Internet History

Charles Severance

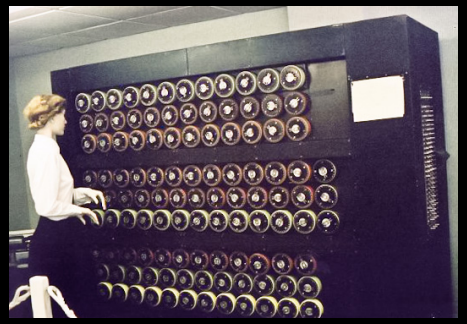
High Level Phases

- Pre-Internet
- Research Networks - 1960s - 1970's
- The First "Internet" - Mid1980's
- Commercialization of the Internet - early 1990's
- Ubiquity of the Internet - 1996 and beyond

Other Resources

- Hobbes Internet Timeline
  - http://www.zakon.org/robert/internet/timeline/
- A Brief History of the Internet. Barry M. Leiner, et al. 2009. SIGCOMM Comput. Commun. Rev. 39, 5 (October 2009), 22-31. DOI=10.1145/1629607.1629613
  - http://doi.acm.org.proxy.lib.umich.edu/10.1145/1629607.1629613

World-War II



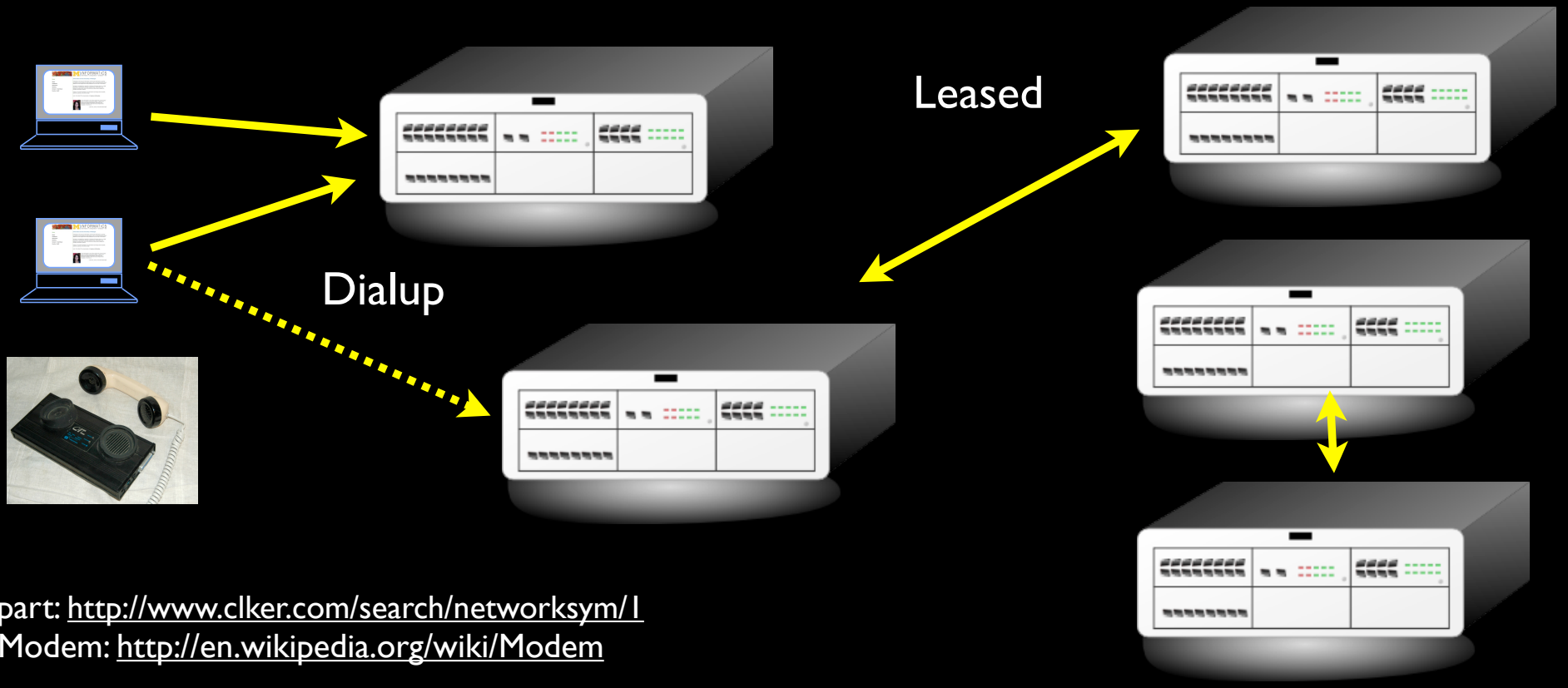
- Advanced technology won the war
- Code breakers moved computers from mechanical to electric
- The *existence* of electronic computers was a crtitical military secret
- Bletchley Park, UK (say hi to Joel)

http://www.bletchleypark.org/

Before the Internet

- We connected computers directly to one another using leased phone lines
- These were very expensive - and the longer the connection the more expensive it was
- The phone companies made the rules

Phone Line Networking



Clipart: http://www.clker.com/search/networksym/1
Modem: http://en.wikipedia.org/wiki/Modem

Phone Line Networking

- You were happy to connect to one computer without having to walk across campus
- You could call other computers long distance
- Pretty Common in the 1970's

http://deepblue.lib.umich.edu/handle/2027.42/79576

Merit Network

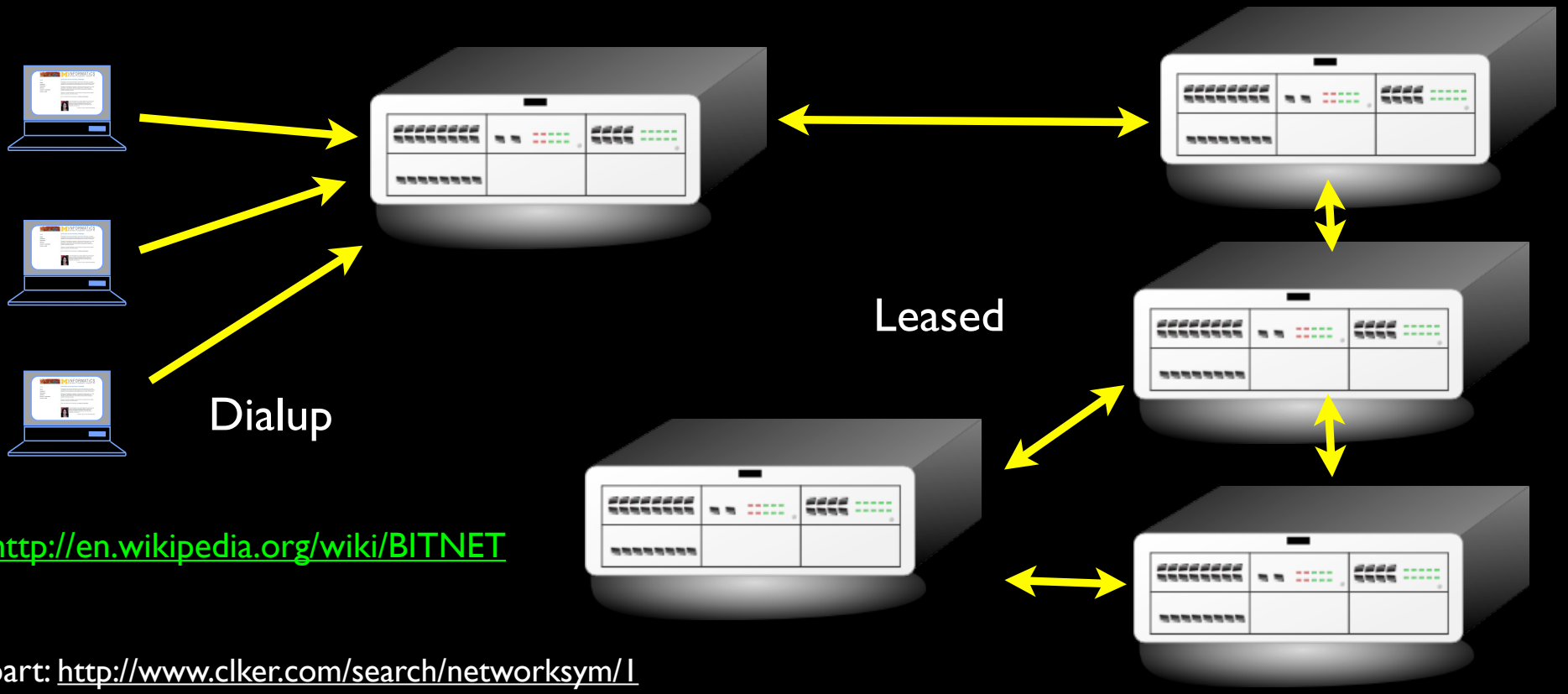
The Michigan Educational Research Information Triad (MERIT) was formed in the fall of 1966 by Michigan State University (MSU), University of Michigan (U-M), and Wayne State University (WSU).[3] It was created to design and implement a computer network between these three Michigan public research universities. [1]

