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Web Technologies and Programming

Lecture 04

Modeling web applications

Implementing and testing web applications

Summary of the previous lecture

- **Introduction to RE**
- **RE basics**
- **Requirements specification**
- **RE process**
- **RE specifics in web engineering**
- **System modeling**
- **Requirement Modeling**
  - **use-case diagram**
  - **activity diagram**

Outline

- Requirement modeling
  - use-case diagram
  - activity diagram
- Content modeling
- Navigation modeling
- Presentation modeling
- Technologies for web applications
- Testing web applications

1. Content modeling

- The information provided by a web application is one of the most important factors for the success of that application
- Content modeling aims at modeling the information requirements of a web application
  - diagraming the structural and behavioral aspects of the information
  - ignores the navigational information

1. Content modeling

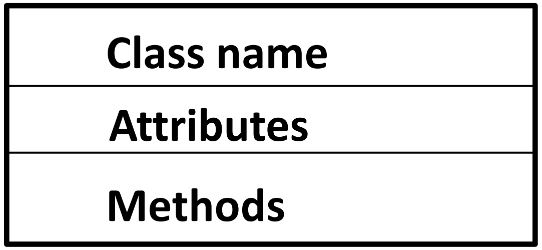
- **Key models**
  - **Class diagram:** to model the structural aspects of information
  - **State machine diagram:** to model behavioral aspects of information

1.1 Class diagram

- **Class diagram describes the structure of a system by**
  - system's classes
  - class attributes
  - operations (methods)
  - relationship among objects

1.1 Class diagram…

- **Elements of a class diagram:**
- **class:**
  - – **class is represented by a rectangle with three compartments**
    - **name**
    - **attributes**
    - **methods**



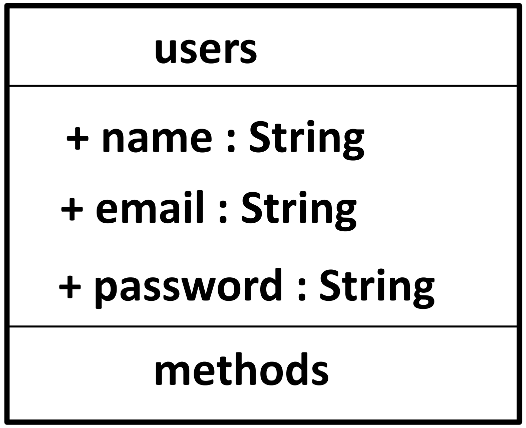
Class name

Attributes

Methods

1.1 Class diagram…

- **Elements of a class diagram:**
- **Adding attributes:**
  - an attribute describes a piece of information that an object owns
    - specified by name
    - kind (data type)
    - visibility (+, - , #)
    - default value
    - visibility name : type= default value
      - + name : string = ‘ali’ {maximum 25 characters}



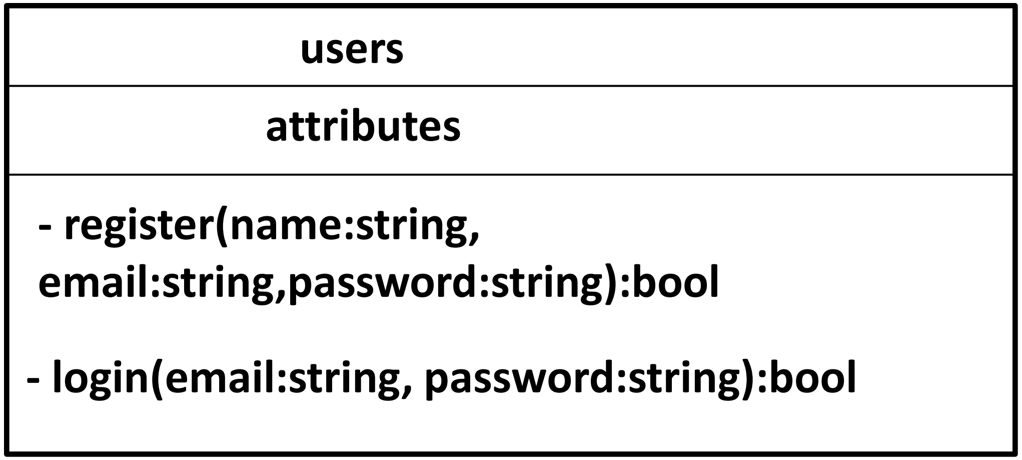
users

+ name : String
+ email : String
+ password : String

methods

1.1 Class diagram…

- Elements of a class diagram:
- Adding methods (functions):
  - – behaviors (things objects can do or can be done with them)
    - name
    - arguments
    - visibility (+, - , #)
    - return value
    - visibility name (argument_name:type): return_value
      - – + userLogin(email:string, password:string):null



