

8 Port Layer Working Draft from SAS r00f

8.1 Overview

The port layer (PL) state machines interface with one or more SAS link layer state machines and one or more SSP, SMP, and STP transport layer state machines to establish port connections and disconnections. The port layer state machines also interpret or pass transmit data, receive data, commands, and confirmations between the link and transport layers.

[Figure 1](#) ~~Figure 4~~ shows the relationship of the port layer to the transport and link layers.

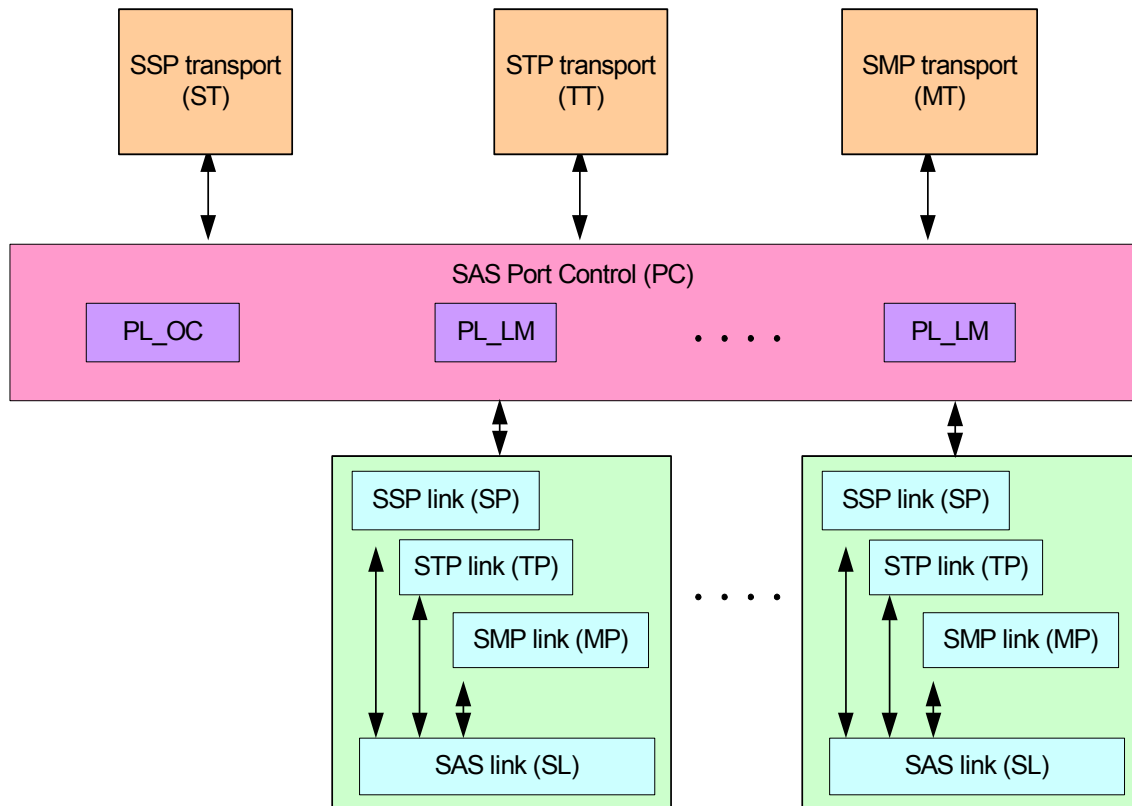


Figure 1. SAS port layer position

Two state machines running in parallel plus several commonly accessible counter/timers form the port layer.

The PL state machines are:

- Overall Control (PL_OC state machine); and
- Link Management (PL_LM state machine).

A single PL_OC state machine exists for the port layer. The PL_OC state machine's purpose is to:

- Receive Transmit Frame requests from the SSP, SMP and STP transport layers.
- If not connected, select the link and initiate a connection sequence by the PL_LM state machine;
- When connected, request a frame transmission by the PL_LM state machine and notify the transport layer when the frame has been transmitted (or an error occurred);
- For target devices only, monitor the bus inactivity time timer, the maximum connect time timer and the maximum burst size counter and initiate a port disconnection if specified limits are exceeded;
- Process the Cancel, SMP Transmit Break, and Open_Reject Opens transport layer commands; and
- Receive the HARD_RESET Received confirmation from the link layer and pass this confirmation to the transport layer
- Initialize the I_T nexus loss timer, the arbitration wait time timer, and the pathway blocked counter.

A PL_LM state machine exists for each link available to the port layer. Each PL_LM state machine's purpose is to:

- a) Request or retry a connection sequence via the link layer and handle exception conditions;
- b) Maintain a connected state for the link;
- c) Request a frame transmission by the link layer, when requested by the PL_OC state machine, and notify the PL_OC state machine when the frame has been transmitted (or an error occurred);
- d) Receive frame transmitted and frame received confirmation statuses from the link layer, and pass these statuses to the transport layer; and
- e) ~~Initialize and u~~utilize the I_T nexus loss timer, the arbitration wait time timer, and the pathway blocked counter.

The port layer contains the following timers/counters for each link that are accessible by all states:

- a) bus inactivity timer;
- b) maximum connect timer;
- c) maximum burst size counter;
- d) I_T nexus loss timer;
- e) arbitration wait timer(AWT); and
- f) pathway blocked counter.

The PL_OC state machine contains two states :

- a) PL_OC1:Overall Control
- b) PL_OC2: SelectLink

The PL_LM state machine contains these states :

- a) Initial State:PL_LM1:Idle;;
- b) PL_LM2: ReqWait;
- c) PL_LM3: Connected;
- d) PL_LM 4:Check I_T Nexus Timer; and
- e) PL_LM 5:Wait For Close.

