

SYNOPSYS[®]

A Brief History of the Internet

Alan Dewar
2023-06-27

Fathers of the Internet

Vint Cerf and Bob Kahn





Vint Cerf

History

- Born June 23, 1943 (*Happy 80th birthday!*)
- 1972: Ph.D., University of California, Los Angeles
- 1972 – 1976: Stanford assistant professor, CS & EE
- 1973 – 1982: Defense Advanced Research Projects Agency (DARPA)
 - Developed TCP/IP protocols, with Bob Kahn
- 1982 – 1986: VP, MCI Digital Information Services
 - MCI Mail: first commercial email service connected to Internet
- 1986: VP, Corporation for National Research Initiatives (CNRI)
- 1992: Launched Internet Society, with Bob Kahn et al.
- 1992: IETF Internet Architecture Board
- 1994: MCI senior VP for data architecture
- 1998: Internet Corporation for Assigned Names and Numbers (ICANN)
 - 2000 – 2007: Chairman



Vint Cerf

Today

- 2005: Vice President and Chief Internet Evangelist, Google
- Suggested title “archduke”
 - Nixed: negative connotations
- Job interview
 - Email to Google CEO Eric Schmidt: “Hi Eric, would you like some help?”
 - Schmidt’s reply: “Yes.”



Vint Cerf

Awards

- IEEE Alexander Graham Bell Medal (1997)
- National Medal of Technology (1997)
- Marconi Prize (1998)
- ACM Turing Award (2004)
- Presidential Medal of Freedom (2005)
- Japan Prize (2008)
- Queen Elizabeth Prize for Engineering (2013)
- IEEE Medal of Honor (2023)



Bob Kahn

History

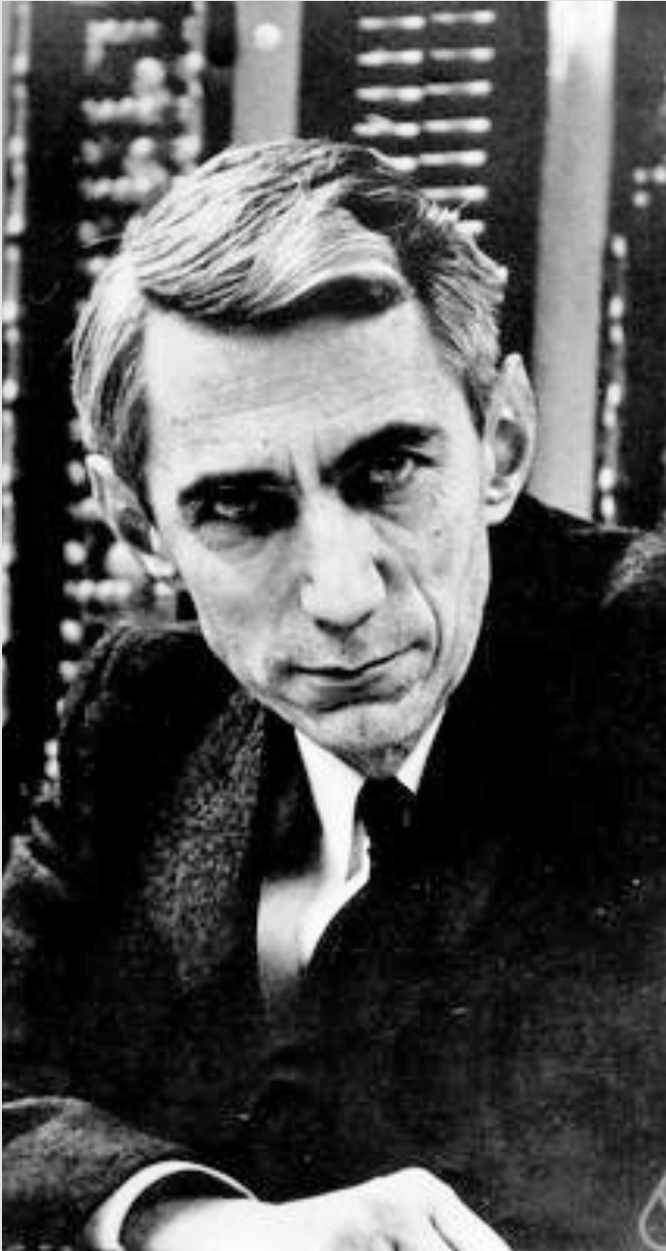
- Bolt Beranek and Newman (BBN)
 - contracted by U.S. ARPA to build switches for ARPANET
- 1972 – 1985: Defense Advanced Research Projects Agency (DARPA)
 - Developed TCP/IP protocols, with Vint Cerf
- 1986: founded the Corporation for National Research Initiatives (CNRI)
 - Remains its chairman, CEO and president
- 1992: Launched Internet Society, with Vint Cerf et al.



