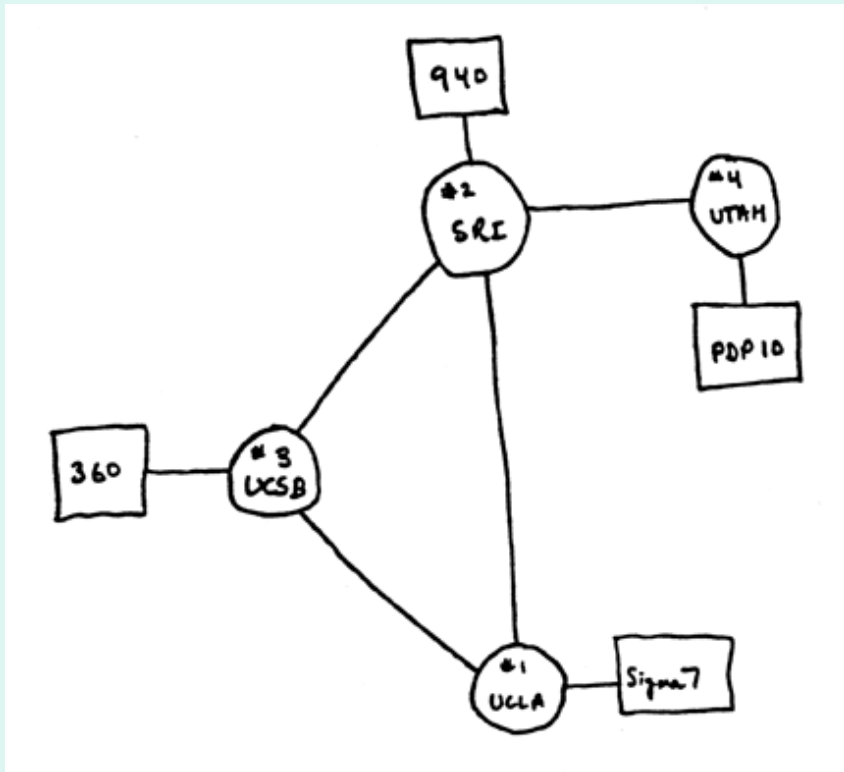


Introduction to the Internet

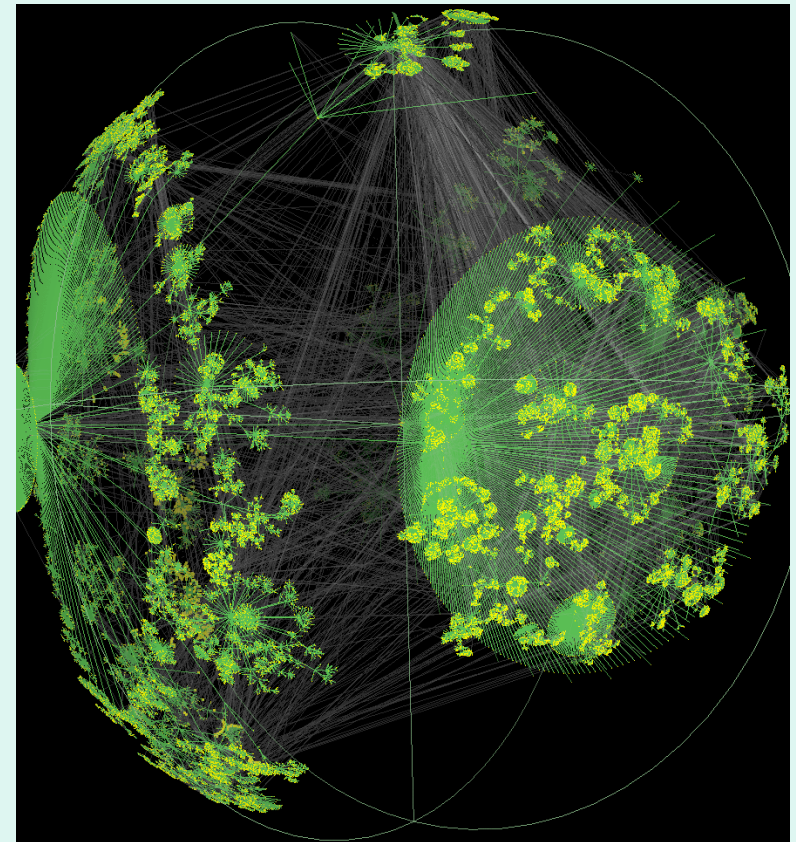
September 7, 2005

Lecture 1

1969 to Present



First 4 Nodes in the “internet”



