

Arbiter Specifications:

Need to design an arbiter which arbitrates 8 client requests for access to a common resource.

The Arbitration scheme can be either **Fixed-Priority** or **Round-Robin**, depending on the selection of the input signal **cfg_arb_scheme**. If (**cfg_arb_scheme** = 0), Fixed-Priority scheme is selected and if (**cfg_arb_scheme** = 1) then Round-Robin scheme is selected.

Let us elaborate on both the schemes:

Fixed-Priority scheme:

In case the Fixed-Priority scheme is selected, the client for which highest priority is accorded is indicated by the input signal **cfg_arb_fixed_port**.

The next port that can be granted is chosen in ascending/increasing order with reference to **cfg_arb_fixed_port**.

Every time the arbiter gets a port request through **port_req[7:0]** it starts checking whether the highest priority port denoted by **cfg_arb_fixed_port** is high. If yes, then the arbiter generates the grant for the **cfg_arb_fixed_port**.

If **cfg_arb_fixed_port** is low in **port_req[7:0]**, then the arbiter considers the next port as the highest priority port and so on.

The grant is indicated by an output signal **gnt_valid** and the port for which the grant is given is indicated by **gnt_port[2:0]**, is also an output signal.

Consider that **cfg_arb_fixed_port** do not change during run time.

Round-Robin scheme:

In Round Robin Scheme the highest priority port is denoted by one port higher to the port which was the last port to send the arbiter an acknowledge through the **ack_port[2:0]**.

Thus, if the last port which sent acknowledge to the arbiter is port 'X' then the highest priority port in the next iteration will be 'X+1'.

When the next port request **port_req[7:0]** comes the arbiter checks whether the highest priority port 'X+1' is high just like the fixed port scheme. If it finds it low it considers the next port 'X+2' to be the highest priority port and so on.

Last served port after reset can be taken as Port '0'.

Block Diagram of Arbiter with I/O interfaces:

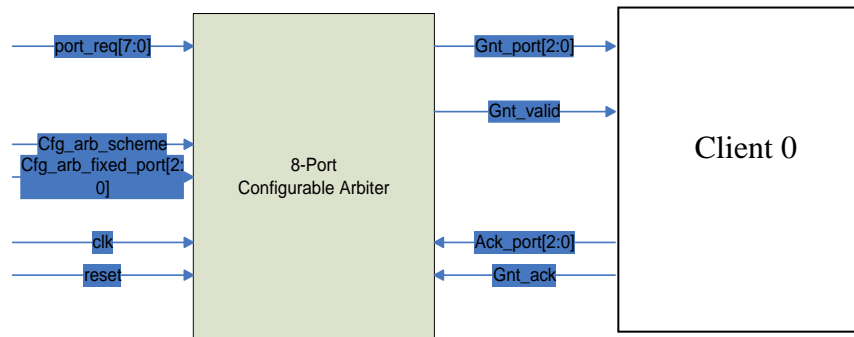


Diagram 1: Arbiter interfacing with a single client. (Scope of the design is only arbiter; client is not to be designed)

