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Networking

More than just a social interaction

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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

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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?

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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

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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
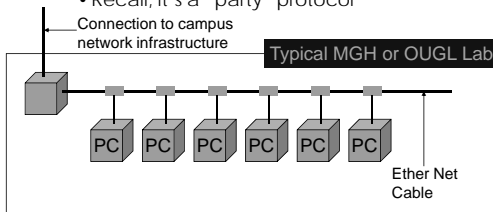 • HTTP -- hypertext transfer protocol -- for Web

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LAN in the Lab

EtherNet is a popular LAN protocol

• Recall, it's a "party" protocol

Connection to campus network infrastructure

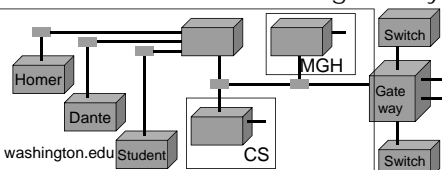Typical MGH or OUGL Lab

PC PC PC PC PC PC

Ether Net Cable

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Campus & The World

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

washington.edu

Switch — MGH — Gate way — Switch

Homer, Dante, Student, CS

All communication by TCP/IP

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IP -- Like Using Postcards

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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

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A Trip to Switzerland

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

UW Gateway

Check Internet Hops

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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

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Naming Computers I

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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

Peers

Domains begin with a "dot" and get "larger" going right

Naming Computers II

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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

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.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

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Logical vs Physical

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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

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Client/Server Structure

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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

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World Wide Web is the collection of servers (subset of Internet computers) & the information they give access to
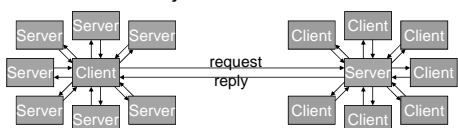- Clearly, WWW ≠ Internet
- The "server" is the web site computer and the "client" is the surfer's browser
- Many Web server's domain names begin with www by tradition, but any name is OK
- Often multiple server names map to the same site: MoMA.org and www.MoMA.org

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Client/Server Interaction

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For Web pages, the client requests a page, the server returns it: there's no connection, just two transmissions

request
reply

Servers serve many clients; clients visit many servers

Dissecting a URL

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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

protocol	= http://	
Web server	= www	
domain	= .cs.washington.edu	
path	= /education/courses/100/04wi/	*directories (folders)*
file	= index	
file extension	= .htm	*hypertext markup language*

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Summary

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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

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