T10/07-008 revision 3

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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). 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) and NOTIFY (GOING OFFLINE); and
c) Initiator devices should:
   A) after receiving a NOTIFY (GOING OFFLINE) terminate any outstanding I_T_L_Q nexus;
   B) after receiving a BROADCAST (EXPANDER) issue a REPORT BROADCAST function to determine the source and cause of the BROADCAST (EXPANDER). If the source of the broadcast was as a result of a NOTIFY (GOING OFFLINE), then the Initiator should terminate any outstanding I_T_L_Q nexus; and
   C) 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 two new primitives and a new SAS function:

a) NOTIFY (GOING OFFLINE) is needed to allow an expander to identify the port to be marked as going away;
b) 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); and
c) REPORT BROADCAST function that provides information on the source and cause of a broadcast.

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.

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) a phy event information peak value detector has reached its threshold value; ~~or~~ b) a phy event information peak value detector has been cleared by an SMP CONFIGURE PHY EVENT INFORMATION function (see 10.4.3.26); or c) a NOTIFY (GOING OFFLINE) was received (see 7.2.5.11.4). 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 (Reserved 3)	yes	Reserved. SAS ports shall ignore this Broadcast.
Broadcast (Reserved 4)	yes	
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.

7.2.5.11 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 2.

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 2.

Table 2 — 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 device is going to disable all phy to phy communication for a period of time. The period of time the expander device is going to be offline may be determined:

a) by requesting write buffer command information using a REPORT SUPPORTED OPERATION CODES command (see SPC-4) issued to a SES device within the expander device; and
b) from the contents of the MAXIMUM OFFLINE TIME field (see 10.4.3.3).

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) on all expander ports except the expander port from which the NOTIFY (GOING OFFLINE) was received;
2) shall wait the time specified in the TIME TO OFFLINE field in the REPORT GENERAL function (see 10.4.3.3);
3) 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);
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) (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 3 shall result in the originating port abandoning the connection request.

Table 3 — 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 4 shall result in the originating port retrying the connection request.

Table 4 — 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), a management application client behind an SMP initiator port should issue a REPORT BROADCAST function to all expander devices to determine which expander port has received a NOTIFY (GOING OFFLINE). Any outstanding I_T_L_Q nexus associated with the expander port that indicates receipt of a NOTIFY (GOING OFFLINE) should be terminated.

7.10 SAS domain changes (Broadcast (Change) usage)

After power on or receiving Broadcast (Change) via an SMP initiator port, the management application client should scan the SAS domain using the discover process (see 4.7) to search for SAS initiator devices, SAS target devices, and expander devices.

The expander device shall originate Broadcast (Change) from at least one phy in each expander port other than the expander port that is the cause for originating Broadcast (Change).

Expander devices shall originate Broadcast (Change) for the following expander phy-related reasons:

a) after an expander phy's SP state machine transitions from the SP15:SAS_PHY_Ready or SP22:SATA_PHY_Ready state to the SP0:OOB_COMINIT state (see 6.8);

NOTE 3 - This occurs when the expander phy is reset or disabled with the SMP PHY CONTROL function DISABLE, LINK RESET, HARD RESET, or TRANSMIT SATA PORT SELECTION SIGNAL phy operations (see 10.4.3.24) as well as when dword synchronization is unexpectedly lost;

