

To: T10 Technical Committee
 From: Rob Elliott, HP (elliott@hp.com)
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 Subject: 05-309r0 SAS-2 Add device name to IDENTIFY address frame

Revision history

Revision 0 (22 August 2005) First revision

Related documents

sas1r09e - Serial Attached SCSI revision 9e

05-144r4 - SAS-2 zoning (Heng Liao and Steve Gorshe, PMC-Sierra and Tom Grieff, HP)

Overview

SAS-1.1 requires all SAS devices (both initiators and targets) to have device names. Target device name can be retrieved through the INQUIRY Device Identification VPD page 83h (an identifier with ASSOCIATION=2h). Initiator device names are not available through any means defined in SAS.

This proposes adding the device name to the IDENTIFY address frame, so both initiators and targets can report their names in a common manner.

The device name could be used by zoning (see 05-144) to grant permissions based on server or operating system instance identity rather than HBA physical port identity. If zoning only uses port identifiers and there is no access to initiator device names, HBA replacement causes confusion. With the initiator device name available, supervisor software can grant the new HBA port the same rights as the old if the device name is still the same.

Suggested changes

4.2 Names and identifiers

4.2.1 Names and identifiers overview

Device names are worldwide unique names for devices within a transport protocol. Port names are worldwide unique names for ports within a transport protocol. Port identifiers are the values by which ports are identified within a domain. Phy identifiers are unique within a device.

Table 1 describes the definitions of names and identifiers for SAS.

Table 1 — Names and identifiers

Attribute	SAS implementation	Reference
Port identifier	SAS address	4.2.2 and 4.2.6
Port name	Not defined	4.2.5
Device name	SAS address	4.2.2 and 4.2.4
Phy identifier	Phy identifier	4.2.7

Table 2 describes how various SAM-3 attributes are implemented in SSP.

Table 2 — SAM-3 attribute mapping

SAM-3 attribute	SSP implementation
Initiator port identifier	SAS address of SSP initiator port
Initiator port name	Not defined
Target port identifier	SAS address of SSP target port
Target port name	Not defined
SCSI device name	SAS address of SCSI device

4.2.2 SAS address

Table 3 defines the SAS address format. SAS addresses shall be compatible with the NAA (Name Address Authority) IEEE Registered format identification descriptor defined in SPC-3.

Table 3 — SAS address format

Byte/Bit	7	6	5	4	3	2	1	0
0	NAA (5h)				(MSB)			
1	IEEE COMPANY ID							
2								
3	(LSB)			(MSB)				
4	VENDOR-SPECIFIC IDENTIFIER							
5								
6								
7								

The NAA field contains 5h.

The IEEE COMPANY ID field contains a 24-bit canonical form company identifier assigned by the IEEE.

NOTE 1 - Information about IEEE company identifiers may be obtained from the IEEE Registration Authority web site at <http://standards.ieee.org/regauth/oui>.

The VENDOR-SPECIFIC IDENTIFIER field contains a 36-bit numeric value that is assigned by the organization associated with the company identifier in the IEEE COMPANY ID field. The VENDOR-SPECIFIC IDENTIFIER field shall be assigned so the SAS address is worldwide unique.

A SAS address of 00000000_00000000h indicates an invalid SAS address.

4.2.3 Hashed SAS address

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4.2.4 Device names

Each expander device, SAS initiator device, SAS target device, and SAS target/initiator device shall include a SAS address (see 4.2.2) as its device name. A SAS address used as a device name shall not be used as any other name or identifier (e.g., a device name, port name, port identifier, or logical unit name (see SAM-3)).

[SAS devices and expander](#) **Expander** devices report their device names in the IDENTIFY address frame (see 7.8.2).

Logical units accessed through SSP target ports report SAS target device names through SCSI vital product data (see 10.2.11).

~~NOTE 2—There is no way to retrieve SAS initiator device names defined in this standard.~~

NOTE 3 A SCSI initiator device contains application clients (e.g., software applications or operating system class drivers that generate SCSI commands) and SCSI initiator ports (e.g., SAS ports)(see SAM-3). In a SCSI device running a single operating system, there should be one device name reported by all the SAS ports. In a device running multiple operating systems, each instance of an operating system should have its own device name, reported through all the SAS ports available to software in that operating system.

Editor's Note 1: Some guidance is needed (like the proposed note) to avoid the Fibre Channel problem where nobody knew what a Node Name represented. In SAS, we need to ensure that the device name represents the operating system instance (i.e. all HBAs), not just one of the HBAs available to the operating system.

4.2.5 Port names

Port names are not defined in SAS.

NOTE 4 - The SAS addresses used by SAS ports in different SAS domains may be the same (e.g., when a set of phys transmit the same SAS address in the identification sequence but receive different SAS addresses, indicating they are attached to two separate SAS domains) so the SAS address serves as a port identifier (see 4.2.6) rather than a port name.

