To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 17 April 2006
Subject: 06-197r1 SAS-2 Add expander change count to all SMP functions

Revision history

Revision 0 (11 April 2006) First revision
Revision 1 (17 April 2006) Incorporated comments from 13 April 2006 SAS zoning teleconference - included EXPECTED EXPANDER CHANGE COUNT field in the nascent ZONED BROADCAST and CONFIGURE PHY EVENT INFORMATION requests for consistency, moving around conflicting fields.

Related documents

sas2r03 - Serial Attached SCSI - 2 (SAS-2) revision 3

Overview

The REPORT GENERAL function includes a CONFIGURING bit indicating that a self-configuring expander is in the process of filling in its routing tables. When set to one, the routing table is incomplete. When set to zero, the routing table is complete. If the expander supports an SMP function that reads route table contents (e.g. REPORT PHY ROUTE INFORMATION), the results are cohesive only when CONFIGURING bit is set to zero.

Since there is a time window between the REPORT GENERAL and REPORT ROUTE INFORMATION functions, though, the expander could begin self-configuring again without notice. The results of later functions do not necessarily correlate with the results of earlier functions.

To close this gap, an EXPANDER CHANGE COUNT field is added to all the read function responses. If the value differs from that received in earlier responses, the management application client knows that something has changed and can take the appropriate action (e.g., start reading the route table again from the beginning).

An EXPECTED EXPANDER CHANGE COUNT field is also added to most of the write function requests to make sure the management application client's request is not based on obsolete information. If the count is too old, the recipient will reject the function. For compatibility with SAS-1/SAS-1.1 designs and to provide a way to force the request to be accepted even if the change count is spiraling out of control, a value of 0000h forces the function to be processed. The expander change count lowest value must be at least 0001h rather than 0000h for expanders implementing the EXPANDER CHANGE COUNT field in more than just the REPORT GENERAL function.

All this works similar to the generation counts in SES-2 diagnostic pages and SPC-3 persistent reservations.

Suggested changes

4.7.1 Discover process

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The discover process may be aborted prior to completion and restarted if there is an indication that it may be based on incorrect information (e.g., arrival of a BROADCAST (CHANGE), or change in the EXPANDER CHANGE COUNT field value in an SMP function).

10.4.3 SMP functions

10.4.3.1 SMP function request frame format

An SMP request frame is sent by an SMP initiator port to request an SMP function be performed by a management device server. Table 1 defines the SMP request frame format.

Table 1 — SMP request frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	ADDITIONAL REQUEST BYTES							
m								
	Fill bytes, if needed							
n - 3	(MSB)	CRC						
n								(LSB)

The SMP FRAME TYPE field is included in each frame format defined in this clause, although that field is parsed by the SMP transport layer (see 9.4). The SMP FRAME TYPE field is set to 40h.

The FUNCTION field specifies which SMP function is being requested and is defined in table 2. If the value in the FUNCTION field is not supported by the SMP target port, it shall return a function result of UNKNOWN SMP FUNCTION as described in table 4.

Table 2 — SMP functions (FUNCTION field)

