Paging and Memory Access in Protected Mode of 80386 Microprocessor

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Introduction

Microprocessor that offers more features and security.

- **Paging**:
  A memory management scheme that eliminates the need for contiguous allocation of physical memor. The process of retrieving processes in the form of pages from the secondary storage into the main memory is known as paging.
- **Protected Mode**:
  An advanced mode of 80386.New features like control registers and the task register enabled these protected mode capabilities.

Protected Mode Features

- **Address Space**: Supports up to 4 GB of virtual memory.
- **Segmentation**: Divides memory into segments, each with its own base address and limit.
- **Protection**: Ensures programs cannot access memory outside their allowed segments.

Paging Mechanism

- **Page**: A fixed-length block of memory, typically 4 KB in size.
- **Page Table**: A data structure used to map virtual addresses to physical addresses.
- **Page Directory**: An array of pointers to page tables.

Memory Access in Paging

- **Virtual Address**: The address used by program. Size of virtual address is 32-bit.
- **Page Directory Entry (PDE)**: The first 10 bits of the virtual address index into the page directory.
- **Page Table Entry (PTE)**: The next 10 bits index into the page table.
- **Offset**: The last 12 bits specify the exact location within the page.

Steps for Memory Access

1. Generates Virtual Address

The CPU generates a virtual address when a program tries to access memory.

2. Divides Virtual Address

The virtual address is divided into three parts:

i. **Page Directory Index(PDI):** Identifies the entry in the page directory.

ii. **Page Table Index(PTI):** Identifies the entry in the Page Table.

iii. **Offset:** The specific location within the physical page.

3. Access Page Directory:

- Use PDI to find the Page Directory Entry(PDE).

4. Access Page Table

- Use PTI to find the Page Table Entry(PTE).

5. Calculate Physical Address:

- Add Offset to the base address from PTE.

6. Memory Access:

- CPU reads or write at the physical address.

Advantages of Paging

- **Efficient Memory Use**

  Paging helps manage memory more efficiently by dividing it into fixed-size pages. This avoids the problem of fragmentation, where free memory is scattered in small, non-contiguous block.

- **Memory Protection**

  Paging isolates different processes by ensuring that each process operates within its own allocated pages which prevents ones process from accessing the memory of another process.

- **Supports for Virtual Memory**

  Extends usable memory beyond physical limits using disk space

Summary

- The Intel 80386 microprocessor introduced important features like protected mode and paging, which improved how computer manage memory and run multiple task.
- **Protected Mode** helps keep programs and data separate, making system more stable and secure.
- **Paging** allows the processor to handle large amounts of memory efficiently by dividing it into manageable memory size.

THANK YOU…