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To: T10 Committee (SCSI)

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Subject: SAS SMP transport layer state diagrams

1 SMP transport layer state machines

1.1 Overview

The SMP transport layer contains state machines that process service requests from the management layer and returns service responses to the management layer. These state machines reside in SAS devices. The SMP transport state machines are as follows:

    a)   Management Application Client (MAC state machine); and
    b)   Management Device Server (MDS state machine).

The MAC state machine when implemented shall only reside in SAS initiator devices.

The MDS state machine shall reside in SAS expander devices and may reside in SAS target devices.

1.1.1 SAS initiator device state machine

1.1.1.1 SAS initiator device state machine overview

The SAS initiator device contains a MAC state machine that processes management service requests from the management layer. These management service requests are communicated to the port layer and the resulting SMP frame or error condition is sent to the management layer in a return service response.

The MAC state machine contains the following states:

    a)   Initial state: MT_MAC1:Idle state;
    b)   MT_MAC2:Send; and
    c)   MT_MAC4:Receive.

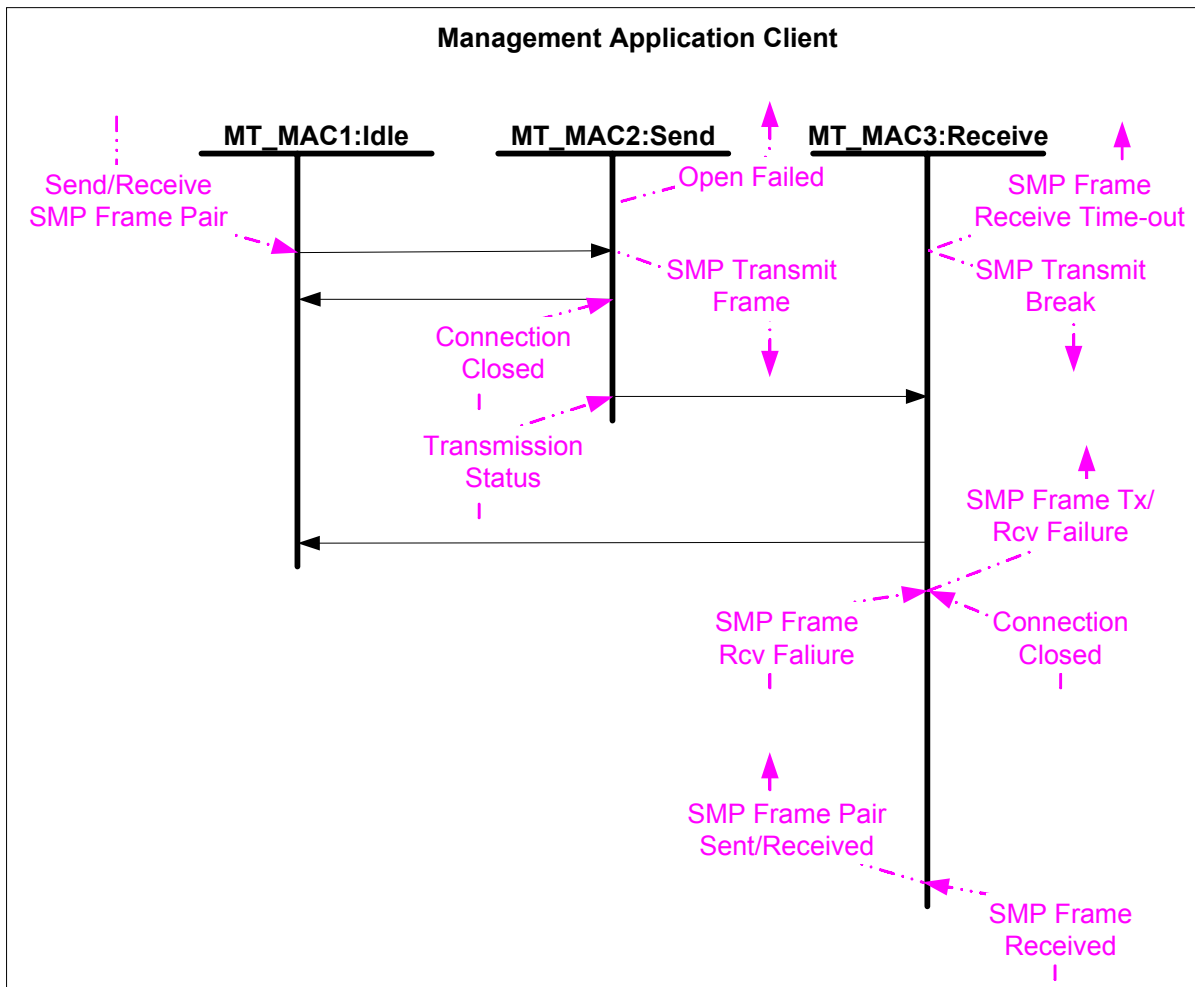Figure 1 describes the SMP transport layer state machine for a management application client.