Figure 2 shows the PL_OC state machine:

SAS port layer Overall Control state machine

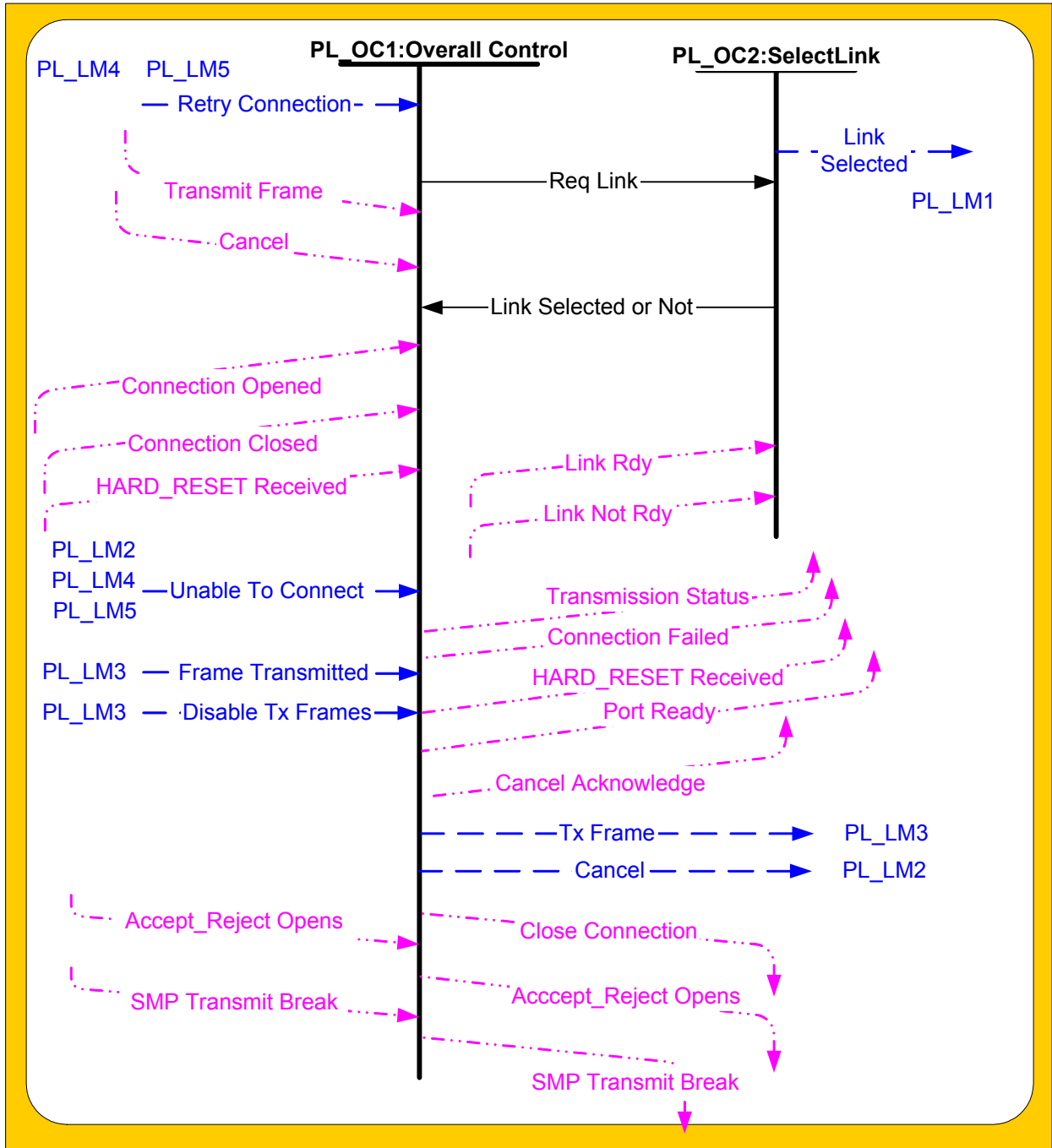


Figure 2. Port layer PL_OC state machine

Figures 3 and 4 shows the PL_LM state machine.

