Operating Systems

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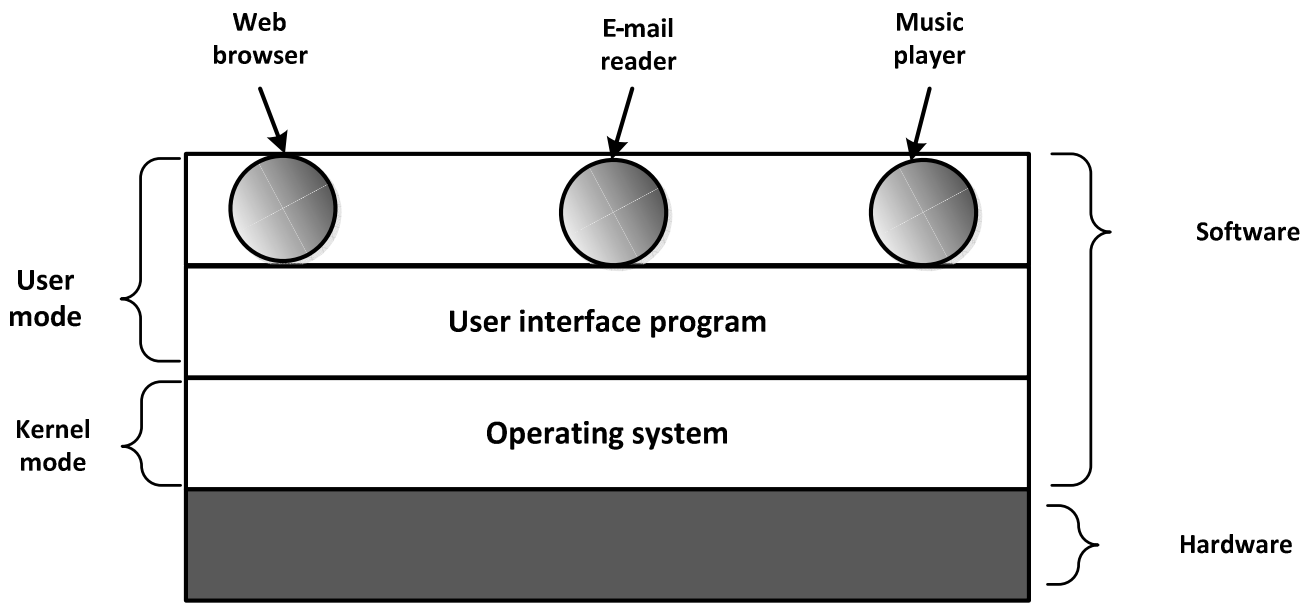
Chapter 1. Introduction

Introduction

Operating System's Job

- Provides user programs with a better, simpler, cleaner, model of the computer.
- Handles managing all the resources (processor, main memory, disks, printers, a keyboard, a mouse, a display, network interfaces,...etc).
- A simple overview of the main components of a computer system is given in the following figure:



Introduction

Source Code of OS and Types

- Operating systems differ from user programs in ways other than where they reside.
  - They are huge,
  - complex, and
  - long-lived.
- The source code of an operating system like Linux or Windows is on the order of five million lines of code (fill 100 books of 1000 pages and 50 lines per page).
- Examples of operating systems are:
  - Windows: 95/98/Me/NT/2000/XP/Vista/windows 7/windows 8/windows 10/windows 11.
  - Unix like operating systems: Linux, System V, Solaris and FreeBSD.

1.1 What is an operating system?

An operating system is a program that runs in kernel mode. Operating systems perform two basically unrelated functions: providing application programmers a clean abstract set of resources instead of the messy hardware ones and managing hardware resources.

OS definition

- **Operating system as an extended machine**. The **architecture** (*instruction set, memory organization, I/O, and bus structure*) of most computers at the machine language is primitive and awkward to program, especially for I/O. When looking at a computer system from top, i.e., a top-down view, the operating system is considered as an extension to the machine that provide an abstraction layer for user programs and application programmer.
- **Operating system as a resource manager**. When having a bottom-up view, the operating system works as a manager for several resources in the system. Resource management includes multiplexing (sharing) resources in time and space. CPU is shared in time between processes while memory is space shared between processes.

