# Unit 2 The Memory

**Structure:**



## 2.1 Introduction

In the previous unit we discussed about the central processing unit and its essentials. As you are aware a computer cabinet is made up of three major components namely, arithmetic and logic unit (ALU), the Central processing Unit (CPU) and the memory; all these components playing a vital role in the performance of the computer system. Therefore, it is important for these components to work without error. The close relationship between memory and the CPU provides the basis for the processor's performance. In order to increase the processing power, larger and larger software modules were introduced. This led to sharp demands in the improvement of memory performance. Thus, these demands gave rise to various types of memory like video memory (VRAM), pipeline burst cache, traditional DRAM,

synchronous DRAM (SDRAM), etc. These new types of memory have drawn the attention of PC technicians because of their advantages. However, at the same time there are some new problems which have become apparent.

In this unit you will get to know the basic and essential concepts of memory which includes the organization of memory and the memory package modules. You will also study the different considerations of memory like speed and memory state, its types and techniques to store the data. Besides these, you will learn selecting and installing the memory by getting the right amount and filling banks. This unit also provides information on how to prevent the memory from facing various problems and also provides different troubleshooting solutions.

**Objectives:**

After studying this unit you will be able to:

- Describe the organization of the memory
- List and explain various considerations of memory.
- Perform the selection and installation of the memory
- Resolve the problems through troubleshooting

## 2.2 Essential memory Concepts

Before tackling the problems in the memory you must first know how it works and how it is organized inside the PC. Memory is used to store and retrieve information and experiences. It involves various processes. The major processes of the memory are *encoding, storage and retrieval*. *Encoding* is a process which converts information into usable form. The encoded form is stored in the *storage* space, i.e. the place where the free space is available in the memory. Whenever the information is stored in the free available space, retrieval process is done to make this information available to our notice whenever there is need. The memory must be available to access and retrieve the information whenever required. But since we cannot understand specifically how the memory is arranged. The organization structure given below will provide you a brief or generalpicture about the basics of memory which helps us to know the memory to carry out certain operations.

### 2.2.1 Memory organizations

Memory is in the form of arrays of individual storage elements which are arranged into rows and columns. A typical figure 2.1 shown below gives you an idea of the different concepts of memory.

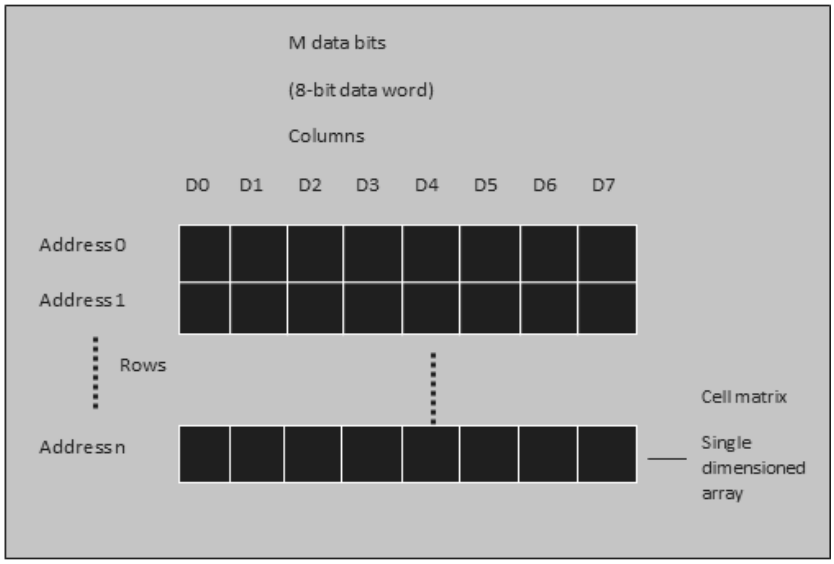


**Figure 2.1: Diagrammatic representation of a Memory array**

Memory is made up of a collection of rows and columns where each row represents an address on a single memory chip. The column represents data bits. There are 8 columns starting from D0, D1… D7 and each column represents a single bit data. The intersection of an individual row and column forms the cell which has a major impact on memory performance because the effectiveness depends on the number of components that make a cell and the way it is arranged. For example some RAM can have a single transistor, while some can have a combination of several transistors and other components on the chip. You should always keep in mind that although you don't have to bean expert in memory designing, you should have ample knowledge about the internal fabrication of the memory because it is directly related to its performance.

