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COURSE NAME : 19ITT202 – COMPUTER ORGANIZATION AND ARCHITECTURE

II YEAR/ III SEMESTER

UNIT – I Basic Structure of Computers

Topic: Bus Structures & Performance

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Bus Structures

A group of lines, that serves as a connecting path for several devices is called as a bus.

The bus have separate lines for carrying the data, address & control purposes.

Bus is a communication part connecting two or more devices .

It is a shared transmission medium where multiple Devices are connected to the bus and signal is transmitted by one device is received by other devices attached to the bus.

In bus each line is capable of sending signals which are nothing but binary zero and binary one.

Several lines of a bus can be used to transmit binary digits simultaneously

Single Bus

- It can be used for only one transfer at a time.
- All units are connected to the single bus.

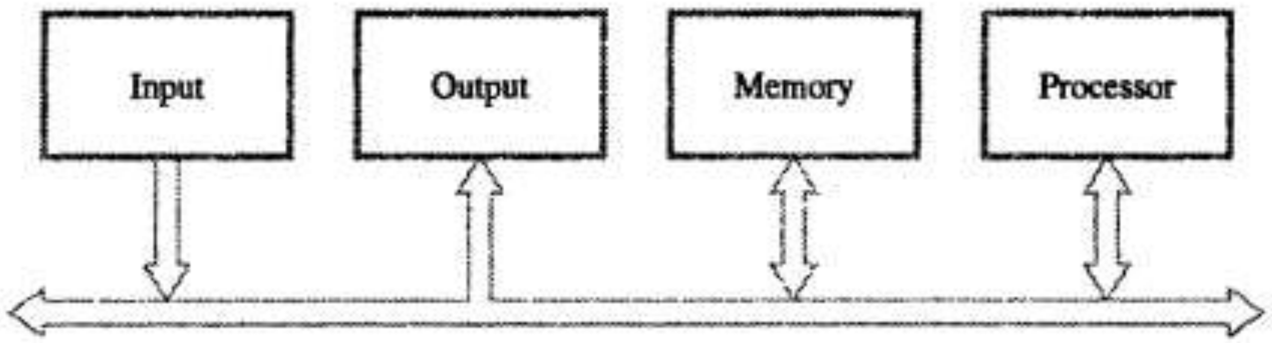
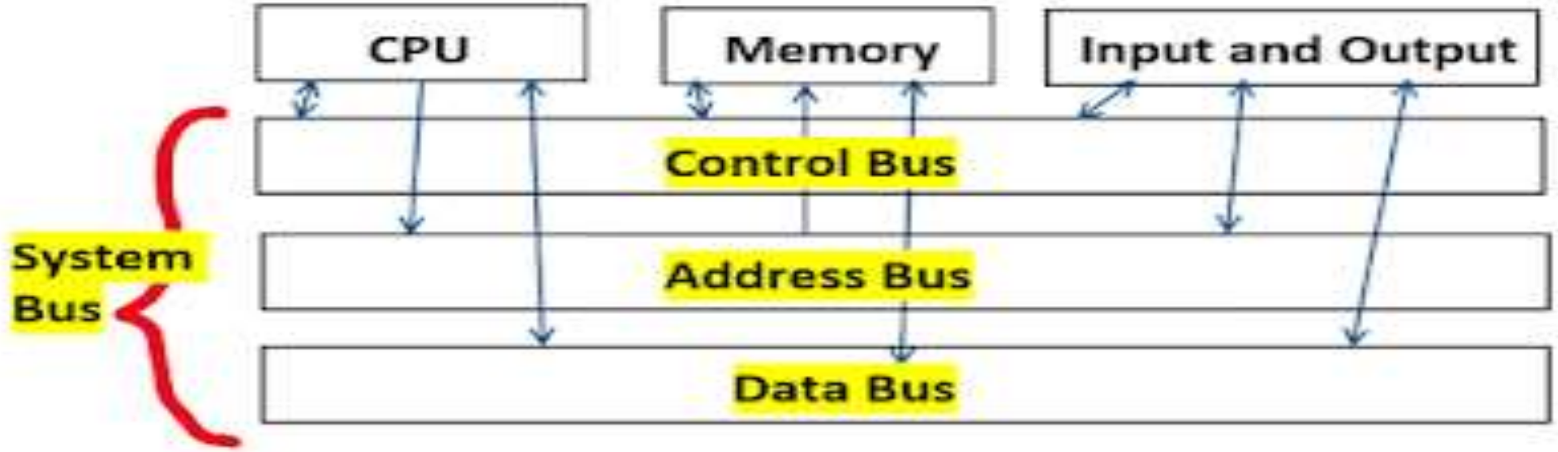


Figure 1.3 Single-bus structure.

Buffer Register – Holds the information during transfer.

Multiple Bus

- Multiple bus organization uses multiple buses for enhanced performance.
- In a multi-bus architecture, all the pathways are suited for handling some special types of information.



Types of Buses in Computer Architecture

- In single bus architecture, all the devices use a common bus for data transfer; thus, the system’s efficiency and performance is lower.
- However, in the multiple bus organization, the wasted time lowers down, and thus the speed and performance of the entire system boost up.
- Thus, this is one of the key reasons behind using Multiple bus organization.

