memorandum

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T10/05-153r2

S To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Read Element Multi-identifiers	05 January 2005

Revision History

Revision 0 – Initial document.

Revision 1 – Not used

Revision 2 - Incorporated changes from September and November T10 meetings

Related Documents

smc3r00 – SCSI Media Changer Commands - 3 revision 00

spc3r22a – SCSI Primary Commands -3 revision 22a

Background

The Read Element Status command is used by applications to describe the contents of all elements within a media changer device. Several attributes about the elements are not currently captured, and media changer vendors have implemented several vendor unique methods for reporting those attributes. Application developers must know which vendor unique method to use with the Read Element Status information from a specific media changer.

Currently Read Element Status provides the MEDIUM TYPE field to report the type of medium in an element. The defined medium types do not contain all medium types commonly found in media changers so this field has not relieved the need for vendor unique methods of reporting medium type.

Read Element Status provides a method for reporting an SPC-2 vital product data device identifier for elements within the device server. Many element types require multiple device identifiers to describe the device. When a data transfer device returns multiple device identifiers, the media changer must return only one device identifier, and which identifier it returns varies by library vendor. Some vendors use this field to return the inquiry data and the serial number. Other vendors use the field to return the fibre channel port world wide name.

Media changer devices often contain multiple types of medium within a single changer. The medium types may be different generations of the same type or completely different types of medium that are incompatible with some of the data transfer devices. A method is needed to report which medium types can be used and which data transfer devices the medium is compatible with.

Many media changers are configurable and the physical location of a logical element can change depending on the configuration. Different tape sizes with different magazine sizes can change the capacity of the media changer and replacing storage slots with import/export slots or data transfer devices can change the number of elements. Since the configuration of a device can be changed dynamically it is not possible to label all of the elements in the media changer and mapping from a logical element to the physical element is difficult. A method is needed to report the physical location of an element so that an application can provide the user with that information to assist in error recovery or for bulk loading. Currently several library vendors have implemented vendor unique methods of reporting the physical locations. Those methods can only be reported by a few custom applications.

A method is proposed for extending the capabilities for reporting device descriptors so that multiple descriptors can be reported for a single element. New descriptors are defined for reporting the medium type and the physical location. A new command leveraged from the SSC Report Density Codes command is proposed for reporting the compatible medium types that can be reported in the Read Element Status data.

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.

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Changes to SMC-2

5.3.5 Data transfer element

A data transfer element represents the ~~interface between the media changer and a~~ data transfer device (e.g., a removable media optical disk drive or tape drive) that is controlled by the media changer device. A data transfer ~~element~~ device is considered to be part of the media changer and associated with the currently addressed logical unit. The data transfer element is not considered to be part of a data transfer device.

6.10 READ ELEMENT STATUS commands

6.10.1 READ ELEMENT STATUS introduction

The READ ELEMENT STATUS and READ ELEMENT STATUS ATTACHED commands (see table 12) request that the device server report the status of its internal elements to the application client. Support for the READ ELEMENT STATUS command is mandatory for independent media changers. Support for the READ ELEMENT STATUS ATTACHED command is mandatory for attached media changers.

Table 12 – READ ELEMENT STATUS & READ ELEMENT STATUS ATTACHED command

Bit/Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE							
1	Reserved			VOLTAG	ELEMENT TYPE CODE			
2	(MSB)							
3	STARTING ELEMENT ADDRESS							(LSB)
4	(MSB)							
5	NUMBER OF ELEMENTS							(LSB)
6	Reserved				MTDO	MID	CURDATA	DVCID
7	(MSB)							
8	ALLOCATION LENGTH							
9								(LSB)
10	Reserved							
11	CONTROL							

The NUMBER OF ELEMENTS field specifies the maximum number of element descriptors to be created by the device server for this command. 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 the element descriptors, the device server shall transfer all those descriptors whose complete contents fit within the allocation field and this shall not be considered an error.

If the multiple identifiers (MID) bit is set to one, the device server may return multiple device identifiers for each element. If the MID bit is set to zero, the device server shall return a single device identifier for each element. If the MID bit is set to one and the DVCID bit is set to zero, the device server shall return CHECK CONDITION status and shall set the sense key to ILLEGAL REQUEST and the additional sense code to INVALID FIELD IN CDB.

