CS 6/75995
Internet-based

Applications & Systems Design, 2001

Kent State University

Department of Computer Science

LECTURE-3

History of Internet

Looking Back..
The History of the Internet

- ARPANET (Advanced Research Projects Agency Network)
- TCP/IP (Transmission Control Protocol/Internet Protocol)
- NSFNET (National Science Foundation Network)
- Desktop computers
- Network upgrades
- Web Technology

1950's

1957 USSR launches Sputnik, first artificial earth satellite. In response, US forms the Advanced Research Projects Agency (ARPA) within the Department of Defense (DoD) to establish US lead in science and technology applicable to the military.

1960's

1969 - The Department of Defense Advanced Research Projects Agency creates an experimental network called ARPANET. This network provides a test-bed for emerging network technologies.

ARPANET originally connected four universities

Node 1: UCLA - (September)
Node 2: SRI - Stanford Research Institute (October)
Node 3: UCSB
Node 4: University of Utah

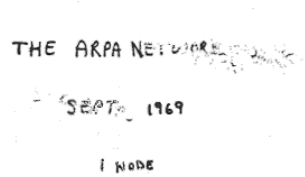
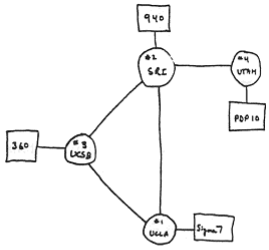


FIGURE 6.1 Drawing of September 1969 (Courtesy of Alex McKenzie)



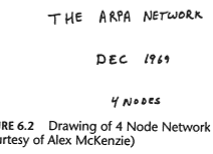
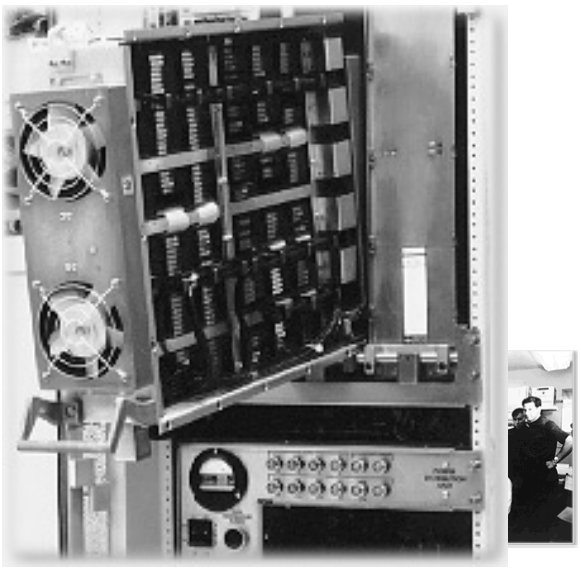


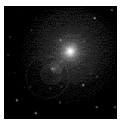
FIGURE 6.2 Drawing of 4 Node Network (Courtesy of Alex McKenzie)

The first node on ARPANET at University California Los Angeles (UCLA) on the 2nd of September 1969. (Source : "Casting the Net", page 55) UCLA was the home of Len Kleinrock' sNetwork Measurement Center. Doug Engelbart' sNetwork Information Center resided at SRI. And some of the earliest graphics work was being done at Santa Barbara and Utah.

By the end of the year there are four nodes on the "ARPA NETWORK", as shown in schematic above. (Source : "Casting the Net", page 56. See also The Computer Museum Timeline.)

IMP





1960's (continued..)

Information Message Processors (IMP) [Honeywell 516 mini computer with 12K of memory] developed by Bolt Beranek and Newman, Inc. (BBN) First node-to-node message sent between UCLA and SRI (October, 1969)

First Request for Comment (RFC): "Host Software" by Steve Crocker (April 9, 1969)

Michigan State and Wayne State University establish X.25-based Merit network for students, faculty, alumni.

1970’S

1971 ALOHAnet developed by Norman Abrahamson, University of Hawaii, heart of Ethernet and connected to the ARPANET in 1972.

1972 The National Center for Supercomputing Applications (NCSA) develops the telnet application for remote login, making it easier to connect to a remote computer.

1973 **FTP** (file transfer protocol) is introduced, standardizing the transfer of files between networked computers.

