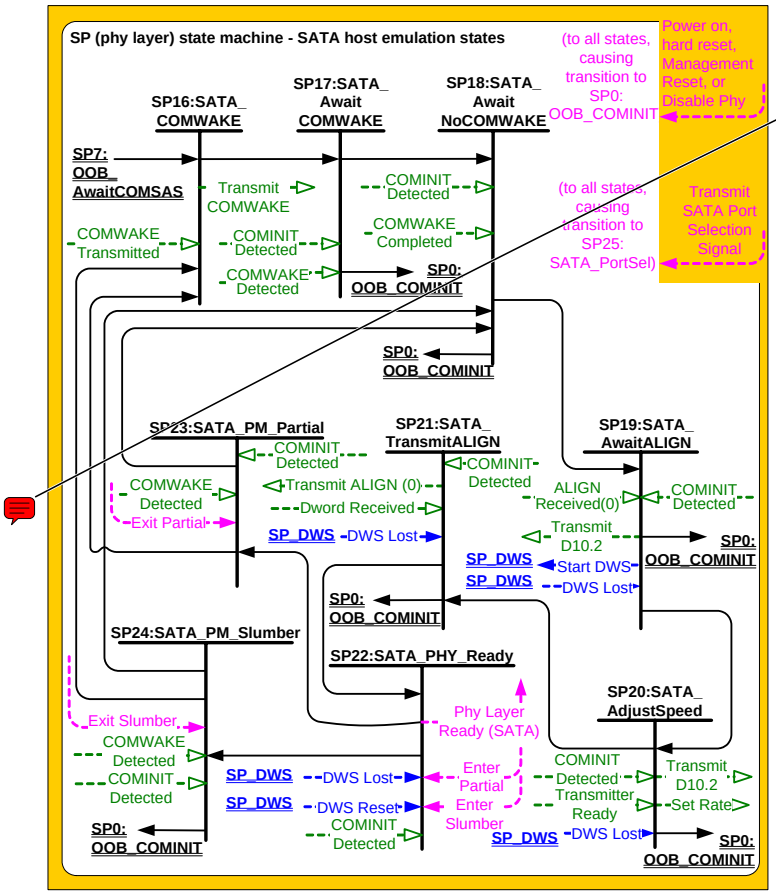

Figure 160 — SP (phy layer) state machine - SATA host emulation states

Summary of Comments on Serial Attached SCSI - 2 (SAS-2) Standard

Page: 279

Author: George Penokie Subject: Sticky Note Date: 8/26/2008 2:32:04 PM
That is nothing in the STP section about Slumber and Partial. This is probably OK for SAS 2 but this could get confusing when SSP starts doing the same kind of functions using the same names. Perhaps we should rename all these to SATA_Partial and SATA_Slumber.

7.10.3.2.2 Transition SL_IR_TIR1:Idle to SL_IR_TIR2:Transmit_Identify

This transition shall occur after both:

a) a Phy Layer ~~Ready (SAS)~~ confirmation is received; and
b) a Transmit IDENTIFY Address Frame request is received.

7.10.3.2.3 Transition SL_IR_TIR1:Idle to SL_IR_TIR3:Transmit_Hard_Reset

This transition shall occur after both:

a) a Phy Layer ~~Ready~~ (SAS) confirmation is received; and
b) a Transmit HARD_RESET request is received.

7.10.3.3 SL_IR_TIR2:Transmit_Identify state

7.10.3.3.1 State description

Upon entry into this state, this state shall send either one or three Transmit IDENTIFY Address Frame messages to the SL_IR transmitter.

NOTE 56 - Phys compliant with previous versions of this standard only transmitted one Transmit IDENTIFY Address Frame message.

After this state receives an IDENTIFY Address Frame Transmitted message in response to its first Transmit IDENTIFY Address Frame message, this state shall send an Identify Transmitted message to the SL_IR_IRC state machine.

7.10.3.3.2 Transition SL_IR_TIR2:Transmit_Identify to SL_IR_TIR4:Completed

If this state sends one Transmit IDENTIFY Address Frame message, then this transition shall occur after sending an Identify Transmitted message to the SL_IR_IRC state machine.

If this state sends three Transmit IDENTIFY Address Frame messages, then this transition shall occur after receiving three Identify Transmitted messsages.

7.10.3.4 SL_IR_TIR3:Transmit_Hard_Reset state

7.10.3.4.1 State description

Upon entry into this state, this state shall send a Transmit HARD_RESET message to the SL_IR transmitter.

After this state receives a HARD_RESET Transmitted message, this state shall send a HARD_RESET Transmitted confirmation to the management application layer.

7.10.3.4.2 Transition SL_IR_TIR3:Transmit_Hard_Reset to SL_IR_TIR4:Completed

This transition shall occur after sending a HARD_RESET Transmitted confirmation to the management application layer.

7.10.3.5 SL_IR_TIR4:Completed state

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL_IR transmitter.

7.10.4 SL_IR_RIF (receive IDENTIFY address frame) state machine

7.10.4.1 SL_IR_RIF state machine overview

The SL_IR_RIF state machine receives an IDENTIFY address frame and checks the IDENTIFY address frame to determine if the frame should be accepted or discarded by the link layer.

Page: 345

Author: George Penokie Subject: Highlight Date: 8/26/2008 2:48:59 PM
This should be change to << a Transmit IDENTIFY Address Frame request is received from the management application layer. >>. I know our convention is not state were requests come from, but in this cases there is nothing in the management application layer that describes the rules for requesting this. And I don't really want those defined.

Author: George Penokie Subject: Highlight Date: 8/26/2008 2:49:36 PM
This should be change to << a TTransmit HARD_RESET request is received from the management application layer. >>. I know our convention is not state were requests come from, but in this cases there is nothing in the management application layer that describes the rules for requesting this. And I don't really want those defined.

This state machine consists of the following states:

a) SL_IR_RIF1:Idle (see 7.10.4.2)(initial state);
b) SL_IR_RIF2:Receive_Identify_Frame (see 7.10.4.3); and
c) SL_IR_RIF3:Completed (see 7.10.4.4).

This state machine shall start in the SL_IR_RIF1:Idle state. This state machine shall transition to the SL_IR_RIF1:Idle state from any other state after receiving a Phy Layer Not Ready confirmation.

7.10.4.2 SL_IR_RIF1:Idle state

7.10.4.2.1 State description

This state waits for an SOAF to be received from the physical link, indicating an address frame is arriving.

7.10.4.2.2 Transition SL_IR_RIF1:Idle to SL_IR_RIF2:Receive_Identify_Frame

This transition shall occur after both:

a) a Start SL_IR Receiver confirmation is received; and
b) an SOAF Received message is received.

7.10.4.3 SL_IR_RIF2:Receive_Identify_Frame state

7.10.4.3.1 State description

This state receives the dwords of an address frame and the EOAF.

If this state receives an SOAF Received message, then this state shall discard any previously received dwords for the address frame, send an Address Frame Failed confirmation to the management application layer to indicate that an invalid address frame was received, and start receiving the new address frame.

If this state receives more than eight Data Dword Received messages (i.e., 32 bytes) after an SOAF Received message and before an EOAF Received message, then this state shall discard the address frame and send an Address Frame Failed confirmation to the management application layer to indicate that an invalid address frame was received.

If this state receives an Invalid Dword Received message or an ERROR Received message after an SOAF Received message and before an EOAF Received message, then this state shall either:

a) ignore the invalid dword or ERROR; or
b) discard the address frame and send an Address Frame Failed confirmation to the management application layer to indicate that an invalid address frame was received.

After receiving an EOAF Received message, this state shall check if it the received frame is a valid IDENTIFY address frame.

This state shall accept an IDENTIFY address frame and send an Identify Received message to the SL_IR_IRC state machine if:

a) the ADDRESS FRAME TYPE field is set to 0h (i.e., IDENTIFY);
b) the number of bytes between the SOAF and EOAF is 32; and
c) the CRC field contains a good CRC.

Otherwise, this state shall discard the address frame and send an Address Frame Failed confirmation to the management application layer to indicate that an invalid address frame was received.

7.10.4.3.2 Transition SL_IR_RIF2:Receive_Identify_Frame to SL_IR_RIF3:Completed

This transition shall occur after sending an Identify Received message confirmation.

7.10.4.4 SL_IR_RIF3:Completed state

This state waits for a Phy Layer Not Ready confirmation.

Page: 346

Author: George Penokie Subject: Highlight Date: 8/12/2008 10:55:44 AM
This should be << Identify Received message >>.

d) a Connection Closed (Transition to Idle) confirmation to the port layer.

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter (see 7.4).

If a BROADCAST Received (Change) message, BROADCAST Received (Reserved Change 0) message, or BROADCAST Received (Reserved Change 1) message is received, then this state shall send a Change Received confirmation to the management application layer.

If a Transmit Broadcast request is received with any argument, then this state shall send a Transmit BROADCAST message with the same argument to the SL transmitter.

If a BREAK Received message is received and the BREAK_REPLY method of responding to received BREAK primitive sequences is enabled (see 7.13.5), then this state shall send a Transmit BREAK_REPLY message to the SL transmitter.

After this state receives an Enable Disable SAS Link (Enable) confirmation, this state shall:

a) set the Reject SSP Opens state machine variable to a vendor-specific default value (i.e., YES or NO);
b) set the Reject SMP Opens state machine variable to a vendor-specific default value (i.e., YES or NO); and
c) set the Reject STP Opens state machine variable to a vendor-specific default value (i.e., YES or NO).

If this state receives a NOTIFY Received (Power Loss Expected) message and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall send a Notify Received (Power Loss Expected) confirmation to the port layer.

7.15.4.2.2 Transition SL_CC0:Idle to SL_CC1:ArbSel

This transition shall occur after receiving both an Enable Disable SAS Link (Enable) confirmation and an Open Connection request. The Open Connection request includes these arguments:

a) initiator port bit;
b) protocol;
c) connection rate;
d) initiator connection tag.
e) destination SAS address;
f) source SAS address;
g) pathway blocked count; and
h) arbitration wait time.

7.15.4.2.3 Transition SL_CC0:Idle to SL_CC2:Selected

This transition shall occur after receiving both an Enable Disable SAS Link (Enable) confirmation and an OPEN Address Frame Received message.

7.15.4.3 SL_CC1:ArbSel state

7.15.4.3.1 State description

This state is used to make a connection request.

Upon entry into this state, this state shall:

1) request an OPEN address frame be transmitted by sending a Transmit SOAF/Data Dwords/EOAF message to the SL transmitter with the dwords containing the OPEN address frame with its fields set to the arguments received with the Open Connection request;
2) initialize and start the Open Timeout timer; and
3) request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter.

This state shall ignore OPEN_REJECT Received and OPEN_ACCEPT Received messages from the time a Transmit SOAF/Data Dwords/EOAF message is sent to the SL transmitter until an SOAF/Data Dwords/EOAF Transmitted message is received from the SL transmitter.

Page: 371

Author: George Penokie Subject: Highlight Date: 8/26/2008 2:54:34 PM
This should be change to << a Transmit Broadcast request is received from the management application layer. >>. I know our convention is not state were requests come from, but in this cases there is nothing in the management application layer that describes the rules for requesting this. And I don't really want those defined.

Author: George Penokie Subject: Highlight Date: 8/11/2008 4:44:46 PM
This is a message not a confirmation

Author: George Penokie Subject: Highlight Date: 8/11/2008 4:45:23 PM
This is a message not a confirmation

Author: George Penokie Subject: Highlight Date: 8/11/2008 4:45:43 PM
This is a message not a confirmation

Page: 373

Author: George Penokie Subject: Highlight Date: 8/26/2008 11:45:42 AM
Change << (Port Layer Request) >> to < (Arb Stopped) >>.

The arbitration fairness comparison shall compare:

a) the value of the arbitration wait time argument in the Open Connection request for the outgoing OPEN address frame; and
b) the value of the ARBITRATION WAIT TIME field received in the incoming OPEN address frame.

7.15.4.3.4 Transition SL_CC1:ArbSel to SL_CC3:Connected

This transition shall occur if this state receives an SOAF/Data Dwords/EOAF Transmitted message followed by an OPEN_ACCEPT Received message.

If the PROTOCOL field in the transmitted OPEN address frame was set to STP, then this state shall send a Connection Opened (STP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open STP Connection argument. At this point an STP connection has been opened between the source phy and the destination phy.

If the PROTOCOL field in the transmitted OPEN address frame was set to SSP, then this state shall send a Connection Opened (SSP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open SSP Connection argument. At this point an SSP connection has been opened between the source phy and the destination phy.

If the PROTOCOL field in the transmitted OPEN address frame was set to SMP, then this state shall send a Connection Opened (SMP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open SMP Connection argument. At this point an SMP connection has been opened between the source phy and the destination phy.

7.15.4.3.5 Transition SL_CC1:ArbSel to SL_CC5:BreakWait

This transition shall occur after receiving a SOAF/Data Dwords/EOAF Transmitted message if a BREAK Received message has not been received and after:

a) a Stop Arb request is received and after sending an Open Failed (Port Layer Request) confirmation to the port layer;
b) there is no response to the OPEN address frame before the Open Timeout timer expires and after sending an Open Failed (Open Timeout Occurred) confirmation to the port layer; or
c) a NOTIFY Received (Power Loss Expected) message is received.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall include a Power Loss Expected argument.

7.15.4.3.6 Transition SL_CC1:ArbSel to SL_CC6:Break

This transition shall occur after:

a) receiving a SOAF/Data Dwords/EOAF Transmitted message;
b) receiving a BREAK Received message; and
c) sending an Open Failed (Break Received) confirmation to the port layer.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall include a Power Loss Expected argument.

7.15.4.4 SL_CC2:Selected state

7.15.4.4.1 State description

This state completes the establishment of an SSP, SMP, or STP connection when an incoming connection request has won arbitration by sending a Transmit OPEN_ACCEPT message, or rejects opening a connection by sending a Transmit OPEN_REJECT message to the SL transmitter.

