

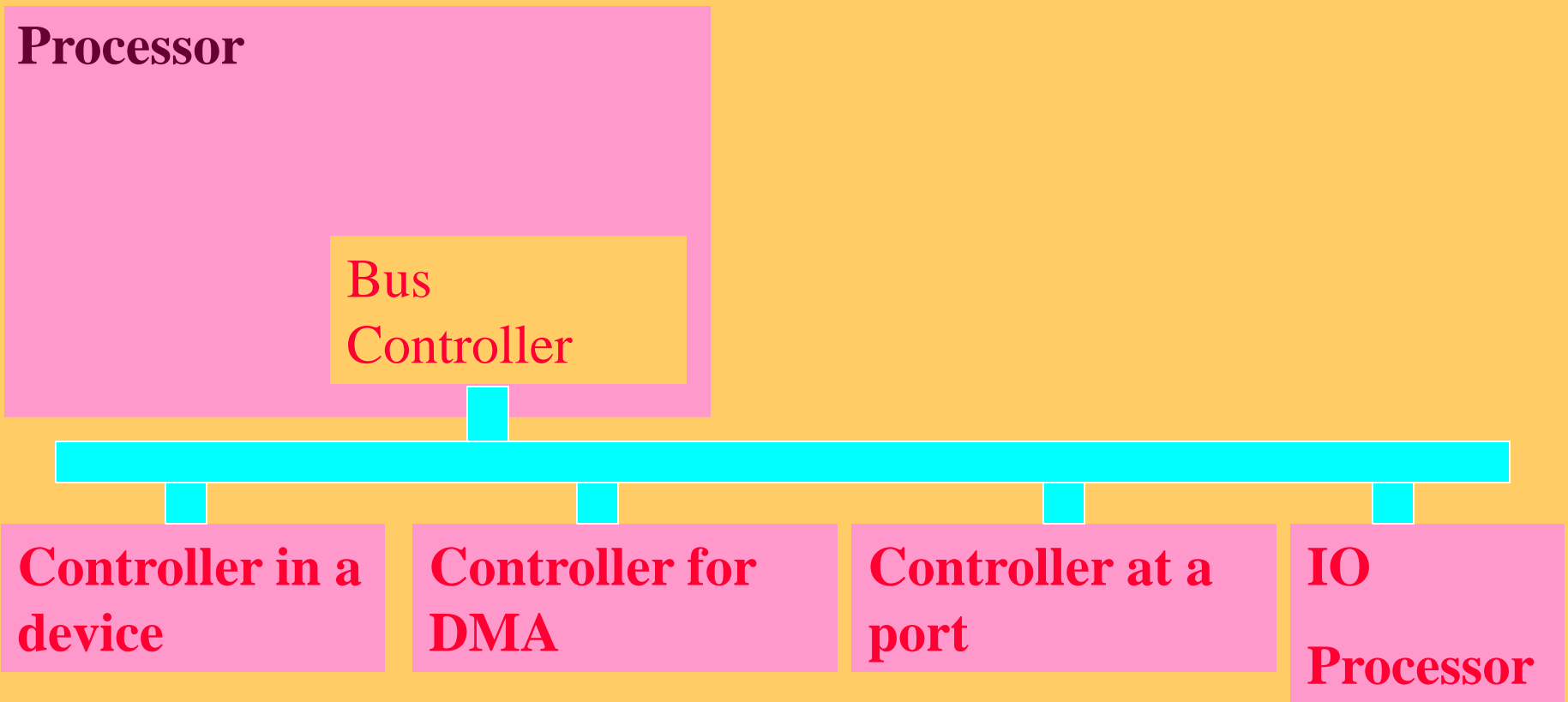
8051, AVR, ARM MICROCONTROLLERS AND REAL WORLD INTERFACING AND IOs USING BUSES – Lesson-9: Bus Arbitration Mechanisms

1. Bus Sharing by Multiple Processors or controllers

Bus Arbitration Requirement

- Several processor and several single purpose processors sharing a bus.*
- Bus can be granted to one processor at an instance

*[A single purpose processor is also called *controller*. A controller can be part of a device or peripheral or port.]