1970’S

1972 Ray Tomlinson (BBN) writes basic email message send and read software (March) Larry Roberts writes first email utility to list, selectively read, file, forward, and respond to messages (July)

1973 Bob Metcalfe' s Harvard Ph.D. Thesis outlines idea for Ethernet.

1976 Elizabeth II, Queen of the United Kingdom sends out an e-mail (various Net folks have e-mailed dates ranging from 1971 to 1978)

UUCP (Unix-to-Unix Copy) developed at AT&T Bell Labs and distributed with UNIX one year later.

1980's

1981 BITNET, the "Because It' s Time NETwork" Started as a cooperative network at the City University of New York, with the first connection to Yale.

CSNET (Computer Science NETwork) built by a collaboration of computer scientists and University of Delaware, Purdue University, University of Wisconsin, RAND Corporation and BBN through seed money granted by NSF to provide networking services (especially email) to university scientists with no access to ARPANET.

1980's

• 1983 Name server developed at Univ of Wisconsin, no longer requiring users to know the exact path to other systems.

•Internet Activities Board (IAB) established, replacing ICCB

•Berkeley releases 4.2BSD incorporating TCP/IP.

•EARN (European Academic and Research Network) established. Very similar to the way BITNET works with a gateway funded by IBM. FidoNet developed by Tom Jennings.

•1984 Domain Name System (DNS) introduced. Number of hosts breaks 1,000

•JUNET (Japan Unix Network) established using UUCP.

1980’s

• 1983 The TCP/IP suite of networking protocols, or rules, becomes the only set of protocols used on the ARPANET. This decision sets a standard for other networks, and generates the use of the term "Internet" as the network of networks which either use the TCP/IP protocols or are able to interact with TCP/IP networks.

• To keep military and non-military network sites separate, the ARPANET splits into two networks: ARPANET and MILNET.

1980’s Continued..

•In 1982 and 1983, the first desktop computers began to appear. Many are equipped with an operating system called Berkeley UNIX, which includes networking software. This allows for relatively easy connection to the Internet using telnet.

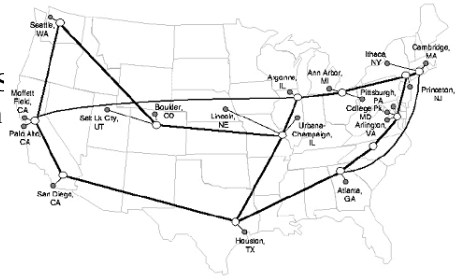
•The personal computer revolution continues through the eighties, making access to computer resources and networked information increasingly available to the general public.

1980's Continued..

1985-86: The National Science Foundation (NSF) connects the nation' s six supercomputing centers together. This network is called the NSFNET, or NSFNET backbone.

To expand access to the Internet, the NSF supported the development of regional networks, which were then connected to the NSFNET backbone. In addition, the NSF supported institutions, such as universities, in their efforts to connect to the regional networks.

Here is a diagram of the NSFNET backbone, as it appeared in



INTERNET BASED SYSTEMS DESIGN

1980's

•**1987** - The NSF awards a grant to Merit Network, Inc. to operate and manage future development of the NSFNET backbone. Merit Network, Inc. collaborates with IBM and MCI to research and develop faster networking technologies.

•1988 2 November - Internet worm burrows through the Net, affecting ~6,000 of the 60,000 hosts on the Internet.

•**1989** - The backbone network is upgraded to "T1" from 56Kbps which means that is able to transmit data at speeds of 1.5 million bits of data per second, or about 50 pages of text per second.

INTERNET BASED SYSTEMS DESIGN

1990's

1990 - The ARPANET is dissolved.

1991 - Gopher is developed at the University of Minnesota. Gopher provides a hierarchical, menu-based method for providing and locating information on the Internet. This tool makes using the Internet much easier.

1992 - Internet Society (ISOC) is chartered
Number of hosts breaks 1,000,000

1993 - The European Laboratory for Particle Physics in Switzerland (CERN) releases the World Wide Web (WWW), developed by Tim Berners-Lee. The WWW uses hypertext transfer protocol (HTTP) and hypertext links, changing the way information can be organized, presented and accessed on the Internet.

1990's

1993 - The NSFNET backbone network is upgraded to "T3" which means that it is able to transmit data at speeds of 45 million bits of data per second, or about 1400 pages of text per second.

1993-1994 - The graphical web browsers Mosaic and Netscape Navigator are introduced and spread through the Internet community. Due to their intuitive nature and graphical interface, these browsers make the WWW and the Internet more appealing to the general public.

