Date: December 20, 2006

To: T10 Committee (SCSI)

From: George Penokie (IBM)

Subject: SAS-2: Expander Notification of Temporary Shutdown

1 Overview

Within the Service Delivery Subsystem in the SAS topology we have intelligent devices that will have to have their software updated. The software is updated by issuing WRITE BUFFER commands to a SES device within the expander device. When this occurs there will be a period of time while the flash is being written when the expander will not permit any traffic between it's phys. This period of time can, depending on the implementation, take longer that a minute. After the code is written the expander will cause a reset sequence to occur on all it's phys before allowing traffic to resume.

Needless to say, this will cause timeouts at every layer of SAS for any operations outstanding at the time of the code download. This is a problem that can be handled within the current SAS and SCSI definitions by the application client/initiator device that issued the WRITE BUFFER command. However, any other application client/initiator device will not be happy, as any outstanding operations will without warning just disappear.

This proposal defines a NOTIFY (GOING OFFLINE) that expanders would use to notify all devices it is connected to that it will be temporarily (as in seconds) be shutting down all traffic. ~~The NOTIFY is being proposed instead of a BROADCAST mainly to allow the information to easily and quickly pass between zoning expanders.~~

The action a SAS device takes with it receives a NOTIFY (GOING OFFLINE) depends on the type of device it is:

  a) Expanders issues a BROADCAST(EXPANDER OFFLINE IMMINENT). After the time-out set by NOTIFY (GOING OFFLINE) expires the expander issues a BROADCAST(CHANGE) and marks the port as gone offline for an extended period of time. Any attempt to open the port after the time-out results in an OPEN REJECT (RETRY LONG). This response continues until the port receives a link reset sequence is received;
  b) Target devices ignore the BROADCAST (EXPANDER OFFLINE IMMINENT) and NOTIFY (GOING OFFLINE); and
  c) Initiator devices should terminate any I_T_L_Q nexus after receiving a BROADCAST (EXPANDER OFFLINE IMMINENT) or a NOTIFY (GOING OFFLINE). Initiators should terminate any I_T_L_Q nexus that receive an OPEN REJECT (RETRY LONG) for a length of time longer than indicated by the WRITE BUFFER commands code update timeout.

This requires three new primitives:

  a) NOTIFY (GOING OFFLINE) is needed to allow an expander to identify the port to be marked as going away;
  b) BROADCAST (EXPANDER OFFLINE IMMINENT) is needed to allow initiators time to quiesce operations before connections through the port are stopped.
  c) OPEN REJECT (RETRY LONG) Provides a response to a request to open a port that is different then the normal OPEN REJECT (NO DESTINATION). However, OPEN REJECT (NO DESTINATION) is still allowed. NOTE: Current implementations are already required to treat OPEN_REJECT (RESERVED CONTINUE 0) like an OPEN_REJECT (RETRY)

2 SAS-2 changes

In addition to the changes below the following tables need to be updated with the new primitives.

NOTIFY (GOING OFFLINE) replaces NOTIFY (RESERVE 1) in Table 87 — Deletable primitives and Table 91 — Primitive encoding for deletable primitives.

BROADCAST (EXPANDER OFFLINE IMMINENT) replaces BROADCAST (RESERVED 3) in Table 88 — Primitives not specific to type of connection and Table 91 — Primitive encoding for deletable primitive.

OPEN REJECT (RETRY LONG) replaces OPEN_REJECT (RESERVED CONTINUE 0) in Table 88 — Primitives not specific to type of connection and Table 91 — Primitive encoding for deletable primitives.

4.1.13 Broadcasts

Broadcasts are used to notify all phys in the SAS domain about certain events. Broadcasts are transmitted using BROADCAST (see 7.2.5.5) or the SMP ZONED BROADCAST function (see 10.4.3.17).

Table 1 defines the types of Broadcast supported.

