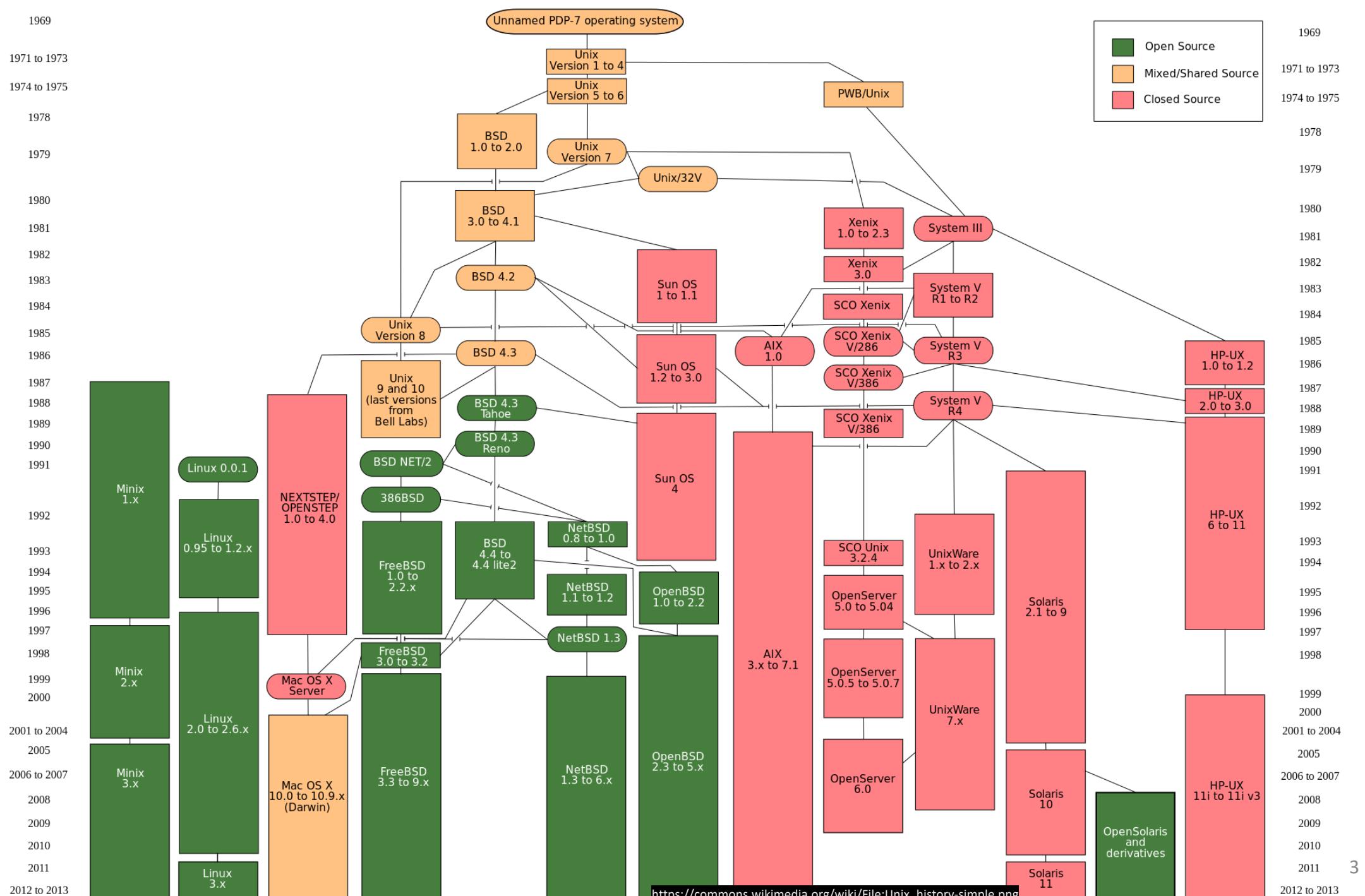


CS 3113 Introduction to Operating
Systems
Fall 2023

Unix to Linux

Outline

A Brief History of Unix, C, Linux and the people involved.



UNIX

THE *Open* GROUP

Unix definitions

- 1) Operating systems that have been certified by “The Open Group”
- 2) Systems that look and behave like classical UNIX

Single UNIX Specification (SUS)

The collective name of a family of standards that allow systems to use the name UNIX.

