memorandum

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T10/06-272r1

To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Report Element Information	11 January, 2007

Revision History

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

Revision 1 – Changes from September 2006 T10
Changed to 16 Byte CDB to reuse number of elements concept from RES and removed "SINGLE" bit
Updated to SMC3r04
Completed element characteristics page
Added element state page

Related Documents

smc3r04 – SCSI Media Changer Commands - 3 revision 04

spc3r23 – SCSI Primary Commands -3 revision 23

Background

The Read Element Status command is used by applications to describe which elements of a media changer device are full and empty. 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 characteristics that are currently reported in vendor unique methods are medium type, and element location which are frequently returned in a vendor specific section at the end of the Read Element Status data. Much of the information currently returned in Read Element Status is static information that does not change and does not need read every time the full/empty status needs refreshed. There are also 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 information about the characteristics of a medium changer element. One page describes the dynamic information about the elements and all other pages describe semi-static information that will not change without a device configuration change. Using the page code mechanism to select information pages about an element allows an application client to select only the information it needs at the time and to get back only that information rather than the monolithic data block used by Read Element Status. By using this command an application client can determine the type and capabilities of an element including volume types that are compatible with this element and the location of this element.

The Read Element Status mechanism for specifying a starting element address and number of elements is leveraged for this command as well as the element type filter to allow requesting information on a single element or range of elements of a specific type or all elements of all types.

The proposed command is intended to be the first of a set of commands to fully describe the elements and the media in the elements. A companion to this command for reporting information about the volume in the element will return the volume tag and other volume characteristics currently reported with the element information in Read Element Status.

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

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Proposed Changes to SMC-3

Changes to table 3 – Volume Type Codes:

Table 3 has the following changes:

Table 3 – Volume type codes

Code	Description
00h	~~Reserved~~ All Types
01h – 7Fh	Vendor-specific
80h – ~~FFh~~FEh	Reserved
FFh	Unknown

If the volume type is set to All Types or Unknown, the volume qualifier shall be set to All Qualifiers.

Changes to 6.1:

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

Command	Operation Code	Type	Reference
REPORT ELEMENT INFORMATION	A3h/10h [a]	O	6.x

Changes to 6.2:

Table 6 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 sub-clauses 6.x and above shift to become 6.x+1 and above with the addition of this new sub-clause)

6.x REPORT ELEMENT INFORMATION command

6.x.1 REPORT ELEMENT INFORMATION command introduction

The REPORT ELEMENT INFORMATION command (see table y) requests information pages that describe an element or a set of elements.

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Table y – REPORT ELEMENT INFORMATION command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (A3h)							
1	Reserved				SERVICE ACTION (10h)			
2	Reserved					ELEMENT TYPE CODE		
3	(MSB)			STARTING ELEMENT ADDRESS				
4								(LSB)
5	(MSB)			NUMBER OF ELEMENTS				
6								(LSB)
7	PAGE CODE							
8	Reserved							
9	Reserved							(LSB)
10	(MSB)			ALLOCATION LENGTH				
11								
12								
13								(LSB)
14	Reserved							
15	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 shown in table y.

The ELEMENT TYPE CODE field specifies the particular element type(s) selected for reporting by this command. A value of zero specifies that all element types shall be reported. The element type codes are defined in 6.10.1 (see table 14).

The STARTING ELEMENT ADDRESS field specifies the lowest element address to report. Only elements with an element type code slected by the ELEMENT TYPE CODE field, and an element address greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field shall be reported. The device server shall not report element information descriptors for undefined element addresses.

The NUMBER OF ELEMENTS field specified the maximum number of elements to be reported. The value specified by this field is not the range of element addresses to be considered for reporting but rather the number of defined elements to report. If the allocation length field is not sufficient to transfer all requested pages, the device server shall transfer all those pages whose complete contents fit within the allocation field and this shall not be considered an error.

Comment: This command would reuse the existing element type codes defined in Read Element Status. It may make sense to move that table to a model clause since several commands will use the same table.

