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

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

Campus & The World

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

All communication 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: `addr | data`
- 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

A Trip to Switzerland

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`

Use Google to find foreign computers.

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

- `.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 server; Server does the service and sends a reply

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

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

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.htm

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