Overview

- Computers.
- Hardware components of a Computer.
- Purpose and functions of computer operating systems.
- Evolution of computer operating systems.
- Operating systems available today.

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Microcomputers

- A microcomputer is computer built around a <u>special</u> integrated circuit (IC) or chip. The Chip, also known as the central processing unit (CPU) or microprocessor. It performs the calculations and computations.
- An integrated circuit is a small, thin piece of <u>silicon</u> onto which the <u>transistors</u> making up the microprocessor have been etched. A chip might be as large as an inch on a side and can contain tens of millions of transistors.



Types of microcomputers:

• Desktops, Laptops – Client computers receiving services

from a server.

- Servers These are computers that provide services to other computers. (File and print, e-mail, web servers)
- Handheld devices There are different handheld devices, each of which is designed for a specific purpose.

Hardware Components of a Microcomputer

- The basic interaction with a computer is called input/output (I/O).
- All electronic devices are made up of components like resistors, capacitors, and transistors.

• • Processor

- Prior to microprocessors, engineers built computers from collection of chips or discrete components like transistors wired one at a time.
- A microprocessor sends and receives commands to and from a computer's hardware and software.
- A microcomputer always has at least one microprocessor.



- Intel 4004 –First Processor, 1971, could add and subtract, 4 bit, used in electronic calculators.
- Intel 8080 In first home computer, 8 bit.
- Intel 8088 Marketed in 1982 with IBM-PC.
- Improvements of 8088 are 80286, 80386, 80486, Pentium, Pentium II, Pentium III, and Pentium IV (approx 5000 times faster than 8088)



- Processors' capabilities define the limits and capabilities of the computer, like speed of the system.
- Operating system work closely with the processor and other hardware, an operating system is written to work with a certain specific processor.
- Processors are distinguished on the basis of
 - operation mode and
 - size of data chunks it works with.



• Processor modes:

- the different ways the processor creates an operating environment for itself
- Specifically, the processor mode controls how the processor sees and manages the system memory and the tasks that use it.
- There are three different modes of operation,
 - Real mode
 - 286 Protected mode
 - 386 Protected mode



- Real Mode: the **real mode** provides a small amount of memory to the operating system.
- Real mode processors could only address 1MB of system memory
- This mode **does not allow** multitasking, protection of hardware from software, and creation of virtual machines
- DOS by its nature is single tasking operating system, i.e. handled one program at a time

Processor

- The 286 protected mode allows the operating system to access up to 16 MB of physical RAM, but does not allow the creation of virtual machines.
- The 386 protected mode allows the operating system to use up to 4 GB of RAM and also supports the use of virtual machines.

Processor

- Full access to all of the system's memory
- Ability to multitask, i.e. the operating system manage multiple programs simultaneously. Each program running has its assigned memory address locations, protected from other programs (if a program uses a unallowed protected memory address, protection fault error message comes up.
- Support for virtual memory, which allows the system to use the hard disk to emulate additional system memory when needed
- Faster (32-bit) access to memory, and faster 32-bit drivers to do I/O transfers.

• • Processor

- Processors can work with 8-bit, 16-bit, 32-bit, and 64-bit chunks of data.
 - The number of bits processed in a single instruction
- The number of bits (binary digits) is the size of data that can be processed at one time.

Motherboard and Chipset

- The motherboard is the central circuit board of a computer.
- It consists of one or more CPU slots or sockets into which the processor is plugged.

Motherboard and Chipset

- The controlling chipset, memory slots, the voltage regulator module (VRM), ROM BIOS, and the expansion bus slots form the other components of a motherboard.
- The chipset consists of chips that control the flow of signals to and from the processor and other components.

• • • Memory

- The computer memory involves chips that store programs and data.
- Random-access memory (RAM) and read-only memory (ROM) are the two different types of memory.
- Terms like megabyte and gigabyte are used to express the amount of memory or disk space.

• • Memory

- The smallest unit of storage is called a binary digit (abbreviated as bit).
- Bits are often used in groups of eight, which is called a byte.
- One kilobyte equals 1024 bytes, one megabyte equals 1,048,576 bytes, one gigabyte equals 1,073,741,824 bytes, and one terabyte equals 1,099,511,627,776 bytes.

• • • Memory

RAM:

- RAM provides temporary storage for programs and data.
- It consists of one or more special circuit cards that contain memory chips.
- The memory is volatile, implying that any data in the memory is lost when the computer is switched off or rebooted.

• • • Memory

ROM:

- ROM is used to store programs more or less permanently.
- The ROM BIOS is a chip containing the read-only memory basic input-output system.
- The BIOS is a set of program instructions for booting the computer as well as for controlling communication between the processor and other components.