This state shall respond to an incoming OPEN address frame using the following rules:

1) If the OPEN address frame DESTINATION SAS ADDRESS field does not match the SAS address of this port, then this state shall send a Transmit OPEN_REJECT (Wrong Destination) message to the SL transmitter (see 7.15.4.4.2);
2) If the OPEN address frame INITIATOR PORT bit, PROTOCOL field, FEATURES field, and/or INITIATOR CONNECTION TAG field are set to values that are not supported (e.g., a connection request from an SMP target port), then this state shall send a Transmit OPEN_REJECT (Protocol Not Supported) message to the SL transmitter (see 7.15.4.4.2);
3) If the OPEN address frame CONNECTION RATE field is set to a connection rate that is not supported, then this state shall send a Transmit OPEN_REJECT (Connection Rate Not Supported) message to the SL transmitter (see 7.15.4.4.2);
4) If the OPEN address frame PROTOCOL field is set to STP, the STP target port supports affiliations, and the source SAS address is not that of an STP initiator port with an affiliation established (see 7.18.4), then this state shall send a Transmit OPEN_REJECT (STP Resources Busy) message to the SL transmitter (see 7.15.4.4.2);
5) If the OPEN address frame PROTOCOL field is set to SSP and the Reject SSP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 7.15.4.4.2);
6) If the OPEN address frame PROTOCOL field is set to SMP and the Reject SMP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 7.15.4.4.2);
7) If the OPEN address frame PROTOCOL field is set to STP and the Reject STP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 7.15.4.4.2);
8) If the OPEN address frame PROTOCOL field is set to SSP and the Reject SSP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (SSP, Destination Opened) confirmation to the port layer (see 7.15.4.4.3);
9) If the OPEN address frame PROTOCOL field is set to SMP and the Reject SMP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (SMP, Destination Opened) confirmation to the port layer (see 7.15.4.4.3); or
10) If the OPEN address frame PROTOCOL field is set to STP and the Reject STP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (STP, Destination Opened) confirmation to the port layer (see 7.15.4.4.3).

If this state sends a Transmit OPEN_REJECT message to the SL transmitter, then it shall also send an Inbound Connection Rejected confirmation to the port layer.

NOTE 64 - Possible livelock scenarios occur if the BREAK_REPLY method of responding to BREAK primitive sequences is disabled and a SAS logical phy transmits BREAK to abort a connection request (e.g., if its Open Timeout timer expires). SAS logical phys should respond to OPEN Address frames faster than 1 ms to reduce susceptibility to this problem.

7.15.4.4.2 Transition SL_CC2:Selected to SL_CC0:Idle

This transition shall occur after sending a Transmit OPEN_REJECT message to the SL transmitter.

7.15.4.4.3 Transition SL_CC2:Selected to SL_CC3:Connected

This transition shall occur after sending a Connection Opened confirmation.

This transition shall include:

a) an Open SSP Connection, Open STP Connection, or Open SMP Connection argument based on the requested protocol; and
b) the received OPEN address frame.

Page: 374

Author: George Penokie Subject: Highlight Date: 8/12/2008 11:06:30 AM
confirmation to the port layer.

7.15.4.4.4 Transition SL_CC2:Selected to SL_CC5:BreakWait

If the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall occur after receiving a NOTIFY Received (Power Loss Expected) message and shall include a Power Loss Expected argument.

7.15.4.4.5 Transition SL_CC2:Selected to SL_CC6:Break

This transition shall occur after a BREAK Received message is received.

7.15.4.5 SL_CC3:Connected state

7.15.4.5.1 State description

This state enables the SSP, STP, or SMP link layer state machine to transmit dwords during a connection. See 7.14 for details on rate matching during the connection.

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open SMP Connection, then this state shall send an Enable Disable SMP (Enable) message to the SMP link layer state machines (see 7.19.5).

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open SSP Connection, then this state shall send an Enable Disable SSP (Enable) message to the SSP link layer state machines (see 7.17.8).

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open STP Connection, then this state shall send an Enable Disable STP (Enable) message to the STP link layer state machines (see 7.18.8).

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter until the SSP, SMP, or STP link layer state machine starts transmitting.

A CLOSE Received message may be received at any time while in this state, but shall be ignored during SSP and SMP connections. If a CLOSE Received (Clear Affiliation) is received during an STP connection, then this state shall clear any affiliation (see 7.18.4).

If a Request Break message is received and a BREAK Received message has not been received, then this state shall send a Connection Closed (Break Requested) confirmation to the port layer.

If a BREAK Received message is received, then this state shall send send a Connection Closed (Break Received) confirmation to the port layer.

7.15.4.5.2 Transition SL_CC3:Connected to SL_CC4:DisconnectWait

This transition shall occur if a Request Close message is received.

7.15.4.5.3 Transition SL_CC3:Connected to SL_CC5:BreakWait

This transition shall occur:

a) after sending a Connection Closed (Break Requested) confirmation to the port layer; or
b) after a NOTIFY Received (Power Loss Expected) message is received, if the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port)

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall include a Power Loss Expected argument.

7.15.4.5.4 Transition SL_CC3:Connected to SL_CC6:Break

This transition shall occur after sending a Connection Closed (Break Received) confirmation to the port layer.

7.15.4.5.5 Transition SL_CC3:Connected to SL_CC7:CloseSTP

This transition shall occur if a CLOSE Received message is received during an STP connection.

Page: 375

Author: George Penokie Subject: Highlight Date: 8/11/2008 5:11:36 PM
This is not correct as there is no <<CLOSE Received (Clear Affiliation) >> defined anywhere. I believe this should be << CLOSE (Clear Affiliation) >> which is defined in section 7.18.4).

Author: George Penokie Subject: Highlight Date: 8/11/2008 5:12:53 PM
Missing period

Page: 376

Author: George Penokie Subject: Highlight Date: 8/11/2008 5:11:54 PM
This is not correct as there is no <<CLOSE Received (Clear Affiliation) >> defined anywhere. I believe this should be << CLOSE (Clear Affiliation) >> which is defined in section 7.18.4).

7.15.4.6 SL_CC4:DisconnectWait state

7.15.4.6.1 State description

This state closes the connection and releases all resources associated with the connection.

Upon entry into this state, this state shall:

1) send a Transmit CLOSE (Normal) message or Transmit CLOSE (Clear Affiliation) message to the SL transmitter (see 7.18.6); and
2) initialize and start the Close Timeout timer.

A CLOSE Received message may be received at any time while in this state. If a CLOSE Received (Clear Affiliation) is received during an STP connection, then this state shall clear any affiliation (see 7.18.4).

NOTE 65 - Possible livelock scenarios occur if the BREAK_REPLY method of responding to received BREAK primitive sequences is disabled and a SAS logical phy transmits BREAK to break a connection (e.g., if its Close Timeout timer expires). SAS logical phys should respond to CLOSE faster than 1 ms to reduce susceptibility to this problem.

7.15.4.6.2 Transition SL_CC4:DisconnectWait to SL_CC0:Idle

This transition shall occur after:

a) sending a Transmit CLOSE message to the SL transmitter;
b) receiving a CLOSE Received message; and
c) sending a Connection Closed (Normal) confirmation to the port layer.

7.15.4.6.3 Transition SL_CC4:DisconnectWait to SL_CC5:BreakWait

This transition shall occur if a NOTIFY Received (Power Loss Expected) message is received or if:

a) a BREAK Received message has not been received;
b) no CLOSE Received message is received in response to a Transmit CLOSE message before the Close Timeout timer expires; and
c) after sending a Connection Closed (Close Timeout) confirmation to the port layer.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall include a Power Loss Expected argument.

7.15.4.6.4 Transition SL_CC4:DisconnectWait to SL_CC6:Break

This transition shall occur after receiving a BREAK Received message and after sending a Connection Closed (Break Received) confirmation to the port layer.

7.15.4.7 SL_CC5:BreakWait state

7.15.4.7.1 State description

This state closes the connection if one is established and releases all resources associated with the connection.

Upon entry into this state, this state shall:

1) send a Transmit BREAK message to the SL transmitter; and
2) initialize and start the Break Timeout timer.

If this state:

a) is entered with a Power Loss Expected argument; or
b) receives a NOTIFY Received (Power Loss Expected) message and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port),

then this state shall send a Notify Received (Power Loss Expected) confirmation to the port layer.

Author: George Penokie Subject: Highlight Date: 8/12/2008 10:35:23 AM
This should be << DONE indicating additional >>

7.17.7 Closing an SSP connection

DONE shall be exchanged prior to closing an SSP connection (see 8.2.2.3.5). There are several versions of the DONE primitive indicating additional information about why the SSP connection is being closed:

a) DONE (NORMAL) specifies that the transmitter has no more SSP frames to transmit (i.e., normal completion);
b) DONE (CREDIT TIMEOUT) specifies that the transmitter still has SSP frames to transmit but did not receive an RRDY granting frame credit within 1 ms, or the transmitter has received a CREDIT_BLOCKED and has consumed all RRDYs received; and
c) DONE (ACK/NAK TIMEOUT) specifies that the transmitter transmitted an SSP frame but did not receive the corresponding ACK or NAK within 1 ms. As a result, the ACK/NAK count is not balanced and the transmitter is going to transmit a BREAK in 1 ms unless the recipient replies with DONE and the connection is closed.

If the transmitter has no more SSP frames to transmit and receives a CREDIT_BLOCKED, then it may transmit either DONE (NORMAL) or DONE (CREDIT TIMEOUT).

After transmitting DONE, the transmitting phy initializes and starts a 1 ms DONE Timeout timer (see 7.17.8.5).

After transmitting DONE, the transmitting phy shall not transmit any more SSP frames during this connection. However, the phy may transmit ACK, NAK, RRDY, and CREDIT_BLOCKED as needed after transmitting DONE if the other phy is still transmitting SSP frames in the reverse direction. Once an SSP phy has both transmitted and received DONE, it shall close the connection by transmitting CLOSE (NORMAL) (see 7.13.7).

Figure 196 shows the sequence for a closing an SSP connection.

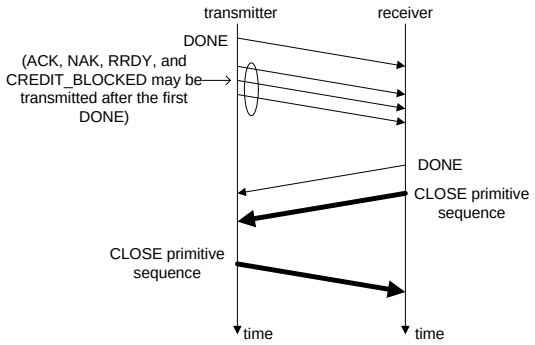

Figure 196 — Closing an SSP connection example

7.17.8 SSP (link layer for SSP phys) state machines

7.17.8.1 SSP state machines overview

The SSP link layer contains several state machines that run in parallel to control the flow of dwords on the physical link during an SSP connection. The SSP state machines are as follows:

a) SSP_TIM (transmit interlocked frame monitor) state machine (see 7.17.8.3);
b) SSP_TCM (transmit frame credit monitor) state machine (see 7.17.8.4);
c) SSP_D (DONE control) state machine (see 7.17.8.5);
d) SSP_TF (transmit frame control) state machine (see 7.17.8.6);
e) SSP_RF (receive frame control) state machine (see 7.17.8.7);
f) SSP_RCM (receive frame credit monitor) state machine (see 7.17.8.8);

If a DONE Received message, a Transmitted DONE (Normal) message, or a Transmitted DONE (Credit Timeout) message has not been received and an Rx Credit Status (Extended) message or an Rx Credit Control (Blocked) message has been received, then this state shall initialize and start the DONE Timeout timer after receiving a Transmitted DONE (Normal) message or a Transmitted DONE (Credit Timeout) message.

If a DONE Received message has not been received and a Transmitted DONE (Normal) message or a Transmitted DONE (Credit Timeout) message has been received, then this state machine shall initialize and start the DONE Timeout timer each time:

a) a Rx Credit Status (Extended) message is received; or
b) a Rx Credit Control (Blocked) message is received.

If a Transmitted DONE (Normal) message or a Transmitted DONE (Credit Timeout) message has been received, then the DONE Timeout timer shall be reinitialized each time an EOF Received message is received.

If a Transmitted DONE (Normal) message or a Transmitted DONE (Credit Timeout) message has been received, then the DONE Timeout timer shall be stopped after:

a) an Rx Credit Status (Exhausted) message is received; and
b) an Rx Credit Control (Blocked) message has not been received.

NOTE 72 - Stopping the timer ensures that, if credit remains exhausted long enough that the Credit Timeout timer of the other phy in the connection expires, the other phy is able to transmit a DONE (CREDIT TIMEOUT).

If a DONE Received message has not been received and a Transmitted DONE (ACK/NAK Timeout) message has been received, then:

a) this state machine shall initialize and start the DONE Timeout timer; and
b) this state shall not reinitialize the DONE Timeout timer if an EOF Received message is received.

If a DONE Received message is received before the DONE Timeout timer expires, then this state machine shall send a Request Close message to the SL_CC state machine and all the SSP state machines.

If a DONE Received message is not received before the DONE Timeout timer expires, then this state machine shall send a Request Break message to the SL_CC state machine and all the SSP state machines.

Any time a DONE Received message is received, this state machine shall send a DONE Received confirmation to the port layer. A DONE Received (ACK/NAK Timeout) confirmation informs the port layer that the SSP transmitter is going to close the connection within 1 ms; other DONE Received confirmations (e.g., DONE Received (Close Connection) and DONE Received (Credit Timeout)) may be used by the SCSI application layer to decide when to reuse initiator port transfer tags.

NOTE 73 - The DONE Timeout timer in one phy (e.g., phy A) may expire concurrently with the ACK/NAK Timeout timer in the other phy (e.g., phy B) in a connection.

For example, if phy A receives DONE (NORMAL) indicating phy B has no more frames to transmit, and phy A then transmits a series of non-interlocked frames where one or more of the SOFs is corrupted, then phy A waits to receive all the ACKs and/or NAKs after transmitting the series of non-interlocked frames. However, since phy B did not receive the full number of SOFs, it does not transmit as many ACKs and/or NAKs as phy A is expecting. The ACK/NAK Timeout timer in phy A expires and phy A transmits DONE (ACK/NAK TIMEOUT). Meanwhile, despite having transmitted DONE, phy B stops receiving frames while phy A is waiting for the final ACKs and/or NAKs. Since phy B does not receive DONE or any more frames, its DONE Timeout timer expires and phy B transmits BREAK.

Since the timers may expire at slightly different times (e.g., due to timer resolution differences), the DONE (ACK/NAK TIMEOUT) may be transmitted before, concurrently with, or after the BREAK. Nevertheless, the phys handle the link layer error (i.e., the ACK/NAK timeout or the DONE timeout) the same way (see 9.2.4.5 and 9.2.4.6).

Page: 403

Author: George Penokie Subject: Highlight Date: 8/26/2008 12:59:02 PM
This is the only place << DONE Received (Close Connection) >> is located. I believe it should be << DONE (Normal) >> or just deleted.

7.19.5.3.3 SMP_IP2:Transmit_Frame state

7.19.5.3.3.1 State description

This state shall send a Transmit Frame message to the SMP transmitter with an argument containing the frame contents.

If an SMP Transmit Break request is received, then this state shall send a Request Break message to the SL state machines (see 7.15) and terminate.

After the Frame Transmitted message is received, this state shall send a Frame Transmitted confirmation to the port layer.

