memorandum

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T10/08-066r2

To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Report Element Information	7 March, 2008

Revision History for original document number 06-272

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

Revision 2 – Moved Page Code field in CDB
- Corrected Opcode in CDB table and command table
- Removed complete descriptors requirement and added note about difference from RES
- Added requirement that element address be ignored if the supported pages list is requested
- Renamed Element Characteristics page to Element Static Information page
- Added requirement for supported pages order in return data
- Added length fields to pages with fixed length descriptors
- Removed "Offline" concept and all bits – disabled with UA's will be used instead
- Added Import and Operator Intervention bits to element state
- Change Exception Cause field to ASC/ASCQ as in RES
- Added support column to page code list

Revision 3 – Changes requested in Feb. 2007 T10 meeting
- Moved "see SPC-3" for allocation and control field to the correct location.
- Changed ELEMENT TYPE CODE field to reference 6.10.1 directly
- Moved truncated descriptors not an error statement to normative text in allocation length description
- Wording corrections on supported element information pages description
- Moved location of single supported pages descriptor for each element type requirement
- Changed return data to allow grouping of elements by starting address and number of elements
- Changed location length descriptor to 4 bytes and location parameter length to 4 bytes
- Removed list of proposed location types
- Corrected location of PARAMETERS LENGTH in element location descriptor.

- Changed supported volume types list to supported volume types parameters
- Added ability to report a supported volume type as read only when in the described data transfer element
- Added a volume index to the state information.

Revision 4 – Changed background to better describe this as part of a two command replacement for RES
- Simplified the header to conform to working group standards of no company logo on pages 2+
- Added text to clarify element can be disabled bit
- Added text to clarify removed bit
- Added CURDATA bit to CDB

Revision 5 – Several wording changes from June 2007 conference call
- Rewrote paragraph on setting volume types and qualifiers in supported volume types list
- Changed read only setting on volumes in drives to reference write OK bit in drive report density codes page
- Added text to each descriptor that may contain variable information to specify behavior when CURDATA=1

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Revision 6 – Changes from July 2007 T10 meeting
Revised definitions for Discovery and Inventory Scan
Added UPG bit to CDB to allow optional selection of elements available with an upgrade
Changed definition of write capable to not tie directly to tape WRTOK bit
Split expansion concept in static descriptor to add-on and COD types of expansion
Replaced virtual bit with can not be exported bit in static descriptor

Revision 7 – Changes from September 2007 T10 meeting
Changed CONTROL byte reference
Changed element state descriptor to only be able to return a single element instead of a range
Changed all pages to be able to wait or return OPERATION IN PROGRESS when CURTDATA = 0
Removed "can not be exported" bit – use volume type/qualifier to create type incompatible with I/O instead
Several minor clarifications and corrections

Revision History for new document number 08-066

Revision 0 – Identical to 06-272r7 new number automatically assigned

Revision 1 – Changes from January, 2008 working group meeting Santa Ana, CA

Revision 1 – Changes from January, 2008 phone conference
Changed CURDATA to CDATA and renamed to cached data to avoid SMC-3 CURDATA confusion
Reformatted and slightly reworded requirements around CDATA in each section.
Added LOCATION DESCRIPTION and CODE SET QUALIFIER to location descriptor

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 the first half of a change to SMC-3 that creates two new media changer commands, "REPORT ELEMENT INFORMATION" and "REPORT VOLUME INFORMATION" which will provide an alternate method to retrieve all of the information currently returned by "READ ELEMENT STATUS". These new commands will provide a mechanism that allows for easier extension in the future and allows selective or all inclusive retrieval of the data. Following the standardization of these commands "READ ELEMENT STATUS" may be deprecated.

The "REPORT ELEMENT INFORMATION" command specified in this proposal reports data pages containing information about a medium changer element. One page describes the dynamic information about the elements and all 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.

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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 or purple, deleted text appears in ~~red strikeout~~, and editorial comments appear in green.

Proposed Changes to SMC-3

Changes to 3.1:

3.1.x Discovery: An action performed by a media changer where values describing the elements in the media changer are determined. The values are determined by vendor specific methods (e.g., loaded from memory or detected by transport movement). Discovery may be performed at startup or following any event which may change the physical characteristics of the media changer.