In 1969, Merit was one of the earliest network projects that was intended for use by an entire campus population of students, faculty, and alumni. [2]

Merit PDP-11 based Primary Communications Processor (PCP) at the University of Michigan, c. 1975

[1] http://en.wikipedia.org/wiki/Merit_Network
[2] http://www.zakon.org/robert/internet/timeline/

Store and Forward Networking



http://en.wikipedia.org/wiki/BITNET

Clipart: http://www.clker.com/search/networksym/1

Store and Forward Networking

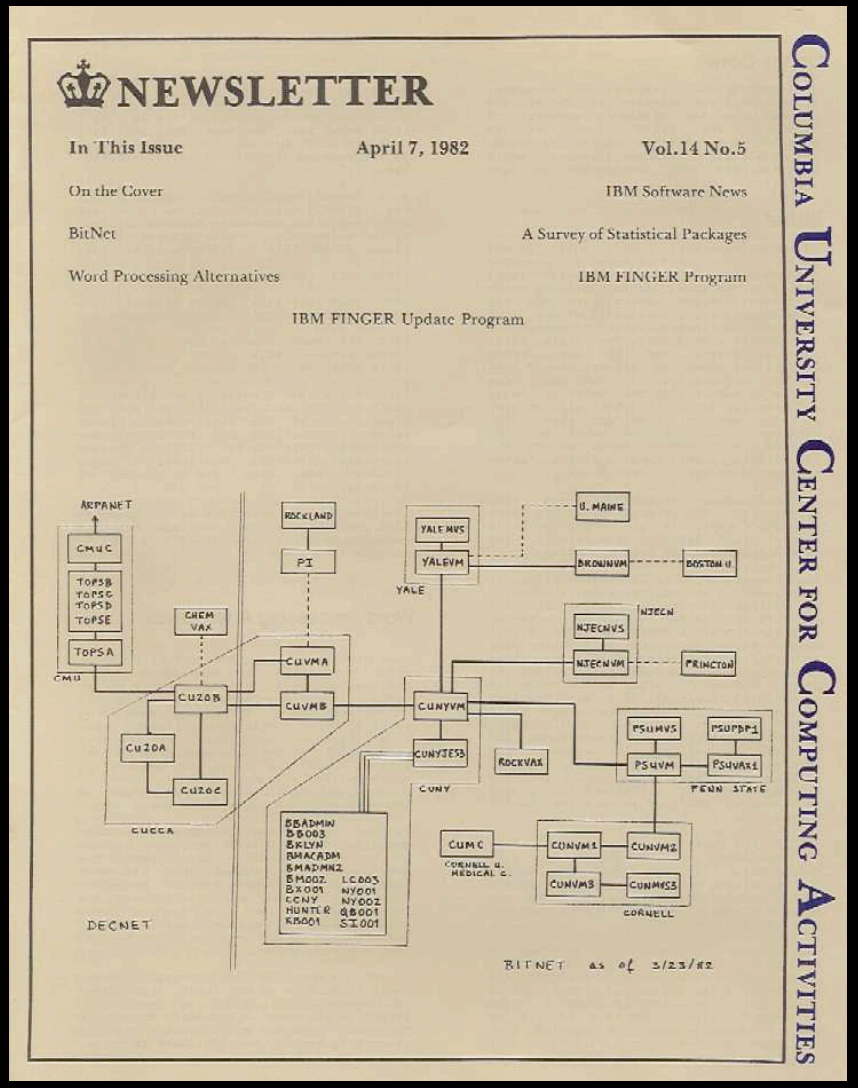
- Typically specialized in Mail
- E-Mail could make it across the country in 6-hours to about 2 days
- You generally focused your life on one computer
- Early 1980's

http://en.wikipedia.org/wiki/IBM_3270

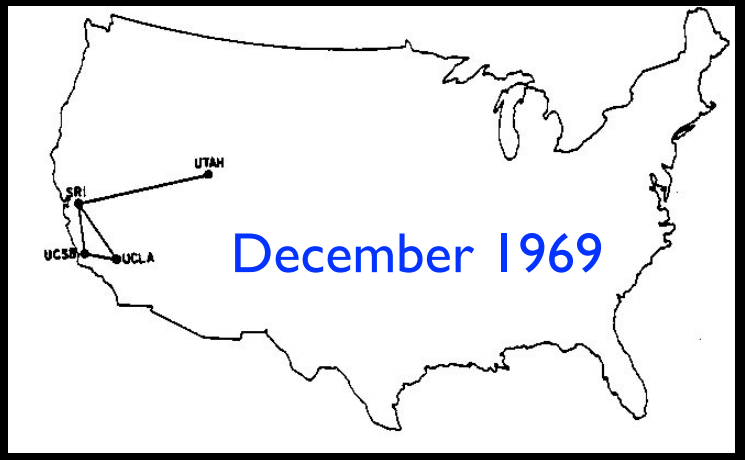
BITNET

- Typically specialized in Mail
- E-Mail could make it across the country in 6-hours to about 2 days
- You generally focused your life on one computer
- Academic network in the 1980's

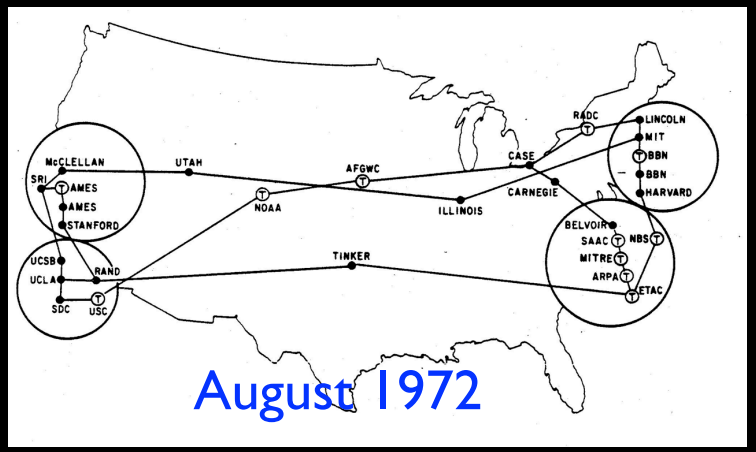
http://www.columbia.edu/acis/history/bitnet.jpg



