Networking

More than just a social interaction

Networking Changes Life

The Internet is making fundamental changes ... The FIT text gives 5 ways

• Nowhere is remote -- access to info is no longer bound to a place
• Connecting with others -- email is great
• Revised human relationships -- too much time spent online could be bad
• English becoming a universal language
• Enhanced freedom of speech, assembly

Can you think of others?

Network Structure

Networks are structured differently based (mostly) on how far apart the computers are

• Local area network (LAN) -- a small area such as a room or building
• Wide area networks (WAN) -- large area, e.g. distance is more than 1 Km

Internet: all of the wires, fibers, switches, routers etc. connecting named computers

LAN in the Lab

EtherNet is a popular LAN protocol

• Recall, it's a "party" protocol
• Connection to campus network infrastructure

Typical MGH or OUGL Lab

EtherNet
Cable
Campus & The World

The campus subnetworks interconnect computers of the UW domain which connects to Internet via a gateway.

IP -- Like Using Postcards

Information is sent across the Internet using IP -- Cerf uses postcard analogy

- Break message into fixed size units
- Form IP packets with destination address, sequence number and content
- Each makes its way separately to destination, possibly taking different routes
- Reassembled at destination forming msg

Taking separate routes lets packets bypass congestion and out-of-service switches

A Trip to Switzerland

A packet sent from UW to ETH (Swiss Fed. Tech. University) took 21 hops

Check Internet Hops

Interested?

- Find software called Visual Routes (personal evaluation copies are free) at http://www.visualroute.com
- Download a copy of the software
- Install software and type in foreign URLs
  - Switzerland eth.ch
  - Australia www.usyd.edu.au
  - Japan kyoto-u.ac.jp
  - South Africa www.uct.ac.za

Naming Computers I

People name computers by a domain name -- a hierarchical scheme that groups like computers

.edu All educational computers
.washington.edu All computers at UW
dante.washington.edu A UW computer
.ischool.washington.edu iSchool computers
.cs.washington.edu CSE computers
.june.cs.washington.edu A CSE computer

Domains begin with a “dot” and get “larger” going right

Naming Computers II

Computers are named by IP address, four numbers in the range 0-255

- cse.washington.edu: 128.95.1.4
- ischool.washington.edu: 128.208.100.150
- Remembering IP addresses would be brutal for humans, so we use domains
- Computers find the IP address for a domain name from the Domain Name System -- an IP address book computer

A computer needs to know IP address of DNS server!
Domains

- .edu, .com, .mil, .gov, .org, .net domains are "top level domains" for the US
  - Recently, new TLD names added
  - Each country has a top level domain name: .ca (Canada), .es (Spain), .de (Germany), .au (Australia), .at (Austria), .us

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The FIT book contains the complete list

Logical vs Physical

There are 2 ways to view the Internet

- Humans see a hierarchy of domains relating computers -- logical network
- Computers see groups of four number IP addresses -- physical network

Both are ideal for the "users" needs

- The Domain Name System (DNS) relates the logical network to the physical network by translating domains to IP addresses

Client/Server Structure

The Internet computers rely on the client/server protocol: servers provide services, clients use them

- Sample servers: email server, web server, ...
- UW servers: dante, courses, www, student,...
- Frequently, a "server" is actually many computers acting as one, e.g. dante is a group of more than 50 servers

Protocol: Client packages a request, and sends it to a server; Server does the service and sends a reply

World Wide Web

World Wide Web is the collection of servers (subset of Internet computers) & the information they give access to

- Clearly, WWW ≠ Internet
- The "server" is the web site computer and the "client" is the surfer's browser
- Many Web server's domain names begin with www by tradition, but any name is OK
- Often multiple server names map to the same site: MoMA.org and www.MoMA.org

Client/Server Interaction

For Web pages, the client requests a page, the server returns it: there's no connection, just two transmissions

Servers serve many clients; clients visit many servers

Dissecting a URL

Web addresses are URLs, uniform resource locator, an IP address+path

- URLs are often redirected to other places:

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Web server</th>
<th>Domain</th>
<th>Path</th>
<th>File</th>
<th>File extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>http://</td>
<td>www</td>
<td>.cs.washington.edu</td>
<td>/education/courses/100/04wi</td>
<td>index</td>
<td>.htm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>hypertext markup language</td>
</tr>
</tbody>
</table>
Summary

Networking is changing the world
Internet: named computers using TCP/IP
WWW: servers providing access to info
• Principles
  • Logical network of domain names
  • Physical network of IP addresses
  • Protocols rule: LAN, TCP/IP, http, ...
  • Domain Name System connects the two
  • Client/Server, fleeting relationship on WWW