3.1.x Inventory Scan: An action performed by a media changer where the inventory of volumes and the element address at which they may be found is determined. The inventory is determined by vendor specific methods (e.g., transport movement or optical scanning). An inventory scan may occur at startup or following a change that may effect the inventory of the media changer. An inventory scan may or may not scan all elements in the media changer.

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, then 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	9Eh/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

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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.

Table y – REPORT ELEMENT INFORMATION command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (9Eh)							
1	Reserved			SERVICE ACTION (10h)				
2	PAGE CODE							
3	Reserved		UPG	CDATA	ELEMENT TYPE CODE			
4	(MSB)							
5	STARTING ELEMENT ADDRESS							(LSB)
6	(MSB)							
7	NUMBER OF ELEMENTS							(LSB)
8	Reserved							
9	Reserved							
10	(MSB)							
11								
12	ALLOCATION LENGTH							
13								(LSB)
14	Reserved							
15	CONTROL							

Comment: Should we include a bit in the header or change CDATA to a field to allow for a "return immediately but fail if not ready" option?

See SPC-3 for the definition of the OPERATION CODE field and the SERVICE ACTION field. The OPERATION CODE and SERVICE ACTION fields shall be set to the values shown in table y.

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, then it 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 upgrade (UPG) bit is set to one, then the device server may use the EXP bit and the COD bit in the element static information page to return information for elements that are not currently accessible but may be purchased or licensed.

If the cached data (CDATA) bit is set to one, then the device server shall return the requested element information page using cached discovery and inventory information without causing device motion. If the CDATA bit is set to zero, then the device server may cause device motion to validate the element information (e.g., perform an inventory scan or other actions). If the CDATA bit is set to zero and discovery (see 3.1.X) or an inventory scan (see 3.1.X) is required to update the element information page requested but the device is not capable of performing the discovery or inventory scan, then the device server shall terminate the command with CHECK CONDITION status, with the sense key set to NOT READY and the additional sense code shall specify the reason for NOT READY. Support for the CDATA bit set to one is mandatory.

See 6.10.1 for the definition of the ELEMENT TYPE CODE field

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The STARTING ELEMENT ADDRESS field specifies the lowest element address to report. Only elements with an element type code selected 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. If the PAGE CODE field is set to 00h (i.e., Supported Element Information Pages), then the STARTING ELEMENT ADDRESS field shall be ignored.

The NUMBER OF ELEMENTS field specifies 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 PAGE CODE field is set to 00h (i.e., Supported Element Information Pages), then the NUMBER OF ELEMENTS field shall be ignored.

See SPC-3 for the definition of the ALLOCATION LENGTH field. If the descriptors are truncated because of the allocation length this shall not be considered an error.

See SAM-3 for a description of the CONTROL byte.

Table y + 1: Element Information Page Codes

PAGE CODE	Definition	Reference	Support
00h	Supported Element Information Pages	6.x.2	Mandatory
01h	Supported Volume Types	6.x.3	Optional
02h	Element Location	6.x.4	Optional
03h	Element Static Information	6.x.5	Optional
04h	Element State	6.x.6	Mandatory
05h-7Eh	Reserved		
7Fh	Return All Supported Pages	6.x.7	Optional
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 supported by the device server for the element type specified in the report element information command. If all element types are specified, then the device server shall return one supported pages descriptor for each element type.

Table y + 2: Supported Element Information Pages

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (00h)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Supported pages descriptors							
4				First supported pages descriptor (see table y + 3)				
	. . .							
n	Last supported pages descriptor (see table y + 3)							

The PAGE CODE field shall be set to the value shown in table y+2.

The value in the PAGE LENGTH field indicates the length in bytes of the supported pages 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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One supported pages descriptor shall be returned for each selected element type. Supported pages descriptors shall be returned in ascending order by element type code.

Table y + 3: Supported Pages descriptor

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 code list							
n								

The ELEMENT TYPE CODE field shall contain the element type code for the element type that supports the following list of pages.

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 code list contains a list of element information page codes (see table y + 1) 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 Volumes information page.

Table y + 4: Supported Volume Types page

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (01h)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Supported volume types descriptors							
4	First supported volume types descriptor (see table y + 5)							
	.							
	.							
	.							
	Last supported volume types descriptor (see table y + 5)							
n								

The PAGE CODE field shall be set to the value shown in table y + 4.

