To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 31 October 2006
Subject: 06-476r0 SAS-2 DISCOVER response Attached Device Name for SATA

Revision history
Revision 0 (31 October 2006) First revision

Related documents
sas2r06 - Serial Attached SCSI - 2 (SAS-2) revision 6

Overview
When 05-309 added the Device Name field to the IDENTIFY address frame and the DISCOVER response Attached Device Name field (bytes 52-59) in SAS-2, it left the ATTACHED DEVICE NAME field set to zero for SATA devices. This field would be more useful if it indicated something about the SATA device's actual identity (as opposed to the SAS address provided for it by the expander to which it happens to be attached).

The expander device could fetch the IDENTIFY (PACKET) DEVICE data itself if a SATA device is attached, and report in the DISCOVER response Attached Device Name field:

a) the Worldwide Name (words 108-111), if it is non-zero
b) a hashed version of the Serial Number (words 10-19) and Model Number (words 27-36). The first 4 bits must not equal 5h to ensure there are no collisions with real NAA identifiers. Since the source fields are not guaranteed unique and hashing in general only weakens uniqueness, this value is not guaranteed to be unique (but it is very likely to be).

This would extend the time until which the ATTACHED DEVICE TYPE field is updated to 001b (as if the initial D2H Register FIS is taking longer) and until which connection requests are accepted.

The expander can discard all other IDENTIFY (PACKET) DEVICE data; it just needs to store 8 bytes x (number of phys).

Suggested changes

3.1.xx IDENTIFY (PACKET) DEVICE data: IDENTIFY DEVICE data from an ATA device, or IDENTIFY PACKET DEVICE data from an ATAPI device. See ATA8-ACS.

7.17.5 Opening an STP connection

If no STP connection exists when the SATA host port in an STP/SATA bridge receives a SATA_X_RDY from the attached SATA device, the STP target port in the STP/SATA bridge shall establish an STP connection to the appropriate STP initiator port before it transmits a SATA_R_RDY to the SATA device.

> Editor's Note 1: The following paragraph and note are moved here from the REPORT PHY SATA section 10.4.3.9, where it should not be hidden.

An STP/SATA bridge that receives a connection request for a SATA device ~~that has not successfully delivered the initial Register – Device to Host FIS~~from which it has not retrieved the IDENTIFY (PACKET) DEVICE data shall return an OPEN_REJECT (NO DESTINATION).

> NOTE 1 - If there is a problem receiving the expected initial Register - Device to Host FIS, the STP/SATA bridge should use SATA_R_ERR to retry until it succeeds. In the DISCOVER response, the ATTACHED SATA DEVICE bit is set to one and the ATTACHED SAS ADDRESS field is valid, but the ATTACHED DEVICE TYPE field is set to 000b (i.e., no device attached) during this time.

If there is a problem retrieving the IDENTIFY (PACKET) DEVICE data (e.g., word 255 (i.e., the Integrity Word) is not correct), the STP/SATA bridge shall set the ATTACHED DEVICE NAME field to zero and set the ATTACHED DEVICE TYPE field to 001b (i.e, end device).

A wide STP initiator port shall not request more than one connection at a time to a specific STP target port.

While a wide STP initiator port is waiting for a response to a connection request to an STP target port, it shall not reject an incoming connection request from that STP target port because of its outgoing connection request. It may reject incoming connection requests for other reasons (see 7.2.5.12).

If a wide STP initiator port receives an incoming connection request from an STP target port while it has a connection established with that STP target port, it shall reject the request with OPEN_REJECT (RETRY).

A wide STP target port shall not request more than one connection at a time to a specific STP initiator port.

While a wide STP target port is waiting for a response to a connection request or has established a connection to an STP initiator port, it shall:

    a) reject incoming connection requests from that STP initiator port with OPEN_REJECT (RETRY); and
    b) if affiliations are supported, reject incoming connection requests from other STP initiator ports with OPEN_REJECT (STP RESOURCES BUSY).

An expander device should not allow its STP ports (e.g., the STP target ports in STP/SATA bridges and any STP initiator ports in the expander device) to attempt to establish more connections to a specific destination port than the destination port width or the width of the narrowest physical link on the pathway to the destination port. This does not apply to connection requests being forwarded by the expander device.

An expander device should not allow its STP ports (e.g., the STP target ports in STP/SATA bridges and any STP initiator ports in the expander device) to attempt to establish more connections than the width of the narrowest common physical link on the pathways to the destination ports of those connections. This does not apply to connection requests being forwarded by the expander device.

10.4.3.7 DISCOVER function

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The ATTACHED DEVICE TYPE field indicates the DEVICE TYPE value received during the link reset sequence and is defined in table 1.

Table 1 — ATTACHED DEVICE TYPE **field**

Code	Description
000b	No device attached
001b	End device
010b	Expander device
011b	Expander device compliant with a previous version of this standard
All others	Reserved

The ATTACHED DEVICE TYPE field shall only be set to a value other than 000b after:

    a) the identification sequence is complete if a SAS device or expander device is attached; or
    b) the ~~initial Register - Device to Host FIS has been received~~IDENTIFY (PACKET) DEVICE data has been retrieved if a SATA phy is attached.