Product	Vendor	Architecture	UNIX V7	UNIX 03	UNIX 98	UNIX 95	UNIX 93
AIX	IBM Corporation	PowerPC	No	Yes	Yes	No	No
FTX	Cemprus LLC	PA-RISC	No	No	No	No	Yes
EulerOS	Huawei	x86-64	No	Yes	No	No	No
HP-UX	Hewlett Packard Enterprise	IA-64, PA-RISC	No	Yes	No	Yes	No
IRIX	Silicon Graphics, Inc.	MIPS	No	No	No	Yes	No
K-UX	Inspur	x86-64	No	Yes	No	No	No
macOS (formerly OS X)	Apple	x86-64	No	Yes	No	No	No
OpenServer	Xinuos	IA-32	No	No	No	No	Yes
Solaris	Oracle Corporation	IA-32, x86-64, SPARC	Yes	Yes	Yes	No	No
Tru64 UNIX	Digital Equipment Corporation	Alpha	No	No	Yes	No	No
UnixWare	Xinuos	IA-32	No	No	No	Yes	No
z/OS USS	IBM Corporation	z/Architecture	No	No	No	Yes	No

~~UNICS~~ UNIX



Fernando José Corbató

MULTICS was a AT&T + MIT + GE project. AT&T left because it wasn't making money.



1969 | First implemented (The year Linus Torvalds was born)

- | The name UNIX was a pun on MULTICS
- | ← UNIX implemented by Ken Thompson

1973 | Dennis Ritchie (Bell Labs) rewrote UNIX in C

ar, cat, chmod, chown, cp, dc, ed, find, ln, ls, mail, mkdir, mv, rm, sh, su, who

- | MIT was already using MULTICS on campus

1974 | UNIX installs on more than 50 systems

1975 | First edition created outside of AT&T



Bell Laboratories

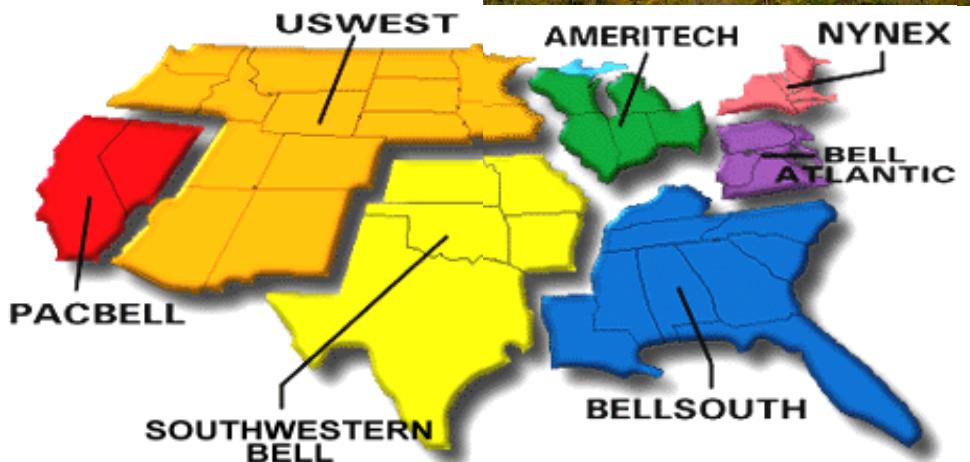
- Inventions: Radio Astronomy, the transistor, the laser, charged-coupled device, Information Theory, C, C++, Unix
- Eight Nobel prize winners

1974 | AT&T was a government sanctioned monopoly.