b) after a virtual phy has been disabled with the SMP PHY CONTROL function DISABLE phy operation or started processing a reset requested by the LINK RESET or HARD RESET phy operations (see 10.4.3.24);
c) after an expander phy's SP state machine reaches the SATA spinup hold state (see 6.8.7and 6.11);
d) after an expander phy's SP state machine receives a COMWAKE Detected message in states SP0:OOB_COMINIT, SP1:OOB_AwaitCOMX, SP3:OOB_AwaitCOMINIT_Sent, or SP4:OOB_COMSAS if the ATTACHED SATA PORT SELECTOR bit is set to zero in the SMP DISCOVER response (see 10.4.3.7) and the SMP DISCOVER LIST response (see 10.4.3.13.3) prior to receiving the COMWAKE detected message (see 6.8.3 and table 232 in 10.4.3.7);
e) after an expander phy's SP state machine transitions from the SP1:OOB_AwaitCOMX state to the SP0:OOB_COMINIT state if the ATTACHED SATA PORT SELECTOR bit was set to one in the SMP DISCOVER response and the SMP DISCOVER LIST response (see 10.4.3.13.3) upon entry to SP1:OOB_AwaitCOMX, and if no COMWAKE detected message was received while in SP1:OOB_AwaitCOMX before the transition to SP0:OOB_COMINIT (see 6.8.3.3.2);
f) after an expander phy completes the link reset sequence (see 7.9);
g) after a virtual phy has been enabled or completed processing a reset requested by the SMP PHY CONTROL function LINK RESET or HARD RESET phy operations (see 10.4.3.24);
h) after an STP/SATA bridge receives an initial Register - Device to host FIS (see 9.3.1); and
i) after the time to offline timer times out (see 10.4.3.15).

In zoning expander devices with zoning enabled, a Broadcast (Change) for an expander phy-related reason shall be originated from the source zone group of the expander phy causing the Broadcast (Change).

Expander devices shall originate Broadcast (Change) for the following expander device-related reasons:

a) after a self-configuring expander device has changed its CONFIGURING bit from one to zero in the SMP REPORT GENERAL response (see 10.4.3.3) as described in 4.7.2. In zoning expander devices with zoning enabled, the source zone group shall be 1;
b) after a locked expander device is unlocked (see 4.9.6.5 and 10.4.3.20), with the source zone group as specified in 4.9.6.5 and 10.4.3.20.

Expander devices shall forward Broadcast (Change) for the following reasons:

a) after an expander phy receives Broadcast (Change).

For a virtual phy, if there is any time after a reset is originated during which connection requests to the attached SAS address result in connection responses of OPEN_REJECT (NO DESTINATION), the expander device shall originate the Broadcast (Change) twice, once at the start of the reset (i.e., when the SAS address becomes unavailable) and once at its completion (i.e., when the SAS address becomes available). If there is no such time window, the expander device shall originate the Broadcast (Change) once.

SAS initiator ports may originate Broadcast (Change) to force other SAS initiator ports and expander ports to re-run the discover process, but should not be sent by SAS target ports.

A SAS initiator port that receives Broadcast (Change) shall follow the SAS initiator device rules (see 7.9.2) to discover and configure the topology.

An expander device that receives Broadcast (Change) shall follow the expander device rules (see 7.9.3) to discover and configure the topology.

See 10.4.3.3 for details on counting Broadcast (Change) origination in an expander device.

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 5 defines the request format.

Table 5 — 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 6 defines the response format.

Table 6 — 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)							
5	EXPANDER CHANGE COUNT							(LSB)
6	(MSB)							
7	EXPANDER ROUTE INDEXES							(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	Reserved							
12	ENCLOSURE LOGICAL IDENTIFIER							
19								
20	Reserved							
29								
30	(MSB)							
31	STP BUS INACTIVITY TIME LIMIT							(LSB)
32	(MSB)							
33	STP MAXIMUM CONNECT TIME LIMIT							(LSB)
34	(MSB)							
35	STP SMP I_T NEXUS LOSS TIME							(LSB)
36	Reserved			ZONE LOCKED	PHYSICAL PRESENCE SUPPORTED	PHYSICAL PRESENCE ASSERTED	ZONING SUPPORTED	ZONING ENABLED
37	Reserved							
38	(MSB)							
39	MAXIMUM NUMBER OF ROUTED SAS ADDRESSES							(LSB)

Table 6 — REPORT GENERAL response (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
40	ACTIVE ZONE MANAGER SAS ADDRESS							
47								
48	(MSB)	ZONE LOCK INACTIVITY TIME LIMIT						
49								(LSB)
50	TIME TO OFFLINE ~~Reserved~~							
51	MAXIMUM OFFLINE TIME ~~RESERVED~~							
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. The content of the TIME TO OFFLINE field is set by the CONFIGURE GENERAL function (see 10.4.3.15).

