



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

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UNIT 2 :DEVICES AND EMERGING BUS STANDARDS

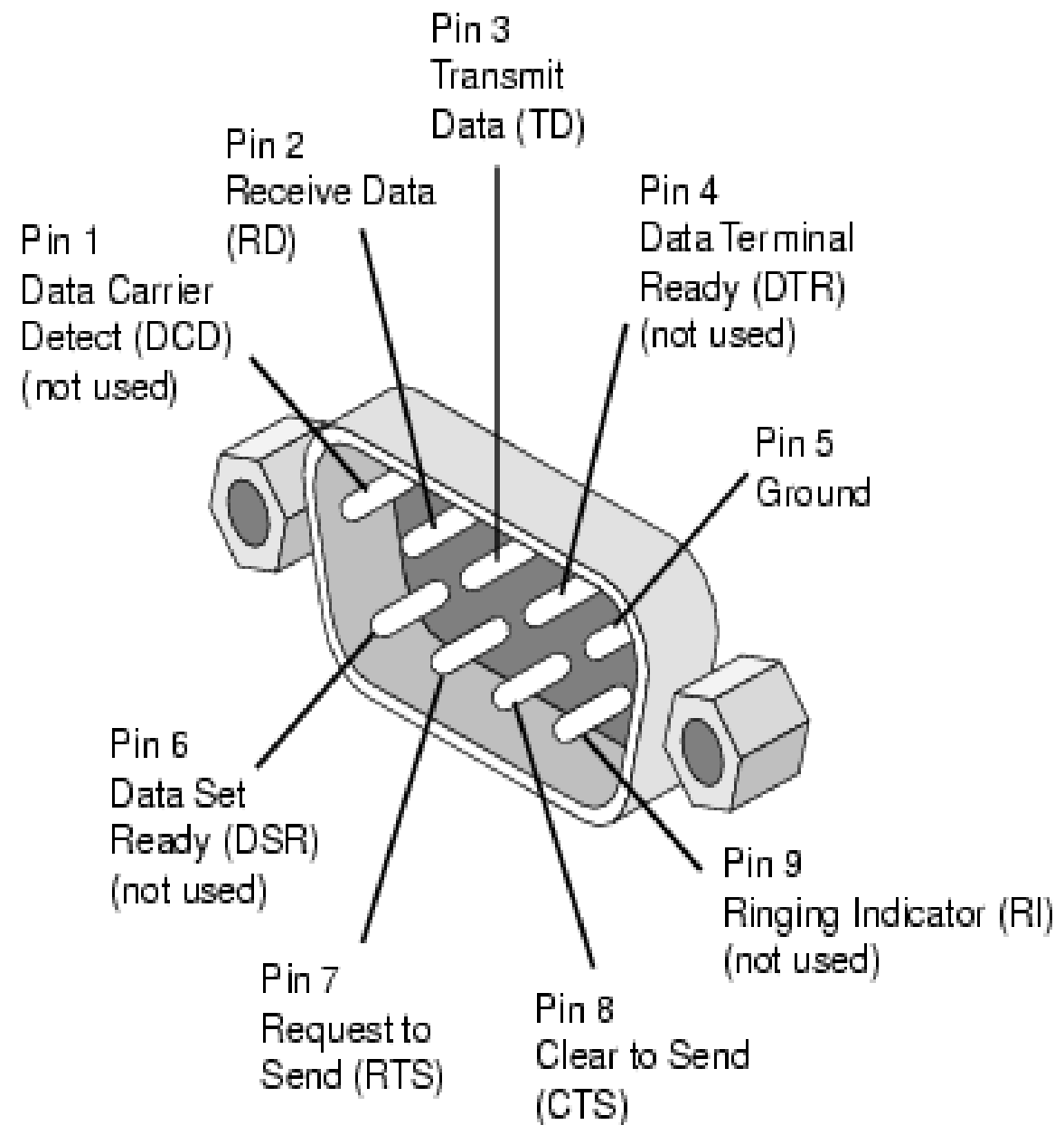
TOPIC 2.2 : Communication from serial devices-UART,SPI,I2C



