#!/UNIX®@50

(A Personal History)

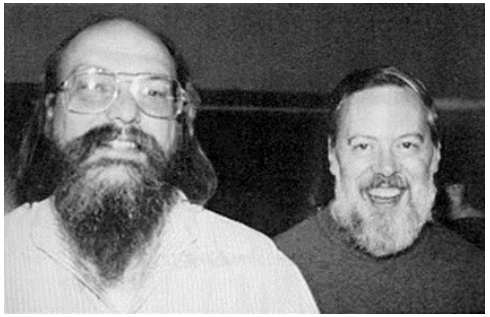
By Gilbert Detillieux, Dec. 2019 MUUG Meeting

University of Manitoba

About me…

- Student at U of Manitoba from 1979 to 1983
- First exposed to UNIX in 1979,
  worked on it starting in 1980
- Worked in industry from 1983 to 1989,
  trying to focus on UNIX support
- Co-founded TUUG ca. 1988 (MUUG in 1992)
- Began current job as a SysAdmin
  in October 1989 (30 years ago)
- Focused on UNIX primarily for 40 years
- Personal bias reflected in this history

Source: http://www.quickmeme.com/meme/356f74



August 1969

Let's start at the beginning… (or Epoch?)

- Bell Lab pulls out of Multics project (with MIT and GE)
- Ken Thompson works on new OS for little-used DEC PDP-7, assembler & editor
- With Dennis Ritchie & others, implement hierarchical FS, device files, shell & utilities
- Modelled on Multics features, but simplified
- In 1970, Brian Kernighan coins the name Unics, later spelled as UNIX.

Source: https://en.wikipedia.org/wiki/History_of_Unix
https://www.youtube.com/watch?v=EY6q5dv_B-o

The PDP-7

Manufacturer	Digital Equipment Corporation
Type	Minicomputer
Release date	1965; 54 years ago
Introductory price	US$72,000 (equivalent to $572,427 in 2018)
Units sold	120[1][2]
Units shipped	120[2]
Memory	4K words (9.2 KB) (expandable up to 64K words (144 KB).)[1] 8Kw (18.4KB) at Bell Labs
Storage	Paper-tape and dual transport DECtape drives (type 555) 1MB disk (RB09 same as an RD10)
Display	Printer
Input	Keyboard
Platform	DEC 18-bit

Sources: https://en.wikipedia.org/wiki/PDP-7
http://bsdimp.blogspot.com/2019/07/the-pdp-7-where-unix-began.html

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1970 to 1979

From Infancy to Portability…

- OS rewrite for PDP-11 in 1970
- Name officially becomes UNIX
- Versions 1-4 written in assembler
- K & R C compiler introduced in V2
- V4 rewrite in C in 1973
- V5 licensed to educational institutions in 1973
- V6 first licensed to companies in 1975 @ US$20K!
- V7 is first “portable” version, in 1978
  - First Bell Labs port is to Interdata 8/32
  - UNIX/32V for DEC VAX then released

Source: https://en.wikipedia.org/wiki/History_of_Unix

PDP-11

- 16-bit word length
- Orthogonal instruction set & general-purpose registers
- Memory-mapped I/O
- Vectored interrupts, 4 priority levels
- Unibus architecture
- Q-bus for later LSI-11 & MicroPDP-11
- Limitations led to development of VAX-11, 32-bit architecture

Source: https://en.wikipedia.org/wiki/PDP-11

PERMUTED INDEX

20boot(VIII) install new	11/20 system
vt(IV)	11/20 (vt01) interface
dp(IV) DP-11	201 data-phone interface
	20boot(VIII) install new 11/20 system
ibm(VI) submit off-line job to HO IBM	370
ac(VIII) login	accounting
sa(VIII) Shell	accounting
dn(IV) DN-11	ACU interface
	ac(VIII) login accounting
shift(I)	adjust Shell arguments
break(II) change core	allocation
alloc(III) core	allocator
	alloc(III) core allocator
yacc(VI) yet	another compiler-compiler
mail(I) send mail to	another user
write(I) write to	another user
	a.out(V) assembler and link editor output
apl(VI)	APL interpreter
	apl(VI) APL interpreter
atan(III)	arc tangent function
ar(I)	archive and library maintainer
ar(V)	archive (library) file format

Source: https://www.tuhs.org/Archive/Distributions/Research/Dennis_v5/v5man.pdf

NAME

chmod — change mode

SYNOPSIS

chmod octal file ...

