Unix and Linux

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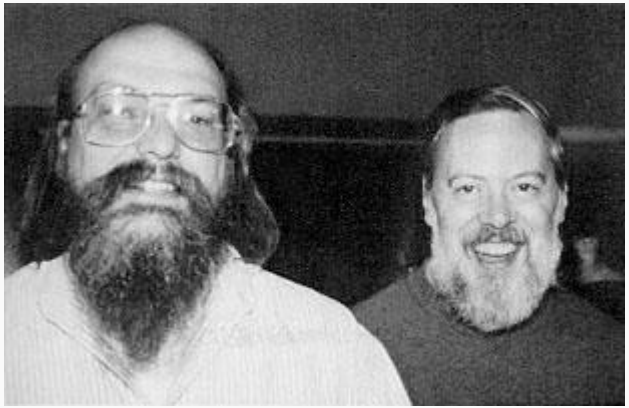
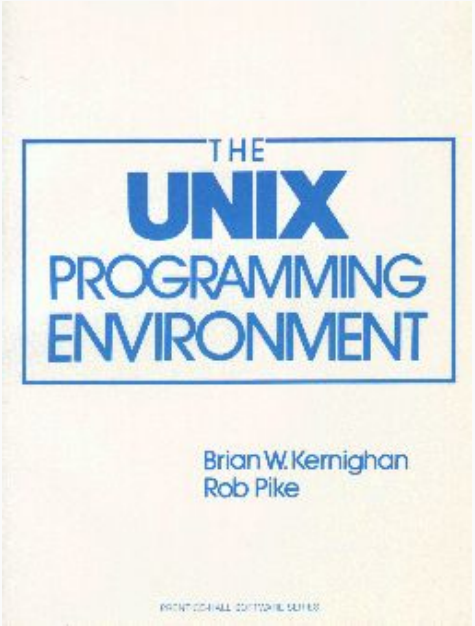
UNIX History

- Development dates back to 1960s at AT&T Bell Labs
- Multitasking and Multiuser OS
- First assembly version in 1969
- Rewritten in C in 1972
- Leads to numerous variants (both academical and commercial)
- Today, UNIX name usually refers to OS family, not just a single OS



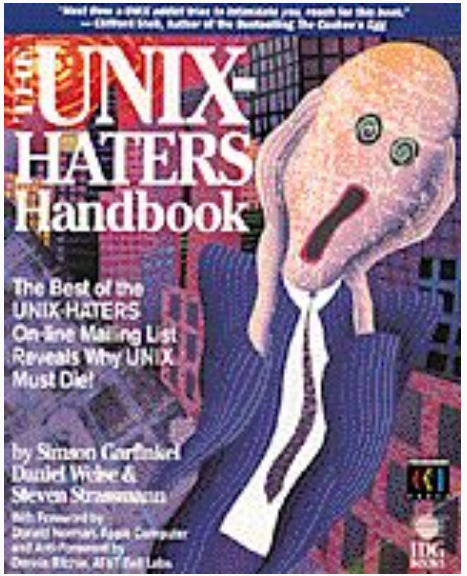
UNIX Legacies

- Simple tools (minimalism)
- Unix pipes (composability)
- Regular expressions
- Everything is a file

