Networking

More than just a social interaction

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

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

Typical MGH or OUGL Lab

Connection to campus network infrastructure

Campus & The World

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

Communication by TCP/IP
**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 by-pass congestion and out-of-service switches

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**A Trip to Switzerland**

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

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**Check Internet Hops**

Interested?

- Find software using Google: Search on "traceroutes"
- 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

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**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

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**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

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**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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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

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

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/ go061.10
http://www.cs.washington.edu/education/courses/100/04wi/index.htm

Summary

Networking is changing the world

Internet: named computers using TCP/IP
WWW: servers providing access to info

• 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