SAS port layer link manager state machine

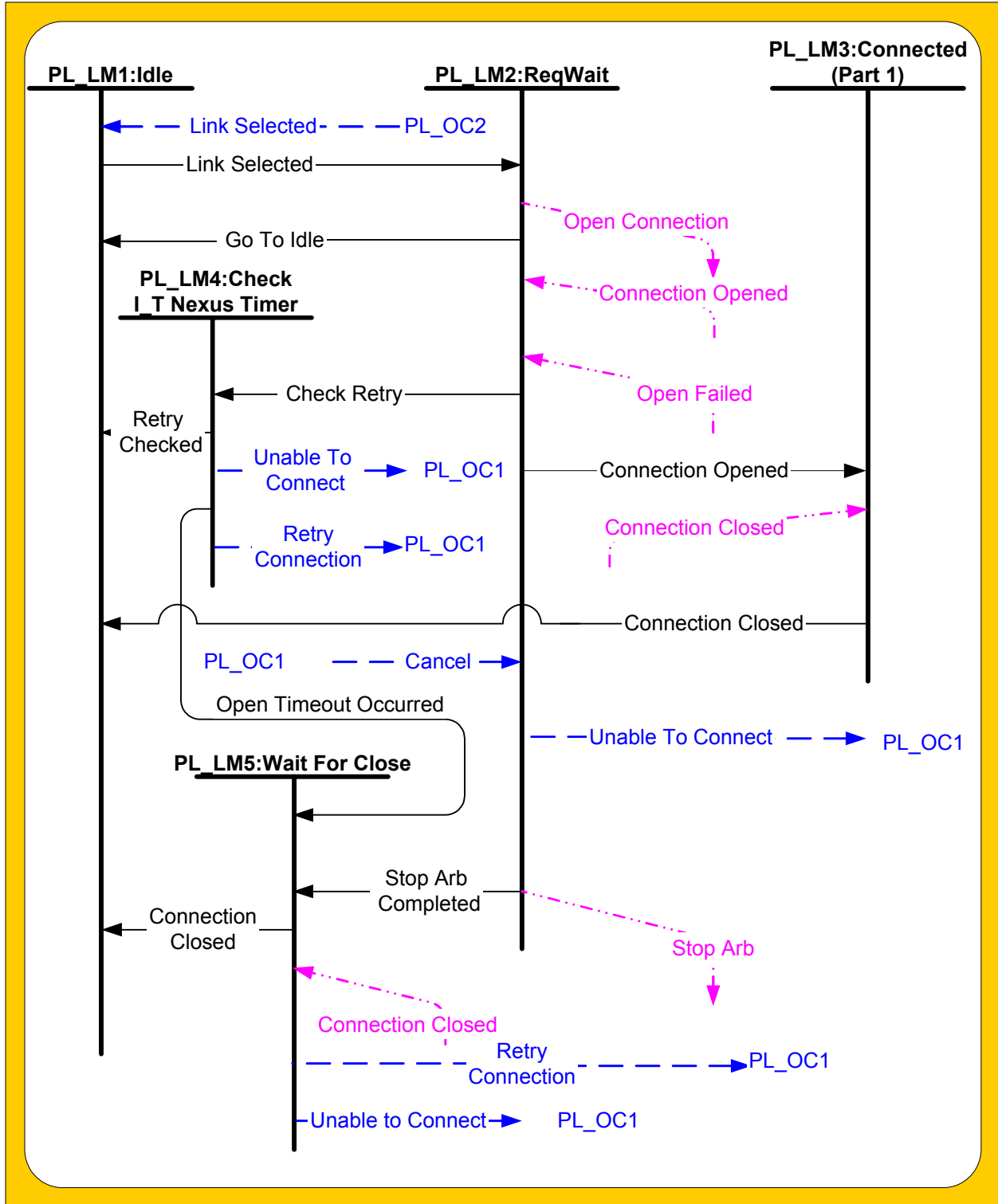


Figure 3. Port layer PL_LM state machine – part 1

SAS port layer link manager state machines

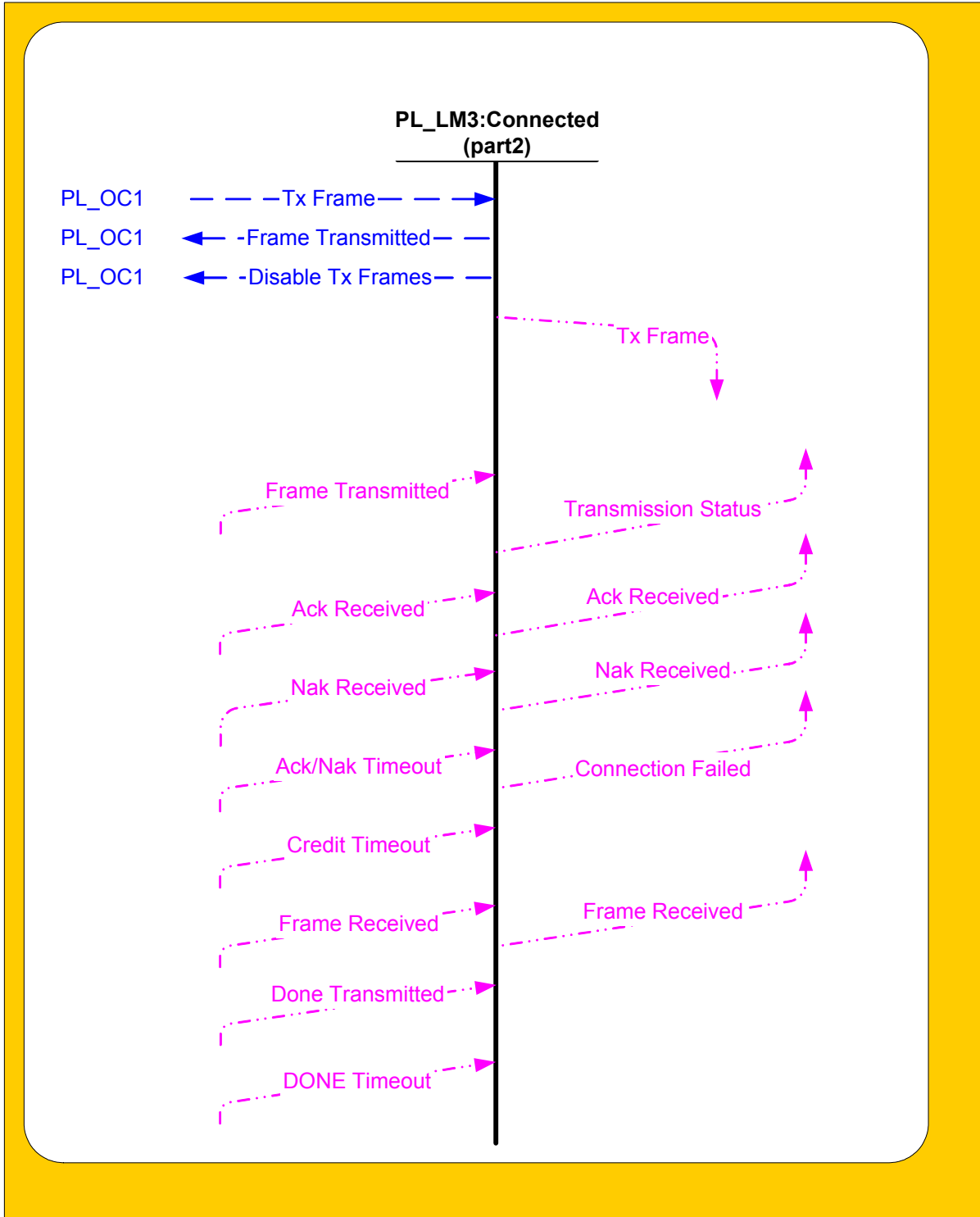


Figure 4. Port layer PL_LM state machine – part 2

8.2 Port Layer timers/counters descriptions

A Counter or timer shall exist for each link.