“Map” of the internet, Young Hyun , from CAIDA

ARPANET

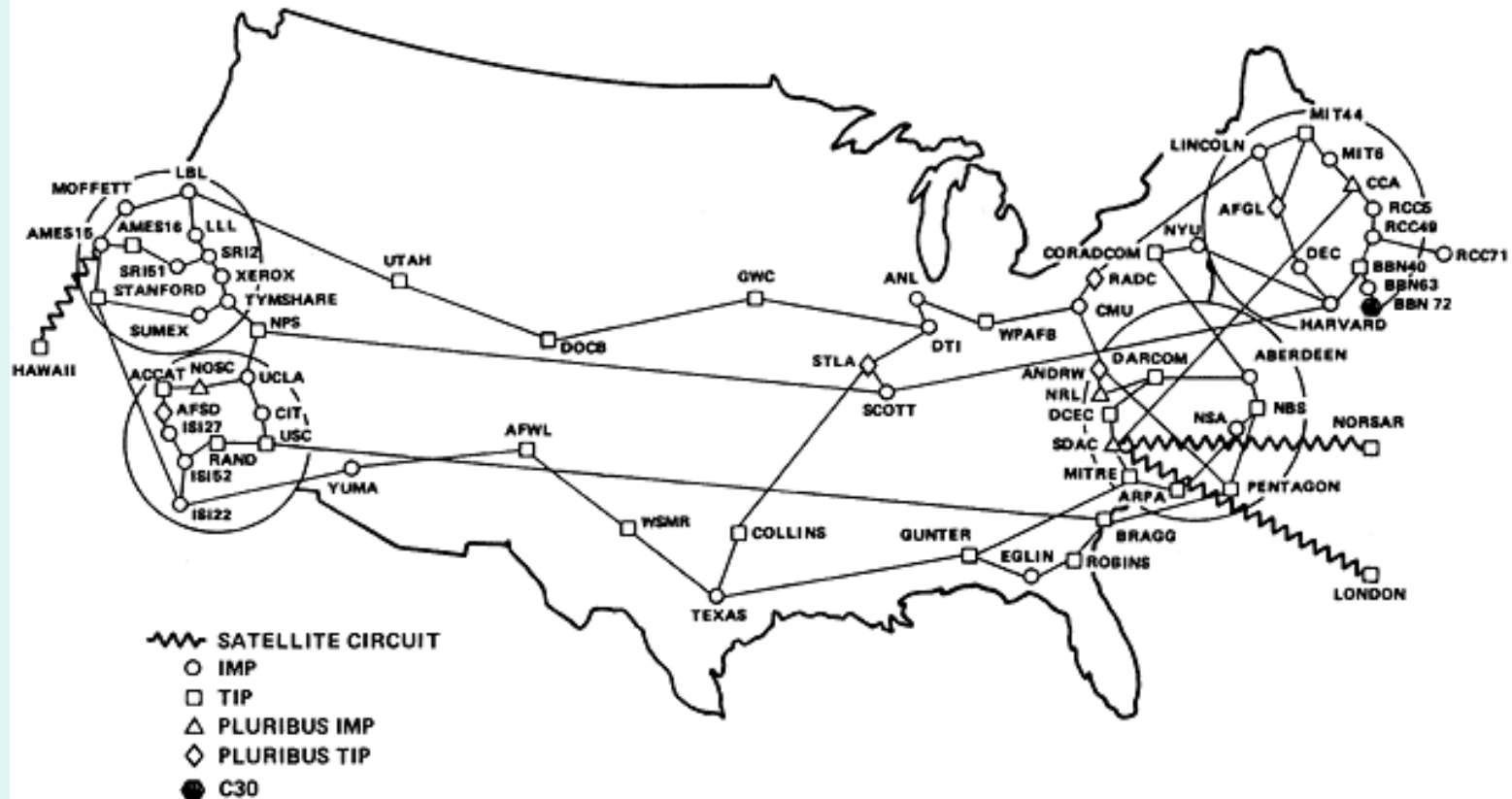
- J. Licklider of MIT first head of ARPA, Advanced Research Projects Agency
 - Proposed idea of “galactic network” of computers
- First 4 nodes in 1969 connecting SRI, UCSB, UCLA, and Utah
- ARPANET was the first “internet”
 - Connected research institutions and military bases
- Many other networks came along: EUNet, NSFNet, UseNet, etc.

