T10/06-272r6

To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Report Element Information	6 September, 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

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

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

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.

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.

2

T10/06-272r6

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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 may be loaded from memory, detected by transport movement, or vendor specific methods. 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 may be determined by transport movement, optical scanning, or vendor specific methods. An inventory scan may occur at startup or following a change that may effect the inventory of the media changer. An inventory scan may scan all elements in the media changer or may scan only elements that may have changed.

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

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	CURDATA	ELEMENT TYPE CODE			
4	(MSB)			STARTING ELEMENT ADDRESS				
5								(LSB)
6	(MSB)			NUMBER OF ELEMENTS				
7								(LSB)
8	Reserved							
9	Reserved							
10	(MSB)							
11				ALLOCATION LENGTH				
12								
13								(LSB)
14	Reserved							
15	CONTROL							

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 and COD bits in the element static information page to return information for elements that are not currently accessible but may be licensed or purchased.

If the current data (CURDATA) 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 CURDATA bit is set to zero, then the device server may perform an inventory scan or other actions to validate the element information. Support for the CURDATA bit set to one is mandatory.

Comment: The intent is that the return data be sent back without delays if CURDATA=1 and be verified before returning if CURATA=0.

See 6.10.1 for the definition of the ELEMENT TYPE CODE field

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 SPC-3 for the definition of the CONTROL field.

4

Table y + 1: Element Information Page Codes

PAGE CODE	Definition	Reference	Support
00h	Supported Element Information Pages	6.x.2	Mandatory
01h	Supported Volumes	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.

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 Volumes

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

Table y + 4: Supported Volumes 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)							
	. . .							
n	Last supported volume types descriptor (see table y + 5)							

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.

Table y + 5: Supported Volume Types descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1				FIRST ELEMENT ADDRESS REPORTED				(LSB)
2	(MSB)							
3				NUMBER OF ELEMENTS				(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB)							
7				PARAMETERS LENGTH (n -7)				(LSB)
	Supported volume types parameters							
8 11	First supported volume type parameter (See table y + 6)							
	: : :							
n-1 n	Last supported volume type parameter (See table y + 6)							

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.

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 Unknown (i.e., FFh) and the VOLUME QUALIFIER field shall be set to All Qualifiers (i.e., 00h). 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 All Types (i.e., 00h) and the VOLUME QUALIFIER field to All Qualifiers (i.e., 00h). If all volume qualifiers for a volume type 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 All Qualifiers (i.e., 00h).

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 CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to zero and a discovery is in progress or is required to update the volume support information, then the device server shall complete the discovery before returning any descriptors. If the CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall not perform a discovery to update the volume support information about any elements and shall use the last known values for the VOLUME TYPE field, VOLUME QUALIFIER field, and WRITE CAPABLE field or shall set the VOLUME TYPE field, VOLUME QUALIFIER field, and WRITE CAPABLE field to Unknown. If the CURDATA 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 will only return information for discovered elements if CURDATA is set to one. That list of elements may not be the complete list of elements.

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)							
1				FIRST ELEMENT ADDRESS REPORTED				(LSB)
2	(MSB)							
3				NUMBER OF ELEMENTS				(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	Reserved							
6	(MSB)							
9				PARAMETERS LIST LENGTH (n -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.

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	Reserved				CODE SET			
5	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 + 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-Eh	Reserved
Fh	The LOCATION field contains an ASCII representation of a decimal value (i.e., code values 30h through 39h, 2Dh through 2Eh)

Comment: Code Fh allows for returning a decimal value in ASCII format so no special handling is required for decimal points or positive/negative. The decimal point and negative sign are allowed characters. Code Fh was used so that SPC can assign meaning to values 4h-Eh before this table conflicts.

The LOCATION TYPE CODE field indicates which type of location value the device server returns in the LOCATION field. Table y + 12 defines the location type codes.

Table y + 12: LOCATION TYPE CODE values

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

Comment: We could define values for some common locations such as magazine, module, cabinet, row, column, panel, drawer.

Note: A vendor specific location type code may be given a name and a value by reporting a name in the first descriptor with that location type code and ASCII or UTF-8 characters in the description field then reporting a value in the second descriptor with the same location type code.

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 CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to zero and a discovery is in progress or is required to update the location information, then the device server shall

a) complete the discovery before returning any descriptors; or
b) return a CHECK CONDITION with the sense key set to NOT READY, and the additional sense code set to LOGICAL UNIT NOT READY, OPERATION IN PROGRESS.