8.2.1 Bus inactivity timer

The bus inactivity timer is initialized and monitored by the PL_OC state machine during the current connection and before a DONE is transmitted (see 10.1.1.2)

8.2.2 Maximum connect timer

The maximum connect timer is initialized and monitored by the PL_OC state machine during the current connection (see 10.1.1.3).

8.2.3 Maximum burst size counter

The maximum burst size counter is initialized and monitored by the PL_OC state machine during the current connection (see 10.1.1.4).

8.2.4 I_T Nexus loss timer

The I_T nexus loss timer is initialized and monitored by the PL_LM state machine while trying to open a connection (see 10.1.2).

8.2.5 AWT timer

The AWT timer value is passed to the link layer by the PL_LM state machine as an argument in its Open Connection request. The timer shall be initialized as described in 7.11.3. (see 7.5.3)

8.2.6 Pathway blocked counter

The pathway blocked counter is initialized, and incremented by the PL_LM state machine. The timer shall be initialized as described in 7.11.3 (see 7.5.3)

8.3 PL_OC State Machine

8.3.1 PL_OC1:Overall Control state

8.3.1.1 State Description

This state shall receive multiple Transmit Frame requests from one or more transport layers. This state machine determines the order in which these requests are processed. This state machine shall service one Transmit Frame request per link at a time. If multiple links exist for this port, this state may establish multiple connections to multiple destination SAS addresses simultaneously and may transmit and receive via the different links simultaneously (see xxx -gop wide link rules).

This state receives either a Transmit Frame (Interlocked) or a Transmit Frame (Non Interlocked) request from the transport layer that includes the following arguments:

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

If a Transmit Frame request is received from any transport layer and if a connection is open to the destination SAS address, this state determines which frame to transmit and sends a Tx Frame parameter for the frame to be transmitted to the PL_LM state machine.

This State machine shall generate a TX Frame parameter with a balance required argument to the PL_LM state machine when:

- a) A Transmit Frame (Interlocked) request is received from the transport layer;
- b) Any Transmit Frame (Non Interlocked) request following a Transmit Frame(Interlocked) request from the transport layer; or
- c) Any Transmit Frame (Non Interlocked) request with a different Tag value in the Frame Header from the previous Transmit Frame (Non Interlocked) request.

This state machine shall generate a TX Frame parameter with a balance not required argument to the PL_LM state machine when:

- a) A Transmit Frame (Non Interlocked) request is received from the transport layer that does not follow a Transmit Frame(Interlocked) request; or
- b) A Transmit Frame (Non Interlocked) request is received from the transport layer that has the same Tag value in the Frame Header that was present in the preceding Transmit Frame (Non Interlocked) request.

If multiple link's exist, this state may then check for additional Transmit Frame requests.

A Transmit Frame Request is normally concluded by this state sending a Transmission Status (Frame Transmitted) confirmation to the transport layer after receiving a Frame Transmitted parameter from the PL_LM state machine.

A Transmit Frame request is abnormally terminated by this state sending a Transmission Status (Connection Lost) confirmation to the transport layer if any Connection Closed confirmation is received from the link layer after a Tx Frame Parameter is sent but before a Frame Transmitted parameter is received. If this frame is to be retransmitted, the transport layer must generate a new Transmit Frame request.

For SSP devices, a Transmit Frame request is abnormally terminated by this state sending a Connection Failed (Connection Lost Without ACK/NAK) confirmation to the transport layer if any Connection Closed confirmation is received from the link layer after a Frame Transmitted parameter is received but before a ACK Received, NAK Received or ACK/NAK Timeout confirmation is received. If this frame is to be retransmitted, the transport layer must generate a new Transmit Frame request.

If any Connection Closed confirmation is received from the link layer, this state shall make this link available for another connection process.

After receiving a Frame Transmitted parameter from the PL_LM state machine, this state may check if any additional Transmit Frame requests exist to this destination SAS Address. If no more Transmit Frame requests exist to the destination SAS Address, this state may send a Close Connection request to the link layer (see 7.14.7.7.2). If this is an initiator port and there is an additional Transmit Frame request to the destination SAS Address, then a Tx Frame parameter for this Transmit Frame request may be sent to the PL_LM state machine. If this is a target port and there is an additional Transmit Frame request to this destination SAS Address, this state shall check if any of the applicable timers/counters have exceeded the specified limits. If the timers/counters have not exceeded the specified limits, then a Tx Frame parameter may be sent to the PL_LM state machine. If any of the timers/counters have exceeded the specified limits, this state machine shall send a Close Connection request to the link layer.

The transport layer responses for any sequence of frame transmissions (e.g. multiple Non Interlocked data frame transmissions) are instantaneous, therefore the next Transmit Request from the transport layer for that I_T_L_Q should be available when the Transmission Status (Frame Transmitted) confirmation for the previous frame is sent to the transport layer by the port layer.

If a Transmit Frame request is received from any transport ~~layer~~ [layer or a Retry Connection parameter has been received from the PL_LM state machine](#) and if a connection is not open to the destination SAS address, the PL_OC1 state shall initiate a connection sequence by transitioning to the PL_OC2 state ~~to~~. This transition shall include [one of the following parameters](#):

- a) [Req Link](#);

- b) Req Preempted Link And Do Not Initialize PBC;
- c) Req Preempted Link And Initialize PBC; or
- d) Retry Connection Process

The Req Link parameter should be specified for first time attempts to establish a connection and will cause the AWT timer and the pathway blocked counter to be initialized when the PL_OC2 state is entered.