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~~The ATTACHED DEVICE NAME field contains the value of the device name received in the IDENTIFY address frame during the identification sequence. If the attached port is an expander port or a SAS port, the ATTACHED DEVICE NAME field contains the device name of the attached expander device or SAS device (see 4.2.4). If the attached port is a SATA device port, the attached device name field contains 00000000 00000000h.~~

~~The ATTACHED DEVICE NAME field shall be updated:~~

    ~~a) after the identification sequence completes, if a SAS phy or expander phy is attached; or~~

b) ~~after the COMSAS Detect Timeout timer expires (see 6.8.3.9), if a SATA phy is attached.~~

Table 2 defines the ATTACHED DEVICE NAME field.

Table 2 — ATTACHED DEVICE NAME **field for SATA devices**

Condition	Update time	Value
A SAS phy or expander phy is attached	Completion of the identification sequence	The DEVICE NAME field in the incoming IDENTIFY address frame (i.e., the attached expander device name or attached SAS device name (see 4.2.4))
A SATA phy is attached	Expiration of the COMSAS Detect Timeout timer (see 6.8.3.9)	00000000 00000000h
	Reception of IDENTIFY (PACKET) DEVICE data from the SATA device	If IDENTIFY (PACKET) DEVICE data word 255 (i.e., the Integrity word) is correct and words 108-111 (i.e., the World Wide Name) are set to zero, a hash of the IDENTIFY (PACKET) DEVICE data words 27-36 (i.e., the Model Number) and words 10-19 (i.e., the Serial Number).
		If IDENTIFY (PACKET) DEVICE data word 255 (i.e., the Integrity word) is correct and words 108-111 (i.e., the World Wide Name field) are not set to zero, set this field to the world wide name indicated by words 108-111 according to table 3.
		If IDENTIFY (PACKET) DEVICE data word 255 (i.e., the Integrity word) is not correct, set this field to 00000000 00000000h.

Editor's Note 2: A hash algorithm needs to be selected to hash 10+10=20 bytes (160 bits) total down to 60 bits.

When specified by table 2, the ATTACHED DEVICE NAME field shall be based on the IDENTIFY (PACKET) DEVICE data WORLD WIDE NAME field as described in table 3.

Table 3 — ATTACHED DEVICE NAME field created from the IDENTIFY (PACKET) DEVICE data

ATTACHED DEVICE NAME field		Contents
Subformat field name (see table 9 in 4.2.2)	Specific bits in table 223	
NAA	Byte 52 bits 7:4	IDENTIFY (PACKET) DEVICE data word 108 bits 15:12 [a]
IEEE COMPANY_ID	Byte 52 bits 3:0	IDENTIFY (PACKET) DEVICE data word 108 bits 11:8
	Byte 53	IDENTIFY (PACKET) DEVICE data word 108 bits 7:0
	Byte 54	IDENTIFY (PACKET) DEVICE data word 109 bits 15:8
	Byte 55 bits 7:4	IDENTIFY (PACKET) DEVICE data word 109 bits 7:4
VENDOR SPECIFIC IDENTIFIER	Byte 55 bits 3:0	IDENTIFY (PACKET) DEVICE data word 109 bits 3:0
	Byte 56	IDENTIFY (PACKET) DEVICE data word 110 bits 15:8
	Byte 57	IDENTIFY (PACKET) DEVICE data word 110 bits 7:0
	Byte 58	IDENTIFY (PACKET) DEVICE data word 111 bits 15:8
	Byte 59	IDENTIFY (PACKET) DEVICE data word 111 bits 7:0
[a] This 4-bit field is required to be set to 5h (i.e., IEEE Registered) by ATA8-ACS.		

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10.4.3.9 REPORT PHY SATA function

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The REGISTER DEVICE TO HOST FIS field contains the contents of the initial Register - Device to Host FIS. For an STP/SATA bridge, this is delivered by the attached SATA device after a link reset sequence (see ATA/ATAPI-7 V3 and SATAII-EXT). For a native STP target port in an end device, this is directly provided.

The FIS contents shall be stored with little-endian byte ordering (i.e., the first byte, byte 24, contains the FIS Type).

For an STP/SATA bridge, the first byte of the field (i.e., the FIS Type) shall be initialized to zero on power on and whenever the phy has restarted the link reset sequence after losing dword synchronization (see 6.9)(i.e., the SP state machine transitioned from SP22:SATA_PHY_Ready to SP0:OOB_COMINIT (see 6.8)) to indicate the field is invalid and the attached SATA device has not delivered a Register – Device to Host FIS. The first byte of the field shall be set to 34h when the attached SATA device has delivered the initial Register – Device to Host FIS. The remaining contents of the REGISTER DEVICE TO HOST FIS field shall remain constant until a link reset sequence causes the attached SATA device to deliver another initial Register – Device to Host FIS.

An STP/SATA bridge that receives a connection request for a SATA device that has not successfully delivered the initial Register – Device to Host FIS shall return an OPEN_REJECT (NO DESTINATION).

NOTE 2 - If there is a problem receiving the expected initial Register - Device to Host FIS, the STP/SATA bridge should use SATA_R_ERR to retry until it succeeds. In the DISCOVER response, the ATTACHED SATA DEVICE bit is set to one and the ATTACHED SAS ADDRESS field is valid, but the ATTACHED DEVICE TYPE field is set to 000b (i.e., no device attached) during this time.