Web Application Architectures

CS-477 Web Engineering

Web
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Fundamentals

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Architecture

- No unique definition of architecture.
- Important properties of an architecture are:
  - Architecture describes structure
  - Architecture forms the transition from analysis to implementation
  - Architecture can be looked at from different viewpoints
  - Architecture makes a system understandable
 - Architecture represents the framework for a flexible system

Patterns

- describe recurring design problems, which arise in a specific design context, and propose solutions
- A solution describes the participating components, their responsibilities, the relationship between these components, and the interplay of these components within the specific problem.
- Architecture patterns: They describe architectural subsystems, their responsibilities, relationships, and interplay.
- Design patterns: These patterns describe the structure, the relationships, and the interplay between components to solve a design problem within a defined context.
- Idioms: describe patterns that refer to a specific implementation in a programming language

Frameworks

- A framework is a reusable software system with general functionality already implemented.
- The framework serves as a blueprint for the basic architecture and basic functionality for a specific field of application

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Different factors and constraints influence the architecture development

Categorising architectures
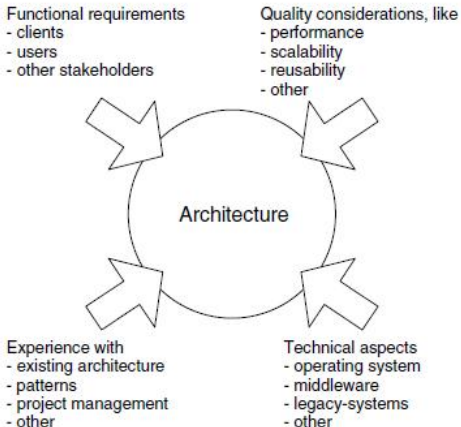
- Different views on how to categorise architectures

Layering aspect

- Based on the concept of separation of Concerns by dividing the application in multiple tiers
- Distributed systems and Web applications frameworks are based on this concept

Data aspect

- Data can be structured or non-structured
- Structured data follows a well-define schema like relational database or XML documents
- Non-structured data includes multimedia content i.e., images, audio and video

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2-Layer architecture

- Also called client/server architecture, a Web server provides services to a client (browser)
- 2-layer architecture can take different forms within a Web application environment
- Mostly used for simple Web applications

Figure: 2 layer architecture
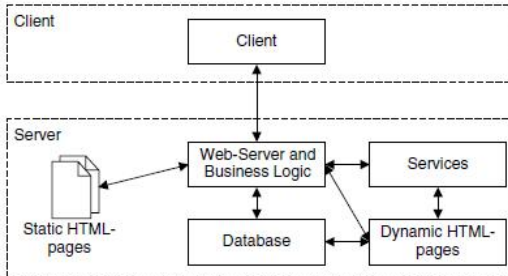
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N-Layer Architecture

- A Web application can be organised in different no. of layers
- Mostly consist of three layers
- Data layer gives access to application data (database management system)
- Business layer hosting the business logic of the application in an application server
- Presentation layers presenting the results of the request in a suitable/desired output format
- Application server provides various service components
- Moreover, application server also provides load balancing and distribution features

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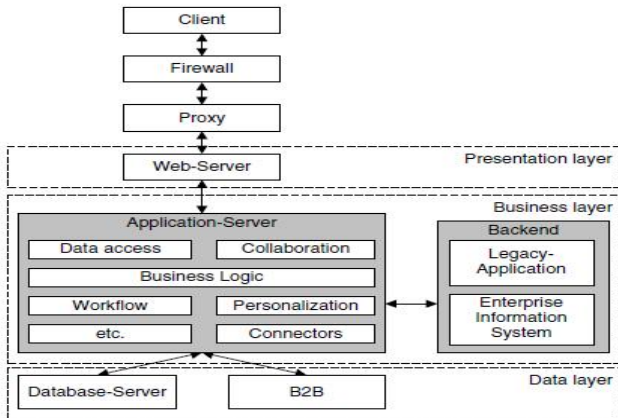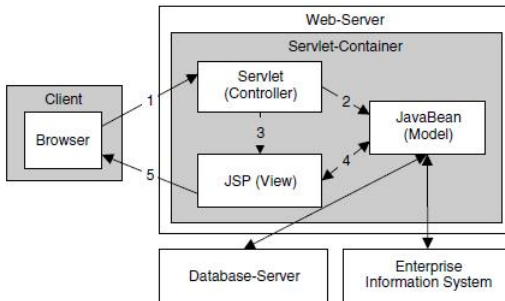# N-Layer Architecture

