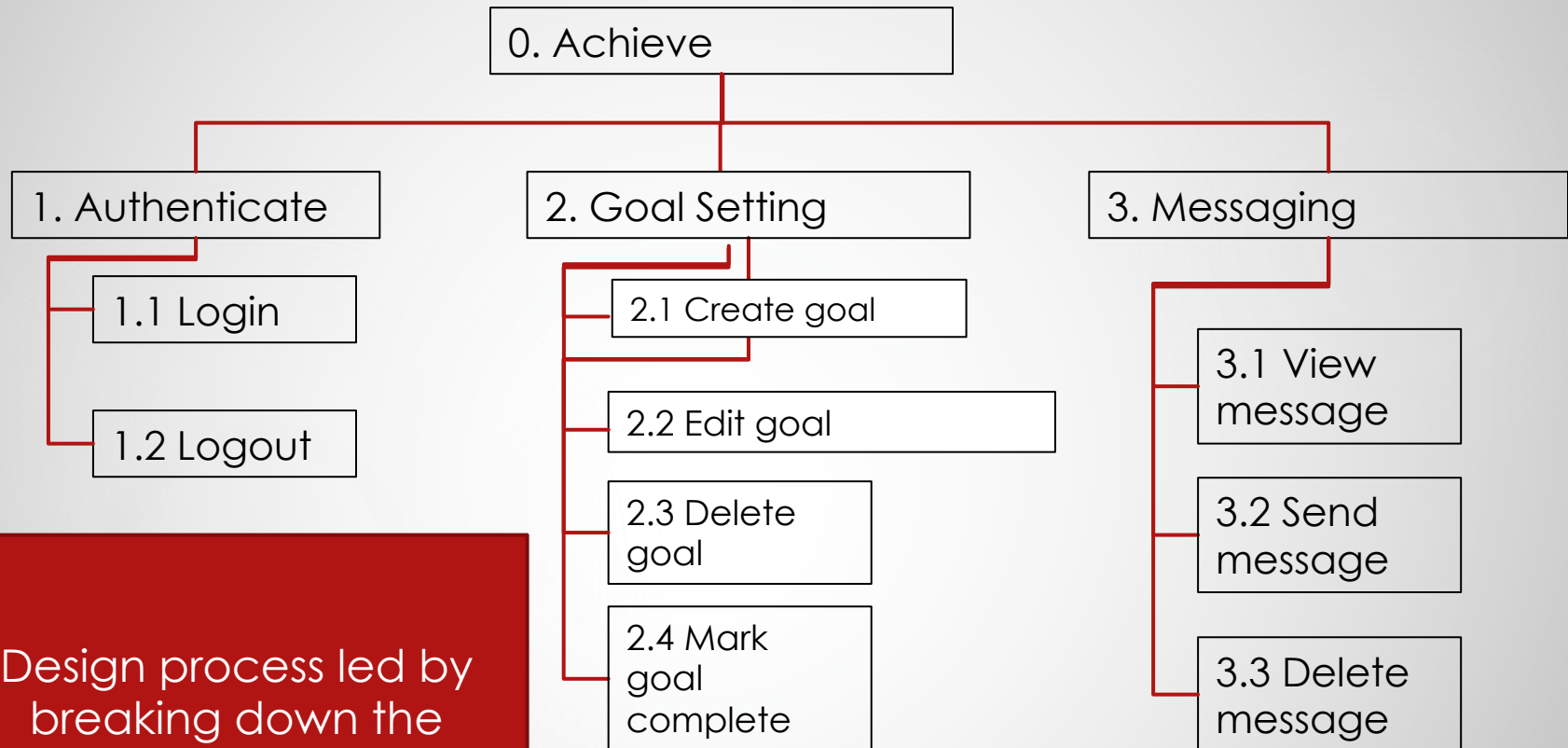
Software Design Goals/Activities

- Making system-wide decisions
 - Architecture, languages, libraries, platforms
- Making lower-level decisions in an *iterative* manner
 - Studying the problem
 - Identifying solutions
 - Creating abstractions
 - Evaluating

