memorandum

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T10/06-163r0

To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Report Element Information	24 March 2006

Revision History

Revision 0 – Initial document. split off from 06-046r1

Related Documents

smc3r01 – SCSI Media Changer Commands - 3 revision 01

spc3r23 – SCSI Primary Commands -3 revision 23

Background

Currently the Read Element Status command is used by applications to describe the contents of all elements within a media changer device. Some information about the element compatibility has been added to the Read Element Status command in SMC and other information is provided using various vendor unique methods. Some of the characteristic that are currently reported in vendor unique methods are medium type, and element location. Much of the information currently returned in Read Element Status is static information that does not change and does not need read more than once. There are several element characteristics that are not currently returned in Read Element Status. Further expansion of Read Element Status to include more static information would add complexity to an already complex command and increase the already large return data.

This document proposes a change to SMC-3 that creates a new media changer command, "Report Element Information". This command reports data pages containing further information about an element. The pages may describe static information which is fixed and will not change without a hardware reconfiguration, or dynamic information which may be changed by normal media changer activity. Using the page code mechanism to select information pages about an element allows an application client to select only the information it needs at this time and get back only that information rather than the monolithic data block used by Read Element Status. An optional feature of this command allows for reporting all static information about all elements in the library in a single command. By using this command an application client can determine the capabilities of a media changer device or can determine the capabilities of a single element in the media changer device. Several types of information are defined in this command.

In the proposed changes that follow, new text appears in blue, deleted text appears in ~~red strikeout~~, and editorial comments appear in green.

Proposed Changes to SMC-3

Changes to 6.1:

Table 3 has the following addition (the entire table is not reproduced here):

Command	Operation Code	Type	Reference
REPORT ELEMENT INFORMATION	A3h/07h [a]	O	6.x

Changes to 6.3:

Table 5 has the following addition (the entire table is not reproduced here):

REPORT ELEMENT INFORMATION	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed

New sub-clause 6.x:

(Note: existing subclauses 6.x through 6.13 shift to become 6.x+1 through 6.14 with the addition of this new subclause)

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T10/06-163r0

6.x REPORT ELEMENT INFOMATION command

6.11.1 REPORT ELEMENT INFORMATION command introduction

The REPORT ELEMENT INFORMATION command (see table y) requests information pages for an element or all elements in a device containing at least one medium changer logical unit.

Table y – REPORT ELEMENT INFORMATION command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (A3h)							
1	Reserved				SERVICE ACTION (07h)			
2	(MSB)			ELEMENT ADDRESS				
3								(LSB)
4	Reserved							ALL
5	PAGE CODE							
6	(MSB)			ALLOCATION LENGTH				
9								(LSB)
10	Reserved							
11	CONTROL							

See SPC-3 for the definition of the OPERATION CODE, SERVICE ACTION, ALLOCATION LENGTH, and CONTROL fields. The OPERATION CODE and SERVICE ACTION fields shall be set to the values show in table y.

An ALL bit set to one specifies that the device server shall return the Element Information page specified in the PAGE CODE field for all elements. An ALL bit set to zero specifies that the device server shall return the Element Information page specified in the PAGE CODE field for the element specified in the ELEMENT ADDRESS field. If the ALL bit is set to one the ELEMENT ADDRESS field shall be set to zero.

The ELEMENT ADDRESS field shall contain an element address if the ALL bit is set to zero and shall be set to zero if the ALL bit is set to one. If the ELEMENT ADDRESS field does not contain a valid element address and the ALL bit is set to zero, the device server shall terminate the command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID ELEMENT ADDRESS. If the ELEMENT ADDRESS field is not set to zero and the ALL bit is set to one, the device server shall terminate the command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

If the ELEMENT ADDRESS field specifies an element that has been disabled (see 6.10.4), the device server shall return CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to ELEMENT DISABLED.

Comment: an ASC/ASCQ of ELEMENT DISABLED is not yet defined in SPC.

The PAGE CODE field specifies the Element Information page requested (see table y+1) by the application client. If the device server detects a PAGE CODE field set to an unsupported value, it shall terminate the command with CHECK CONDITON status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

Table y+1: Element Information Page Codes

PAGE CODE	Definition
Page codes 00h-7Fh – Static data	
00h	Supported element information pages
01h	Return all supported pages
02h	Return all supported pages from 03h to 7Fh
03h	Compatible Medium List page
04h	Compatible Medium Descriptors page
05h	Element Location page
06h-6Fh	Reserved
70h-7Fh	Vendor specific static data

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Page codes 80h-FFh – Current Data	
80h	Return all supported pages from 81h to FFh
81h	Medium in element type page
82h-EFh	Reserved
F0h-FFh	Vendor specific current data

6.11.2 Supported Element Information Pages

Table y+2 shows the format of the Supported Element Information Pages page. The Supported Element Information Pages page lists the supported Element Information pages for an element type. If the ALL bit in the CDB is set to one, the device server shall return one Supported Element Information page for each element type supported by the device server. If the ALL bit in the CDB is set to zero, the device server shall return one page for the element type of the requested element address.