DESCRIPTION

The octal mode replaces the mode of each of the files. The mode is constructed from the OR of the following modes:

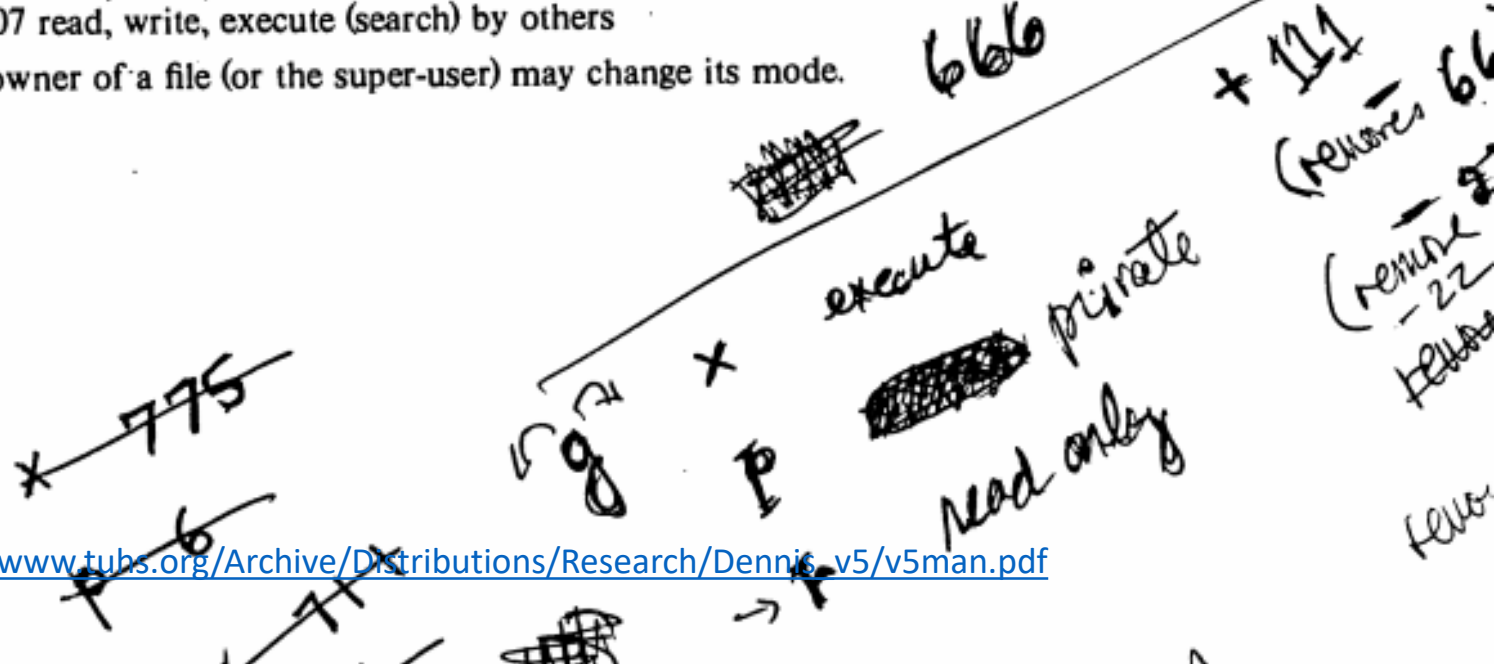
4000 set user ID on execution
2000 set group ID on execution
0400 read by owner
0200 write by owner
0100 execute (search in directory) by owner
0070 read, write, execute (search) by group
0007 read, write, execute (search) by others

Only the owner of a file (or the super-user) may change its mode.

SEE ALSO

ls(I)

BUGS



Source: https://www.tuhs.org/Archive/Distributions/Research/Dennis_v5/v5man.pdf

NAME

dsw — delete interactively

SYNOPSIS

dsw [directory]

DESCRIPTION

For each file in the given directory ('.' if not specified) *dsw* types its name. If **y** is typed, the file is deleted; if **x**, *dsw* exits; if new-line, the file is not deleted; if anything else, *dsw* asks again.

SEE ALSO

rm(I)

BUGS

The name *dsw* is a carryover from the ancient past. Its etymology is amusing.

Source: https://www.tuhs.org/Archive/Distributions/Research/Dennis_v5/v5man.pdf

CSW(II) 7/29/72

NAME

csw – read console switches

SYNOPSIS

(csw = 38.; not in assembler)
sys csw

getcsw( )

DESCRIPTION

The setting of the console switches is returned (in r0).

