

Chapter 08: The Memory System

Lesson 16:

Memory speed, size and cost

Objective

- Understand that Cost per bit is least at the lowest level in memory hierarchy (secondary memory)
- Speed of memory and the cost increase towards the highest level (cache)
- Learn that memory system design made such that average access time similar to the access time of the fastest level, but with an average cost per bit similar to that of the slowest level

Memory systems

Memory

- Having rows of chips or an array of chips increases memory size
- RDRAM circuitry is more complex than DDR SDRAM, DDR SDRAM is more complex than SDRAM, and SDRAM is more complex than asynchronous DRAM

Memory

- RDRAM circuitry has more speed and much less latency than DDR SDRAM; DDR SDRAM less than SDRAM; SDRAM less than asynchronous DRAM

Fast Memory

- Fast memory, such as static RAMs (SRAMs), tend to have a high cost per bit (in both dollars, chip power dissipation and area)
- Making it prohibitively expensive to construct a computer's memory entirely out of these devices

Slower technologies, such as dynamic RAM (DRAM)

- Less expensive, making it practical to construct larger memories using these technologies

Secondary storage memories

- Least expensive, making it practical to construct very large memories using these technologies
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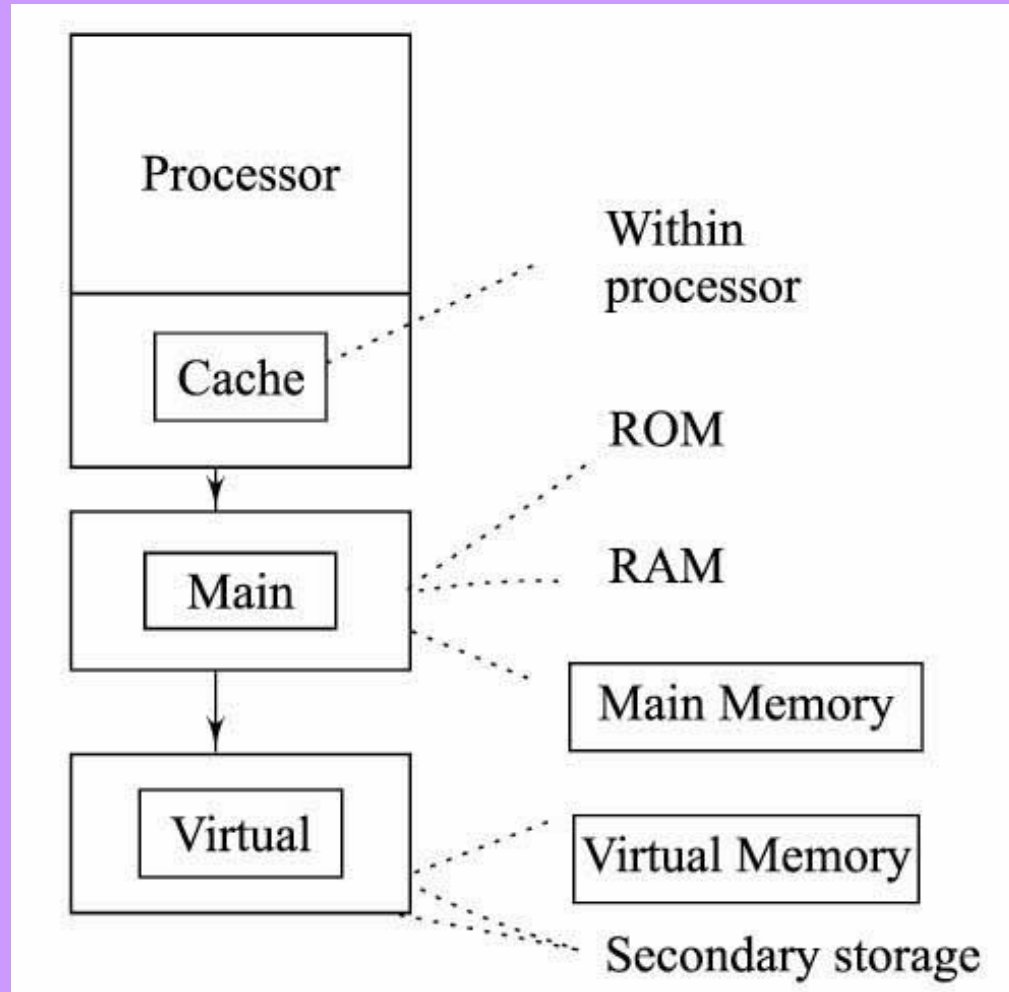
Speed and cost

- If speed of access and size of memory system are to be increased, the cost of main memory is going to be increased
- The cost of main memory system thus depends on the speed and bandwidth required

Memory hierarchy

- The cost depends on the level
- Cost per bit is minimum for secondary storage memory, then semiconductor memories RAMs and ROMs, and the costliest are the caches

Memory hierarchy



Memory hierarchy goal

- Proceeding down the hierarchy, each level contains more storage and takes longer to access than the level above it
- The goal of a memory hierarchy is to keep the data that will be referenced most by a program in the top levels of the hierarchy, so that the top level or levels can handle most memory requests

Average cost

- This results in a memory system that has an average access time similar to the access time of the fastest level, but with an average cost per bit similar to that of the slowest level
- Refer examples in Section 8.8

Summary

We learnt

- Cost per bit is least at the lowest level in memory hierarchy (secondary memory)
- Speed of memory and the cost increase towards the highest level (cache)
- Memory system design made such that average access time similar to the access time of the fastest level, but with an average cost per bit similar to that of the slowest level

End of Lesson 16 on
Memory speed, size and cost