Some Approaches to Software Design

- Software architecture
 - Functional decomposition
 - Relational database design
 - Object-oriented design and UML
 - User interface design
-
- (Sketching) – Lecture 10

Functional Decomposition



Design process led by
breaking down the
functionality

Relational Database Design

Hypothetical Relational Database Model

PubID	Publisher	PubAddress
03-4472822	Random House	123 4th Street, New York
04-7733903	Wiley and Sons	45 Lincoln Blvd, Chicago
03-4859223	O'Reilly Press	77 Boston Ave, Cambridge
03-3920886	City Lights Books	99 Market, San Francisco

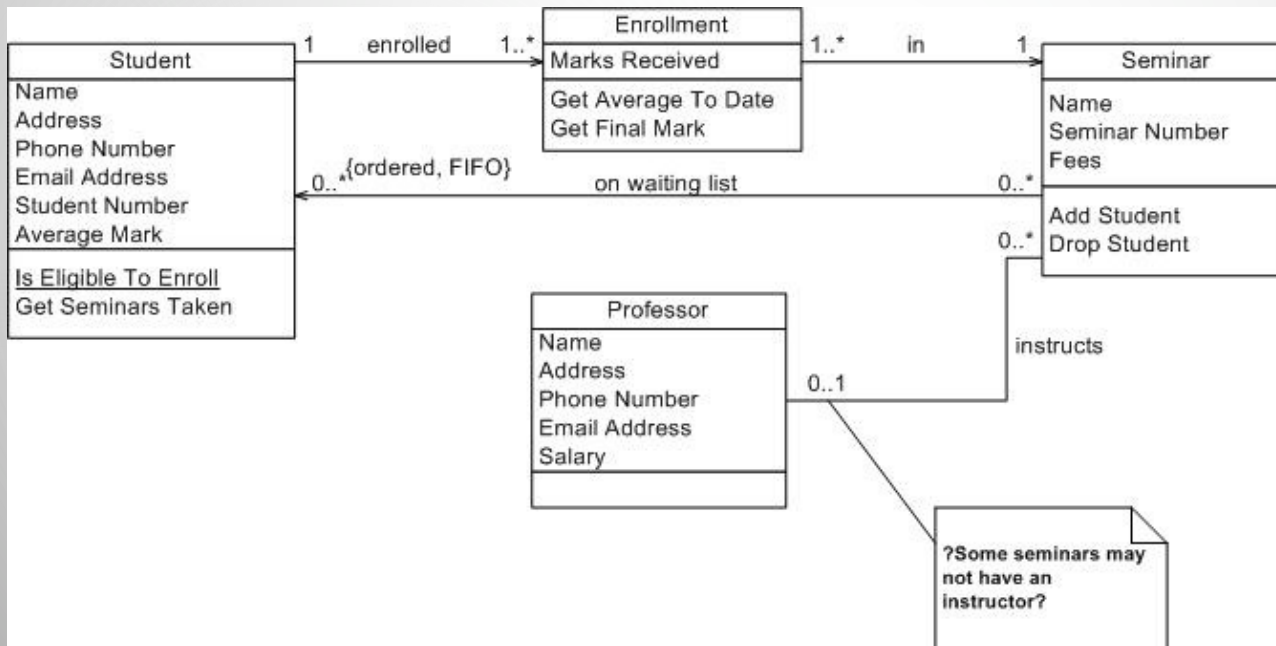
Design process
led by breaking
down the data

AuthorID	AuthorName	AuthorBDay
345-28-2938	Haile Selassie	14-Aug-92
392-48-9965	Joe Blow	14-Mar-15
454-22-4012	Sally Hemmings	12-Sept-70
663-59-1254	Hannah Arendt	12-Mar-06