The Req Preempted Link And Do Not Initialize PBC parameter should be specified if the values of the AWT timer and the pathway blocked counter for the link used for the previous connection attempt is to be used for this connection attempt. This parameter should be used if the previous Transmit Frame connection attempt had been preempted by a connection opened to this SAS Address from another source SAS Address because of a selected (i.e., either a Connection Opened (By SSP Destination), or a Connection Opened (By SMP Destination), or a Connection Opened (By STP Destination) confirmation is received) path and if:

- a) This Transmit Frame connection is for the previous Transmit Frame connection which was preempted because of a selected path; or
- b) This Transmit Frame connection is for a higher priority Transmit Frame request than the previous Transmit Frame request whose connection was preempted because of a selected path and if this Transmit Frame connection is to the same destination address. If this occurs, the previous Transmit Frame request will lose its preempted status and become a normal Transmit Frame request.

The Req Preempted Link And Initialize PBC parameter should be specified if the value of the AWT timer for the link used for the last connection attempt is to be used for this connection attempt but the value of the pathway blocked counter is to be initialized. This parameter should be used if the previous Transmit Frame connection attempt had been preempted by a connection opened to this SAS Address from another source SAS Address because of a selected path and if:

- a) This Transmit Frame connection is for a higher priority Transmit Frame request than the previous Transmit Frame request whose connection was preempted because of a selected path and if this Transmit Frame connection is to a different destination address. If this occurs, the previous Transmit Frame request will lose its preempted status and become a normal Transmit Frame request.

The Retry Connection Process parameter should be specified if the connection process attempt is due to receiving the Retry Connection parameter from the PL_LM state machine.

~~either a Req Link or Req Preempted Link parameter to the PL_OC2 state. The Req Link parameter shall cause the AWT timer to be initialized when the PL_OC2 state is entered. The Req Preempted Link parameter shall cause no change to the AWT timer value when the PL_OC2 state is entered. The Req Preempted Link parameter is used to establish a connection that had been previously requested but had been preempted by a connection opened to this SAS Address from another source SAS Address because of a selected (i.e., either a Connection Opened (By SSP Destination), or a Connection Opened (By SMP Destination), or a Connection Opened (By STP Destination) confirmation is received) path.~~

The transition from the PL_OC2 state to the PL_OC1 state shall indicate with parameters if the connection process is proceeding or if no connection attempt shall be made. If the PL_OC2 state returns a Link Not Ready parameter, that signifies that all links are not ready, the PL_OC1 state shall terminate this Transmit Frame request and send a Transmission Status (Open Failed – ~~Port-Link~~ Not Ready) confirmation to the transport layer. If the PL_OC2 state returns a Link Ready parameter and a Link Busy parameter, that signifies that at least one LINK is ready but that all links are busy, then the PL_OC1 state machine shall wait until a Connection Closed confirmation is received from the link layer or an Unable to Connect parameter is received from the PL_LM state machine and then resend the Req Link or Req Preempted Link parameter to the PL_OC2 state. If the PL_OC2 state returns a Link Ready parameter and no Link Busy parameter, that signifies that at least one link is ready and not busy, then a connection process is being performed by the PL_LM2 state machine and the PL_OC1 state machine may service the next Transmit Frame request from the transport layer.

The PL_OC2 state shall select a link and request ~~by~~ by sending the the Link Selected parameter to the PL_LM2 state that the PL_LM2 state send an Open Connection request to the link layer. When the PL_LM state machine sends an Open Connection request to the link layer, one of the following occurs:

- a) The connection is opened for this destination SAS Address as a result of the Open Connection request (i.e., either a Connection Opened (By SSP Source), or a Connection Opened (By SMP Source), or a Connection Opened (By STP Source) confirmation is received) and as a result the requested frame transmission may occur.
- b) The connection is opened with this port from the destination SAS Address requested in the Open Connection request (i.e., either a Connection Opened (By SSP Destination), or a Connection Opened (By SMP Destination), or a Connection Opened (By STP Destination) confirmation is received) and as a result the requested frame transmission may occur.
- c) The connection is opened with this port from a different destination SAS Address requested in the Open Connection request (i.e., either a Connection Opened (By SSP Destination) , or a Connection Opened (By SMP Destination), or a Connection Opened (By STP Destination) confirmation is received) and as a result the requested frame transmission shall not occur. The PL_OC1 state may reexamine the Transmit Frame requests for this transport layer to determine if any transmit requests exist for this destination SAS Address. If transmit requests exist for this different destination SAS Address, these frames may be transmitted during this connection. The original requested frame transmission shall be saved with a [Req Preempted Link And Do Not Initialize PBC parameter](#) ~~Preempted status~~ for priority, [_pathway blocked counter control](#) and AWT control; or
- d) The connection is not established, the Transmit Frame request shall be terminated, and one of the confirmations listed in Table 60 shall be sent to the transport layer based on the received Unable To Connect parameter from the PL_LM state machine.

Confirmation Sent To Link Layer	Received Unable To Connect Parameter
Transmission Status (Open Failed – Wrong Destination)	Unable To Connect (Wrong Destination)
Transmission Status (Open Failed – Link Rate Not Supported)	Unable To Connect (Link Rate Not Supported)
Transmission Status (Open Failed – Protocol Not Supported)	Unable To Connect (Protocol Not Supported)
Transmission Status (Open Failed – Bad Destination)	Unable To Connect (Bad Destination)
Transmission Status (Open Failed – STP Resources Busy)	Unable To Connect (STP Resources Busy)
Transmission Status (Open Failed – Break Received)	Unable To Connect (Break Received)
Transmission Status (Open Failed – I_T Nexus Loss Timeout)	Unable To Connect (No Destination)
Transmission Status (Open Failed – I_T Nexus Loss Timeout)	Unable To Connect (Open Timeout Occurred)
Cancel Acknowledgement	Unable To Connect (Cancel Acknowledgement)

Table 60 – Confirmations to transport layer from the PL_OC state machine

If a Disable Tx Frames parameter is received from the PL_LM state machine, this state shall not send another Tx Frame parameter to the PL_LM state machine until after a Connection Closed confirmation has been received from the link layer.

