Ken Thompson

Kenneth Lane Thompson (born February 4, 1943) is an American pioneer of computer science. Thompson worked at Bell Labs for most of his career where he designed and implemented the original Unix operating system. He also invented the B programming language, the direct predecessor to the C programming language, and was one of the creators and early developers of the Plan 9 operating system. Since 2006, Thompson has worked at Google, where he co-developed the Go progra language.

Other notable contributions included his work on expressions and early computer text editors QED and definition of the UTF-8 encoding, and his work on comput that included the creation of endgame tablebases and th machine Belle. He won the Turing Award in 1983 with h term colleague Dennis Ritchie.

Nokia Bell Labs, originally named **Bell Telephone Laboratories** (1925–1984), then **AT&T Bell Laboratories** (1984–1996) and **Bell Labs Innovations** (1996–2007), is an American industrial research and scientific development company owned by Finnish company Nokia. It is headquartered in Murray Hill, New Jersey, and operates a global network of laboratories.

Early life and education

Thompson was born in New Orleans, Louisiana. When ask he learned to program, Thompson stated, "I was always fas with logic and even in grade school I'd work on arithmetic p in binary, stuff like that. Just because I was fascinated."[3]

Thompson received a Bachelor of Science in 1965 and a degree in 1966, both in Electrical Engineering and Co Sciences, from the University of California, Berkeley, wh master's thesis advisor was Elwyn Berlekamp.[4]

Career and research

Thompson was hired by Bell Labs in 1966.[5] In the 1960s at Bell Labs, Thompson and Dennis Ritchie worked on the Multics operating system. While writing Multics, Thompson created the Bon programming language.[6][7] He also created a video game called *Space Travel*. Later, Bell Labs withdrew from the MULTICS project.[8] In order to go on playing the game, Thompson found an old PDP-7 machine and rewrote *Space Travel* on it.[9] Eventually, the tools developed by Thompson became the Unix operating system: Working on a PDP-7, a team of Bell Labs researchers led by Thompson and Ritchie, and including Rudd Canaday, developed a hierarchical file system, the concepts of computer processes and

language)
Belle (chess machine)
UTF-8
Plan 9 from Bell Labs
Inferno (operating system)
grep
Endgame tablebase
Go

device files, a command-line interpreter, pipes for easy inter-process communication, and some small utility programs. In 1970, Brian Kernighan suggested the name "Unix", in a pun on the name "Multics".[10] After initial work on Unix, Thompson decided that Unix needed a system programming language and created B, a precursor to Ritchie's C.[11]

In the 1960s, Thompson also began work on regular expressions. Thompson had developed the CTSS version of the editor QED, which included regular expressions for searching text. QED and Thompson's later editor ed (the standard text editor on Unix) contributed greatly to the eventual popularity of regular expressions, and regular expressions became pervasive in Unix text processing programs. Almost all programs that work with regular expressions today use some variant of Thompson's notation. He also invented Thompson's construction algorithm used for converting regular expressions into nondeterministic finite automata in order to make expression matching faster.[12]

1970s

Throughout the 1970s, Thompson and Ritchie collaborated on the Unix operating system; they were so prolific on Research Unix that Doug McIlroy later wrote, "The names of Ritchie and Thompson may safely be assumed to be attached to almost everything not otherwise attributed."[13] In a 2011 interview, Thompson stated that the first versions of Unix were written by him, and that Ritchie began to advocate for the system and helped to develop it:[14]

> I did the first of two or three versions of UNIX all alone. And Dennis became an evangelist. Then there was a rewrite in a higher-level language that would come to be called C. He worked mostly on the language and on the I/O system, and I worked on all the rest of the operating system. That was for the PDP-11, which was serendipitous, because that was the computer that took over the academic community.

Awards	IEEE Emanuel R. Piore Award (1982)[1]
	Turing Award (1983)
	Member of the National Academy of Sciences (1985)[2]
	IEEE Richard W. Hamming Medal (1990)
	Computer Pioneer Award (1994)
	National Medal of Technology (1998)
	Tsutomu Kanai Award (1999)
	Harold Pender Award (2003)
	Japan Prize (2011)
Scientific career	
Fields	Computer science
Institutions	Bell Labs
	Entrisphere, Inc
	Google

