

Announcements

- Everyone must Fill Out A Survey
<https://catalyst.uw.edu/webq/survey/snyder/193428>
- Answers 3 things:
 - Path name to your web site ... something like
<http://students.washington.edu/YOURUWNETID/mycode/show.html>
 - Yes/No Do I have your permission for CSE120's Gallery Page to link to your page? ...
 - Who would you like to 'pair programming"

Connected computers are better! How's it done?

Networking ...

Lawrence Snyder
University of Washington, Seattle

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, email, texting, mobile, etc.

Today's Message: Internet is NOT really a bunch of tubes!

Network Structure

Networks are structured differently based (mostly) on distance between computers:

- Local area network (LAN)
 - Small area: room or building
 - Either wired (Cu or fiber) or wireless
- Wide area networks (WAN)
 - Large area: more than 1 km
 - Fiber-optic, copper transmission lines, μ -wave, satellite
- Metropolitan area networks (MAN)
 - Neighborhood or several blocks of business district
 - Private service provider owns network

Protocol Rules!

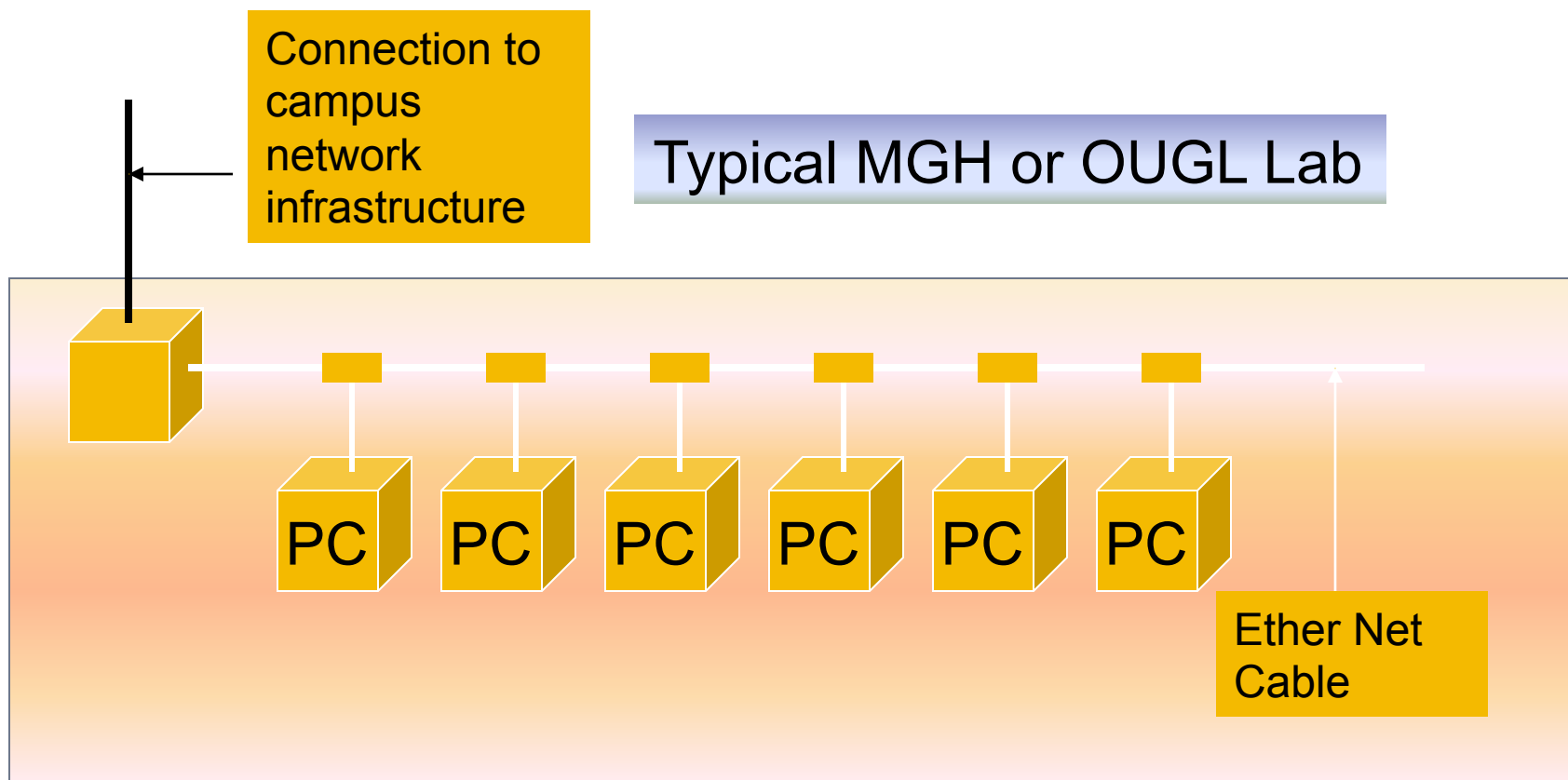
To communicate computers need to know how to set up the info to be sent and interpret the info received

