

Memory Management- Paging

CS3600

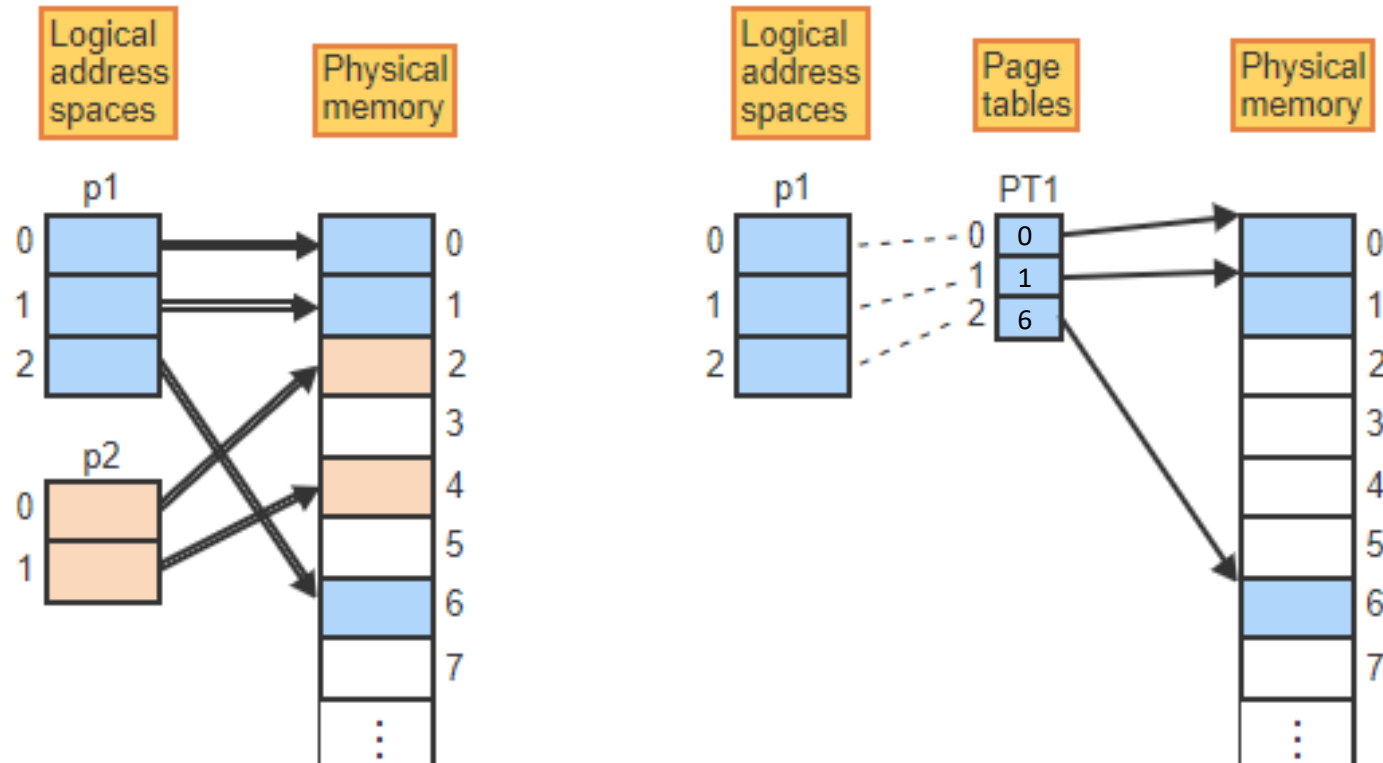
Spring 2022

Paging

- A **page** is a fixed-size contiguous block of a **logical address space** identified by a single number, the **page number**.
- A **page frame** is a fixed-size contiguous block of **physical memory** identified by a single number, the **page frame number**.
- A **page table** is an array that keeps track of which pages of a given logical address space reside in which page frames.

