



**Sunbeam Institute of Information Technology**  
**Pune and Karad**  
**PreCAT**

**Module – Operating System Concepts**

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# Operating System - Introduction

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- Interface between end user and computer hardware.
- Interface between Programs and computer hardware.
- Control program that controls execution of all other programs.
- Resource manager/allocator that manage all hardware resources.
- Bootable CD/DVD = Core OS + Applications + Utilities
- Core OS = Kernel -- Performs all basic functions of OS.



# Operating System - Functions

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- Compulsory / Kernel Functionalities
  - CPU scheduling
  - Process Management
  - Memory Management
  - File & IO Management
  - Hardware abstraction
- Optional / OS Functionalities
  - User interfacing
  - Security & Protection
  - Networking



# Operating System - Program

- Set of instructions given to the computer(Executable file).
- **Program** --> Sectioned binary --> "objdump" & "readelf".
  - **Exe header:** Magic number, Address of entry-point function, Information about all sections. (objdump -h program.out)
  - **Text:** Machine level code (objdump -S program.out)
  - **Data:** Global and Static variables (Initialized)
  - **BSS:** Global and Static variables (Uninitialized)
  - **RoData:** String constants
  - **Symbol Table:** Information about the symbols (Name, Size, section, Flags, Address) (objdump -t program.out)
- Program (Executable File) Format
  - Windows -- PE
  - Linux -- ELF
- Program are stored on disk (storage).



# Operating System - Process

- Program under execution
- Process executes in RAM.
- Process control block contains information about the process (required for the execution of process).
  - Process id
  - Exit status
  - Scheduling information (State, Priority, Sched algorithm, Time, ...)
  - Memory information (Base & Limit, Segment table, or Page table)
  - File information (Open files, Current directory, ...)
  - IPC information (Signals, ...)
  - Execution context
  - Kernel stack
- PCB is also called as process descriptor (PD), uarea (UNIX), or task\_struct (Linux)



# Operating System - Evolution

- Resident Monitor
- Batch Systems
- Multi-Programming
  - Degree of Multi-Programming
  - CPU Burst – Time spend for CPU Computations
  - IO Burst – Time spend for IO
  - If CPU burst > IO burst, then process is called as "CPU bound".
  - If IO burst > CPU burst, then process is called as "IO bound".
- Multi-tasking OR time-sharing
  - Process Based Multitasking
  - Thread Base Multitasking or Multi-threading
- Multi-user
- Multiprocessing systems (Increase throughput)
  - Asymmetric Multi Processing
  - Symmetric Multi Processing



# Operating System – Process Life Cycle

- **Data Structures / Lists**
  - **Job queue / Process table**
    - PCBs of all processes in the system are maintained here.
  - **Ready queue**
    - PCBs of all processes ready for the CPU execution are kept here.
  - **Waiting queue**
    - Each IO device is associated with its waiting queue
    - processes waiting for that IO device will be kept in that queue.



# Operating System – Process Life Cycle

- **Process States**

- **New**

- New process PCB is created and added into job queue. PCB is initialized and process get ready for execution.

- **Ready**

- The ready process is added into the ready queue. Scheduler pick a process for scheduling from ready queue and dispatch it on CPU.

- **Running**

- The process runs on CPU. If process keeps running on CPU, the timer interrupt is used to forcibly put it into ready state and allocate CPU time to other process.

- **Waiting**

- If running process request for IO device, the process waits for completion of the IO. The waiting state is also called as sleeping or blocked state.

- **Terminated**

- If running process exits, it is terminated.







Thank you!

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