

To: T10 Technical Committee
From: Steve Johnson LSI Logic (steve.johnson@lsi.com)
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Subject: 07-017r2 SAS-2 More Zone Groups

Revision history

Revision 0 (14 January 2007) First revision.
Revision 1(8 March 2007) Updates as discussed in January meeting.
Revision 2(12 March 2007) Updates as voted on in March 12 meeting.

Related documents

sas2r08 - Serial Attached SCSI 2 revision 08

Overview

In the SAS 2.0 time frame there are some blade server topologies that contain many end devices (initiators and targets). The initiators and their respective designated targets need to be zoned from each other with unique zone groups. 127 zone groups will not be enough to support some of these types of topologies, however 254 zone groups is enough to support them.

This proposal allows for a zone group permission table size of 256 as discusses in zoning meetings in 2006. Two table sizes are defined 128 and 256 with room to define other sizes in future versions of the spec.

Suggested changes

4.9 Zoning

4.9.1 Zoning overview

4.9.2 Zoning expander device requirements

In addition to the requirements for expander devices described in 4.6, a zoning expander device shall:

- a) contain a zoning expander route table (see 4.9.3.4);
- b) contain active and shadow zone permission tables that supports 128 or 256 zone groups (see 4.9.3.3);
- c) contain active and shadow zone phy information for each phy;
- d) if zoning is enabled, allow or deny connection requests based on the active zone permission table (see 4.9.3.5);
- e) set the ZONING SUPPORTED bit to one in its SMP REPORT GENERAL response (see 10.4.3.3);
- f) support the ZONING ENABLED bit in the SMP REPORT GENERAL response;
- g) support the zone lock inactivity timer;
- h) be self-configuring;
- i) contain an SMP initiator port (see 4.6.1); and
- j) support zoning-related SMP functions.

b

4.9.3 Zone operation

The ZONE GROUP field contains a value in the range of 0 to ~~127~~ 255 that specifies the zone group to which the phy belongs. The zone group of the SMP initiator port and SMP target port in a zoning expander device shall be 1. 4.9.3.2 defines more about zone groups.

4.9.3.1 Zone groups

Table 25 — Zone groups function in different ways based on zone group number as shown in table 25.

Table 25 — Zone groups

Zone group	Configurable in zone permission table ^a	Description
0	No	Phys in zone group 0 have access to phys in zone group 1 and do not have access to phys in other zone groups.
1	No	Phys in zone group 1 have access to phys in all zone groups.
2	Yes	<p>Phys in zone group 2 have access to phys in the zone groups indicated by the zone permission table.</p> <p>A management device server in a zoning expander device with zoning enabled only allows management application clients using phys in zone groups with access to zone group 2 to perform the following SMP functions:</p> <ul style="list-style-type: none"> a) CONFIGURE GENERAL (see 10.4.3.15); b) ENABLE DISABLE ZONING (see 10.4.3.16); and c) ZONE LOCK (see 10.4.3.18). <p>A management device server in a zoning expander device with zoning enabled only allows management application clients to perform certain SMP phy-based control and configuration functions (e.g., PHY CONTROL, PHY TEST FUNCTION, and CONFIGURE PHY EVENT INFORMATION) if the zone group of the management application client's phy has access to zone group 2 or the zone group of the specified phy.</p>
3	Yes	<p>Phys in zone group 3 have access to phys in the zone groups indicated by the zone permission table.</p> <p>A management device server in a zoning expander device with zoning enabled only allows management application clients using a phy in a zone group with access to zone group 3 to perform certain SMP zoning-related functions (i.e., ZONED BROADCAST (see 10.4.3.17)).</p>
4 to 7	Reserved	
8 to 127 255	Yes	Phys in zone groups 8 through 127 255 have access to phys in the zone groups indicated by the zone permission table.
^a A zone group defined as configurable is able to be changed with the SMP CONFIGURE ZONE PERMISSION TABLE function (see 10.4.3.22).		

