

COMMAND LINE

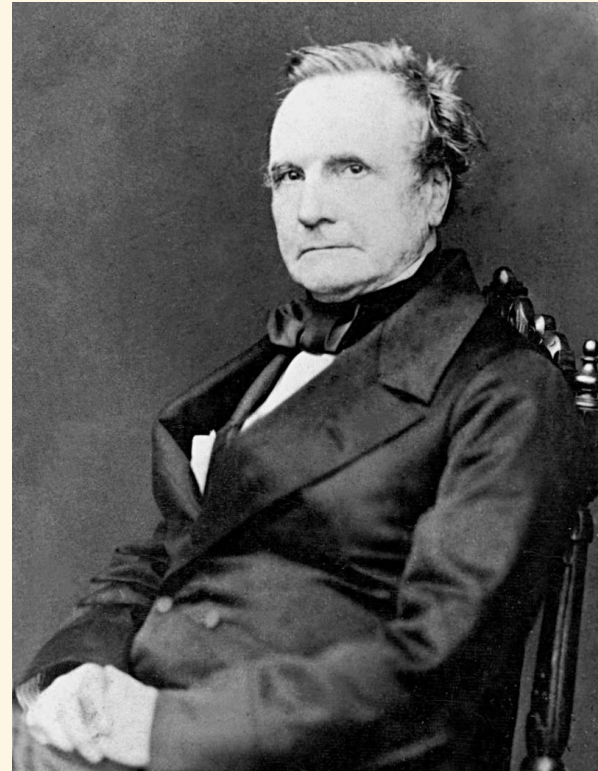
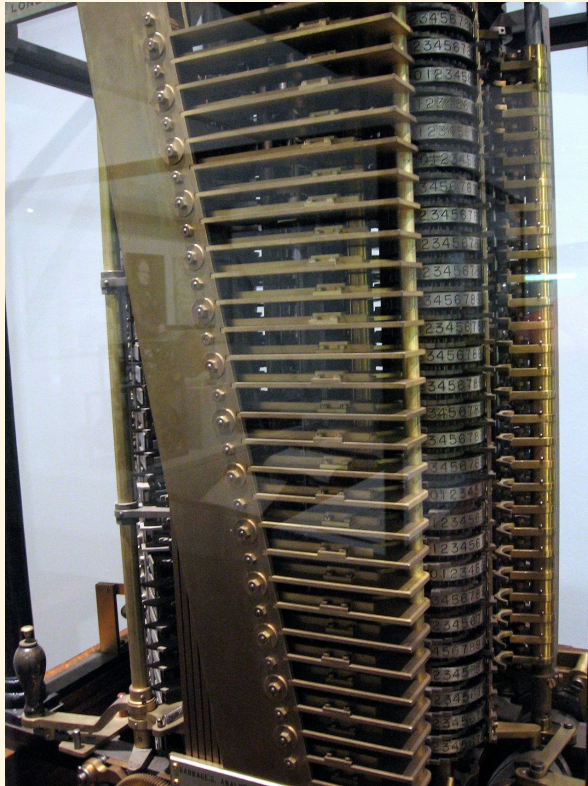
Architecture & Deployment

A SHORT HISTORY OF COMPUTERS & COMPUTER INTERFACES

For old time's sake.

THE FIRST GENERAL-PURPOSE COMPUTER (1837)

The Analytical Engine, proposed by Charles Babbage



Speaker notes

Charles Babbage, an English mathematician, proposed the mechanical [Analytical Engine](#): the first [digital programmable, general-purpose computer](#).

THE FIRST PROGRAMMER (1842)

Ada Lovelace publishes the first algorithm

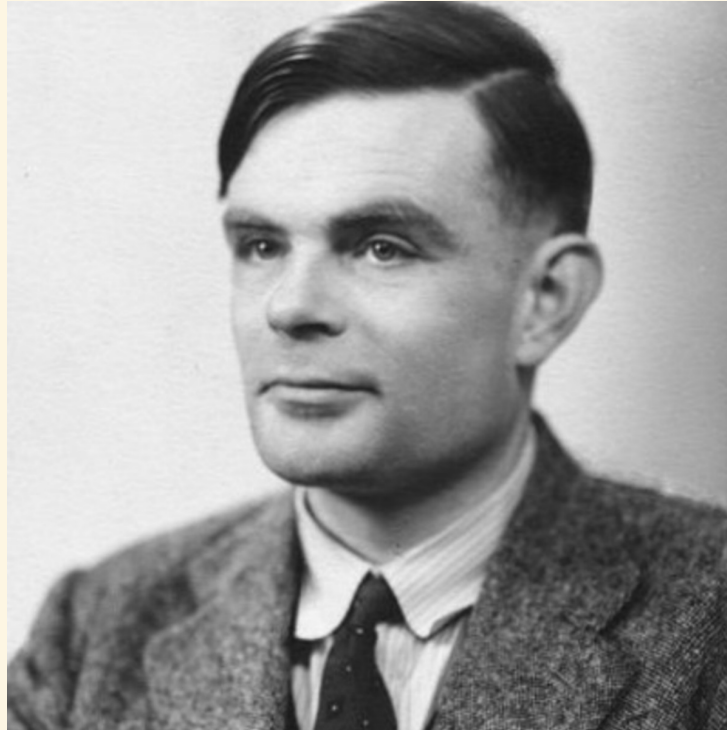


Speaker notes

In 1842, [Ada Lovelace](#) translated into English and extensively annotated a description of the engine, including a way to calculate [Bernoulli numbers](#) using the machine (widely considered to be the [first complete computer program](#)). She has been described as the first computer programmer.