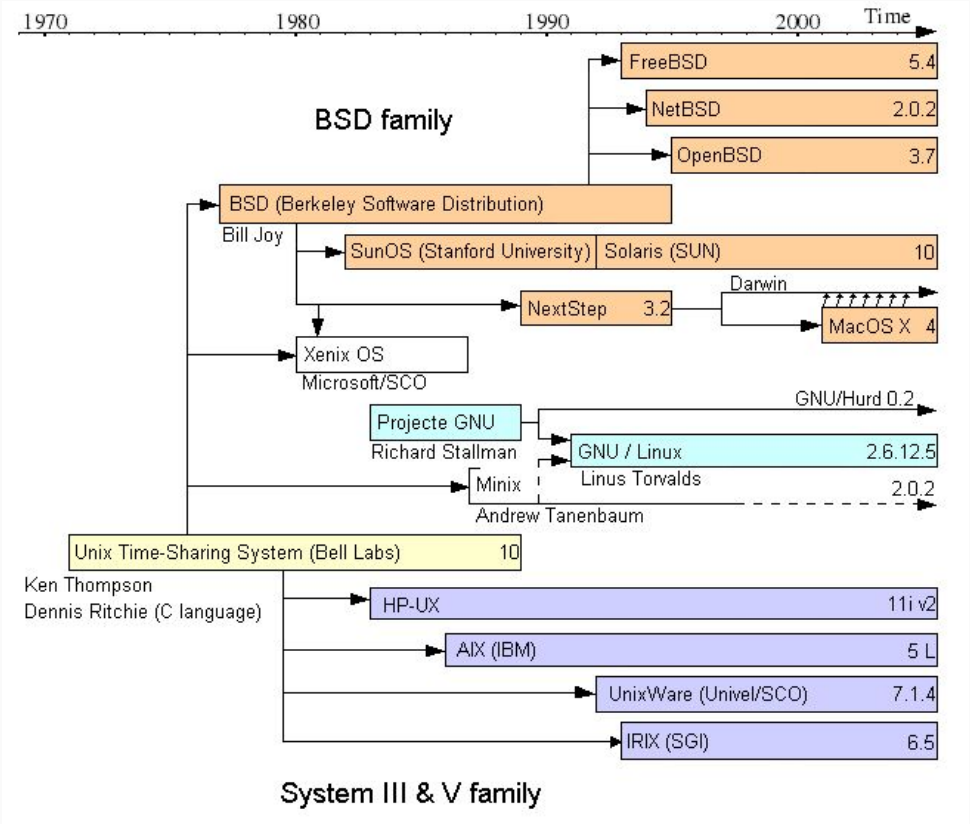


UNIX Pitfalls

1. Unix - The World's First Computer Virus
2. Welcome, New User! - Like Russian Roulette with Six Bullets Loaded
3. Documentation? - What documentation?
4. ...



UNIX Family


1970
1980
1990
2000
Time
BSD family
FreeBSD 5.4
NetBSD 2.0.2
OpenBSD 3.7
BSD (Berkeley Software Distribution)
Bill Joy
SunOS (Stanford University)
Solaris (SUN) 10
Darwin
NextStep 3.2
MacOS X 4
Xenix OS
Microsoft/SCO
GNU/Hurd 0.2
Projecte GNU
Richard Stallman
GNU / Linux 2.6.12.5
Linus Torvalds
Minix 2.0.2
Andrew Tanenbaum
Unix Time-Sharing System (Bell Labs) 10
Ken Thompson
Dennis Ritchie (C language)
HP-UX 11i v2
AIX (IBM) 5 L
UnixWare (Univel/SCO) 7.1.4
IRIX (SGI) 6.5
System III & V family

Documentaries

1. https://archive.org/details/UNIX1985
2. https://archive.org/details/RevolutionOS

OS Standards

- Portable Operating System Interface (POSIX) by IEEE (1988)
- Single UNIX Specification (SUS) by The Open Group (1990s)
- Later merged as Open Group Base Specification by Austin Group (2008)

POSIX for Windows

- Cygwin (https://www.cygwin.com/)
- MinGW (http://www.mingw.org/)
- Windows Subsystem for Linux (WSL) (Beta) (https://blogs.msdn.microsoft.com/wsl/)

