

To: T10 Technical Committee
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Date: 19 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

Related documents

sas2r03 - Serial Attached SCSI 2 revision 3
SAS-2 06-176.

Revision Overview r2 to r3

Editorial repair.
Strikeout zoning election fields
Phy filter definition in list format.
Added function result table for PHY DOES NOT EXIST.
Fixed length fields

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.

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 | |
| <u>03h</u> | <u>REPORT ZONE PERMISSION</u> | <u>Return zone permission table entries</u> | |
| 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 |
| <u>15h</u> | <u>REPORT ZONE ROUTE TABLE</u> | <u>Return zone information for each specified phy</u> | |
| <u>16h</u> | <u>DISCOVER LIST</u> | <u>Return information about the specified list of phys</u> | |
| 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 | |
| <u>83h</u> | <u>CONFIGURE ZONE PERMISSION</u> | <u>Change zone permission table information</u> | |
| 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 | <u>CONFIGURE PHY ZONE</u> | <u>Change phy entries within a zone route table</u> | |
| 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 | <u>TBD</u> | 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, <u>DISCOVER LIST</u> , 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 3 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 | Reserved | | | | | | | |
| 8 | STARTING PHY IDENTIFIER | | | | | | | |
| 9 | NUMBER OF DESCRIPTORS | | | | | | | |
| 10 | Reserved | | | | PHY FILTER | | | |
| 11 | Reserved | | | | DESCRIPTOR TYPE | | | |
| 12 | Reserved | | | | | | | |
| 15 | Reserved | | | | | | | |
| 16 | Vendor specific | | | | | | | |
| 29 | Vendor specific | | | | | | | |
| 30 | (MSB) | CRC | | | | | | (LSB) |
| 31 | | | | | | | | |

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

The PHY FILTER field is defined in Table 4 and specifies which PHY IDENTIFIER shall be returned in the DISCOVER LIST of descriptors.

Table 4 — 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 (see 10.4.3.5) bit set to one 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 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 6). All other values are reserved.

The CRC field is defined in 10.4.3.2.

Table 5 — 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 | Reserved | | | | | | | | |
| 8 | STARTING PHY IDENTIFIER | | | | | | | | |
| 9 | NUMBER OF DESCRIPTORS | | | | | | | | |
| 10 | Reserved | | | | PHY FILTER | | | | |
| 11 | Reserved | | | | DESCRIPTOR TYPE | | | | |
| 12 | DESCRIPTOR LENGTH | | | | | | | | |
| 13 | Reserved | | | | | | | | |
| 15 | Reserved | | | | | | | | |
| 16 | ZONE DEVICE | ZONE ADDRESS RESOLVED DEVICE | Reserved | | | | CONFIGURING | CONFIGURABLE ROUTE TABLE | |

Table 5 — DISCOVER LIST response (part 2 of 2)

| Byte\Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------------------------------------|---|---|---|---|-------------------------------------|---|---|---|
| 17 | Reserved | | | | | | | |
| 22 | | | | | | | | |
| 23 | ACTIVE ZONE SUPERVISOR PRIORITY | | | | ZONE SUPERVISOR PRIORITY | | | |
| 24 | | | | | | | | |
| 31 | ACTIVE ZONE SUPERVISOR SAS ADDRESS | | | | | | | |
| 32 | | | | | | | | |
| 47 | Vendor specific | | | | | | | |
| DISCOVER LIST descriptor list | | | | | | | | |
| 48 | DISCOVER LIST descriptor (first) | | | | | | | |
| m | | | | | | | | |
| ... | ... | | | | | | | |
| y | DISCOVER LIST descriptor (last) | | | | | | | |
| n - 4 | | | | | | | | |
| n - 3 | (MSB) | | | | | | | |
| n | CRC | | | | | | | |
| | (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 NUMBER OF DESCRIPTORS field specifies the number of descriptors returned in the list. If the STARTING PHY IDENTIFIER + NUMBER OF DESCRIPTORS exceeds 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 of PHY DOES NOT EXIST.

The PHY FILTER field is defined in Table 4 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 strikethrough 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

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

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

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

The CRC field is defined in 10.4.3.2.

Table 6 defines the descriptor format.

Table 6 — 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 | ATTACHED SAS ADDRESS | | | | | | | |
| 16 | ATTACHED PHY IDENTIFIER | | | | | | | |
| 17 | PHY CHANGE COUNT | | | | | | | |
| 18 | Reserved | | | | ZONE ADDRESS RESOLVED | ZONE GROUP PERSISTENT | ZONE PARTICIPATING | ZONING ENABLED |
| 19 | ZONE GROUP | | | | | | | |
| 20 | Reserved | | | | | | | |

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.