A CENTURY LATER (1940S)

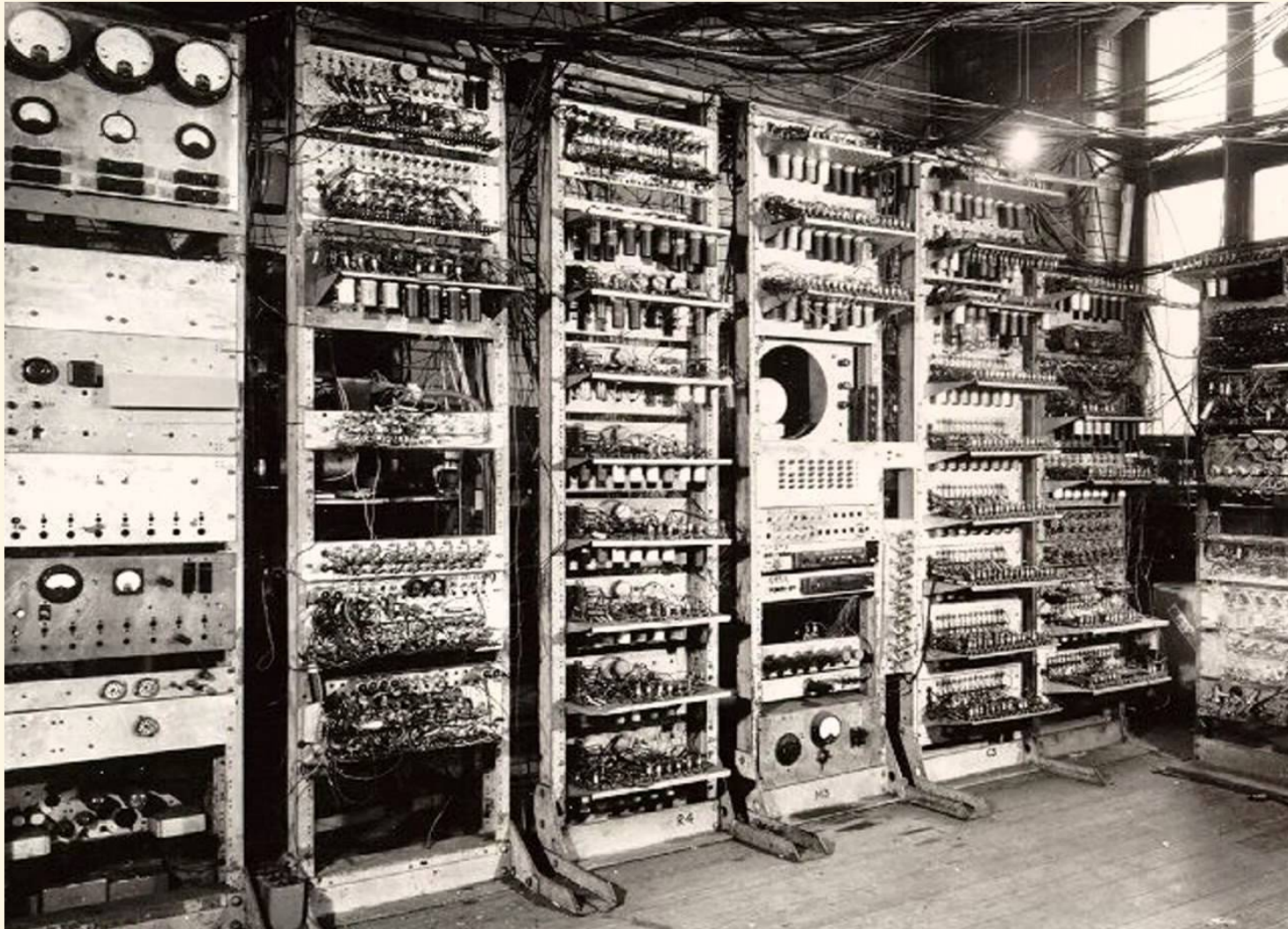
Alan Turing formalizes algorithms and computation



Did you see [The Imitation Game](#)?

Alan Turing formalized the concepts of [algorithm](#) and [computation](#) with the [Turing machine](#). He is widely considered to be the father of theoretical [computer science](#) and [artificial intelligence](#).