DEC PDP-7, as used for initial work on Unix

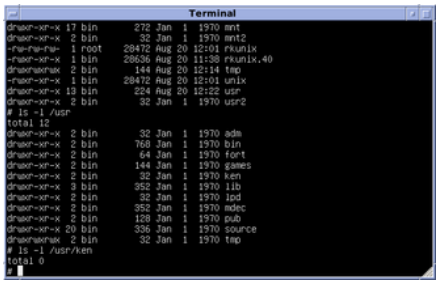
Feedback from Thompson's Unix development was also instrumental in the development of the C programming language. Thompson would later say that the C language "grew up with one of the rewritings of the system and, as such, it became perfect for writing systems".[14]

In 1975, Thompson took a sabbatical from Bell Labs and went to his alma mater, UC Berkeley. There, he helped to install Version 6 Unix on a PDP-11/70. Unix at Berkeley would later become maintained as its own system, known as the Berkeley Software Distribution (BSD).[15]

In early 1976, Thompson wrote the initial version of Berkeley Pascal at the Computer Science Division, Department of Electrical Engineering and Computer Science, UC Berkeley (with extensive modifications and additions following later that year by William Joy, Charles Haley and faculty advisor Susan Graham).

Thompson (sitting) and Ritchie working together at a PDP-11

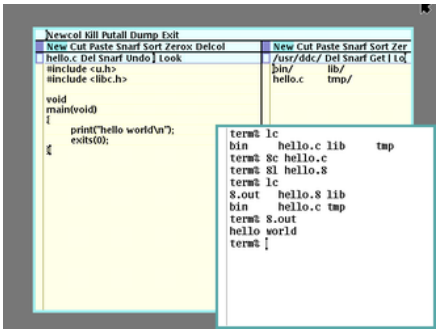
Thompson wrote a chess-playing program called "chess" for the first version of Unix (1971).[16] Later, along with Joseph Condon, Thompson created the hardware-assisted program Belle, a world champion chess computer.[17] He also wrote programs for generating the complete enumeration of chess endings, known as endgame tablebases, for all 4, 5, and 6-piece endings, allowing chess-playing computer programs to make "perfect" moves once a position stored in them is reached. Later, with the help of chess endgame expert John Roycroft, Thompson distributed his first results on CD-ROM. In 2001, the *ICGA Journal* devoted almost an entire issue to Thompson's various contributions to computer chess.[16]



Version 6 Unix running on the SIMH PDP-11 simulator, with "/usr/ken" still present

1980s

In 1983, Thompson and Ritchie jointly received the Turing Award "for their development of generic operating systems theory and specifically for the implementation of the UNIX operating system". His acceptance speech, "Reflections on Trusting Trust", presented the persistent compiler backdoor attack now known as the *Thompson hack* or trusting trust attack, and is widely considered a seminal computer security work in its own right.[18]



Plan 9 from Bell Labs, running the acme text editor, and the rc shell

Throughout the 1980s, Thompson and Ritchie continued revising Research Unix, which adopted a BSD codebase for the 8th, 9th, and 10th editions. In the mid-1980s, work began at Bell Labs on a new operating system as a replacement for Unix. Thompson was instrumental in the design and implementation of the Plan 9 from Bell Labs, a new operating system utilizing principles of Unix, but applying them more broadly to all major system facilities. Some programs that were part of later versions of Research Unix, such as mk and rc, were also incorporated into Plan 9.

Thompson tested early versions of the C++ programming language for Bjarne Stroustrup by writing programs in it, but later refused to work in C++ due to frequent incompatibilities between versions. In a 2009 interview, Thompson expressed a negative view of C++, stating, "It does a lot of things half well and it's just a garbage heap of ideas that are mutually exclusive."[19]

1990s

In 1992, Thompson developed the UTF-8 encoding scheme together with Rob Pike.[20] UTF-8 encoding has since become the dominant character encoding for the World Wide Web, accounting for more than 90% of all web pages in 2019.[21]

In the 1990s, work began on the Inferno operating system, another research operating system that was based around a portable virtual machine. Thompson and Ritchie continued their collaboration with Inferno, along with other researchers at Bell Labs.[22]

2000s

In late 2000, Thompson retired from Bell Labs. He worked at Entrisphere, Inc. as a fellow until 2006 and now works at Google, first as a Distinguished Engineer and now as Google Advisor.[23] Recent work has included the co-design of the Go programming language. Referring to himself along with the other original authors of Go, he states:[14]

> When the three of us [Thompson, Rob Pike, and Robert Griesemer] got started, it was pure research. The three of us got together and decided that we hated C++. [laughter] ... [Returning to Go,] we started off with the idea that all three of us had to be talked into every feature in the language, so there was no extraneous garbage put into the language for any reason.

