

Classification of 1394b PHY (2)

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1 Purpose of contribution

Border functions are very important to realize a mixed bus with both legacy nodes and BOSS capable nodes in P1394b. Currently a selection method of the border node and the bus configuration which is allowed by border functions are not clarified yet. They are very important and have an impact on classification of 1394b phy.

We would like to classify bus configuration according to the number of border node, and clarify study items in each case.

2 Bus configuration

First of all, we have classified the bus configuration from the viewpoint of the number of allowed border node since it is considered that border functions make 1394b PHY complex. Table 1 shows the summary of bus configuration. There are 3 kinds of bus configurations. We suppose the bus configuration of Figure 1 as a example. It is the mixed bus which is composed of both 8 BOSS capable nodes and 3 legacy nodes. The study items in each configuration are described following sections.

Table. 1 : Summary of bus configuration

the number of allowed border node	commnets
0	<ul style="list-style-type: none">• Simplest bus configuration• Border function is not needed.• BOSS arbitration is used when all nodes in the bus are BOSS capable.• If there is a legacy node in the bus all nodes use legacy arbitration. This fashion is similar to the relation between 1394a and 1394-1995. For example, short bus reset can't be operated if there is 1995 phy in the bus.
1	<ul style="list-style-type: none">• Simpler bus configuration. Bus is composed of both a legacy cloud and a BOSS cloud.• BOSS arbitration is used in the BOSS cloud. Legacy arbitration is used in the legacy cloud.• It may be expected that border functions become simple.
more than 2	<ul style="list-style-type: none">• Complex bus configuration. Bus is composed of both some legacy clouds and some BOSS clouds.• Complete border functions may be expected.

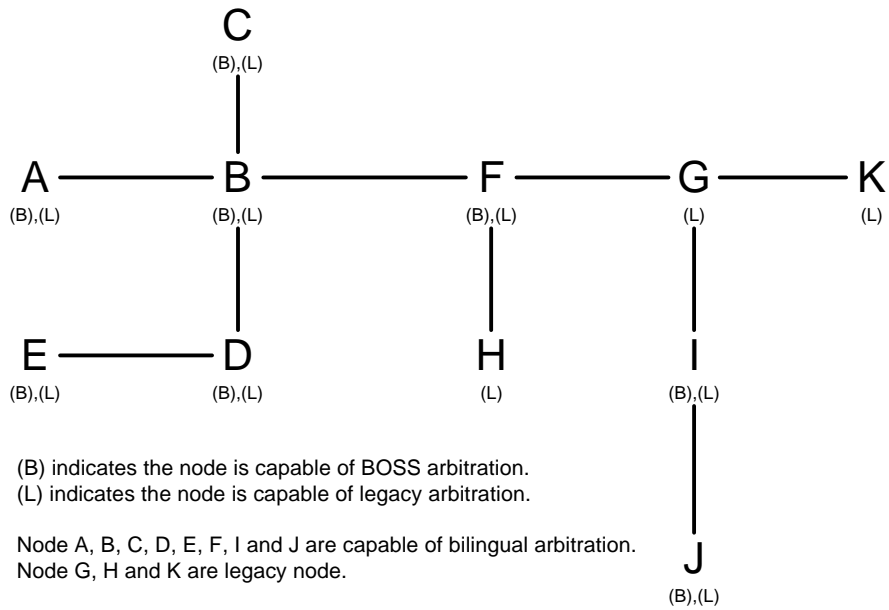


Fig. 1 : Mixed bus with both legacy nodes and BOSS capable nodes

2.1 No border node in a bus

In this section, it is supposed that a border node is not allowed in the bus.

1394 bus operates according to following process to complete bus initialization under the condition.

- The default of arbitration scheme is legacy arbitration.
- The bus manager confirms whether there are legacy nodes in the bus or not.
- If there are legacy nodes in the bus, all phys have to use legacy arbitration, which is shown in figure 2.

