COV888
Distributed Systems

Web-based Systems:
Web Developments

Web Services

S. Bhalla, (2018)
Special Module on Database Systems
Client Server Systems

- Ordinary
  - LAN/WAN

- Web based
  - LAN/WAN I
  - Internet
  - World Wide Web
  - LAN/WAN II
Web-based Client Server Systems

**Advantage I**
Servers are accessible by clients all over the world

⇒ Basis for Web Applications

**Advantage II**
Servers are accessible by servers all over the world

⇒ Basis for Web Services
Web Engineering: Service-Oriented Architecture (SOA)

- Definition by Pressman (p. 469):

**Web Engineering (WE) : SOA**
→ applies sound scientific, engineering, and management principles,
→ disciplined and systematic approaches to the successful development,
→ deployment, and maintenance of high-quality web-based systems and applications.

Software Systems

- Monolithic Systems
- Distributed Systems
  - Ordinary Systems
  - Web-based systems
    - lecture's focus
      - Web Applications
      - Web Services
        - Semantic Web
Web Engineering: Service-oriented Architecture
Conceptual Architecture

Client/Server Architecture
History of the Web

1969: ARPA (Advanced Research Projects Agency)
– First small network: Stanford Research Institute, UCLA, UC Santa Barbara, Univ. of Utah
– TCP (Transmission Control Protocol)
– IP (Internet Protocol)
• 1972: Telnet protocol
• 1973: SMTP (Simple Mail Transfer Protocol)
• 1973: FTP (File Transfer Protocol)
• 1989: T. Berners-Lee et al.: Word Wide Web (WWW)
• 1994: W3C (World Wide Web Consortium)
• 1996: HTTP (HyperText Transfer Protocol)
Internet - Web

• Internet Protocols
  • SSH Secure Shell, …..
  • SMB Server Message Block, CIFS (Common Internet File System)
  • FTP File Transfer Protocol, SMTP Simple Mail Transfer Protocol
  • TCP Transmission Control Protocol, Telnet Telephone Network
  • HTTP Hyper Text Transfer Protocol
  • HTTPs Secure Hyper Text Transfer Protocol
  • POP Post Office Protocol, HTCP CP Hyper Text Coffee Pot Control Protocol, MTP Media Transfer Protocol
  • SFTP Secure File Transfer Protocol, SSL Secure Socket Layer
  • …..
  • ----------------------------------
  • WEB ➔ HTTP, HTTPS
Protocol Stack

```
client
  Application
  HTTP
  TCP
  IP

server
  Application
  HTTP
  TCP
  IP

physical layer
```
World Wide Web Consortium (W3C)

- international consortium → member organizations, a full-time staff, and the public
- work together → develop Web standards

- [http://www.w3.org](http://www.w3.org)

- W3C's mission:
  - → to lead the WWW to its full potential
  - → by developing protocols and guidelines that ensure long-term growth for the Web.
Web Application

• Definition:

A Web Application is a software system based on technologies and standards of the World Wide Web

Provided by:

• Consortium (W3C) that provides Web specific resources content and services through a user interface, the Web browser [Kappel et al. 2004]
Categories of Web Applications

- document-centered
- interactive
- transactional
- workflow-based
- collaborative
- social web
- semantic web
- ubiquitous
Supporting Developments

- **HTML 0** → Web Pages and URLs
- Web search
- XML → XHTML (tags → CSS templates)
- Forms ↔ Web server
- Memory-less web servers
  + HTML/HTTP Cookies
- Web Services
- **HTML 5** → X,Y coordinates
- Semantic Web → SPARQ, RDF, ontology
Categories of Web Applications (1)

- (cf. Pressman, p. 472, Kappel, p.5)

- **document-centered**
  → Informational
  - read-only content is provided with simple navigation and links
  → Download
  - a user downloads information from the appropriate server (ftp-server)
  → Customizable
  - the user customizes content to specific needs

- **examples:**
  - static HTML-pages, „home pages“
  - web radio
  - simple presentations of companies/products
Categories of Web Applications (2)

• **Interactive**
  - content of a website is dynamically generated as response to a user request
  - form-based input is the primary mechanism for communication between client and server
  - usage of HTML-forms and Common Gateway Interface (CGI) techniques
    - radio button, string input, choice lists