ISBN	AuthorID	PubID	Date	Title
1-34532-482-1	345-28-2938	03-4472822	1990	Cold Fusion for Dummies
1-38482-995-1	392-48-9965	04-7733903	1985	Macrame and Straw Tying
2-35921-499-4	454-22-4012	03-4859223	1952	Fluid Dynamics of Aquaducts
1-38278-293-4	663-59-1254	03-3920886	1967	Beads, Baskets & Revolution

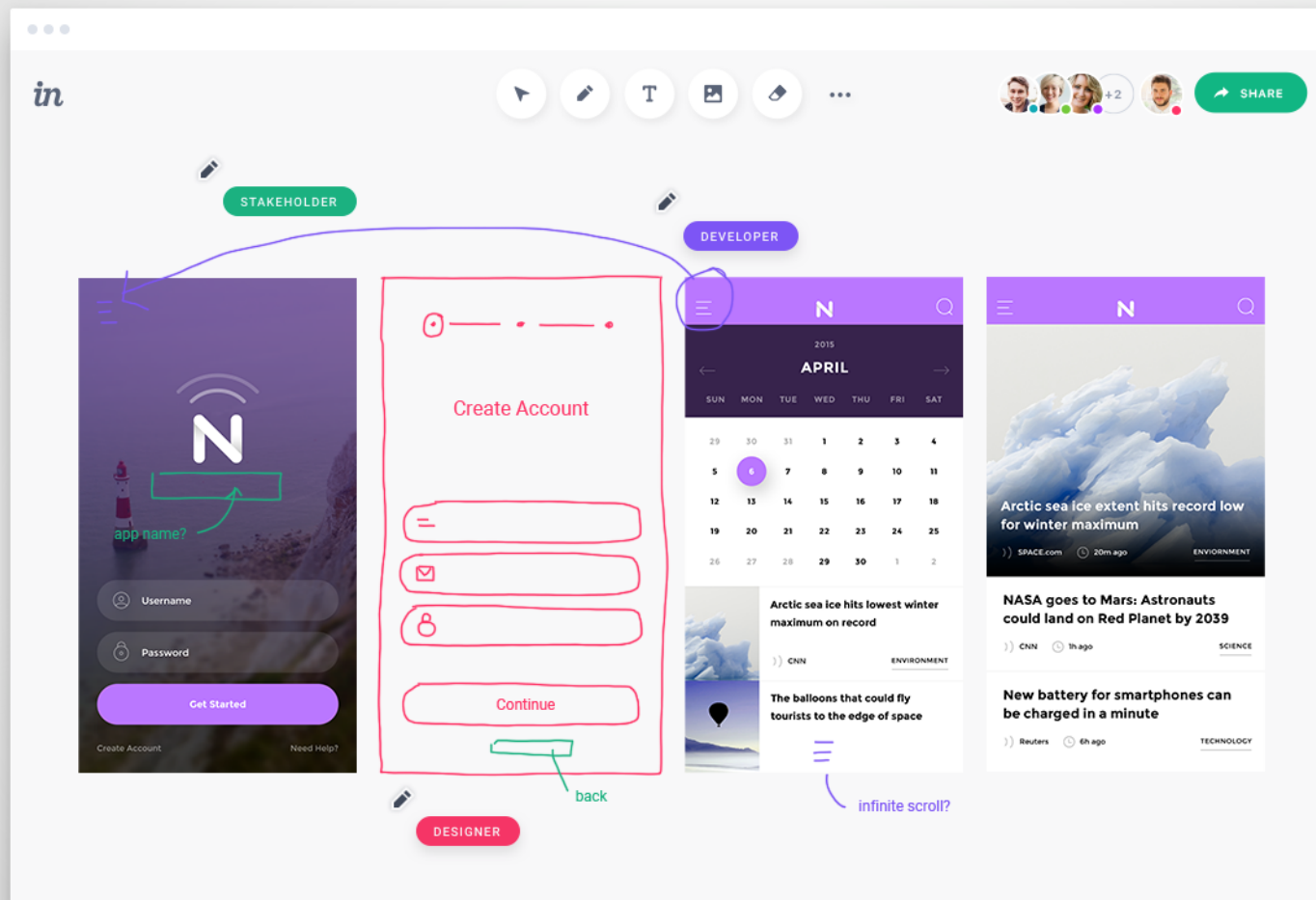