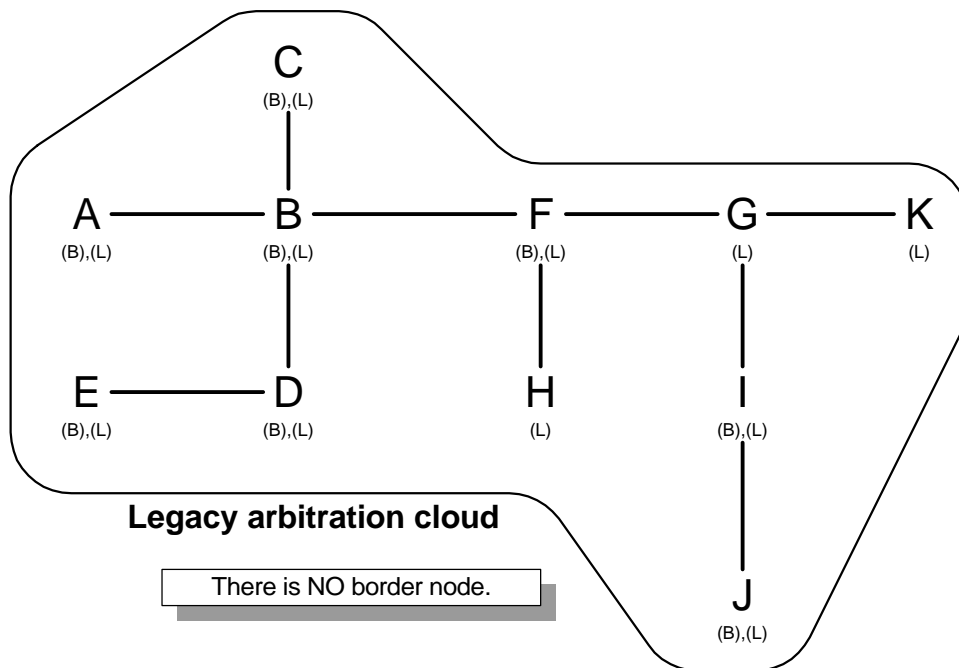


Fig. 2 : No border node in the bus (1)

When the both connections between F and H and between F and G are disconnected in figure 2, the bus is separated as shown in figure 3.

- In this case the bus manager recognizes that bus 1 is composed of BOSS capable nodes.
- The bus manager sends command packet to change arbitration scheme to the nodes of A, B, C, D, E and F.
- Bus 1 operates using BOSS arbitration scheme.

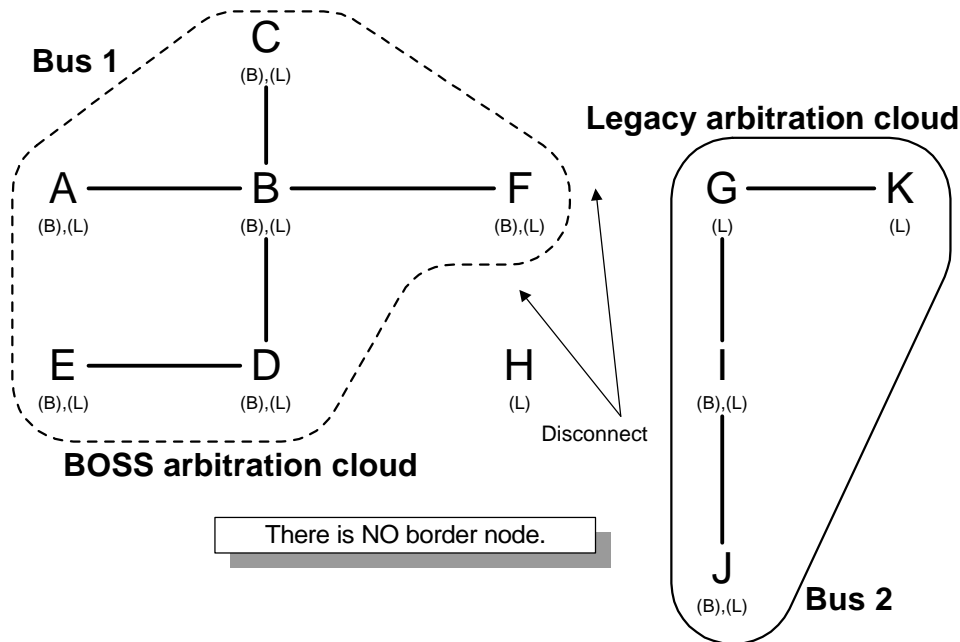


Fig. 3 : No border node in the bus (2)