If the medium type descriptors only (MTDO) bit is set to zero, the device server shall return all available identifiers for all elements requested. If the MTDO bit is set to one, the device server shall only return the MEDIUM TYPE descriptor. If the MTDO bit is set to one, the MID bit shall also be set to one.

A device ID (DVCID) bit of one specifies that the device server shall return device identifiers (see 6.10.8), if available, for the specified range. A DVCID bit of zero specifies that the target shall not return device identifiers. If the DVCID is set to one and the device ID feature is not supported by the media changer, CHECK CONDITION status shall be returned. The sense key shall be set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

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6.10.4 Medium transport element descriptor

Table 16 defines the medium transport element descriptor.

Table 16 – Medium transport element descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB)	ELEMENT ADDRESS						
1								(LSB)
2	Reserved					EXCEPT	RSVD	FULL
3	Reserved							
4	ADDITIONAL SENSE CODE							
5	ADDITIONAL SENSE CODE QUALIFIER							
6		Reserved						
8								
9	SVALID	INVERT	Reserved		ED	MEDIUM TYPE		
10	(MSB)	SOURCE STORAGE ELEMENT ADDRESS						
11								(LSB)
. . .								
(36 Bytes)	PRIMARY VOLUME TAG INFORMATION (field omitted if PVOLTAG=0)							
(36 Bytes)	ALTERNATE VOLUME TAG INFORMATION (field omitted if AVOLTAG=0)							
. . .								
(4 Bytes)	MID HEADER (field omitted if MID=0)							
(x Bytes)	IDENTIFICATION DESCRIPTOR(S)							
. . .								
To z-1	Vendor-specific							

The MEDIUM TYPE field provides the type of medium currently present in the element as determined by the medium changer. Table 17 describes the values for the ~~Medium Type~~ MEDIUM TYPE field.

Table 17 – Medium Type codes

Code	Description
0h	Unspecified. The medium changer does not support this field, cannot determine the medium type, or the element is empty
1h	Data medium
2h	Cleaning medium
3h	Diagnostic medium
4h	WORM medium
5h	Microcode update medium
~~3h~~6h – 7h	Reserved

The SOURCE STORAGE ELEMENT ADDRESS field provides the address of the last storage element this unit of media occupied. This field is valid only if the SVALID bit is one.

The PRIMARY VOLUME TAG INFORMATION and ALTERNATE VOLUME TAG INFORMATION fields provide for identifying the unit of media residing in this element (see 5.4). Either or both of these fields may be omitted for all the element descriptor blocks that comprise an element status page as indicated by the PVOLTAG and AVOLTAG bits in the element status page header.

If the MID bit in the READ ELEMENT STATUS or READ ELEMENT STATUS ATTACHED CDB is set to one, the device server shall return the MID HEADER. If MID bit is set to zero, the device server shall not return the MID HEADER.

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The MID HEADER field describes the identifier data to follow and is defined in table y.

Table y: MID HEADER field

(1 Byte)	VALID	IDENTIFIER COUNT	
(1 Byte)	Reserved		
(1 Byte)	(MSB)	IDENTIFIERS LENGTH	
(1 Byte)			(LSB)

If the VALID bit is set to one, the MID header contains valid data. If the VALID bit is set to zero the device server has not implemented support for MID and no MID header is available.

Comment: SMC-2 has an identifier field in the location that will now contain an MID header. If the device server has implemented a vendor unique use of the bit now defined as MID, or if the device server does not check reserved bits and did not reject the command for INVALID FIELD IN CDB, then this location will contain an SMC-2 identifier. Using the VALID bit allows an application to detect that MID is not implemented and skip directly to parsing an identifier.

The IDENTIFIER COUNT field contains a count of the total number of identifiers to follow. If the identifiers field is truncated because of the allocation length, the IDENTIFIER COUNT field shall not be affected.

~~The CODE SET field and IDENTIFIER TYPE field are defined in 6.10.8.~~

The IDENTIFIERS LENGTH field contains the total length in bytes of the ~~IDENTIFIER field (see 6.10.8)~~ identifiers to follow. ~~If no device identifier is available, or the DVCID bit in the CDB is zero, the IDENTIFIERS LENGTH field shall be zero and the CODE SET and IDENTIFIER TYPE fields shall also be zero.~~ If the identifiers are truncated because of the allocation length, the IDENTIFIERS LENGTH field shall not be affected. The value of the IDENTIFIERS LENGTH field shall be the same for all elements of the same element type. If the sum of the length of the identifiers is not equal to the value of the IDENTIFIERS LENGTH field, the device server shall add padding bytes with the value 00h after the last identifier to make up the difference.