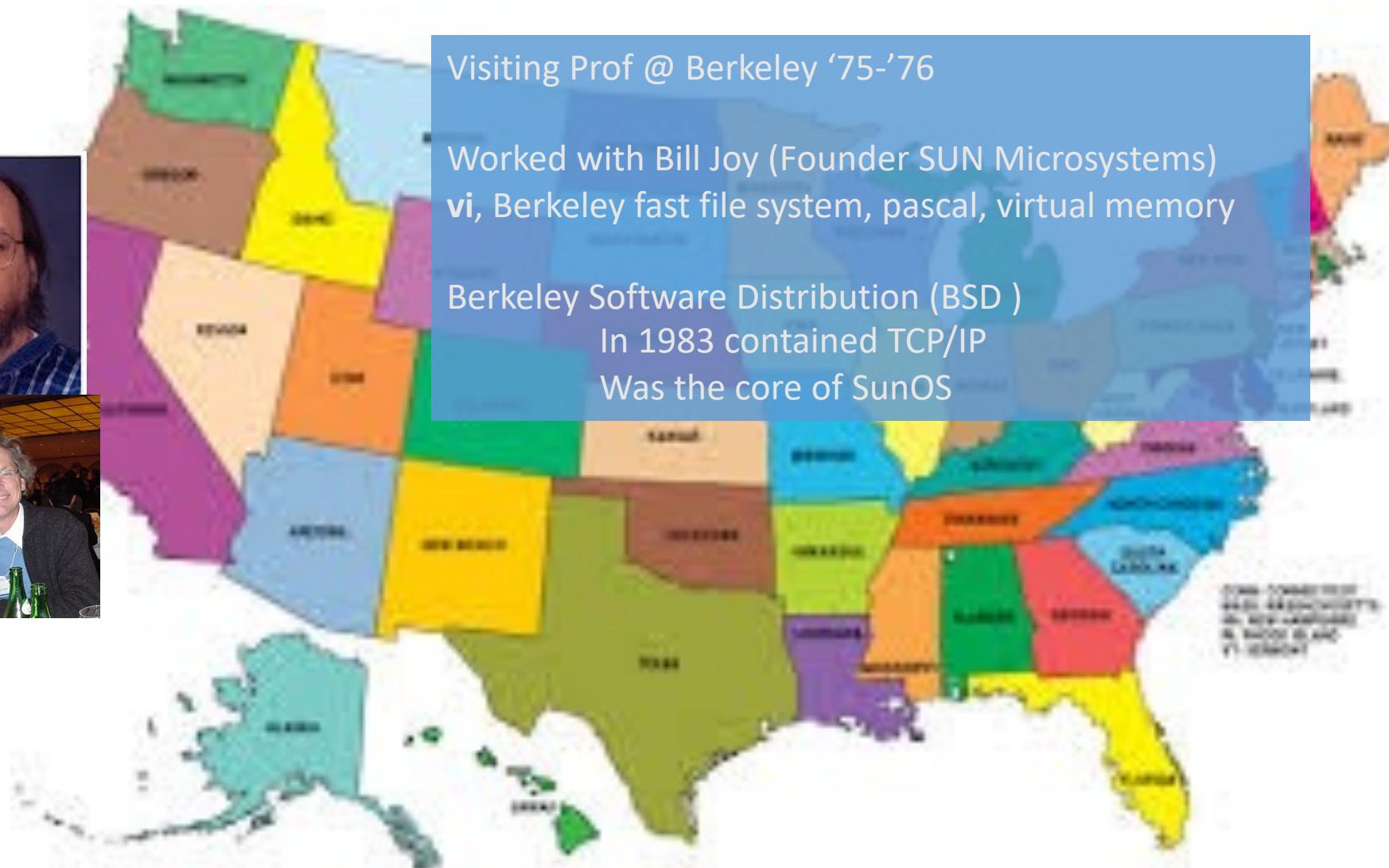
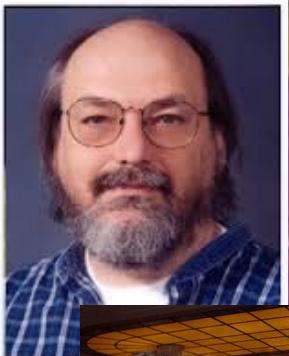
They couldn't sell UNIX so they licensed it away.

1977 | Unix running at 500 cities including 125 universities.

Profs taught for OS and graduates adopted it.



More history: <http://noll.uscannenberg.org/BellLabs.html>



Visiting Prof @ Berkeley '75-'76

Worked with Bill Joy (Founder SUN Microsystems)
vi, Berkeley fast file system, pascal, virtual memory

Berkeley Software Distribution (BSD)

In 1983 contained TCP/IP

Was the core of SunOS

Vi / Vim

- 1976 | Developed by Bill Joy as the visual mode for a line editor (ex) | Vi short for `visual`; `ed` used a series of commands to edit text | Inspired by BRAVO text editor (Xerox PARC)
- 1985 | Because Joy began with `ed`, people outside of AT&T could not use (copyright issues) so they looked for other editors (enter EMACS).
- 1991 | Vim Improved vi.

vi is ex

Command Mode

Copy, Insert, append, move, and delete text.
Enter with `ESC` key.