Comment: operation in progress seems like the best currently defined ASC/ASCQ. Could use SELF TEST IN PROGRESS, REBUILD IN PROGRESS, or RECALCULATION IN PROGRESS but those don't seem quite right.

If the CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall not perform a discovery to update the location information about any elements and shall return location descriptors using cached data. If the CURDATA 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 will only return 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 + 13 shows the format of the Element Static Information page.

Table y + 13: Element Static Information page

Bit Byte	7	6	5	4	3	2	1	0
0	PAGE CODE (03h)							
1	Reserved							
2	(MSB)			DESCRIPTOR LENGTH				
3								(LSB)
4	Reserved							
5	Reserved							
6	(MSB)			PAGE LENGTH (n-7)				
7								(LSB)
	Element static data descriptors							
4	First element static information descriptor (see table y + 14)							
	. . .							
n	Last element static information descriptor (see table y + 14)							

The PAGE CODE field shall be set to the value shown in table y + 13.

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.

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 + 14: 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, RMV field, VRT field, MDO field, EDBD field, IESTOR field, and EXP field 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 connected. An EXP bit set to zero indicates that the specified element is not in an expansion module that is not connected. If the EXP bit is set to one, then the ECBD bit shall be set to one. If the UPG bit in the CDB is set to one, 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 one, then the COD bit shall be set to zero.

A can not be exported (CNXP) bit set to one indicates that a volume in the specified element is not capable of being exported. A CNXP bit set to zero indicates that the specified element is capable of being exported.

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 changes moves a magazine to position a selected volume in front of the drive for loading and all volumes in that magazine move at the same time so their position is not fixed).

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 ECBD 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 CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to zero and a discovery is in progress or is required to update the element static information, then the device server shall

- c) complete the discovery before returning any descriptors; or
- d) return a CHECK CONDITION with the sense key set to NOT READY, and the additional sense code set to LOGICAL UNIT NOT READY, OPERATION IN PROGRESS.

If the CURDATA bit in the REPORT VOLUME INFORMATION CDB is set to one, then the device server shall not perform a discovery to update the element static information about any elements and shall return element static descriptors using last known values. If the CURDATA 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 will only return information for discovered elements if CURDATA is set to one. That list of elements may not be the complete list of elements.

Comment: this page currently does not allow returning information on import export element reporting whether they are import only or export only but that functionality is in RES. Do we need that?

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)			FIRST ELEMENT ADDRESS REPORTED				
1								(LSB)
2	(MSB)			NUMBER OF ELEMENTS				
3								(LSB)
4	Reserved				ELEMENT TYPE CODE			
5	IVALID	IMP	OIR	FULL	ED	RMVD	EXCPT	ACCESS
6	ADDITIONAL SENSE CODE							
7	ADDITIONAL SENSE CODE QUALIFIER							
8	(MSB)			VOLUME INDEX				
9								(LSB)
10	Reserved							
n								

The FIRST ELEMENT ADDRESS AVAILABLE 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, IMP field, OIR field,

FULL field, ED field, RMVD field, EXCPT field, ACCESS field, ADDITIONAL SENSE CODE field, and ADDITIONAL SENSE CODE QUALIFIER field values.

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

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 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.

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 for device servers that have elements which may be disabled. 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.

A removed (RMVD) bit set to one indicates that the specified element or a component containing the specified element has been removed. A RMVD bit set to zero indicates that the specified element is present. If the RMVD bit is set to one, then the ED bit shall be set to one, the FULL bit shall be set to zero, the ACCESS bit shall be set to zero, and all fields for the volume in the element shall be set to defaults.

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.

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, then the VOLUME INDEX field may 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 any event occurs which causes the volume index values to change (e.g. a bulk load door is opened), 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.

If the CURDATA bit in the REPORT ELEMENT INFORMATION CDB is set to zero and a discovery or inventory scan is in progress or is required to update the element state information, then device server shall

a) complete the discovery before returning any descriptors; or

    b)   return a CHECK CONDITION with the sense key set to NOT READY, and the additional sense code set to LOGICAL UNIT NOT READY, OPERATION IN PROGRESS.

If the CURDATA bit in the REPORT ELEMENT INFORMATION CDB is set to one and a discovery is in progress or is required to update the element state information, the device server shall terminate the command with CHECK CONDITION status, with the sense key set to NOT READY, and the additional sense code set as described in SPC-3.

If the CURDATA bit in the REPORT ELEMENT INFORMATION CDB is set to one and an inventory scan is in progress or is required to update the element state information, 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 known 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 will always be the complete list of elements.

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 will be returned before any page code 02h pages).