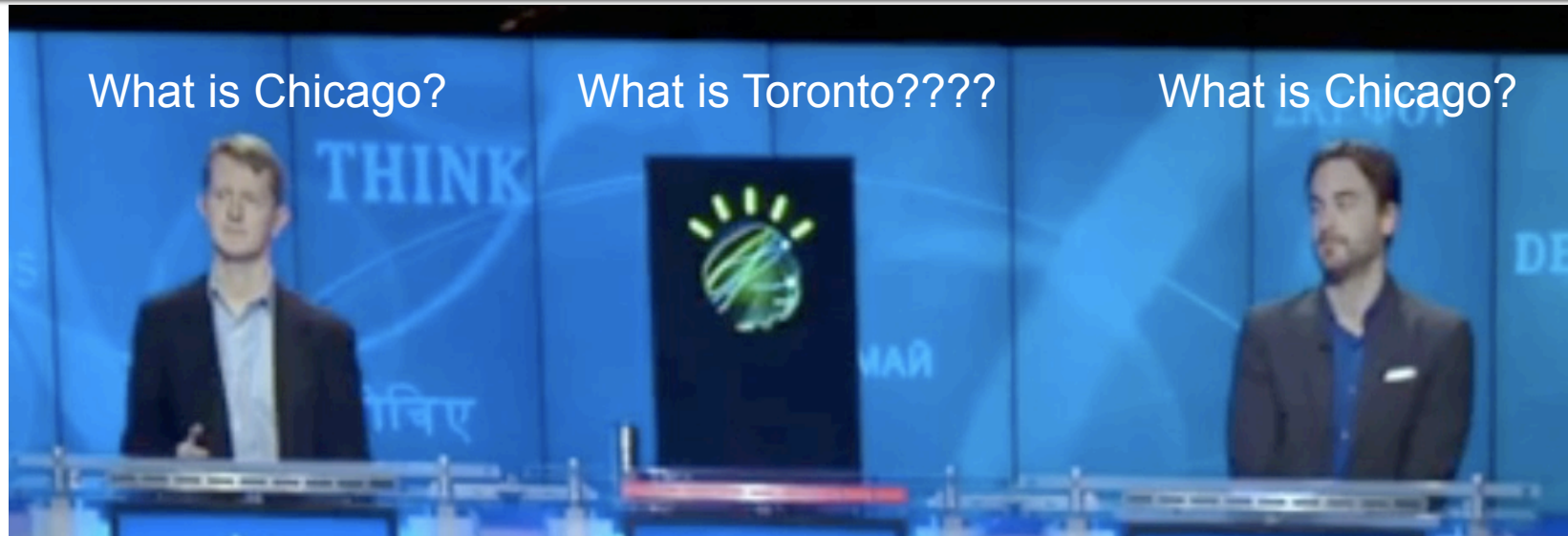# Announcements

- Midterm corrections – BEFORE Friday
- LOCATION CHANGE – next Tuesday's lab (Feb 22) will be held in CSE 403, where we will hear Richard Ladner on "accessibility"

- Due date for pairs programming assignment is next Wednesday before class

Watson "Crushes" Jeopardy Stars

What is Chicago?   What is Toronto????   What is Chicago?

- But, in Final Jeopardy: US Cities

"This city's largest airport is named for a WWII hero, and its second largest airport is named for a famous WWII battle"

Watson completely blew it!