Bob Kahn

Awards

- Marconi Prize (1994)
- National Medal of Technology and Innovation (1997)
- IEEE Alexander Graham Bell Medal (1997)
- Presidential Medal of Freedom (2005)
- Japan Prize (2008)
- Queen Elizabeth Prize for Engineering (2013)



Claude Shannon

- Father of modern information theory
- 1948: “A Mathematical Theory of Communication”
- Cryptanalysis for national defense of the United States during World War II
- Fundamental work on codebreaking and secure telecommunications

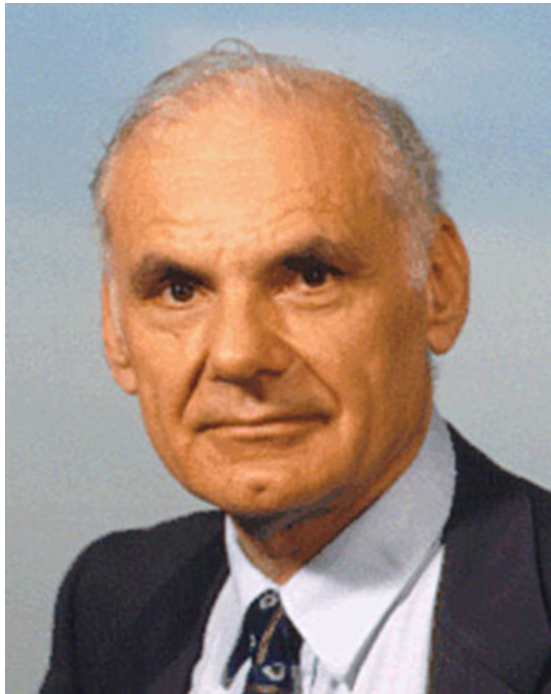


J.C.R. Licklider

- 1960: “Man-Computer Symbiosis”
 - Outlined the need for simpler interaction between computers and computer users
- 1962: head of the Information Processing Techniques Office (IPTO) at ARPA
 - Funding research which led to GUI, ARPANET
- 1962: Bolt Beranek and Newman (BBN)
 - “Intergalactic Computer Network” concept: earliest ideas of a global computer network
- 1968: “The Computer as a Communication Device”

Packet Switching Pioneers

Larry Roberts, Leonard Kleinrock, Paul Baran, Donald Davies





Larry Roberts

- Program manager at the Advanced Research Projects Agency
- Led team that created the ARPANET



Leonard Kleinrock

- Managed UCLA software team, including Steve Crocker, Vint Cerf, and Jon Postel
- 1962 Ph.D. thesis on queueing theory



Paul Baran

- 1959: RAND Corporation
 - Design of a “survivable” communications system
- Packet switching: “message blocks”
- “On Distributed Communications”