Code	SMP function	Description	Reference
00h	REPORT GENERAL	Return general information about the device	10.4.3.3
01h	REPORT MANUFACTURER INFORMATION	Return vendor and product identification	10.4.3.4
02h	READ GPIO REGISTER	See SFF-8485	
03h - 0Fh	Reserved for general SMP input functions		
10h	DISCOVER	Return information about the specified phy	10.4.3.5
11h	REPORT PHY ERROR LOG	Return error logging information about the specified phy	10.4.3.6
12h	REPORT PHY SATA	Return information about a phy currently attached to a SATA phy	10.4.3.7
13h	REPORT ROUTE INFORMATION	Return route table information	10.4.3.8
14h	REPORT PHY EVENT INFORMATION	Return phy event information for the specified phy	10.4.3.9
15h - 1Fh	Reserved for phy-based SMP input functions		
20h - 3Fh	Reserved for SMP input functions		
40h - 7Fh	Vendor specific		
80h	CONFIGURE GENERAL	Configure the device	10.4.3.10
81h	Reserved for a general SMP output function		
82h	WRITE GPIO REGISTER	See SFF-8485	
83h - 84h	Reserved for general SMP output functions		
85h	ZONED BROADCAST	Transmit the specified BROADCAST on the expander ports in the specified zone group(s)	10.4.3.11
86h - 8Fh	Reserved for general SMP output functions		
90h	CONFIGURE ROUTE INFORMATION	Change route table information	10.4.3.12
91h	PHY CONTROL	Request actions by the specified phy	10.4.3.13
92h	PHY TEST FUNCTION	Request a test function by the specified phy	10.4.3.14
93h	CONFIGURE PHY EVENT INFORMATION	Configure phy event information for the specified phy	10.4.3.15
94h - 9Fh	Reserved for phy-based SMP output functions		
A0h - BFh	Reserved for SMP output functions		
C0h - FFh	Vendor specific		

The REQUEST LENGTH field specifies the number of dwords that follow, not including the CRC field. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h sometimes specifies a non-zero number of dwords; this is defined in the function description.

The ADDITIONAL REQUEST BYTES field definition and length are based on the SMP function. The maximum size of the ADDITIONAL REQUEST BYTES field is 1 024 bytes, making the maximum size of the frame 1 032 bytes (i.e., 1 024 bytes of data + 4 bytes of header + 4 bytes of CRC).

Fill bytes shall be included after the ADDITIONAL REQUEST BYTES field so the CRC field is aligned on a four byte boundary. The contents of the fill bytes are vendor specific.

The CRC field is included in each request frame format defined in this clause, although that field is defined by the SMP transport layer (see 9.4.1) and parsed by the SMP link layer (see 7.18).

10.4.3.2 SMP function response frame format

An SMP response frame is sent by an SMP target port in response to an SMP request frame. Table 3 defines the SMP response frame format.

Table 3 — SMP response frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	ADDITIONAL RESPONSE BYTES							
m								
	Fill bytes, if needed							
n - 3	(MSB)	CRC						
n								(LSB)

The SMP FRAME TYPE field is included in each frame format defined in this clause, although that field is parsed by the SMP transport layer (see 9.4). The SMP FRAME TYPE field is set to 41h.

The FUNCTION field indicates the SMP function to which this frame is a response, and is defined in table 2 in 10.4.3.1.

The FUNCTION RESULT field is defined in table 4.

Table 4 — FUNCTION RESULT **field** (part 1 of 2)

Code	Name	SMP function(s)	Description
00h	SMP FUNCTION ACCEPTED	All	The SMP target port supports the SMP function. The ADDITIONAL RESPONSE BYTES field contains the requested information.
01h	UNKNOWN SMP FUNCTION	Unknown	The SMP target port does not support the requested SMP function. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
02h	SMP FUNCTION FAILED	All	The SMP target port supports the SMP function, but the requested SMP function failed. The ADDITIONAL RESPONSE BYTES may be present but shall be ignored.
03h	INVALID REQUEST FRAME LENGTH	All	The SMP target port supports the SMP function, but the SMP request frame length was invalid (i.e., did not match the frame size defined for the function). The ADDITIONAL RESPONSE BYTES may be present but shall be ignored.
04h	SMP ZONE VIOLATION	TBD	The SMP target port supports the function, but the application zone permission bit is set to zero (e.g., the ZP[s, 2] bit is set to zero).
05h	INVALID EXPANDER CHANGE COUNT	PHY CONTROL, PHY TEST FUNCTION, ZONED BROADCAST, CONFIGURE PHY EVENT INFORMATION	The SMP target port supports the SMP function, but the EXPECTED EXPANDER CHANGE COUNT field does not match the current expander change count.
10h	PHY DOES NOT EXIST	DISCOVER, REPORT PHY ERROR LOG, REPORT PHY SATA, REPORT ROUTE INFORMATION, REPORT PHY EVENT INFORMATION, CONFIGURE ROUTE INFORMATION, PHY CONTROL, PHY TEST FUNCTION, CONFIGURE PHY EVENT INFORMATION	The phy specified by the PHY IDENTIFIER field in the SMP request frame does not exist (e.g., the value is not within the range of zero to the value of the NUMBER OF PHYS field reported in the REPORT GENERAL function). The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.

