Operating Systems W11L2 - Memory Management III

Class	Operating Systems
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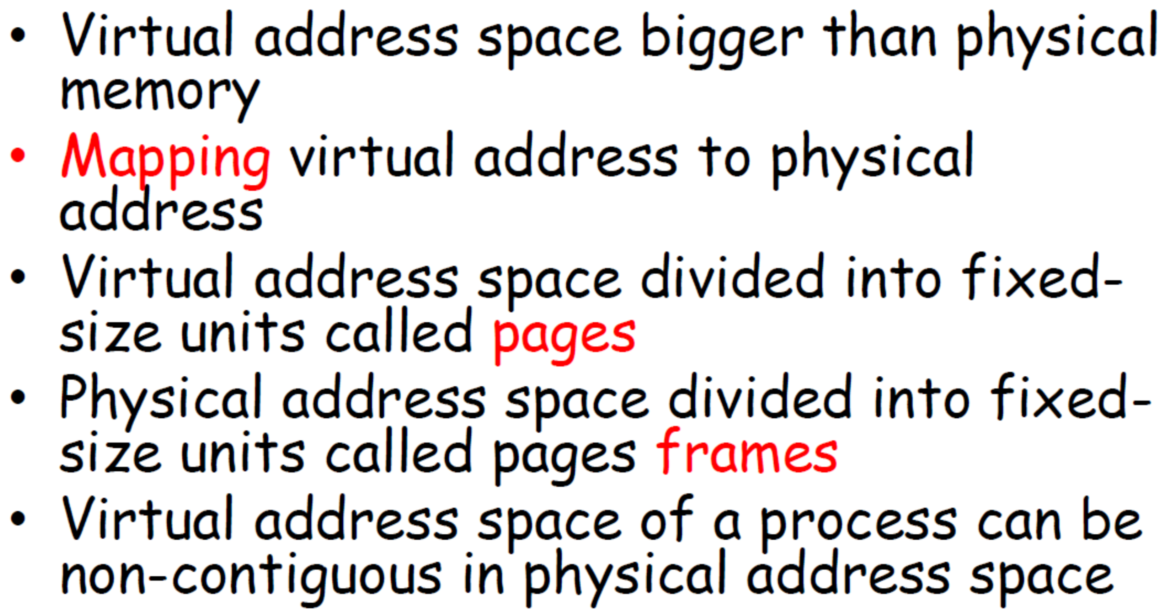
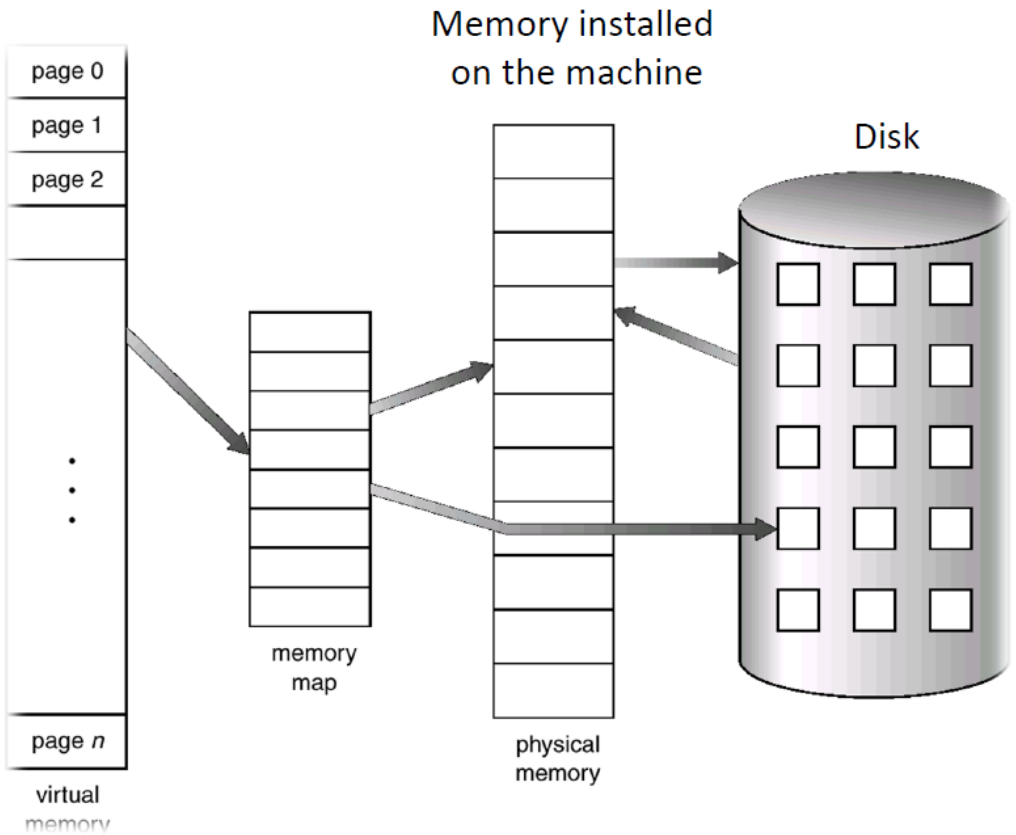
Materials	08 - Memory Management III.pdf
Reviewed	□
Type	Lecture