Donald Davies

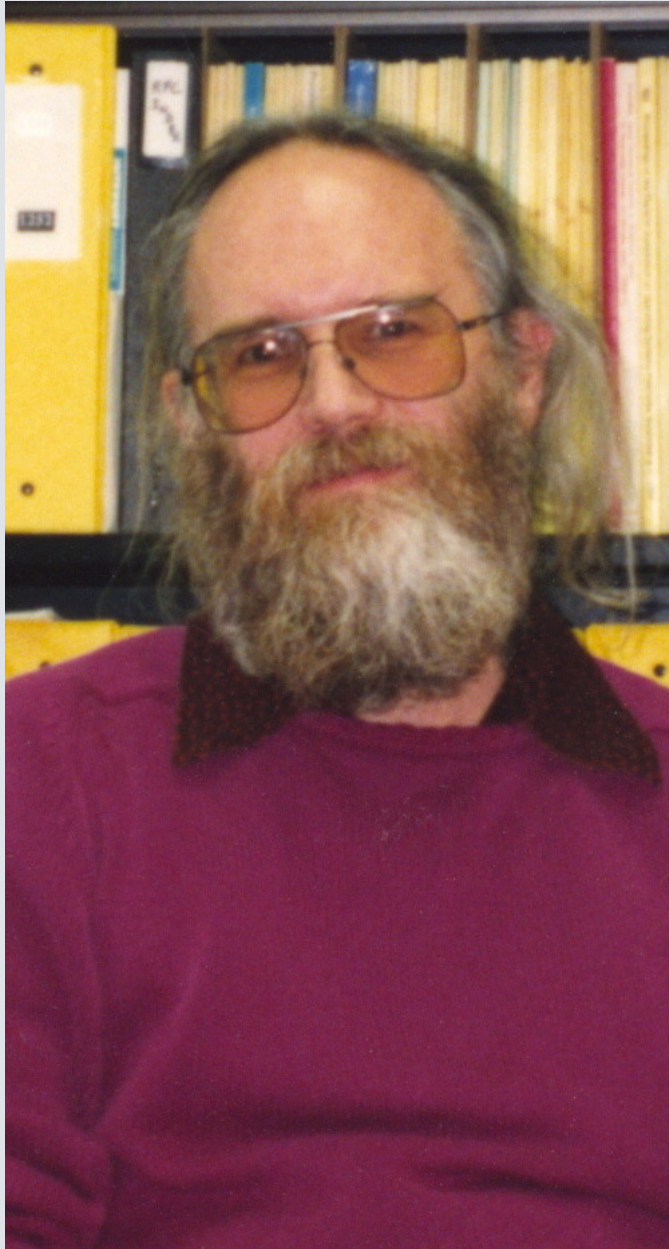


- National Physical Laboratory in the United Kingdom
- Packet switching: “packets”
 - Translatable into other languages



Louis Pouzin

- CYCLADES packet communication network
 - First actual implementation of the pure datagram model



Jon Postel

- “The god of the internet”
- 1969 – 1998: Editor of the Request for Comment (RFC) document series
- Simple Mail Transfer Protocol (SMTP)
- DNS
- Administrator of Internet Assigned Numbers Authority (IANA)
- Postel’s Law: “Be conservative in what you send, be liberal in what you accept”



Steve Crocker

- 1969: RFC 1: Host Software
- 1969: Created the ARPA “Networking Working Group”
- 2011 – 2017: chair of the board of the Internet Corporation for Assigned Names and Numbers (ICANN)
- Internet Engineering Task Force (IETF) security area director
- Internet Architecture Board
- Internet Society Board



Radia Perlman

- “Mother of the Internet”
- 1985: Spanning-Tree Protocol (STP)
- Transparent Interconnection of Lots of Links (TRILL)
- More than 100 patents
- Multiple RFCs