The value in the PAGE LENGTH field is the length in bytes of the supported volume types 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)			FIRST ELEMENT ADDRESS REPORTED				
1								(LSB)
2	(MSB)			NUMBER OF ELEMENTS				
3								(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB)			PARAMETERS LENGTH (n -7)				
7								(LSB)
	Supported volume types parameters							
8	First supported volume type parameter (See table y + 6)							
11								
	. . .							
n-1	Last supported volume type parameter (See table y + 6)							
n								

The FIRST ELEMENT ADDRESS REPORTED field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field in the CDB, and with the same set of supported volume type parameters.

Comment: The working group requested that the statement "in the command" following STARTING ELEMENT ADDRESS in the paragraph above be researched for precedence in SMC-3 and that it be removed globally if it was not already in use. The previous format of this statement was "in the CDB". The phrase "in the CDB" shows up in SMC-3 eleven times, in SSC-3 two times, and in SPC4 70 times. The phrase "in the command descriptor block" is used once in SMC-3. No occurrences of "in the command" in this context were found in SPC4. This proposal has been changed back to the original form to use the phrase "in the CDB" which seems to be the most common.

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

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

The supported volume types parameters indicate the volume types that may be moved to or from the specified element. Table y + 6 shows the supported volume type parameter format.

Table y + 6: Supported Volume Type parameter

Bit / Byte	7	6	5	4	3	2	1	0
0	VOLUME TYPE							
1	VOLUME QUALIFIER							
2	Reserved							WRITE CAPABLE
3	Reserved							

See 5.4 for the definition of the VOLUME TYPE field and the VOLUME QUALIFIER field.

If the device server is unable to determine the volume types supported by the specified element, then the VOLUME TYPE field shall be set to FFh (i.e., Unknown) and the VOLUME QUALIFIER field shall be set to 00h (i.e., All Qualifiers). If all volume types supported by the device may be moved to or from the element described, then the device server may set the VOLUME TYPE field to 00h (i.e., All Types) and the VOLUME QUALIFIER field to 00h (i.e., All Qualifiers). If all volume qualifiers for a volume type

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supported by the device may be moved to or from the element described, then the device server shall set VOLUME TYPE field to the value for the specified volume type and may set the VOLUME QUALIFIER field to 00h (i.e., All Qualifiers).

If the ELEMENT TYPE CODE field in the supported volume types descriptor is set to 4h (i.e., data transfer element), then the WRITE CAPABLE field specifies whether the selected data transfer element is capable of writing to a volume with the specified volume type and volume qualifier. (e.g., for SSC devices the data transfer device server reports a WRTOK bit set to one in a density support data block descriptor for a volume with this volume type and volume qualifier in response to a REPORT DENSITY SUPPORT command, see SSC-3). The WRITE CAPABLE field values are defined in table y + 7.

Table y + 7: WRITE CAPABLE field values

WRITE CAPABLE	Description
00b	Unknown
01b	Data transfer device is capable of writing to this volume type.
10b	Data transfer device is not capable of writing to this volume type.
11b	Reserved

If the CDATA bit in the REPORT VOLUME INFORMATION command is set to zero and the device server is not ready or a discovery (see 3.1.X) is in progress, then the device server shall

a) complete discovery before returning any descriptors; or
b) terminate the command with CHECK CONDITION status with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY.

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall not perform a discovery and shall use cached values for the VOLUME TYPE field, VOLUME QUALIFIER field, and WRITE CAPABLE field or shall

a) set the VOLUME TYPE field to FFh (i.e., Unknown);
b) set the VOLUME QUALIFIER field to 00h (i.e., All Quanlifiers); and
c) set the WRITE CAPABLE field to 00h (i.e., Unknown).

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one and discovery is incomplete, then the device server shall only return descriptors for elements that have been discovered.

Note: The device server only returns information for discovered elements if CURDATA is set to one. That list of elements may not be the complete list of elements.

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6.x.4 Element Location Page

Table y + 8 shows the format of the Element Location page.

Table y + 8: Element Location page

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (02h)							
1	Reserved							
2	(MSB)			PAGE LENGTH (n-3)				
3								(LSB)
	Element location descriptors							
4				First element location descriptor (see table y + 9)				
				. . .				
n				Last element location descriptor (see table y + 9)				

The PAGE CODE field shall be set to the value shown in table y + 8.