Table 1 — Broadcast types

Broadcast	Primitive	Description
Broadcast (Change)	yes	Originated by an expander device to notify SAS initiator ports that a SAS domain change has occurred (see 7.11). May also be originated by SAS initiator ports. Ignored by SAS target ports.
Broadcast (Reserved Change 0)	yes	Reserved. SAS ports (i.e, SAS initiator ports and SAS target ports) shall process this Broadcast the same as Broadcast (Change).
Broadcast (Reserved Change 1)	yes	Reserved. SAS ports shall process this Broadcast the same as Broadcast (Change).
Broadcast (SES)	yes	Originated by a logical unit with a peripheral device type set to 0Dh (i.e., enclosure services device) (see SPC-4 and SES-2) accessible through a SAS target port in the SAS domain to notify SAS initiator ports of an asynchronous event. SSP initiator ports should poll all the logical units in the SAS domain with peripheral device types set to 0Dh to determine the source. SAS target ports shall ignore this Broadcast.
Broadcast (Expander)	yes	Originated by an expander device to notify SAS initiator ports that an expander event has occurred, including: a phy event information peak value detector has reached its threshold value; or a phy event information peak value detector has been cleared by an SMP CONFIGURE PHY EVENT INFORMATION function (see 10.4.3.26). Expander events do not include SAS domain changes, which are communicated with Broadcast (Change).
Broadcast (Asynchronous Event)	yes	Originated by an SSP target port when an event occurs that causes one or more unit attention conditions to be established for one or more logical units accessible through the SSP target port. An SSP target port shall only originate one Broadcast (Asynchronous Event) for each event that affects multiple logical units accessible through the SSP target port (e.g., only one Broadcast (Asynchronous Event) is originated when a hard reset occurs).
Broadcast (EXPANDER OFFLINE IMMINENT)	yes	Originated by an expander device to notify SAS initiator ports that a NOTIFY (GOING OFFLINE) was received (see 7.2.5.11.4). SAS target ports shall ignore this Broadcast.
Broadcast (Reserved 4)	yes	Reserved. SAS ports shall ignore this Broadcast.
Broadcast (Zone Activate)	no	Initiates the zone activate step (see 4.9.6.4). Devices that are not locked zoning expander devices shall ignore this Broadcast.
[a] All Broadcasts are supported by the SMP ZONED BROADCAST function (see 10.4.3.17). Broadcasts labeled "yes" are also transmitted via BROADCAST primitive sequences (see 7.2.5.5).		

When an expander port receives a Broadcast, the BPP (see 4.6.5) shall forward the Broadcast on at least one phy in each other expander port if zoning is disabled, or forward the Broadcast as described in 4.9.5 if zoning is enabled.

An expander device is not required to queue multiple identical Broadcasts for the same expander port. If a second identical Broadcast is requested before the first Broadcast has been transmitted, the second Broadcast may be ignored.

See 10.4.3.3 for details on counting Broadcast (Change)s originated in an expander device. See 4.11 for details on phy event information.

7.2.5.5 BROADCAST

BROADCASTs are used to notify all SAS ports in a domain of an event.

The versions of BROADCAST representing different Broadcast types are defined in table 2.

Table 2 — BROADCAST primitives

Primitive	Description
BROADCAST (CHANGE)	Broadcast (Change)
BROADCAST (RESERVED CHANGE 0)	Broadcast (Reserved Change 0)
BROADCAST (RESERVED CHANGE 1)	Broadcast (Reserved Change 1)
BROADCAST (SES)	Broadcast (SES)
BROADCAST (EXPANDER)	Broadcast (Expander)
BROADCAST (ASYNCHRONOUS EVENT)	Broadcast (Asynchronous Event)
BROADCAST (EXPANDER OFFLINE IMMINENT)	Broadcast (Expander Offline Imminent)
BROADCAST (RESERVED 4)	Broadcast (Reserved 4)

A phy that has not completed the link reset sequence shall not transmit a BROADCAST. A phy shall not transmit a BROADCAST inside a connection.