Source: https://www.tuhs.org/Archive/Distributions/Research/Dennis_v5/v5man.pdf

Man Pages by Version

Version	V1	V5	V6	V7
Commands(1)	61	81	81	136
System Calls(2)	34	41	43	47
Subroutines/libc(3)	14	36	39	56
Special Files(4)	7	18	18	16
File Formats(5)	9	13	16	17
User-maintained/games(6)	10	30	25	16
Miscellaneous(7)	18	5	4	6
System Maintenance(8)	--	23	27	7

Sources: https://www.tuhs.org/Archive/Distributions/Research/
https://9p.io/7thEdMan/

USENIX

The “UNIX Users Group”

- Founded in 1975
- Had to change name to avoid trademark infringement
- Based out of Berkeley, CA
- Publishes ;login: magazine
- Sponsors several annual conferences
- Fairly academic focus

Sources: https://en.wikipedia.org/wiki/USENIX
http://static.usenix.org/publications/login/whysemi.html

BSD

Berkeley Software Distribution

- Initial release in 1978
- Originally called Berkeley Unix
- 1BSD based on Bell Labs (Research) UNIX V6
  - An add-on, rather than a full OS on its own
  - Included a Pascal compiler, ex editor
  - 30 copies licensed
- 2BSD released in May 1979
  - Added vi (visual editor) and the C Shell
  - 75 copies licensed (including one to U of M)
- 3BSD released at end of 1979
  - Based on UNIX/32V, added full VM support for VAX

Sources: https://en.wikipedia.org/wiki/Berkeley_Software_Distribution
https://en.wikipedia.org/wiki/History_of_the_Berkeley_Software_Distribution

1980 to 1989

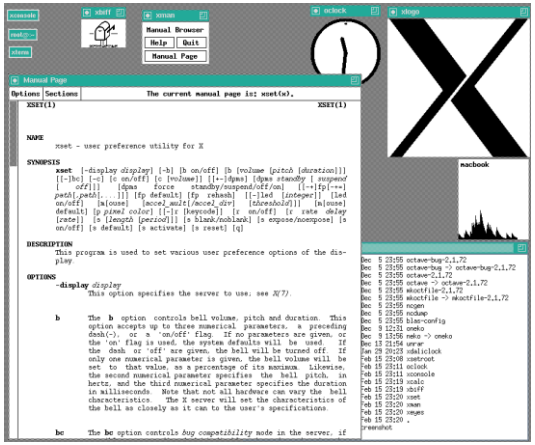
From Curiosity to Viability…

- AT&T announced UNIX System III, based on V7 and PWB/UNIX, in 1981
- 1983 anti-trust case against AT&T leads to Bell Labs break-up, but allows unrestricted commercial licensing
- SVR1 released later in 1983
- Research UNIX V8, V9, V10, leading to Plan 9
- Richard Stallman starts GNU Project in 1983
- Andrew Tanenbaum releases MINIX in 1987
- UNIX & variant (clone) ports to 16 arch, 60 vendors, including Xenix & PC/ix on 8086 (& Apple Lisa on 68000)
- mainframe UNIX: Amdahl UTS in 1981, IBM IX/370 and VM/IX

Sources: https://en.wikipedia.org/wiki/History_of_Unix
https://en.wikipedia.org/wiki/MINIX

1980 to 1989

From Curiosity to Viability…



- BSD developer Bill Joy co-founds Sun Microsystems in 1982, creates SunOS & Sun workstations
- 4BSD adds job control, fast file system, sockets & TCP/IP stack
- X Window Release 1 in June 1984
- X11R2 (X Consortium release) in Feb 1988
- X11R4 adds XDMCP, twm, & more in Dec 1989

Sources: https://en.wikipedia.org/wiki/History_of_Unix
https://en.wikipedia.org/wiki/X_Window_System

