Sources

Please read the following topics. I will go over these very quickly. This material is not in the textbook but the web site is excellent.

4. What is an IP address? http://computer.howstuffworks.com/question549.htm

Recommended
Internet Interaction

- The basic process

http://computer.howstuffworks.com/web-server.htm

Protocol Server Page

Visit Source: http://computer.howstuffworks.com/web-server1.htm

What is in a URL?

- The protocol
  - http://
  - telnet://
  - ftp://
  - gopher://

- Server

- The Page is the path name of a file on the server
  - web_class/URL/anatomy.html
  - Default page name (Server dependent)
  - default.htm | default.html | index.htm | index.html etc.

- Named files – use lowercase and proper extension
  - .gif - for GIF files (GIF is a graphic format)
  - .jpg - for JPEG files (JPEG is a graphic format)
  - .qt or .mov - for movie files
  - .au - for sound files
What is in a URL?

- The File name can be a directory
  - `http://www.ecs.csun.edu/~shan/586coursenotes/`

- A server has many ports
  - A server/handle can be connected to each port (like interrupt handlers)

- The URL can specify a Port where the message arrives
  - `http://www.server.com:8088`
  - `http:// Port 80`
  - `telnet:// Port 23`
  - `ftp:// Port 21`
  - `gopher:// Port 70`

- Search for “Commonly used Ports”


IP Address

- Everything that exists on the internet has an IP address
- IP address has FOUR octets
  - `216.27.61.137`
  - `10001110.00010111.00110001.01011000`

- Find your computer’s IP address
  - Try “ipconfig” from the command window
  - Also try “ipconfig /all”

- Fixed vs. Dynamic IP addresses
  - DHCP servers
  - See the “properties” of the TCP/IP connection from the Network Connection Icon
The IP Address

- Each octet = 256 entries
  - Theoretical max $2^{32}$ or a possible 4,294,967,296 addresses
  - 0.0.0.0 is reserved for default network
  - 255.255.255.255 reserved for broadcasts
  - 127.0.0.1 reserved for loop back (try pinging)
- Class A network
  - 1st bit is zero
  - 1st octet has values 1 – 126 and represents the network address
  - Other parts of the IP address represent a server (or host) address.
  - 126 networks
  - $16,777,214$ ($2^{24} - 2$) possible hosts per network
  - $2,147,483,648$ ($2^{31}$) unique IP addresses
  - Example of class A address
    - Net = 115  Host = 23.43.106

Class B
- 1st octet values 128-191 and the 2nd octet form the network address
- $16,384$ ($2^{14}$) Class B networks
- $65,534$ ($2^{16} - 2$) hosts per network
- $1,073,741,824$ ($2^{30}$) unique IP addresses
- Example of class B address
  - Net = 146.125  Host = 143.111

Class C
- 1st octet values 192 to 223 plus the 2nd & 3rd. octets form the network address
- $2,097,152$ ($2^{21}$) Class C networks
- $254$ ($2^{8} - 2$) hosts per network
- $536,870,912$ ($2^{29}$) unique IP addresses
- Example of class C address
  - Net = 196.112.126  Host = 143

- Class D is for multicast, 1st octet = 11100000
- Class E is experimental, 1st octet = 11110000
Domain Name Server

- Internet works with IP Address (physical)
- We humans like domain names (logical)
- Domain Name Server does the translation
  - www.howstuffworks.com ➔ http://216.183.103.150

- Browsers connect to a Domain Name Server (DNS) to find the IP address of the server
- How does the browser find the DNS?
  - From the “properties” of the TCP/IP connection
  - Can be fixed or given by a DHCP server on the network
- Browser asks its default DNS to translate the logical domain name to its physical IP address

How Big is the Domain Name Server

- Logically, the DNS is a “Humongous” database with a translation table with Billions of entries
  - Entries changing constantly!!
  - Millions of queries per minute
- In reality the DNS is a distributed database
- If one name server can’t translate a domain name, it can point to another name server than might have the answer.
The DNS Organization

- Every published web site has an associated name server
  - The name server for the web site translates the domain name to an IP address
  - Typically each name server stores info about thousands of domain names and also knows the IP addresses of other name servers
- Anyone can set up a name server
  - E.g. Microsoft has its own name server to handle all its domain names.
  - Most hosting companies have their own name servers
- Typically there is a different name server for each top-level domain (.com .gov .edu .org .au .uk etc.)
- There are "ROOT SERVERS" scattered all over the planet that know the name servers for the top-level domains

What does a Name Server (NS) do?