The MAXIMUM OFFLINE TIME field contains the maximum time the expander device 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 the MAXIMUM OFFLINE TIME 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 4 - The DISCOVER LIST function (see 10.4.3.13) returns information about one or more phys.

Table 7 defines the request format.

Table 7 — 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) CRC							
15								(LSB)

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The NEGOTIATED LOGICAL LINK RATE field and NEGOTIATED PHYSICAL LINK RATE field are defined in table 8 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 8 — 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 8 — 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 9 defines the request format.

Table 9 — 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 (0~~3~~4h)							
4	(MSB)	EXPECTED EXPANDER CHANGE COUNT						
5								(LSB)
6		Reserved						
7								
8	Reserved				UPDATE TIME TO OFFLINE	UPDATE STP SMP I_T NEXUS LOSS TIME	UPDATE STP MAXIMUM CONNECT TIME LIMIT	UPDATE STP BUS INACTIVITY TIME LIMIT
9	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	TIME TO OFFLINE							
17		Reserved						
19								
~~16~~20	(MSB)	CRC						
~~19~~21								(LSB)

...

An UPDATE TIME TO OFFLINE bit set to one specifies that the TIME TO OFFLINE field shall be honored. An UPDATE TIME TO OFFLINE bit set to zero specifies that the TIME TO OFFLINE field shall be ignored.

...

The TIME TO OFFLINE field contains the minimum period that an expander device shall wait:

a) from the transmission of a NOTIFY (GOING OFFLINE) to disabling phy to phy communication (see 7.2.5.11.4); or
b) from the receipt of a NOTIFY (GOING OFFLINE) to transmitting a BROADCAST (CHANGE) (see 7.2.5.11.4) and setting the NEGOTIATED LOGICAL LINK RATE field and NEGOTIATED PHYSICAL LINK RATE field to CODE_UPDATE_IN_PROGRESS (6h).

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 TO OFFLINE field in the SMP REPORT GENERAL response (see 10.4.3.3). The expander device should set the default value for the TIME TO OFFLINE field to 2 s (i.e., 14h).

10.4.3 SMP functions

10.4.3.1 SMP function request frame format

An SMP request frame is sent by a management application client via an SMP initiator port to request an SMP function be performed by a management device server. Table 10 defines the SMP request frame format.

Table 10 — SMP request frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	ADDITIONAL REQUEST BYTES							
m								
	Fill bytes, if needed							
n - 3	(MSB)							
n	CRC							(LSB)

The SMP FRAME TYPE field is included in each frame format defined in this clause, although that field is parsed by the SMP transport layer (see 9.4). The SMP FRAME TYPE field is set to 40h.

The FUNCTION field specifies which SMP function is being requested and is defined in table 11. If the value in the FUNCTION field is not supported by the management device server, it shall return a function result of UNKNOWN SMP FUNCTION as described in table 13.

Table 11 — SMP functions (FUNCTION field) (part 1 of 2)

