

The History of Solaris

UNIX is plural. It is not one operating system but, many implementations of an idea that originated in 1965. As a system administrator, you need to understand the history of the UNIX operating system—where it came from, how it was built, and where it is now. Understanding the various versions of UNIX and its origins makes it clear why UNIX became known as a somewhat hostile operating system. For example, UNIX was not developed by a single company with a large marketing organization driving the user interface. (In other words, it did not follow the development path of, say, Microsoft Windows.) On the other hand, UNIX was not invented by hackers who were fooling around; it grew out of strong academic roots. The primary contributors to UNIX were highly educated mathematicians and computer scientists employed by what many people feel is the world's premier industrial research center, Bell Laboratories. Although knowledgeable and experienced in their own right, these developers maintained professional contacts with researchers in academia, leading to an exchange of ideas that proved beneficial for both sides. Understanding the symbiotic relationship between UNIX and the academic community means understanding the background of the system's inventors and the history of interactions between universities and Bell Laboratories.

How It All Began

It all began at Bell Labs, the research lab of AT&T, one of the largest and most powerful companies of our time. Ironically, AT&T was not interested in developing and selling computers or operating systems. In fact, the U.S. Department of Justice did not allow AT&T to sell software. However, AT&T's existing systems, made up of people and paper, were in danger of being overwhelmed in the boom of the 1960s. By the 1970s, the phone business was in jeopardy. Out of desperation and need, Ken Thompson of AT&T set out to develop what no computer company was ready to provide—a multiuser, multiprocessing operating system to be used in-house for its own information processing department. Specifically, the goal was an operating system to support several programmers simultaneously in a more hospitable environment.

What follows is an account of major dates and events in the development cycle of the UNIX operating system.

1965–1969

In 1965, Bell Labs joined with MIT and General Electric in a cooperative development of Multics, a multiuser interactive operating system running on a GE 645 mainframe computer. However, unhappy with the progress in the development of a system that was experiencing many delays and high costs, Bell Labs dropped out of the development of Multics in 1969.

In 1969, Ken Thompson, exposed to Multics at Bell Labs, met up with Dennis Ritchie, who provided a Digital Equipment Corporation PDP-7 minicomputer to continue the development of an operating system capable of supporting a team of programmers in a research environment. After they created a prototype, Thompson returned to Bell Labs to propose the use of this new operating system as a document preparation tool in the Bell Labs patent department. The new operating system was named UNIX to distinguish it from the complexity of Multics. Efforts to develop UNIX continued, and UNIX became operational at Bell Labs in 1971.

The first version of UNIX was written in assembly language on a PDP-11/20. It included the file system, `fork`, `roff`, and `ed`. It was used as a text-processing tool for the preparation of patents.

1970–1972

During the early 1970s, UNIX began to gain popularity throughout Bell Labs, and as word of the new operating system spread, universities embraced it. However, although UNIX was viewed favorably by the academic and high-tech sectors, it was with skepticism by the business community. In a move to heighten the popularity of UNIX, AT&T began to license the UNIX source code to universities at a minimal cost. AT&T

gave many licensees the software code and manuals, but didn't provide technical support. By the late 1970s, 70% of all colleges and universities had UNIX.

Computer science graduates were using it, even modifying the code to make it more robust. UNIX was written in assembly language and ran primarily on DEC hardware—first on the PDP-7, and then the PDP-11/40, the 11/45, and finally the 11/70, on which it gained wide popularity.

1973–1979

This period became the most significant in the development of UNIX. Ritchie and Thompson had developed the C programming language between 1969 and 1973, and now rewrote the UNIX kernel in the high-level C language. The operating system could be compiled to run on different computers. Within months, UNIX could be ported to new hardware. Modifications to the operating system were easy. Again, Thompson resonated with members of the academic community who were already using UNIX in many of their system design courses. UNIX, written in a general-purpose language featuring modern commands, began to take off in the areas of word processing and programming.