A BROADCAST received by a phy that has not completed the link reset sequence shall be ignored.

See 4.1.13 for definitions of Broadcasts.

7.2.5.11 NOTIFY

7.2.5.11.1 NOTIFY overview

NOTIFY may be transmitted in place of any ALIGN (see 7.2.5.2) being transmitted for physical link rate tolerance management (see 7.3) and rate matching (see 7.13). Substitution of a NOTIFY for an ALIGN may or may not affect the ALIGN rotation (i.e., the NOTIFY may take the place of one of the ALIGNs in the rotation through ALIGN (0), ALIGN (1), ALIGN (2), and ALIGN (3), or it may delay the rotation). A specific NOTIFY shall not be transmitted in more than three consecutive dwords until at least three other dwords have been transmitted.

NOTIFYs are deletable primitives (see 7.3).

The forwarding of NOTIFY through expander devices is as specified in table 3.

NOTIFY shall not be forwarded through expander devices. Expander devices shall substitute an ALIGN for a NOTIFY if necessary.

SAS target devices are not required to detect every transmitted NOTIFY.

The versions of NOTIFY representing different reasons are defined in table 3.

Table 3 — NOTIFY primitives

Primitive	Description	Reference
NOTIFY (ENABLE SPINUP)	Specify to a SAS target device that it may temporarily consume additional power while transitioning into the active or idle power condition state.	7.2.5.11.2
NOTIFY (POWER LOSS EXPECTED)	Specify to a SAS target device that power loss may occur within the time specified by the POWER LOSS TIMEOUT field in the Protocol-Specific Port mode page Shared Port Control subpage (see 10.2.7.2.4).	7.2.5.11.3
NOTIFY (GOING OFFLINE)	Specify to a SAS device that an expander device is going to temporarily disable communication between SAS devices.	7.2.5.11.4
NOTIFY (RESERVED 1)	Reserved.	

NOTIFY (RESERVED 1) and NOTIFY (RESERVED 2) shall be ignored by all devices.

7.2.5.11.2 NOTIFY (ENABLE SPINUP)

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7.2.5.11.3 NOTIFY (POWER LOSS EXPECTED)

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7.2.5.11.4 NOTIFY (GOING OFFLINE)

NOTIFY (GOING OFFLINE) is transmitted by an expander port to specify that the expander is going to disable all phy to phy communication for a period of time. An application client may determine the length of time the expander device is going to be offline by requesting write buffer command information using a REPORT SUPPORTED OPERATION CODES command (see SPC-4).

NOTIFY (GOING OFFLINE) shall be transmitted at least three times on each expander port. After the last NOTIFY (GOING OFFLINE) is transmitted the expander device shall wait the time specified in the TIME TO OFFLINE field in the CONFIGURE GENERAL function (see 10.4.3.15) before disabling phy to phy communication.

The expander device shall only transmit a NOTIFY (GOING OFFLINE) on one phy of each expander port.

After the operation that caused the phy to phy communication to be disabled is complete the expander device shall initiate a link reset sequence on all phys.

When an expander device receives NOTIFY (GOING OFFLINE) that expander device:

1) shall transmit BROADCAST (EXPANDER OFFLINE IMMINENT) on all expander ports except the expander port from which the NOTIFY (GOING OFFLINE) was received;
2) shall indicate that access to the expander port is, or is going to be, temporarily blocked by setting the NEGOTIATED LOGICAL LINK RATE field and NEGOTIATED PHYSICAL LINK RATE field to CODE_UPDATE_IN_PROGRESS (6h) (see 10.4.3.7);
3) shall wait the time specified in the TIME TO OFFLINE field in the REPORT GENERAL function (see 10.4.3.3);
4) shall transmit BROADCAST (CHANGE) on all expander ports except the expander port from which the NOTIFY (GOING OFFLINE) was received;

