Operating system resource optimization

16 System Software	
16.1 Purposes of an Operating System (OS)	
Candidates should be able to:	Notes and guidance
Show understanding of how an OS can maximise the use of resources	
Describe the ways in which the user interface hides the complexities of the hardware from the user	
Show understanding of process management	The concept of multi-tasking and a process The process states: running, ready and blocked The need for scheduling and the function and benefits of different scheduling routines (including round robin, shortest job first, first come first served, shortest remaining time) How the kernel of the OS acts as an interrupt handler and how interrupt handling is used to manage low-level scheduling
Show understanding of virtual memory, paging and segmentation for memory management	The concepts of paging, virtual memory and segmentation The difference between paging and segmentation How pages can be replaced How disk thrashing can occur

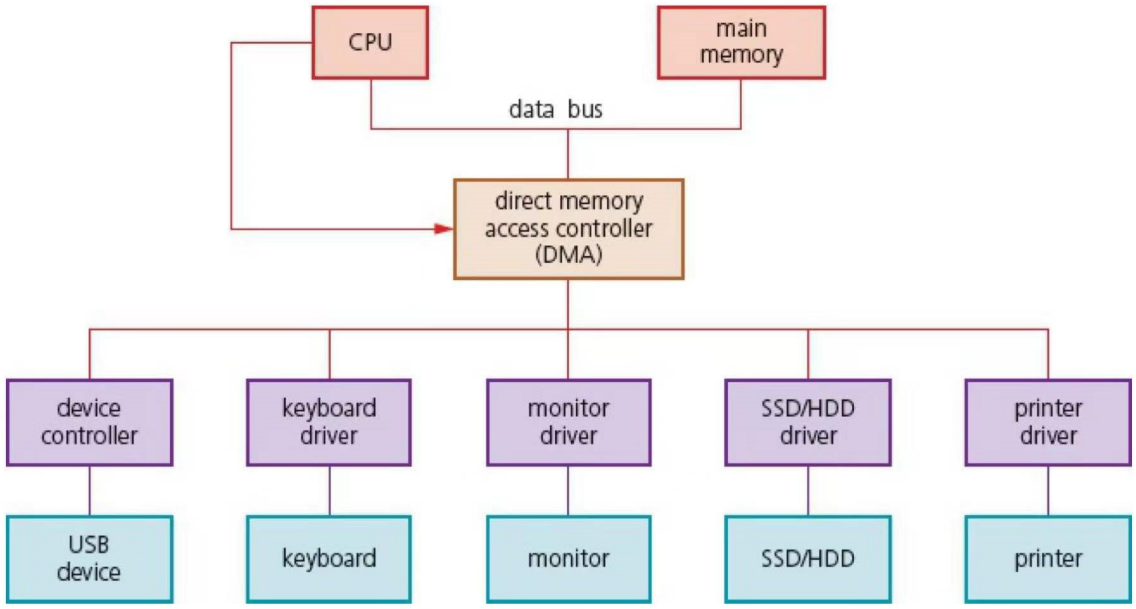
---

Operating system resource optimization

How an operating system can maximize the use of resources:

- Primary memory
  - Moving frequently accessed instructions to cache
  - … for faster recall
  - … as SRAM is used rather than DRAM for cache
  - Making use of virtual memory
  - … with paging or segmentation
  - … to swap memory to and from disk
  - Partition memory
  - … dividing main memory into static partitions
  - … to allow more than one task to be available
  - Removing unused item/tasks from RAM
  - … by marking a partition as available

    - ... as soon as the process using it has terminated
- Disk
    - Disk cache
    - … a disk cache holds data that is frequently transferred to/from the disk
    - … the cache can be held in disk or RAM
    - Compression utility
    - … decreasing the size of file stored on the disk
    - … in order to fit larger files on the disk
    - Defragmentation utility
    - … files are rearranged to occupy contiguous disk space
    - … this reduces the time taken to access files/decrease latency
- CPU
    - Scheduling
    - … Better utilization of CPU time and resources
- Input/Output system
    - IO operation initiated by the computer user
    - IO operation which occurs while software is being run and resources such as printers and disk drives are requested
    - **Direct memory access(DMA)** controller is needed to allow hardware to access the main memory independently of the CPU.
        - DMA initiates the data transfer
        - CPU carries out other tasks while this data transfer operation take place
        - Once the data transfer is complete, an interrupt signal is sent from the DMA to CPU.


CPU
main memory
data bus
direct memory access controller (DMA)
device controller
keyboard driver
monitor driver
SSD/HDD driver
printer driver
USB device
keyboard
monitor
SSD/HDD
printer