Welcome to the History of Unix Spotlight Talk!

► If there are any technical problems, let me know!

What is Unix?
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The Early Days
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Standards
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A Short History of Unix

Nicolas König

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What is Unix?   The Early Days   The Unix War   Standards   Conclusions

What is Unix?

What is Unix?

What is Unix?   The Early Days   The Unix War   Standards   Conclusions

What is Unix?

The Definition

A system can call itself Unix if it conforms to the Single Unix Specification maintained by The Open Group.

Difference between Unix and Linux

Unix is an interface description, Linux is an OS

- ▶ Linux's syscall interface doesn't provide all the required functions
- ▶ Also, to be complient, many more things have to be provided
  - ▶ header files
  - ▶ struct definitions
  - ▶ even shell & command line utilities
- ▶ More on that later

Current Unixs

▶ MacOS
▶ AIX
▶ Only one Linux distributions (EulerOS)!
  ▶ All of them still adhere to the standards very closely

What is Unix?
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The Early Days

The Early Days

Nicolas König

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Context for the creation

Bell Labs

- ▶ Part of telephone-monopoly company AT&T
- ▶ very "free" research culture
    - ▶ The choice of research topic was largely decided by the researchers
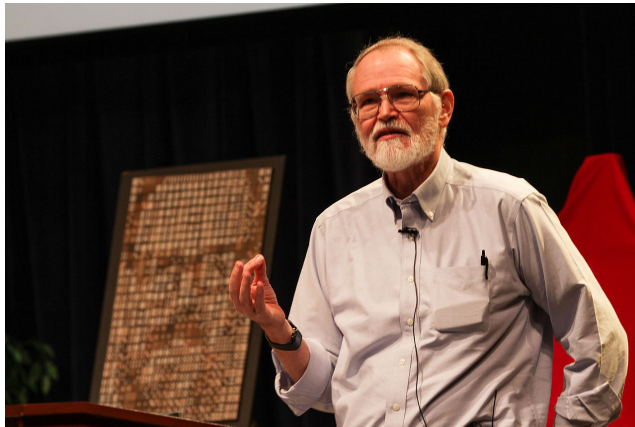- ▶ 9 Nobel price winners!

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Context for the creation

Multics

▶ "MULTiplexed Information and Computing Service"
▶ Collaboration between Bell Labs, General Electric and the MIT
▶ Successor to MIT's Compatible Time Sharing System (CTSS)

Thompson, Kerningham, Ritchi

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Context for the creation

Thompson, Kerningham, Ritchi

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Context for the creation

The PDP-7

- 8K 18-bit words memory
- ca. 570 kHz
- Produced by the Digital Equipment Cooperation (DEC)

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Context for the creation

The PDP-7

A restored PDP-7

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The First Unix

A Game

First, there was a Game

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The First Unix

An IO-Scheduler

Then, an IO-Scheduler

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The First Unix

An Operating System

"At some Point I realized I was just three weeks away from an operating system."

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The First Unix

The Unix Philosophy

Make each program do one thing well

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The First Unix

The Unix Philosophy

If you only have this little memory, you can't make your programs complex!
It turned out, that this is a good idea in general

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Released Unix Versions

The First Edition

Released in Nov. 1971
- ▶ Supported the PDP-11
- ▶ relatively feature-rich
- ▶ already included a Fortran compiler

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Released Unix Versions

Common Utilities

▶ A lot of commonly known utilities already included in the first release

    ▶ `cd`, `chown`, `ls`, `cp`, `dc`, `ln`, `su`, `who`, ...

