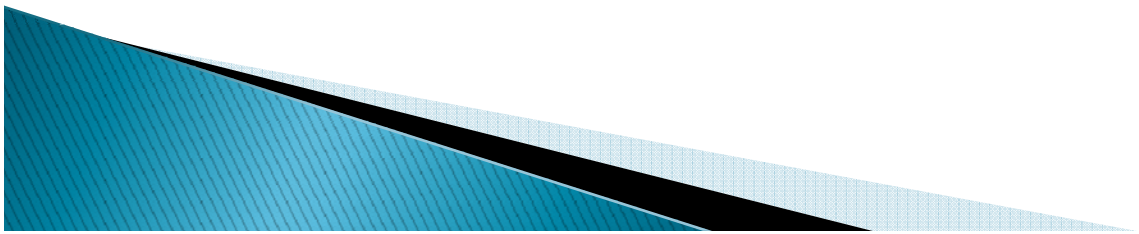
The World Wide Web

Outline

- Background
- Structure
- Protocols



WWW Background

- 1989-1990 – Tim Berners-Lee invents the World Wide Web at CERN
  - Means for transferring text and graphics simultaneously
  - Client/Server data transfer protocol
    - Communication via application level protocol
    - System ran on top of standard networking infrastructure
  - Text mark up language
    - Not invented by Bernes-Lee
    - Simple and easy to use
    - Requires a client application to render text/graphics

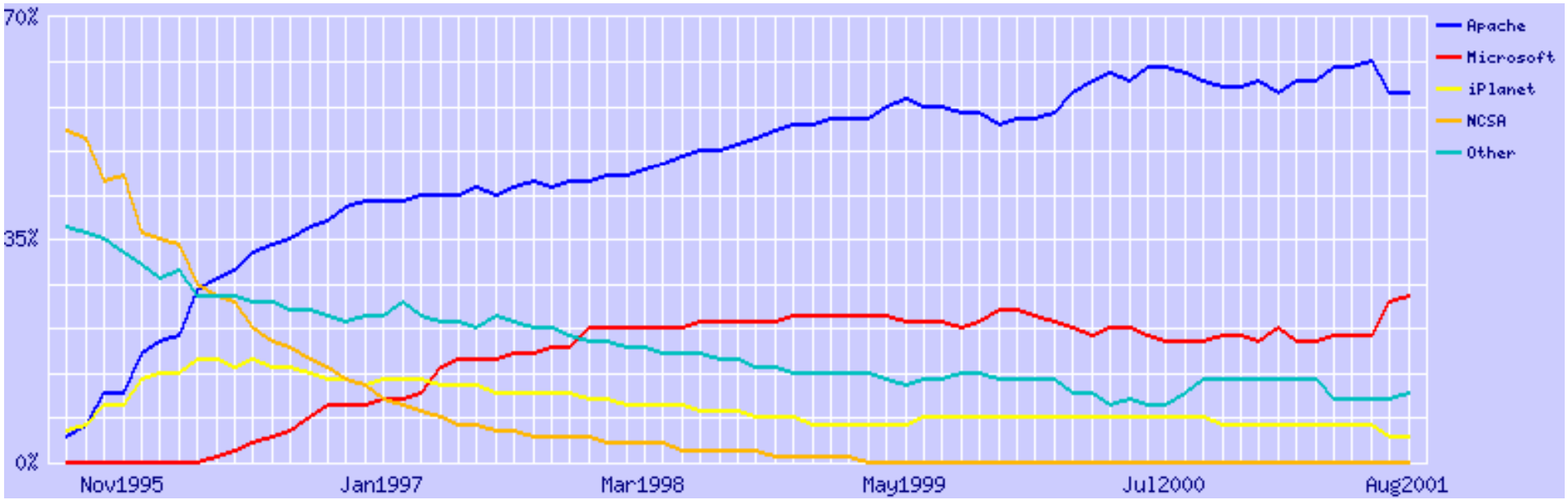
WWW History contd.