Standardization with TCP/IP

- TCP/IP developed in 1974 – Stanford and ARPA
- TCP/IP : Transmission Control Protocol/ Internet Protocol
- All these computers and networks need a way to “talk” to each other
- ARPANET adopted (finally) TCP/IP in 1982

ARPANET 1980

ARPANET GEOGRAPHIC MAP, OCTOBER 1980



(NOTE: THIS MAP DOES NOT SHOW ARPA'S EXPERIMENTAL SATELLITE CONNECTIONS)

NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

Internet Grows

- NSFNet provided backbone in US
 - Only for research and education
- By 1986, 5000 hosts online
- By 1987, 28,000 hosts online
- Excluding commercial uses from NSFNet led to creation of private internet service providers

ARPANET Dies

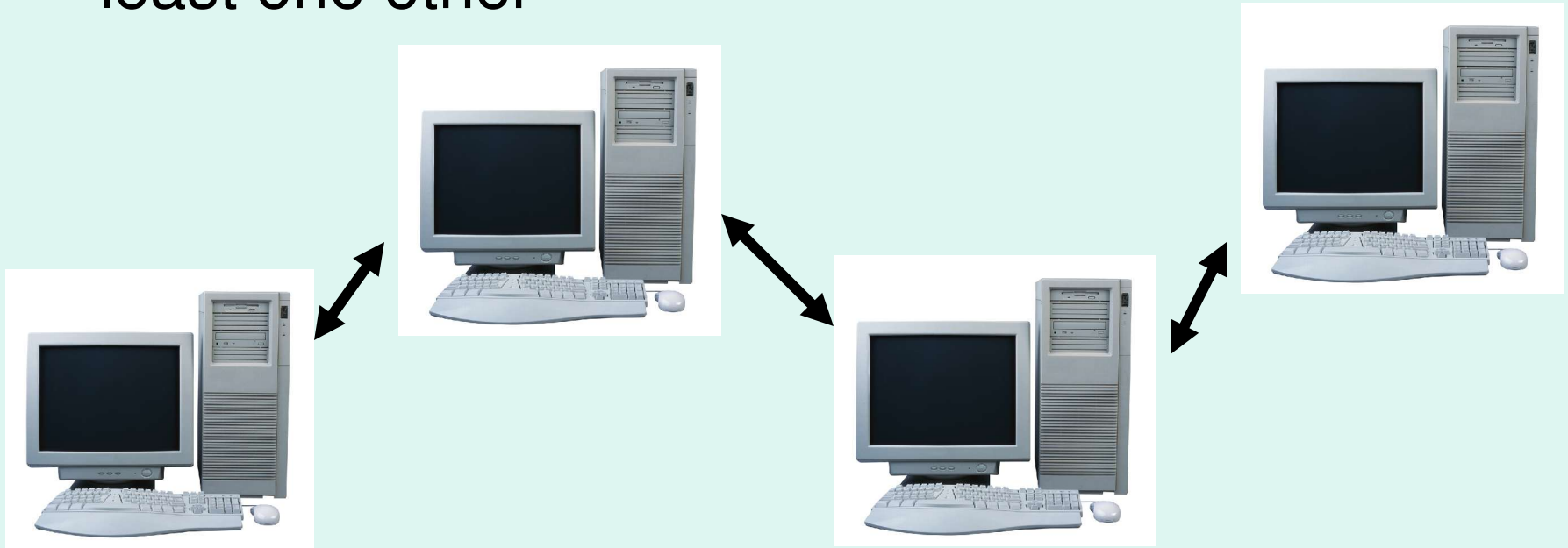
- 1989 300,000 hosts online
- 1990 ARPANET transfers to NSFNet
- 1991 NSFNet allows commercial users
- 1991 WWW is released

How Does the Internet Work?

Unit 1

What is the Internet?

