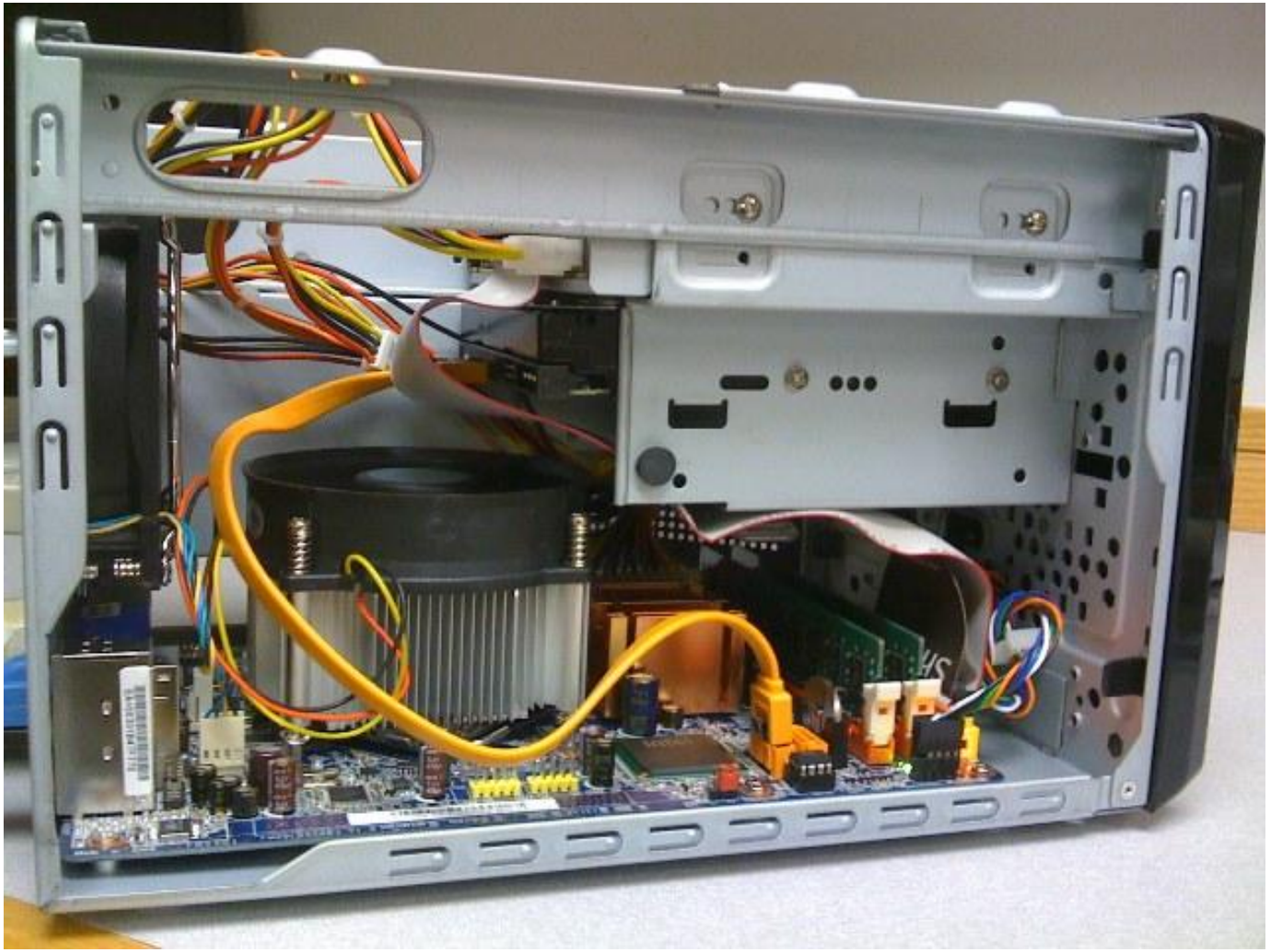
BUS and their Interconnection

Bus

- A group of wires connecting two or more devices and providing a path to perform communication is called bus.
- A bus that connect major computer component such as (CPU, Memory, I/O) is called system bus.
- A bus is a set of physical connections (cables, printed circuits, etc.) which can be shared by multiple hardware components in order to communicate with one another.
- The purpose of buses is to reduce the number of "pathways" needed for communication between the components, by carrying out all communications over a single data channel.
- A bus consist of multiple communication pathways or lines. Each line is capable of transmitting signals represented by 1 and 0.

Bus



Kinds of bus inside the System

- There are three main bus groups or System bus can be separated into three functional group

  - ADDRESS BUS
  - DATA BUS
  - CONTROL BUS

Data Bus

- The Data Bus carries the data which is transferred throughout the system.
- It is bi-directional.

- Examples of data transfers
  - Program instructions being read from memory into CPU.
  - Data being sent from CPU to I/O port.
  - Data being read from I/O port going to CPU.
  - Results from CPU sent to Memory.
- These are called read and write operations.