7.19.5.3.3.2 Transition SMP_IP2:Transmit_Frame to SMP_IP3:Receive_Frame

This transition shall occur after sending a Frame Transmitted confirmation to the port layer.

7.19.5.3.4 SMP_IP3:Receive_Frame state

This state checks the SMP response frame and determines if the SMP response frame was successfully received (e.g., no CRC error).

If this state receives a subsequent SOF Received message after receiving an SOF Received message but before receiving an EOF Received message (i.e., SOF, data dwords, SOF, data dwords, and EOF instead of SOF, data dwords, EOF, SOF, data dwords, and EOF), then this state shall discard the Data Dword Received messages received before the subsequent SOF Received message.

This state shall discard the frame, send a Frame Received (SMP Failure) confirmation to the port layer, send a Request Break message to the SL state machines, and terminate the state machine if:

a) this state receives more than 257 Data Dword Received messages (i.e., 1 028 bytes) after an SOF Received message and before an EOF Received message; or

NOTE 80 - SMP target phys compliant with previous versions of the standard may send vendor-specific SMP frames containing 258 data dwords (i.e., 1 032 bytes).

b) this state receives fewer than 2 Data Dword Received messages (i.e., 8 bytes) after an SOF Received message and before an EOF Received message.

If this state receives an Invalid Dword Received message or an ERROR Received message after an SOF Received message and before an EOF Received message, then this state machine shall either:

a) ignore the invalid dword or ERROR; or
b) discard the frame, send a Frame Received (SMP Failure) confirmation to the port layer, send a Request Break message to the SL state machines, and terminate the state machine.

If the SMP response frame is received with a CRC error, then this state shall discard the frame, send a Frame Received (SMP Failure) confirmation to the port layer, send a Request Break message to the SL state machines, and terminate the state machine.

If the SMP response frame is received with no CRC error and the SMP response frame is valid, then this state shall:

a) send a Frame Received confirmation to the port layer; and
b) send a Request Close message to the SL state machines (see 7.15).

If an SMP Transmit Break request is received, then this state shall send a Request Break message to the SL state machines and this state machine shall terminate.

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SMP transmitter.

Page: 423

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:35:19 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:35:53 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:36:06 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:56:39 PM
In many cases the Frame Received confirmation has an argument.(e.g., ACK/NAK Balance, ACK/NAK Not Balance, SMP Failure) as a result the statement << Frame Received confirmation >> implies all those arguments. That is clearly not the case here or in many other places that use Frame Received confirmation. In most cases this is a << normal >> frame received. I have marked all the cases were I believe << Frame Received confirmation >> should be << Frame Received (normal) confirmation >>.

If this state receives a subsequent SOF Received message after receiving an SOF Received message but before receiving an EOF Received message (i.e., SOF, data dwords, SOF, data dwords, and EOF instead of SOF, data dwords, EOF, SOF, data dwords, and EOF), then this state shall discard the Data Dword Received messages received before the subsequent SOF Received message.

This state shall discard the frame, send a Request Break message to the SL state machines (see 7.15) and shall terminate the state machine if:

a) this state receives more than 257 Data Dword Received messages (i.e., 1 028 bytes) after an SOF Received message and before an EOF Received message; or

NOTE 81 - SMP initiator phys compliant with previous versions of the standard may send vendor specific SMP frames containing 258 data dwords (i.e., 1 032 bytes).

b) this state receives fewer than 2 Data Dword Received messages (i.e., 8 bytes) after an SOF Received message and before an EOF Received message.

If this state receives an Invalid Dword Received message or an ERROR Received message after an SOF Received message and before an EOF Received message, then this state machine shall either:

a) ignore the invalid dword or ERROR; or
b) discard the frame, send a Request Break message to the SL state machines (see 7.15) and shall terminate the state machine.

If the SMP request frame is received with a CRC error, then this state shall discard the frame, send a Request Break message to the SL state machines (see 7.15) and shall terminate the state machine.

Otherwise, this state shall send a Frame Received confirmation to the port layer.

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SMP transmitter.

7.19.5.4.2.2 Transition SMP_TP1:Receive_Frame to SMP_TP2:Transmit_Frame

This transition shall occur after sending a Frame Received confirmation to the port layer.

7.19.5.4.3 SMP_TP2:Transmit_Frame state

If this state receives an SMP Transmit Break request, then this state shall send a Request Break message to the SL state machines and terminate.

If this state receives a Tx Frame request, then this state shall send a Transmit Frame message to the SMP transmitter with an argument containing the frame contents, then wait for a Frame Transmitted message. After receiving a Frame Transmitted message, this state shall send a Frame Transmitted confirmation to the port layer, send a Request Close message to the SL state machines (see 7.15) and terminate.

After sending Transmit Frame message to the SMP transmitter, this state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SMP transmitter.

Page: 425

Author: George Penokie Subject: Sticky Note Date: 8/25/2008 2:42:58 PM
There is no need to specify that the state machine is terminated after a Break message as SL:Idle will send a Enable Disable SMP (Disable) message that terminates this state machine. As a result all the << terminate >> statements could be removed from the SMP_TP1 and SMP_TP2 states.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:36:15 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:36:27 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:36:38 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/12/2008 4:40:55 PM
Frame Received (normal) confirmation

Author: George Penokie Subject: Highlight Date: 8/12/2008 4:41:18 PM
Frame Received (normal) confirmation

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:37:04 PM
This would be clearer if stated as << terminate this state machine >>.

Author: George Penokie Subject: Highlight Date: 8/25/2008 2:37:27 PM
This would be clearer if stated as << terminate this state machine >>.

If this state receives a Notify Received (Power Loss Expected) confirmation, then this state shall send a Notify Received (Power Loss Expected) confirmation to the transport layer.

If this state receives an ~~Accept_Reject Opens request~~, then this state shall send an Accept_Reject Opens request to all link layers in the port.

If this state receives a Transmit Frame request, then this state shall send a Transmission Status (No Phys In Port) confirmation to the transport layer.

If an I_T Nexus Loss timer expires for a destination SAS address, then this state shall perform the following:

a) delete the I_T Nexus Loss timer for the SAS address;
b) send a Transmission Status (I_T Nexus Loss) confirmation for each pending Tx Frame message for the SAS address; and
c) discard each pending Tx Frame message for the SAS address and any corresponding pending Tx Open messages.

If the port is an STP target port or an STP initiator port, then the port shall handle all pending commands as described in 4.5.

8.2.2.2.2 Transition PL_OC1:Idle to PL_OC2:Overall_Control

This transition shall occur after a Phy Enabled confirmation is received for at least one phy assigned to the port.

8.2.2.3 PL_OC2:Overall_Control state

8.2.2.3.1 PL_OC2:Overall_Control state overview

This state may receive Transmit Frame requests from the transport layers (i.e., SSP and SMP) and Retry frame messages from PL_PM state machines. This state shall create a pending Tx Frame message for each received Transmit Frame request and Retry Frame message. There may be more than one pending Tx Frame message at a time for each SSP transport layer. There shall be only one pending Tx Frame message at a time for each SMP transport layer.

This state selects PL_PM state machines through which connections are established. This state shall only attempt to establish connections through PL_PM state machines whose phys are enabled. In a vendor-specific manner, this state selects PL_PM state machines on which connections are established to transmit frames. This state shall receive a response to a message from a PL_PM state machine before sending another message to that PL_PM state machine.

This state also:

a) receives connection management requests from the transport layers;
b) sends connection management messages to PL_PM state machines;
c) receives connection management messages from PL_PM state machines; and
d) sends connection management confirmations to the transport layers.

After receiving a Transmit Frame request for a destination SAS address for which there is no connection established and for which no I_T Nexus Loss timer has been created, this state shall create an I_T Nexus Loss timer for that SAS address if:

a) the protocol is SSP, the port is an SSP target port, the Protocol-Specific Port mode page is implemented, and the I_T NEXUS LOSS TIME field in the Protocol-Specific Port mode page (see 10.2.7.4) is not set to 0000h;
b) the protocol is STP, the port is an STP target port, and the STP SMP I_T NEXUS LOSS TIME field in the SMP CONFIGURE GENERAL function is not set to 0000h; or
c) the protocol is SMP, the port is an SMP initiator port, and the STP SMP I_T NEXUS LOSS TIME field in the SMP CONFIGURE GENERAL function is not set to 0000h.

This state may create an I_T Nexus Loss timer for that SAS address if:

a) the protocol is SSP and the port is an SSP initiator port; or;
b) the protocol is STP and the port is an STP initiator port.

Page: 431

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:45:23 PM
Should be << request to all link layers in the port. The request shall include the arguments received with the request. >>

When this state creates an I_T Nexus Loss timer it shall:

1) initialize the I_T Nexus Loss timer as specified in table 159 (see 8.2.2.1); and
2) not start the I_T Nexus Loss timer.

If this state machine is in an SSP initiator port, then this state may create an I_T Nexus Loss timer for the SAS address. If a state machine in an SSP initiator port creates an I_T Nexus Loss timer, then the state machine should use the value in the I_T NEXUS LOSS TIME field in the Protocol-Specific Port mode page for the SSP target port (see 10.2.7.4) as the initial value for its I_T Nexus Loss timer.

If there are no pending Tx Frame messages for a destination SAS address and an I_T Nexus Loss timer has been created for that destination SAS address, then this state shall delete the I_T Nexus Loss timer for that destination SAS address.

If this state receives a HARD_RESET Received confirmation, then this state shall:

a) discard all pending Tx Frame messages;
b) discard all pending Tx Open messages;
c) delete all timers (e.g., I_T Nexus Loss timers, Arbitration Wait Time timers, and Reject To Open Limit timers); and
d) send a HARD_RESET Received confirmation to the transport layer.

If this state receives a Notify Received (Power Loss Expected) confirmation, then this state shall:

a) discard all pending Tx Frame messages;
b) discard all pending Tx Open messages;
c) delete all timers (e.g., I_T Nexus Loss timers, Arbitration Wait Time timers, and Reject To Open Limit timers);
d) send a Close Connection message to each of the PL_PM state machines;
e) send a Cancel Open message to each of the PL_PM state machines; and
f) send a Notify Received (Power Loss Expected) confirmation to the transport layer.

8.2.2.3.2 PL_OC2:Overall_Control state establishing connections

This state receives Phy Enabled confirmations indicating when a phy is available.

This state receives Retry Open messages from a PL_PM state machine.

This state creates pending Tx Open messages based on pending Tx Frame messages and Retry Open messages. Pending Tx Open messages are sent to a PL_PM state machine as Tx Open messages.

If this state receives a Retry Open (Retry) message, then this state shall process the Retry Open message.

If this state receives a Retry Open (No Destination), or a Retry Open (Open Timeout Occurred) message and an I_T Nexus Loss timer has not been created for the destination SAS address (e.g., an SSP target port does not support the I_T NEXUS LOSS TIME field in the Protocol-Specific Port mode page or the field is set to 0000h), then this state shall process the Retry Open message as either a Retry Open message or an Unable To Connect message. This selection is vendor-specific.

If this state receives a Retry Open (Pathway Blocked) message and an I_T Nexus Loss timer has not been created for the destination SAS address, then this state shall process the Retry Open message.

If this state receives a Retry Open (No Destination), Retry Open (Open Timeout Occurred), or Retry Open (Pathway Blocked) message, and an I_T Nexus Loss timer has been created for the destination SAS address with an initial value of FFFFh, then this state shall process the Retry Open message (i.e., the Retry Open message is never processed as an Unable to Connect message).

If this state receives a Retry Open (No Destination) or a Retry Open (Open Timeout Occurred) message, an I_T Nexus Loss timer has been created for the destination SAS address, and there is no connection established with the destination SAS address, then this state shall check the I_T Nexus Loss timer, and:

a) if the I_T Nexus Loss timer is not running, the I_T nexus loss time is not set to FFFFh, and the CONFIGURING bit is set to zero in the REPORT GENERAL response (see 10.4.3.4) for each expander device between this port and the destination port that is two or more levels away from this port, then this state shall start the timer;

Page: 432

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:48:41 PM
This should be << Retry Open (No Destination) message >>

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:42:34 PM
This should be << Retry Open (No Destination) message, Retry Open (Open Timeout Occurred) message >>

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:48:26 PM
This should be << Retry Open (No Destination) message >>

Page: 433

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:47:59 PM
This should be << Retry Open (No Destination) message >>

NOTE 82 - The port layer may require assistance from the management application layer to determine the values of the CONFIGURING bits; this interaction is not specified by this standard. Consequently, the I_T Nexus Loss timer may not start immediately after this state receives a Retry Open (No Destination) or a Retry Open (Open Timeout Occurred) message.

b) if the I_T Nexus Loss timer is not running and the I_T nexus loss time is not set to FFFFh, then this state shall start the timer;
c) if the I_T Nexus Loss timer is running, then this state shall not stop the timer; and
d) if the I_T Nexus Loss timer has expired, then this state shall process the Retry Open message as if it were an Unable To Connect message (see 8.2.2.3.4).

If this state receives a Retry Open (Pathway Blocked) message, an I_T Nexus Loss timer has been created for the destination SAS address, and there is no connection established with the destination SAS address, then this state shall check the I_T Nexus Loss timer, and:

a) if the I_T Nexus Loss timer is running, then this state shall not stop the timer; and
b) if the I_T Nexus Loss timer has expired, then this state shall process the Retry Open message as if it were an Unable To Connect message (see 8.2.2.3.4).

If this state receives a Retry Open (Retry) message and an I_T Nexus Loss timer is running for the destination SAS address, then this state shall:

a) stop the I_T Nexus Loss timer (if the timer has been running); and
b) initialize the I_T Nexus Loss timer.

This state shall create a pending Tx Open message if:

a) this state has a pending Tx Frame message or has received a Retry Open message;
b) this state has fewer pending Tx Open messages than the number of PL_PM state machines (i.e., the number of phys in the port);
c) there is no pending Tx Open message for the destination SAS address; and
d) there is no connection established with the destination SAS address.

This state may create a pending Tx Open message if:

a) this state has a pending Tx Frame message, or this state has received a Retry Open message and has not processed the message by sending a confirmation; and
b) this state has fewer pending Tx Open messages than the number of PL_PM state machines.

This state shall have no more pending Tx Open messages than the number of PL_PM state machines.

If this state receives a Retry Open message and there are pending Tx Frame messages for which pending Tx Open messages have not been created, then this state should create a pending Tx Open message from the Retry Open message.

If this state does not create a pending Tx Open message from a Retry Open message (e.g., the current number of pending Tx Open messages equals the number of phys), then this state shall discard the Retry Open message. This state may create a new pending Tx Open message at a later time for the pending Tx Frame message that resulted in the Retry Open message.

