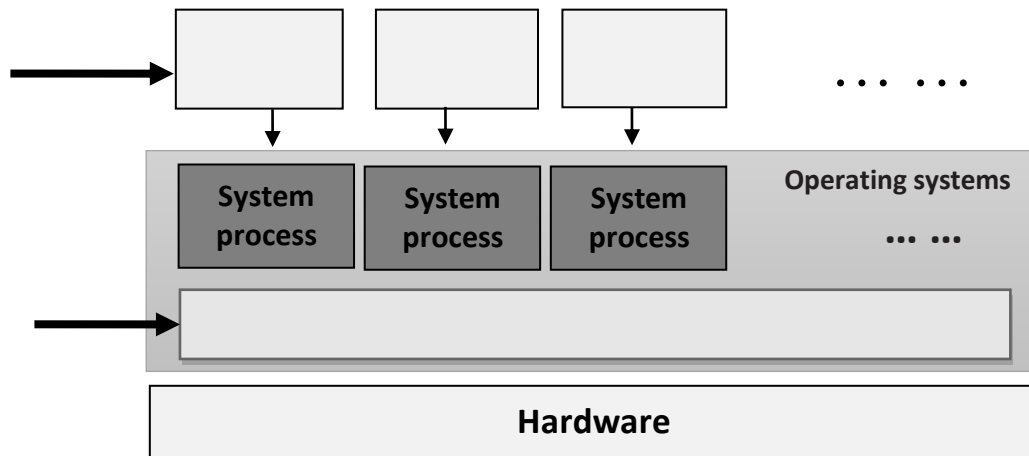


Exercise Series N°01 : Introduction to Operating Systems

Exercise I.1: (Operating System Structure)

- Q1) What is an operating system?
- Q2) Distinguish between application software and system software.
- Q3) What is a system call?
- Q4) The diagram shows the basic structure of an operating system. Fill in the boxes with the names of the components marked by the arrow.



Exercise I.2: (Operating Systems Types)

- Q1) Describe the objective of batch processing.
- Q2) Name the preconditions that must be satisfied for batch processing before the execution of a task can begin.
- Q3) Describe what spooling is.
- Q4) Describe the objective of time-sharing.
- Q5) Describe how time-sharing distributes the computing time among the processes.
- Q6) Give the name of the quasi-parallel program or process execution.
- Q7) Describe the objective of the quasi-parallel program or process execution.
- Q8) What are the main advantages of multiprogramming ?
- Q9) Define the essential difference between Spooling and Buffering.

Exercise I.3: (Classifications of Operating Systems)

- Q1) At any given moment, only a single program can be executed. Give the technical term for this operation mode.
- Q2) Name one single-tasking operating system.
- Q3) Name multitasking operating system.
- Q4) Name one single-user operating system.
- Q5) Name one multi-user operating system.
- Q6) Describe the difference between 8-bit, 16-bit, 32-bit, and 64-bit operating systems.

Exercise I.4: (Uni-programming and Multi-programming)

In a batch operating system, three jobs are submitted for execution. Each job involves an I/O activity, CPU time, and another I/O activity of the same time span as the first.

- **JOB 1**, requires a total of **27ms** with **4ms** CPU time;
- **JOB 2**, requires a total time of **35ms** with **5ms** CPU time;
- **JOB 3**, requires a total time of **13ms** with **6ms** CPU time.

Q1) Illustrate their execution and find the CPU utilization for Uni-programming and Multi-programming systems.

- A)** All jobs share a single I/O device
- B)** Each job has its own I/O device.

Exercise I.5: (Uni-programming, Multi-programming, and Time-Sharing)

Suppose we have four jobs in a computer system, in the order JOB1, JOB2, JOB3 and JOB4.

- JOB1 requires **6 s** of CPU time and **6 s** of I/O time;
- JOB2 requires **4 s** of CPU time and **12 s** of disk time;
- JOB3 requires **8 s** of CPU time; and
- JOB4 requires **4 s** of CPU time and **14 s** of printer time.

Define the following quantities for system utilization:

- Turnaround time = actual time to complete a job
- Throughput = average number of jobs completed per time period **T** (take **T = one minute**)
- Processor utilization = percentage of time that the processor is active (not waiting)

Q1) Compute these quantities (with illustrations if needed) in each of the following systems:

- A)** Uni-programming system, whereby each job executes to completion before the next job can start its execution.
- B)** Multiprogramming system.
- C)** Time-Sharing system, each process gets **2 s** of CPU time turn-wise in a circular manner

Exercise I.6: (DMA: Direct Memory Access)

A batch is made up of **50 jobs**, each of which, for simplicity, is assumed to consist of **3 phases**:

- Reading data (duration **20 s**)
- Calculation operation on the data (duration **15 s**)
- writing the result (duration **5 s**).

The time it takes to go from one job to the next is negligible.

Q1) Calculate the total batch processing time, then the CPU utilization for “real” calculation, in the following **2 cases**:

- A)** The CPU manages I/O devices (and therefore can't do anything other than wait while I/O takes place).
- B)** Peripherals are self-contained, with direct memory access (DMA).