

Basic Memory Management

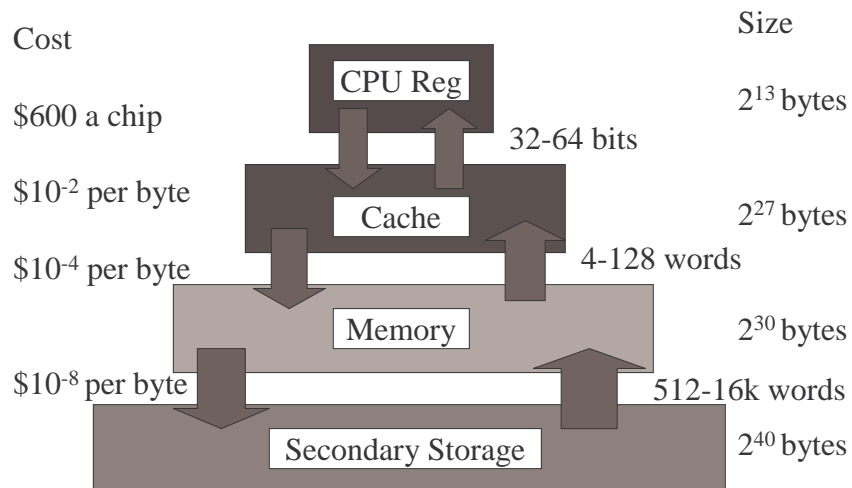
- Storage Hierarchy
- Memory Management Problems
- Fixed Partitions for Multiprogramming
- Variable Sized Partitions
- Memory Allocation Strategies

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Storage Hierarchy



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General Memory Problem

- Limited (expensive) physical resources: Main memory
 - E.g. Windows Vista recommends 1G and prefers 2G RAM
 - We want to use it as efficiently as possible

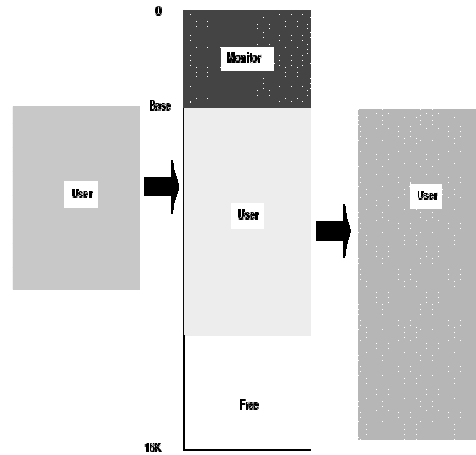
- Abundant, slower resources: Disk

Scenarios of Memory Management Problems

- Many programs, total size is less than memory size
 - Technically possible to pack them together
 - Will programs know about each other's existence?
- One program, using lots of memory
 - Can you only keep part of the program in memory?
- Lots of programs, total size exceeds memory size
 - What programs are in memory, and how to decide?

Responsibilities of Memory Manager

- Manage memory hierarchy
 - Monitor used and free memory
 - Allocate memory to processes
 - Reclaim (De-allocate) memory
 - Swapping between main memory and disk



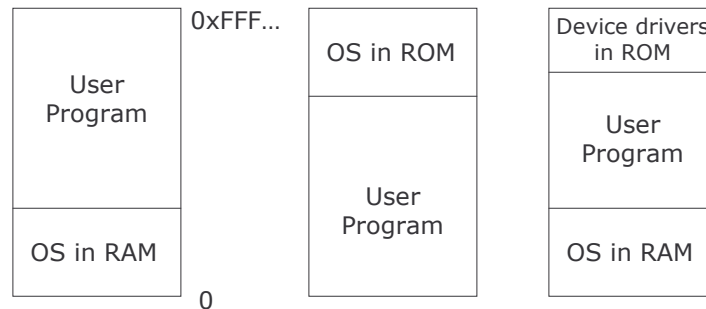
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Mono-programming No Swapping

- Run one process at a time
 - simplest possible memory management scheme
- Memory is shared only between OS and the process.
- Three different ways to organize memory



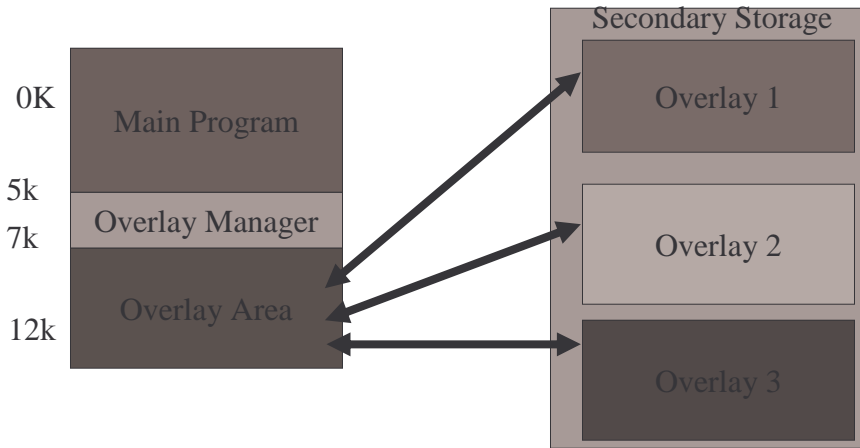
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Overlaying