4.9.3.3 Zone permission table

The zone permission table specifies access permission between zone groups. If a bit in the zone permission table is set to one then connection requests shall be permitted between phys in the zone groups. If a bit in the zone permission table is set to zero then connection requests between phys in the zone groups shall be rejected with OPEN_REJECT (ZONE VIOLATION) or OPEN_REJECT (RETRY) as described in 4.9.3.5.

The zone permission table structure is shown in table 26.

Table 26 — Zone permission table

Destination zone group (i.e., d)	Source zone group (i.e., s)				
	0	1	2 to 3	4 to 7	8 to $427n-1^c$
0	0	1	0	0	0
1	1	1	1	1	1
2 to 3	0	1	ZP[s = 2 to 3, d = 2 to 3] ^a	Reserved ^b	ZP[s = 8 to $427n-1^c$, d = 2 to 3] ^a
4 to 7	0	1	Reserved ^b	Reserved ^b	Reserved ^b
8 to $427n-1^c$	0	1	ZP[s = 2 to 3, d = 8 to $427n-1^c$] ^a	Reserved ^b	ZP[s = 8 to $427n-1^c$, d = 8 to $427n-1^c$] ^a

^a Shading identifies configurable zone groups.
^b All reserved ZP bits shall be set to zero (e.g., bits ZP[4 to 7, 4 to $427n-1$] are set to zero).
^c [The value of n is reported in the NUMBER OF ZONE GROUPS field in the REPORT GENERAL response \(see 10.4.3.3\), \(i.e., 128 or 256\)](#)

A ZP[s, d] bit set to one specifies that the source zone group (i.e., s) has permission to access the destination zone group (i.e., d). A ZP[s, d] bit set to zero specifies that the source zone group (i.e., s) does not have permission to access the destination zone group (i.e., d).

If ZP[s, d] is set to a value, ZP[d,s] shall be set to the same value.

If an expander phy has the ZONE ADDRESS RESOLVED bit set to one, then the zone group of that phy shall be configured to have permission to access all the zone groups to which the SAS addresses in the zoning expander route table for that expander phy have access (e.g., in figure 57 in 4.9.3.5, zone group 18 has access to all the zone groups that the end devices in its routing table have access).

[If a zone manager enables zoning on zoning capable expander devices with different values reported in the NUMBER OF ZONE GROUPS field reported in the REPORT GENERAL response \(see 10.4.3.3\), then the zone manager shall](#)

- [a\) configure all zoning enabled expander devices contained within the ZPSDS to use the highest commonly supported NUMBER OF ZONE GROUPS field \(i.e., 128 or 256\); and](#)
- [b\) zero all zone permission table entries higher than the highest commonly supported NUMBER OF ZONE GROUPS field.](#)

4.9.3.4 REPORT GENERAL function

The REPORT GENERAL function...

Table 225 defines the response format.

Table 225 — REPORT GENERAL response

Byte\Bit	7	6	5	4	3	2	1	0	
0	SMP FRAME TYPE (41h)								
1	FUNCTION (00h)								
...									
36	NUMBER OF ZONE GROUPS	Reserved	ZONE LOCKED	PHYSICAL PRESENCE SUPPORTED	PHYSICAL PRESENCE ASSERTED	ZONING SUPPORTED	ZONING ENABLED		
37	Reserved								
...									
52	(MSB)	CRC						(LSB)	
55									

[The NUMBER OF ZONE GROUPS field indicates the number of zone groups \(e.g., the number of entries in the zone group permission table\) supported by the expander device and is defined in table 226.](#)

Table 226 — NUMBER OF ZONE GROUPS field

Code	Description
00b	128 zone groups
01b	256 zone groups
All others	Reserved

Table 227 — REPORT ZONE PERMISSION TABLE response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (04h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	(MSB) EXPANDER CHANGE COUNT							
5	(LSB)							
6	ZONE LOCKED	Reserved						REPORT SHADOW
7	NUMBER OF ZONE GROUPS		Reserved					
7 8	Reserved							
13	Reserved							
14	STARTING SOURCE ZONE GROUP							
4 5	Reserved	NUMBER OF ZONE PERMISSION DESCRIPTORS						
15	NUMBER OF ZONE PERMISSION DESCRIPTORS							
Zone permission descriptor list								
16	Zone permission descriptor (first)(see table 234 in 10.4.3.6.4)							
m								
	...							
n - m	Zone permission descriptor (last)(see table 234 in 10.4.3.6.4)							
n - 4								
n - 3	(MSB) CRC							
n	(LSB)							