Figure 1 - SMP Transport Layer for Management Application Client

1.1.1.2 MT_MAC1:Idle state

1.1.1.2.1 MT_MAC1:Idle state description

The MT_MAC1:idle state waits for a request from the management layer to transmit an SMP frame. The request to transmit an SMP frame shall consist of values to be used in the LINK RATE, INITIATOR CONNECTION TAG, DESTINATION SAS ADDRESS, and SOURCE SAS ADDRESS fields in the OPEN address frame, and the FUNCTION and ADDITIONAL REQUEST BYTES fields in the SMP_REQUEST frame.

1.1.1.2.2 Transition MT_MAC1:Idle to MT_MAC2:Send

This transition shall occur after a Send/Receive SMP Frame Pair request is received from the management layer. This transition shall pass the following arguments to the MT_MAC2 state:

    a) link rate;
    b) initiator connection tag;
    c) destination sas address;
    d) source sas address;
    e) function; and
    f) additional request bytes.

1.1.1.3 MT_MAC2:Send state

1.1.1.3.1 MT_MAC2:Send state description

The MT_MAC2:send state constructs an SMP_REQUEST frame using the function and additional request bytes arguments received in the MT_MAC1:MT_MAC2 transition and sends a SMP Transmit Frame request to the port layer. In addition to the SMP_REQUEST frame the SMP Transmit Frame request shall contain the values to be used for the LINK RATE, INITIATOR CONNECTION TAG, DESTINATION SAS ADDRESS, and SOURCE SAS ADDRESS fields in the OPEN address frame.

1.1.1.3.2 Transition MT_MAC2:Send to MT_MAC3:Receive

This transition shall occur after a Transmission Status(Frame Transmitted) confirmation is received from the port layer.

1.1.1.3.3 Transition MT_MAC2:Send to MT_MAC1:Idle

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

1.1.1.4 MT_MAC3:Receive state

1.1.1.4.1 MT_MAC3:Receive state description

The MT_MAC3:receive state waits for a confirmation from the port layer that either an SMP frame has been received or a failure occurred.

This state shall initialize a SMP frame receive timeout timer to a vendor specific time and start the timer on the transition into this state.

1.1.1.4.2 Transition MT_MAC3:Receive to MT_MAC1:Idle

This transition shall occur after one of the following:

  a) an SMP Frame Received confirmation is received from the port layer and as a result the receive state has sent an SMP Frame Pair Sent/Received confirmation to the management layer;
  b) a Connection Closed or SMP Frame Rcv Failure confirmation is received from the port layer and as a result the receive state has sent an SMP Frame Tx/Rcv Failure confirmation to the management layer; or
  c) the SMP frame receive timeout timer is exceeded before a SMP Frame Pair Sent/Received confirmation is received from the port layer and as a result the receive state has sent an SMP Frame Receive Timeout confirmation to the management layer and has sent an SMP Transmit Break request to the port layer.

1.1.2 SAS expander device and SAS target device state machine

1.1.2.1 SAS expander device and SAS target device state machine overview

A SAS expander device and optionally a SAS target device contain an MDS state machine that informs the device server of the receipt of an SMP frame. Confirmation of the receipt of an SMP frame is communicated from the port layer and that confirmation is sent to the device server. The device server creates the corresponding SMP_RESPONSE frame and sends that SMP transport layer request to the port layer.

The MDS state machine contains the following states:

a) Initial state: MT_MDS1:Idle state; and
b) MT_MDS2:Send.