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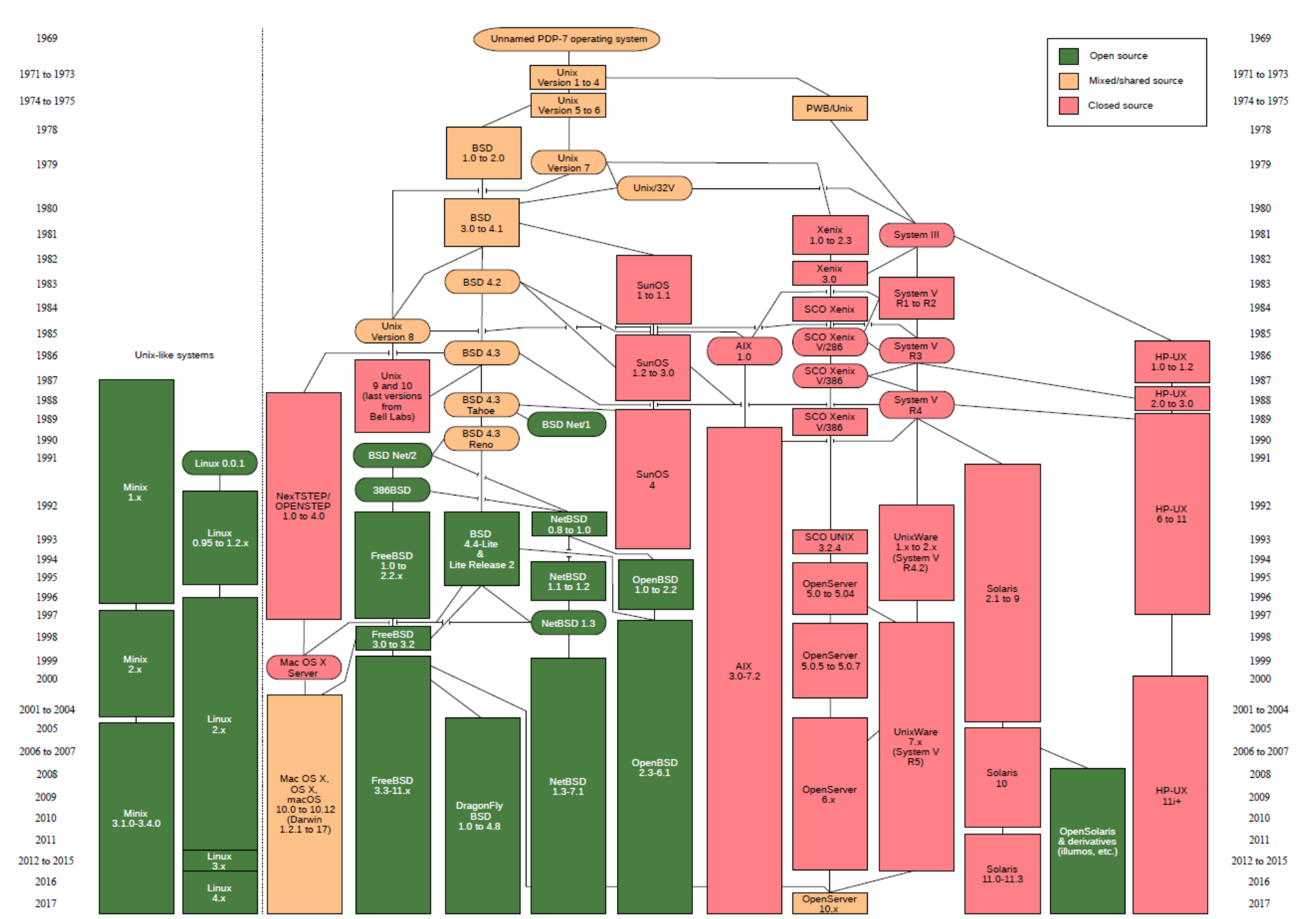
1980 to 1989

The UNIX Wars, Part 1:

- AT&T SysV and BSD diverge, with incompatible system calls, libraries, file system standards
- AT&T responds with SVID in 1985
- X/Open (Euro vendor) consortium work toward open system spec (eventually SVID)
- IEEE works with others on POSIX spec in 1988
- AT&T in 1988 works with
  - SCO to merge SysV and Xenix into System V/386
  - Sun to merge SysV, BSD/SunOS and Xenix into SVR4

Source: https://en.wikipedia.org/wiki/History_of_Unix



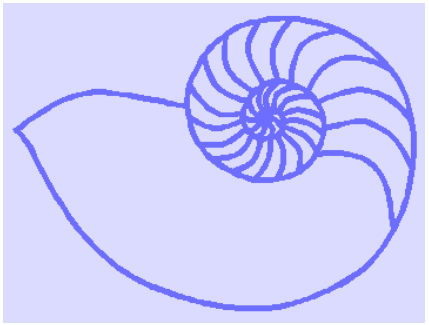
/usr/group

A.K.A. UniForum

- Founded in 1980
- Industry association dedicated to the "promotion of the UNIX operating system“
- Independent from, but collaborated with USENIX
- Changed name to UniForum in 1989
- Worked with IEEE on POSIX standards
- Faded into obscurity by the mid/late-2000’s

Sources: https://www.usenix.org/about/history/international
https://books.google.ca/books?id=-inF2Gv9w68C&pg=PT82

The Birth of MUUG



Technical UNIX™ User Group

- /usr/group/winnipeg formed in 1985
  - Heavy focus on UNIX advocacy and marketing
  - Affiliated with /usr/group/canada
  - Crashed and burned in early 1986
  - Last 3 attendees at (final?) meeting work on alternative group
- Conduct UNIX user survey, trying to meet user needs
- TUUG begins very informal monthly meetings in fall 1986, with tech./education focus
- Name notation, newsletter, formal membership by fall 1988

Source: https://muug.ca/about.html

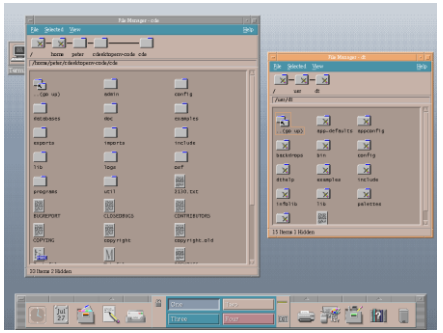
1988: We Broke the Internet, pt.1

The Morris Internet Worm

- Written by Robert T. Morris in 1988
- Exploited UNIX vulnerabilities:
  - Debug mode in sendmail
  - Buffer overrun in fingerd
  - Weak security settings in rexec/rsh
- First person indicted under Computer Fraud and Abuse Act (1986), in July 1989
  - Convicted in 1990
- Clifford_Stoll writes “The Cuckoo’s Egg” in 1989, based on capture of Markus_Hess