- **Logical Memory organizations**

The logical memory organization is the management of the modules of different programs that can be used and retrieved whenever required. Some of the programs are read only data and some are editable instructions. This

can be different from physical address space. The data can be organized in different ways with different classification of computer memory. In the course of upgradation of the CPU and chipsets, there has also been an improvement in the capabilities of the memory. Recent chips are capable of addressing 4GB of system memory. This improvement has proved microprocessors to be better unlike earlier PCs with 8088 processors which could address not more than 1GB of memory. This has made microprocessors stronger than any typical software applications.

Whenever there is upgradation of new memory there must be a proficient compatibility with the old memory. This has to co-relate with the limitations and the needs of the computer users. The old system may have a lot of limitations and drawbacks. The new system comes with a facility to overcome the inherent limitations of the old memory by different ways of its use and hardware and software selection.

**The use of computer memory is classified under the following types:**

- Conventional
- Extended
- Expanded memory

- **Conventional memory:** Conventional memory is that part of the memory which is used to perform standard DOS programs. The first 640KB memory is considered to be conventional memory. The name indicates that it has been used in DOS to run DOS programs. Although there is 1MB of address space in the DOS memory which is called *real-mode memory or base memory*, only 640 KB is available for conventional memory because the initial 384 KB is reserved for system use which is called *upper memory*. Previously the original PC provided only 512KB for DOS program, but in recent evolution another 128KB has been added.
    - **Upper memory area:** This is one of the key factors to enable free place for conventional memory. This is one of busiest places in the memory and often creates confusion in its organization. This memory is also called *High DOS Memory Range.* DOS command (MEM /C /P) is used to see the amount of memory used in conventional memory and what is free. The conventional memory is separated from the other usable memory of the PC and is called

*extended memory.* Though we have 640KB memory as conventional we can use a maximum of only 620KB of the memory by utilizing the combination of high memory area and upper memory area. The advantage of high DOS memory is that more of the 640KB DOS range remains available for your application program.

- **Extended Memory:** The memory above first megabyte is called extended memory. This memory is an add-on as an extension to the available 1MB memory. Extended memory is not available to the PC in normal DOS programs. To have access to this memory you should use the protected mode. Extended memory can be used in two ways. One in full protected mode where windows accesses the extended memory directly and second, sometimes it must be used by the real mode to operate the PC by the use of some extended memory manager. Generally, extended memory is also known as XMS (extended memory specification) and in particular it is a standard which is used for utilization of the extended memory in DOS program.
- **Expanded memory:** This is an older style of using memory beyond conventional memory. This memory uses a standard called EMS (expanded memory specification). This was earlier created to overcome the limitation of 1MB of memory use. You should keep in mind that an extended memory is not the same as expanded memory. So expanded memory card cannot be used to use extended memory and vice-versa.

### 2.2.2 Memory package

Memory package consist of two circuit boards. In one board multiple socket elements are arranged and in the other board, it consists of controller chip. Both the circuits are coupled to each other. This coupled circuit is placed on single base with two sides. An handle is connected to the base which has a lever system and latch which slides with lever system. Memory package is used to easily connect the controller to store the data and readily available for retrieval, so that the controller can transmit data to the required location during the time of data loss. Due to the tray and single base memory package is safe even when it is not used. Like processors, memory is also arranged in the semiconductor chip. Therefore you should always take care

that the organization is very delicate and compact so that it can be integrated with the rest of the system. There are different types of memory packages and you have to decide which type will best suit your system design. Here the figure 2.2 will show you the typical diagram of a basic memory chip. The figure explains as to how the different signals flow and perform their respective activities.