users

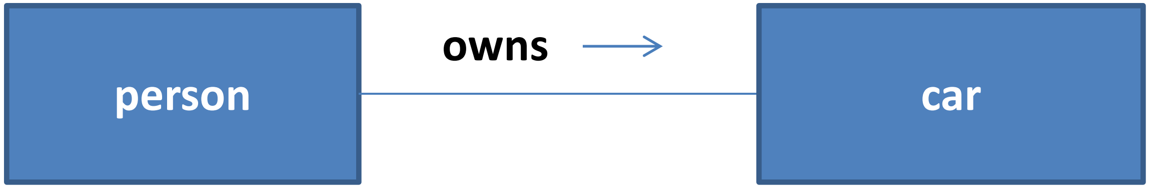
attributes

- register(name:string, email:string,password:string):bool

- login(email:string, password:string):bool

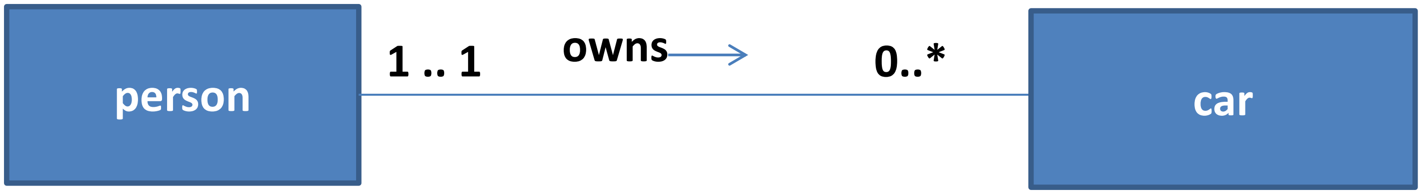
1.1 Class diagram…

- **Elements of a class diagram:**
- **Association**
  - – relationship between classes
    - name of relationship
    - direction of relationship



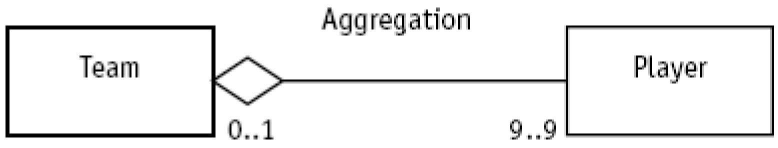
1.1 Class diagram…

- Elements of a class diagram:
- Association multiplicity
  - How many objects participating in the relation



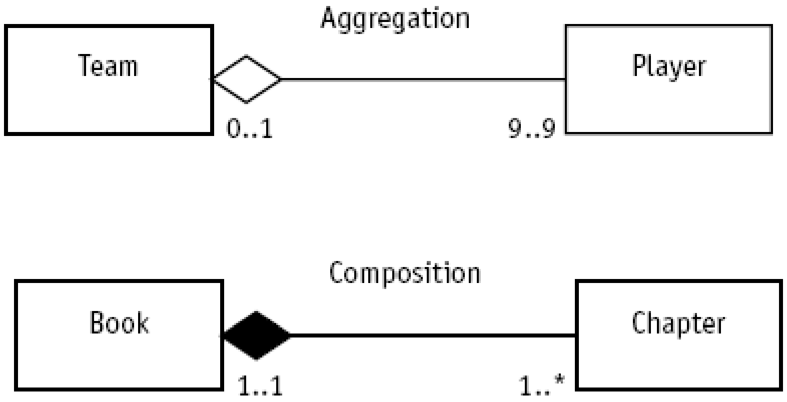
1.1 Class diagram…

- **Elements of a class diagram:**
- **Aggregation relation**
  - – **class has features of another class plus some own features**