Inputs and Outputs of Arbiter

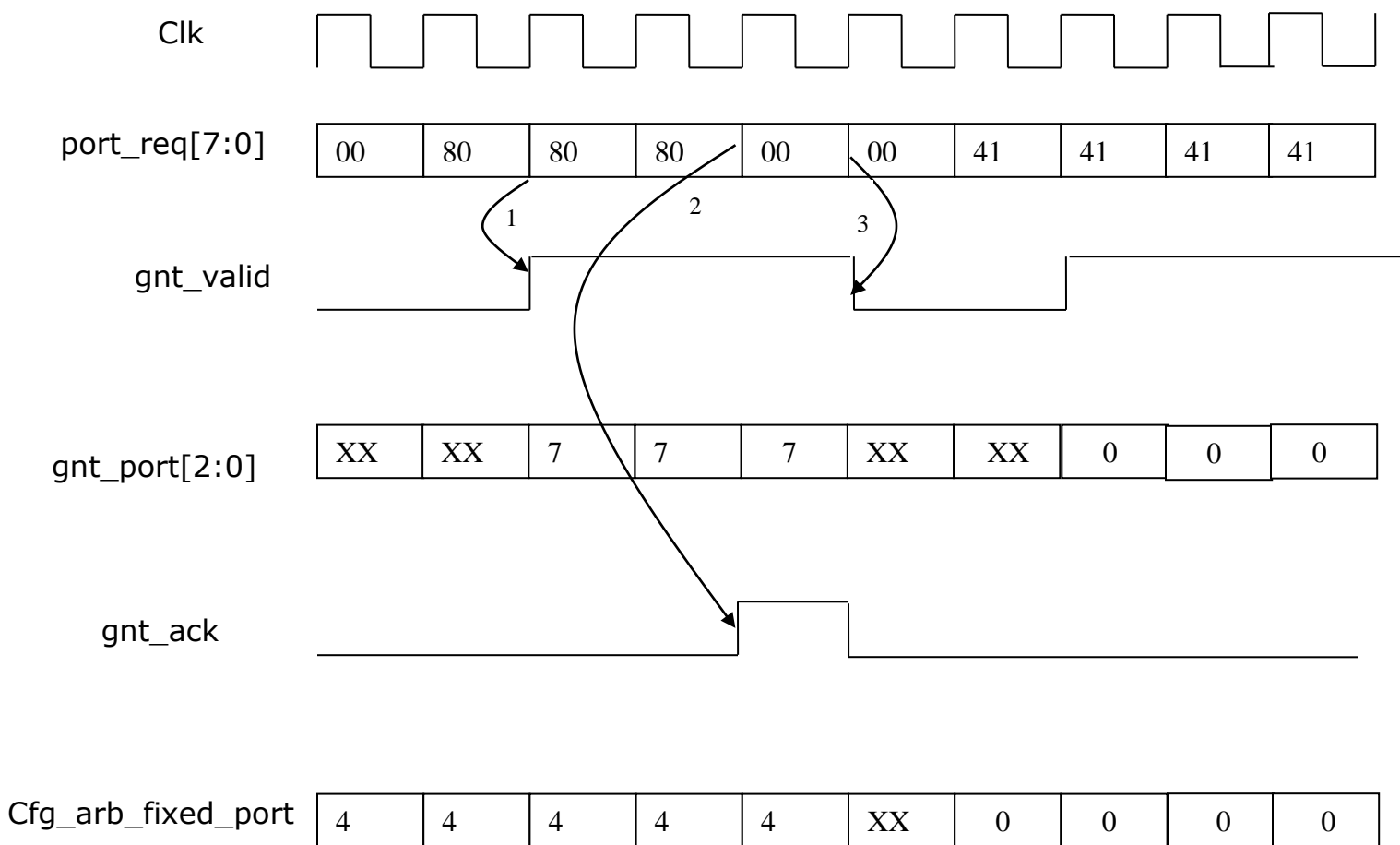
Following are the input ports of the Arbiter:

- Clk -> System Clock
- Reset -> Asynchronous and active high System Reset
- Port_req[7:0] -> 8 Client request
- Cfg_arb_scheme -> Select signal for Fixed-Priority or Round-Robin scheme
- Cfg_arb_fixed_port[2:0] -> Highest priority port for Fixed Priority scheme
- Ack_port[2:0] -> last Granted port
- Gnt_ack -> One clock duration valid signal for ack_port[2:0] signal

Following are the output ports of the Arbiter:

- Gnt_port[2:0] -> Granted port
- Gnt_valid -> Valid signal for granted port

Diagram 2: Timing Diagram of Fixed-Priority Scheme



Note:

XX means don't care i.e. it can be any value. When `gnt_valid` is high, `gnt_port` is valid else it is don't care.

Diagram 3: Timing Diagram of Round Robin Scheme