[The NUMBER OF ZONE GROUPS field indicates the number of elements in ZONE PERMISSION DESCRIPTORS and is defined in table 225 \(i.e., 128 or 256\).](#)

10.4.3.6.4 Zone permission descriptor

Table 234 defines the zone permission descriptor [containing 128 entries](#).

Table 234 — Zone permission descriptor for 128 source zone group (i.e., s)

Byte\Bit	7	6	5	4	3	2	1	0
0	ZP[s, 127]	ZP[s, 126]	ZP[s, 125]	ZP[s, 124]	ZP[s, 123]	ZP[s, 122]	ZP[s, 121]	ZP[s, 120]
...	...							
15	ZP[s, 7] (0b)	ZP[s, 6] (0b)	ZP[s, 5] (0b)	ZP[s, 4] (0b)	ZP[s, 3]	ZP[s, 2]	ZP[s, 1] (1b)	ZP[s, 0] (0b)

[Table 235 defines the zone permission configuration descriptor containing 256 entries.](#)

Table 235 — Zone permission configuration descriptor for 256 source zone group (i.e., s)

Byte\Bit	7	6	5	4	3	2	1	0
0	ZP[s, 255]	ZP[s, 254]	ZP[s, 253]	ZP[s, 252]	ZP[s, 251]	ZP[s, 250]	ZP[s, 249]	ZP[s, 248]
...	...							
31	ZP[s, 7] (0b)	ZP[s, 6] (0b)	ZP[s, 5] (0b)	ZP[s, 4] (0b)	ZP[s, 3]	ZP[s, 2]	ZP[s, 1] (1b)	ZP[s, 0] (0b)

The zone permission descriptor contains all of the zone permission table entries for the source zone group (i.e., s) [where the value of n is specified in table 226 \(i.e., 128 or 256\)](#).

Table 235 defines how the zone permission descriptor bits shall be set by the management device server.

Table 235 — Zone permission descriptor bit requirements

Source zone group (i.e., s)	Management device server requirement(s)
0	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 2 through 427 n-1] shall be set to zero.
1	ZP[s, 0 through 427 n-1] shall be set to one.
4, 5, 6 or 7	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 4 through 427 n-1] shall be set to zero.
2, 3, or 8 through 427 n-1	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 2 through 3] shall be set to zero or one as specified by the CONFIGURE ZONE PERMISSION TABLE function (see 10.4.3.22). ZP[s, 4 through 7] shall be set to zero. ZP[s, 8 through 427 n-1] shall be set to zero or one as specified by the CONFIGURE ZONE PERMISSION TABLE function.

Editor's Note 1: Add table foot note: [The value of n is specified in table 226 \(i.e., 128 or 256\).](#)

10.4.3.7 DISCOVER function

The DISCOVER function...

The ZONE GROUP field contains the value of the ZONE GROUP field in the zone phy information (see 4.9.3.1).

~~Zone group values between 128 and 255, inclusive, are reserved.~~

10.4.3.17 ZONED BROADCAST function

The ZONED BROADCAST function...

Each BROADCAST SOURCE ZONE GROUP field specifies a source zone group for the Broadcast. The expander device forwards the Broadcast to each destination zone group accessible to that source zone group. ~~Zone group values between 128 and 255, inclusive, are reserved.~~

Table 236 defines the request format.