Memory
ROM (continued):

- The ROM BIOS also stores the system setup program, which defines the basic configuration information.
- The configuration information is stored in another special kind of non-volatile RAM called the CMOS RAM.
- The software stored on the ROM is referred to as 'firmware' since it is non-volatile.

Video Adapter and Display

- The video adapter is a set of circuitry that receives video control signals from the computer and sends the controlling output signals to the display screen.
- The computer has a display screen, which is either a monitor or a flat panel display (FPD), for visual output from the computer.

Pointing Device

- A pointing device is required to move a graphical pointer called cursor around a graphical user interface (GUI).
- The mouse is the most common pointing device, which connects to the computer via a physical cable or a wireless connection.
- Other pointing devices include track balls, joysticks, and light pens.

Disk Drives

- Disk drives are used for storing data and programs.
- The data is stored by putting it onto the surface of small spinning platters using either magnetic or optical technology.
- Floppy drives and hard disk drives use magnetic technology, while compact disk (CD) and digital versatile disk (DVD) drives use optical technology for storing data.

Peripheral Devices

- Peripheral devices refer to nonessential add-on devices.
- Add-on devices include digital cameras, printers, scanners, pointing devices, and external modems and disk drives.

System Components



Purpose and Functions of Microcomputer Operating Systems

- An operating system (OS) is a program (or group of programs) that acts as the central control program for a computer.
- The operating system acts as an intermediary between the applications and the hardware.
- OS kernel remains in the memory when the computer is running.

Purpose and Functions of Microcomputer Operating Systems

- OS kernel:
 - The fundamental part of an operating system.
 - A piece of software responsible for providing secure access to the machine's hardware to various computer programs.
 - Since there are many programs, and access to the hardware is limited, the kernel is also responsible for deciding when and how long a program should be able to make use of a piece of hardware, which is called multiplexing. ...
 - en.wikipedia.org/wiki/Operating_system_kernel

 Purpose and Functions of Microcomputer Operating Systems

• User interface.

- Job management and task management.
- Memory management.
- File management.
- Device management.
- Security.

User Interface

- The user interface, also called the 'shell,' is a software layer through which the user communicates with the operating system.
- The user interface includes the command processor as well as the visual components of the operating system.
- The visual component can either be a character-based command line or a GUI.

Job Management and Task Management

- Job management controls the order and time in which programs are run.
 An Example is Scheduled Tasks through System Tools in Windows XP.
- <u>Task management</u> is an operating system function found in multitasking operating systems.

Job Management and Task Management

Task Management:

- Multitasking implies that a computer can run two or more programs (tasks) simultaneously.
- Task management allows the user to switch between tasks by lending focus to the application the user brings to the foreground.

Memory Management

- Memory management
 - Manages the placement of programs and data in memory
 - Keeping track of it.
- Operating systems use the 'virtual memory manager,' to move code and data as required to a portion of the disk known as virtual memory.
- Virtual memory, as compared to the actual physical system memory, allows more code and data to be in memory.

• • File Management

- o File management, also referred to as data management, allows the operating system to read, write, and modify data.
- The data is organized into entities called files.
- File management also allows users to organize their files, using other special files called folders or directories that act as containers.

Device Management

- The device management function controls hardware devices through the use of special software called device drivers.
- The device driver contains commands that are used to control a device.
- Device drivers are unique to a device and are created by the manufacturer of the device to work with a specific operating system.

• • • Security

- The security function provides password-protected authentication of the user before allowing access to the local computer.
- The security function also restricts the actions that can be performed on a computer.
- The validation of the user account and password is called authentication.

Categories of OS

- Operating systems are organized on the basis of number of simultaneous tasks and the number of simultaneous users served
 - Single-user/ Single-tasking
 - Single-user/ Multitasking
 - Multi-user/Multitasking
 - Real time

Single-user / Single-tasking

 OS allows a single user to perform a single task at a time.

- MS-DOS
- Palm OS based hand-held
Single-user / Multitasking

- OS allows a single user to perform two or more functions at once.
 - Microsoft Windows
 - Macintosh Mac OS X
- OS is increased in size and complexity

Multi-user / Multitasking

- OS allows multiple user to run programs simultaneously on a single server machine
- Multi-user OS gives each user a complete operating environment on the server.
 - Terminal server
 - Main frame systems

Real- Time Operating systems

- Real-time OS is embedded in the circuitry of a device and not found on a disk drive
- Real-time OS is needed to run a realtime application, may support multiple tasks
 - Run medical diagnostics equipment
 - Windows CE



Operating Available Today

- MS-DOS.
- Windows NT.
- Windows 98.
- Windows ME (Millennium Edition).

