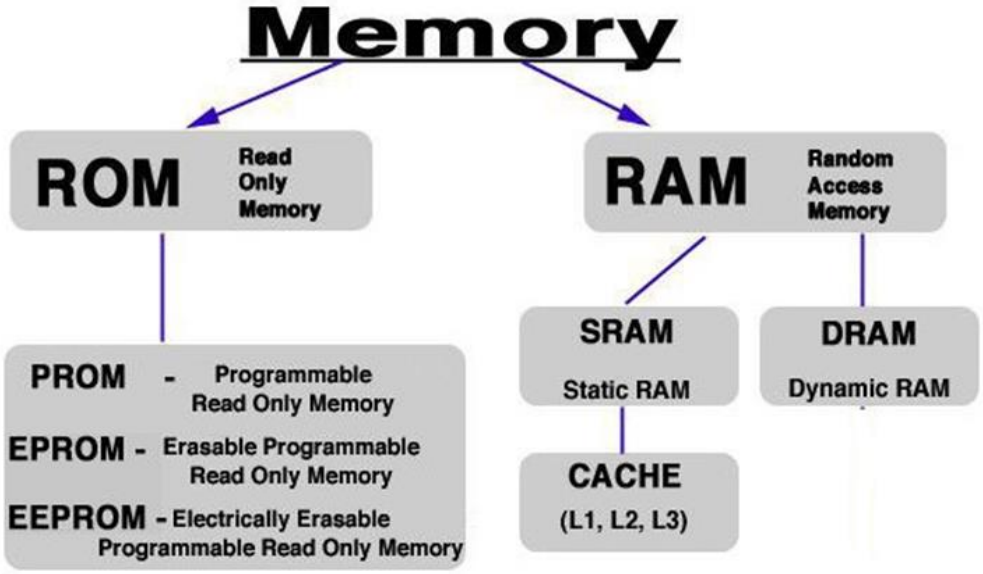
RAM (Random Access Memory)

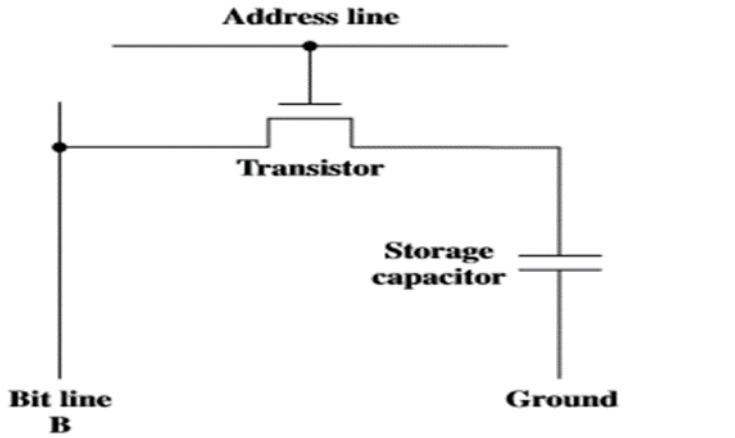
RAM a temporary (Volatile) storage area utilized by the CPU. Before a program can be ran the program is loaded into the memory which allows the CPU direct access to the program.



DYNAMIC RAM

- RAM technology is divided into two technologies: dynamic and static. A dynamic RAM (DRAM) is made with cells that store data as charge on capacitors. The presence or absence of charge in a capacitor is interpreted as a binary 1 or 0. Because capacitors have a natural tendency to discharge, dynamic RAMs require periodic charge refreshing to maintain data storage. The term dynamic refers to this tendency of the stored charge to leak away, even with power continuously applied. Figure 5.2a is a typical DRAM structure for an individual cell that stores 1 bit. The address line is activated when the bit value from this cell is to be read or written. The transistor acts as a switch that is closed (allowing current to flow) if a voltage is applied to the address line and open (no current flows) if no voltage is present on the address line.

For the write operation, a voltage signal is applied to the bit line; a high voltage represents 1, and a low voltage represents 0. A signal is then applied to the address line, allowing a charge to be transferred to the capacitor. For the read operation, when the address line is selected, the transistor turns on and the charge stored on the capacitor is fed out onto a bit line and to a sense amplifier. The sense amplifier compares the capacitor voltage to a reference value and determines if the cell contains a logic 1 or a logic 0.The readout from the cell discharges the capacitor, which must be restored to complete the operation.



(a) Dynamic RAM (DRAM) cell

Figure 5.2 Typical Memory Cell Structures

Static RAM

- **SRAM** is the most expensive types of electronic memory which is characterized by that it does not need to overpower the computer so they can deal with a so-called Refresh in contrast to the changing electronic memory, called **static** RAM and is therefore faster in the deal.
- Usually uses this type of electronic memory in the Cache Memory

SRAM VERSUS DRAM

- Both static and dynamic RAMs are volatile; that is, power must be continuously supplied to the memory to preserve the bit values. A dynamic memory cell is simpler and smaller than a static memory cell.Thus,a DRAM is more dense (smaller cells more **cells per unit area**) and less **expensive** than a corresponding SRAM.
- On the other hand, a DRAM requires the supporting refresh circuitry. For larger memories, the fixed cost of the refresh circuitry is more than compensated for by the smaller variable cost of DRAM cells.Thus,DRAMs tend to be favored for large memory requirements. A final point is that SRAMs are generally somewhat faster than DRAMs.

Synchronous DRAM (SDRAM)

- Was the invention of this type of electronic memory in order to allow for the processor that performs a greater number of commands in a specific time period. The speed of this type of electronic memory measured in MHz, the same unit used to measure the speed of the processor and also to measure the speed of Data Bus.
- Given the consolidation method of measuring the speed between the three units can easily choose the previous type that corresponds to the speed with each other to achieve the best performance of the computer.

Double Data Rate DDRAM

- This kind of electronic memory Double Data Rate DDRAM was able to this type of electronic memory that increases the speed of memory for up to more than 500 MHz after it had been in previous types do not exceed 133 MHz
- This technique depends on increasing the speed of chips twice, at least from the techniques that were used before with

  Electronic memory.

Characteristics of Memory Systems

- **capacity.** For internal memory, this is typically expressed in terms of bytes (1 byte 8 bits) or words. Common word lengths are 8, 16, and 32 bits. External memory capacity is typically expressed in terms of bytes
- **unit of transfer**. For internal memory, the unit of transfer is equal to the number of electrical lines into and out of the memory module
- **Addressable units**: In some systems, the addressable unit is the word. However, many systems allow addressing at the byte level. In any case, the relationship between the length in bits A of an address and the number N of addressable units is $2^A = N$.

- **Unit of transfer**: For main memory, this is the number of bits read out of or written into memory at a time. The unit of transfer need not equal a word or an addressable unit. For external memory, data are often transferred in much larger units than a word, and these are referred to as blocks.

method of accessing

- **Sequential access**: Memory is organized into units of data,called records. Access must be made in a specific linear. this must be moved from its current location to the desired location, passing and rejecting each intermediate record.
- **Random access**:Each addressable location in memory has a unique,physically wired-in addressing mechanism. The time to access a given location is independent of the sequence of prior accesses and is constant.Thus, any location can be selected at random and directly addressed and accessed.Main memory and some cache systems are random access.

- **Associative**:This is a random access type of memory that enables one to make a comparison of desired bit locations within a word for a specified match,and to do this for all words simultaneously. Thus, a word is retrieved based on a portion of its contents rather than its address.As with ordinary random-access memory,each location has its own addressing mechanism,and retrieval time is constant independent of location or prior access patterns. Cache memories may employ associative access.