

To: T10 Technical Committee  
From: Rob Elliott, HP (elliott@hp.com)  
Date: 8 September 2004  
Subject: 04-247r0 SAS-1.1 XL6 and idle dwords

### **Revision history**

Revision 0 (8 September 2004) First revision

### **Related documents**

sas1r05 - Serial Attached SCSI - 1.1 revision 5

### **Overview**

1. SAS is inconsistent on whether the XL6:Open\_Response\_Wait state (the state entered after the phy transmits an OPEN address frame and is waiting for a response) forwards dwords from the ECR (the crossbar) or generates its own idle dwords. Most of the examples in the “Expander device handling of connections” annex indicate that “idle dwords (pass-through)” are transmitted by the expander; only one figure matches the XL state machine text and just says “idle dwords” implying that they are generated. The XL6:Open\_Response\_Wait state should be able to do either.

If it forwards during that state, it does not need to worry about all the rate matching and clock skew management ALIGN rules. The source of the OPEN is already worrying about those, and the dword stream is ready to forward.

If it generates idle dwords during that state, it must honor most of those ALIGN rules. It is not required to insert STP initiator throttling ALIGNs for STP connections - it may wait for the first STP primitive to arrive to do so.

One benefit of generating rather than forwarding is that any incorrect AIP, OPEN\_REJECT, or OPEN\_ACCEPT primitives in the incoming stream are filtered and cannot confuse the arbitration on the outgoing physical link.

2. The standard uses messages named like “Transmit OPEN” to name messages from a state machine to its corresponding transmitter. The XL state machine descriptions also use messages named like “Transmit Open” for requests from XL to ECR and indications from ECR to XL. For example, XL7 discusses:

- a) Transmit Dword indication coming in (the dword stream from the ECR)
- b) Transmit Dword request going out (the dword stream to the ECR)
- c) Transmit Dword message to the XL transmitter (sending the incoming stream out the phy)

This would be a bit less confusing if Transmit Open/Close/Break/Dword were renamed Forward Open/Close/Break/Dword. That separates them from the XL transmitter-related terms and helps clarify forwarded vs. generated differences.

### **Suggested changes**

#### **4.6.6.2 Expander device interfaces detail**

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[\[In figure 35, change Transmit Open/Close/Break/Dword to Forward Open/Close/Break/Dword\]](#)

#### **Figure 35 — Expander device interface detail**

#### **4.6.6.4 ECR interface**

Table 1 describes the requests from an expander phy to the ECR and the corresponding indications from the ECR to another expander phy.

**Table 1 — Expander phy to ECR to expander phy requests and indications**

Message	Description
<del>Transmit</del> <a href="#">Forward</a> Open (arguments)	Request/indication to transmit an OPEN address frame.
<del>Transmit</del> <a href="#">Forward</a> Close	Request/indication to transmit a CLOSE.
<del>Transmit</del> <a href="#">Forward</a> Break	Request/indication to transmit a BREAK.
<del>Transmit</del> <a href="#">Forward</a> Dword	Request/indication to transmit a dword.

Table 13 describes the responses from an expander phy to the ECR and the corresponding confirmations from the ECR to another expander phy. These responses are sent in response to a ~~Transmit~~ [Forward](#) Open indication.

#### 7.12.4.4 Pathway recovery

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The pathway blocked count and source SAS address values used to form the pathway recovery priority of a destination phy are those of the Request Path request if the phy sent a Request Path request to the ECM or those of the ~~Transmit~~ [Forward](#) Open indication if the phy received a ~~Transmit~~ [Forward](#) Open indication from the ECR.

#### 7.15.1 XL state machine overview

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**Figure 95** - [Next to Transmit Idle Dword add Transmit Dword.](#)

**Figures 94, 95, 96** - [Change Transmit Open/Close/Break/Dword to Forward Open/Close/Break/Dword.](#)

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[\[Global throughout 7.15 state machine text: Change Transmit Open/Close/Break/Dword to Forward Open/Close/Break/Dword. This affects XL0, XL1, XL2, XL3, XL6, XL7, and XL8.\]](#)

#### 7.15.9 XL6:Open\_Response\_Wait state

##### 7.15.9.1 State description

This state waits for a response to a transmitted OPEN address frame and determines the appropriate action to take based on the response.

