



INTERNET & WEB
APPLICATION DEVELOPMENT
SWE 444

Fall Semester 2008-2009 (081)

**Module I: Internet Basics for
Web Development (I)**

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Objectives/Outline

• Objectives

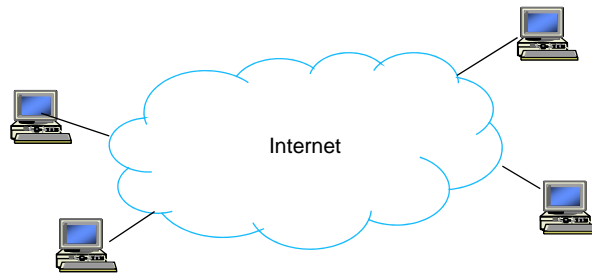
- Learn the basics of the Internet and the Web
- Identify and describe the key elements of the Internet and the Web

• Outline

- Introduction to the Internet
 - Definition
 - Hierarchical Structure
 - Internet Protocols
 - Addressing
- Introduction to the Web
 - Definition
 - Web Architecture & Operation
 - Websites & Web Documents
 - Web Browsers
- Internet and Web Growth
- Questions & Answers

What is the Internet?

- A global heterogeneous network that connects a collection of computers all over the world
 - Using transmission media (copper, fiber, wireless, etc.), special purpose devices (routers, switches, etc.), network operating systems (NOS) and applications software (email, browsers, etc)



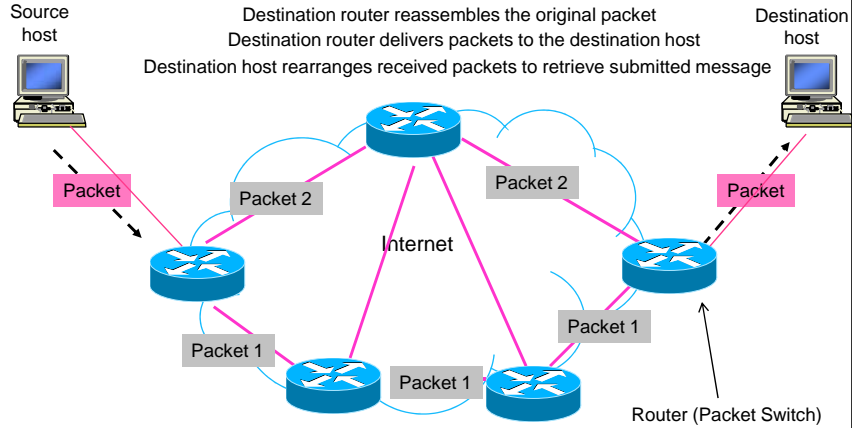
What is the Internet? ...

- The goal is to provide connectivity between machines and between users to
 - Share resources
 - Increase reliability and availability
 - Collaborate (email, distributed computing, etc)
 - Access remote information
- Thus the Internet is a vehicle for transferring data from one machine to another.

What is the Internet?

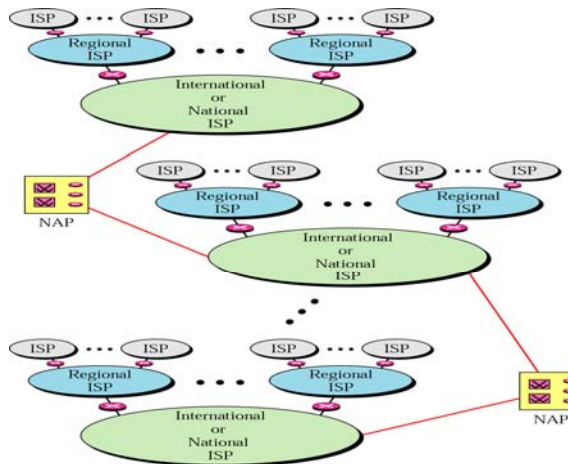
➤ An example of a packet-switched computer network

