SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

COURSE NAME : 19IT301 COMPUTER ORGANIZATION AND ARCHITECTURE

II YEAR / III SEMESTER

Unit 1 : BASIC STRUCTURE OF COMPUTER
Topic : MEMORY LOCATIONS AND ADDRESSES
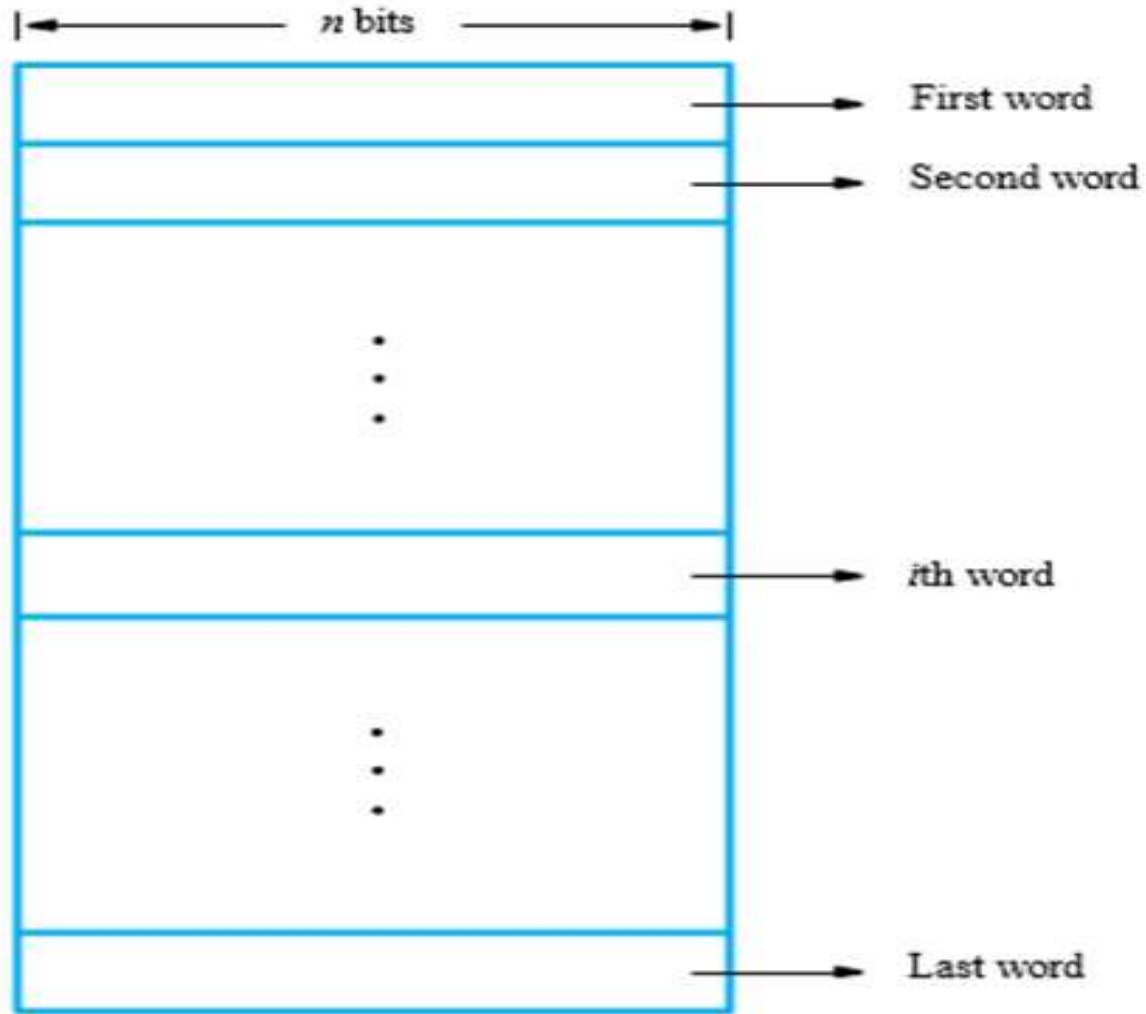
Memory Locations and addresses

- The memory consists of many millions of storage cells (flip-flops), each of which can store a bit of information having the value 0 or 1 .

- Each group of n bits is referred to as a word of information, and n is called the word length.

- The word length can vary from 8 to 64bits.

- A unit of 8 bits is called a byte.

- Accessing the memory to store or retrieve a single item of information (either a word or a byte) requires distinct addresses for each item location. (It is customary to use numbers from 0 through 2k-1 as the addresses of successive locations in the memory).

- If 2k=number of addressable locations, then 2k addresses constitute the address space of the computer. For example, a 24-bit address generates an address space of 224 locations (16MB).
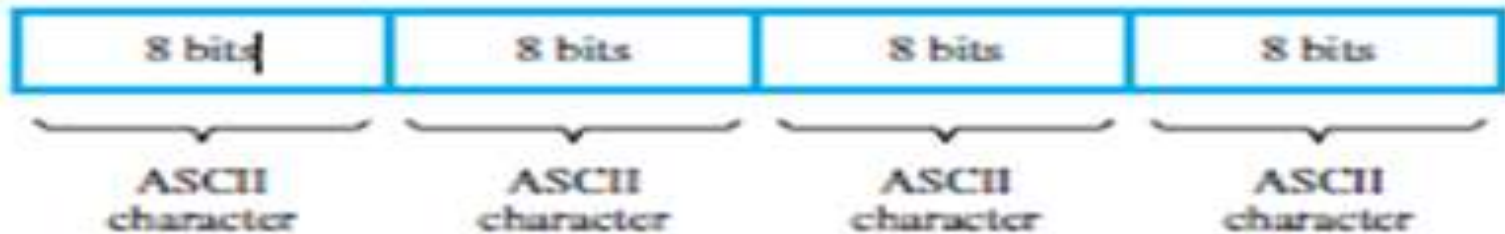
Memory Locations and addresses

Memory words.