Recap

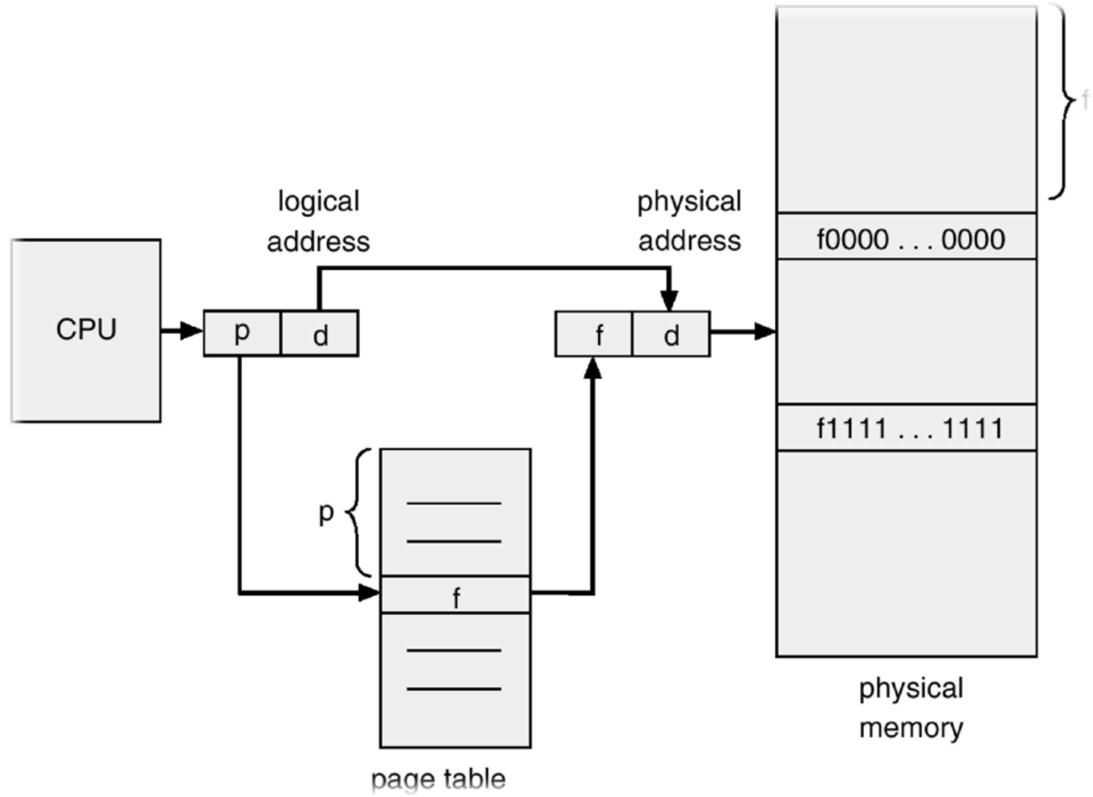
▼ Paging Summary Slide and Diagrams

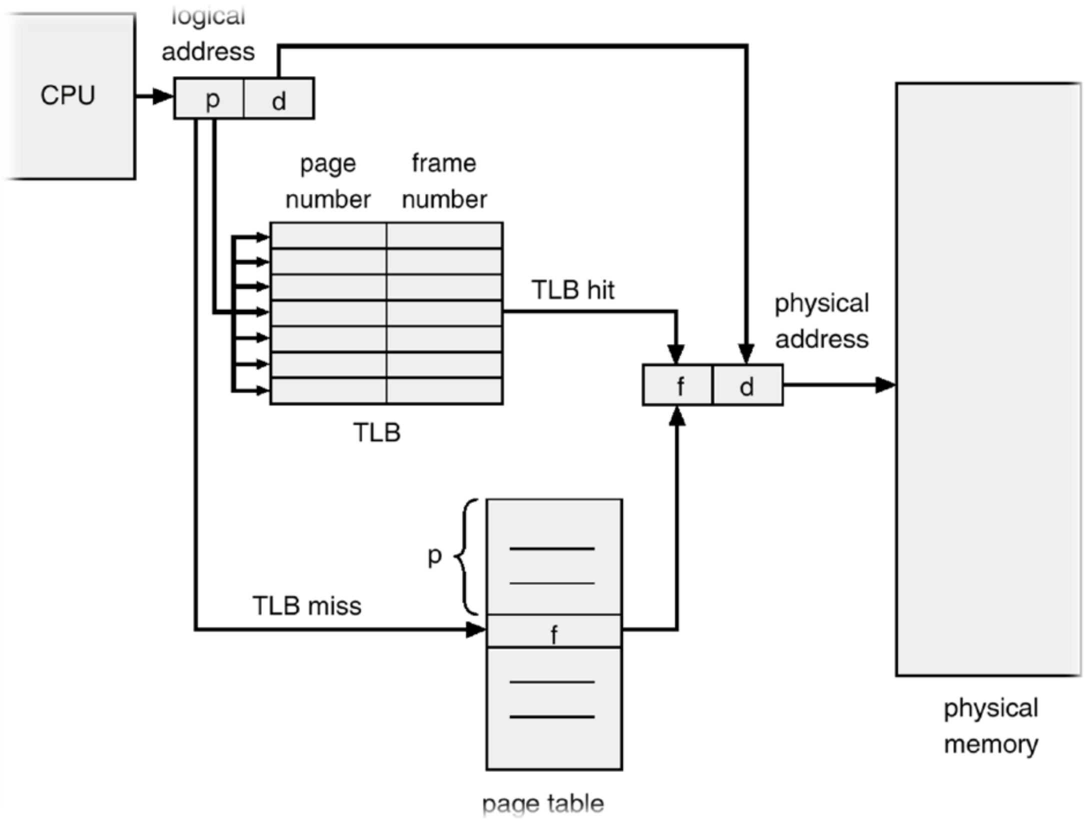


- Virtual address space bigger than physical memory
- Mapping virtual address to physical address
- Virtual address space divided into fixed-size units called pages
- Physical address space divided into fixed-size units called pages frames
- Virtual address space of a process can be non-contiguous in physical address space



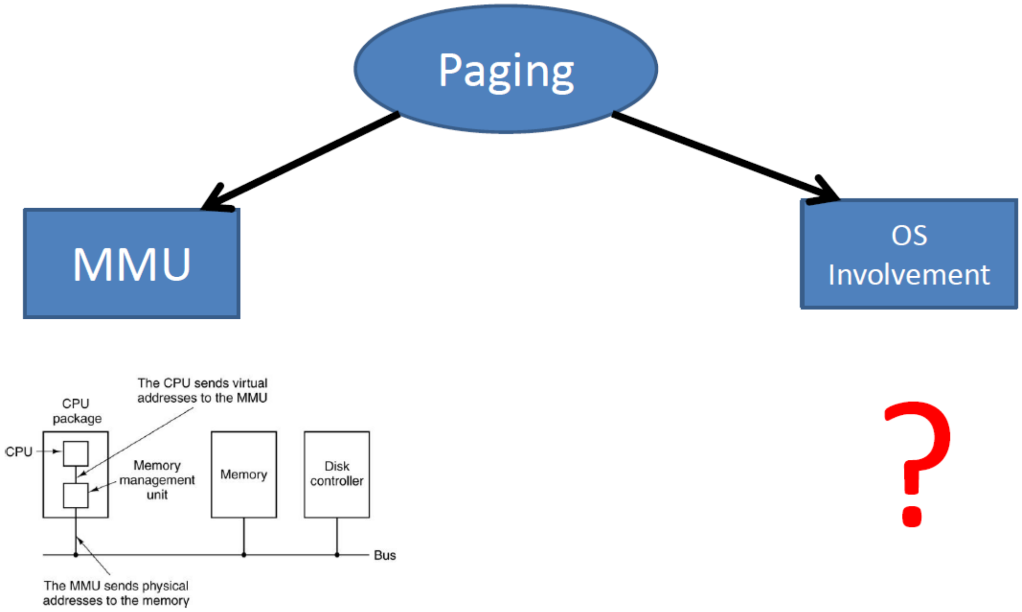
`d` is just some constant, i.e. page size


CPU
logical address
p
d
physical address
f
d
f
p
f
page table
f0000 . . . 0000
f1111 . . . 1111
physical memory



- Simply speaking, one page table per process and one TLB per core (and one MMU per core)
- Harware must update the TLB on a TLB miss
- Without MMU, we can still have virtual memory but performance would be incredibly bad
- We can have a system with a TLB but without an MMU, but again it would be very slow

OLS Involvement


Paging

MMU

OS Involvement

?

The CPU sends virtual addresses to the MMU
CPU package
CPU
Memory management unit
Memory
Disk controller
Bus
The MMU sends physical addresses to the memory

▼ If things can be done w/ hardware, where does OS come into play?

1. When a new process is created
    - Determine how large the program and data will be (initially)
    - Creating a page table
    - Allocate space in memory for page table
    - Record info about the page table and swap area in the process table
2. When a process is scheduled for execution (context switch)
    - MMU resets for the process
    - TLB flushed
    - Process table made current
3. When process exits
    - OS releases the process page table
    - Frees its pages and disk space
4. When a page fault occurs
    - The handling is covered in depth on the slides

- Interesting case of virtual memory and I/O interaction

> ❗ This is the end of the **Memory Management** unit.