To:　　　T10 Technical Committee
From:　　Rob Elliott, HP (elliott@hp.com)
Date:　　12 March 2005
Subject: 05-064r1 SES-2 Additional Element Status diagnostic page Valid bit

Revision history
Revision 0 (9 February 2005) First revision
Revision 1 (12 March 2005) Incorporated comments from March CAP WG - use INVALID rather than VALID bit, and add an ELEMENT INDEX field (which rearranges the data structures) to support additional element definitions

Related documents
ses2r10 - SCSI Enclosure Services - 2 revision 10

Overview
The Additional Element Status diagnostic page provides additional information about Device, Array Device, and SAS Expander elements.

2. If the element is not installed, unknown, or not available (per the ELEMENT STATUS CODE field reported in the element status in the Enclosure Status diagnostic page), the additional information might not be available.

Since the element status and additional information are reported in different diagnostic pages, there is always a time gap between reading them (separate RECEIVE DIAGNOSTIC RESULTS commands). This precludes depending on the element status to indicate additional status validity - software could read the status as OK, but then obtain out-of-date additional information.

An INVALID bit is proposed to mark the additional information as valid or invalid when needed. The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field is always valid.

2. As Additional Status descriptors are defined for additional element types, it will become impossible to tell which element each of the additional status descriptors are describing. So, an ELEMENT INDEX field is added to the header, increasing it from 2 to 4 bytes in length. Two additional reserved fields are added within each protocol-specific data section to keep remaining fields aligned on natural 4-byte boundaries.

Suggested changes

6.1.13 Additional Element Status diagnostic page

6.1.13.1 Additional Element Status diagnostic page overview

The optional Additional Element Status diagnostic page provides additional information about Device elements (see 7.3.2), Array Device elements (see 7.3.3), and SAS Expander elements (see 7.3.25).

The Additional Element Status diagnostic page returns a device information descriptor for each of the Device elements, Array Device elements, and SAS Expander elements that have been allowed for by the NUMBER OF POSSIBLE ELEMENTS field in the corresponding type descriptor header in the Configuration diagnostic page (see 6.1.2). The device information descriptors shall be in the same order as the ELEMENT STATUS fields in the Enclosure Status diagnostic page (see 6.1.4).

The Additional Element Status diagnostic page is read by the RECEIVE DIAGNOSTIC RESULTS command with a PCV bit set to one and a PAGE CODE field set to 0Ah. If the parameter list for a SEND DIAGNOSTIC command contains a PAGE CODE field set to 0Ah, the command shall be treated as having an invalid field error (see 4.5).

Table 1 defines the Additional Element Status diagnostic page.

Table 1 — Additional Element Status diagnostic page

Byte\Bit	7	6	5	4	3	2	1	0
0	PAGE CODE (0Ah)								
1	Reserved								
2	(MSB)							
3	\multicolumn{8}{c}{PAGE LENGTH (n - 3)}							(LSB)
4	(MSB)							
7	GENERATION CODE							(LSB)
	Additional Element Status descriptor list								
8								
n	Zero or more Additional Element Status descriptors (see table 2)							

The PAGE LENGTH field indicates the length in bytes of the diagnostic parameters that follow.

The format of the Additional Element Status descriptor is shown in table 2.

Table 2 — Additional Element Status descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	\multicolumn{3}{c}{Reserved}			\multicolumn{3}{c}{PROTOCOL IDENTIFIER}		
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (n - 1)								
2	Reserved								
3	ELEMENT INDEX								
~~2~~4								
n	Protocol-specific information							

An INVALID bit set to one indicates that the contents of the protocol-specific information are invalid. An INVALID bit set to zero indicates that the contents of the protocol-specific information are valid. The enclosure services process may set the INVALID bit to one when the ELEMENT STATUS CODE field in the element status for the associated element (see table 83 in 7.2.3) is set to 5h (i.e., not installed), 6h (i.e., unknown), or 7h (not available).

The PROTOCOL IDENTIFIER field is defined in SPC-3 and identifies the protocol of the device being described by the Additional Element Status descriptor.

The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field indicates the length in bytes of the protocol-specific information.

The ELEMENT INDEX field indicates the index of the element that this descriptor is describing.

6.1.13.2 Additional Element Status descriptor for Fibre Channel

Table 3 defines the Additional Element Status descriptor for Fibre Channel devices.

Table 3 — Additional Element Status descriptor for Fibre Channel

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved			PROTOCOL IDENTIFIER (0h)			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (n - 1)							
2	Reserved							
3	ELEMENT INDEX							
~~2~~4	NUMBER OF PORTS							
~~3~~	~~Reserved~~							
5	Reserved							
7								
~~4~~8	(MSB)	NODE NAME						
~~11~~15								(LSB)
One port descriptor for each port								
~~12~~16	PORT LOOP POSITION							
~~13~~17	Reserved							
~~15~~19								
~~16~~20	PORT REQUESTED HARD ADDRESS							
~~17~~21	(MSB)	N_PORT IDENTIFIER						
~~19~~23								(LSB)
~~20~~24	(MSB)	N_PORT_NAME						
~~27~~31								(LSB)
~~28~~32 to n	...							