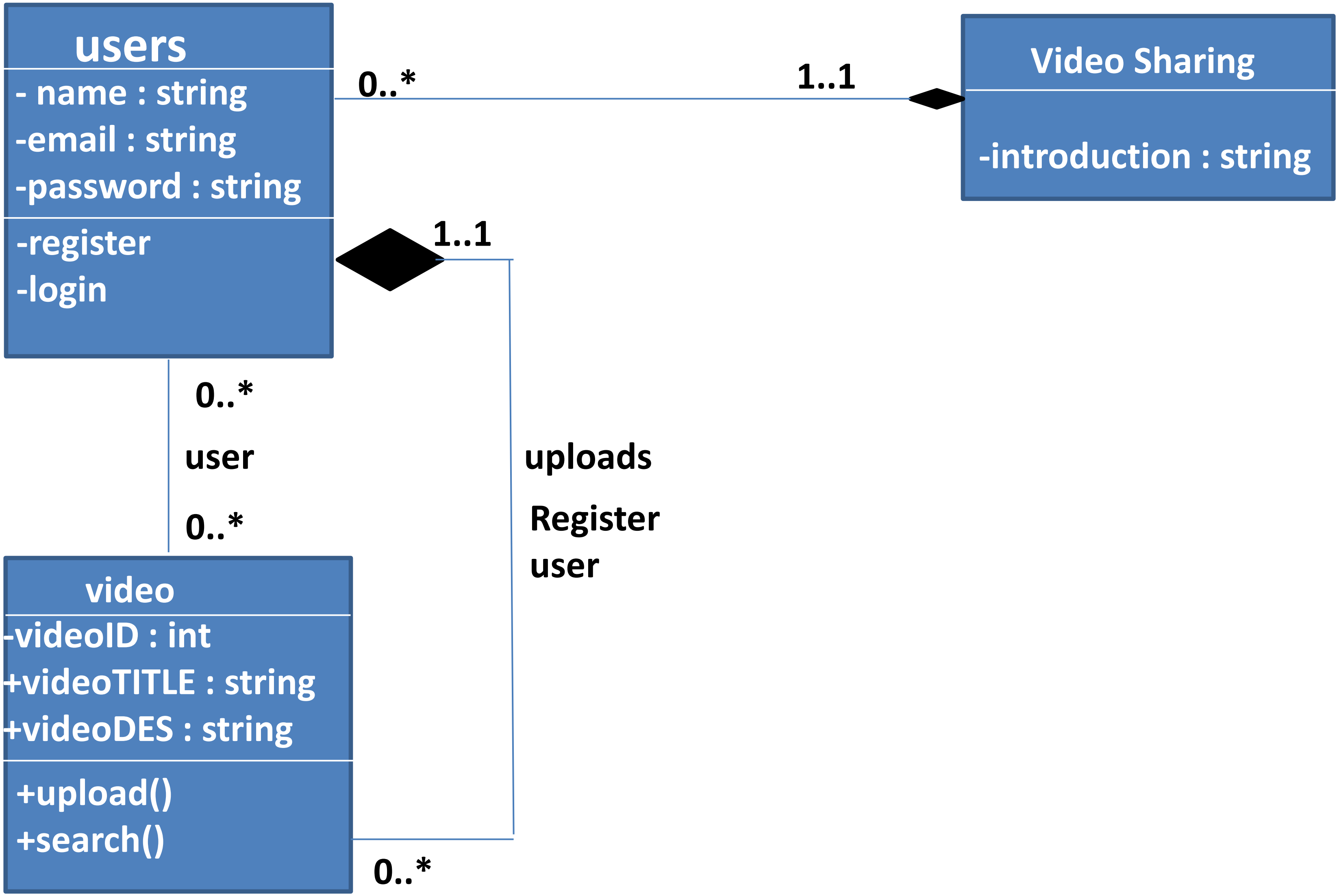


1.1 Class diagram…

- **Elements of a class diagram:**
- **Composition relation**



1.1 Class diagram…



users

- name : string
-email : string