Table y+2: Supported Element Information Pages format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved				ELEMENT TYPE CODE			
1	PAGE CODE (0)							
2	(MSB)	PAGE LENGTH (N-3)						
3								(LSB)
4	Supported element information page list							
N								

See section 6.11.3 for the definition of the ELEMENT TYPE CODE field. The ELEMENT TYPE CODE field shall contain the element type value for the currently described element.

The PAGE LENGTH field contains the total length in bytes of the page to follow. If the page is truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The supported element information page list shall contain a list of all page codes implemented by the device server in ascending order beginning with page code 00h. The device server shall support page code 00h. The supported pages may be different for different element types.

6.11.3 Compatible Medium List page

Table y+3 shows the format of the Compatible Medium List page.

Table y+3: Compatible Medium List Page format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved				ELEMENT TYPE CODE			
1	PAGE CODE (3h)							
2	(MSB)	PAGE LENGTH (N-3)						
3								(LSB)
4	COMPATIBLE MEDIUM COUNT							
5	Reserved							
6	Compatible medium list							
N								

See section 6.11.3 for the definition of the ELEMENT TYPE CODE field. The ELEMENT TYPE CODE field shall contain the element type value for the currently described element.

The PAGE LENGTH field contains the total length in bytes of the page to follow. If the page is truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The COMPATIBLE MEDIUM COUNT field contains the number of medium types that are compatible with this element. If the page is truncated because of the allocation length, the COMPATIBLE MEDIUM COUNT field shall not be affected.

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The compatible medium list shall contain a list of medium types that are compatible with this element. Each medium type shall be described by two bytes containing a PRIMARY MEDIUM TYPE CODE followed by a SECONDARY MEDIUM TYPE CODE.

See section 5.3.2 for the definition of the PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE.

If the ALL bit in the CDB is set to zero and the element described is compatible with all primary medium types supported by the device server, the device server may report "Universal primary medium type". If the all bit is set to zero and the element described is compatible with all secondary medium types for the reported primary medium type, the device server may report "Universal secondary medium type". (e.g. if an element is capable of holding any medium compatible with the installed drives, the reported primary/secondary codes could be 00h,00h. If the element was capable of holding only ½ inch tapes but could hold all compatible ½ inch tapes and a ¼ inch drive was also installed in the media changer then the primary code could be the value for ½ inch tape and the secondary could be 00h)

If the ALL bit in the CDB is set to zero and the device server is not able to detect which medium types are supported by the addressed element, the unknown medium type codes may be returned.

If the ALL bit in the CDB is set to one, the device server shall return a single page listing all medium types which may be used in the media changer and the ELEMENT TYPE CODE field shall be set to 00h.

The device server may support a Compatible Medium List page for an element containing a data transfer device.

6.11.4 Compatible Medium Descriptors page

The Compatible Medium Descriptors page contains a Compatible Medium Header followed by one or more Compatible Medium Descriptors. Table y+4 shows the format of the Compatible Medium Descriptors page.

The Compatible Medium Descriptors page is only valid for data transfer devices and shall be supported if the device server implements the REPORT ELEMENT INFORMATION command.

Table y+4: Compatible Medium Descriptors Page format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved				ELEMENT TYPE CODE (4h)			
1	PAGE CODE (4h)							
2	(MSB)			PAGE LENGTH (N-3)				
3								(LSB)
4	COMPATIBLE MEDIUM DESCRIPTORS COUNt							
5	Reserved							
6	(MSB)			First COMPATIBLE MEDIUM DESCRIPTOR				
13								(LSB)
	:							
N-7	(MSB)			Last COMPATIBLE MEDIUM DESCRIPTOR				
N								(LSB)

See section 6.11.3 for the definition of the ELEMENT TYPE CODE field. The ELEMENT TYPE CODE field shall be set to 4h.