Table 4 — FUNCTION RESULT **field** (part 2 of 2)

Code	Name	SMP function(s)	Description
11h	INDEX DOES NOT EXIST	REPORT ROUTE INFORMATION, CONFIGURE ROUTE INFORMATION	The phy specified by the PHY IDENTIFIER field in the SMP request frame does not have the table routing attribute (see 4.6.7.1), or the expander route index specified by the EXPANDER ROUTE INDEX field does not exist (i.e., the value is not in the range of 0000h to the value of the EXPANDER ROUTE INDEXES field in the REPORT GENERAL function). The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
12h	PHY DOES NOT SUPPORT SATA	REPORT PHY SATA and PHY CONTROL (TRANSMIT SATA PORT SELECTION SIGNAL)	The phy specified by the PHY IDENTIFIER field in the SMP request frame is not part of an STP target port. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
13h	UNKNOWN PHY OPERATION	PHY CONTROL	The operation specified by the PHY OPERATION field in the SMP request frame is unknown. The SMP function had no affect. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
14h	UNKNOWN PHY TEST FUNCTION	PHY TEST FUNCTION	The operation specified by the PHY TEST FUNCTION field in the SMP request frame is unknown. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
15h	PHY TEST FUNCTION IN PROGRESS	PHY TEST FUNCTION	The specified phy is already performing a phy test function. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
16h	PHY VACANT	DISCOVER, REPORT PHY ERROR LOG, REPORT PHY SATA, REPORT ROUTE INFORMATION, REPORT PHY EVENT INFORMATION, CONFIGURE ROUTE INFORMATION, PHY CONTROL, CONFIGURE PHY EVENT INFORMATION	The SMP target port processing the SMP request frame does not have access to the phy, although the value is within the range of zero to the value of the NUMBER OF PHYS field reported in the REPORT GENERAL function. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
17h	PHY EVENT INFORMATION SOURCE NOT SUPPORTED	CONFIGURE PHY EVENT INFORMATION	The phy event information source specified by a PHY EVENT INFORMATION SOURCE field is not supported.
All others	Reserved		

The RESPONSE LENGTH field indicates the number of dwords that follow, not including the CRC field. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h sometimes indicates a non-zero number of dwords; this is defined in the function description.

The ADDITIONAL RESPONSE BYTES field definition depends on the SMP function requested. The maximum size of the ADDITIONAL RESPONSE BYTES field is 1 024 bytes, making the maximum size of the frame 1 032 bytes (i.e., 1 024 bytes of data + 4 bytes of header + 4 bytes of CRC).

Fill bytes shall be included after the ADDITIONAL RESPONSE BYTES field so the CRC field is aligned on a four byte boundary. The contents of the fill bytes are vendor specific.

The CRC field is included in each response frame format defined in this clause, although that field is defined by the SMP transport layer (see 9.4.1) and parsed by the SMP link layer (see 7.18).

10.4.3.3 REPORT GENERAL function

The REPORT GENERAL function returns general information about the SAS device (e.g., a SAS device contained in an expander device). This SMP function shall be implemented by all SMP target ports.

Table 5 defines the request format.

Table 5 — REPORT GENERAL request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (00h)							
2	Reserved							
3	REQUEST LENGTH (00h)							
4	(MSB)							
7	CRC							(LSB)

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

The FUNCTION field shall be set to 00h.

The REQUEST LENGTH field shall be set to 00h.