By this point, UNIX was at version 6. This was the first release of UNIX to be picked up by a commercial firm, Whitesmiths, Inc., which created a commercial copy of version 6 called Idris.

In 1975, Thompson visited Berkeley while on sabbatical, and installed version 6 on a PDP-11/70. It was at this time that two graduate students, Bill Joy and Chuck Haley, got involved with version 6 and later played an important role in the development of the UNIX system at Berkeley. The first project they worked on was the development of the UNIX `ex` editor.

Joy and Haley began to take interest in the internal operations of UNIX—specifically, the kernel. Joy put together a distribution of UNIX called the Berkeley Software Distribution (BSD). He included enhancements such as the C shell (a C-like interface to UNIX) and the vi editor. 1BSd was released in 1975. By the second release of BSD in 1978, Joy had added virtual memory support, which allowed programs to run even if they required more physical memory than was available at the time. This second edition of BSD had a strong influence on the release of Bell Labs' version 7 of UNIX, which was released in 1979 and was the last of the “clean” versions of UNIX (produced solely by Bell Labs). Version 7 gave rise to a number of UNIX ports to other platforms, and for the first time, both industry and academia supplied enhancements, which were incorporated into future releases.

In the late 1970s, the United States Department of Defense's Advanced Research Projects Agency (DARPA) decided to base its universal computing environment on Berkeley's version of UNIX. In the 4.1 release of BSD, DARPA provided some important performance tune-ups. The fast file system, which provided a way to improve the file system's performance and prevent file fragmentation, was added in release 4.2.

1982–1983

AT&T formally released a beta version of UNIX to the commercial sector in 1982. In 1983, AT&T released the first true production version of UNIX, naming it System III (Systems I and II never existed). Although it was based on version 7 of UNIX, and thus included some BSD utilities, the release of System III did not include the vi editor or the C shell. Instead, AT&T included the programmer's workbench.

With the release of System III, AT&T saw a future in UNIX, and soon released System V. (System IV was never seen outside of AT&T.) System V included the editor, curses (the screen-oriented software libraries), and the `init` program, which was used to start up processes at UNIX boot-up.

In the early 1980s, Joy left Berkeley with a master's degree in electrical engineering, and became cofounder of Sun Microsystems (Sun stands for Stanford University Network). Sun's implementation of BSD was called SunOS. Sun extended the networking tools of the operating system to include the Networked File System (NFS), which was to become an industry standard. Sun also did some of the early work in developing windowing software for UNIX. SunOS was first released in 1983.

With workstation products now offered by Sun, UNIX began to gain acceptance in the high-tech arena, especially in computer-aided design and computer-aided engineering (CAD/CAE) environments. The early 1980s saw CAD/CAE become popular. Additional workstation vendors, such as HP and Apollo, began to exploit CAD/CAE capabilities and performance gains over the popular personal computers of the time. These UNIX workstations could outperform PCs and, with UNIX as an operating system, could provide a multi-user environment.

In other business computing environments, however, UNIX was still considered a hostile environment, and did not pose a threat to the mainframes of the time. UNIX had yet to define itself as a user-friendly, tried-and-tested operating system. However, it was gaining ground in the areas of multitasking and networking. More important, UNIX was being touted as the operating system that provided portability between different hardware architectures, and as a consequence, software developers were getting excited about UNIX. In theory,

a program written in C for UNIX would be portable to any hardware platform running the UNIX operating system.

1984–1987

In 1984, AT&T released System V, release 2, and in 1987, release 3. Release 2 introduced the terminal capability database `termcap` file, named `terminfo`, which provided support for various CRT terminals connected to the UNIX system. Other changes included the addition of `streams` and Remote File Systems.

1988–1992

In 1988, AT&T shocked the UNIX community by purchasing a percentage of Sun Microsystems, already a leader in the industry. Other hardware vendors saw this as an unfair advantage for Sun, so they quickly formed a consortium group called the Open Software Foundation (OSF). Together, they raised millions of dollars to develop a new UNIX standard to compete against Sun's.