The PAGE LENGTH field contains the total length in bytes of the page to follow. If the page is truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The COMPATIBLE MEDIUM DESCRIPTOR COUNT field specifies the number of compatible medium descriptors that are available to be returned. If the page is truncated because of the allocation length, the COMPATIBLE MEDIUM DESCRIPTOR COUNT field shall not be affected. If the allocation length is not sufficient to transfer all of the compatible medium descriptors, the device server shall transfer all of the descriptors whose complete contents fit within the allocation length and this shall not be considered an error.

Compatible Medium Descriptors shall be returned for each PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE that is compatible with the addressed data transfer device and is supported by the device server. Table y+5 shows the format of the compatible medium descriptor.

If the ALL bit in the CDB is set to one, a single page shall be returned containing all descriptors for all medium types that are compatible with at least one installed data transfer device.

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T10/06-163r0

Table y+5: Compatible Medium Descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	PRIMARY MEDIUM TYPE CODE							
1	SECONDARY MEDIUM TYPE CODE							
2	WRTOK	MAM	NATIVE	MSMTOK	MSDCOK	Reserved		
3	Reserved					MEDIUM TYPE		
4	MODE SENSE MEDIUM TYPE							
5	MODE SENSE DENSITY CODE							
6	Reserved							
7	Reserved							

A WRTOK bit set to zero specifies that the described data transfer device does not support writing to this medium type. A WRTOK bit set to one specifies that the described data transfer device supports writing to this medium type. The described data transfer device shall support reading from the media at this density. If the ALL bit in the CDB is set to one, the WRTOK bit shall be set to one if at least one data transfer device installed in the media changer supports writing to this medium type.

A MAM bit set to zero specifies that the medium type does not support Medium Auxiliary Memory (MAM, see SPC-3) when used with this data transfer device type. A MAM bit set to one specifies that the medium type, when used with the described data transfer device type, supports MAM. If the ALL bit in the CDB is set to one, the MAM bit shall be set to one if at least one data transfer device installed in the media changer supports MAM when used with this medium type.

A NATIVE bit set to zero specifies that this medium type is not the default medium type of the described data transfer device. A NATIVE bit set to one specifies that this medium type is the default medium type of the described data transfer device. More than one medium type may be reported with the NATIVE bit set to one. If the ALL bit in the CDB is set to one, the NATIVE bit shall be set to one if this medium type is the default medium type for at least one data transfer device installed in the media changer.

The MSMTOK bit shall be set to one if the MODE SENSE MEDIUM TYPE field contains a value that corresponds to the value returned by the data transfer device in the mode sense MEDIUM TYPE field (see SPC-4).

The MSDCOK bit shall be set to one if the MODE SENSE DENSITY CODE field contains a value that corresponds to the value returned by the data transfer device in the mode sense DENSITY CODE field (see SPC-4).

Comment: Both the mode sense medium type and mode sense density code values are vendor unique and are they are used differently by different data transfer devices. Some data transfer devices use the density code field to designate a data transfer device type while other data transfer devices support multiple density codes in the same data transfer device type. Having valid bits on both of these fields lets the media changer use the values that are appropriate for the referenced data transfer device and not set values if they are not used by that data transfer device type.

The MEDIUM TYPE field specifies the type of medium for this combination of PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values. Table 17 describes the values for the MEDIUM TYPE field.

If the MSMTOK bit is set to one, the MODE SENSE MEDIUM TYPE field shall be the MEDIUM TYPE value reported by the data transfer device in the mode sense header when this medium type is loaded (see SPC-3). If the MSMTOK bit is set to zero, the MODE SENSE MEDIUM TYPE field shall be set to zero.

If the MSDCOK bit is set to one, the MODE SENSE DENSITY CODE field shall be the DENSITY CODE value reported by the data transfer device in the mode sense block descriptor when this medium type is loaded (see SPC-3). If the MSDCOK bit is set to zero, the MODE SENSE DENSITY CODE field shall be set to zero.

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6.11.5 Element Location page

Table y+6 shows the format of the Element Location page. If the ALL bit in the CDB is set to one, the device server shall return an Element Location page for each element location in the device.

Table y+6: Element Location Page format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved				ELEMENT TYPE CODE			
1	PAGE CODE (5h)							
2	(MSB)							
3	PAGE LENGTH (N-3)							(LSB)
4	(MSB)							
5	ELEMENT ADDRESS							(LSB)
6	ELEMENT LOCATION DESCRIPTOR COUNT				CODE SET			
7	Reserved							
	Element location descriptors							

COMMENT: Management and ISV software need a method to indicate the physical location of a logical element reported over SCSI. This proposal allows multiple fields to support coordinate-style location information or a single field if the device does not use coordinate-style location information. Applications may report the location information in a human readable format without any interpretation or may provide device specific interpretation for supported devices.

