Test Your Tech

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A. An exclusive social club.
B. A group of computers, usually in a single building, connected by cables.
C. Local television affiliates of the big networks.

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Special Guests

• Scott Barker, Director of IT and Chair of the Informatics program for the Information School (iSchool)
• Marshall Bjerke, Senior, Informatics

Announcements

• Deadlines at noon today
  − HW1 and Lab 2
  − Watch for your grades on MyUW’s Student tab in the CS pane
• Last week’s quiz:
  − Students who answered that RAM is measured in MB or GB will receive credit for that question.

Announcements

• Videocasts of the course are available within a couple hours after each lecture
  − Linked at top of Calendar on the course Web site

Announcements

• Office hours
  − Listed on course Web site’s Home page
  − Maps to our offices for office hours
• In addition to office hours
  − Drop-in labs
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

1. Nowhere is remote—access to info is no longer bound to a place
2. Connecting with others—email is great
3. Revised human relationships—too much time spent online could be bad
4. English becoming a universal language
5. 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

Basic Types of Networks

<table>
<thead>
<tr>
<th>Network Type</th>
<th>Differentiating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer-to-Peer</td>
<td>• No computer running server software</td>
</tr>
<tr>
<td>Server-Based Networks</td>
<td>• Computer running server software manages network traffic</td>
</tr>
<tr>
<td>Local Area Network</td>
<td>• Limited geographical area</td>
</tr>
<tr>
<td></td>
<td>• One-time capital cost (wire or fiber optics cable installation)</td>
</tr>
<tr>
<td>Wide Area Network</td>
<td>• Across town or across the globe</td>
</tr>
<tr>
<td></td>
<td>• Third-party service provider (monthly $$)</td>
</tr>
<tr>
<td></td>
<td>• More bandwidth = more expense</td>
</tr>
<tr>
<td></td>
<td>• Connects to LANs with a router</td>
</tr>
<tr>
<td>Campus Network</td>
<td>• One-time capital expense</td>
</tr>
<tr>
<td></td>
<td>• Buildings in close proximity</td>
</tr>
<tr>
<td>Metropolitan Area Network (MAN)</td>
<td>• Clusters of buildings in close proximity, separated from other clusters</td>
</tr>
</tbody>
</table>
LAN in the Lab

EtherNet is a popular LAN protocol
- Recall, it’s a “party” protocol

Connection to campus

EtherNet Cable

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

A Trip to Switzerland

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

TCP/IP

Packet-Switching

Animation

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

Use Google to find foreign computers
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
- 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.

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.

Domains

- .edu .com .mil .gov .org .net domains are “top level domains” for the US.
- 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.

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

<table>
<thead>
<tr>
<th>protocol</th>
<th>http://</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web server</td>
<td>www .cs.washington.edu</td>
</tr>
<tr>
<td>path</td>
<td>/education/courses/100/04wi directories (folders)</td>
</tr>
<tr>
<td>file</td>
<td>index</td>
</tr>
<tr>
<td>file extension</td>
<td>.htm</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