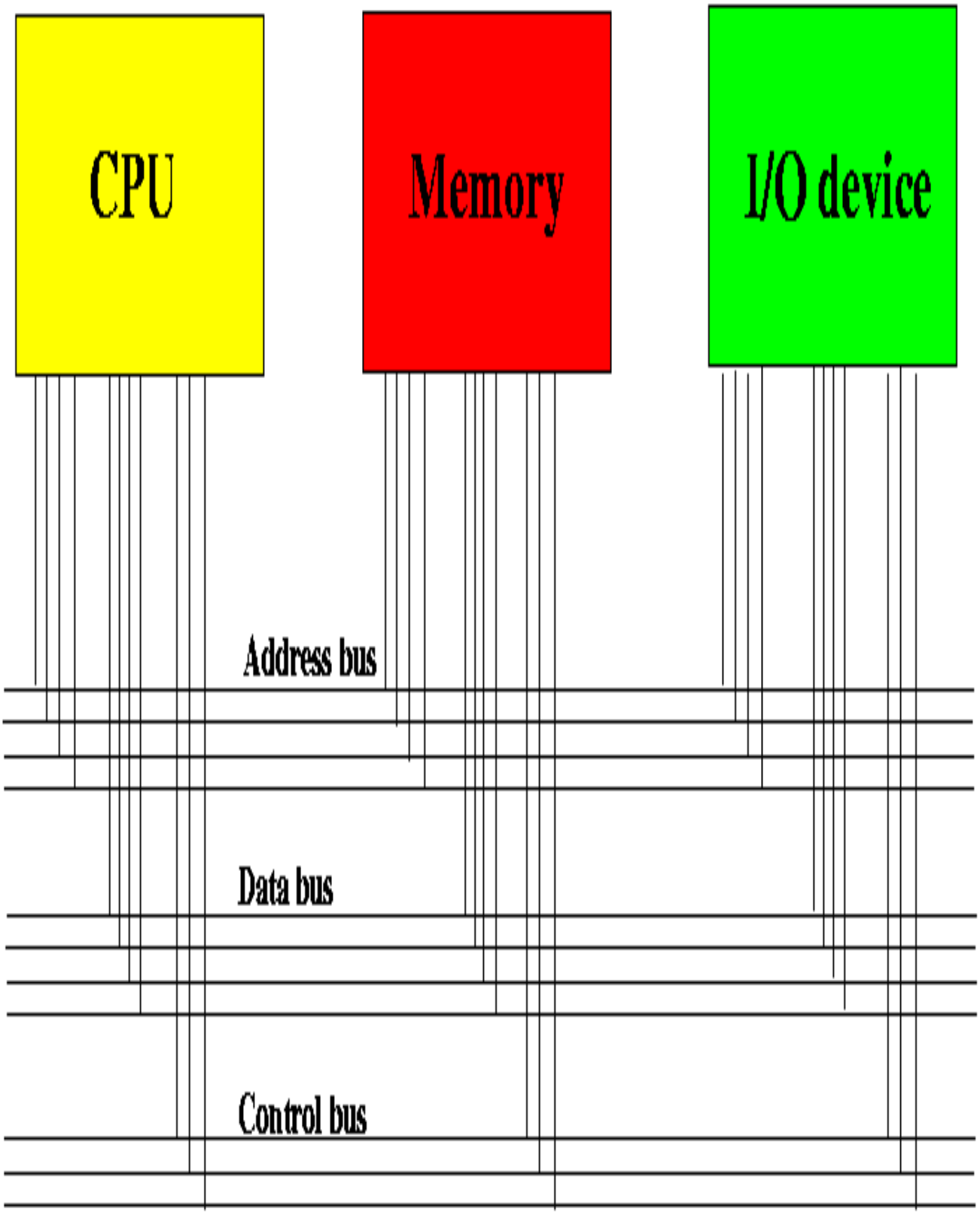
CPU
Memory
I/O device
Address bus
Data bus
Control bus

Lecture-3

Bussed Architecture

The basic components of a microcomputer, as discussed earlier, are:

1) CPU
2) Program memory
3) Data memory
4) Output ports
5) Input ports
6) Clock generator.

The clock generator generates the appropriate clock pulses for the synchronized operation of different components of microcomputer.

how the microprocessor is connected to other components - memory and I/O ports. One possibility is that all the memory chips and ports are connected separately to CPU as shown in fig.1