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 CONDTION 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
00h	Supported Element Information Pages
01h	Supported Volume Types
02h	Element Location
03h	Element Characteristics

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04h	Element State
05h-7Eh	Reserved
7Fh	Return All Supported Pages
80h-FFh	Vendor Specific

6.x.2 Supported Element Information Pages

The Supported Element Information Pages information page (see Table y+2) returns the list of element information pages implemented by the logical unit and supported by elements with an element type code permitted by the ELEMENT TYPE CODE field. Logical units that implement the report element information command shall implement this information page.

Table y+2: Supported Element Information Pages format

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (0)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Supported Pages							
4				First supported pages descriptor (see table y+3)				
	.							
	.							
	.							
n				Last supported pages descriptor (see table y+3)				

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the supported page descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

Table y+3: Supported Page Code Descriptors

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

The ELEMENT TYPE CODE field shall contain the element type value for the element type that supports the following list of pages. If the ELEMENT TYPE CODE field in the CDB is set to all element types then supported page descriptors shall be returned for all supported element type codes. If the ELEMENT TYPE CODE field in the CDB is not set to all element types then the supported page descriptor shall be returned for the element type selected by the ELEMENT TYPE CODE field in the CDB. All elements with the same element type code shall support the same list of element information pages.

Only one supported element information pages descriptor shall be returned for each element type.

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The value in the DESCRIPTOR LENGTH field is the length in bytes of the data that follows. If the descriptor is truncated because of the allocation length, the DESCRIPTOR LENGTH field shall not be affected.

The supported element information page list contains a list of element information page codes implemented by the logical unit for the specified element type code in ascending order beginning with page code 00h.

6.x.3 Supported Volume Types

Table y+4 shows the format of the Supported Volume Types information page.

Table y+4: Supported Volume Types page format

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (1)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Supported Volume Types Descriptors							
4								
	First supported volume types descriptor (see table y+5)							
	.							
	.							
	.							
n	Last supported volume types descriptor (see table y+5)							

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the supported page descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

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Table y+5: Supported Volume Types Descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			ELEMENT ADDRESS				
1								(LSB)
2	Reserved				ELEMENT TYPE CODE			
3	Reserved							
4	(MSB)			SUPPORTED VOLUME TYPES LIST LENGTH (n-3)				
5								(LSB)
	Supported Volume Types List							
6				First supported volume type				
7								
	. . .							
n-1				Last supported volume type				
n								

Comment: The six bytes before the volume types list combined with a single volume type will allow reporting of many elements in an 8 byte block since many medium changer elements either support all qualifiers for a type or all volumes both of which can be described with a single volume type.

The ELEMENT ADDRESS field shall contain the element address of the element being described.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

The SUPPORTED VOLUME TYPES LIST LENGTH field is the length in bytes of the data to follow. If the data is truncated because of the allocation length, the SUPPORTED VOLUME TYPES LIST LENGTH field shall not be affected.

The supported volume types list contains a list of volume types that may be moved to or from the element specified in the ELEMENT ADDRESS field, returned in order of most preferred volume type to least preferred volume type. See section 5.3.2 for the definition of the volume type. If the device server is unable to determine the volume types supported by the element specified in the ELEMENT ADDRESS field, the Unknown volume type shall be returned. If all volume types supported by the device may be moved to or from the element described, the device server may return All Types. If all volume qualifiers for a volume type supported by the device may be moved to or from the element described, the device server may return the All Qualifiers qualifier for that volume type.

6.x.4 Element Location

Table y+6 shows the format of the Element Location page.

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Table y+6: Element Location page format

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (2)							
1	Reserved							
2	(MSB)							
3	PAGE LENGTH (n-3)							(LSB)
	Supported Volume Types Descriptors							
4	First element location descriptor (see table y+7)							
	.							
	.							
	.							
	Last element location descriptor (see table y+7)							
n								

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element location descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

Table y+7: Element Location Descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1	ELEMENT ADDRESS							(LSB)
2	Reserved				ELEMENT TYPE CODE			
3	Reserved							
4	(MSB)							
5	PARAMETERS LENGTH (n -3)							(LSB)
6	Reserved				LOCATION PARAMETERS COUNT			
7	Reserved							
	Location parameters							
4	First element location parameter (see table y+8)							
	.							
	.							
	.							
	Last element location parameter (see table y+8)							
n								

Comment: A proposal for describing a medium changer is pending and may provide a more universal location description which could replace the one proposed here or could be put in a new page code.