• **Examples:**
  - dynamic HTML pages
  - public transport schedules
  - search engines
    1. HTML specifications → FORM feature
    2. **Browser (HTML) → Web-Server → CGI Program**
Categories of Web Applications (3)

- transactional
  - complex interactions
  - read and write actions
  - atomicity / roll-back in case of problems
  - usage of transaction management of database systems
- efficient and consistent data management
- structured data and queries

- examples:
  - online banking
  - e-shopping
  - reservation systems

REQUIRES → Web Services support
Categories of Web Applications

- document-centered
- interactive
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- collaborative
- social web
- semantic web
- ubiquitous

Axes:
- Complexity
- Historical development
Categories of Web Applications (4)

- **workflow-based**
  - support business processes (“workflows”) within respective units between different enterprises or private users
  - an application provides a complex service to the user, e.g.
    assists the user in determining the mortgage payment
  - prerequisite: structured flow of activities

- **examples:**
  - Business-to-Business (B2B) Integration Frameworks
  - E-Government
  - patient workflows in health care systems

REQUIRES ➔ Web Services support
Workflow Examples

**Workflows** are (the computerized part of) **business processes**,

→ consisting of a set of (automated or intellectual) **activities**

→ with specified control and data flow between them (e.g., specified as a state chart or Petri net)
Workflow Examples

Conference travel planning:
• Select a conference, based on subject, program, time, and place. If no suitable conference is found → the process is terminated.
• Check out the cost of the trip to this conference.
• Check out the registration fee for the conference.
• Compare total cost of the conference → to allowed budget, → and decide to attend only if the cost is within the budget.

Observations: activities spawn transactions on information servers, workflow state must be failure-resilient, long-lived workflows are not isolated
Workflow Examples

• Transactions
• Workflows

• RPC based Systems: Banking, ATMs (LAN, dedicated lines)

• Web Services Based Systems (now, in future):
  • Car company and part suppliers, AMAZON and its suppliers \(\leftarrow\) closed group
  • Paytm, yahoo auctions \(\leftarrow\) open groups
Categories of Web Applications (5)

• collaborative
  → support cooperation in case of unstructured flow of activities and high degree of communication
  → “groupware”

– examples:
  • support of shared information- and workspaces
    – BSCW, http://public.bscw.de/
    – Microsoft Windows SharePoint Services
  – chat rooms
  • e-Learning platforms: Khan Academy
Categories of Web Applications (6)

• portal-oriented
  → the application channels the user to other Web content or services outside the domain of the portal application
  → “single point of access“

— examples:
  • community portals
    – dedicated user groups
    – customer profiles
  • enterprise portals
    – Intranet, extranet
Categories of Web Applications (7)

• social-web
  ➔ people provide their identity to a community of others with the same interests
  – serve the purpose of finding other people
  – examples:
    • weblogs
    • networking platforms
    – XING, facebook
    • virtual shared workspace
Categories of Web Applications (8)

• ubiquitous
  → personalized services at every time at every location
  → multi-platform delivery (PC, PDA, mobile phone)
  → context-dependent information

– example:

• display of today’s menu on end-user devices while entering a restaurant
Categories of Web Applications (9)

- **semantic web**
  - Extension of the WWW
  - WWW links data (Hypertext)
  - Semantic Web links data on the basis of its meaning
  - Information available on the web
  - adequate for human understanding and
  - adequate for automatic manipulation
  - “knowledge management“
  - derivation of new knowledge
  - re-use of knowledge
  - based on ontology’s

  – Example:
  - Google, semantic web content management systems
Summary

• 1. Web Applications ➔ Support Business Activities
→ ➔ E-commerce and Production Systems (Electricity Distribution)

• 2. Government Support Programs
• Education
• Healthcare and Life (Air-traffic Control)
• Defence Services
• : Scientific Evolution for critical applications
→ Security, Overheads, Long duration Transactions, workflows
→ Specifications: Form, client-Server, Web Services, HTML 5 (transmitts GIS coordinates of clients), tracking tools/systems
• 1. Get the details of listed web sites and terms (in this set of slides).

• 2. Classify the following web applications:
  → Skype, MedlinePlus, MedlinePlus Encyclopedia, Google Docs, Google Maps API, gmail, LMMP (NASA), Facebook, Twitter, LinkedIn, JAL home page, IITD home page, AMAZON, Any e-auction web site, Postgres web site, Wikipedia.