CS343 - Operating Systems

Module-1C

Operating System Services

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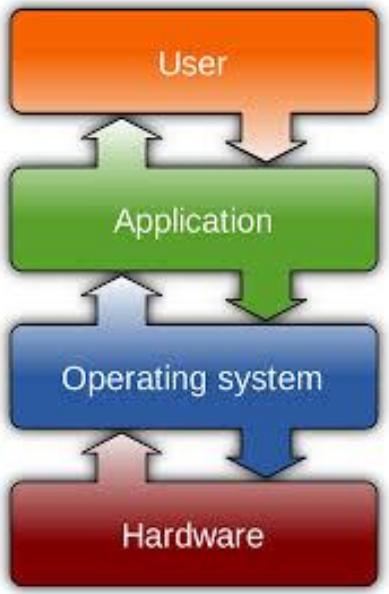
Session Outline

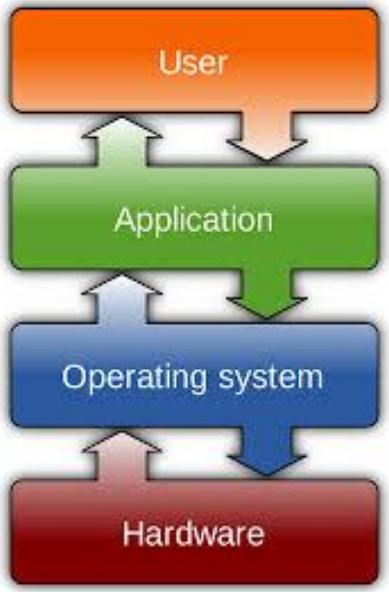
- OS structure
- Process Execution
- Process Management
- Memory Management
- File Management
- Storage Management
- I/O Sub-system Management
- Protection and Security
- User Interface

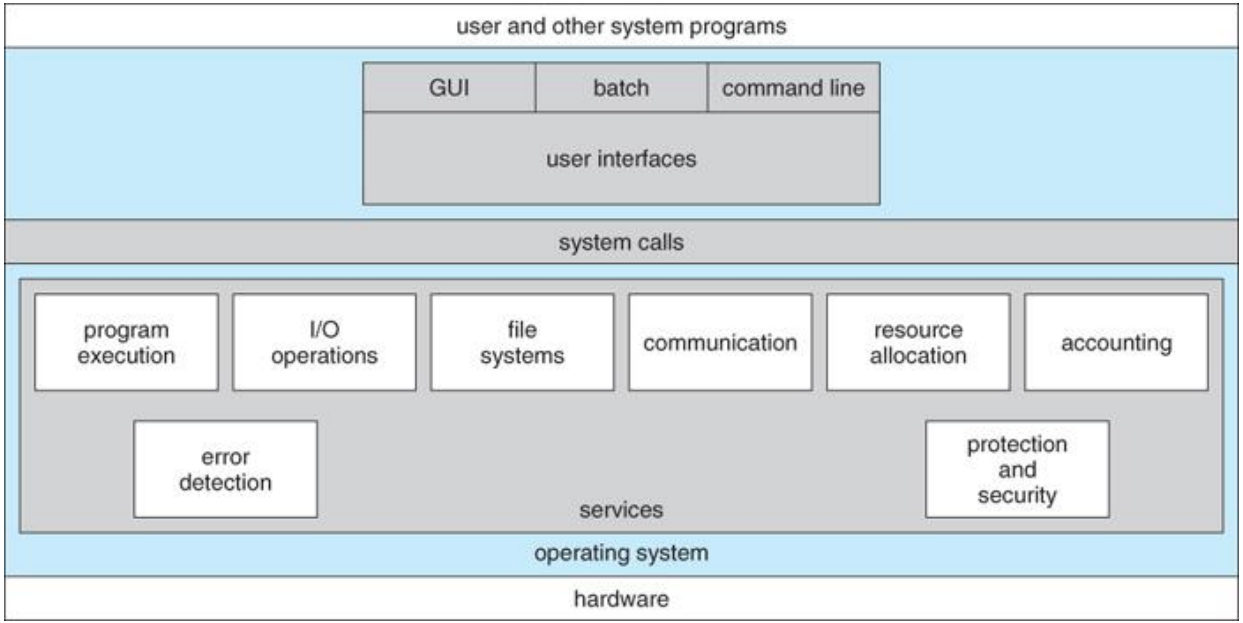
Operating System

- Operating system goals:
  - Execute user programs on hardware
  - Make the computer system convenient to use
  - Use the computer hardware in an efficient manner
- OS is a **resource allocator**
- OS is a **control program**