-password : string

-register
-login

Video Sharing

-introduction : string

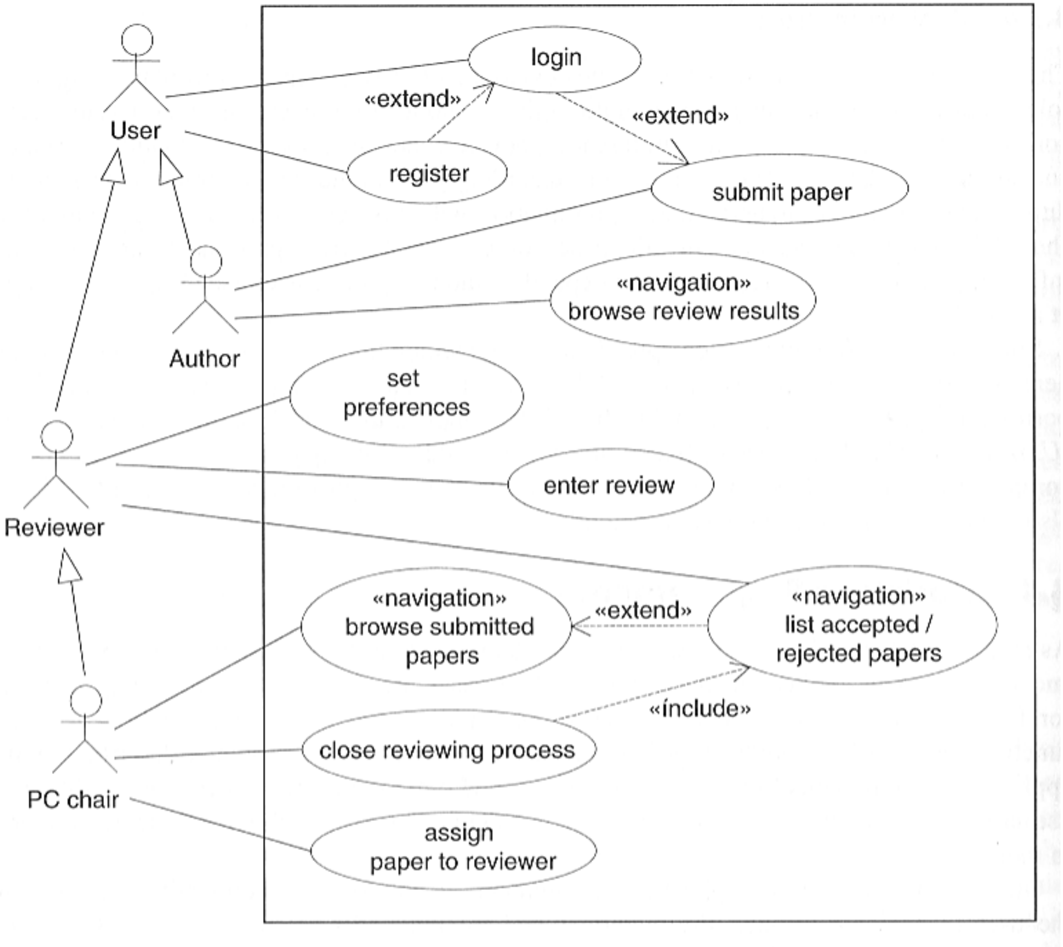
video

-videoID : int
+videoTITLE : string
+videoDES : string

+upload()
+search()

