COA

Chapter 08: | OS Support – Memory Management

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AGENDA

- Memory Management

Intro…

- **Memory** is **central** to the operation of a modern computer system.
- Memory consists of a **large array of words or bytes**, each with its own **address**.
- The CPU **fetches instructions**
  - May cause **additional loading**

Basic Hardware

- **Main memory** and the **registers** built into the processor itself are the only storage that the **CPU can access directly**
- Any instructions in execution, and any data being used by the instructions, **must be in one of these direct-access storage devices**.

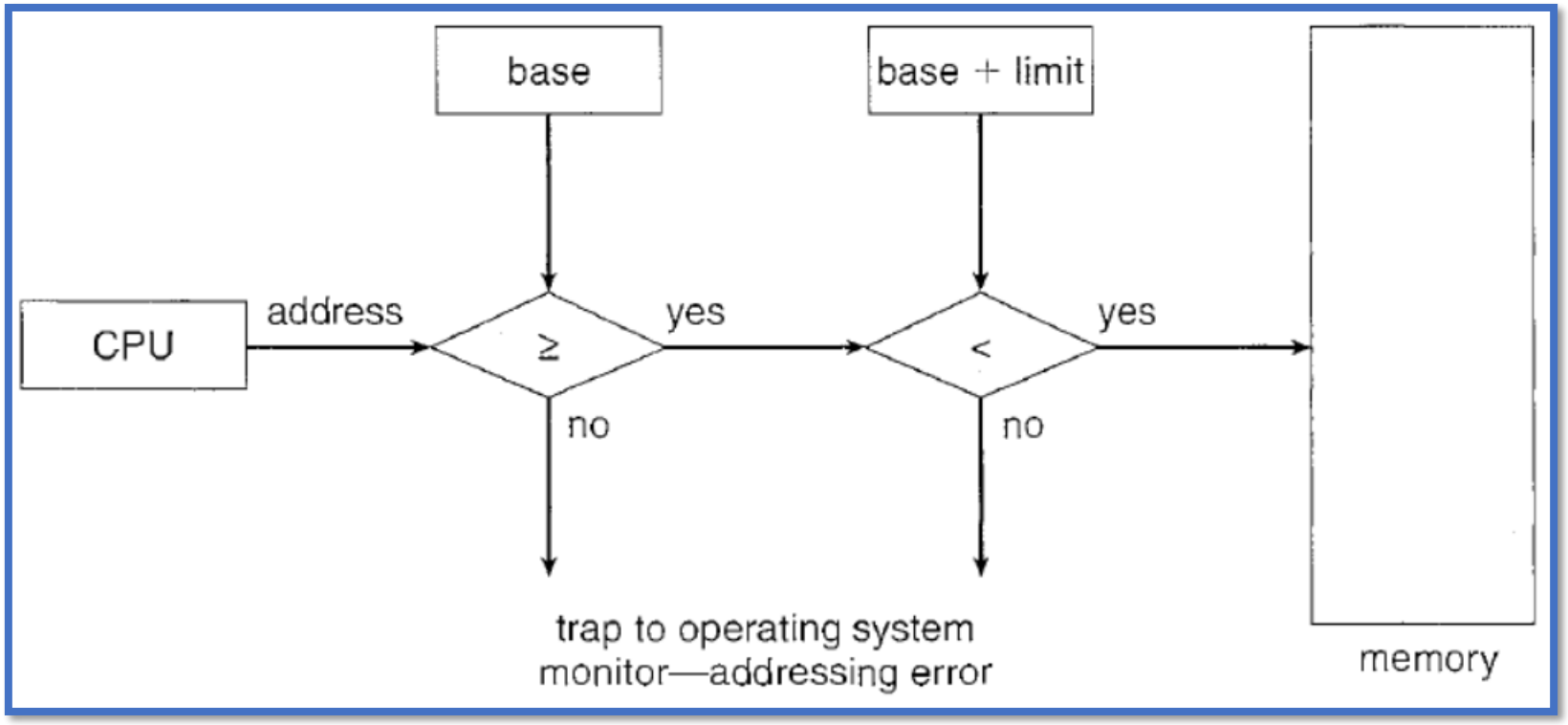
Basic Hardware

- **Registers** that are built into the CPU are generally accessible within one cycle of the CPU clock
- **Most CPUs can decode instructions** and perform simple operations on register contents at the rate of one or more operations per clock tick
- The same cannot be said of main memory