If this state receives a Retry Open (Opened By Destination) message and the initiator port bit and protocol arguments match those in the Tx Open messages that resulted in the Retry Open message, then this state may discard the Retry Open message and use the established connection to send pending Tx Frame messages as Tx Frame messages to the destination SAS address. If this state receives a Retry Open (Opened By Destination) message and state has a pending Tx Open slot available, then this state may create a pending Tx Open message from the Retry Open message.

NOTE 83 - If a connection is established by another port as indicated by a Retry Open (Opened By Destination) message, credit may not be granted for frame transmission. In this case this state may create a pending Tx Open message from a Retry Open message in order to establish a connection where credit is granted.

This state shall send a pending Tx Open message as a Tx Open message to a PL_PM state machine that has an enabled phy and does not have a connection established. If there is more than one pending Tx Open

If a pending Tx Open message was created as the result this state receiving a Retry Open (Pathway Blocked) message, then:

a) if the Retry Open message pathway blocked count argument is FFh, then this state shall set the Tx Open pathway blocked count argument to FFh; or
b) if the Retry Open pathway blocked count argument is less than FFh, then this state shall set the Tx Open pathway blocked count argument to the Retry Open pathway blocked count argument plus 01h.

If a pending Tx Open message was created as the result of this state receiving one of the following:

a) a Retry Open (Opened By Destination) message;
b) a Retry Open (Opened By Other) message;
c) a Retry Open (Collided) message;
d) a Retry Open (Pathway Blocked) message; or
e) if the CONTINUE AWT bit is set to one in the Protocol-specific Port mode page (see 10.2.7.4), then a Retry Open (Retry) message,

then this state shall set the arbitration wait time argument in the Tx Open message to be the value from the Arbitration Wait Time timer created as a result of the Retry Open message.

After this state sends a Tx Open message, this state shall discard the pending Tx Open message from which the Tx Open message was created. After this state discards a pending Tx Open message, this state may create a new pending Tx Open message.

If this state receives a Connection Opened message and the initiator port bit and protocol arguments match those in a pending Tx Open message, then any Reject To Open Limit timer associated with that pending Tx Open message shall be discarded.

If this state receives a Connection Opened message and the initiator port bit and protocol arguments match those in any pending Tx Frame messages, then this state may use the established connection to send pending Tx Frame messages as Tx Frame messages to the destination SAS address.

8.2.2.3.3 PL_OC2:Overall_Control state connection established

If this state receives a Connection Opened message or a Retry Open (Opened By Destination) message for a SAS address, and an I_T Nexus Loss timer has been created for the SAS address, then this state shall:

a) if the I_T Nexus Loss timer for the SAS address has been running, then stop the timer; and
b) initialize the I_T Nexus Loss timer.

8.2.2.3.4 PL_OC2:Overall_Control state unable to establish a connection

If this state receives a Retry Open (No Destination), Retry Open (Open Timeout Occurred), or Retry Open (Pathway Blocked) message and the I_T Nexus Loss timer for the SAS address has expired, then this state shall perform the following:

a) delete the I_T Nexus Loss timer for the SAS address;
b) discard the Retry Open message;
c) send a Transmission Status (I_T Nexus Loss) confirmation for the pending Tx Frame message from which the Retry Open message resulted;
d) discard the pending Tx Frame message from which the Retry Open message resulted;
e) if this state has any pending Tx Frame messages with the same destination SAS address and protocol as the Retry Open message, and this state has not sent a Tx Open message to a PL_PM state machine for the messages, then this state shall send a Transmission Status (I_T Nexus Loss) confirmation for each pending Tx Frame message and discard the pending Tx Frame messages and any corresponding pending Tx Open messages; and
f) if this state has any pending Tx Frame messages with the same destination SAS address and protocol as the Retry Open message, and this state has sent a Tx Open message to a PL_PM state machine for a message, then this state shall send a Cancel Open message to each PL_PM state machine to which it has sent a Tx Open message. After receiving an Unable To Connect (Cancel Acknowledge) message from a PL_PM state machine in response to the Cancel Open message, then this state shall send a Transmission Status (I_T Nexus Loss) confirmation for each pending Tx Frame

Page: 435

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:43:50 PM
This should be << Retry Open (No Destination) message, Retry Open (Open Timeout Occurred) message >>

Author: George Penokie Subject: Highlight Date: 8/26/2008 11:40:36 AM
This message << Unable To Connect (Cancel Acknowledge) message >> does not exist. To fix this requires two steps:
1- Unable To Connect (Cancel Acknowledge) message to Unable To Connect (Arb Stopped) message
2- Change the term << Port Layer Request >> to << Arb Stopped >> as the only port layer request is current as a result of a stop arb request. This attempt to be generic has caused a cross connect between the cancel request and the stop arb request. If we need a new thing then we will define it as needed.

message and discard the pending Tx Frame messages and any corresponding pending Tx Open messages.

If this state receives a Retry Open (No Destination), Retry Open (Open Timeout Occurred), or Retry Open (Pathway Blocked) message and processes it as an Unable To Connect message, or this state receives an Unable To Connect message, then this state shall send a Transmission Status confirmation as defined in table 160.

Table 160 — Confirmations from Unable To Connect or Retry Open messages

Message received	Confirmation to be sent to transport layer
Retry Open (No Destination)	Transmission Status (I_T Nexus Loss) if the I_T Nexus Loss timer for the SAS address has expired, or Transmission Status (No Destination) if it has not
Retry Open (Open Timeout Occurred)	Transmission Status (I_T Nexus Loss) if the I_T Nexus Loss timer for the SAS address has expired, or Transmission Status (Open Timeout Occurred) if it has not
Retry Open (Pathway Blocked)	Transmission Status (I_T Nexus Loss) if the I_T Nexus Loss timer for the SAS address has expired
Unable To Connect (Break Received)	Transmission Status (Break Received)
~~Unable To Connect (Port Layer Request)~~	~~Transmission Status (Cancel Acknowledge)~~
Unable to Connect (Bad Destination)	Transmission Status (Bad Destination)
Unable To Connect (Connection Rate Not Supported)	Transmission Status (Connection Rate Not Supported)
Unable To Connect (Protocol Not Supported)	Transmission Status (Protocol Not Supported)
Unable To Connect (Reserved Abandon 1)	Transmission Status (Reserved Abandon 1)
Unable To Connect (Reserved Abandon 2)	Transmission Status (Reserved Abandon 2)
Unable To Connect (Reserved Abandon 3)	Transmission Status (Reserved Abandon 3)
Unable To Connect (STP Resources Busy)	Transmission Status (STP Resources Busy)
Unable To Connect (Wrong Destination)	Transmission Status (Wrong Destination)
Unable To Connect (Zone Violation)	Transmission Status (Zone Violation)

If this state receives an Unable To Connect (Connection Rate Not Supported), Unable To Connect (Protocol Not Supported), Unable To Connect (Zone Violation), Unable To Connect (Reserved Abandon 1), Unable To Connect (Reserved Abandon 2), Unable To Connect (Reserved Abandon 3), or Unable To Connect (STP Resources Busy) message and an I_T Nexus Loss timer is running for the SAS address, then this state shall:

a) stop the I_T Nexus Loss timer, if the timer has been running; and
b) initialize the I_T Nexus Loss timer.

This state shall discard the pending Tx Frame message for which the Transmission Status confirmation was sent.

8.2.2.3.5 PL_OC2:Overall_Control state connection management

If this state receives an Accept_Reject Opens request, then this state shall send an Accept_Reject Opens request to all phys in the port.

Page: 436

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:44:29 PM
This should be << Retry Open (No Destination) message, Retry Open (Open Timeout Occurred) message >>

Author: George Penokie Subject: Cross-Out Date: 8/26/2008 11:44:54 AM
As stated in the earlier comment: there is no relationship between the >> Unable To Connect (Port Layer Request)>> and the << Transmission Status (Cancel Acknowledge) >> so this row should just be deleted.

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:45:11 PM
Should be << request to all phys in the port. The request shall include the arguments received with the request. >>

g) pathway blocked count argument set to the value received with the Tx Open message; and
h) arbitration wait time set to the value of the Arbitration Wait Time timer.

An Unable To Connect message shall include the following arguments:

a) initiator connection tag set to the value received with the Tx Open message;
b) destination SAS address set to the value received with the Tx Open message; and
c) source SAS address set to the value received with the Tx Open message.

8.2.3.3.5 PL_PM2:Req_Wait connection management

If this state receives a Cancel Open message and a Connection Opened confirmation has not been received, then this state shall send a Stop Arb request to the link layer.

8.2.3.3.6 Transition PL_PM2:Req_Wait to PL_PM1:Idle

This transition shall occur after:

a) a Retry Open message is sent to the PL_OC state machine;
b) an Unable To Connect message is sent to the PL_OC state machine;
c) all operations have been terminated after a HARD_RESET Received confirmation is received; or
d) a Phy Disabled confirmation is received.

8.2.3.3.7 Transition PL_PM2:Req_Wait to PL_PM3:Connected

This transition shall occur after a Connection Opened confirmation is received.

8.2.3.3.8 Transition PL_PM2:Req_Wait to PL_PM4:Wait_For_Close

This transition shall occur after one of the following confirmations is received:

a) an Open Failed (Open Timeout Occurred);
b) an Open Failed (Break Received); or
c) an Open Failed (Port Layer Request).

8.2.3.4 PL_PM3:Connected state

8.2.3.4.1 PL_PM3:Connected state description

If this state was entered from the PL_PM1:Idle state, then this state shall send a Connection Opened message to the PL_OC state machine that includes as an argument the received OPEN address frame.

If:

a) the protocol for the connection is SSP, the port is an SSP target port, the Disconnect-Reconnect mode page is implemented, and the MAXIMUM CONNECT TIME LIMIT field in the Disconnect-Reconnect mode page (see 10.2.7.2) is not set to zero;
b) the protocol for the connection is SMP and the port is an SMP target port; or
c) the protocol for the connection is STP, the port is an STP target port, and the STP MAXIMUM CONNECT TIME LIMIT field is not set to zero in the SMP REPORT GENERAL response (see 10.4.3.4),

then, upon entry into this state, this state shall:

1) create a Maximum Connect Time Limit timer;
2) initialize the Maximum Connect Time Limit timer as specified in table 161 (see 8.2.3.1); and
3) start the Maximum Connect Time Limit timer.

If:

a) the protocol for the connection is SSP, the port is an SSP initiator port, and the MAXIMUM CONNECT TIME LIMIT field in the Disconnect-Reconnect mode page (see 10.2.7.2) for the destination SSP target port is not set to zero; or

Page: 445

Author: George Penokie Subject: Highlight Date: 8/26/2008 11:45:58 AM
Change << (Port Layer Request) >> to < (Arb Stopped) >>.

Page: 448

Author: George Penokie Subject: Highlight Date: 8/25/2008 4:46:25 PM
This should be << then this state shall send a Connection Closed confirmation to the transport layer including the argument received with the confirmation. >>

Author: George Penokie Subject: Highlight Date: 8/26/2008 11:46:12 AM
Change << (Port Layer Request) >> to < (Arb Stopped) >>.

If this state receives a Connection Closed (Normal) confirmation, a Connection Closed (Transition to Idle) confirmation, or a Phy Disabled confirmation after sending a Tx Frame request but before receiving a Frame Transmitted confirmation, then this state shall send a Retry Frame message to the PL_OC state machine.

If this state receives a Connection Closed confirmation during an SMP connection, then this state shall send a Connection Closed confirmation to the transport layer.

If this state receives a Credit Timeout confirmation, then this state shall send a Retry Frame message to the PL_OC state machine.

A Retry Frame message shall include the following arguments from the Tx Frame message:

a) initiator port bit;
b) protocol;
c) connection rate;
d) initiator connection tag;
e) destination SAS address;
f) source SAS address; and
g) frame.

After this state receives a DONE Received (Normal) or DONE Received (Credit Timeout) confirmation, if it does not receive a Tx Frame message within 1 ms, then this state shall send a Disable Tx Frames message to the PL_OC state machine.

If this state receives a DONE Received (ACK/NAK Timeout) or DONE Transmitted confirmation, then this state shall send a Disable Tx Frames message to the PL_OC state machine.

If this state receives an SMP Transmit Break message, then this state shall send an SMP Transmit Break request to the link layer.

If this state receives a HARD_RESET Received confirmation, then this state machine shall terminate all operations.

8.2.3.4.2 Transition PL_PM3:Connected to PL_PM1:Idle

This transition shall occur after:

a) a Connection Closed (Transition to Idle) message is sent to the PL_OC state machine; or
b) all operations are terminated after a HARD_RESET Received confirmation is received.

8.2.3.5 PL_PM4:Wait_For_Close state

8.2.3.5.1 PL_PM4:Wait_For_Close state description

After receiving a Connection Closed (Transition to Idle) confirmation, if this state was entered as the result of the PL_PM2:Req_Wait state receiving an Open Failed (Open Timeout Occurred) confirmation, then this state shall send a Retry Open (Open Timeout Occurred) message to the PL_OC state machine. The Retry Open message shall include the following arguments:

a) initiator port bit set to the value received with the Tx Open message;
b) protocol set to the value received with the Tx Open message;
c) connection rate set to the value received with the Tx Open message;
d) initiator connection tag set to the value received with the Tx Open message;
e) destination SAS address set to the value received with the Tx Open message;
f) source SAS address set to the value received with the Tx Open message;
g) pathway blocked count argument set to the value received with the Tx Open message; and
h) arbitration wait time set to the value of the Arbitration Wait Time timer.

If this state receives a Connection Closed confirmation and the connection request was for an SMP connection, then this state shall send a Connection Closed confirmation to the transport layer.

After receiving a Connection Closed (Transition to Idle) confirmation, if this state was entered after the PL_PM2:Req_Wait state received an Open Failed (Port Layer Request) confirmation (i.e., as the result of the

PL_PM2:Req_Wait state sending a Stop Arb request), then this state shall send an Unable to Connect (Port Layer Request) message to the PL_OC state machine.

Page: 449

Author: George Penokie Subject: Highlight Date: 8/26/2008 11:46:25 AM
Change << (Port Layer Request) >> to < (Arb Stopped) >>.

After receiving a Connection Closed (Transition to Idle) confirmation, if this state was entered as the result of the PL_PM2:Req_Wait state receiving an Open Failed (Break Received) confirmation, then this state shall send an Unable to Connect (Break Received) message to the PL_OC state machine.

The Unable To Connect message shall include the following arguments:

a) initiator connection tag set to the value received with the Tx Open message;
b) destination SAS address set to the value received with the Tx Open message; and
c) source SAS address set to the value received with the Tx Open message.

If this state receives a HARD_RESET Received confirmation, then this state shall terminate all operations.