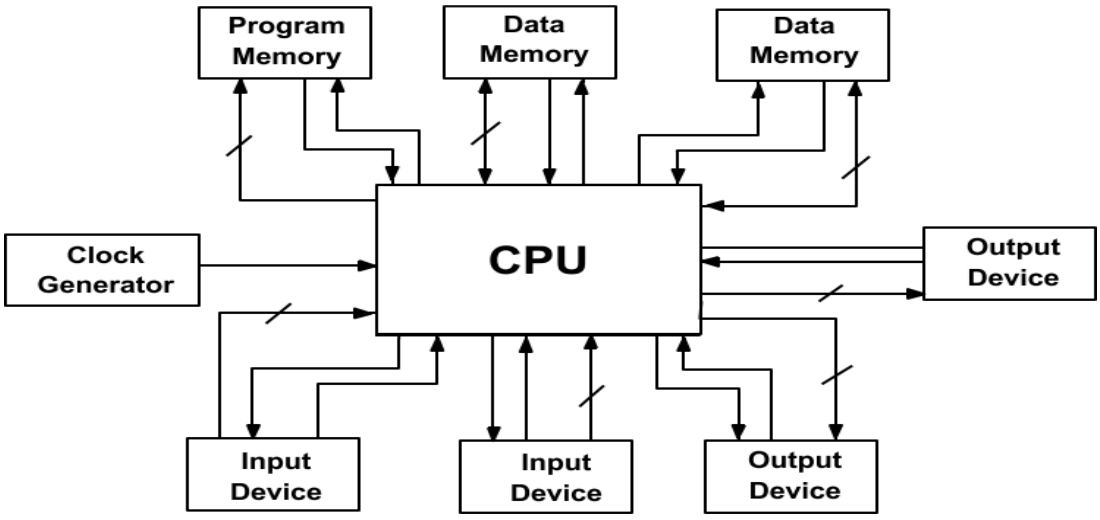

Fig.1. Separate Connection of Memory and I/O Devices with CPU

The size of the CPU increases much if all the components are to be simultaneously controlled. The system becomes too complex, therefore, bussed architecture is used to connect component to the microprocessor.

The Bussed Architecture for Microprocessor:

The first question is what is a 'Bus'? Bus is a group of parallel lines that connect two or more devices as shown in fig.2. It carries information in bits. Whenever processor (CPU) needs to access any memory or I/O device of the microcomputer system.

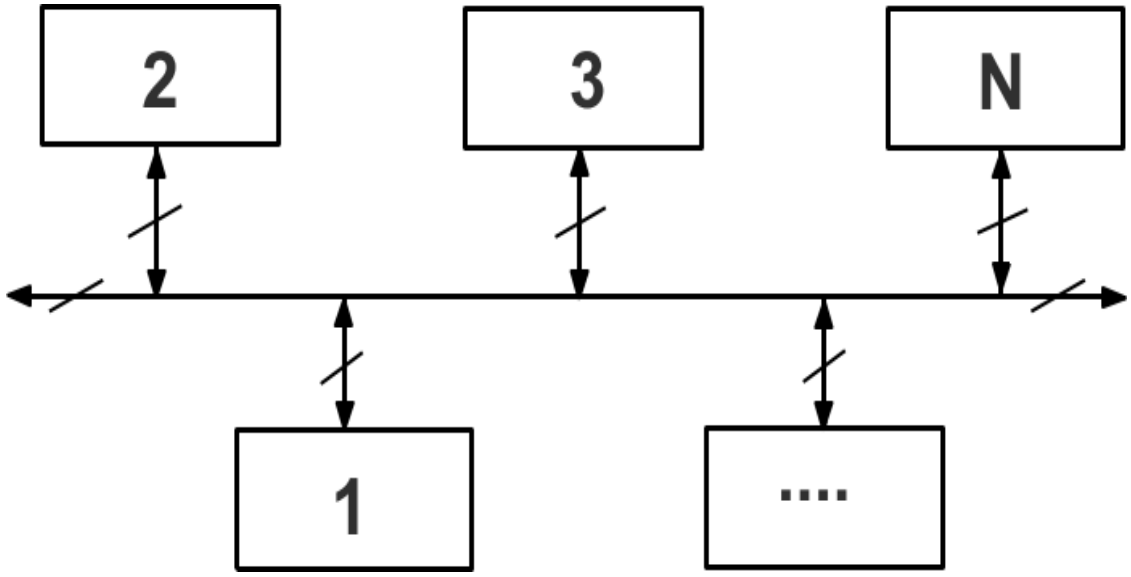

Fig.2 Data Bus Shared by 'N' Devices

Some of them are input and some are output devices. Let us consider, device '1' wants to transfer data to device '2' using this line. This transfer of data can be performed provided:

a. Device '1' knows when to output data such that device '2' is in a position to receive the data. This can be easily ensured if device '2' has some means of signally device '1' to output data.

b. Other than device '1', no device outputs data on that signal line during this period. Device '1' should be the only device driving the signal line at this time.

c. Other than device '2', no device should accept the data from the data bus.

The Microcomputer Bus:

The microcomputer contains three buses which carry all the address, data and control information involved in program execution.

Address Bus:

In a microcomputer system, processor always selects the device for data transfer by putting the address of the device on the address bus. On address bus, information (address) flow takes place only in one direction, i.e., from the microprocessor to the memory or I/O devices. Therefore, this is called unidirectional address bus. The processor uses the address bus to identify an I/O device or memory.

In 8085A processor, this bus is typically 16 bit long (A0 to A15). The CPU can generate 216 = 65,536 different addresses on this bus. A memory location or an I/O device can be represented by each one of these addresses.

