To: T10 Technical Committee
From: Tyson Hartshorn, LSI Logic
Date: 22 March 2007
Subject: Serial Attached SCSI - 2 (SAS-2)

Revision history

Revision 0, 07-102r0 (March 22, 2007) First revision.

Related documents

sas2r09 - Serial Attached SCSI 2 revision 7.

Overview

The current method for retrieving phy event information is by per phy SMP requests. There is also no way of knowing that new phy event information is available. This proposal suggests a methods that both indicate when new phy event information is available and provide an optimized interface for retrieving this information.

Suggested changes

Add 16 bit fields to the REPORT GENERAL and DISCOVER LIST responses to indicate the index of the last self configuration status log written by the management device server.

Remove phy identifier field from the REPORT PHY EVENT INFORMATION request and instead provide a 16 bit field that indicates the index of the first phy event information descriptor to return.

Add 8 bit phy identifier field to the REPORT PHY EVENT INFORMATION descriptor to indicate which phy this information is for.

Add 3 16 bit fields in the REPORT PHY EVENT INFORMATION response to indicate the index of the first descriptor returned in the response, the total number of descriptors available, and the maximum descriptor index value.

Table 180 defines the response format.

Table 180 — REPORT GENERAL response (part 1 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (00h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ~~(0Eh)~~ (0Fh)							
4	(MSB)							
5	EXPANDER CHANGE COUNT							(LSB)
6	(MSB)							
7	EXPANDER ROUTE INDEXES							(LSB)
8	Reserved							
9	NUMBER OF PHYS							
10	TABLE TO TABLE SUPPORTED	Reserved				CONFIGURES OTHERS	CONFIGURING	EXTERNALLY CONFIGURABLE ROUTE TABLE
11	Reserved							
12	ENCLOSURE LOGICAL IDENTIFIER							
19								
20	Reserved							
29								
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	Reserved			ZONE LOCKED	PHYSICAL PRESENCE SUPPORTED	PHYSICAL PRESENCE ASSERTED	ZONING SUPPORTED	ZONING ENABLED
37	Reserved							
38	(MSB)							
39	MAXIMUM NUMBER OF ROUTED SAS ADDRESSES							(LSB)

Table 180 — REPORT GENERAL response (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
40	ACTIVE ZONE MANAGER SAS ADDRESS							
47								
48	(MSB)							
49	ZONE LOCK INACTIVITY TIME LIMIT							(LSB)
50	Reserved							
51								
52	Reserved							
53	FIRST ENCLOSURE CONNECTOR ELEMENT INDEX							
54	NUMBER OF ENCLOSURE CONNECTOR ELEMENT INDEXES							
55	Reserved							
56	REDUCED FUNCTIONALITY	Reserved						
57	TIME TO REDUCED FUNCTIONALITY							
58	INITIAL TIME TO REDUCED FUNCTIONALITY							
59	MAXIMUM REDUCED FUNCTIONALITY TIME							
~~60~~	(MSB)							
~~63~~	~~CRC~~							(LSB)
60	Reserved							
61								
62	(MSB)							
63	LAST PHY EVENT INFORMATION DESCRIPTOR INDEX							(LSB)
64	(MSB)							
67	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 ~~0Eh~~ 0Fh. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h indicates 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). Management device servers in expander devices shall support this field. management device servers in other device types (e.g., end devices) shall set this field to 0000h. This field shall be set to at least 0001h at power on. If the expander device has originated Broadcast (Change) for any reason described in 7.11 since transmitting a REPORT GENERAL response, it shall increment this field at least once from the

value in the previous REPORT GENERAL response. It shall not increment this field when forwarding a Broadcast (Change). This field shall wrap to at least 0001h after the maximum value (i.e., FFFFh) has been reached.

NOTE 81 - 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 82 - Management device servers in expander devices compliant with previous versions of this standard may return an EXPANDER CHANGE COUNT field set to 0000h.