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 SELF-CONFIGURATION STATUS	Return status of the discover process in a self-configuring expander device	10.4.3.5
04h	REPORT ZONE PERMISSION	Return zone permission table active or shadow values	10.4.3.6
05h	REPORT BROADCAST	Return information on broadcasts	10.4.3.3
056h - 0Fh	Reserved for general SMP input functions		
10h	DISCOVER	Return information about the specified phy	10.4.3.7
11h	REPORT PHY ERROR LOG	Return error logging information about the specified phy	10.4.3.8
12h	REPORT PHY SATA	Return information about a phy currently attached to a SATA phy	10.4.3.9
13h	REPORT ROUTE INFORMATION	Return phy-based expander route table information	10.4.3.10
14h	REPORT PHY EVENT INFORMATION	Return phy event information for the specified phy	10.4.3.11
15h	REPORT PHY BROADCAST COUNTS	Return Broadcast counts	10.4.3.12
16h	DISCOVER LIST	Return information about the specified phys	10.4.3.13
17h	REPORT EXPANDER ROUTE TABLE	Return contents of the expander-based expander route table	10.4.3.14
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	10.4.3.15
81h	ENABLE DISABLE ZONING	Enable or disable zoning	10.4.3.16
82h	WRITE GPIO REGISTER	See SFF-8485	
83h - 84h	Reserved for general SMP output functions		
85h	ZONED BROADCAST	Transmit the specified Broadcast on the expander ports in the specified zone group(s)	10.4.3.17
86h	ZONE LOCK	Lock a zoning expander device	10.4.3.18
87h	ZONE ACTIVATE	Set the zoning expander active values equal to the zoning expander shadow values	10.4.3.19

Table 11 — SMP functions (FUNCTION **field)** (part 2 of 2)

Code	SMP function	Description	Reference
88h	ZONE UNLOCK	Unlock a zoning expander device	10.4.3.20
89h	Reserved for a zoning function		
8Ah	CONFIGURE ZONE PHY INFORMATION	Configure zone phy information	10.4.3.21
8Bh	CONFIGURE ZONE PERMISSION TABLE	Configure the zone permission table	10.4.3.22
8Ch - 8Fh	Reserved for general SMP output functions		
90h	CONFIGURE ROUTE INFORMATION	Change phy-based expander route table information	10.4.3.23
91h	PHY CONTROL	Request actions by the specified phy	10.4.3.24
92h	PHY TEST FUNCTION	Request a test function by the specified phy	10.4.3.25
93h	CONFIGURE PHY EVENT INFORMATION	Configure phy event information for the specified phy	10.4.3.26
94h - 9Fh	Reserved for phy-based SMP output functions		
A0h - BFh	Reserved for SMP output functions		
C0h - FFh	Vendor specific		

The REQUEST LENGTH field specifies the number of dwords that follow, not including the CRC field. For compatibility with previous versions of this standard, a REQUEST LENGTH field set to 00h sometimes specifies a non-zero number of dwords; this is defined in the function description.

The ADDITIONAL REQUEST BYTES field definition and length are based on the SMP function. The maximum size of the ADDITIONAL REQUEST BYTES field is 1 024 bytes, making the maximum size of the frame 1 032 bytes (i.e., 1 024 bytes of data + 4 bytes of header + 4 bytes of CRC).

Fill bytes shall be included after the ADDITIONAL REQUEST BYTES field so the CRC field is aligned on a four byte boundary. The contents of the fill bytes are vendor specific.

The CRC field is included in each request frame format defined in this clause, although that field is defined by the SMP transport layer (see 9.4.1) and parsed by the SMP link layer (see 7.18).

10.4.3.2 SMP function response frame format

An SMP response frame is sent by a management device server via an SMP target port in response to an SMP request frame. Table 12 defines the SMP response frame format.

Table 12 — SMP response frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	ADDITIONAL RESPONSE BYTES							
m								
	Fill bytes, if needed							
n - 3	(MSB)							
n	CRC							(LSB)

...

Table 13 defines the priority of the SMP function results defined in table 13.