`Yy, p, gg, G`

Insert Mode

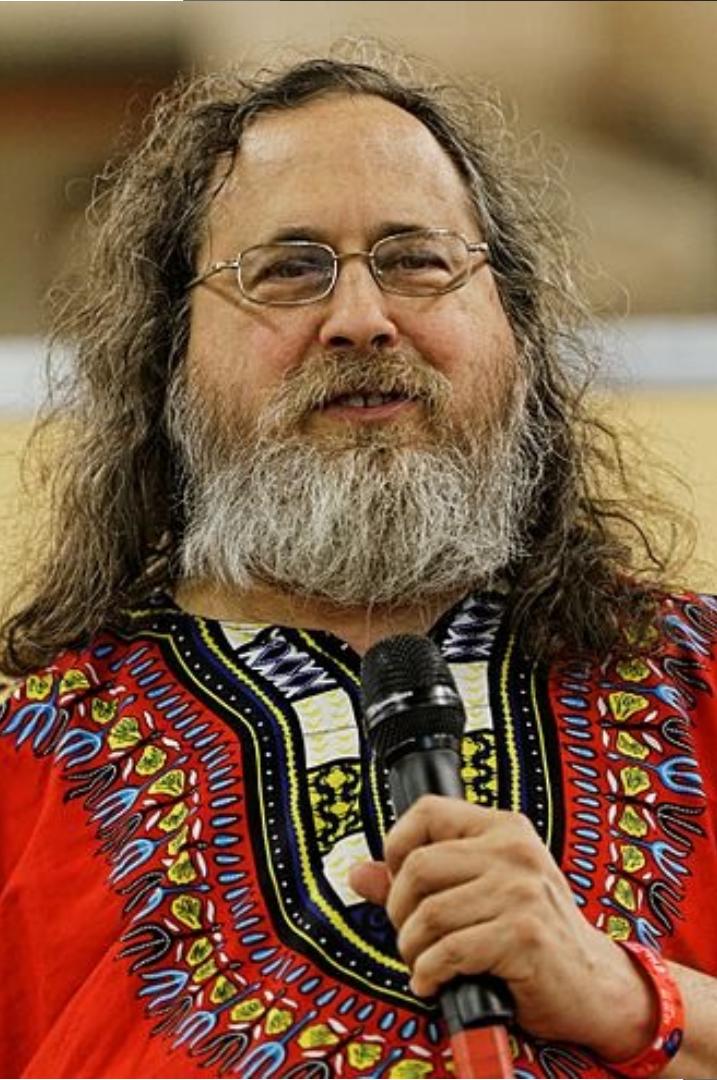
Edit in normal WYSIWYG style.

Last line Mode

Enter with colon `:` Save, exit, search, replace etc.

`:wq :make :!ls`

SUS specifies vi so all UNIX systems must have it.



Emacs and Richard Stallman (rms)

- 1974 | Visited the Stanford AI lab while at the MIT AI Lab.
 - | He saw the *E* editor and liked it because it was WYSIWYG.
- 1975 | He combined it with TECO with a *macro* feature.
 - | Many people added their own macros.

There were so many macros, RMS asked everybody to send him their updates and changes so he could make the whole system better.

- 1984 | Started working on GNU Emacs

- The government broke up AT&T in 1982
 - No monopoly on telephone, they can now market UNIX
- AT&T's UNIX Support Group (USG) developed an implementation
 - System III (1981) — Included named pipes, and a mix of AT&T Unixes.
 - System V (1983) — SVR4, most successful, competed with BSD in usage and technology (sockets vs streams). Still infused with features from BSD
- UNIX was implemented over several different hardware types.
 - Hardware purchasers were no longer locked in

GNU

1984 | Richard Stallman starting creating a free¹ UNIX

Started GNU (**GNU is not UNIX**)

1985 | founded FSF

GPL license

Bash shell, glibc

GCC (gnu c compiler → gnu compiler collection)



General Public License (GPL) → Software licensed must be freely redistributable under GPL. Modifications to and distributions of GPL software must also abide by the license.

