

# DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK—

## Lesson-12: Distributed Network of Embedded Systems

# Embedded systems Networking

- Embedded systems connected internally on same IC or systems at very short, short and long distances can be networked using a type of the I/O buses- CAN, I<sup>2</sup>C, USB, PCI, ...

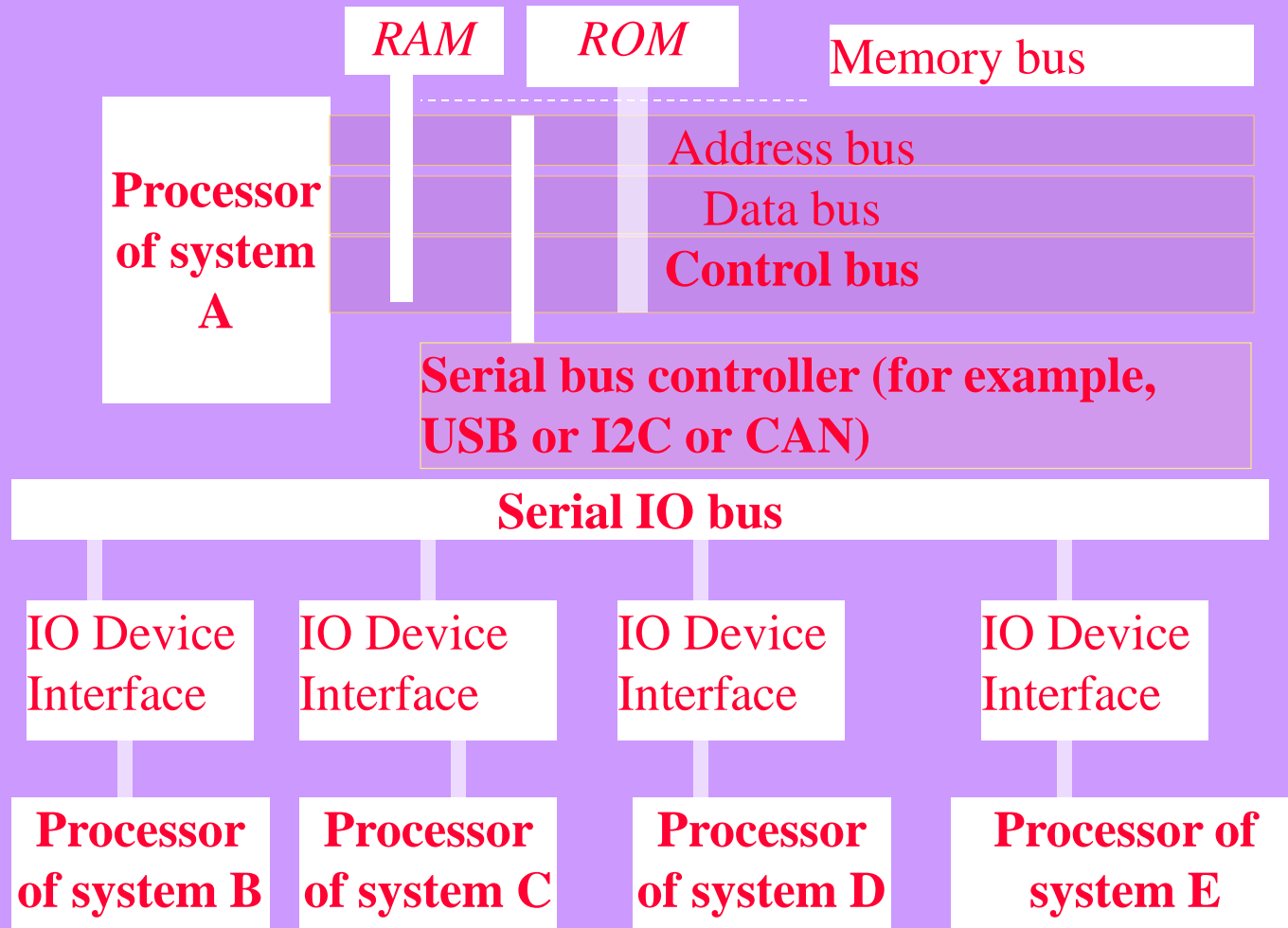
# Bus Communication for networking

- Each specific I/O device may be connected to other using specific interfaces, for example, with I/O device for example, LCD controller, keyboard controller and print controller.
- Bus communication simplifies the number of connections and provides a common way (protocol) of connecting different or same type of I/O devices

# IO Bus

- Any device that is compatible with a system's I/O bus can be added to the system (assuming an appropriate device driver program is available), and a device that is compatible with a particular I/O bus can be integrated into any system that uses that type of bus.

# System Bus and Serial IO bus



# IO Bus

- I/O devices communicate with the processor through an I/O bus, which is separate from the memory bus that the processor uses to communicate with the memory system.

# IO Bus for Networking vs. direct connections

- Use of I/O bus, as opposed to direct connections between the processor and each I/O device, very flexible, allowing a system to support many different I/O devices depending on the needs of its users and allowing users to change the I/O devices that are attached to a system as their needs change.

# Main disadvantage of an I/O bus

- A bus has a fixed bandwidth that must be shared by all of the devices on the bus.
- Even worse, electrical constraints (wire length and transmission line effects) cause buses to have less bandwidth than using the same number of wires to connect just two devices.
- Essentially, there is a trade-off between interface simplicity and bandwidth



# Example

- A bus has bandwidth of 2 Mb/s (can be used to transfer 2 Mb data in one s).
- If 10 devices are connected, the 2 Mb/s is shared between the networked systems

# Serial Bus

1. A serial bus has very few lines and the number of lines as per the protocol

# Serial Bus

1. A wide range of I/O devices without having to implement a specific interface for each I/O device. When the I/O devices in the distributed embedded systems are networked at long distances of 25 cm and above, all can communicate through a common serial bus.

# Internet or intranet

- Using Internet or intranet, a computer or controller or embedded system IO device interface and globally network with computers and a wide range of devices in the systems

# Parallel Bus

- Using a parallel I/O bus allows a computer or controller or embedded system to interface with number of internal systems at very short distances without having to implement a specific interface for each I/O device.

# Short distances Wireless Bus protocol

- Up to 100 m using wireless personal area network (WPAN)
- WPAN protocol without having to implement a specific wireless interface for each I/O device
- Allows a handheld computer or controller or embedded system I/O device to interface and network with number of handheld system I/O devices of other handheld

# Summary

## We learnt

- Embedded systems can be distributed and networked using an IO bus or networking protocol
- Serial bus protocols
- Parallel bus protocols
- Internet protocols
- Wireless protocols



End of Lesson 12 of Chapter 5  
on  
Distributed Network of Embedded  
Systems