System buses shared between the controllers and an IO processor and multiple controllers that have to access the bus, but only one of them can be granted the bus master status at any one instance

Bus Arbitration Mechanism

- System buses are shared between the controllers and an IO processor and multiple controllers that have to access the bus, but only one of them can be granted the bus master status at any one instance
- Bus master has the access to the bus at an instance

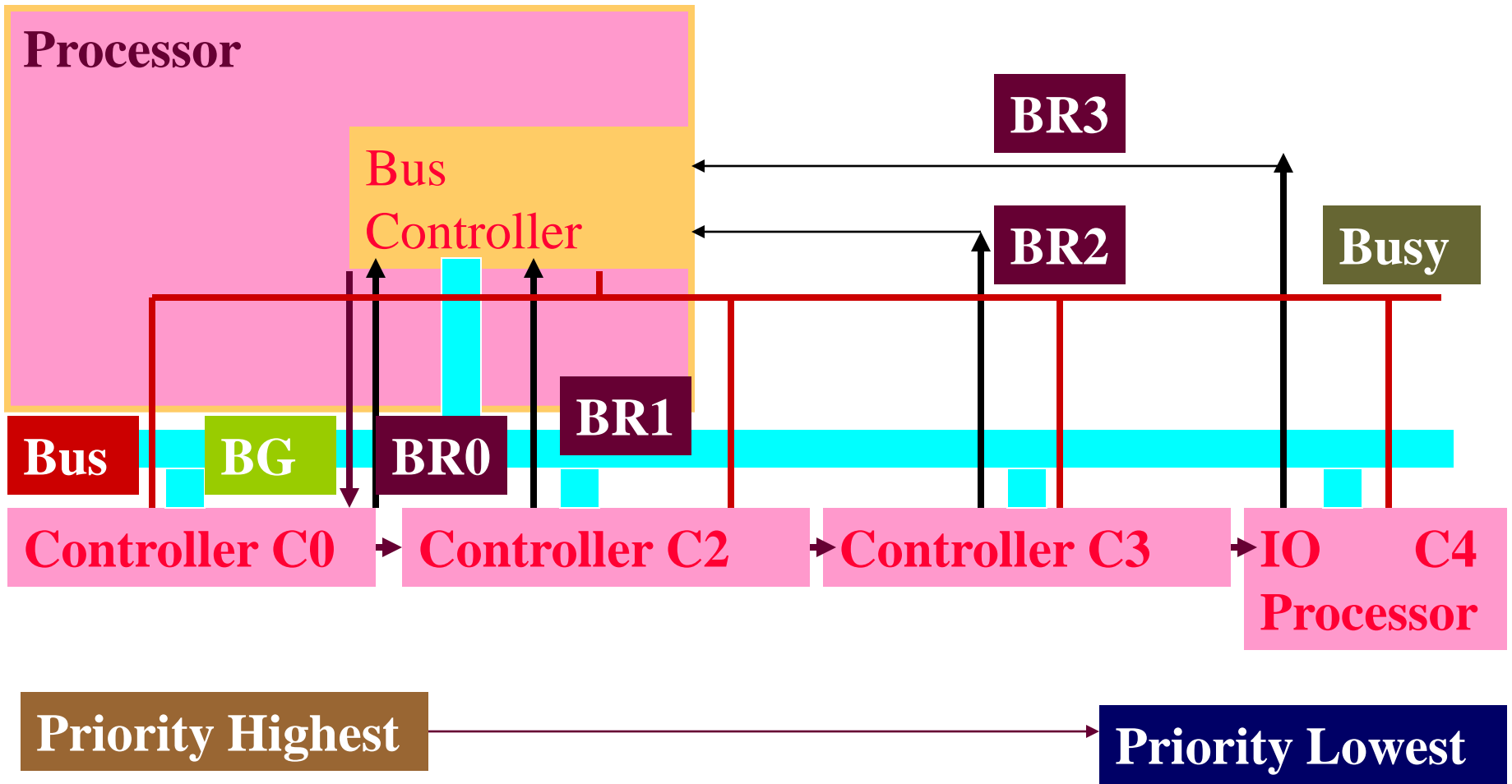
Bus arbitration process

- A process by which the current bus master accesses the bus and then leaves the control of bus and passes it to another bus-requesting processor unit.
- Three methods in bus arbitration process.
- Daisy Chain method,
- Independent Bus Requests and Grant method,
- Polling method

2. Daisy Chaining for Bus Sharing by Multiple Processors or controllers

Daisy chaining method

- Centralized bus arbitration process.
- Bus control passes from one bus master to the next one, then to the next and so on.
- Bus control passes from controller units C0 to C1, then to C2, then U3, and so on.



Daisy Chaining

Sequence of Signals in the arbitration process

- Bus-grant signal (BG) which functions like a token, is first sent to C0.
- If C0 does not need the bus, it passes BG to C1.
- A controller needing the bus raises a bus-request (BR) signal.
- A bus-busy (BUSY) signal generates when that controller becomes the bus master.