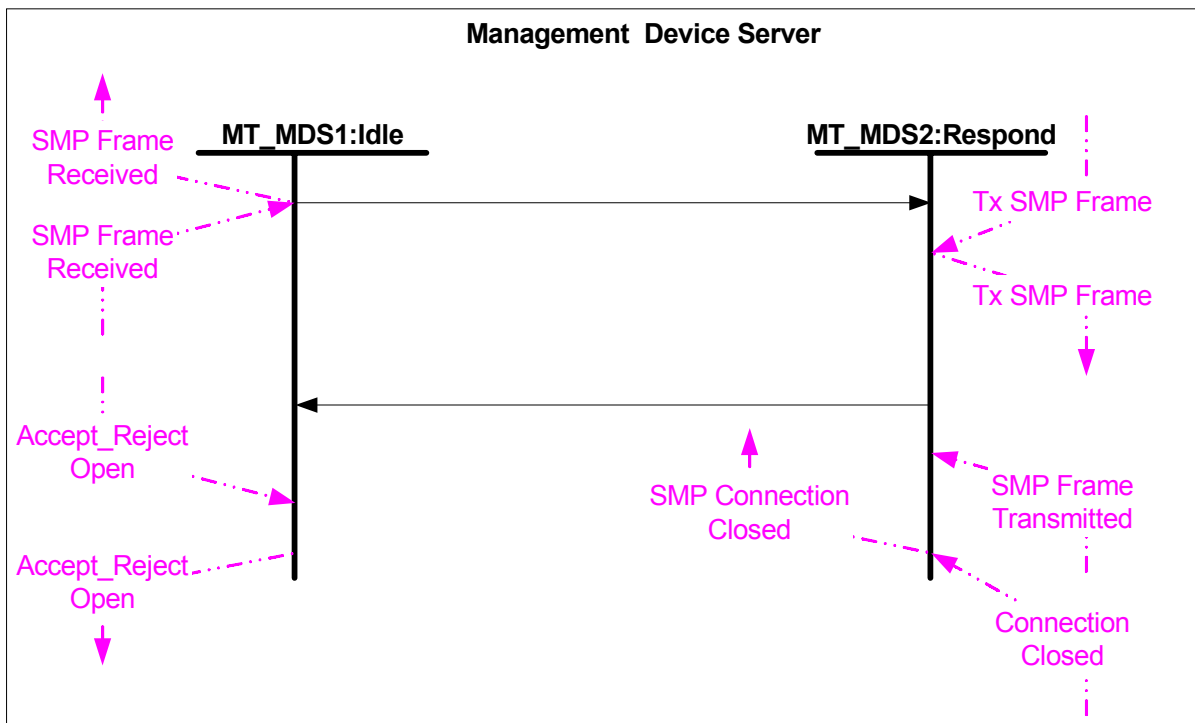Figure 2 describes the SMP transport layer state machine for a management device server.

Figure 2 - SMP Transport Layer for Management Device Server

1.1.2.2 MT_MDS1:Idle state

1.1.2.2.1 MT_MDS1:Idle state description

The MT_MDS1:idle state waits for a SMP Frame Received confirmation from the port layer.

To prevent a target port from being opened the device server may send an Accept_Reject OPENs(Reject) request to the management server while the management server is in this state. When an Accept_Reject OPENs(Reject) is requested this state shall send that request to the port layer.

To enable the target port to accept opens after requesting an Accept_Reject OPENs(Reject) the device server is required to send an Accept_Reject OPENs(Accept) to the management server while the management server is in this state. When an Accept_Reject OPENs(Accept) is requested this state shall send that request to the port layer.

1.1.2.2.2 Transition MT_MDS1:Idle to MT_MDS2:Respond

This transition shall occur after an SMP Frame Received confirmation is received from the port layer and as a result the respond state has sent an SMP Frame Receive confirmation to the management layer.

1.1.2.3 MT_MDS2:Respond state

1.1.2.3.1 MT_MDS2:Respond state description

The MT_MDS2:respond state waits for a Tx SMP Frame request from the device server. This state shall send the Tx SMP Frame request to the port layer.

1.1.2.3.2 Transition MT_MDS2:Respond to MT_MDS1:Idle

This transition shall occur after one of the following:

    a) an SMP Frame Transmitted confirmation is received from the port layer; or
    b) a Connection Closed confirmation is received from the port layer and as a result the respond state has sent an SMP Connection Closed confirmation to the management layer.