



OPERATING SYSTEM

Memory Management - Allocation

Dr Rahul Nagpal
Computer Science

OPERATING SYSTEM

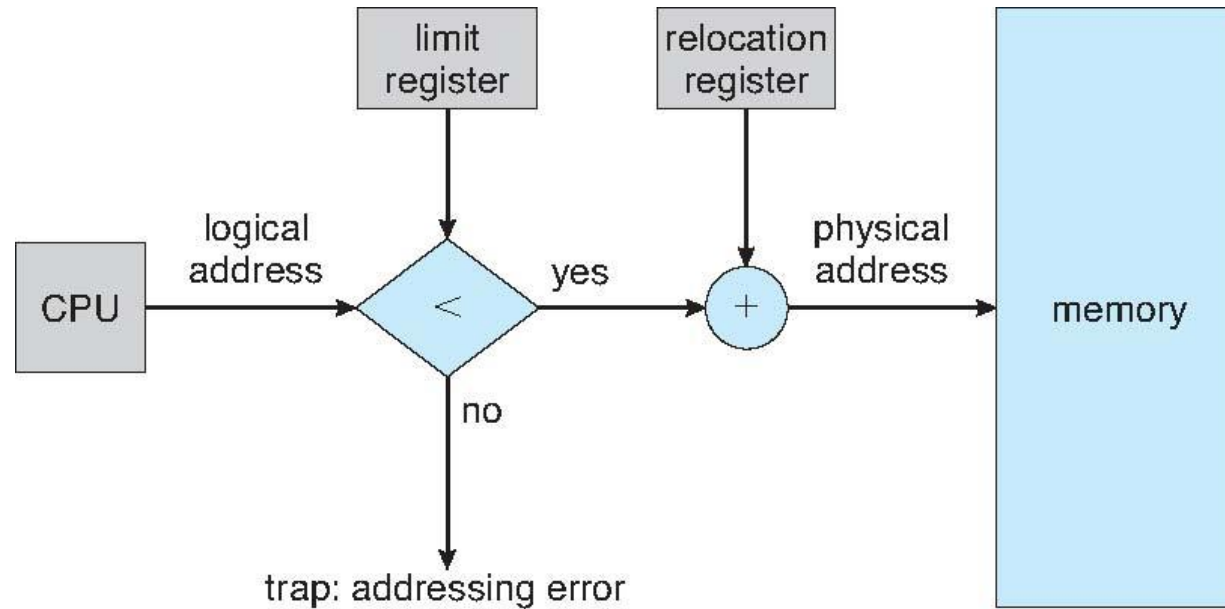
Memory Management -Allocation

Dr. Rahul Nagpal
Computer Science

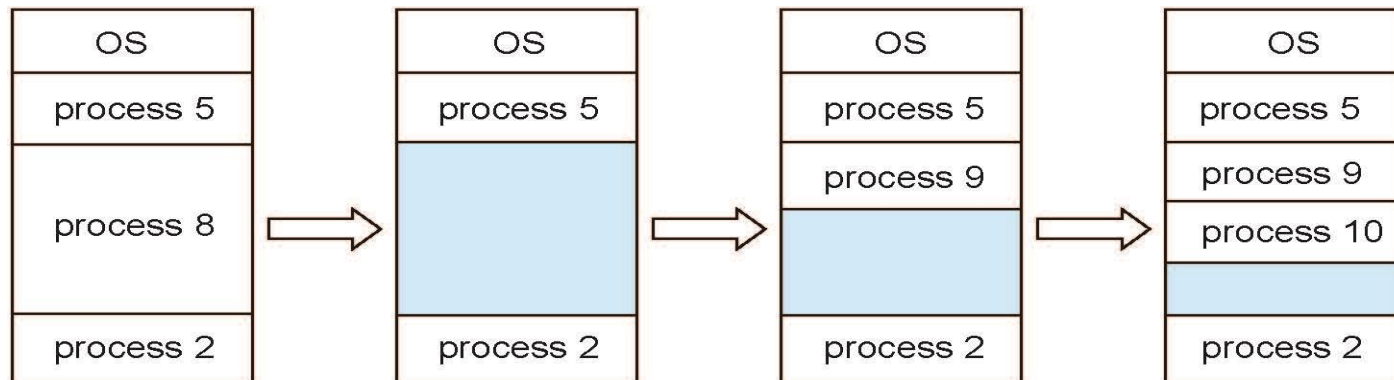
- Relocation registers used to protect user processes from each other, and from changing operating-system code and data
 - Base register contains value of smallest physical address
 - Limit register contains range of logical addresses – each logical address must be less than the limit register
 - MMU maps logical address *dynamically*
 - Can then allow actions such as kernel code being **transient** and kernel changing size

OPERATING SYSTEMS

Hardware Support for Relocation and Base Register



- Multiple-partition allocation
 - Degree of multiprogramming limited by number of partitions
 - **Variable-partition** sizes for efficiency (sized to a given process' needs)
 - **Hole** – block of available memory; holes of various size are scattered throughout memory
 - When a process arrives, it is allocated memory from a hole large enough to accommodate it
 - Process exiting frees its partition, adjacent free partitions combined
 - Operating system maintains information about:
 - a) allocated partitions b) free partitions (hole)



How to satisfy a request of size n from a list of free holes?

- **First-fit**: Allocate the *first* hole that is big enough
- **Best-fit**: Allocate the *smallest* hole that is big enough; must search entire list, unless ordered by size
 - Produces the smallest leftover hole
- **Worst-fit**: Allocate the *largest* hole; must also search entire list
 - Produces the largest leftover hole

- **External Fragmentation** – total memory space exists to satisfy a request, but it is not contiguous
- **Internal Fragmentation** – allocated memory may be slightly larger than requested memory; this size difference is memory internal to a partition, but not being used
- First fit analysis reveals that given N blocks allocated, $0.5 N$ blocks lost to fragmentation
 - $1/3$ may be unusable -> **50-percent rule**

- Reduce external fragmentation by **compaction**
 - Shuffle memory contents to place all free memory together in one large block
 - Compaction is possible *only* if relocation is dynamic, and is done at execution time
 - I/O problem
 - Latch job in memory while it is involved in I/O
 - Do I/O only into OS buffers
- Now consider that backing store has same fragmentation problems



THANK YOU

Dr Rahul Nagpal

Computer Science

rahulnagpal@pes.edu