8.2.3.5.2 Transition PL_PM4:Wait_For_Close to PL_PM1:Idle

This transition shall occur after:

a) a Retry Open or Unable To Connect message is sent to the PL_OC state machine; or
b) all operations are terminated after a HARD_RESET Received confirmation is received.

Page: 453

Author: George Penokie Subject: Highlight Date: 8/19/2008 11:47:17 AM
This << SSP target port does receives a non-zero value >> should be << SSP target port receives a non-zero value >>

Table 165 defines the TLR CONTROL field for COMMAND frames. The TLR CONTROL field is reserved for all other frame types.

Table 165 — TLR CONTROL field for COMMAND frames

Code [a]	Description
00b or 11b	The SSP target port shall use the TRANSPORT LAYER RETRIES bit in the Protocol-Specific Logical Unit mode page (see 10.2.7.3) to enable or disable transport layer retries for this command as follows: a) if the TRANSPORT LAYER RETRIES bit is set to one, then the SSP target port shall set the RETRY DATA FRAMES bit to one in any XFER_RDY frames that the SSP target port transmits for this command; or b) if the TRANSPORT LAYER RETRIES bit is set to zero, then the SSP target port shall set the RETRY DATA FRAMES bit to zero in any XFER_RDY frames that the SSP target port transmits for this command.
01b	The SSP target port may enable transport layer retries for this command. If the SSP target port enables transport layer retries, then it shall set the RETRY DATA FRAMES bit to one in any XFER_RDY frames that it transmits for this command. If the SSP target port does not enable transport layer retries, then it shall set the RETRY DATA FRAMES bit to zero in any XFER_RDY frames that it transmits for this command.
10b	The SSP target port shall: a) disable transport layer retries for this command; and b) set the RETRY DATA FRAMES bit to zero in any XFER_RDY frames that it transmits for this command.
[a] If the SSP target port does receives a non-zero value in the TLR CONTROL field and does not support non-zero values in the TLR CONTROL field, then it shall reply with a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to 02h (i.e., INVALID FRAME).	

If an SSP initiator port supports transport layer retries, then it shall set the TLR CONTROL field to 01b in each COMMAND frame that it sends unless it has determined that the I_T_L nexus does not support the TLR CONTROL field.

If an SSP initiator port does not support transport layer retries, then it shall set the TLR CONTROL field to 10b in each COMMAND frame that it sends unless it has determined that the I_T_L nexus does not support the TLR CONTROL field.

An SSP initiator port determines that an I_T_L nexus does not support the TLR CONTROL field if it sends a COMMAND frame with the TLR CONTROL field set to 01b or 10b and receives a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to 02h (i.e., INVALID FRAME). After determining that an I_T_L nexus does not support the TLR CONTROL field, the SSP initiator port shall set the TLR CONTROL field to 00b for subsequent COMMAND frames for that I_T_L nexus.

NOTE 85 - Initiator ports compliant with previous versions of this standard always set the TLR CONTROL field to 00b.

NOTE 86 - The TLR CONTROL SUPPORTED field in the Protocol-Specific Logical Unit Information VPD page (see 10.2.11.3) indicates if the SSP target port supports the TLR CONTROL field set to a non-zero value.

An SSP target port sets the RETRY DATA FRAMES bit in an XFER_RDY frame based on the TLR CONTROL field received in the COMMAND frame for the command (see table 165) and the TRANSPORT LAYER RETRIES bit in the Protocol-Specific Logical Unit mode page (see 10.2.7.3).

A RETRY DATA FRAMES bit set to one in an XFER_RDY frame specifies that the SSP initiator port shall enable transport layer retries for write DATA transfers related to this XFER_RDY.

shall discard the frame and send a Command Complete Received confirmation to the SCSI application layer with the Service Response argument set to Service Delivery or Target Failure. If the length of the information unit is not correct and the RESPONSE frame was for a task management function, then this state machine shall discard the frame and send a Received Task Management Function – Executed confirmation to the SCSI application layer with the Service Response argument set to Service Delivery or Target Failure.

If the frame type is correct relative to the Frame Received confirmation, then this state machine shall check the initiator port transfer tag. If the initiator port transfer tag does not specify a valid ST_ITS state machine, then this state machine shall discard the frame and may send a vendor-specific confirmation to the SCSI application layer to cause the command using that initiator port transfer tag to be aborted.

If the frame type is RESPONSE and this state machine has previously received a RESPONSE frame for the I_T_L_Q nexus, then this state machine shall discard the frame.

If the frame type is RESPONSE, the fields checked in the frame are correct, and this state machine has not previously received a RESPONSE frame for this I_T_L_Q nexus, then this state machine shall send a Return To Start message to the ST_ITS state machine for the specified initiator port transfer tag and:

a) if the RESPONSE frame was for a command, then this state machine shall send a Command Complete Received protocol service confirmation to the SCSI application layer with the arguments set as specified in table 202 (see 10.2.1.5); or
b) if the RESPONSE frame was for a task management request, then this state machine shall send a Received Task Management Function Executed protocol service confirmation to the SCSI application layer with the arguments set as specified in table 202 (see 10.2.1.5).

If the frame type is XFER_RDY and the fields checked in the frame are correct, then this state machine shall wait to receive an ACK Transmitted confirmation.

If this state machine receives an ACK Transmitted confirmation for an XFER_RDY frame, then it shall send an XFER_RDY Arrived message to the ST_ITS state machine specified by the initiator port transfer tag. The message shall include the following Xfer_Rdy arguments:

a) retry data frames;
b) retransmit bit;
c) target port transfer tag;
d) requested offset; and
e) write data length.

If the frame type is DATA and the fields checked in the frame are correct, then this state machine shall send a Data-In Arrived message to the ST_ITS state machine specified by the initiator port transfer tag. The message shall include the following Read Data arguments:

a) changing data pointer;
b) number of fill bytes;
c) data offset; and
d) data.

9.2.6.2.2.4 Processing Transmission Complete and Reception Complete messages

If this state machine receives a Transmission Complete (I_T Nexus Loss), then it shall send a Nexus Loss event notification to the SCSI application layer.

Page: 480

Author: George Penokie Subject: Highlight Date: 8/13/2008 10:38:28 AM
Transmission Complete (I_T Nexus Loss) message, then it

Table 177 defines the transport protocol service confirmation and Delivery Result argument generated as a result of receiving a Transmission Complete message or a Reception Complete message indicating that an error occurred during the transmission or reception of a frame.

Table 177 — Confirmations sent to the SCSI application layer if a frame transmission or reception error occurs

Message received from ST_ITS state machine	Protocol service confirmation and Delivery Result argument sent to the SCSI application layer
Transmission Complete (Command Failed, ACK/NAK Timeout)	Command Complete Received (Service Delivery or Target Failure - ACK/NAK Timeout)
Transmission Complete (Command Failed, NAK Received)	Command Complete Received (Service Delivery or Target Failure - NAK Received)
Transmission Complete (Command Failed, Connection Failed)	Command Complete Received (Service Delivery or Target Failure - Connection Failed)
Transmission Complete (Task Failed, ACK/NAK Timeout)	Received Task Management Function - Executed (Service Delivery or Target Failure - ACK/NAK Timeout)
Transmission Complete (Task Failed, NAK Received)	Received Task Management Function - Executed (Service Delivery or Target Failure - NAK Received)
Transmission Complete (Task Failed, Connection Failed)	Received Task Management Function - Executed (Service Delivery or Target Failure - Connection Failed)
Transmission Complete (XFER_RDY Incorrect Write Data Length)	Command Complete Received (Service Delivery or Target Failure - XFER_RDY Incorrect Write Data Length)
Transmission Complete (XFER_RDY Requested Offset Error)	Command Complete Received (Service Delivery or Target Failure - XFER_RDY Requested Offset Error)
Transmission Complete (Cancel Acknowledged)	Command Complete Received (Service Delivery or Target Failure - Cancel Acknowledged)
Reception Complete (Data Offset Error)	Command Complete Received (Service Delivery or Target Failure - DATA Offset Error)
Reception Complete (Too Much Read Data)	Command Complete Received (Service Delivery or Target Failure - DATA Too Much Read Data)
Reception Complete (Information Unit Too Short)	Command Complete Received (Service Delivery or Target Failure - DATA Information Unit Too Short)
Reception Complete (Command Failed, ACK/NAK Timeout)	Command Complete Received (Service Delivery or Target Failure - ACK/NAK Timeout)
Reception Complete (Cancel Acknowledged)	Command Complete Received (Service Delivery or Target Failure - Cancel Acknowledged)

The protocol service confirmation shall include the initiator port transfer tag as an argument.

9.2.6.2.2.5 Processing miscellaneous requests

If this state machine receives an Accept_Reject OPENs (Accept SSP) or Accept_Reject OPENs (Reject SSP) request, then this state machine shall send a corresponding Accept_Reject OPENs request to the port layer.

If this state machine receives a HARD_RESET Received confirmation, then this state machine shall send a Transport Reset event notification to the SCSI application layer.

Page: 481

Author: George Penokie Subject: Highlight Date: 8/25/2008 5:00:31 PM
There needs to be wording added to the application layer that states << a Command Complete Received (Service Delivery or Target Failure - Cancel Acknowledged) confirmation may be received as a vendor-specific request to Cancel a transfer. >>

Author: George Penokie Subject: Highlight Date: 8/25/2008 5:00:16 PM
There needs to be wording added to the application layer that states << a Command Complete Received (Service Delivery or Target Failure - Cancel Acknowledged) confirmation may be received as a vendor-specific request to Cancel a transfer. >>

This state machine may receive vendor-specific requests from the SCSI application layer that cause this state machine to send a Cancel message to an ST_ITS state machine.

Page: 482

Author: George Penokie Subject: Sticky Note Date: 8/26/2008 9:56:04 AM
There needs to be wording added to the application layer that states << a Command Complete Received (service delivery or target failure Cancel acknowledged) confirmation may be received as a vendor-specific request to Cancel a transfer. >> or some such wording.

9.2.6.2.3 ST_ITS (initiator transport server) state machine

9.2.6.2.3.1 ST_ITS state machine overview

The ST_ITS state machine performs the following functions:

a) receives and processes messages from the ST_IFR state machine;
b) sends messages to the ST_IFR state machine;
c) sends request to the port layer regarding frame transmission;
d) receives confirmations from the port layer regarding frame transmission; and
e) receives HARD_RESET Received confirmations from the port layer.

This state machine consists of the following states:

a) ST_ITS1:Initiator_Start state (see 9.2.6.2.3.2) (initial state);
b) ST_ITS2:Initiator_Send_Frame state (see 9.2.6.2.3.3);
c) ST_ITS3:Prepare_Command state (see 9.2.6.2.3.4);
d) ST_ITS4:Prepare_Task state (see 9.2.6.2.3.5);
e) ST_ITS5:Prepare_Data_Out state (see 9.2.6.2.3.6); and
f) ST_ITS6:Receive_Data_In state (see 9.2.6.2.3.7).

This state machine shall start in the ST_ITS1:Initiator_Start state after power on.

If this state machine receives a HARD_RESET Received confirmation, then this state machine shall transition to the ST_ITS1:Initiator_Start state.

This state machine shall maintain the state machine variables defined in table 178.

Table 178 — ST_ITS state machine variables

State machine variable	Description
Data-In Buffer Offset	Current offset in the application client's data-in buffer (i.e., the application client buffer for read data)
Data-Out Buffer Offset	Current offset in the application client's data-out buffer (i.e., the application client buffer for write data)
Previous Requested Offset	Offset in the application client's data-out buffer (i.e., the application client buffer for write data) from the last XFER_RDY frame received
Previous Write Data Length	Write data length from the last XFER_RDY frame received

DATA frame from the ST_ITS5:Prepare_Data_Out state and the following arguments to be used for any OPEN address frame:

a) initiator port bit set to one;
b) protocol set to SSP;
c) Connection Rate argument;
d) Initiator Connection Tag argument;
e) Destination SAS Address argument; and
f) Source SAS Address argument.

After sending a Transmit Frame request this state shall wait to receive a Transmission Status confirmation.

If the confirmation is Transmission Status (I_T Nexus Loss), then this state shall send a Transmission Complete (I_T Nexus Loss) message to the ST_IFR state machine. This Transmission Complete message shall include the initiator port transfer tag as an argument.

If the confirmation is not Transmission Status (Frame Transmitted) or Transmission Status (I_T Nexus Loss) (see table 160 in 8.2.2.3.4), and the Transmit Frame request was for a COMMAND frame or a DATA frame, then this state shall send a Transmission Complete (Command Failed, Connection Failed) message to the ST_IFR state machine. The message shall include the initiator port transfer tag.

If the confirmation is not Transmission Status (Frame Transmitted) or Transmission Status (I_T Nexus Loss) (see table 160 in 8.2.2.3.4), and the Transmit Frame request was for a TASK frame, then this state shall send a Transmission Complete (Task Failed, Connection Failed) message to the ST_IFR state machine. The message shall include the initiator port transfer tag.

If the confirmation is Transmission Status (Frame Transmitted), and the Transmit Frame request was for a COMMAND frame not requesting a read operation, a COMMAND frame not requesting a write operation, a TASK frame, or a write DATA frame where the number of data bytes that have been transmitted equal the Data-Out Buffer Size state machine argument, then this state shall wait to receive one of the following confirmations:

a) Transmission Status (ACK Received);
b) Transmission Status (NAK Received);
c) Transmission Status (ACK/NAK Timeout); or
d) Transmission Status (Connection Lost Without ACK/NAK).

If the confirmation is Transmission Status (Frame Transmitted), and the Transmit Frame request was for a COMMAND frame requesting a write operation, or a write DATA frame where the number of data bytes that have been transmitted is less than the Data-Out Buffer Size state machine argument and the write data length from the previous XFER_RDY frame, then this state shall wait to receive one of the following confirmations:

a) Transmission Status (ACK Received);
b) Transmission Status (NAK Received);
c) Transmission Status (ACK/NAK Timeout);
d) Transmission Status (Connection Lost Without ACK/NAK); or
e) XFER_RDY Arrived message.

If a XFER_RDY Arrived message is received, then the ST_ITS shall respond to the XFER_RDY frame as if a Transmission Status (ACK Received) was received.

NOTE 90 - If the number of data bytes requested to be transmitted for the Send SCSI Command protocol service request are fewer than the number of bytes in the service request, then this state may send additional Transmit Frame requests for write DATA frames for the protocol service request before receiving a Transmission Status (ACK Received), Transmission Status (NAK Received), Transmission Status (ACK/NAK Timeout), or Transmission Status (Connection Lost Without ACK/NAK) confirmation for Transmit Frame requests for previous write DATA frames sent for the I_T_L_Q nexus.

