TOPIC#2: PAGING AND VIRTUAL MEMORY

PAGING:

Paging is a memory management technique used by operating systems to efficiently allocate and manage memory. It divides the memory into fixed-sized blocks called pages. Each page has a unique address, and these addresses are used by programs when accessing data in memory.

Virtual Memory:

Virtual memory is a technique that allows programs to use more memory than what is physically available in the system. It provides an abstraction layer called the virtual address space. Each program is assigned its own virtual address space, which is divided into pages. The program accesses data using virtual addresses, which are then translated into physical addresses by the operating system.

ADDRESS TRANSLATION:

When a program accesses data using a virtual address, the operating system translates that address into a physical address. This translation is performed using a data structure called the page table. The page table maps virtual pages to physical frames in memory. The operating system uses this mapping to retrieve the actual data from the physical memory.

PAGE FAULTS:

A page fault occurs when a program tries to access a page that is not currently in the physical memory. This can happen if the page has been swapped out to secondary storage or has not been loaded yet. When a page fault occurs, the operating system retrieves the required page from secondary storage and loads it into an available physical frame.

MEMORY PROTECTION:

Virtual memory provides memory protection by assigning each page a set of permissions. These permissions

determine whether a page can be read from, written to, or executed. If a program tries to access a page with improper permissions, a hardware exception or software interrupt occurs, and the operating system can take appropriate action, such as terminating the program. Memory protection ensures the security and isolation of processes.

EFFICIENT MEMORY UTILIZATION:

Paging and virtual memory enable efficient memory utilization. Less frequently used pages can be swapped out to secondary storage, freeing up space in the physical memory for other active processes or pages. This allows programs to use more memory than what is physically available and improves overall system performance by reducing the need to constantly access the slower secondary storage.

Paging and virtual memory are critical components of modern operating systems. They allow programs to work with larger memory spaces, provide memory protection, and improve memory utilization. By using paging and virtual memory techniques, operating systems can

effectively manage memory resources and enhance the performance and stability of computer systems.