If this state receives a Connection Opened confirmation from the link layer and there are no pending Transmit Frame requests to this source SAS address, this state shall send a Close Connection request to the link layer (see 7.14.7).

If this state receives a Cancel request for a specific Transmit Frame request from the transport layer and if this specified Transmit Frame request has not been initiated by this state, this state shall terminate this Transmit Frame request and send a Cancel Acknowledge confirmation to the Transport layer. If this state receives a Cancel request for a specific Transmit Frame request from the transport layer and if this specified Transmit Frame request has been initiated by this state and if a connection has been opened, this state shall send a Close Connection request to the link layer. When the connection has been closed, this state shall send a Cancel Acknowledge confirmation to the transport layer for this Transmit Frame request.

If this state receives a Cancel request for a specific Transmit Frame request from the transport layer and if this specified Transmit Frame request has been initiated by this state and if a connection sequence is in process, this state shall send a Cancel parameter to the PL_LM state machine. When the PL_LM state machine has terminated the connection sequence and returned a Unable To Connect (Cancel Acknowledge) parameter, this state shall terminate processing of the Transmit Frame request and send a Cancel Acknowledge confirmation to the transport layer.

If this state receives a Accept_Reject Opens request or an SMP Transmit Break request from the transport layer, this state shall send this request to the link layer.

If this state receives a HARD_RESET Received confirmation from the link layer, this state shall send this confirmation to the transport layer.

For a target port layer this state initializes the following counters/timers for each link when a Connection Opened confirmation is received from the link layer:

- a) maximum connect time timer;
- b) maximum burst size counter; and
- c) bus inactivity timer

For a target port layer, after each Frame Transmitted parameter is received from the PL_LM state machine and if any of the following counter/timers have reached the specification limit, a Close Connection sequence shall be initiated if an additional frame is to be transmitted to this destination SAS address:

- a) maximum connect time timer;
- b) maximum burst size counter; and
- c) bus inactivity timer

The PL_OC state machine shall later open a connection to continue with the frame transmissions.

8.3.1.1 Transition PL_OC1:OverallControl to PL_OC2:SelectLink

The PL_OC1:PL_OC2 transition shall occur when a Transmit Frame request is received from the transport layer [or a Retry Connection parameter is received from the PL_LM state machine](#) and a connection is not open to the destination SAS address, and the PL_OC1 state has determined that this frame is to be transmitted at this time.

8.3.2 PL_OC2:SelectLink state

8.3.2.1 State Description

~~If this state receives a Req Link or a Req Preempted Link, parameter from the PL_OC1 state or a Retry Connection parameter from the PL_LM state machine~~ [When the transition into this state first occurs](#), this state shall first determine if any link's are ready for a connection request. If no link's are ready, this state shall return a Link Not Ready parameter and the connection process shall be terminated. If a link is ready but no link is not busy, a Link Ready parameter and a Link Busy parameter shall be returned and the connection process shall be terminated. If a link is ready and not busy, this state shall return a Link Ready parameter and not return a Link Busy parameter and the connection process shall be continued.

When this state detects a Req Link, a Req Preempted link [And Do Not Initialize PBC](#), or [A Req Preempted Link And Initialize PBC parameter](#) and a link is ready and not busy, this state shall:

- a) Select the link ~~through for~~ the connection request ~~is to be made~~;
- b) Initialize this link's I_T nexus loss time timer;
- c) Initialize this link's arbitration wait timer (AWT) [and the pathway blocked counter](#) if a Req Link parameter was received from the PL_OC state machine;
- d) Not initialize this link's AWT if a Req Preempted Link [And Initialize PBC, or a Req Preempted Link And Initialize PBC](#) parameter was received from the PL_OC state machine. [If a different link than the link used for the previous connection attempted is selected, then the previous link's AWT value will be transferred to the selected link's AWT timer](#);
- e) Initialize this links pathway blocked count counter [if a Req Preempted Link And Initialize PBC parameter was received from the PL_OC state machine](#); ~~and~~

- f) Not initialize this link's pathway blocked counter if a Req Preempted Link And Do Not Initialize PBC parameter was received from the PL_OC state machine If a different link than the link used for the previous connection attempted is selected, then the previous link's pathway blocked count will be transferred to the selected link's counter; and
- g) Send a Link Selected parameter to the PL_LM1 state to continue the connection process.

When this state detects a Retry Connection Process parameter and a link is ready and not busy, this state may select a different link (if the port is a wide port) to attempt another Open Connection request. No timers or counters shall be initialized. If a different link than the link used for the previous connection attempted is selected, then the previous link's pathway blocked count and AWT value will be transferred to the selected link's pathway blocked counter and AWT timer respectively. This state shall send a Link Selected parameter to the PL_LM state machine for the selected link.

8.3.2.2 Transition PL_OC2:SelectLink to PL_OC1:OverallControl

The PL_OC2:PL_OC1 transition shall occur after the PL_OC2 state sends a Link Selected parameter to the PL_LM1 state or after determining that a Link selected parameter should not be sent to the PL_LM1 state.

8.4 PL_LM state machine

8.4.1 PL_LM1:Idle state

8.4.1.1 State description

This is the initial state of the PL_LM state machine. This state is also entered when a connection is closed or a connection attempt is terminated.

8.4.1.2 Transition PL_LM1:Idle to PL_LM2: ReqWait

The PL_LM1:PL_LM2 transition shall occur after receiving a Link Selected parameter from the PL_OC2 state.

8.4.2 PL_LM2:ReqWait state

8.4.2.1 State description

This state:

- a) Sends an Open Connection request to the selected link and interprets the resultant responses; or
- b) Sends a Stop Arb request to the link layer in response to a Cancel parameter transfer from the PL_OC state machine and interprets the resultant response.