- Source host generates a message & converts it to packets
- Source router may fragment a packet into smaller packets (fragments)
- Packets transferred independently across network
- Destination router reassembles the original packet
- Destination router delivers packets to the destination host
- Destination host rearranges received packets to retrieve submitted message



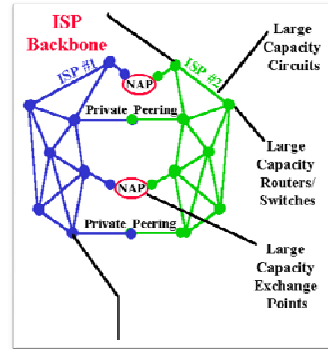
Internet Hierarchical Structure

➤ To manage the growth of the Internet (scalability), it is roughly structured in a hierarchical manner



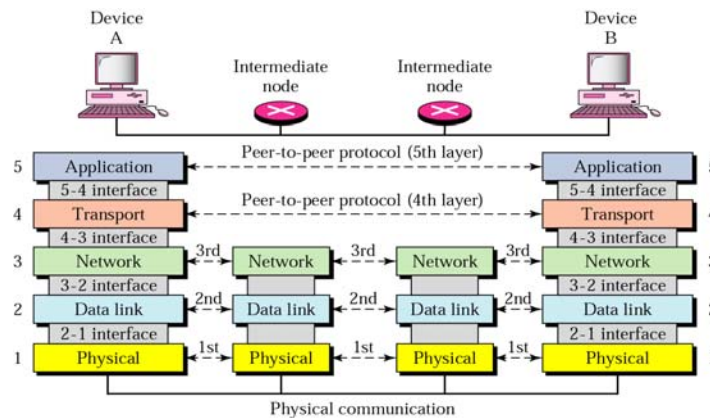
Internet Hierarchical Structure ...

- Internet Service Provider (ISP)
 - International, National, Regional, Local
- At the lowest level are the organizations networks
 - e.g. KFUPM network
 - Which can act as ISP for lower-level user networks as well (e.g. home networks or small office networks)
- Two ISP networks can be connected to each other through network access points (NAP) or private peering.
 - NAP: data communication facilities that provide access to higher-speed links
- Routers:
 - Computer networking devices that forward data packets across a network toward their destinations



Layered Architecture

- The Internet operating system is structured in layers called TCP/IP protocol stack
- Each has a number of protocols to facilitate the communication between different devices



Layered Architecture ...

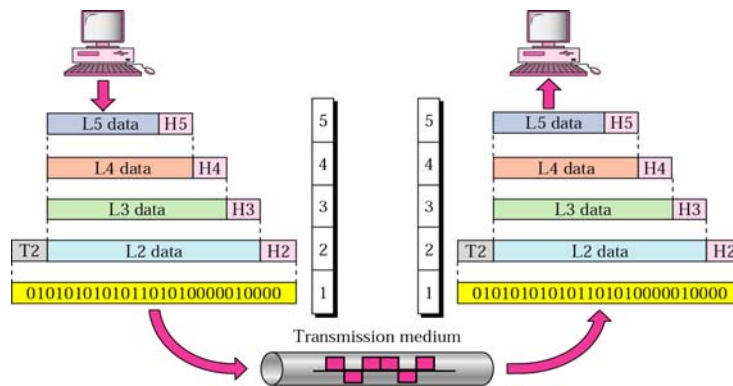
➤ Summary of layers' roles

- Application layer: acts as an interface to allow access to network resources. Each Internet application has its own application layer protocol.
- Transport layer: to provide reliable process-to-process message delivery and error recovery
- Network layer: to move packets from the the source to the destination across the network
- Data link layer: to organize bits into frames and provide hop-to-hop delivery
- Physical layer: to transmit bits over a medium and provide mechanical and electrical specifications.

Layered Architecture ...