1.1 Class diagram…

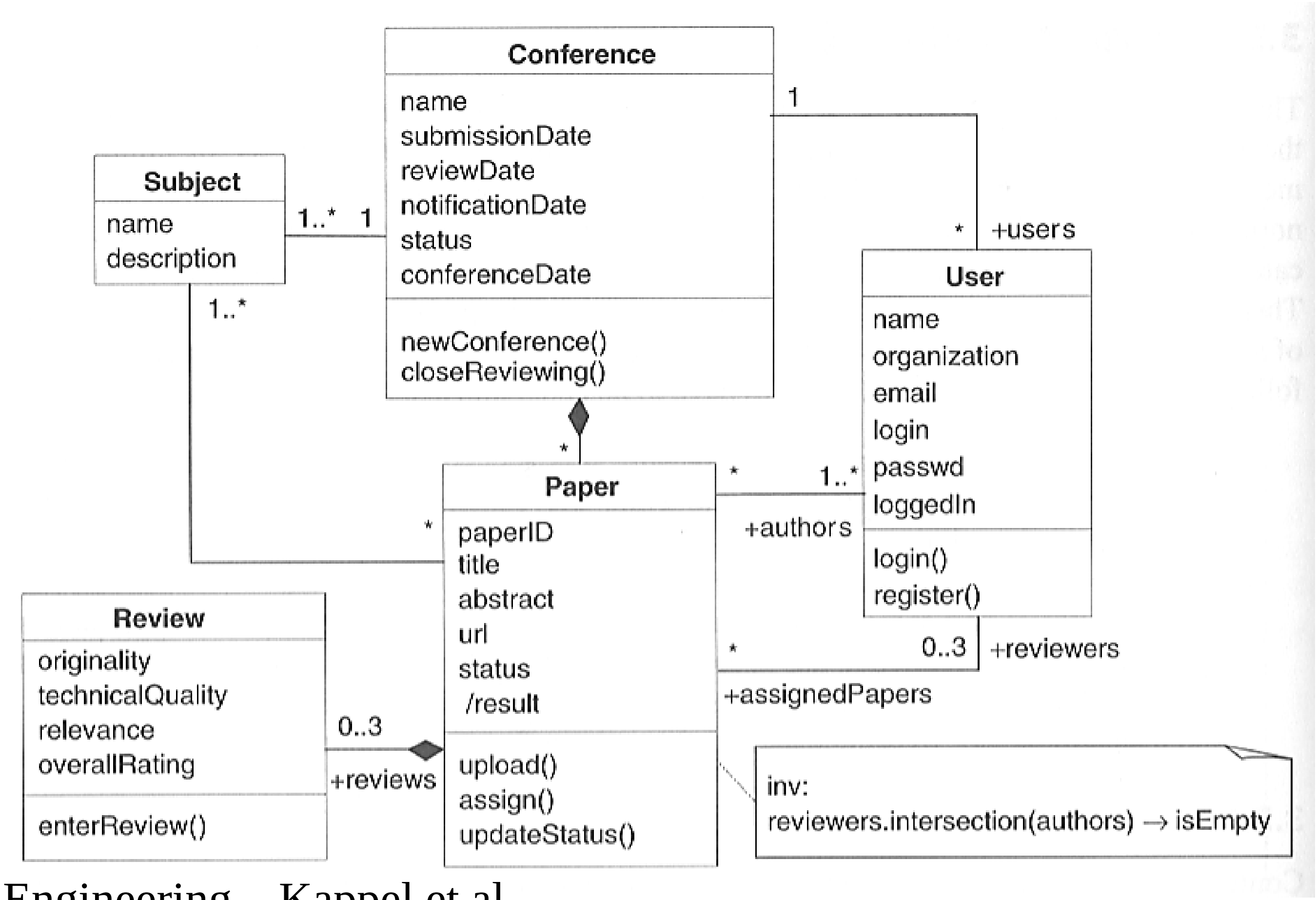
- Use-case diagram : Conference Paper Submission



Source: Web Engineering – Kappel et al.

1.1 Class diagram…

- **Conference Paper Submission System**



Source: Web Engineering – Kappel et al.

2. Navigation Modeling

- Models how web-pages are linked together
  - defines the structure of the hypertext
    - Which classes of the content model can be visited by navigation
  - Content to navigation
  - http://uwe.pst.ifi.lmu.de/teachingTutorialNavigation.html

