System Programming in Linux

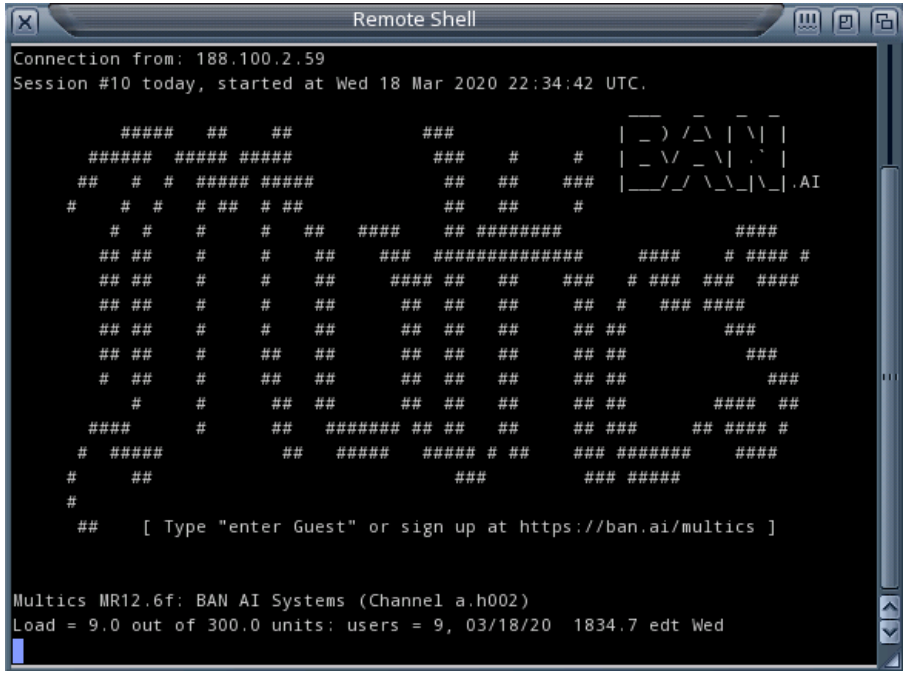
Reda Maher

Linux History

Multics

Multics ("MULTiplexed Information and Computing Service") is an influential early time-sharing operating system based on the concept of a single-level memory.

In 1964, Multics was developed as a cooperative project led by MIT along with General Electric and Bell Labs.



Multics Failure

In 1969, Bell withdrew from the project as it became clear it would not deliver a working system in the short term.

In 1970, GE decided to exit the computer industry entirely and sold the division to Honeywell.

Nathan Gregory writes that “*Multics has influenced all modern operating systems since, from microcomputers to mainframes*”.

Novel Ideas:

- Dynamic linking.
- Hierarchical file system.
- Single-level store for data access.
- ...

Bell Labs

In 1880, when the French government awarded Alexander Graham Bell the Volta Prize of 50,000 francs for the invention of the telephone. He used the award to fund the Volta Laboratory ("Alexander Graham Bell Laboratory").

In 1889, *American Telephone & Telegraph Company (AT&T)* and its own subsidiary company took control of American Bell and the Bell System.

Innovations at Bell labs:

- Transistor.
- Laser.
- Information theory.
- C, C++, AWK, and others.
- Unix.

Nine Nobel Prizes have been awarded for work completed at Bell Laboratories.

Unix Creation

Ken Thompson and Dennis Ritchie developed Unix in Bell Labs on DEC PDP-7 machine.

DEC PDP-7

The PDP-7 was an 18-bit minicomputer produced by Digital Equipment Corporation (DEC) as part of the PDP series (1965).

Price: US$72,000 (equivalent to $668,604 in 2022).

Weight: 500 KG.

Memory: 4K words (9.2 KB).

Display: Printer.

Input: Keyboard.

Unix First Version

Ken Thompson wrote UNIX in 3 weeks in his wife vacation ☺.

He wrote:

- Editor.
- Assembler.
- Kernel.