COMMUNICATION FROM SERIAL DEVICES



Serial buses

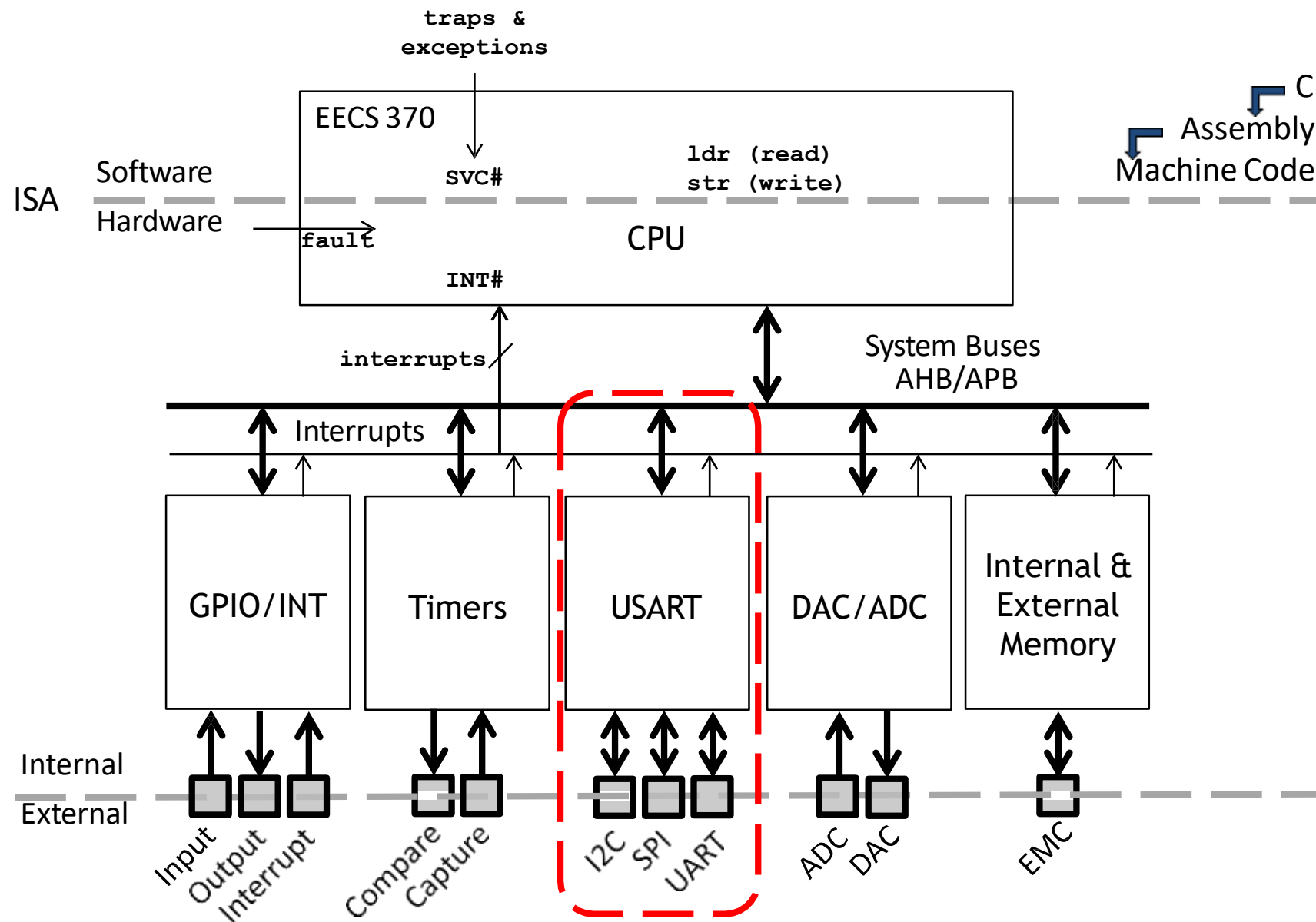




COMMUNICATION FROM SERIAL DEVICES



Serial interfaces





COMMUNICATION FROM SERIAL DEVICES



Outline

- Introduction to Serial Buses
- UART
- SPI
- I2C



SERIAL BUS INTERFACE MOTIVATIONS



- Motivation
 - Connect different systems together
 - Two embedded systems
 - A desktop and an embedded system
 - Connect different chips together in the same embedded system
 - MCU to peripheral
 - MCU to MCU
 - Without using a lot of I/O lines
 - I/O lines require I/O pads which cost \$\$\$ and size
 - I/O lines require PCB area which costs \$\$\$ and size
 - Often at relatively low data rates
 - But sometimes at higher data rates
- So, what are our options?
 - Universal Synchronous/Asynchronous Receiver Transmitter
 - Also known as USART (pronounced: “you-zart”)



COMMUNICATION FROM SERIAL DEVICES



Serial bus design space

- Number of wires required?
- Asynchronous or synchronous?
- How fast can it transfer data?
- Can it support more than two endpoints?
- Can it support more than one master (i.e. txn initiator)?
- How do we support flow control?
- How does it handle errors/noise?