Wandering The Halls of CSE

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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
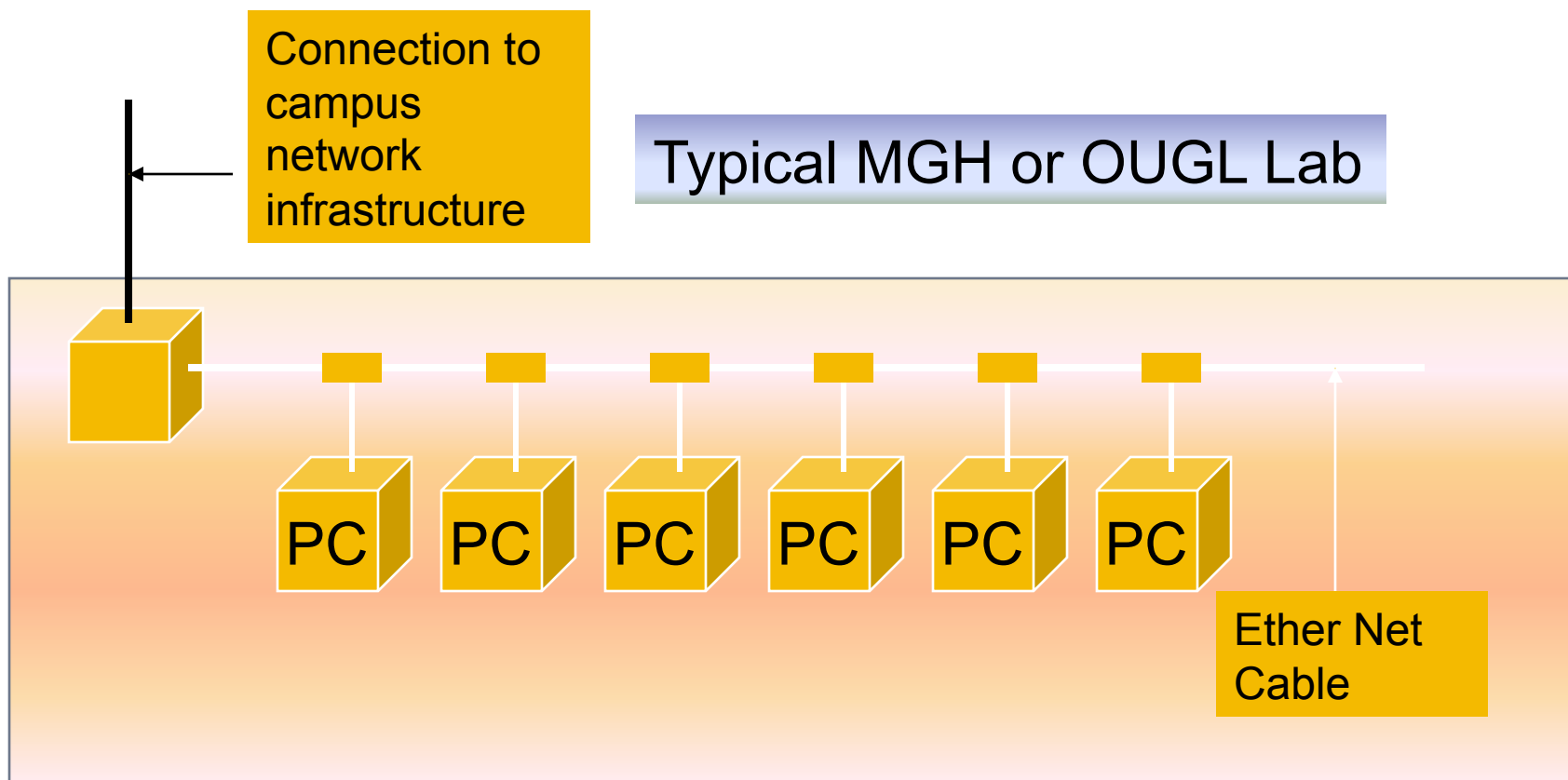
Protocol Rules!