Table 13 — Function result priority (part 1 of 4)

SMP function	SMP function result priority
REPORT GENERAL (see 10.4.3.3)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
REPORT MANUFACTURER INFORMATION (see 10.4.3.4)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
READ GPIO REGISTER (see SFF-8485)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
REPORT SELF-CONFIGURATION STATUS (see 10.4.3.5)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
REPORT ZONE PERMISSION TABLE (see 10.4.3.6)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
REPORT BROADCAST (see 10.4.3.3.3)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED

Table 13 — Function result priority (part 2 of 4)

SMP function	SMP function result priority
DISCOVER (see 10.4.3.7)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
REPORT PHY ERROR LOG (see 10.4.3.8)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
REPORT PHY SATA (see 10.4.3.9)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) PHY DOES NOT SUPPORT SATA; 5) SMP FUNCTION FAILED; and 6) SMP FUNCTION ACCEPTED
REPORT ROUTE INFORMATION (see 10.4.3.10)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) INDEX DOES NOT EXIST; 5) SMP FUNCTION FAILED; and 6) SMP FUNCTION ACCEPTED
REPORT PHY EVENT INFORMATION (see 10.4.3.11)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
REPORT PHY BROADCAST COUNTS (see 10.4.3.12)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
DISCOVER LIST (see 10.4.3.13)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) UNKNOWN DESCRIPTOR TYPE; 4) UNKNOWN PHY FILTER; 5) SMP FUNCTION FAILED; and 6) SMP FUNCTION ACCEPTED
REPORT EXPANDER ROUTE TABLE (see 10.4.3.14)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED
CONFIGURE GENERAL (see 10.4.3.15)	1) INVALID REQUEST FRAME LENGTH; 2) SMP ZONE VIOLATION; 3) INVALID EXPANDER CHANGE COUNT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
WRITE GPIO REGISTER (see SFF-8485)	1) INVALID REQUEST FRAME LENGTH; 2) SMP FUNCTION FAILED; and 3) SMP FUNCTION ACCEPTED

Table 13 — Function result priority (part 3 of 4)

SMP function	SMP function result priority
ENABLE DISABLE ZONING (see 10.4.3.16)	1) INVALID REQUEST FRAME LENGTH; 2) ZONE LOCK VIOLATION; 3) UNKNOWN ENABLE DISABLE ZONING VALUE; 4) NO MANAGEMENT ACCESS RIGHTS; 5) INVALID EXPANDER CHANGE COUNT; 6) SMP FUNCTION FAILED; and 7) SMP FUNCTION ACCEPTED
ZONED BROADCAST (see 10.4.3.17)	1) INVALID REQUEST FRAME LENGTH; 2) SMP ZONE VIOLATION; 3) SMP FUNCTION FAILED; and 4) SMP FUNCTION ACCEPTED
ZONE LOCK (see 10.4.3.18)	1) INVALID REQUEST FRAME LENGTH; 2) ZONE LOCK VIOLATION; 3) NO MANAGEMENT ACCESS RIGHTS; 4) INVALID EXPANDER CHANGE COUNT; 5) SMP FUNCTION FAILED; and 6) SMP FUNCTION ACCEPTED
ZONE ACTIVATE (see 10.4.3.19)	1) INVALID REQUEST FRAME LENGTH; 2) ZONE LOCK VIOLATION; 3) INVALID EXPANDER CHANGE COUNT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
ZONE UNLOCK (see 10.4.3.20)	1) INVALID REQUEST FRAME LENGTH; 2) ZONE LOCK VIOLATION; 3) NOT ACTIVATED; 4) BUSY; 5) SMP FUNCTION FAILED; and 6) SMP FUNCTION ACCEPTED
CONFIGURE ZONE PHY INFORMATION (see 10.4.3.21)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) ZONE LOCK VIOLATION; 4) UNKNOWN ZONE PHY INFORMATION VALUE; 5) INVALID EXPANDER CHANGE COUNT; 6) SMP FUNCTION FAILED; and 7) SMP FUNCTION ACCEPTED
CONFIGURE ZONE PERMISSION (see 10.4.3.22)	1) INVALID REQUEST FRAME LENGTH; 2) ZONE LOCK VIOLATION; 3) INVALID EXPANDER CHANGE COUNT; 4) SMP FUNCTION FAILED; and 5) SMP FUNCTION ACCEPTED
CONFIGURE ROUTE INFORMATION (see 10.4.3.23)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) INDEX DOES NOT EXIST; 5) INVALID EXPANDER CHANGE COUNT; 6) SMP FUNCTION FAILED; and 7) SMP FUNCTION ACCEPTED