Programming setup

According to a 2009 interview, Thompson used a Linux-based operating system.[24] A 2023 article commented on his long-time affinity for Apple Computers, but noted that he has recently moved on to a Raspbian device.[25]

Awards

National Academies

In 1980, Thompson was elected to the National Academy of Engineering for "designing UNIX, an operating system whose efficiency, breadth, power, and style have guided a generation's exploitation of minicomputers".[26] In 1985 he was elected a Member of the National Academy of Sciences.[2]

Turing Award

In 1983, Thompson and Ritchie jointly received the Turing Award "for their development of generic operating systems theory and specifically for the implementation of the UNIX operating system". In his acceptance speech, "Reflections on Trusting Trust", Thompson outlined an attack in the form of a compiler backdoor that has been referred to as the **Thompson hack** or the **trusting trust** attack, and is widely considered a seminal computer security work in its own right.[27]

IEEE Richard W. Hamming Medal

In 1990, both Thompson and Dennis Ritchie received the IEEE Richard W. Hamming Medal from the Institute of Electrical and Electronics Engineers (IEEE), "for the origination of the UNIX operating system and the C programming language".[28]

Fellow of the Computer History Museum

In 1997, both Thompson and Ritchie were inducted as Fellows of the Computer History Museum for "the co-creation of the UNIX operating system, and for development of the C programming language".[29]

National Medal of Technology

On April 27, 1999, Thompson and Ritchie jointly received the 1998 National Medal of Technology from President Bill Clinton for co-inventing the UNIX operating system and the C programming language which together have "led to enormous advances in computer hardware, software, and networking systems and stimulated growth of an entire industry, thereby enhancing American leadership in the Information Age".[30]

Tsutomu Kanai Award

In 1999, the Institute of Electrical and Electronics Engineers chose Thompson to receive the first Tsutomu Kanai Award "for his role in creating the UNIX operating system, which for decades has been a key platform for distributed systems work".[31]

Japan Prize

In 2011, Thompson, along with Dennis Ritchie, was awarded the Japan Prize for Information and Communications for the pioneering work in the development of the Unix operating system.[32]

Personal life

Ken Thompson is married and has a son.[33][16]

See also

- Brian Kernighan
- Dennis Ritchie

References

1. "IEEE Emanuel R. Piore Award Recipients" (https://web.archive.org/web/20101124232834/http://ieee.org/documents/piore_rl.pdf) (PDF). IEEE. Archived from the original (http://www.ieee.org/documents/piore_rl.pdf) (PDF) on November 24, 2010. Retrieved March 20, 2021.
2. "Kenneth Thompson" (https://ghostarchive.org/archive/20211021/http://www.nasonline.org/member-directory/members/49764.html). *www.nasonline.org*. Archived from the original (http://www.nasonline.org/member-directory/members/49764.html) on October 21, 2021. Retrieved June 9, 2019.

