Test Your Tech

A local area network is:

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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Announcements

- **Homework 1**
  - Grading link
  - We are the first class on campus that will have grading linked to MyUW
    - Check MyUW for current status on points for the course
  - Will be set up in the next couple weeks
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

- Lab sections have pretty much settled
- Labs are pretty full
- Opportunity for more help, smaller class size
  - Lab AE on W-F mornings at 8am
  - Only 9 students are registered
Announcements

• Maps to our offices for office hours
  * On course Web site’s Home page
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
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

![Diagram of typical MGH or OUGL Lab with connected PCs through EtherNet 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 Trip to Switzerland

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

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<tr>
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<th>IP Address</th>
<th>Node Name</th>
<th>Location</th>
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<td>Swiss Federal Institute of Technology ETH-ETHER</td>
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</table>

Roundtrip time to eth.ch, average = 192ms, min = 187ms, max = 204ms ~ 14-Nov-02 1:39:08 PM
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

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

The FIT book contains the complete list
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;
  e.g.  http://www.cs.washington.edu/100/  goes to
  http://www.cs.washington.edu/education/courses/100/04wi/index.htm

<table>
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<td>domain</td>
<td>= .cs.washington.edu</td>
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<tr>
<td>path</td>
<td>= /education/courses/100/04wi/  <em>directories (folders)</em></td>
</tr>
<tr>
<td>file</td>
<td>= index</td>
</tr>
<tr>
<td>file extension</td>
<td>= .htm  <em>hypertext markup language</em></td>
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</table>
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