Operating system principle

Introduction

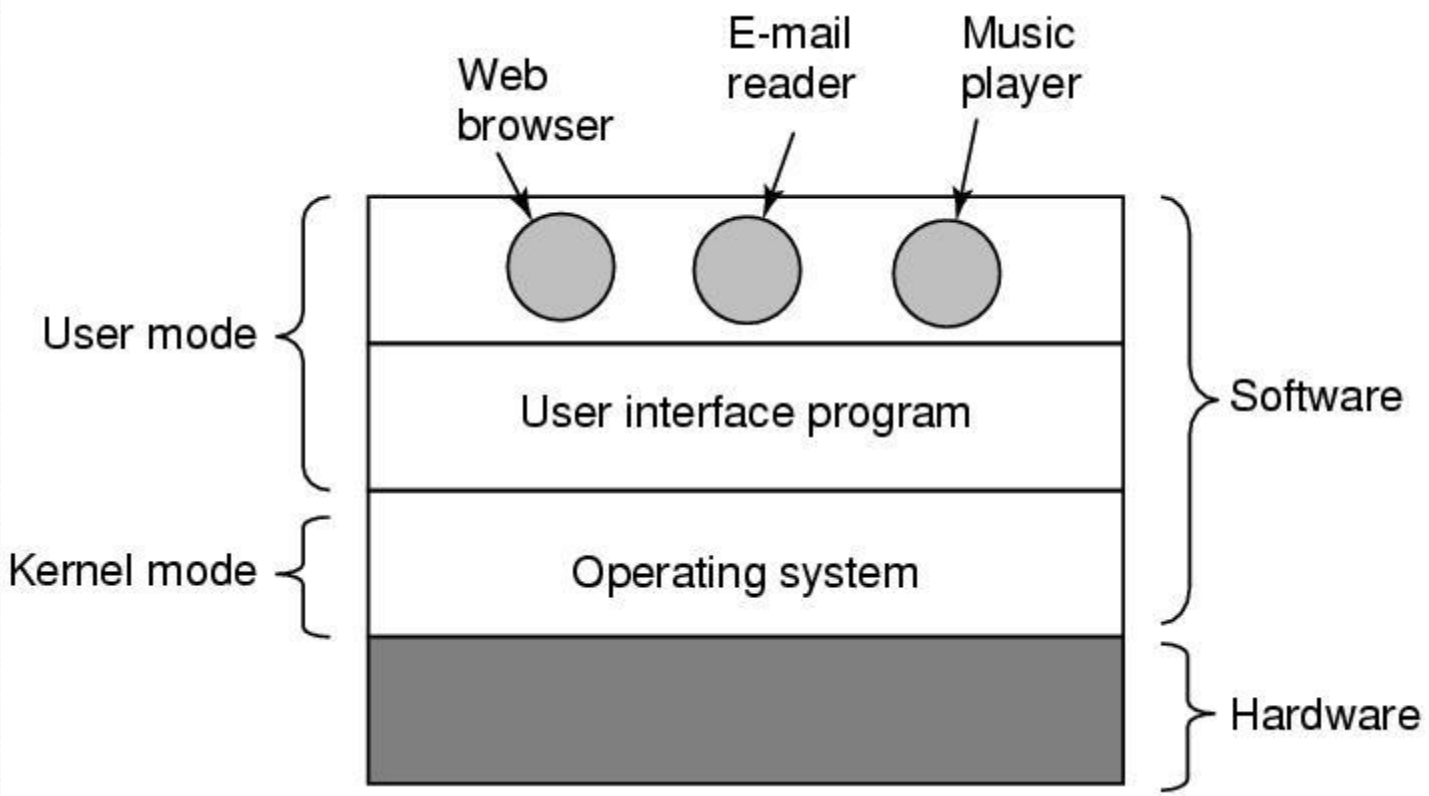
What Is An Operating System (1)

A modern computer consists of:

- One or more processors
- Main memory
- Disks
- Printers
- Various input/output devices