Data Bus:

A set of data lines (8 in 8085A processor) referred to as the data bus is shared by number of devices to transfer data between microprocessor and peripherals. The data can flow in both directions, i.e., to or from the microprocessor. Therefore, this is called bidirectional data bus (BDB). In Intel 8085A microprocessor lower 8-bits of the address (A7-A0) are time-multiplexed with the 8-bit data (D7-D0) and, therefore, this bus is called AD bus (AD7-AD0).

Control Bus:

The control bus is comprised of various single lines that carry control signals. These signals are used to synchronize the operation of the individual microcomputer elements. The microprocessor uses these signals for every operation it performs, like reading or writing a memory location or I/O device. These signals are also used to identify a memory location or an I/O device, e.g., RD,WR, IO/$\overline{M}$. Some of the signals of the control bus are issued by the processor and some of the signals are received by the processor. Therefore, the control bus is called bidirectional control bus (BCB).

The difference between BDB and BCB is that in BDB all data lines are either in input mode or in output mode whereas in BCB the direction of signal flow on a line is fixed. The bussed architecture of microprocessor is shown in fig.3

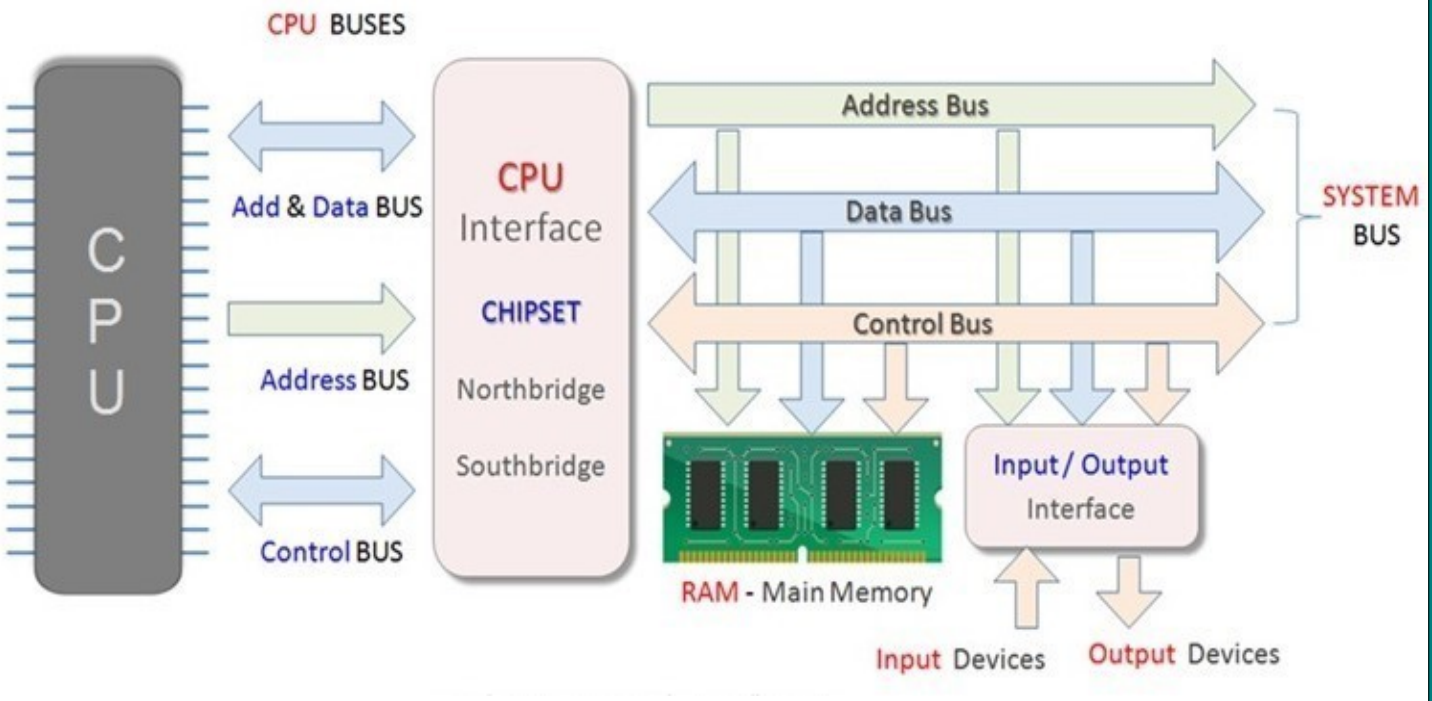

Fig.3 Bussed Architecture of Microprocessor

Computer Language:

Each machine has its own set of instructions based on the design of its microprocessor. To communicate with the computer, one must give instruction in binary language or machine language the form in which it is stored in memory, i.e., as patterns of 1s & 0s.

A computer language is a method of communication that humans use to tell computers how to execute specific tasks.

There are three types of programming languages: machine language, assembly language, and high-level language. Machine language is easier for the computer to understand but harder for the programmer to understand.