Table 13 — Function result priority (part 4 of 4)

SMP function	SMP function result priority
PHY CONTROL (see 10.4.3.24)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP ZONE VIOLATION; 5) LOGICAL LINK RATE NOT SUPPORTED; 6) UNKNOWN PHY OPERATION; 7) PHY DOES NOT SUPPORT SATA; 8) INVALID EXPANDER CHANGE COUNT; 9) SMP FUNCTION FAILED; and 10) SMP FUNCTION ACCEPTED
PHY TEST FUNCTION (see 10.4.3.25)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP ZONE VIOLATION; 5) UNKNOWN PHY TEST FUNCTION; 6) PHY TEST FUNCTION IN PROGRESS; 7) INVALID EXPANDER CHANGE COUNT; 8) SMP FUNCTION FAILED; and 9) SMP FUNCTION ACCEPTED
CONFIGURE PHY EVENT INFORMATION (see 10.4.3.26)	1) INVALID REQUEST FRAME LENGTH; 2) PHY DOES NOT EXIST; 3) PHY VACANT; 4) SMP ZONE VIOLATION; 5) UNKNOWN PHY EVENT INFORMATION SOURCE; 6) INVALID EXPANDER CHANGE COUNT; 7) SMP FUNCTION FAILED; and 8) SMP FUNCTION ACCEPTED

The RESPONSE LENGTH field indicates the number of dwords that follow, not including the CRC field. For compatibility with previous versions of this standard, a RESPONSE LENGTH field set to 00h sometimes indicates a non-zero number of dwords; this is defined in the function description.

The ADDITIONAL RESPONSE BYTES field definition depends on the SMP function requested. The maximum size of the ADDITIONAL RESPONSE BYTES field is 1 024 bytes, making the maximum size of the frame 1 032 bytes (i.e., 1 024 bytes of data + 4 bytes of header + 4 bytes of CRC).

Fill bytes shall be included after the ADDITIONAL RESPONSE BYTES field so the CRC field is aligned on a four byte boundary. The contents of the fill bytes are vendor specific.

The CRC field is included in each response frame format defined in this clause, although that field is defined by the SMP transport layer (see 9.4.1) and parsed by the SMP link layer (see 7.18).

10.4.3.3 REPORT BROADCAST function

Editor's Note 1: All new in this section

10.4.3.3.1 REPORT BROADCAST function overview

The REPORT BROADCAST function returns information about broadcasts that were issued from this expander device. An expander device is not required to maintain broadcast information in non-volatile storage or across events that cause the expander device to be reset. This SMP function may implemented by any management device server.

10.4.3.3.2 REPORT BROADCAST request

Table 14 defines the request format.

Table 14 — REPORT BROADCAST request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (05h)							
2	Reserved							
3	REQUEST LENGTH (00h)							
12	(MSB)	CRC						
15								(LSB)

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

The FUNCTION field shall be set to 05h.

The REQUEST LENGTH field shall be set to 00h.

The CRC field is defined in 10.4.3.1.

10.4.3.3.3 REPORT BROADCAST response

Table 239 defines the response format.

Table 15 — REPORT BROADCAST response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (05h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH							
4	(MSB)	Reserved						
6								(LSB)
7	NUMBER OF BROADCAST DESCRIPTORS							
Broadcast descriptor list								
8	Broadcast descriptor (first)(see table 16)							
19								
...	...							
n - 15	Broadcast descriptor (last)(see table 16)							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 05h.

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 NUMBER OF BROADCAST DESCRIPTORS field indicates how many broadcast descriptors follow.

The broadcast descriptor list contains broadcast descriptors as defined in 10.4.3.3.4.

The CRC field is defined in 10.4.3.2.