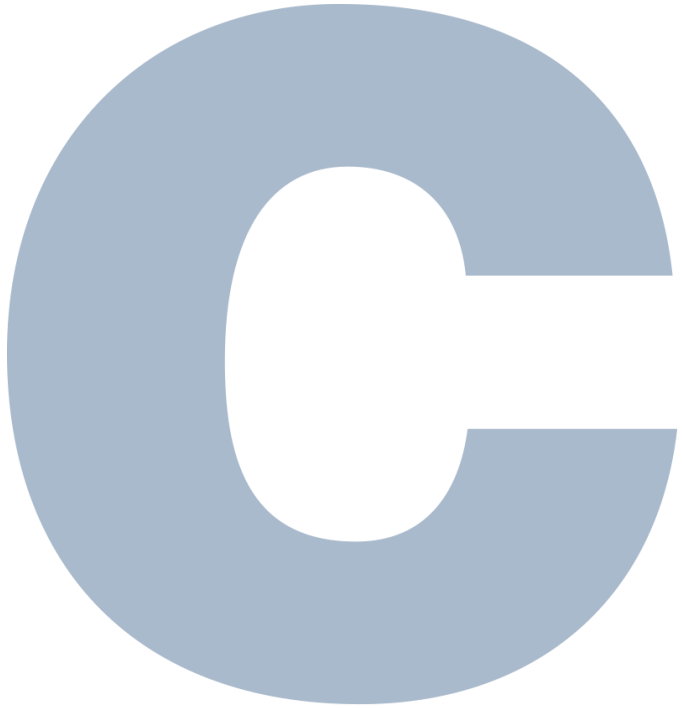
Rewriting Unix on PDP-11

As UNIX was written in assembly, Ken Thompson needs to rewrite it again on the PDP-11.

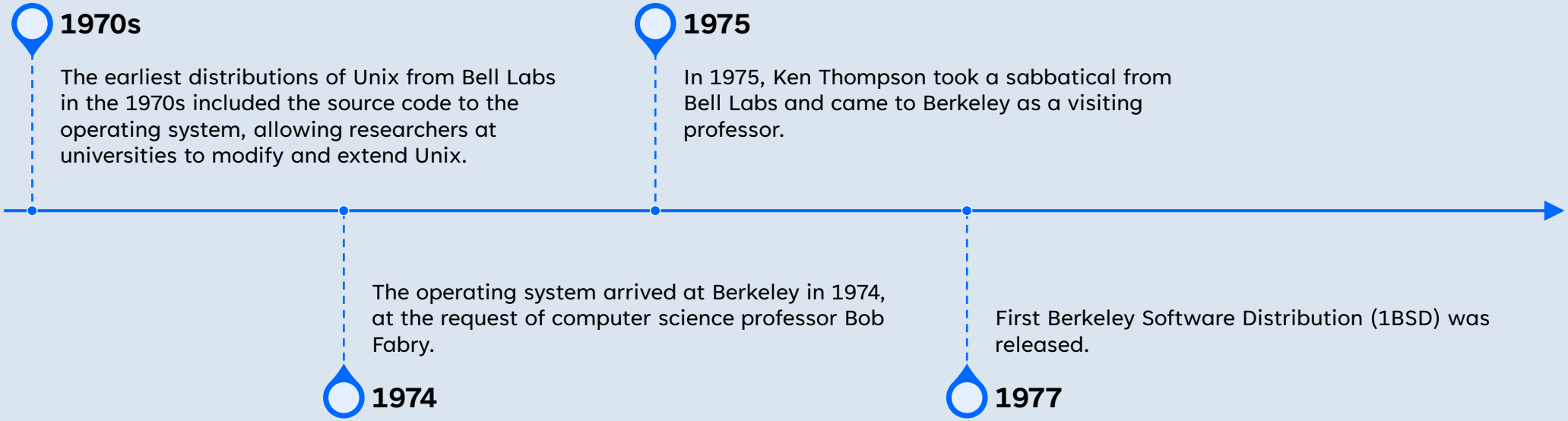
Inventing C language

Dennis Ritchie developed C language as a successor to B language (created by Ken Thompson).

Then, Unix was ported to the C language.



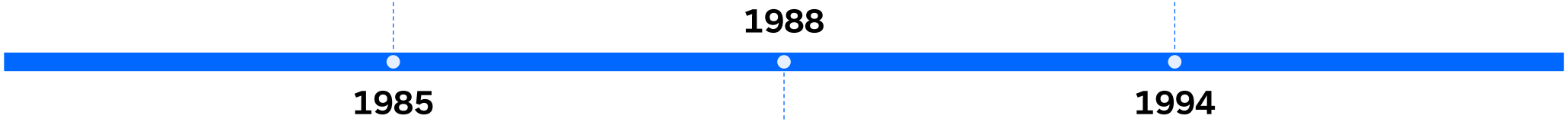
Unix in UC Berkeley



Unix standardization efforts

In 1985, AT&T published *System V Interface Definition (SVID)*, a specification of UNIX System V programming interfaces.