Comment: SMC-2 had padding in the identifier field to produce equal length fields. If a total field length is given the padding can be outside of the identifier field to allow for identifiers that are exactly the same as those returned in the VPD page.

~~The IDENTIFIER field provides a device identifier for this medium transport element as defined in .~~ The IDENTIFICATION DESCRIPTOR(S) field returns identification data, see section 6.10.8. If no ~~device~~ identifier is available for this element, or the DVCID bit in the READ ELEMENT STATUS OR READ ELEMENT STATUS ATTACHED CDB is zero, ~~this field~~ the device server shall ~~be omitted~~ return one zero length identification descriptor. If the DVCID bit is set to one and the MID bit is set to zero, the device server shall return one identification descriptor. If the DVCID bit is set to one and the MID bit is set to one the device server may return multiple identification descriptors.

NOTE: Returning a single identification descriptor when either DVCID is set to zero or DVCID is set to one and MID is set to zero is backwards compatible with SMC-2.

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6.10.5 Storage element descriptor

Table 18 defines the storage element descriptor.

Table 18: Storage element descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB)	ELEMENT ADDRESS						
1								(LSB)
2	Reserved				ACCESS	EXCEPT	RSVD	FULL
3	Reserved							
4	ADDITIONAL SENSE CODE							
5	ADDITIONAL SENSE CODE QUALIFIER							
6	Reserved							
7								
8								
9	SVALID	INVERT	Reserved		ED	MEDIUM TYPE		
10	(MSB)	SOURCE STORAGE ELEMENT ADDRESS						
11								(LSB)
. . .								
(36 Bytes)	PRIMARY VOLUME TAG INFORMATION (field omitted if PVOLTAG=0)							
(36 Bytes)	ALTERNATE VOLUME TAG INFORMATION (field omitted if AVOLTAG=0)							
. . .								
(4 Bytes)	MID HEADER (field omitted if MID=0)							
(x Bytes)	IDENTIFICATION DESCRIPTOR(S)							
. . .								
To z-1	Vendor-specific							

The SOURCE STORAGE ELEMENT ADDRESS field provides the address of the last storage element this unit of media occupied. This element address value may or may not be the same as this element. This field is valid only if the SVALID bit is one.

~~The CODE SET field and IDENTIFIER TYPE field are defined in 6.10.8.~~

~~The IDENTIFIER LENGTH field contains the length in bytes of the IDENTIFIER field (see 6.10.8). If no device identifier is available, or the DVCID bit in the CDB is zero, the IDENTIFIER LENGTH field shall be zero and the CODE SET and IDENTIFIER TYPE fields shall also be zero.~~

~~The IDENTIFIER field provides a device identifier for this storage element as defined in 6.10.8. If no device identifier is available for this element, or the DVCID bit in the CDB is zero, this field shall be omitted.~~

For fields not defined in this subclause, see 6.10.4.

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6.10.6 Import/export element descriptor

Table 19 defines the import/export element descriptor.

Table 19: Import/export element descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB)	ELEMENT ADDRESS						
1								(LSB)
2	OIR	CMC	INENAB	EXENAB	ACCESS	EXCEPT	IMPEXP	FULL
3	Reserved							
4	ADDITIONAL SENSE CODE							
5	ADDITIONAL SENSE CODE QUALIFIER							
6	Reserved							
7								
8								
9	SVALID	INVERT	Reserved		ED	MEDIUM TYPE		
10	(MSB)	SOURCE STORAGE ELEMENT ADDRESS						
11								(LSB)
. . .								
(36 Bytes)	PRIMARY VOLUME TAG INFORMATION (field omitted if PVOLTAG=0)							
(36 Bytes)	ALTERNATE VOLUME TAG INFORMATION (field omitted if AVOLTAG=0)							
. . .								
(4 Bytes)	MID HEADER (field omitted if MID=0)							
(x Bytes)	IDENTIFICATION DESCRIPTOR(S)							
. . .								
To z-1	Vendor-specific							

An import export (IMPEXP) bit of one indicates the unit of media in the import/export element was placed there by an operator. An IMPEXP bit of zero indicates the unit of media in the import/export element was placed there by the medium transport element.

