SAS-1.1 SSP Response / DATA ACK timing Issues

May 27, 2005

Authors:
Alexander Amezquita (alex@expertio.com) of Expert I/O
Craig Stoops (craig@expertio.com) of Expert I/O
www.expertio.com

1. SSP Transport Layer – ST_T Response Frame/Ack Transmitted Handshake

Problem
The current version of the SAS 1.1 specification (rev 9c) does not provide a handshake in the target between transmission of an Ack for the last frame of a data out sequence, and the transmission of the response frame for the command. This creates a race condition where a Response frame could arrive at the initiator before the Ack of the last data frame for the data out sequence.

Solution
A valid solution would be to add wording similar to the following excerpt except for changing COMMAND to the last data frame of a data out sequence. In addition, change SCSI Command Received transport protocol service indication to Data-Out Received transport protocol service indication.

An excerpt from section 9.2.6.3.2:
"If the frame type is COMMAND or TASK and the items checked in the frame are correct, then this state machine shall wait to receive an ACK Transmitted confirmation.
If the frame type is COMMAND, the items checked in the frame are correct, and this state machine receives an ACK Transmitted confirmation, then this state machine shall send a SCSI Command Received transport protocol service indication with the following arguments to the SCSI application layer:"

2. SSP Transport Layer – ST_I State Machine sending Command Complete Received transport protocol service indication

Problem
The specification is rather loose regarding the sequence of events leading to transmission of a Command Complete Received transport protocol service indication in the non-Error Data Out case. The following excerpt illustrates the point.

Excerpt from Section 9.2.6.2.2:
"If the frame type is RESPONSE, the items checked in the frame are correct, and this state machine has not received a RESPONSE frame for this I_T_L_Q nexus, then this state machine shall send a protocol service confirmation to the SCSI application layer based on the content of the DATAPRES and RESPONSE DATA fields. If the RESPONSE frame was for a command, then the delivery result and other arguments sent with the Command Complete Received protocol service confirmation are defined in 10.2.1.5."

In Table 128, it is detailed that a Command Complete Received protocol service confirmation Iis issued upon reception of a Transmission Complete (Data Out Delivered) message from the ST_ITS state machine. The ST_ITS state machine delivers the Transmission Complete (Data Out Delivered) message upon reception of ACK_Received for the last data frame in a data out sequence.

These two items seem to overlap one another and I suspect that the latter should be used to qualify the former.

Solution
It seems natural that the Command Complete Received message is issued upon reception of the RESPONSE frame. Wording should indicate that the Transmission Complete message from the ST_ITS state machine should be a prerequisite to sending a Command Complete Received message but not cause the message.