Hidden Early History of Unix

FOSDEM '20
.org

Warner Losh

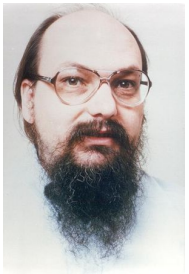
Source: https://www.bell-labs.com/unix50/event/

Standard History of Unix

Condensed to 3ish slides

Typical Unix History (1)

1964 →Join Multics
1969 ←Exit Multics



1969
PDP-7 Unix

1971
PDP-11 Unix

1973 (V4)
C rewrite of Unix

Typical Unix History (2)

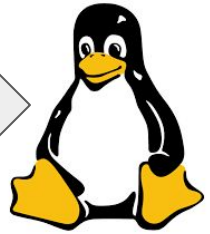
1975 (V6)
Unix in the wild
and ports start

1979 (V7)
Unix explodes

1983 4.2BSD
Unix gets networking

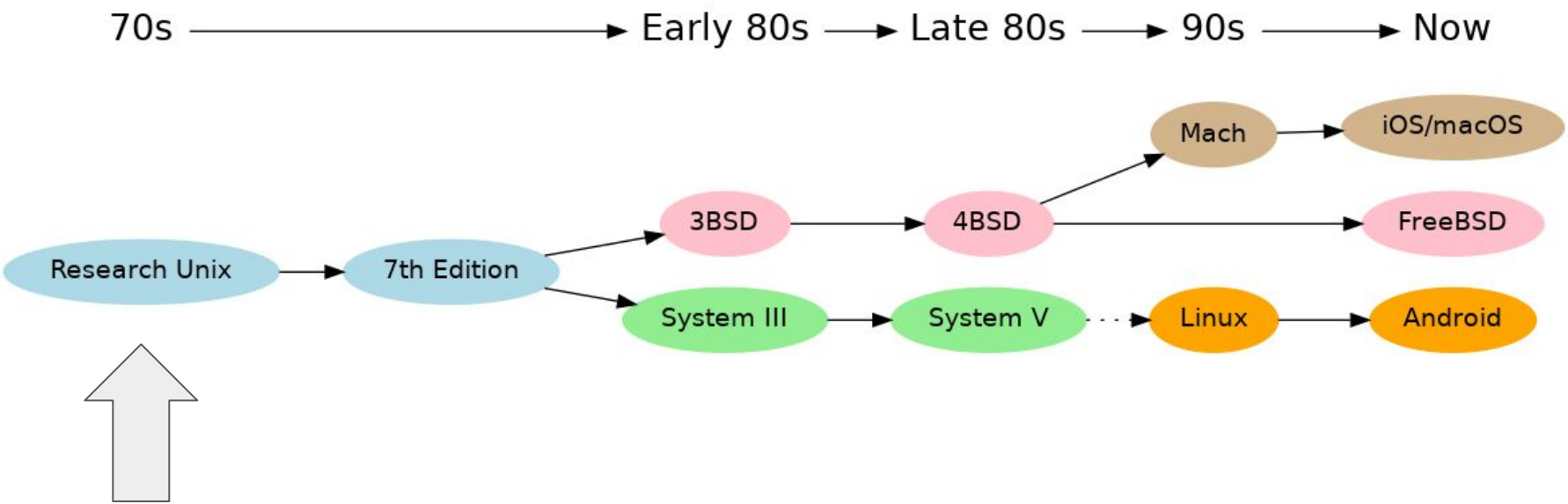
1984 System V
Unix goes Commercial

1980s
Unix Wars



1990s
Rise of Linux
and FOSS

Simplified Family Tree



Today's Talk

Lost and Found Unix Firsts

A deep dive on the first 10 years

The Unix Historical Society (TUHS)

- Founded by Warren Toomey
- Outgrowth of the PUPS (PDP Unix Preservation Society)
- http://tuhs.org
- Collects all publicly available Unix artifacts in one place
  - Also some private ones that can't be redistributed (but are preserved)
- Provides a community for preservation and restoration of artifacts
  - 1972 version of Unix from DECtapes (V2/V3 kernel with surviving V5 disk image)
  - 1st Edition kernel from listings
  - PDP-7 kernel and userland source restoration
  - Some hardware emulation work to run old systems
  - BSD 4.1 restoration from partial copies
- Pronounced "Toos" or "2's"

Bitsavers

- Dedicated to preserving paper and media artifacts from computing history
- http://www.bitsavers.org
- Started by Al Kossow
- Scanning paper documents for almost 20 years
- Focused on preserving documentation needed to write emulators
- Labor of love by Al, although he now accepts well scanned documents
  - And works under the Computer History Museum in Mountain View

Who is AT&T?

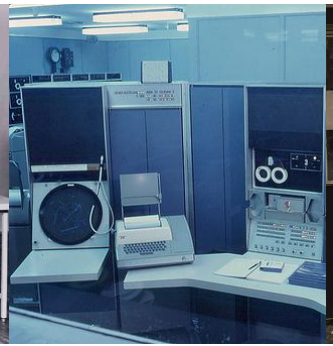
- AT&T is The American Telephone and Telegraph Company
- “The Phone Company” monopoly in the US through 1982
- Founded by Alexander Graham Bell
- Bell Labs is the research group inside of AT&T
- The Bell System is all the things it took for AT&T to deliver phone service
- The US is big, so AT&T made most of its money on Long Distance Calls
- Monopoly consent decree in 1956 made early licensing weird
- 1982 breakup allowed AT&T to monetize Unix aggressively (System V)

What's a PDP-7?

- "Low Cost" 18-bit mini computers from 60s
- Mostly binary compatible from model to model

PDP-1 (59)
~10

PDP-4 (62)
~25



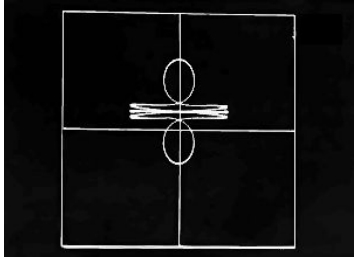
PDP-7 (64)
~100

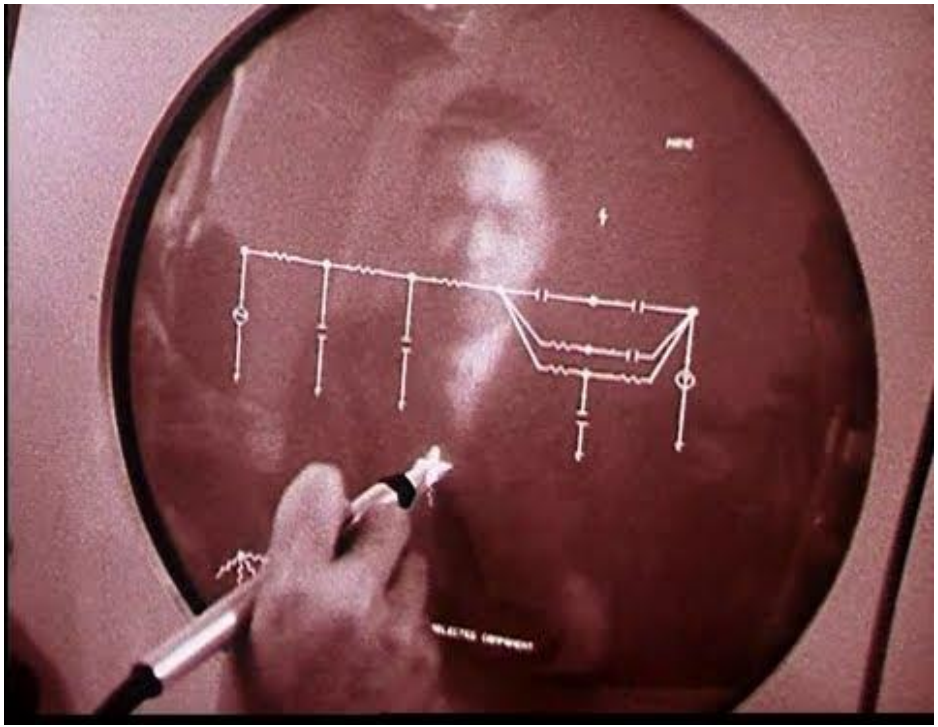
PDP-9 (66)
~400

PDP-15 (70)
~200

JANUS 71

Ken’s New System





- Ken loved the game Space Travel
- GECOS version $50-$75 per game
- Ken found discarded PDP-7 from Visual and Acoustics Department
- Ken rewrote GECOS Space Travel in PDP-7 assembler to play
- Transported binaries from GE-635 to PDP-7 on paper tape
- Started Ken’s New System to make Space Travel hacking easier
- Ken started a Fortran compiler, ended up with B...

Source: The Incredible Machine 1968 Bell Labs

PDP-7 Unix

- Largely a Footnote to history
- Ported to PDP-7, PDP-9 and PDP-15
  - Total install base was 4 (1 pdp-7, 2 pdp-9 and 1 pdp-15)
- Built credibility in Unix to allow PDP-11 port to happen
- Sources believed lost to history
- Many recent discoveries

Lost? Not so fast...

- Robert Morris Sr
- Bell Labs from 1960-1986
- Known for crypt, /etc/passwd
- Passed away in 2011
- Had large collection of papers
- Doug McIlroy sorted in 2015
- Found PDP-7 Unix manuals
- Posted scans on https://tuhs.org/

DRAFT

The UNIX Time-Sharing System

D. M. Ritchie

1. Introduction

UNIX is a general-purpose, multi-user time sharing system implemented on several Digital Equipment Corporation PDP series machines.

UNIX was written by K. L. Thompson, who also wrote many of the command programs. The author of this memorandum contributed several of the major commands, including the assembler and the debugger. The file system was originally designed by Thompson, the author, and R. H. Canaday.

There are two versions of UNIX. The first, which has been in existence about a year, runs on the PDP-7 and -9 computers; a more modern version, a few months old, uses the PDP-11. This document describes UNIX-11, since it is more modern and many of the differences between it and UNIX-7 result from redesign of features found to be deficient or lacking in the earlier system.