10.4.3.3.4 REPORT BROADCAST response phy event descriptor

Table 16 defines the broadcast descriptor.

Table 16 — Broadcast descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	BRDC_SCR	Reserved			BROADCAST TYPE			
1	BROADCAST REASON CODE							
2	RESERVED							
3	PHY IDENTIFIER							
4	(MSB)	ATTACHED SAS ADDRESS						
11								(LSB)

The BROADCAST TYPE field, defined in table 264 in 10.4.3.17, indicates the last broadcast of this type that was received by the expander device.

A broadcast source (BRDC_SCR) bit set to zero indicates that the broadcast originated from this expander device. A BRDC_SCR bit set to one indicates that the broadcast originated from another SAS device.

The BROADCAST REASON CODE field indicates the reason the broadcast indicated in the BROADCAST TYPE field was transmitted as defined in table 17.

Table 17 — BROADCAST REASON CODE **field**

Broadcast type	Code	Description
Broadcast (Change)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Reserved Change 0)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Reserved Change 1)	00h	Unknown
	01h - FFh	Reserved
Broadcast (SES)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Expander)	00h	Unknown
	01h	A phy event information peak value detector has reached its threshold value.
	02h	A phy event information peak value detector has been cleared by an SMP CONFIGURE PHY EVENT INFORMATION function (see 10.4.3.26).
	03h	A NOTIFY (GOING OFFLINE) was received (see 7.2.5.11.4)
	04h	A BROADCAST (EXPANDER) was received
	05h - FFh	Reserved
Broadcast (Asynchronous Even)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Reserved 3)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Reserved 4)	00h	Unknown
	01h - FFh	Reserved
Broadcast (Zone Activate)	00h	Unknown
	01h - FFh	Reserved

If the BRDC_SCR bit is set to one, then the PHY IDENTIFIER field indicates the phy through which the broadcast was received. If the BRDC_SCR bit is set to zero, then the PHY IDENTIFIER field shall be ignored.

If the BRDC_SCR bit is set to one, then the SAS ADDRESS field contains the value of the SAS ADDRESS field received in the IDENTIFY address frame during the identification sequence associated with the phy through which the broadcast was received. If the BRDC_SCR bit is set to zero, then the SAS ADDRESS field contains the SAS address of this expander device.

3 SPC-4 changes

Add the following section to the WRITE BUFFERS command. This change assumes that 05-284 is accepted.

6.36.1 WRITE BUFFER commands command processing times descriptor

Editor's Note 2: All new in this section

The command processing times descriptor (see table 18) reported by the REPORT SUPPORTED OPERATION CODES command (x.x) for a WRITE BUFFER command indicates timeout information specific to the WRITE BUFFER command.

Table 18 — Command Processing Times descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	(MSB)			DESCRIPTOR LENGTH (0Ah)				
1								(LSB)
2	RESERVED							
3	MAXIMUM OFFLINE TIME							
4	(MSB)			NOMINAL COMMAND PROCESSING TIME				
7								(LSB)
8	(MSB)			RECOMMENDED COMMAND TIMEOUT				
11								(LSB)

The MAXIMUM OFFLINE TIME field contains the maximum time the SCSI device is going to disable all communication through any SCSI ports associated with the logical unit that receives the WRITE BUFFER command. This timer value shall be in 1 s increments. A value of zero in the MAXIMUM OFFLINE TIME field indicates that the there is no maximum time specified. The MAXIMUM OFFLINE TIME field shall only apply when the following modes are specified:

a) Download microcode mode (04h);
b) Download microcode and save mode (05h);
c) Download microcode with offsets mode (06h);
d) Download microcode with offsets and save mode (07h);
e) Download microcode with offsets and defer activation mode (0Eh) only if the microcode is activated by an event other than an activate deferred microcode mode; and
f) Activate deferred microcode mode (0Fh).

The NOMINAL COMMAND PROCESSING TIME field and RECOMMENDED COMMAND TIMEOUT field are defined in x.x.