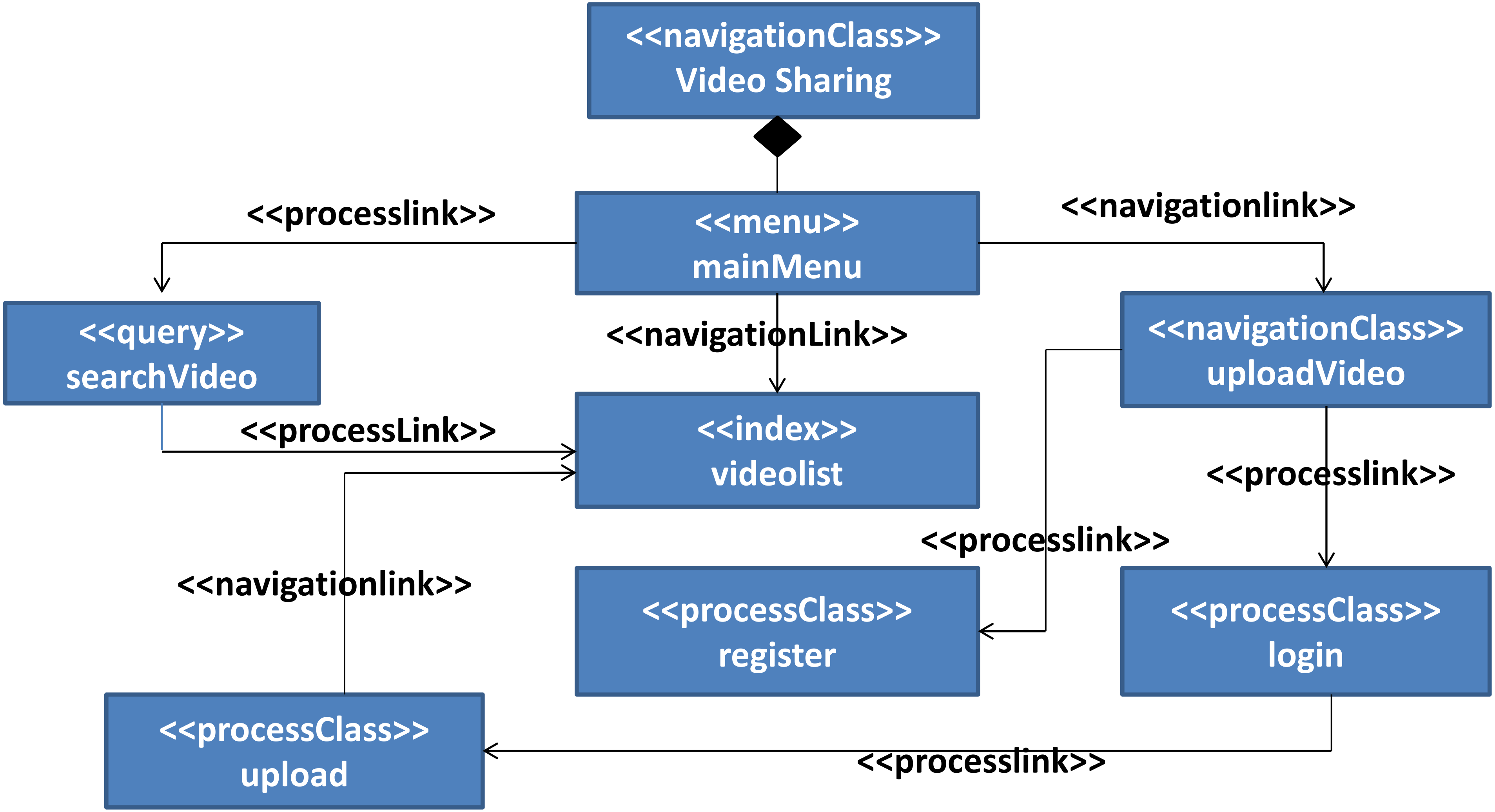
2. Navigation Modeling…

- **UWE navigation modeling**
  - navigationClass □
  - menu ▤
  - Index ≡
  - query ⍰
  - processClass ⋙
  - Processlink
  - Navigation link
  - External link ⍈

2. Navigation Modeling

- Online video sharing:
- Home page
  - video list
  - search video
  - upload video
    - register
    - login
      - upload

2. Navigation modeling…



<<navigationClass>>
Video Sharing

<<processlink>>

<<menu>>
mainMenu

<<navigationlink>>

<<query>>
searchVideo

<<navigationLink>>

<<navigationClass>>
uploadVideo

<<processLink>>

<<index>>
videolist

<<processlink>>

<<processlink>>

<<navigationlink>>

<<processClass>>
register

<<processClass>>
login

<<processClass>>
upload

<<processlink>>

3. Presentation Modeling

- **Purpose: To model the look & feel of the Web application at the page level**
- **The design should aim for simplicity and self-explanation**
- **Describes presentation structure:**
  - **Composition & design of each page**