Spring 1971
UNIX-7 Late 1969
UNIX-11 Feb 1971

Although the PDP-7 and PDP-11 are both small computers, the design of UNIX is amenable to expansion for use on more powerful machines. Indeed, UNIX contains a number of features very seldom offered even by larger systems, including

1. A versatile, convenient file system with complete integration between disk files and I/O devices;

2. The ability to initiate asynchrously running processes.

It must be said, however, that the most important features of UNIX are its simplicity, elegance, and ease of use.

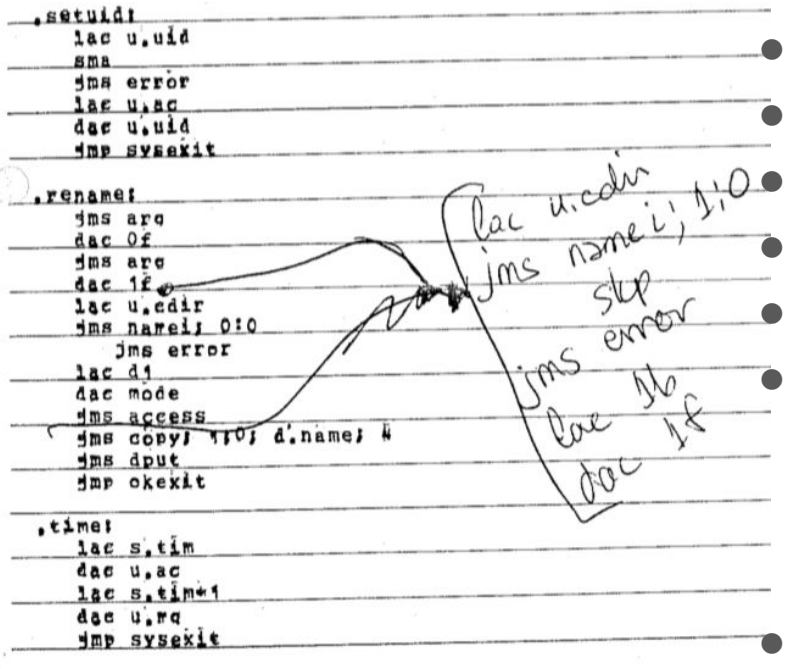
Besides the system proper, the major programs available under UNIX are an assembler, a text editor based on QED, a symbolic debugger for examining and patching faulty programs, and "B", a higher level language resembling BCPL. UNIX-7 also has a version of the compiler writing language TMGL contributed by M. D. McIlroy, and besides its own assembler, there there is a PDP-11 assembler which was used to write UNIX-11. On the PDP-11 there is a version of BASIC [reference] adapted from the one supplied by DEC [reference]. All but the last of these programs were written locally, and except for the very first versions of the editor and assembler, using UNIX itself.

2. Hardware

The PDP-11 on which UNIX is implemented is a 16-bit 12K computer, and UNIX occupies 8K words. More than half of this space, however, is utilized for a variable number of disk buffers; with some loss of speed the number of buffers could be cut significantly.

The PDP-11 has a 256K word disk, almost all of which is used for file system storage. It is equipped with DECTAPE, a variety of magnetic tape facility in which individual records may be addressed and rewritten at will. Also available are a high-speed paper tape reader and punch. Besides the standard Teletype, there are

2016 PDP-7 sources recovered



```
.setuid:
    lac u.uid
    sma
    jms error
    lac u.ac
    dac u.uid
    jmp sysexit

.rename:
    jms arg
    dac 0f
    jms arg
    dac 1f
    lac u.cdir
    jms namei; 0:0
        jms error
    lac d1
    dac mode
    jms access
    jms copyi; 1:0; d.name; 4
    jms dput
    jmp okexit

.time:
    lac s.tim
    dac u.ac
    lac s.tim+1
    dac u.mq
    jmp sysexit
```

- Norman Wilson finds PDP-7 sources
- Warren Toomey / TUHS “V0 unix”
- PDP-7 toolchain written
- PDP-7 “user mode” simulator
- SIMH enhanced to run pdp-7 unix
- Userland limited to: adm, als, apr, as, bc, bi, bl, cas, cat, check, chmod, chown, chrm, cp, db, dmabs, ds, dskio, dskres, dsksav, dsw, ed, and mksys
- init, ln, ls, mv and sh newly written
- https://github.com/DoctorWkt/pdp7-unix

pdp7 Unix Book II

- To celebrate the 50th The Computer History Museum releases scans
- This is the other half of the listing Norman Wilson Found
- Was found in the papers of Dennis Ritchie
- TUHS pdp-7 restoration group typed these listing in
- Space Travel was among the sources

Living Computer History Museum boots pdp7 unix

SN 129

Custom JK09 no RC09/RB09

No video display, just TTY

Using TUHS source base

Source: https://www.youtube.com/watch?v=pvaPaWyiuLA at 00:09

pdp7-unix New Discoveries

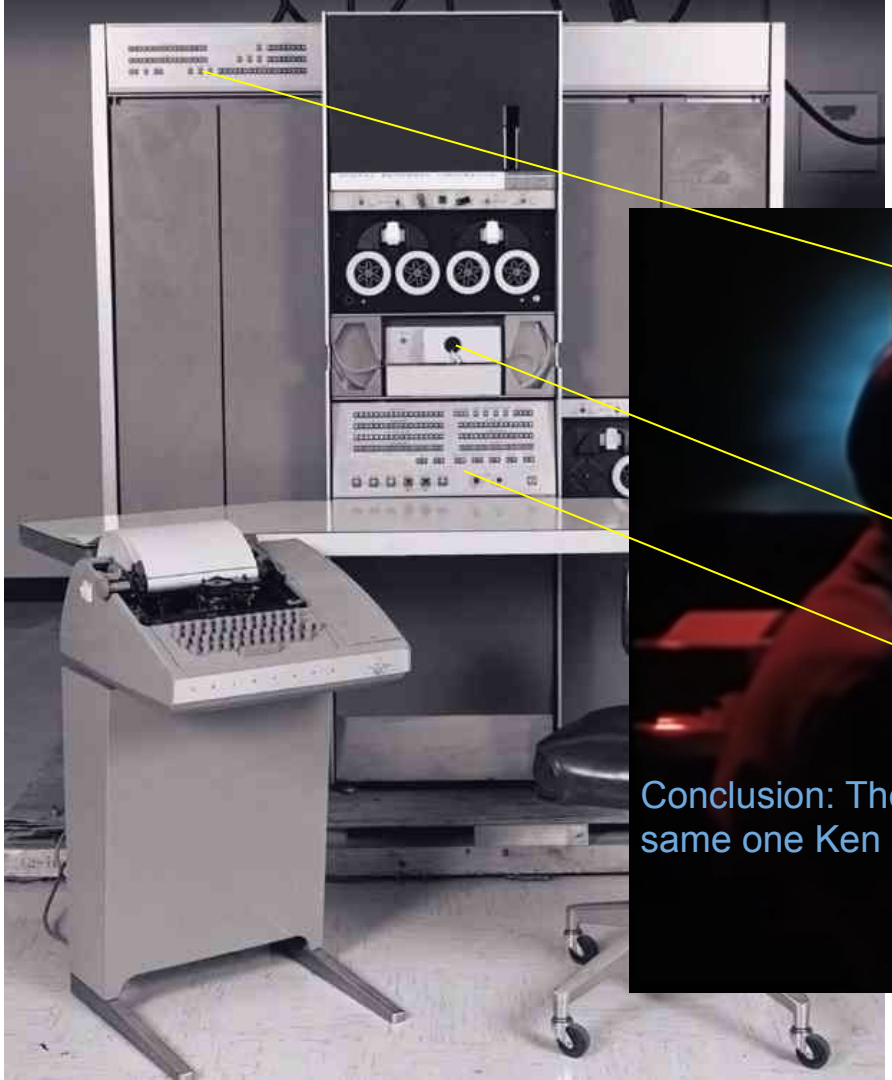
- Know what devices the kernel supports
- Also found 18 bit field service logs
- Confirmed that disk drive was a retro fit from PDP-9 RC-09/RB-09 combo
- Know there's tty, light pen, DEC display 340 driver, Graphics II driver
- No other PDP-7 could run it, none had the disk…
- No other PDP-7 at Bell Labs had DEC display 340
- There were 2 PDP-9 and 1 PDP-15 at bell labs that ran pdp7-unix
- IOCCC winner: https://www.ioccc.org/2018/mills/hint.html (pdp-7 emulator to run restored V0)
- Detailed analysis: https://bsdimp.blogspot.com/2019/07/the-pdp-7-where-unix-began.html