- Accepts requests from browsers & other name servers to convert domain names into IP addresses.
  - It can provide the IP address from its stored table.
  - It can contact another name server to find the IP address and repeat as necessary.
  - It can return the IP address for another name server that knows more.
  - It can return an error message because the requested domain name is invalid or does not exist.
- Caches all recent information
  - Caching expires after a while (TTL = Time to live)
  - Propagation typically takes 24 hours
Translation process

- Browser asks its default NS for IP address of say www.howstuffworks.com
- The default NS may respond with a “known” IP address
- If not, the NS will contact one of many ROOT SERVERS for help
  - Each root servers know the IP address of all the name servers that handle the top-level domains.
  - The Root server may provide the IP address (from its cache)
- If not it will respond by sending the IP address for the COM name server
  - The default NS will then query the COM for the IP address of www.howstuffworks.com

The Translation goes on

- The COM NS returns the IP address of the name server that handles www.howstuffworks.com
  - Remember every website must have an associated name server
- The default NS then contacts this site’s NS for the IP address
- Redundancy
  - DNS is highly redundant
    - There are many root servers
    - Each website has at least two name servers
    - There are many name servers in the network, if one fails look for another
Das Magnificent DNS Machines

- The DNS handles billions of requests for billions of names every day, yet it is quite transparent to most users
- Deals with a network of millions of name servers scattered throughout the world
  - Each owned & administered by different companies & people
- Yet, the process is usually completely invisible and extremely reliable!

Nuts and Bolts- The Internet

- Browser send the msg to the ISP
- The ISP Drops the "addresses" message into the internet
- The network of computers is the Internet
- The "Routers" move the message to its destination IP address

Nuts & Bolts – The Routers

- The routers forward the message to the addressee (IP address in the message header)
- The message is divided into one or more packets
  - Each packet contains sender/receiver data
- Routers have configuration tables
  - To find best route
  - Keep alive route for long messages


Packet switching

- The routers read the destination IP address and forward the packet to a nearby router
- When the packet arrives in the neighborhood of the destination, it gets routed to the destination server
- Routers are smart-
  - Keep alive protocol
  - Avoid bottleneck
- Try “tracert www.yahoo.com” from command window
TCP (Transmission Control Protocol) is a set of rules (protocol) used along with the Internet Protocol (IP) to send data over internet.

TCP breaks the message into packets, numbers each packet and forwards them individually to the IP program.

IP takes care of handling the actual delivery of the packets.

Each packet may travel a different route and arrive in different order.

At the receiving end TCP reassembles the packets to form the message.

Subnet masks are used by the routers to decide when to keep packets within a local network.

If a subnet mask has the value 255.255.255.0, then

- The router knows that all packets with the sender and receiver having an address with the same values for the 1st three octet of the IP address are on the same network.
- These packets are not sent out to another network.

Example: The computer at address 16.67.41.140 sends a packet to the computer at 16.67.41.152.

- The router, matches the first three octets in the address of both sender and receiver (16.67.41) and keeps the packet on the local network i.e. does not send it out on the internet.
Protocols, Protocols

- **IP** (Internet Protocol) – Delivers data over the Internet
- **TCP** (Transport Control Protocol) – Packetize and reassemble **HTTP** (Hyper Text Transfer Protocol) – Web page transmission
- **FTP** (File Transfer Protocol) – File uploads/downloads
- **UDP** (User Datagram Protocol) – used for sending data that requires no response (e.g. streaming audio and video)
- **ICMP** (Internet Control Message Protocol) - used by a routers to exchange the information with other routers
- **SMTP** (Simple Mail Transport Protocol) – Sending textual data typically for email
- **SNMP** (Simple Network Management Protocol) - For collecting system information from a remote host
- **Telnet** – Command console on a remote computer.

LAN vs. WAN

- **Local area network** (LAN) technologies connect hosts and devices that are relatively close to each other, usually in the same building.
- **Wide area network** (WAN) technologies connect a hosts that are typically many kilometers apart
Generic Architecture & Tools

- Front end
  - Web clients
- Commerce server
  - Runs e-commerce applications
- Web server
  - Http/ftp services
- Operating system
  - Networking, Security
- Connectivity Tools
  - Connects to data base
- Backend system
  - Stores enterprise data

Front End Technology

- Users
  - Buyers
  - Suppliers
  - Web clients request information (URL based); the web server retrieves or generates the HTML data and transmits

- Technology
  - Reads and displays HTML, XML documents
  - Runs Java applets
  - General purpose browsers
  - Plug-ins
Web Servers

Web Server Software
- Provided by the operating system
- Provides connectivity services between e-commerce servers and the web clients
  - HTTP, FTP, HTTPS, Telnet
- Transmits data (HTML, XML files) to the web client
- NT server, Unix and look alike system, Win-2000, OS/2

Commerce Servers

Commerce Servers
- Off the shelf product & customize
- Create and manage electronic stores
- Manage order processing - shopping carts etc.
- Manage payment processing
- Manage customer profiles
- Maintain usage statistics
- Provide pluggability to e-commerce components
  - Customer service, credit card, shipping, etc.
- Microsoft - Site Server commerce edition
- IBM - Web sphere commerce edition
Connectivity Tools

- **Read and write**
  - Access to enterprise database or legacy database
    - Customer profile, Store catalog, Inventory

- **Bundled with other software**
  - Operating system - ODBC connections
  - Commerce server - Microsoft Transaction Server
  - Database vendors - Sybase, Oracle, DB2 provide connectivity to leading commerce servers
  - Custom software - C++, C, etc.
    - Still quite common, particularly when dealing with legacy systems

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Typical Architecture

- **Inventory**
- **Accounting**
- **Customer**
- **Credits & Payments**
- **Commerce applications**
- **Maintenance**
- **Firewall**
- **Routers**
- **Proxy servers**
- **Clients**