To: T10 Technical Committee
From: Steve Johnson LSI Logic (steve.johnson@lsil.com), Brad Besmer LSI Logic
Date: 28 April, 2006
Subject: 06-037r3 SAS-2 SMP Lists (DISCOVER LIST)

Revision history
Revision 0 (9 January, 2006) First revision
Revision 1 (7 April, 2006) Revised from January 9 and CC meeting discussions.
Revision 2 (19 April, 2006).
Revision 3(19 April, 2006). Revised from various feedback
Revision 4(28 April, 2006). Revised from April 20 meeting discussions.

Related documents
sas2r03 - Serial Attached SCSI 2 revision 3
SAS-2 06-176~~.~~
SAS-2 06-~~176.~~213

Revision Overview ~~r2~~ r3 to ~~r3~~r4
Editorial repair.
~~Strikeout~~ Unstrikeout zoning election fields
~~Phy filter definition in list format.~~
~~Added function result table for PHY DOES NOT EXIST.~~
~~Fixed length fields~~
Changes from previous version in red

Overview

SMP DISCOVER, requires a separate SMP request and response per PHY identifier. In typical SAS-1.1 topologies the overhead of discovering and configuring the topology can become a significant hindrance to active I/O and fail-over scenarios. Self discovery, zoning, supervisor elections, table to table links, all using 1.1 discovery and routing procedures would add a “boat load” more of SMPs to the SMP storm. The discussion (or requirement) of very large SAS-2 topologies containing 1000’s of end devices, dozens of self configuring expanders and initiators necessitates the need to dramatically improved the discovery and configuration mechanisms.

Part of the solution is to reduce the number of SMP request and responses by combining multiple highly used SMP operations into single requests and responses.

The descriptor format provides the necessary information for each phy (up to 48 phys) in a single SMP request and response for a self configuring expander to perform self configuration of routing tables, zoning route tables, and zoning election for the requested expander.

Suggested changes

Add new SMP DISCOVER LIST function to section 10.4.3.x SMP functions of SAS-2. The DISCOVER LIST provides all the necessary data for a self configuring expander to program it’s zoning and route tables along with supervisor election information if included into the spec.

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Table 1 — 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	REPORT ZONE PERMISSION	Return zone permission table entries	
04h - 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	
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	REPORT ZONE ROUTE TABLE	Return zone information for each specified phy	
16h	DISCOVER LIST	Return information about the specified list of phys	
17h - 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	CONFIGURE ZONE PERMISSION	Change zone permission table information	
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	10.4.3.11
91h	PHY CONTROL	Request actions by the specified phy	10.4.3.12
92h	PHY TEST FUNCTION	Request a test function by the specified phy	10.4.3.13
93h	CONFIGURE PHY EVENT INFORMATION	Configure phy event information for the specified phy	10.4.3.14

Table 1 — SMP functions (FUNCTION field)

Code	SMP function	Description	Reference
94h	CONFIGURE PHY ZONE	Change phy entries within a zone route table	
95h - 9Fh	Reserved for phy-based SMP output functions		
A0h - BFh	Reserved for SMP output functions		
C0h - FFh	Vendor specific		

The FUNCTION RESULT field is defined in table 2.

Table 2 — 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 ZPs, 2] bit is set to zero).
10h	PHY DOES NOT EXIST	DISCOVER, DISCOVER LIST, 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 2 — 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		

10.4.3.x DISCOVER LIST function

The DISCOVER LIST function returns a list of phy descriptors. This SMP function shall be implemented by all SMP target ports.

Table 4 defines the request format.

Table 3 — DISCOVER LIST request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (16h)							
2	Reserved							
3	REQUEST LENGTH (06h)							
4	Reserved							
7								
8	STARTING PHY IDENTIFIER							
9	NUMBER OF DESCRIPTORS							
10	Reserved				PHY FILTER			
11	Reserved				DESCRIPTOR TYPE			
12	Reserved							
15								
16	Vendor specific							
29								
30	(MSB)			CRC				
31								(LSB)

Table 4 — DISCOVER LIST request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (16h)							
2	Reserved							
3	REQUEST LENGTH (06h)							
4	Reserved							
7								
8	STARTING PHY IDENTIFIER							
9	MAXIMUM NUMBER OF DESCRIPTORS							
10	IGNORE ZONE GROUP	Reserved			PHY FILTER			
11	Reserved				DESCRIPTOR TYPE			
12	Reserved							
15								
16	Vendor specific							
29								
30	(MSB) CRC							
31								(LSB)

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

The FUNCTION field shall be set to 16h.