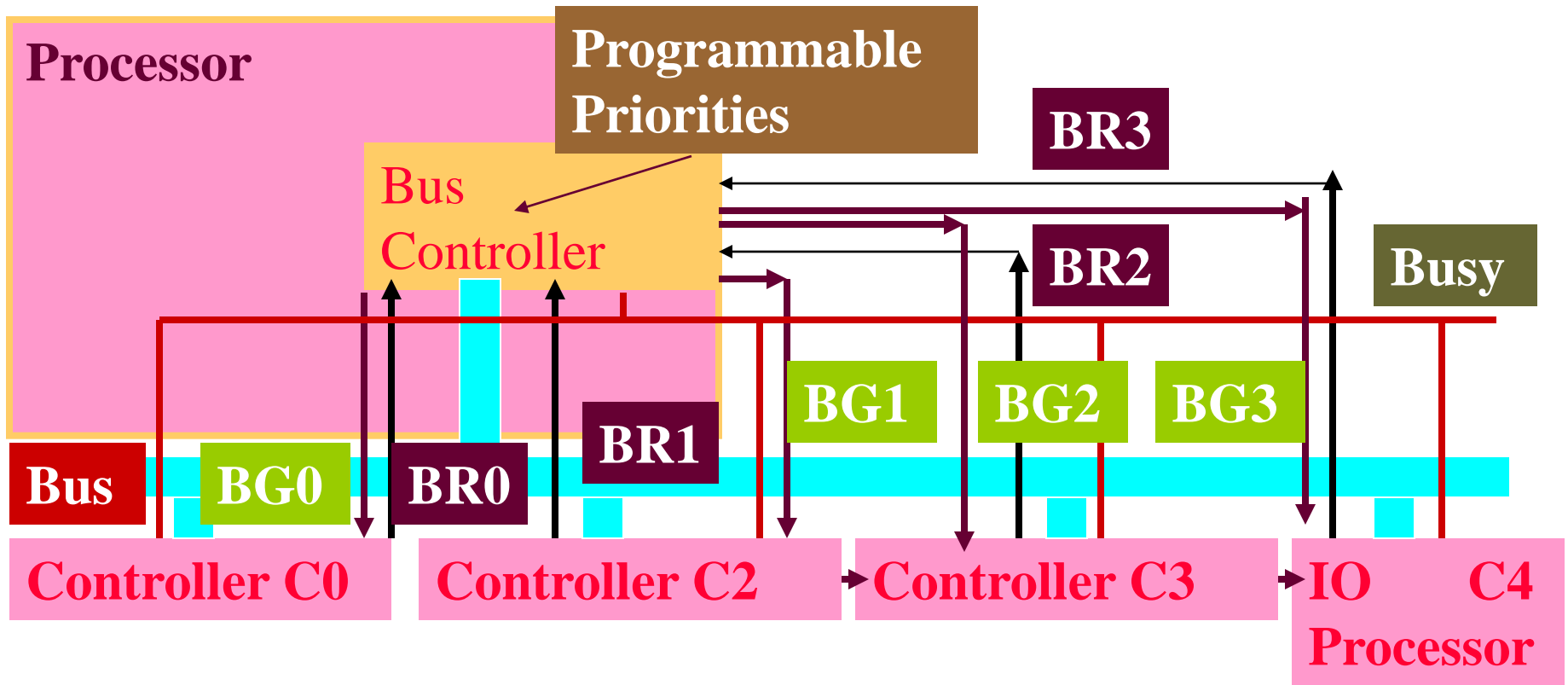
Signals in the arbitration process

- When bus master no longer needs the bus, it deactivates BR and BUSY signal also deactivates.
- Another BG is issued and passed from C0 to down the priority controllers one by one [For example, COM2 to COM1 in IBM PC]

Daisy method advantage

- At each instance of bus access the i -th controller gets the highest priority to bus compared to $(i + 1)$ th.
- Controllers and processors priorities for granting the bus access (bus master status) fixed