¹Free as in liberty, not price

BSD + Linux

1990 | Bill and Lynne Jolitz ported the mature BSD (386BSD)

1993 | NetBSD and FreeBSD development groups

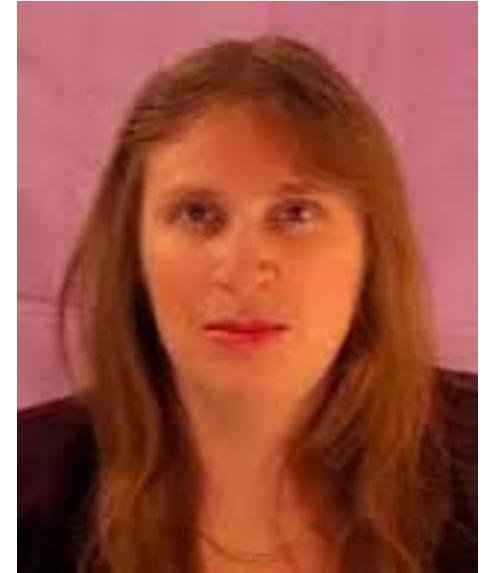
1996 | OpenBSD (performance emphasis)

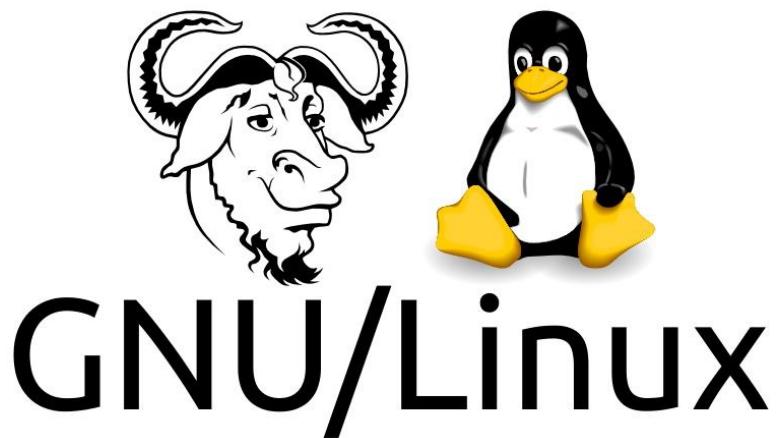
1991 | Linus Torvalds sent a msg inviting people to build an OS

Started with MINIX (by Tanenbaum); still a popular
instructional version

1994 | Linux and a team of people developed 1.0

Now on 4.19 (<https://www.kernel.org/>)





Linux

- “Linux” refers to the kernel developed by Linus Torvalds
 - Stallman prefers GNU/Linux
 - The market opened up to companies who can package Linux. (distributions)
 - Slackware is the oldest then Debian then SUSE and Red Hat.
- 2004 | Ubuntu, based on Debian
- | Close binary compatibility with Debian
 - | Most popular cloud OS
 - | "I am what I am because of who we all are"

