Ken Thompson: A Short Biography

Ken Thompson has had a long and illustrious career as a software engineer that has spanned 5 decades covering two programming languages, an operating system and character encoding used the world over. In this biography, Thompson's work and its tremendous impact, from his role in the design of UNIX and the B programming language as well as UTF-8 at Bell Laboratories, to the GO programming language at Google will be discussed.

Born in New Orleans, Thompson developed an interest in computer science from an early age. When asked about how he learned to program he stated "I was always fascinated with logic and even in grade school I'd work on arithmetic problems in binary, stuff like that. Just because I was fascinated." From these beginnings he went on to study Electrical Engineering and Computer Science at University of California, Berkeley where he received his Bachelor of Science in 1965 and his master's degree in 1966. That same year Thompson was hired by Bell Laboratories where he, along with colleague Dennis Ritchie, would shape the world of computing for decades to come with the introduction of the UNIX operating system.

When they started, Thompson and Ritchie worked on the Multics operating system, an MIT designed OS which was to be run on the minicomputers that were becoming available in the late 1960s. While working on Multics Thompson developed the Bon programming language in which he wrote a video game called Space Travel. Following Bell Laboratories withdrawal from the Multics project, Thompson ported his game to a PDP-7 machine which was smaller and more efficient than the ones that were used for the Multics environment he was working on previously. In doing so, he developed tools which would be the genesis of his own, new operating system. Thompson and Ritchie went on to lead a team of researchers who developed a hierarchical file system, a command-line interpreter, and some small utility programs which together would form the basis of UNIX. Thompson then implemented this functionality into a self-hosting operating system complete with an assembler, editor and shell. Thompson also developed a new programming language called B at this time. This was a stripped-down version of BCPL, a programming language Thompson had used during his time working on Multics.

At this point Bell Laboratories began to see potential in the project. The team received funding for a PDP-11/20 machine which was used to develop both a text formatting program called

roff and a text editor for UNIX, all of which were written in assembly language. Things started to move more quickly now, and the system became more and more complex. To attract more users The UNIX Programmer's Manual was published with commands documented in the new man page format which is still in use to this day. Around this time Dennis Ritchie adapted Thompson's B language into a higher-level language called C and eventually the entirety of the UNIX operating system was rewritten in this language. This was at a time where it was generally accepted that an operating system had to be written in assembly language. This new approach made UNIX far more portable than ever before and in 1973, the OS was presented to the world at the Symposium on Operating System Principles.

The UNIX operating system and the C programming language have both had an immeasurable impact on modern day computing. The term Unix-like is used to describe a range of operating systems that have been designed to behave similarly to UNIX OS and has become part of everyday language in computer science. BSD is one such example of a Unix-like operating system which was developed at Berkeley and has been incorporated into modern operating systems such as Mac OS and IOS which are used on all Apple products today. Richard Stallman took inspiration from the UNIX design in his GNU operating system (GNU stands for GNU's not UNIX) which is most commonly run using the Linux kernel designed by Linus Torvalds. This combination (known as GNU/Linux) has become one of the most highly used operating systems in the world and is completely open source and free to use.

Thompson continued working for Bell Laboratories after the success of Unix and in 1992, along with Rob Pike, developed UTF-8 character encoding. This was not only capable of encoding all valid code points in Unicode but was completely backwards compatible with the previous major character encoding standard ASCII. UTF-8 was designed to create a better standard for encoding multi-byte character sets than the existing UTF-1 standard. UTF-1 could encode all the same code points but did not have a clear separation between ASCII and non-ASCII which, along with a few other issues, led it to perform poorly. Thompson's newer system enabled much faster implementation as well as being self-synchronizing. Upon completion, UTF-8 was presented to the world at the USENIX conference in San Diego in January 1993.

UTF-8 was a great success and is still in use today as the de facto standard for character encoding across the world. It is used all over the internet and has grown in popularity steadily over the last decade to the point now where it is used in over 90% of all webpages to display

text. Its use extends beyond the world wide web though and it is used in all areas of computing which is why you will see it written in the settings of modern text editors and other programming tools. For example, UTF-8 is the recommended encoding for XML and HTML files by the W3C and almost all modern high-level programming languages support the format.

Thompson's latest endeavour has been the development of the GO programming language at Google where he is currently employed as a Distinguished Engineer. Again, Thompson teamed up with Rob Pike as well as Robert Griesemer to create a replacement for C++ to solve engineering problems at Google. When speaking about the original design of the language, Thompson stated, "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". Google revealed GO to the public in November 2009.

The GO language has become a staple of Google's internal production for the last several years as it enables higher productivity when used with their modern multicore processor machines, complex computer networks and large codebases. Also, due to it being free and open source, GO has started to be adopted outside of the company as well. It is quickly becoming a popular model for all kinds of programming tasks and in just two years the language rose from the 65th most popular programming language in the world to the 17th most popular.

Ken Thompson's accomplishments have earned him an outstanding reputation in the world of computer science and software engineering as well as garnering him numerous awards. For designing UNIX Thompson has received several honours including being receiving a Turing Award in 1983, an IEEE Richard W. Hamming Medal in 1990 and Tsutomu Kanai Award in 1999 among others. There is no doubt Thompson's work will continue to influence innovations in computer science for many years to come.

His approach to tackling problems in software engineering has been remarkably successful and can be summed up in the words of Doug McIlroy from his statements at Thompson and Richie's Japan Prize award ceremony. "Ritchie and Thompson made an amazing team; and they played Unix and C like a fine instrument. They sometimes divided up work almost on a subroutine-by-subroutine basis with such rapport that it almost seemed like the work of a

single person. In fact, as Dennis has recounted, they once got their signals crossed and both wrote the same subroutine. The two versions did not merely compute the same result, they did it with identical source code! Their output was prodigious. Once I counted how much production code they had written in the preceding year − 100,000 lines! Prodigious didn't mean slapdash. Ken and Dennis have unerring design sense. They write code that works, code that can be read, code that can evolve."

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