To: T10 Technical Committee
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Subject: 06-358r0 SAS-2 Zone Configuration model

Revision Information

- Revision 0: Initial proposal

[Start: Changes in the latest revision are shown in red]

Referenced Documents

sas2r05a Serial Attached SCSI – 2 (SAS-2) revision 5a
06-286r2 SAS-2 SMP ZONE CONFIGURATION LOCK (Tim Symons, PMC-Sierra).
06-201r1 SAS-2 SMP Configure phy zone (Tim Symons, PMC-Sierra)
06-202r2 SAS-2 SMP Configure zone permission (Tim Symons, PMC-Sierra)
06-288r2 SAS-2 SMP ZONE CONFIGURATION ACTIVATE function (Tim Symons, PMC-Sierra)
06-289r2 SAS-2 SMP ZONE CONFIGURATION UNLOCK (Tim Symons, PMC-Sierra)

Overview

The zone configuration models help identify the scenarios encountered when configuring zoning expander devices. There are 3 categories to be considered:
1. Initializing a zoning expander prior to zone enable.
2. Reconfiguring zone information for an established ZPSDS
3. Resolving zoning when joining two or more ZPSDS'.

For a ZPSDS to function correctly all zoning expander devices must have identical zone permission tables. A change to the zone permission tables shall be originated by a zone management client and applied to each zoning expander device individually. If there is any interruption to the process then there is a potential for the zone route tables in zoning expander devices to become inconsistent with each other and for the ZPSDS to be corrupted. The zone management lock, activate and unlock function minimizes the risk of corruption, and provides a positive mechanism for confirmation of completion.

Examples of causes of inconsistent zone permission tables are:
a) Two or more zone management clients attempt to update the ZPSDS at the same time with different information; and
b) A device failure causes the process to be aborted part way through an update.

This proposal minimizes the risk of a ZPSDS becoming inconsistent using a lock, load, activate and release procedure, and ensures identification of process completion and error conditions:
1. LOCK: writes the SAS address of the zone management client to all zoning expanders to ensure that only one zone management client updates the zone configuration at any time. A zoning expander shall not forward any received Broadcast (change), Broadcast (Reserved Change 0) or Broadcast (Reserved Change 0) when locked.
2. LOAD: Only the device that locked the ZPSDS may issue zone locked SMP function requests. Changes are applied to shadow registers and shall not be activated until requested.
3. ACTIVATE: When all zoning configuration changes have been successfully loaded to the shadow registers, then the zone management client shall issue an activate request to all zoning expander devices and the shadow data then becomes operational.
4. UNLOCK: When the shadow registers of all zoning expander devices have been activated then the zone expanders shall originate Broadcast (change) with source zone group 1 notification for all changes and unlock and send outstanding Broadcast

(Reserved Change 0) and (Reserved Change 1) notifications that occurred when the expander was locked.

5. The configuration process is complete.

Zoning expander devices shall support a shadow zone permission table. When a management application client locks the zone, all changes shall be written to shadow registers.

3.1 Definitions

3.1.x active zone management application client: The zone management application client that locked the zoning expander devices in a ZPSDS.

3.1.x SMP zone locked function: a function that is only accepted from the active zone application management client when the zoning expander devices are locked, indicated by the ZONE LOCKED bit set to one in the REPORT GENERAL response.

3.1.x zoned expander shadow registers: registers that store all SMP zone locked request data inactively until activated by the SMP zone activate request.

4.8.2 Zoning expander device requirements

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

…

h)   contain a shadow zone permission table that supports 128 zone groups; and

i)   contain a shadow phy zone configuration descriptor for each phy.

4.7.5.x Zone configuration model

4.7.5.x.1 Reference model for zone configuration

Figure 1 shows a reference example for zone configuration modeling
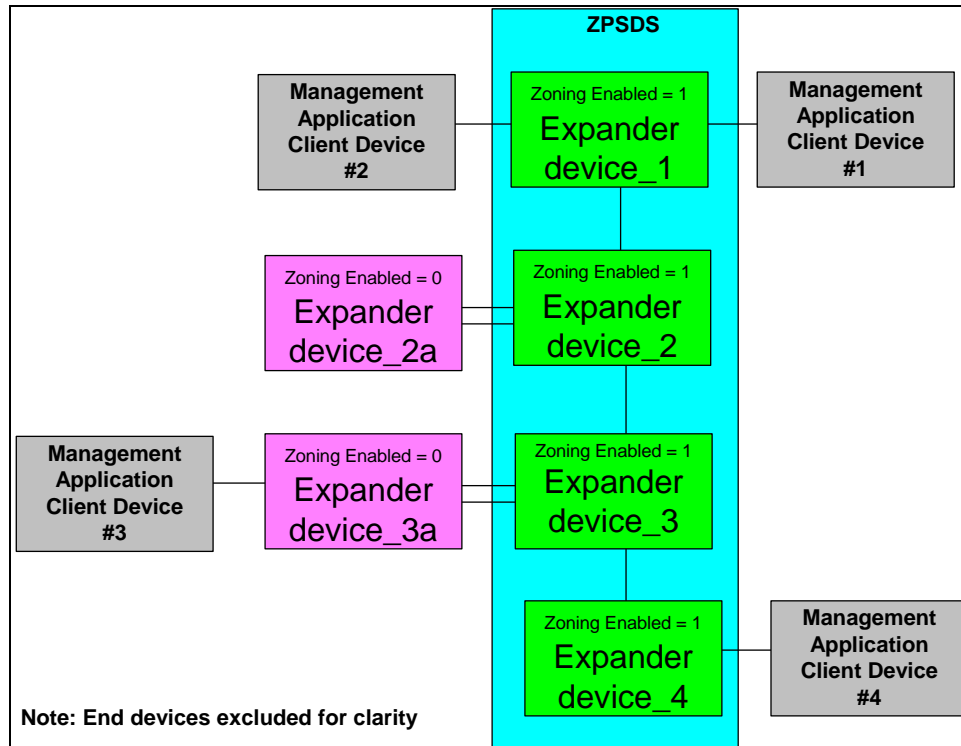
Figure 1 – ZPSDS with Management application clients.

