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## Dennis M Ritchie

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The sixties were years of transition in computers. Mainframe computers ruled the roost in the late 50s and the early 60s. Massachusetts Institute of Technology had an IBM 709 in 1961, one of the biggest, fastest computers of the time costing over 2 million dollars. It had 32 kilo words, 36 bits/word memory. Users' programs on punched cards were assembled as a batch and run one after another. A user had to normally wait for at least eight hours to get the result printed, only to find that he/she had made a silly error. It required at least three or four runs on the machine to get a usable result. John McCarthy who was on the faculty of the Electrical Engineering Department at MIT was impatient with long delays in debugging programs. He wrote a note proposing interactive time sharing of the computer among several users providing each user a tele-typewriter access to the computer. This started a project at MIT called Compatible Time Sharing Systems (CTSS) led by Fernandó Corbató [1]. The project involved hardware modifications to IBM 709 and creation of a new operating system allowing time sharing. As IBM 709 was the main computer used by the entire campus community it was not an appropriate platform for extensive research on time sharing systems. A full fledged research project called Multics (*Multiplexed Information and Computing Service*) started in 1964 with a computer dedicated for this purpose [2]. It was a joint project between MIT, General Electric Company and Bell Telephone Laboratories that initially used a GE-645 mainframe computer and later Honeywell 6180 when GE's computer division was taken over by Honeywell. Ken Thompson and Dennis Ritchie were the Bell Labs researchers in this project. Bell Labs pulled out of this project in 1969. While Ritchie was a member of Multics team he wrote a compiler for a language called BCPL which was an 'ancestor' of the C language he developed later when he returned to Bell Labs.

The mid-60s saw the emergence of minicomputers. Digital Equipment Corporation was a pioneer in this area and developed a series called PDP (Programmable Data Processors). These were smaller machines which individual laboratories/research groups could buy as they were affordable (less than US \$ 100,000) and had teletype input/output units. In 1969 Ken Thompson found a little used PDP-7 computer at Bell Labs and started developing a 'user friendly' operating system. The PDP-7 that Ken Thompson used had 4Kword, 18 bit word memory! As Ken Thompson had worked on Multics project it influenced the development of the system which he first called *Unics*, a pun on *Multics*, where *Uni* is supposed to stand for *Uniplexed* as opposed to *Multiplexed* of Multics. It was designed to work on smaller computers with much less resources compared to mainframes. Unics later was renamed UNIX. UNIX system provided interactive remote terminal based computing to users and had a shared file system.



Ken Thompson also designed a language called B based on BCPL which he used to re-implement parts of UNIX. Dennis Ritchie enriched B by adding types to it and called it C. The first compiler for C was written by Ritchie. Thompson and Ritchie rewrote UNIX using C in 1973 which made it portable to other computers and allowed further improvements. C was not intended as a user oriented high level language. The design philosophy of C was to make it a high level system programming language appropriate for writing programs such as Operating Systems. However, the efficiency of C and free availability of compilers for it led to its wide usage.

Once UNIX was written in C, it became portable. In 1974, Ritchie and Thompson wrote a paper titled 'The UNIX™ Time Sharing System' [3] which received the ACM Award for the best paper in programming languages and systems. The design of UNIX was elegant and simple. It provided a useful and extensible multi-user programming environment on affordable minicomputers. The file systems and libraries which were part of the system enabled users to write and share application programs and to augment the system's functions. UNIX became popular particularly in University Computer Science laboratories as it was available in the then popular PDP-11 computers. AT&T was forbidden by court decree from selling UNIX. AT&T consequently licensed it for the cost of magnetic tapes containing a copy of UNIX. The source code was thus freely available and several improvements were made particularly by the University of California at Berkeley and their version called BSD UNIX was ported on several desktop workstations.

In India, after a long delay, private computer manufacturers were permitted to make minicomputers in 1978. Several manufacturers, for instance, DCM Dataproducts, HCL, PSI and WIPRO adopted UNIX as the operating system on their machines, as source code was freely available. Expertise in UNIX and C developed fast in late 70s and early 80s which enabled these companies later to compete in the international software market.

The co-developer of UNIX, Dennis MacAlistair Ritchie was born on September 9, 1941 in Bronxville, New York. His father Alistair E Ritchie was employed in Bell Labs and was the coauthor of the book *The Design of Switching Circuits* along with W Keister and S Washburn. It was a popular textbook in pre-transistor days (I used it as a graduate student in USA). Dennis Ritchie received a Bachelor's degree in Physics and a doctoral degree in Applied Mathematics in 1968 from Harvard University. He joined Bell Labs in 1967 and was assigned to work on the Multics project at MIT. When Bell Labs withdrew from the project in 1969 he returned to Bell Labs at Murray Hills where he had sufficient freedom to work on projects of his choice. He chose to work with Ken Thompson on UNIX and the two had fruitful collaboration over several years. Their seminal work on operating systems was recognized by the Association of



Computing Machinery, USA and given the A.M.Turing Award, the highest award of ACM, in 1983. It honours Alan M Turing, the English mathematician who made major contributions to computing sciences. The Turing Award Selection Committee wrote: “The success of the UNIX System stems from its tasteful selection of a few key ideas and their elegant implementation. The model of the UNIX system has led a generation of software designers to new ways of thinking about programming. The genius of the UNIX system is its framework, which enables programmers to stand on the work of others”. His Turing Award Lecture titled ‘Reflections on Software Research’ appears as a Classic in this issue of *Resonance*.

In 1990, Ritchie became Head of Bell Labs Computing Techniques Research Department and led a group in designing the Inferno distributed operating system and the Limbo Language. He retired in 2007.

Besides the Turing Award the most significant awards which he shared with Ken Thompson are: IEEE Richard Hamming Medal in 1990 and the National medal of Technology in 1998. To students, Ritchie is well known as the co-author of the book *The C Programming Language* which he wrote with Brian Kernighan.

Dennis Ritchie died on October 12, 2011 leaving behind innumerable UNIX and C fans.

### Suggested Reading

- [1] F J Corbató *et al*, *The Compatible Time Sharing System: A Programmer’s Guide*, The MIT Press, Cambridge, MA, 1963.
- [2] F J Corbató and V A Vyssotsky, *Introduction and Overview of the Multics System*, *Proceedings of the 1965 Fall Joint Computer Conference*, USA, pp.185–196.
- [3] Dennis M Ritchie and Ken Thompson, *The UNIX™ Time-Sharing System*, *Communications of ACM*, Vol.17, No.7, pp.365–375, July 1974.

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