Object-Oriented Design and UML

- An “object” contains both data and methods
- A “class” is a blueprint for making objects



Design process led by breaking down the entities identified in the domain and the functionality that accompanies each entity

User Interface Design

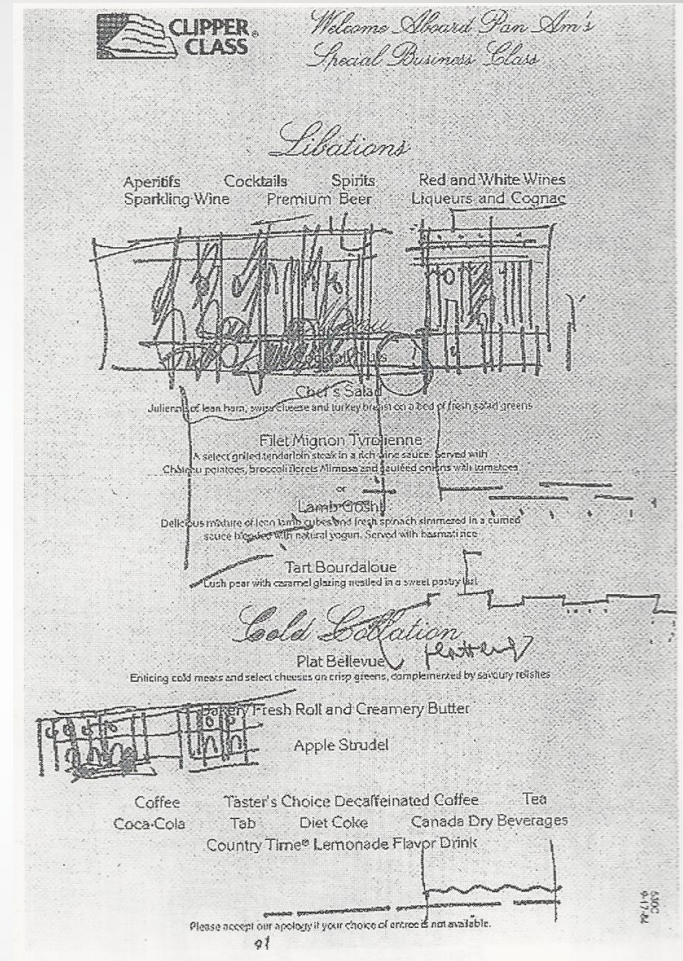
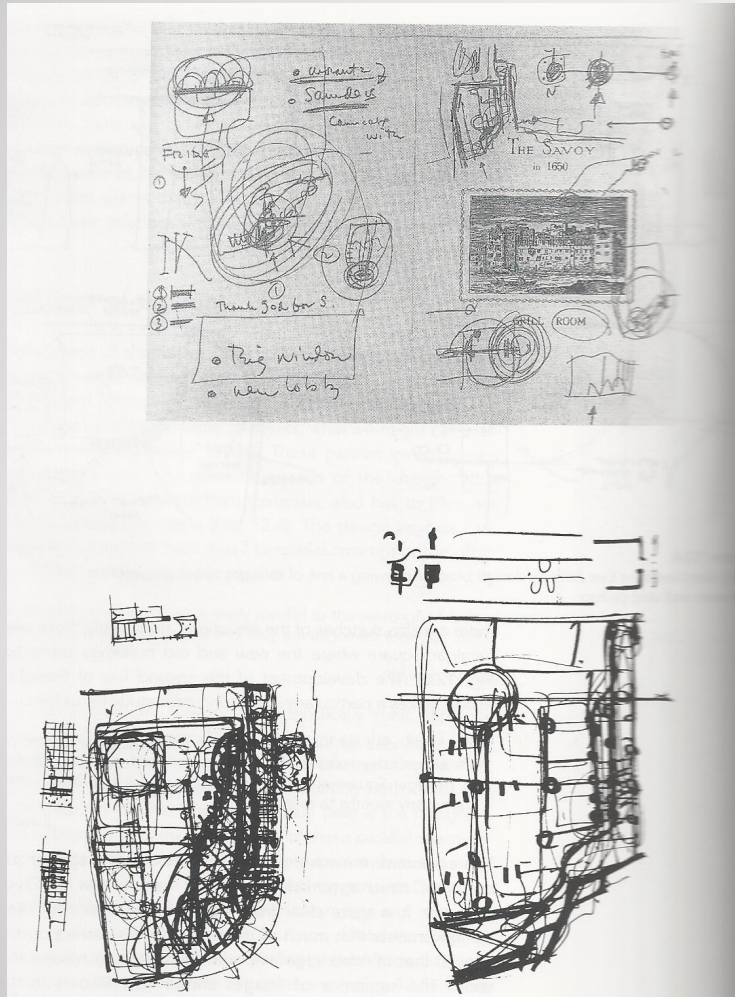