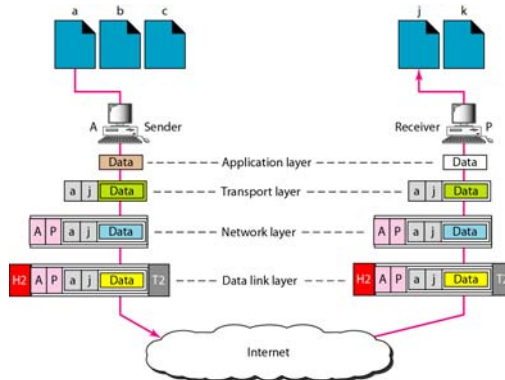
➤ Each layer adds meta-data (control information) to facilitate communication between layers

- E.g. source address, destination address, identification, error control information, etc.



Addressing

- Hosts are identified using a unique global address (called IP address) or hostnames
 - DNS servers map hostnames to IP addresses
- Processes on the same host are uniquely identified using the host address (IP address) + the transport layer protocol port number (e.g. web server is running at TCP port # 80)

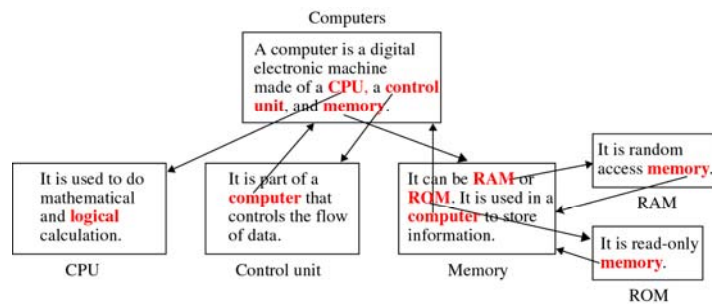


Common Internet Applications

- The World-Wide Web (WWW)
- Electronic mail (email)
- File transfer (e.g. ftp)
- Remote login (e.g. telnet)
- Streaming multimedia (e.g. Internet feeds of live audio and video, video on demand (VoD))
- Internet telephony (VoIP)
- Chatting
- Many others

What is the World-Wide Web?

- Also called WWW or just the Web
- A collection of web documents and other web resources uniquely identified (using URLs), can be accessed via the Internet, and are linked to each other.
 - Forms an overlay network over the Internet
 - Web documents can have different types of information (multimedia): text, images, audio and video
- Main features of the Web: Portability, Scalability, User friendly

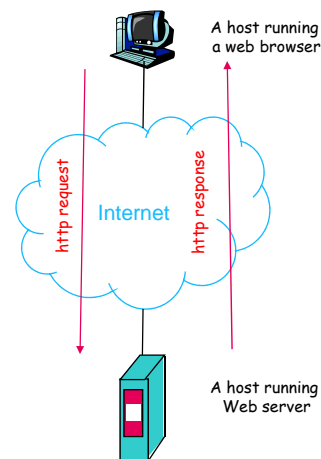


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Web Architecture & Operation

- Web documents are hosted (stored) in machines running special software called Web servers
- Web documents can be accessed and viewed using special programs called browsers (Web clients or user agents)
- Browsers & Web servers are often running on different machines
- Browsers use HTTP protocol to communicate with the Web servers



The web is a client-server Internet application

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Web Architecture & Operation ...

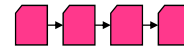
- Web documents (or web pages)
- Web browser (also called user agent, web client or HTTP client)
 - Application program that represents the user interface to the Web
 - Fetches information from Web server and displays it to the user
 - Examples: Mosaic (1993), NN (1994), IE (1995), Mozilla (1998), Firefox (2004), Opera, Safari, many others
- Web server (or HTTP server)
 - Stores a set of Web documents (web pages)
 - Responding to requests from the browser by sending a copy of the document
 - Examples: Apache, MS IIS
- Web standards
 - Transfer protocol
 - HyperText Transfer Protocol (HTTP)
 - Hypermedia links
 - Uniform Resource Locator (URL) to identify web resources
 - Document representation
 - HyperText Markup Language (HTML)
 - eXtensible Markup Language (XML)
 - etc

Web Architecture & Operation ...