Editor's Note 1: move the port descriptor into its own table

The INVALID bit, ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field, and ELEMENT INDEX field are defined in 6.1.13.1.

The PROTOCOL IDENTIFIER field of 0h indicates the descriptor is describing a Device element or an Array Device element that can contain a Fibre Channel device.

~~The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field indicates the length of the Additional Element Status descriptor.~~

The NUMBER OF PORTS field indicates how many Fibre Channel ports are being described. There is one port descriptor for each port.

The NODE_NAME field contains the node Name_Identifier of the corresponding Fibre Channel node.

The PORT LOOP POSITION field indicates the position of the corresponding Fibre Channel port on a Fibre Channel Arbitrated Loop.

The PORT REQUESTED HARD ADDRESS field contains the Fibre Channel Arbitrated Loop requested hard address of the corresponding Fibre Channel port.

The N_PORT IDENTIFIER field contains the address identifier of the corresponding Fibre Channel port. Applications may compare the lower 8 bits of this field with the PORT REQUESTED HARD ADDRESS field to determine whether the port was assigned its requested address.

The N_PORT_NAME field contains the Name_Identifier of the corresponding Fibre Channel port.

6.1.13.3 Additional Element Status descriptor for Serial Attached SCSI

6.1.13.3.1 Additional Element Status descriptor for Serial Attached SCSI overview

Table 4 defines the Additional Element Status descriptor for SAS devices and expander devices.

Table 4 — Additional Element Status descriptor for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved			PROTOCOL IDENTIFIER (6h)			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (n - 1)							
2	Reserved							
3	ELEMENT INDEX							
~~2~~4	Descriptor-type specific							
~~3~~5	DESCRIPTOR TYPE		Descriptor-type specific					
~~25~~6	Descriptor-type specific							
n								

The INVALID bit, ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field, and ELEMENT INDEX field are defined in 6.1.13.1.

The PROTOCOL IDENTIFIER field set to 6h indicates the descriptor is describing a Device element or an Array Device Element that can contain a SAS device or a SATA device, or is describing a SAS Expander element.

A DESCRIPTOR TYPE field set to 00b indicates the descriptor describes a Device element or an Array Device element (see 6.1.13.3.2). A DESCRIPTOR TYPE field set to 01b indicates the descriptor describes a SAS Expander element (see 6.1.13.3.3). A DESCRIPTOR TYPE field set to 10b or 11b is reserved.

6.1.13.3.2 Additional Element Status descriptor for Device and Array Device elements for SAS

Table 5 defines the Additional Element Status descriptor for Device elements and Array Device elements that can contain SAS devices or SATA devices.

Table 5 — Additional Element Status descriptor for Device and Array Device elements for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved			PROTOCOL IDENTIFIER (6h)			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (n - 1)							
2	Reserved							
3	ELEMENT INDEX							
~~2~~4	NUMBER OFPHY DESCRIPTORS							
~~3~~5	DESCRIPTOR TYPE (00b)	Reserved						NOT ALL PHYS
6	Reserved							
7								
	Phy descriptor list							
~~4~~8	Phy descriptor (see table 6)(first)							
~~31~~35								
	...							
n - 27	Phy descriptor (see table 6)(last)							
n								

The INVALID bit, ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field, and ELEMENT INDEX field are defined in 6.1.13.1.

The PROTOCOL IDENTIFIER field set to 6h and DESCRIPTOR TYPE field set to 00b indicate the descriptor is describing a Device element or Array Device element that can contain a SAS device or a SATA device.

~~The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field indicates the length in bytes of the rest of the Additional Element Status descriptor.~~

The NUMBER OF PHY DESCRIPTORS field indicates how many phy descriptors are in the phy descriptor list.

A NOT ALL PHYS bit set to one indicates that all phys in the SAS device or SATA device may or may not be described. A NOT ALL PHYS bit set to zero indicates that all phys in the SAS device or SATA device are described.

> NOTE 1 - The NOT ALL PHYS bit may be set to one for SAS devices with multiple ports, where the enclosure services process only has access to information about the phys in one of the ports (e.g., in the same SAS domain as the enclosure services process).

Table 6 defines the phy descriptor.

