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To: T10 Committee (SCSI)

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Subject: SAS Identification state machine

## 1 Overview

This proposal defines the SAS identification state machine.

### 1.1 Identification/HARD\_RESET sequence description

#### 1.1.1 Overview

The identification/HARD\_RESET sequence contains several state machines that run in parallel to control the flow of dwords on a link that are associated with the identification and HARD\_RESET sequences (see figure 1). The identification/HARD\_RESET sequence (IR) state machines are as follows:

- a) SAS phy receiver (R state machine);
- b) Originate IDENTIFY address frame and HARD\_RESET (OIR state machine);
- c) SAS phy transmitter (T state machine);
- d) Frame receive (FR state machine); and
- e) IDENTIFY and HARD\_RESET control (IRC state machine).

All the state machines within the identification/HARD\_RESET sequence shall begin on an indication of an enable identification/HARD\_RESET sequence from the XXX:xxx state of the xx state machine.

If a state machine consists of multiple states the initial state is as indicated in state machine description in this subclause.

The R state machine's function is to receive primitives and frames from the link and indicate to other IR state machines the receipt of those dwords. The R state machine contains the IR\_R1:Receive state (see 1.1.2).

The OIR state machine's function is to transmit an IDENTIFY address frame or a HARD\_RESET. The OIR state machine contains the following states:

- a) Initial state: IR\_OIR1:IDENTIFY\_idle (see 1.1.3);
- b) IR\_OIR2:Indicate\_frame\_tx (see 1.1.4); and
- c) IR\_OIR3:Indicate\_reset\_tx (see 1.1.5).

The T state machine's function is to transmit primitives and frames to the link and indicate to other state machines the transmission of those dwords. The T state machine contains the IR\_T1:Transmit state (see 1.1.6).

The FR state machine's function is to receive an IDENTIFY address frame and indicating the successful or unsuccessful receipt of the IDENTIFY address frame. The FR state machine contains the IR\_FR1:Frame\_receive state (see 1.1.7).

The IRC state machine's function is to:

- a) ensure an IDENTIFY address frame has been received and transmitted before confirming the identify sequence has completed; and
- b) ensure a confirmation occurs if a HARD\_RESET is received before an IDENTIFY address frame has been received.

The IRC state machine contains the IR\_IRC1:IDENTIFY\_reset\_wait state (see 1.1.8).

