Internet History of 1970s | Internet History

Originalartikel

Backup

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                                Nodes are added to the ARPANET at the rate of
one per month.<p>Programmers Dennis Ritchie and Kenneth Thompson at Bell
Labs complete the UNIX operating system on a spare DEC minicomputer. UNIX
combines many of the time-sharing and file-management features offered by
Multics and wins a wide following, particularly among scientists.</p><p>Bob
Metcalfe builds a high-speed (100 Kbps) network interface between the MIT
IMP and a PDP-6 to the ARPANET. It runs for 13 years without human
intervention. Metcalfe goes on to build another ARPANET interface for Xerox
PARC&#8217;s PDP-10 clone (MAXC).</p><p>DEC announces the Unibus for its
PDP-11 minicomputers to allow the addition and integration of myriad
computer-cards for instrumentation and communications.</p><p>In December,
the Network Working Group (NWG) led by Steve Crocker finishes the initial
ARPANET Host-to-Host protocol, called the Network Control Protocol (NCP).
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                                The ARPANET begins the year with 14 nodes in
operation. BBN modifies and streamlines the IMP design so it can be moved to
a less cumbersome platform than the DDP-516. BBN also develops a new
platform, called a Terminal Interface Processor (TIP) which is capable of
supporting input from multiple hosts or terminals.<p>The Network Working
Group completes the Telnet protocol and makes progress on the file transfer
protocol (FTP) standard. At the end of the year, the ARPANET contains 19
nodes as planned.</p><p>Intel&#8217;s release of the 4004, the first
&#8216;computer on a chip,&#8217; ushers in the epoch of the microprocessor.
The combination of memory and processor on a single chip reduces size and
cost, and increases speed, continuing the evolution from vacuum tube to
transistor to integrated circuit.</p><p>Many small projects are carried out
across the new network, including the demonstration of an aircraft-carrier
landing simulator. However, the overall traffic is far lighter than the
network&#8217;s capacity. Something needs to stimulate the kind of
collaborative and interactive atmosphere consistent with the original
vision. Larry Roberts and Bob Kahn decide that it is time for a public
demonstration of the ARPANET. They choose to hold this demonstration at the
International Conference on Computer Communication (ICCC) to be held in
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                                        The ARPANET grows by ten more nodes in the
first 10 months of 1972. The year is spent finishing, testing and releasing
all the network protocols, and developing network demonstrations for the
ICCC.<p>At BBN, Ray Tomlinson writes a program to enable electronic mail to
be sent over the ARPANET. It is Tomlinson who develops the
&#8216;user@host&#8217; convention, choosing the @ sign arbitrarily from the
non-alphabetic symbols on the keyboard. Unbeknownst to him, @ is already in
use as an escape character, prompt, or command indicator on many other
systems. Other networks will choose other conventions, inaugurating a long
period known as the e-mail &#8216;header wars.&#8217; Not until the late
1980s will &#8216;@&#8217; finally become a worldwide
standard.</p><p>Following the lead of Intel&#8217;s 4004 chip, hand-held
calculators ranging from the simple Texas Instruments four-function adding
machines to the elaborate Hewlett-Packard scientific calculators immediately
consign ordinary slide rules to oblivion.</p><p>Xerox PARC develops a
program called Smalltalk, and Bell Labs develops a language called
&#8216;C.&#8217;</p><p>Steve Wozniak begins his career by building one of
the best-known &#8216;blue boxes;&#8217; tone generators that enable long-
distance dialing while bypassing the phone company&#8217;s billing
equipment.</p><p>The ICCC demonstrations are a tremendous success. One of
the best known demos features a conversation between ELIZA, Joseph
Weizenbaum&#8217;s artificially-intelligent psychiatrist located at MIT, and
PARRY, a paranoid computer developed by Kenneth Colby at Stanford. Other
demos feature interactive chess games, geography quizzes, and an elaborate
air traffic control simulation. An AT&amp;T delegation visits ICCC but
leaves in puzzlement.
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                            Thirty institutions are connected to the
ARPANET. The network users range from industrial installations and
consulting firms like BBN, Xerox PARC and the MITRE Corporation, to
government sites like NASA&#8217;s Ames Research Laboratories, the National
Bureau of Standards, and Air Force research facilities.<p>The ICCC
demonstrations prove packet-switching a viable technology, and ARPA (now
DARPA, where the &#8216;D&#8217; stands for &#8216;Defense&#8217;) looks for
ways to extend its reach. Two new programs begin: Packet Radio sites are
modeled on the ALOHA experiment at the University of Hawaii designed by Norm
Abramson, connecting seven computers on four islands; and a satellite
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connection enables linking to two foreign sites in Norway and the
UK.</p><p>Bob Kahn moves from BBN to DARPA to work for Larry Roberts, and
his first self-assigned task is the interconnection of the ARPANET with
other networks. He enlists Vint Cerf, who has been teaching at Stanford. The
problem is that ARPANET, radio-based PRnet, and SATNET all have different
interfaces, packet sizes, labeling, conventions and transmission rates.
Linking them together is very difficult.</p><p>Kahn and Cerf set about
designing a net-to-net connection protocol. Cerf leads the newly formed
International Network Working Group. In September 1973, the two give their
first paper on the new Transmission Control Protocol (TCP) at an INWG
meeting at the University of Sussex in England.</p><p>Meanwhile, at Xerox
PARC, Bob Metcalfe is working on a wire-based system modeled on ALOHA
protocols for Local Area Networks (LANs). It will become Ethernet.
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                            Ethernet is demonstrated by networking Xerox
PARC&amp;#8217;s new Alto computers.<p>BBN recruits Larry Roberts to direct a
new venture, called Telenet, which is the first public packet-switched
service. Roberts&amp;#8217; departure creates a crisis in the DARPA IPTO
office.</p><p>DARPA has fulfilled its initial mission. Discussions about
divesting DARPA of operational responsibility for the network are held.
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Because it is DARPA-funded, BBN has no exclusive right to the source code for the IMPs. Telenet and other new networking enterprises want BBN to release the source code. BBN argues that it is always changing the code and that it has recently undergone a complete rewrite at the hands of John McQuillan. Their approach makes Roberts’ task of finding a new director for IPTO difficult. J.C.R. Licklider agrees to return to IPTO from MIT on a temporary basis. In addition to DARPA, The National Science Foundation (NSF) is actively supporting computing and networking at almost 120 universities. The largest NSF installation is at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. There, scientists use a home-built ‘remote job entry’ system to connect to NCAR’s CDC 7600 from major universities. Bob Kahn and Vint Cerf publish "A Protocol for Packet Network Interconnection"" in the May 1974 issue of IEEE Transactions on Communications Technology. Shortly thereafter, DARPA funds three contracts to develop and implement the Kahn-Cerf TCP protocol described in their paper, one at Stanford (Cerf and his students), one at BBN (Ray Tomlinson), and one at University College London (directed by Peter Kirstein and his students). Daily traffic on the ARPANET exceeds 3 million packets.