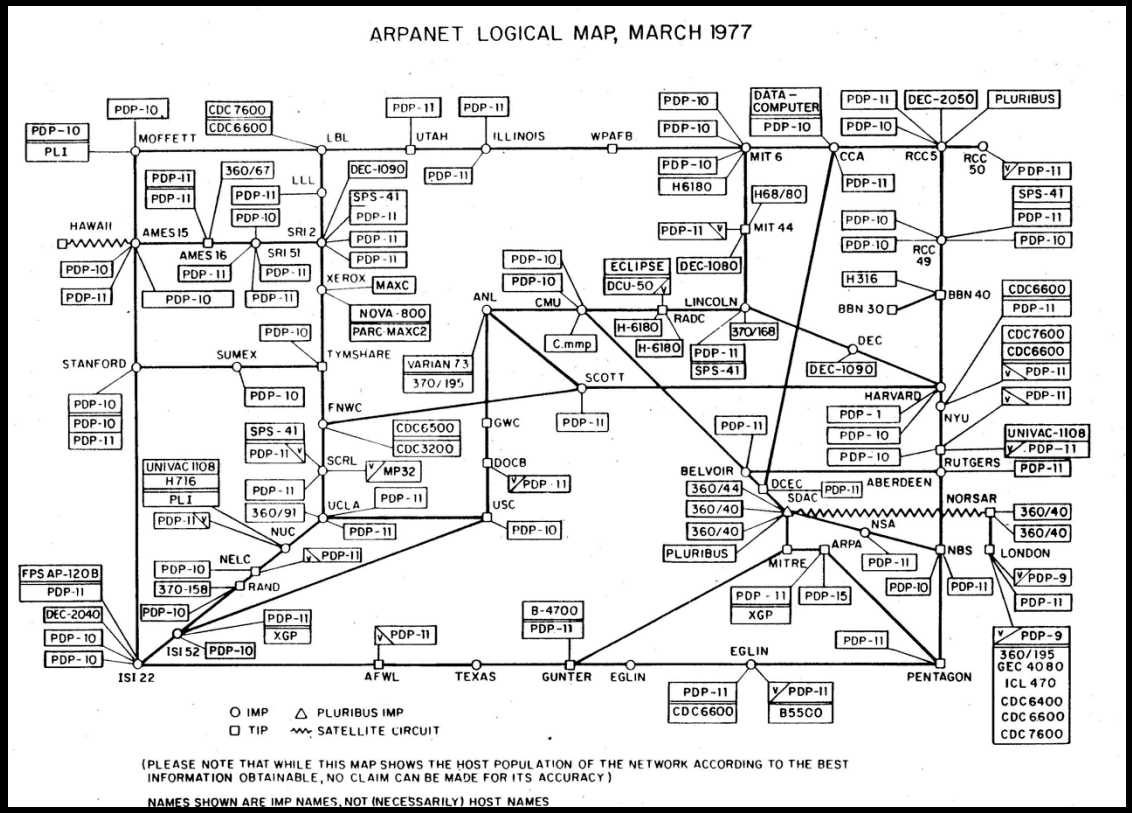
Research Networks 1960-1980's



- How can we avoid having a direct connection between all pairs of computers?
- How to transport messages efficiently?
- How can we dynamically handle outages?



http://som.csudh.edu/fac/lpress/history/arpamaps/



Heart, F., McKenzie, A., McQuillian, J., and Walden, D., ARPANET Completion Report, Bolt, Beranek and Newman, Burlington, MA, January 4, 1978.

http://som.csudh.edu/fac/lpress/history/arpamaps/arpanetmar77.jpg

Efficient Message Transmission: Packet Switching

- Challenge: in a simple approach, like store-and-forward, large messages block small ones
- Break each message into packets
- Can allow the packets from a single message to travel over different paths, dynamically adjusting for use
- Use special-purpose computers, called routers, for the traffic control

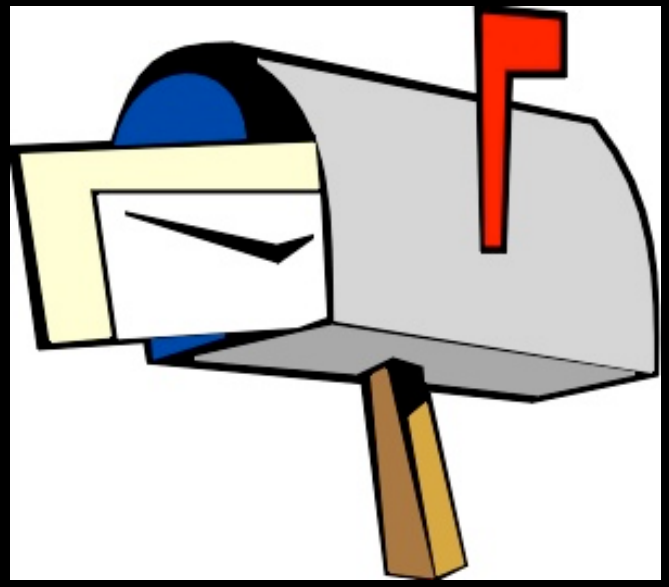
Packet Switching - Postcards

Hello there, have a nice day.

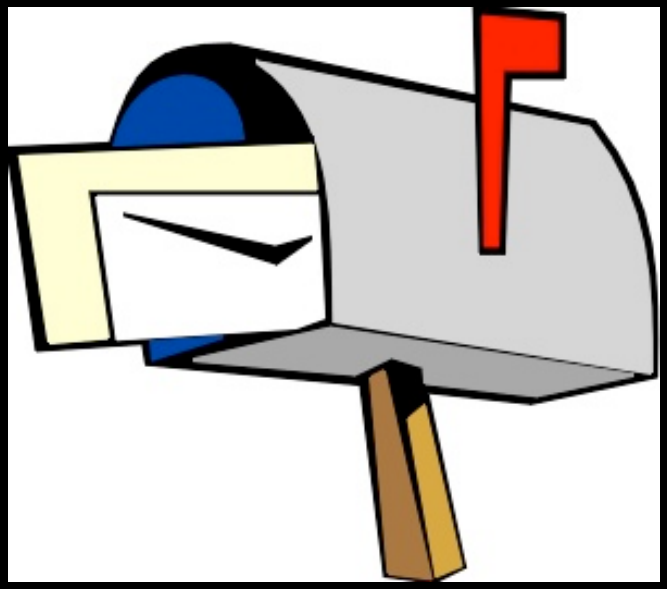
Hello ther (1, csev, glenn)

e, have a (2, csev, glenn)

nice day. (3, csev, glenn)