- Communication rules are a *protocol*
- Example protocols
 - EtherNet—for physical connection in a LAN
 - TCP/IP—for Internet—transmission control protocol / internet protocol
 - HTTP—for Web—hypertext transfer protocol

LAN in the Lab

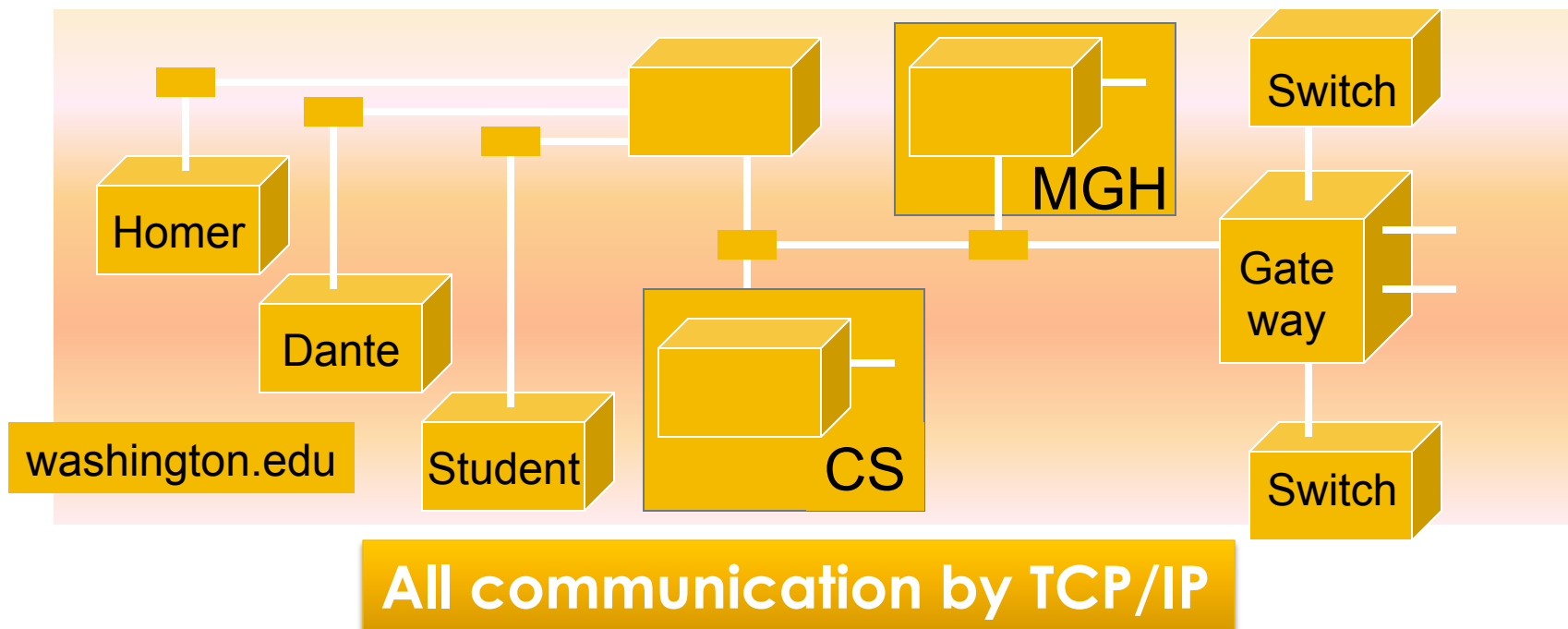
EtherNet is a popular LAN protocol

- It uses a “party” protocol




Campus & The World

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