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
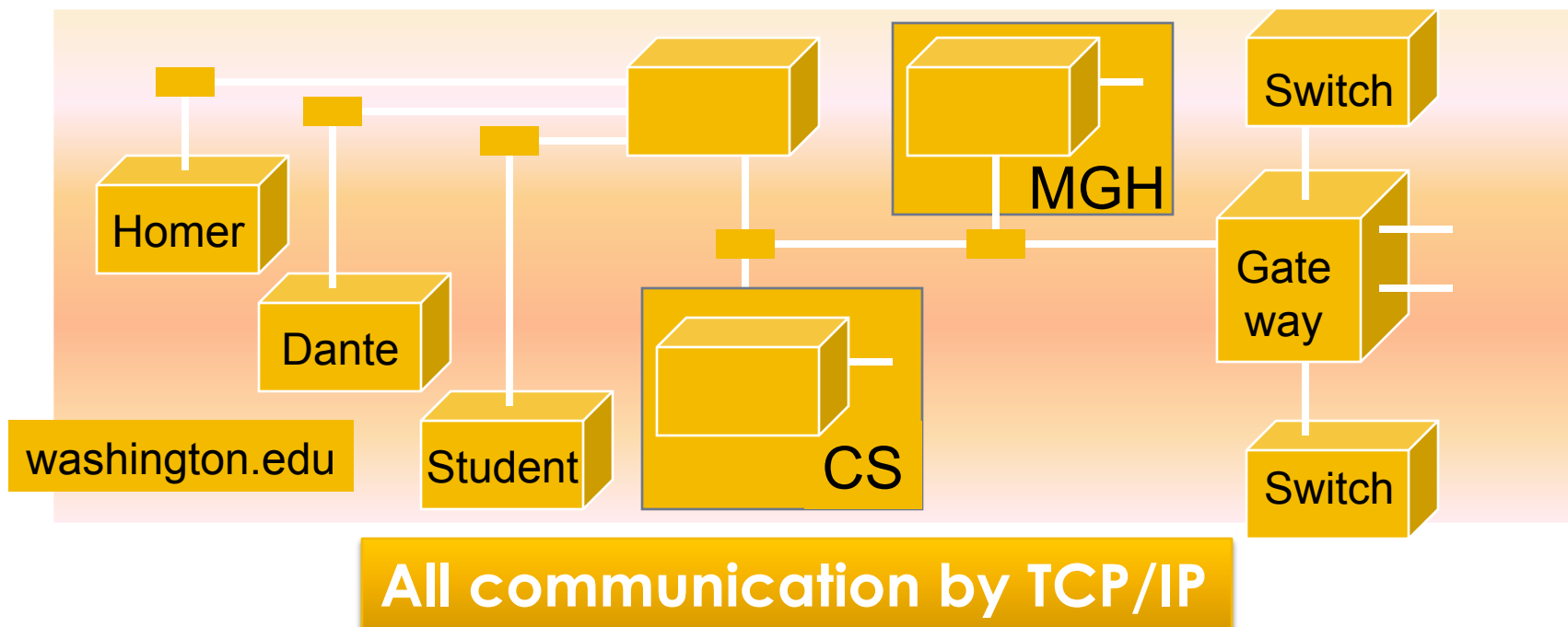 - HTTP—for Web—hypertext transfer protocol

