

**To: T10 SAS Protocol Working Group**

**From: Brian Day**

**Subject: SAS 2 : 08-425 TRAIN\_DONE race condition fix**

### **Revision History**

Revision 0 - Initial draft

### **Related Documents**

sas2r14f - Serial Attached SCSI - 2 Draft revision 14f

### **Overview**

As originally indicated on the T10 reflector by Bill Martin of Emulex (posted 10/27/2008), there is a race condition relative to when devices transition from SP29:SAS\_Train to SP30:SAS\_TrainingDone.

From the reflector email:

“There is an issue of devices not coming out of the train done sequence properly in the following case:

Device A and Device B begin transmitting the TRAIN pattern.

Device A locks on the TRAIN pattern and begins transmitting TRAIN\_DONE

Device A completes sending 4 TRAIN\_DONE patterns and continues sending TRAIN\_DONE patterns waiting for the TRAIN\_DONE primitive to be received

Device A sends TRAIN\_DONE primitive sequence and one of the dword of the TRAIN\_DONE pattern

Device B completes TRAIN and sends TRAIN\_DONE

Device A detects TRAIN\_DONE before completing the current TRAIN\_DONE pattern and exits the TRAIN SNW (not sending any more TRAIN\_DONE primitives

Device B never detects TRAIN\_DONE primitive from device A”

This then results in Device A continuing to SP15:SAS\_PHY\_Ready, sending its IDENTIFY frame, timing out after 1ms, and going back to COMINIT.

Since there is some expectation that there will be devices in production that use the “current” training protocol with the existing race condition, this proposal adds a new receiver requirement that both fixes the problem above, and increases interoperability with these early production devices.

### **Proposed Changes**

#### **6.8.4.12 SP29:SAS\_Train state**

##### **6.8.4.12.1 State description**

Upon entry into this state, the phy shall:

- a) initialize and start the MTT timer;
- b) initialize and start the TLT timer;
- c) send a Start Training message to the SP receiver; and
- d) send a Start DWS message to the SP\_DWS state machine.

This state shall repeatedly send Transmit TRAIN Pattern messages to the SP transmitter.

Each time this state receives a DWS Lost message, this state shall send a Start DWS message to the SP\_DWS state machine to re-acquire dword synchronization.

If the MTT timer expires, then this state shall send an Abort Training message to the SP receiver.

A phy reset problem occurs if:

- a) the MTT timer expires; and
- b) the Commonly Supported Settings state machine variable does not contain additional commonly supported settings.

#### 6.8.4.12.2 Transition SP29:SAS\_Train to SP0:OOB\_COMINIT

This transition shall occur after receiving a COMINIT Detected message.

Before the transition, this state shall set the ResetStatus state machine variable to UNKNOWN.

#### 6.8.4.12.3 Transition SP29:SAS\_Train to SP1:OOB\_AwaitCOMX

This transition shall occur if a phy reset problem occurs.

Before the transition, this state shall set the ResetStatus state machine variable to PHY\_RESET\_PROBLEM.

#### 6.8.4.12.4 Transition SP29:SAS\_Train to SP28:SAS\_TrainSetup

This transition shall occur if:

- a) the MTT timer expires; and
- b) the Commonly Supported Settings state machine variable contains additional commonly supported settings.

#### 6.8.4.12.5 Transition SP29:SAS\_Train to SP30:SAS\_TrainingDone

This transition shall occur if:

- a) the TLT timer has not expired;
- b) this state receives a Training Completed message; ~~and~~
- c) dword synchronization is acquired; ~~and~~
- d) this state receives a TRAIN Received message or TRAIN\_DONE Received message.

If a TRAIN\_DONE Received message was received, then the transition shall include a TRAIN\_DONE Received argument.

### 6.8.4.13 SP30:SAS\_TrainingDone state

#### 6.8.4.13.1 State description

This state shall repeatedly send Transmit TRAIN\_DONE Pattern messages to the SP transmitter.

Each time this state receives a DWS Lost message, this state may send a Start DWS message to the SP\_DWS state machine to re-acquire dword synchronization without running a new link reset sequence.

This state waits for the MTT timer to expire or a TRAIN\_DONE Received message from the receiver.

This state shall send a Start SL\_IR Receiver confirmation to the link layer when a TRAIN\_DONE Received message is received.

A phy reset problem occurs if:

- a) TRAIN\_DONE Received message is not received before the MTT timer expires; and
- b) the Commonly Supported Settings state machine variable does not contain additional commonly supported settings.

**6.8.4.13.2 Transition SP30:SAS\_TrainingDone to SP0:OOB\_COMINIT**

This transition shall occur after receiving:

- a) a DWS Lost message if this state does not send a Start DWS message; or
- b) a COMINIT Detected message.

Before the transition, this state shall set the ResetStatus state machine variable to UNKNOWN.

**6.8.4.13.3 Transition SP30:SAS\_TrainingDone to SP1:OOB\_AwaitCOMX**

This transition shall occur if a phy reset problem occurs.

Before the transition, this state shall set the ResetStatus state machine variable to PHY\_RESET\_PROBLEM.

**6.8.4.13.4 Transition SP30:SAS\_TrainingDone to SP28:SAS\_TrainSetup**

This transition shall occur if:

- a) the MTT timer expires; and
- b) the Commonly Supported Settings state machine variable contains additional commonly supported settings.

**6.8.4.13.5 Transition SP30:SAS\_TrainingDone to SP15:SAS\_PHY\_Ready**

This transition shall occur if this state receives: at least four TRAIN\_DONE Pattern Transmitted messages; ~~and~~and:

- a) a TRAIN\_DONE Received message ~~before the MTT timer expires;~~or
- b) this state was entered with a TRAIN\_DONE Received argument.~~;~~