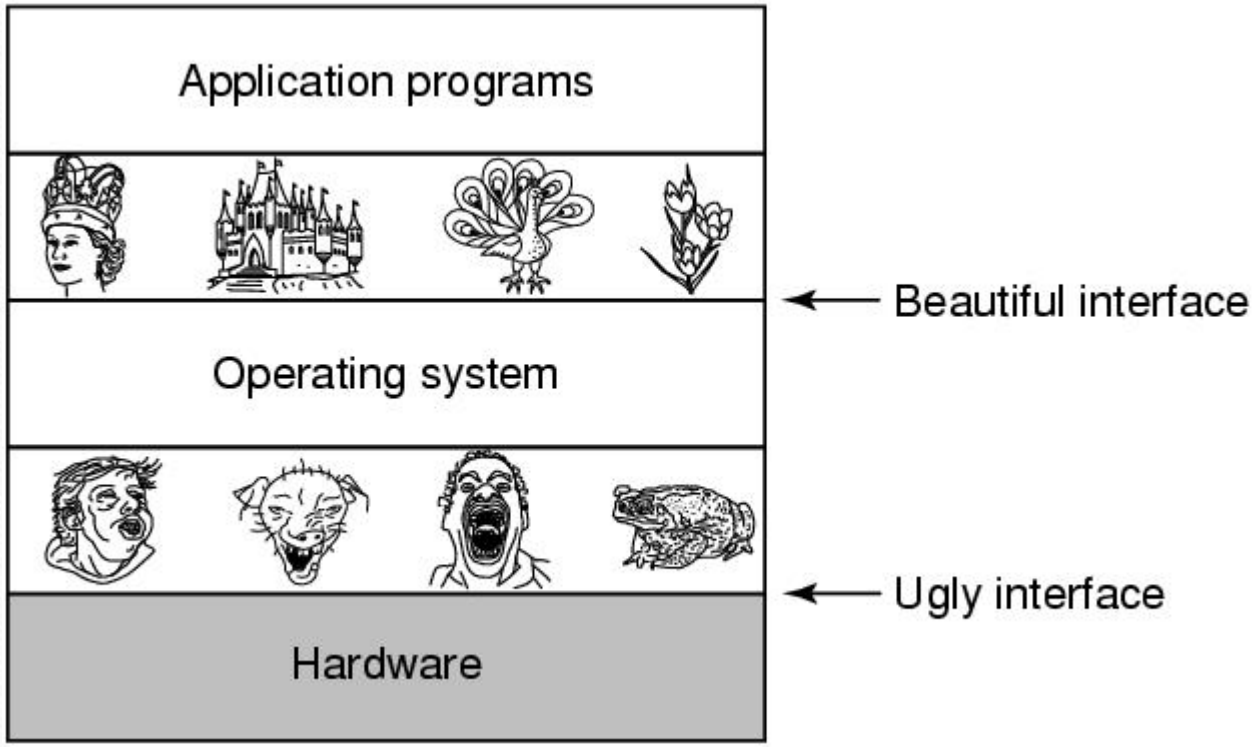
Managing all these components requires a layer of software – the **operating system**

What Is An Operating System (2)



Where the operating system fits in.

The Operating System as an Extended Machine



Operating systems turn ugly hardware into beautiful abstractions.

The Operating System as a Resource Manager

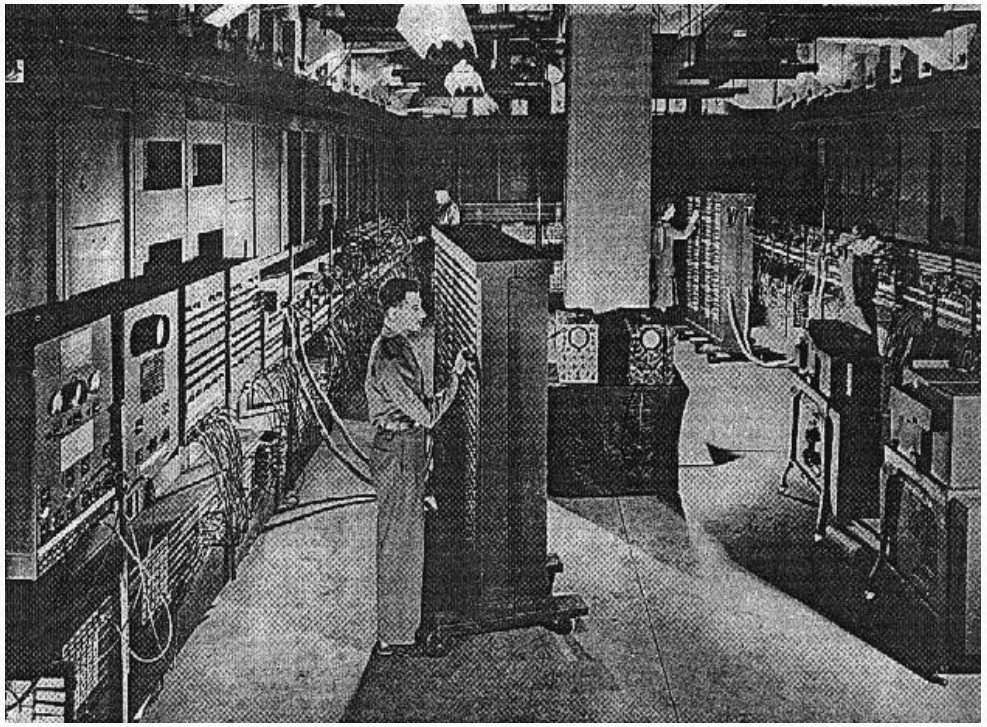
- Allow multiple programs to run at the same time
- Manage and protect memory, I/O devices, and other resources
- Includes multiplexing (sharing) resources in two different ways:
  - In time
  - In space