ENIAC (1946)



Speaker notes

At that time, there was no such thing as a stored computer program. Programs were **physically hard-coded**. On the **ENIAC**, this was done using function tables with **hundreds of ten-way switches**, which took weeks.

THE FIRST BUG THAT WAS CAUGHT (1947)

92

9/9

0800 Antan started
 1000 " stopped - antan ✓
 1300 (032) MP-MC 1.58217000
 (033) PRO 2 2.130476415
 conv 2.130676415

{ 1.2700 9.037847025
 9.037846895 conv
 4.615925059(-2)

Relays 6-2 in 033 failed special speed test
 in relay " 10,000 test.

Relay
 2145
 Relay 3370

Relays changed
 1700 Started Cosine Tape (Sine check)
 1525 Started Multi-Adder Test.

1545 Relay #70 Panel F
 (moth) in relay.



First actual case of bug being found.
 1630 Antan started.
 1700 closed down.

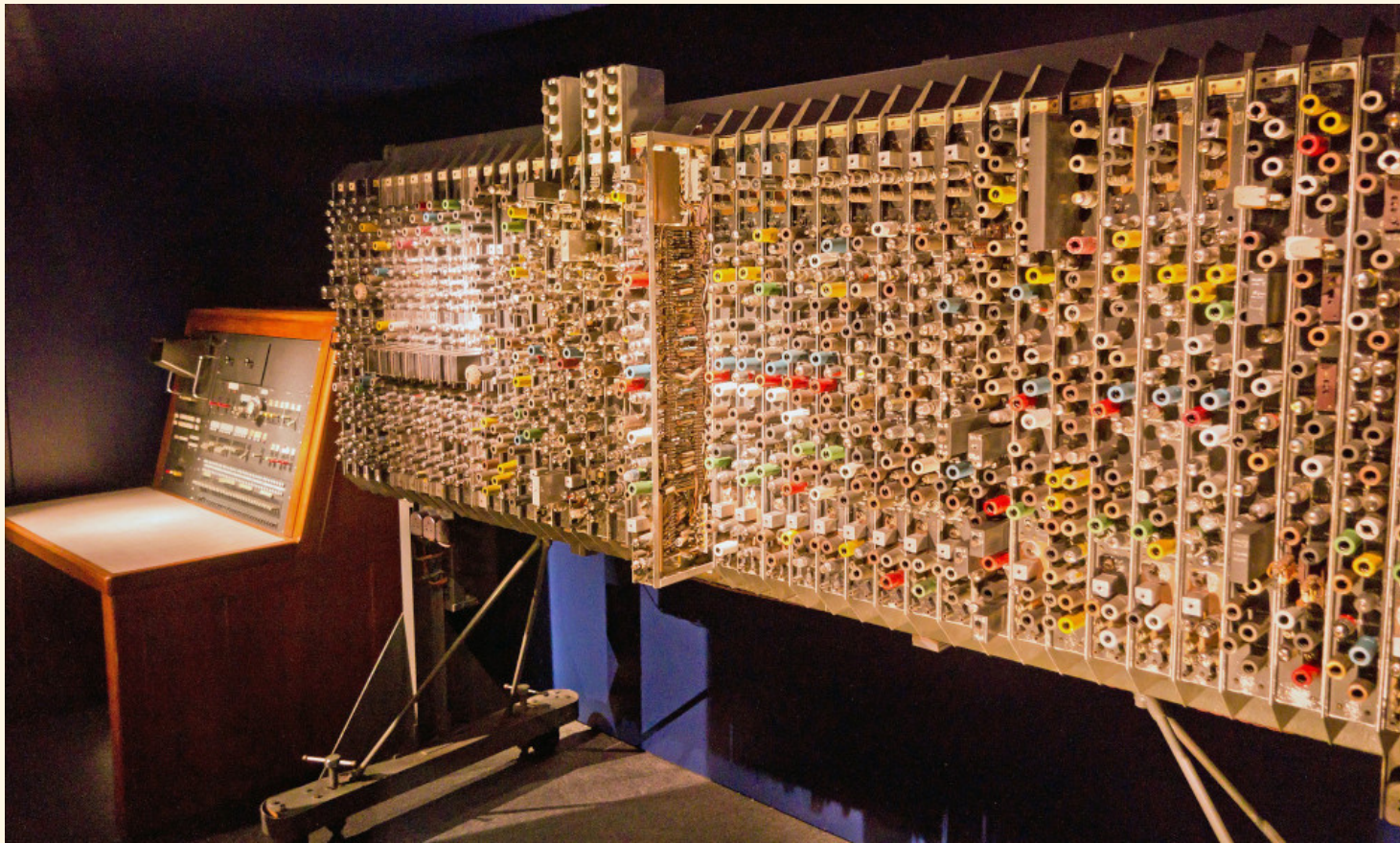
Speaker notes

Computers like these are [electro-mechanical computers](#) because they were based on switches and relays, as opposed to the [transistors](#) our current electronic computers are based on.