Ubuntu Family Tree

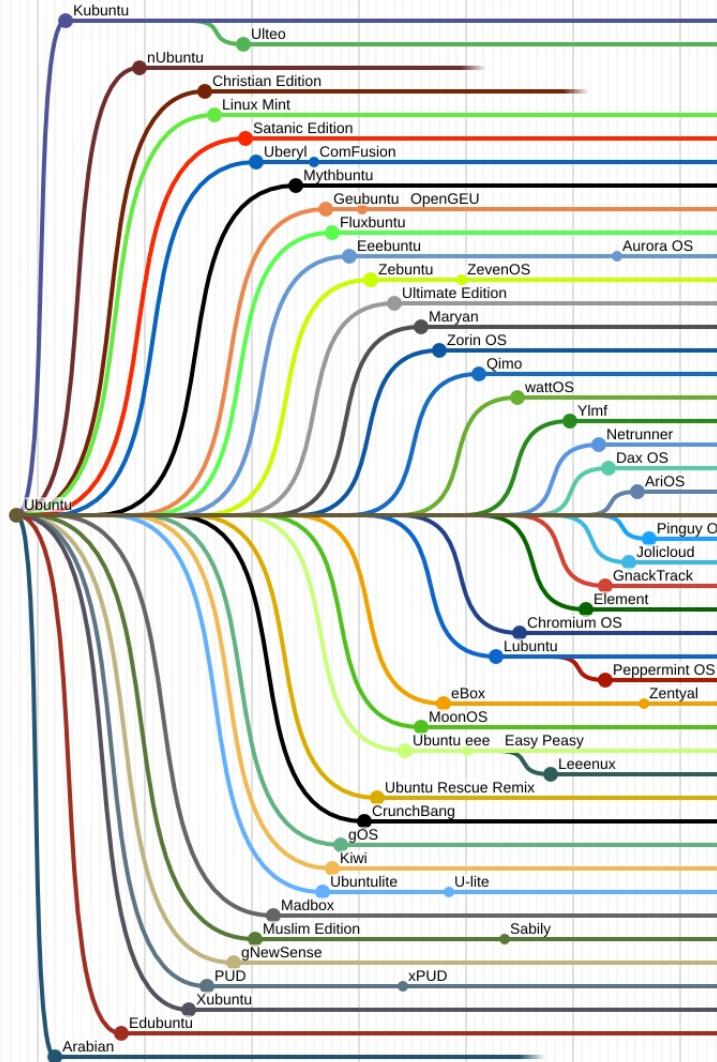
based on GLDT version 11.6

A. Lundqvist, D. Rodic - futurist.se/gldt
Published under the GNU Free Documentation License



- Influence, developer switching
- Rebasin, substantial code flow, project overtaking
- **** Developer & code sharing, project merging

2004 2005 2006 2007 2008 2009 2010 2011



2004 2005 2006 2007 2008 2009 2010 2011

C programming

Ken Thompson worked on the B language (inspired by BCPL).

Dennis Ritchie (also at BellLabs) wrote C.

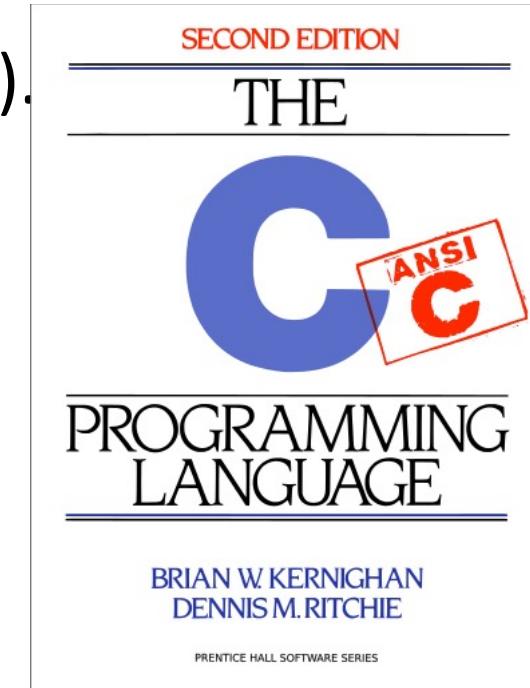
All Unix implementations made a standard for C necessary.

1978 | K & R is a defacto standard

1985 | C++ highlighted improvements

1989 | American National Standards Institute (ANSI) C

C89 -> C99 -> C11 -> C18



POSIX — Portable Operating System Interface (X for UNIX)

- Group of standards developed to promote source code portability
- Describes the interface that will support different files system activities

Single UNIX Specification

The book will specify what under what SUS functions were standardized. Some are non standard and some are legacy.