2.1.1 Study Items for bus operation without border node

- Item 1. How does a bus manager confirm whether there are legacy nodes in the bus or not?
- Item 2. Two types of request type mapping on beta mode coding scheme are necessary. One is the type for BOSS arbitration requests. Another is the type for legacy arbitration requests. In this case the table 10-1, 10-2, 10-3 and 10-4 in draft 0.17 are insufficient.
- Item 3. The definition of configuration packet format to change arbitration scheme into BOSS arbitration.

2.1.2 Solution for study items

One of solutions for the study item 1 is modification of self ID packet format. The field "B" is added into legacy format as shown in figure 4. Bus manager confirms the field of "B" of all self ID packets and recognizes whether there are legacy nodes in the bus or not.

One of solutions for study item 3 is modification of PHY configuration packet format. The field "B" is added into legacy format as shown in figure 5. The bus manager which confirms

that there is no legacy node in the bus sends PHY configuration packet of which “B” is set to ‘1’.
1394b PHYs operate using BOSS arbitration after receiving the PHY configuration packet.

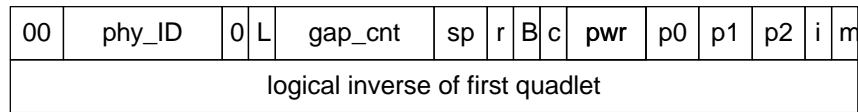


Fig. 4 : Self ID packet format

Table. 2 : Self ID packet field

Field	Affects	Comment
B	BOSS capable	0 : Legacy arbitration capable 1 : BOSS arbitration capable

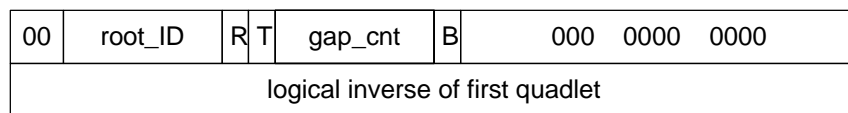


Fig. 5 : PHY configuration packet format

Table. 3 : PHY configuration packet field

Field	Affects	Comment
B	BOSS capable	0 : Legacy arbitration 1 : BOSS arbitration

2.2 Only one border node in a bus

In this section it is supposed that only one border node is allowed in a bus.

1394 bus operates according to following process to complete bus initialization under the condition.

- The default of arbitration scheme is legacy arbitration.
- Bus manager confirms whether there are legacy nodes in the bus or not, and it also confirms bus topology.
- If there are legacy nodes in the bus, bus manager separates a bus into 2 areas as shown in figure 6. One is BOSS arbitration cloud. Another is legacy arbitration cloud. The border line is determined by bus manager.
- Bus manager sends command packet to change arbitration scheme to the nodes in BOSS arbitration cloud.
- Node B in figure 6 becomes border node.
- Node A, C, D and E operate using BOSS arbitration. Node F, G, H, I, J and K operate using legacy arbitration.

