

Date: May 08, 2007

To: T10 Committee (SCSI)

From: George Penokie (IBM)

Subject: SAS-2: REPORT BROADCAST function

## 1 Overview

Attempting to locate the origin of a broadcast (other than BROADCAST(CHANGE)) is impossible in SAS today. There is also a very limited number of broadcast primitives. This proposal addresses both those issues by defining a new SMP function that could be used by a management application client to determine the source of the broadcast and to allow multiple reasons to be assigned to a single broadcast type.

## 2 SAS-2 changes

### 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 1 defines the SMP request frame format.

**Table 1 — 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)	CRC							
n								(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 2. 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 2 — 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
<a href="#">05h</a>	<a href="#">REPORT BROADCAST</a>	<a href="#">Return information on broadcasts</a>	10.4.3.3
<del>05</del> 6h - 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 2 — 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 3 defines the SMP response frame format.

**Table 3 — 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)	CRC							
n								(LSB)	

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Table 4 defines the priority of the SMP function results defined in table 13.

**Table 4 — 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
<a href="#">REPORT BROADCAST</a> (see 10.4.3.3.3)	<a href="#">1) INVALID REQUEST FRAME LENGTH;</a> <a href="#">2) SMP FUNCTION FAILED; and</a> <a href="#">3) SMP FUNCTION ACCEPTED</a>

Table 4 — 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 4 — 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 4 — 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

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[Editor's Note 1: All new in this section](#)

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#### 10.4.3.3.1 REPORT BROADCAST function overview

The REPORT BROADCAST function returns information about broadcasts that were issued from this expander device. This SMP function may implemented by any management device server. 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.

**10.4.3.3.2 REPORT BROADCAST request**

Table 5 defines the request format.

**Table 5 — 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)								
4	(MSB)	CRC							
5								(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 6 — 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)	EXPANDER CHANGE COUNT						(LSB)
5								
6	Reserved							
7	NUMBER OF BROADCAST DESCRIPTORS							
Broadcast descriptor list								
8	Broadcast descriptor (first) (see table 7)							
15								
...	...							
n - 11	Broadcast descriptor (last) (see table 7)							
n - 4								
n - 3	(MSB)	CRC						(LSB)
n								

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 EXPANDER CHANGE COUNT field is defined in the SMP REPORT GENERAL response (see x.x.x.x). If the SMP initiator port detects a change in the value of this field while retrieving multiple response frames, it should start again because the status information returned is incomplete and inconsistent. An expander device is not required to maintain expander change count information in non-volatile storage or across events that cause the expander device to be reset.

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

NOTE 1 - The number of broadcast descriptors is limited to 126.

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 broadcast descriptor

The expander device shall, for each combination of broadcast type and broadcast reason code that the expander device has originated:

- a) maintain a single count; and
- b) report a single broadcast descriptor.

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.

A broadcast descriptor shall only be returned for expander device if the broadcast originated on a phy contained within the expander device.

The broadcast descriptors shall be returned in the order indicated in table 8 (i.e., the numerical ascending order of byte 0 in table 7).

Table 7 defines the broadcast descriptor.

**Table 7 — Broadcast descriptor**

Byte/Bit	7	6	5	4	3	2	1	0
0	BROADCAST TYPE				BROADCAST REASON CODE			
1	PHY IDENTIFIER							
2	(MSB)	COUNT						(LSB)
3								
4	Reserved							
7								

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

The BROADCAST REASON CODE field (see table 8) indicates the reason the broadcast indicated in the BROADCAST TYPE field was originated.

**Table 8 — BROADCAST REASON CODE field**

Broadcast type	Code	Description
Broadcast (Change)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Reserved Change 0)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Reserved Change 1)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (SES)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Expander)	0h	Unspecified
	1h	A phy event information peak value detector has reached its threshold value.
	2h	A phy event information peak value detector has been cleared by an SMP CONFIGURE PHY EVENT INFORMATION function (see 10.4.3.26).
	3h	The expander device is going to temporarily have reduced function (e.g., disable SMP access, reduced performance, disable phy to phy communication) for a period of time (see 4.6.8)
	4h - Fh	Reserved
Broadcast (Asynchronous Even)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Reserved 3)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Reserved 4)	0h	Unspecified
	1h - Fh	Reserved
Broadcast (Zone Activate)	0h	Unspecified
	1h - Fh	Reserved
All others		Reserved

The COUNT field counts the number of broadcasts of the type specified in the BROADCAST TYPE field originated by an expander device. The COUNT field zero to indicates that the expander device does not support issuing a broadcast for the indicated reason code. If the expander device supports issuing the broadcast reason code, then this field shall be set to at least 0001h at power on. If the expander device has originated the broadcast for any reason since transmitting a REPORT BROADCAST response, it shall increment this field at least once from the value in the previous REPORT BROADCAST response. It shall not increment this field when forwarding a broadcast. This field shall wrap to at least 0001h after the maximum value (i.e., FFFFh) has been reached.

NOTE 2 - The management application clients that use the COUNT field should read and save all the COUNT field values once following discovery, and then read them after each receipt of each broadcast to ensure that the count does not increment a multiple of 65 536 times between reading the field.

The PHY IDENTIFIER field indicates the phy that caused the last broadcast to be originated of the broadcast type indicated by this broadcast descriptor. A PHY IDENTIFIER field set to FFh indicates that no specific phy caused the last broadcast to be originated of the broadcast type indicated by this broadcast descriptor.