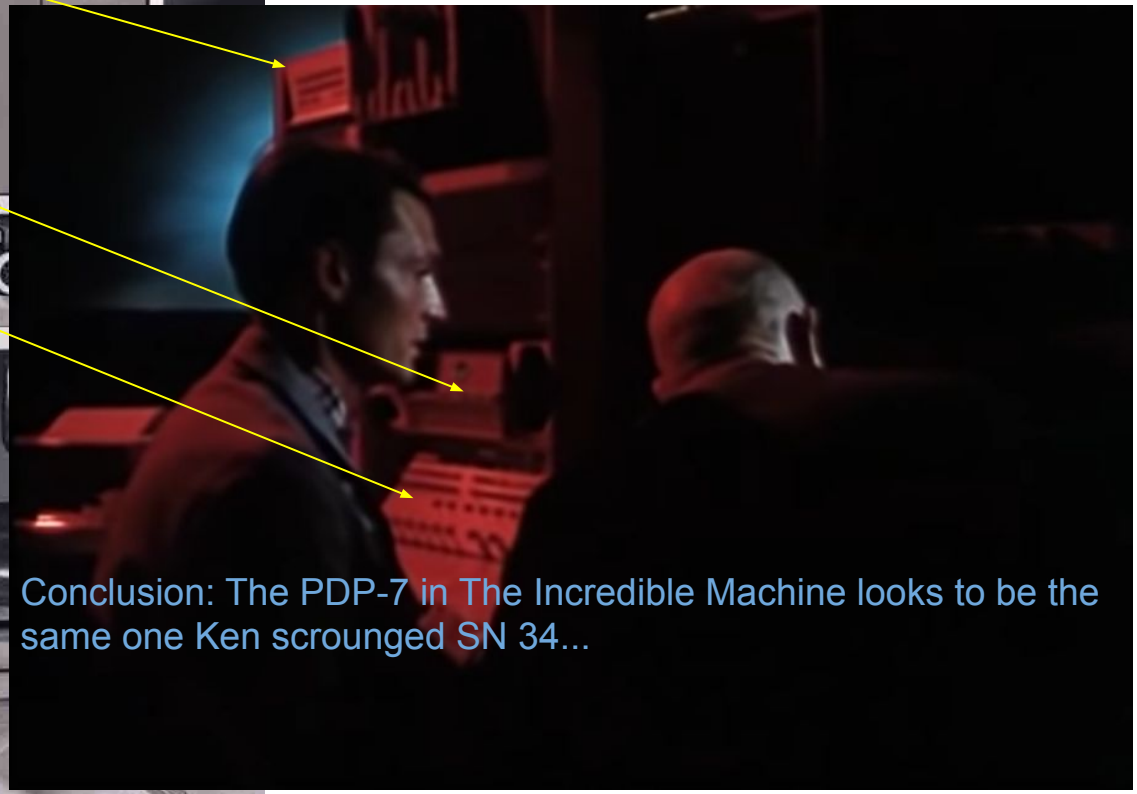
Ken’s Discarded PDP-7 was SN 34

SYSTEM TYPE	SYSTEM SERIAL	OPTION DESIG	OPTION SERIAL	WL REV	MDL REV	REG	OST	BRN	PL	S T	SHIP MMYY	DEC NUMBER	CUST CODE	CUSTOMER NAME	
PDP7	000034					762	71W	779	07	F	0169	048308		BELL TELEPHONE LABS,	
		75 D	000033						07	F	0765	999999			
$45,000		149 B	39						07	F	0765	999999			
$32,700		177	000025						07	F	0765	999999			
$6,300															
		340	000020						07	F	0765	999999			
$25,800		342	000012						07	F	0765	999999			
$7,700		370	000105						07	F	0765	999999			
$1,625		444 B	000033						07	F	0765	999999			
$4,100		647	000034						07	F	0765	999999			
		CR01 B	000013						07	F	1266	010048			
~$125,000		PDP7	43						07	F	0765	999999			
		RC09	000017						07	F	0169	048308			
		76 05477	000001						07	F	0169	048308			

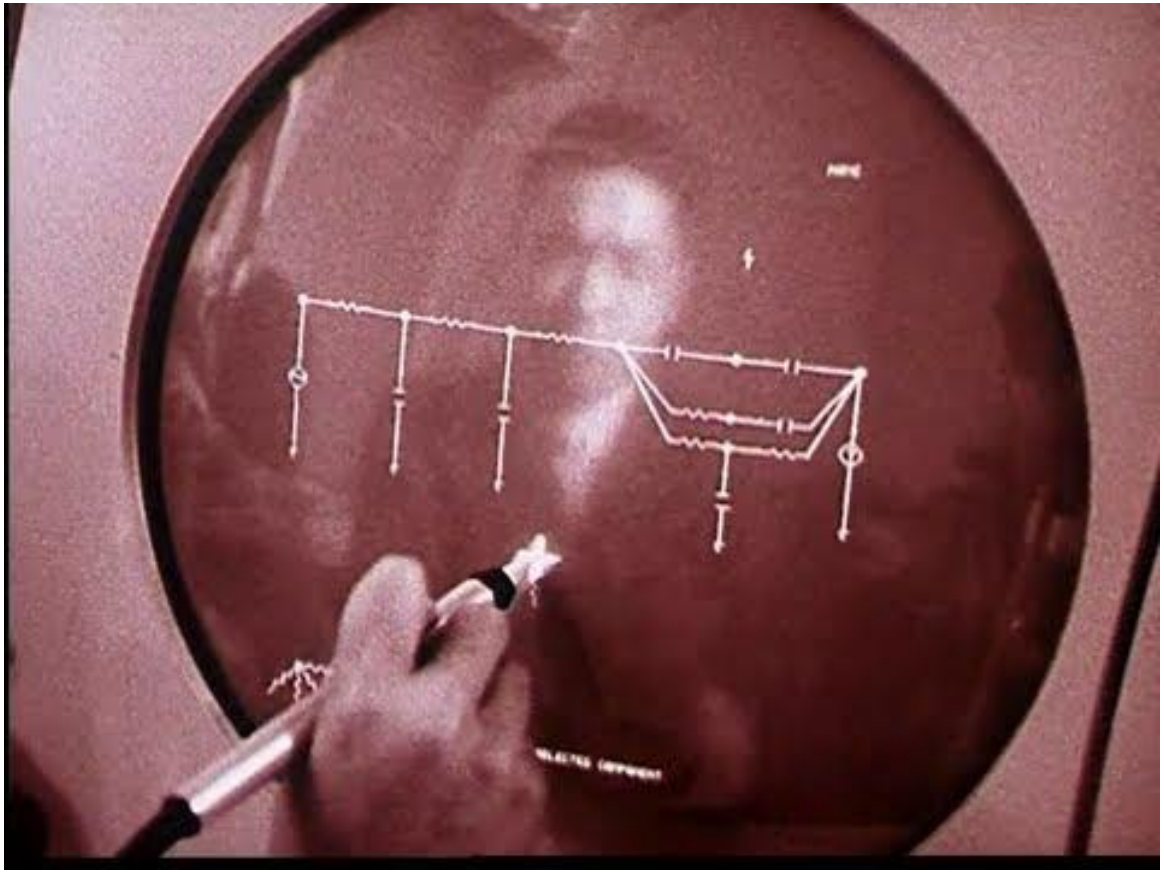
Total: ~$250,000 1965 Price List

Could it be?





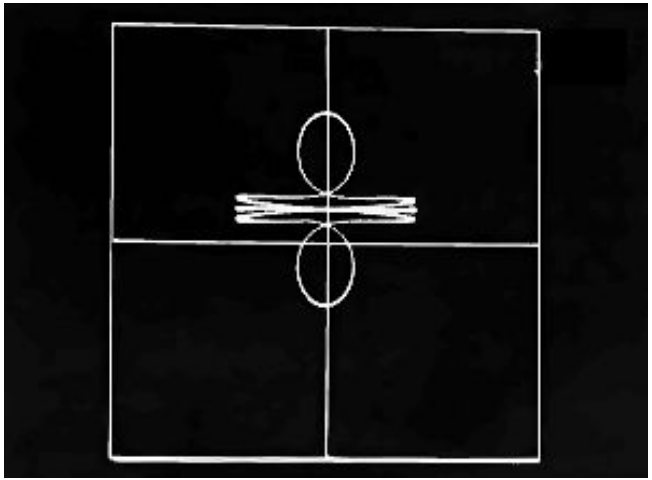
Conclusion: The PDP-7 in The Incredible Machine looks to be the same one Ken scrounged SN 34...



Still No working Space Travel

This remains the only Space Travel screen shot we have

Sources build, need full working SIMH Graphics II simulator (coming soon?)



The PDP-11Era of Unix (1970-1980)

- 16-bit CPU
- PDP-11/20 with 8kW
- 330,000 adds/second
- US $20,000 List Price
- Released 1970

- > 30 models over 20 years

1st Edition PDP-11/20

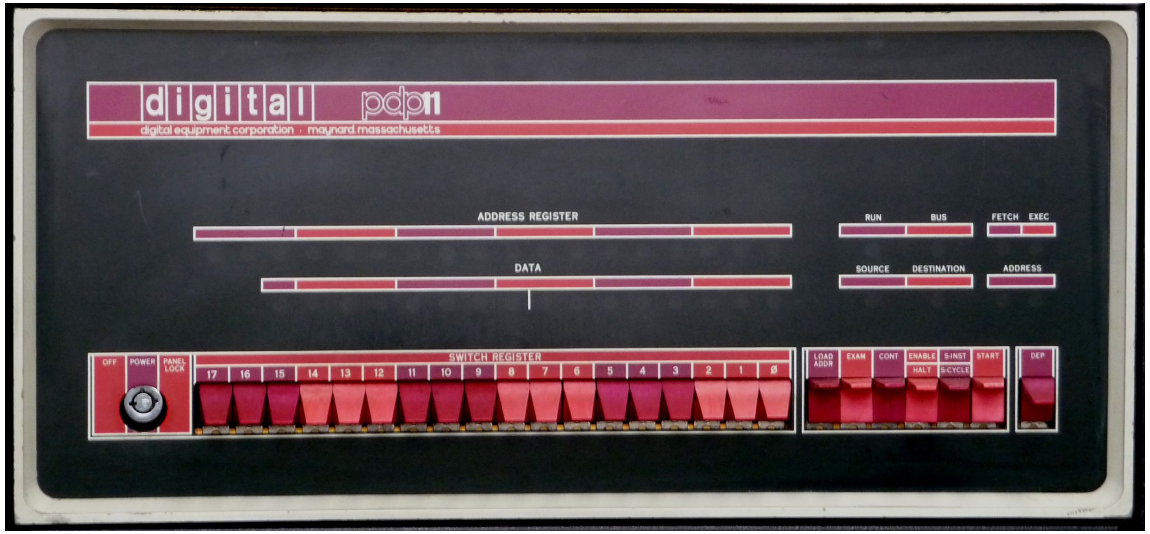
November 1971

UNIX PROGRAMMER'S MANUAL

K. Thompson

D. M. Ritchie

November 3, 1971



1st Edition Unix

- Released November, 1971
- Supported only the PDP 11/20
- Transliteration of PDP-7 assembler into PDP-11 assembler (not MACRO-11)
- We have reconstructed sources, but no tapes from the time remain
  - Only kernel, shell and init survive
- We have scans of the manual
- We have scans of Bell Labs slide deck to reconstruct sources

ID U2-9 sys setuid

FUNCTION "Sys setuid" sets the user id u.uid of the current process to the process id (u.r0). Both the effective user u.uid and the real user u.ruid are set to this. Only the super user may make this call.