2.2.1 Study items for bus operation with only one border node in a bus

- Item 1. How does a bus manager confirm whether there are legacy nodes in the bus or not? How does it confirm bus topology?
- Item 2. Two types of request type mapping on beta mode coding scheme are necessary. One is the type for BOSS arbitration requests. Another is the type for legacy arbitration requests. In this case the table 10-1, 10-2, 10-3 and 10-4 in draft 0.17 are insufficient.
- Item 3. The definition of command packet format to change arbitration scheme into BOSS arbitration.
- Item 4. Complete border functions

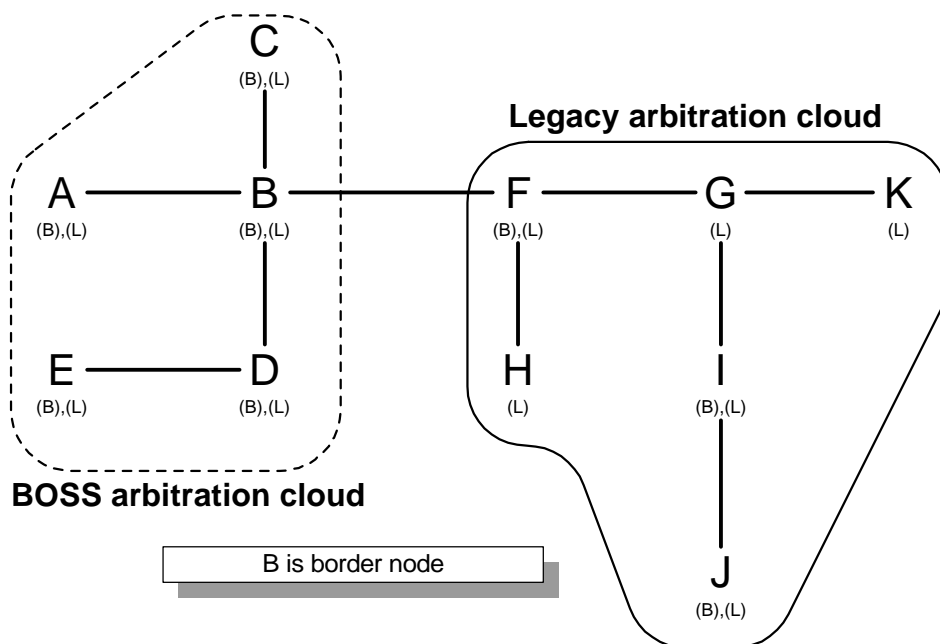


Fig. 6 : Only one border node in the bus

2.2.2 Solution for study items

One of solutions for study item 1 is modification of self ID packet format. The field “B” is added into legacy format as shown in figure 4. Bus manager confirms the field of “B” of all self ID packets and knows whether or not there are legacy nodes in the bus.

One of solutions for study item 3 is addition of command in the remote command packet. The bus manager sends remote command packet of which “e_cmd” is set to ‘3’ to the nodes which are expected to operate using BOSS arbitration. 1394b PHYs operate using BOSS arbitration after receiving the remote command packet.

00	phy_ID	00	type(8)	e_cmd	port	0000	0000	cmd
logical inverse of first quadlet								

Fig. 7 : Remote command packet format

Table. 4 : Remote commnad packet fields

Field	Comment
phy_ID	Physical node identifier of the destination of this packet
type	Extended PHY packet type
port	This field selects one of the PHY's ports.
cmd	Command: 0 : NOP 1 : Transmit TX_DISABLE_NOTIFY then disable port 2 : Initiate suspend 4 : Clear the port's fault bit to zero 5 : Enable port 6 : Resume port 7 : Extended commnad (see e_cmd)
e_cmd	Extended command (cmd = 7) 0 : NOP 1 : Initiate Stanby with connected peer port 2 : Restore from standby with connected peer port 3 : Set BOSS arbitration mode

2.3 More than 2 border nodes in a bus

In this section it is supposed that more than 2 border nodes are allowed in a bus.

1394 bus operates according to following process to complete bus initialization under the condition.

- Each node confirms whether all neighboring nodes are BOSS capable or not. If all neighboring nodes are BOSS capable the node can operate using BOSS arbitration. A neighboring node is not BOSS capable, the node has to become a border node as shown in figure 8.

Figure 9 shows the data path in the PHY of node F. Port 1 is connected to the port of node B. Port 2 and 3 are connected to the port of node H and G respectively. Both port 2 and port 3 can be either beta mode port or DS mode port.