5) should respond to any attempt to open a connection on any phy associated with this expander port with an OPEN REJECT (RETRY LONG) and may respond with an OPEN REJECT (NO DISTINATION) until a link reset sequence is received;

6) shall, if responding to open requests with OPEN REJECT (RETRY LONG), switch to responding open requests with OPEN REJECT (NO DISTINATION) if no link reset sequence is received within the time specified in the MAXIMUM OFFLINE TIME field in the REPORT GENERAL function (see 10.4.3.15)

7) shall, after a link reset sequence is received on all phys associated with this expander port, transmit BROADCAST (CHANGE) on all expander ports except the expander port which the NOTIFY (GOING OFFLINE) was originally received.

NOTE 1 - In item 5) the option to respond with an OPEN REJECT (NO DISTINATION) is to allow interpretability with expanders compliant with prior versions of this standard. Future versions of this standard may obsolete this option.

If a SAS initiator device supports NOTIFY (GOING OFFLINE) and receives NOTIFY (GOING OFFLINE) that SAS initiator device should terminate all outstanding I_T_L_Q nexus associated with the SAS negotiator port on which the NOTIFY (GOING OFFLINE) was received.

For the SAS initiator device rules on handling a BROADCAST (EXPANDER OFFLINE IMMINENT) (see 7.9.2).

SAS target devices shall ignore NOTIFY (GOING OFFLINE).

7.2.5.13 OPEN_REJECT

OPEN_REJECT specifies that a connection request has been rejected and specifies the reason for the rejection. The result of some OPEN_REJECTs is to abandon (i.e., not retry) the connection request and the result of other OPEN_REJECTs is to retry the connection request.

All of the OPEN_REJECT versions defined in table 4 shall result in the originating port abandoning the connection request.

Table 4 — OPEN_REJECT abandon primitives

Primitive	Originator	Description
OPEN_REJECT (BAD DESTINATION)	Expander phy	A connection request arrives through an expander phy using the direct routing or table routing method and the expander device determines the connection request would have to be routed to the same expander port as the expander port through which the connection request arrived (e.g., the destination SAS address equals the source SAS address), and the expander device has not chosen to return OPEN_REJECT (NO DESTINATION) (see 7.12.4.3).
OPEN_REJECT (CONNECTION RATE NOT SUPPORTED)	Any phy	The requested connection rate is not supported on some physical link on the pathway between the source phy and destination phy. When a SAS initiator phy is directly attached to a SAS target phy, the requested connection rate is not supported by the destination phy. The connection request may be modified and reattempted as described in 7.12.2.2.
OPEN_REJECT (PROTOCOL NOT SUPPORTED)	Destination phy	Phy with destination SAS address exists but the destination phy does not support the requested initiator/target role, protocol, initiator connection tag, or features (i.e., the values in the INITIATOR PORT bit, the PROTOCOL field, the INITIATOR CONNECTION TAG field, and/or the FEATURES field in the OPEN address frame are not supported).
OPEN_REJECT (RESERVED ABANDON 1)	Unknown	Reserved. Process the same as OPEN_REJECT (WRONG DESTINATION).
OPEN_REJECT (RESERVED ABANDON 2)		
OPEN_REJECT (RESERVED ABANDON 3)		
OPEN_REJECT (STP RESOURCES BUSY)	Destination phy	STP target port with destination SAS address exists but the STP target port has an affiliation with another STP initiator port or all of the available task file registers have been allocated to other STP initiator ports (see 7.17.4). Process the same as OPEN_REJECT (WRONG DESTINATION) for non-STP connection requests.
OPEN_REJECT (WRONG DESTINATION)	Destination phy	The destination SAS address does not match the SAS address of the SAS port to which the connection request was delivered.
OPEN_REJECT (ZONE VIOLATION)	Zoning expander phy	The connection request is from a zone group that does not have permission to access the zone group that contains the destination phy according to the zone permission table of an unlocked zoning expander device.

