Internet History

Charles Severance
High Level Phases

- Pre-Internet
- Research Networks - 1960s - 1970's
- The First “Internet” - Mid 1980's
- Commercialization of the Internet - early 1990's
- Ubiquity of the Internet - 1996 and beyond
Other Resources

- Hobbes Internet Timeline
  - 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 critical 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

Dialup

Leased

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]

Store and Forward Networking

Dialup

Leased

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/
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
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

Local Area Network

Wide Area Network

Router

Cable or DSL

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"?

To: 67.149.*.*
University of Illinois
at Urbana-Champaign
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?”

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http://creativecommons.org/licenses/by-sa/2.0/fr/deed.en_GB
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
NSFNET Backbone network
IBM NSS nodes, 1.544 kbps, physical T1 topology
July 1988 - July 1989

Source: http://hpwren.ucsd.edu/~hwb/NSFNET/NSFNET-200711Summary/
NSFNET T1 Backbone and Regional Networks, 1991

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

- University of Michigan did not get a Supercomputer 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

Doug Van Houweling
President and CEO, Internet2

http://www.vimeo.com/11044819
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=x2GylLq59rl
Bringing the Web to America
Lecture by Paul F. Kunz (SLAC)

CERN, Geneva, 17 Sep 1999
duration: 1:10:57, 16 slides

Summary of Talk:
On 12 December 1991, Dr. Kunz installed the first Web server outside of Europe at the Stanford Linear Accelerator Center. Today, if you do not have access to the Web you are considered disadvantaged.

Before it made sense for Tim Berners-Lee to invent the Web at CERN, there had to a number of ingredients in place. Dr. Kunz will present a history of how these ingredients developed and the role the academic research community had in forming them. In particular, the role that big science, such as high energy physics, played in giving us the Web we have today.

Choose the format you wish to use to view the lecture:

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=lOgqP2yoKwc
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

What industry was thinking in 1993...

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

• University 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
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
Hobbes' Internet Timeline Copyright ©2006 Robert H Zakon
http://www.zakon.org/robert/internet/timeline/

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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

Additional Videos...

http://www.vimeo.com/7307422

http://www.vimeo.com/3800796

http://www.vimeo.com/6215179