The ELEMENT ADDRESS field specifies the element address of the element being described.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

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The PARAMETERS LIST LENGTH field is the length in bytes of the data to follow. If the data is truncated because of the allocation length, the PARAMETERS LIST LENGTH field shall not be affected.

The LOCATION PARAMETERS COUNT field shall contain a count of the location parameters to follow.

The location parameters list contains a list of location parameters implemented by the logical unit for the specified element type code in a vendor specified order.

Table y+8 shows the element location parameter format.

Table y+8: Element location parameter format

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

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

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+9. This field is intended to be an aid to software that displays the IDENTIFIER field.

Table y+9 – CODE SET field

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

Comment: for coordinate style locations it could be useful to return numeric or floating point values. Those could be returned as binary data but an application could use those values if there were code set codes defined for decimal and floating point.

The LOCATION TYPE CODE field indicates which type of location value the device server returns in the LOCATION field. Table y+10 defines the location type codes. The X Coordinate shall refer to the primary axis for horizontal motion. The Y Coordinate shall refer to the primary axis for perpendicular motion. The Z Coordinate shall refer to the secondary axis for horizontal motion, for example a plunge axis. The D, E, F, and G Coordinates are vendor specified directions. For example a transport may invert the media and the vendor may assign the D Coordinate to the invert motion.

Table y+10 – LOCATION TYPE CODE values

LOCATION TYPE CODE	Description
00h	X Coordinate
01h	Y Coordinate
02h	Z Coordinate
03h	D Coordinate
04h	E Coordinate
05h	F Coordinate
06h	G Coordinate

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LOCATION TYPE CODE	Description
07h-0Fh	Reserved
10h	Absolute address
10h-EFh	Reserved
F0h-FFh	Vendor specific

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.x.5 Element Characteristics

Comment: this page is intended to be used for reporting static characteristics about an element that can be described in a True/False manner or in a few bits.

Table y+11 shows the format of the Element Characteristics page.

Table y+11: Element Characteristics page format

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (3)							
1	Reserved							
2	(MSB)							
3	PAGE LENGTH (n-3)							(LSB)
	Element Characteristics Descriptors							
4								
	First element characteristics descriptor (see table y+12)							
	.							
	.							
	.							
n	Last element characteristics descriptor (see table y+12)							

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element characteristics descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

Table y+12: Element Characteristics Descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1	ELEMENT ADDRESS (n-3)							(LSB)
2	Reserved				ELEMENT TYPE CODE			
3	Reserved							
4	Reserved	CBOL	RMV	VRT	MDO	ECBD	IESTOR	EXP
5	Reserved							
6	Reserved							
7	Reserved							

The ELEMENT ADDRESS field specifies the element address of the element being described.

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The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

A can be offline (CBOL) bit set to one indicates that the element specified in the element address field may be taken offline. A CBOL bit set to zero indicates that the element specified in the element address field can not be taken offline. The CBOL bit shall not be set to zero if the element is only taken offline when the entire medium changer is taken offline.

A removable (RMV) bit set to one indicates that the element specified in the element address field is end user removable and may not always be installed. An RMV bit set to zero indicates that the element specified in the element address field is not end user removable.

A virtual (VRT) bit set to one indicates that the element specified in the element address field is a virtualized element that is being emulated by a device outside the scope of this standard. A VRT bit set to zero indicates that the element specified in the element address field is not a virtualized element.

A moves during operation (MDO) bit set to one indicates that the physical position of the element specified in the element address field is not fixed and the element can move during normal operation. A MDO bit set to zero indicates that the physical position of the element specified in the element address field is fixed and the element does not move during normal operation.