4.2.6 Port identifiers

Each SAS initiator port, SAS target port (e.g., including STP target ports in STP/SATA bridges), and SAS target/initiator port shall include a SAS address (see 4.2.2) as its port identifier. A SAS address used as a port identifier shall not be used as any other name or identifier (e.g., a device name, port name, or logical unit name (see SAM-3)) but may be used as a port identifier in one or more other SAS domains (see 4.1.3).

SAS ports in end devices report their port identifiers in the IDENTIFY address frame (see 7.8.2). Expander devices containing SAS ports (e.g., SAS ports attached to virtual phys, or STP target ports in STP/SATA bridges) report the port identifiers of those SAS ports in the SMP DISCOVER function (see 10.4.3.5).

Port identifiers are used as source and destination addresses in the OPEN address frame (see 7.8.3).

Logical units accessed through SSP target ports report SAS target port identifiers through SCSI vital product data (see 10.2.11).

4.2.7 Phy identifiers

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7.8.2 IDENTIFY address frame

Table 4 defines the IDENTIFY address frame format used for the identification sequence. The IDENTIFY address frame is sent after the phy reset sequence completes if the physical link is a SAS physical link.

Table 4 — IDENTIFY address frame format

Byte/Bit	7	6	5	4	3	2	1	0
0	Restricted (for OPEN address frame)	DEVICE TYPE			ADDRESS FRAME TYPE (0h)			
1	Restricted (for OPEN address frame)							
2	Reserved				SSP INITIATOR PORT	STP INITIATOR PORT	SMP INITIATOR PORT	Restricted (for OPEN address frame)
3	Reserved				SSP TARGET PORT	STP TARGET PORT	SMP TARGET PORT	Restricted (for OPEN address frame)
4	Restricted (for OPEN address frame)							
11	<u>DEVICE NAME</u>							
12	SAS ADDRESS							
19								
20	PHY IDENTIFIER							
21	Reserved							
27								
28	(MSB)	CRC						
31								

The DEVICE TYPE field specifies the type of device containing the phy, and is defined in table 5.

Table 5 — DEVICE TYPE field

Code	Description
001b	End device
010b	Edge expander device
011b	Fanout expander device
All others	Reserved

The ADDRESS FRAME TYPE field shall be set to 0h.

An SSP INITIATOR PORT bit set to one specifies that an SSP initiator port is present. An SSP INITIATOR PORT bit set to zero specifies that an SSP initiator port is not present. Expander devices shall set the SSP INITIATOR PORT bit to zero.

An STP INITIATOR PORT bit set to one specifies that an STP initiator port is present. An STP INITIATOR PORT bit set to zero specifies that an STP initiator port is not present. Expander devices shall set the STP INITIATOR PORT bit to zero.

An SMP INITIATOR PORT bit set to one specifies that an SMP initiator port is present. An SMP INITIATOR PORT bit set to zero specifies that an SMP initiator port is not present. Expander devices may set the SMP INITIATOR PORT bit to one.

An SSP TARGET PORT bit set to one specifies that an SSP target port is present. An SSP TARGET PORT bit set to zero specifies that an SSP target port is not present. Expander devices shall set the SSP TARGET PORT bit to zero.

An STP TARGET PORT bit set to one specifies that an STP target port is present. An STP TARGET PORT bit set to zero specifies that an STP target port is not present. Expander devices shall set the STP TARGET PORT bit to zero.

An SMP TARGET PORT bit set to one specifies that an SMP target port is present. An SMP TARGET PORT bit set to zero specifies that an SMP target port is not present. Expander devices shall set the SMP TARGET PORT bit to one.

[The DEVICE NAME field specifies the device name \(see 4.2.4\) of the SAS device or expander device transmitting the IDENTIFY address frame. A DEVICE NAME field set to 00000000 00000000h specifies the device name is not provided.](#)

For SAS ports, the SAS ADDRESS field specifies the port identifier (see 4.2.6) of the SAS port transmitting the IDENTIFY address frame. For expander ports, the SAS ADDRESS field specifies the device name (see 4.2.4) of the expander device transmitting the IDENTIFY address frame.

[NOTE 5 In expander devices, the DEVICE NAME field, if not set to 00000000 00000000h, contains the same value as the SAS ADDRESS field.](#)

The PHY IDENTIFIER field specifies the phy identifier of the phy transmitting the IDENTIFY address frame.

See 4.1.3 for additional requirements concerning the DEVICE TYPE field, SSP INITIATOR PORT bit, STP INITIATOR PORT bit, SMP INITIATOR PORT bit, SSP TARGET PORT bit, STP TARGET PORT bit, SMP TARGET PORT bit, and SAS ADDRESS field.

The CRC field is defined in 7.8.1.

10.4.3.5 DISCOVER function

The DISCOVER function returns the physical link configuration information for the specified phy. This SMP function provides information from the IDENTIFY address frame received by the phy and additional phy-specific information. This SMP function shall be implemented by all SMP target ports.