All of the OPEN_REJECT versions defined in table 5 shall result in the originating port retrying the connection request.

Table 5 — OPEN_REJECT retry primitives

Primitive	Originator	Description
OPEN_REJECT (NO DESTINATION) [a]	Expander phy	Either: a) No such destination phy; b) the expander device determines the connection request would have to be routed to the same expander port as the expander port through which the connection request arrived (e.g., the destination SAS address equals the source SAS address) and the expander device has not chosen to return OPEN_REJECT (BAD DESTINATION) (see 7.12.4.3); or c) the SAS address is valid for an STP target port in an STP/SATA bridge, but the initial Register - Device to Host FIS has not been successfully received (see 10.4.3.9).
OPEN_REJECT (PATHWAY BLOCKED) [b]	Expander phy	An expander device determined the pathway was blocked by higher priority connection requests.
OPEN_REJECT (RETRY LONG) [c]	Expander phy	Phy with destination SAS address exists but is not able to accept connections (see 7.2.5.11.4).
OPEN_REJECT (RESERVED CONTINUE 1) [c]	Unknown	Reserved. Process the same as OPEN_REJECT (RETRY).
OPEN_REJECT (RESERVED INITIALIZE 0) [a]	Unknown	Reserved. Process the same as OPEN_REJECT (NO DESTINATION).
OPEN_REJECT (RESERVED INITIALIZE 1) [a]		
OPEN_REJECT (RESERVED STOP 0) [b]	Unknown	Reserved. Process the same as OPEN_REJECT (PATHWAY BLOCKED).
OPEN_REJECT (RESERVED STOP 1) [b]		
OPEN_REJECT (RETRY) [c]	Destination phy or zoning expander phy	Phy with destination SAS address exists but is not able to accept connections, or the connection request is from a zone group that does not have permission to access the zone group that contains the destination phy according to the zone permission table of a locked zoning expander device.
[a] If the I_T Nexus Loss timer is already running, it continues running; if it is not already running, it is initialized and started. Stop retrying the connection request if the I_T Nexus Loss timer expires. [b] If the I_T Nexus Loss timer is already running, it continues running. Stop retrying the connection request if the I_T Nexus Loss timer expires. [c] If the I_T Nexus Loss timer (see 8.2.2) is already running, it is stopped.		

NOTE 2 - Some SAS logical phys compliant with earlier versions of this standard also transmit OPEN_REJECT (RETRY) if they receive an OPEN address frame while their SL_CC state machines are in the SL_CC5:BreakWait state (see 7.14.4.7).

When a SAS logical phy detects more than one reason to transmit an OPEN_REJECT, the SL_CC state machine determines the priority in the SL_CC2:Selected state (see 7.14.4.4).

When an expander logical phy detects more than one reason to transmit an OPEN_REJECT, the ECM determines the priority (see 7.12.4).

See 7.12 for details on connection requests.

7.9.2 SAS initiator device rules

After a link reset sequence, or after receiving a Broadcast (Change), a management application client behind an SMP initiator port should perform a discover process (see 4.7).

When a discover process is performed after a link reset sequence, the management application client discovers all the devices in the SAS domain. When a discover process is performed after a Broadcast (Change), the management application client determines which devices have been added to or removed from the SAS domain.

The discover information may be used to select connection rates for connection requests (see 7.8.3).

After receiving a Broadcast (Expander Offline Imminent), a management application client behind an SMP initiator port should issue a DISCOVER function to all expander devices to determine which expander port has the NEGOTIATED LOGICAL LINK RATE field or the NEGOTIATED PHYSICAL LINK RATE field set to CODE_UPDATE_IN_PROGRESS (6h) (see 10.4.3.7). Any outstanding I_T_L_Q nexus associated with the expander port which indicates a code update is in progress should be terminated.