The CRC field is defined in 10.4.3.1.

Table 6 defines the response format.

Table 6 — REPORT GENERAL response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (00h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (08h)							
4	(MSB)							
5	EXPANDER CHANGE COUNT							(LSB)
6	(MSB)							
7	EXPANDER ROUTE INDEXES							(LSB)
8	Reserved							
9	NUMBER OF PHYS							
10	Reserved						CONFIGURING	CONFIGURABLE ROUTE TABLE
11	Reserved							
12								
19	ENCLOSURE LOGICAL IDENTIFIER							
20								
29	Reserved							
30	(MSB)							
31	STP BUS INACTIVITY TIME LIMIT							(LSB)
32	(MSB)							
33	STP MAXIMUM CONNECT TIME LIMIT							(LSB)
34	(MSB)							
35	STP SMP I_T NEXUS LOSS TIME							(LSB)
36	(MSB)							
39	CRC							(LSB)

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

The FUNCTION field shall be set to 00h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 08h. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 6 dwords before the CRC field.

The EXPANDER CHANGE COUNT field counts the number of BROADCAST (CHANGE)s originated by an expander device (see 7.11). SMP target ports in expander devices shall support this field. SMP target ports in other device types (e.g., end devices) shall set the EXPANDER CHANGE COUNT field to 0000h. This field shall be set to ~~0000h~~at least 0001h at power on. If the SMP target port has transmitted BROADCAST (CHANGE) for any reason described in 7.11 other than forwarding a BROADCAST (CHANGE) since transmitting a REPORT GENERAL response, it shall increment this field at least once from the value in the previous REPORT GENERAL response. This field shall not be incremented when forwarding a BROADCAST (CHANGE) from another expander device. This field shall wrap to ~~zero~~at least 0001h after the maximum value (i.e., FFFFh) has been reached.

NOTE 1 - Application clients that use the EXPANDER CHANGE COUNT field should read it often enough to ensure that it does not increment a multiple of 65 536 times between reading the field.

NOTE 2 - SMP target ports in expander devices compliant with previous versions of this standard may return an EXPANDER CHANGE COUNT field set to 0000h.

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10.4.3.4 REPORT MANUFACTURER INFORMATION function

The REPORT MANUFACTURER INFORMATION function returns vendor and product identification. This SMP function may be implemented by any SMP target port.

Table 7 defines the request format.

Table 7 — REPORT MANUFACTURER INFORMATION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (01h)							
2	Reserved							
3	REQUEST LENGTH (00h)							
4	(MSB)			CRC				
7								(LSB)

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

The FUNCTION field shall be set to 01h.

The REQUEST LENGTH field shall be set to 00h.

The CRC field is defined in 10.4.3.1.

Table 8 defines the response format.

Table 8 — REPORT MANUFACTURER INFORMATION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (01h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (0Eh)							
4	(MSB)	Reserved EXPANDER CHANGE COUNT						
5								(LSB)
6		Reserved						
7								
8	Reserved							SAS-1.1 FORMAT
9		Reserved						
11								
12	(MSB)	VENDOR IDENTIFICATION						
19								(LSB)
20	(MSB)	PRODUCT IDENTIFICATION						
35								(LSB)
36	(MSB)	PRODUCT REVISION LEVEL						
39								(LSB)
40	(MSB)	COMPONENT VENDOR IDENTIFICATION						
47								(LSB)
48	(MSB)	COMPONENT ID						
49								(LSB)
50	COMPONENT REVISION ID							
51	Reserved							
52		Vendor specific						
59								
60	(MSB)	CRC						
63								(LSB)

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

The FUNCTION field shall be set to 01h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 0Eh. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 14 dwords before the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

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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 9 defines the request format.

Table 9 — DISCOVER request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (10h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)							
15	CRC							(LSB)

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

The FUNCTION field shall be set to 10h.

The REQUEST LENGTH field shall be set to 02h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 2 dwords before the CRC field.

