Computing Fundamentals and Programming (CE-100)
Batch 2019 (Electronic Engineering)
Chapter 6: System Software

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Software Significance: Discussion in class

Types of Software

System Software

It works "behind the scene"; it underlies application software. These program start up the computer and function as the principal coordinator of all hardware components and application software programs. Without system software loaded into the RAM of your computer, your hardware and applications software are useless.

Application Software

It consists of compute programs designed to satisfy a user's need. Applications software communicates to system software; all file management and resource requests (use of peripheral devices).

System software components:

System software comprises a large number of instructions that can be grouped into three basic parts

1) Operating System
2) Utilities
3) Language Translators

1) Operating System: In Control

- The Operating System (OS), the most important system software component, consists of the master programs, called the supervisor, that manage the basic operations of the computer.

- These program reside in RAM while computer is ON and provide resource management services of many kinds.

- The Term “BOOTING” refers to the process of loading parts of the operating system into computer’s main memory, usually form hard disk.

  See Fig 5.1 from book: Self Study

- This loading is accomplished by a program called bootstrap loader or boot routine stored permanently in the computer electronic circuitry.

- **POST:** When you turn on the machine the program performs an automatic power-on-self-test (POST), which usually tests RAM, the keyboard and disk drives.

- The parts of the OS that always remain in memory while the computer is ON are called resident. Less frequently used parts of the OS are copied from disk when needed and are called non resident or transient.

- BIOS: The OS includes BIOS which manage the essential peripherals such as the keyboard, screen, disk drives, and parallel and serial ports. BIOS also maintains some internal services such as time and date. This is the part of the OS that tests the computer when you power up.

- After running the autostart program, it loads the rest of the OS and turns control over to it. BIOS is usually stored on one or ROM chips or flash memory chips.

- The OS controls additional functions such as managing program and data, managing memory, handling input and output, and coordinating some network communication functions.

Managing Programs and Data

Among the ways Operating Systems manage operations more efficiently are multitasking, multiprogramming, time sharing and multiprocessing.

Multitasking: It is the execution of two or more programs by one user concurrently on the same computer with one central processor.

Self Study:

- How it does
- What is foreground and background processing?

Multiprogramming: It is the execution of two or more programs on a multi user operating system. (It is essentially a multiple-user version of multitasking)

Self Study:

- How it does

Time Sharing: A single computer processes the tasks of several users at different stations in round-robin fashion.
Time sharing is the operative principle when several users are linked by a communication network to a single computer.

The difference between multitasking and time sharing is that in multitasking each event may take a different amount of time to accomplish while with time sharing the computer spends a fixed amount of time with each program before going to the next one.

Self Study:

- Applications:

Multiprocessing: It is the processing which is done by two or more computers or processors linked together to perform work simultaneously-that is precisely at the same time.

It can be done in several ways

- One way is by coprocessing
- Another way is the parallel processing. These kinds of systems are called fault tolerant system because one processor fails other continue to do their work. Example is Airline reservation system.

Managing Memory

- Virtual Memory
- Swapping or Paging

The use of virtual memory slows down the performance but it provides the user more flexibility.

Handling input and output

- The OS commands the driver, which in turn commands the peripheral device.
- Coordinating some Network communication Functions
- Now some are built in OS.

2) Utility Programs: Helping Hands

It is the second part of the system software and generally used to support, enhance, or expand existing programs in a computer system. Examples are

Backup:
It is used to make a backup, or duplicate copy, of the information on your hard disk.
Examples are Norton Backup and Colorado Scheduler

Data Recovery:
A data recovery utility is used to restore data that has been physically damaged or corrupted. Data can be damaged by viruses, bad software, hardware failure and power fluctuations that occur while data is being written/recorded.

Virus Protection:
A virus consists of hidden programming instructions that are buried within a program or code in a data file. Viruses are spread when people exchange diskettes or download files from Internet. Antivirus software is a utility program that scans disk drives and memory to detect viruses.

Popular antivirus software utilities are Norton Antivirus, McAfee's etc

New Viruses are constantly being developed so you need to update your antivirus frequently.

Data Compression:
Data compression utilities remove redundant elements, gaps and unnecessary data from a computer's storage space so that fewer bits are required to store or transmit data.

Data Compression Techniques:

- Lossy
- lossless

They differ by storage space and quality

Lossy data compression involves a certain loss of accuracy in exchange for a high degree of compression. This is used for graphic files and digital voice files.

Lossless compression involves techniques that generate an exact duplicate with a lower degree of compression. This is achieved by removing redundant data elements. It is often used with database records, spreadsheets and word processing files.

Lossy compression Utilities:

These schemes use ratios of 1:10 up to 1:50, meaning that the compressed files are about 1/10 to 1/50 of the original size.

(1) JPEG (Joint Photographers Experts Group): It is the compression program for still images. Motion-JPEG can be used for digital video storage and editing but not for transmission. (File Extension is .JPG)

(2) MPEG (Motion Pictures Experts Group): It is the compression program for storage, editing and transmission of video images. It keeps a complete, detailed image for the first frame (or key frame) of a video segment. For subsequent frames, only the information that changes is stored. (File Extension is MPG).

Lossless compression Utilities: These schemes use ratios of 1:4 and are used for text files and graphics file.

Examples are WINZIP, ARC, etc

Defragmentation:

It rearranges the data so that the data units of each file are repositioned together (contiguously) in one location on the disk.

3) Language Translators:

It is the third component of the system software that translates a program written by a programmer in a language such as C++ into machine language, which the computer can understand.

System Software Interfaces:

- Command Line Interface (CLI)
- Graphical User Interface (GUI)

Operating Systems platforms:

The type of processor used in a computer determines the type of machine language it uses. And the computer's operating system is created to work with that particular type of machine language. Thus the processor model and the operating system determine the platform- that is the type of computer architecture, or family; the PC and apple and Apple Macintosh are two common platforms.

Microcomputer Operating Systems:

- DOS and Windows 3.x
- Windows 9x
- Windows NT/ Windows 2000
- Windows XP/Windows Vista
- OS/2 Wrap
- UNIX
- LINUX
- Mac OS
- Netware

DOS and Windows 3.x

- Command driven
- 16-bit OS
- Obsolete

Windows 9x

- Windows 95 released in 1995.
- Multitasking OS
- 32-bit OS
- Windows 98, provided more support.
- Windows CE for palmtop computers.

Windows NT/ Windows 2000

- It is multitasking, multiprocessing OS
- Support for multiuser system

Windows XP/Windows Vista

S/2 Wrap

- See yourself from book

UNIX:

- Invented by AT&T (American Telephone and Telegraph)
- It is a multiuser, multitasking OS with built in networking capability.

LINUX:

- A version of UNIX
- A computer science student in Finland developed it as freeware.
- It can be downloaded free from Internet

Mac OS and Netware: **Study yourself**