When you had a bug in one of these computers, *debugging* meant getting your hands dirty and finding the [actual bug](#) in the physical machine.

STORED COMPUTER PROGRAMS (1950S)

The Automated Computing Engine, designed by Alan Turing



Speaker notes

The [Automatic Computing Engine \(ACE\)](#) was a British early electronic serial [stored-program computer](#) designed by [Alan Turing](#). It used [mercury delay lines](#) for its main memory.

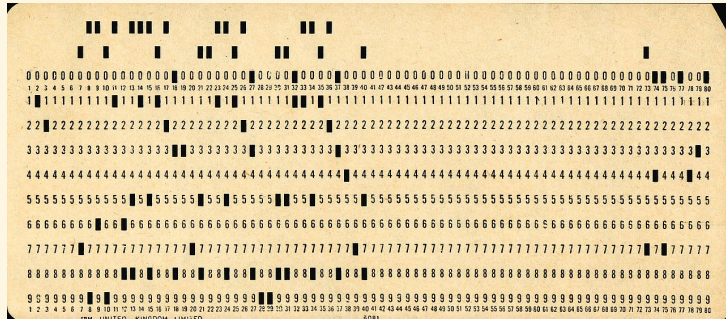
MERCURY DELAY LINE MEMORY (1950S)

Better not spill it...



PUNCHED CARDS (1950S)

One of the first user interfaces



Invented in 1725



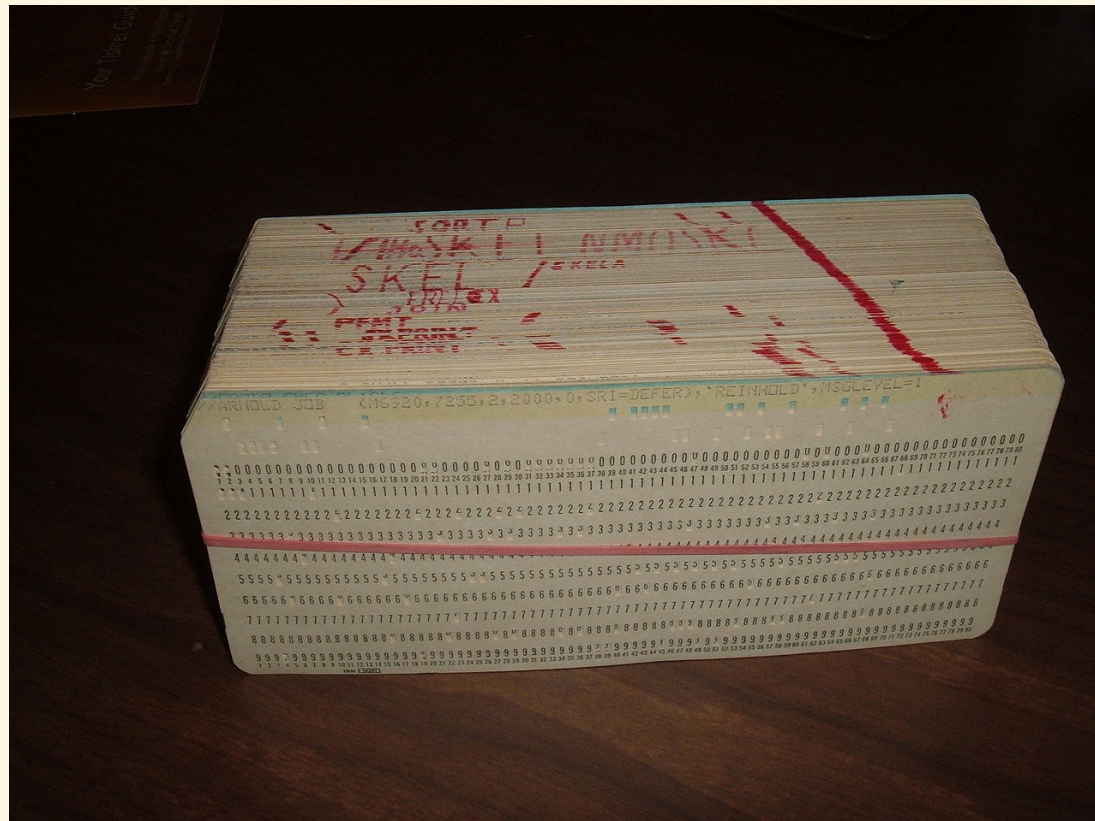
Speaker notes

Many early general-purpose digital computers used **punched cards** for data input, output and storage. Someone had to use a **keypunch** machine to write your cards, then feed them to the computer.

Punched cards are much older than computers. They were first invented around 1725 to control mechanical **looms**.

A TYPICAL PROGRAM (1950S)

Whatever you do, **DON'T** drop it!