See section 6.11.3 for the definition of the ELEMENT TYPE CODE field. The ELEMENT TYPE CODE field shall contain the element type value for the currently described element.

The PAGE LENGTH field contains the total length in bytes of the page to follow. If the page is truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The ELEMENT ADDRESS field specifies the address of the element being described. If the ALL bit in the CDB is set to zero, this address shall be the address selected in the ELEMENT ADDRESS field in the CDB.

The ELEMENT LOCATION DESCRIPTOR COUNT field specifies the number of element location descriptors that are available to be returned. If the page is truncated because of the allocation length, the ELEMENT LOCATION DESCRIPTOR COUNT field shall not be affected. If the allocation length is not sufficient to transfer all of the element location descriptors, the device server shall transfer all of the descriptors whose complete contents fit within the allocation length and this shall not be considered an error.

The CODE SET field indicates the code set used for the LOCATION field in the element location descriptor. The CODE SET is described in table y+7. This field is intended to be an aid to software that displays the IDENTIFIER field.

Table y+7 – CODE SET field

Code	Description
0h	Reserved
1h	The LOCATION field shall contain binary values.
2h	The LOCATION field shall contain ASCII printable characters (i.e., code values 20h through 7Eh).
3h	The LOCATION field shall contain ISO/IEC 10646-1 (UTF-8) codes.
4h – Fh	Reserved

COMMENT: The definition of the CODE SET field follows that of the CODE SET field used in identifiers in SPC-3 (see spc3r23, 7.6.3.1 *Device identification VPD page overview*).

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Table y+8 shows the element location descriptor format.

Table y+8: Element location descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
1 byte	(MSB)							
1 byte	ELEMENT LOCATION LENGTH (w+2)							(LSB)
1 byte	Reserved							
1 byte	LOCATION TYPE CODE							
w bytes	LOCATION							

The ELEMENT LOCATION LENGTH field indicates the length in bytes of the element location descriptor data to follow.

Comment: The ELEMENT LOCATION IDENTIFIER LENGTH field is required to allow for different length coordinate fields.

The LOCATION TYPE CODE field indicates which type of location value the device server returns in the LOCATION field. Table y+9 defines the location type codes.

Table y+9 – LOCATION TYPE CODE values

LOCATION TYPE CODE	Description
00h	Coordinate A
01h	Coordinate B
02h	Coordinate C
03h	Coordinate D
04h	Coordinate E
05h	Coordinate F
06h	Coordinate G
07h-0Fh	Reserved
10h	Absolute address
10h-EFh	Reserved
F0h-FFh	Vendor specific

The Coordinate A through Coordinate G values may be assigned by the vendor to coordinate systems appropriate for the device server (e.g. ABC may be XYZ coordinates respectively).

The LOCATION field reports a vendor specified location value of the type specified in the LOCATION TYPE CODE field using the CODE SET specified in the Element Location Identifier header.

6.11.6 Medium In Element Type page

Table y+10 shows the format of the Medium In Element Type page. If the ALL bit in the CDB is set to one, the device server shall return a page for each element that contains medium. The device server shall not return a page for an empty element. If the ALL bit in the CDB is set to zero and the addressed element is empty the device server shall return CHECK CONDITION status. The sense key shall be set to ILLEGAL REQUEST and the additional sense code shall be set to MEDIUM NOT PRESENT.

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T10/06-163r0

Table y+10: Medium in Element Type Page format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved				ELEMENT TYPE CODE			
1	PAGE CODE (81h)							
2	(MSB)			PAGE LENGTH (4)				
3								(LSB)
4	(MSB)			ELEMENT ADDRESS				
5								(LSB)
6	PRIMARY MEDIUM TYPE CODE							
7	SECONDARY MEDIUM TYPE CODE							

See section 6.11.3 f or the definition of the ELEMENT TYPE CODE field. The ELEMENT TYPE CODE field shall contain the element type value for the currently described element.

The PAGE LENGTH field contains the total length in bytes of the page to follow. The PAGE LENGTH field shall be set to 4h. If the page is truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

The ELEMENT ADDRESS field specifies the element address of the element being described. If the ALL bit in the CDB is set to zero, this address shall be the address selected in the ELEMENT ADDRESS field in the CDB.

See section 5.3.2 for the definition of the PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE. If the device server is unable to determine the type of medium currently in the element, the unknown medium type shall be returned.