CSE 100: Computer Skills

Lecture 4: Operating Systems

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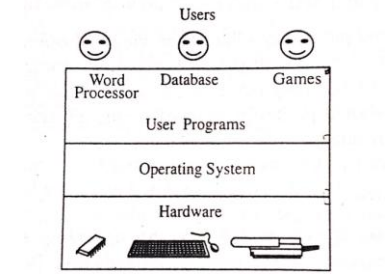
Operating Systems Basics

Operating System



Hypothetical view of a computer system with operating system

Functions of Operating Systems

- Sits between hardware and user programs
- Provide a user interface
- Run programs
- Manage hardware devices
- Organized file storage
- Do not solve user problems unlike user programs

Types of Operating Systems

- Batch Processing Operating System
- Multiprogramming Operating System
- Time Sharing Operating System
- Multiprocessing Operating System
- Real Time Operating System

Types of Operating Systems

- Batch Processing Operating system
  - One user works on the system
  - Performs one task at a time
  - Programmers write programs and punch into cards
  - Operator collect and run them in batches of similar language
  - Most things are done by programming
  - Common language include FORTRAN, COBOL, BASIC etc
  - MS-DOS and CP/M are examples

Types of Operating Systems

- Multiprogramming OS
  - User performs many tasks at once
  - UNIX and IBM VM are examples
  - Require expensive computers
  - Tends to be complex and requires more memory
  - When one program waits for I/O other program runs
  - OS keeps several programs in memory and switches among them
  - Improves CPU utilization
  - Increases throughput

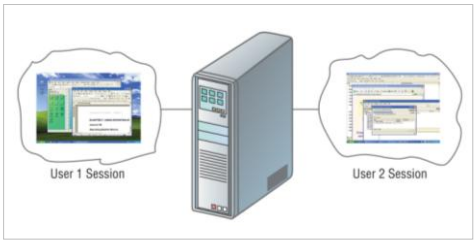
Types of Operating Systems

- Time sharing/ Multi Tasking OS
  - Most common form of OS
  - Similar to multiprogramming
  - User performs many tasks at once
  - Windows XP, 7, 8, 10, OS X are examples
  - Require expensive computers
  - Runs different program in time sharing basis
  - OS keeps several programs in memory and switches among them
  - Improves CPU utilization
  - Increases throughput

Types of Operating Systems

- Multiprocessing OS
  - Used in computers with more than 1 CPU
  - Runs multiple program in parallel because of more than 1 CPU
  - Many users connect to one computer
  - UNIX, Linux, VMS, Windows NT are examples
  - Maintenance can be easy
  - Saves money
  - More Reliable
  - Requires a powerful computer

Multi user/Multi tasking OS



Types of Operating Systems

- Real-time operating system
  - Very fast small OS
  - Built into a device
  - Respond quickly to user input
  - MP3 players, Medical devices

Operating System Components

- Process Management
- Memory Management
- Device Management
- Storage Management
- Application Interface
- User Interface

Process Management

- A *process* is a program in execution. A process needs certain resources, including CPU time, memory, files, and I/O devices, to accomplish its task.
- OS also has its own process
- The operating system is responsible for the following activities in connection with process management.
  - Process creation and deletion
  - Process suspension and resumption
  - Provision of mechanisms for:
    - process synchronization
    - process communication

Memory Management

- Every process requires memory to operate
- Main memory (RAM) is a volatile storage device. It loses its contents in the case of system failure.
- The operating system is responsible for the following activities in connections with memory management:
  - Keep track of which parts of memory are currently being used and by whom.
  - Decide which processes to load when memory space becomes available.
  - Allocate and de-allocate memory space as needed.