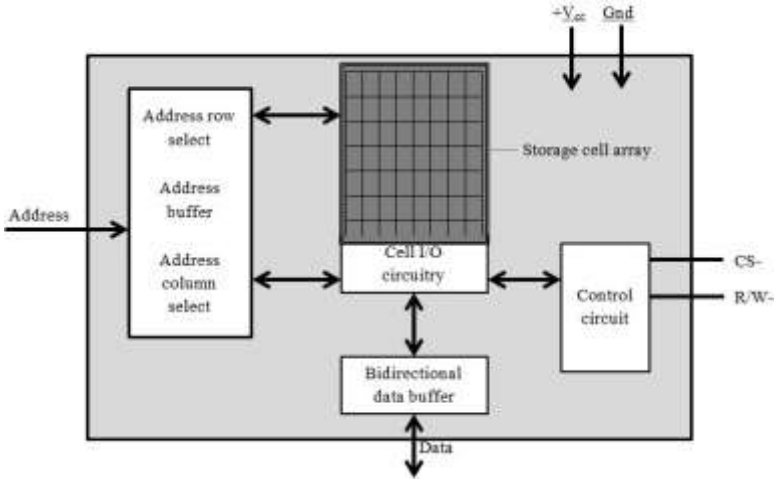


**Figure 2.2: Diagram of a Basic memory chip**

The communication between the outside world and memory is through signals. Basically there are three sets of signals like address lines, data lines and control lines. Address lines are used to define the row which needs to be active. It converts the binary number into row signals. Data lines are responsible for moving data bits back and forth to the storage cells at the address defined. Control lines are needed to operate the memory chip. For example, a read/-write (R/-W) signal helps the memory to know whether the data is being read or is to be written on it. A –chipset (-CS) signal will make memory active or inactive. Row address-select (RAS) column address-select (CAS) refreshes the memory.

Memory die is mounted in a package as any other chip. The complete package is welded on the motherboard. There are different types of package styles as follows:

1. **Dual Inline Package:** It is packaged into a plastic or ceramic package known as *Dual Inline Package* (DIP). This is mostly used in older PCs and older video boards and is still used to hold memory cache or BIOS chips. This is compatible with sockets and allows the pin to be inserted

and removed as and when required. But there is a chance of breakage of pin in the socket if it is incorrectly put. This package requires more space in the PC.

2. **Single Inline Package:** This package does not have enough pins. Although it is not in use today, sometimes it is used when there is a need for expansion in the proprietary memory by the use of memory modules. The disadvantage of this package is that it is very difficult to find its replacement; and if found it is very costly.
3. **Small-Outline "J" lead:** This package is the enhancement of DIP for surface-amount circuits, with a bend around the package in the form of *"j".* Sockets which are SOJ packages can be replaced by BIOS ROM and SOJ devices are welded into the motherboard.
4. **Thin, Small-Outline Package:** This package is similar to SOJ which is mounted on surface-amount circuits. This is a small, thin body which makes TSOP memory made of slim spaces. Such packages are used in serving the net books or notebooks.
5. **Chip Scale Package:** this package does not have pins and is mounted on the surface circuits with the help of pads fitted to the bottom of the chip.

**2.2.3 Modules:** Memory module in a general term is a circuit board consisting of memory chips. Specifically it is dynamic random access memory inside the circuit board is known as memory module. You are well aware that the memory chips are welded into the motherboard, which gives the PC a fixed amount of RAM and also does not give any option to extend the memory. Therefore, in order to increase the performance of the memory expansion memory modules are added to extend the memory space. Generally, there are three types of memory modules. They are:

1. **SIMMs**: SIMM is a memory module which supports the proprietary memory expansions. These *single Inline memory modules* can support between 1MB to 16MB of RAM according to the module's life. At present the SIMM can hold up to 32MB of RAM and 72 pins. SIMM is usually measured in terms of bytes.

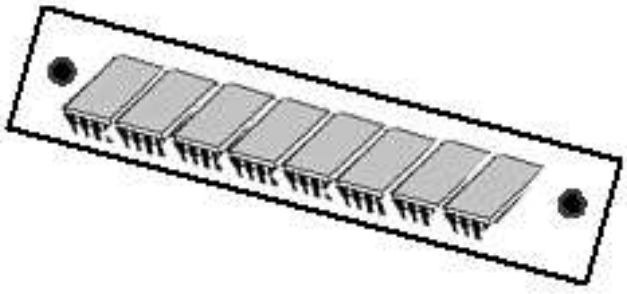

**Figure 2.3: SIMM**

The SIMM is so placed inside the motherboard that the sockets ensure that it holds tightly when once inserted in the motherboard. This is done by inserting the socket at an angle of about 60 degree from the motherboard and then moving upwards so that it represents L shape or is perpendicular to the motherboard. This can be fitted with the help of metal clips. It should be kept in mind that SIMM once inserted cannot be installed backwards.