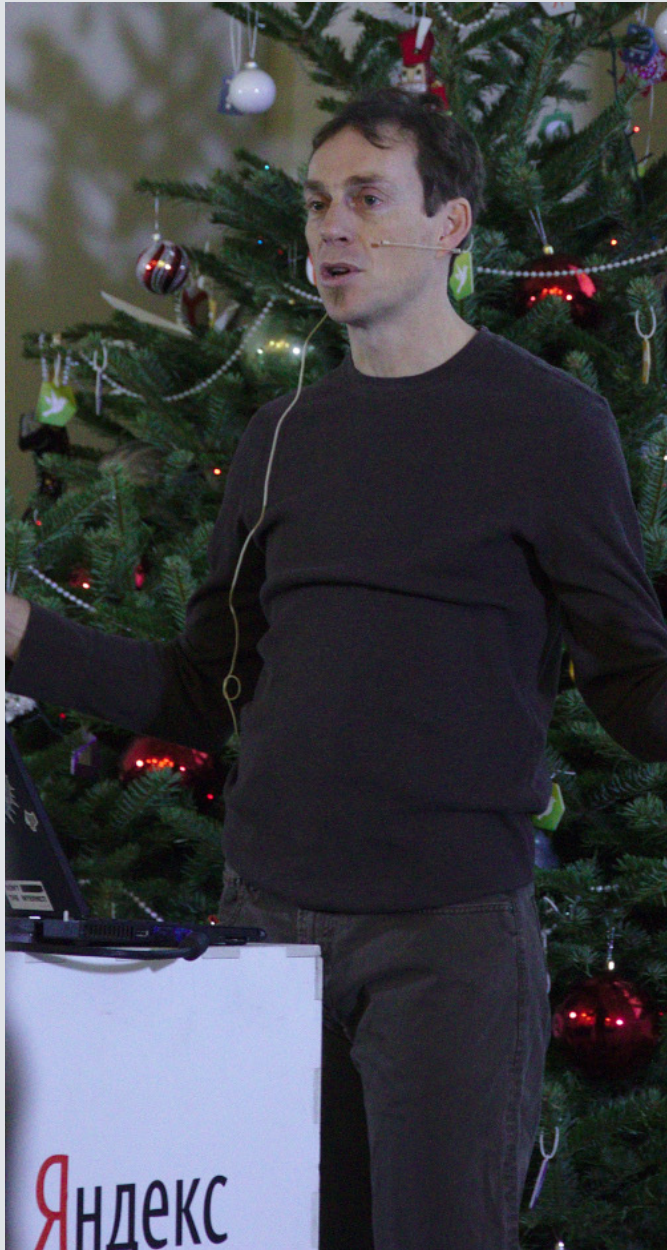
Tim Berners-Lee

- 1989: Hypertext Transfer Protocol (HTTP)
- 1990: First web site, at CERN
- 1994: founded World Wide Web Consortium (W3C)
- 2009: co-founded the World Wide Web Foundation
- Time magazine's list of the 100 Most Important People of the 20th century
- Net neutrality advocate
- 2017: Accepted Encrypted Media Extensions (EME) proposal
 - Digital Rights Management (DRM)



Marc Andreessen

- Mosaic Communications Corporation co-founder and vice president of technology
- 1993: NCSA Mosaic web browser



Theo de Raadt

- 1993: Co-founder of NetBSD
- 1995: Founder of OpenBSD
- 1999: OpenSSH



Joyce Reynolds

- 1993 – 1998: Worked with Jon Postel developing Internet Assigned Numbers Authority (IANA)
- 1998 – 2001: Helped transition IANA functions to the Internet Corporation for Assigned Names and Numbers (ICANN)
- 1987 – 2006: Request for Comments (RFC) editorial team
- RFCs
 - Telnet
 - FTP
 - POP



Al Gore

No, he didn't invent the Internet, but he helped

- 1980s – 1990s: promoted legislation to fund ARPANET expansion, public access
- 1986: S 2594, Supercomputer Network Study Act of 1986
- 1991: High Performance Computing and Communication Act of 1991 (“The Gore Bill”)
- Helped fund National Center for Supercomputing Applications (NCSA)
- Quoted out of context as claiming to have invented the Internet
 - “I took the initiative in creating the Internet.”

