To: T10 Technical Committee
From: Steve Johnson LSI Logic (steve.johnson@lsil.com)
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Subject: 06-214r0 SAS-2 Expander Route Table (CONFIGURE EXPANDER ROUTE TABLE)

Revision history
Revision 0 (1 May, 2006) First revision

Related documents
sas2r03a - Serial Attached SCSI 2 revision 3a
06-078r1.

Overview

In SAS 1.1 each table routing phy has it's own routing table. The tables are required to be programmed on a phy basis in a very specific order to facilitate several initiators reading and writing them at the same time. Disadvantages of this method are:

1) Expander add and removal (depending on location) can cause the tables to have to be completely rebuilt.
2) To program and build the tables complete discovery must be performed to determine routing phy attributes.
3) All unused entries are required to be zeroed by initiators
4) The exact number of route entries for a given phy route table can only be determined by a process of trial an error requiring each initiator to send the SMP REPORT ROUTE INFORMATION function or the SMP CONFIGURE ROUTE INFORMATION until a status of INDEX DOSE NOT EXIST is returned.

Another way to implement SAS routing tables is to view the routing tables as one single table for all the phys of the expander, where there is a list of SAS Addresses and phys that the addresses are routed to. Some advantages of this method are:

1) The table does not have to be in any specific order.
2) Add and remove of SAS ADDRESSES is independent of order.
3) Allows for partial discoveries where an initiator does not have to look at all the PHYs to talk to down stream devices (Important for new supervisor based configuration).
4) Table does not have to be rebuilt or reorder when expanders are added or removed.
5) No zeroing of table entries.
6) Matches most hardware implementations.
7) The exact table size can be reported.

A method to program the route table for non self configuring expanders that matches the REPORT EXPANDER ROUTE TABLE function is needed.

Suggested changes

Add the following new SMP functions to section 10.4.3.x SMP functions of the SAS-2.

1) CONFIGURE EXPANDER ROUTE TABLE

The CONFIGURE EXPANDER ROUTE TABLE function is being proposed to provide a new mechanism to program route tables that use lists of SAS ADDRESSES and PHYs to improve efficiency. It provides for a list of addresses to be assigned or removed to a given list of PHYs.

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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 for the specified phy	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	REPORT EXPANDER ROUTE TABLE	Return expander route table information	
18h - 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 for the specified phy	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

Table 1 — SMP functions (FUNCTION field)

Code	SMP function	Description	Reference
93h	CONFIGURE PHY EVENT INFORMATION	Configure phy event information for the specified phy	10.4.3.14
94h	CONFIGURE PHY ZONE	Change phy entries within a zone route table	
95h	CONFIGURE EXPANDER ROUTE TABLE	Configure expander route table information	
96h - 9Fh	Reserved for phy-based SMP output functions		
A0h - BFh	Reserved for SMP output functions		
C0h - FFh	Vendor specific		

10.4.3.x CONFIGURE EXPANDER ROUTE TABLE function

The CONFIGURE EXPANDER ROUTE TABLE function assigns or removes a list of SAS ADDRESSES to one or more expander table route phys. The list can be in any order. Other SMP target ports shall not support this SMP function.

Editor's Note 1: The CONFIGURE EXPANDER ROUTE TABLE function does not specify a route index because the order of the table is vendor specific.

Table 2 defines the request format.

Table 2 — CONFIGURE EXPANDER ROUTE TABLE request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (93h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7h) / 4)							
4	Reserved							
7								
8	NUMBER OF DESCRIPTORS							
9								
10	Reserved							REMOVE ROUTED ADDRESSES
11	Reserved							
15								
16	STARTING PHY IDENTIFIER							
17								
18	Vendor specific							
31								
CONFIGURE EXPANDER ROUTE TABLE descriptor list								
32	CONFIGURE EXPANDER ROUTE TABLE descriptor (first)							
47								
...	...							
n - 20	CONFIGURE EXPANDER ROUTE TABLE descriptor (first)							
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 93h.

The REQUEST LENGTH field shall be set to ((n - 7) / 4).

The REMOVE ROUTED ADDRESSES bit when set to one specifies that the SAS ADDRESSES shall be removed from the route table. otherwise, the list of ROUTED SAS ADDRESSES shall be added to the expander device route table.

The STARTING PHY IDENTIFIER field specifies the first phy identifier of the PHY IDENTIFIER BIT FIELD defined in Table 4.

Table 4 defines the CONFIGURE EXPANDER ROUTE TABLE descriptor format.

Table 3 — CONFIGURE EXPANDER ROUTE TABLE descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	PHY IDENTIFIER BIT FIELD							
5								
6	Reserved							
7	ZONE GROUP							
8	ROUTED SAS ADDRESS							
15								

The PHY IDENTIFIER BIT FIELD specifies the phy identifiers the ROUTED SAS ADDRESS is routed to. This field is a bit array where each bit position indicates a corresponding phy identifier (e.g. bit zero set to one specifies that phy identifier zero). The STARTING PHY IDENTIFIER field defined in Table 2 specifies the phy identifier of bit zero.

The zone group field is defined in 4.8.3.1

The ROUTED SAS ADDRESS field contains the SAS address in the expander route entry (see 4.6.7.3).

Table 4 defines the response format.

Table 4 — CONFIGURE EXPANDER ROUTE TABLE response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (93h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (00h)							
4	(MSB)	CRC						
7								(LSB)

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

The FUNCTION field shall be set to 93h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 00h.

The CRC field is defined in 10.4.3.2.