Types of memories

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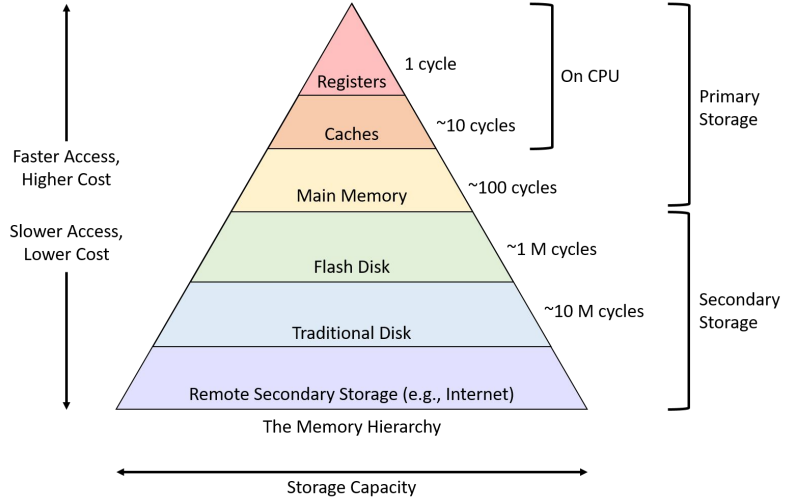
Outlines

- Introduction
- Registers
- Read Only Memory (ROM)
- Random Access Memory (RAM)
- Non-Volatile RAM (NVRAM)

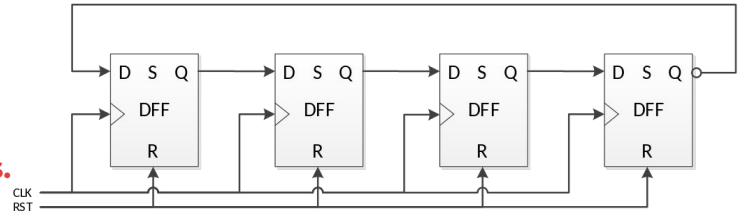
Introduction

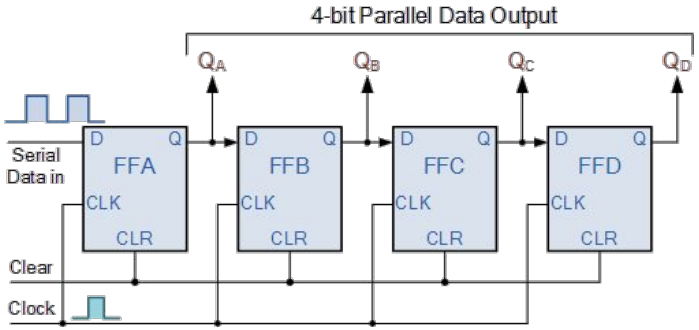
- Memories in computer are electronic components that stores data and program instructions.
- Memories are characterized by:
  - **Access speed (read and write)**
  - **Capacity**
  - **Volatile or non-volatile**



Registers

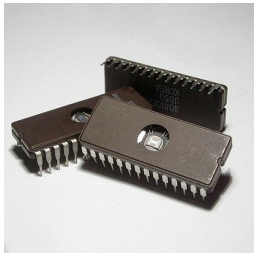
- **Characteristics:**
  - The fastest memory
  - Small capacity
  - Some of them store addresses, instructions, or status.
- **Components:**
  - Registers consists of Flip-Flops
  - A Flip-Flop stores only 1-bit
  - 8-bit registers have 8 connected Flip-Flops
- **Types:**
  - Shift registers
  - Counter registers



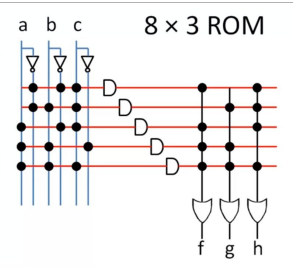


Read Only Memory (ROM)

- It is non-volatile and read only memory.
- ROM types:
  - MROM:
    - Maskable ROM, and can not be programmed.
  - PROM:
    - Programmable ROM, and can be programmed once.
  - EPROM:
    - Erasable PROM, it can be erased using UV and reprogrammed.
  - EEPROM:
    - Electrically EPROM, it can be electrically erased and reprogrammed.
  - Flash:
    - It is EEPROM with larger page size.



a b c	f	g	h
0 0 0	0	0	0
0 0 1	1	0	1
0 1 0	0	0	0
0 1 1	0	1	1
1 0 0	0	0	0
1 0 1	1	0	1
1 1 0	1	1	0
1 1 1	1	1	1



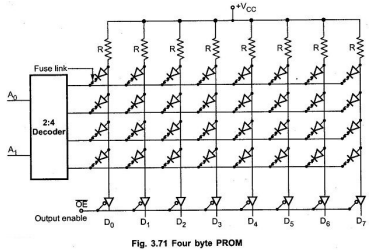
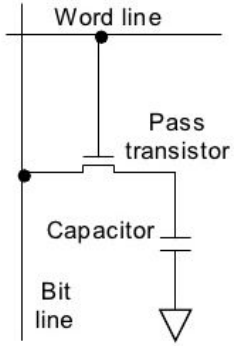


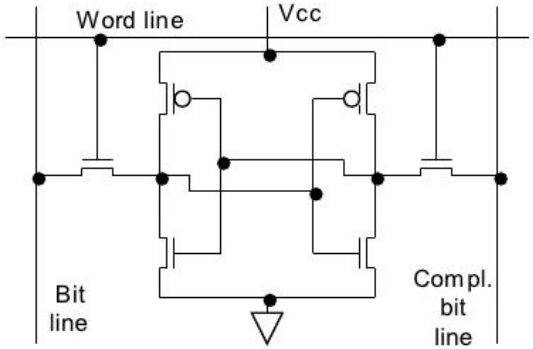
Fig. 3.71 Four byte PROM

Random Access Memory (RAM)

- **It is volatile with read/write operations.**
- **RAM types:**
  - **SRAM:**
    - Static RAM
    - It is faster than DRAM (no precharge is needed)
    - It consumes more power
    - It has larger physical size
    - It has smaller capacity/area
  - **DRAM:**
    - Dynamic RAM
    - It is slower than SRAM (precharge is needed)
    - It consumes less power
    - It has smaller physical size
    - It has larger capacity/area



(a) DRAM cell



(b) Typical SRAM cell

Non-Volatile RAM (NVRAM)

- It is a category of Random Access Memory (RAM) that retains stored data even if the power is switched off.
- **Types**:
  - Battery-backed static RAM
  - Magneto resistive RAM
  - Ferroelectric RAM
- **Advantages**:
  - Provides excellent performance when compared to other non-volatile memory products
  - Supports applications that need quick read or write operations using non-volatile memories, such as antilock braking systems and parallel processing controllers for local area networks.
  - Less power is required for NVRAMs.

Summary

- Now you are familiar with different memory types and its uses.
- Remember, registers are temporary memories.
- Remember, flash memory is used as a program memory.
- Remember, RAM is used as data memory.
- Remember, NVRAM is faster than ROM.