Internet History
Charles Severance

https://www.coursera.org/course/insidetheinternet
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• Thanks to Richard Wiggins for the use of his video material

• Thanks to Dave Malicke and Open Michigan (open.umich.edu) for help with copyright review of these materials
High Level Phases

• Dawn of Electronic Computing
• Pre-Internet Communication
• Research Networks - 1960s - 1970’s
• The First “Internet” - Mid 1980’s
• The Web Makes it Easy - 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
Alan Turing and Bletchley Park

- Top secret code breaking effort
- 10,000 people at the peak (team effort)
- BOMBE: Mechanical Computer
- Colossus: Electronic Computer

http://www.youtube.com/watch?v=5nK_ft0Lf1s
Post-War (1940s)

- Alumni of the US and UK codebreaking efforts and other started building general purpose computers
  - Manchester Baby
  - Ferranti Mark I
  - Harvard Mark I
  - US Army ENIAC

http://upload.wikimedia.org/wikipedia/commons/b/bb/SSEM_Manchester_museum.jpg
Post-War (1950s)

• Math / Science “Won the war”

• Broad-based investment in maintaining the US/West intellectual lead

• Mathematicians were valued, recruited, brilliant, arrogant, and quirky

• "A Beautiful Mind" gives a sense of the culture of the time

http://www.youtube.com/watch?v=CemLiSl5ox8
John Forbes Nash

• Received his Phd. Mathematics at Princeton in 1950 at 22 years old

• Mathematics faculty at MIT - 1951 - 1958

• Schizophrenia 1959 - 1995

• Nobel Prize in Economic Sciences - 1994

Phone Line Networking

Dial-Up Access

• You were happy to connect to one computer without having to walk across campus
• You could 'call' other computers long distance
• The characters were encoded as sound
• Pretty Common in the 1970’s

http://deepblue.lib.umich.edu/handle/2027.42/79576 (1969)
Data Transfer with Leased Lines

- You could get a dedicated connection between two points from the phone company.
- No dialing was needed; leased lines are always connected.
- Reserved dedicated phone wires and permanent connections.
- Expensive because of limited copper - cost was based on distance.
- Think bank branch offices and other places where cost is significant.

http://en.wikipedia.org/wiki/Leased_line
Store and Forward Networking

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

Clipart: http://www.clker.com/search/networksym/1
Store and Forward Networking

Dialup

Leased

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Clipart: http://www.clker.com/search/networksym/1
Saving Money with More "Hops"
Saving Money with More "Hops"

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 six hours to about 2 days
- You generally focused your life on one computer
- Early 1980’s

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

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- E-Mail could make it across the country in 6-hours to about 2 days
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- 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 or long snake-like connections?
- How can we dynamically handle outages switching between multiple paths?
- How to transport many messages simultaneously and efficiently?

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.
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)

http://www.flickr.com/photos/stephto/1519649375/
Packet Switching - Postcards

Hello there, have a nice day.

http://www.flickr.com/photos/stephoto/1519649375/
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"?

Clipart: http://www.clker.com/search/networksym/1
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?”
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
NSF Net

- NSFNet was funded by the National Science Foundation
- Standardized on TCP/IP
- The first national TCP/IP network that was “inclusive”
- Initially the goal was all research universities

ARPANET August 1972

http://som.csudh.edu/fac/lpress/history/arpamaps/
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. [1]

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
Source: http://hpwren.ucsd.edu/~hwb/NSFNET/NSFNET-200711Summary/
NSF Net Advocacy

• Initially aimed at research universities

• Cleveland FreeNet and similar efforts provided indirect Internet access to the average citizen

• In about 1989-1990, the "academic-only" started being relaxed - led to Internet Service Providers making "dial-up Internet" available to the general public
CERN - High-Energy (physics)

• Brilliant physicists from all over the world
• Work on long, highly detailed projects - 15-20 years
• Have a lot of time to think..
• (And have fun)

http://musicclub.web.cern.ch/MusiClub/bands/cernettes/
http://www.youtube.com/watch?v=A1L2xODZSI4
"...You Prefer your Collider"
Visits to CERN!

http://club-softball.web.cern.ch/club-softball/Canettes/

http://www.youtube.com/watch?v=f90ysF9BenI
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
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
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=sYNUcFMCzkw
Steve Jobs and the World-Wide-Web?

- For several years the primary web browser and web server were built as NeXT applications.
- Apple computers provided far superior graphics that allowed the development of Mosaic.

http://www.youtube.com/watch?v=W9rPUFW6czc
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 - With a vengeance!
Netscape, JavaScript and FireFox

• As Microsoft worked to suffocate Netscape::

• JavaScript was invented to compete withVisual 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
Did Microsoft Save the World-Wide Web?

- Netscape wanted to make the web browser, web server, and web protocols proprietary and owned by them.
- The web browser would be $50-$100 and sold separately.
- This threatened to make the desktop operating system irrelevant.
World-Wide-Web Consortium

• The W3C was formed in October 1994 (www.w3c.org)

• Led by Tim Berners-Lee who moved from CERN to MIT

• Goal was to develop standards for the web and avoid proprietary balkanization of the Web

• Many large companies (Microsoft, IBM, etc) joined quickly

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 their NSFNet proposal
• 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
Some Great 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
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
The “Web Effect”
A History of Open Source ....

http://www.vimeo.com/7307422

http://www.vimeo.com/3800796

http://www.vimeo.com/6215179
Additional Source Information