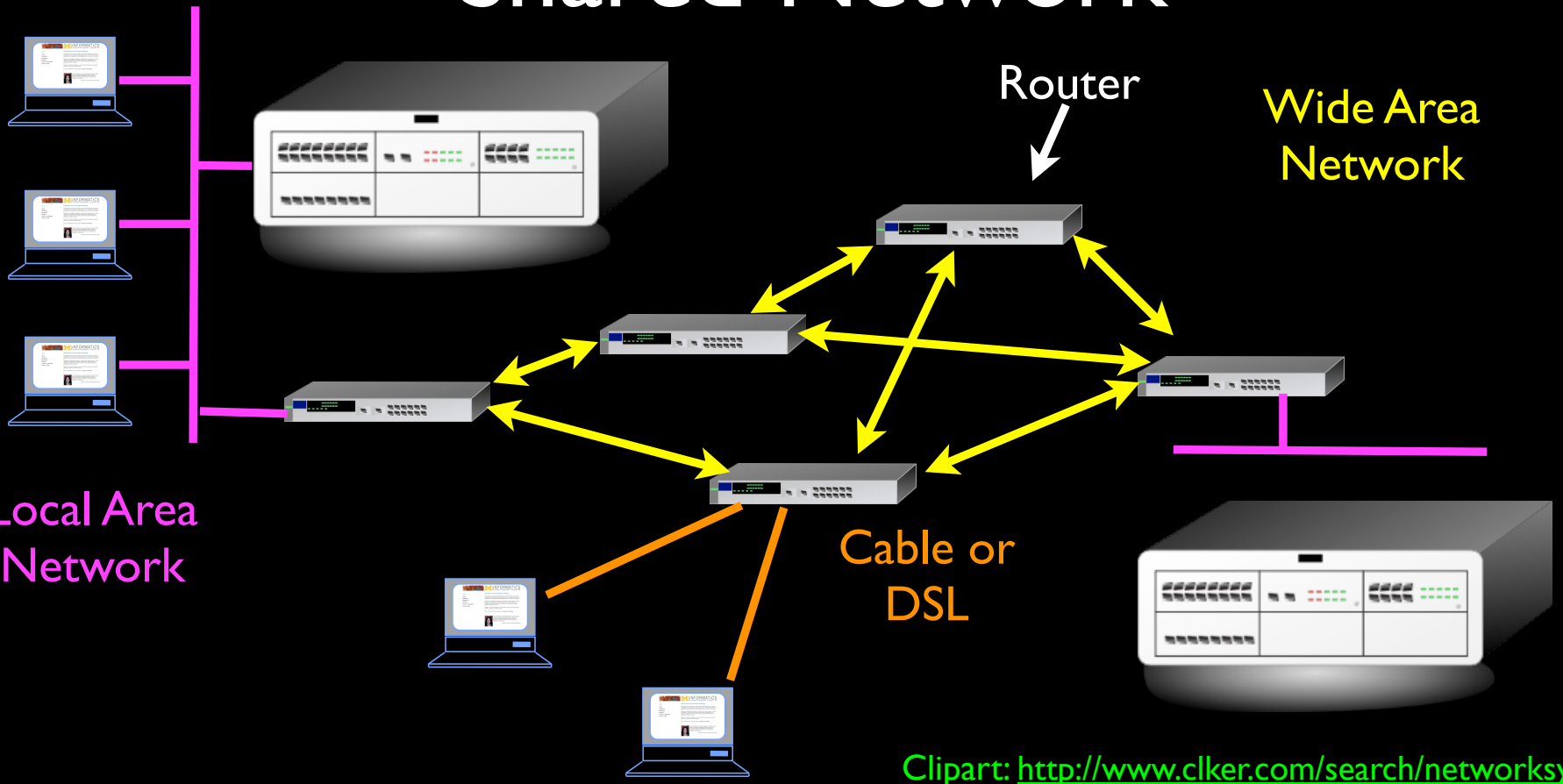


Packet Switching - Postcards



Hello there, have a nice day.

Shared Network

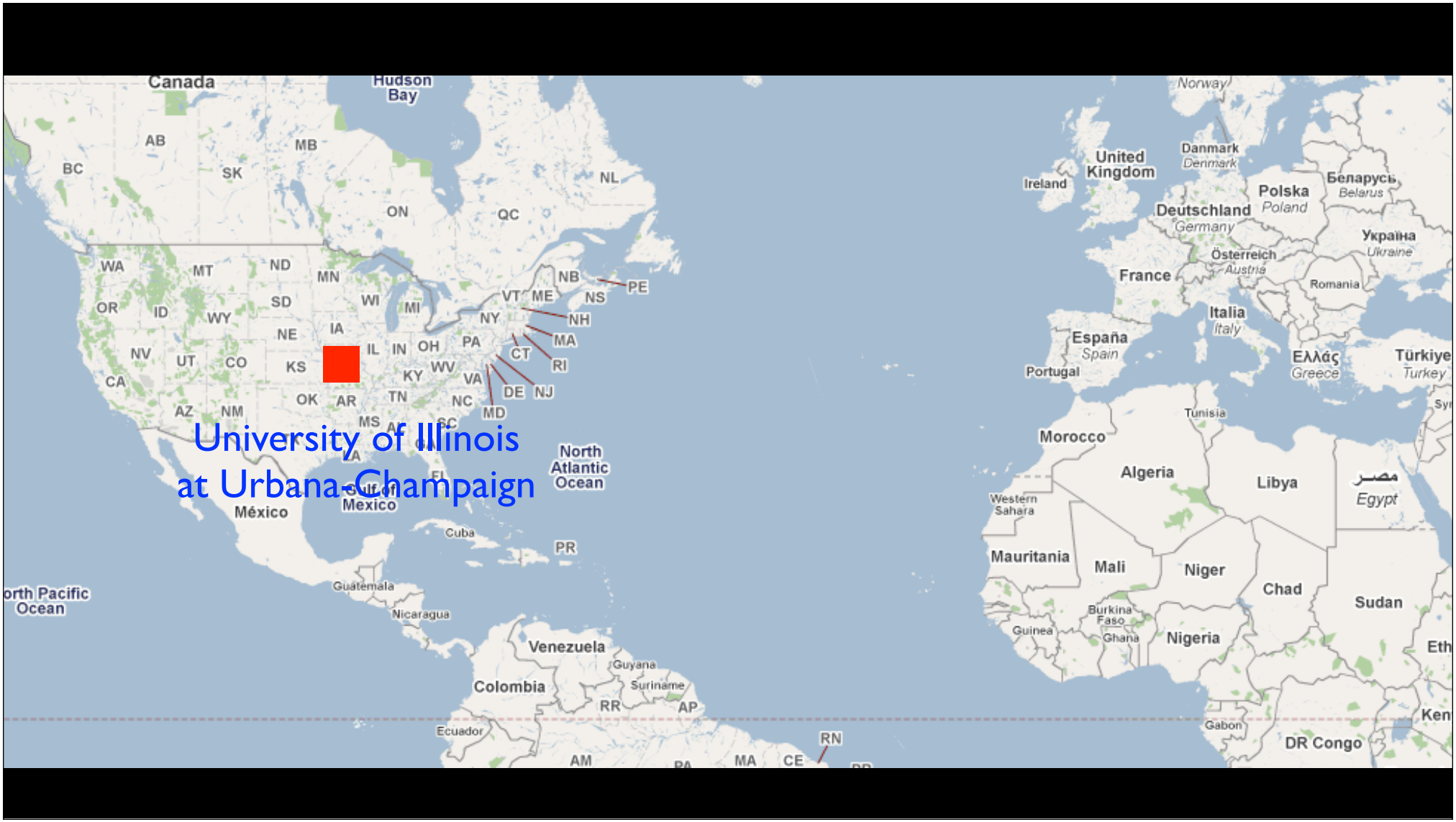


Clipart: http://www.clker.com/search/networksym/1

An Example Problem to Solve

- With each router having only a local / subset knowledge of the shape of the network, how do we avoid confusion if the information is a little "messed up"?

Clipart: http://www.clker.com/search/networksym/1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Supercomputers...

- As science needed faster and faster computers, more universities asked for their own Multimillion dollar supercomputer
- The National Science Foundation asked, "Why not buy a few supercomputers, and build up a national shared network?"

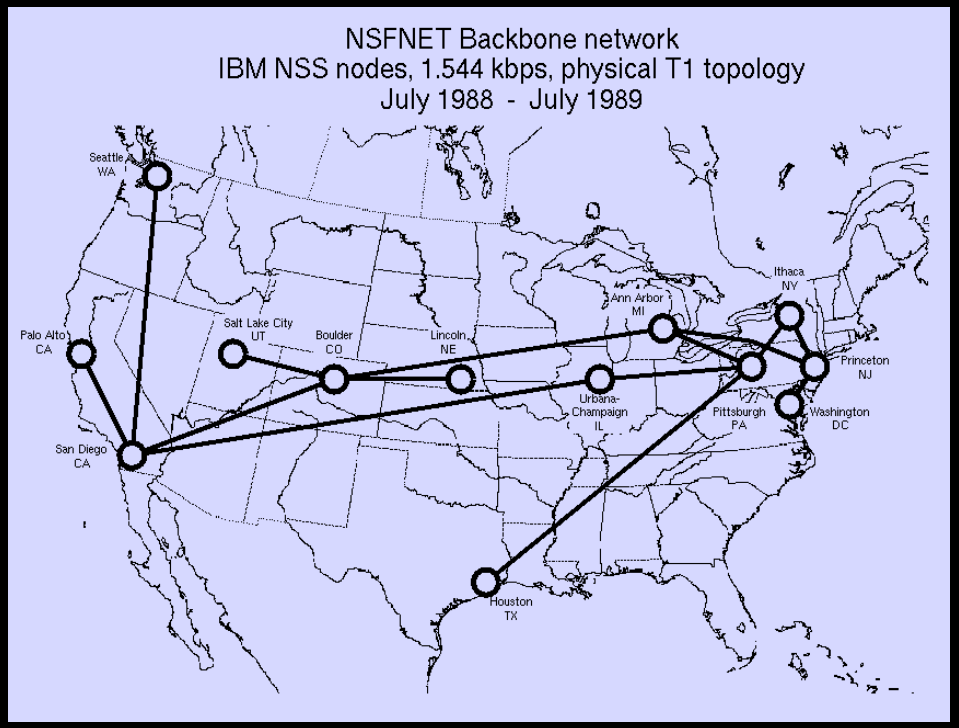
NCSA - Innovation

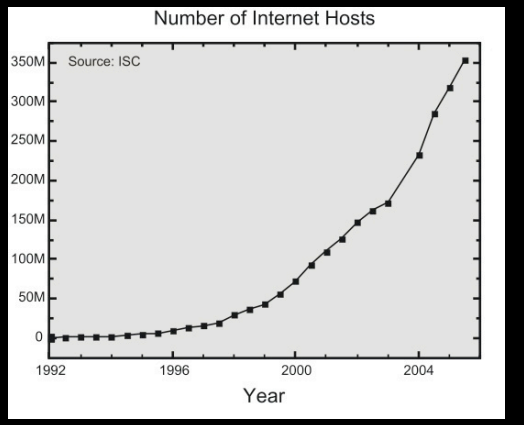
- We now "assume" the Internet and the Web - it was not so easy...
- A number of breakthrough innovations came from the National Center for Supercomputing Applications at Urbana-Champaign, Illinois
- High Performance Computing and the Internet were deeply linked

http://www.vimeo.com/6982439 (11:53)