Basic Hardware

- In such cases, the **processor** normally needs to **stall**
- The remedy is to **add fast memory** between the CPU and main memory – **Cache**
- Not only are we concerned with the **relative speed of accessing physical** memory but also **protection**
  - This **protection** must be provided by the **hardware**

Basic Hardware



Memory Management

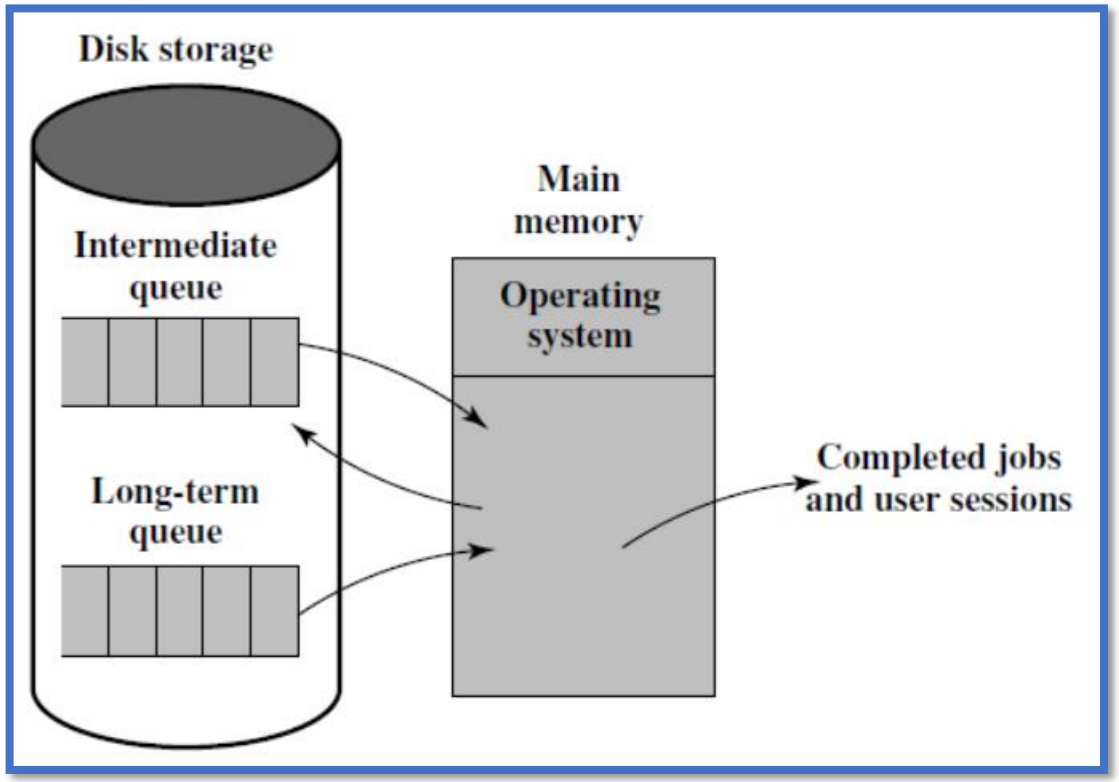
- Uni-program
  - Memory split into two
  - One for Operating System (monitor)
  - One for currently executing program
- Multi-program
  - User part is **sub-divided** and shared among active processes

Swapping

- **Problem**: I/O is so slow compared with CPU that even in multi-programming system, CPU can be idle most of the time
- Solutions:
  - Increase main memory
  - Expensive
  - Leads to larger programs
- Swapping

Swapping

- Long term queue of process requests stored on disk
- Processes “swapped” in as space becomes available
- As a process completes, it is moved out of main memory



Swapping

- If none of the processes in memory are ready (i.e., all I/O blocked)
  - Swap out a blocked process to **intermediate queue**
  - Swap in a ready process or a new process
  - But swapping is an **I/O process**
  - Disk I/O is generally the **fastest I/O** on a system
- **Virtual Memory**