3. Seibel 2009, p. 450.
4. "Thesis Students" (https://ghostarchive.org/archive/20211021/http://math.berkeley.edu/~berlek/students.html). *Elwyn Berlekamp's Home Page*. University of California, Berkeley Department of Mathematics. Archived from the original (http://math.berkeley.edu/~berlek/students.html) on October 21, 2021.
5. "Ken Thompson: developed UNIX at Bell Labs" (http://www.linfo.org/thompson.html). Retrieved October 31, 2016.
6. Thompson, K. L. (1969). "Bon User's Manual" (https://web.archive.org/web/20210214210534/https://people.csail.mit.edu/saltzer/Multics/MHP-Saltzer-060508/filedrawers/180.btl-misc/Scan%204.PDF) (PDF). *Multics History Project*. Multics Documents: MIT Computer Science & Artificial Intelligence Lab. p. 1. Archived from the original (http://people.csail.mit.edu/saltzer/Multics/MHP-Saltzer-060508/filedrawers/180.btl-misc/Scan%204.PDF) (PDF) on February 14, 2021. Retrieved March 18, 2021.
7. Ritchie, Dennis. "The Development of the C Language" (https://www.bell-labs.com/usr/dmr/www/chist.html). Bell Labs. Retrieved October 31, 2016.
8. J. Stanley Warford (2009). *Computer Systems* (https://books.google.com/books?id=PERY_m5yyl4C&pg=PA460). Jones & Bartlett Publishers. p. 460. ISBN 978-1-4496-6043-7.
9. Ritchie, Dennis M. (2001). "Space Travel: Exploring the solar system and the PDP-7" (https://www.bell-labs.com/usr/dmr/www/spacetravel.html). Bell Labs. Archived (https://web.archive.org/web/20151226030544/https://www.bell-labs.com/usr/dmr/www/spacetravel.html) from the original on December 26, 2015. Retrieved February 4, 2016.
10. Ritchie, Dennis M. "The Evolution of the Unix Time-sharing System" (https://ghostarchive.org/archive/20211021/https://www.bell-labs.com/usr/dmr/www/hist.html). Archived from the original (https://www.bell-labs.com/usr/dmr/www/hist.html) on October 21, 2021. Retrieved October 31, 2016.
11. Dennis M. Ritchie. "The Development of the C Language" (https://www.bell-labs.com/usr/dmr/www/chist.html). Bell Labs/Lucent Technologies. Retrieved October 31, 2016.
12. Cox, Russ. "Regular Expression Matching Can Be Simple And Fast" (https://ghostarchive.org/archive/20211021/http://swtch.com/~rsc/regexp/regexp1.html). Archived from the original (http://swtch.com/~rsc/regexp/regexp1.html) on October 21, 2021. Retrieved October 30, 2016.
13. McIlroy, M. D. (1987). *A Research Unix reader: annotated excerpts from the Programmer's Manual, 1971–1986* (https://web.archive.org/web/20140504225225/http://www.cs.dartmouth.edu/~doug/reader.pdf) (PDF) (Technical report). CSTR. Bell Labs. 139. Archived from the original (http://www.cs.dartmouth.edu/~doug/reader.pdf) (PDF) on May 4, 2014.
14. "Dr. Dobb's: Interview with Ken Thompson" (https://ghostarchive.org/archive/20211021/http://www.drdobbs.com/open-source/interview-with-ken-thompson/229502480). May 18, 2011. Archived from the original (http://www.drdobbs.com/open-source/interview-with-ken-thompson/229502480) on October 21, 2021. Retrieved November 10, 2014.
15. Salus, Peter H. (2005). "Chapter 7. BSD and the CSRG" (http://www.groklaw.net/article.php?story=20050505095249230). *The Daemon, the Gnu and the Penguin*. Groklaw.
16. Dennis Ritchie (June 2001). "Ken, Unix and Games" (https://ghostarchive.org/archive/20211021/https://www.bell-labs.com/usr/dmr/www/ken-games.html). *ICGA Journal*. **24** (2). Archived from the original (https://www.bell-labs.com/usr/dmr/www/ken-games.html) on October 21, 2021. Retrieved March 5, 2020.
17. "Joe Condon (obituary)". *Physics Today*. 2013. doi:10.1063/PT.4.1752 (https://doi.org/10.1063%2FPT.4.1752).
18. Thompson, Ken (1984). "Reflections on trusting trust" (https://doi.org/10.1145%2F358198.358210). *Communications of the ACM*. **27** (8): 761–763. doi:10.1145/358198.358210 (https://doi.org/10.1145%2F358198.358210).
19. Seibel 2009, p. 475.

