



Networking and Protocols

CSE 264

Web Systems Programming

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A graphic of a spiral-bound notebook with a silver metal spiral on the left side. The notebook has a cream-colored page with a horizontal line near the top. The background is a solid brown color.

4 What is the internet?

4 What is the World Wide Web?

Definition

- 4 The Internet is an international network of packet-switched networks that communicate using the Internet Protocol Suite (TCP/IP).

Packet-Switched Networks

4 Example: US Postal Service

- Information put into packets (envelopes) with addresses
- Packets are mingled from different sources
- Local post office sorts and routes mail to regional post office
- Regional PO sends to local POs who deliver to address on envelope

Internet - a packet switched network

- 4 Information is bundled in discrete units (packets)
- 4 Packets from different sources are mingled together
- 4 Packet moves from node to node until it reaches its destination

Traceroute

4 traceroute www.lehigh.edu

4 tracert www.lehigh.edu (Win)

TCP/IP Internet Layering Model

- 4 **Application** - programs run by users(FTP, HTTP, SMTP)
- 4 **Transport** - communication between application programs (TCP, UDP)
- 4 **Internet** - communication between machines (IP)
- 4 **Network Interface (Data Link)** - hardware specific interface (drivers)
- 4 **Hardware**

IP - Internet Protocol (Internet Layer)

- 4 Determines how a packet gets from one computer to another
- 4 Packets (datagrams)
 - 1 byte - 1.5K bytes
- 4 IP Addresses (v4)
 - 4 octets - each 0-255 (eg. 97.0.1.31)
 - Network - Host parts
- 4 Connectionless
- 4 ipconfig/ifconfig

Problems

- 4 Packets can be lost or damaged
- 4 Packets can arrive out of sequence

UDP (Transport Layer)

- 4 User Datagram Protocol
- 4 Sends data to a particular port
- 4 Unreliable
- 4 Connectionless
- 4 Use for small amounts of data
- 4 Application provides error handling
- 4 Lower overhead than TCP
- 4 Uses IP to send packets

TCP (Transport Layer)

- 4 Transmission Control Protocol
- 4 Sends data to a particular port
- 4 Reliable Delivery
- 4 Unstructured , Stream Oriented
- 4 Virtual Circuit, Connection Oriented
- 4 Buffered Transfer
- 4 Full Duplex
- 4 Uses IP to send packets

Ports

- 4 Represented by a small integer
- 4 Many are assigned to particular protocols
- 4 List of assigned ports

Application Layer

Telnet, ssh (terminal/shell)

FTP, SFTP (file transfer)

SMTP, IMAP, POP (email)

HTTP (web clients and servers)

DNS - Domain Name System

- 4 Assigns names to IP addresses
- 4 Name = sub-domains separated by periods
 - Example: `occam.cse.lehigh.edu`
- 4 Server(s) responsible for each domain
- 4 ICANN/Registrars
 - Registers top level domains (TLD): `.com .net .org`

Definition - WWW

- 4 A world wide network of HTTP servers and their associated hyperlinked documents running on computers that are connected to the Internet.

Browsers

- 4 Type of client
- 4 Interpret and Display HTML pages
- 4 Use HTTP to communicate with server
- 4 Firefox, Chrome, Safari, Opera, IE

HTTP Servers (Web Servers)

- 4 Listen for TCP connections on (default) Port 80
- 4 Respond to GET and POST (plus others) requests from client (methods)
- 4 Return resources to client (web pages, etc)
- 4 Stateless – does not retain information from one request/response to the next

Media Types

4 MIME

- Multipurpose Internet Mail Extensions

4 Primary type/Subtype

4 Examples

- text/html
- text/plain
- image/jpeg
- video/quicktime
- application/vnd.ms-powerpoint

URLs

- 4 Uniform Resource Locator / Web Address
- 4 Format: protocol://host[:port]/path?query
 - Example <http://www.lehigh.edu/>
- 4 URN – Uniform Resource Name
 - No specific location
 - Example: urn:isbn:1565925092
- 4 URI – Uniform Resource Identifier
 - Either URN or URL

Methods

4 GET

- Retrieve resource from server

4 POST

- Send data to server application

4 PUT

- Store resource on server

4 DELETE

- Delete resource from server

4 HEAD

- Get the headers for a resource

Status Codes - Ranges

4 100 – 199 Informational

4 200 – 299 Successful

4 300 – 399 Redirection

4 400 – 499 Client Error

4 500 – 599 Server Error

Status Codes - Examples

- 4 100 - Continue
- 4 200 - Resource returned correctly
- 4 302 - Redirect. Get resource elsewhere.
- 4 404 - Not found. Resource unavailable.
- 4 500 - Internal server error.

Request/Response Message Format

- 4 Start Line
- 4 Header Lines
- 4 Blank Line
- 4 Body

HTTP Examples - Request

- 4 GET /default.html HTTP/1.0
- 4 User-Agent: Mozilla/1.1N (Macintosh; I; 68K)
- 4 Accept: */*
- 4 Accept: image/gif
- 4 Accept: image/x-xbitmap
- 4 Accept: image/jpeg
- 4 <blank line followed by other information>

HTTP Examples - Response

4 HTTP/1.0 200 OK

4 Date: Sat, 10-Apr-99 03:23:12 GMT

4 Server: NCSA/1.3

4 MIME-version: 1.0

4 Content-type: text/html

4 Last-modified: Date: Sat, 10-Apr-99 01:21:02
GMT

4 Content-length: 1029

4 <blank line followed by body of document>