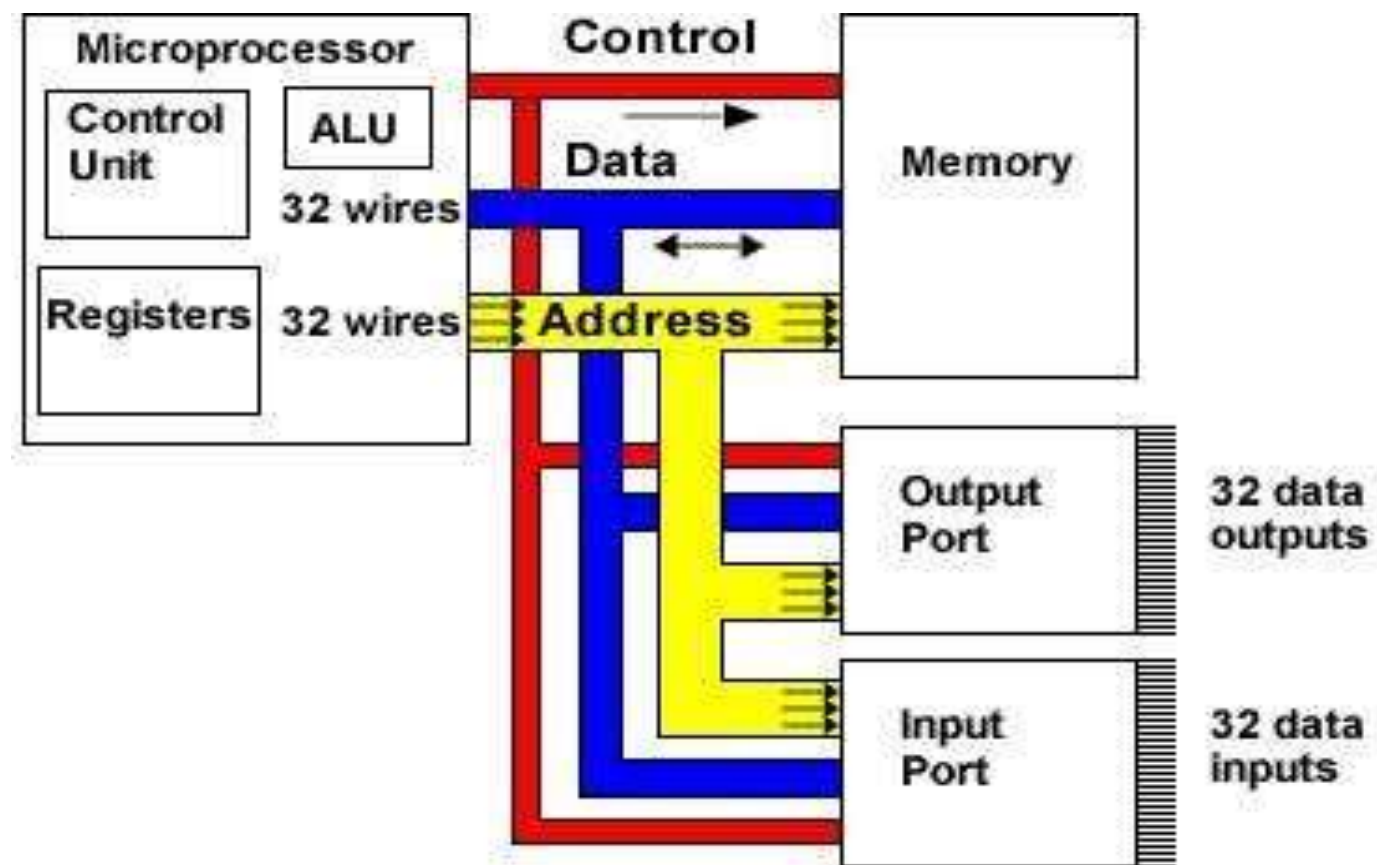


COMMUNICATION FROM SERIAL DEVICES



Fun with buses

- A multidrop bus (MDB) is a computer bus in which all components are connected to the same set of electrical wires. (from Wikipedia)
 - In the general case, a bus may have more than one device capable of driving it.
 - That is, it may be a “multi-master” bus as discussed earlier.