3. Independent request and grant method for Bus Sharing by Multiple Processors or controllers



Independent request and grant

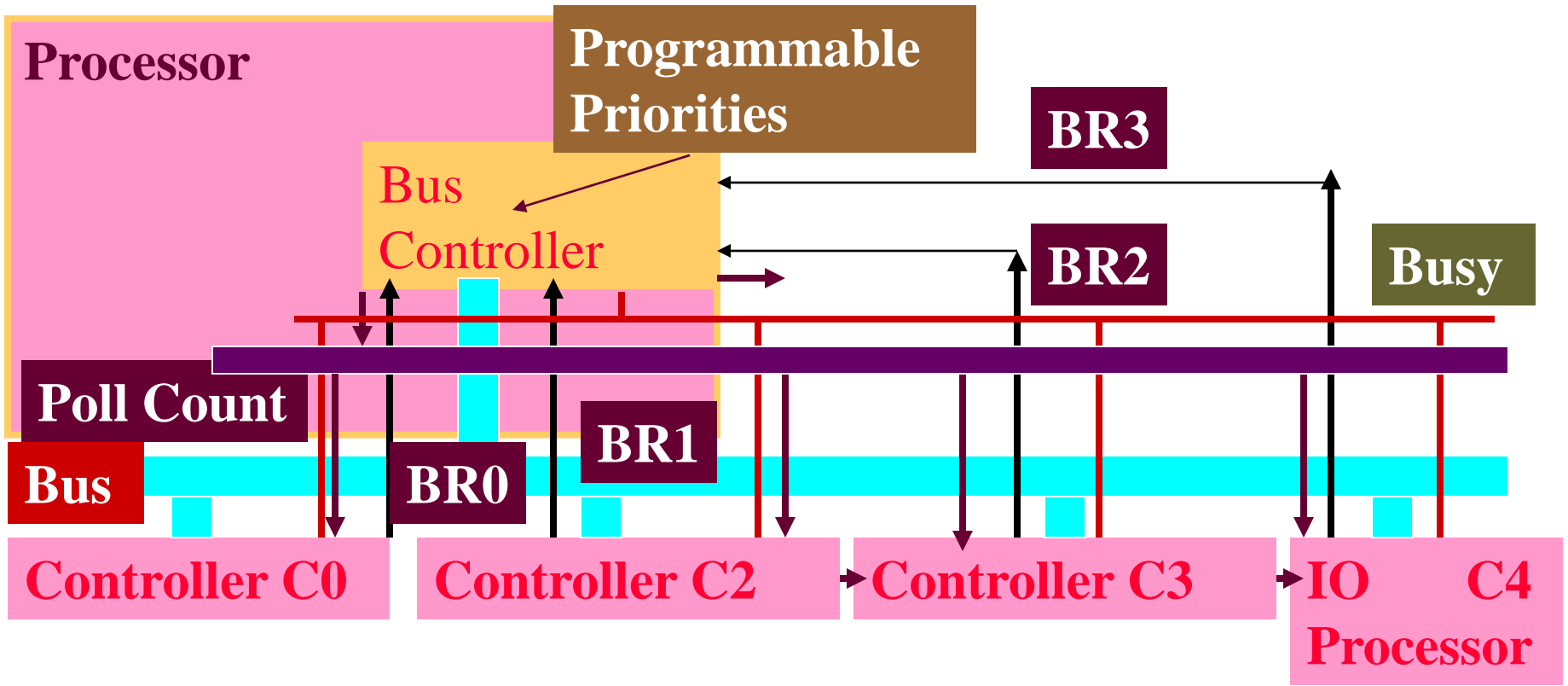
Independent bus request method

- Controller separate BR signals, BR0, BR1, ..., BRn.
- Separate BG signals, BG0, BG1, ..., BGn for the controllers.
- An *i*th controller sends BR_{*i*} (*i*-th bus request signal) and when it receives BG_{*i*} (*i*-th bus grant signal), it uses the bus and then BUSY signal activates

Independent bus request method

- Any controller, which finds active BUSY, does not send BR from it.
- Independent bus request method advantage is that the i -th controller can be programmed to get the highest priority to the bus and the priority of a controller can be programmed dynamically

4. Polling method for Bus Sharing by Multiple Processors or controllers



Polling Method

Polling the Requesting Device Method

- A poll counts value is sent to the controllers and is incremented. Assume that there are 8 controllers. Three poll count signals p2, p1, p0 successively change from 000, 001, ..., 110, 111, 000, ... If on count = i, a BR signal is received then counts increment stops, BG is sent.

Polling the Requesting Device Method

- Then BUSY activates when that controller becomes the bus master. When BR deactivates then BG and BUSY also deactivates and counts increment starts. Polling method advantage is that the controller next to the current bus master gets the highest priority to the access the bus after the current bus master finishes the operations through the bus.

Summary

We learnt

- Bus Sharing by Multiple Processors or controllers
- Bus Arbitration mechanisms
- Daisy Chaining method of Sharing by Multiple Processors or controllers
- Independent Requests and Grants of Sharing by Multiple Processors or controllers
- Polling Method of Sharing by Multiple Processors or controllers

End of Lesson 8 of Chapter 2