Systems

- o Windows 2000.
- Windows XP.
- Macintosh operating systems.
- o UNIX/Linux.



- Disk operating system (DOS) is an operating system that provides support for interaction with disk drives.
- Microsoft's first version of DOS, called PC DOS, was introduced with the first IBM-PC in 1981.
- Each major version of DOS was released to support new disk capacities.
- o DOS provides for a text-mode command line interface.

Microsoft Windows

- 1985-1990: Microsoft worked on both DOS and Windows. Initially Windows dressed up DOS
- Windows 3.0 supported the three modes of processor, real mode, standard mode (286 Protected mode), and Enhanced mode (386 Protected mode).
- Windows 3.1 was adopted as a standard desktop OS by organizations

Windows for Workgroup

- Windows 3.1 was an OS for desktops only.
- If a PC needed to connect to a network, Network Operating system had to be added (3Com, or Novell or Microsoft LAN manager NOS)
- The PC also need to be installed with a Network client software (drivers and protocols) required to share file and print services
- Windows for Workgroup included both the client and server software

• • • Windows 98

- Windows 98 is an important development to the earlier Windows operating system in terms of GUI and integrated components.
- It provides new options for customizing the GUI, including tighter integration with Microsoft's Web browser, the Internet Explorer (IE).
- Windows 98 is the choice for PCs with plug and play (PnP) hardware, not supported by Windows NT.

• • Windows ME

o Windows ME, introduced in 2000, is similar to Windows 98 with improved music, video, and home networking support.

- o It included the system restore utility
- Windows ME provides utilities as well as applications for dealing with PC software configuration, digital music, and video.

• • • Windows NT

- Windows NT 4.0, introduced in 1996, had a GUI similar to Windows 95.
- Pure 32 bit operating system.
- Windows NT is a server operating system that includes server protocols in its integrated network support.
- Introduced NTFS, better security

• • Windows NT

- Windows NT was the first Microsoft operating system to take full advantage of the capabilities of the special protected mode.
- Microsoft created two versions of NT

 one designed mainly for servers and
 another for individual user systems.

Windows 2000

- Windows 2000 family of operating system products, introduced in 2000, includes the best features of Windows 98 and Windows NT.
- Microsoft OS now shared the basic kernel but had a range of OS from desktop to enterprise level.
- The versions of Windows 2000 include Windows 2000 Professional, Windows 2000 Server, Windows 2000 Advanced Server, and Windows 2000 Enterprise Edition.

• • Windows XP

- Windows XP Home Edition and Windows XP Professional are the two XP products.
- Windows XP professional provides for improved GUI as well as several network- and security-related features.
- The Windows XP desktop, by default, only includes the Recycle Bin icon.

Macintosh Systems

Operating

- Macintosh operating systems only run on Apple Macintosh computers.
- The operating systems commonly used today are Mac OS 8, Mac OS 9, and Mac OS X.

MacintoshSystems

Operating

- Macintosh hardware and software are proprietary products of Apple Computer Company.
- Macintosh computers generally use the PowerPC chip with an architecture that is enhanced for graphics and multimedia.



- UNIX was introduced by Bell Labs Computing Science Research
 Center (Bell Labs) as UNIX Version 6 in 1975.
- UNIX is a portable operating system for mini-computers and mainframe computers.
- It supports timesharing and multi-user systems.
- It is an excellent server operating system as it utilizes resources carefully, allowing only the required services to be loaded.

• • UNIX/Linux

- The current commercial versions of UNIX include Sun Microsystems' Solaris, Hewlett-Packard's HP-UX, IBM's AIX, and Compaq's Tru64 UNIX.
- Many open source versions of UNIX are also available, which can be changed according to requirements.

Differences Among Operating Systems

- Command line interface (CLI) vs. Graphical user interface (GUI).
- Personal vs. network operating systems.
- Types and numbers of processors supported.

Utility Programs

- Utility program—a type of systems program written to perform a specific system task, usually related to managing or maintaining the system.
- Many utilities are built into operating systems as well as being available as stand-alone programs.
- File management programs—allow you to look at and manage the files stored on your PC (copy, move, organize into folders, etc.).

• Antivirus programs — find and eliminated computer viruses on your PC.

- *Diagnostic* programs—evaluate the computer system and make recommendations for fixing any errors found.
- Disk management programs—diagnose and repair problems related to the hard drive.
 - Disk de-fragmentation programs rearrange the files on a hard drive to store them in contiguous locations to speed up performance.

- Uninstall utilities remove programs from your hard drive without leaving bits and pieces behind.
 - Programs should never be deleted from the hard drive without using an uninstall procedure, unless there is no other alternative.
- File compression programs make files smaller for archiving or sending over the Internet.
 - Compression programs can both compress (*zip*) and decompress (*unzip*) files.
 - Common programs are WinZip for Windows users and Stuffit for Mac users.

