A Short, BSD-specific, UNIX History

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1 Introduction

I am going to look briefly at the history of UNIX, up until 4.4BSD Lite / 386BSD. This essay is geared particularly towards the BSDs[1] as it can be argued they are the most pure of the UNIXes.

Where appropriate I will discuss implications for the operating system world, the innovations and drawbacks. I will also briefly cover the major USL/BSDi lawsuit toward the end of the essay.

2 Short History

2.1 BSD, System III and Linux

The BSDs have their roots in the original "UNICS"[2] source code. This was created jointly by Ken Thompson, Dennis Ritchie (the creator of C) and Rudd Canaday at Purdue University, 1969.

In 1971 UNICS became known as UNIX with the release of "UNIX Time-Sharing System First-Edition". The first fork happened in 1973/4, creating PWB/UNIX and MERT, as well as the existing UNIX5. MERT soon died away, while PWB would later become System III[3]. The next major UNIX6 fork would come on March 9, 1978, creating 1BSD – this work was by the CSRG[4] at Berkeley. Interestingly UNIX7 would fork in 1984 to create Minix, which was used by Linus Torvalds as the framework for his Linux kernel.

The main UNIX trunk would end with the release of UNIX10 in 1989. In this time it would influence and be influenced by many of its siblings. A list of important dates can be found in the references.

2.2 DARPA and Rapid Development

A plethora of new features were added in 2 and 3BSD – most importantly support for DEC's 32-bit VAX machine, which would quickly be accepted as the successor of the PDP-11. Other additions included Thompson's modified Pascal compiler, the "vi" editor and C-shell.

Shortly after the release of 2BSD, AT&T gained control of UNIX and released System III. With the introduction of commercial UNIX (i.e. non-academic) BSD took the spotlight and was to be the subject of much innovation.

Much of this rapid development was the result of financial support from DARPA[5]. This support was obtained by Bob Fabry in the guise of an 18-month sponsorship for 3BSD, possibly obtained as a result of the powerful new features available in 3BSD – virtual memory, demand paging and page replacement. As a result 4BSD included the ARPANET network protocol[6], which would later evolve into TCP/IP, improved (reimplemented) virtual memory, termcap[7] and improved support for large numbers of devices.

In true development style[8], the next release, 4.1BSD, was mainly a development/bug-fix release. However, Jim Kulp's job control and a device probe / auto-configuration were also included. Personally I believe the probe code to be most interesting – at boot-time all attached devices are probed and dynamically allocated memory, interrupts, etc., thus allowing a single kernel-binary to run on many machines without the requirement of hard reconfiguration.

4.2BSD brought many of the features commonly associated with today's UNIX – signals[9], IPC[10], TCP/IP[11] and the new, optimised filing system, designed by Joy and Kirk McKusick, known as Berkeley

[1] Berkeley Software Distribution

[2] UNICS based on the MULTICS name. Possibly because UNICS was designed to be good at a single purpose, unlike MULTICS, which was designed to be more universal.

[3] Final version: System V Release 4, but went on to become UnixWare

[4] Computer Systems Research Group – comprised technical, administrative and support members. A full list of members can be found at http://www.netbsd.org/People/CSRG-contrib.html

[5] Defence Advanced Research Projects Agency – a US defence body concerned with defence research projects

[6] RFCs 1 & 2 can be found at ftp://ftp.rfc-editor.org/in-notes/rfc1.txt and ftp://ftp.rfc-editor.org/in-notes/rfc2.txt

[7] A database of terminal types, providing information on how to handle cursor keys, screen clears, etc. – termcap provided a layer of abstraction for termcap-aware applications, allowing them to run on any termcap-supported terminal

[8] Even minor versions often indicate a "stable," or "production" release, while odd minor numbers indicate "development," or, in this case, maintenance releases

[9] Signals allow two processes (or the kernel and a process) to communicate on a low-level. Signals are predefined messages that allow for the notification of unexpected external events.

[10] Inter-Process Communication

[11] While still not a standard, 4.2BSD implemented TCP/IP with a "best guess" approach

Fast Filesystem (FFS). FFS was designed to overcome many of the problems with the more traditional UFS[12] – data throughput was much improved and the system effectively fragmented blocks to allow more efficient storage utilisation. Due to the improvements seen in 4.2BSD, a number of important forks began to appear, notably SunOS 1.2, Ultrix-II, Mach and MIPS OS.

Three years later (1986) saw 4.3BSD, which was essentially an updated version of 4.2BSD. The changes were primarily the result of a maturing TCP/IP protocol.

2.3 4.4BSD, BSDi, USL, "The Lawsuit" and 386BSD

In 1990 a commercial company, BSDi[13], forked BSD Net/2 (from the 4.3BSD Lite branch) to create BSD/386 0.3.2. This was marketed as a UNIX®and a suitable, albeit heavily discounted, alternative to AT&T's System V. While BSD code had always been freely distributable, a license was still required from AT&T.

Around 1992 AT&T filed a lawsuit against BSDi for "trademark infringement, false advertising and unfair competition under the federal Lanham Trademark Act"[14]. This was dismissed by the judge a month later but AT&T filed again, this time against BSDi and the University of California. The following is a quote from the official complaint[15]:

> "*Substantial portions of the source code embodied in the Networking Release 2 software and its BSDI derivative, BSD/386 Source, are based upon, substantially copied from or derived from original UNIX(R) system source code disclosed in confidence to the Regents under restrictive license agreements.*"

In essence AT&T were complaining about a small number of files that were being used and distributed in violation of their license – specifically that the end-user was required to pay the licensing fee. Before the proceedings were resolved AT&T sold off USL (and therefore the UNIX trademark and all claims), which was eventually bought by Novell in 1993. The lawsuit was finally resolved on February 4, 1994 – as a result a 4.4BSD Lite was created, which was a non-functional version of 4.4BSD-Encumbered (which was made available for license holders).

Bill Jolitz' 386BSD code already had working alternatives for some of the newly missing files, and replacements for the rest were work-in-progress. These replacement files allowed a truly free and unencumbered BSD to be created. While this resulted in a temporary set-back for the distributors, in the long-run it was a major step forward.

2.4 The Future

In the near future NetBSD[16] would be started, based on the BSD Net/2 (4.3BSD Lite) code, and FreeBSD would take up where 386BSD left off. Closer to the current time we have the recent FreeBSD fork to create DragonFlyBSD and (importantly) the release of MacOS X[17] with its part-Mach, part-FreeBSD kernel.

[12] UNIX Filesystem
[13] BSD, Incorporated
[14] http://cm.bell-labs.com/cm/cs/who/dmr/bsdi/920420.complaint.txt. An almost complete list of lawsuit documents can be found in the references
[15] http://cm.bell-labs.com/cm/cs/who/dmr/bsdi/920724.complaint.txt
[16] http://www.netbsd.org/
[17] http://www.apple.com/macosx/

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