1.2 History of operating systems

Operating systems have been closely tied to the architecture of the computers on which they run, therefore in the following we will look at the computer generations and see how their operating systems were like.

The first generation (1945-55) **Vacuum tubes.**

- Prof. Atanasoff and his graduate student in Iowa State University built the first functioning digital computers. Primitive computers that need seconds to do simple calculations.
- No programming languages were known even assembly language, programming is connecting wires.
- Operating systems were **unheard of**. Calculations are of sines, cosines and logarithms.

1.2 History of operating systems

The second generation (1955-65) **transistors and batch systems**

- Mainframes (of multi-million-dollar price) were introduced were transistors are used to build such computer in a locked and air conditioned rooms.
- Programmers wrote their programs on paper using FORTRAN then punched them on cards and brought them to the operator then waiting for the outputs. Most of the **time were wasted** while operators were walking between input/output rooms and mainframe.
- The solution was to use **Batch system** where a tray of jobs in the input room is read into a magnetic tape using an inexpensive computer. This tape was brought to the machine room and (a kind of OS) was used to read jobs one by one until the end while each output was written into output tape after finishing these batch of jobs output and input tapes were replaced by new batches.
- Calculations were solving differential equations programmed in FORTRAN.

1.2 History of operating systems

The third generation (1965-1980) **ICs and multiprogramming**

- By the early 1960s, two product lines were there; word-oriented, large scale scientific computers like 7094; character-oriented, commercial computers like 1401.
- Both lines combined in one IBM system/360. 360 make it possible for several innovations; multiprogramming, then timesharing.
- The first serious OS is CTSS (Compatible Time Sharing System) by MIT on a modified 7094.
- MIT, Bell Labs. and General Electronics decided to embark on a computer utility. It is called MULTICS (MULTiplexed Information and Computing Service). 80 users were loyal to this even after 30 years up to late 1990s.
- DEC PDP-1 and its successors up to PDP-11 is the start of minicomputers. which lead to UNIX based on MULTICS on PDP-7 by Ken Thompson.
- Based on Unix two major versions were developed System V and BSD. Another clone of Unix was developed by Tanenbaum called Minix in 1987.
- Linux also was developed by Finnish student Linus Torvalds based in Minix and Unix.

History of operating systems

The fourth generation (1980-present) **Personal Computers**

- With the development of LSI circuits, it was possible to manufacture a small chips that contains thousands of transistors and hence make it possible for personal computer due to size and cost of the computers.
- Staring in 1974 when Intel came out with 8080 CPU, a series of operating systems started CP/M then DOS and Basic interpreter by Bill Gates.
- Then the staring of Microsoft with MS-DOS.
- Steve Jobs co- started Apple with an invention of GUI (It provide a user friendly interface) which later inspired windows to make such GUI on top of DOS. Until 1995 when windows 95 is invented followed by win98 then windows 2000 and Me up to windows 11 now a days.
- At this time period a network OS is developed where user is aware of the existence of such networked computers and also A distributed OS is founded where users are not aware of where their file are stored or even where their processes are running. At this time there is a GUI for Unix, it is called X windows system where KDE and Gnome are built on top of it.

History of operating systems

The fifth generation (1990-present) **Mobile Computers**

- The first real smartphone appears in the mid-1990s where telephony and computing were combined in a phone-like device.
- In 1997 Sony Ericsson coined the term smartphone with its GS88 phone.
- Symbian OS were the dominant in the first decade of smartphones and it was used by Samsung, Sony Ericsson, Motorola and Nokia.
- Then RIM's Blackberry OS released in 2002 and Apple's iOS appeared in 2007 get some share from Symbian.
- In 2011, Nokia focused on Windows Phone as its primary platform.
- In 2008, Google released Android, which is a Linux based OS. Android is the dominant OS, because it is open and has a huge community of developers.