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 10 defines the response format.

Table 10 — 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	RESPONSE LENGTH (0Eh)							
4	(MSB)	Reserved						
5	EXPANDER CHANGE COUNT							(LSB)
6	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
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
16	SAS ADDRESS							
23								
24	ATTACHED SAS ADDRESS							
31								
32	ATTACHED PHY IDENTIFIER							
33	Reserved							
39								
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							

Table 10 — DISCOVER response (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
48	Reserved							
49								
50	Vendor specific							
51								
52	ATTACHED DEVICE NAME							
59								
60	(MSB)	CRC						
63								(LSB)

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.

The RESPONSE LENGTH field shall be set to 0Eh. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 12 dwords before the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

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The PHY CHANGE COUNT field counts the number of BROADCAST (CHANGE)s originated by an expander phy. Expander devices shall support this field. Other device types shall not support this field. This field shall be set to zero at power on. The expander device shall increment this field at least once when it transmits a BROADCAST (CHANGE) for any reason described in 7.11 originating from the expander phy other than forwarding a BROADCAST (CHANGE).

The expander device is not required to increment the PHY CHANGE COUNT field again unless a DISCOVER response is transmitted. This field shall not be incremented when forwarding a BROADCAST (CHANGE) from another expander device.The PHY CHANGE COUNT field shall wrap to zero after the maximum value (i.e., FFh) has been reached.

NOTE 3 - Application clients that use the PHY CHANGE COUNT field should read it often enough to ensure that it does not increment a multiple of 256 times between reading the field.

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10.4.3.6 REPORT PHY ERROR LOG function

The REPORT PHY ERROR LOG function returns error logging information about the specified phy. This SMP function may be implemented by any SMP target port.

Table 11 defines the request format.

Table 11 — REPORT PHY ERROR LOG request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (11h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)	CRC						
15								(LSB)

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

The FUNCTION field shall be set to 11h.

The REQUEST LENGTH field shall be set to 02h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 2 dwords before the CRC field.

The PHY IDENTIFIER field specifies the phy (see 4.2.7) for which information shall be reported.

The CRC field is defined in 10.4.3.1.

Table 12 defines the response format.

Table 12 — REPORT PHY ERROR LOG response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (11h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (06h)							
4	(MSB)			~~Reserved~~ EXPANDER CHANGE COUNT				
5								(LSB)
6				Reserved				
8								
9	PHY IDENTIFIER							
10				Reserved				
11								
12	(MSB)			INVALID DWORD COUNT				
15								(LSB)
16	(MSB)			RUNNING DISPARITY ERROR COUNT				
19								(LSB)
20	(MSB)			LOSS OF DWORD SYNCHRONIZATION COUNT				
23								(LSB)
24	(MSB)			PHY RESET PROBLEM COUNT				
27								(LSB)
28	(MSB)			CRC				
31								(LSB)

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

The FUNCTION field shall be set to 11h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 06h. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 6 dwords before the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

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10.4.3.7 REPORT PHY SATA function

The REPORT PHY SATA function returns information about the SATA state for a specified phy. This SMP function shall be implemented by SMP target ports that share SAS addresses with STP target ports and by SMP target ports in expander devices with STP/SATA bridges. This SMP function shall not be implemented by any other type of SMP target port.

Table 13 defines the request format.

Table 13 — REPORT PHY SATA request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (12h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)							
15	CRC							(LSB)

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

The FUNCTION field shall be set to 12h.

The REQUEST LENGTH field shall be set to 02h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 2 dwords before the CRC field.

The PHY IDENTIFIER field specifies the phy (see 4.2.7) for which information shall be reported.

The CRC field is defined in 10.4.3.1.

Table 14 defines the response format.