LAN in the Lab

EtherNet is a popular LAN protocol

- It uses a "party" protocol

Connection to campus network infrastructure

Typical MGH or OUGL Lab

PC PC PC PC PC PC

Ether Net Cable

Campus & The World

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

Homer

Dante

washington.edu

Student

CS

MGH

Switch

Gateway

Switch

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

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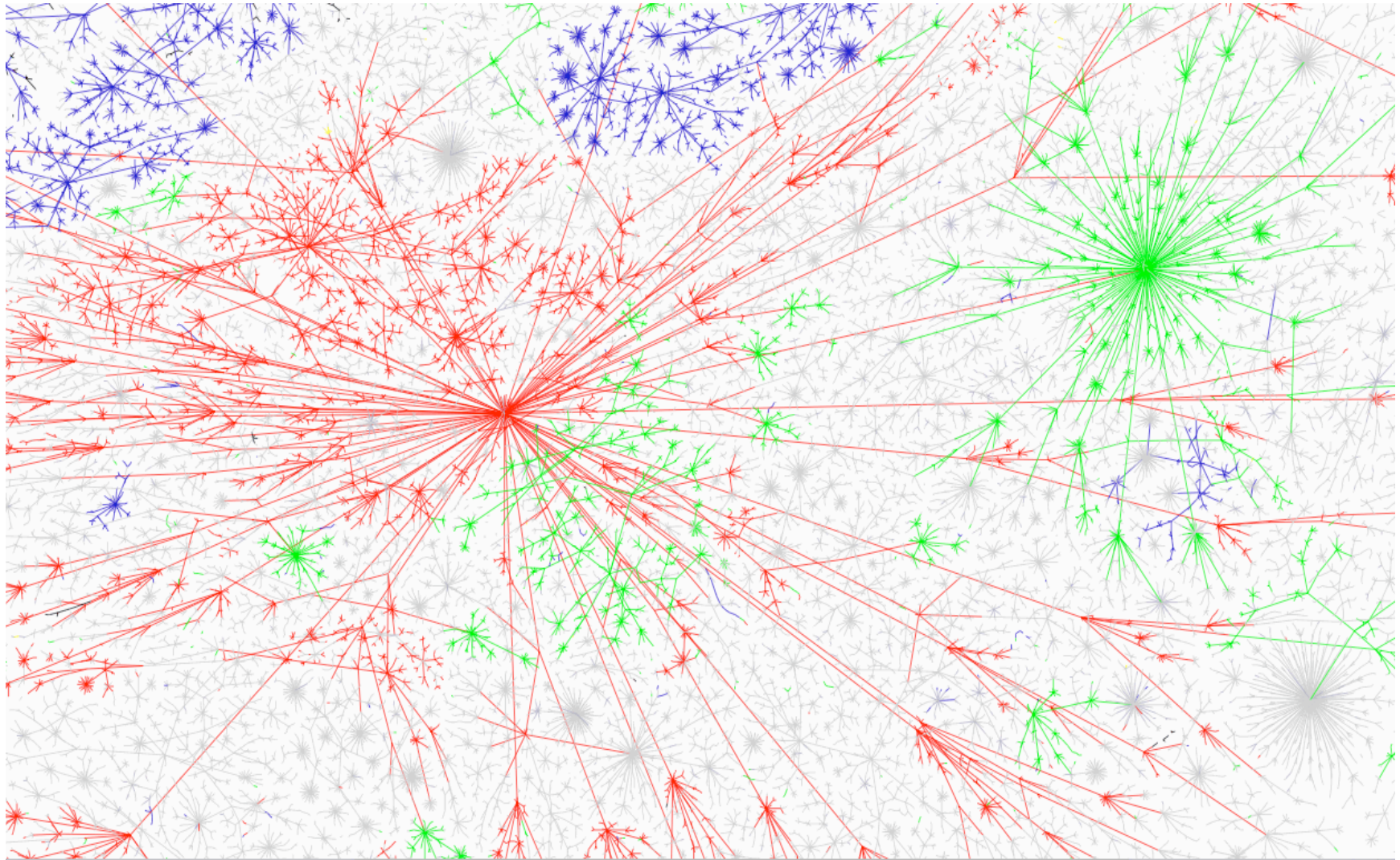
Check Out the Vids

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

History of the Internet
by Melih Bilgil
1 year ago
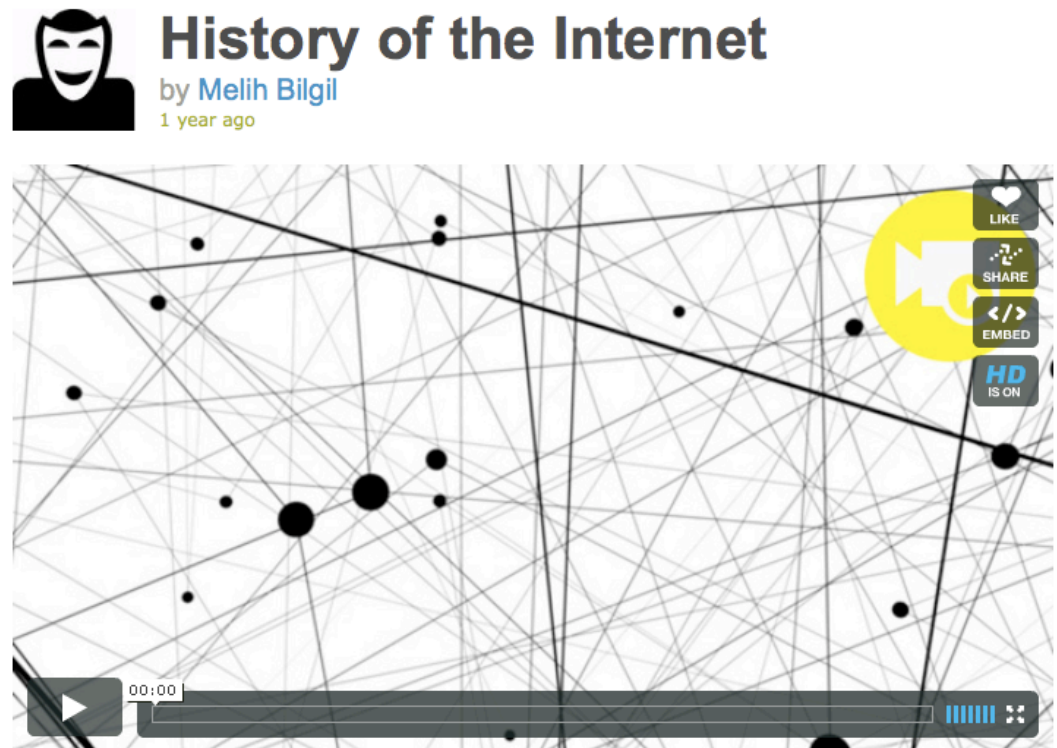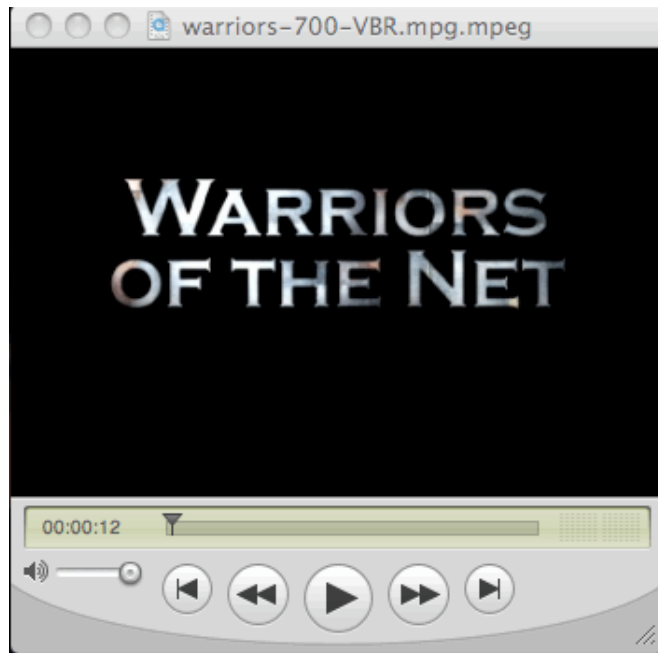
http://www.youtube.com/watch?v=PBWhzz_Gn10   http://www.vimeo.com/2696386