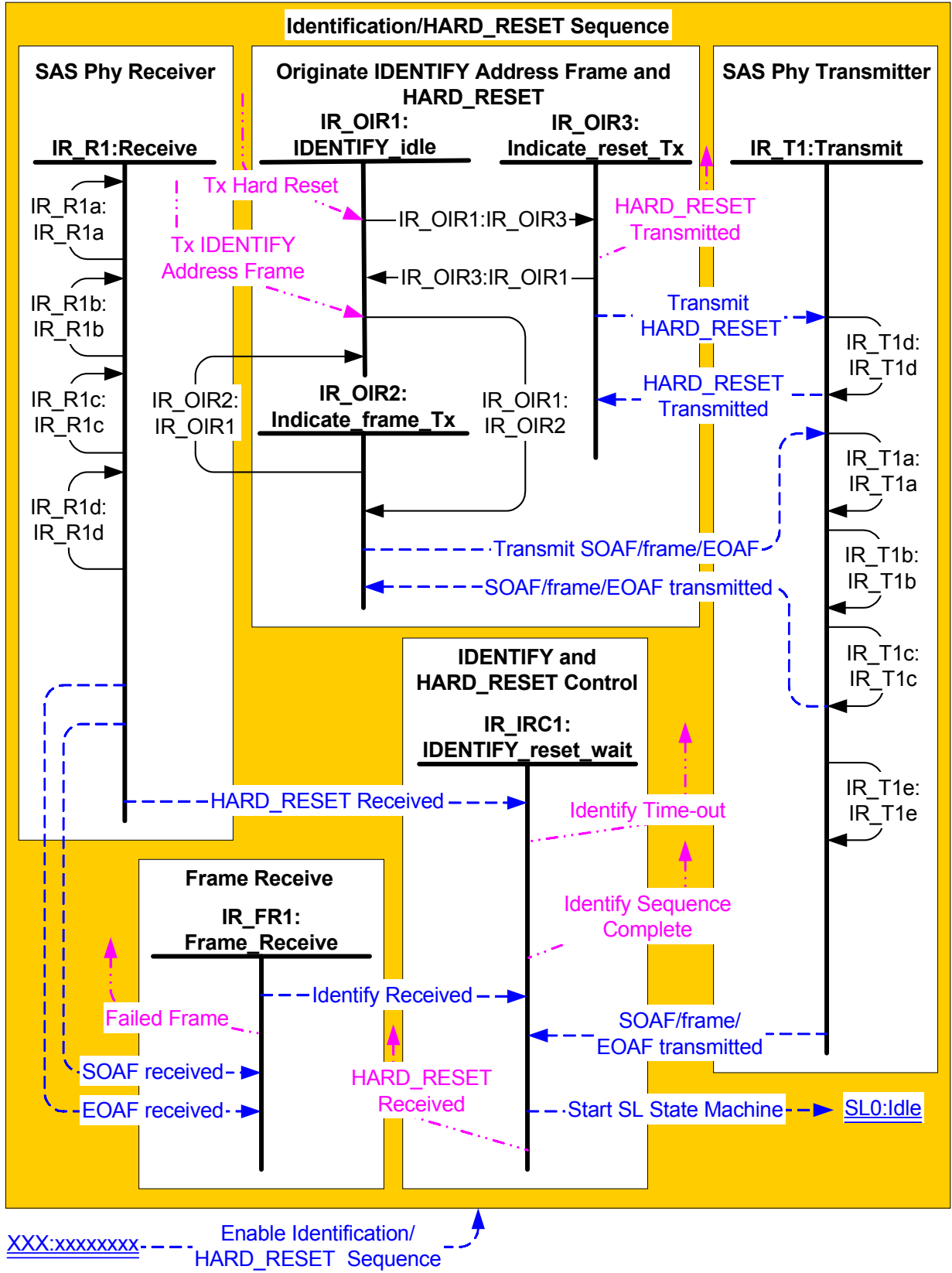


Figure 1 - Identification/HARD\_RESET sequence state machine

## 1.1.2 IR\_R1:Receive state

### 1.1.2.1 IR\_R1:Receive state description

The receive state receives frames and primitives from the link.

As a result of receiving an SOAF from the link the receive state shall indicate using the SOAF received parameter that an SOAF was received to the frame\_receive state.

As a result of receiving an EOAF from the link the receive state shall indicate using the EOAF received parameter that an EOAF was received to the frame\_receive state.

As a result of receiving a HARD\_RESET from the link the receive state shall indicate using the HARD\_RESET received parameter that a HARD\_RESET was received to the IDENTIFY\_reset\_wait state.

### 1.1.2.2 Transition IR\_R1a:IR\_R1a (Receive:Receive)

The IR\_R1a:IR\_R1a transition shall occur every time an SOAF is received on the link.

### 1.1.2.3 Transition IR\_R1b:IR\_R1b (Receive:Receive)

The IR\_R1b:IR\_R1b transition shall occur every time an dword associated with a frame is received on the link.

### 1.1.2.4 Transition IR\_R1c:IR\_R1c (Receive:Receive)

The IR\_R1c:IR\_R1c transition shall occur every time an EOAF is received on the link.

### 1.1.2.5 Transition IR\_R1d:IR\_R1d (Receive:Receive)

The IR\_R1d:IR\_R1d transition shall occur every time a HARD\_RESET is received on the link.

## 1.1.3 IR\_OIR1:IDENTIFY\_idle state

### 1.1.3.1 IR\_OIR1:IDENTIFY\_idle state description

The IDENTIFY\_idle state shall transition:

- a) to the indicate\_frame\_tx state on a request from the port layer to transmit an IDENTIFY address frame; or
- b) to the indicate\_reset\_tx state on a request from the port layer to transmit a HARD\_RESET.

### 1.1.3.2 Transition IR\_OIR1:IR\_OIR2 (IDENTIFY\_idle:Indicate\_frame\_tx)

The IR\_OIR1:IR\_OIR2 transition shall occur when the port layer requests using the Tx IDENTIFY Address Frame parameter that an IDENTIFY address frame is to be transmitted.

### 1.1.3.3 Transition IR\_OIR1:IR\_OIR3 (IDENTIFY\_idle:Indicate\_reset\_tx)

The IR\_OIR1:IR\_OIR3 transition shall occur when the port layer requests using the Tx HARD\_RESET parameter that a HARD\_RESET is to be transmitted.

## 1.1.4 IR\_OIR2:Indicate\_frame\_tx state

### 1.1.4.1 IR\_OIR2:Indicate\_frame\_tx state description

The indicate\_frame\_tx state indicates to the transmit state using the transmit SOAF/frame/EOAF

parameter that an IDENTIFY address frame be transmitted on the link.

#### **1.1.4.2 Transition IR\_OIR2:IR\_OIR1 (Indicate\_frame\_tx:IDENTIFY\_idle)**

The IR\_OIR2:IR\_OIR1 transition shall occur after the SOAF/frame/EOAF transmitted parameter is received from the transmit state.

#### **1.1.5 IR\_OIR3:Indicate\_reset\_tx state**

##### **1.1.5.1 IR\_OIR3:Indicate\_reset\_tx state description**

The indicate\_reset\_tx state indicates to the transmit state using the transmit HARD\_RESET parameter that a HARD\_RESET is be transmitted on the link.

##### **1.1.5.2 Transition IR\_OIR3:IR\_OIR1 (Indicate\_reset\_tx:IDENTIFY\_idle)**

The IR\_OIR3:IR\_OIR1 transition shall occur after the indicate\_reset\_tx state receives a HARD\_RESET transmitted parameter from the transmit state and a confirmation is sent to the port layer using the HARD\_RESET Transmitted parameter that the HARD\_RESET has been transmitted.