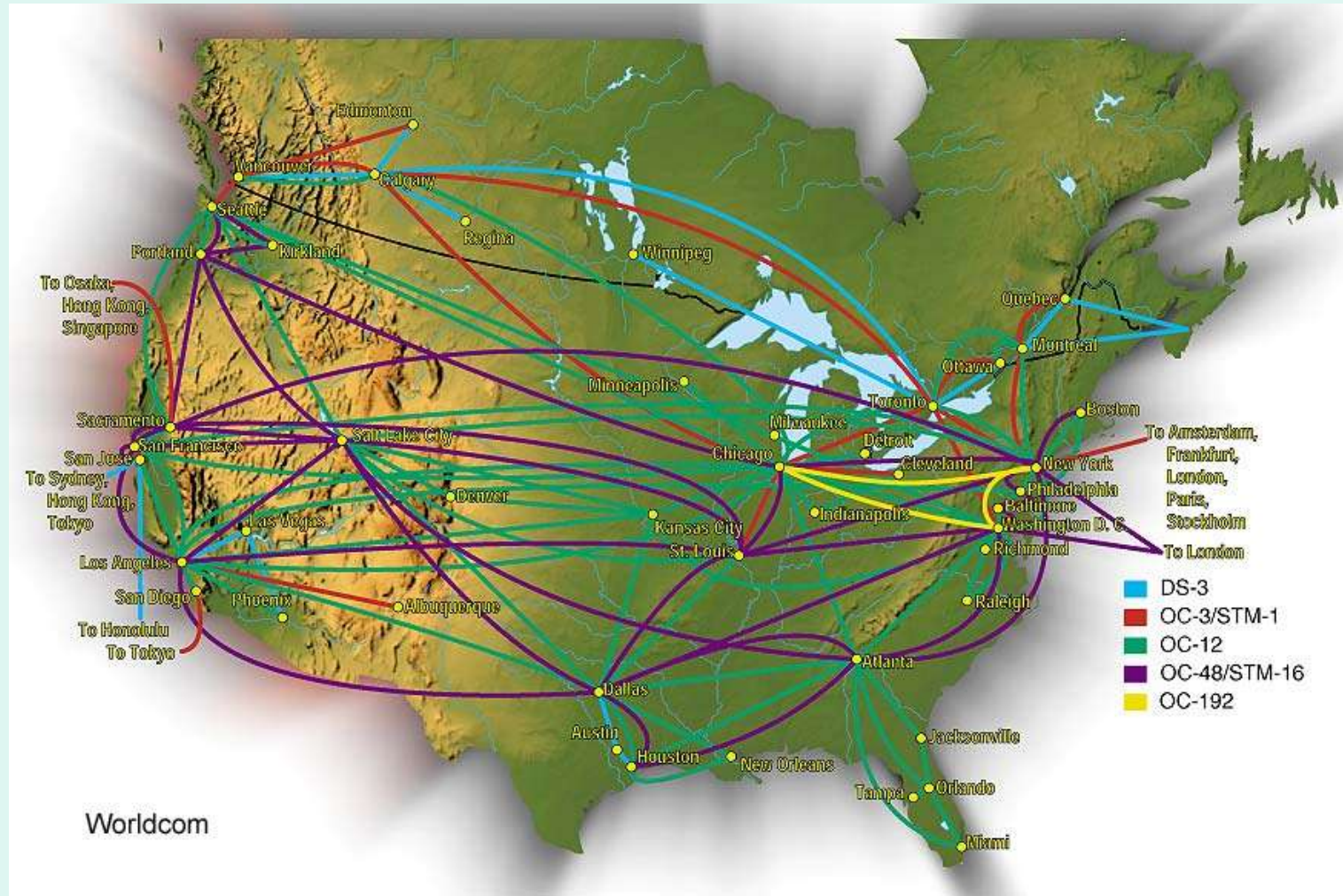
- HUGE network of connected computers
- Each computer must be connected to at least one other



Internet Organization

- Personal computers generally connected to one computer, its *Gateway*
- *Gateway* probably on a high speed connection to a *Backbone*
- *Backbones* form the core of the Internet infrastructure
 - Usually optical fiber

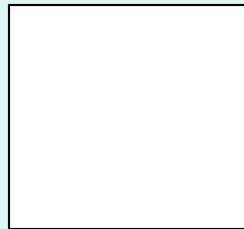
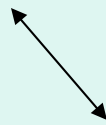
Worldcom US Backbone



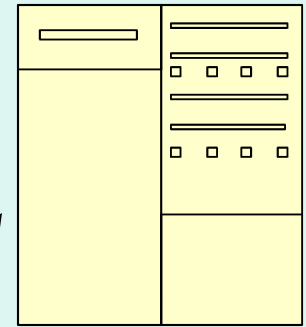
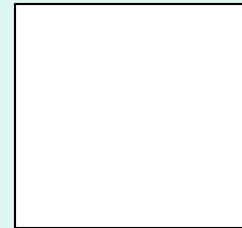
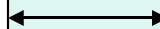
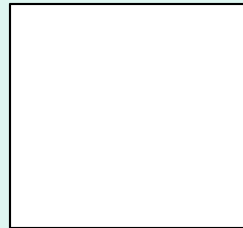
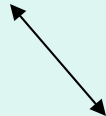
How does it get from there to here?