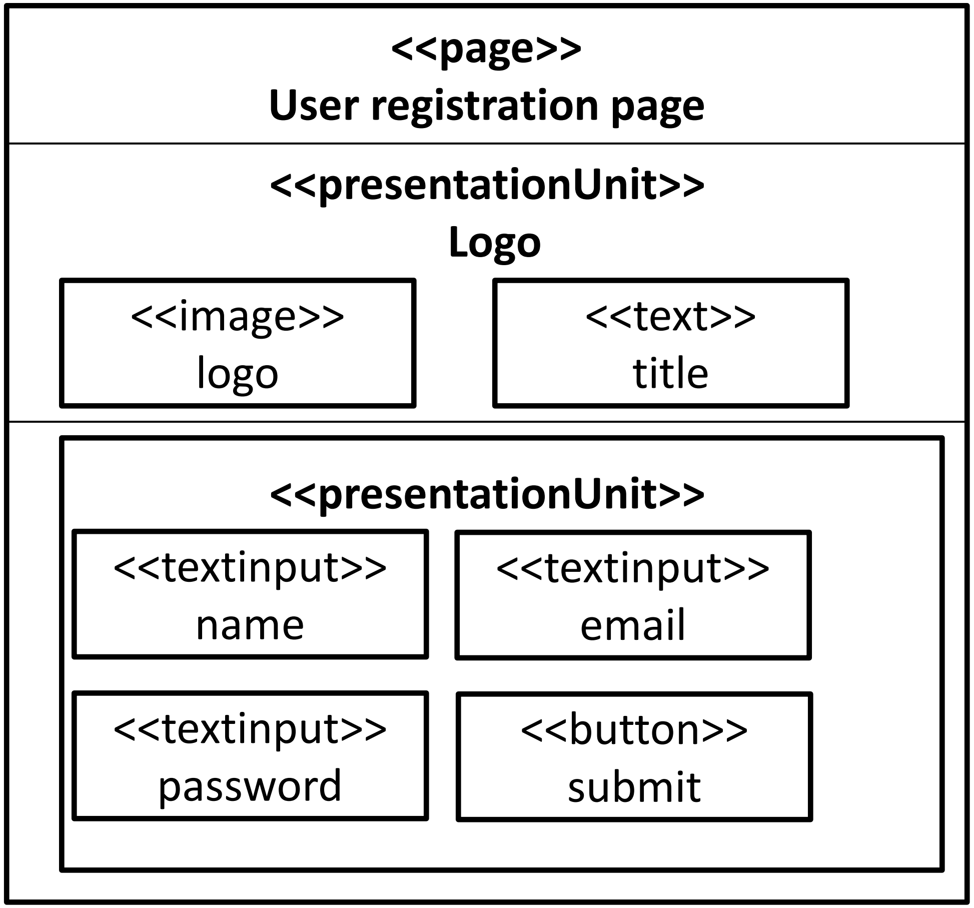
3. Presentation Modeling…

- **Levels:**
- **Presentation Page**
  - **page container**
- **Presentation Unit**
  - **A fragment of the page logically defined by grouping related elements**

3. Presentation Modeling…

- Levels:
- Presentation Element
  - A unit’s informational components
  - Text, images, buttons, fields

3. Presentation Modeling…



<<page>>
User registration page

<<presentationUnit>>
Logo

<<image>>
logo

<<text>>
title

<<presentationUnit>>

<<textinput>>
name

<<textinput>>
email

<<textinput>>
password

<<button>>
submit

Implementing and testing web applications

1. Technologies for web applications

- When we have decided the ‘What’ of the web application i.e.
  - requirements are defined
  - system architecture is decided
  - system model and design is ready
- We are ready for ‘how’ i.e. to implementation phase

1. Technologies for web applications…

- **The implementation phase begins with deciding the technologies for development**
- **Technologies for web application development concerns within three 'views'**
  - **request (client)**
  - **response (server)**
  - **rules for communication between them(protocols)**

1.1 client/server communication on the web

- Client/server paradigm forms the backbone between the user and the application
- This communication model is based on two-layer architecture
- How ever the web server integrates additional systems i.e. database server, application server etc.
- Several protocols play an important role to guide this communication

1.1 client/server communication on the web

- SMTP- simple mail transfer protocol:
- SMTP along with POP3(post office protocol) or IMAP (internet message access protocol) allows us to send email
- RTSP- real-time streaming protocol:
- Designed to facilitate delivery of multimedia data in real time
  - allows transmission in timely manner instead of whole

1.1 client/server communication on the web

- **HTTP- hyper text transfer protocol:**
- **Most popular transport protocol for web contents**
  - **a text based stateless protocol**
  - **controls how resources are accessed**
  - **resources are addressed by URL**
  - **URL is used with domain name system to find the server where the resource is located**

1.1 client/server communication on the web

- Session tracking:
- Web applications must be able to distinguish requests by multiple simultaneous users
  - also need to identify request from the same user
- The term session is used to define a sequence of HTTP requests between a specific user and the server
- Whenever a user sends a request to the server, it identify itself with session id

1.2 Client-side technologies

- Helper program and plug-in:
- Applications that can add functionality to browsers
- When the browser receives a media type included in the helper program or plugin list, the media file is forwarded to external program
- Installed by the user

1.2 Client-side technologies

- Java applets:
- Java applets are programs written in Java that are loaded dynamically into the browser
  - have controlled access to system resources after checking security policies
- Applets are loaded by server and executed in browser within JVM
- Can run on all platforms with a JVM

