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Date: 05 November 2002

Subject: SAS SSP transport layer state machine modification proposal

Introduction

The following proposes minor corrections and an additional requirement to the SSP transport layer state diagrams. The additional requirement adds a new confirmation (ACK Transmitted). This new confirmation shall be received by the transport layer state machine before a non-interlocked frame may be transmitted for an I_T_L_Q after an interlocked frame is transmitted for that nexus (e.g., no data-out DATA frames may be transmitted until the ACK Transmitted confirmation has been received for the COMMAND frame). The following proposal is "drop-in replacement text" based on SAS-r02c.

Figure 77 – SSP link layer (SSP) state machines (part 3 - primitive transmission)

Add a confirmation named ACK Transmitted from the SSP_TAN1:Idle state machine.

7.16.7.16 SSP_TAN1:Idle state

7.16.7.16.1 State description

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This state waits for a Frame Received parameter from the SSP_RF1:Rcv_Frame state. When this state is transitioned into from the SSP_TAN2:Indicate_ACK/NAK_Tx state with an indication that an ACK was transmitted it shall send the ACK Transmitted parameter to the SSP_RIM1:Rcv_Interlock_Monitor state [and an ACK Transmitted confirmation to the port layer state machine](#).

Figure 88 — Port layer link manager (PM_LM) state machine part 2

Add a confirmation named ACK Transmitted received by the PL_LM3:Connected (part 2) state from the link layer state machine. Add a confirmation named ACK Transmitted sent by the PL_LM3:Connected (part 2) state to the transport layer state machine.

8.4.4 PL_LM3:Connected state

8.4.4.1 State description

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When an ACK Transmitted confirmation is received by this state, this state shall send an ACK Transmitted confirmation to the transport layer state machine.

Figure 93 – SSP transport layer (ST) state machines - initiator device

Add a confirmation named ACK Transmitted from the port layer state machine to the ST_ISF1:Initiator_Send_Frame state.

9.2.6.2.2 ST_ISF1:Send_Frame state

9.2.6.2.2.1 State description

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If the ST_ISF state machine was initiated as the result of receiving an XFER_RDY Arrived parameter, then this state shall check the length of the XFER_RDY information unit. If the length of the information unit is not 12 bytes, then this state shall send a Delivery Failure parameter to the ST_IPR:Process_Received_Response state. This state machine shall terminate after sending the parameter. If the length of the XFER_RDY information unit is 12 bytes, then this state shall check the write data length in the XFER_RDY information unit. If the write data length exceeds the amount of data remaining to be transferred for the data-out command, then this state shall send a Delivery Failure parameter to the ST_IPR:Process_Received_Response state. This state machine shall terminate after sending the parameter. If the length of the XFER_RDY frame is correct, and the write data length is correct, and an ACK Transmitted confirmation has been received from the port layer state machine, then this state shall transition to the ST_ISF3:Prepare_Send_Data_Out state.

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After sending a Delivery Failure parameter to the ST_IPR state machine, the ST_ISF state machine shall terminate.

If the transmitted frame was a DATA frame, then this state may transition to the ST_ISF3:Prepare_Send_Data_Out state after receiving a Transmission Status (Frame Transmitted) confirmation.

After receiving a Transmission Status (Frame Transmitted) confirmation, this state shall then receive one of the following confirmations from the port layer state machine.

- a) ACK Received;
- b) NAK Received; or
- c) Connection Failed.

If the transmitted frame was a COMMAND frame or TASK frame requiring a data-out operation, then this state shall wait to receive an ACK Received, NAK Received, or Connection Failed confirmation before transitioning from this state.

If ~~the a~~ confirmation is ~~not~~ ~~ACK~~ ~~NAK~~ Received or Connection Failed, then this state shall send a Delivery Failure (Service Delivery Subsystem Failure) parameter to the ST_IPR (initiator process response) state machine including any argument received from the port layer state machine. After sending the Delivery Failure parameter to the ST_IPR state machine, the ST_ISF state machine shall terminate.