To configure a zoning expander ZPSDS a management application client device shall lock the zoning expander device.

If the zoning expander device has the ZONING ENABLED bit set to one then the management application client device originating the SMP ZONE CONFIGURATION LOCK request shall:
   a) have permission to access ZG2; and
   b) be attached to the ZPSDS through a phy with the ZONE PARTICIPATING bit set to one.

If the zoning expander device has the ZONING ENABLED bit set to zero then:
   a) the zoning expander device shall accept the CONFIGURE PHY ZONE request from any zone management client device;
   b) the zoning expander device shall be locked by an SMP ZONE CONFIGURATION LOCK request and then only accept the CONFIGURE PHY ZONE request from the active zone management client device; or
   c) if the zoning expander device has the physical presence asserted bit set to one then it shall accept the CONFIGURE PHY ZONE request from a zone management client device that also has the physical presence asserted bit set to one;

4.7.5.x.2 Zone configuration lock

To lock a zoning expander device a management application client device shall originate an SMP ZONE LOCK request.

If a zoning expander device has the ZONE ENABLED bit set to one then an SMP ZONE LOCK request shall only be accepted if the zone management application client device has zone permission to zone group 2.

If a zoning expander device has the ZONE ENABLED bit set to zero and the PHYSICAL PRESENCE ASSERTED set to one (see 10.4.3.3), then an SMP ZONE LOCK request shall be accepted by any zone management application client device.

To resolve any instance where more than one zone management client attempts to lock the zoning expanders in the ZPSDS, the following rules ensure that any concurrent requests are always resolved:

a) If all zoning expander devices respond with SMP FUNCTION ACCEPTED then the ZPSDS is locked by the zone management application client;

b) If the first zoning expander device responds with the function result ZONE LOCK VIOLATION, then the ZPSDS is locked by another zone management application client and no further requests should be originated until a BROADCAST (change) event;

c) If at least one zoning expander device responds with SMP FUNCTION ACCEPTED and any other response has a function result of ZONE LOCK VIOLATION, then this indicates that another zone management application client device has locked the zoning expander device and the following actions shall proceed;

    a. if the returned SAS address has a higher numeric value than the SAS address of the zone management client, then the zone management client shall send ZONE LOCK RELEASE requests to all zoning expander devices that returned SMP FUNCTION ACCEPTED; or

    b. if the returned SAS address has a lower numeric value than the SAS address of the zone management client, then it shall send ZONE LOCK requests to all zoning expander devices that returned a function result of ZONE LOCK VIOLATION;

d) If all zoning expander devices respond with a function result of ZONE LOCK VIOLATION then the ZPSDS is locked by another zone management client and no further requests should be originated until a BROADCAST (change) event.

When a zoning expander device sets the ZONE CONFIGURATION LOCK bit from zero to one, the shadow registers shall be loaded with the values of the active zone register values.

When a zoning expander device has the ZONE CONFIGURATION LOCK bit set to one then any received Broadcast (change), Broadcast (Reserved Change 0) and Broadcast (Reserved Change 1) shall not be forwarded.

4.7.5.x.3 Zone configuration load

When a zoning expander device is locked then the active zone management client device shall originate SMP zone locked requests to configure the zones.

When a zoning expander device receives a SMP zone locked request the CONFIGURING bit shall be set to one (see 10.4.3.3) to indicate that the shadow registers are being updated.

If an expander device receives an SMP CONFIGURE ZONE LOCK request when it is already locked then:

a) if the request originates from the active zone management application client device then the function response shall be SMP FUNCTION ACCEPTED.

b) if the request originates from the active zone management application client device then the function response shall be ZONE LOCK VIOLATION.

If the active zone management application client receives an error from any of the locked zoning expander devices during configuration changes, the active zone management client server shall resolve the error by originating a duplicate request. If the error cannot be resolved then an ZONE CONFIGURATION UNLOCK request shall be requested without originating an ZONE CONFIGURATION ACTIVATE request.

4.7.5.x.4 Zone configuration activate

When the active zone management client has completed all zone updates and received SMP FUNCTION ACCEPTED from all zoning expander devices in the ZPSDS it shall activate the changes by originating the CONFIGURE ZONE ACTIVATE request to all locked zoning expander devices. The activate function causes each zoning expander device to make the shadow zone permission table active.

4.7.5.x.5 Zone configuration unlock

The SMP CONFIGURE ZONE UNLOCK function is used by a zone management client to unlock each zoning expander device.

When a locked zoning expander device receives an SMP CONFIGURE ZONE UNLOCK request and there is a change to any zone group then:

a) if the phy has zone group access permission to zone group 3 then the zoning expander device shall originate a BROADCAST (Change) on each expander port that has access permission to the expander phy before the change, and after the change based on the zone permission table including the phy with that changed; or

b) if the phy does not have zone group access permission to zone group 3 then the zoning expander device shall originate a BROADCAST (Change) with access to zone group 1 on all ports.

When a zoning expander device receives a SMP ZONE CONFIGURATION UNLOCK request the CONFIGURING bit shall be set to zero (see 10.4.3.3) to indicate that the shadow registers contain the same values at the active registers.

When a zoning expander device has the ZONE CONFIGURATION LOCK bit set to zero then any received Broadcast (change), Broadcast (Reserved Change 0) and Broadcast (Reserved Change 1) shall be forwarded to all ports.