GNU/Linux

GNU components include

- GCC
- GDB
- LibC
- CoreUtils
- BinUtils
- Build System
- Bash Shell
- Gnome Desktop

and Linux is the OS kernel

GNU/Linux Distributions

A software collection including

- Kernel (e.g. Linux)
- Userland (e.g. GNU)
- Window System (e.g. xorg)
- Window Manager (e.g. Compiz)
- Desktop Env. (e.g. GNOME)
- Package manager (e.g. dpkg)
- Software repositories
- Textual/Graphical installer

redhat

debian

CentOS

openSUSE

ubuntu

Linux Mint

from freedom came elegance

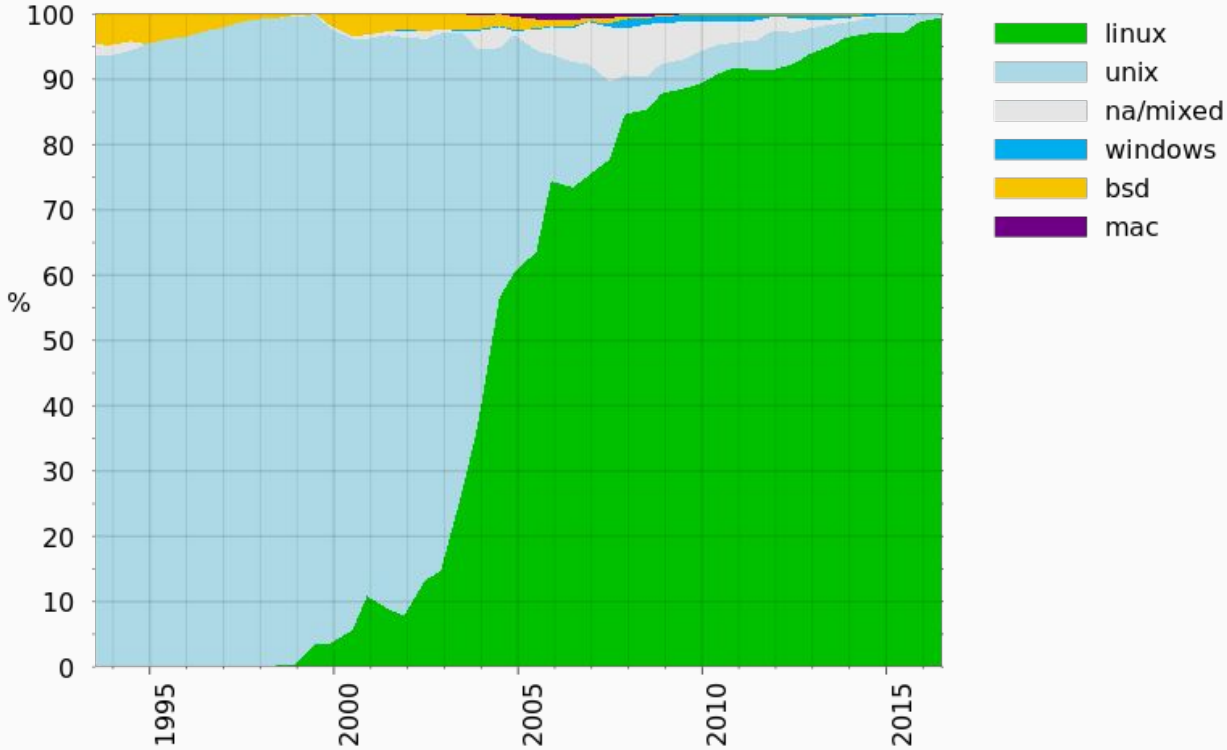
OS Usage Share (Desktop & Mobile)
(https://en.wikipedia.org/wiki/Usage_share_of_operating_systems)

Category	Source	Date	Linux	Unix and Unix-like (not incl. Linux)	Windows	Other
Desktop, laptop (excluding Android and Chrome OS)	Net Applications	August 2017	3.37% (Ubuntu, etc.)	5.94% (macOS)	90.70%	
Smartphone, tablet	StatCounter Global Stats	July 2017	70.27% (Android)	22.47% (iOS)	0.81%	6.43%

OS Usage Share (Web Servers)
(https://en.wikipedia.org/wiki/Usage_share_of_operating_systems)