Device Management

- Hardware devices manufactured by different vendors work in different way.
- When connected to computer system they need to work in co0peration with others
- OS ensures that different devices work in cooperation with each other
- OS takes into notice if hardware is
  - Changed
  - Upgraded
  - Updated

Storage Management

- Since main memory (primary storage) is volatile and too small to accommodate all data and programs permanently, the computer system must provide secondary storage to back up main memory.
- Most modern computer systems use disks as the principle on-line storage medium, for both programs and data.
- The operating system is responsible for the following activities in connection with disk management:
  - Free space management
  - Storage allocation
  - Disk scheduling

Organizing Files and Folders

- Organized storage
- Long file names
- Folders can be created and nested
- All storage devices work consistently

Application Interface

- Common interface of hardware to be used by different applications
- For example, there are many vendors for printers, which becomes tricky for an application to handle printing, thus operating system handles the hardware interface and application can simply call for a print operation

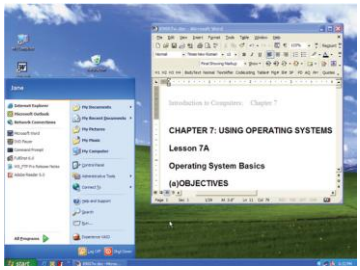
User Interface

- How a user interacts with a computer
- It determines whether users control the computer or computer forces the user to act in certain ways

Providing a User Interface

- Graphical user interface (GUI)
  - Most common interface
    - Windows, OS X, Gnome, KDE
  - Uses a mouse to control objects
  - Uses a desktop metaphor
  - Shortcuts open programs or documents
  - Open documents have additional objects
  - Task switching
  - Dialog boxes allow directed input

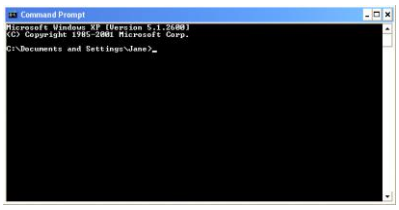
Graphical User Interface



Providing a User Interface

- Command line interfaces
  - Older interface
    - DOS, Linux, UNIX
  - User types commands at a prompt
  - User must remember all commands
  - Included in all GUIs

Command Line Interface



Operating System Services

- Program Execution
  - System capability to load program into memory and run it
- I/O Operations
  - since user programs cannot execute I/O operations directly, the operating system must provide some means to perform I/O.
- File Manipulation
  - program capability to read, write, create, and delete files.

Operating System Services

- Communication
  - exchange of information between processes executing either on the same computer or on different systems tied together by a network. Implemented via shared memory or message passing.
- Error Detection
  - ensure correct computing by detecting errors in the CPU and memory hardware, in I/O devices, or in user programs.

System Calls

- Provides consistent access to OS features
- System calls provide the interface between a running program and the operating system.
  - Generally available as assembly-language instructions.
  - Languages defined to replace assembly language for systems programming allow system calls to be made directly (e.g., C, C++)
- On Windows OS system calls are known as API (Application Program Interface)

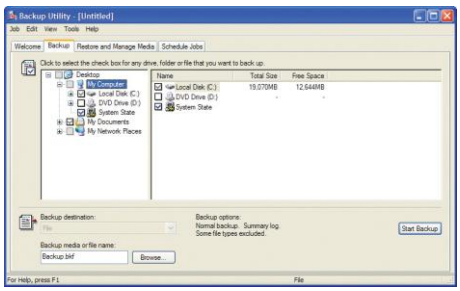
System Programs

- Programs built using system calls for better use of a computer system by its users
- On windows explorer is the best example of system program
- Other examples on windows include: Scandisk, Defrag, Backup, System information etc
- System programs can also be made by third party vendors
  - Example include Norton antivirus, Avro etc

Enhancing an OS

- Utilities
  - Provide services not included with OS
  - Goes beyond the four functions
  - Firewall, anti-virus and compression
  - Prices vary
- Backup software
  - Archives files onto removable media
  - Ensures data integrity
  - Most OS include a backup package
  - Many third party packages exist

Backup Software



Enhancing an OS

- Anti-virus software
  - Crucial utility
  - Finds, blocks and removes viruses
  - Must be updated regularly
  - McAfee and Norton Anti-Virus

Enhancing an OS

- Firewall
  - Crucial utility
  - Protects your computer from intruders
  - Makes computer invisible to hackers
  - Zone Labs is a home firewall
  - Cisco sells hardware firewalls
- Intrusion detection
  - Often part of a firewall package
  - Announces attempts to breach security
  - Snort is a Linux based package

Enhancing an OS

- Screen savers
  - Crucial utility for command line systems
    - Prevents burn in
  - Merely fun for GUI systems
  - Screen saver decorates idle screens

Managing Hardware

- Programs need to access hardware
- Interrupts
  - CPU is stopped
  - Hardware device is accessed
- Device drivers control the hardware