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


Key Point: Taking separate routes lets packets by-pass congestion and out-of-service switches; packet reassembly discovers lost packets; ask for resend

Check Out the Vids

- Two videos are linked from the calendar ... please check them out

How The Internet Works In 5 Min

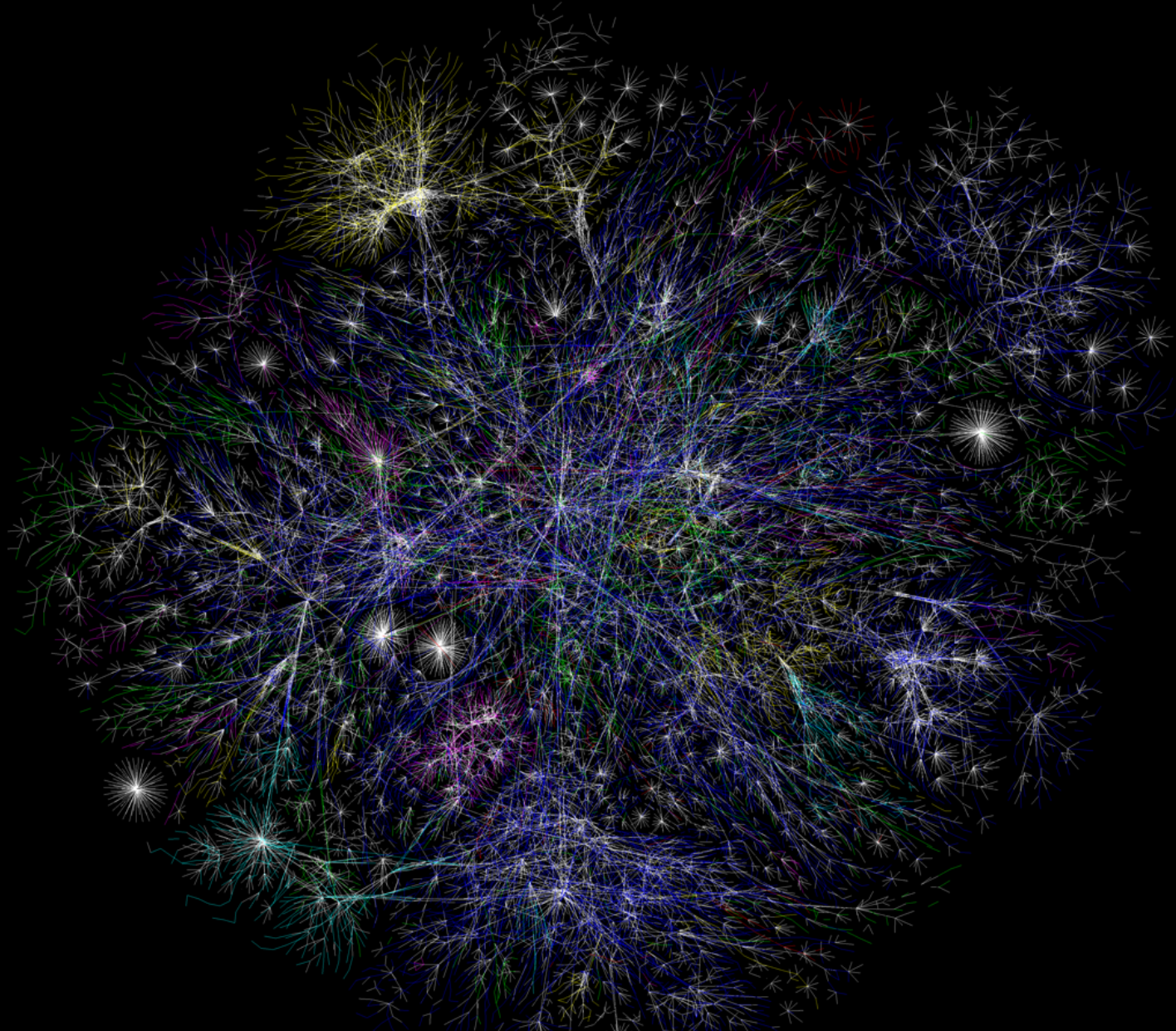
 **History of the Internet**
by Melih Bilgil
1 year ago