Source: https://en.wikipedia.org/wiki/Robert_Tappan_Morris

1990 to 1999



From Open Standards to Open Source…

- Linus Torvalds releases Linux in 1991
- AT&T and Sun form UNIX International, as competitor to X/Open's OSF, part ways soon after
- UI & OSF merge in 1994, abandon OSF/1
  - OSF/1 rebranded as Digital UNIX in 1995
  - Compaq buys out Digital in 1998, Tru64 UNIX rebranding
- AT&T sells SVR4 rights to Novell
  - UnixWare merges NetWare with SVR4
  - UNIX trademark transferred to X/Open in 1993
  - X/Open merges with OSF into Open Group in 1996

Sources: https://en.wikipedia.org/wiki/History_of_Unix
https://en.wikipedia.org/wiki/Tru64_UNIX

The Evolution of MUUG

Manitoba UNIX® User Group

- Group continues to grow as Internet becomes popular
- Group's executive meets to formalize by-laws (the "Shoal Lake Accord"), summer 1991
- Adopt current structure with board and officers
- Name changed to reflect broadening membership in May-June 1992
- MUUG Online Network Access (MONA) start June 1992, website by September 1994
  - Membership soars to peak of over 200, settles to ~60

Sources: https://muug.ca/about.html
https://muug.ca/pub/muuglines/pdf/tuug9205.pdf
https://muug.ca/pub/muuglines/pdf/muug9206.pdf

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1990's: We Broke the Internet, pt.2

The Rise of the Commercial Web…

- .COM bubble strains DNS infrastructure
- Graphic-intensive web sites break HTTP/1.0
- More buffer overrun exploits
- Kevin Mitnick IP spoofing attack in 1994
- Mitnick sentenced to 5 years in 1999 (4 already served)
- ISC proposes use of DNSSEC in 1998

Source: https://en.wikipedia.org/wiki/List_of_security_hacking_incidents

2000 to 2009

From Elation to Consolidation…

- SCO sells UNIX assets to Caldera, which renames to The SCO Group
- SCO Group sues Novell, IBM, others in 2003
  - Court rules in Novell's favour in 2007
  - Ruling overturned in 2009, Novell wins jury trial in 2010
  - Lawsuit against IBM dismissed in 2016
- HP buys Compaq in 2002, winds down Tru64 by end of 2004
- Sun releases OpenSolaris, including ZFS, in 2005
- Sun buys MySQL in 2008, Oracle buys Sun in 2009
- macOS, Solaris, HP-UX, AIX remain in market
- Linux dominates in open source

Sources: https://en.wikipedia.org/wiki/History_of_Unix
https://en.wikipedia.org/wiki/Sun_Microsystems

2000's: We Broke the Internet, pt.3

Dan Kaminsky and the DNS Vulnerability

- In 2008 Dan Kaminsky discovers serious DNS flaw
- Foreseen by Dan Bernstein in 2003
- Lack of port randomization can lead to DNS cache poisoning
- Kaminsky holds press conference July 2008
- Details to be revealed at BlackHat conference a month later
- Leaked details force rushed release of patches

Source: https://www.schneier.com/blog/archives/2008/07/the_dns_vulnera.html

2010 to 2019

From Obscurity to Ubiquity…

- US & EU approve Oracle purchase of Sun in 2010
  - Oracle drops OpenSolaris, releases Solaris 11
  - Also continues to support Oracle Linux
- RIP Dennis Ritchie, Oct 12, 2011
- Linux turns 20 in 2011 (UNIX is 42!)
- Raspberry Pi released in 2012, for US$35
- HP commits to supporting Linux as alternative to HP-UX and Windows in 2012
- Windows Subsystem for Linux added to Win10 in 2016; OpenSSH client & server added in late 2017
- Toyota adopts Automotive Grade Linux in 2018
- IBM buys Red Hat in late 2018