NSF Net

- NSFNet was the first network that was “inclusive”
- Standardized on TCP/IP
- Initially the goal was all research universities
- In the early 1990’s commercial companies (Internet Service Providers) could join and resell service

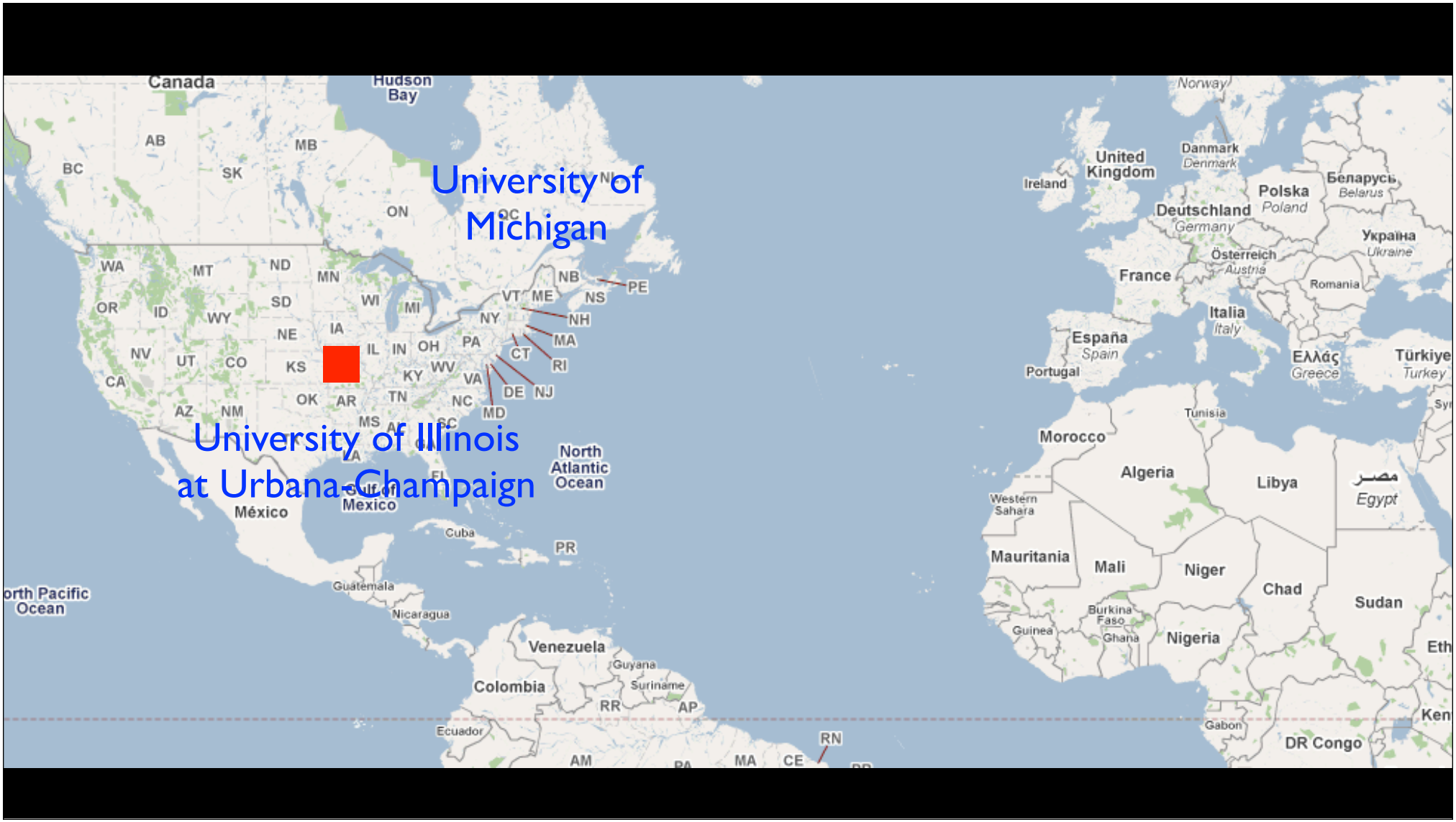




Source: http://hpwren.ucsd.edu/~hwb/NSFNET/NSFNET-20071ISummary/

NSFNET T1
Backbone and
Regional
Networks, 1991

http://virdir.ncsa.uiuc.edu/virdir/raw-material/networking/nsfnet/NSFNET_1.htm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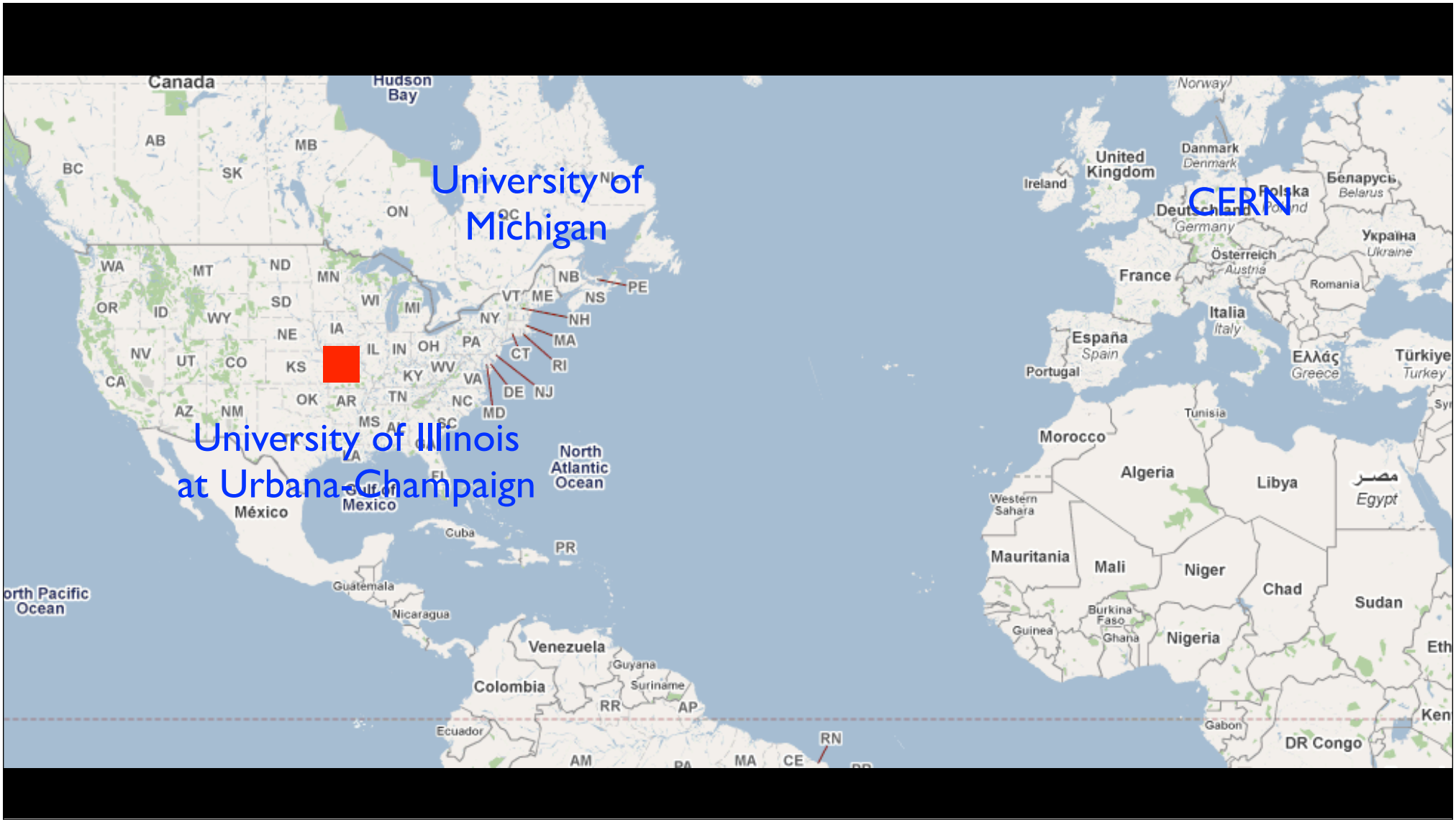
NSFNet @ University of Michigan