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The ARPANET geographical map now shows 61 nodes. Licklider arranges its administration to be turned over to the Defense Communications Agency (DCA). BBN remains the contractor responsible for network operations. BBN agrees to release the source code for IMPs and TIPs. The Network Working Group maintains its open system of discussion via RFCs and e-mail lists. Discomfort grows with the bureaucratic style of DCA. The Department of Energy creates its own net to support its own research. This net operates over dedicated lines connecting each site to the computer centers at the National Laboratories. NASA begins planning its own space physics network, SPAN. These networks have connections to the

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ARPANET so the newly developed TCP protocol begins to get a workout.
Internally, however, the new networks use such a variety of protocols that
true interoperability is still an issue.
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                            DARPA supports computer scientists at UC
Berkeley who are revising a Unix system to incorporate TCP/IP protocols.
Berkeley Unix also incorporates a second set of Bell Labs protocols, called
UUCP, for systems to use dial-up connections.<p>Seymour Cray demonstrates
the first vector-processor supercomputer, the CRAY-1. The first customers
include Lawrence Livermore National Laboratory, Los Alamos National
Laboratory, and NCAR. The CRAY-1 hardware is more compact and faster than
previous supercomputers. No wire is more than 4 feet long, and the clock
period is 12.5 nanoseconds (billionths of a second). The machine is cooled
by freon circulated through stainless steel tubing bonded within vertical
wedges of aluminum between the stacks of circuit boards (Cray patents the
bonding process). The CRAY-1&amp;#8217;s speed and power attract researchers,
who want access to it over networks.</p><p>Vint Cerf moves from Stanford to
DARPA to work with Bob Kahn on networking and the TCP/IP protocols.
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                                        Steve Wozniak and Steve Jobs announce the
Apple II computer. Also introduced are the Tandy TRS-80 and the Commodore
Pet. These three off-the-shelf machines create the consumer and small
business markets for computers.<p>Cerf and Kahn mount a major demonstration,
&#8216;internetting&#8217; among the Packet Radio net, SATNET, and the
ARPANET. Messages go from a van in the Bay Area across the US on ARPANET,
then to University College London and back via satellite to Virginia, and
back through the ARPANET to the University of Southern California&#8217;s
Information Sciences Institute. This shows its applicability to
international deployment.</p><p>Larry Landweber of the University of
Wisconsin creates THEORYNET providing email between over 100 researchers and
linking elements of the University of Wisconsin in different cities via a
commercial packet service like Telenet.
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                                The appearance of the first very small
computers and their potential for communication via modem to dial up
services starts a boom in a new set of niche industries, like software and
modems.<p>Vint Cerf at DARPA continues the vision of the Internet, forming
an International Cooperation Board chaired by Peter Kirstein of University
College London, and an Internet Configuration Control Board, chaired by Dave
Clark of MIT.</p><p>The ARPANET experiment formally is complete. This leaves
an array of boards and task forces over the next few years trying to sustain
the vision of a free and open Internet that can keep up with the growth of
computing.
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                                Larry Landweber at Wisconsin holds a meeting
with six other universities to discuss the possibility of building a
Computer Science Research Network to be called CSNET. Bob Kahn attends as an
advisor from DARPA, and Kent Curtis attends from NSF&amp;#8217;s computer
research programs. The idea evolves over the summer between Landweber, Peter
Denning (Purdue), Dave Farber (Delaware), and Tony Hearn (Utah).<p>In
November, the group submits a proposal to NSF to fund a consortium of eleven
universities at an estimated cost of $3 million over five years. This is
viewed as too costly by the NSF.</p><p>USENET starts a series of shell
scripts written by Steve Bellovin at UNC to help communicate with Duke.
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Newsgroups start with a name that gives an idea of its content. USENET is an
early example of a client server where users dial in to a server with
requests to forward certain newsgroup postings. The server then
&#8216;serves&#8217; the request.
                      </p></div>
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