~~The CODE SET field and IDENTIFIER TYPE field are defined in 6.10.8.~~

~~The IDENTIFIER LENGTH field contains the length in bytes of the IDENTIFIER field (see 6.10.8). If no device identifier is available, or the DVCID bit in the CDB is zero, the IDENTIFIER LENGTH field shall be zero and the CODE SET and IDENTIFIER TYPE fields shall also be zero.~~

~~The IDENTIFIER field provides a device identifier for this storage element as defined in 6.10.8. If no device identifier is available for this element, or the DVCID bit in the CDB is zero, this field shall be omitted.~~

For fields not defined in this subclause, see 6.10.4.

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6.10.7 Data transfer element descriptor

Table 20 defines the data transfer element descriptor.

Table 20: Data transfer element descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)			ELEMENT ADDRESS				
1								(LSB)
2	Reserved				ACCESS	EXCEPT	RSVD	FULL
3	Reserved							
4	ADDITIONAL SENSE CODE							
5	ADDITIONAL SENSE CODE QUALIFIER							
6	Obsolete	RSVD	Obsolete	Obsolete	RSVD	Obsolete		
7	Obsolete							
8	Reserved							
9	SVALID	INVERT	Reserved		ED	MEDIUM TYPE		
10	(MSB)			SOURCE STORAGE ELEMENT ADDRESS				
11								(LSB)
. . .								
(36 Bytes)	PRIMARY VOLUME TAG INFORMATION (field omitted if PVOLTAG=0)							
(36 Bytes)	ALTERNATE VOLUME TAG INFORMATION (field omitted if AVOLTAG=0)							
. . .								
(4 Bytes)	MID HEADER (field omitted if MID=0)							
(x Bytes)	IDENTIFICATION DESCRIPTOR(S)							
. . .								
To z-1	Vendor-specific							

An ACCESS bit value of one indicates access to the data transfer element by the medium transport element is allowed. A value of zero indicates access to the data transfer element by a medium transport element is denied.

NOTE 8— Access to the data transfer element by medium transport elements might be denied if a data transfer operation was under way. Note that a one value in this bit may not be sufficient to ensure a successful operation. This bit only reflects the best information available to the media changer device, which may not accurately reflect the state of the data transfer device.

~~The CODE SET field and IDENTIFIER TYPE field are defined in 6.10.8.~~

~~The IDENTIFIER LENGTH field contains the length in bytes of the IDENTIFIER field (see 6.10.8). If no device identifier is available, or the DVCID bit in the CDB is zero, the IDENTIFIER LENGTH field shall be zero and the CODE SET and IDENTIFIER TYPE fields shall also be zero.~~

~~The IDENTIFIER field provides a device identifier for this storage element as defined in 6.10.8. If no device identifier is available for this element, or the DVCID bit in the CDB is zero, this field shall be omitted.~~

For fields not defined in this subclause, see 6.10.4.

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6.10.8 Identification descriptor

Table 21 defines the identification descriptor ~~fields returned in element descriptors~~.

Table 21: Identification descriptor ~~fields~~

Bit / Byte	7	6	5	4	3	2	1	0
(1 Byte)	PROTOCOL IDENTIFIER				CODE SET			
(1 Byte)	PIV	Reserved	ASSOCIATION		IDENTIFIER TYPE			
(1 Byte)	Reserved				COMMAND SET SPECIFIC TYPE			
(1 Byte)	IDENTIFIER LENGTH (x)							
(x Bytes)	IDENTIFIER							

The CODE SET, PROTOCOL IDENTIFIER, ~~IDENTIFIER TYPE,~~ PIV, IDENTIFIER LENGTH and IDENTIFIER fields ~~in element descriptors~~ are defined by the device identification page in SPC-~~2~~3. Identification descriptors may be available for some or all elements in a media changer. If no identification descriptor is available or the DVCID bit in the CDB is zero, the IDENTIFIER LENGTH shall be zero, the IDENTIFIER field ~~is~~ shall be omitted, and the CODE SET ~~and~~, PROTOCOL IDENTIFIER, IDENTIFIER TYPE, ASSOCIATION, PIV and COMMAND SET SPECIFIC TYPE fields shall be zero.