In a counterstrike, AT&T, Sun, Data General, and Unisys joined forces to start their own organization to fight OSF. This consortium of companies, called UNIX International (UI), was formed to oversee the development of System V standards. OSF and UI turned out to be the two major competing commercial standards for UNIX.

By the late 1980s, AT&T concluded that UNIX was a distraction from the company's focus on producing hardware. As a result, AT&T formed the UNIX Software LAB (USL), ultimately purchased by Novell in 1992.

In 1992, at the summer UseNIX conference, Berkeley announced it would conclude its development activities at version 4.4 of BSD. Several people who were involved with BSD formed smaller companies to try to continue the development of BSD, but without Berkeley and ARPA, it was not the same.

In the 1990s, BSD and System V dominated the industry, with several vendors providing their versions of one of the two operating systems. Soon UNIX, an operating system meant to provide portability of applications between multiple hardware platforms, was getting out of control. Applications were not portable between UNIX System V, release 3, and BSD. To create even more confusion, hardware vendors were enhancing their versions of BSD and System V.

1993

Sun announced that SunOS, release 4.1.4, would be its last release of an operating system based on BSD. Sun saw the writing on the wall and moved to System V, release 4, which they named Solaris. System V, release 4 (SRV4) was a merger of System V and BSD, incorporating the important features found in SunOS.

As more hardware vendors, such as Sun, began to enter the picture, a proliferation of UNIX versions emerged. Although these hardware vendors had to purchase the source code from AT&T and port UNIX to their hardware platforms, AT&T's policy toward licensing the UNIX brand name allowed nearly any hardware vendor willing to pay for a license to pick up UNIX. Because UNIX was a trademark, hardware vendors had to give their operating systems a unique name. Here are a few of the more popular versions of UNIX that have survived over the years:

- ◆ SCO UNIX. SCO Open Desktop and SCO Open Server from the Santa Cruz Operation for the Intel platform. Based on System V.

- ◆ SunOS. Sun's early operating system and the best-known BSD operating system.
- ◆ Solaris. Sun's SRV4 implementation, also referred to as SunOS 5.x.
- ◆ HP-UX. Hewlett-Packard's version of UNIX. HP-UX 9.x was System V, release 3, and HP-UX 11i is based on the System V, release 4 OS.
- ◆ Digital UNIX. Digital Equipment's version of OSF/1.
- ◆ IRIX. The Silicon Graphics version of UNIX. Early versions were BSD-based; version 6 was System V, release 4.
- ◆ AIX. IBM's System V-based UNIX.
- ◆ Linux. A free UNIX operating system for the INTEL platform; it was quickly gaining a hold in the UNIX community. Versions of Linux became available on Sun, HP, and IBM systems.

With the uncontrolled proliferation of UNIX versions, standards became a major issue. In 1993, Sun announced that it was moving to System V in an effort to promote standards in the UNIX community. With two major flavors of UNIX, standards could not become a reality. Without standards, UNIX would never be taken seriously as a business computing system. Thus, Sun developed BSD, but provided its users with System V, release 4, shrink-wrapped directly from AT&T. In addition, any applications developed by Sun to be added onto UNIX were to be SRV4-compliant. Sun challenged its competitors to provide true portability for the user community.

The Graphical User Interface (GUI) was the next wave in the development of the UNIX operating system. As each hardware vendor tried to outdo the others, ease of use became an issue. Again, in this area especially,

standards were important. Applications that were to be portable needed a GUI standard. Therefore, Sun and AT&T started promoting OPEN LOOK, which they jointly developed. Their goal was to create a consistent look and feel for all flavors of UNIX; unfortunately, OSF had its own GUI called OSF/MOTIF. Thus, round two of the fight for standards began, with MOTIF beating out OPEN LOOK.