The advantage of SIMM is standardization. That is, with the help of standard pin architecture it can be transported from one PC to another PC very easily.

2. **DIMMs:** *Dual Inline Memory module* is very much similar to SIMM except that it is larger in size. It can accommodate up to 64-bit data bus width. Unlike SIMM, a DIMM works by keeping all the electrical signals separate. DIMM uses circuit board to connect a series of RAM chips mounted on it. They together form a memory module. DIMM communicates with the data bus through teeth like connectors that are fixed into the socket. In DIMM the socket is inserted vertically and locked in avertical position using special plastic clips. DIMM is fixed with a series of notches depending on the type and operating voltage and therefore once installed it cannot be reinstalled. Three factors are considered in the standardization of the installation of DIMMs. They are voltage, buffering and module technology. Voltage level always tends to decrease to moderate the temperature and to improve the performance. Buffers stand external to memory module and they improve its

performance by reinitiating the signals that are produced in the memory chip. Composite and non-composite module helps in identifying the difference between different modules of the same capacity and the number of chips that are used.

In actual practice, the term buffer is used with all types of RAM, though this is technically incorrect. For example, you will see “un-buffered SDRAM,” even though it should technically be “unregistered SDRAM”.[1]

3. **RIMMs:** RIMM is similar to DIMM but uses different pin settings which are much bigger than that. RIMM is the acronym for *Rambus Inline Memory Module* because it uses Rambus technology. It is responsible for reducing the high heat energy generated by RDRAM chips with the help of long heat sink.
4. Thus with the help of memory modules it is possible to increase the size and performance of the memory.

**Self Assessment Questions**

1. What do row and column represent?
2. The communication between the outside world and memory is through _____.
3. Which of the three set of signals are needed to operate the memory chip?
4. What are the different types of memory modules?
5. State whether the following statements are true or false:
   a. RIMM is responsible for reducing the high heat energy generated by RDRAM chips with the help of long heat sink.
   b. SIMM works by keeping all the electric signals separate.
6. _____ is one of the key factors to enable free space for conventional memory.
7. The memory above first megabyte is called _____.

[1]BOOK: Troubleshooting, maintaining & repairing PCs, fifth edition by StephenJ.Bigelow, Tata McGraw Hill Education private limited.

## 2.3 Memory considerations

In the previous section, we discussed the essential concepts of memory such as its organization and packages. This section introduces you to the memory types with the current memory architecture and the important issues related to them.

The importance of memory has grown to such an extent that it is no more just a storage place for data bits. It has become specialized to such a level that it has become very difficult to track the memory options and understand the architecture. Therefore many considerations have to be taken into account like memory speed, its layout and so on.

**2.3.1 Memory speed:** There is always a conflict with respect to price and performance. When you need high performance memory you have to pay high price. But generally people are attracted by low cost memory. As you know, CPU performance also depends on the memory, and when you use low cost memory devices then CPU has to wait for the memory to catch up with the speed. *Memory speed* is defined as the time taken to access one bit of data form the storage space**.** The speed of the memory is always measured in access time which is measured in nanoseconds (ns).*Access time* is the time delay that takes place from the beginning of the access till you get the valid data ready for your use. *Cycle time* is the minimum amount of time needed between the accesses. Though these times are measured in nanoseconds today's memory with high performance is rated in terms of system time rather than cycle time or access time since system speed in measured in terms of megabyte. The system can always extend its memory with faster memory to increase its performance. But the main problem with this task is that care should be taken that the system continues to operate normally. Therefore, some mechanism should be altered between the memory and its architecture for a particular performance. But the cost incurred in tailoring the architecture and memory is too high when compared to the rate of performance. Therefore, it is better that the system be altered only when the system gets obsolete.

**Wait State:** Wait state is defined as the state of a program which is waiting for the processor so that an event should complete its processing. It is a state when processor is not available for an operation in the computer because it is waiting for another operation to complete its execution. When

memory process needs to tell the memory to wait then it needs to insert a clock cycle. This gives additional time to memory to operate. Generally one wait state is used in today's PC. The older PCs may use two-three wait states. Therefore we observe that as wait state increases the performance of the system decreases. The systems with zero wait state are considered to allow optimum performance which is ideal in nature. The use of wait states help in supporting the old systems to process. There are three ways of selecting wait states:

- The number of wait states may be fixed
- The wait states may be selected by keeping one or two jumpers in the motherboard.
- Keeping the wait state control in the SMOS setup routines.

