Networking

More than just a social interaction

Networks...

Computers are useful alone, but are better when connected (networked)
- Access more information and software than is stored locally
- Help users to communicate, exchange information ... changing ideas about social interaction
- Perform other services -- printing, Web...

UW’s networks move more than trillion bytes per day

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

Protocol Rules!

To communicate computers need to know how to set-up the info to be sent and interpret the info received
- Communication rules are a protocol
- Example protocols
  - EtherNet for physical connection in a LAN
  - TCP/IP -- transmission control protocol / Internet protocol -- for Internet
  - HTTP -- hypertext transfer protocol -- for Web

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

Ether Net Cable
The campus subnetworks interconnect computers of the UW domain which connects to Internet via a gateway. All communication is by TCP/IP.

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 by-pass congestion and out-of-service switches.

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

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!

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: School computers
- .cs.washington.edu: CSE computers
- june.cs.washington.edu: A CSE computer

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

  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

  Protocol: Client package request, Server receive request, Server process, Server send reply, Client receive reply

  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; e.g. http://www.cs.washington.edu/100/ goes to http://www.cs.washington.edu/education/courses/100/04wi/index.html

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