TELETYPEWRITER (1960S)

The first **command line interfaces (CLI)**



Speaker notes

Teletypewriters (TTYs) became the most popular **computer terminals** in the 1960s. They were basically electromechanical typewriters adapted as a user interface for early [mainframe computers](#).

This is when the first **command line interfaces (CLI)** were created. As you typed commands, a program running on the computer would interpret that input, and the output would be printed on physical paper.

VIDEO TERMINALS (1970S)

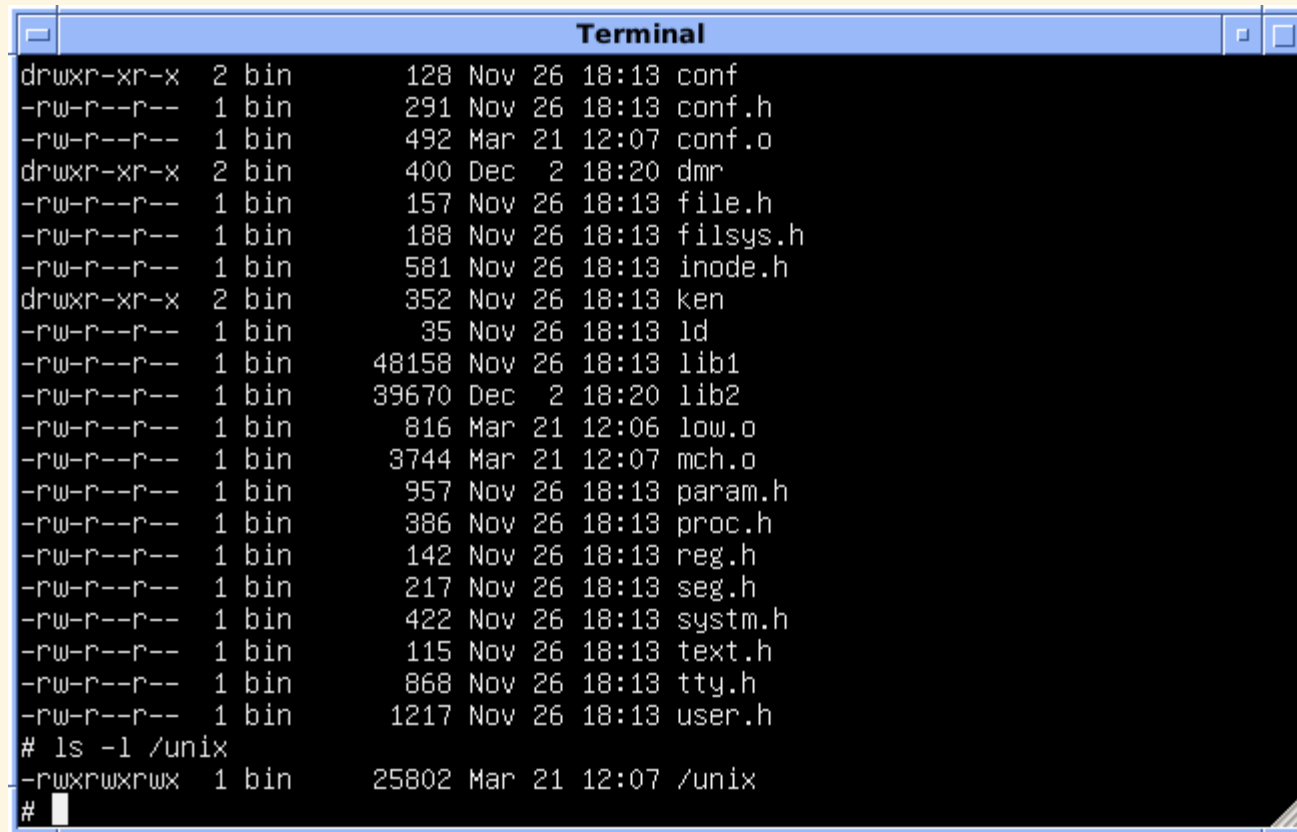


Speaker notes

As available memory increased, **video terminals** such as the [VT100](#) replaced TTYs in the 1970s. Initially they only displayed text. Hence they were fundamentally the same as TTYs: textual input/output devices.

UNIX (1970S)