Source: https://muug.ca/pub/muuglines/

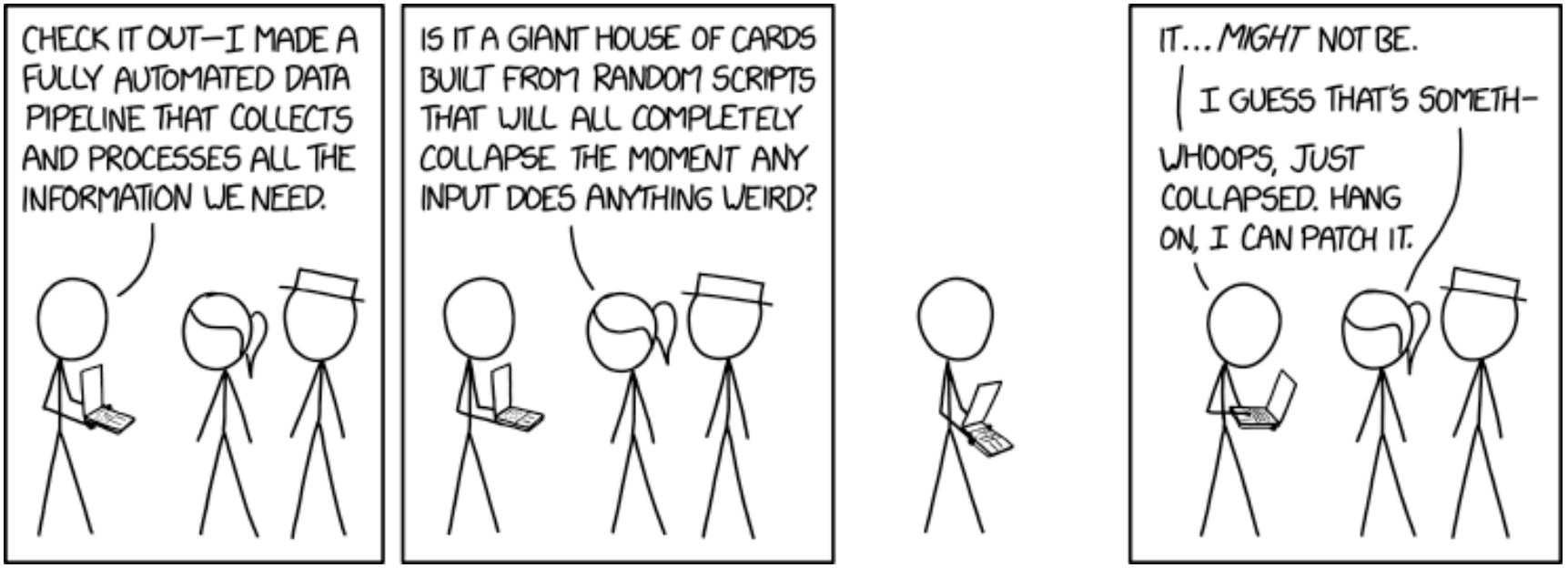
2010's: We Broke the Internet, pt.4

From Security to Vulnerability?

- Heartbleed, POODLE & 6 other OpenSSL vulnerabilities, all in 2014
  - "OpenSSL is not developed by a responsible team." – Theo de Raadt
- Shellshock (GNU Bash) remote execution, also in 2014
- FREAK SSL/TLS (Factoring RSA Export Keys) in 2015
- GHOST (Glibc gethostbyname stack buffer overflow), in 2015
- VENOM vulnerability in QEMU, Xen & KVM, in 2015
- Row Hammer DRAM vulnerabilities in 2013-2015
- NTP DDoS in 2013, MitM bogus data in 2015
- Dirty Cow (Linux kernel) privilege escalation, in 2016
- Meltdown & Spectre in 2017
- WikiLeaks publishes CIA Vault 7 Hacking Tools, in 2017

Sources: https://muug.ca/pub/muuglines/
https://www.darkreading.com/vulnerabilities---threats/the-10-worst-vulnerabilities-of-the-last-10-years/d/d-id/1325425