After a Transmission Status (Frame Transmitted) is received, if a confirmation of Transmission Status (NAK Received) is received, the Transmit Frame request was for a COMMAND frame, and the vendor-specific number of retries has not been reached, then this state shall send a Transmit Frame (interlocked) request to the port layer (i.e., the last COMMAND frame is retransmitted).

Page: 484

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:34:35 PM
After the state does this << then this state shall send a Transmission Complete (Command Failed, Connection Failed) message to the ST_IFR state machine >> then what. The state machine seems to be stuck in this state as there is no provision to transition to another state when this occurs. See the ST_ITS2 to ST_ITS1 transition section for suggested fix.

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:34:44 PM
After the state does this << then this state shall send a Transmission Complete (Task Failed, Connection Failed) message to the ST_IFR state machine >> then what. The state machine seems to be stuck in this state as there is no provision to transition to another state when this occurs. See the ST_ITS2 to ST_ITS1 transition section for suggested fix.

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:37:48 PM
This is messed up because there is a mix of confirmations and messages in the list. The confirmation should be deleted and added to each of the items that are confirmations which is everything except the XFER_RDY message.

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:02:16 AM
Transmission Status (ACK Received) confirmation was received

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:03:23 AM
Transmission Status (Frame Transmitted) confirmation is received

After a ~~Transmission Status (Frame Transmitted) is received~~, if a confirmation of Transmission Status (NAK Received) is received, the Transmit Frame request was for a TASK frame, and the ~~vendor-specific number of~~ retries has not been reached, then this state shall send a Transmit Frame (interlocked) request to the port layer (i.e., the last TASK frame is retransmitted).

Table 180 defines the messages that this state shall send to the ST_IFR state machine upon receipt of the listed confirmations, based on the conditions under which each confirmation was received.

Table 180 — Messages sent to the ST_IFR state machine

Confirmation received from the port layer	Conditions under which confirmation was received	Message sent to ST_IFR state machine
Transmission Status (ACK/NAK Timeout) or Transmission Status (Connection Lost Without ACK/NAK)	The Transmit Frame request was for a COMMAND frame.	Transmission Complete (Command Failed, ACK/ NAK Timeout)
	The Transmit Frame request was for a TASK frame.	Transmission Complete (Task Failed, ACK/NAK Timeout)
Transmission Status (NAK Received)	The Transmit Frame request was for a COMMAND frame and the vendor-specific number of retries has been reached.	Transmission Complete (Command Failed, NAK Received)
	The Transmit Frame request was for a TASK frame and the vendor-specific number of retries has been reached.	Transmission Complete (Task Failed, NAK Received)
Transmission Status (NAK Received)	The Transmit Frame request was for a write DATA frame and: a) the RETRY DATA FRAMES bit was set to zero in the XFER_RDY frame requesting the data; or b) the RETRY DATA FRAMES bit was set to one in the XFER_RDY frame requesting the data, and the vendor-specific number of retries has been reached.	Transmission Complete (Data-Out Failed, NAK Received)
Transmission Status (ACK/NAK Timeout) or Transmission Status (Connection Lost Without ACK/NAK)		Transmission Complete (Data-Out Failed, ACK/ NAK Timeout)

After this state sends a Transmission Complete (Command Failed, ACK/NAK Timeout) this state shall continue processing messages and confirmations.

NOTE 91 - The application client may determine the command was received and is being processed by the device server and allow the command to complete. The application client may accomplish this by the use of the QUERY TASK task management request.

If this state receives a Return to Start message or a Return to Start argument, and this state has not received confirmations for all Transmit Frame requests sent to the port layer, then this state shall send a Cancel request to the port layer. This state may also send a Cancel request to the port layer to cancel a previous Transmit Frame request.

If this state receives a Cancel message or a Cancel argument, and this state has received confirmations for all Transmit Frame requests sent to the port layer, then this state shall send a Transmission Complete (Cancel Acknowledged) message to the ST_IFR state machine.

If this state receives a Cancel message or a Cancel argument, and this state has not received confirmations for all Transmit Frame requests sent to the port layer, then this state shall send a Cancel request to the port layer. This state may also send a Cancel request to the port layer to cancel a previous Transmit Frame request. The Cancel request shall include the following arguments:

a) destination SAS address; and

Page: 485

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:04:06 AM
Transmission Status (Frame Transmitted) confirmation is received

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:05:15 AM
Transmission Complete (Command Failed, ACK/NAK Timeout) message this state shall

Page: 487

Author: George Penokie Subject: Highlight Date: 8/26/2008 1:37:57 PM
Add to this list the following (see comment above for reason):
J) Transmission Complete (Command Failed, Connection Failed) message; or
K) Transmission Complete (Task Failed, Connection Failed) message;

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:36:04 PM
Status (ACK Received) confirmation for a COMMAND

9.2.6.2.3.3.1 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS1:Initiator_Start

This transition shall occur after:

a) this state has sent one of the following to the ST_IFR state machine:
   A) a Transmission Complete (Command Failed, NAK Received) message;
   B) a Transmission Complete (Task Failed, ACK/NAK Timeout) message;
   C) a Transmission Complete (Task Failed, NAK Received) message;
   D) a Transmission Complete (Command Failed, ACK/NAK Timeout) message and the command was for a non-data operation;
   E) a Transmission Complete (Data-Out Failed, NAK Received) message;
   F) a Transmission Complete (Data-Out Failed, ACK/NAK Timeout) message;
   G) a Transmission Complete (XFER_RDY Incorrect Write Data Length) message;
   H) a Transmission Complete (XFER_RDY Requested Offset Error) message; or
   I) a Transmission Complete (Cancel Acknowledged) message;

or

b) this state has received a Return To Start message or Return To Start argument, and has received:
   A) confirmations for all Transmit Frame requests sent to the port layer; or
   B) a Transmission Status (Cancel Acknowledged) confirmation.

9.2.6.2.3.3.2 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS5:Prepare_Data_Out

If first burst is enabled, then this transition shall occur and include the First Burst argument after receiving:

a) a Transmission Status (Frame Transmitted) confirmation followed by a Transmission Status (ACK Received) for a COMMAND frame requesting a write operation; or
b) a Transmission Status (Frame Transmitted) confirmation for a Transmit Frame (Non-interlocked) request if the Data-Out Buffer Offset state machine variable is less than the first burst size.

This transition shall occur after receiving:

a) an XFER_RDY Arrived message; or
b) a Transmission Status (Frame Transmitted) confirmation for a Transmit Frame (Non-interlocked) request if the Data-Out Buffer Offset state machine variable is less than the Requested Offset Xfer_Rdy state machine argument plus the Write Data Length Xfer_Rdy state machine argument.

NOTE 93 - This transition occurs even if this state has not received a Transmission Status (ACK Received) for the write DATA frame.

This transition shall include a Retry argument and occur after:

a) this state receives one of the following confirmations or arguments for a write DATA frame:
   A) Transmission Status (NAK Received);
   B) Transmission Status (ACK/NAK Timeout); or
   C) Transmission Status (Connection Lost without ACK/NAK);
b) the RETRY DATA FRAMES bit is set to one in the XFER_RDY frame for the write operation;
c) the Data-Out Buffer Offset state machine variable is set to the Requested Offset Xfer_Rdy state machine argument;
d) all write DATA frames that have received a Transmission Status (Frame Transmitted) confirmation have received a Transmission Status confirmation; and
e) the vendor-specific number of retries, if any, for the write DATA frame has not been reached.

9.2.6.2.3.3.3 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS6:Process_Data_In

This transition shall occur after receiving a Transmission Status (Frame Transmitted) confirmation for a COMMAND frame for a command requesting a read operation.

NOTE 94 - This transition occurs even if this state has not received a Transmission Status (ACK Received) for the COMMAND frame.

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 read DATA frame verification is successful 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.

If data received in the read DATA frame overlaps data previously received and verified successfully, then this state may either discard the overlapping data, or replace the previously received data with the new data.

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 95 - 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 initiator port transfer tag as an argument.

NOTE 96 - 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 SSP target port did not receive the COMMAND frame.

9.2.6.2.3.7.2 Transition ST_ITS6:Receive_Data_In to ST_ITS1:Initiator_Start

This transition shall occur after this state:

a) sends one of the following to the ST_IFR state machine:
   A) a Reception Complete (Data Offset Error) message;
   B) a Reception Complete (Too Much Read Data) message;
   C) a Reception Complete (Incorrect Data Length) message; or
   D) a Reception Complete (Cancel Acknowledged) message;

   or

b) receives a Return To Start message.

9.2.6.2.3.7.3 Transition ST_ITS6:Receve_Data_In to ST_ITS2:Initiator_Send_Frame

This transition shall occur after receiving a Transmission Status (NAK Received) confirmation for a COMMAND frame for a command requesting a read operation.

9.2.6.3 ST_T (transport layer for SSP target ports) state machines

9.2.6.3.1 ST_T state machines overview

The ST_T state machines are as follows:

a) ST_TFR (target frame router) state machine (see 9.2.6.3.2); and
b) ST_TTS (target transport server) state machine (see 9.2.6.3.3).

The SAS target port includes:

a) one ST_TFR state machine; and
b) one ST_TTS state machine for each possible command and task management function (i.e., for each initiator port transfer tag).

Page: 491

Author: George Penokie Subject: Highlight Date: 8/25/2008 5:01:29 PM
This should be << receives Transmission Status (ACK/NAK Timeout) confirmation or Transmission Status (Connection Lost Without ACK/NAK) confirmation, >>

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:09:32 AM
Reception Complete (Command Failed, Connection Failed) message to

If first burst is enabled, then the Request (Receive Data_Out) message shall also include the Enable First Burst argument and First Burst Size argument. The First Burst Size argument shall be set to the first burst size from the Disconnect-Reconnect mode page (see 10.2.7.2.5).

If this state machine receives a Send Command Complete transport protocol service response from the SCSI application layer with the Service Response argument set to TASK COMPLETE, then this state machine shall send a Request (Send Application Response) message to the ST_TTS state machine specified by the initiator port transfer tag. The message shall include the following Application Response arguments:

a) connection rate;
b) initiator connection tag;
c) destination SAS address (i.e., the SAS address to which the RESPONSE frame is to be transmitted);
d) source SAS address set to the SAS address of the SSP target port;
e) initiator port transfer tag;
f) status;
g) status qualifier, if any;
h) sense data, if any; and
i) response fence.

If this state machine receives a Task Management Function Executed transport protocol service response from the SCSI application layer, then this state machine shall send the following to the ST_TTS state machine specified by the initiator port transfer tag:

a) a Request (Send Transport Response) message with the Transport Response arguments;
b) the service response argument set as specified in table 184; and
c) the response fence argument set to the Task Management Function Executed protocol service response Response Fence argument.

Table 184 specifies which argument to send with Request (Send Transport Response) based on the Service Response argument that was received.

Table 184 — Task Management Function Executed Service Response argument mapping to Request (Send Transport Response) service response argument

Task Management Function Executed protocol service response Service Response argument received	Request (Send Transport Response) message service response argument
FUNCTION COMPLETE	Task Management Function Complete
FUNCTION SUCCEEDED	Task Management Function Succeeded
FUNCTION REJECTED	Task Management Function Not Supported
INCORRECT LOGICAL UNIT NUMBER	Incorrect Logical Unit Number
SERVICE DELIVERY OR TARGET FAILURE - Overlapped Initiator Port Transfer Tag Attempted	Overlapped Initiator Port Transfer Tag Attempted

If this state machine receives a Terminate Data Transfer protocol service request from the SCSI application layer and this state machine has not sent a Request message to a ST_TTS state machine for the Send Data-In or Receive Data-Out protocol service request to which the Terminate Data Transfer request applies, then this state machine shall:

1) discard the Terminate Data Transfer request and any corresponding Send Data-In or Receive Data-Out request; and
2) send a Data Transfer Terminated protocol service confirmation to the SCSI application layer.

If this state machine receives a Terminate Data Transfer protocol service request from the SCSI application layer and this state machine has sent a Request message to a ST_TTS state machine for the Send Data-In protocol service request to which the Terminate Data Transfer request applies, then this state machine shall send a Cancel message to the ST_TTS state machine specified by the initiator port transfer tag and the Send Data-In protocol service request.

Page: 497

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:31:24 AM
Request (Send Transport Response) message based

Author: George Penokie Subject: Sticky Note Date: 8/25/2008 5:02:12 PM
There needs to be wording added to the application layer that states << a Command Complete Received (Service Delivery or Target Failure - Cancel Acknowledged) confirmation may be received as a vendor-specific request to Cancel a transfer. >>

If the confirmation or argument is not Transmission Status (Frame Transmitted) or Transmission Status (I_T Nexus Loss), then this state shall send the Transmission Complete message defined in table 188 to the ST_TFR state machine. The message shall include the following arguments:

a) initiator port transfer tag; and
b) arguments received with the Transmission Status confirmation.

If the confirmation is Transmission Status (Frame Transmitted) and the Transmit Frame request was for:

a) an XFER_RDY frame; or
b) a RESPONSE frame,

then this state shall wait to receive one of the following confirmations:

a) Transmission Status (ACK Received);
b) Transmission Status (NAK Received);
c) Transmission Status (ACK/NAK Timeout); or
d) Transmission Status (Connection Lost Without ACK/NAK).

If the confirmation is Transmission Status (Frame Transmitted) and the Transmit Frame request was for a read DATA frame, then this state shall:

a) increment the Read Data Frames Transmitted state machine variable by one; and
b) set the Read Data Offset state machine variable to the current Read Data Offset state machine variable plus the number of read data bytes transmitted in the DATA frame associated with the Transmission Status (Frame Transmitted) confirmation.

If the confirmation is Transmission Status (ACK Received) and the Transmit Frame request was for a read DATA frame, then this state shall increment the Read Data Frames ACKed state machine variable by one.

If the confirmation is Transmission Status (Frame Transmitted), the Transmit Frame request was for a read DATA frame, and the Read Data Offset state machine variable is equal to the Read Data Buffer End state machine variable, then this state shall wait to receive:

a) Transmission Status (ACK Received) confirmations or arguments for each outstanding read DATA frame (i.e., Read Data Frames Transmitted state machine variable equals the Read Data Frames ACKed state machine variable); or
b) one of the following:
   A) Transmission Status (NAK Received);
   B) Transmission Status (ACK/NAK Timeout); or
   C) Transmission Status (Connection Lost Without ACK/NAK).

NOTE 97 - If the number of data bytes that have been transmitted for a Request (Send Data-In) message are fewer than the Request Byte Count Data-In state machine argument, then this state transitions to the ST_TTS3:Prepare_Data_In state to construct the additional read DATA frames for the request before receiving a Transmission Status (ACK Received), Transmission Status (NAK Received), Transmission Status (ACK/NAK Timeout), or Transmission Status (Connection Lost Without ACK/NAK) confirmation.