The first portable operating system



A terminal window titled "Terminal" with a black background and white text. It displays the output of the command `ls -l /unix`. The output lists various files and directories in the `/unix` directory, including `conf`, `conf.h`, `conf.o`, `dmr`, `file.h`, `filsys.h`, `inode.h`, `ken`, `ld`, `lib1`, `lib2`, `low.o`, `mch.o`, `param.h`, `proc.h`, `reg.h`, `seg.h`, `sysm.h`, `text.h`, `tty.h`, `user.h`, and `/unix` itself. Each line shows the file permissions, size, date, time, and filename. The permissions are in octal format, and the size is in bytes. The date and time are in YYYY-MM-DD HH:MM format. The filename is the last column. The terminal window has a blue title bar and standard window controls (minimize, maximize, close) on the right.

```
drwxr-xr-x  2 bin      128 Nov 26 18:13 conf
-rw-r--r--  1 bin      291 Nov 26 18:13 conf.h
-rw-r--r--  1 bin      492 Mar 21 12:07 conf.o
drwxr-xr-x  2 bin      400 Dec  2 18:20 dmr
-rw-r--r--  1 bin      157 Nov 26 18:13 file.h
-rw-r--r--  1 bin      188 Nov 26 18:13 filsys.h
-rw-r--r--  1 bin      581 Nov 26 18:13 inode.h
drwxr-xr-x  2 bin      352 Nov 26 18:13 ken
-rw-r--r--  1 bin        35 Nov 26 18:13 ld
-rw-r--r--  1 bin    48158 Nov 26 18:13 lib1
-rw-r--r--  1 bin   39670 Dec  2 18:20 lib2
-rw-r--r--  1 bin      816 Mar 21 12:06 low.o
-rw-r--r--  1 bin     3744 Mar 21 12:07 mch.o
-rw-r--r--  1 bin      957 Nov 26 18:13 param.h
-rw-r--r--  1 bin      386 Nov 26 18:13 proc.h
-rw-r--r--  1 bin      142 Nov 26 18:13 reg.h
-rw-r--r--  1 bin      217 Nov 26 18:13 seg.h
-rw-r--r--  1 bin      422 Nov 26 18:13 sysm.h
-rw-r--r--  1 bin      115 Nov 26 18:13 text.h
-rw-r--r--  1 bin      868 Nov 26 18:13 tty.h
-rw-r--r--  1 bin     1217 Nov 26 18:13 user.h
# ls -l /unix
-rwxrwxrwx  1 bin    25802 Mar 21 12:07 /unix
#
```

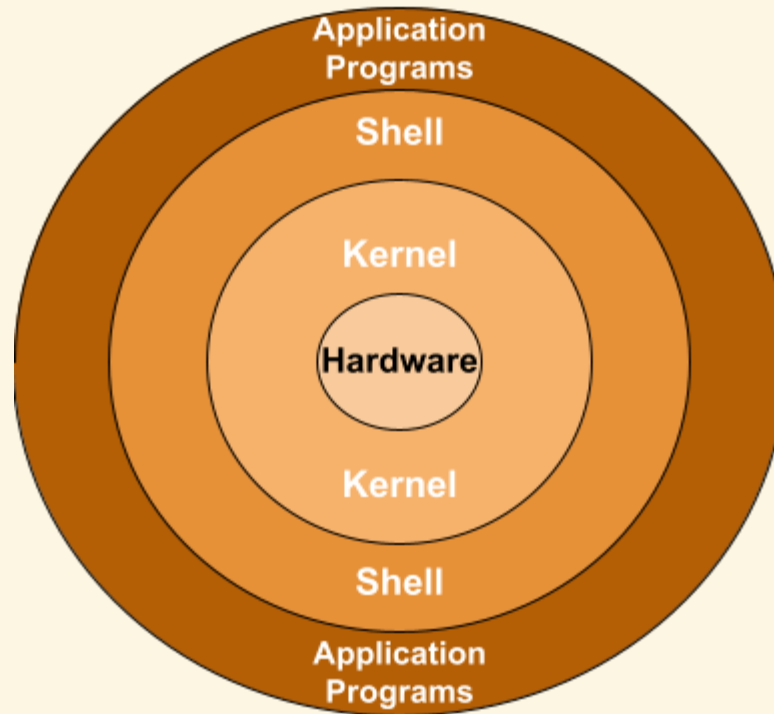
Speaker notes

It's also in this period that the [Unix](#) operating system was developed. Compared to earlier systems, Unix was the first **portable operating system** because it was written in the [C programming language](#), allowing it to be installed on multiple platforms.

Unix is the ancestor of [Linux](#). [FreeBSD](#), a Unix-like system, is also used as the basis for [macOS](#) (since Mac OS X).

SHELLS (1970S)

Text-based at that time



Speaker notes

In Unix-like systems, the program serving as the **command line interpreter** (handling input/output from the terminal) is called a **shell**. It is called this way because it is the outermost layer around the operating system; it wraps and hides the lower-level kernel interface.

GRAPHICAL USER INTERFACES (1980S)

Also a type of shell



Speaker notes

Eventually, [graphical user interfaces \(GUIs\)](#) were introduced in reaction to the perceived steep learning curve of command line interfaces. They are one of the most common end user computer interface today.

Note that the GUI of a computer is also a shell. It's simply a different way to interact with the kernel (graphical instead of textual).