Different PC and Network Operating Systems

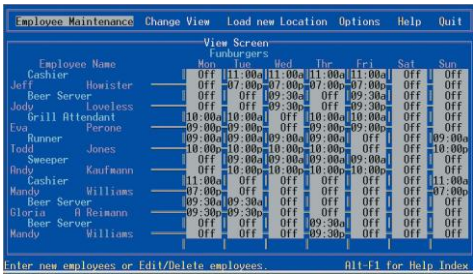
PC Operating Systems

- Microsoft Windows is the most popular
  - Installed more than other OS combined
  - Installed on about 95% of computers
  - Apple and Linux represent the other 5%

PC Operating Systems

- DOS
  - Disk Operating System
  - Single user single-tasking OS
  - Command line interface
  - 16-bit OS
  - Powerful
  - Fast
  - Supports legacy applications

DOS Application



PC Operating Systems

- Windows NT
  - Designed for a powerful system
  - 32-bit OS
  - Very stable
  - Windows NT Workstation
    - Single user multi tasking OS
  - Windows NT Server
    - Multi user multi tasking OS
    - Network operating system

PC Operating Systems

- Windows 9x
  - 95, 98, and Millennium Edition (Me)
  - 32-bit OS
    - Supported 16-bit programs well
  - Very pretty not stable OS
  - Still found in large corporations
  - 95 introduced the Start button
  - 98 introduced active desktop
  - Me improved multimedia software

PC Operating Systems

- Windows 2000
  - Look of 9x with NT stability
  - Optimized for office and developers
  - Application software ran very well
  - Entertainment software ran very poorly

PC Operating Systems

- Windows XP
  - Different look from 2000
  - Many different versions
  - Digital multimedia support was enhanced
  - Communications was enhanced
  - Mobile computing became a priority

PC Operating Systems

- Windows 7
  - Developed after disastrous performance of windows Vista
  - Different look from XP but looks similar to vista
  - Many different versions
  - Digital multimedia support was enhanced
  - Communications was enhanced

PC Operating Systems

- Windows 8
  - Released 5 years after windows 7
  - Main focus on touch computing
  - Ditches start menu after decades of usage
  - Many different versions
  - Optimization for running in wide variety of hardware
  - Runs on tablets also

PC Operating Systems

- Windows 10
  - Microsoft's newest desktop product
  - Looks like a combination of windows 7 and 8
  - Focuses mainly on creativity
  - Improves touch computing
  - Same OS runs on many different form factor
    - PC
    - XBOX
    - Mobile
    - Tablets

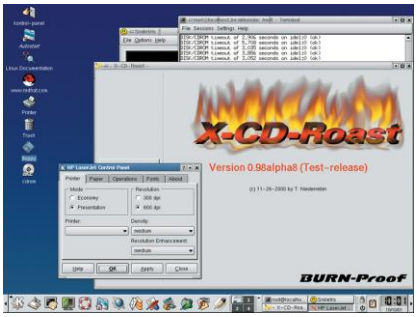
PC Operating Systems

- UNIX
  - Runs on all computer types
  - 32- or 64-bit
  - Very stable and fast
  - Command-line interface
  - Can cost thousands of dollars

PC Operating Systems

- Linux
  - Free or inexpensive version of UNIX
  - 32-bit OS
  - Very stable and fast
  - Most flavors are open source
  - X Windows GUI
    - Command line interface is available

Linux Desktop



PC Operating Systems

- Macintosh operating systems
  - OS X
  - Based on FreeBSD Linux
  - Very stable and easy to configure
  - Only runs on Mac hardware

OS X Desktop

Embedded Operating Systems

- Devices have EOS built in
- Cell phones, PDAs, medical equipment, ATM booth
- Stable and fast
- Windows XP embedded
  - Based on Windows XP
  - Customized for each device

Embedded Operating Systems

- Palm OS
  - Standard on Palm PDA
  - First PDA OS for consumers
  - Can be found on cell phones
- Symbian
  - Found in smart cell phones
  - Games, Instant Messaging, Internet
  - Full color display

Self Study

- Section 4.8 :An Introduction to windows 2000

Homework Based on Lecture 4

- Questions from Introduction to computers by Mohammed Alamgir
- 1,4,5,6,7,9,13,14,17,19,20

END