The Open Connection request includes these arguments:

- a) destination SAS address;
- b) protocol;
- c) arbitration wait time (current AWT timer value)
- d) pathway blocked count (current pathway blocked counter value);
- e) link rate;
- f) Initiator bit; and
- g) initiator connection tag.

This state shall monitor the link layer confirmations to determine if:

- a) The connection is opened due to the Open Connection Request;
- b) A receive connection occurs that overrides the Open Connection request;
- c) Arbitration is lost, no retry is allowed, an Unable To Connect parameter is to be sent to the PL_OC state machine, and the Idle state is to be entered;
- d) Arbitration is lost, and a check if retry is allowed should be performed; or
- e) Arbitration is terminated due to the link layer completing a Stop Arb request and the PL_LM state machine must wait for a Connection Closed confirmation from the link layer to proceed. . The link layer responds with an Open Failed(Port Layer Response) confirmation when an

arbitration has been terminated due to the link layer completing a Stop Arb request. The PL_LM state machine shall assume that an Open Failed (Open Timeout Occurred) confirmation received from the link layer shall signify that a Stop Arb function has been completed if a Cancel parameter has been received from the PL_OC state machine.

This state shall increment the pathway blocked counter if a Open Failed(Pathway Blocked) confirmation is received from the link layer. This state shall reinitialize the pathway blocked counter if a confirmation other than Open Failed(Pathway Blocked) is received except if the confirmation is either a Connection Opened (By SSP Destination), or a Connection Opened (By SMP Destination), or a Connection Opened (By STP Destination) confirmation then the pathway blocked counter will not be reinitialized.

This state shall reinitialize the AWT timer if a Open Failed(Retry), Open Failed(No Destination), or Open Failed(Open Timeout Occurred) confirmation is received from the link layer.

An Unable To Connect parameter, based on the received Open Failed conformation from the link layer, listed in either table 61 or table 62 shall be sent to the PL_OC state machine when the transition from the PL_LM2 to the PL_LM1 transition occurs:

Parameter sent to PL_OC state machine	Confirmations received from the link layer
Unable to Connect (Wrong Destination)	Open Failed (Wrong Destination)
Unable to Connect (Link Rate Not Supported)	Open Failed (Link Rate Not Supported)
Unable to Connect (Protocol Not Supported)	Open Failed (Protocol Not Supported)
Unable to Connect (Bad Destination)	Open Failed (Bad Destination)
Unable to Connect (STP Resources Busy)	Open Failed (STP Resources Busy)
Unable to Connect (Break Received)	Open Failed (Break Received)

Table 61– Parameters to PL_OC state machine if a Cancel parameter has not been sent to the PL_LM state machine by the PL_OC state machine

Parameter sent to PL_OC state machine	Confirmations received from the link layer
Unable to Connect (Cancel Acknowledgement)	Open Failed (Wrong Destination)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Link Rate Not Supported)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Protocol Not Supported)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Bad Destination)
Unable to Connect (Cancel Acknowledgement)	Open Failed (STP Resources Busy)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Break Received)
Unable to Connect (Cancel Acknowledgement)	Open Failed (No Destination)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Retry)
Unable to Connect (Cancel Acknowledgement)	Open Failed (Pathway Blocked)

Table 62– Parameters to PL_OC state machine if a Cancel parameter has been sent to the PL_LM state machine by the PL_OC state machine

8.4.2.2 Transition PL_LM2:ReqWait to PL_LM1:Idle

The PL_LM2:PL_LM1 transition shall occur after any of the following confirmations are received from the link layer regardless if a Cancel parameter has or has not been sent to the PL_LM state machine by the PL_OC state machine.

- a) Open Failed (Wrong Destination)
- b) Open Failed (Link Rate Not Supported)
- c) Open Failed (Protocol Not Supported)
- d) Open Failed (Bad Destination)
- e) Open Failed (STP Resources Busy)
- f) Open Failed (Break Received)

The PL_LM2:PL_LM1 transition shall occur after any of the following confirmations are received from the link layer if a Cancel parameter has been sent to the PL_LM state machine by the PL_OC state machine

- a) Open Failed (No Destination)
- b) Open Failed (Retry)
- c) Open Failed (Pathway Blocked)

8.4.2.3 Transition PL_LM2:ReqWait to PL_LM3:Connected

The PL_LM2:PL_LM3 transition shall occur after any of the following confirmations are received from the link layer:

- a) Connection Opened (By SSP Source)
- b) Connection Opened (By STP Source)
- c) Connection Opened (By SMP Source)
- d) Connection Opened (By SSP Destination)
- e) Connection Opened (By STP Destination)
- f) Connection Opened (By SMP Destination)

8.4.2.4 Transition PL_LM2:ReqWait to PL_LM4: Check I_T Nexus Timer

If a Cancel parameter is not received from the PL_OC state machine, the PL_LM2:PL_LM4 transition shall occur after receiving one of the following confirmations from the link layer:

- a) Open Failed(Retry);
- b) Open Failed(No Destination);
- c) Open Failed(Pathway Blocked); or
- d) Open Failed(Open Timeout Occurred).

During this PL_LM2 to PL_LM4 transition, the above four confirmations shall be passed to the PL_LM4 state as parameters.

~~If a Cancel parameter is received from the PL_OC state machine, the PL_LM2:PL_LM4 transition shall not occur after receiving any possible confirmation from the link layer.~~

8.4.2.5 Transition PL_LM2:ReqWait to PL_LM5:Wait For Close

The PL_LM2:PL_LM5 transition shall occur after receiving an Open Failed (Port Layer Request) confirmation from the link layer.

If a Cancel parameter is received from the PL_OC state machine, the PL_LM2:PL_LM5 transition shall occur after receiving an Open Failed (Open Timeout Occurred) confirmation from the link layer:

During the PL_LM2 to PL_LM5 transition, the Open Failed (Port Layer Request) and Open Failed (Open Timeout Occurred) confirmations shall be passed as parameters to the PL_LM5 state.