Picture of Portion of I'net

A Quick Trip to U. Florida

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	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_lambdarail_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

Table: Traceroute to cise.ufl.edu

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

Route Across the US

- The route
  - Starts with my ISP moving packet through MAN
  - Next, the packet enters a regional WAN
  - Next, the packet crosses the backbone
  - Arriving at another regional WAN
  - Next arriving on campus in a LAN
  - Delivered to the destination computer

Regional Network

- The Watchtower regional network of Eastern MA
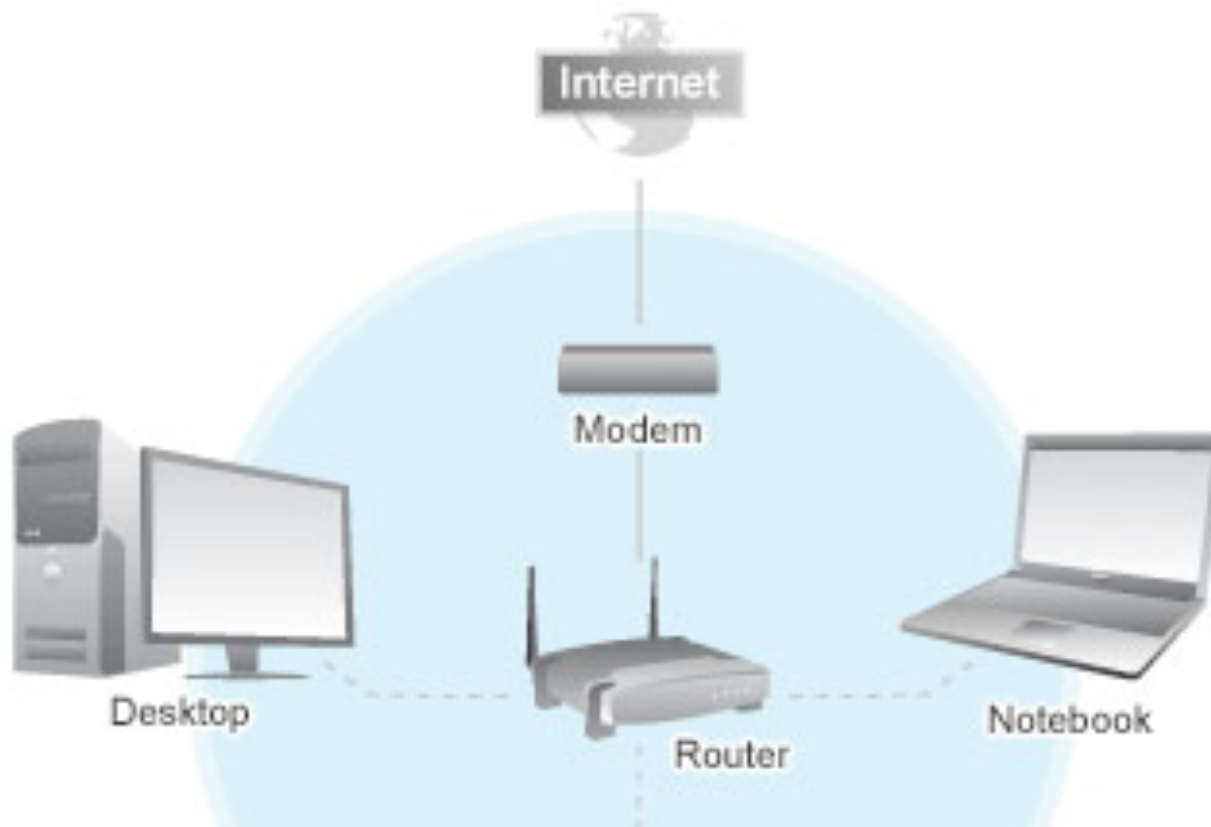- Every state/region has one or a few