Internet Timeline

Pre-1980

- 1948: Claude Shannon: “A Mathematical Theory of Communication”
- 1968: J.C.R. Licklider: “The Computer as a Communication Device”: computer networks
- 1969: Steve Crocker: RFC 1: Host Software
- 1969: Leonard Kleinrock: first message on the ARPANET
 - “l”, “o”, <crash>; later, “login”
- 1973: TCP draft standard
- 1975: connect Stanford to BBN in Cambridge Mass and University College London (not a success)
- 1979: Tom Truscott and Jim Ellis (Duke University): Usenet

Internet Timeline

1980s

- 1981: Computer Science Network (CSNET) for institutions that could not connect directly to ARPANET
- 1983: DNS
- 1986: IETF formed, from predecessor Gateway Algorithms and Data Structures (GADS) Task Force
- 1980s – 1990s: Al Gore: promoted legislation to fund ARPANET expansion, greater public access
- 1986: Al Gore introduced S 2594, Supercomputer Network Study Act of 1986
- 1986: NSFNET project
- 1989: commercial ISPs emerge
- 1989 – 1990: Tim Berners-Lee: HTTP, first web site (CERN)

Internet Timeline

1990s

- 1990: ARPANET decommissioned
- 1991: CUUG formed
- 1991: High Performance Computing and Communication Act of 1991 (“The Gore Bill”)
- 1992: Internet Society (ISOC): home of IETF, IAB, IESG, IRTF
- 1994: Tim Berners-Lee: founded World Wide Web Consortium (W3C)
- 1995: optical backbone of NSFNET decommissioned
 - Sprint, MCI and AT&T optical networks; commercial traffic OK
- 1998: Morris worm
- 1998: IPv6 draft standard
- 1999: IANA project transferred USC (Jon Postel) to ICANN

Internet Timeline

21st Century

- 2000s: IoT devices surpassed the number of humans alive at some point in the late 2000s
- 2008: NASA conducted field test of “deep space internet”
- 2009: Tim Berners-Lee: co-founded the World Wide Web Foundation
- 2010: first Internet link into low Earth orbit: T. J. Creamer Twitter update from the International Space Station
- 2011: last available IPv4 address assigned
- 2017: Tim Berners-Lee: Encrypted Media Extensions (EME) proposal: W3C recommendation

Significant RFCs

- 1969: RFC 1: Host Software (Steve Crocker)
- 1974: RFC 675: SPECIFICATION OF INTERNET TRANSMISSION CONTROL PROGRAM (Vinton Cerf, Yogen Dalal)
- 1981: RFC 791: INTERNET PROTOCOL (Postel)
 - RFC 792: INTERNET CONTROL MESSAGE PROTOCOL (Postel)
 - RFC 793: TRANSMISSION CONTROL PROTOCOL (Postel)
- 1982: RFC 819: The Domain Naming Convention for Internet User Applications (Za-Sing Su, Postel)
 - RFC 819, RFC 881, RFC 882 and RFC 920
- 1983: RFC 883: The Domain Names Plan and Schedule (Postel)
- 1984: RFC 920: Domain Requirements (Postel, Reynolds)