History of Operating Systems

Generations:

- (1945–55) Vacuum Tubes
- (1955–65) Transistors and Batch Systems
- (1965–1980) ICs and Multiprogramming
- (1980–Present) Personal Computers

1945-1955 Vacuum Tubes



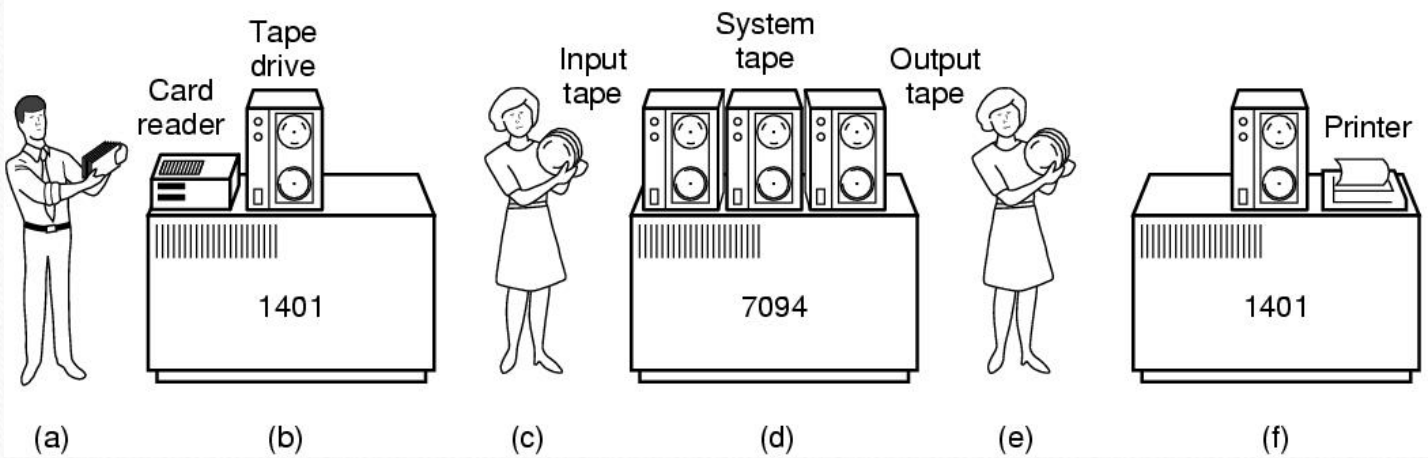
ENIAC

Ada Lovelace

John Von Neumann

Alan Turing

Transistors and Batch Systems



An early batch system.

(a) Programmers bring cards to 1401.

(b) 1401 reads batch of jobs onto tape.