MOTIF was based on a GUI developed at MIT named the X Window System, which allowed a user sitting at one machine to run programs on a remote machine while still interacting with the program locally. X was, in effect, one way for different systems to interface with each other. X allowed a program run on one computer to display its output on another computer, even when the other computer was of a different operating system and hardware architecture. The program displayed its output on the local machine, and accepted keyboard and mouse input from the local machine, but it executed on the CPU of the remote machine.

The local machine was typically a workstation or terminal called a dedicated X terminal, and was built specifically to run the X Window System. The remote machine might be a minicomputer or server, a mainframe, or even a supercomputer. In some cases, the local machine and the remote machine might, in fact, be the same. In summary, X was a distributed, intelligent, device-independent, operating-system-independent windowing system.

As stated earlier, MOTIF beat OPEN LOOK in the standards war. Sun conceded, and started to provide a package that contained both OPEN LOOK and MOTIF—called the Common Desktop Environment (CDE)—as standard equipment beginning with Solaris 2.5.1.

2001 AND BEYOND

Today, many hardware vendors have buried the hatchet and, for the sake of users, are moving their implementations of UNIX to be SVR4-compliant. SVR4 will clearly be the dominant flavor of UNIX across most major platforms. As all vendors begin to implement SVR4 along with the CDE or GNOME interface, users will begin to see a more consistent implementation of UNIX. In addition, software providers can be assured that applications written to be SVR4-compliant will be portable across many hardware platforms.

Look for the GNOME desktop around mid-2002 with the release of Solaris 9. This new desktop will eventually replace CDE, and will be much better than CDE in terms of usability, visual design, and core features. Most major UNIX vendors will be moving toward GNOME.

Linux will still be a major player. Now that most of the major UNIX vendors—including Sun, HP, and IBM—have embraced it, Linux will not go away.

Solaris

No other flavor of UNIX is more popular or has enjoyed a wider user base and cultural following than Sun Microsystems' Solaris. Since it was founded in 1982, Sun Microsystems' focus has been on UNIX, and it appears to have no intention of moving away from the UNIX operating system. Sun's user base has strong loyalty to the company, as well as to the operating system. Sun's most recent version is Solaris 8, based on System V, release 4. The Solaris operating system is available for the SPARC architecture, Sun's own processor, and the Intel platform.

MILESTONES IN THE DEVELOPMENT OF SOLARIS

- 1965 Bell Laboratories joins with MIT and General Electric to develop Multics.
- 1970 Ken Thompson and Dennis Ritchie develop UNIX.
- 1971 The B-language version of the operating system runs on a PDP-11.
- 1973 UNIX is rewritten in the C language.
- 1974 Thompson and Ritchie publish a paper and generate enthusiasm in the academic community. Berkeley starts the BSD program.
- 1975 The first licensed version of BSD UNIX is released.
- 1979 Bill Joy introduces "Berkeley Enhancements" as BSD 4.1.
- 1982 AT&T first markets UNIX. Sun Microsystems is founded.
- 1983 Sun Microsystems introduces SunOS.
- 1984 About 100,000 UNIX sites exist worldwide.
- 1988 AT&T and Sun start work on SVR4, a unified version of UNIX.
- 1988 OSF and UI are formed.
- 1989 AT&T releases System V, release 4.
- 1990 OSF releases OSF/1.
- 1992 Sun introduces Solaris, which is based on System V, release 4. SunOS, which is based on BSD UNIX, will be phased out.

- 1993 Novell buys UNIX from AT&T.
- 1994 Solaris 2.4 is available.
- 1995 Santa Cruz Operation buys UNIXware from Novell. SCO and HP announce a relationship to develop a 64-bit version of UNIX. Solaris 2.5 is available.
- 1997 Solaris 2.6 is available.
- 1998 Solaris 7 is available.
- 2000 Solaris 8 is available.
- 2001 Solaris 9 in Beta testing Q3.

Excerpt from the Solaris 8 System Administrator Certification Training Guide author: Bill Calkins

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