**2.3.2 Memory types:** Memory types are broadly divided into ROM and RAM.

**ROM:** As the name indicates *Read Only Memory* is a integrated circuit chip that allow the user only to read and not to edit or modify the data inside it. It is also called as *firmware*. This gives us the nonvolatile memory in which data security is guaranteed, i.e. once the power cut off any failure occurs data is not lost. Due to the embedding of programmes data is not erased or neither be changed. But the disadvantage with ROM chip is once the data is stored by the manufacture it cannot be erased. While creating the programes to embed if any mistake occurs then correcting that mistake is a heavy risk and costly. There were different types of ROM available in a course of time to overcome this difficulty which allowed to an extent to rewrite the content in the memory or reuse the memory.

**They are**

**PROM:** In *Programmable Read-Only Memory*, you can write the data only once into it. We cannot erase or modify the data once entered into PROM.

**EPROM:** In erasable read-only memory, you can erase the data and overwrite the data into it. But you cannot keep or delete the part of old content and add new. Entire data is deleted and new content is added into the EPROM.

**EEPROM:** In electrically erasable programmable read-only memory, you can edit/modify or delete a part of data and use it for storing the data. These PROMs are also called as *flash memory.*

Please note in all the types of ROMs the data is electrically burnt into the circuit. This will be very difficult to use when we need to do large amount of addition deletion operation to a single stored data with increase in the development of processor and its upgradation.Due to the advance in the speed of the processors, the CPU is becoming more and more specialized with specific functions of the PC.

Due to this advancement withina short timethe CPU will encounter many of the types like EDO, BEDO, DDR SDRAM, DRAM, EDORAM (extended data output), EDRAM (enhanced DRAM), SRAM (static Radom Access Memory), Cache memory, etc which is explained in detail below.

- **EDO RAM:** *Extended Data Out RAM* extends the validity time of the output. So the meaning of extended implies the data bus can keep the data bit in it for a longer period. This needs modification in the output buffer which can create time for the validity of the data bit. That means the data should be alive until it is read by the recipient. Although EDO accesses the memory faster than earlier conventional memory actually there is only a slight difference. Some of the older systems will work very slowly with EDO and others might not at all support EDO. The problem with EDO is that it requires the system chipset support for its slower performance.

- **BEDO RAM:** *Burst Extended Data Output RAM* is the extended versions of EDO RAM which was developed to read large blocks of data bits than EDO RAM. This reads the data in one burst. That means that the CPU can read the BEDO data in five consecutive memory locations in five clock cycles i.e. 5:1:1:1 pattern which means five cycles for memory address and 1 cycle each for the addresses. However these days BEDO is not used much due to the difficulty in supporting motherboards above 66MHz.

- **DRAM:** *Dynamic Random Access Memory* is mostly used by the PCs for their system's Main memory. It is called dynamic because it is continuously refreshed using the *refresh circuitry* and holds the data. It uses single capacitor and transistor to hold the data bit. DRAM is simpler and cheaper because it is made up of only one capacitor and transistor. However, the problem with DRAM is that the capacitor holds the data for a very short time and needs to refresh with the help of refresh circuitry before the content fades away. Otherwise there is a loss of content.

- **SRAM:** *Static Random Access Memory* is used to hold data that can stay for a longer time without the need of refresh circuit. It holds data bit as long as current supply exists in the circuit. This type of memory is used whenever there is need of fast memory especially in case of cache memory. SRAMs are known for their simplicity and speed. But at the same time SRAMs are comparatively very expensive and small. Therefore they are used wherever there is need for faster memory. They are also used in level 1 and level 2 cache memory. Cache memory is extensively faster and not very large.

- **SDRAM:** *Synchronous DRAM* is the rapidly growing memory type as a new standard. This is very much different from other types since it is connected to the system clock and able to read and write in burst mode at the rate of 1 clock cycle per data bit. The pattern followed is 5:1:1:1 which you have discussed in the BEDO type but it can support up to 100 MHz. It is specially designed for higher operating speeds. This type is relatively unique in its technology and rated in Nano seconds. This is because SDRAM offers the second burst before the current burst completes. This continuous access will speed up the system processor and increase the performance.