Figure: N-Layered architecture

Figure: JSP 2.0 model

- Java Server Pages 2 implements MVC pattern for Web applications
- Integrates navigation aspects, internationalisation, and multi-platform delivery in Web applications
- Deployed on a Web server extension - servlet container
- The controller i.e., flow and control logic of the Web application is implemented in the form of a servlet
- **Servlets** are software components which run in the servlet container
- **JavaBeans** present the application data
- **Java Server Pages(JSP)** are used for presentation

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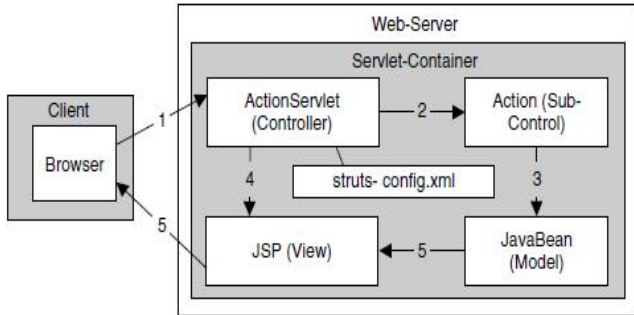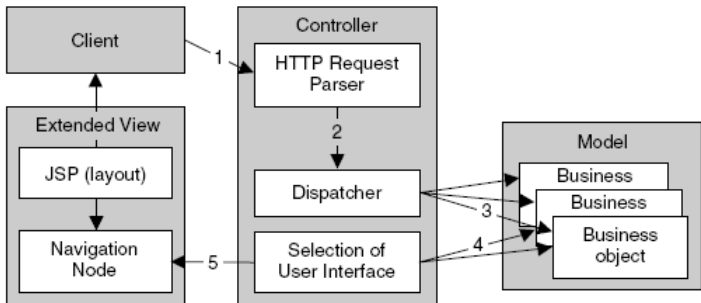architectures

Struts

Figure: JSP-Model-2 implementation in struts

- An open-source project by Apache Software Foundation project
- Enhances JSP-Model-2 architecture
- Struts offers error handling and internationalisation
- Struts uses an XML configuration file for control of the processing

OOHDM-Java2

- OOHDM (Object Oriented Hypermedia Design Method) is a method for the development of Web applications
- First to introduce the concept of seperation of concerns
- OOHDM-Java2 approach maps the OOHDM navigational model onto J2EE platform

Integration architectures

- Integration of existing systems and external resources (external partners' resources) can be carried out at three levels

    - Presentation level, application logic level and content level

- Enterprise Integration Architectures (EAI) generally address integration at the application logic level and content level

- EAI has emerged from the field of business-to-business integration. This integration can be implemented in any of the following manner:

    - Point-to-point
    - Data delivery
    - Data integration
    - Delivery of functionality
    - Reconstruction of functionalists
    - Porting

EAI architecture

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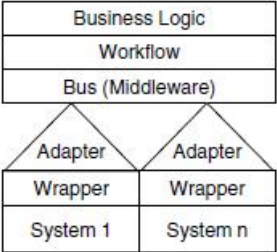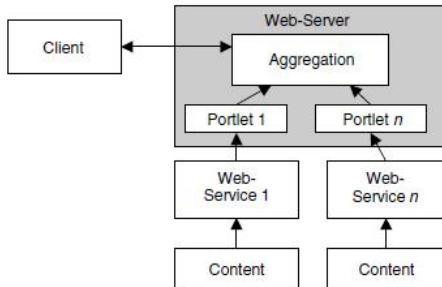architectures