Address Bus

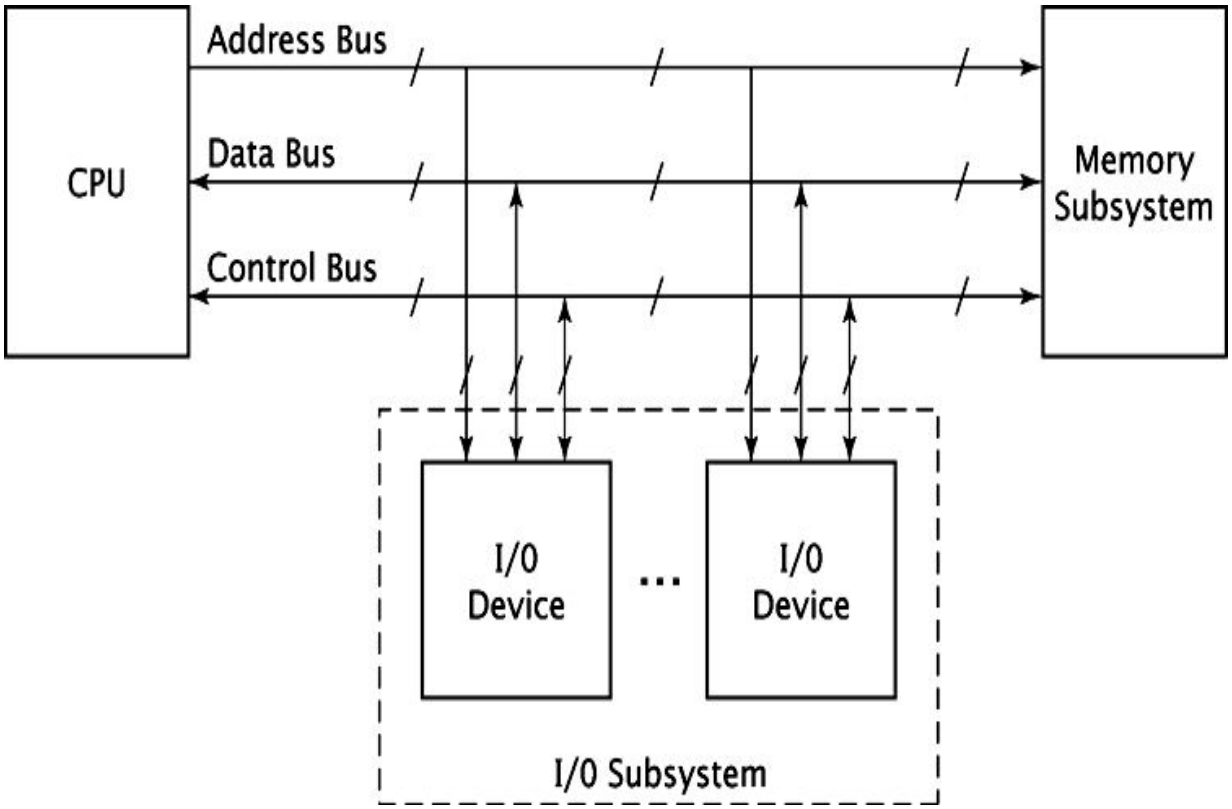
- As the name suggests, address bus is used to carry address from CPU to memory/IO devices.
- It is used to identify the particular location in memory.
- It carries the source or destination address of data i.e. where to store or from where to retrieve the data.
- The Address Bus is unidirectional (one way): addresses are always issued by the CPU.

Control Bus

- The Control Bus: is used to transfer the control and timing signals from one component to the other component.
- The CPU uses control bus to communicate with the devices that are connected to the computer system.
- The CPU transmits different types of control signals to the system components.
- The data and address lines are shared by all the components there must be a means of controlling their use.
- It is bi-directional.

- Example Control signals
  - **Memory read –** Data from memory address location to be placed on data bus.
  - **Memory write –** Data from data bus to be placed on memory address location.
  - **I/O Read –** Data from I/O address location to be placed on data bus.
  - **I/O Write –** Data from data bus to be placed on I/O address location.

Bus Interconnection Scheme/Architecture



Control signals

- **Memory Write**-Data on bus written into the address location.
- **Memory Read**-Data read from the address location to placed on the bus.
- **I/O Write**-Data on the bus to be output to the address I/O port.
- **I/O Read**-Data from the addressed I/O port to placed on the bus.
- **Transfer ACK**-indicate that data have been accepted from or placed on the bus.
- **Bus Request**-Indicate that a module needs to gain control of the bus.
- **Bus Grant-** Indicate that a requesting module has been granted control of the bus.
- **Interrupt Request**-Indicate that an interrupt is pending.
- **Interrupt ACK**-ACKed that the pending interrupt has been recognized.
- **Clock-**Used to synchronized the operations.
- **Reset**- Initializes all the modules.

Characteristics of a bus

- A bus is characterised by the amount of information that can be transmitted at once.
- This amount, expressed in bits, corresponds to the number of physical lines over which data is sent simultaneously.
- A 32-wire ribbon cable can transmit 32 bits in parallel. The term "**width**" is used to refer to the number of bits that a bus can transmit at once.

- Additionally, the bus speed is also defined by its **frequency** (expressed in Hertz), the number of data packets sent or received per second.
- Each time that data is sent or received is called a **cycle**.