When the Read Data Frames Transmitted state machine variable equals the Read Data Frames ACKed state machine variable and the Transmit Frame request was for a read DATA frame, this state shall:

a) not modify the Balance Point Read Data Offset state machine variable (i.e., the balance point remains at the last point at which balance occurred); or
b) set the Balance Point Read Data Offset state machine variable to the current Read Data Offset state machine variable.

If the Transmit Frame request was for a RESPONSE frame, the vendor-specific number of retries has not been reached, and this state receives one of the following confirmations:

a) Transmission Status (NAK Received);
b) Transmission Status (ACK/NAK Timeout); or
c) Transmission Status (Connection Lost Without ACK/NAK),

Page: 502

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:48:55 AM
the following confirmations:

Table 189 defines messages that this state shall send to the ST_TFR state machine upon receipt of the listed confirmations and arguments.

Table 189 — Additional messages sent to the ST_TFR state machine

Confirmation received from the port layer or argument received from ST_TTS3:Prepare_Data_In	Message sent to the ST_TFR state machine
Transmission Status (Bad Destination)	Transmission Complete (Connection Failed)
Transmission Status (Connection Rate Not Supported)	Transmission Complete (Connection Failed)
Transmission Status (Protocol Not Supported)	Transmission Complete (Connection Failed)
Transmission Status (Reserved Abandon 1)	Transmission Complete (Connection Failed)
Transmission Status (Reserved Abandon 2)	Transmission Complete (Connection Failed)
Transmission Status (Reserved Abandon 3)	Transmission Complete (Connection Failed)
Transmission Status (STP Resources Busy)	Transmission Complete (Connection Failed)
Transmission Status (Wrong Destination)	Transmission Complete (Connection Failed)
Transmission Status (Zone Violation)	Transmission Complete (Connection Failed)
Transmission Status (Break Received)	Transmission Complete (Data Transfer Terminated)

If this state receives a Cancel message or a Cancel argument and this state has received confirmations for all Transmit Frame requests sent to the port layer, then this state shall send a Transmission Complete (Data Transfer Terminated) message to the ST_TFR state machine.

If this state receives a Cancel message or a Cancel argument and this state has not received confirmations for all Transmit Frame requests sent to the port layer, then this state shall send a Cancel request to the port layer to cancel previous Transmit Frame requests. The Cancel request shall include the following arguments:

a) destination SAS address; and
b) initiator port transfer tag.

Upon receipt of a Transmission Status (Cancel Acknowledged) confirmation or argument this state shall send a Transmission Complete (Data Transfer Terminated) message to the ST_TFR state machine.

A Transmission Complete message to the ST_TFR state machine shall include the following arguments:

a) destination SAS address; and
b) initiator port transfer tag.

9.2.6.3.3.3.2 Transition ST_TTS2:Target_Send_Frame to ST_TTS1:Target_Start

This transition shall occur after sending a Transmission Complete message other than Transmission Complete (Xfer_Rdy Delivered) to the ST_TFR state machine.

9.2.6.3.3.3.3 Transition ST_TTS2:Target_Send_Frame to ST_TTS3:Prepare_Data_In

This transition shall occur after receiving a Transmission Status (Frame Transmitted) confirmation for a read DATA frame if the Read Data Offset state machine variable is less than the Read Data Buffer End state machine variable (i.e., there is more read data to transfer).

If transport layer retries are enabled and the vendor-specific number of retries, if any, for the read DATA frame has not been reached, then this transition shall occur and include a Retry argument after receiving one of the following confirmations for a read DATA frame:

a) Transmission Status (NAK Received);
b) Transmission Status (ACK/NAK Timeout); or

Page: 505

Author: George Penokie Subject: Sticky Note Date: 8/26/2008 2:08:42 PM
The following confirmations from the port layer are missing from this table:

-Transmission Status (No Phys in Port)
-Transmission Status (Open Timeout Received) and
-Transmission Status (No Destination)

Author: George Penokie Subject: Highlight Date: 8/26/2008 10:06:44 AM
Note that the Cancel request does not cause the connection to be closed so the data transfer is not terminated in the same sense as if a break occurred. Is this what was intended??

Author: George Penokie Subject: Highlight Date: 8/13/2008 11:52:49 AM
Complete (Xfer_Rdy Delivered) message to the ST_TFR state

c) Transmission Status (Connection Lost Without ACK/NAK).

9.2.6.3.3.3.4 Transition ST_TTS2:Target_Send_Frame to ST_TTS5:Receive_Data_Out

This transition shall occur after sending a Transmission Complete (Xfer_Rdy Delivered) message to the ST_TFR state machine.

9.2.6.3.3.4 ST_TTS3:Prepare_Data_In state

9.2.6.3.3.4.1 State description

This state retrieves the data from the Device Server Buffer Data-In state machine argument and constructs a read DATA frame.

This state shall construct a read DATA frame using the Data-In state machine arguments as follows:

a) FRAME TYPE field set to 01h (i.e., DATA frame);
b) HASHED DESTINATION SAS ADDRESS field set to the hashed value of the Destination SAS Address Data-In state machine argument;
c) HASHED SOURCE SAS ADDRESS field set to the hashed value of the SSP target port's SAS address;
d) RETRY DATA FRAMES bit set to zero;
e) RETRANSMIT bit set to zero;
f) CHANGING DATA POINTER set as specified in this subclause;
g) NUMBER OF FILL BYTES field set to the number of fill bytes needed for the specified read data;
h) INITIATOR PORT TRANSFER TAG field set to the Initiator Port Transfer Tag Data-In state machine argument;
i) TARGET PORT TRANSFER TAG field set to a vendor-specific value;
j) DATA OFFSET field set as specified in this subclause;
k) in the information unit, DATA field set as specified in this subclause; and
l) fill bytes, if required.

If this state is entered without a Retry argument then this state shall:

a) set the CHANGING DATA POINTER bit set to zero;
b) set the DATA OFFSET field to the Read Data Offset state machine variable; and
c) in the information unit, set the DATA field to the information in the Device Server Buffer argument that corresponds to the read data to be transferred. If the Read Data Buffer End state machine variable minus the Read Data Offset state machine variable is equal to the maximum size of the read Data information unit, then the amount of data shall be the maximum size of the read Data information unit. Otherwise, the amount of data shall be the lesser of:
   A) the Read Data Buffer End state machine variable minus the Read Data Offset state machine variable; and
   B) the maximum size of the read Data information unit for this Data-In request.

If this state is entered with a Retry argument then this state shall either:

a) set the CHANGING DATA POINTER bit in the frame to one;
b) set the DATA OFFSET field to the Balance Point Read Data Offset state machine variable;
c) set the Read Data Offset state machine variable to the Balance Point Read Data Offset state machine variable;
d) set the Read Data Frames Transmitted state machine variable to zero;
e) set the Read Data Frames ACKed state machine variable to zero; and
f) in the information unit, set the DATA field to the information in the Device Server Buffer argument that corresponds to the read data to be transferred. If the Read Data Buffer End state machine variable minus the Read Data Offset state machine variable is equal to the maximum size of the read Data information unit, then the amount of data shall be the maximum size of the read Data information unit. Otherwise, the amount of data shall be the lesser of:
   A) the Read Data Buffer End state machine variable minus the Balance Point Read Data Offset state machine variable; and
   B) the maximum size of the read Data information unit for this Data-In request;

Page: 506

Author: George Penokie Subject: Highlight Date: 8/13/2008 1:07:45 PM
for this Send Data-In request.

Author: George Penokie Subject: Highlight Date: 8/13/2008 1:08:16 PM
this Send Data-In request

Page: 507

Author: George Penokie Subject: Highlight Date: 8/13/2008 1:09:42 PM
this Send Data-In request.

or:

a) set the CHANGING DATA POINTER bit in the frame to one;
b) set the DATA OFFSET field to the Application Client Buffer Offset Data-In state machine argument;
c) set the Read Data Offset state machine variable to the Application Client Buffer Offset Data-In state machine argument;
d) set the Read Data Frames Transmitted state machine variable to zero;
e) set the Read Data Frames ACKed state machine variable to zero; and
f) in the information unit, set the DATA field to the information in the Device Server Buffer argument that corresponds to the read data to be transferred. If the Request Byte Count Data-In state machine argument is equal to the maximum size of the read Data information unit, then the amount of data shall be the maximum size of the read Data information unit. Otherwise, the amount of data shall be the lesser of:
   A) the Request Byte Count Data-In state machine argument; and
   B) the maximum size of the read Data information unit for this Data-In request.

9.2.6.3.3.4.2 Transition ST_TTS3:Prepare_Data_In to ST_TTS2:Target_Send_Frame

This transition shall occur after this state:

a) constructs a read DATA frame; or
b) receives a Cancel message.

This transition shall include the received Transmission Status, if any, as an argument and:

a) if a Cancel message was not received, then the read DATA frame as an argument; or
b) if a Cancel message was received, then a Cancel argument.

9.2.6.3.3.5 ST_TTS4:Prepare_Xfer_Rdy state

9.2.6.3.3.5.1 State description

This state shall construct an XFER_RDY frame using the Data-Out state machine arguments:

a) FRAME TYPE field set to 05h (i.e., XFER_RDY frame);
b) HASHED DESTINATION SAS ADDRESS field set to the hashed value of the Destination SAS Address Data-Out state machine argument;
c) HASHED SOURCE SAS ADDRESS field set to the hashed value of the SSP target port's SAS address;
d) RETRY DATA FRAMES bit set to one if transport layer retries are enabled and zero if transport layer retries are disabled;
e) RETRANSMIT bit set to zero;
f) CHANGING DATA POINTER bit set to zero;
g) NUMBER OF FILL BYTES field set to 00b;
h) INITIATOR PORT TRANSFER TAG field set to the Initiator Port Transfer Tag Data-Out state machine argument;
i) if transport layer retries are disabled, TARGET PORT TRANSFER TAG field set to a vendor-specific value;
j) if transport layer retries are enabled, TARGET PORT TRANSFER TAG field set to a vendor-specific value that is different from:
   A) the target port transfer tag in the previous XFER_RDY frame associated with the Data-Out state machine arguments; and
   B) any other target port transfer tag currently in use.

   If write data is received for a subsequent XFER_RDY frame for a command, then all target port transfer tags used for previous XFER_RDY frames for the command are no longer in use;

k) DATA OFFSET field set to 00000000h;
l) in the information unit, REQUESTED OFFSET field set to the Requested Write Data Offset state machine variable;
m) in the information unit, WRITE DATA LENGTH field set as specified in this subclause; and
n) no fill bytes.

c) the value in the DATA OFFSET field is not equal to the Write Data Offset state machine variable,

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

If the WRITE data frame verification is successful and the Data-Out Arrived message in not discarded, then this state shall:

a) process the write data as indicated in the Data-Out state machine arguments using the Device Server Buffer (e.g., logical block address) to which the write data is to be transferred; and
b) set the Write Data Offset state machine variable to the current Write Data Offset state machine variable plus the number of bytes received in the DATA field of the write Data information unit.

If the WRITE data frame verification is successful and the CHANGING DATA POINTER bit set to one, then this state shall:

a) set the Write Data Offset state machine variable to the Requested Write Data Offset state machine variable plus the number of bytes received in the DATA field of the write Data information unit; and
b) process the write data as indicated in the Data-Out state machine arguments using the Device Server Buffer (e.g., logical block address) to which the write data is to be transferred.

If data received in the write DATA frame overlaps data previously received and verified successfully, then this state may either discard the overlapping data, or replace the previously received data with the new data.

If the Initiator Response Timeout timer is implemented, then this state shall initialize and start the Initiator Response Timeout timer:

a) upon entry into this state; and
b) when this state receives and verifies the write DATA frame received with the Data-Out Arrived values (i.e., Data-Out data was received and processed).

If the Initiator Response Timeout timer is running, then this state shall stop the timer before transitioning from this state.

If the Initiator Response Timeout timer expires, then this state shall send a Reception Complete (Initiator Response Timeout) message to the ST_TFR state machine.

If the Write Data Offset state machine variable equals the Request Byte Count Data-Out state machine argument plus the Application Client Buffer Offset Data-Out state machine argument, then this state shall send a Reception Complete (Data-Out Received) message to the ST_TFR state machine after a Reception Complete (ACK Transmitted) confirmation is received for each write DATA frame previously received.

If this state receives a Cancel message, then this state shall send a Reception Complete (Data Transfer Terminated) message to the ST_TFR state machine.

If this state receives Transmission Status (Break Received) confirmation, then this state shall send a Reception Complete (Data Transfer Terminated) to the ST_TFR state machine.

The Reception Complete message, if any, shall include the initiator port transfer tag as an argument.

9.2.6.3.3.6.2 Transition ST_TTS3:Receive_Data_Out to ST_TTS1:Target_Start

This transition shall occur after sending a Reception Complete message to the ST_TFR state machine.

9.2.6.3.3.6.3 Transition ST_TTS5:Receive_Data_Out to ST_TTS4:Prepare_Xfer_Rdy

This transition shall occur:

1) if the Write Data Offset state machine variable is less than Request Byte Count Data-Out state machine argument plus the Application Client Buffer Offset Data-Out state machine argument and equal to the Requested Write Data Offset state machine variable plus the Requested Write Data Length state machine variable;
2) after a Reception Complete (ACK Transmitted) confirmation is received for each write DATA frame previously received;

Page: 509

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:32:26 PM
This << after a Reception Complete (ACK Transmitted) confirmation is >> should be << ACK Transmitted confirmation is >> as there is no such thing as a Reception Complete (ACK Transmitted) confirmation but this is an ACK Transmitted confirmation.

Author: George Penokie Subject: Highlight Date: 8/26/2008 10:10:02 AM
Note that the Cancel does not cause the connection to be closed so the data transfer is not terminated in the same sense as if a break occurred. Is this what was intended??

Author: George Penokie Subject: Highlight Date: 8/25/2008 1:32:12 PM
This << after a Reception Complete (ACK Transmitted) confirmation is >> should be << ACK Transmitted confirmation is >> as there is no such thing as a Reception Complete (ACK Transmitted) confirmation but this is an ACK Transmitted confirmation.

Page: 516

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:02:39 PM
Frame Received (normal) confirmation

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:03:00 PM
Frame Received (normal) confirmation

9.4.5.2.3 MT_IP2:Send state

9.4.5.2.3.1 State description

This state constructs an SMP_REQUEST frame using the following arguments received in the transition into this state:

a) request bytes;

and sends a Transmit Frame request to the port layer with the following arguments:

a) initiator port bit set to one;
b) protocol set to SMP;
c) connection rate;
d) initiator connection tag set to FFFFh;
e) destination SAS address;
f) source SAS address set to the SAS address of the SMP initiator port; and
g) request bytes.