MOTION SENSING USER INTERFACES (2000S)

Invented 1940s, on TV 1950s, in wide use 2000s



Speaker notes

Motion sensing

TOUCH USER INTERFACES (2000S)

Invented 1960s, on TV 1980s, in wise use 2000s



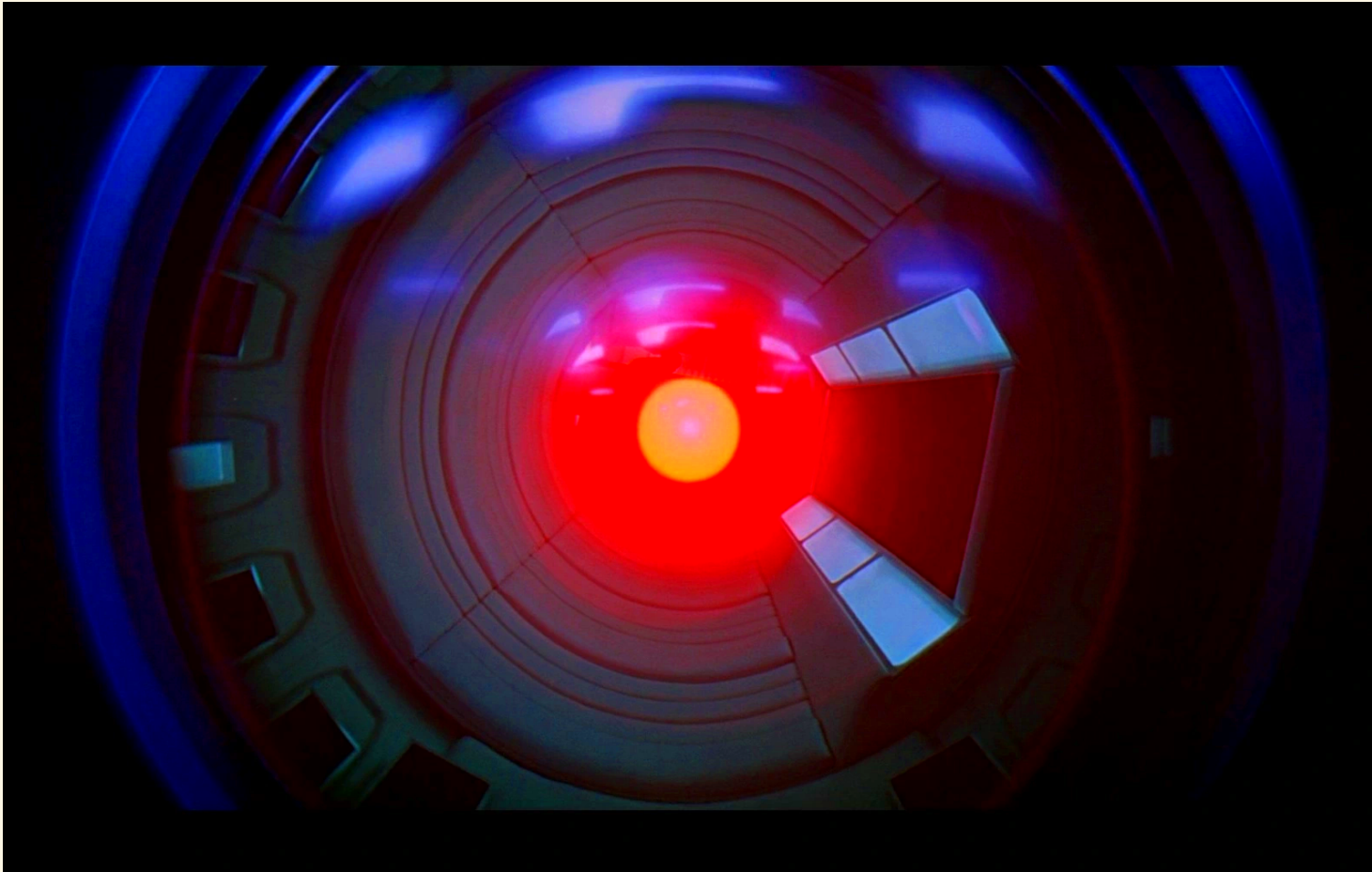
Paramount Pictures

Speaker notes

Touch user interface

VOICE USER INTERFACES (2010S)

Invented 1950s, on TV 1960s, in wise use 2010s



Speaker notes

Voice user interface

AUGMENTED REALITY (2010S)