The image displays two video player thumbnails side-by-side. The left thumbnail shows a hand drawing a horizontal line on a whiteboard. The right thumbnail shows a network diagram with nodes and connections. The video player interface includes a play button, a progress bar, and a volume icon. The right video player also has a yellow play button overlay and a 'HD IS ON' indicator.

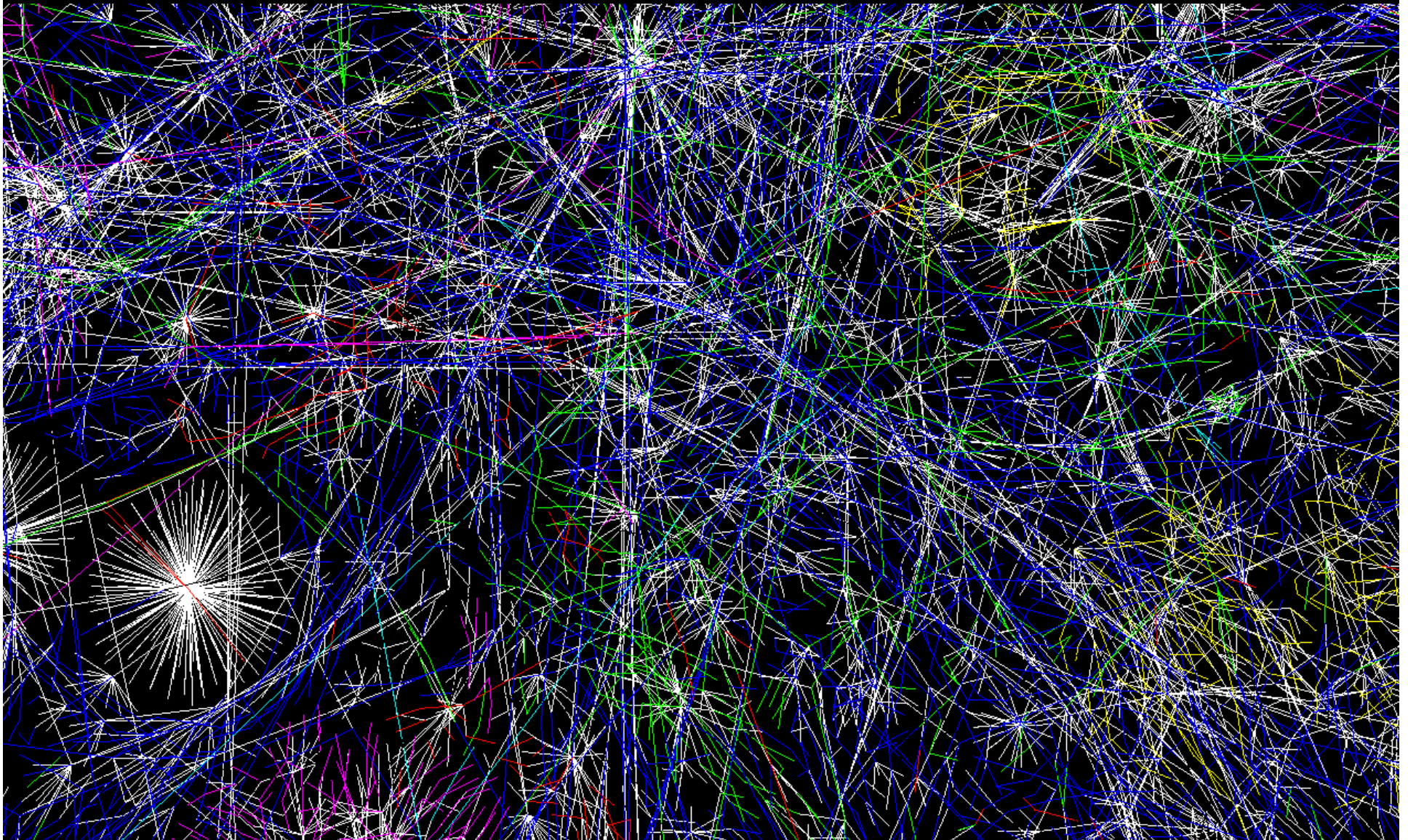
https://www.youtube.com/watch?v=7_LPdttKXPc