SUSv1 | 1988

SUSv2 | 1997

SUSv3 | 2001

SUSv4 | 2008

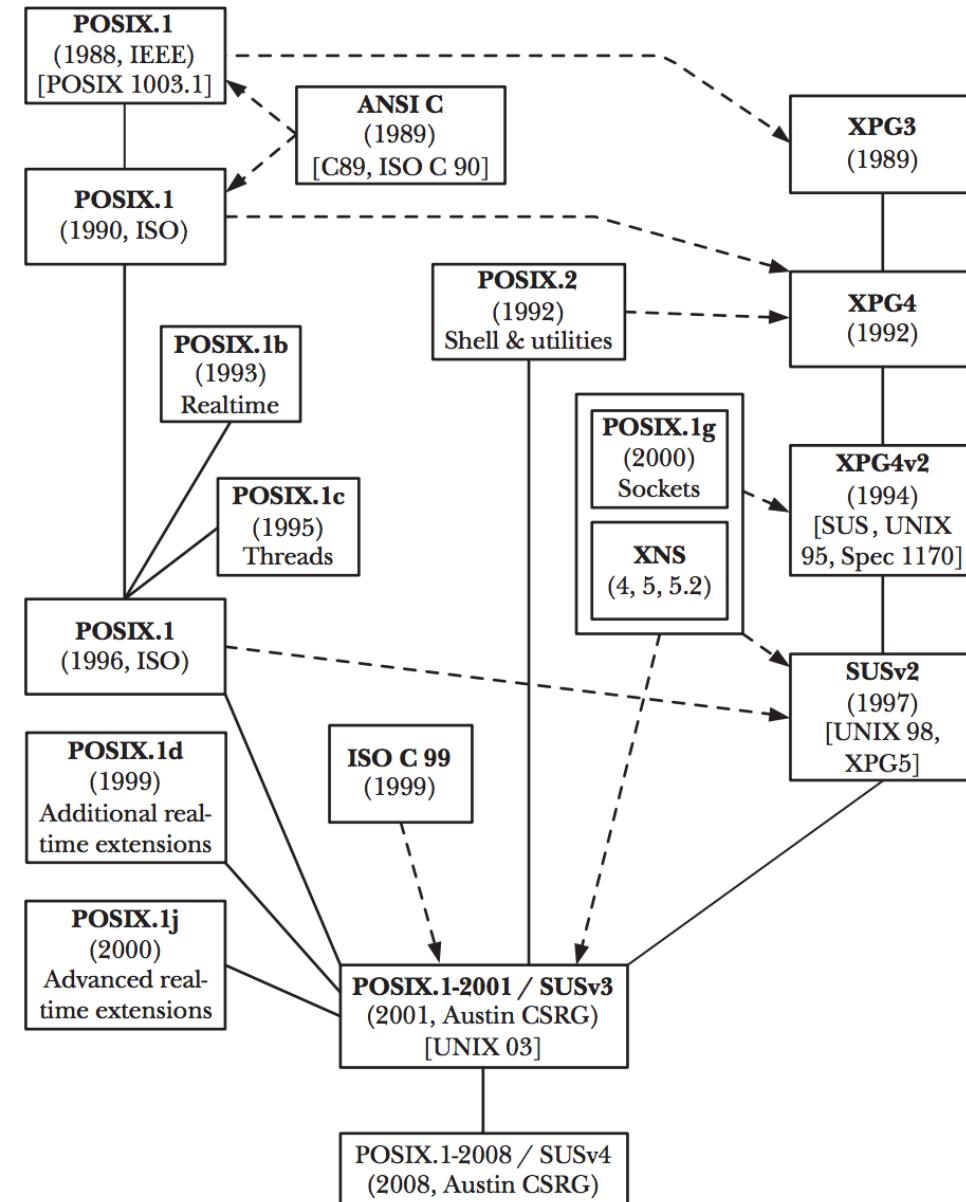
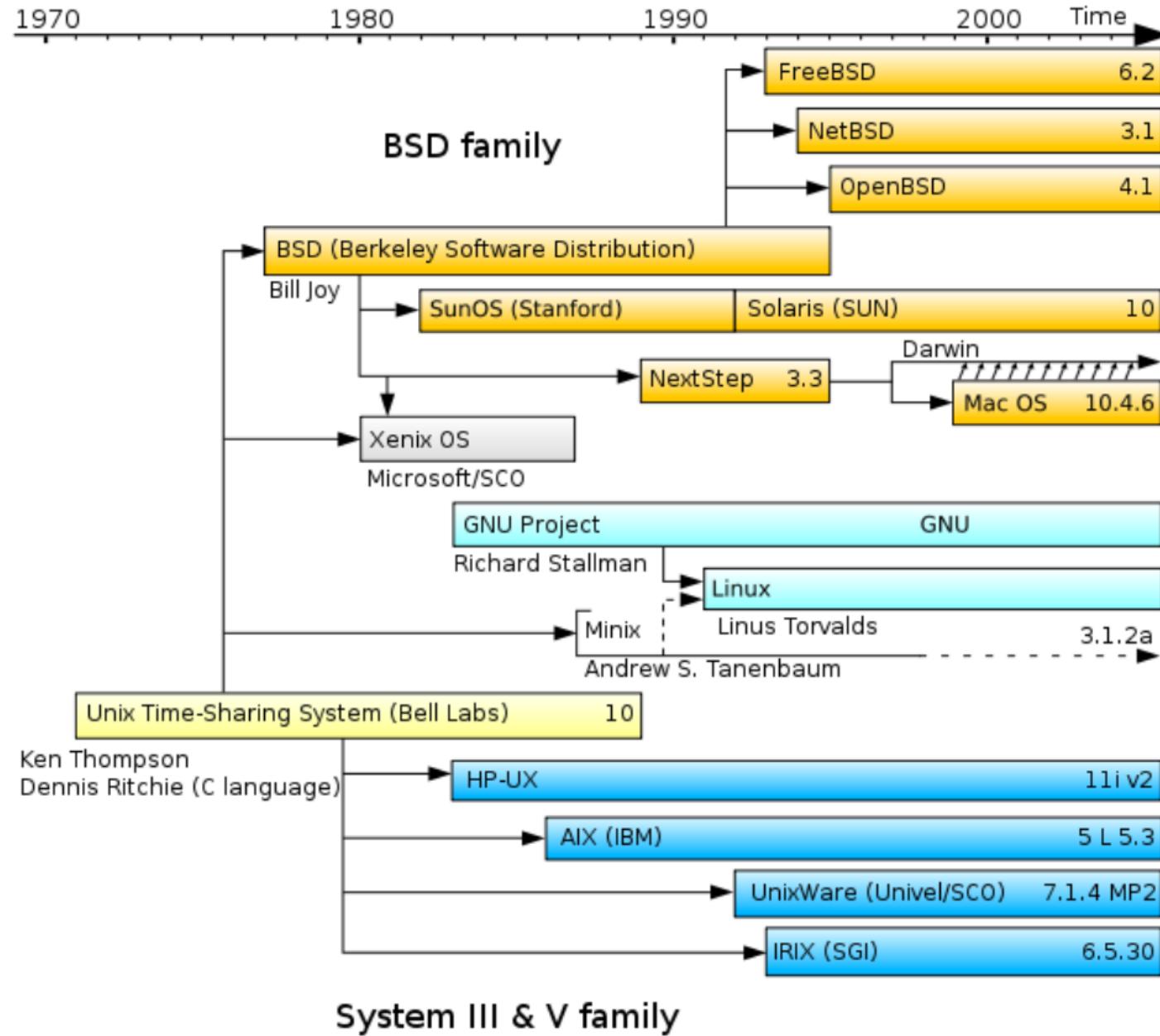
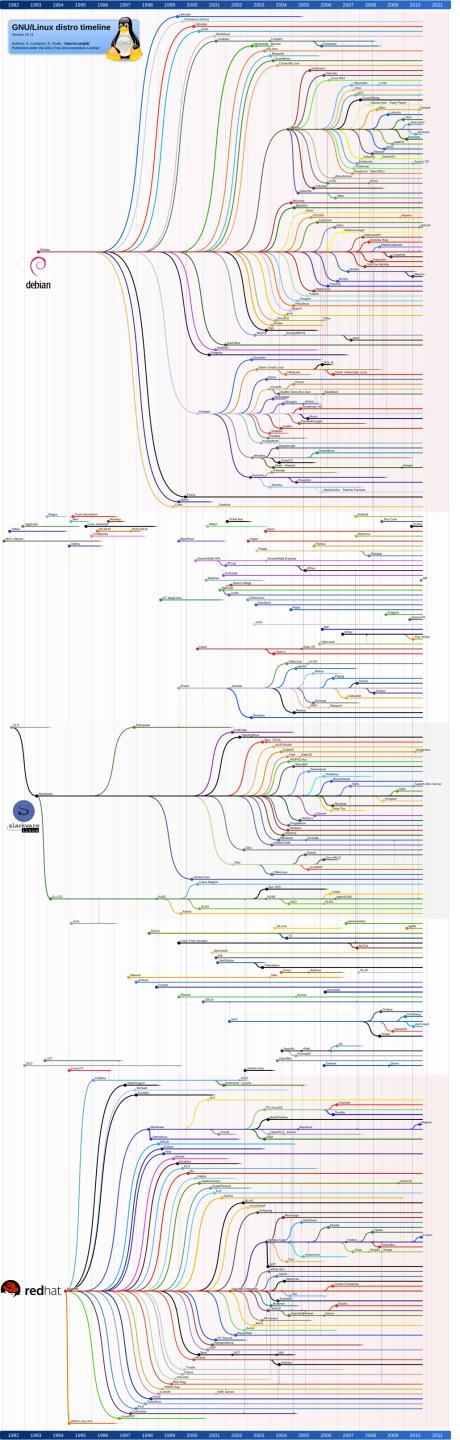


Figure 1-1: Relationships between various UNIX and C standards



System III & V family



Family trees of redhat, Slackware, Debian

Even Linus Torvalds doesn't completely understand the Linux kernel

In a wide-ranging interview at Open Source Summit, Torvalds talked about programmers, Linux, and open-source development.



By [Steven J. Vaughan-Nichols](#) for [Linux and Open Source](#) | September 4, 2018 -- 18:46 GMT (11:46 PDT) | Topic: [Enterprise Software](#)

<https://www.zdnet.com/article/even-linus-torvalds-doesnt-completely-understand-the-linux-kernel/>

More information

A timeline of operating systems

https://en.wikipedia.org/wiki/Timeline_of_operating_systems