Table 14 — REPORT PHY SATA response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (12h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (0Fh)							
4	(MSB)			~~Reserved~~ EXPANDER CHANGE COUNT				
5								(LSB)
6				Reserved				
8								
9	PHY IDENTIFIER							
10	Reserved							
11	Reserved					STP I_T NEXUS LOSS OCCURRED	AFFILIATIONS SUPPORTED	AFFILIATION VALID
12				Reserved				
15								
16				STP SAS ADDRESS				
23								
24				REGISTER DEVICE TO HOST FIS				
43								
44				Reserved				
47								
48				AFFILIATED STP INITIATOR SAS ADDRESS				
55								
56				STP I_T NEXUS LOSS SAS ADDRESS				
63								
64	(MSB)			CRC				
67								(LSB)

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

The FUNCTION field shall be set to 12h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 0Fh. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 13 dwords before the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

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10.4.3.8 REPORT ROUTE INFORMATION function

The REPORT ROUTE INFORMATION function returns an expander route entry from the expander route table within an expander device. This SMP function shall be supported by SMP target ports in expander devices if the EXPANDER ROUTE INDEXES field is non-zero in the REPORT GENERAL function. This SMP function may be used as a diagnostic tool to resolve topology issues.

Table 15 defines the request format.

Table 15 — REPORT ROUTE INFORMATION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (13h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
5								
6	(MSB)	EXPANDER ROUTE INDEX						
7								(LSB)
8	Reserved							
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)	CRC						
15								(LSB)

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

The FUNCTION field shall be set to 13h.

The REQUEST LENGTH field shall be set to 02h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 2 dwords before the CRC field.

The EXPANDER ROUTE INDEX field specifies the expander route index for the expander route entry being requested (see 4.6.7.3).

The PHY IDENTIFIER field specifies the phy for which the expander route entry is being requested.

The CRC field is defined in 10.4.3.1.

Table 16 defines the response format.

Table 16 — REPORT ROUTE INFORMATION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (13h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (09h)							
4	(MSB)	Reserved EXPANDER CHANGE COUNT						
5								(LSB)
6	(MSB)	EXPANDER ROUTE INDEX						
7								(LSB)
8	Reserved							
9	PHY IDENTIFIER							
10		Reserved						
11								
12	EXPANDER ROUTE ENTRY DISABLED	Reserved						
13		Reserved						
15								
16		ROUTED SAS ADDRESS						
23								
24		Reserved						
39								
40	(MSB)	CRC						
43								(LSB)

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

The FUNCTION field shall be set to 13h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 09h. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h specifies that there are 9 dwords before the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

...

10.4.3.9 REPORT PHY EVENT INFORMATION function

The REPORT PHY EVENT INFORMATION function returns phy event information (see 4.10) about the specified phy. This SMP function may implemented by any SMP target port.

Table 17 defines the request format.

Table 17 — REPORT PHY EVENT INFORMATION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (14h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
5	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)							
15	CRC							(LSB)

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

The FUNCTION field shall be set to 14h.

The REQUEST LENGTH field contains the number of dwords that follow, not including the CRC field (i.e., 2).

The PHY IDENTIFIER field specifies the phy (see 4.2.7) for which information shall be reported.

The CRC field is defined in 10.4.3.1.

Table 12 defines the response format.

Table 18 — REPORT PHY EVENT INFORMATION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (14h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH							
4	(MSB)			~~Reserved~~ EXPANDER CHANGE COUNT				
5								(LSB)
6				Reserved				
8								
9	PHY IDENTIFIER							
10				Reserved				
14								
15	NUMBER OF PHY EVENT DESCRIPTORS							
16				Phy event descriptor(s)				
n - 4								
n - 3	(MSB)			CRC				
n								(LSB)

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

The FUNCTION field shall be set to 14h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field contains the number of dwords that follow, not including the CRC field.

The EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see 10.4.1.3).

...

10.4.3.10 CONFIGURE GENERAL function

The CONFIGURE GENERAL function requests actions by the device containing the SMP target port. This SMP function may be implemented by any SMP target port.

Table 19 defines the request format.