Source	Date	Unix, Unix-like				Microsoft Windows
		All	Linux	FreeBSD	Unknown	
W3Techs	Feb 2015	67.80%	35.90%	0.95%	30.90%	32.30%
Security Space	Feb 2014	<79.3%	N/A			>20.7%
W3Cook	May 2015	98.30%	96.60%	1.70%	0%	1.70%

OS Usage Share (Supercomputers)
(https://en.wikipedia.org/wiki/Usage_share_of_operating_systems)



References

1. https://en.wikipedia.org/wiki/Unix
2. https://en.wikipedia.org/wiki/History_of_Unix
3. https://en.wikipedia.org/wiki/Unix_philosophy
4. https://en.wikipedia.org/wiki/Linux
5. https://en.wikipedia.org/wiki/GNU
6. https://en.wikipedia.org/wiki/GNU_Project
7. https://en.wikipedia.org/wiki/Linux_distribution
8. https://en.wikipedia.org/wiki/Desktop_environment

Shell

- User interface for OS services including:
  - File management
  - Process management
  - Task automation
  - System Monitoring
  - System Configuration
- Textual (e.g. cmd.exe or bourne shell) or Graphical (e.g. Windows or Unity)

Unix Shells

- Bourne shell (sh) (default in UNIX Version 7)
- Almquist shell (ash)
- Debian almquist shell (dash)
- Bourne-again shell (bash) (default in Linux and MacOS X)
- Korn shell (ksh)
- C shell (csh)
- Tenex C shell (tcsh) (default in FreeBSD)

Motivational Story (1986)

Jon Bentley asks Donald Knuth to demonstrate “literate programming” for his column named “Programming Pearls” in Communications of the ACM magazine. He asks for a solution to the following problem:

> “Given a text file and an integer k, print the k most common words in the file (and the number of their occurrences) in decreasing frequency.”

Knuth comes up with a program in WEB (a literate PASCAL system) that is more than 10 pages in length.

Motivational Story (1986) (Cont.)

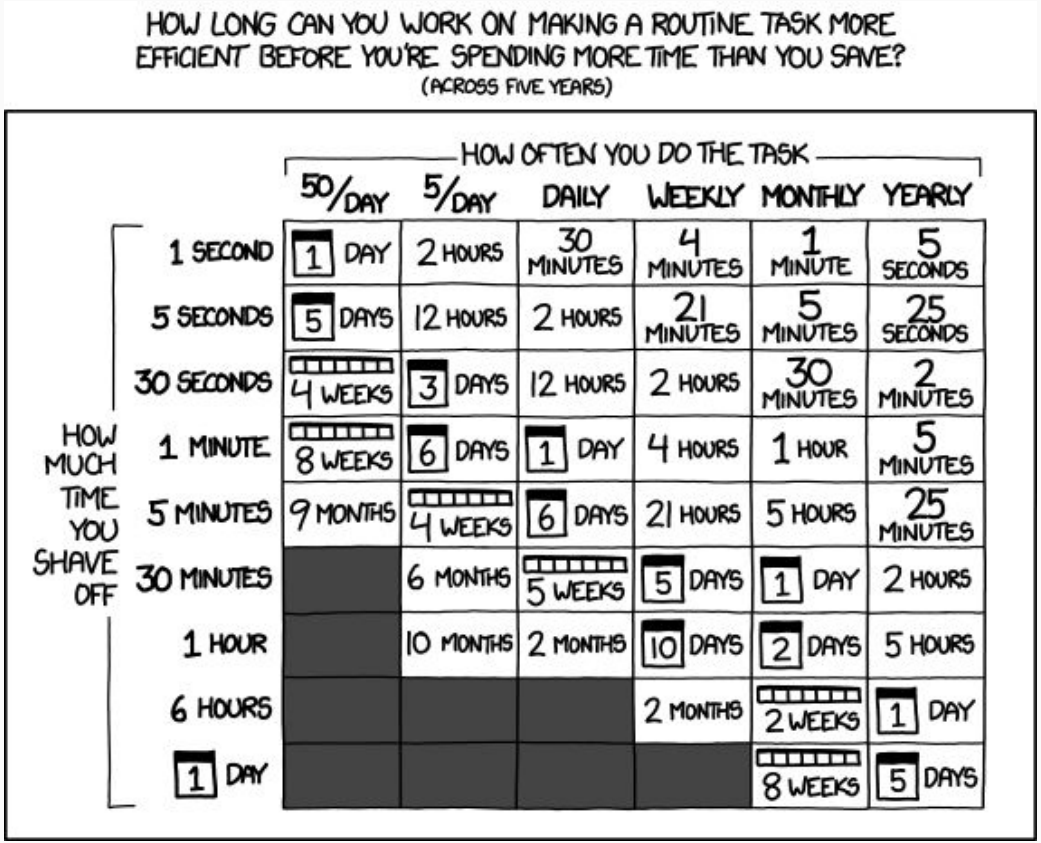
Next week, Jon Bentley asks Douglas McIlroy to review Knuth's program.