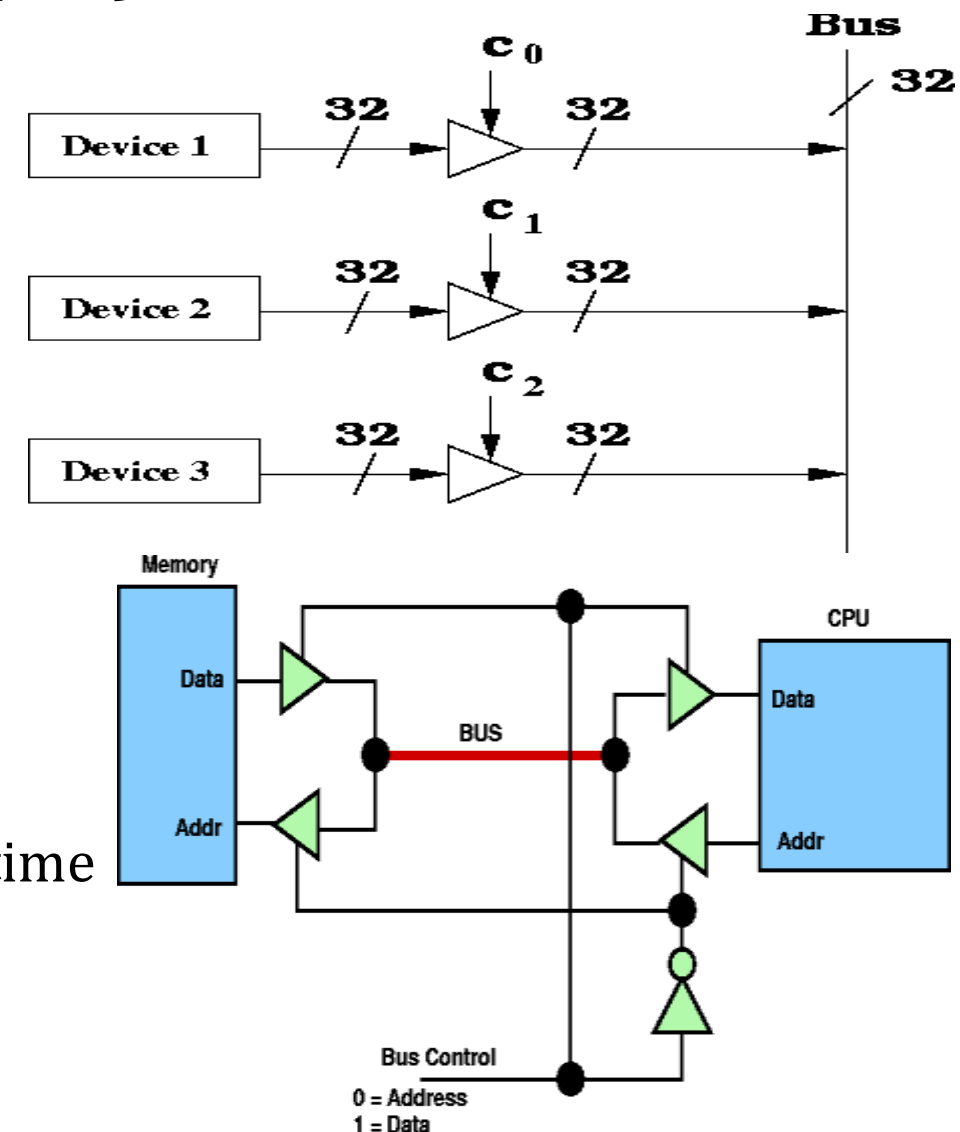


COMMUNICATION FROM SERIAL DEVICES



How can we handle multiple (potential) busdrivers? (1/3)

- Tri-state devices, just have one device drive at a time. Everyone can read though
 - Pros:
 - Very common, fairly fast, pin-efficient.
 - Cons:
 - Tri-state devices can be slow.
 - Especially drive-to-tristate?
 - Need to be sure two folks not driving at the same time
 - Let out the magic smoke.
 - Most common solution (at least historically)
 - Ethernet, PCI, etc.





COMMUNICATION FROM SERIAL DEVICES



How can we handle multiple (potential) bus drivers? (2/3)

- MUX
 - Just have each device generate its data, and have a MUX select.
 - That's a LOT of pins.
 - Consider a 32-bit bus with 6 potential drivers.
 - » Draw the figure.
 - » How many pins needed for the MUX?
 - Not generally realistic for an “on-PCB” design as we’ll need an extra device (or a lot of pins on one device)
 - But reasonable on-chip
 - In fact AHB, APB do this.