- 1994 – Mark Andreesen invents MOSAIC at National Center for Super Computing Applications (NCSA)
  - First graphical browser
  - Internet's first "killer app"
  - Freely distributed
  - Became Netscape Inc.
- 1995 (approx.) – Web traffic becomes dominant
  - Exponential growth
  - E-commerce
  - Web infrastructure companies
  - World Wide Web Consortium
- Reference: "Web Protocols and Practice", Krishnamurthy and Rexford

WWW Components

- Structural Components
  - Clients/browsers – to dominant implementations
  - Servers – run on sophisticated hardware
  - Caches – many interesting implementations
  - Internet – the global infrastructure which facilitates data transfer
- Semantic Components
  - Hyper Text Transfer Protocol (HTTP)
  - Hyper Text Markup Language (HTML)
    - eXtensible Markup Language (XML)
  - Uniform Resource Identifiers (URIs)

Quick Aside – Web server use



Source: Netcraft Server Survey, 2001

WWW Structure

- Clients use browser application to send URIs via HTTP to servers requesting a Web page
- Web pages constructed using HTML (or other markup language) and consist of text, graphics, sounds plus embedded files
- Servers (or caches) respond with requested Web page
  - Or with error message
- Client's browser renders Web page returned by server
  - Page is written using Hyper Text Markup Language (HTML)
  - Displaying text, graphics and sound in browser
  - Writing data as well
- The entire system runs over standard networking protocols (TCP/IP, DNS,…)

Uniform Resource Identifiers

- Web resources need names/identifiers – Uniform Resource Identifiers (URIs)
  - Resource can reside anywhere on the Internet
- URIs are a somewhat abstract notion
  - A pointer to a resource to which request methods can be applied to generate potentially different responses
    - A request method is eg. fetching or changing the object
- Instance: http://www.foo.com/index.html
  - Protocol, server, resource
- Most popular form of a URI is the Uniform Resource Locator (URL)

HTTP Basics

- Protocol for client/server communication
  - The heart of the Web
  - Very simple request/response protocol
    - Client sends request message, server replies with response message
  - Stateless
  - Relies on URI naming mechanism
- Three versions have been used
  - 09/1.0 – very close to Berners-Lee's original
  - 1.1 – developed to enhance performance, caching, compression
  - 1.0 dominates today but 1.1 is catching up

HTTP Request Messages

- GET – retrieve document specified by URL
- PUT – store specified document under given URL
- HEAD – retrieve info. about document specified by URL
- OPTIONS – retrieve information about available options
- POST – give information (eg. annotation) to the server
- DELETE – remove document specified by URL
- TRACE – loopback request message
- CONNECT – for use by caches

HTTP Request Format

request-line (request request-URI HTTP-version)
headers (0 or more)
<blank line>
body (only for POST request)

- First type of HTTP message: *requests*
  - Client browsers construct and send message
- Typical HTTP request:
  - GET http://www.cs.wisc.edu/index.html HTTP/1.0

HTTP Response Format

status-line (HTTP-version response-code response-phrase)
headers (0 or more)
<blank line>
body

- Second type of HTTP message: *response*
  - Web servers construct and send response messages
- Typical HTTP response:
  - HTTP/1.0 301 Moved Permanently
    Location: http://www.wisc.edu/cs/index.html

HTML Basics

- Hyper-Text Markup Language
  - A subset of Standardized General Markup Language (SGML)
  - Facilitates a hyper-media environment
    - Embedded links to other documents and applications
- Documents use elements to "mark up" or identify sections of text for different purposes or display characteristics
- Mark up elements are not seen by the user when page is displayed
- Documents are rendered by browsers
- NOTE: Not all documents in the Web are HTML!
- Most people use WYSIWYG editors (MS Word) to generate HTML

HTML Example

<HTML>
<HEAD>
<TITLE> PB's HomePage </TITLE>
</HEAD>
<BODY>
<CENTER><IMG SRC = "bad_picture.gif" ALT = " ">
</CENTER>
<P><CENTER><H1>UW Computer Science Department</H1></CENTER>
Welcome to my goofy HomePage!
…
<A HREF = http://www.cs.wisc.edu/~pb/mydogs_page.html> Spot's Page </A>
</BODY>
</HTML>

Applications

- Email
- Search engines
- Online Banking
- Online Shopping
- Social Networking
- Online Games
- YouTube videos for education and entertainment

Scope of Research

- Security over WWW
- High-speed WWW

Assignment 6

- Make a note on one real-life application of WWW and demonstrate in class.

ThankYou