Editor's Note 61: A BROADCAST EXPANDER COUNT field is also needed, so recipients of that BROADCAST can pinpoint which expander it came from. Expander-wide counts for all BROADCASTs (e.g. reception of ASYNCHRONOUS EVENT) might be needed.

The EXPANDER ROUTE INDEXES field contains the maximum number of expander route indexes per phy for the expander device (see 4.6.7.3). Management device servers in externally configurable expander devices containing phy-based expander route tables shall support this field. Management device servers in other device types (e.g., end devices, externally configurable expander devices with expander-based expander route tables, and self-configuring expander devices) shall set the EXPANDER ROUTE INDEXES field to zero. Not all phys in an externally configurable expander device are required to support the maximum number indicated by this field.

The NUMBER OF PHYS field contains the number of phys in the device, including any virtual phys and any vacant phys.

A TABLE TO TABLE SUPPORTED bit set to one indicates the expander device is a self-configuring expander device that supports its table routing phys being attached to table routing phys in other expander devices. The TABLE TO TABLE SUPPORTED bit shall only be set to one if the EXTERNALLY CONFIGURABLE ROUTE TABLE bit is set to zero. A TABLE TO TABLE SUPPORTED bit set to zero indicates the expander device is not a self-configuring expander device that supports its table routing phys being attached to table routing phys in other expander devices.

A CONFIGURES OTHERS bit set to one indicates that the expander device is a self-configuring expander device that performs the configuration subprocess defined in 4.8. A CONFIGURES OTHERS bit set to zero indicates the expander device may or may not perform the configuration subprocess. Self-configuring expander devices compliant with this standard shall set the CONFIGURES OTHERS bit to one.

NOTE 83 - If the CONFIGURES OTHERS bit is set to zero, the expander device may configure all externally configurable expander devices in the SAS domain.

A CONFIGURING bit set to one indicates that either:

a) the management device server is in a self-configuring expander device, the self-configuring expander device's management application client is currently performing the discover process (see 4.7), and it has identified at least one change to its expander routing table; or
b) the zoning expander device is locked and the zoning expander shadow values differ from the zoning expander active values.

A CONFIGURING bit set to zero indicates that the management device server is not in a self-configuring expander device currently performing the discover process and changing its expander routing table. Changes in this bit from one to zero result in a Broadcast (Change) being originated (see 7.11). Management device servers in self-configuring expander devices shall support this bit. Management device servers in externally configurable expander devices and in other device types shall set the CONFIGURING bit to zero.

An EXTERNALLY CONFIGURABLE ROUTE TABLE bit set to one indicates that the management device server is in an externally configurable expander device that has a phy-based expander route table that is required to be configured with the SMP CONFIGURE ROUTE INFORMATION function (see 4.6.7.3). An EXTERNALLY CONFIGURABLE ROUTE TABLE bit set to zero indicates that the management device server is not in an externally

configurable expander device (e.g., it is in an end device, in a self-configuring expander device, or in an expander device with no phys with table routing attributes).

The ENCLOSURE LOGICAL IDENTIFIER field identifies the enclosure, if any, in which the device is located, and is defined in SES-2. The ENCLOSURE LOGICAL IDENTIFIER field shall be set to the same value reported by the enclosure services process, if any, for the enclosure. An ENCLOSURE LOGICAL IDENTIFIER field set to zero indicates no enclosure information is available.

The STP BUS INACTIVITY TIME LIMIT field contains the bus inactivity time limit for STP connections which is set by the CONFIGURE GENERAL function (see 10.4.3.15).

The STP MAXIMUM CONNECT TIME LIMIT field contains the maximum connect time limit for STP connections which is set by the CONFIGURE GENERAL function (see 10.4.3.15).

The STP SMP I_T NEXUS LOSS TIME field contains the time that an STP target port and an SMP initiator port retry certain connection requests which is set by the CONFIGURE GENERAL function (see 10.4.3.15).

A ZONE LOCKED bit set to one indicates that the zoning expander device is locked (see 4.9.6.2). A ZONE LOCKED bit set to zero indicates that the zoning expander device is not locked.