- University of Michigan did not get a Supercomptuer Center
- Proposed a $55M high-speed network for $15M
- Partners: University of Michigan, Merit Network, IBM Corporation, MCI, and State of Michigan
- Operated from 1988-1995

http://www.vimeo.com/11044819

15:18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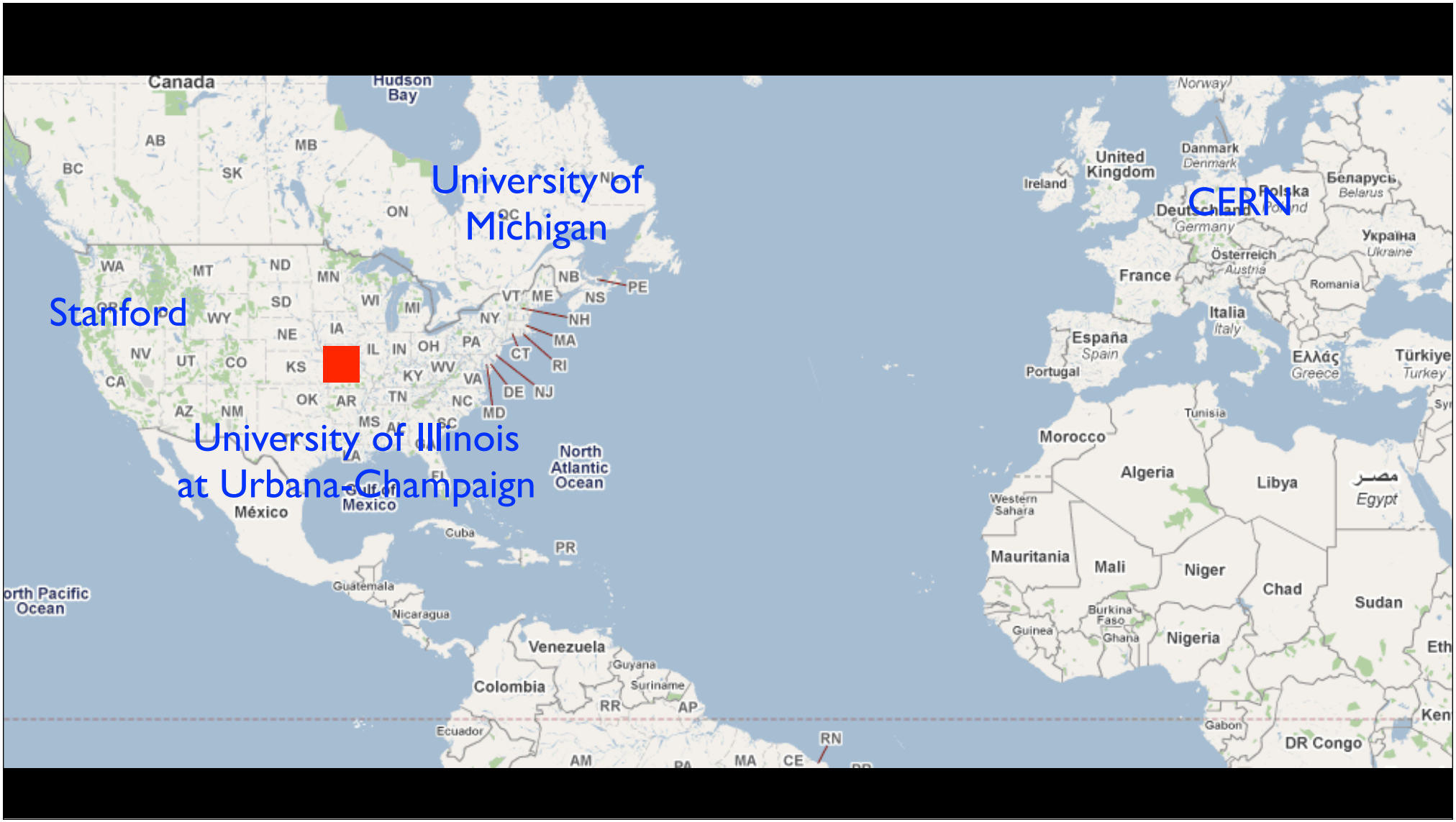
The Beginning of the Web: CERN

- The Internet was infrastructure - the web gave the Internet a "user interface and URLs
- The Web was invented at CERN by Tim Berners-Lee and Robert Cailliau
- CERN developed browsers and servers - with a goal of worldwide hyperlinked documents

http://www.youtube.com/watch?v=x2GylLq59rI

(9:42)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http://www.wlap.org/cern/lectures/colloq/1999/kunz/

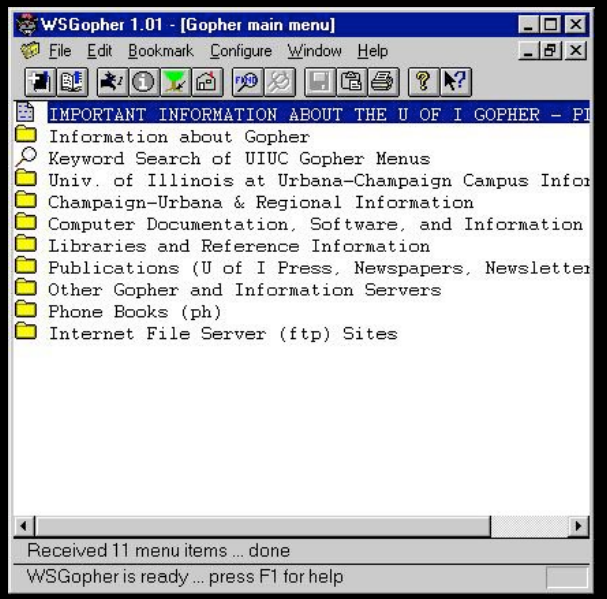
The First Web Server in America

- The first web server in America was at the Stanford Linear Accellerator (SLAC)
- It was a database of 300,000 research papers
- Dr. Paul Kunz
- December 12, 1991

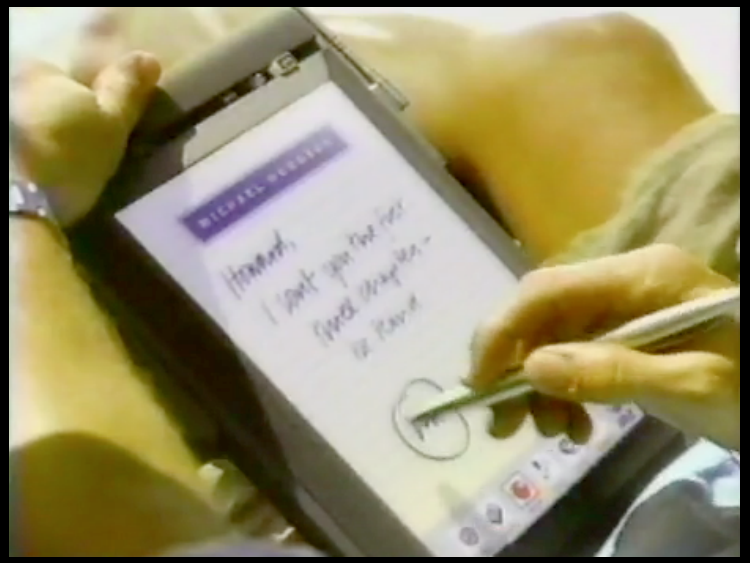
http://www.youtube.com/watch?v=IOgqP2yoKwc (5:30)