Invented 1960s, on TV 1970s, in wise use 2010s

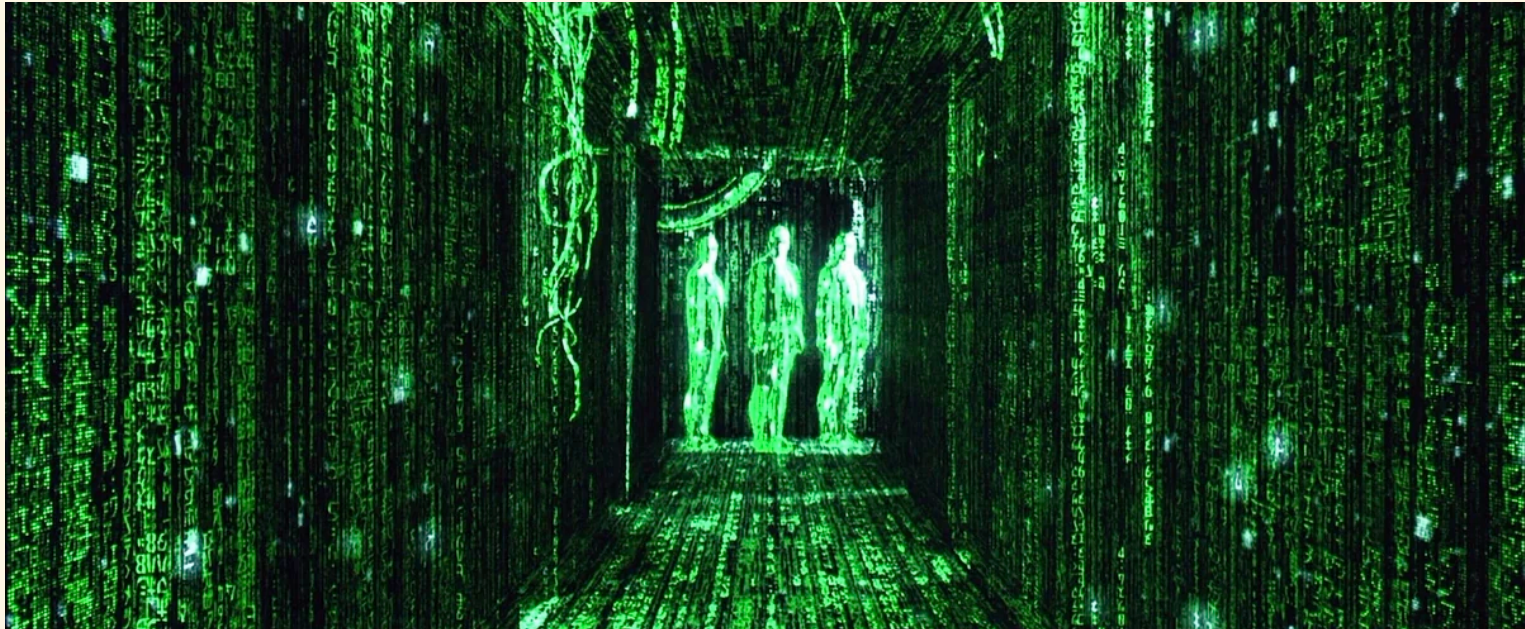


Speaker notes

Augmented reality

VIRTUAL REALITY (2010S)

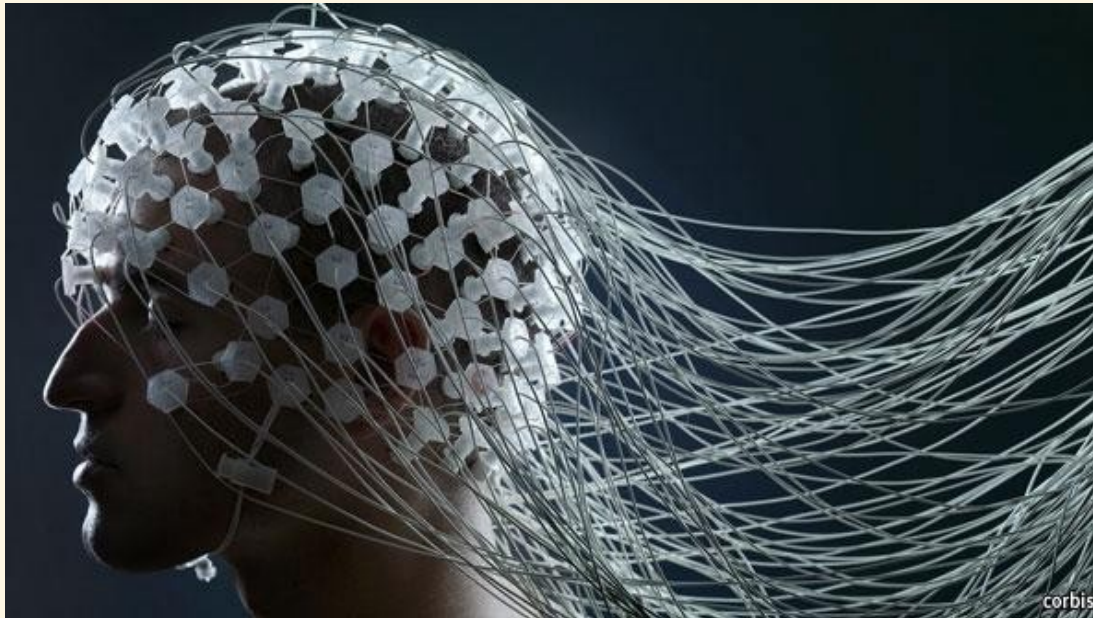
Invented 1960s, on TV 1980s, in wise use 2010s



Speaker notes

Virtual reality

TOMORROW?



Speaker notes

Brain-computer interface?