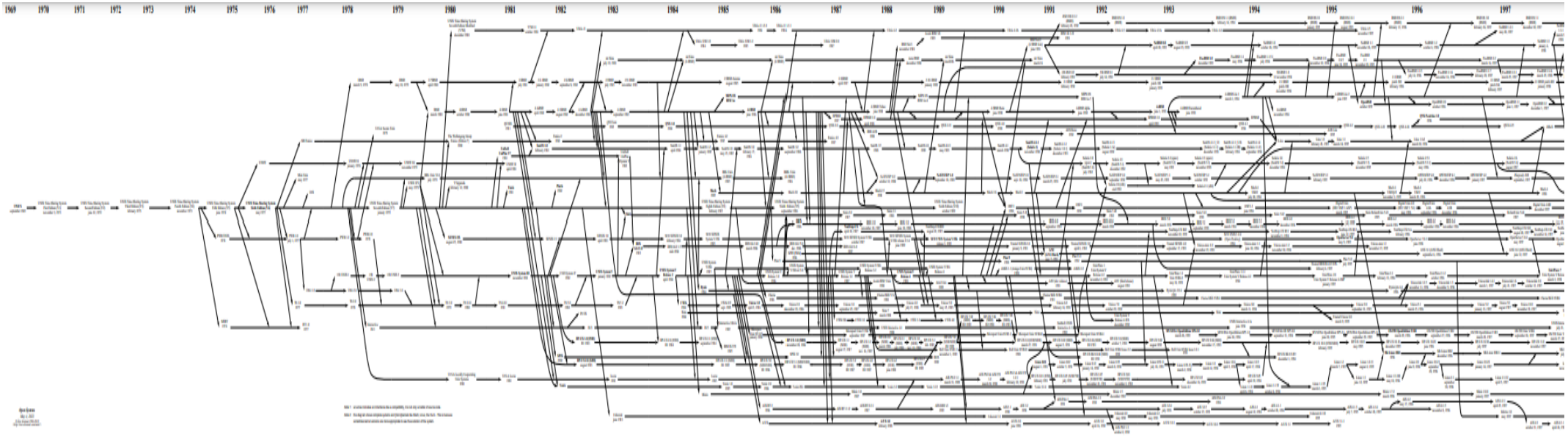
In 1994, the *Single UNIX Specification (SUS)* was made and then compliance with which is required to qualify for using the "UNIX" trademark.



In 1988, standardization efforts resulted in IEEE 1003 or POSIX.1-1988, which loosely stands for *Portable Operating System Interface*.

Unix Evolution

https://www.levenez.com/unix/



GNU

The GNU Project is a free software, mass collaboration project announced by *Richard Stallman* on September 27, 1983.

A recursive acronym meaning ***"GNU's not Unix!"***

The GNU General Public License (GNU GPL or simply GPL) is a series of widely used free software licenses that guarantee end users the four freedoms on the software:

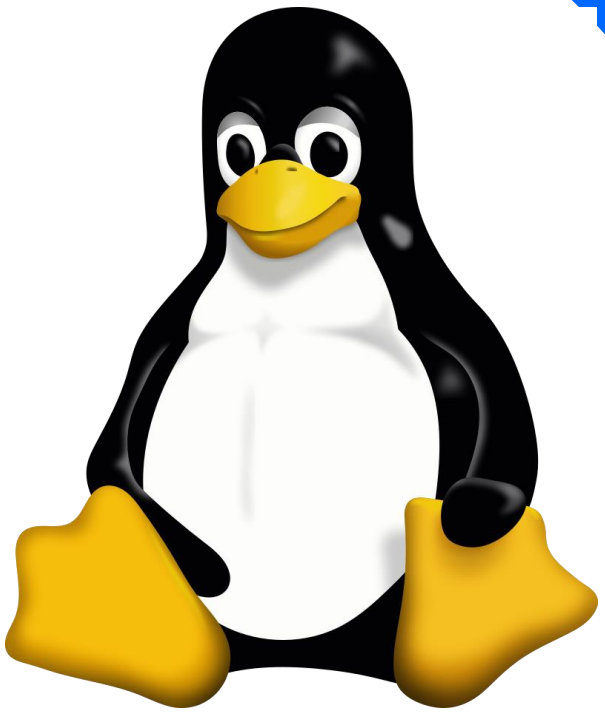
- Run.
- Study.
- Share.
- Modify.