~~Within the element descriptors for a single element status page, the device server may pad IDENTIFIER fields to the right with 00h to achieve a consistent length between such fields.~~

For a data transfer element, the IDENTIFIER field returns a device identifier from the data transfer device (e.g. disk or tape drive) associated with this element. If the COMMAND SET SPECIFIC TYPE field is set to zero, ~~with the exception of 00h padding in the IDENTIFIER field,~~ the same CODE SET, PROTOCOL IDENTIFIER, IDENTIFIER TYPE, ASSOCIATION, PIV, IDENTIFIER LENGTH and IDENTIFIER fields should be data that could be returned in response to ~~available via~~ an INQUIRY command (see SPC-~~2~~3) ~~issued~~ addressed to a logical unit in the data transfer device. The device server may provide identifiers that are not reported by the data transfer device.

Comment: The SMC device is required to return a T10 format identifier with specific contents. That identifier may not be reported by the data transfer device or the data transfer device may not be a SCSI device. The identifier reported by the SMC device will be one that a SCSI data transfer device could report.

For an import/export element, the IDENTIFIER field returns a unique identifier for the import/export device. An element used to exchange media between two media changers should return the same CODE SET, PROTOCOL IDENTIFIER, IDENTIFIER TYPE, ASSOCIATION, PIV, IDENTIFIER LENGTH and IDENTIFIER fields via either media changer.

For a storage or medium transport element the CODE SET, PROTOCOL IDENTIFIER, IDENTIFIER TYPE, ASSOCIATION, PIV, IDENTIFIER LENGTH and IDENTIFIER fields refer to the element, and are not an identifier for a volume stored in this location.

If the MID bit is set to one, a medium changer element may have more than one identification descriptor (e.g., if the element supports several types or associations of identifier). The device server may report any of the device identifier types defined in SPC-3. In addition the device server may report command set specific identification descriptors:

a) Medium type
b) Compatible Medium List
c) Element location

If the MID bit is set to one, the first identification descriptor in a data transfer element descriptor shall be a T10 vendor ID based logical unit identifier with the IDENTIFIER the field created by concatenating the PRODUCT IDENTIFICATION field from the standard INQUIRY data (see SPC-3) and the PRODUCT SERIAL NUMBER field from the Unit Serial Number VPD page (see SPC-3).

NOTE: The T10 logical unit identifier with this format provides the information commonly used by application clients to map the data transfer device reported by the medium changer to the data transfer device interface path.

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The ASSOCIATION field (see table y+1) indicates the entity with which the IDENTIFIER field is associated. If the COMMAND SET SPECIFIC IDENTIFIER TYPE field is set to a value other than zero, the ASSOCIATION field shall be set to 10b.

Table y+1 – ASSOCIATION field

Code	Element descriptor type	Description
00b	Data transfer	The IDENTIFIER field is associated with a logical unit in a data transfer device.
	Import/Export, Medium transport, or Storage	The IDENTIFIER field is associated with the addressed logical unit.
01b	Data transfer	The IDENTIFIER field is associated with a target port in a data transfer device.
	Import/Export, Medium transport, or Storage	The IDENTIFIER field is associated with the target port that received the request.
10b	Data transfer	The IDENTIFIER field is associated with a data transfer device.
	Import/Export, Medium transport, or Storage	The IDENTIFIER field is associated with SCSI target device that contains the addressed logical unit.
11b	Any	Reserved

The IDENTIFIER TYPE field is defined by the device identification VPD page in SPC-3. If the COMMAND SET SPECIFIC IDENTIFIER TYPE field is set to a value other than zero, the IDENTIFIER TYPE field contents are reserved.

The COMMAND SET SPECIFIC TYPE field (see table y+2) indicates the format for the identifier for those identifier formats specific to this standard.

Table y+2: COMMAND SET SPECIFIC TYPE field

Code	Identifier Type
0h	Device identifier (see SPC-3)
1h	Medium type
2h	Compatible Medium List
3h	Element location
3h – Fh	Reserved

If the COMMAND SET SPECIFIC TYPE field is set to 1h, the identifier has the format shown in table y+3.

Table y+3: Medium Type identifier field format

Bit / Byte	7	6	5	4	3	2	1	0
0	PRIMARY MEDIUM TYPE CODE							
1	SECONDARY MEDIUM TYPE CODE							
2	Reserved							
3	Reserved							

The PRIMARY MEDIUM TYPE CODE field and the SECONDARY MEDIUM TYPE CODE field contain values returned in a medium type supported descriptor by the REPORT MEDIUM TYPES SUPPORTED command.