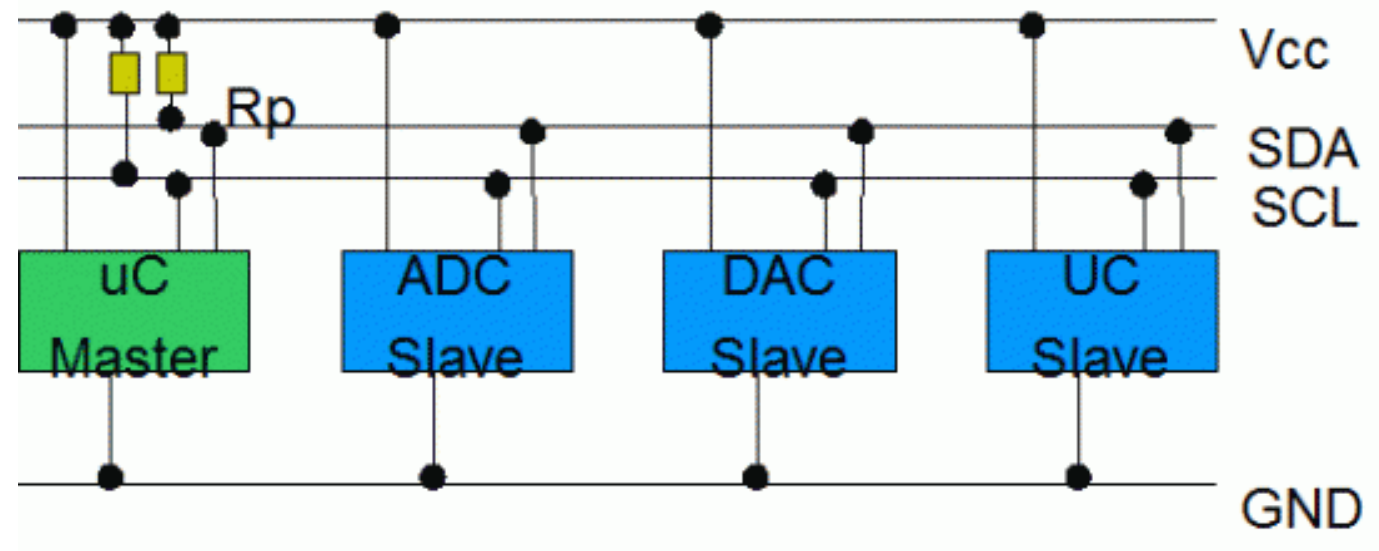
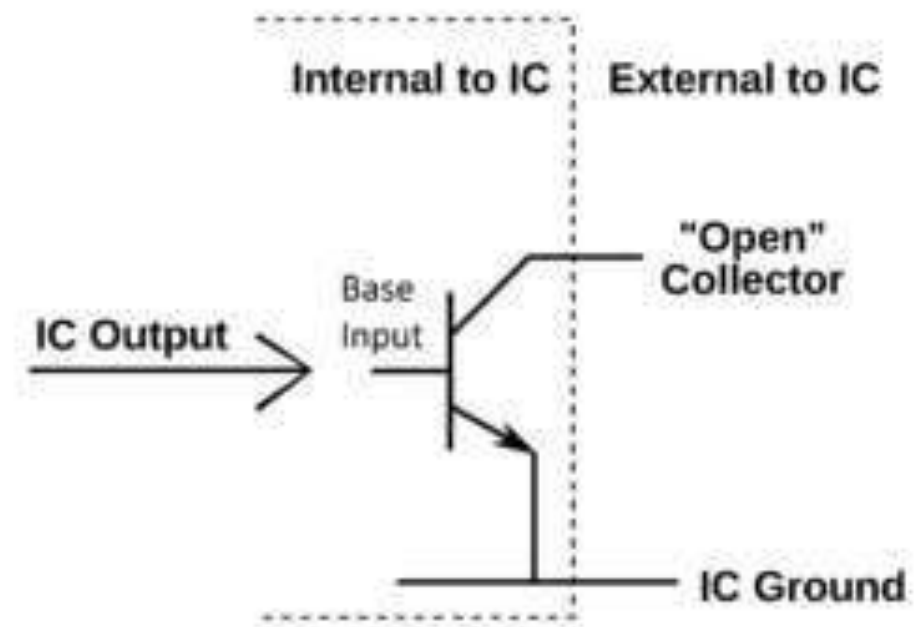


COMMUNICATION FROM SERIAL DEVICES



How can we handle multiple (potential) bus drivers? (3/3)

- “pull-up” aka “open collector” aka “wired OR”
 - Wire is pulled high by a resistor
 - If any device pulls the wire low, it goes low.
- Pros:
 - If two devices both drive the bus, it still works!
- Cons:
 - Rise-time is very slow.
 - Constant power drain.
- Used in I2C, CAN





SUMMARY & THANK YOU