CALLING SEQUENCE sys setuid

ARGUMENTS –

INPUTS (u.r0) . contains the process id
u.ruid - real user id
u.uid effective current user id

OUTPUTS u.ruid - set equal to the process id (u.r0)
u.uid - " " " " " "

```
syssetuid: / set process id
        movb    *u.r0,r1 / move process id (number) to r1
        cmpb    r1,u.ruid / is it equal to the real user id number
        beq     1f / yes
        tstb    u.uid / no, is current user the super user?
        bne     error4 / no, error
1:
        movb    r1,u.uid / put process id in u.uid
        movb     r1,u.ruid / put process id in u.ruid
        br      sysret4 / system return

sysgetuid:
        movb    u.ruid,*u.r0 / move the real user id to (u.r0)
        br      sysret4 / system return, sysret
```


Source: https://www.tuhs.org/Archive/Distributions/Research/Dennis_v1/

2nd Edition PDP-11/20 (prep for 11/45)

June 1972

UNIX PROGRAMMER'S MANUAL

Second Edition

K. Thompson

D. M. Ritchie

June 12, 1972

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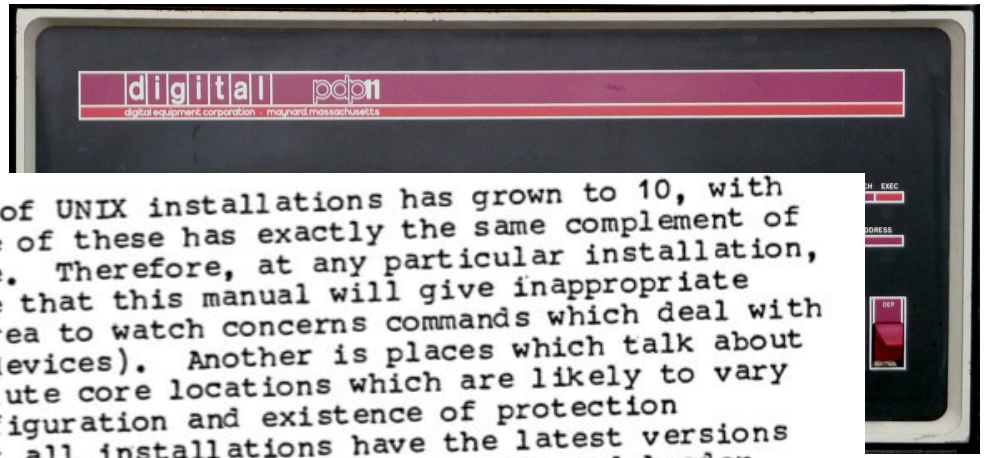

Finally, the number of UNIX installations has grown to 10, with more expected. None of these has exactly the same complement of hardware or software. Therefore, at any particular installation, it is quite possible that this manual will give inappropriate information. One area to watch concerns commands which deal with special files (I/O devices). Another is places which talk about such things as absolute core locations which are likely to vary with the memory configuration and existence of protection hardware. Also, not all installations have the latest versions of all the software. In particular, the assembler and loader have just undergone major reorganizations in anticipation of a UNIX for the PDP-11/45.

2nd Edition Unix

- June, 1972 (+7 months)
- “The number of Unix installations has grown to 10, with more expected.”
- Start of transition to newer machines (11/45)
- Have scan manual
- Have start of C compiler
- Have commands a through l
  - Mix of pdp-11 assembler and C code
  - Goto written in ‘C’ since stdin was script input!
  - BASIC, C, Fortran
  - Standard library used for ‘C’ (mostly just system calls)

3rd Edition PDP-11/45

February 1973

UNIX PROGRAMMER'S MANUAL

Third Edition

K. Thompson

D. M. Ritchie

February, 1973

Finally, the number of UNIX installations has grown to 16, with more expected. None of these has exactly the same complement of hardware or software. Therefore, at any particular installation, it is quite possible that this manual will give inappropriate information.

In particular, any system which uses a PDP-11/20 processor will not include all the software described herein, nor will the software behave the same way. The second, or even the first, edition of this manual is likely to be more appropriate.

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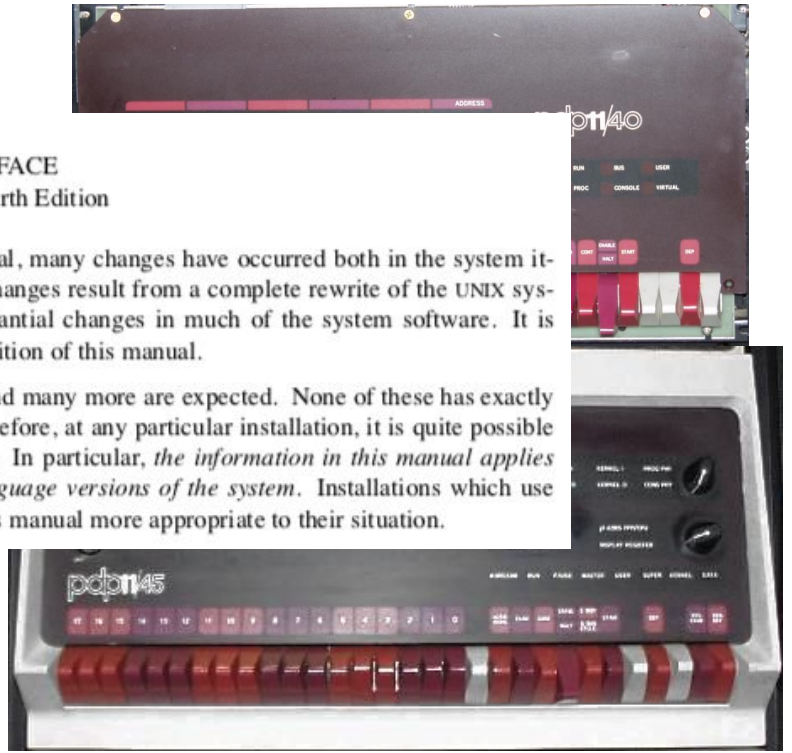
the written permission of Bell Telephone Laboratories.

3rd Edition Unix

- February 1973 (+8 months)
- “The number of Unix installations has grown to 16, with more expected.”
- Have both scanned manual and nroff sources
- A mix of assembler and C
- Have early C compiler from this release
- No binary snapshots exist

4th Edition PDP-11/40, PDP-11/45

November 1973 (+9 months)



UNIX PROGRAMMER'S

Fourth Edition

K. Thompson

D. M. Ritchie

November, 1973

PREFACE
to the Fourth Edition

In the months since the last appearance of this manual, many changes have occurred both in the system itself and in the way it is used. The most important changes result from a complete rewrite of the UNIX system in the C language. There have also been substantial changes in much of the system software. It is these changes, of course, which mandated the new edition of this manual.

The number of UNIX installations is now above 20, and many more are expected. None of these has exactly the same complement of hardware or software. Therefore, at any particular installation, it is quite possible that this manual will give inappropriate information. In particular, *the information in this manual applies only to UNIX systems which operate under the C language versions of the system*. Installations which use older versions of UNIX will find earlier editions of this manual more appropriate to their situation.

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Throw it away… 4th! Rewrite of unix kernel 1973

- 4th rewrite
  - Pdp-7 assembler (V0 or 0th Edition) 1970
  - pdp-11/20 transliteration (1st edition) 1971
  - pdp-11/45 port (start using MMU) (3rd edition) 1972
  - C rewrite (4th Edition) 1973
    - Kernel remains in C and fundamentally the same through System III (1982)

4th Edition (November 1973)

- “The number of UNIX installations is now above 20, and many more are expected.”
- Only have man page sources from this release (first release typeset)
- Have a almost 4th edition kernel sources (first one in C)
  - Dates from August 1973, mostly complete, but lacks pipes
  - Recovered from a tape Dennis Ritchie had laying around labeled ‘nsys’
- Rest of the system is lost
- Key revision for Bell System adoption and specialization
- First version released to Universities (4 or 5 universities)
- USENIX forms

setuid() in V4 and later...

sys4.c

```
setuid()
{

        if(u.u_ruid==u.u_arg[0] || suser()) {
                u.u_uid = u.u_ar0[R0];
                u.u_ruid = u.u_uid;
        }
}

getuid()
{

        u.u_ar0[R0] = u.u_ruid;
}
```

4th Symposium on
Operating
System Principles
Oct 15-17, 1973

THE UNIX TIME-SHARING SYSTEM

Dennis M. Ritchie
Ken Thompson

Bell Laboratories
Murray Hill, New Jersey 07974

ABSTRACT

UNIX is a general-purpose, multi-user, interactive operating system for the Digital Equipment Corporation PDP-11/40 and 11/45 computers. It offers a number of features seldom found even in larger operating systems, including

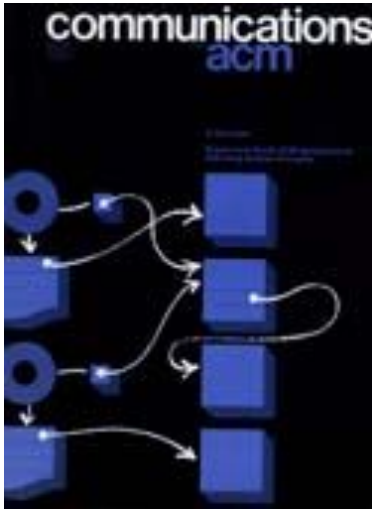
1. A hierarchical file system incorporating demountable volumes,
2. Compatible file, device, and inter-process I/O,
3. The ability to initiate asynchronous processes,
4. System command language selectable on a per-user basis,
5. Over 100 subsystems including a dozen languages.

This paper discusses the usage and implementation of the file system and of the user command interface.