Memory Locations and addresses

Examples of encoded information in a 32-bit word.

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Memory Locations and addresses

- Characters can be letters of the alphabet, decimal digits, punctuation marks and so on.

- Characters are represented by codes that are usually 8 bits long. E.g. ASCII code

- The three basic information quantities are: bit, byte and word.

- A byte is always 8 bits, but the word length typically ranges from 1 to 64 bits.

- It is impractical to assign distinct addresses to individual bit locations in the memory.

BYTE ADDRESSABILITY

- In byte addressable memory, successive addresses refer to successive byte locations in the memory.

- Byte locations have addresses 0, 1, 2. . . . .

- If the word length is 32 bits, successive words are located at addresses 0, 4, 8. .with each word having 4 bytes.

There are two ways in which byte addresses are arranged.

- 1) Big-endian assignment: lower byte addresses are used for the more significant bytes of the word

- 2) Little-endian: lower byte addresses are used for the less significant bytes of the word

In both cases, byte addresses 0, 4, 8. . . . . are taken as the addresses of successive words in the memory.
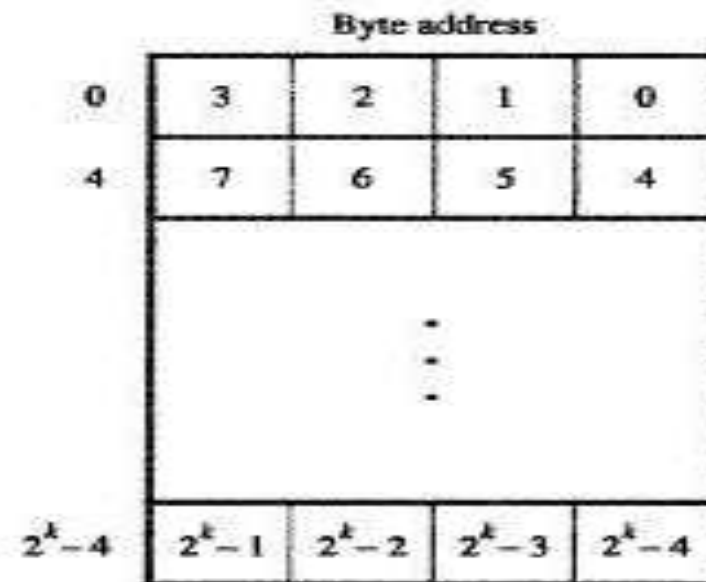
BIG-ENDIAN AND LITTLE-ENDIAN ASSIGNMENTS
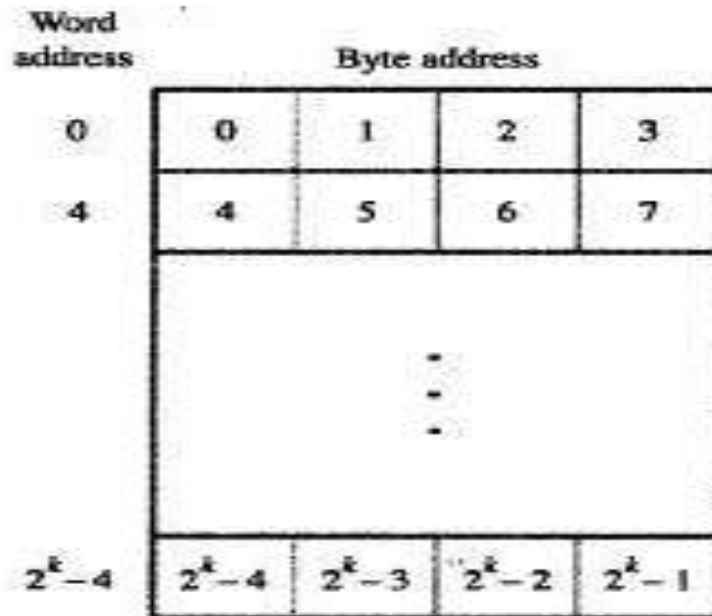
(a) Big-endian assignment

(b) Little-endian assignment

Byte and word addressing.

WORD ALIGNMENT

- Words are said to be aligned in memory if they begin at a byte address that is a multiple of the number of bytes in a word.

- For example, if the word length is 16(2 bytes), aligned words begin at byte addresses 0, 2, 4 . . . . . And for a word length of 64, aligned words begin at byte addresses 0, 8, 16. . . . . . .

- Words are said to have unaligned addresses, if they begin at an arbitrary byte address.

ACCESSING NUMBERS, CHARACTERS & CHARACTERS STRINGS

- A number usually occupies one word. It can be accessed in the memory by specifying its word address.

- Similarly, individual characters can be accessed by their byte address.

- There are two ways to indicate the length of the string.

- A special control character with the meaning "end of string" can be used as the last character in the string, or

- A separate memory word location or processor register can contain a number indicating the length of the string in bytes.

Performance Measurement

- If the SPEC rating = 50 means that computer under test is 50 times as fast as the reference computer.

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ASSESSMENT

- What is word length?
- What is byte?

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Reference

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", McGraw-Hill, 6th Edition 2012.

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