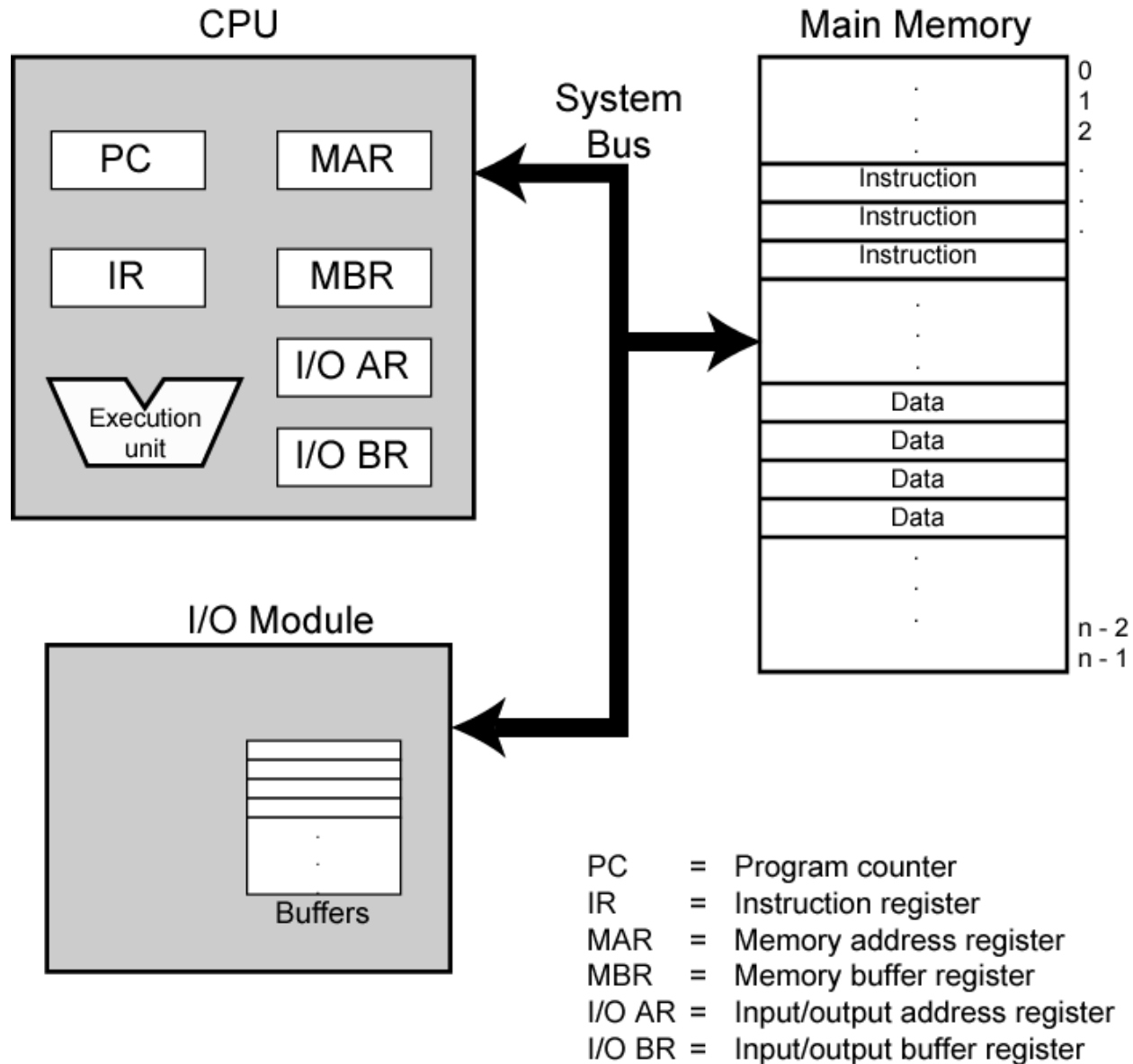


# Computer Components: Top Level View

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# **What is a program?**

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- A sequence of steps
- For each step, an arithmetic or logical operation is done
- For each operation, a different set of control signals is needed

# Components

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- The Control Unit and the Arithmetic and Logic Unit constitute the Central Processing Unit
- Data and instructions need to get into the system and results out
  - Input/output
- Temporary storage of code and results is needed
  - Main memory

# Function of Control Unit

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- For each operation a unique code is provided
  - e.g. ADD, MOVE
- A hardware segment accepts the code and issues the control signals
- We have a computer!