A Backbone Carrier -- NCSA
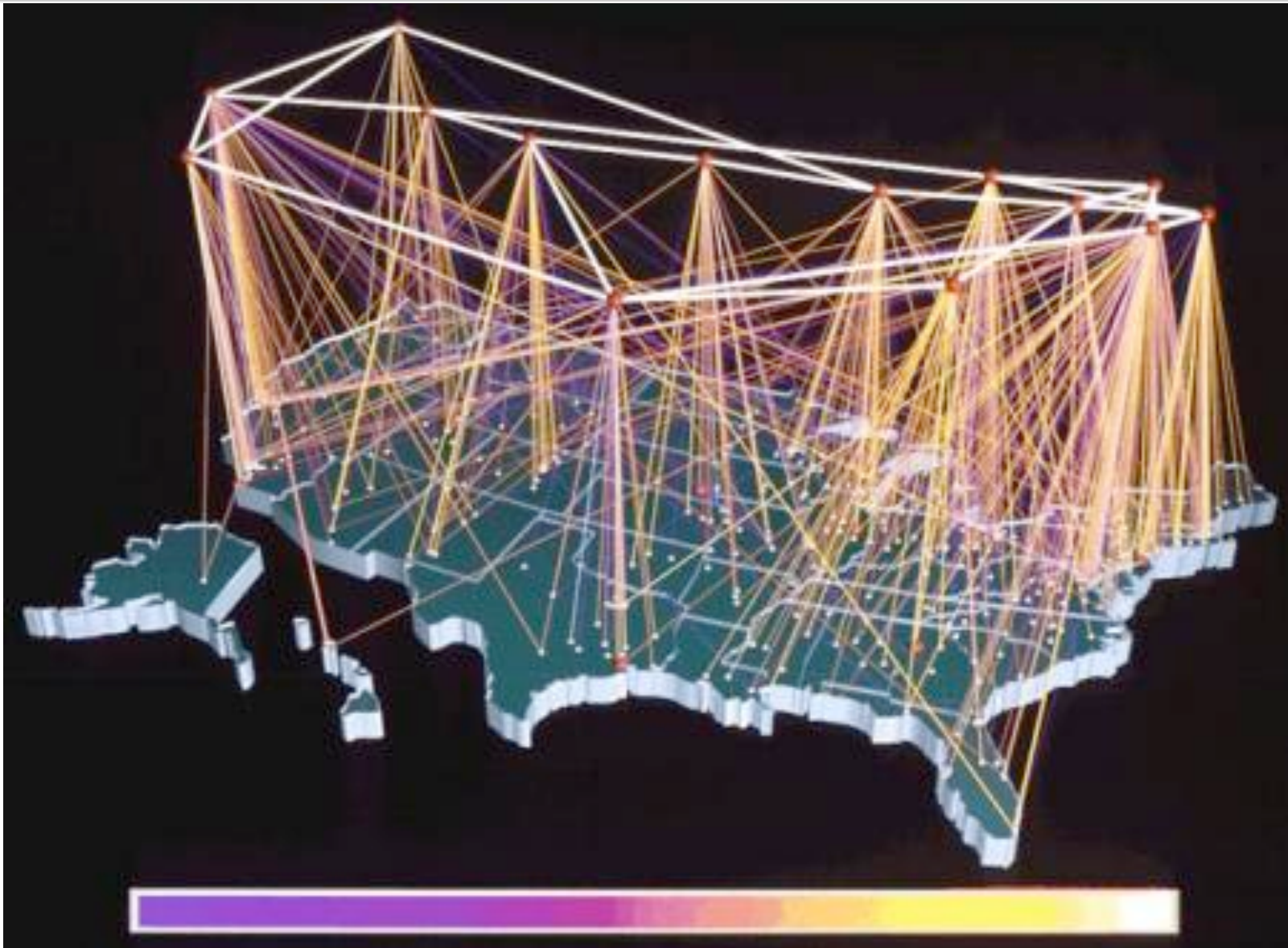
Wireless is a LAN technology