Table 19 — CONFIGURE GENERAL request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (80h)							
2	Reserved							
3	REQUEST LENGTH (03h)							
4	(MSB)	~~Reserved~~ EXPECTED EXPANDER CHANGE COUNT						
5								(LSB)
6		Reserved						
7								
8	Reserved					UPDATE STP SMP I_T NEXUS LOSS TIME	UPDATE STP MAXIMUM CONNECT TIME LIMIT	UPDATE STP BUS INACTIVITY TIME LIMIT
9	Reserved							
10	(MSB)	STP BUS INACTIVITY TIME LIMIT						
11								(LSB)
12	(MSB)	STP MAXIMUM CONNECT TIME LIMIT						
13								(LSB)
14	(MSB)	STP SMP I_T NEXUS LOSS TIME						
15								(LSB)
16	(MSB)	CRC						
19								(LSB)

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

The FUNCTION field shall be set to 80h.

The REQUEST LENGTH field shall be set to 03h.

If the SMP target port is not in an expander device or the EXPECTED EXPANDER CHANGE COUNT field is set to 0000h, the EXPECTED EXPANDER CHANGE COUNT field shall be ignored. If the SMP target port is in an expander device and the EXPECTED EXPANDER CHANGE COUNT field is not set to 0000h, then:

a) if the EXPECTED EXPANDER CHANGE COUNT field contains the current expander change count (i.e., the value of the EXPANDER CHANGE COUNT field that would be returned by an SMP REPORT GENERAL response at this time), the SMP target port shall process the function; and
b) If the EXPECTED EXPANDER CHANGE COUNT field does not contain the current expander change count, the SMP target port shall return a function result of INVALID EXPANDER CHANGE COUNT in the response frame.

...

10.4.3.11 ZONED BROADCAST function

The ZONED BROADCAST function requests that the specified BROADCAST be transmitted on all the ports that are in one or more specified zone groups, with the exception of the port on which the ZONED BROADCAST function was received (see 4.8.5). This SMP function shall be supported by SMP target ports in zoning expander devices (see 4.8). Other SMP target ports shall not support this SMP function.

Table 20 defines the request format.

Table 20 — ZONED BROADCAST request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (85h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
~~4~~	~~Reserved~~					~~BROADCAST TYPE~~		
~~5~~	~~Reserved~~							
4	(MSB)	~~Reserved~~						
5	EXPECTED EXPANDER CHANGE COUNT							(LSB)
6	Reserved					~~Reserved~~ BROADCAST TYPE		
7	NUMBER OF ZONE GROUPS							
Zone group list								
8	ZONE GROUP (first)							
	...							
	ZONE GROUP (first)							
	PAD (if needed)							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 85h.

The REQUEST LENGTH field contains the number of dwords that follow, not including the CRC field.

The EXPECTED EXPANDER CHANGE COUNT field is defined in the CONFIGURE GENERAL request (see 10.4.1.10).

...

10.4.3.12 CONFIGURE ROUTE INFORMATION function

The CONFIGURE ROUTE INFORMATION function sets an expander route entry within the expander route table of a configurable expander device. This SMP function shall be supported by SMP target ports in expander devices if the CONFIGURABLE ROUTE TABLE field is set to one in the REPORT GENERAL response data. Other SMP target ports shall not support this SMP function.

Table 21 defines the request format.

Table 21 — CONFIGURE ROUTE INFORMATION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (90h)							
2	Reserved							
3	REQUEST LENGTH (09h)							
4	(MSB)			~~Reserved~~ EXPECTED EXPANDER CHANGE COUNT				
5								(LSB)
6	(MSB)			EXPANDER ROUTE INDEX				
7								(LSB)
8	Reserved							
9	PHY IDENTIFIER							
10				Reserved				
11								
12	DISABLE EXPANDER ROUTE ENTRY	Reserved						
13				Reserved				
15								
16				ROUTED SAS ADDRESS				
23								
24				Reserved				
39								
40	(MSB)			CRC				
43								(LSB)

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

The FUNCTION field shall be set to 90h.