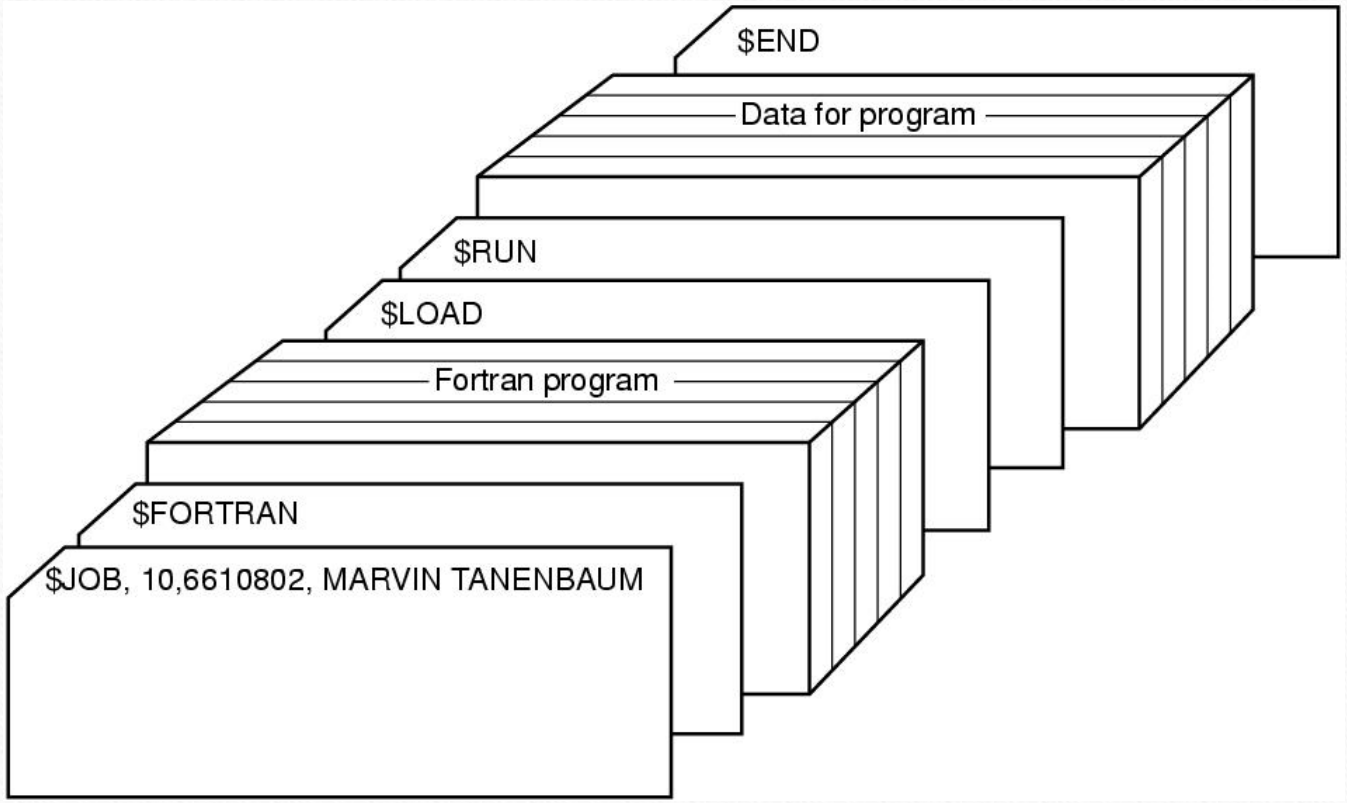
(c) Operator carries input tape to 7094.

(d) 7094 does computing.

(e) Operator carries output tape to 1401.

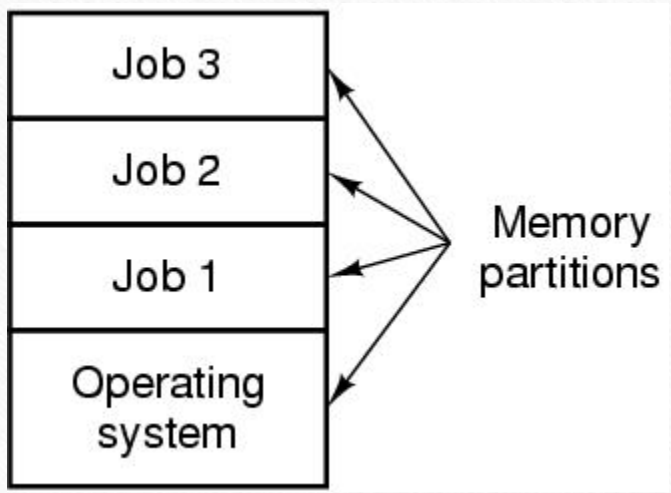
(f) 1401 prints output.

