CS31 Worksheet: Week 11: Virtual Memory

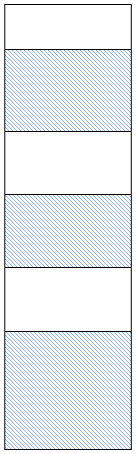
Which memory allocation algorithm would you choose? Why?

A. first-fit

B. worst-fit

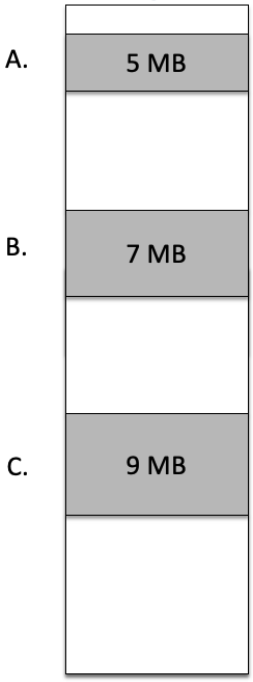
C. best-fit

Is leaving small fragments a good thing or a bad thing?



Where would worst-fit place this memory chunk?

5 MB

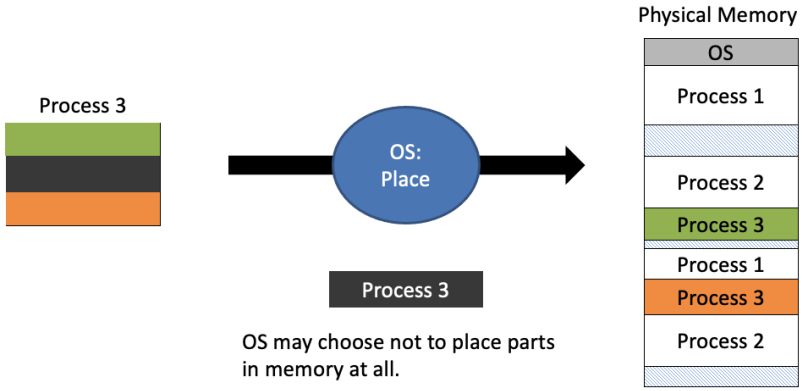


Problem Summary: Placement

- What if a process's memory can't fit into a contiguous memory slot?

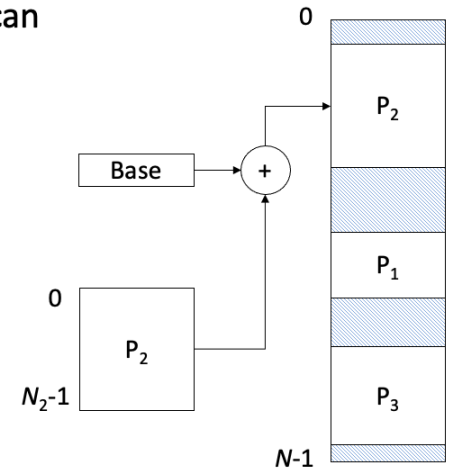
Problem Summary: Placement

- General solution: don't require all of a process's memory to be in one piece!
- What problems does this generate for a compiler?

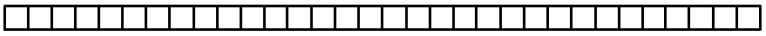


Hardware for Virtual Addressing

- With help from the hardware, we can translate a process from a virtual address to a physical address by changing the base.
- Are we done?
- Is our model safe?