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The Third Edition

Released in Feb. 1973

- ▶ Included a C compiler
- ▶ Included first implementation of pipes

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Released Unix Versions

The C Programming Language

- ► Heavily influenced by BCPL
- ► Designed as a system programming language
- ► The language still looked slightly different
  - ► The Dialect is known as K&R-C
- ► Publicised in the book "The C Programming Language" by Kerningham & Ritchi

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Released Unix Versions

The C Programming Language

```
foo(a, b)
    int a;
    int *b;
{
    return a + *b;
}
```

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Released Unix Versions

Fourth Edition

Released in Nov. 1973

- ▶ The first edition almost completely written in C
  - ▶ Made portability possible
- ▶ Typically licensed with source code (and for a nominal fee)

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Released Unix Versions

Seventh Edition

Released in Jan. 1979

- ▶ Many new tools still in use today
    - ▶ `awk`, `make`, `sed`, `tar`
- ▶ Included the first version of the Bourne Shell (`sh`)
- ▶ Included a fully featured Fortran77 Compiler

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Released Unix Versions

A story of overwhelming success

The number of installed Systems rapidly increased

▶ 2. Edition (Jun. 1972): 10 systems inside AT&T

▶ 5. Edition (Jun. 1974): 50 systems inside AT&T

By 1977, it was running on 500 sites, including 125 Universities

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The Unix War

The Unix War

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The two large competitors

Berkley Software Distribution (BSD)

▶ Thompson was a visiting Professor at UCal in the year 1975/1976

There, many new tools and features where developed

▶ the editor `vi`

▶ `sendmail`

▶ a Pascal Compiler

Then, with 3BSD (1979), a full Unix distribution was released

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The two large competitors

BSD

They also wrote a port to DEC's new VAX architecture

▶ Added support for Virtual memory

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The two large competitors

4.2BSD

Released in 1983

► Added sockets and a complete TCP/IP-stack

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The two large competitors

System V

In 1982, antitrust legislation forces AT&T to break up
- ▶ Lifts the ban on selling software

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The two large competitors

System V

AT&T immideatly proceeded to bundle Unix for commercial use and released
System V in 1983

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The two large competitors

System V Release 1 (SVR1)

▶ Added an extensive interprocess communication API
▶ Also included many features from BSD
    ▶ `curses`
    ▶ `vi`

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The two large competitors

Derivatives of the Two

There where many derivatives by different companies.
For BSD:

▶ SunOS

▶ Xenix

and for System V:

▶ HP-UX

▶ AIX

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The two large competitors

Derivatives

A Short History of Unix

Nicolas König
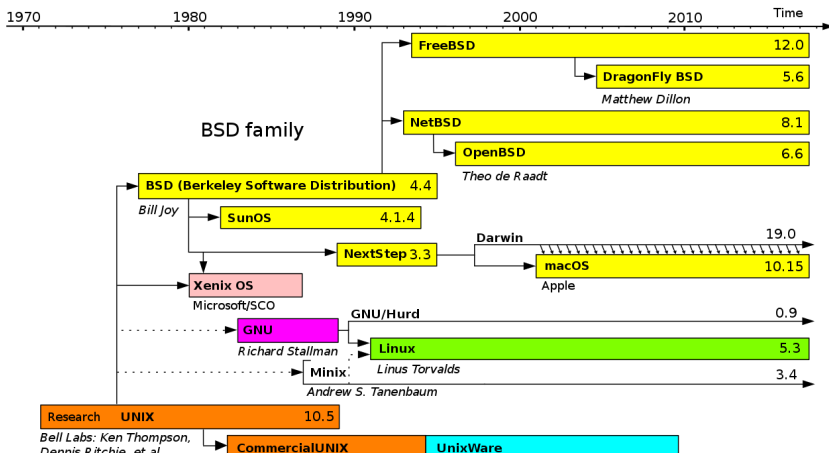
System V Release 4 (SVR4)

- ▶ The most successful release of System V
- ▶ Result of a unification drive between several Unix vendors
- ▶ Added a lot of features from all over the Unix world
  - ▶ `ksh`
  - ▶ ELF file format
  - ▶ TCP/IP-support

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The two large competitors

X/Open

The drive for unification was formalized in the formation of the X/Open consortium

- ▶ It was supposed to provide compatibility guides and standards
- ▶ Would later go on to acquire the rights to the Unix name

BSD, out of fear over the influence of AT&T & Sun, founded its own alternative, the Open Software Foundation.

- ▶ AT&T then founded, as an answer, Unix International.

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The two large competitors

Differences

There were huge differences between these two distributions
Both technical

▶ System V `STREAM` (introduced with SRV3) vs. Berkley `socket`

and culturally

▶ "long-haired Berkley" vs. "short-haired AT&T"

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Differences

The differences between the two are still found all throughout UNIX!