First Published Unix Paper

July 74 Communications of the ACM
(Abstract in SOSP '73: Proceedings of the fourth ACM symposium on Operating system principles October 1973)

- Papers typeset with troff on Unix cite this paper in references
- Uptick of Unix in the literature begins here
- Best reference until 1978 BSTJ



The UNIX Time-Sharing System

Dennis M. Ritchie and Ken Thompson
Bell Laboratories

UNIX is a general-purpose, multi-user, interactive operating system for the Digital Equipment Corporation PDP-11/40 and 11/45 computers. It offers a number of features seldom found even in larger operating systems, including: (1) a hierarchical file system incorporating demountable volumes; (2) compatible file, device, and inter-process I/O; (3) the ability to initiate asynchronous processes; (4) system command language selectable on a per-user basis; and (5) over 100 subsystems including a dozen languages. This paper discusses the nature and implementation of the file system and of the user command interface.

Key Words and Phrases: time-sharing, operating system, file system, command language, PDP-11

CR Categories: 4.30, 4.32

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This is a revised version of a paper presented at the Fourth ACM Symposium on Operating Systems Principles, IBM Thomas J. Watson Research Center, Yorktown Heights. New York, October 15–17, 1973. Authors' address: Bell Laboratories, Murray Hill, NJ 07974.

The electronic version was recreated by Eric A. Brewer, University of California at Berkeley, brewer@cs.berkeley.edu. Please notify me of any deviations from the original; I have left errors in the original unchanged.

1. Introduction

There have been three versions of UNIX. The earliest version (circa 1969–70) ran on the Digital Equipment Corporation PDP-7 and -9 computers. The second version ran on the unprotected PDP-11/20 computer. This paper describes only the PDP-11/40 and /45 [1] system since it is more modern and many of the differences between it and older UNIX systems result from redesign of features found to be deficient or lacking.

Since PDP-11 UNIX became operational in February 1971, about 40 installations have been put into service; they are generally smaller than the system described here. Most of them are engaged in applications such as the preparation and formatting of patent applications and other textual material, the collection and processing of trouble data from various switching machines within the Bell System, and recording and checking telephone service orders. Our own installation is used mainly for research in operating systems, languages, computer networks, and other topics in computer science, and also for document preparation.

Perhaps the most important achievement of UNIX is to demonstrate that a powerful operating system for interactive use need not be expensive either in equipment or in human effort: UNIX can run on hardware costing as little as $40,000, and less than two man years were spent on the main system software. Yet UNIX contains a number of features seldom offered even in much larger systems. It is hoped, however, the users of UNIX will find that the most important characteristics of the system are its simplicity, elegance, and ease of use.

Besides the system proper, the major programs available under UNIX are: assembler, text editor based on QED [2], linking loader, symbolic debugger, compiler for a language resembling BCPL [3] with types and structures (C), interpreter for a dialect of BASIC, text formatting program, Fortran compiler, Snobol interpreter, top-down compiler-compiler (TMG) [4], bottom-up compiler-compiler (YACC), form letter generator, macro processor (M6) [5], and permuted index program.

There is also a host of maintenance, utility, recreation, and novelty programs. All of these programs were written locally. It is worth noting that the system is totally self-supporting. All UNIX software is maintained under UNIX; likewise, UNIX documents are generated and formatted by the UNIX editor and text formatting program.

2. Hardware and Software Environment

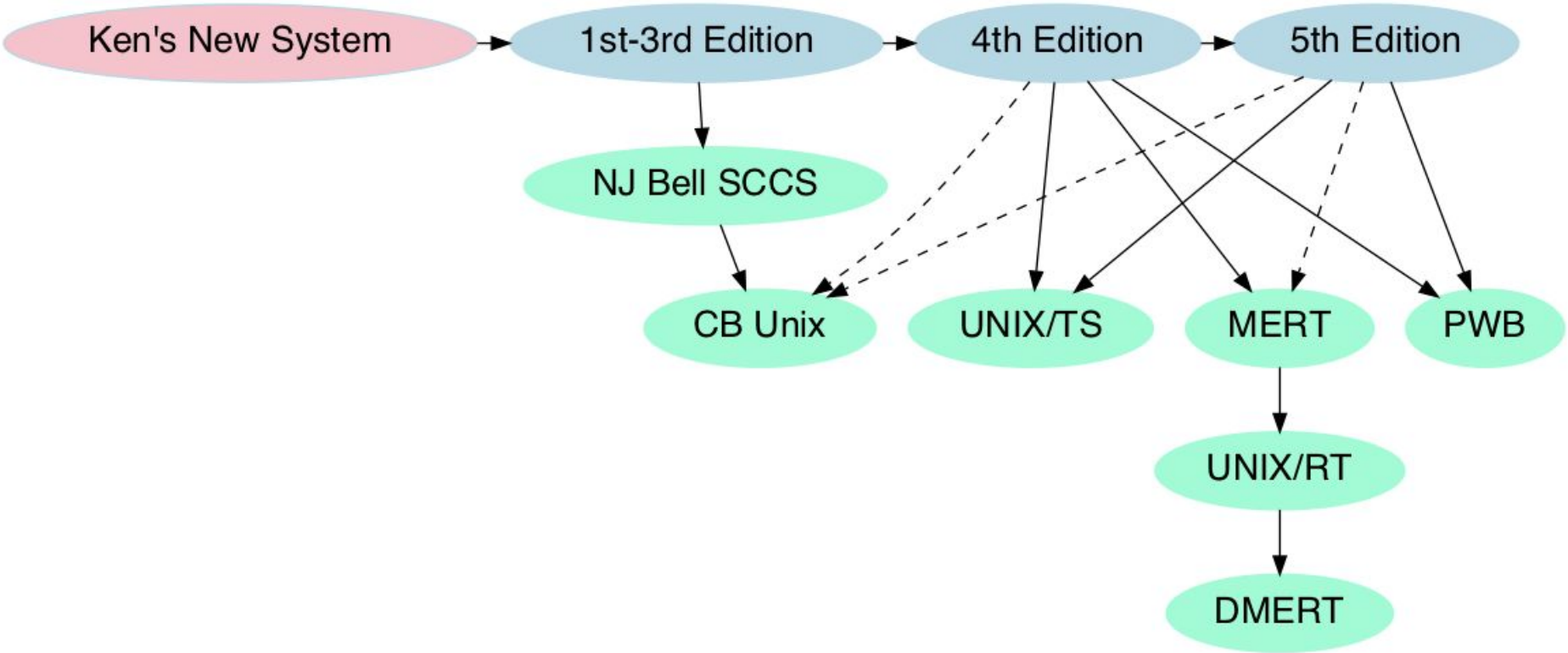
The PDP-11/45 on which our UNIX installation is implemented is a 16-bit word (8-bit byte) computer with 144K bytes of core memory; UNIX occupies 42K bytes. This system, however, includes a very large number of device drivers and enjoys a generous allotment of space for I/O buffers and system tables; a minimal system capable of running the

When was the first fork Unix version?

- BSD forking 7th Edition (well, 32V, 7th edition for VAX)? (1980)
- PWB 1.0 fork of 6th Edition? (Started 1973, first release 1977)
- USG fork of UNIX/TS 1.0 from 6th Edition? (Started 1973, first release 1975)
- MERT forking UNIX/RT from 4th Edition? (1973)
- New Jersey Bell forking SCCS from 1st/2nd Edition? (1971/1972)

- Close to a 4 way tie for the honors of FIRST

4th Edition Family Tree



- SCCS Unix
- Evolved into Columbus Unix (CB-Unix)

CB-UNIX

Programmer's Manual

Edition 2.3

J. D. Doan
Editor

May 1981

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ACKNOWLEDGEMENTS

The form of this manual follows that of the *UNIX Programmer's Manual—Seventh Edition, Volume 1* developed by M. D. McIlroy. A large part of the present manual's contents is descended from the *UNIX Programmer's Manual—Sixth Edition* by K. Thompson and D. M. Ritchie (Bell Telephone Laboratories, May 1975) and the *PWB/UNIX User's Manual* by T. A. Dolotta, R. C. Haight, and E. M. Piskorik, eds. (Bell Telephone Laboratories, May 1977). A special credit should also be given to the UNIX support effort of department 3624; their support of UNIX helped make this manual possible. The number of our colleagues who have contributed to UNIX and CB-UNIX software and documentation is, by now, too large to list here, but the usefulness and acceptance of UNIX and of CB-UNIX is a true measure of their collective success.

Columbus, Ohio

J.D.D.

Columbus Unix - CB Unix

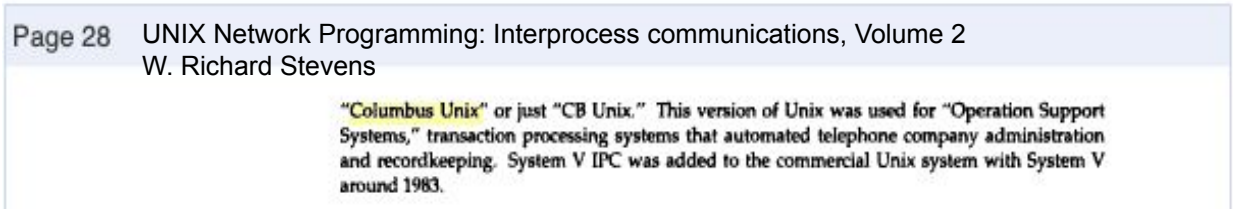
- Started in 1971 (1st Edition) for a Switching Control Center System (SCCS!) for a Electronic Switching System (ESS) by New Jersey Bell.
- Earliest “fork” I could find of Unix
  - Pulled in code from research version frequently in early days
  - Had a lot of Add Ons that were innovative, many appeared in later versions
  - Power-fail restart, tty line disciplines, terminal types and IPC features (1974)
- Maintained by Division 59473 in Columbus Ohio
  - OSG Operating System Group
- Widely used for call data systems by different Bell divisions
- Little known outside of Bell System, mostly lost

CB Unix Timeline

- 1971 First SCCS deployed by New Jersey Bell in New Brunswick, NJ
  - First application outside of Research / Patent Office
  - Ran on 11/20 with no memory management
- 1974 semaphores (Hal Pearson) and tty line disciplines (Bill Snider)
- 1975 messages and shared memory added (derived from R.J. Purdue)
  - Maus (pronounced mouse) was shared memory, and survived into PDP-11 System Vr1
- ~1976 CB Unix 1.0 based on 6th Edition Released + local additions
- November 1979 CB Unix 2.1 released (PWB Unix 1.0 and 7th Edition + local)
- May 1980 CB Unix 2.3 released
- 1982 Roger Faulkner merged semaphores, messages and shared memory into UNIX/TS 4.0 (eventually became System V semaphores, etc)

What Remains of CB Unix?