- A user starts a browser on his computer and request a web document by specifying its URL
 - E.g. <http://www.kfupm.edu.sa/>
- The browser resolve the URL to get the server IP address using the DNS server.
- Then, the browser sends a message to the server requesting the required document
- The server finds the document in its file system and sends it back to the browser
- The browser interprets the content of the document and displays (renders) it for the user
- If the document contains images,
 - Images will be on separate files and only their URLs will be embedded in the base document
 - The browser will send a different request for each image file

Websites & Web Documents

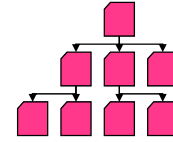
- A website is made of a set of related web pages linked to each other; these pages can be on one server or distributed on different servers



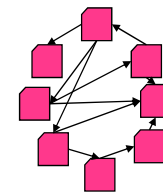
Linear

- Navigation order

- Linear
 - Web pages are linked in a strict sequence
 - Useful for guided navigation, tutorials, multi-part articles, etc.
- Hierarchical (tree)
 - Web pages are arranged hierarchically (also called tree)
 - The “root” is the website’s homepage
- Hybrid (non-linear)
 - Webpage links can form sequences, trees, loops, or whatever paths are needed
 - Might this be confusing to a site visitor?



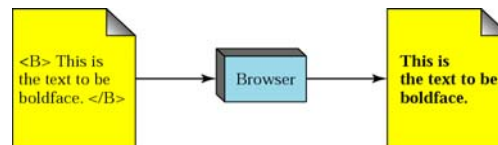
Hierarchical



Hybrid

Websites & Web Documents ...

- Web document



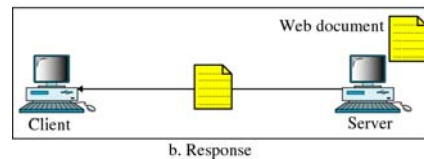
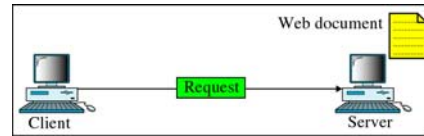
- Categories of Web documents

- Static documents
- Dynamic documents
- Active documents

Websites & Web Documents ...

➤ Static documents

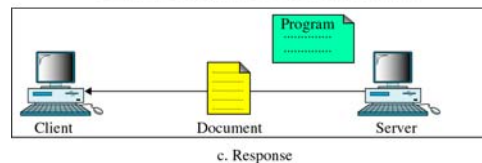
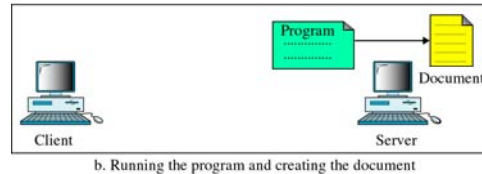
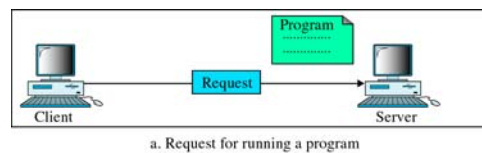
- Fixed-content document created and stored in a server
 - Content is determined when it is first created not when it is used
- The file contains text and formatting instructions
- The client can not change the content of the document
- Use HTML technology



Websites & Web Documents ...

➤ Dynamic documents

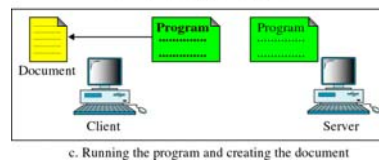
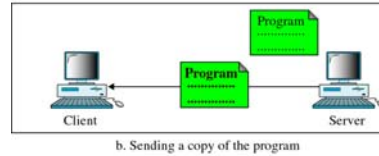
- The requested document does not exist in a predefined format but is created on demand
- The accessed document contains code (application program) that the server executes to generate the document to be submitted to the browser
- Personalized (customized) web pages
- Can access restricted resources on the server such as databases
- High load on the server
- Use Common Gateway Interface (CGI) or ASP technologies for server side programming



Websites & Web Documents ...