Transistors and Batch Systems

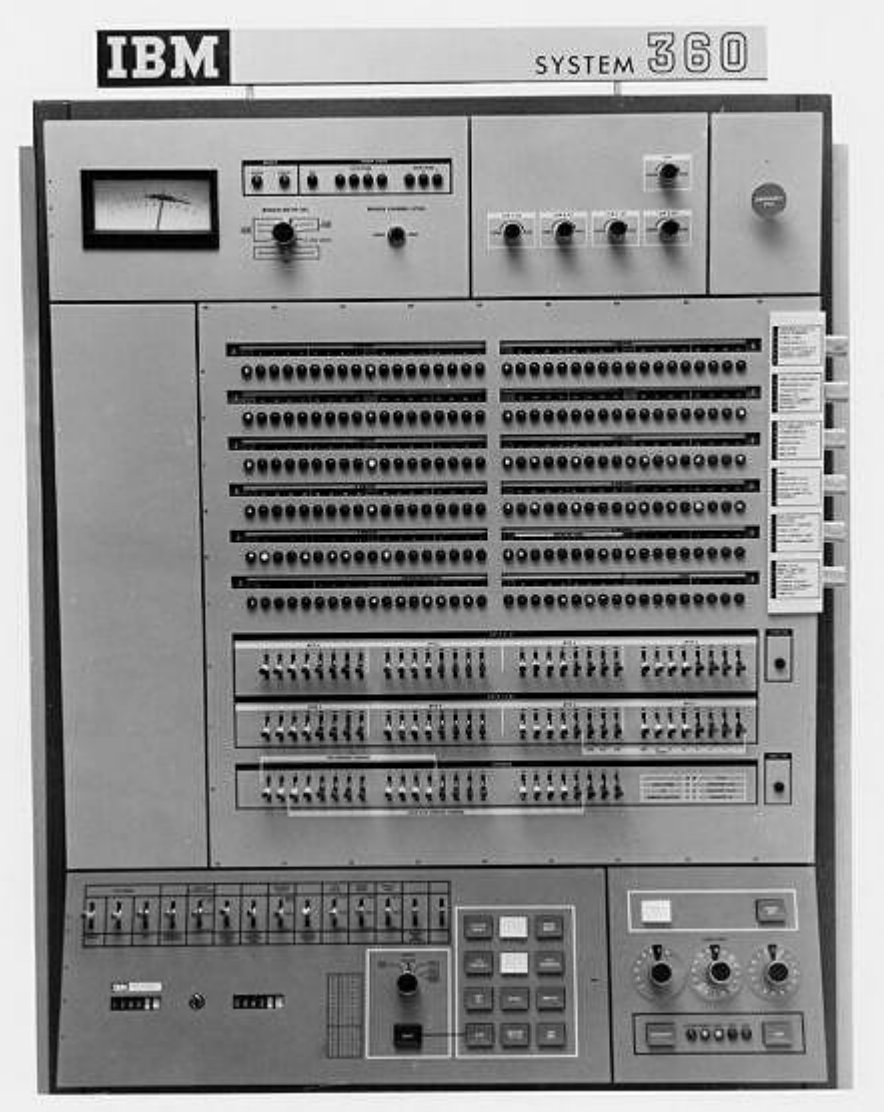


Structure of a typical FMS job.

ICs and Multiprogramming



A multiprogramming system with three jobs in memory.