The REQUEST LENGTH field shall be set to 09h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 9 dwords before the CRC field.

The EXPECTED EXPANDER CHANGE COUNT field is defined in the CONFIGURE GENERAL request (see 10.4.1.10).

...

10.4.3.13 PHY CONTROL function

The PHY CONTROL function requests actions by the specified phy. This SMP function may be implemented by any SMP target port.

Table 22 defines the request format.

Table 22 — PHY CONTROL request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (91h)							
2	Reserved							
3	REQUEST LENGTH (09h)							
4	(MSB)	Reserved						
5		EXPECTED EXPANDER CHANGE COUNT						(LSB)
6		Reserved						
8								
9	PHY IDENTIFIER							
10	PHY OPERATION							
11	Reserved							UPDATE PARTIAL PATHWAY TIMEOUT VALUE
12		Reserved						
31								
32	PROGRAMMED MINIMUM PHYSICAL LINK RATE				Reserved			
33	PROGRAMMED MAXIMUM PHYSICAL LINK RATE				Reserved			
34		Reserved						
35								
36	Reserved				PARTIAL PATHWAY TIMEOUT VALUE			
37		Reserved						
39								
40	(MSB)	CRC						
43								(LSB)

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

The FUNCTION field shall be set to 91h.

The REQUEST LENGTH field shall be set to 09h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 9 dwords before the CRC field.

The EXPECTED EXPANDER CHANGE COUNT field is defined in the CONFIGURE GENERAL request (see 10.4.1.10).

...

10.4.3.14 PHY TEST FUNCTION function

The PHY TEST FUNCTION function requests actions by the specified phy. This SMP function may be implemented by any SMP target port.

Table 23 defines the request format.

Table 23 — PHY TEST FUNCTION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (92h)							
2	Reserved							
3	REQUEST LENGTH (09h)							
4	(MSB)	Reserved						
5		EXPECTED EXPANDER CHANGE COUNT						(LSB)
6		Reserved						
8								
9	PHY IDENTIFIER							
10	PHY TEST FUNCTION							
11	PHY TEST PATTERN							
12		Reserved						
14								
15	Reserved				PHY TEST PATTERN PHYSICAL LINK RATE			
16		Reserved						
18								
19	PHY TEST PATTERN DWORDS CONTROL							
20		PHY TEST PATTERN DWORDS						
27								
28		Reserved						
39								
40	(MSB)	CRC						
43								(LSB)

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

The FUNCTION field shall be set to 92h.

The REQUEST LENGTH field shall be set to 09h. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h specifies that there are 9 dwords before the CRC field.

The EXPECTED EXPANDER CHANGE COUNT field is defined in the CONFIGURE GENERAL request (see 10.4.1.10).

...

10.4.3.15 CONFIGURE PHY EVENT INFORMATION function

The CONFIGURE PHY EVENT INFORMATION function configures phy event information (see 4.10) about the specified phy. This SMP function may implemented by any SMP target port.

Table 24 defines the request format.

Table 24 — CONFIGURE PHY EVENT INFORMATION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (92h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	~~Reserved~~							~~CLEAR PEAKS~~
~~5~~	~~Reserved~~							
4	(MSB)	EXPECTED EXPANDER CHANGE COUNT						
5								(LSB)
6	Reserved							CLEAR PEAKS
7	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11	NUMBER OF PHY EVENT CONFIGURATION DESCRIPTORS							
12	Phy event configuration descriptor(s)							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 92h.

The REQUEST LENGTH field contains the number of dwords that follow, not including the CRC field.

The EXPECTED EXPANDER CHANGE COUNT field is defined in the CONFIGURE GENERAL request (see 10.4.1.10).

A CLEAR PEAKS field set to one specifies that all phy event information peak value detectors shall be set to zero. A CLEAR PEAKS field set to zero specifies no change to the phy event information peak value detectors.

...