Operating System Services





Operating System Services

- The OS structure is divided into many sub-components.
  - Process Execution
  - Process Management
  - Memory Management
  - File Management
  - Storage Management
  - I/O Sub-system Management
  - Protection and Security
  - User Interface

Process Execution

- A process is a program in execution
- It is a unit of work within the system
- Program is a passive entity, process is an active entity.
- OS must be able to load a program into memory, run that program, and end execution
- Assign resources like CPU, memory, I/O, files, data to accomplish its task
- Process termination requires reclaim of any reusable resources

Process Execution

- Single-threaded process has one program counter specifying location of next instruction to execute
- Multi-threaded process has one program counter per thread
- Typically system has many processes, some user, some operating system running concurrently on one or more CPUs
- Concurrency by multiplexing the CPUs among the processes / threads

Process Management

- Creating and deleting both user and system processes
- Suspending and resuming processes
- Providing mechanisms for process synchronization
- Providing mechanisms for process communication
- Providing mechanisms for deadlock handling

Memory Management

- To execute a program all (or part) of the instructions must be in memory
- All (or part) of the data that is needed by the program must be in memory
- Memory management determines what is in memory and when
- Keeping track of which parts of memory are currently being used and by whom
- Deciding which processes and data to move into and out of memory
- Allocating and deallocating memory space as needed

File Management

- OS provides uniform, logical view of information storage
- Abstracts physical properties of storage to logical storage unit - file
  - Files are usually organized into directories
  - OS determines access control on files/directories that determine who can access what
- File-System management include
  - Creating and deleting files and directories
  - Primitives to manipulate files and directories
  - Mapping files onto secondary storage
  - Backup files onto stable (non-volatile) storage media

Storage Management

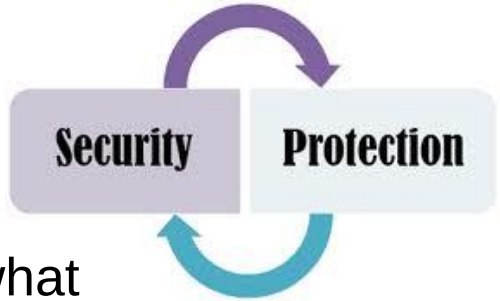
- Mass storage devices (disks/ tape drives) store data that does not fit in main memory or data that must be kept for a long period of time
- Devices vary in access speed, capacity, data-transfer rate, access method
- OS activities in disk management includes
  - Free-space management
  - Storage allocation
  - Disk scheduling

I/O Subsystem Management

- OS hides peculiarities of hardware devices from the user
- I/O subsystem responsible for
  - Buffering (storing data temporarily while it is being transferred)
  - Caching (storing parts of data in faster storage for performance)
  - Spooling (the overlapping of output of one job with input of other jobs)
  - Providing device-driver interface

Protection and Security

- **Protection** – any mechanism for controlling access of processes or users to resources defined by the OS
- **Security** – defense of the system against internal and external attacks
  - Huge range, including denial-of-service, worms, viruses, identity theft, theft of service



- Distinguish among users, to determine who can do what
  - User identities (user IDs) and associated access controls on resources
  - Group identifier (group ID) associated access controls on resources
  - Privilege escalation to change to give more rights

User Interface

- Provides a user friendly platform to initiate actions from user side.
- The UI primarily receives command from user and executes it
- Command-Line Interface (CLI) allows direct command entry
- User-friendly desktop Graphical User Interface (GUI)
  - Usually mouse, keyboard, and monitor used for giving inputs.
  - Icons represent files, programs, actions, etc
  - Various mouse buttons over objects in the interface cause various actions (provide information, options, execute function, open directory)
- Many systems (Microsoft, Apple-Mac OS, UNIX) now include both CLI and GUI interfaces

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