<http://www.vimeo.com/2696386>



net, ca, us com, org mil, gov, edu
jp, cn, tw, au de, uk, it, pl, fr br, kr, nl unknown

Picture of Portion of I'net 2005



A Quick Trip to U. Florida

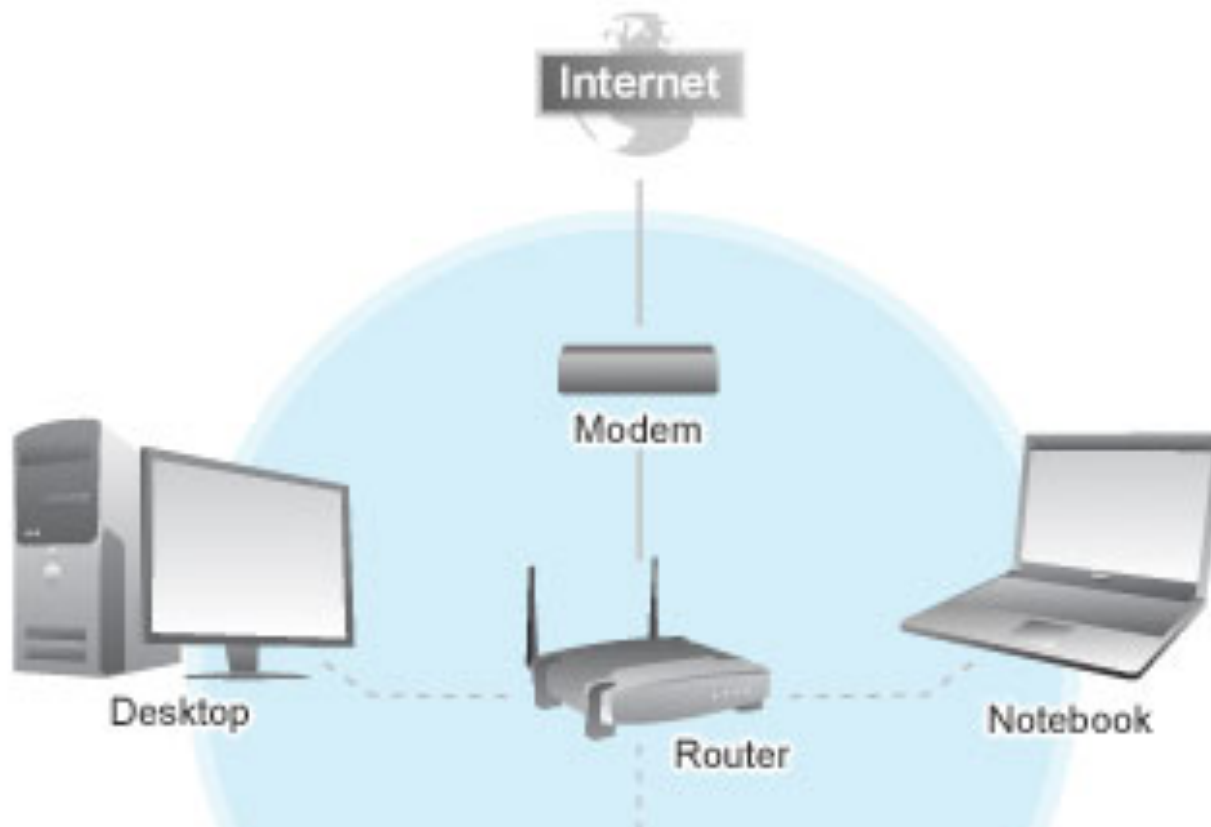
Table: Traceroute to cise.ufl.edu

Hop	IP Address	Node Name	Location	ms	Network
0	10.0.1.1	-		4	[Local Network]
1	10.0.1.1	-		3	[Local Network]
2					
3	68.87.205.1	-	Mt Laurel, usa	16	[Network for 68.87.205.1]
4	68.85.240.101	be-70-ar01.burien.wa.seattle.comcast.net	Mt Laurel, usa	13	[Network for 68.85.240.101]
5	68.85.240.69	be-30-ar01.seattle.wa.seattle.comcast.net	Seattle, WA, USA	13	[Network for 68.85.240.69]
6	68.86.90.213	pos-0-5-0-0-cr01.seattle.wa.ibone.comcast.net	Seattle, WA, USA	10	[Network for 68.86.90.213]
7	68.86.85.206	pos-0-8-0-0-cr01.portland.or.ibone.comcast.net	Portland, OR, USA	16	[Network for 68.86.85.206]
8	68.86.85.197	pos-1-15-0-0-cr01.sacramento.ca.ibone.comcast.net	Sacramento, CA, USA	26	[Network for 68.86.85.197]
9	68.86.85.181	pos-0-9-0-0-cr01.sanjose.ca.ibone.comcast.net	San Jose, CA, USA	34	[Network for 68.86.85.181]
10	154.54.11.105	te3-3.mpd01.sjc04.atlas.cogentco.com	San Jose, CA, USA	45	PSINet, Inc.