Figure: An example of an EAI Architecture

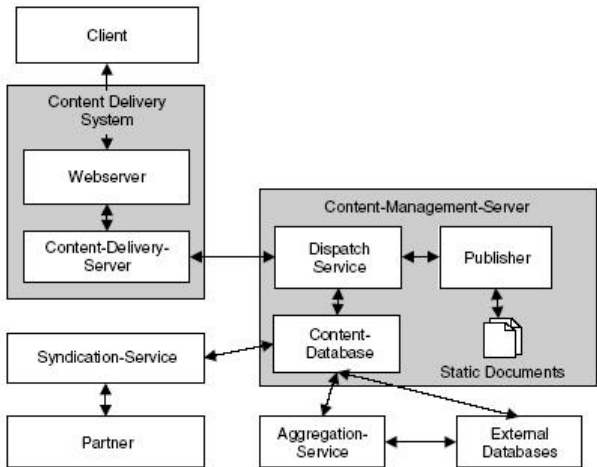Figure: Portal-oriented Web application architecture

Database-centric architectures

- No. of tools and approaches are available for database integration
- Java database connectivity (JDBC) and Open Database Connectivity (ODBC) are API for database connectivity

Web Document management

- Besides data held in databases and media on media servers, Web applications also process documents
- Content management architectures support the integration of documents from different sources
- A request from a client is passed to a content delivery server by a Web server
- Content delivery server will interact with Content management server to retrieve the required content

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Web Document management

Figure: Content management architecture for Web applications

- Data volume plays an important role when defining multimedia centric Web applications
- Multimedia data can be transmitted over standard Internet protocols like HTTP or FTP
- No additional components are required on the server side
- However it is problematic for users (slow downloads)
- The alternative approach is to use *streaming*
- A client can start playing audio and/or video a few seconds after it begins receiving the media content
- The content is transmitted in real time with required bandwidth available and low jitter
- Multimedia streaming uses 2 protocols 1) one handling transmission of multimedia data 2) controls presentation flow and the transmission of meta-data
- Examples are Real Time Protocol (RTP), which collaborates with a control protocol, the Real Time Streaming Protocol (RTSP)

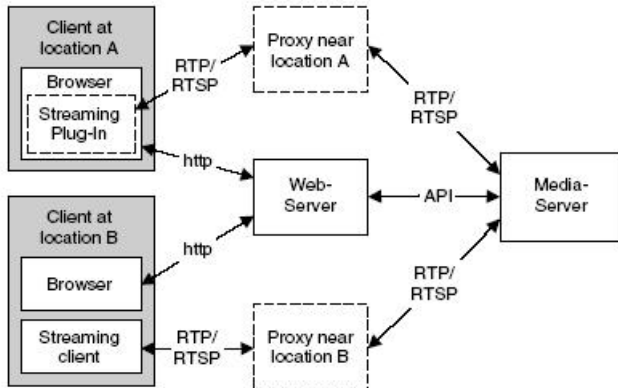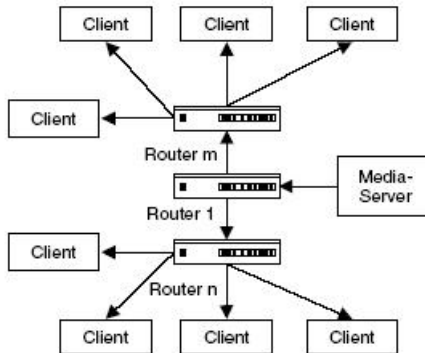Figure: Streaming media architecture using point-to-point connections

Figure: Streaming in broadcasting mode

- Web application development is driven by the new client devices and changing server infrastructures
- Portal oriented applications will continue to be the main stream applications supplemented by the service architectures and Web services
- In view of the above and the peer-to-peer application development, the architectural trends seem to be in the integration architectures.

1. Chapter 4 "Web Application Architectures"
2. Further see Apache Cocoon 2 framework from
   http://cocoon.apache.org/2.1/