Table 6 — Phy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	DEVICE TYPE			Reserved			
1	Reserved							
2	Reserved				SSP INITIATOR PORT	STP INITIATOR PORT	SMP INITIATOR PORT	Reserved
3	SATA PORT SELECTOR	Reserved			SSP TARGET PORT	STP TARGET PORT	SMP TARGET PORT	SATA DEVICE
4	ATTACHED SAS ADDRESS							
11								
12	SAS ADDRESS							
19								
20	PHY IDENTIFIER							
21	Reserved							
27								

If the device currently associated with the Device element or Array Device element is a SAS device:

a) the DEVICE TYPE field, SSP INITIATOR PORT bit, STP INITIATOR PORT bit, SMP INITIATOR PORT bit, SSP TARGET PORT bit, STP TARGET PORT bit, SMP TARGET PORT bit, SAS ADDRESS field, and PHY IDENTIFIER field contain the values of the fields in the IDENTIFY address frame transmitted by the phy (see SAS);
b) the SATA PORT SELECTOR bit shall be set to zero; and
c) the SATA DEVICE bit shall be set to zero.

   NOTE 2 - The phy transmits these fields in the IDENTIFY address frame to the attached phy (usually an expander phy in an expander device). The enclosure services process may retrieve the values from the attached phy (e.g., an enclosure process built into an expander device has direct access to the values received by the expander phy).

If the device currently associated with the Device element or Array Device element is a SATA device:

a) the DEVICE TYPE field shall be set to 000b;
b) the SSP INITIATOR PORT bit shall be set to zero;
c) the STP INITIATOR PORT bit shall be set to zero;
d) the SMP INITIATOR PORT bit shall be set to zero;
e) the SSP TARGET PORT bit shall be set to zero;
f) the STP TARGET PORT bit shall be set to zero;
g) the SMP TARGET PORT bit shall be set to zero;
h) the SATA PORT SELECTOR bit shall be set to one if the SATA device is attached to a SATA port selector and the SATA PORT SELECTOR bit shall be set to zero if it is not;
i) the SATA DEVICE bit shall be set to one;
j) the SAS ADDRESS field shall be set to the SAS address of the STP target port of the STP/SATA bridge, and
k) the PHY IDENTIFIER field shall be set to 00h.

The ATTACHED SAS ADDRESS field contains the SAS address of the attached phy (e.g., the SAS address of the expander phy to which the SAS device or SATA device is attached)(see SAS).

NOTE 3 - All the fields are from the perspective of the SAS device or SATA device associated with the Device element or Array Device element (e.g., the disk drive), not the device (e.g., the expander device) which receives the IDENTIFY address frame. The ATTACHED SAS ADDRESS fields for multiple phys in the same SAS device or SATA device differ if it is attached to more than one SAS domain.

NOTE 4 - A SATA device may be attached to more than one SAS domain using a SATA port selector.

6.1.13.3.3 Additional Element Status descriptor for SAS Expander elements

Table 7 defines the Additional Element Status descriptor for SAS Expander elements.

Table 7 — Additional Element Status descriptor for SAS Expander elements

Byte\Bit	7	6	5	4	3	2	1	0
0	INVALID	Reserved			PROTOCOL IDENTIFIER (6h)			
1	ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH (n - 1)							
2	Reserved							
3	ELEMENT INDEX							
~~2~~4	NUMBER OF EXPANDER PHY DESCRIPTORS							
~~3~~5	DESCRIPTOR TYPE (01b)	Reserved						
6	Reserved							
7								
~~4~~8	SAS ADDRESS							
~~11~~15								
Expander phy descriptor list								
~~12~~16	Expander phy descriptor (see table 8) (first)							
17								
	...							
n - 1	Expander phy descriptor (see table 8) (last)							
n								

The INVALID bit, ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field, and ELEMENT INDEX field are defined in 6.1.13.1.

The PROTOCOL IDENTIFIER field set to 6h and DESCRIPTOR TYPE field set to 01b indicate the descriptor is describing a SAS Expander element.

~~The ADDITIONAL ELEMENT STATUS DESCRIPTOR LENGTH field indicates the length in bytes of the rest of the Additional Element Status descriptor.~~

The NUMBER OF EXPANDER PHY DESCRIPTORS field indicates how many expander phy descriptors are in the phy descriptor list.

The SAS ADDRESS field indicates the SAS address of the expander device (see SAS).

Table 8 defines the expander phy descriptor.

Table 8 — Expander phy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	CONNECTOR ELEMENT INDEX							
1	OTHER ELEMENT INDEX							

The CONNECTOR ELEMENT INDEX field indicates the index of a SAS Connector element (see 7.3.26) to which the expander phy is attached. If the expander phy is not attached to a connector represented by a SAS Connector element, this field shall be set to FFh.

The OTHER ELEMENT INDEX field indicates the index of a Device element (see 7.3.2), Array Device element (see 7.3.3), or SAS Expander element (see 7.3.25) to which the expander phy is attached. If the expander phy is not attached to one of those elements, this field shall be set to FFh.