Data Pipeline



Source: https://xkcd.com/2054/

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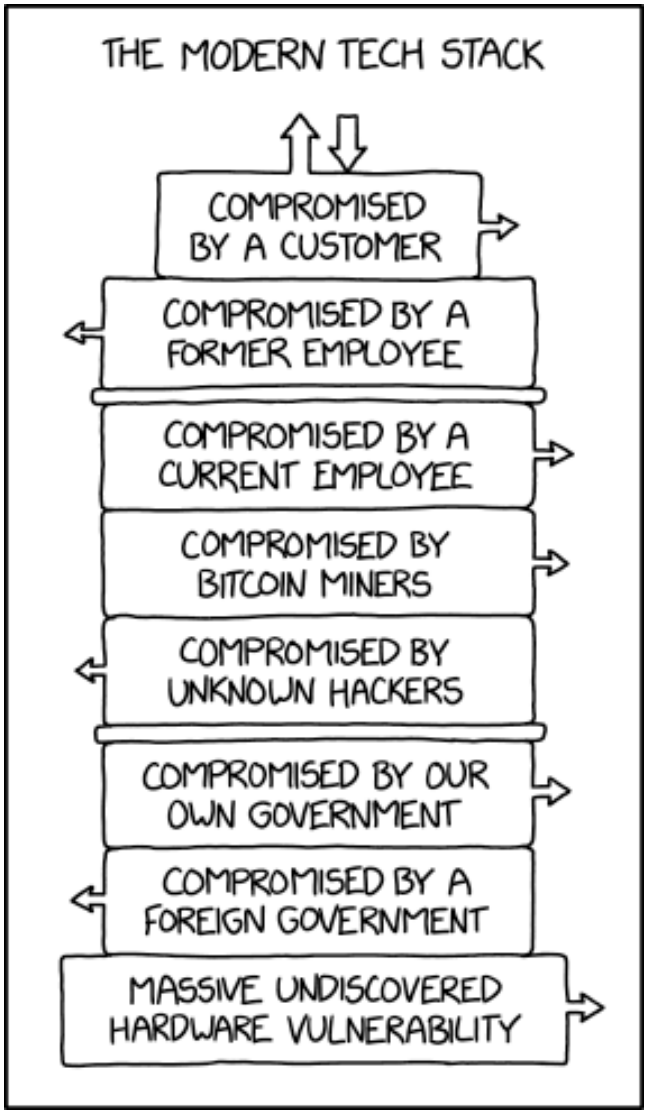
Stack



Source: https://xkcd.com/2166/

Five Decades of Hardware

Year	1969	1979	1989	1999	2009	2019
Model	PDP-7	PDP-11/45	MicroVAX-11	Sun Ultra 1/140	Sun Fire X4200	Dell PE R730xd
Bits/ word	18	16	32	32	64	64
RAM	4-64 Kw 9-144KB	256KB ½ core	13 MB 16 max	224 MB	12 GB	64 GB
Storage	1 x RB09/ RD10 1MB	4 x RK05 2.5 MB/ea	3 x CDC Wren VI 680MB/ea	SCSI 63 GB tot	IDE RAID5 5 TB tot	SAS RAID6 11 TB tot
OS	Unics (V0)	UNIX V6	Ultrix-32	Solaris 7	CentOS 5	Scientific Linux 6

Sources: https://en.wikipedia.org/wiki/PDP-7
and Gilbert's own memory/notes

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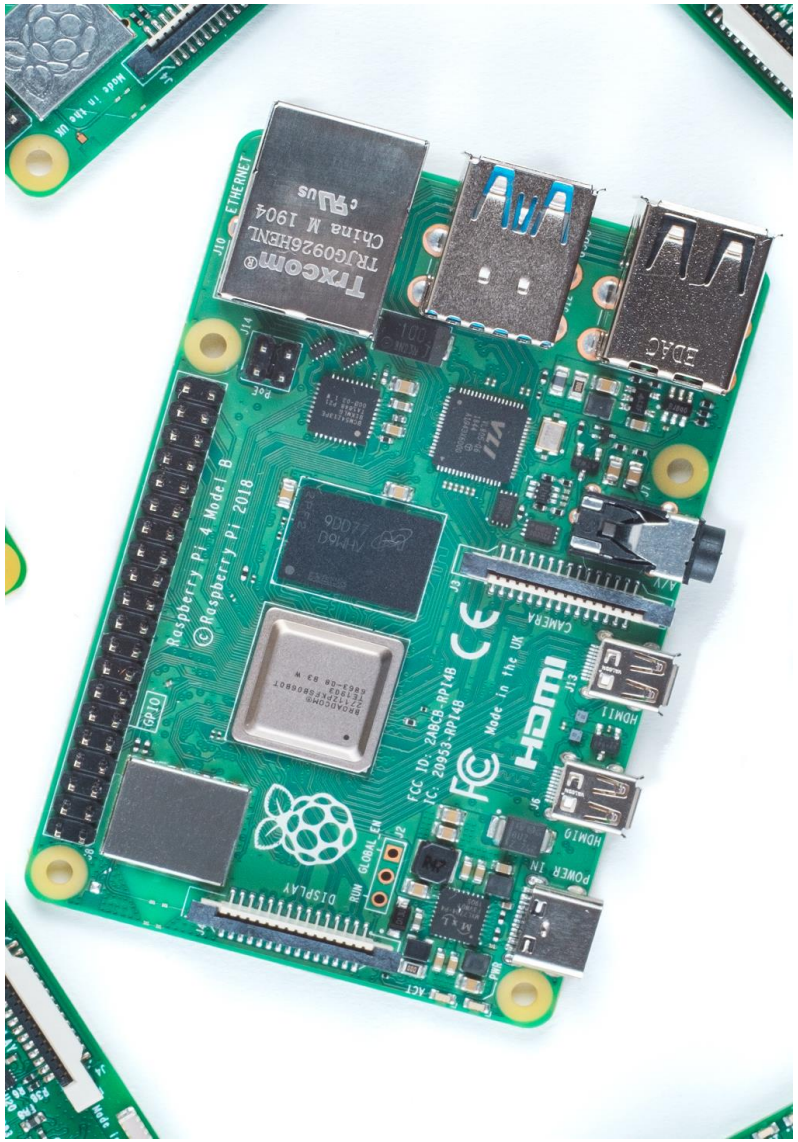
Raspberry Pi