The REQUEST LENGTH field shall be set to 06h.

The STARTING PHY IDENTIFIER field specifies the phy identifier of the first phy in the list of descriptors being requested.

The MAXIMUM NUMBER OF DESCRIPTORS field specifies the maximum number of descriptors requested starting with the value specified by the STARTING PHY IDENTIFIER field.

The PHY FILTER field is defined in Table 5 and specifies which PHY IDENTIFIER shall be returned in the DISCOVER LIST of descriptors.

The IGNORE ZONE GROUP bit is defined in 10.4.3.5.

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Table 5 — PHY FILTER field

Code	Description
0h	The SMP target port shall return in the list of descriptors all phy identifiers beginning with the vale specified in the STARTING PHY IDENTIFIER field.
1h	The SMP target port shall return in the list of descriptors only phy identifiers with the ATTACHED ~~SMP TARGET PORT~~ DEVICE TYPE (see 10.4.3.5) ~~bit~~ field set to ~~one~~ 010b or 011b beginning with the vale specified in the STARTING PHY IDENTIFIER field.
2h	the SMP target port shall return in the list of descriptors only phy identifiers with the ATTACHED DEVICE TYPE (see 10.4.3.5) field set to a value other than zero beginning with the vale specified in the STARTING PHY IDENTIFIER field.
All others	Reserved

.A DESCRIPTOR TYPE field set to 0h specifies that the descriptor shall contain a DISCOVER response as defined in 10.4.3.5 not including the CRC field ~~(see 10.4.3.5)~~. A DESCRIPTOR TYPE field set to 1h specifies that the descriptor shall contain a Discover List descriptor (see table 7). All other values are reserved.

The CRC field is defined in 10.4.3.2.

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Table 6 — DISCOVER LIST response (part 1 of 2)

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-3)/4)							
4	Reserved							
7								
8	STARTING PHY IDENTIFIER							
9	NUMBER OF DESCRIPTORS							
10	Reserved				PHY FILTER			
11	Reserved				DESCRIPTOR TYPE			
12	DESCRIPTOR LENGTH							
13	Reserved							
15								
16	ZONE DEVICE	ZONE ADDRESS RESOLVED DEVICE	Reserved				CONFIGURING	CONFIGURABLE ROUTE TABLE

Table 6 — DISCOVER LIST response (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
17	Reserved							
22								
23	ACTIVE ZONE ~~SUPERVISOR~~ PROXY PRIORITY				ZONE ~~SUPERVISOR~~ PROXY PRIORITY			
24	ACTIVE ZONE ~~SUPERVISOR~~ PROXY SAS ADDRESS							
31								
32	Vendor specific							
47								
DISCOVER LIST descriptor list								
48	DISCOVER LIST descriptor (first)							
m								
...	...							
y	DISCOVER LIST descriptor (last)							
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 STARTING PHY IDENTIFIER field specifies the phy identifier of the first phy in the list of descriptors being returned. The PHY IDENTIFIERS shall be returned in order from low to high.~~

The STARTING PHY IDENTIFIER field specifies the phy identifier of the first phy in the list of descriptors being returned. If this value specified in this field exceeds the value of the NUMBER OF PHYS field reported in the REPORT GENERAL response (see 10.4.3.3) then SMP target devcie shall return an empty list with the NUMBER OF DESCRIPTORS field set to zero, otherwise the PHY IDENTIFIERS shall be returned in order from low to high.

The NUMBER OF DESCRIPTORS field specifies the number of descriptors returned in the list. If the value of the STARTING PHY IDENTIFIER ~~+~~ field plus the value of the MAXIMUM NUMBER OF DESCRIPTORS FIELD exceeds the value of the NUMBER OF PHYS field reported in the REPORT GENERAL response (see 10.4.3.3) then the SMP target device shall return a ~~FUNCTION RESULT~~ list with the last descritors PHY IDENTIFER set to (NUMBER OF ~~PHY DOES NOT EXIST~~PHYS -1).