- 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
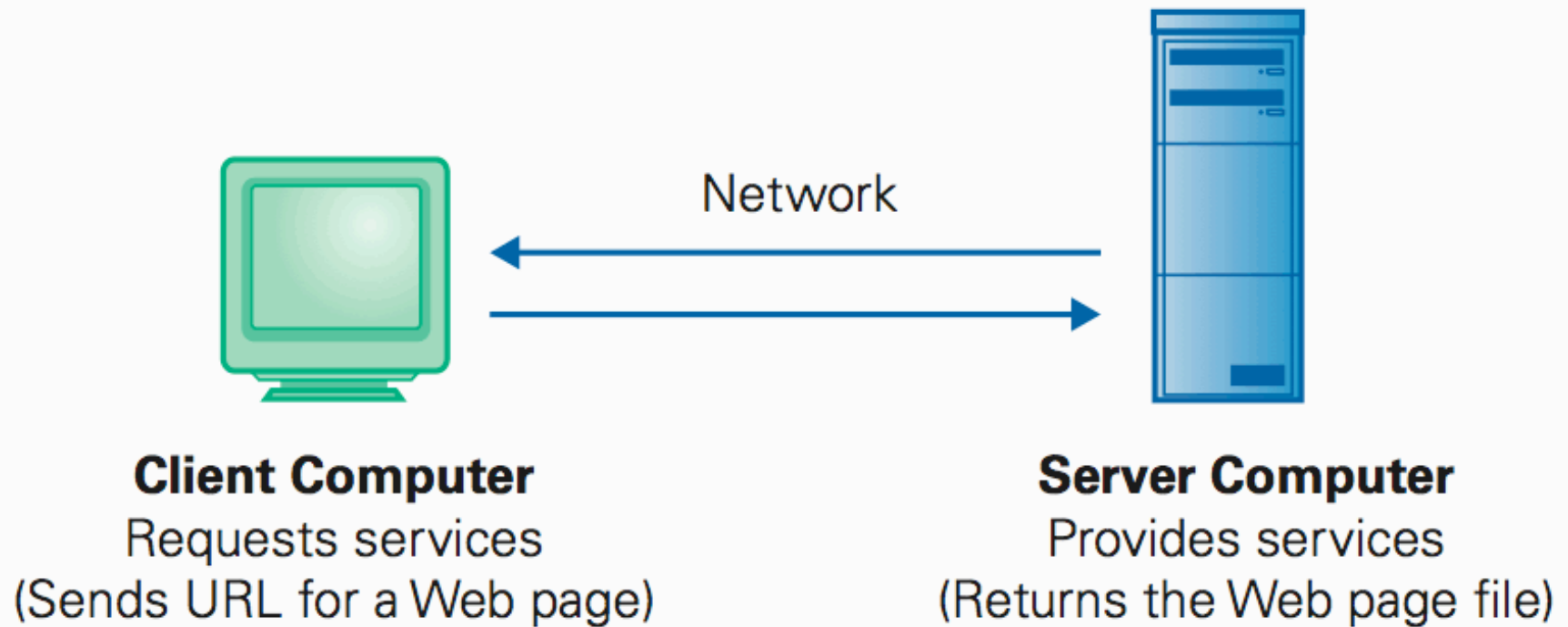
Internet vs. World Wide Web