Design process led by envisioning the user interface and iterating

Today's Lecture - How do we structure the software in detail?

- Design phase of software engineering
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- Abstraction

Designs



Designs

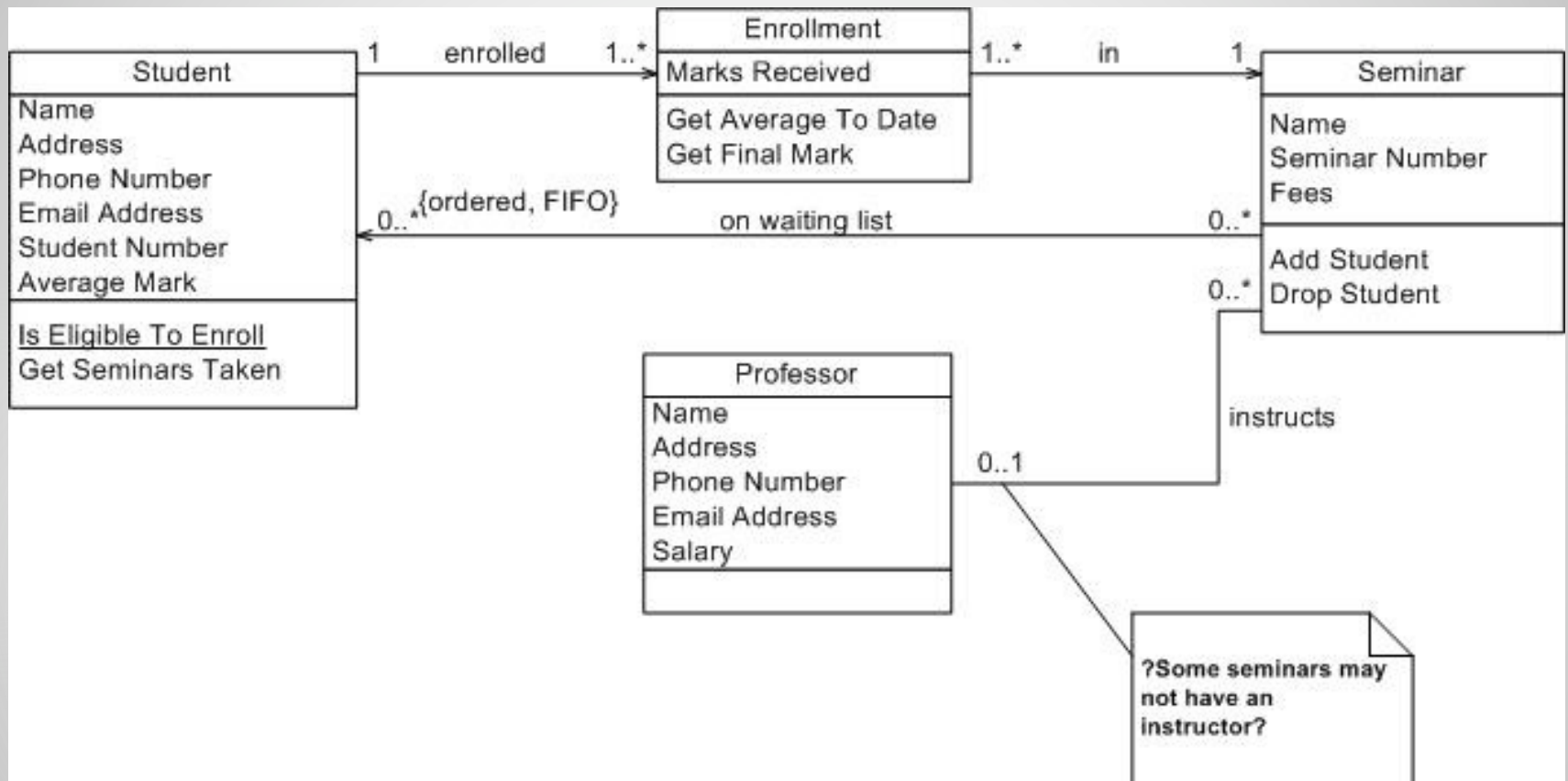


Designs



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Designs/Models



Purpose of designs

- Designs to *think*
- Designs to *talk*
- Designs to *prescribe*

Designs are developed ***iteratively***

Today's Lecture - **How do we structure the software in detail?**