20. Pike, Rob (April 30, 2003). "UTF-8 history" (https://ghostarchive.org/archive/20211021/http://www.cl.cam.ac.uk/~mgk25/ucs/utf-8-history.txt). Archived from the original (http://www.cl.cam.ac.uk/~mgk25/ucs/utf-8-history.txt) on October 21, 2021.
21. "Usage Statistics and Market Share of UTF-8 for Websites, June 2019" (https://ghostarchive.org/archive/20211021/https://w3techs.com/technologies/details/en-utf8/all/all). *w3techs.com*. Archived from the original (https://w3techs.com/technologies/details/en-utf8/all/all) on October 21, 2021. Retrieved June 9, 2019.
22. Khamlichi, M.el. "Ken Thompson UNIX systems father" (https://ghostarchive.org/archive/20211021/https://www.unixmen.com/ken-thompson-unix-systems-father/). Unixmen. Archived from the original (https://www.unixmen.com/ken-thompson-unix-systems-father/) on October 21, 2021. Retrieved October 31, 2016.
23. School, Stanford Law. "Biographies of Amici Curiae in Oracle America, Inc., v. Google, Inc" (https://law.stanford.edu/list-of-amici-curiae-in-oracle-america-inc-v-google-inc/). *Stanford Law School*. Retrieved July 27, 2023.
24. Seibel 2009, p. 479.
25. Proven, Liam (March 17, 2023). "UNIX co-creator Ken Thompson is a… what user now?" (https://www.theregister.com/2023/03/17/ken_thompson_is_a_maccie/). *The Register*. Retrieved March 19, 2023.
26. "Dr. Ken Thompson" (https://ghostarchive.org/archive/20211021/https://www.nae.edu/MembersSection/Directory20412/28454.aspx). National Academy of Engineering. Archived from the original (https://www.nae.edu/MembersSection/Directory20412/28454.aspx) on October 21, 2021.
27. Thompson, Ken (1984). "Reflections on trusting trust" (https://doi.org/10.1145%2F358198.358210). *Communications of the ACM*. **27** (8): 761–763. doi:10.1145/358198.358210 (https://doi.org/10.1145%2F358198.358210).
28. "IEEE Richard W. Hamming Medal Recipients" (https://web.archive.org/web/20110726160451/http://www.ieee.org/documents/hamming_rl.pdf) (PDF). IEEE. Archived from the original (https://www.ieee.org/documents/hamming_rl.pdf) (PDF) on July 26, 2011. Retrieved May 29, 2011.
29. "Ken Thompson" (https://ghostarchive.org/archive/20211021/http://www.computerhistory.org/fellowawards/hall/ken-thompson). Computer History Museum. Archived from the original (http://www.computerhistory.org/fellowawards/hall/ken-thompson) on October 21, 2021. Retrieved October 29, 2016.
30. "Bell Labs Luminaries Dennis Ritchie And Ken Thompson To Receive National Medal Of Technology" (https://ghostarchive.org/archive/20211021/https://www.sciencedaily.com/releases/1998/12/981208172703.htm). ScienceDaily. December 8, 1998. Archived from the original (https://www.sciencedaily.com/releases/1998/12/981208172703.htm) on October 21, 2021.
31. "Ken Thompson Receives Kanai Award for Impact of UNIX System" (https://web.archive.org/web/20130326045523/http://www.bell-labs.com/news/1999/march/25/1.html). Bell Labs. March 25, 1999. Archived from the original (http://www.bell-labs.com/news/1999/march/25/1.html) on March 26, 2013.
32. Evangelista, Benny (January 25, 2011). "Ken Thompson, Dennis Ritchie win Japan Prize" (http://www.sfgate.com/business/article/Ken-Thompson-Dennis-Ritchie-win-Japan-Prize-2478569.php#ixzz1C5LtXdf3). *The San Francisco Chronicle*.
33. "Ken Thompson: A Brief Introduction" (http://www.linfo.org/thompson.html). *The Linux Information Project*. August 24, 2007. Retrieved March 5, 2020.

Sources

- Seibel, Peter (2009). *Coders at Work – Reflections on the Craft of Programming* (online (https://archive.org/details/B-001-000-162)). New York: Apress. ISBN 978-1-4302-1948-4 (pbk.) ISBN 978-1-4302-1949-1 (electronic)

External links

- Ken Thompson (http://cs.bell-labs.co/who/ken/), Bell Labs
- Reflections on Trusting Trust (https://dl.acm.org/citation.cfm?doid=358198.358210) 1983 Turing Award Lecture
- Unix and Beyond: An Interview with Ken Thompson (http://cse.unl.edu/~witty/class/csce351/howto/ken_thompson.pdf) IEEE Computer Society (http://www.computer.org/)
- Ken Thompson: A Brief Introduction (http://www.linfo.org/thompson.html) The Linux Information Project (LINFO)
- Computer Chess Comes of Age: Photos (https://web.archive.org/web/20070622103738/http://www.computerhistory.org/chess/viewAll.php?sec=thm-42eeabf470432&sel=thm-42f15c52333a3&table=item_still_image) Computer History Museum (http://www.computerhistory.org)
- Computer Chess Comes of Age: Video of Interview with Ken Thompson (https://web.archive.org/web/20070622103716/http://www.computerhistory.org/chess/viewAll.php?sec=thm-42eeabf470432&sel=thm-42f15c52333a3&table=item_oral_history) Computer History Museum (http://www.computerhistory.org)
- Reading Chess paper by HS Baird and Ken Thompson (http://doc.cat-v.org/bell_labs/reading_chess/) on optical character recognition

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