• **1995** - The NSFNET backbone is replaced by a new network architecture, called vBNS (very high speed backbone network system) that utilizes Network Service Providers, regional networks and Network Access Points (NAPs).

1995

1995 - RealAudio, an audio streaming technology, lets the Net hear in near real-time

1995 Radio HK, the first commercial 24 hr., Internet-only radio station starts broadcasting

1995 NSF establishes the very high speed Backbone Network Service (vBNS) linking super-computing centers: NCAR, NCSA, SDSC, CTC, PSC

Technologies of the Year: WWW, Search engines

Emerging Technologies: Mobile code (JAVA, JAVAscript), Virtual environments (VRML), Collaborative tools

1996

ISP Meltdown: AOL (19 hours), Netcom (13 hours), AT&T WorldNet (28 hours - email only)

New Yorks' Public Access Networks Corp (PANIX) is shut down after repeated SYN attacks by a cracker using methods outlined in a hacker magazine (2600)

Various US Government sites are hacked into and their content changed, including CIA, Department of Justice, Air Force
MCI upgrades Internet backbone adding ~13,000 ports, bringing the effective speed from 155Mbps to 622Mbps.

Technologies of the Year: Search engines, JAVA, Internet Phone

1997

2000th RFC: "Internet Official Protocol Standards"

The American Registry for Internet Numbers (ARIN) is established to handle administration and registration of IP numbers to the geographical areas currently handled by Network Solutions (InterNIC), starting March 1998.

Longest hostname registered with InterNIC: CHALLENGER.MED.SYNAPSE.UAH.

Technologies of the Year: Push, Multicasting
Emerging Technologies: Push, Streaming Media.

1998

Electronic postal stamps become a reality, with the US Postal Service allowing stamps to be purchased and downloaded for printing from the Web

Network Solutions registers its 2 millionth domain on 4 May.

San Francisco sites without off-city mirrors go offline as the city blacks out on 8 December.

Technologies of the Year: E-Commerce, E-Auctions, Portals
Emerging Technologies: E-Trade, XML.

1999

Internet access becomes available to the Saudi Arabian (.sa) public in January, Somalia gets its first ISP - Olympic Computer (Sep), .ps is registered to Palestine (11 Oct)

MCI/Worldcom, the vBNS provider for NSF, begins upgrading the US backbone to 2.5GBps .

First Internet Bank of Indiana, the first full-service bank available only on the Net, opens on 22 February

MCI/Worldcom launches vBNS+, a commercialized version of vBNS

RFC 2550 Proposes the solution of Y10K and Beyond

Technologies of the Year: E-Trade, Online Banking, MP3
Emerging Technologies: Net-Cell Phones, Thin Computing, Embedded Computing

2000

The US timekeeper (USNO) and a few other time services around the world report the new year as 19100 on 1 January.

ICANN selected new TLDs aero, biz, coop, info, museum, name, pro. These will be available on late 2001.

Internet2 backbone deploys IPv6.

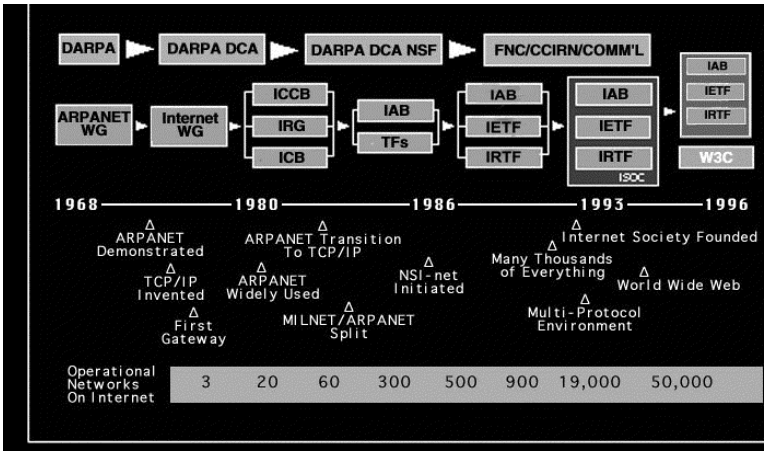
A Massive DOS attach crippled Yahoo, Amazon and eBay in early February.

2001

Forwarding email become illegal in Australia with the passing of the Digital Agenda Act on the grounds of copyright infringement.

.biz and .info are added to the root DNS server on 27th June with registration beginning in July.

Summary



Next Class

Review of Networking Technologies

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