- 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

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)

Network

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"
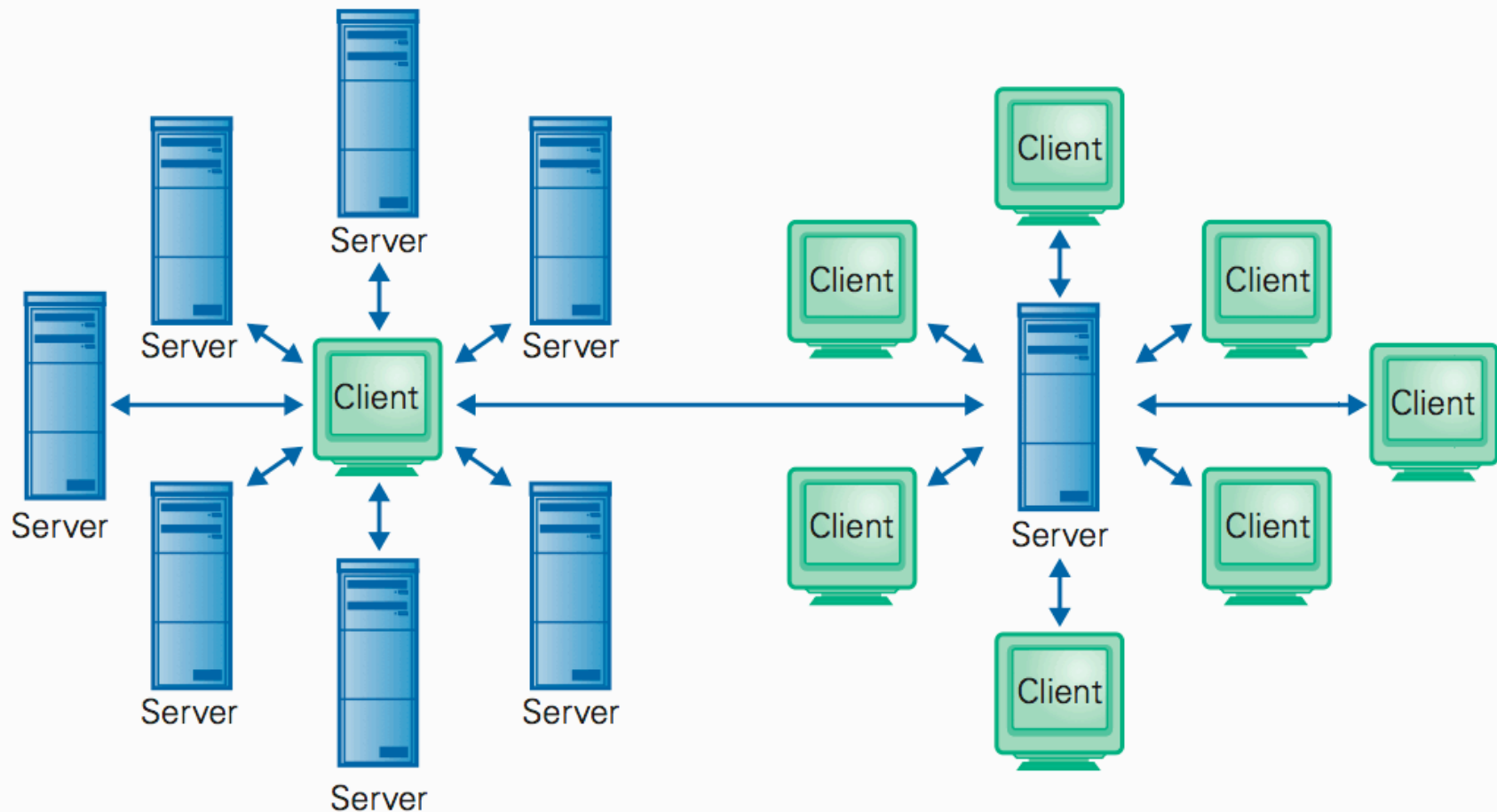
Summary

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