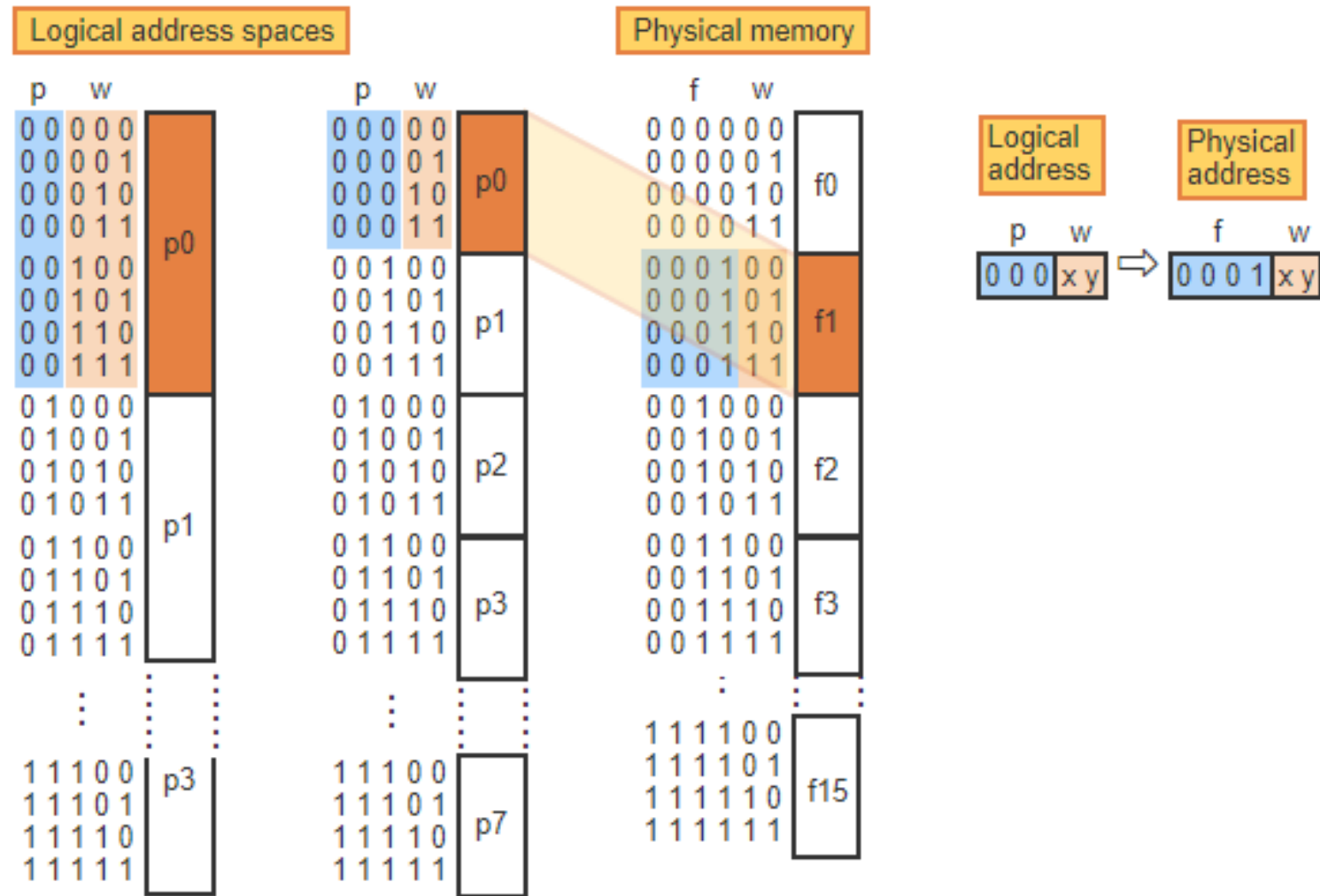


Paging



Each page table entry points to the beginning of the corresponding frame.

Logical and physical addresses



If page 0 is mapped to frame 1, then p is mapped to f. All logical addresses starting with 000 are translated into physical addresses starting with 0001. The offset w is unchanged (bits xy).

Example

Logical address 5 in which page ?

0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

	p	w	
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

	p		w
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Number of words in a page is 4