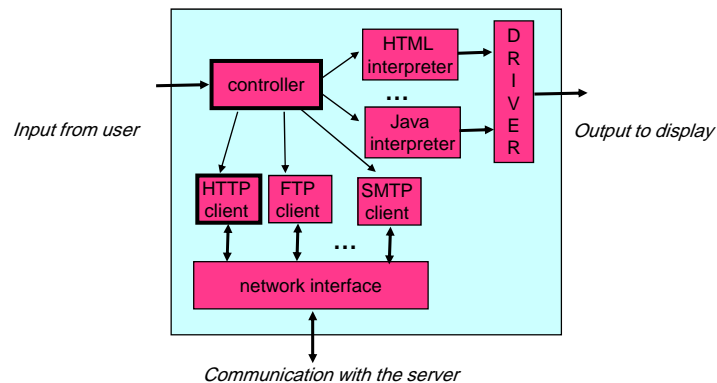
➤ Active documents

- The requested document contains a program; the server submits a copy of the program to the browser; the browser will run the program at the client side
- Can interact with user
- Does not create overhead for the server in the same way as dynamic documents
- The client can store the document and run it again and again without making another request
- Can save bandwidth and transmission time
- Use Java, Javascript and Vbscript technology for client side programming



Web Browsers

- A variety of vendors offer commercial browsers that interpret and display a webpage but all use nearly the same architecture
- The browser consists mainly of three modules: **controller**, **client programs**, and **interpreters**

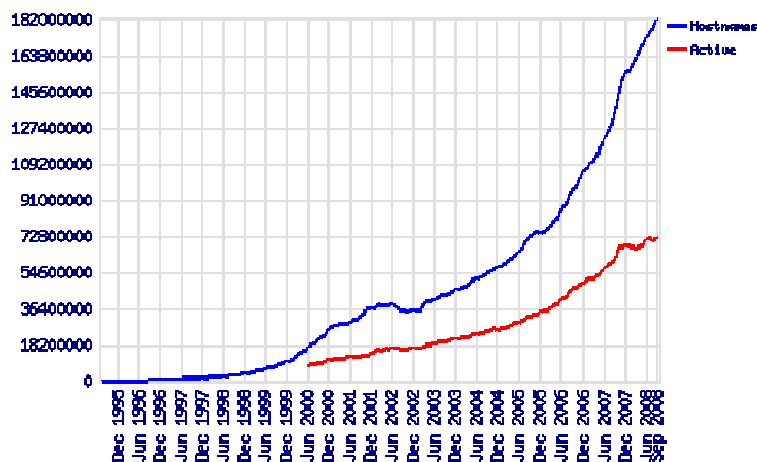


Cross-Browser Compatibility

- There are literally hundreds of web browsers in use around the world.
- All browsers differ in functionality, performance and features
 - Implement different HTML layout engines, JavaScript and Cascading Style Sheets (CSS)
 - May make Web pages look totally different
 - Makes cross-browser compatibility difficult to achieve
- Write clean code that conforms to the www consortium (W3C) standards to get consistent results across all browser platforms
 - A cross-browser compatible Web page will look more or less the same in all of the existing Web browsers
 - Obviously, 100% compatibility with all potential browsers is impossible.
 - HTML editors are, on their part, notorious for creating non-compliant and garbage code.
 - Write your code by hand, e.g., using notepad
 - If you must use a HTML editor, the best choice for compatibility is Dreamweaver and worst is FrontPage.