This state shall [either](#):

- a) request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the XL transmitter, [honoring ALIGN insertion rules for rate matching and clock skew management](#); or
- b) [send Transmit Dword messages to the XL transmitter to transmit all dwords received with Forward Dword indications.](#)

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#### H Expander device handling of connections

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**Figure H.2** - [In the right Tx column next to XL6, change “idle dwords \(pass-through\)” to “idle dwords \(forwarded or generated\)”](#)

**Figure H.2** - [In the right Tx column next to XL7, add “idle dwords \(forwarded\)”](#)

**Figure H.2** - In the left XL req/rsp column and the right XL cnf/ind column next to XL3, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.2** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.2** - In each XL req/rsp column and each XL cnf/ind column cell associated with XL7, change “Transmit Dword” to “Forward Dword (connection dwords)”

**Figure H.3** - In the right Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.3** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.3** - In the left XL req/rsp column and the right XL cnf/ind column next to XL3, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.4** - no changes

**Figure H.5** - In the right Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.5** - In the right Tx column next to XL7, add “idle dwords (forwarded)”

**Figure H.5** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.5** - In the left XL req/rsp column and the right XL cnf/ind column next to XL3, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.5** - In each XL req/rsp column and each XL cnf/ind column cell associated with XL7, change “Transmit Dword” to “Forward Dword (connection dwords)”

**Figure H.6** - In the right Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.6** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.6** - In the left XL req/rsp column next to XL3, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.7** - In the right Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.7** - In the left Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.7** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.7** - In the left XL req/rsp column, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.7** - In the left XL cnf/ind column and right XL req/rsp column next to XL3, add yellow “Forward Dword (idle dwords)”

**Figure H.8** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Dword" to "Forward Dword \(connection dwords\)"](#)

**Figure H.8** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Close" to "Forward Close"](#)

**Figure H.9** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Dword" to "Forward Dword \(connection dwords\)"](#)

**Figure H.9** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Close" to "Forward Close"](#)

**Figure H.10** - no changes

**Figure H.11** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Dword" to "Forward Dword \(connection dwords\)"](#)

**Figure H.11** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Break" to "Forward Break"](#)

**Figure H.12** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Open" to "Forward Open"](#)

**Figure H.12** - [In the left XL req/rsp column and the right XL cnf/ind column, change yellow "Transmit Dword idle dwords \(pass-through\)" to "Forward Dword \(idle dwords\)"](#)

**Figure H.12** - [In the left XL req/rsp column and the right XL cnf/ind column, change yellow "Transmit Dword idle dwords \(STP connection dwords\)" to "Forward Dword \(STP connection dwords\)"](#)

**Figure H.12** - [In the right XL req/rsp column and the left XL cnf/ind column, change orange and green "Transmit Dword \(SATA device dwords\)" to "Forward Dword \(SATA device dwords\)"](#)

**Figure H.12** - [In the right Tx column, change "STP initiator dwords" to "STP connection dwords"](#)

**Figure H.13** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Open" to "Forward Open"](#)

**Figure H.13** - [In the right XL req/rsp column and the left XL cnf/ind column, change orange "Transmit Dword idle dwords \(pass-through\)" to "Forward Dword \(idle dwords\)"](#)

**Figure H.13** - [In the right XL req/rsp column and the left XL cnf/ind column, change orange and green "Transmit Dword \(SATA device dwords\)" to "Forward Dword \(SATA device dwords\)"](#)

**Figure H.13** - [In the left XL req/rsp column and the right XL cnf/ind column, change yellow "Transmit Dword \(STP connection dwords\)" to "Forward Dword \(STP connection dwords\)"](#)

**Figure H.13** - [In the right Tx column, change "STP initiator dwords" to "STP connection dwords"](#)

**Figure H.14** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Dword" to "Forward Dword"](#)

**Figure H.14** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Close" to "Forward Close"](#)

**Figure H.15** - [In each XL req/rsp column and each XL cnf/ind column, change "Transmit Dword" to "Forward Dword"](#)

**Figure H.15** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Close” to “Forward Close”

**Figure H.16** - In the right Tx column next to XL6, change “idle dwords (pass-through)” to “idle dwords (forwarded or generated)”

**Figure H.16** - In each XL req/rsp column and each XL cnf/ind column, change “Transmit Open” to “Forward Open”

**Figure H.16** - In the left XL req/rsp column and the right XL cnf/ind column, change yellow “Transmit Dword idle dwords (pass-through)” to “Forward Dword (idle dwords)”

**Figure H.16** - In each XL req/rsp column and each XL cnf/ind column cell (green and yellow) associated with XL7, change “Transmit Dword” to “Forward Dword (connection dwords)”

**Figure H.16** - In the right Tx column next to XL7, add “idle dwords (forwarded)”