Three types of bus are used

- Address bus
- Data bus
- Control bus

Address bus –

- carries memory addresses from the processor to other components such as primary storage and input/output devices.
- They are used to designate the source and destination of the data on the data bus.
- For ex: Of a processor wants to read a word from memory then the processor will put the address of the word on the address line.

Data bus –

- carries the data between the processor and other components.
- They provide the path for Moring the data between system modules. These lines collectively called data bus.

Control bus –

- carries control signals from the processor to other components.
- These are used to control the data and address lines access.

Control signals are divided in to 2 types.

- 1) Timing signals: Which indicate the validity of the data and address information.
- 2) Command signals: They specify operations to be performed.

Performance

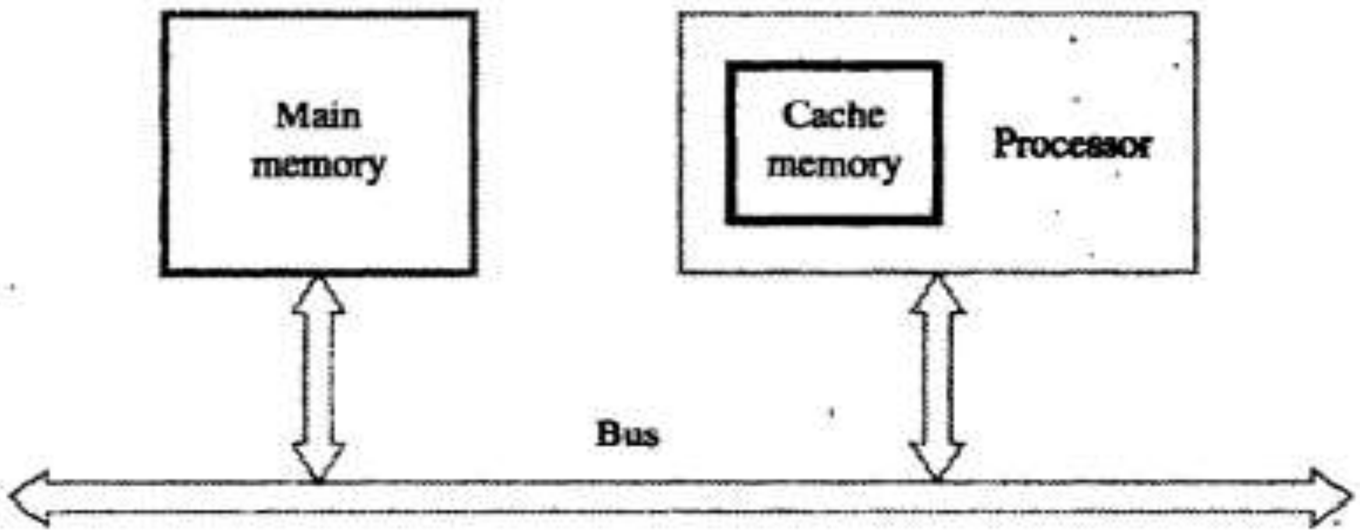


Figure 1.5 The processor cache.

Basic Performance Equation

$$T = \frac{N \times S}{R}$$

Where,

T → Processor time Required

N →Number of Instruction execution

S → Average Number of basic steps

R → Clock rate

Processor Clock

Processor circuits are controlled by a timing signal called clock.

The clock defines regular time intervals, called **clock cycles.**

The processor divides action to be performed into a sequence of steps, each step can be completed in one clock cycle.

Clock Rate

Clock rate, R=1/P

The length P of one clock cycle is the parameter that affects the processor performance. It is inverse in clock rate, measured in cycles per second.

performance and execution time for a computer X:

$$\text{Performance}_X = \frac{1}{\text{Execution time}_X}$$

This means that for two computers X and Y, if the performance of X is greater than the performance of Y, we have

$$\text{Performance}_X > \text{Performance}_Y$$

$$\frac{1}{\text{Execution time}_X} > \frac{1}{\text{Execution time}_Y}$$

$$\text{Execution time}_Y > \text{Execution time}_X$$

That is, the execution time on Y is longer than that on X, if X is faster than Y.

In discussing a computer design, we often want to relate the performance of two different computers quantitatively. We will use the phrase "X is n times faster than Y"—or equivalently "X is n times as fast as Y"—to mean

$$\frac{\text{Performance}_X}{\text{Performance}_Y} = n$$

If X is n times as fast as Y, then the execution time on Y is n times as long as it is on X:

$$\frac{\text{Performance}_X}{\text{Performance}_Y} = \frac{\text{Execution time}_Y}{\text{Execution time}_X} = n$$

Example

If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, how much faster is A than B?

We know that A is *n* times as fast as B if

$$\frac{\text{Performance}_A}{\text{Performance}_B} = \frac{\text{Execution time}_B}{\text{Execution time}_A} = n$$

Thus the performance ratio is

$$\frac{15}{10} = 1.5$$

and A is therefore 1.5 times as fast as B.


THANK
YOU!