Table 236 — CONFIGURE ZONE PERMISSION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (8Bh)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	(MSB)	EXPECTED EXPANDER CHANGE COUNT						(LSB)
5								
6	STARTING SOURCE ZONE GROUP							
7	Reserved	NUMBER OF ZONE PERMISSION CONFIGURATION DESCRIPTORS						
7	NUMBER OF ZONE PERMISSION CONFIGURATION DESCRIPTORS							
8	NUMBER OF ZONE GROUPS			Reserved				
9	Reserved							
15	Reserved							
Zone permission configuration descriptor list								
8	Zone permission configuration descriptor (first)(see table 284 in							
23	10.4.3.22.3)							
...								
n - 20	Zone permission configuration descriptor (last)(see table 284 in							
n - 4	10.4.3.22.3)							
n - 3	(MSB)	CRC						(LSB)
n								

[The NUMBER OF ZONE GROUPS field indicates the number of elements in ZONE PERMISSION CONFIGURATION DESCRIPTORS and is defined in table 225 \(i.e., 128 or 256\).](#)

10.4.3.21.3 Zone phy configuration descriptor

The ZONE GROUP field specifies the value of the ZONE GROUP field in the zone phy information (see 4.9.3.1).

~~Zone group values between 128 and 255, inclusive, are reserved.~~

10.4.3.22.3 Zone permission configuration descriptor

Table 284 defines the zone permission configuration descriptor [containing 128 entries](#).

Table 284 — Zone permission configuration descriptor for 128 source zone group (i.e., s)

Byte\Bit	7	6	5	4	3	2	1	0
0	ZP[s, 127]	ZP[s, 126]	ZP[s, 125]	ZP[s, 124]	ZP[s, 123]	ZP[s, 122]	ZP[s, 121]	ZP[s, 120]
...	...							
15	ZP[s, 7] (0b)	ZP[s, 6] (0b)	ZP[s, 5] (0b)	ZP[s, 4] (0b)	ZP[s, 3]	ZP[s, 2]	ZP[s, 1] (1b)	ZP[s, 0] (0b)

[Table 285 defines the zone permission configuration descriptor containing 256 entries.](#)

Table 285 — Zone permission configuration descriptor for 256 source zone group (i.e., s)

Byte\Bit	<u>7</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>
<u>0</u>	ZP[s, 255]	ZP[s, 254]	ZP[s, 253]	ZP[s, 252]	ZP[s, 251]	ZP[s, 250]	ZP[s, 249]	ZP[s, 248]
...	...							
<u>31</u>	ZP[s, 7] (0b)	ZP[s, 6] (0b)	ZP[s, 5] (0b)	ZP[s, 4] (0b)	ZP[s, 3]	ZP[s, 2]	ZP[s, 1] (1b)	ZP[s, 0] (0b)

The zone permission configuration descriptor contains all of the zone permission table entries for the source zone group (i.e., s). To preserve symmetry about the ZP[s, s] table axis, the management device server shall apply the same value to both the source and destination zone groups for the zone permission entries.

Table 285 defines how the zone permission descriptor bits shall be set by the management application client and processed by the management device server.

Table 285 — Zone permission configuration descriptor bit requirements

Source zone group (i.e., s)	Management application client requirement(s)	Management device server requirement(s)
0	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 2 through 427 n-1] shall be set to zero.	ZP[s, 0 through 427 n-1] shall be ignored.
1	ZP[s, 0 through 427 n-1] shall be set to one.	ZP[s, 0 through 427 n-1] shall be ignored.
4, 5, 6 or 7	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 4 through 427 n-1] shall be set to zero.	ZP[s, 0 through 427 n-1] shall be ignored.
2, 3, or 8 through 427 n-1	ZP[s, 0] shall be set to zero. ZP[s, 1] shall be set to one. ZP[s, 2 through 3] may be set to zero or one. ZP[s, 4 through 7] shall be set to zero. ZP[s, 8 through 427 n-1] may be set to zero or one.	ZP[s, 0 through 1] shall be ignored. ZP[s, 2 through 3] shall be processed. ZP[s, 4 through 7] shall be ignored. ZP[s, 8 through 427 n-1] shall be processed. For each source zone group t other than s, ZP[t, s] shall be set to ZP[s, t].