10.4.3.3 REPORT GENERAL function

The REPORT GENERAL function returns general information about the SAS device (e.g., a SAS device contained in an expander device). This SMP function shall be implemented by all management device servers.

Table 6 defines the request format.

Table 6 — REPORT GENERAL request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (00h)							
2	Reserved							
3	REQUEST LENGTH (00h)							
4	(MSB)							
7	CRC							(LSB)

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

The FUNCTION field shall be set to 00h.

The REQUEST LENGTH field shall be set to 00h.

The CRC field is defined in 10.4.3.1.

Table 7 defines the response format.

Table 7 — REPORT GENERAL response (part 1 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (00h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (0Ch)							
4	(MSB)	EXPANDER CHANGE COUNT						
5								(LSB)
6	(MSB)	EXPANDER ROUTE INDEXES						
7								(LSB)
8	Reserved							
9	NUMBER OF PHYS							
10	TABLE TO TABLE SUPPORTED	Reserved			ZONE ADDRESS RESOLVED SUPPORTED	CONFIGURES OTHERS	CONFIGURING	EXTERNALLY CONFIGURABLE ROUTE TABLE
11	TIME TO OFFLINE~~Reserved~~							
12	ENCLOSURE LOGICAL IDENTIFIER							
19								
20	MAXIMUM OFFLINE TIME~~Reserved~~							
21	Reserved							
29								
30	(MSB)	STP BUS INACTIVITY TIME LIMIT						
31								(LSB)
32	(MSB)	STP MAXIMUM CONNECT TIME LIMIT						
33								(LSB)
34	(MSB)	STP SMP I_T NEXUS LOSS TIME						
35								(LSB)
36	Reserved			ZONE LOCKED	PHYSICAL PRESENCE SUPPORTED	PHYSICAL PRESENCE ASSERTED	ZONING SUPPORTED	ZONING ENABLED
37	Reserved							

Table 7 — REPORT GENERAL response (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
38	(MSB)							
				MAXIMUM NUMBER OF ROUTED SAS ADDRESSES				
39								(LSB)
40								
				ACTIVE ZONE MANAGER SAS ADDRESS				
47								
48	(MSB)							
				ZONE LOCK INACTIVITY TIME LIMIT				
49								(LSB)
50								
				Reserved				
51								
52	(MSB)							
				CRC				
55								(LSB)

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The TIME TO OFFLINE field contains the time the expander waits from transmitting a NOTIFY (GOING OFFLINE) to disabling phy to phy communication which is set by the CONFIGURE GENERAL function (see 10.4.3.15).

The ENCLOSURE LOGICAL IDENTIFIER field identifies the enclosure, if any, in which the device is located, and is defined in SES-2. The ENCLOSURE LOGICAL IDENTIFIER field shall be set to the same value reported by the enclosure services process, if any, for the enclosure. An ENCLOSURE LOGICAL IDENTIFIER field set to zero indicates no enclosure information is available.

The MAXIMUM OFFLINE TIME field contains the maximum time the expander shall issue OPEN REJECT (RETRY LONG) in response to an open request to an expander port that received a NOTIFY (GOING OFFLINE) (see 7.2.5.11.4). This timer value shall be in 1 s increments. A value of zero in this field indicates that the there is no maximum time specified.

10.4.3.7 DISCOVER function

The DISCOVER function returns information about the specified phy. This SMP function provides information from the IDENTIFY address frame received by the phy and additional phy-specific information. This SMP function shall be implemented by all management device servers.

> NOTE 3 - The DISCOVER LIST function (see 10.4.3.13) returns information about one or more phys.

Table 8 defines the request format.