#### **1.1.6 IR\_T1:Transmit state**

##### **1.1.6.1 IR\_T1:Transmit state description**

The transmit state requests the link to transmit:

- a) an SOAF/frame/EOAF when the indicate\_frame\_tx state using the transmit SOAF/frame/EOAF parameter indicates an IDENTIFY address frame be transmitted; or
- b) a HARD\_RESET when the indicate\_reset\_tx state using the transmit HARD\_RESET parameter indicates a HARD\_RESET be transmitted.

In the absence of any transmit requests the transmit state shall transmit idle dwords and ALIGNs on the link as necessary.

On an indication that a SOAF/frame/EOAF is to be transmitted the transmit state shall transmit an SOAF in the dword before the first dword of the frame and an EOAF in first dword after the last dword of the frame. If during the transmission of a frame an indication that a primitive is to be transmitted occurs the transmit state may transmit the indicated primitive by inserting the primitive between the frames' dwords.

The transmit state shall:

- a) indicate using the SOAF/frame/EOAF transmitted parameter to the indicate\_frame\_tx state each time an EOAF is transmitted; and
- b) indicate using the HARD\_RESET transmitted parameter to the indicate\_reset\_tx state each time a HARD\_RESET is transmitted.

##### **1.1.6.2 Transition IR\_T1a:IR\_T1a (Transmit:Transmit)**

The IR\_T1a:IR\_T1a transition shall occur every time an SOAF is transmitted on the link.

##### **1.1.6.3 Transition IR\_T1b:IR\_T1b (Transmit:Transmit)**

The IR\_T1b:IR\_T1b transition shall occur every time a dword associated with a frame is transmitted on the link.

**1.1.6.4 Transition IR\_T1c:IR\_T1c (Transmit:Transmit)**

The IR\_T1c:IR\_T1c transition shall occur every time an EOAF is transmitted on the link.

**1.1.6.5 Transition IR\_T1d:IR\_T1d (Transmit:Transmit)**

The IR\_T1d:IR\_T1d transition shall occur every time a HARD\_RESET is transmitted on the link.

**1.1.6.6 Transition IR\_T1e:IR\_T1e (Transmit:Transmit)**

The IR\_T1e:IR\_T1e transition shall occur every time an idle is transmitted on the link.

**1.1.7 IR\_RF1:Frame\_receive state****1.1.7.1 IR\_RF1:Frame\_receive state description**

The frame\_rcv state checks the IDENTIFY address frame to determine if the frame should be accepted or discarded by the link.

The IDENTIFY address frame (i.e., all the dwords between an SOAF and EOAF) shall be discarded and a confirmation sent to the port layer using the Failed Frame Parameter that an illegal IDENTIFY address frame was received if any one or more of the following conditions is true:

- a) the ADDRESS FRAME TYPE field is not set to identify;
- b) the number of bytes between the SOAF and EOAF is not equal to 32 bytes; or
- c) the CRC is invalid.

The IDENTIFY address frame shall be accepted and the frame\_receive state shall send an IDENTIFY received parameter to the IDENTIFY\_reset\_wait state if:

- a) the ADDRESS FRAME TYPE field is set to identify;
- b) the number of bytes between the SOAF and EOAF is equal to 32 bytes; and
- c) the CRC is valid.

**1.1.8 IR\_IRC1:IDENTIFY\_reset\_wait state****1.1.8.1 IDENTIFY\_reset\_wait state description**

The IDENTIFY\_reset\_wait state ensures that an IDENTIFY address frame has been received and transmitted on the link before indicating to the SL0:Idle state it may accept connection requests from the port layer. The IDENTIFY address frame may be transmitted and received on the link in any order.

After the IDENTIFY\_reset\_wait state receives an SOAF/frame/EOAF transmitted parameter from the transmit state it shall initialize a receive identify time-out timer to one millisecond. If an identify received parameter is indicated from the frame\_receive state before the identify time-out timer is exceeded the IDENTIFY\_reset\_wait state shall:

- a) send a confirmation to the port layer using the Identify Sequence Complete parameter that the identify sequence has completed; and
- b) indicate to the SL0:idle state (see xxxx) using the start SL state machine parameter that the SL state machine may accept connection requests from the port layer.

If the identify time-out timer is exceeded before an identify received parameter from the frame\_receive state is indicated the IDENTIFY\_reset\_wait state shall send a confirmation to the port layer using the Identify Time-Out parameter that an identify time-out occurred.

If the IDENTIFY\_reset\_wait state receives a HARD\_RESET received parameter from the receive state

before an identify received parameter is received from the frame\_receive state the following shall occur:

- a) the IDENTIFY\_reset\_wait state shall send a confirmation to the port layer using the HARD\_RESET Received parameter that a HARD\_RESET occurred; and
- b) all the state machines within the identification and hard reset sequence shall be disabled until an indication of an enable identification/HARD\_RESET sequence from the XXX:xxx state of the xx state machine occurs.

If the IDENTIFY\_reset\_wait state receives a HARD\_RESET received parameter from the receive state after an identify received parameter is received from the frame\_receive state the HARD\_RESET shall be ignored.