1.2 Client-side technologies

- Client side scripting:
- Refers to the class of computer programs on the web that are executed at client-side, by the user's web browser
- Usually embedded in HTML code
- Browser interpret several client side scripting
- Used to add dynamic affects in HTML page

1.3 Document specific technologies

- HTML- hypertext markup language
- HTML describes the element
  - to mark contents
  - Hypertext
- Defines a large number of tags to denote different semantics

1.4 Server side technologies

- URL handlers:
- special applications used to process HTTP requests and to deliver a requested resource
- Client request for a resource by URL
  - takes the request and forwards it for execution
  - result of this execution is then returned to the web server

1.4 Server side technologies…

- Server side scripting:
- Are executed by the web server when the user requests a document
- Usually embedded in HTML code
- Server-side scripts require that their language's interpreter be installed on the server

2. Testing web applications

- Testing is an activity conducted to evaluate the quality of a product and to improve it by identifying defects and problems
- If we run a program with the intent to find errors, then we talk about testing
- By testing we determine the quality state of the system
  - which provides a basis for improvement

2. Testing web applications…

- We say that an error is present if the actual result from a test run does not comply with the expected result
  - each deviation from the requirements definition is an error

2. Testing web applications…

- Objectives:
- Finding error instead of showing their absence (defect testing)
  - if no error is found it does not mean that there is no error
  - a test run is successful if errors are detected
- To demonstrate to the developer and the customer that the software meets its requirements (validation testing)

2. Testing web applications…

- Testing Levels:
- Unit tests: test the smallest testable units (Web pages, etc.), independently of one another
- Unit testing is done by the developer during implementation

2. Testing web applications…

- **Testing Levels:**
- **Integration tests:** evaluate the **interaction** between distinct and separately tested units once they have been integrated
- Integration tests are performed by a tester, a developer, or both jointly

2. Testing web applications…

- **Testing Levels:**
- **System tests:** test the complete, integrated system
- System tests are typically performed by a specialized test team

2. Testing web applications…

- **Testing Levels:**
- **Acceptance tests:** evaluate the system in cooperation with the client
- Acceptance tests use real conditions and real data
- The client will test it, in their place, in a near-real-time or simulated environment.
- **Beta tests:** let users work with early versions of a product with the goal to provide early feedback

2. Testing web applications…

- **Web application testing:**
- **Link testing**
- **Browser testing**
- **Usability testing**
- **Load, stress and continuous testing**
- **Security testing**
- **Content testing**

2. Testing web applications…

- **Link testing:**
- **Goals:**
  - **broken links (linked document does not exist)**
  - **orphan pages (page does not link any other page)**
- **Strategy:**
- **All links are systematically visited**

2. Testing web applications…

- **Browser testing**:
- Goals:
- Try to find **errors** in web application due to **incompatibilities** between different Web browsers
- Strategy:
- Test application on all popular combinations (browser, version, operating system)

2. Testing web applications…

- Usability testing:
- Goals:
- Evaluate ease-of-use, lay-out and navigation structure
- Strategy:
- By a set of representative users
- By one or more HCI specialists

2. Testing web applications…

- **Load testing:**
- **Goals:**
- **system meets response time requirements**
- **Strategy:**
- **Identify load profile**
- **Identify response time**
- **Perform the test**

2. Testing web applications…

- Stress testing:
- Goals:
- system reaches the required response times and the required throughput under stress
- Continuous testing:
- Goals:
- Testing system behavior over a period of time

2. Testing web applications…

- Security testing:
- Goals:
- Regulate access to information, to verify user identities, and to encrypt confidential information
- Strategy:
- A systematic test scheme

2. Testing web applications…

- **Content testing**:
- Goals:
- Test the quality of contents
- Strategy:
- Proofreading

2. Testing web applications…

- **Challenges in web testing:**
- Content testing requires costly manual measures
- Usability is difficult to measure
- Divers platforms (devices, operating environment)
- Globality (understanding cultural differences)
- Dominance of change makes is more challenging

Summary

- **Content modeling**
  - **class diagram**
  - **state machine diagram**
- **Navigation modeling**
- **Presentation modeling**

Summary

- **Technologies for web development**
- **Protocol**
  - client-side technologies
  - server-side technologies
- **Testing web applications**
  - Objectives
  - Levels
  - Web application specifics
  - challenges

THANK YOU