~~he~~ The PHY FILTER field is defined in Table 5 and specifies which PHY IDENTIFIER shall be returned in the DISCOVER LIST of descriptors.

The DESCRIPTOR TYPE field is defined in the DISCOVER LIST request.

The DESCRIPTOR LENGTH field is determined by the descriptor specified in the DESCRIPTOR TYPE field. The DISCOVER LIST descriptor length is 05h. The DISCOVER response length is defined in the 10.4.3.5.

The CONFIGURABLE ROUTE TABLE field is defined in 10.4.3.3.

The CONFIGURING field is defined in 10.4.3.3.

The ZONE ADDRESS RESOLVE DEVICE field is defined in 10.4.3.3.

The ZONE DEVICE field is defined in 10.4.3.3.

Editor's Note 1: Not sure if the red strikeout fields will be included in the spec to handle election of the zoning supervisor. If they are then they need to be included here so a self configuring expander only needs to send this SMP request

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The ZONE ~~SUPERVISOR~~ PROXY PRIORITY field is defined in 10.4.3.3.

The ACTIVE ZONE ~~SUPERVISOR~~ PROXY PRIORITY field is defined in 10.4.3.3.

The ACTIVE ZONE ~~SUPERVISOR~~ PROXY SAS ADDRESS field is defined in 10.4.3.3.

The CRC field is defined in 10.4.3.2.

Table 7 defines the descriptor format.

Table 7 — DISCOVER LIST descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	PHY IDENTIFIER							
1	FUNCTION RESULT							
2	Reserved	ATTACHED DEVICE TYPE			Reserved			
3	Reserved				NEGOTIATED PHYSICAL LINK RATE			
4	Reserved				ATTACHED SSP INITIATOR	ATTACHED STP INITIATOR	ATTACHED SMP INITIATOR	ATTACHED SATA HOST
5	ATTACHED SATA PORT SELECTOR	Reserved			ATTACHED SSP TARGET	ATTACHED STP TARGET	ATTACHED SMP TARGET	ATTACHED SATA DEVICE
6	VIRTUAL PHY	Reserved			ROUTING ATTRIBUTE			
7	Reserved							
8	ATTACHED SAS ADDRESS							
15								
16	ATTACHED PHY IDENTIFIER							
17	PHY CHANGE COUNT							
18	Reserved				ZONE ADDRESS RESOLVED	ZONE GROUP PERSISTENT	ZONE PARTICIPATING	ZONING ENABLED
19	~~ZONE GROUP~~Reserved							
20	~~Reserved~~ZONE GROUP							

The PHY IDENTIFIER field is defined in 10.4.3.5.

The FUNCTION RESULT field is defined in 10.4.3.2.

The ATTACHED DEVICE TYPE field is defined in 10.4.3.5.

The NEGOTIATED PHYSICAL LINK RATE field is defined in 10.4.3.5.

The ATTACHED SATA HOST bit is defined in 10.4.3.5.

The ATTACHED SMP INITIATOR bit is defined in 10.4.3.5.

The ATTACHED STP INITIATOR bit is defined in 10.4.3.5.

The ATTACHED SSP INITIATOR bit is defined in 10.4.3.5.

The ATTACHED SATA DEVICE bit is defined in 10.4.3.5.

The ATTACHED SMP TARGET bit is defined in 10.4.3.5.

The ATTACHED STP TARGET bit is defined in 10.4.3.5.

The ATTACHED SSP TARGET bit is defined in 10.4.3.5.

The ATTACHED SATA PORT SELECTOR bit is defined in 10.4.3.5.

The ROUTING ATTRIBUTE field is defined in 10.4.3.5.

The VIRTUAL PHY bit is defined in 10.4.3.5.

The ATTACHED SAS ADDRESS field is defined in 10.4.3.5.

The ATTACHED PHY IDENTIFIER field is defined in 10.4.3.5.

The PHY CHANGE COUNT field is defined in 10.4.3.5.

The ZONE ENABLED bit is defined in 10.4.3.5.

The ZONE PARTICIPATING bit is defined in 10.4.3.5.

The ZONE GROUP PERSISTENT bit is defined in 10.4.3.5.

The ZONE ADDRESS RESOLVED bit is defined in 10.4.3.5.

The ZONE GROUP bit is defined in 10.4.3.5.