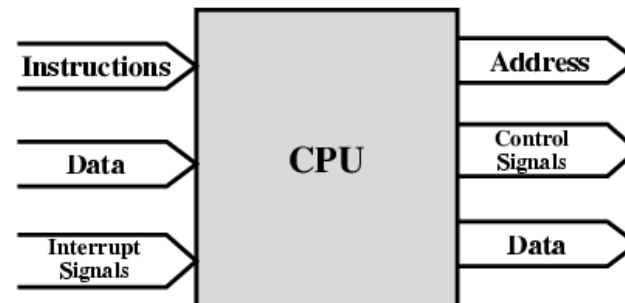
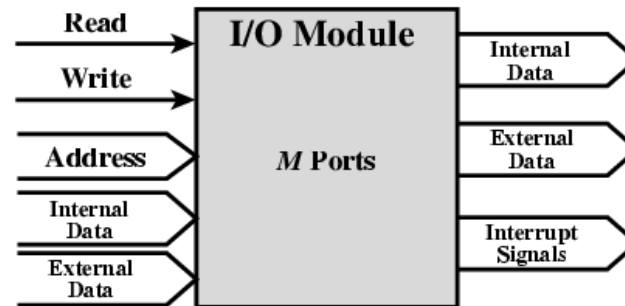
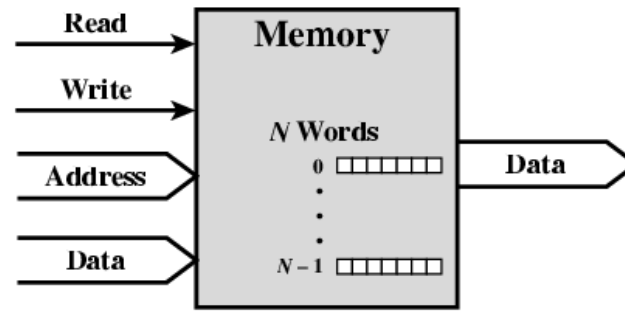
# Connecting

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- All the units must be connected
- Different type of connection for different type of unit
  - Memory
  - Input/Output
  - CPU

# Computer Modules

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# Memory Connection

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- Receives and sends data
- Receives addresses (of locations)
- Receives control signals
  - Read
  - Write
  - Timing

# **Input/Output Connection(1)**

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- Similar to memory from computer's viewpoint
- Output
  - Receive data from computer
  - Send data to peripheral
- Input
  - Receive data from peripheral
  - Send data to computer



## **Input/Output Connection(2)**

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- Receive control signals from computer
- Send control signals to peripherals
  - e.g. spin disk
- Receive addresses from computer
  - e.g. port number to identify peripheral
- Send interrupt signals (control)

# CPU Connection

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- Reads instruction and data
- Writes out data (after processing)
- Sends control signals to other units
- Receives (& acts on) interrupts

# Buses

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- There are a number of possible interconnection systems
- Single and multiple BUS structures are most common
- e.g. Control/Address/Data bus (PC)
- e.g. Unibus (DEC-PDP)

# What is a Bus?

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- A communication pathway connecting two or more devices
- Usually broadcast
- Often grouped
  - A number of channels in one bus
  - e.g. 32 bit data bus is 32 separate single bit channels
- Power lines may not be shown

# Data Bus

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- Carries data
  - Remember that there is no difference between “data” and “instruction” at this level
- Width is a key determinant of performance
  - 8, 16, 32, 64 bit

# Address bus

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- Identify the source or destination of data
- e.g. CPU needs to read an instruction (data) from a given location in memory
- Bus width determines maximum memory capacity of system
  - e.g. 8080 has 16 bit address bus giving 64k address space

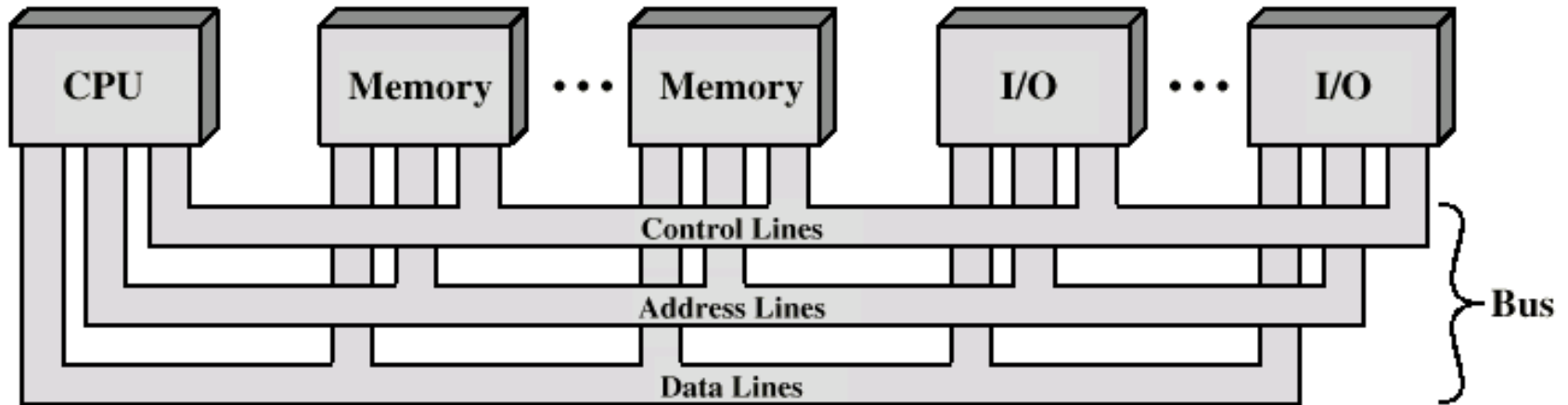
# Control Bus

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- Control and timing information
  - Memory read/write signal
  - Interrupt request
  - Clock signals

# Bus Interconnection Scheme

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# Big and Yellow?