Internet and Web Growth

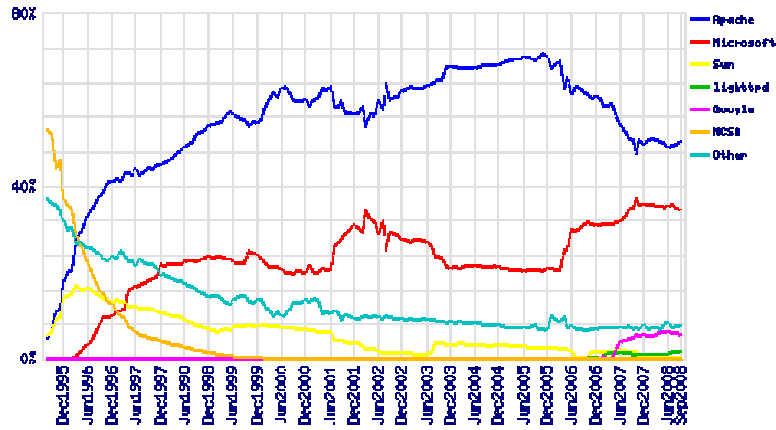
- Total sites across all domains (August 1995 - September 2008)



[source: <http://news.netcraft.com/>]

Internet and Web Growth ...

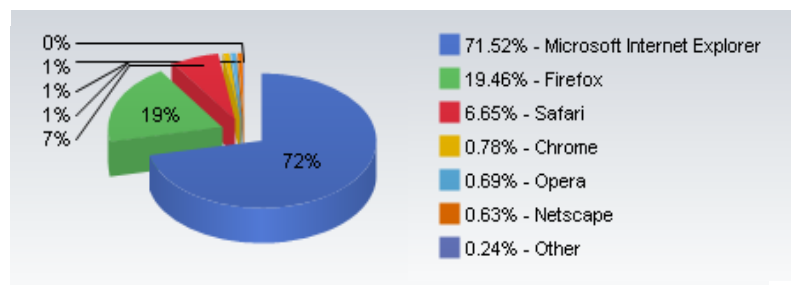
- Market share for top servers across all domains (August 1995 - September 2008)



[source: <http://news.netcraft.com/>]

Web Browsers

- Total market share of web browsers [Oct. 2008]



[Source: [Net Applications](#)]

Internet and Web Growth ...

Top Ten Languages Used in the Web (Number of Internet Users by Language)					
TOP TEN LANGUAGES IN THE INTERNET	% of all Internet Users	Internet Users by Language	Internet Penetration by Language	Language Growth in Internet (2000 - 2007)	2007 Estimated World Population for the Language
English	31.2 %	365,893,996	17.9 %	157.7 %	2,042,963,129
Chinese	15.7 %	184,001,513	13.6 %	469.6 %	1,351,737,925
Spanish	8.7 %	101,539,204	22.9 %	311.4 %	442,525,601
Japanese	7.4 %	86,300,000	67.1 %	83.3 %	128,646,345
French	5.0 %	59,207,849	15.3 %	385.4 %	387,820,873
German	5.0 %	58,981,592	61.1 %	112.9 %	96,488,326
Portuguese	4.0 %	47,326,760	20.2 %	524.7 %	234,099,347
Korean	2.9 %	34,120,000	45.6 %	79.2 %	74,811,368
Italian	2.7 %	31,481,928	52.9 %	138.5 %	59,546,696
Arabic	2.5 %	28,782,300	8.5 %	940.5 %	340,548,157
TOP TEN LANGUAGES	85.0 %	997,635,142	19.3 %	203.7 %	5,159,187,766
Rest of World Languages	15.0 %	175,474,783	12.4 %	440.3 %	1,415,478,651
WORLD TOTAL	100.0 %	1,173,109,925	17.8 %	225.0 %	6,574,666,417

[source: <http://www.internetworldstats.com>]

Q & A



Other Resources

- *Data Communications and Networking, 4/e.* B.A. Forouzan, McGraw-Hill Higher Education 2007.
<http://www.mhhe.com/forouzan>
- [The World Wide Web Consortium \(W3C\)](#)