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 +9: Element Location descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			FIRST ELEMENT ADDRESS REPORTED				
1								(LSB)
2	(MSB)			NUMBER OF ELEMENTS				
3								(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB)			PARAMETERS LIST LENGTH (n -9)				
9								(LSB)
	Location parameters							
10				First element location parameter (see table y + 10)				
				. . .				
n				Last element location parameter (see table y + 10)				

The FIRST ELEMENT ADDRESS REPORTED field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field in the CDB and with the same set of location parameters.

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 for the specified element.

Table y + 10 shows the element location parameter format.

Table y + 10: Element location parameter

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
3	ELEMENT LOCATION LENGTH (W-3)							(LSB)
4	CODE SET				Reserved		CODE SET QUALIFIER	
5	LOCATION TYPE CODE							
6	Reserved							
7								
8	LOCATION DESCRIPTION							
23								
24	LOCATION							
n								

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 + 11. This field is intended to be an aid to software that displays the LOCATION field.

Table y + 11: 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

The CODE SET QUALIFIER field provides additional information about the value the device server returns in the LOCATION field in the element location descriptor.

Table y + 12: CODE SET QUALIFIER field

Code	Description
000b	No qualifier
001b	The LOCATION field contains a decimal number (e.g., ASCII values 20h, 2Dh through 2Eh, and 30h through 39h if the CODE SET field is set to 02h)
010b-111b	Reserved

Comment: the "decimal number" reference in 001b could easily just be referred back to a table such as table 1 in SPC4r12 which gives number examples. That table is repeated in many standards but not SMC-3. Should we copy that table into this standard?

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The LOCATION TYPE CODE field indicates which type of location value in the LOCATION field. Table y + 13 defines the location type codes.

Table y + 13: LOCATION TYPE CODE values

LOCATION TYPE CODE	Description
00h - EFh	Reserved
F0h - FFh	Vendor specific

The LOCATION DESCRIPTION field contains sixteen bytes of left-aligned ASCII data (see SPC-4) defined by the vendor.

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.

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to zero and the device server is not ready or a discovery (see 3.1.X) is in progress, then the device server shall

a) complete the discovery before returning any descriptors; or
b) terminate the command with CHECK CONDITION status with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY.

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall return location descriptors using cached data. If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one and discovery is incomplete, then the device server shall only return descriptors for elements that have been discovered.

Note: The device server only returns information for discovered elements if CURDATA is set to one. That list of elements may not be the complete list of elements.

6.x.5 Element Static Information Page

Table y + 14 shows the format of the Element Static Information page.

Table y + 14: Element Static Information page

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (03h)							
1	Reserved							
2	(MSB)							
3	DESCRIPTOR LENGTH							(LSB)
4	Reserved							
5	Reserved							
6	(MSB)							
7	PAGE LENGTH (n-7)							(LSB)
	Element static data descriptors							
4	First element static information descriptor (see table y + 15)							
	. . .							
	Last element static information descriptor (see table y + 15)							
n								

The PAGE CODE field shall be set to the value shown in table y + 14.

The value in the PAGE LENGTH field is the length in bytes of the element static data 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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The DESCRIPTOR LENGTH field shall contain the length of each element static information descriptor. The DESCRIPTOR LENGTH shall be a multiple of 4. The element static information descriptors shall be zero padded.

Table y + 15: Element Static Information descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			FIRST ELEMENT ADDRESS REPORTED				
1								(LSB)
2	(MSB)			NUMBER OF ELEMENTS				
3								(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	Reserved		EXP	COD	CNXP	MDO	IESTOR	EDC
6	Reserved							
n								

The FIRST ELEMENT ADDRESS REPORTED field indicates the lowest element address being reported.

The NUMBER OF ELEMENTS field indicates the number of contiguous elements with element addresses greater than or equal to the value specified in the STARTING ELEMENT ADDRESS field in the CDB and with the same ELEMENT TYPE CODE field, EXP bit, COD bit, CNXP bit, MDO bit, IESTOR bit, and EDC bit values.

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

An expansion (EXP) bit set to one indicates that the specified element is in an expansion module that is not present. An EXP bit set to zero indicates that the specified element is not in an expansion module that is not present. If the UPG bit in the CDB is set to zero, then the EXP bit shall be set to zero.

