



Announcements

Today's Labs are moved to Tuesday
... join any section: 8:30, 9:30, 1:30, 2:30

- Office hours have been posted on the class Web Page

Reminder of the Day: This class will have unannounced quizzes on the reading

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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,...

WWW'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

What do 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

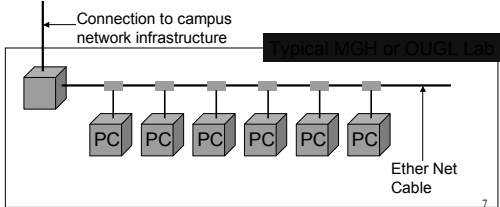
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LAN in the Lab

EtherNet is a popular LAN protocol

- Recall, it's a "party" protocol

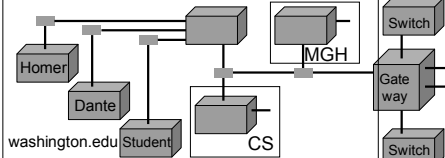


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Campus & The World

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



All communication by TCP/IP

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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 **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

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

Hop	IP Address	Node Name	Location	ms	Network
0	128.95.1.207	spitc.cse.washington.edu	University of Washington WASHINGTON		University of Washington WASHINGTON
1	128.95.1.100	uw02-GE0-1.cse.washington.edu	University of Washington WASHINGTON		University of Washington UW-SEA
2	140.142.150	uw02-GE0-1.cse.washington.edu	University of Washington WASHINGTON		University of Washington UW-SEA
3	193.107.50	through-washington-back-to-gigapop.net	...	0	Verio, Inc. VRCX-193-107
4	193.48.91.78	abilene-gmw-gigapop.net	...	5	University of Washington UW-SEA29
5	193.22.1.15	cdtmg-eth.abilene.ucsl.edu	...	10	Exchange Point Blocks NET-EP-1
6	193.22.8.50	dmw-eth.abilene.ucsl.edu	...	35	Exchange Point Blocks NET-EP-1
7	193.22.11.115	27	Exchange Point Blocks NET-EP-1
8	193.22.8.14	kisp-dmw.abilene.ucsl.edu	...	40	Exchange Point Blocks NET-EP-1
9	193.22.11.111	kisp-g-dmw.abilene.ucsl.edu	...	24	Exchange Point Blocks NET-EP-1
10	193.22.8.100	kisp-g-dmw.abilene.ucsl.edu	...	29	Exchange Point Blocks NET-EP-1
11	193.22.8.100	kisp-g-dmw.abilene.ucsl.edu	...	52	Exchange Point Blocks NET-EP-1
12	193.22.8.100	kisp-g-dmw.abilene.ucsl.edu	...	72	Exchange Point Blocks NET-EP-1
13	193.22.8.100	kisp-g-dmw.abilene.ucsl.edu	...	66	Exchange Point Blocks NET-EP-1
14	62.40.103.25	abilene-gmw-dmw.gigapop.net	(United Kingdom)	165	IP allocation for OGEANT network
15	62.40.103.62	gw-eth.gigapop.net	(United Kingdom)	171	IP allocation for OGEANT network
16	62.40.103.25	abilene-gmw-dmw.gigapop.net	(United Kingdom)	162	IP allocation for OGEANT network
17	62.40.103.18	swiCE2-P6-1.switch.ch	(Switzerland)	178	IP allocation for OGEANT network
18	128.95.36.42	uw02-GE0-2.switch.ch	(Switzerland)	167	SWITCH Teleinformatics Services SWITCH-LAN
19	192.33.92.1	ipw-eth-switch-1-giga-to-switch.ethz.ch	(Switzerland)	192	Swiss Federal Institute of Technology ETH-NETB
20	128.132.28.10	ipw-eth-switch-1-giga-to-switch.ethz.ch	(Switzerland)	198	Swiss Federal Institute of Technology ETH-ETHER
21	129.132.1.15	eth.ch	(Switzerland)	192	Swiss Federal Institute of Technology ETH-ETHER

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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

Peers →

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

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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 relates the logical network to the physical network by translating domains to IP.

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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

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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*

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Brief Encounter

Web surfers are not "connected" to a server, but interact briefly: Browser (client) sends a request for a page, the server replies; it's 2 transmissions

- This is a smart scheme: clients can flit from site to site; servers handle other requests

This scheme is part of the hypertext transfer protocol, http

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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/100/03wi/index.htm>

protocol	= http://	
Web server	= www	
domain	= .cs.washington.edu	
path	= /education/courses/100/03wi/	<i>directories (folders)</i>
file	= index	
file extension	= .htm	<i>hypertext markup language</i>

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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
- Domain Name System connects the two
- Client/Server, fleeting relationship on WWW