Table 6 defines the request format.

Table 6 — DISCOVER request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (10h)							
2	Reserved							
8	Reserved							
9	PHY IDENTIFIER							
10	Reserved							
11	Reserved							
12	(MSB)	CRC						(LSB)
15								

The SMP FRAME TYPE field shall be set to 40h.

The FUNCTION field shall be set to 10h.

The PHY IDENTIFIER field specifies the phy (see 4.2.7) for the link configuration information being requested.

The CRC field is defined in 10.4.3.1.

Table 7 defines the response format.

Table 7 — DISCOVER response (part 1 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (10h)							
2	FUNCTION RESULT							
3	Reserved							
8	Reserved							
9	PHY IDENTIFIER							
10	Reserved							
11	Reserved							
12	Reserved	ATTACHED DEVICE TYPE			Reserved			
13	Reserved				NEGOTIATED PHYSICAL LINK RATE			
14	Reserved				ATTACHED SSP INITIATOR	ATTACHED STP INITIATOR	ATTACHED SMP INITIATOR	ATTACHED SATA HOST
15	ATTACHED SATA PORT SELECTOR	Reserved			ATTACHED SSP TARGET	ATTACHED STP TARGET	ATTACHED SMP TARGET	ATTACHED SATA DEVICE

Table 7 — DISCOVER response (part 2 of 2)

Byte/Bit	7	6	5	4	3	2	1	0	
16	SAS ADDRESS								
23	SAS ADDRESS								
24	ATTACHED SAS ADDRESS								
31	ATTACHED SAS ADDRESS								
32	ATTACHED PHY IDENTIFIER								
33	Reserved								
39	Reserved								
40	PROGRAMMED MINIMUM PHYSICAL LINK RATE				HARDWARE MINIMUM PHYSICAL LINK RATE				
41	PROGRAMMED MAXIMUM PHYSICAL LINK RATE				HARDWARE MAXIMUM PHYSICAL LINK RATE				
42	PHY CHANGE COUNT								
43	VIRTUAL PHY	Reserved			PARTIAL PATHWAY TIMEOUT VALUE				
44	Reserved				ROUTING ATTRIBUTE				
45	Reserved	CONNECTOR TYPE							
46	CONNECTOR ELEMENT INDEX								
47	CONNECTOR PHYSICAL LINK								
48	Reserved								
49	Reserved								
50	Vendor specific								
51	Vendor specific								
52	ATTACHED DEVICE NAME								
59	ATTACHED DEVICE NAME								
5260	(MSB)	CRC							
5563		CRC							(LSB)

Editor's Note 2: Bytes 16-23 are where the ATTACHED DEVICE NAME field would naturally go, but that is already taken by the SMP target port's own SAS ADDRESS field. Feedback from some software developers is that just extending the frame size is the simplest way to add new fields. New software can parse it; however, it might confuse old software unless it was designed to expect the frame to grow and knows to ignore additional bytes. Alternatives include: create an EXTENDED DISCOVER function with just the new fields, or define a new DISCOVER2 function that includes both old and new fields. Since this problem will always exist with new versions of SAS, software tolerance of expanded frames seems to be the best approach.

[Previous versions of this standard defined a shorter \(e.g., 56 byte\) DISCOVER response. The length of the DISCOVER response indicates which fields are present. The CRC field is always in the last four bytes.](#)

The SMP FRAME TYPE field shall be set to 41h.

The FUNCTION field shall be set to 10h.

The FUNCTION RESULT field is defined in 10.4.3.2.

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The SAS ADDRESS field contains the value of the SAS ADDRESS field transmitted in the IDENTIFY address frame during the identification sequence. If the phy is an expander phy, the SAS ADDRESS field contains the SAS address of the expander device (see 4.2.4). If the phy is a SAS phy, the SAS ADDRESS field contains the SAS address of the SAS port (see 4.2.6).

The ATTACHED SAS ADDRESS field contains the value of the the SAS ADDRESS field received in the IDENTIFY address frame during the identification sequence. If the attached port is an expander port, the ATTACHED SAS ADDRESS field contains the SAS address of the attached expander device (see 4.2.4). If the attached port is a SAS port, the ATTACHED SAS ADDRESS field contains SAS address of the attached SAS port (see 4.2.6). If the attached port is a SATA device port, the ATTACHED SAS ADDRESS field contains the SAS address of the STP/SATA bridge (see 4.6.2).

The ATTACHED SAS ADDRESS 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.

An STP initiator port should not make a connection request to the attached SAS address until the ATTACHED DEVICE TYPE field is set to a value other than 000b.

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The CONNECTOR PHYSICAL LINK field indicates the physical link in the connector used to access the phy, as reported by the enclosure services process for the enclosure (see the SAS Connector element in SES-2).

The ATTACHED DEVICE NAME field contains the value of the the DEVICE NAME field 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.

The CRC field is defined in 10.4.3.2.