- **DDR SDRAM:** *Double Data Rate SDRAM* is an improvement over SDRAM. Its functions are similar to SDRAM but it supports more bandwidth by transferring twice data bit per cycle i.e. it transit from 0 to 1 and again back to 0. Therefore the data bit read is twice per cycle. Thus there exist two end points called *rising edge* and *falling edge*. In the other types of memory any one of these edges are triggered. Only in DDRSDRAM both the edge signals are used.

- **EDRAM:** Enhanced Dynamic Random Access Memory is a DRAM in which small amount of SRAM is embedded inside the large amount of DRAM so that the memory access can be made faster by embedding two memory into one. This avoids using the external cache memory. This can be used as Level 1 and Level 2 cache and also known as cached DRAM or CDRAM. EDRAM acts like a page mode memory i.e. if the read requests are available in the cache then the data can be accessed in 15 nanoseconds otherwise if it is not available then the data is read by the DRAM portion and it takes 35-40 nanoseconds to access the data from the

memory. That means if the data has to be accessed very fast then the data request must have been repeatedly made.

**2.3.3 Memory techniques:** For all the above reasons when you choose the architecture of the memory you should select it in such a way that its performance is not affected by the expense. It is wiser for youto use the inexpensive and existing memory types in the architectures which is well defined with the help of memory technologies. The most commonly found architectures in all the systems are:

- **Paged memory:** It is technique in which the data is transferred from secondary memory to main memory. In this the data is retrieved from the secondary storage in the form of pages. *Pages* are the blocks of same size. Paging allows the CPU to use the free address space which are randomly available in the memory. This memory makes partition of the RAM into smaller groups or pages of size 512 KB or a bit more. If the access takes place in the current page it can accomplish the access within zero wait state. If simultaneously accesses occur outside the current page then one or two wait state can be allowed until that particular page is found. If you observe carefully, you will find that this architecture works very similar to fast-page mode DRAM which you discussed in the earlier section. This type of architecture is used on high end i286, PS/2 models and i386 systems.

- **Interleaved memory:** Unlike paged memory, interleaved memory is the combination of two bank memory. That means when the first memory is performing some process the second is reading the data of another process. For example, if you need to install two memory modules then you will find that while one module is accessing, the other module is being read. Performance is better in interleaved memory because of the combination.

- **Memory cache:** These are the very fast memory that is used by the CPU to run programs that are used very frequently or repeatedly in software. This involves faster execution of the programs and less time taking in reading the instruction set. This is as mall memory which is very fast and acts between the CPU and RAM. RAM generally operates in 5ns-15ns which is fast enough to process CPU in zero wait states. The content which is read on the motherboard is copied on to the cache. When the memory is read it first reads from cache to cache if there is any content present in it. If the content is not present in the cache memory it is called

*cache miss*. Then it can search in the DRAM for the content with one or more wait states. Cache memory can be classified into two levels as internal cache and external cache.

- **Shadow memory:** Shadow memory is a technique in which data is transferred from ROM to RAM creating a copy of the data. ROM devices are comparatively very slow and the access time takes several nanoseconds. Therefore in turn it increases number of wait states used in access. This automatically decreases the potential performance of the system. In *shadow memory* the content is loaded form ROM to RAM. So when ever content in the ROM need to be accessed, it can be accessed from the faster RAM memory or shadow memory rather than accessing from the real ROM.

**Activity 1:**

Collect some old processors and try to find out the different types of modules adopted by them and list out the advantages and disadvantages in their performance.

**Self Assessment Questions**

8. _____ is the minimum amount of time needed between the accesses.
9. What are the different types of Memory?
10. State whether the following statements are true or false:
    a. The system that uses more than one wait state for accessing will have very high performance.
    b. The use of wait states will help in supporting the old systems to perform its processes.
11. What are the different architectures of the memory that are found in the system?

## 2.4 Selection and installation of memory

You have discussed about the various considerations of memory and its types. This section will help you in selecting the memory and enable you to install successfully. When you decide to use the memory, it is very important to decide whether to buy new memory; how to use the existing memory and if required to buy new ones, then how much to buy. Here you can learn how to choose and use the memory.