8.4.3 PL_LM3:Connected state

8.4.3.1 State description

When in this state, frame transmissions and receptions may occur.

When in this state and a frame is to be transmitted, the PL_OC state machine may send the Tx Frame parameter to this state. [For SMP frames, no arguments are used. For STP frames, the port layer connects the transport layer to the link layer and is transparent. For SSP frames, a](#)Arguments shall include whether to transmit with Balance Required or Not, and the Frame to be transmitted.

This state shall generate a TX Frame (Balanced Required) request to the link layer when a Tx Frame parameter with a balance required argument is received.

This state shall generate a TX Frame (Balance Not Required) request to the link layer when a Tx Frame parameter with a balance not required argument is received.

After a Tx Frame request has been sent to the link layer and when the frame has been transmitted by the link layer, a Frame Transmitted confirmation is received from the link layer. This state shall then send the PL_OC state machine a Frame Transmitted parameter that notifies the PL_OC state that another frame may be transmitted.

This state shall also send the following confirmations regarding the previous frame transmission confirmations from the link layer to the transport layer:

- 1) Ack Received;
- 2) Nak Received;
- 3) Connection Failed (Connection ~~Lost Without~~Failed ACK/NAK Timeout)– Mapped from the ACK/NAK Timeout confirmation from the link layer; or
- 4) Transmission Status (Credit Timeout) – Mapped from the Credit Timeout confirmation from the link layer);

This state shall send the Frame Received (Ack/Nak Balanced) or Frame Received (Ack/Nak Not Balanced) confirmations from the link layer to the transport layer.

This state shall transfer a Disable Tx Frames parameter to the PL_OC state machine if a Done Received confirmation is received from the link layer.

8.4.3.2 Transition PL_LM3:Connected to PL_LM1:Idle

The PL_LM3:PL_LM1 transition shall occur after a Connection Closed confirmation is received from the link layer.

8.4.4 PL_LM4:Check I_T Nexus Timer state

8.4.4.1 State description

This state shall either set up for a connection retry or set up to terminate connection retries from this state, or indicate that a connection retry or a terminate connection retry function is to be performed from the PL_LM5 state after a Connection Closed confirmation is received from the link layer,

This state shall set up a connection retry by transferring a Retry Connection parameter to the PL_~~OC2~~OC1 state if:

- a) An Open Failed (Retry) or Open Failed (Pathway Blocked) conformation is received from the link layer; or
- b) An Open Failed (No Destination) confirmation is received and if the I_T nexus loss timer has not exceeded the specified limit.

This state shall terminate connection retries by transferring an Unable to Connect (No Destination) parameter to the PL_OC state machine if:

- a) An Open Failed (No Destination) confirmation is received and if the I_T nexus loss timer has exceeded the specified limit.

This state shall indicate whether to continue or terminate connection retries, after a Connection Closed confirmation is received from the link layer, by transferring one of the following parameters during the PL_LM4 to PL_LM5 transition:

- a) An Open Timeout Occurred (I_T nexus loss timer limit not exceeded) after receiving an Open Failed (Open Timeout Occurred) confirmation from the link layer and the I_T nexus loss timer has not exceeded the specified limit); or
- b) An Open Timeout Occurred (I_T nexus loss timer limit exceeded) after receiving an Open Failed (Open Timeout Occurred) confirmation from the link layer and the I_T nexus loss timer has not exceeded the specified limit)

. This state shall initialize the I_T nexus loss timer if a Open Failed (Retry) or Open Failed (Pathway Blocked) confirmation is received from the link layer.

8.4.4.2 Transition PL_LM4:Check I_T Nexus Timer to PL_LM1:Idle

The PL_LM4:PL_LM1 transition shall occur at least ~~15 microseconds~~ one Retry Delay after: Editors note: 15 Us rules should also occur in section 7.12 give 15 us a name - "Retry Delay" - will be defined in 7.12

- a) A Open Failed(Retry) or Open Failed(Pathway Blocked) conformation is received from the link layer; or
- b) A Open Failed(No Destination) confirmation is received and if the I_T nexus loss timer has not exceeded the specified limit.

The PL_LM4:PL_LM1 transition shall occur after:

- a) An Open Failed(No Destination) confirmation is received and if the I_T nexus loss timer has exceeded the specified limit

8.4.4.3 Transition PL_LM4:Check I_T Nexus Timer to PL_LM5:Wait For Close

The PL_LM4: PL_LM5 transition shall occur at least one Retry Delay ~~15 microseconds~~ after:

- a) A Open Failed (Open Timeout Occurred) confirmation is received and if the I_T nexus loss timer has not exceeded the specified limit.

The PL_LM4: PL_LM5 transition shall occur after:

- a) An Open Failed (Open Timeout Occurred) confirmation is received and if the I_T nexus loss timer has exceeded the specified limit.

8.4.5 PL_LM5:Wait For Close state

8.4.5.1 State description

This state shall wait for a Connection Closed confirmation to be received from the link layer and then:

- a) Transfer a Retry Connection parameter to the PL_~~OC2~~OC1 state if the PL_LM5 state was entered from the PL_LM4 state with a received parameter of Open Timeout Occurred (I_T nexus loss timer limit not exceeded);
- b) Transfer a Unable to Connect (Open Timeout Occurred) parameter to the PL_OC1 state if the PL_LM5 state was entered from the PL_LM4 state with a received parameter of Open Timeout Occurred (I_T nexus loss timer limit exceeded); or
- c) Transfer an Unable to Connect (Cancel Acknowledge) parameter to the PL_OC1 state if the PL_LM5 state was entered from the PL_LM2 state with a received parameter of either Open Failed (Open Timeout Occurred) or Open Failed (Port Layer Request).

8.4.5.2 Transition PL_LM5:Wait For Close to PL_LM1:Idle

The PL_LM5:PLLM1 transition shall occur after a Connection Closed confirmation is received from the link layer.