He reviews the code thoroughly and says it's brilliant but not wise. He then comes up with the following solution in shell:

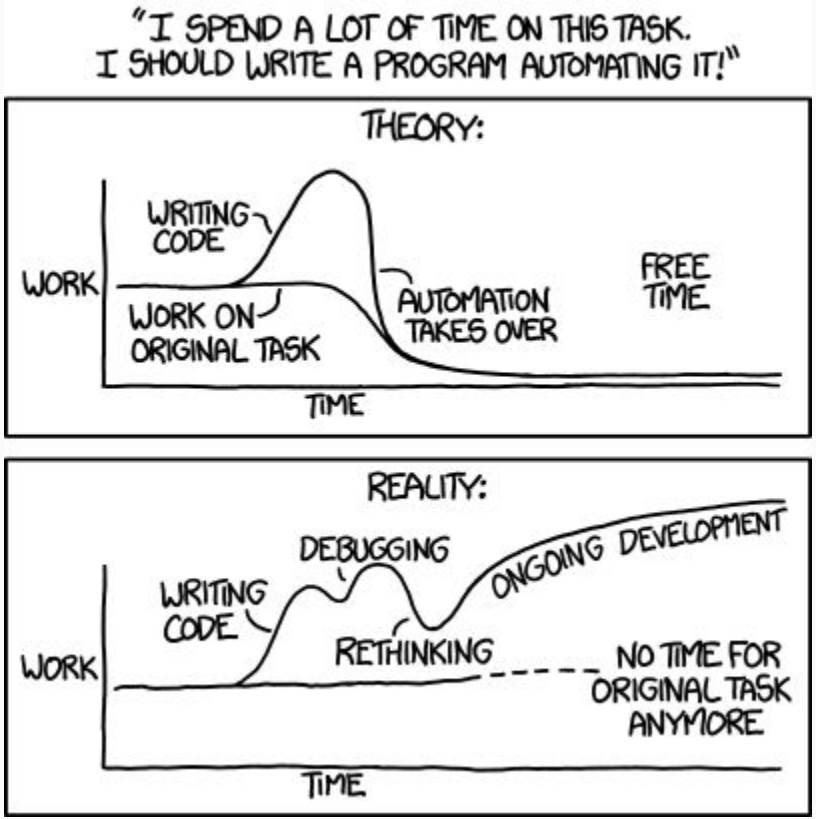
```
tr -cs A-Za-z '\n' | tr A-Z a-z | sort | uniq -c | sort -rn | sed ${1}q
```