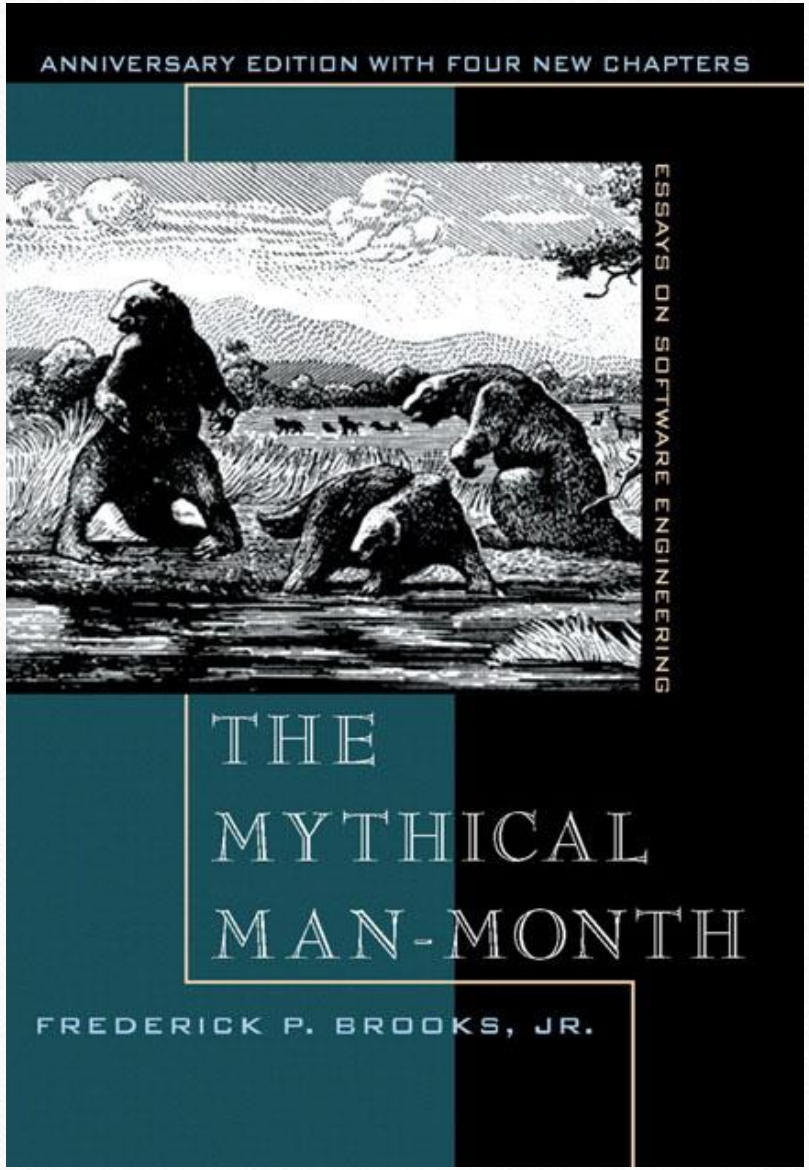
IBM System/360

One Family

OS/360

Multiprogramming

SPOOLing (Simultaneous Peripheral Operation On Line)

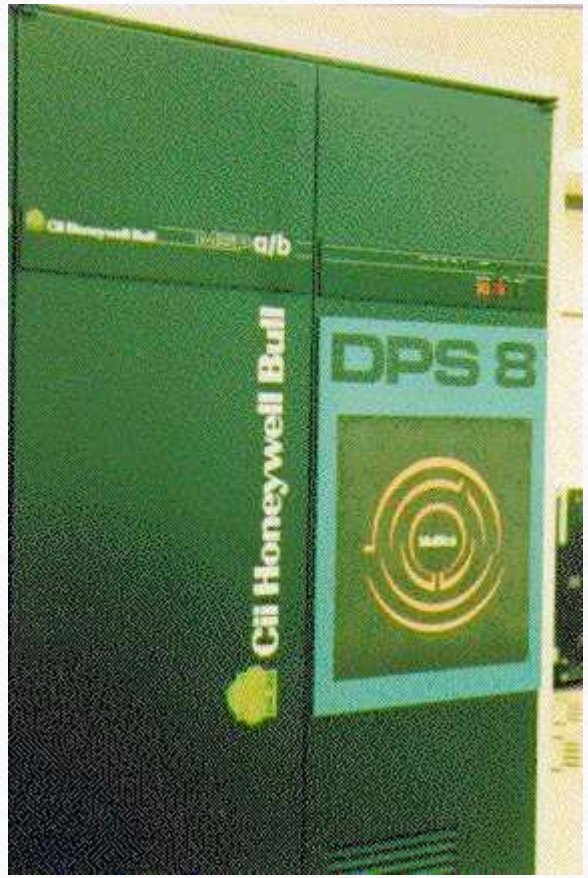


OS/360

Written by Fred Brooks, One of the designers of OS/360

Time Sharing Systems

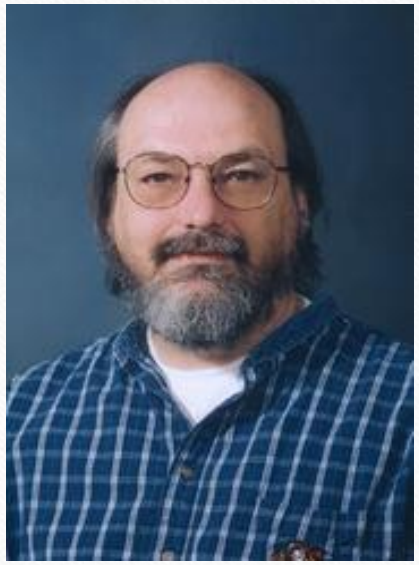
- CTSS
  - Compatible Time Sharing system
  - MIT, 7094
- MULTICS
  - MULTiplexed Information and Computing Service
  - MIT, Bell Labs, General Electric
  - Sold by Honeywell