Empty elements capable of holding any medium type supported by the drives currently installed shall report a medium type identifier with the PRIMARY MEDIUM TYPE CODE set to universal (00h) and the SECONDARY MEDIUM TYPE CODE set to universal (00h). Empty elements capable of holding only one medium type shall report a medium type identifier with the PRIMARY MEDIUM TYPE CODE set to the supported primary medium type and the secondary medium type code set to universal (00h).

If the COMMAND SET SPECIFIC TYPE field is set to 2h, the identifier has the format shown in table y+4.

Table y+4: Compatible Medium List identifier field format

Bit / Byte	7	6	5	4	3	2	1	0
1	First COMPATIBLE PRIMARY MEDIUM TYPE CODE							

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Bit / Byte	7	6	5	4	3	2	1	0
2	Second COMPATIBLE PRIMARY MEDIUM TYPE CODE							
:	:							
w	Last COMPATIBLE PRIMARY MEDIUM TYPE CODE							

The COMPATIBLE MEDIUM TYPE CODE fields contain values returned as PRIMARY MEDIUM TYPE CODES in a medium type supported descriptor by the REPORT MEDIUM TYPES SUPPORTED command. All medium with a PRIMARY MEDIUM TYPE CODE reported in this list shall be supported by the element reporting this descriptor.

Empty elements capable of holding 2 or more primary medium types but not capable of holding all medium types supported by the currently installed drives shall reported a COMPATIBLE MEDIUM LIST identifier.

If the COMMAND SET SPECIFIC TYPE field is set to 3h, the identifier has the format shown in table y+5.

Table y+5: Element Location identifier field format

Bit / Byte	7	6	5	4	3	2	1	0
0	ELEMENT LOCATION DESCRIPTOR COUNT				CODE SET			
1	Reserved							
2	(MSB)	ELEMENT LOCATION IDENTIFIER LENGTH (x-4)						
3								(LSB)
x bytes	Element location descriptors							

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

The ELEMENT LOCATION DESCRIPTOR COUNT field specifies the number of element location descriptors that describe the element location.

The CODE SET field indicates the code set used for the IDENTIFIER field, as described in table y+5. This field is intended to be an aid to software that displays the IDENTIFIER field.

Table y+6 – CODE SET field

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

COMMENT: The definition of the CODE SET field follows that of the CODE SET field in SPC-3 (see spc3r22a, 7.6.3.1 *Device identification VPD page overview*).

The ELEMENT LOCATION IDENTIFIER LENGTH field indicates the length in bytes of the element location descriptors, as described in table y+6.

Table y+7: Element location descriptor format

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

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Bit / Byte	7	6	5	4	3	2	1	0
1 byte	Reserved							
w bytes	ELEMENT COORDINATE							

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

Comment: The ELEMENT LOCATION IDENTIFIER LENGTH field is not absolutely required since the same value could be generated by multiplying the number of element location descriptors by the length of each descriptor. Having fixed length descriptors is not absolutely necessary but having a total identifier length that is fixed is required so that all elements of a given type can return the same data length. If fixed length descriptors are not used then some method of reporting the length of each descriptor is required.

The ELEMENT COORDINATE field specifies a physical location coordinate for this element within the media changer device using vendor-specific coordinate system.

NOTE: The element location identifier provides a way for the device server to describe the location of an element. An application client may report the location description. The device server may use multiple fields for multi-dimensional (e.g. X-Y) coordinate system.

6.x REPORT MEDIUM TYPES SUPPORTED command

The REPORT MEDIUM TYPES SUPPORTED command (see table y+8) requests that information regarding the supported medium types for the logical unit be sent to the application client.

Table y+8 – REPORT MEDIUM TYPES SUPPORTED command

Bit / Byte	7	6	5	4	3	2	1	0
0	OPERATION CODE (44h)							
1	Reserved							INSTLD
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB)	ALLOCATION LENGTH						
8								(LSB)
9	CONTROL							

See SPC-3 for the definition of the OPERATION CODE, ALLOCATION LENGTH, and CONTROL fields.

A INSTLD bit set to zero specifies that the device server shall return medium type supported descriptors for all medium types supported by the logical unit even if the currently installed data transfer devices do not support all of these medium types. An INSTLD bit set to one specifies the device server shall return medium type supported descriptors for medium types supported by the currently installed data transfer devices. If the INSTLD bit is set to one and the logical unit either does not contain a data transfer device or contains a data transfer device but cannot determine the supported medium types (e.g. during power on when the media changer has not yet determined the data transfer device type), the device server shall return CHECK CONDITION status and shall set the sense key to NOT READY.

