

Server-Side Web Development
JSP

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Lecture #3 2007

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Web Technologies

- Markup & presentation (HTML, XHTML, CSS etc)
- Data storage & access (JDBC, XML etc)
- Network & application protocols (TCP/IP, HTTP etc)
- Programming & scripting languages (Java, JSP etc)

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Internet

- Heterogenous network of networks
- More than 1 billion users
- Handles the web, e-mail, file transfers, instant messaging, telecommunication etc

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Internet

- Internet Protocol (IP)
- Packet-oriented
- Uses IP-addresses (130.239.8.60)

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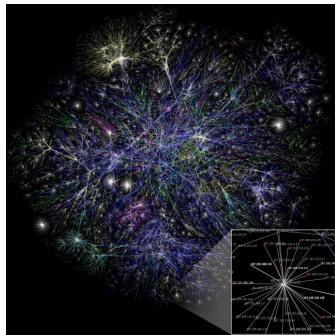
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World Wide Web (WWW)

- Web clients and servers
- More than 1 billion web pages on
- More than 100 million sites
- HTML, graphics and components
- Transferred via HTTP (over TCP/IP)

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Hypertext Markup Language (HTML)

- Text-based
- Content + Markup
- Interpreted and visualized by browsers
- Constitutes a small part of the resulting network traffic

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Extensible Hypertext Markup Language (XHTML)

- XML version of HTML
- Well-formed XML document
- Can be parsed by any XML tool
- Treated by browsers as a new version of HTML

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Uniform Resource Locator (URL)

<http://www.cs.umu.se:80/kurser/5DV076/SOM-07/index.html>

Contains

- Protocol (http)
- Address (www.cs.umu.se)
- Port (80)
- Path (/kurser/5DV076/SOM-07/index.html)

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Universally Unique Identifier (UUID)

20269f4c-9111-4778-8f78-249fea2b2e6e

- Generated from MAC-address, timestamps and random numbers
- Unique to a very high probability
- Used as unique filenames, database ids etc

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Web Client

- Requests resources via HTTP
- Interprets and presents the data retrieved
- Can be anything that requests data via HTTP
- Usually a web browser
- Uses URLs to reference resources

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Web Server

- Serves resources via HTTP
- Can be anything that serves data via HTTP
- Usually a dedicated server software
- May contain several pieces of software working together
- One server may serve several sites (and vice versa)
- Large sites often clustered for performance

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Domain Name System (DNS)

- A network of DNS servers
- Resolves IP-addresses
- www.umu.se = 130.239.8.60
- 130.239.8.60 = www.umu.se

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Proxy

Acts as an intermediary between clients and servers

A web proxy can, e.g.,

- Enforce access control
- Block, filter or alter information
- Cache information
- Anonymize traffic
- Perform network address translation

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Firewall

Regulates traffic between networks

A firewall can, e.g.,

- Enforce access control
- Block, filter or alter connections
- Perform network address translation
- Be stateless, stateful or application-aware

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Actors

```

graph LR
    DNS[DNS] --> CLIENT[CLIENT]
    DNS --> PROXY[PROXY]
    CLIENT <--> PROXY
    PROXY <--> FIREWALL[FIREWALL]
    FIREWALL <--> SERVER[SERVER]
  
```

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Protocols

Specifies how information is exchanged in networks

- In which order
- In what format
- Transport level and application level protocols
- Built in protocol stacks

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TCP/IP

- Packet-switched transport protocols
- Transport: Internet Protocol (IP)
- Reliable: Transmission Control Protocol (TCP)
- Unreliable: User Datagram Protocol (UDP)

- Each computer has (at least one) IP-address
- IP-addresses are resolved using DNS-systems
- Packets are routed from sender to receiver
- Packets can be lost, delayed or arrive in any order

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Hypertext Transfer Protocol (HTTP)

- Text-based
- Application-level protocol (mostly used over TCP)
- Client-driven (requests and responses)
- Stateless (sessions are stored in cookies or rewritten URLs)
- Can handle text as well as binary data (encoded as text)