9.4.5.2.3.2 Transition MT_IP2:Send to MT_IP1:Idle

This transition shall occur after receiving either a Connection Closed confirmation or a Transmission Status confirmation other than a Transmission Status (Frame Transmitted) confirmation, and after sending an Open Failed confirmation to the management application layer.

9.4.5.2.3.3 Transition MT_IP2:Send to MT_IP3:Receive

This transition shall occur after receiving a Transmission Status (Frame Transmitted) confirmation.

9.4.5.2.4 MT_IP3:Receive state

9.4.5.2.4.1 State description

This state waits for a confirmation from the port layer that either an SMP frame has been received or a failure occurred.

If a Frame Received confirmation is received and the SMP frame type is equal to 41h, then this state shall send a Received SMP Function Complete confirmation to the management application layer.

If a Frame Received confirmation is received and the SMP frame type is not equal to 41h, then this state shall send an SMP Frame Transmit Receive Failure confirmation to the management application layer.

If a Connection Closed or Frame Received (SMP Failure) confirmation is received, then this state shall send an SMP Frame Transmit Receive Failure confirmation to the management application layer.

9.4.5.2.4.2 Transition MT_IP3:Receive to MT_IP1:Idle

This transition shall occur after one of the following:

a) sending a Received SMP Function Complete confirmation; or
b) sending an SMP Frame Transmit Receive Failure confirmation.

9.4.5.3 MT_TP (transport layer for SMP target ports) state machine

9.4.5.3.1 MT_TP state machine overview

The MT_TP state machine informs the management application layer of the receipt of an SMP frame, and sends the resulting SMP frame to the port layer.

This state machine consists of the following states:

a) MT_TP1:Idle (see 9.4.5.3.2)(initial state); and
b) MT_TP2:Respond (see 9.4.5.3.3).

This state machine shall start in the MT_TP1:Idle state.

Page: 517

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:03:16 PM
Frame Received (normal) confirmation

Figure 222 describes the MT_TP state machine.

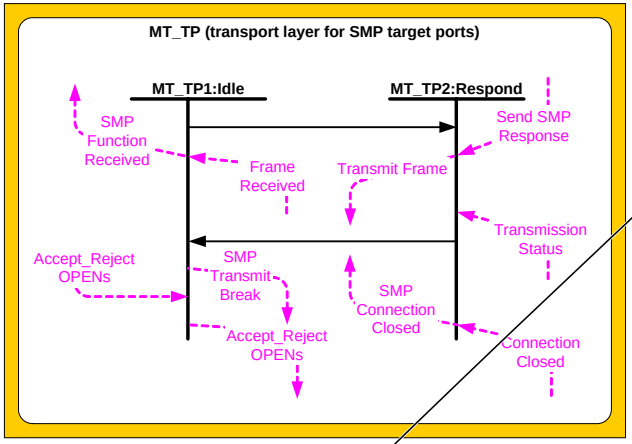

Figure 222 — MT_TP (transport layer for SMP target ports) state machine

The MT_TP state machine shall comply with the time limits listed in table 196.

Table 196 — MT_TP time limits

Time limit	Value	Description
SMP Response time limit	1 900 µs	Maximum time from receiving an SMP_REQUEST frame to transmitting an SMP_RESPONSE frame

9.4.5.3.2 MT_TP1:Idle state

9.4.5.3.2.1 State description

This state is the initial state of the MT_TP state machine.

This state waits for a Frame Received confirmation. If the SMP frame type is not equal to 40h, then this state shall discard the frame and send an SMP Transmit Break request to the port layer. Otherwise, this state shall send an SMP Function Received confirmation to the management application layer.

If an Accept_Reject OPENs (Accept SMP) or Accept_Reject OPENs (Reject SMP) request is received, then this state shall send an Accept_Reject OPENs request with the same arguments to the port layer.

9.4.5.3.2.2 Transition MT_TP1:Idle to MT_TP2:Respond

This transition shall occur after sending an SMP Function Received confirmation.

A device server shall not call Receive Data-Out () for a given I_T_L_Q nexus after a Send Command Complete () has been called for that I_T_L_Q nexus or after a Task Management Function Executed () has been called for a task management function that terminates that command (e.g., an ABORT TASK).

Table 205 shows how the arguments to the Receive Data-Out transport protocol service are used.

Table 205 — Receive Data-Out transport protocol service arguments

Argument	SAS SSP implementation
I_T_L_Q nexus	I_T_L_Q nexus, where: a) I specifies the initiator port to which the XFER_RDY frame is to be sent; b) T specifies the target port to send the XFER_RDY frame; c) L specifies the LOGICAL UNIT NUMBER field in the XFER_RDY frame header; and d) Q specifies the INITIATOR PORT TRANSFER TAG field in the XFER_RDY frame header.
Application Client Buffer Offset	Specifies the REQUESTED OFFSET field in the XFER_RDY frame.
Request Byte Count	Specifies WRITE DATA LENGTH field in the XFER_RDY frame.
Device Server Buffer	Internal to the device server.

10.2.1.9 Data-Out Received transport protocol service

An SSP target port uses the Data-Out Received transport protocol service indication to notify a device server of the result of transmitting an XFER_RDY frame (e.g., receiving write DATA frames in response).

Data-Out Received (IN (I_T_L_Q Nexus, Delivery Result))

Table 206 shows how the arguments to the Data-Out Received transport protocol service are determined.

Table 206 — Data-Out Received transport protocol service arguments

Argument	SAS SSP implementation
I_T_L_Q nexus	I_T_L_Q nexus, where: a) I indicates the initiator port to which the XFER_RDY frame was sent; b) T indicates the target port that sent the XFER_RDY frame; c) L indicates the value of the LOGICAL UNIT NUMBER field in the XFER_RDY frame header; and d) Q indicates the value of the INITIATOR PORT TRANSFER TAG field in the XFER_RDY frame header.
Delivery Result	From the response to the XFER_RDY: a) DELIVERY SUCCESSFUL: The XFER_RDY frame was successfully transmitted and all the write DATA frames for the requested write data were received; or b) DELIVERY FAILURE: The XFER_RDY frame received a NAK or no response.

10.2.1.10 Terminate Data Transfer transport protocol service

A device server uses the Terminate Data Transfer transport protocol service request to request that an SSP target port terminate any Send Data-In () or Receive Data-Out () transport protocol services, if any, being processed using the specified nexus.

Terminate Data Transfer (IN (Nexus))

Page: 526

Author: George Penokie Subject: Sticky Note Date: 8/26/2008 10:17:17 AM
This currently does not result in a connection being closed. Is that in intended behavior?

Table 207 shows how the arguments to the Terminate Data Transfer transport protocol service are used.

Table 207 — Terminate Data Transfer transport protocol service arguments

Argument	SAS SSP implementation
Nexus	I_T nexus, I_T_L nexus, or I_T_L_Q nexus, specifying the scope of the data transfer(s) to terminate.

10.2.1.11 Data Transfer Terminated transport protocol service

An SSP target port uses the Data Transfer Terminated transport protocol service indication to notify a device server that all data transfers for the indicated nexus have been terminated.

Data Transfer Terminated (IN (Nexus))

Table 208 shows how the arguments to the Data Transfer Terminated transport protocol service are determined.

Table 208 — Data Transfer Terminated transport protocol service arguments

Argument	SAS SSP implementation
Nexus	I_T nexus, I_T_L nexus, or I_T_L_Q nexus indicated by the preceding Terminate Data Transfer () call.

10.2.1.12 Send Task Management Request transport protocol service

An application client uses the Send Task Management Request transport protocol service request to request that an SSP initiator port transmit a TASK frame.

Send Task Management Request (IN (Nexus, Function Identifier, Association, [Request Fence]))

Page: 527

Author: George Penokie Subject: Sticky Note Date: 8/26/2008 10:19:43 AM
This may (if a break occurred) or may not (if as a result of a terminate data transfer request). Is this uncertainty acceptable or intended?

Table 212 shows how the arguments to the Received Task Management Function Executed transport protocol service are determined.

Table 212 — Received Task Management Function Executed transport protocol service arguments

Argument	SAS SSP implementation
Nexus	I_T nexus, I_T_L nexus, or I_T_L_Q nexus (depending on the function), where: a) I indicates the initiator port that received the RESPONSE frame; b) T indicates the target port that sent the RESPONSE frame; c) L (for an I_T_L nexus or an I_T_L_Q nexus) indicates the logical unit that sent the response frame, and is indicated by the LOGICAL UNIT NUMBER field of the TASK frame with an INITIATOR PORT TRANSFER TAG field equal to the INITIATOR PORT TRANSFER TAG field in the RESPONSE frame header; and d) Q (for an I_T_L_Q nexus) indicates the command that was managed by the task management function, and is indicated by the INITIATOR PORT TRANSFER TAG field of the COMMAND frame with an INITIATOR PORT TRANSFER TAG field equal to the INITIATOR PORT TRANSFER TAG TO MANAGE field in the TASK frame with an INITIATOR PORT TRANSFER TAG field equal to the INITIATOR PORT TRANSFER TAG field in the RESPONSE frame header.
Service Response	Indicates the response to the TASK frame: a) FUNCTION COMPLETE: The RESPONSE frame contains a DATAPRES field set to RESPONSE_DATA and a RESPONSE CODE field set to TASK MANAGEMENT FUNCTION COMPLETE; b) FUNCTION SUCCEEDED: The RESPONSE frame contains a DATAPRES field set to RESPONSE_DATA and a RESPONSE CODE field set to TASK MANAGEMENT FUNCTION SUCCEEDED; c) FUNCTION REJECTED: The RESPONSE frame contains a DATAPRES field set to RESPONSE_DATA and a RESPONSE CODE field set to TASK MANAGEMENT FUNCTION NOT SUPPORTED; d) INCORRECT LOGICAL UNIT NUMBER: The RESPONSE frame contains a DATAPRES field set to RESPONSE_DATA and a RESPONSE CODE field set to INCORRECT LOGICAL UNIT NUMBER; or e) SERVICE DELIVERY OR TARGET FAILURE: The RESPONSE frame contains a DATAPRES field set to RESPONSE_DATA and a RESPONSE CODE field set to: A) INVALID FRAME; B) TASK MANAGEMENT FUNCTION FAILED; or C) OVERLAPPED INITIATOR PORT TRANSFER TAG ATTEMPTED, or a NAK was received for the TASK frame, or the length of the RESPONSE frame is incorrect.
[Additional Response Information]	Indicates the ADDITIONAL RESPONSE INFORMATION field in the RESPONSE frame.
Association	Indicates the INITIATOR PORT TRANSFER TAG field in the RESPONSE frame header or the TASK frame header.

10.2.2 Application client error handling

If an SSP initiator port calls Command Complete Received () with a Service Response of:

a) Service Delivery or Target Failure - XFER_RDY Information Unit Too Short;
b) Service Delivery or Target Failure - XFER_RDY Information Unit Too Long;
c) Service Delivery or Target Failure - XFER_RDY Incorrect Write Data Length;
d) Service Delivery or Target Failure - XFER_RDY Requested Offset Error;
e) Service Delivery or Target Failure - XFER_RDY Not Expected;
f) Service Delivery or Target Failure - DATA Information Unit Too Short;

Page: 531

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:13:32 PM
Does not exist anywhere else and should be deleted

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:13:43 PM
Does not exist anywhere else and should be deleted;

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:13:53 PM
Does not exist anywhere else and should be deleted

Page: 532

Author: George Penokie Subject: Highlight Date: 8/13/2008 3:18:40 PM
This << DATA Data Offset Error; >> should be << DATA Offset Error >> as that is what it is called in all other places.

g) Service Delivery or Target Failure - DATA Too Much Read Data;
h) Service Delivery or Target Failure - DATA Data Offset Error;
i) Service Delivery or Target Failure - DATA Not Expected; or
j) Service Delivery or Target Failure - NAK Received,

then the application client shall abort the command (e.g., by sending an ABORT TASK task management function).

After an application client calls Send SCSI Command (), if Command Complete Received () returns a Service Response of Service Delivery or Target Failure - ACK/NAK Timeout, then the application client shall send a QUERY TASK task management function with Send Task Management Request () to determine whether the command was received successfully. If Received Task Management Function Executed () returns a Service Response of FUNCTION SUCCEEDED, then the application client shall assume the command was delivered successfully. If Received Task Management Function Executed () returns a Service Response of FUNCTION COMPLETE, and Command Complete Received () has not yet been invoked a second time for the command in question (e.g., indicating a RESPONSE frame arrived for the command before the QUERY TASK was processed), then the application client shall assume the command was not delivered successfully and may reuse the initiator port transfer tag. The application client should call Send SCSI Command () again with identical arguments.

After a Received Task Management Function Executed () call with a Service Response of Service Delivery or Target Failure - ACK/NAK Timeout, an application client should call Send Task Management Request () with identical arguments, including the same initiator port transfer tag.

After a Command Complete Received () or Received Task Management Function Executed () call returns a Service Response other than Service Delivery or Target Failure - ACK/NAK Timeout, an application client shall not reuse the initiator port transfer tag until it determines the initiator port transfer tag is no longer in use by the logical unit (e.g., the ACK for the RESPONSE frame was seen by the SSP target port). Examples of ways the application client may determine that an initiator port transfer tag may be used are:

a) receiving another frame in the same connection;
b) receiving a DONE (NORMAL) or DONE (CREDIT TIMEOUT) in the same connection; or
c) receiving a DONE (ACK/NAK TIMEOUT) in the same connection, then running a QUERY TASK task management function to confirm that the initiator port transfer tag is no longer active in the logical unit.

10.2.3 Device server error handling

If an SSP target port calls Data-Out Received () with a Delivery Result set to a value in table 213, then the device server shall terminate the command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set as indicated in table 213.

Table 213 — Delivery Result to additional sense code mapping

Delivery Result	Additional sense code
DELIVERY FAILURE - DATA OFFSET ERROR	DATA OFFSET ERROR
DELIVERY FAILURE - TOO MUCH WRITE DATA	TOO MUCH WRITE DATA
DELIVERY FAILURE - INFORMATION UNIT TOO SHORT	INFORMATION UNIT TOO SHORT
DELIVERY FAILURE - ACK/NAK TIMEOUT	ACK/NAK TIMEOUT
DELIVERY FAILURE - NAK RECEIVED	NAK RECEIVED
DELIVERY FAILURE - INITIATOR RESPONSE TIMEOUT	INITIATOR RESPONSE TIMEOUT

10.2.4 Task router and task manager error handling

If a SCSI target device performs initiator port transfer tag checking and an SSP target port calls SCSI Command Received () with an initiator port transfer tag already in use by another command (i.e., an overlapped command) in any logical unit, then the task router and task manager(s) shall:

a) abort all task management functions received on that I_T nexus; and