1993: Gopher is Dominant

- Internet Engineering Task Force (IETF) Meeting
  - March 29-April 2, 1993 - Columbus, Ohio, USA (638 attendees)
  - Gopher BOF - 200 attendees
  - World-Wide Web BOF - 15 attendees including Tim Berners-Lee
- P.S. DVD is invented this year



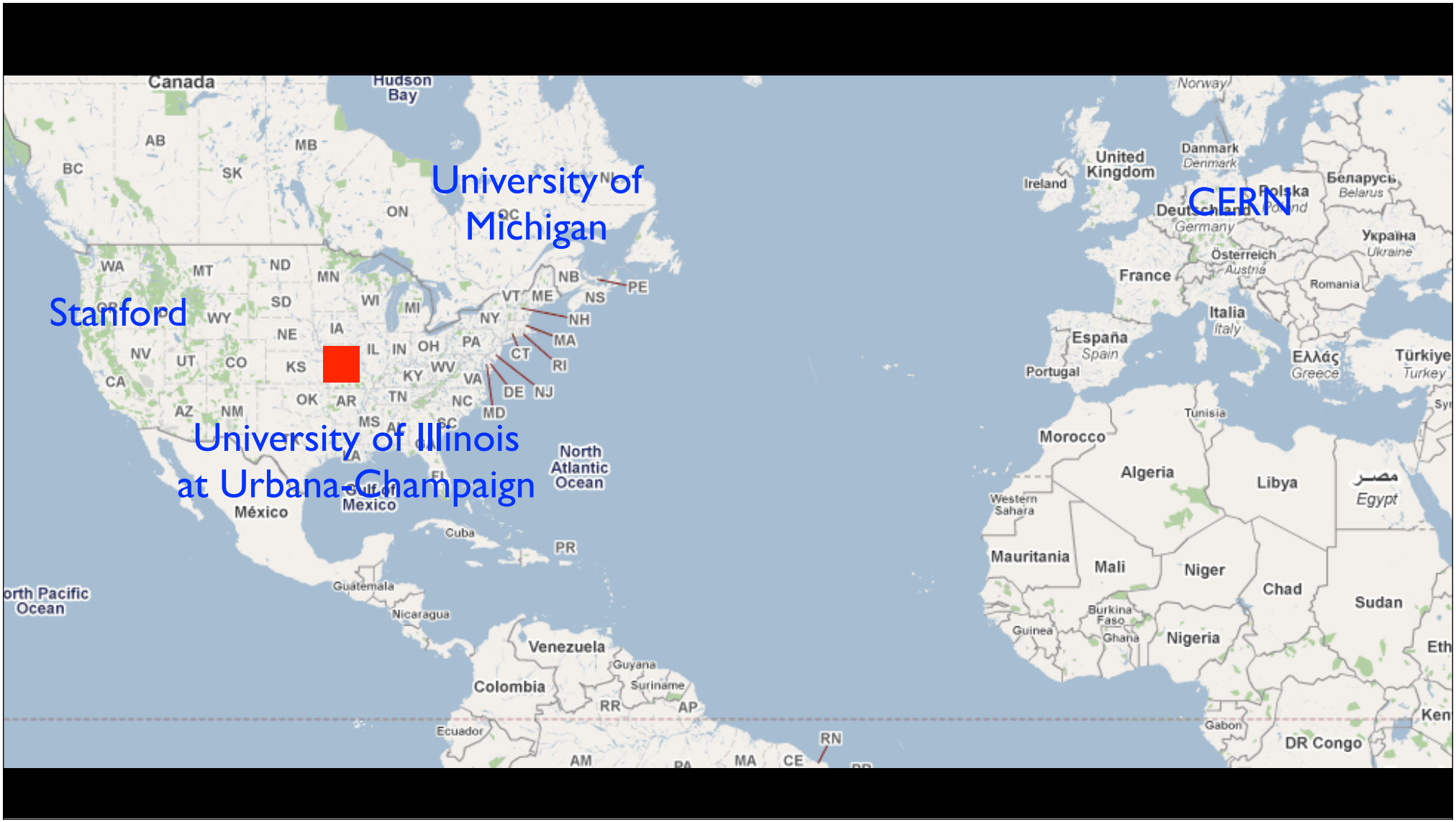
http://www.ietf.org/proceedings/26.pdf



What industry was thinking in 1993...

http://www.youtube.com/watch?v=sYNUcFMCIzw

0:30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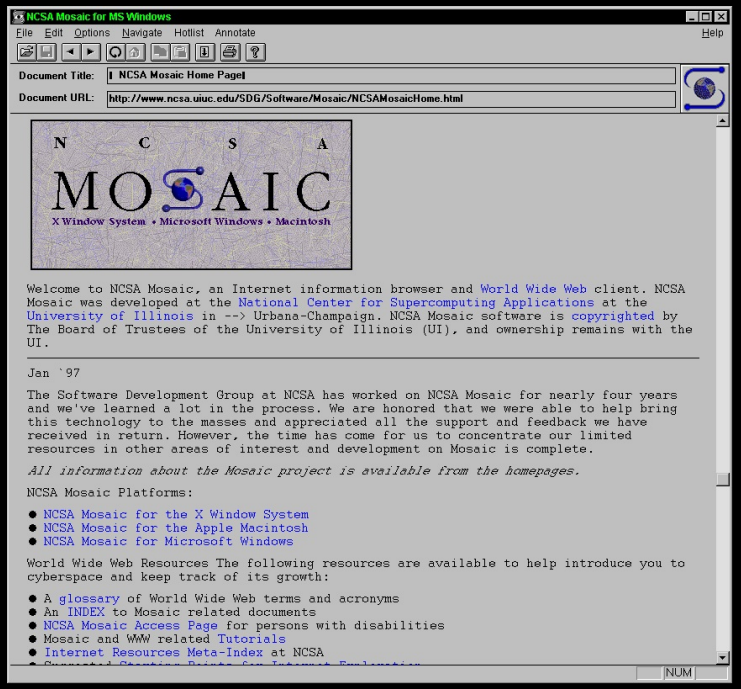
The Explosive Growth of the Web

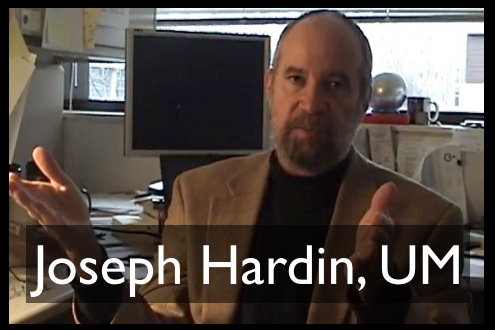
- The web was invented in the early 1990's
- Growing in Academia 1993
- Growing everywhere 1994 - 1995
- Cable Modems to the home started in the mid 1990's



http://gladiator.ncsa.uiuc.edu/Images/press-images/mosaic.1.0.tif

Mosaic - Netscape - Mozilla - Firefox

- Mosaic was the first "consumer" web browser developed at NCSA
- NCSA created the httpd web server which is the basic for the Apache web server
- While most of the NCSA programmers formed Netscape and made their fortunes, NCSA released their browser for free and focused on building standards to keep the web open



http://www.vimeo.com/7053726 9:01

1994: Year of the Web

- Netscape Founded - April 4, 1994
- WWW Conf: May 25-26-27 1994, CERN, Geneva (Switzerland)
- WWW Conf: October 17-19, 1994, Chicago, IL
- October 1994, Tim Berners-Lee founded the (W3C) at MIT
- November 8, 1994 - Windows 95 beta 2

Netscape, JavaScript and FireFox

- As Microsoft worked to suffocate Netscape::
  - JavaScript was invented to compete with Visual Basic (1995)
  - Netscape slowly leaked out into Open Source as Mozilla - which later became FireFox (late 1990's)
- FireFox's search box gave the small Mozilla Foundation millions of dollars of revenue