11	154.54.0.177	te9-1.ccr02.sfo01.atlas.cogentco.com	San Francisco, CA, USA	33	PSINet, Inc.
12	154.54.3.137	te3-8.ccr01.lax01.atlas.cogentco.com	Los Angeles, CA, USA	62	PSINet, Inc.
13	154.54.0.226	te3-8.ccr01.iah01.atlas.cogentco.com	Houston, TX, USA	97	PSINet, Inc.
14	154.54.24.194	te3-2.ccr01.mia01.atlas.cogentco.com	Miami, FL, USA	110	PSINet, Inc.
15	154.54.1.186	te3-3.ccr01.mia03.atlas.cogentco.com	Miami, FL, USA	114	PSINet, Inc.
16	38.112.31.66	florida_lambda_rail_llc.demarc.cogentco.com	Washington, DC, USA	111	PSINet, Inc.
17	198.32.155.10	tpa-flrcore-7609-1-te21-1.net.flrnet.org	Marina del Rey, usa	124	EP.NET, LLC.
18	198.32.173.161	tlh-flrcore-7609-1-te41-1907.net.flrnet.org	Marina del Rey, usa	122	EP.NET, LLC.
19	198.32.173.162	ctx36-ewan-msfc-1-v1907-1.ns.ufl.edu	Marina del Rey, usa	203	EP.NET, LLC.
20	128.227.236.85	ctx36-nexus-msfc-1-v50-1.ns.ufl.edu	Gainesville, FL, USA	147	University of Florida
21	128.227.236.14	csev1-core-msfc-1-v41-1.ns.ufl.edu	Gainesville, FL, USA	156	University of Florida
22	128.227.254.74	-	Gainesville, FL, USA	146	University of Florida
23	128.227.205.2	cise.ufl.edu	Gainesville, FL, USA	131	University of Florida