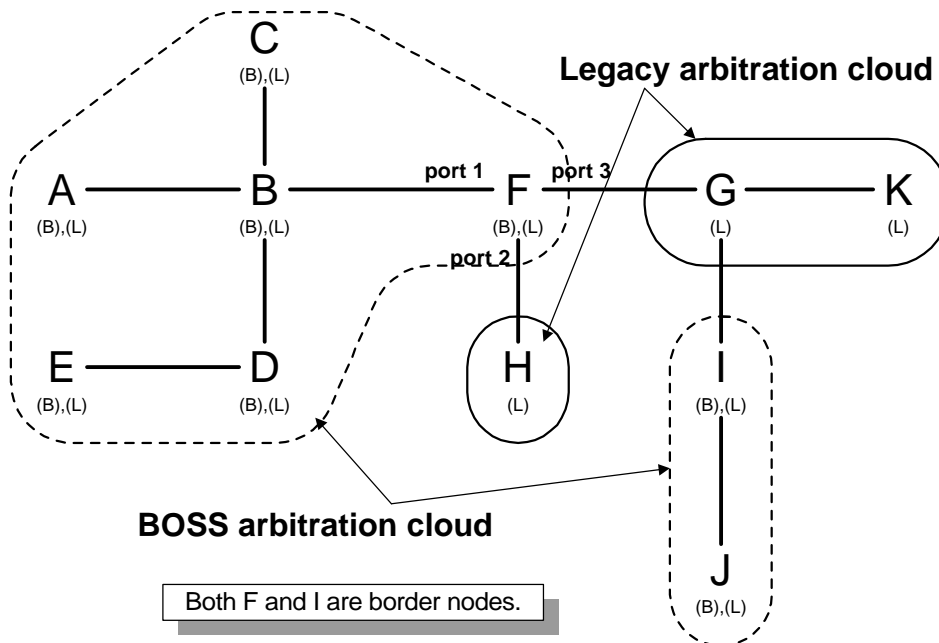


Fig. 8 : Some border nodes in the bus

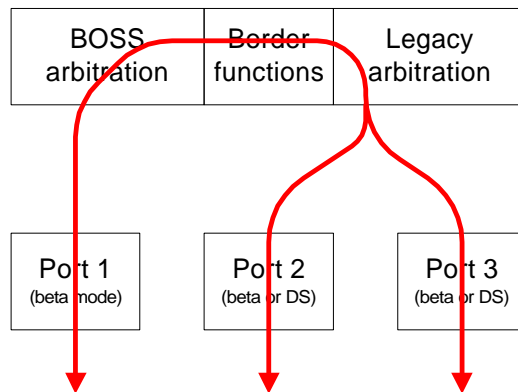


Fig. 9 : Data path in the PHY of node F

2.3.1 Study items for bus operation with more than 2 border nodes in a bus

- Item 1. How does a node confirm whether a neighboring node is BOSS capable or not?
- Item 2. Complete border functions

2.3.2 Solution for study items

One of solutions for item 1 is negotiation between ports in the up-start phase. A tone signal is added for arbitration negotiation as shown in figure 9. Each node negotiates both arbitration scheme and operation speed.

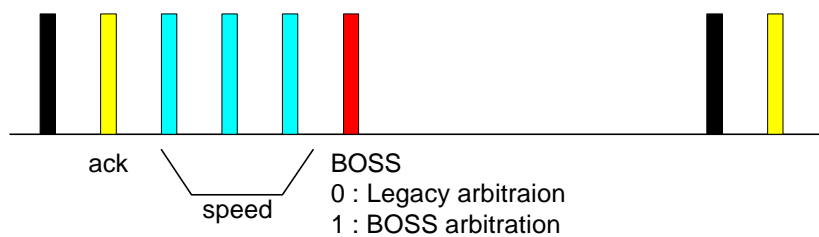


Fig. 10 : Tone signal

3 Conclusion

We classified the bus configuration from the viewpoint of the number of border since the handling of border node is not clear in 1394b. By fixing the scope regarding border node, we expect that the study items are clarified.