**2.4.1 Getting the right amount:** The question often asked is, what is the amount of memory required. The answer is that more memory is required to increase the CPU performance at any given time. Getting memory and installing would never be a problem if its cost is less. Here the problem with cost is related to the SDRAMs; memory hard drive as well as memory is too high compared to all the rest. Also, too much of memory installation results in dead investment on the resource that remains idle. Also we cannot install very little memory and take the result of low performance in accessing which results in swapping the file from here and there to make memory location free for the current task.

We must have enough memory in hand for the system. But it is difficult to define how much is *enough* Due to the transformation in the PC industry the defining of memory amount varied from one generation to other generation systems. In today's system, you need a minimum of 64MB of memory for processing and it could vary from 64MB -128MB for general purpose home and office PCs. The industry is now using up to 1GB of RAM in the systems.

**2.4.2 Filling Banks:** The amount of memory that is enough to fit the bit width of the data bus is called *memory bank.* The size of the memory in MB does not matter until the entire bank is filled. The major requirement of the bank mainly depends on three components. It is not sufficient to just have it installed. The three components are *memory amount, memory matching, and bank order*. The entire bank must be filled by the sufficient amount of memory. For example if the Pentium system has bank 0 filled with 8MB then, you must store another 8MB in bank 1 for the sake of processing. The modules must have the same size and speed in the bank. This is called memory matching. Bank is added with memory modules; each memory module has the same speed and shares the same memory configuration. Some memory modules are so configured that module based system have their own requirements. If it does not have correct speed, type, size and RAM technology, the system fails to recognize the module. Note the following points regarding DIMMs for the installation:

- If the system has two identical DIMMs, then you can install them in either bank 0 or bank 1
- If the system has two DIMMs with different sizes, install the larger DIMM in bank 0 and smaller in bank 1.

- If the system has identical size and one single sided and one is double sided, then you install single-sided DIMMs in bank 0 and double-sided DIMMs in bank 1.

There is one more important component called bank order. You can fill the data bits in bank 0 and when it is filled then you can start filling bank 1, bank 2 and so on. If you don't fill bank 0 but fill bank 1, then your PC will not identify the RAM chip which has been additionally installed.

**Activity 2:**

Suppose you are a network administrator and need to take decision on memory upgradation. Write a brief note on how you will take a decision on buying a new system or adding more memory.

**Self Assessment Questions**

12. In buying the memory the cost is related to _____, _____ and _____.
13. The amount of memory that is enough to fit the bit width of the data bus is called _____.

## 2.5 Troubleshooting

By now you must be familiar with different considerations of memory. You must have understood how to select and install the memory. In spite of the best devises used they are prone to failures sometimes. The reasons may be accidental static discharge during installation, incorrect installation, a poor system configuration, operating system problems, and even outright failures due to old age or poor manufacturer leading to memory problems. This section shows you how to deal with such problems.

Troubleshooting a memory is a form of solving the problems incurred in the memory and correcting the faults and failures.

**2.5.1 Memory test equipment:** there are mechanisms to use a testing device so that it can identify the memory failure. As memory modules is used to accelerate the performance, modular-based system memory tester is used to conduct a deep check on the various memory modules and inform you if there is any failure in the specific chip. An adapter is installed in the

memory module which allows configuring. Intelligent testers automatically perform their failure checking with large configuration and display their result on an LCD. In this type of memory testing guesswork is completely eliminated.

**2.5.2 Repairing SIMM/DIMM/RIMM sockets:** it is the function of the socket to fit in tightly in the motherboard. You need to apply force to make the module fit into the socket firmly. Ideally it has to gently pierce inside the socket without the application of much force. With more pressure there is a chance of it breaking. It is risky to remove it once it is fitted and if at all it has to be done it should be done very carefully. Rather than repairing the damaged socket it is best to remove it and use a new one. This tooinvolves then following steps which is cumbersome.

- To remove the old socket, you need to remove the motherboard.
- Detach the socket that is damaged.
- Solder the new socket.

Fortunately there are a few tricks through which you can overcome these problems. The following can be done in case of problems.

- When the clip is bent you can use a medium-weight rubber band around the module and socket and the rubber band will serve as holder for socket and module just like a clip.
- Epoxy can be used if the socket breaks or cracks. But you need to be a little careful with respect to ventilation. Though it will not serve the purpose of fixing the damage completely but it will help in allowing the motherboard to work for considerable long life.