You can find such “trace route” facilities by Googling, and then type in the IP-Addresses around the world

Wireless is a LAN technology

- As with “wired Ethernet,” all computers in range can hear the radio signals of the others



Naming Computers—Take 1

People name computers by a domain name

- a hierarchical scheme that groups like computers
 - `.edu` All educational computers, a TLD
 - `.washington.edu` All computers at UW
 - `dante.washington.edu` A UW computer
 - `.ischool.washington.edu` iSchool computers
 - `.cs.washington.edu` CSE computers
 - `spiff.cs.washington.edu` A CSE computer

Domains begin with a “dot” and get “larger” going right

Naming Computers—Take 2

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 (US)

Do you know sites like:
bit.ly
www.nba.tv
del.icio.us
... they exploit TLDs

Logical vs Physical

View the Internet in two ways:

1. Humans see a hierarchy of domains relating computers—**logical network**
2. Computers see groups of four number IP addresses—**physical network**

Both are ideal for the “user's” needs

- The Domain Name System (DNS) relates the logical network to the physical network by translating domains to IP addresses

Internet vs. World Wide Web

- Many people mis-use the terms “Internet” and “World Wide Web”
- Let’s get them right

Internet: all of the wires, fibers, switches, routers etc. connecting named computers

Web: That part of the Internet —web servers—that store info and serve Web pages and provide other services to client computers

The Web Is Big

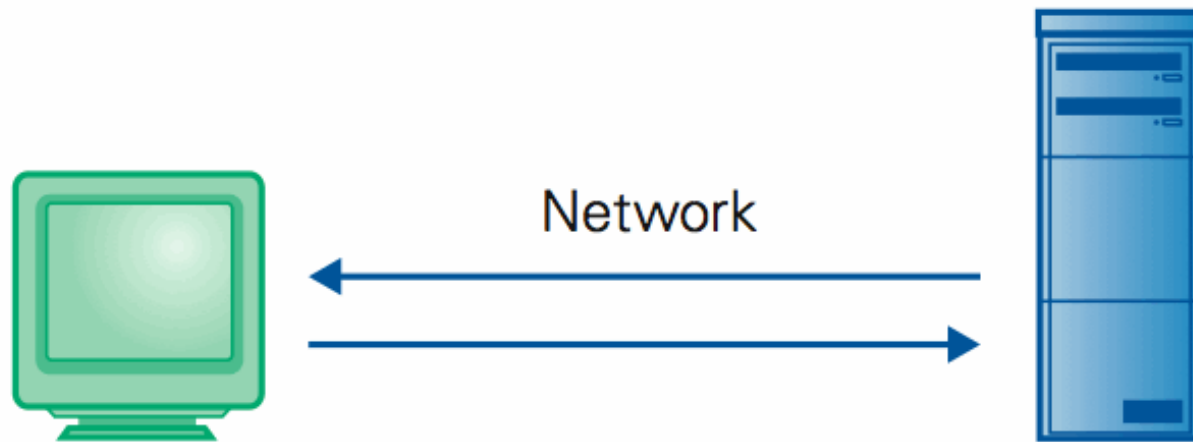
- 14 Billion Web Pages
- 1 Trillion Web Documents ...

Yet, it is possible to get to any one of them in 19 clicks or fewer!

New analysis as of 18 Feb 2013

One More Protocol: Client/Server

- The Web and much of the Internet services use the client server form of interaction



Client Computer

Requests services

(Sends URL for a Web page)