A PHYSICAL PRESENCE SUPPORTED bit set to one indicates that the expander device supports physical presence as a mechanism for allowing zoning to be enabled or disabled from phys in zone groups without access to zone group 2. A PHYSICAL PRESENCE SUPPORTED bit set to zero indicates that the expander device does not support physical presence as a mechanism for allowing zoning to be enabled or disabled.

A PHYSICAL PRESENCE ASSERTED bit set to one indicates that the expander device is currently detecting physical presence. A PHYSICAL PRESENCE ASSERTED bit set to zero indicates that the expander device is not currently detecting physical presence. The PHYSICAL PRESENCE ASSERTED bit shall be set to zero if the PHYSICAL PRESENCE SUPPORTED bit is set to zero.

A ZONING SUPPORTED bit set to one indicates that zoning is supported by the expander device (i.e., it is a zoning expander device). A ZONING SUPPORTED bit set to zero indicates that zoning is not supported by the expander device.

A ZONING ENABLED bit set to one indicates that zoning is enabled in the expander device. A ZONING ENABLED bit set to zero indicates that zoning is disabled in the expander device. The ZONING ENABLED bit shall be set to zero if the ZONING SUPPORTED bit is set to zero.

The MAXIMUM NUMBER OF ROUTED SAS ADDRESSES field contains the number of routed SAS addresses in an expander-based expander route table (see 4.6.7.3 and 4.9.3.4). Management device servers in expander devices containing expander-based expander route tables shall support this field. Management device servers in other device types (e.g., end devices and expander devices with phy-based expander route tables) shall set this field to 0000h.

The ACTIVE ZONE MANAGER SAS ADDRESS field indicates the SAS address of the zone manager that last locked the zoning expander device. If the zoning expander device is currently being configured by a vendor-specific sideband method then the ACTIVE ZONE MANAGER SAS ADDRESS field shall be set to zero. This field shall be set to zero at power on.

The ZONE LOCK INACTIVITY TIME LIMIT field indicates the minimum time between any SMP ZONE LOCK requests, SMP zone configuration function requests, or SMP ZONE ACTIVATE requests from the active zone manager that the locked expander device allows and is set in the SMP ZONE LOCK request (see 10.4.3.18).

The FIRST ENCLOSURE CONNECTOR ELEMENT INDEX field indicates the lowest CONNECTOR ELEMENT INDEX field of all the expander phys in all the expander devices in the enclosure that have CONNECTOR TYPE fields set to 20h through 2Fh (i.e., an internal connector to an end device) in their SMP DISCOVER responses.

The NUMBER OF ENCLOSURE CONNECTOR ELEMENT INDEXES field indicates the number of expander phys in all the expander devices in the enclosure that have CONNECTOR TYPE fields set to 20h through 2Fh (i.e., an internal connector to an end device) in their SMP DISCOVER responses.

NOTE 84 - The NUMBER OF ENCLOSURE CONNECTOR ELEMENT INDEXES field assumes that all internal connectors to end devices are assigned to a contiguous range of CONNECTOR ELEMENT INDEX field values.

A REDUCED FUNCTIONALITY bit set to one indicates that:

a) the expander device is scheduled to reduce its functionality (see 4.6.8) in the time indicated in the TIME TO REDUCED FUNCTIONALITY field; or
b) that the expander device is currently operating with reduced functionality (see 4.6.8).

A REDUCED FUNCTIONALITY bit set to zero indicates the expander device is not scheduled to reduce functionality and that the contents of the TIME TO REDUCED FUNCTIONALITY field shall be ignored.

If the REDUCED FUNCTIONALITY bit set to one, then the TIME TO REDUCED FUNCTIONALITY field contains the time, in 100 ms increments, remaining until the expander device is scheduled to reduce functionality. The expander device starts the reduced functionality delay timer after originating a Broadcast (Expander) (see 4.6.8).