- Scan of CB Unix 2.3 Manual
  - Apparent from the SCCS division based on the local manual sections
- Scan of a kernel source listing
- A 1984 in net.unix posting by Dale DeJager supervisor of Columbus group
- Interview mention from Victor Vyssotsky 1985 Unix Review
- A tape was mailed to Dennis Ritchie before his death
  - TUHS mailing list post from 2003 confirms receipt by Dennis from Larry
  - Current whereabouts are unknown
- Lots of invocations of its name in ~10 books for System V IPC:



Page 28 UNIX Network Programming: Interprocess communications, Volume 2
W. Richard Stevens

"Columbus Unix" or just "CB Unix." This version of Unix was used for "Operation Support Systems," transaction processing systems that automated telephone company administration and recordkeeping. System V IPC was added to the commercial Unix system with System V around 1983.

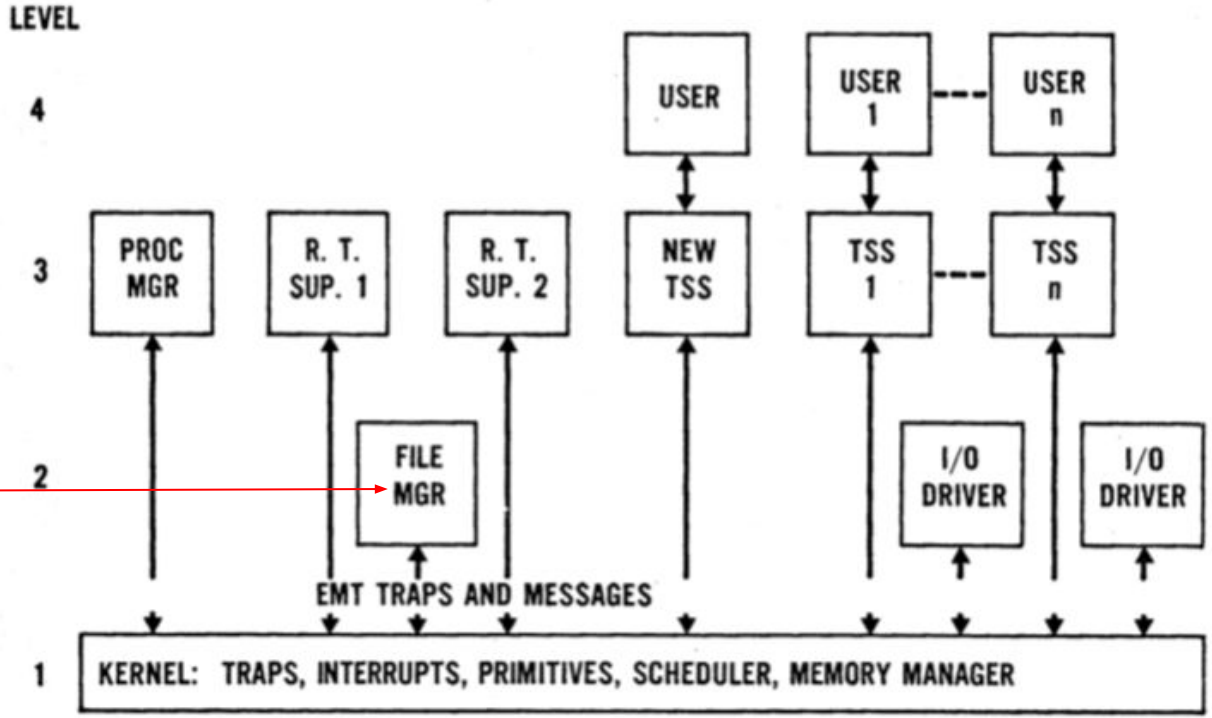
First Unix running under hypervisor

- AIX under POWER4 hypervisor (2001)
- Linux under vmware (1999)
- UTS under VM/370 (1981)
- Bell Labs V7 VM/370 port (1979)
- Princeton V6 port to VM/370 by Tom Lyon (1977)
- Bell Labs MERT group ports V4 (1973)

MERT - Multiple Executive Real Time

- Approximately 4th Edition Unix (later updated through 6th edition)
- Unix ran as a supervisor process under MERT
  - Much like today’s paravirtual KVM or HyperV guests
- MERT allowed real time scheduling and used HW registers for separation

SYSTEM STRUCTURE



Unix

FIGURE 1

MERT - Multiple Executive Real Time (2)

- Rebranded as Unix/RT in 1978
- Flurry of papers in Communications of the ACM (1975) and Bell System Technical Journal (1978)
- Became DMERT (UNIX-RTR) after port to 3B20 (later 3B21 and SPARC)
  - Realtime Reliable Unix-like environment

Programmer's Workbench (PWB)

ACKNOWLEDGEMENTS

The form and organization of this manual, as well as a major fraction of its contents, have been copied from the *UNIX Programmer's Manual—Sixth Edition,* by K. Thompson and D. M. Ritchie (Bell Telephone Laboratories, May 1975). The number of our colleagues who have contributed to UNIX and PWB/UNIX software and documentation is, by now, too large to list here, but the usefulness and acceptance of UNIX and of PWB/UNIX is a true measure of their collective success.

Piscataway, New Jersey
May 1977

T.A.D.
R.C.H.
E.M.P.

PWB - Programmer’s Workbench

- PWB’s first system installed 1973
  - Canaday, Mashey in BISP division
- Focused on expanding Unix to being a development platform
  - SCCS (Source Code Control System) originated here
  - Remote Job Entry for various mainframes
  - Make, pwb sh (not bourne), other tools
  - October 1976 CACM had 6 articles on it
- PWB 1.0 May 1977 (first release outside of bell labs)
  - 6th Edition Unix (plus patches)
  - Typestter C
- PWB 2.0 1981 (first official release outside of bell labs)
  - 7th Edition based
- PWB was blended into Unix/TS 3.0 aka System III

UNIX/TS

- Unix Support Group, USG, 1973 Berkley Teague
- Support focused on using Unix for Time Sharing 4th Edition and newer
- Started formal releases with 6th Edition
  - V6 + 50 patches + typesetter C UNIX/TS 1.0 (1978)
  - V7 UNIX/TS 2.0 (1979)
- Merged with PWB and 32V to become UNIX/TS 3.0 aka System III
- More merges with CB-UNIX to become UNIX/TS 4.0 (never released)
- UNIX-TS 5.0 merged in pager and became System V

5th Edition Released to The World (PDP-11/70)

June 1974 (+7 months)

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UNIX PROGRAMMER'S MANU

Fifth Edition

K. Thompson
D. M. Ritchie

June, 1974

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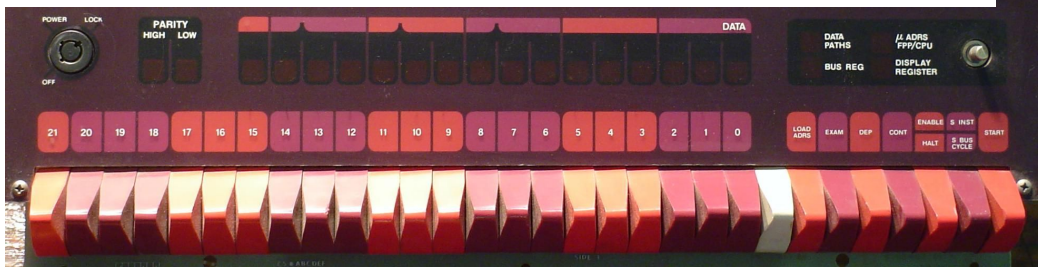
PREFACE
to the Fifth Edition

The number of UNIX installations is now above 50, and many more are expected. None of these has exactly the same complement of hardware or software. Therefore, at any particular installation, it is quite possible that this manual will give inappropriate information.

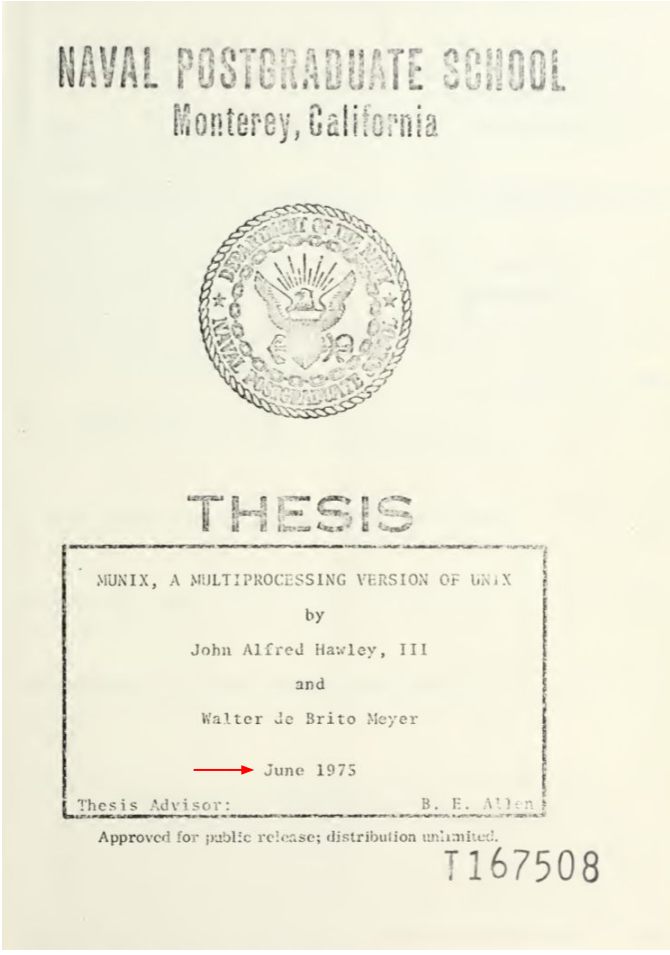


5th edition

- More universities outside of Bell Labs get this
- Still exclusively PDP-11 (added PDP-11/70 support)
- Userland a mix of C and assembler
- First version with complete surviving sources and binaries
- PWB / MERT (Unix/RT) / Unix/TS / CB-Unix import this version
- June 1974

First MP System

- System V 4.0MP (1988)
- AT&T’s OS/370 3B20 Port (1983)
- Masscomp 7th Edition 68k port (1982)
- Purdue’s Dual VAX 11/780 (1981)
- MUNIX (1975)


NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

MUNIX, A MULTIPROCESSING VERSION OF UNIX

by

John Alfred Hawley, III

and

Walter de Brito Meyer

June 1975

Thesis Advisor: B. E. Allen

Approved for public release; distribution unlimited.