Full story: http://dl.acm.org/citation.cfm?id=5948.315654

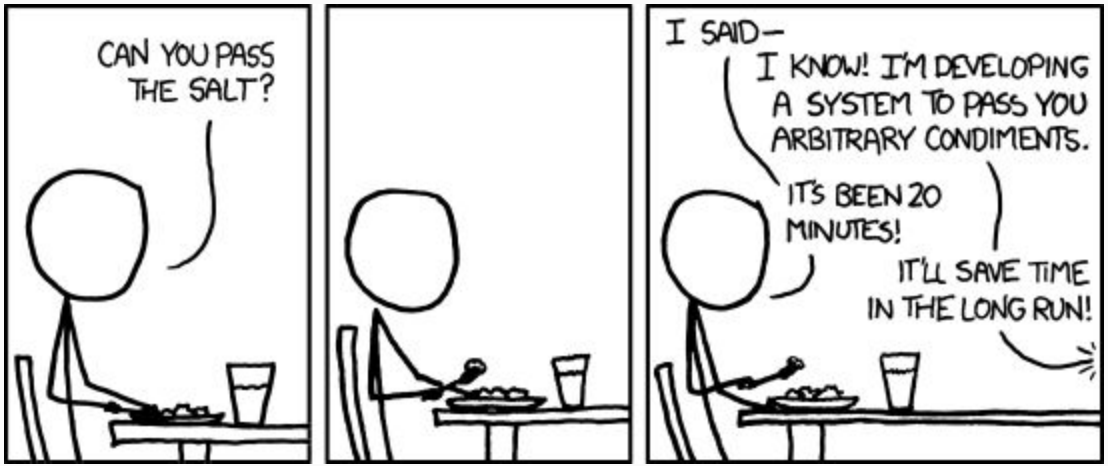
Is It Worth the Time? (https://xkcd.com/1205/)



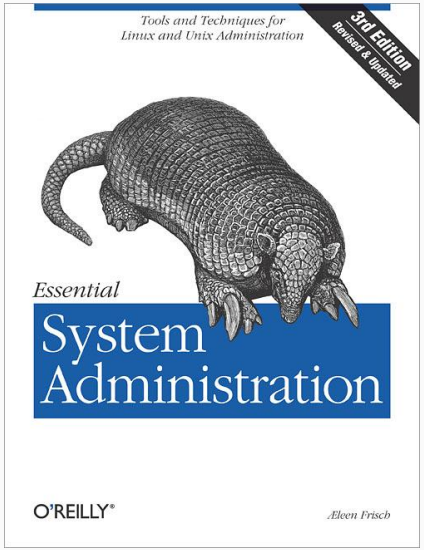
Automation (https://xkcd.com/1319/)

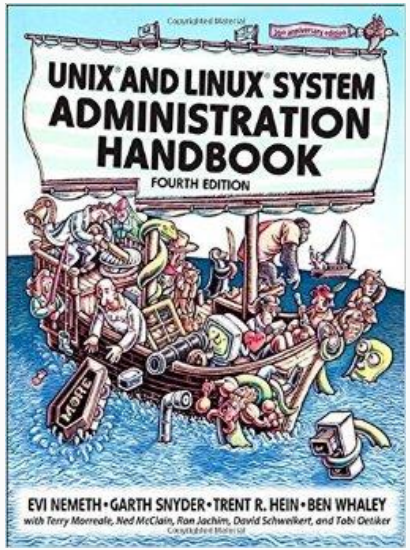


The General Problem (https://xkcd.com/974/)



Books


Tools and Techniques for
Linux and Unix Administration
3rd Edition
Revised & Updated
Essential
System
Administration
O'REILLY®
Æleen Frisch


UNIX® AND LINUX® SYSTEM
ADMINISTRATION
HANDBOOK
FOURTH EDITION
EVI NEMETH • GARTH SNYDER • TRENT R. HEIN • BEN WHALEY
with Terry Morreale, Ned McClain, Ran Jachim, David Schweikert, and Tobi Oetiker

Ubuntu on VirtualBox (demo)

Links

1. http://www.tldp.org/
2. https://www.die.net/
3. https://linuxjourney.com
4. http://www.commandlinefu.com
5. https://wiki.ubuntu.com/DashAsBinSh
6. http://mywiki.wooledge.org/BashPitfalls