The INITIAL TIME TO REDUCED FUNCTIONALITY field contains the minimum period of time, in 100 ms increments, that an expander device waits from originating a Broadcast (Expander) to reducing functionality. The expander device should set the default value for the INITIAL TIME TO REDUCED FUNCTIONALITY field to at least 2 000 ms (i.e., 14h).

The MAXIMUM REDUCED FUNCTIONALITY TIME field contains the maximum time, in seconds, that the expander device responds with OPEN_REJECT (RETRY) to connection requests that map to an expander phy or an SMP target port that is not accessible during expander device reduced functionality. This timer starts after the reduced functionality delay timer expires.

The LAST PHY EVENT INFORMATION DESCRIPTOR INDEX field indicates the last index of the last recorded phy event information descriptor.

The CRC field is defined in 10.4.3.2.

9.4.5.4 REPORT PHY EVENT INFORMATION function

9.4.5.4.1 REPORT PHY EVENT INFORMATION function overview

The REPORT PHY EVENT INFORMATION function returns phy event information (see 4.11) about the specified phy. This SMP function may implemented by any management device server.

9.4.5.4.2 REPORT PHY EVENT INFORMATION request

Table 181 defines the request format.

Table 181 — 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~~							
9	Reserved							
~~10~~	~~Reserved~~							
~~11~~								
10	(MSB)	STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX						
11								(LSB)
12	(MSB)	CRC						
15								(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 STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX field indicates the first phy event information descriptor that the management device server shall return in the SMP response frame. If the STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX field specifies a descriptor which contains no status information, the management device server shall return a response with the NUMBER OF SELF-CONFIGURATION STATUS DESCRIPTORS field set to zero.

The CRC field is defined in 10.4.3.1.

9.4.5.4.3 REPORT PHY EVENT INFORMATION response

Table 247 defines the response format.

Table 182 — 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)	EXPANDER CHANGE COUNT						
5								(LSB)
~~6~~		~~Reserved~~						
~~8~~								
6	(MSB)	STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX						
7								(LSB)
8		Reserved						
9								
~~9~~	~~PHY IDENTIFIER~~							
10	(MSB)	MAXIMUM SUPPORTED PHY EVENT INFORMATION DESCRIPTORS						
11								(LSB)
12	(MSB)	TOTAL NUMBER OF PHY EVENT INFORMATION DESCRIPTORS						
13								(LSB)
14	Reserved							
15	NUMBER OF PHY EVENT DESCRIPTORS							
Phy event descriptor list								
16	Phy event descriptor (first)(see table 183 in 9.4.5.4.4)							
27								
...	...							
n - 15	Phy event descriptor (last)(see table 183 in 9.4.5.4.4)							
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 10.4.3.3).

~~The PHY IDENTIFIER field indicates the phy (see 4.2.7) for which information is being reported.~~

The STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX field indicates the index of the first phy event information descriptor being returned, and is set to the same value as the STARTING PHY EVENT INFORMATION DESCRIPTOR INDEX field in the SMP request frame. A value of 0h shall indicate that the requested starting log index was invalid.

The MAXIMUM SUPPORTED PHY EVENT INFORMATION DESCRIPTORS field indicates how many phy event information descriptors are supported by the management device server.

The TOTAL NUMBER OF PHY EVENT INFORMATION DESCRIPTORS field indicates how many phy event information descriptors are available at this time from the management device server.

The NUMBER OF PHY EVENT DESCRIPTORS field indicates how many phy event descriptors follow.

The phy event descriptor list contains phy event descriptors as defined in 9.4.5.4.4.

The CRC field is defined in 10.4.3.2.

9.4.5.4.4 REPORT PHY EVENT INFORMATION response phy event descriptor

Table 183 defines the phy event descriptor.

Table 183 — Phy event descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved							
~~2~~ 1								
2	PHY IDENTIFIER							
3	PHY EVENT INFORMATION SOURCE							
4	(MSB)	PHY EVENT INFORMATION						
7								(LSB)
8	(MSB)	PEAK VALUE DETECTOR THRESHOLD						
11								(LSB)

The PHY IDENTIFIER field indicates the phy for which information is being reported.

