To: T10 Technical Committee
From: Bob Sheffield (Robert.L.Sheffield@intel.com)
           Vicky Duerk (vicky.p.duerk@intel.com)
Date: 27 October 2006
Subject: SAS-2: Initiator handling of retransmit read DATA frames

Revision history

Revision 0 (27 October 2006) First revision (This is the first half of the split up proposal : 06-371r0)
Revision 1 (9 January 2007) Incorporate changes from November '06 SAS WG

Related documents

SAS-2-r07 - Serial Attached SCSI - 2 (SAS-2) revision 07
06-371r0 SAS2: Transport-layer handling of extraneous retransmit DATA frames

Overview

While SAS-2 defines clearly how the transport layer handles (ST_ITS) receipt of retransmitted DATA frames when previous data frames have been lost, it does not specify how the transport layer handles receipt of retransmitted data frames when the original data frames have been received and processed without error (i.e., the ACK was lost). This proposal adds text to the ST_ITS6:Receive_Data_In state to define how this is handled, and allows the ST_ITS to either discard the previously received read DATA frame and replace it with the retry DATA frame, or to discard the retry read DATA frame if the read DATA frame it would replace was received without error.

<u>**Suggested changes**</u>

Modify subclause 9.2.6.2.3.7.1 as follows:

9.2.6.2.3.7 ST_ITS6:Receive_Data_In state

9.2.6.2.3.7.1 State description

If this state receives a Data-In Arrived message, then this state shall verify the values in the read DATA frame received with the message as defined in table 1.

If the verification fails, then this state sends the Reception Complete message specified in table 1 to the ST_IFR state machine.

Table 1 — Reception Complete messages for read DATA frame verification failures

Message sent to ST_IFR [a]	Condition
Reception Complete (Data Offset Error)	Transport layer retries are disabled, and the DATA OFFSET field in the read DATA frame is not equal <u>to the</u> Data-In Buffer Offset state machine variable.
	The DATA OFFSET field in the read DATA frame is greater than the Data-In Buffer Size state machine argument.
Reception Complete (Too Much Read Data)	The number of bytes in the DATA field in the read DATA information unit plus the Data-In Buffer Offset state machine variable is greater than the Data-In Buffer Size state machine argument.
Reception Complete (Incorrect Data Length)	The number of bytes in the DATA field in the read DATA information unit is zero.
[a] If more than one condition is true, then this state shall select which message to send to the ST_IFR state machine using the following order: 1) Reception Complete (Data Offset Error); 2) Reception Complete (Too Much Read Data); or 3) Reception Complete (Incorrect Data Length).	

~~If:~~

> ~~a)　transport layer retries are enabled;~~
> ~~b)　the CHANGING DATA POINTER bit is set to zero;~~
> ~~c)　the DATA OFFSET field is not set to the Data-In Buffer Offset state machine variable;~~
> ~~d)　the DATA OFFSET field is less than the Data-In Buffer Size state machine argument; and~~
> ~~e)　the DATA OFFSET field plus the number of bytes in the DATA field in the read Data information unit is less than or equal to the Data-In Buffer Size state machine argument,~~

~~then this state should discard all Data-In Arrived messages until a read DATA frame is received in which the CHANGING DATA POINTER bit is set to one. This state shall resume processing additional Data-In Arrived messages when it receives a Data-In Arrived message with the CHANGING DATA POINTER bit set to one.~~

~~If the verification succeeds or after this state resumes processing Data-In Arrived messages, then this state shall process the data received in the read DATA frame and set the Data-In Buffer Offset state machine variable to the DATA OFFSET field plus the number of bytes in the DATA field in the read Data information unit.~~

<u>A SAS initiator port shall implement a policy for the disposition of data arriving in DATA frames that overlap (i.e., based on the DATA OFFSET field and the length of the DATA information unit) DATA frames the ST_ITS has previously received and processed successfully. The SAS initiator port shall implement either a policy to override previously received data, or a policy to discard the arriving data.</u>

The ST_ITS6 shall process arriving DATA frames which have been successfully verified (see table 1) as shown in table 2.

Table 2 — Processing of Data-In Arrived messages

TLR enabled	CHANGING DATA POINTER bit	DATA OFFSET field $\leq$ Data-In Buffer Offset	DATA OFFSET field + length of the Data IU $\leq$ Data-In Buffer Offset	Redundant data processing policy	
				Discard	**Override**
Yes	n/a	No	n/a	Discard the frame and send a Reception Complete (Data Offset Error) message to the ST_IFR state machine.	
Yes	1	Yes	Yes	Discard the frame.	Process the frame and set the Data-In Buffer Offset state machine variable to the DATA OFFSET field plus the length of the DATA IU.
			No	1) Discard data up to the Data-In Buffer Offset; 2) process the remaining data; and 3) set the Data-In Buffer Offset to the DATA OFFSET field plus the length of the DATA IU.	
Yes	0	Yes	No		If the Data-In Buffer Offset equals the DATA OFFSET field, then Process the frame and set the Data-In Buffer Offset state machine variable to the DATA OFFSET field plus the length of the DATA IU. Otherwise, handle as verification failed by sending a Reception Complete (Data Offset Error) message to the ST_IFR state machine.
Yes	0	Yes	Yes	Discard the frame.	
No	0	Yes	n/a	If the Data-In Buffer Offset is not equal to the DATA OFFSET field, then handle as verification failed by sending a Reception Complete (Data Offset Error) message to the ST_IFR state machine. Otherwise, process the frame and set the Data-In Buffer Offset state machine variable to the DATA OFFSET field plus the length of the DATA IU.	
No	1	n/a		Handle as verification failed by sending a Reception Complete (Data Offset Error) message to the ST_IFR state machine.	

Editor's Note 1: Is it an error if TLR is enabled using the override policy, when a DATA frame arrives with the CHANGING DATA POINTER field set to zero, and the Data-In Buffer Offset state machine variable is not equal to the DATA OFFSET FIELD? It is not specified in the current draft (SAS2r07).

Editor's Note 2: Perhaps the verification failed condition in the last row should be addressed in table 1.

If this state receives Transmission Status (ACK/NAK Timeout) or Transmission Status (Connection Lost Without ACK/NAK), then this state shall send a Reception Complete (Command Failed, Connection Failed) to the ST_IFR state machine.

After this state sends a Reception Complete (Command Failed, Connection Failed) message, this state shall continue processing messages and confirmations.

> NOTE 1 - The application client may determine the command was received and is being processed by the device server and allow the command to complete.

If this state receives a Cancel message, then this state shall send a Reception Complete (Cancel Acknowledged) message to the ST_IFR state machine. The Reception Complete message shall include the tag as an argument.

> NOTE 2 - The Cancel message results from a vendor-specific request from the SCSI application layer after the SCSI application layer has used a task management function to determine that the SAS target port did not receive the COMMAND frame.

Editor's Note 3: The remaining subclauses in 9.2.6.2.3.7 remain unchanged.