A capacity on demand (COD) bit set to one indicates that the specified element is an unlicensed capacity on demand element and may be made accessible by licensing. A COD bit set to zero indicates that the specified element is not an unlicensed capacity on demand element. If the UPG bit in the CDB is set to zero, then the COD bit shall be set to zero.

A moves during operation (MDO) bit set to one indicates that the physical position of the specified element is not fixed and the element moves during normal operation. A MDO bit set to zero indicates that the physical position of the specified element is fixed and the element does not move during normal operation. (e.g. the media changer moves a magazine as part of the process of opening an import/export element and all elements in that magazine have the MDO bit set to one).

An import/export or storage (IESTOR) bit set to one indicates that the specified element is configurable as either an import/export element or as a storage element. An IESTOR bit set to zero indicates that the specified element is not configurable as an import/export element or as a storage element. If the IESTOR bit is set to one, then the EDC bit shall be set to one.

An element disabled capable (EDC) bit set to one indicates that the specified element is capable of being disabled. An EDC bit set to zero indicates that the specified element is not capable of being disabled.

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to zero and the device server is not ready or a discovery (see 3.1.X) is in progress, then the device server shall

a) complete the discovery before returning any descriptors; or
b) terminate the command with CHECK CONDITION status with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY.

If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall return element static descriptors using cached values. If the CDATA bit in the REPORT VOLUME INFORMATION CDB is set to one and discovery is incomplete, then the device server shall only return descriptors for elements that have been discovered.

Note: The device server only returns information for discovered elements if CURDATA is set to one. That list of elements may not be the complete list of elements.

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6.x.6 Element State

Table y + 15 shows the format of the Element State page.

Table y + 15: Element State page

Bit / Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (04h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			PAGE LENGTH (n-7)				
7								(LSB)
	Element state descriptors							
8	First element state descriptor (see table y + 16)							
	.							
	.							
	.							
n	Last element state descriptor (see table y + 16)							

The PAGE CODE field shall be set to the value shown in table y + 15.

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.

The DESCRIPTOR LENGTH field shall contain the length of each element state descriptor. The DESCRIPTOR LENGTH shall be a multiple of 4. The element state descriptors shall be zero padded.

Table y + 16: Element State descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			ELEMENT ADDRESS				
1								(LSB)
2	Reserved							
3								
4	Reserved				ELEMENT TYPE CODE			
5	Reserved	IVALID	IMP	OIR	FULL	ED	EXCPT	ACCESS
6	ADDITIONAL SENSE CODE							
7	ADDITIONAL SENSE CODE QUALIFIER							
8	(MSB)			VOLUME INDEX				
9								(LSB)
10	Reserved							
n								

The ELEMENT ADDRESS field indicates the element address being reported.

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

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An index valid (IVALID) bit set to one indicates that the volume index field is valid. An IVALID bit set to zero indicates that the volume index field is not valid.

An import (IMP) bit set to one indicates that the medium in this element was not present during the previous scan and was not moved to this element by the medium changer (e.g., a user bulk load or medium inserted into import/export element). An IMP bit set to zero indicates that the medium in this element was present during the previous scan, was moved to this element by the medium changer, or the previous scan results are not known.

Comment: Do we want the IMP bit to be zero if there is no previous scan results or should it be 1. If there are no previous scan results the library won't know if the volume has been imported so it could be zero, but if it is the trigger for an ISV to perform a scan of that volume, then the safer path would be to mark it as imported when unknown.

An operator intervention required (OIR) bit set to one indicates that operator intervention is required to make the element accessible (e.g. a mailslot or access panel must be closed). An OIR bit set to zero indicates that operator intervention is not required. If the OIR bit is set to one, then the ED bit shall be set to one and the ACCESS bit shall be set to zero.

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

An element disabled (ED) bit set to one indicates that the specified element is disabled. An ED bit set to zero indicates that the specified element is not disabled. Support of the ED bit set to one is required. If the ED bit is set to one, then the ACCESS bit shall be set to zero. If the ED bit is set to one, then the ECBD bit in the static data descriptor for this element shall be set to one.

An exception (EXCPT) bit set to one indicates that an exception has occurred at the specified element. An EXCPT bit set to zero indicates that no exception has occurred at the specified element or any previous exception has been cleared. If the EXCPT bit is set to one, then 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. If the EXCPT bit is set to one, then the additional sense code and additional sense code qualifier fields shall contain additional information about the exception.