Table 8 — DISCOVER request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (10h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
7								
8	Reserved							IGNORE ZONE GROUP
9	PHY IDENTIFIER							
10	Reserved							
11								
12	(MSB)							
15	CRC							(LSB)

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The NEGOTIATED LOGICAL LINK RATE field and NEGOTIATED PHYSICAL LINK RATE field are defined in table 9 and indicate the logical and physical link rate negotiated during the link reset sequence or other conditions of the phy. The negotiated physical link rate may be less than the programmed minimum physical link rate or greater than the programmed maximum physical link rate if the programmed physical link rates have been changed since the last link reset sequence.

Table 9 — NEGOTIATED PHYSICAL LINK RATE **field and** NEGOTIATED PHYSICAL LINK RATE **field** (part 1 of 2)

Code	Name	Description
0h	UNKNOWN	Phy is enabled; unknown logical or physical link rate. [a]
1h	DISABLED	Phy is disabled.
2h	PHY_ RESET_ PROBLEM	Phy is enabled; the phy obtained dword synchronization for at least one physical link rate during the SAS speed negotiation sequence (see 6.7.4.2), but the SAS speed negotiation sequence failed (i.e., the last speed negotiation window, using a physical link rate expected to succeed, failed). These failures may be logged in the SMP REPORT PHY ERROR LOG function (see 10.4.3.8), the SMP REPORT PHY EVENT INFORMATION function (see 10.4.3.11), and/or the Protocol-Specific Port log page (see 10.2.8.1).

Table 9 — NEGOTIATED PHYSICAL LINK RATE **field and** NEGOTIATED PHYSICAL LINK RATE **field** (part 2 of 2)

Code	Name	Description
3h	SPINUP_ HOLD	Phy is enabled; detected a SATA device and entered the SATA spinup hold state. The SMP PHY CONTROL function (see 10.4.3.24) phy operations of LINK RESET and HARD RESET may be used to release the phy. This field shall be updated to this value at SATA spinup hold time (see 6.8.7 and 6.11)(i.e., after the COMSAS Detect Timeout timer expires during the SATA OOB sequence) if SATA spinup hold is supported.
4h	PORT_ SELECTOR	Phy is enabled; detected a SATA port selector. The physical link rate has not been negotiated since the last time the phy's SP state machine entered the SP0:OOB_COMINIT state. The SATA spinup hold state has not been entered since the last time the phy's SP state machine entered the SP0:OOB_COMINIT state. The value in this field may change to 3h, 8h, 9h, or Ah if attached to the active phy of the SATA port selector. Presence of a SATA port selector is indicated by the ATTACHED SATA PORT SELECTOR bit (see table 232).
5h	RESET_ IN_ PROGRESS	Phy is enabled; the expander phy is performing an SMP PHY CONTROL function (see 10.4.3.24) phy operation of LINK RESET or HARD RESET. The value in this field shall change when this field is updated to any other value. This value shall only be returned if the specified phy contained a value of 8h, 9h, or Ah in this field when an SMP PHY CONTROL function phy operation of LINK RESET or HARD RESET phy operation is processed.
6h	CODE_ UPDATE_ IN_ PROGRESS	Phy is enabled; the attached expander device is going to disable all phy to phy communication for a period of time (see 7.2.5.11.4). The value in this field shall change when this field is updated to any other value.
8h	G1	Phy is enabled; 1,5 Gbps logical or physical link rate. [b] The NEGOTIATED LOGICAL LINK RATE field shall be updated to this value after the speed negotiation sequence completes if it negotiates a single 1,5 Gbps logical link or negotiates two multiplexed 1,5 Gbps logical links.
9h	G2	Phy is enabled; 3 Gbps logical or physical link rate. [b] The NEGOTIATED LOGICAL LINK RATE field shall be updated to this value after the speed negotiation sequence completes if it negotiates a single 3 Gbps logical link or negotiates two multiplexed 3 Gbps logical links.
Ah	G3	Phy is enabled; 6 Gbps logical or physical link rate. [b] The NEGOTIATED LOGICAL LINK RATE field shall be updated to this value after the speed negotiation sequence completes if it negotiates a single 6 Gbps logical link.
Bh - Fh	Reserved	Phy is enabled; reserved for future logical or physical link rates.
All others	Reserved.	