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The two large competitors

Differences

From bigger

▶ System V used `/usr/bin` and `/usr/sbin`, Berkley `/bin` and `/sbin`

to smaller things

▶ The `ps` command takes two kinds of arguments

  ▶ `ps aux`: BSD-style arguments
  ▶ `ps -eL`: System V style

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1-800-ITS-UNIX

Berkley System Distribution, inc. (BSDi) was formed 1991

- ▶ immediately sued by AT&T (1992)
  - ▶ Usage of the Unix trademark
  - ▶ Illegal distribution of AT&T source code
- ▶ Settled out of court in favor of BSDi (1994)

Standards

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Early Standardisation

The ANSI-C Standard

- ▶ drive for standardization started in the early 1980s
- ▶ Many new features added
  - ▶ `void`, function prototypes, type qualifiers,. . .

Finally released by ANSI as X3.159-1989, it usually called ANSI-C or C89

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Early Standardisation

Posix.1

- ▶ "Portable Operating System Interface" + -x for Unix
- ▶ standardizes the interface C programs use to interact with the OS
- ▶ can be implemented by any OS!
- ▶ Standadized by ISO/IEC 9945-1:1990

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Early Standardisation

Posix.1b/c

There where two important extensions for the standard

▶ Posix.1b
  realtime extensions
▶ Posix.1c
  posix threads

Eventually leading to ISO/IEC 9945-1:1996, a revised version of Posix.1

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Early Standardisation

The Open Group

- ▶ Formed in 1996 from a merger between X/Open and the Open Software Foundation
- ▶ Inherited the rights to the Unix name from X/Open
- ▶ Continued X/Opens standarization

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Early Standardisation

X/Open Portability Guide

X/Open (and later The Open Group) released portability guides (XPG)

- ▶ based upon Posix and typical practices
- ▶ The guides where later renamed to "Single Unix Specification" (SUS)
- ▶ XPG4 and XPG5 (later SUSv1 and SUSv2) where the two most influential standards
    - ▶ Conformance required to call something Unix!

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Early Standardisation

Posix.1-2001/SUSv3

in 1999, The Open Group and the ISO/IEC Joint Technical Committee 1
collaborated on a new standard

► Meant to unify SUSv2 and Posix
► Eventually resulted in Posix.1-2001 / ISO/IEC 9945:2002 / SUSv3
  ► most commonly referred to as SUSv3
► 3700 Pages!

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Early Standardisation

Posix.1-2001/SUSv3

Split in four part

▶ Base Definition
Concepts, Definitions, Contents of headers

▶ System Interfaces
Specification of various functions (1123 in total)

▶ Shell and Utilities
Specifies the shell and utilities (160)

▶ Rational
Contains explanations and justifications

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Early Standardisation

Posix.1-2008 / SUSv4

- ▶ The newest standard
- ▶ Not many changes relative to the previous standard

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Weird Features

A few weird features of earlier distributions made it into the standards

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Weird Features

gets()

```
char *gets(char *);
```

Reads a line from stdin.

▶ No way to tell gets the length of the buffer!

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Weird Features

hsearch()

```
#include <search.h>

int hcreate(size_t nel);
// The two available actions are FIND and ENTER
ENTRY *hsearch(ENTRY item, ACTION action);
void hdestroy(void);
```

Does anyone notice something weird?

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Weird Features

insque()

```
#include <search.h>

void insque(void *elem, void *prev);
void remque(void *elem);
```

These functions require you to pass in structs with a certain layout!

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Weird Features

Prefixed struct fields

```
struct addrinfo {
            int             ai_flags;
            int             ai_family;
            /* ... */
            struct addrinfo *ai_next;
        };
```

Why are the fields in these structs prefixed?

▶ K&R-C just threw struct fields in the global namespace!

Shared Memory

There are two (incompatible) shared memory implementations!

▶ System V-style: `shmget`
▶ Posix Style: `shm_open`

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We know know both what Unix is and where it comes from

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Thank you for listening! Any questions?