The PHY EVENT INFORMATION SOURCE field, defined in table 31 in 4.11, indicates the type of phy event information being reported in the PHY EVENT INFORMATION field.

The PHY EVENT INFORMATION field contains the value (i.e., the count or peak value detected) of the phy event indicated by the phy event information source field.

If the phy event information source is a peak value detector, the PEAK VALUE DETECTOR THRESHOLD field contains the value of the peak value detector that causes the expander device to originate a Broadcast (Expander)(see 7.2.5.5). If the phy event information source is not a peak value detector, then the PEAK VALUE DISCOVER LIST function

9.4.5.4.5 DISCOVER LIST response

Table 184 defines the response format.

Table 184 — DISCOVER LIST response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (16h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	(MSB)			EXPANDER CHANGE COUNT				
5								(LSB)
6				Reserved				
7								
8	STARTING PHY IDENTIFIER							
9	NUMBER OF DISCOVER LIST DESCRIPTORS							
10	Reserved				PHY FILTER			
11	Reserved				DESCRIPTOR TYPE			
12	DESCRIPTOR LENGTH							
13				Reserved				
15								
16	ZONING SUPPORTED	ZONING ENABLED	Reserved				CONFIGURING	EXTERNALLY CONFIGURABLE ROUTE TABLE
17				Reserved				
18								
19	(MSB)			LAST PHY EVENT INFORMATION DESCRIPTOR INDEX				
20								(LSB)
21				Reserved				
31								
32				Vendor specific				
47								
DISCOVER LIST descriptor list								
48				DISCOVER LIST descriptor (first)(see table 186 in 9.4.5.4.5, and table 236 in 10.4.3.7 or table 188 in 9.4.5.4.8)				
				...				
				DISCOVER LIST descriptor (last)(see table 186 in 9.4.5.4.5, and table 236 in 10.4.3.7 or table 188 in 9.4.5.4.8)				
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 16h.

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 10.4.3.3).

The STARTING PHY IDENTIFIER field indicates the phy identifier of the first phy in the DISCOVER LIST descriptor list.

NOTE 85 - The STARTING PHY IDENTIFIER field may be different than the STARTING PHY IDENTIFIER field in the request frame (see 10.4.3.13.2) due to the filter specified by the PHY FILTER field in the request frame.

The NUMBER OF DISCOVER LIST DESCRIPTORS field indicates the number of DISCOVER LIST descriptors returned in the DISCOVER LIST descriptor list.

The DESCRIPTOR LENGTH field indicates the length of the DISCOVER LIST descriptor (see table 259 in 10.4.3.13.2).

The LAST PHY EVENT INFORMATION DESCRIPTOR INDEX is defined in the SMP REPORT GENERAL response (see 10.4.3.3).

The ZONING SUPPORTED bit is defined in the SMP REPORT GENERAL response (see 10.4.3.3).

The ZONING ENABLED bit is defined in the SMP REPORT GENERAL response (see 10.4.3.3).

The CONFIGURING bit is defined in the SMP DISCOVER response (see 10.4.3.7).

The CONFIGURABLE ROUTE TABLE bit is defined in the SMP DISCOVER response (see 10.4.3.7).

The DISCOVER LIST descriptor list contains DISCOVER LIST descriptors for each phy:

a) starting with the phy whose phy identifier is specified in the STARTING PHY IDENTIFIER field in the request (see 10.4.3.13.2);
b) satisfying the filter specified in the PHY FILTER field in the request (see table 258 in 10.4.3.13.2); and
c) that is able to be included in the response frame without being truncated.

Each DISCOVER LIST descriptor shall use the format specified in the DESCRIPTOR TYPE field in the request (see table 259 in 10.4.3.13.2)

The management device server shall not include DISCOVER LIST descriptors for phys with phy identifiers greater than or equal to the NUMBER OF PHYS field reported in the SMP REPORT GENERAL response (see 10.4.3.3). The management device server shall not include partial DISCOVER LIST descriptors.

The CRC field is defined in 10.4.3.2.