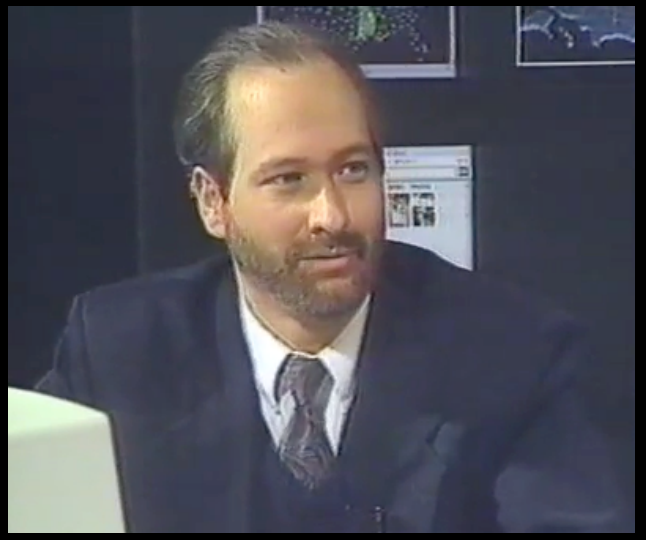
http://www.youtube.com/watch?v=IPxQ9kEaF8c

Mitchell Baker
CEO Mozilla

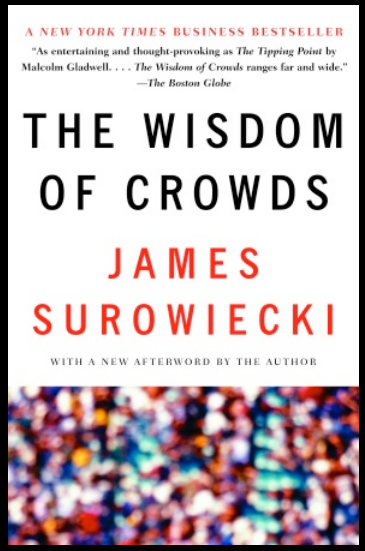
When You can Assume the Web

Internet: TCI Show 08
http://www.vimeo.com/4275919

December 11-14, 1995
http://www.w3.org/Conferences/WWW4/



- Larry Smarr wanted to make supercomputers available to physicists
- Unversity of Michigan sneaked in 1.54Mb/sec instead of 56kb/sec backbone for the NSFNet
- Tim Berners-Less and Robert Cailliau were building a system for network hosted documentation
- Paul Kunz was trying to make his article database easier to use
- Joseph Hardin wanted to make supercomputers more user friendly



The Web Land Rush...

- In the late 1990's there were many fortunes to be made - simply by being first in a market
- Everything was "novel" when it was re-invented on the web
- New brands were quickly established and became dominant

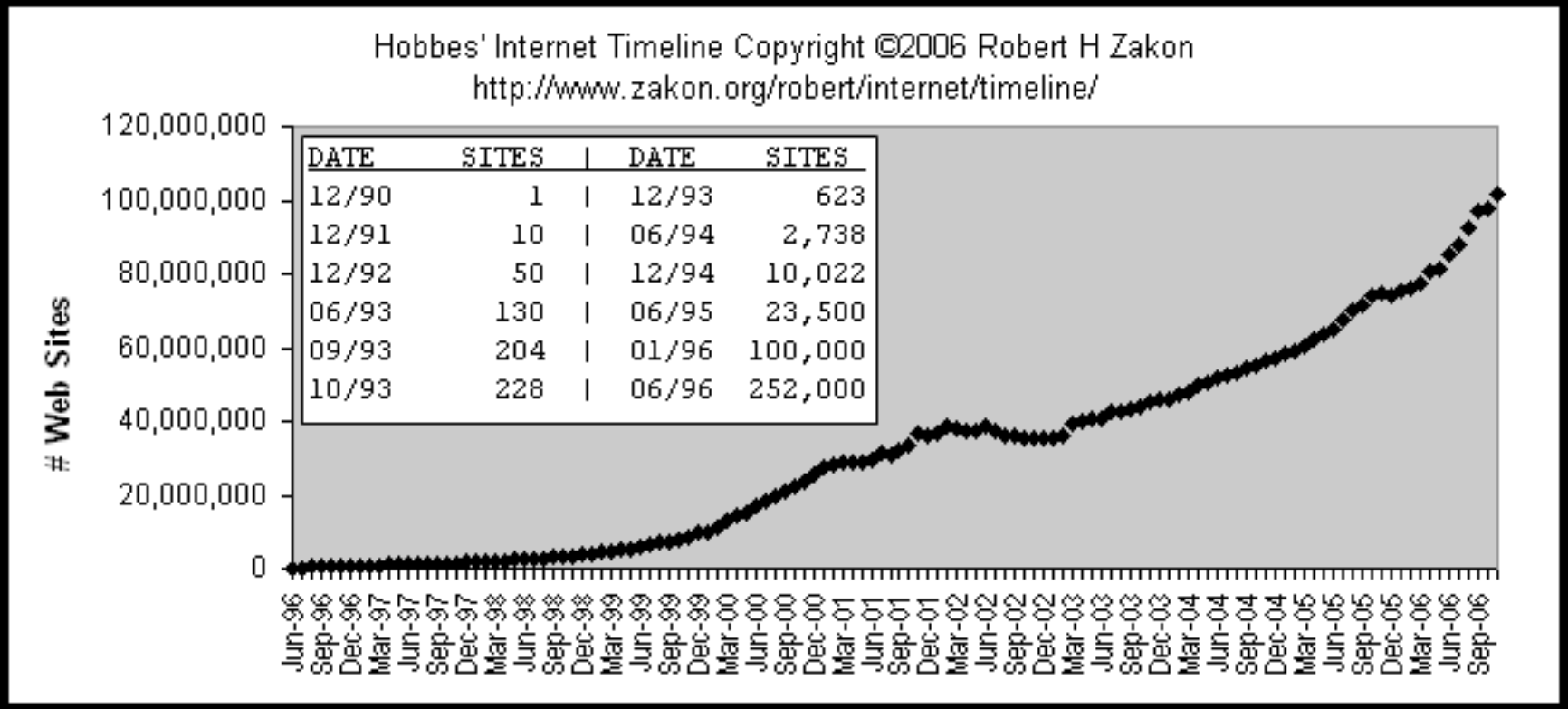
http://www.vimeo.com/7048422

5:39

The Modern Internet

- In the late 1990's in the boom there was a great deal of Fiber optic that was installed in the US
- High speed and long distance were cheap and common
- Many national backbone networks emerged - commercial, government, academic, etc
- These networks swap data at "peering points" so we see one seamless Internet - after about 1999 - this was all pretty boring - it just worked

http://en.wikipedia.org/wiki/Internet_Exchange_Point

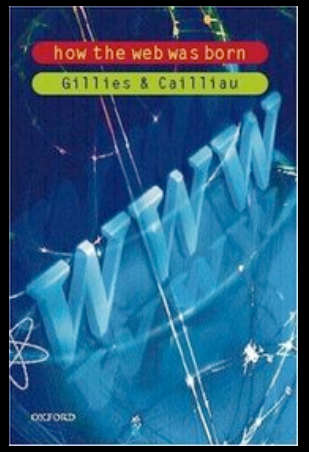


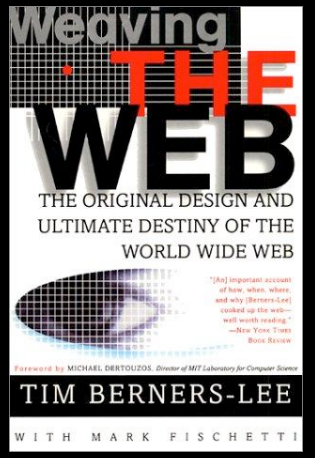
http://www.zakon.org/robert/internet/timeline/

The "Web Effect"

Some Books

- How the Web was Born: The Story of the World Wide Web, James Gillies , Robert Cailliau
- Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web, Tim Berners-Lee





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