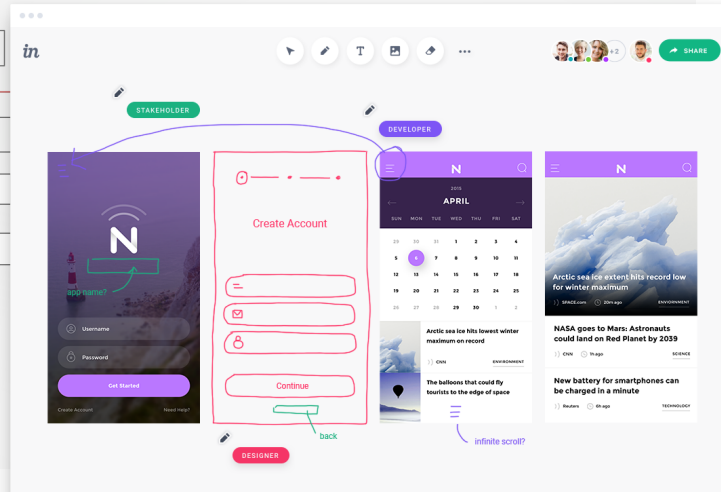
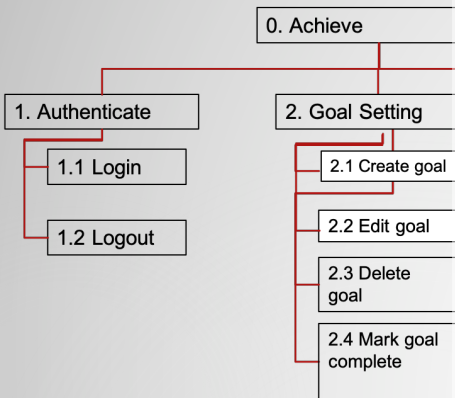
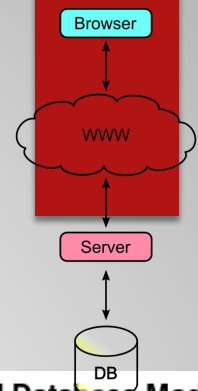
- Design phase of software engineering
- Designs
- **Abstraction**

Abstraction



- Abstractions are formed by removing irrelevant information and retaining/highlighting relevant information
- Every design notation supports a certain kind of abstraction
- Software engineering is all about constructing and elaborating abstractions/models

What do each of these highlight/abstract away?