[a] This code may be used by an application client in its local data structures to indicate an unknown negotiated logical or physical link rate (e.g., before the discover process has queried the phy).
[b] The NEGOTIATED PHYSICAL LINK RATE field shall be updated to this value after the speed negotiation sequence completes if it negotiates this physical link rate.

10.4.3.15 CONFIGURE GENERAL function

The CONFIGURE GENERAL function requests actions by the device containing the management device server. This SMP function may be implemented by any management device server. In zoning expander devices, if zoning is enabled then this function shall only be processed from SMP initiator ports that have access to zone group 2 (see 4.9.3.2).

Table 10 defines the request format.

Table 10 — CONFIGURE GENERAL request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (80h)							
2	Reserved							
3	REQUEST LENGTH (03h)							
4	(MSB)		EXPECTED EXPANDER CHANGE COUNT					
5								(LSB)
6	Reserved							
7								
8	Reserved					UPDATE STP SMP I_T NEXUS LOSS TIME	UPDATE STP MAXIMUM CONNECT TIME LIMIT	UPDATE STP BUS INACTIVITY TIME LIMIT
9	TIME TO OFFLINE ~~Reserved~~							
10	(MSB)		STP BUS INACTIVITY TIME LIMIT					
11								(LSB)
12	(MSB)		STP MAXIMUM CONNECT TIME LIMIT					
13								(LSB)
14	(MSB)		STP SMP I_T NEXUS LOSS TIME					
15								(LSB)
16	(MSB)		CRC					
19								(LSB)

...

The TIME TO OFFLINE field contains the minimum period that an expander device shall wait from the transmission of a NOTIFY (GOING OFFLINE) to disabling phy to phy communication (see 7.2.5.11.4). This timer value shall be in 100 ms increments. When this timer is exceeded, the expander device may disable phy to phy communication. A value of zero in this field specifies that the time from transmission of a NOTIFY (GOING OFFLINE) to disabling phy to phy communication is vender specific. This value is reported in the TIME

10.4.3.16 ZONED BROADCAST function

The ZONED BROADCAST function requests that the specified Broadcast be forwarded as specified in 4.9.5. This SMP function shall be supported by management device servers in zoning expander devices (see 4.9). Other management device servers shall not support this SMP function. This SMP function shall only be processed from SMP initiator ports that have access to zone group 3 (see 4.9.3.2).

Table 11 defines the request format.

Table 11 — ZONED BROADCAST request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (85h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	Restricted							
5								
6	Reserved				BROADCAST TYPE			
7	NUMBER OF BROADCAST SOURCE ZONE GROUPS							
Broadcast source zone group list								
8	BROADCAST SOURCE ZONE GROUP (first)							
...	...							
	BROADCAST SOURCE ZONE GROUP (last)							
	PAD (if needed)							
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 85h.

The REQUEST LENGTH field contains the number of dwords that follow, not including the CRC field.

The BROADCAST TYPE field specifies the type of BROADCAST SOURCE that shall be forwarded and is defined in Table 12.

Table 12 — BROADCAST TYPE field

Code	Description
0000b	Broadcast (Change)
0001b	Broadcast (Reserved Change 0)
0010b	Broadcast (Reserved Change 1)
0011b	Broadcast (SES)
0100b	Broadcast (Expander)
0101b	Broadcast (Asynchronous Event)
0110b	Broadcast (Expander Offline Imminent)
0111b	Broadcast (Reserved 4)
1000b	Broadcast (Zone Activate)
All others	Reserved for Broadcasts only supported by the ZONED BROADCAST function

The NUMBER OF BROADCAST SOURCE ZONE GROUPS field specifies the number of zone groups to which the specified Broadcast is to be forwarded.