T167508

MUNIX 1975

- Likely V5 (delivered fall 1974, V6 May 1975)
  - No known copies survive
- Dual PDP 11/50 processor
- Paper talks about semaphores, u areas, etc

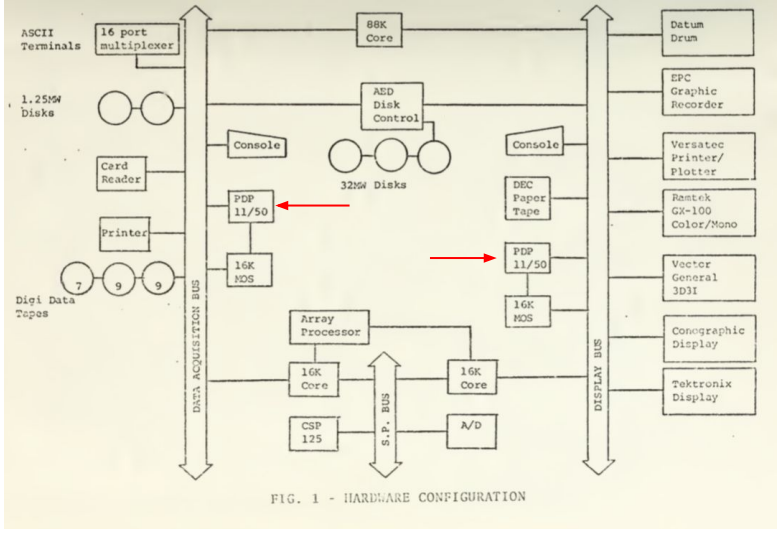


FIG. 1 - HARDWARE CONFIGURATION

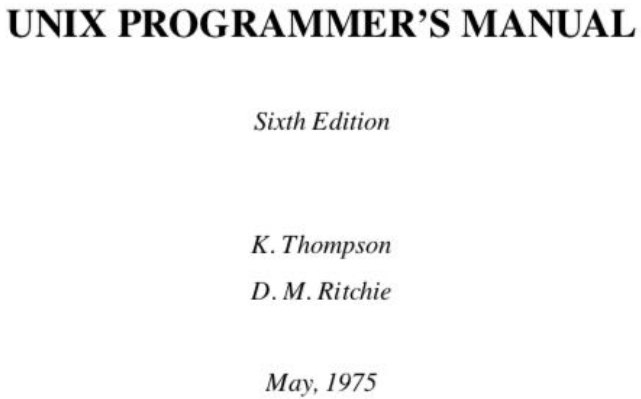
First Network Implementation

- 4.1aBSD adds sockets with TCP/IP stack (1982)
- Berknet (1979)
- Datakit (1979)
- UUCP (1978)
- BBN TCP/IP stack (V6 based 1977)
  - surprise: BSD did socket API for 4.1a, but reused descendant of this stack for protocol
- Terminal Interface Unix MACRO-11 TCP/IP stack SRI/BBN Jim Mathis (1976)
- University of Illinois NCP stack (late 1974)
  - Modifications to V5 and later V6
- Spider Cell Network (1973)
  - V3/V4 (Aug 1973) Unix driver available, maybe prior versions had driver (source for them lost)

6th Edition - Unix goes Viral

May 1975 (+11 months)

- Usenix
- Ports
  - LSI-11
  - Intersil 7/32
  - Intersil 8/32
  - IBM 360 VM
- Lions Book
- Network Unix popular on APRANET
- First commercial licenses



UNIX PROGRAMMER'S MANUAL

Sixth Edition

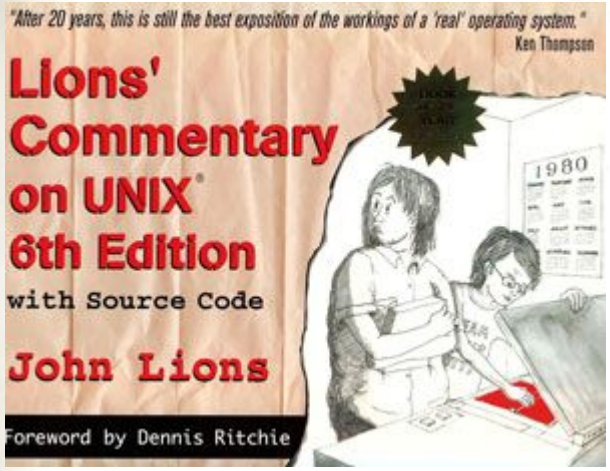
K. Thompson

D. M. Ritchie

May, 1975

6th Edition May 1975

- Widespread distribution: easily over 100 sites
- Many improvements
  - New system calls
  - Mike Lesk's iolib (libp) starts standardizing I/O, but only similar to stdio in v7
  - First tape install system from Dennis Ritchie (RK05 images before)
  - fc -- FORTRAN 66 compiler and sno -- a SNOBOL III compiler
- First commercial licenses (RAND had the first one)
- PWB / MERT (Unix/RT) / Unix/TS / CB-Unix import this version
- PWB First release (1977) based on v6 (CB-Unix too!)



A COMMENTARY ON THE UNIX OPERATING SYSTEM

This booklet has been produced for students at the University of New South Wales taking courses 6.602B and 6.657G.

It is intended as a companion to, and commentary on, the booklet ***UNIX Operating System Source Code, Level Six.***

The UNIX Software System was written by K. Thompson and D. Ritchie of Bell Telephone Laboratories, Murray Hill, NJ. It has been made available to the University of New South Wales under a licence from the Western Electric Company.

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J. Lions
Department of Computer Science
The University of New South Wales
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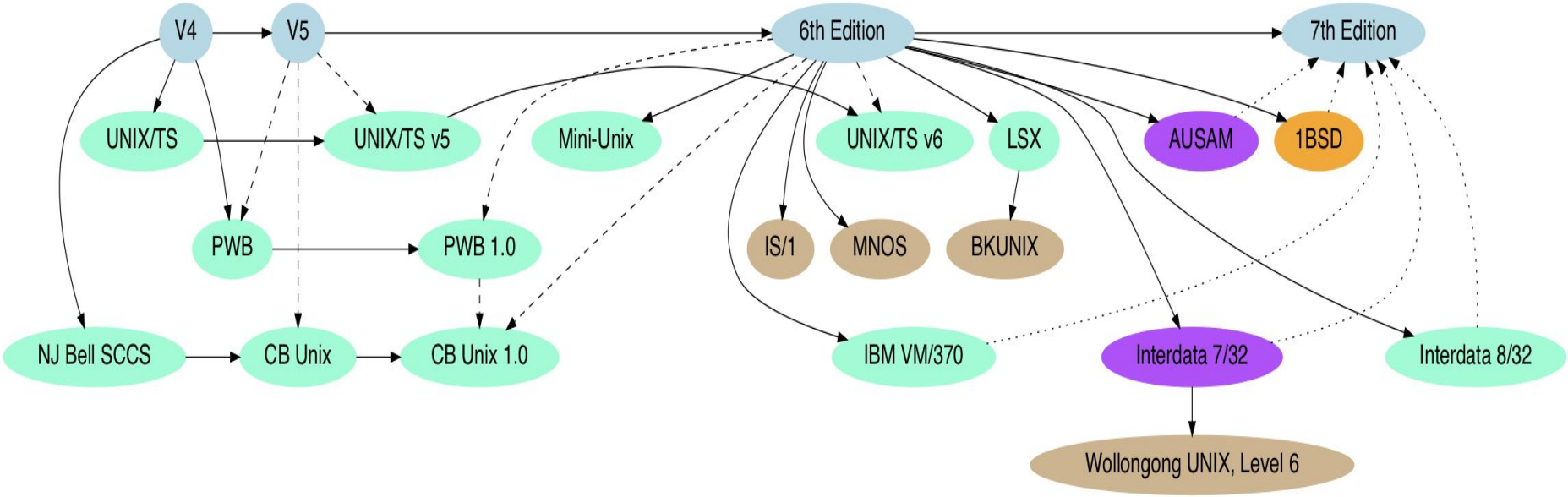
with compliments
John Lions

“First Distro” Bell Labs Fork - AUSAM

- Australian Unix Share Accounting Method
- First sustained, community maintained fork on Unix
- University of New South Wales and Sydney
- Based on the 6th Edition and 50 patches
- Fixed many bugs, improved stability, security and performance
  - Bug fixes given to Bell Labs and made it into V7
- Never made the leap to a full 7th Edition