Comment: At the last review there was a request to modify the above paragraph and remove the statement about the ACCESS bit shall be set to one or zero and replace it with a statement that the ACCESS bit shall be supported if this bit is supported. Stating that ACCESS shall be supported isn't necessary because that bit is mandatory. Having that clause is intended to make it clear that an element may have an exception and still be accessible so the bit does not cause ISV's to make the volume in the element as bad. The exception may be something like a damaged barcode which shouldn't cause the ISV to quit using the volume but should be addressed by the operator.

An accessible (ACCESS) bit set to one indicates that access to the specified element by a medium transport element is allowed. An ACCESS bit set to zero indicates that access to the specified element by a medium transport element is not allowed. Support for the ACCESS bit set to one is mandatory.

The ADDITIONAL SENSE CODE field may provide additional information about the specified element. The values in this field are as defined for the ADDITIONAL SENSE CODE field of REQUEST SENSE command response data (see SPC-3). This field shall be set to 00h if there is no additional sense information available.

The ADDITIONAL SENSE CODE QUALIFIER field may provide more detailed additional information about the specified element. The values in this field are as defined for the ADDITIONAL SENSE CODE QUALIFIER field of REQUEST SENSE command response data (see SPC-3). This field shall be set to 00h if there is no additional sense code qualifier information available.

If the specified element contains a volume and the IVALID bit is set to one, then the VOLUME INDEX field shall contain a device server assigned index value which may be used with the REPORT VOLUME INFORMATION command to retrieve information about the volume in the specified element. The device server shall report the same volume index value for the volume in the specified element when that volume is in any element. If the IVALID bit is zero, then the VOLUME INDEX field shall be ignored. If an event occurs which causes the volume index values to change (e.g. the device is reset and volume index values are not retained across a reset), then the device server shall establish a unit attention (see SAM-4) condition for every I_T nexus with the additional sense code set to VOLUME INDEX VALUES CHANGED.

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If the CDATA bit in the REPORT ELEMENT INFORMATION command is set to zero, and

a) the device server is not ready;
b) a discovery (see 3.1.X) is in progress; or
c) an inventory scan is in progress;

then the device server shall

a) complete the discovery before returning any descriptors; or
b) terminate the command with CHECK CONDITION status with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY.

If the CDATA bit in the REPORT ELEMENT INFORMATION command is set to one and the device server is not ready or a discovery is in progress, then the device server shall terminate the command with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code shall specify the reason for NOT READY.

If the CDATA bit in the REPORT ELEMENT INFORMATION command is set to one and the device server is not ready or an inventory scan is in progress, then the device server shall

a) set the EXCPT to one;
b) set the ADDITIONAL SENSE CODE field and ADDITIONAL SENSE CODE QUALIFIER field to LOGICAL UNIT IS IN PROCESS OF BECOMING READY; and
c) set the IVALID bit, IMP bit, FULL bit, ED bit, RMVD bit, and ACCESS bit to the last cached values or to zero.

Note: The device server is required to complete discovery before returning descriptors with CURDATA set to one and the list of elements is always the complete list of elements and the EXCPT bit will be set to one if the element data is from cache.

Comment: An additional sense code value for VOLUME INDEX VALUES CHANGED does not yet exist.

Comment: The above paragraph refers to the REPORT VOLUME INFORMATION command for the definition of the volume index value but that command does not yet exist. A follow on proposal will introduce that command.

Comment:

The following characteristics can or previously could be reported in READ ELEMENT STATUS but are not represented here.

- Primary Voltag – media information
- Secondary Voltag – media information
- Source Valid – media information
- Source Address – media information
- Invert – media information
- Medium Type – media information
- VPD Identifier – could be here but covered by "REPORT DTD ELEMENT INQUIRY"
- Import Enable – believed obsolete
- Export Enable – believed obsolete
- On Bus – Could be good information but needs different format from SCSI-2 RES command
- Address – Similar to on bus – would need updated format

6.x.7 Return All Supported Pages

If the Return All Supported Pages information page code is requested, then the device server shall return all of the pages supported by the elements selected by the STARTING ELEMENT ADDRESS field in the CDB and the ELEMENT TYPE CODE field in the CDB in ascending order by page code (i.e. all page code 01h pages shall be returned before any page code 02h pages).