Memory Management

PAANA ACADEMY

Memory Address

Main Memory is a large array of words or bytes, ranging in size from hundreds of thousands to billions.

Main memory is the place where programs and information are kept when the processor is effectively utilizing them.

Main memory is also known as RAM.

This memory is volatile.

RAM loses its data when a power interruption occurs.

Logical Address   & Physical Address

- **Logical Address Space:** An address generated by the CPU is known as a "Logical Address". It is also known as a virtual address. Logical address space can be defined as the size of the process. A logical address can be changed.

- **Physical Address Space:** An address seen by the memory unit (i.e the one loaded into the memory address register of the memory) is commonly known as a "Physical Address". A physical address is also known as a Real address.

- The run-time mapping from virtual to physical addresses is done by a hardware device Memory Management Unit(MMU).

Memory Allocation

To gain proper memory utilization, memory allocation must be allocated efficient manner. One of the simplest methods for allocating memory is to divide memory into several fixed-sized partitions and each partition contains exactly one process. Thus, the degree of multiprogramming is obtained by the number of partitions.

First Fit: In the first-fit , the first available free hole fulfil the requirement of the process allocated.

Best Fit:In the best-fit, allocate the smallest hole that is big enough to process requirements. For this, we search the entire list, unless the list is ordered by size.

Worst Fit: In the worst fit allocate the largest available hole to process.

Fragmentation

Fragmentation Is defined as when the process is loaded and removed after execution from memory, it creates a small free hole.

These holes can not be assigned to new processes because holes are not combined or do not fulfill the memory requirement of the process.

Internal fragmentation: Internal Fragmentation occurs when memory blocks are allocated to the process more than their requested size. Due to this some unused space is left over and creating an internal fragmentation.

External fragmentation: In external fragmentation, we have a free memory block, but we can not assign it to a process because blocks are not contiguous.

Compaction

In the compaction technique, all free memory space combines and makes one large block. So, this space can be used by other processes effectively.

Non-contiguous

Another possible solution to the external fragmentation is to allow the logical address space of the processes to be noncontiguous, thus permitting a process to be allocated physical memory wherever the latter is available.

Paging

Paging is a memory management scheme that eliminates the need for a contiguous allocation of physical memory. This scheme permits the physical address space of a process to be non-contiguous.

- **Logical Address or Virtual Address (represented in bits):** An address generated by the CPU.
- **Logical Address Space or Virtual Address Space (represented in words or bytes):** The set of all logical addresses generated by a program.
- **Physical Address (represented in bits):** An address actually available on a memory unit.
- **Physical Address Space (represented in words or bytes):** The set of all physical addresses corresponding to the logical addresses.
- The mapping from virtual to physical address is done by the memory management unit (MMU) which is a hardware device and this mapping is known as the paging technique.

- The Physical Address Space is conceptually divided into several fixed-size blocks, called **frames**.

- The Logical Address Space is also split into fixed-size blocks, called **pages**.

- Page Size = Frame Size

Memory Leak

A memory leak occurs when a program fails to release memory that it no longer needs, resulting in wasted memory resources.

Page Replacement Algorithms

- First In First Out (FIFO)

- Optimal Page replacement

- Least Recently Used

- Most Recently Used (MRU)

File system

A file is a collection of related information that is recorded on secondary storage.

A file system is a method an operating system uses to store, organize, and manage files and directories on a storage device.

- **FAT (File Allocation Table):** An older file system used by older versions of Windows and other operating systems.
- **NTFS (New Technology File System):** A modern file system used by Windows. It supports features such as file and folder permissions, compression, and encryption.
- **ext (Extended File System):** A file system commonly used on Linux and Unix-based operating systems.
- **HFS (Hierarchical File System):** A file system used by macOS.
- **APFS (Apple File System):** A new file system introduced by Apple for their Macs and iOS devices.

The name of the file is divided into two parts as shown below:

- Name

- Extension, separated by a period.

The collection of files is a file directory.

The directory contains information about the files, including attributes, location, and ownership.

MCQ

https://www.sanfoundry.com/operating-system-questions-answers-memory-management/

https://www.sanfoundry.com/operating-system-mcqs-memory-allocation-1/

https://www.sanfoundry.com/operating-system-mcqs-memory-allocation-2/