**2.5.3 Contact corrosion:** Contact corrosion is defined as area of contact with the similar metals when there is no protective layer between then and the metals are in the liquid creates an electrolytic cell. Contact corrosion can occur when the memory module contacts the metal and socket does not contact. This causes problem in contacts. This can be taken care of temporarily by cleaning the metals with the cotton swap and good quality contact cleaner. Meanwhile, the memory and sockets contact must be made to contact at the same time.

**Activity 3:**

Find an old system and find out the problems in it and try to trouble shoot them.

**Self Assessment Questions**

14. _____is a form of solving the problems incurred in the memory and correcting the faults and failures.
15. What are the three difficult processes in installing a new socket when it is unsuccessful?
16. _____ can be used if the socket breaks or cracks.
17. _____ can occur when the memory module contacts the metal and socket does not contact.

## 2.6 Summary

The Memory is the brain of any system. Memory is in the form of arrays of individual storage elements which are arranged into rows and columns. The organization structure is the important aspect before starting to learn memory. Memory is mounted on a package which are of many types like Dual Inline Package, Single Inline Package, Small-Outline “J” lead, Thin, Small-Outline Package, and Chip Scale Package.

Modular approach is the best way of organizing a system. In memory youfind three types of modules. Using these memory modules you can enhance or add the different extended slots. These memory modules are SIMM, DIMM, and RIMM.

Whenever there is upgradation of new memory there must be a proficient compatibility with the old memory. The new system comes with facility to overcome the inherent limitations of the old memory by different ways of its use and hardware and software selection. The use of computer memory is classified as following types: Conventional, Extended, and Expanded memory.

The importance of memory has become specialized to that level that it has become very difficult to track the memory options and understand the architecture. Therefore many things are taken care of which include memory

speed, wait states etc. Advancement in the memory lead to specific memory types such as EDO RAM, BEDO, DRAM, SRAM, SDRAM, etc.

You might face a lot of problem when you select and install a memory. These can be solved by trouble shooting it. Troubleshooting a memory is a form of solving the problems incurred in the memory and correcting the faults and failures.

## 2.7 Glossary

| Term | Description |
|---|---|
| Composite | The module using old technology and additional chips |
| Non-composite | The module using latest technology and fewer chips |
| Internal cache | It is also called as level 1cache which has to be enabledalways. Turning off this cache will lead to severe performance hit. |
| External cache | It is also called as level 2 cache. Disabling this memory will slow down your system dramatically. |
| ROM | Read Only Memory is an integrated circuit memory chip that contains configuration data. It is also called as firmware as its programming is fully embedded on its ROM chip |
| DRAM | Dynamic Random Access Memory needs to have its storage cells refreshed or given a new electronic charge every few milliseconds. |
| Epoxy | Epoxies are copolymers and are also referred to as resins or hardeners which are known for their excellent adhesion, chemical and heat resistance, good-to-excellent mechanical properties and very good electrical insulating properties. |
| Rising edge | When the clock cycle shows 1 or the signal is high it is called rising edge |
| Falling edge | When the clock cycle shows 0 or the signal is low it is called falling edge. |

## 2.8 Terminal Questions

1. Explain the organization of memory.
2. Describe the different types of memory modules.
3. What are the different considerations to be kept in mind while upgrading/installing memory?
4. How do you select a memory?
5. How will you troubleshoot memory?

## 2.9 Answers

### Self Assessment Questions

1. Address and data bits
2. Signals
3. Control lines
4. SIMM, DIMM and RIMM
5. 
   - True
   - False
6. Upper memory area
7. Extended memory
8. Cycle time
9. EDO RAM, BEDO, SRAM, SDRAM, DRAM, DDRSDRAM, EDRAM
10. 
    - False
    - True
11. Paged memory, interleaved memory, memory cache, shadow memory
12. SDRAMs, memory hard drive and memory
13. memory bank
14. Troubleshooting a memory
15. First remove the motherboard, detach the damage socket and fix the new socket
16. Epoxy
17. Contact corrosion'

### Terminal Questions

1. Refer section 2.2.1. Memory organization
2. Refer section 2.2.3 Modules
3. Refer section 2.3 Memory considerations
4. Refer section 2.4 selection and installing a memory
5. Refer section 2.5 Troubleshooting

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