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HTTP Request

- Request line (method + URI + protocol)
- Headers (request information)
- Body (optional)

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HTTP GET Request Example

```
GET /kurser/5DV076/SOM-07/test.html HTTP/1.1
Host: www.cs.umu.se
```

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HTTP Response

- Status line (protocol + status code + reason phrase)
- Headers (response information)
- Body (response data)

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HTTP Response Example

```
HTTP/1.1 200 OK
Date: Tue, 15 May 2007 14:25:27 GMT
Server: Apache/2.0.54 (Unix)
Accept-Ranges: bytes
Content-Length: 50
Keep-Alive: timeout=15, max=100
Connection: Keep-Alive
Content-Type: text/html; charset=ISO-8859-1

<html>
<head>
</head>
<body>
test
</body>
</html>
```

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HTTP Request Methods

- **HEAD** - simulate a get request
- **GET** - retrieve resource
- **POST** - submit data to resource
- **PUT** - upload resource
- **DELETE** - delete resource
- **TRACE** - echo request
- **OPTIONS** - query server for supported methods
- **CONNECT** - create TCP/IP tunnel



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HTTP HEAD Request

- Used to retrieve meta-information (headers)
- Simulates GET request
- No body (data) in response



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HTTP GET Request

- Used to retrieve resources from web servers
- Parameters stored in query string (limited size)
- Default method for data retrieval



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HTTP POST Request

- Used to submit (form) data to resources
- Data stored in request body
- Default method for data storage



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HTTP PUT Request

- Used to upload resources
- Data stored (encoded) in request body



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HTTP Response Status Codes

Directs client behavior

- 100-199 - informational
- 200-299 - request successful
- 300-399 - resource unavailable / moved
- 400-499 - client-side error
- 500-599 - server-side error



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Server-Side Web Development

- Data access and logic rather than interfaces
- More technical than HTML/CSS design
- Several alternative technology platforms exists
- Dynamic content vs static content
- Content-driven solutions
- Focus on web applications
- Need for a structured programming model
- Need for a simpler way to do programming

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Web Applications

- Applications with a web interface
- Ideal for thin-client solutions
- Suffers from limitations of the web media
- Usually combines techniques (e.g., JSP + AJAX)
- Several development frameworks available
- Clear trend towards generated web interfaces
- Usually session-oriented
- Usually deployed in WAR files

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Web Archives (WAR)

- ZIP-file = compressed archive
- JAR-file = Java Archive (ZIP file with a manifest)
- WAR-file = JAR-file with web application information

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Sessions

- Used to store data for a series of HTTP requests
- E.g., a shopping cart, user preferences, site history
- A session identifier is sent with each request
- The session identifier is used to locate the session
- Data is stored in the session context

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Three Layer Architectures

- 1 Interface - web pages
- 2 Logic - software components (JavaBeans, EJB)
- 3 Data Access - databases

- Clean separation of concerns
- Scalable
- Support role-based development cycles
- Well suited for large sites and business logic integration

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Two Layer Architectures

- 1 Interface (+ Logic)
- 2 Data Access + Logic

- Requires fewer software components
- Shorter development cycles for small development teams
- Better suited for smaller web sites

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Java Servlets

- Java classes
- Implements the Java Servlet API interfaces (predates JSP)
- Receives a request and generates a response
- Can be written manually
- Must be thread-safe
- Usually generated automatically from JSP
- Hosted in a Servlet container

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The Servlet Lifecycle

- 1 init() - called on Servlet instantiation
- 2 service() - called for each request
- 3 destroy() - called on container shutdown

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The Servlet service() method

- Part of a service-pattern
- Should not be implemented directly
- Inherit base class and implement handler methods
- Distinct handlers for each HTTP method (e.g., doGet())

- 1 service() parses request and determines HTTP method
- 2 service() calls appropriate handler method
- 3 Handler method processes request

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- JavaServer Pages (JSP)

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