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- What do buses look like?
  - Parallel lines on circuit boards
  - Ribbon cables
  - Strip connectors on mother boards
    - e.g. PCI
  - Sets of wires

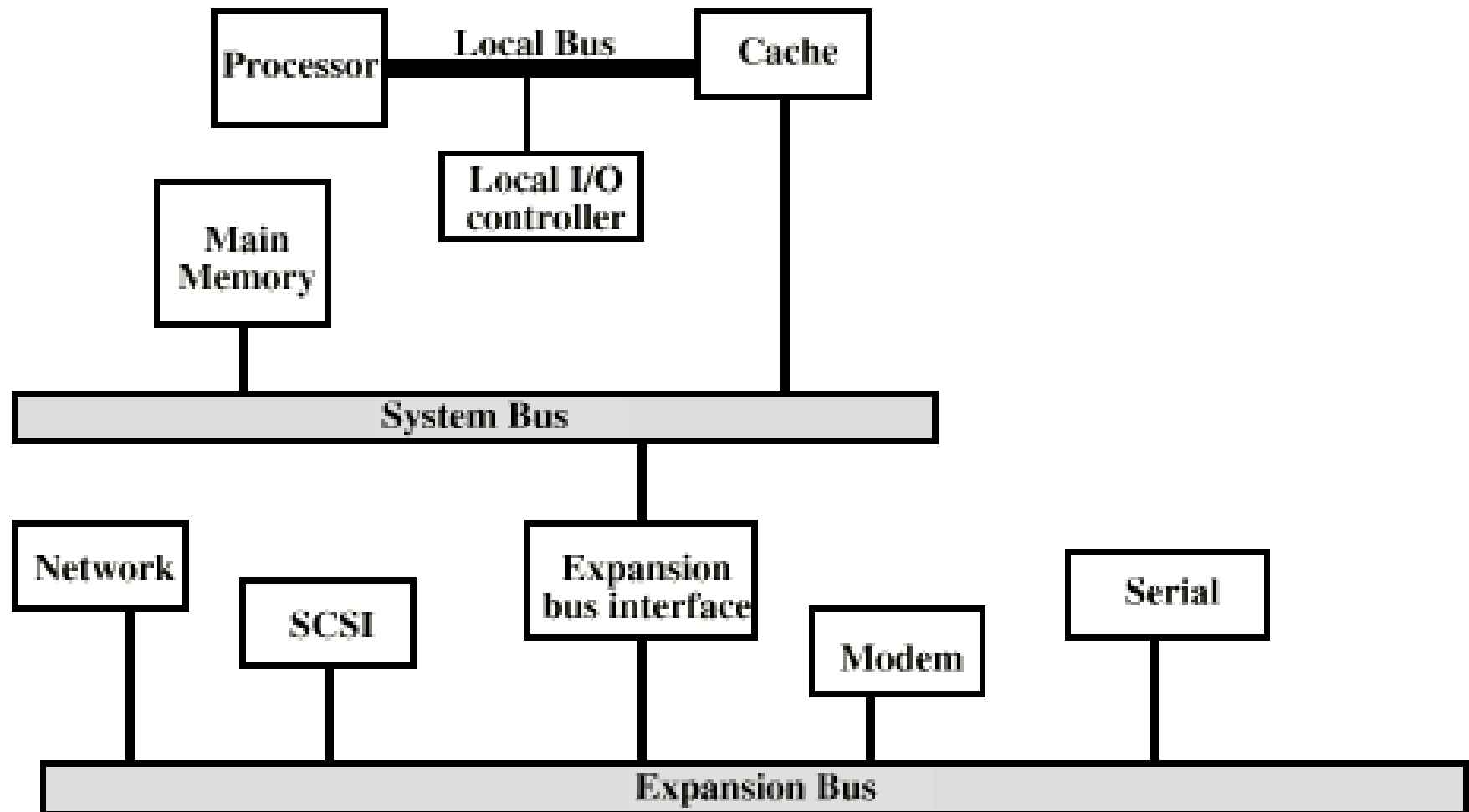
# Single Bus Problems

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- Lots of devices on one bus leads to:
  - Propagation delays
    - Long data paths mean that co-ordination of bus use can adversely affect performance
    - If aggregate data transfer approaches bus capacity
- Most systems use multiple buses to overcome these problems

# Traditional (ISA) (with cache)

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# High Performance Bus

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