Home PC



ISP
Gateway



SFU Web Server

Other computers
at SFU or in
Vancouver

Computers in the Internet

- Personal Computers – using the Internet
 - Home users
 - Computers in labs
- Routers – move Internet traffic
 - Send data from one location to another
- Servers – serve the Internet
 - Web servers
 - Email servers

Routing Internet Traffic

- Routers determine where information goes
- Information broken into small chunks called *packets*
- Packets are sent by the fastest route
- Can move information around broken sections of the Internet
- Not all packets are sent by the same route

Servers

- Servers run special software:
 - Apache
- Usually bigger and faster than home computers
- Typically provide a service:
 - Email
 - Web servers
 - File storage

Protocols

- Protocols dictate how a client (like a home PC) and a server talk to each other and transfer information
- TCP/IP is an example of a protocol
- Web pages are transferred using HTTP
 - HyperText Transfer Protocol
- Other protocols involve those for:
 - Email
 - Instant Messaging
 - FTP –File Transfer Protocol
 - Gaming

How Web Pages Travel

- URL – Uniform Resource Locator
 - Internet “address”
- <http://www.sfu.ca>
- <http://www.cs.sfu.ca/CC/165/sbrown1/>
- <https://my.sfu.ca>
- <ftp://ftp.mozilla.org/pub/mozilla/releases>

Which Protocol?

- http at the beginning of a URL denotes using the HTTP protocol
 - <http://www.sfu.ca>
- https denotes using a secure HTTP protocol
 - Information is encrypted so that sensitive information is protected, like passwords
 - <https://my.sfu.ca>
- ftp is usually for downloading files from a server
 - Uses the ftp protocol
 - <ftp://ftp.mozilla.org/pub/mozilla/releases>
- The protocol is indicated by its *scheme*

Parts of a URL

- <http://www.cs.sfu.ca/CC/165/sbrown1/index.html>
- Scheme: http
- Server: www.cs.sfu.ca
- Path: CC/165/sbrown1/index.html

MIME Types

- Pretty much any type of data can be transmitted via HTTP
 - Web pages
 - Graphics : GIF, JPG, PNG, etc.
 - Video files
 - Audio files
- Web browsers handle all these files
 - If it can open it (like a webpage) it will
 - Other files, like MP3s or PDFs it will tell the appropriate program to handle these

File Extensions Won't Work

- If you are used to using Windows or Linux, you may be used to seeing *file extensions*
- File extensions denote the type of file it is
 - .doc indicates MS Word file
 - .txt indicates a text file
- Not all systems use file extensions
- The browser may not know the file name when the data is sent

Use MIME types

- MIME: Multipurpose Internet Mail Extensions
 - Serves same purpose as a file extension
- Made up of 2 parts:
 - Type: general type of information, such as video, image, text
 - Subtype: Specific kind of information
- GIF: type of image file
 - image/gif

Why Internet Explorer is Bad

- Doesn't handle MIME types correctly
- Part of the reason it's not suggested for this course

How MIME Type is Determined

- Usually based on the file extension
- Some servers are different
- Just because the MIME is based on the file extension, remember it is not the same thing!

How is a Web Page Fetched?

Suppose we want to see

<http://www.sfu.ca/about/index.html>

And it has a graphic on the page is stored at

<http://www.sfu.ca/hp/images/sfu.jpg>

Fetching a Web Page

1. Browser contacts www.sfu.ca and asks for the file with path /about/index.html
2. Server responds with an “OK”, indicates that the MIME type is text/html, and sends the contents of the page
3. Browser still needs graphic, so contacts www.sfu.ca again and asks for /hp/images/sfu.jpg
4. Server again responds with an “OK”, gives the MIME type image/jpeg, then sends the image file

Questions?