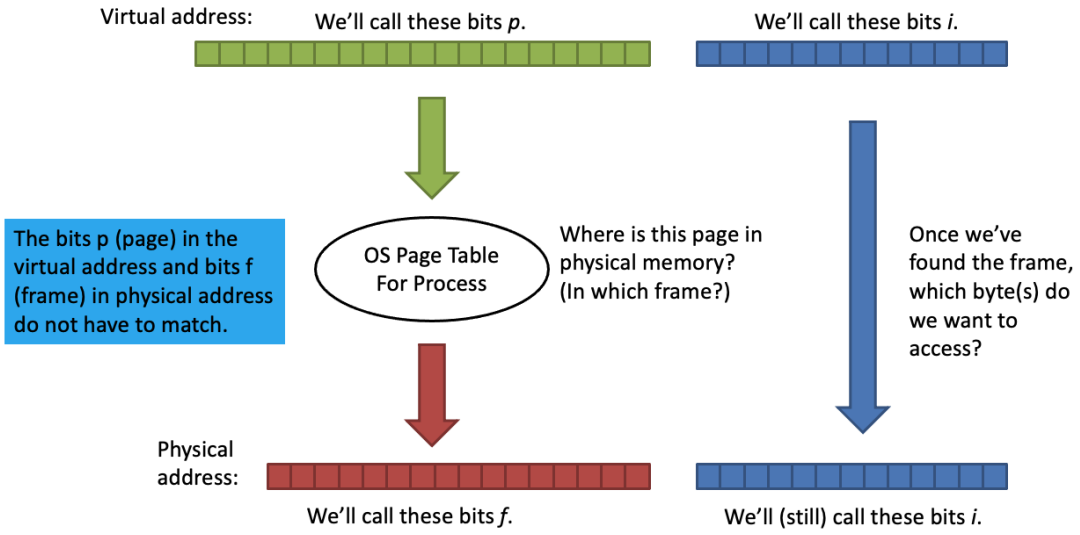
Example: 32-bit virtual addresses



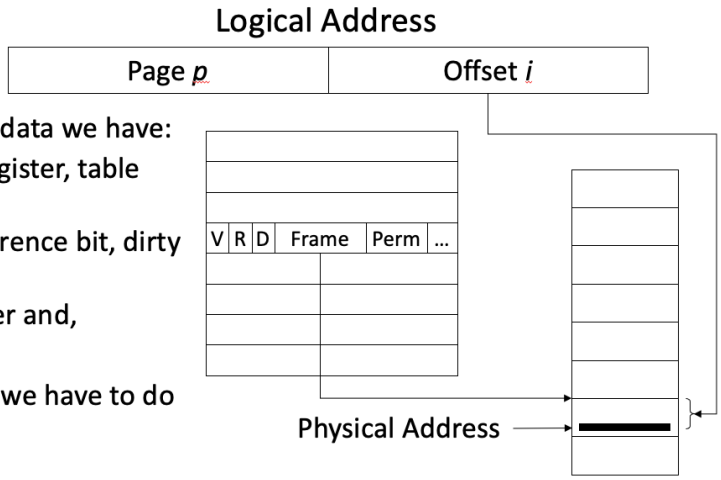
- Suppose we have 8-KB (8192-byte) pages.
- We need enough bits to individually address each byte in the page.
  - How many bits do we need to address 8192 items?

2^{10}	2^{11}	2^{12}	2^{13}	2^{14}	2^{15}
1024	2048	4096	8192	16384	32768

Address Partitioning



Address Translation

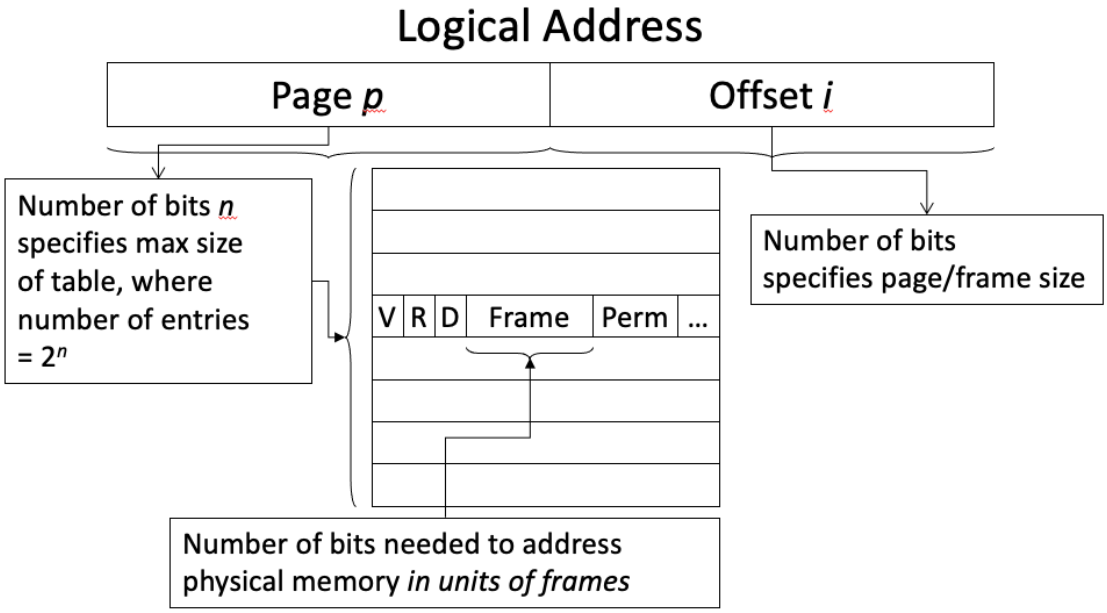


Given the meta data we have:

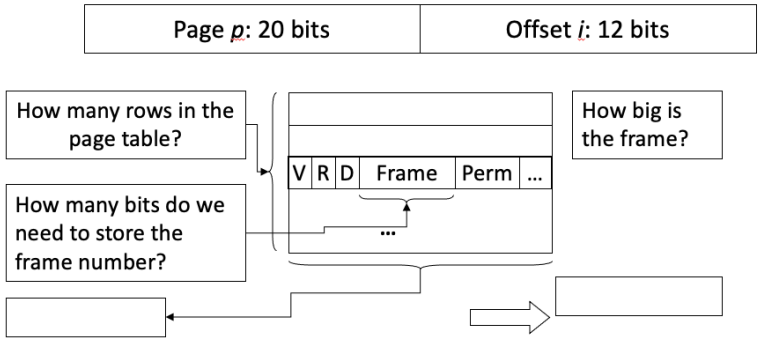
- table base register, table top register
- valid bit, reference bit, dirty bit
- frame number and,
- permissions

what checks do we have to do for a page hit?

Sizing the Page Table



Example of Sizing the Page Table



Given: 32 bit virtual addresses, 1 GB physical memory

– Address partition: 20 bit page number, 12 bit offset

2^{10}	2^{20}	2^{30}	2^{40}
1KB	1MB	1GB	1TB