Used when the process memory requirement exceeds the physical memory space



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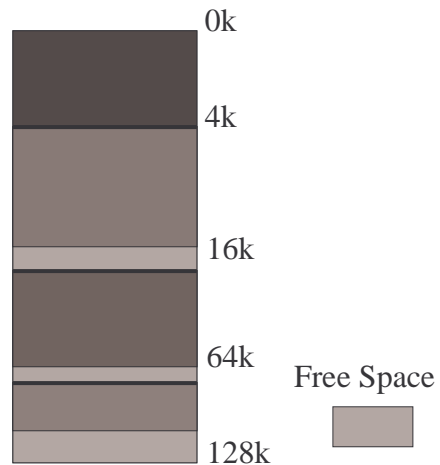
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Multiprogramming with Fixed Partitions

□ Divide memory into n (possibly unequal) partitions.

□ Problem:

■ Internal Fragmentation



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Fixed Partition Allocation

- Separate input queue for each partition
 - Requires sorting the incoming jobs and putting them into separate queues
 - Problems?

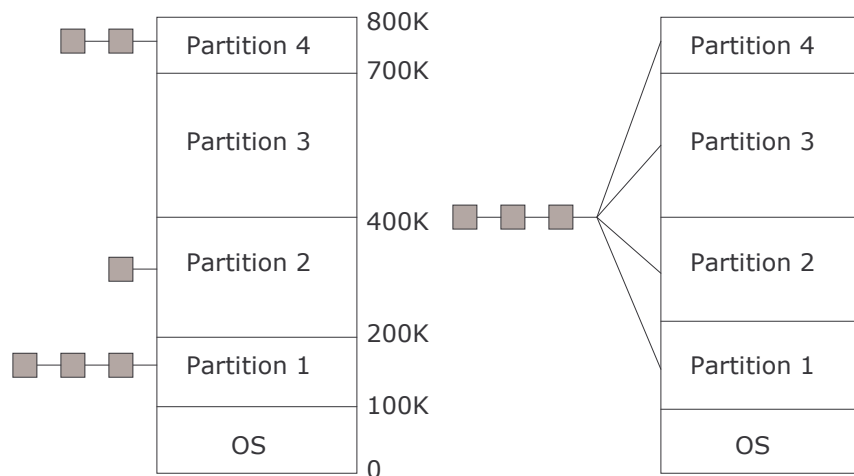
- One single input queue for all partitions.
 - Find a job for fitting in an available partition
 - Available Fit
 - Best Fit
 - Problems?

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Problems?



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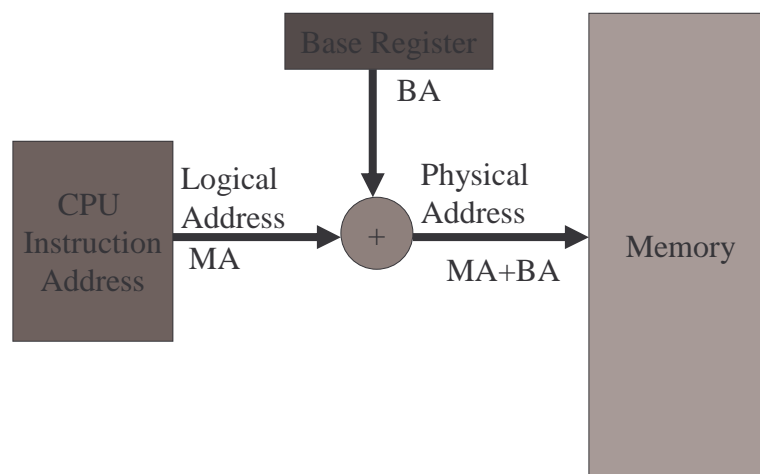
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Relocation

- Correct starting address when a program should start in the memory
- Different jobs will run at different addresses
 - When a program is linked, the linker must know at what address the program will begin in memory.
- Logical addresses, Virtual addresses
 - Logical address space , range (0 to max)
- Physical addresses, Physical address space
 - range (R+0 to R+max) for base value R.
- User program never sees the real physical addresses
- Who translates virtual to physical addresses?
 - Program rewriting at loading time
 - Help from relocation registers at execution time

Relocation Register



Protection

□ Problem:

- How to prevent a malicious process to write or jump into other user's or OS partitions

□ Solutions:

- Memory protection code
- Base bounds registers



Base Bounds Registers

