Most modern systems use virtual memory management. How does this system operate?

VIRTUAL MEMORY

• Allocate memory in fixed-size blocks called pages (e.g. 4K each)

– process can have as many pages as it needs – process can allocate more memory as it needs it by requesting more blocks

– no fragmentation: use any block anywhere

• Need to keep track of physical location of each page (using a page table)

VIRTUAL ADDRESS TRANSLATION

• Imagine 1000-byte pages:

– page 0 is addresses 0000 to 0999

– page 1 is addresses 1000 to 1999

– page 2 is addresses 2000 to 2999

• Page number is first digit of address

– last three digits give address within the page

VIRTUAL ADDRESS TRANSLATION

• Now consider 4K pages with binary addresses (4K in binary is 0x1000)

– page 0 is 0x00000000 to 0x00000FFF

– page 1 is 0x00001000 to 0x00001FFF

– page 2 is 0x00002000 to 0x00002FFF

• Page number is first 20 bits (5 hex digits)

– last 12 bits (3 hex digits) give address within the page

THE PAGE TABLE

• OS maintains a page table in its own memory area for each process

– n-th entry contains physical address of start of page n

To Translating a virtual address:

– take page number (first 20 bits of address) and get corresponding physical address

– add on last 12 bits of address (offset into 4K page)