GE-645

History of UNIX

Dennis Ritchie



Ken Thompson

History of UNIX

- 1969' UNIX
  - Ken Thompson
  - Bell Lab (AT&T)
  - DEC PDP-7
  - space travel
  - UNICS -> UNIX
  - Written in assembly language

PDP - Programmed Data Processor

History of UNIX

- 1970: PDP-11/20
- 1971: Unix Programmer's Manual
- 1972: Richie BCPL(Basic Combined Programming Language)->B->C, *The C Programming Language*
- 1973: *The UNIX Time ─ Sharing System*
- 1983 Turing Award

History of UNIX

- AT&T: System V Release 4.2
- Berkeley Software Distribution: 4.4BSD
- UNIX Family
  - IBM: AIX
  - HP: HP-UX
  - SGI: IRIX
  - SUN: Solaris
  - Linux, FreeBSD

1997 Deep Blue vs Kasparsov

First Microcomputer

1975: MIPS Altair 8800 (Intel 8080)

Apple

1976: Apple I

Apple Computer

1977: Apple II

1MHz, 4KB Memory

Macintosh

- 1984: Motorola 68000
- 1998: PowerPC
- 2006: Intel
- 2020: ARM

IBM PC

- 1981: IBM Personal Computer
  - Intel 8088(4.77MHz) 16KB
  - MS-DOS/PC-DOS
- 1985: Intel 80386
- 1986: Compaq 386
- 1987: IBM PS/2 (386, MCA)

  IBM OS/2
- RISC: PowerPC vs Intel
- 1993: Intel Pentium

Microsoft Windows

- 1985: Windows 1.0; 1987: 2.0
- 1990: Windows 3.0; 1992: 3.1
- 1993: Windows NT 3.1
- 1995: Windows 95; 1996: NT4.0
- 1998: Windows 98
- 2000: Windows ME; Win2000 (NT 5.0)
- 2001: XP(NT 5.1); 2003:Server 2003
- 2006: Vista; 2008: Server 2008
- 2009: Windows 7 (NT 6.1)
- 2015: Windows 10 (NT 10.0)

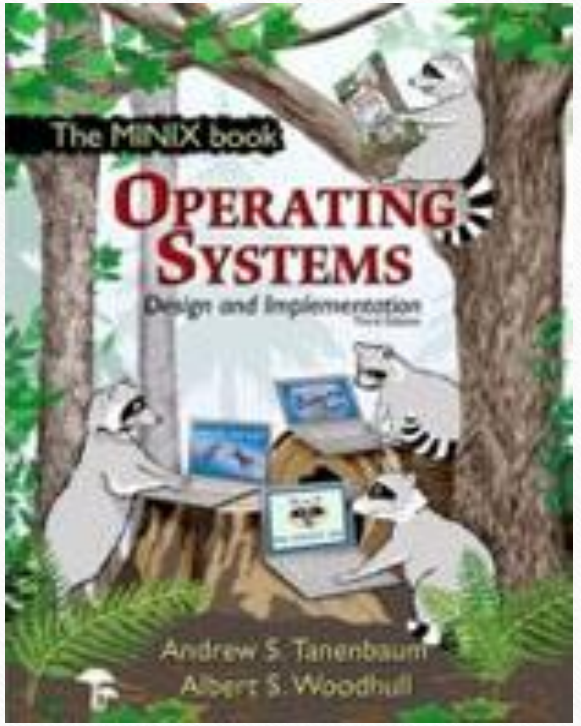
GNU Free Software

- 1984: Richard Stallman starts GNU project
  - GNU's not UNIX
  - http://www.gnu.org
- Purpose: Free UNIX
  - "Free as in Free Speech, not Free Beer"
- First step: re-implementation of UNIX Utilities
  - C compiler, C library
  - emacs
  - bash
- To fund the GNU project, the Free Software Foundation is founded
  - http://www.fsf.org