Server Computer

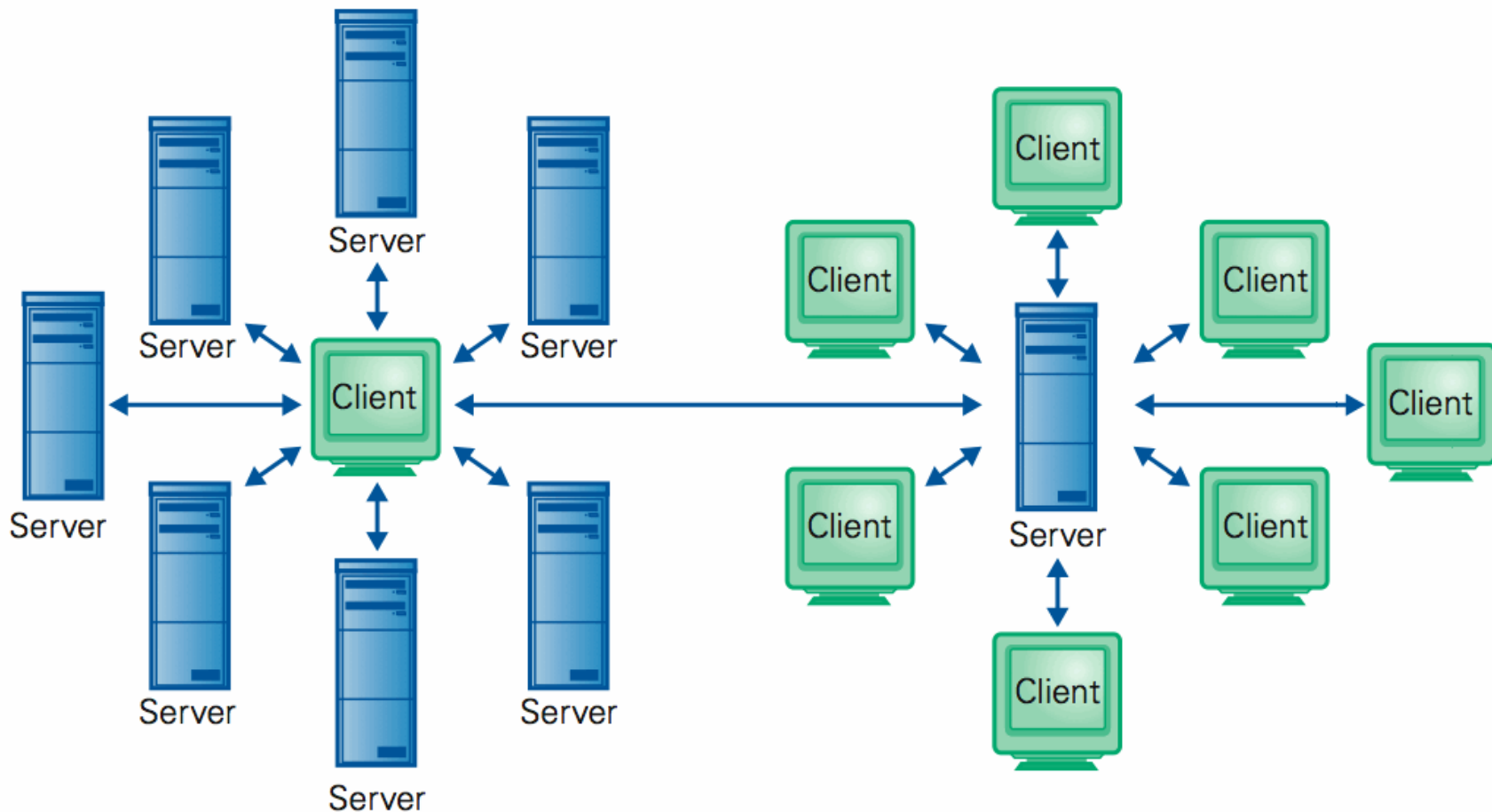
Provides services

(Returns the Web page file)

- It's a VERY BRIEF relationship

Client/Server Is Also Smart

- Clients and servers are not connected – they only exchange info ... “no commitment issues”



Summary

Networking changed the world

Internet: named computers using TCP/IP

WWW: servers providing Web pages

- 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

Pair Programming

- Pair programming – two people work side-by-side programming one problem together
 - It's thought to be more productive – fewer errors, smarter code
 - It's certainly more fun
- CSE120 Rules –
 - ALL WORK ON PROJECT MUST BE DONE TOGETHER
 - Share coding duties, commenting duties
- Teams: comparable skill, compatible times