Hypothetical Relational Database Model

PubID	Publisher	PubAddress
03-4472822	Random House	123 4th Street, New York
04-7733903	Wiley and Sons	45 Lincoln Blvd, Chicago
03-4859223	O'Reilly Press	77 Boston Ave, Cambridge
03-3920886	City Lights Books	99 Market, San Francisco

AuthorID	AuthorName	AuthorBDay
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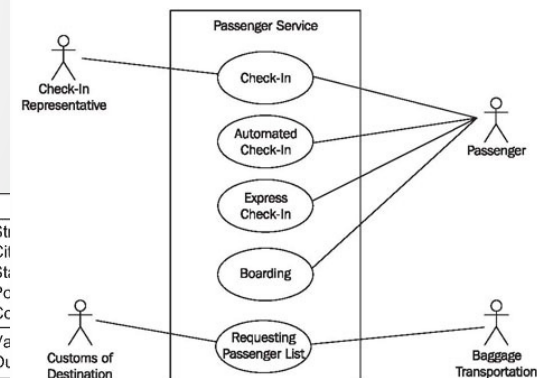
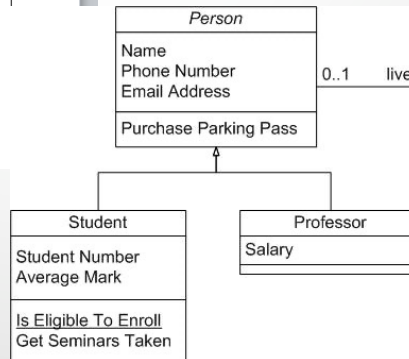
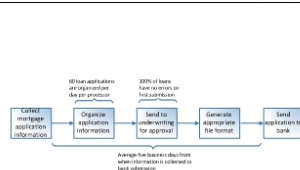
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038278-293-4	663-59-1254	03-3920886	1967	Beads, Baskets & Revolution

Requirements Document

1. Shopping Cart

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada libero, sit amet commodo magna eros quis urna.

Process Flow with XPIM Example- L1



```
state.getActionStateRepository()
    .add((FireAction) action
ruleExec.update(gui, RuleExecuto
"FireDestroyObjectsRuleA
destChecker.update(false, gui);
} else if (action instanceof Purcha
Vector<SSObject> participants =
for (int i = 0; i < participants
SSObject obj = participants.
if (obj instanceof Employee)
    if (menuText.equals("Pur
        ((Employee) obj)
            .setOverhead
    }
} else if (obj instanceof Cu
    if (menuText.equals("Pur
        ((Customer) obj)
            .setOverheadText("Tool(s) have been purchased!");
    }
}
}
state.getActionStateRepository()
    .getPurchaseToolActionStateRepository()
    .add((PurchaseToolAction) action);
ruleExec.update(gui, RuleExecutor.UPDATE_ONE,
    "PurchaseToolEffectRuleA", action);
destChecker.update(false, gui);
}
```

Attendance Quiz

Abstraction of Software Engineering Artifacts

Summary



- Design phase of software engineering
 - The “how” to the “what” of requirements
 - Architecture, functional decomposition, relational database design, OO design/UML, UI design, sketching
- Designs are used iteratively to think, talk, and prescribe
- Software engineering is all about constructing and elaborating abstractions/models

Next time

- Designs, Models, and Notations, Part 2