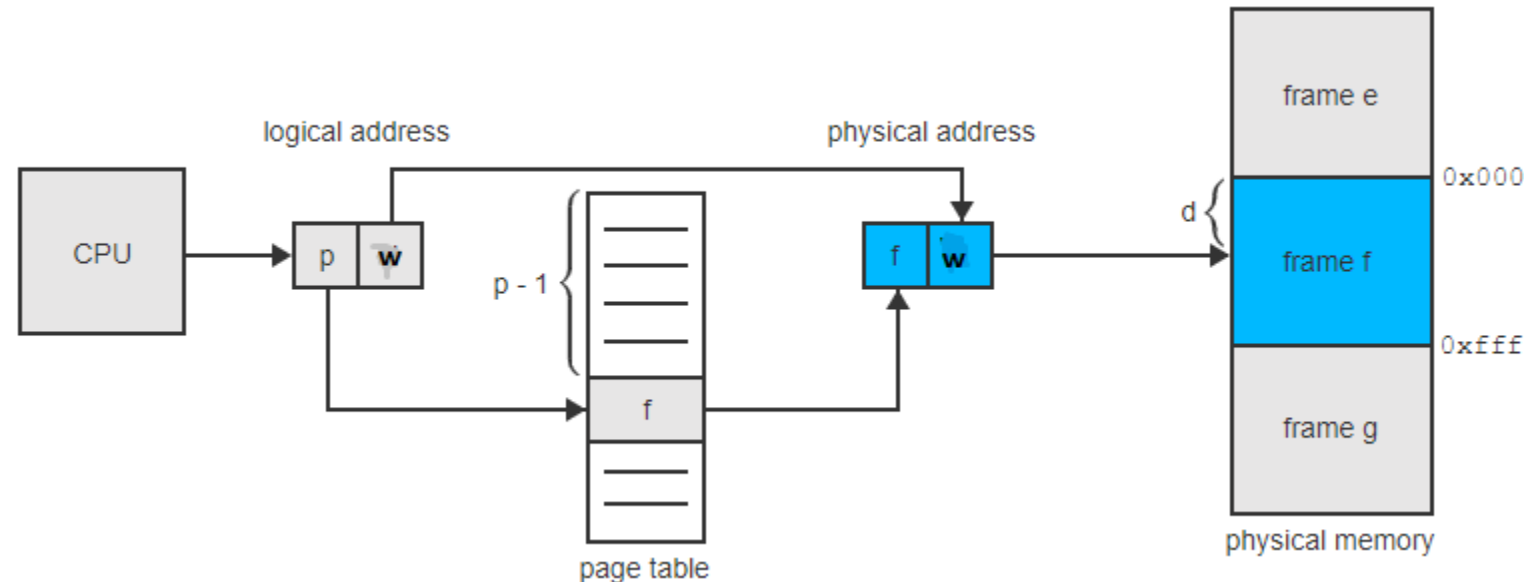
Page = $5/4 = 1$,
offset = $5\%4 = 1_{10} = 01_2$

Number of words in a page is 2

Page = $5/2 = 2$,
offset = $5\%2 = 1_{10} = 01_2$

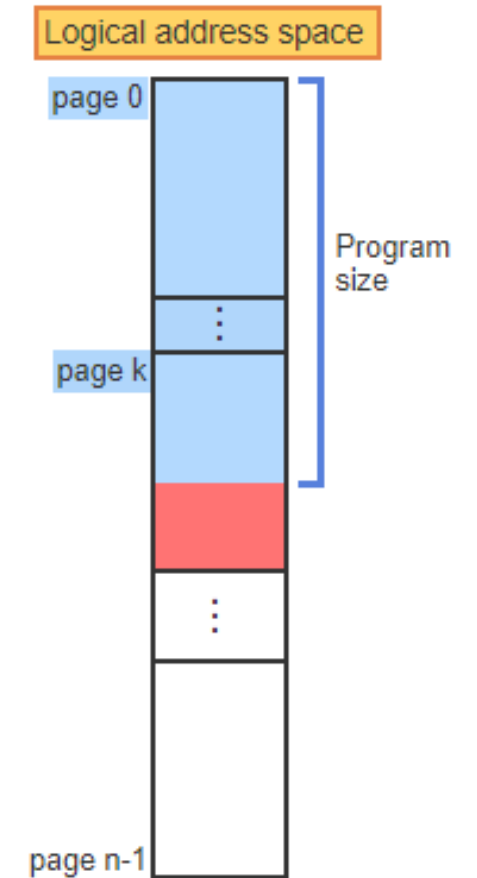
Address Translation

- The OS must translate logical addresses of the form (p, w) into corresponding physical addresses (f, w) :
 - Given a logical address (p, w) , access the page table entry corresponding to page p .
 - Read the frame number, f , of the frame containing p .
 - Combine f with the offset w to find the physical address (f, w) corresponding to the logical address (p, w) .



Internal fragmentation

- **Internal fragmentation** is the loss of usable memory space due to the mismatch between the page size and the size of a program, which creates a hole at the end of the program's last page.
- Any address exceeding the program size must be rejected.



- Complete Worksheet 08 - Memory 1

- No Homework this week
- Weekly Quiz and Class reflection will be posted on (04/01)