Less-Significant RFCs

April 1

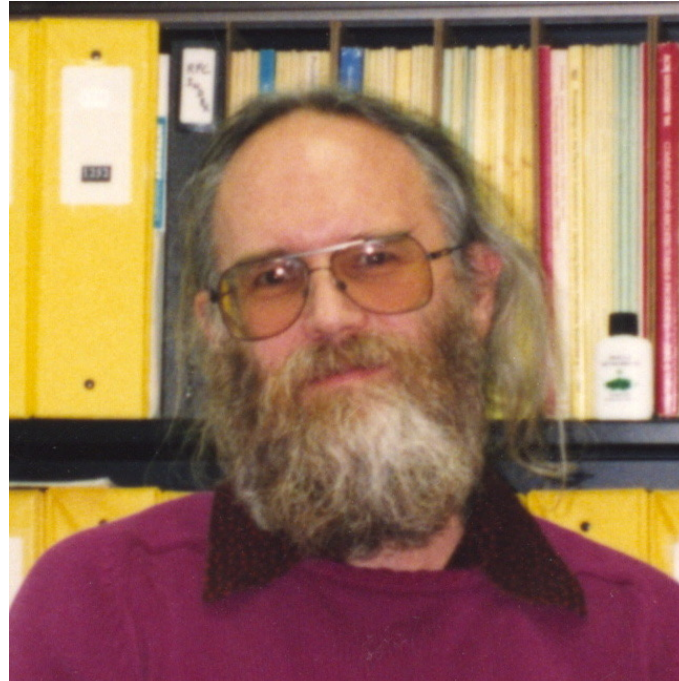
- 1990: RFC 1149: A Standard for the Transmission of IP Datagrams on Avian Carriers
- 1991: RFC 1217: Memo from the Consortium for Slow Commotion Research (CSCR) (Cerf)
- 1994: RFC 1607: A VIEW FROM THE 21ST CENTURY (Cerf)
 - actual historical background of Internet
- 1999: RFC 2549: IP over Avian Carriers with Quality of Service
- 2003: RFC 3514: The Security Flag in the IPv4 Header
- 2011: RFC 6214: Adaptation of RFC 1149 for IPv6
- 2014: RFC 7168: The Hyper Text Coffee Pot Control Protocol for Tea Efflux Appliances (HTCPCP-TEA)

Trivia

Van Nuys High School, Los Angeles



Vint Cerf



Jon Postel



Steve Crocker

Trivia

Van Nuys High School, Los Angeles




















Your Internet Recollections

What have I missed?

Thank You

Image Credits

-  Vint Cerf: By [Duncan.Hull](#) - Own work, [CC BY-SA 4.0](#), [Link](#)
-  Bob Kahn: By [Вени Марковски | Veni Markovski](#) - Own work, [CC BY-SA 3.0](#), [Link](#)
-  Claude Shannon: By [Jacobs, Konrad](#) - [CC BY-SA 2.0 de](#), [Link](#)
-  J. C. R. Licklider: By Unknown author - [Public Domain](#), [Link](#)
-  Larry Roberts: By [Unknown author](#) - [CC BY-SA 4.0](#), [Link](#)
-  Leonard Kleinrock: By Brewster Kahle - Personal camera, Public Domain, [Link](#)
-  Paul Baran: By [Paul Baran](#), Fair use, [Link](#)
-  Donald Davies: By [Unknown author](#) - Fair use, [Link](#)
-  Louis Pouzin: By [Jérémie Bernard](#) - Own work, [CC BY-SA 3.0](#), [Link](#)
-  Jon Postel: By [Carl Malamud](#) - [Flickr: Jon Postel](#), [CC BY 2.0](#), [Link](#)
-  Steve Crocker: By [Joi Ito](#) - [Flickr](#), [CC BY 2.0](#), [Link](#)
-  Radia Perlman: By [Scientist-100](#) at [English Wikipedia](#) - Transferred from [en.wikipedia](#) to Commons., Public Domain, [Link](#)
-  Tim Berners-Lee: By [Paul Clarke](#) - Own work, [CC BY-SA 4.0](#), [Link](#)
-  Marc Andreessen: By [JD Lasica](#) - [CC BY 2.0](#), [Link](#)
-  Theo de Raadt: By [FAndrey](#) - [CC BY 2.0](#), [Link](#)
-  Joyce Reynolds: https://icannwiki.org/images/1/16/Joyce_Reynolds.JPG
-  Al Gore: By [U.S. Senate Committee on Environment and Public Works](#) - Public Domain, [Link](#)