R. Stallman

Minix

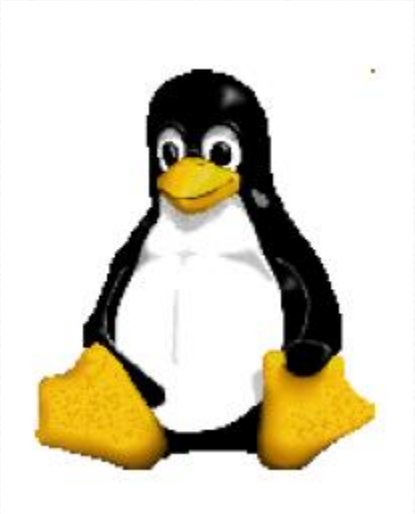
Andrew S. Tanenbaum (AST)
http://www.cs.vu.nl/~ast/



http://www.minix3.org

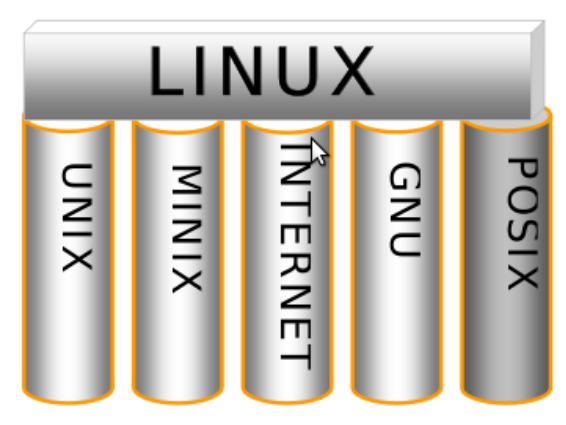
Linux

Linus Torvalds



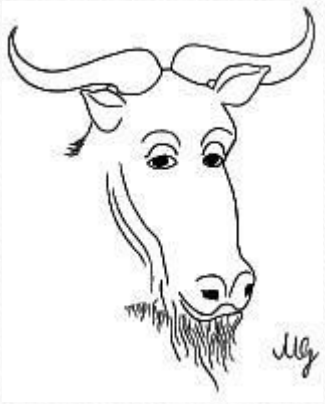
Mascot: Tux

- 1991: Linus Torvalds writes 1st version of Linux kernel
- Linus' UNIX -> Linux
- Combined with the GNU and other tools forms a complete UNIX system



General Public License

- **Most software (including the Linux kernel) is GPL'ed (GNU General Public License)**
  - **http://www.gnu.org/copyleft/gpl.html**
- **Linux is called "copyleft" (instead of "copyright").**
  - **You can copy the software.**
  - **You get the source code.**
  - **You can alter the source code and recompile it.**
  - **You can distribute the altered source and binaries.**
  - **You can charge money for all this.**
- **You cannot change the license.**
  - **So all your customers have the same rights as you.**
  - **So you really cannot make money from selling the software alone.**
- **Other Open Source licenses (for example, BSD) are also used**

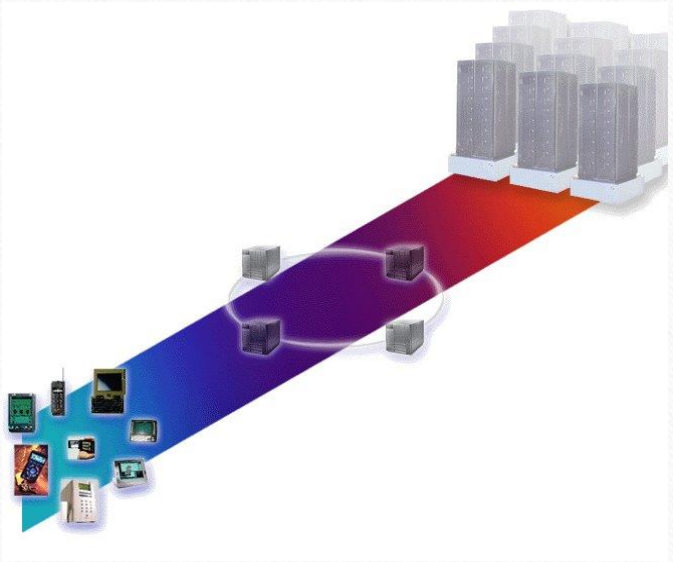


Linux Kernel vs Distributions

- Kernel : Latest Release 5.8.6
- Distributions:
  - RedHat: Fedora, RHEL, CentOS
  - Ubuntu: from Debian
  - Slackware
  - SuSE: OpenSuSE
  - RedFlag
  - …

Linux Today

- Linux covers the whole spectrum of computing
  - Embedded devices
  - Laptops
  - Desktop systems
  - Development systems
  - Small and large servers
  - Megaclusters/supercomputers



- Linux is used throughout the world by home users and by some of the largest companies in the world
  - IBM
  - Boeing
  - NASA