6th Edition Family Tree



First Emulation of other OS under Unix

- 4.1 BSD compat(8) to run PDP-11 V7 binaries (ZORK aka dungeon) (1982)
  - Really from 1980 Deleware USENIX tape from PITT
- PWB/CB UNIX running V6 images under V7 kernel (1980)
- Dungeon.sav RT-11 on V7 Unix Dan Strict (1979 Toronto USENIX tape)
- DEC FORTRAN, BASIC-PLUS and linker running on V6 (Princeton 1979)
  - Earlier dates referenced in discussion, but no extant artifacts to explore
- University of British Columbia RT-11 Emulator Bill Webb (1976-1983)
  - Dates of files as early as 1976, but we only have tape snapshot from 1983
  - Allowed both rt11 sources and binaries to run on V6
  - A RT-11 library to run on V6 binaries

First 3 Unix Ports

- Bell Labs Interdata 8/32 (January-June 1977)
  - Never released outside Bell Labs
  - Portability changes merged into 7th Edition
  - Gave us PCC (Portable C compiler) critical for later ports (including Minix and Linux)
- Princeton VM/370 Tom Lyon (August 1975-May 1977)
  - IBM System/360 Model 91
  - Amdahl used it for UTS after hiring Tom Lyon
  - Used PCC from Bell Labs as C compiler
- Wollongong Interdata 7/32 (December 1976- April 1977)
  - First one to boot on bare iron
  - C compiler debugged by driving 90 miles to Sydney
  - First brought up as a guest OS under OS/32

IBM 360 Model 91

Interdata 7/32

First Unix miniaturization: mini-unix

- First Unix minimization efforts (akin to busybox) 1976
- Ported Unix back to original PDP-11/20 with 28kW (56kB) of RAM
- Reduced kernel space down from 56kB+64kB to 24kB total for kernel
- 32kB available for programs (most V6 programs run unmodified)
- Supports up to 4 users, but no pipes.
- Very popular outside of Bell Labs
- AUUG news letter refers to many patches circulating
  - Yet few, if any, of these survive today
- Done by H. Lycklama of MERT fame
- LSX similar effort (also by H. Lycklama) with different focus later in 1976

THE BELL SYSTEM TECHNICAL JOURNAL

JULY–AUGUST 1978
VOL. 57, NO. 6, PART 2

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UNIX TIME-SHARING SYSTEM

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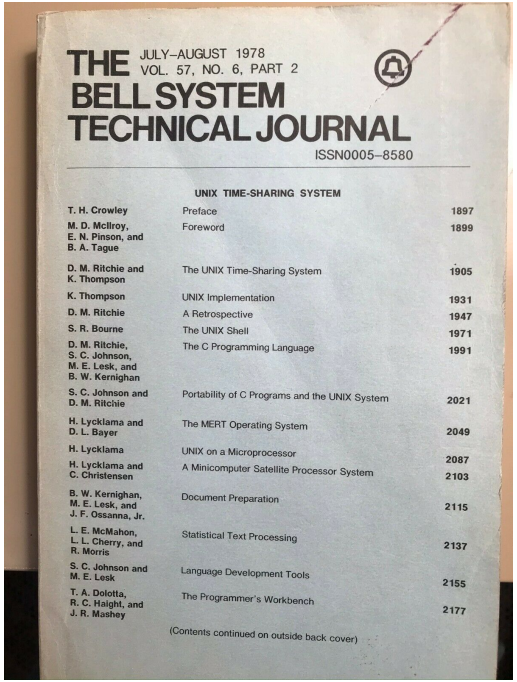
Bell System

Bell System Technical Journal 57 No 6 July/Aug ‘78

- Unix Implementation
- The Unix Shell (new Bourne Shell)
- The C Programming Language
- Portability of C Programs
- The MERT Operating System (real time
- Unix on a Microprocessor (LSX on LSI-11)
- A Minicomputer Satellite System (think RPC)
- Document Preparation
- The Programmer’s Workbench



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(Contents continued on outside back cover)

https://archive.org/search.php?query=bstj%20unix

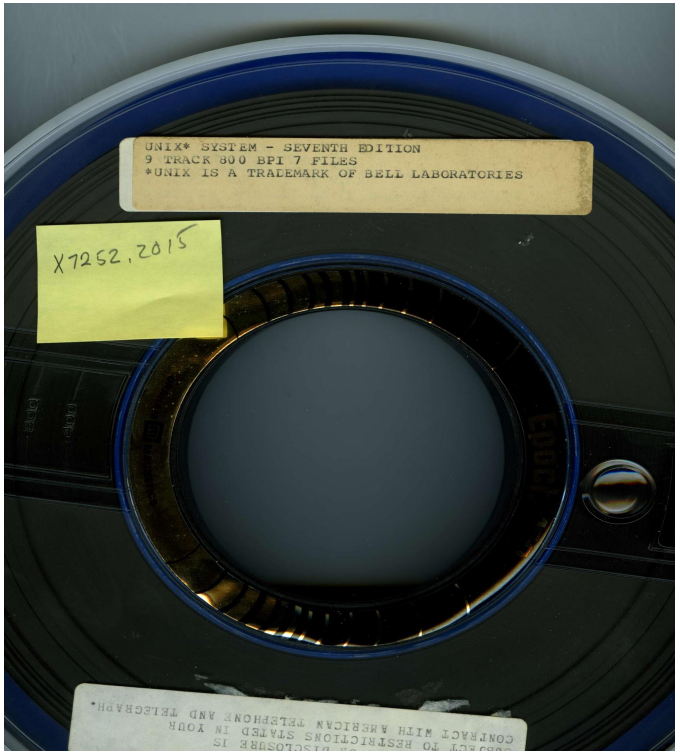
Typesetter C and the “50 changes”

- After 6th Edition
- Newest ‘C’ language features, including
  - long, unsigned and union data types
  - Typedef, struct initializers
  - Bit field support
  - Static support
  - Cpp enhancements
- Dennis Ritchie came up with 50 diffs to take V6 into the then-current Research Unix that were supposedly adopted, at least in part by Unix/TS, PWB and CB-Unix in advance of V7.
- Similar fixes wound up leaking out of Bell Labs… was an early viral spread of data...

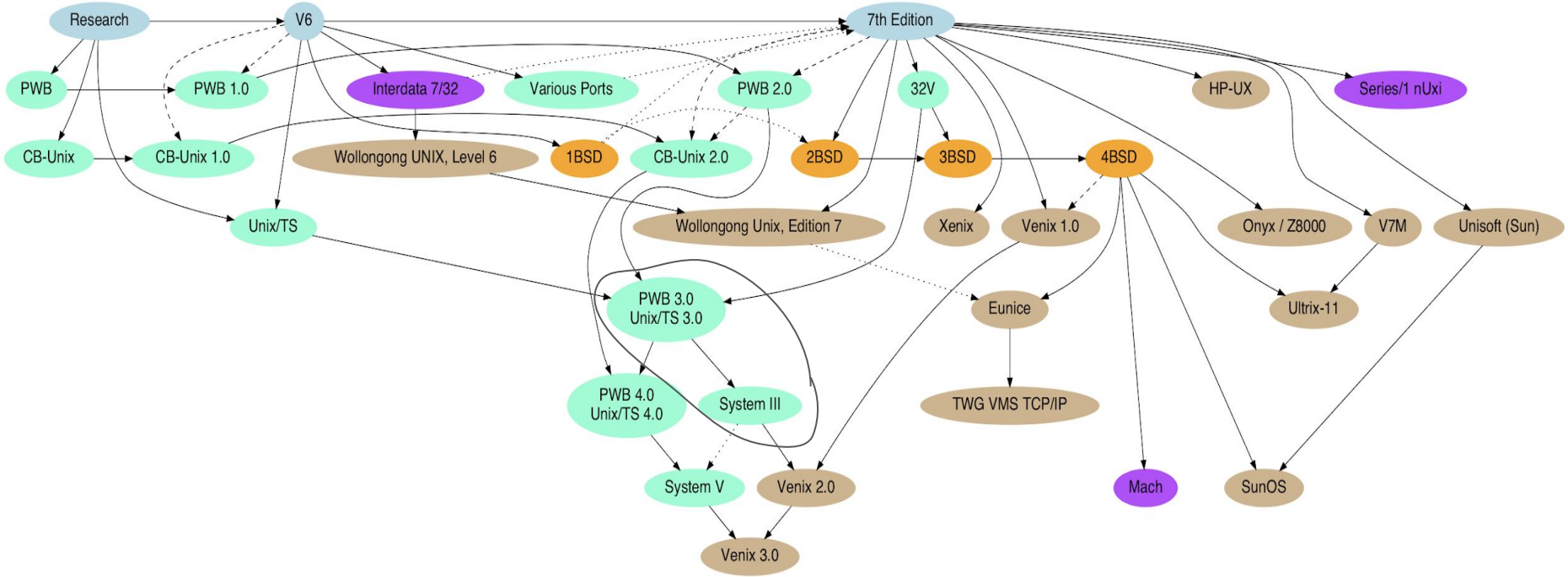
7th Edition - Unix Explodes

January 1979 (+43 months)

- Most popular Unix
- Basis for all future versions
- Ported to
  - VAX
  - 68000
  - Zilog Z8000
  - IBM Series/1
- First binary distributions



7th Edition Family Tree



New Features in V7

- New Development tools: lex, lint and make
- Migrated to portable C compiler (though only with pdp-11 back end)
- Bourne Shell (shell scripts could be in pipeline, v6 sh had script as stdin)
- awk, sed, tar, fortune, at, calendar, and f77
- Networking support (not TCP/IP, but UUCP and datakit)
- New system calls: access, acct, alarm, chroot, exece, ioctl, lseek, umask, utime.
- New stdio, environment variables, getenv, popen and system
- Support for disks and files > 1GB in size…
- New Terminal Interface (yuck)
- Datakit’s mpx IPC method (similar to pipes) that never caught on

M

Credit: https://www.mckusick.com/beastie/jpg/foglio.jpg

Fixing Dinosaurs

Before

After

Questions

Warner Losh - HER OWLS RAN

Netflix OCA Team / FreeBSD core team

imp@freebsd.org

ADDED SINCE TALK: http://unix50.org has a web service you can try the different systems out on if you don't want to setup the emulator yourself.