~~If the confirmation is ACK Received and the number of data bytes that has been transferred for a data-out request is less than the first burst size or the write data length, then this state shall transition to the ST_ISF3:Prepare_Send_Data_Out state.~~

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9.2.6.2.2.3 Transition ST_ISF1:Send_Frame to ST_ISF3:Prepare_Send_Data_Out

This transition shall occur after:

- a) an ACK Received confirmation has been received from the port layer state machine for a COMMAND frame for a data-out operation and the first burst size is not zero;
- b) an XFER_RDY Arrived parameter has been received from the ST_IFR state machine, ~~and~~ all required values are present and correct, and an ACK Transmitted confirmation has been received; or,
- c) a Transmission Status (Frame Transmitted) ~~an ACK Received~~ confirmation for a Transmit Frame (Non-interlocked) request has been received from the port layer state machine and the number of data bytes that has been transmitted for the request is less than the first burst size or the write data length.

Figure 94 – SSP transport layer (ST) state machines - target device

Add a confirmation named ACK Transmitted from the port layer state machine to the ST_TTS2:Send_Frame state.

9.2.6.3.4 ST_TTS2:Send_Frame state

9.2.6.3.4.1 State description

This state is entered when a DATA frame is received from the ST_TTS3:Prepare_Send_Data_In state, when an XFER_RDY frame is received from the ST_TTS4:Receive_Data_Out state, when a RESPONSE frame is received from the ST_TTS7:Prepare_Response state, or after the ST_TTS7:Prepare_Response state has determined that the number of retries for a RESPONSE frame has been exceeded.

If the TTS state machine was initiated as the result of this state receiving a Send Data-In data-in delivery service request ~~and~~, the specified values are included with the request, and this state has received an ACK Transmitted confirmation from the port layer state machine. then this state shall transition to the ST_TTS3:Prepare_Send_Data_In state.

If this state is entered from the ST_TTS3:Prepare_Send_Data_In state for transmission of a DATA frame, then this state shall send a Transmit Frame (Non-interlocked) request to the port layer state machine.

If this state is entered from the ST_TTS4:Receive_Data_Out state for transmission of an XFER_RDY frame and this state has received an ACK Transmitted confirmation from the port layer state machine. then this state shall send a Transmit Frame (Interlocked) request to the port layer state machine.

If this state is entered from the ST_TTS7:Prepare_Response state for transmission of a RESPONSE frame and this state has received an ACK Transmitted confirmation from the port layer state machine. then this state shall send a Transmit Frame (Interlocked) request to the port layer state machine.

A Transmit Frame request from this state (either interlocked or non-interlocked) shall include the SSP frame and the following to be used for any OPEN address frame:

- a) the initiator bit set to zero;
- b) connection rate;

- c) initiator connection tag;
- d) destination SAS address; and,
- e) source SAS address.

After sending a Transmit Frame request this state shall receive a Transmission Status confirmation from the port layer state machine.

If the frame transmitted was a DATA frame, then this state may transition to the ST_ISF3:Prepare_Send_Data_Out state after receiving a Transmission Status (Frame Transmitted) confirmation.

If the confirmation is Transmission Status (Frame Transmitted) confirmation, then this state shall receive one of the following confirmations from the port layer state machine.

- a) ACK Received;
- b) NAK Received; or,
- c) Connection Failed.

If the frame transmitted was an XFER_RDY frame or a RESPONSE frame, then this state shall wait to receive an ACK Received, NAK Received, or Connection Failed confirmation before transitioning from this state.

~~If the confirmation is ACK Received, the transmitted frame was a DATA frame, and the number of bytes moved for the Send Data-In data-in delivery service request is less than the Request Byte Count, then this state shall transition to the ST_TTS3:Prepare_Send_Data_In state.~~

If the confirmation is ACK Received and the transmitted frame was an XFER_RDY frame, then this state shall transition to the ST_TTS4:Receive_Data_Out state.

9.2.6.3.4.2 Transition ST_TTS2:Send_Frame to ST_TTS3:Prepare_Send_Data_In

This transition shall occur after ~~either:~~

- a) the ST_TTS2:Send_Frame state receives a Send Data-In data-in delivery service request is received by the ST_TTS2:Send_Frame state from the SCSI target device's application layer and an ACK Transmitted confirmation for the port layer state machine; or
- b) the ST_TTS2:Send_Frame state has received a Transmission Status (Frame Transmitted) confirmation and an ACK Received confirmation for a DATA frame and the number of bytes moved for the Send Data-In data-in delivery service request is less than the Request Byte Count.

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