- Backup utilities are programs designed to back up the contents of a hard disk.
- Recovery utilities are designed to help you recover from a major computer problem, such as rolling back your hard drive to an earlier state if it quits working after you install a new piece of hardware or software.

- Encryption programs are used to secure e-mail messages and files that are sent over the Internet or other networks; can also be used with individual files stored on a hard drive.
- Network and Internet utilities include:
 - Performance monitors
 - Logging programs
 - Directory services or identity management programs
 - Firewall programs
 - Antispam and e-mail filtering programs



What Is Unix?

- Operating system developed at AT&T in the 1970s
- Portable (moveable) to any platform (not proprietary to a particular hardware vendor)
- Now available as a public domain OS
 - known as Linux
- Reference: Red Hat Linux Survival Guide
 - M. J. Kabir, 2002

What Is An Operating System?

- A program that:
 - interprets commands you give it
 - provides a file system for your files
 - provides interfaces to peripherals such as printers, disks, tapes, CDs, screens, networks
- Examples of other OSs
 - Mac OS, Windows, NT, VMS, ...

Basics Of Linux

- Commands are case sensitive
 Is and LS are NOT the same
- The shell is the command line interpreter and there are different shells
 - bash, tcsh, csh, sh, ksh ...
 - they make each Linux look different
 - *tesla* & *casimirs* use **bash** by default
 - Check you shell: echo \$SHELL

Basics Of Linux Continued

- Command syntax
 - command [flags] arg1 arg2 ...
- Examples:

- ls -l *.ps
- ls smith
- ls -a
 - lists all files that begin with the dot character
- **ls** -**R**
 - lists all subdirectories

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Files And Directories

- Files contain information
 - ASCII characters
 - binary code
 - executable files (binary code)
 - a directory (encoded information about what files are in the directory)
- Directory is a collection of files and other directories

Pathnames

- The entire Linux file system is a series of files, some of which are yours
- You get to your files (your desk in the building and a particular drawer in your desk) by specifying a path
- Path names are:
 - /usr/local/bin
 - /home/bsmith or the short form ~bsmith or ~



Pathnames Cont'd

- A pathname is a series of names separated by slashes
- The root file system is /
- Names are a sequences of letters, digits, underscores, dots, ... (other characters but be very careful with some of these)
- Absolute pathnames begin with /

Special Pathnames

- . (a single dot) is the current directory
- .. (double dot) is the directory above the current directory
- \sim is your home directory (csh and tcsh only)
- ~user_name is user name's home directory(csh and tcsh)
- \$HOME is the home directory

Relative pathnames

- Let's say you are currently in */home/bsmith* and want to edit a file */home/bsmith/dir/fname.ext* with **pico**. You can use any of:
 - pico /home/bsmith/dir/fname.ext
 - pico dir/fname.ext
 - pico ./dir/fname.ext
 - pico ../bsmith/dir/fname.ext

Basic commands

- Copying files
 - cp [flags] file(s) destination
 - destination can be a file or directory
 - Analogue: COPY in MSDOS and VMS
- Renaming or moving files
 - mv [flags] file(s) destination
 - Analogues: RENAME and MOVE in MSDOS

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Basic commands cont.

- Deleting files [and directories]
 - rm [flags] file(s)
 - rm -r directory
 - Analogues: DEL, DELTREE in DOS
- Listing files and directories
 - more file
 - ls [flags] [file(s) or directories]
 - Analogues: MORE and DIR in DOS

Basic Commands - cont.

- Changing directories
 - cd [directory]
- Creating/deleting directories
 - mkdir [directory]
 - rmdir [directory]
- Finding out where you are
 - pwd

Basic commands - cont.

- Job/process control (* csh and tcsh)
 - jobs (list suspended and background tasks *)
 - $-^{\mathbf{Z}} or ^{\mathbf{C}}$ (suspend* or terminate current task)
 - bg [%job] (run suspended task in backgrnd *)
 - fg [%job] (bring task to foreground *)
 - kill -9 %job [or id] (terminate task)
 - command & (run command in background *)
 - **ps** [flags] (show status of processes)
Basic Commands - cont.

- Secure Connection to remote machines
 - ssh host [-l username]
 - ssh username@host
- Secure File Transfer

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- sftp host or scp (over a network)
- Collecting files into a single file
 - tar cvf archive.tar files_and/or_directories
 - tar xvf archive.tar



Basic File I/O

- Most commands read from standard input and write to standard output, and can be chained together to perform complicated tasks
 - command < input > output
 - command < input >& output
 - cmd1 < input | cmd2 | cmd 3 > output