Year	2012	2017	2019
Model	B Rev 2	Zero W	4
Bits/ Cores	32/ 1	32/ 1	64/ 4 v8
RAM	256-512MB	512MB	1-4GB
Clock	700 MHz	1 GHz	1.5 GHz
SD slot	SD, SDHC	microSD	microSD
Price	$35US	$10US	$35US *(1GB RAM)*



Source: http://socialcompare.com/en/comparison/raspberrypi-models-comparison

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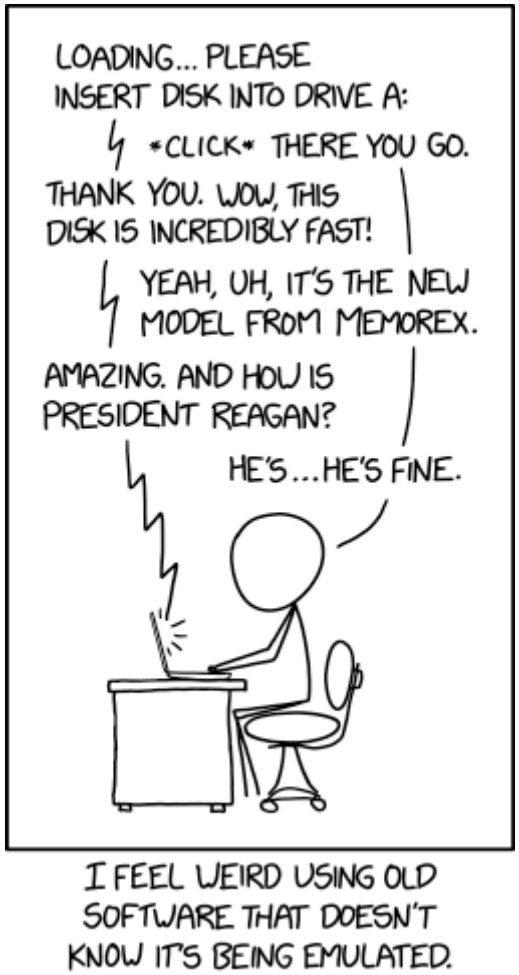
UNIX V7 on a PDP-11, on a Pi

Emulation: The Cure for Nostalgia

- **`sudo apt-get install simh`**
- **`wget`** https://www.tuhs.org/Archive/Distributions/Research/Keith_Bostic_v7/v7.tap.gz
- **`gunzip v7.tap.gz`**
- **`pdp11`**
- *(etc.)*



Sources: https://obsolescence.wixsite.com/obsolescence/pidp-11, https://xkcd.com/2221/
https://www.linkedin.com/pulse/adventures-raspberry-pi3-1-running-unix-v7-emulated-pdp-11-chris-tham

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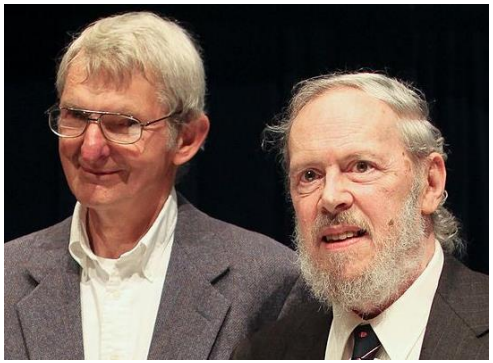
2020 to 2038, and Beyond?

The UNIX Legacy

- Portability and vendor independence
- Open standards & accessible source code
- Scalability (embedded to mainframe)
- Hierarchical, mountable file systems
  - link/unlink (& symlink) concepts
  - device special files (hardware and virtual)
  - pipes, sockets, streams as files (generic I/O)
- Small, modular commands
  - Programs as filters, with I/O redirection
  - Pipelines and shell scripts build complexity

Sources: https://www.bell-labs.com/usr/dmr/www/retro.pdf
https://www.cis.upenn.edu/~lee/07cis505/Papers/ritchie-bstj84.pdf

2020 to 2038, and Beyond?



The UNIX Philosophy:

Write programs that do one thing and do it well.

Write programs to work together.

Write programs to handle text streams, because that is a universal interface.

Doug McIlroy, as paraphrased by Peter H. Salus in A Quarter-Century of Unix (1994)

Source: https://en.wikipedia.org/wiki/Unix_philosophy

Source: https://www.digi.no/emne/unix

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