An element can be disabled (ECBD) bit set to one indicates that the element specified in the element address field can be disabled and may not always be available. An ECBD bit set to zero indicates that the element specified in the element address field can not be disabled.

An import/export or storage (IESTOR) bit set to one indicates that the element specified in the element address field can be configured as an import/export element or as a storage element and will only be accessible which configured as the element type specified in the element type code field. An IESTOR bit set to zero indicates that the element specified in the element address field can not be configured as an import/export element or as a storage element and will always be configured as the element type specified in the element type code field. If the IESTOR bit is set to one the ECBD bit shall be set to one.

An expansion (EXP) bit set to one indicates that the element specified in the element address field is in an expansion module that has not yet been purchased or licensed and the element is not available for use. An EXP bit set to zero indicates that the element specified in the element address field is not in an expansion module that has not yet been purchased or licensed and the element is available for use. If the EXP bit is set to one the ECBD bit shall be set to one.

6.x.6 Element State

Comment: this page is intended to be used for reporting the current state of an element

Table y+13 shows the format of the Element State page.

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Table y+13: Element State page format

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (3)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Element State Descriptors							
4				First element state descriptor (see table y+14)				
				. . .				
n				Last element state descriptor (see table y+14)				

The PAGE CODE field contains the number of the element information page that is being transferred.

The value in the PAGE LENGTH field is the length in bytes of the element state descriptors that follow. If the descriptors are truncated because of the allocation length, the PAGE LENGTH field shall not be affected.

Table y+14: Element State Descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			ELEMENT ADDRESS (n-3)				
1								(LSB)
2	Reserved				ELEMENT TYPE CODE			
3	Reserved							
4	Reserved		FULL	ED	OL	RMVD	EXCPT	ACCESS
5	EXCEPTION CODE							
6	Reserved							
7	Reserved							

The ELEMENT ADDRESS field specifies the element address of the element being described.

The ELEMENT TYPE CODE field shall contain the element type code for the element being described.

A FULL bit set to one indicates that the element specified in the element address field contains a volume. A FULL bit set to zero indicates that the element specified in the element address field does not contain a volume.

An element disabled (ED) bit set to one indicates that the element specified in the element address field is disabled and is not available for use. An ED bit set to zero indicates that the element is not disabled and is available for use. Support of the ED bit set to one is required for device servers that have elements which can be disabled. If the ED bit is set to one the ACCESS bit shall be set to zero.

An offline (OL) bit set to one indicates that the element specified in the element address field is temporarily offline and is not available for use. An OL bit set to zero indicates that the element specified in the element address field is online and is available for use. If the OL bit is set to one the ACCESS bit shall be set to zero.

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A removed (RMVD) bit set to one indicates that the element specified in the element address field has been removed and is not available for use. A RMVD bit set to zero indicates that the element specified in the element address field is present and is available for use. If the RMVD bit is set to one the ACCESS bit shall be set to zero.

An exception (EXCPT) bit set to one indicates that an exception has occurred at the element specified in the element address field. An EXCPT bit set to zero indicates that no exception has occurred at the element specified in the element address field. If the EXCPT bit is set to one the ACCESS bit shall be set to one if the element is still accessible and shall be set to zero if the element is not accessible.

An accessible (ACCESS) bit set to one indicates that the element specified in the element address field is accessible and is available for use. An ACCES bit set to zero indicates that the element specified in the element address field is not accessible and is not available for use. Support for the ACCESS bit set to one is mandatory.

The EXCEPTION CODE field contains a value that provides additional details for what exception has occurred at the element specified in the element address field. The exception code values are defined in table Y+15. If the EXCPT bit is set to zero the EXCEPTION CODE field shall be set to zero.

Table y+15 –EXCEPTION CODE values

CODE	Description
00h	Unknown
01h	A successful retry occurred on the last move
02h-7Fh	Reserved
80h-FFh	Vendor Specific

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6.x.7 Return All Supported Pages

If the Return All Supported Pages information page code is requested the device server shall return all of the pages supported by the elements selected by the starting element address field and the element type field in ascending order by page code. All page codes for an element shall be returned before the first page for the next element.