Editor's Note 2: Add table foot note: [The value of n is specified in table 226 \(i.e., 128 or 256\).](#)

Annex A

(informative)

Zone permission configuration descriptor examples

This annex provides examples of using multiple zone permission configuration descriptors in the SMP CONFIGURE ZONE PERMISSION TABLE function (see 10.4.3.22).

Table A.1 shows an example initial value of the zone permission table.

Table A.1 — Zone permission table example initial value

Zone group	0 ^a	1 ^a	2 to 3	4 to 7 ^a	8	9	10	11	12 to 427 255
0 ^a	0	1	0	0	0	0	0	0	0
1 ^a	1	1	1	1	1	1	1	1	1
2 to 3	0	1	0	0	0	0	0	0	0
4 to 7 ^a	0	1	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	0	0
9	0	1	0	0	0	0	0	0	0
10	0	1	0	0	0	0	0	0	0
11	0	1	0	0	0	0	0	0	0
12 to 427 255	0	1	0	0	0	0	0	0	0

^a Zone permission table entries for this zone group are not changeable.

Table 284 shows an example SMP CONFIGURE ZONE PERMISSION TABLE request where the STARTING ZONE GROUP field is set to 10 (i.e., 0Ah) and the zone permission configuration descriptor list contains two zone permission configuration descriptors.

Table A.2 — CONFIGURE ZONE PERMISSION TABLE request example

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (8Bh)							
2	Reserved							
3	REQUEST LENGTH (0Bh)							
4	(MSB) _____							
5	EXPECTED EXPANDER CHANGE COUNT _____ (LSB)							
6	STARTING SOURCE ZONE GROUP (0Ah)							
7	Reserved	NUMBER OF ZONE PERMISSION CONFIGURATION DESCRIPTORS (02h)						
7	NUMBER OF ZONE PERMISSION CONFIGURATION DESCRIPTORS (02h)							
Zone permission configuration descriptor (first)(source zone group 10)								
8	FFh							
...	(each byte set to FFh)							
23	0Eh							
Zone permission configuration descriptor (second)(source zone group 11)								
24	00h							
...	(each byte set to 00h)							
47	00h							
48	(MSB) _____							
51	CRC _____ (LSB)							

Table A.3 shows the zone permission table after processing the first zone permission configuration descriptor (i.e., source zone group 10).

Table A.3 — Zone permission table after processing the first zone permission configuration descriptor

Zone group	0 ^a	1 ^a	2 to 3	4 to 7 ^a	8	9	10 ^b	11	12 to 427 255
0 ^a	0	1	0	0	0	0	0	0	0
1 ^a	1	1	1	1	1	1	1	1	1
2 to 3	0	1	0	0	0	0	1	0	0
4 to 7 ^a	0	1	0	0	0	0	0	0	0
8	0	1	0	0	0	0	1	0	0
9	0	1	0	0	0	0	1	0	0
10 ^b	0	1	1	0	1	1	1	1	1
11	0	1	0	0	0	0	1	0	0
12 to 427 255	0	1	0	0	0	0	1	0	0

^a Zone permission table entries for this zone group are not changeable.
^b Changeable entries in this zone group are changed by the descriptor.

Table A.4 shows the zone permission table after processing the second zone permission configuration descriptor (i.e., source zone group 11).

Table A.4 — Zone permission table after processing the second zone permission configuration descriptor

Zone group	0 ^a	1 ^a	2 to 3	4 to 7 ^a	8	9	10	11 ^b	12 to 427 255
0 ^a	0	1	0	0	0	0	0	0	0
1 ^a	1	1	1	1	1	1	1	1	1
2 to 3	0	1	0	0	0	0	1	0	0
4 to 7 ^a	0	1	0	0	0	0	0	0	0
8	0	1	0	0	0	0	1	0	0
9	0	1	0	0	0	0	1	0	0
10	0	1	1	0	1	1	1	0	1
11 ^b	0	1	0	0	0	0	0	0	0
12 to 427 255	0	1	0	0	0	0	1	0	0

^a Zone permission table entries for this zone group are not changeable.
^b Changeable entries in this zone group are changed by the descriptor.