The Creation of Linux

Surrounding conditions:

- Hardware evolved and Intel created X86.
- Internet evolved and mailing lists were popular.
- In 1987, MINIX, a Unix-like system intended for academic use, was released by Andrew S. Tanenbaum.

Linus Torvalds wrote the first kernel version in 1991.



The Creation of Linux

Hello everybody out there using minix -

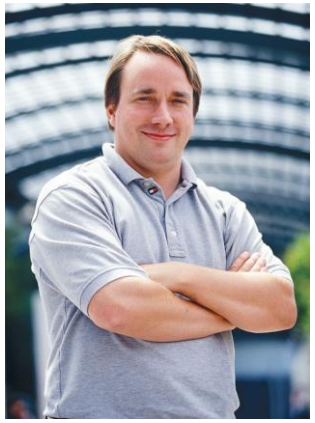
I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat (same physical layout of the file-system (due to practical reasons) among other things).

I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)

Linus (torvalds@kruuna.helsinki.fi)

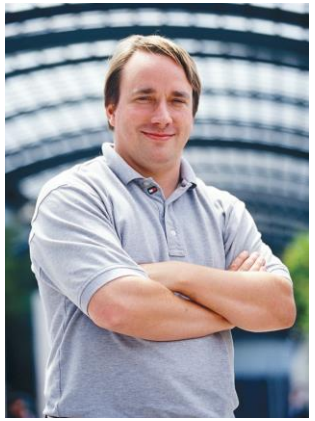
PS. Yes - it's free of any minix code, and it has a multi-threaded fs. It is NOT portable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

—Linus Torvalds[18]



The Creation of Linux

Do you pine for the nice days of Minix-1.1, when men were men and wrote their own device drivers? Are you without a nice project and just dying to cut your teeth on a OS you can try to modify for your needs? Are you finding it frustrating when everything works on Minix? No more all-nighters to get a nifty program working? Then this post might be just for you. As I mentioned a month ago, I'm working on a free version of a Minix-look-alike for AT-386 computers. It has finally reached the stage where it's even usable (though may not be depending on what you want), and I am willing to put out the sources for wider distribution. It is just version 0.02 . . . but I've successfully run bash, gcc, gnu-make, gnu-sed, compress, etc. under it.



Linux Statistics

47% of professional developers use Linux-based operating systems. (Statista)

Linux powers 39.2% of websites whose operating system is known. (W3Techs)

Linux powers 85% of smartphones. (Hayden James)

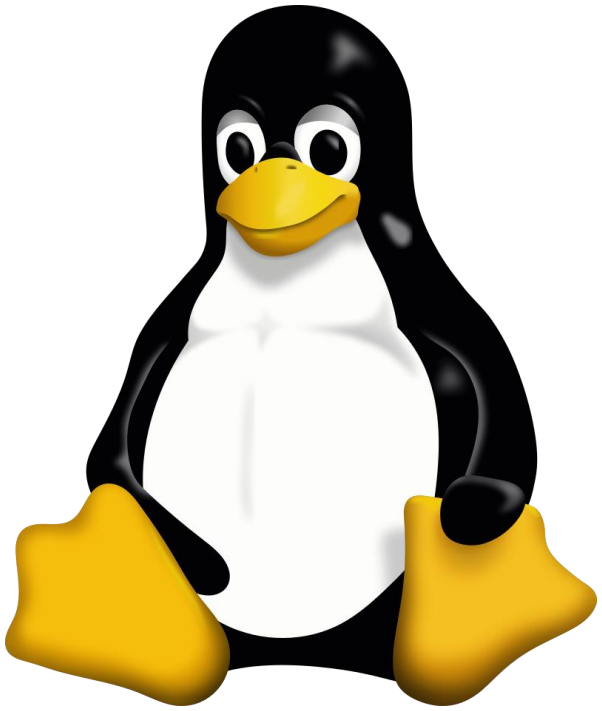
Linux, the third most popular desktop OS, has a market share of 2.09%. (Statista)

The Linux market size worldwide will reach $15.64 billion by 2027. (Fortune Business Insights)

The world’s top 500 fastest supercomputers all run on Linux. (Blackdown)

96.3% of the top one million web servers are running Linux. (ZDNet)

Today, there are over 600 active Linux distros. (Tecmint)



Thank you

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