Memories

Chapter 8

Memory And Storage

Topics

- Introduction
- Definition
- Key Aspects Of Memory
- Characteristics Of Memory Technologies
- Memory Volatility
- Memory Access Paradigm: Random Or Sequential Access
- Permanence Of Values
- Primary And Secondary Memory

Topics

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- Instruction And Data Store
- The Fetch-Store Paradigm
- Summary

Introduction

- Part 2 covered
  - processor, a primary component of a computer
- This part discusses
  - memories, a major component of any computer
  - physical memory, virtual memory, caches

Definition

- Architect's view of memory
  - solid-state digital device that provides storage for data values

Key Aspects Of Memory

- Technology
  - properties of the underlying hardware mechanisms used to construct memory systems
- Organization
  - way technology is used to form a working system
- Technology refers to individual pieces. Organization refers to how these pieces are put together to create good storage systems

Characteristics Of Memory Technologies

- Volatile or non-volatile
- Random or sequential
- Read-write or read-only
- Primary or secondary

Memory Volatility

- Volatile
  - contents of memory disappear when power is removed.
  - example, main memory of computer is volatile. When computer is shut, running applications are lost
- Non-volatile
  - content remain even after power is removed.
  - example, memory used in digital camera.

Memory Access Paradigm: Random Or Sequential Access

- Random access
  - any value in the memory can be accessed at any time.
- Sequential access
  - values are read in the same order they were inserted
  - also called First-in-First Out (FIFO)

Permanence Of Values

- Memory can be read from, written to, or allow both operations at any time. Some memories do not allow both read and write access.
- ROM: Read only memory
  - read only memory memory contains data values that can be accessed but cannot be changed
- PROM Programmable read only memory
  - data values is entered once and then accessed many times values are burned into the memory

Permanence Of Values

- Intermediate permanence
  - EEPROM Electrically Erasable Programmable Read only memory nonvolatile memory that permits values to change
  - storing needs special circuits and takes longer than reading a value.
- Flash memory
  - variant of EEPROM takes longer to store image

Primary And Secondary Memory

- Primary
  - example, fast volatile internal main memory
- Secondary
  - example, slower non volatile memory on external disk

Memory Hierarchy

- Cost and performance of memory is considered.
- Observation
  - for a given cost, optimal performance is not achieved by using one type of memory.

    To optimize memory performance for a given cost, a set of technologies are arranged in hierarchy that contains a relatively small amount of fast memory and larger amounts of less expensive but slower memory

Instruction And Data Store

Although most modern computer systems (Von Neumann's architecture) place programs and data in a single memory, it is possible to seperate the instruction store from data store. Doing so allows an architect to select memory performance appropriate for each activity

The Fetch-Store Paradigm

- Memory use fetch-store paradigm
- Fetch a value from memory, or storing a value in memory
- Fetch is also called read or load, store is also called write.

Summary

- Technology and memory are key aspects of memory
- Technologies can be classified as volatile or non-volatile, random or sequential, permanent or non-permanent, and primary or secondary. To achieve maximal performance at a given cost a memory hierarchy is used
- Hierarchy has small amount of high performance memory, and large amount of low performance memory.
- Memory supports two operations, fetch to retrieve a value from memory, and store to store a value in memory