The REPORT MEDIUM TYPES SUPPORTED command returns a medium types supported header (see table y+9) followed by one of more medium type supported descriptors (see table y+10).

Table y+9: Medium types supported header

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)	MEDIUM TYPES SUPPORTED LENGTH (n-1)						
1								(LSB)

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2	Reserved
3	Reserved
4	Medium type supported descriptors
n	

The MEDIUM TYPES SUPPORTED LENGTH field specifies the length in bytes of the following data that is available to be transferred. The medium types supported length does not include the number of bytes in the MEDIUM TYPES SUPPORTED LENGTH field. If the device server truncates parameter data due to an insufficient allocation length, it shall not alter the MEDIUM TYPES SUPPORTED LENGTH field to reflect the truncation.

The device server may return multiple medium type supported descriptors with the same PRIMARY MEDIUM TYPE CODE or with the same PRIMARY MEDIUM TYPE CODE and the same SECONDARY MEDIUM TYPE CODE. The device server shall order the medium type supported descriptors by:

1. Ascending PRIMARY MEDIUM TYPE CODE;
2. Ascending SECONDARY MEDIUM TYPE CODE;
3. Most to least preferred DATA TRANSFER DEVICE VENDOR ID; and
4. Most to least preferred DATA TRANSFER DEVICE PRODUCT ID.

If multiple supported data transfer device types use the same medium type, then the device server shall return one medium type supported descriptor for each data transfer device type that uses this media type. The device server shall return these media type supported descriptors in order from most to least preferred data transfer device type.

NOTE: This ordering allows a media changer device to support of multiple generations of data transfer devices. It also allows a media changer device to support multiple vendors' versions of the same generation data transfer device.

Table y+10: Medium type supported descriptor

Byte \ Bit	7	6	5	4	3	2	1	0
0	PRIMARY MEDIUM TYPE CODE							
1	SECONDARY MEDIUM TYPE CODE							
2	WRTOK	DUP	DEFLT	MAM	Reserved			
3	Reserved					MEDIUM TYPE		
4	MODE SELECT MEDIUM TYPE							
5	MODE SELECT DENSITY CODE							
6	Reserved							
7	Reserved							
8	(MSB)	DATA TRANSFER DEVICE VENDOR ID						
15								(LSB)
16	(MSB)	DATA TRANSFER DEVICE PRODUCT ID						
31								(LSB)
32	(MSB)	DESCRIPTION						
63								(LSB)

The PRIMARY MEDIUM TYPE CODE field and the SECONDARY MEDIUM TYPE CODE field contain the values (see table y+10) returned in the medium type identifier of a READ ELEMENT STATUS command for the medium type described by the remainder of this medium type supported descriptor.

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The PRIMARY MEDIUM TYPE CODE shall be the same for all physically compatible medium supported by the device server. Any medium with physical difference that causes incompatibility with one or more elements in the device server shall have a different PRIMARY MEDIUM TYPE CODE.

Comment: There has been some disagreement among vendors whether "almost compatible" medium needs to have a different PRIMARY MEDIUM TYPE CODE. Some medium families have added minor physical features to prevent loading a new medium type into an old drive. Under this definition the new medium must have a different PRIMARY MEDIUM TYPE CODE.

The SECONDARY MEDIUM TYPE CODE field shall be the same for all medium of the same type within a PRIMARY MEDIUM TYPE. If the device server is able to detect different medium capacities the SECONDARY MEDIUM TYPE CODE should be different for each capacity point.

Table y+11 – PRIMARY MEDIUM TYPE CODE AND SECONDARY MEDIUM TYPE CODE values

PRIMARY MEDIUM TYPE CODE	SECONDARY MEDIUM TYPE CODE	Description
00h	00h	Universal medium type
01h - FEh	00h - FEh	Vendor-specific
01h - FEh	FFh	Primary medium type vendor-specific; Secondary medium type unknown
FFh	FFh	Unknown medium type

A WRTOK bit set to zero specifies that the described data transfer device does not support writing to the media at this density. A WRTOK bit set to one specifies that the described data transfer device supports writing to the media at this density. The described data transfer device shall support reading from the media at this density.

A DUP bit set to zero specifies that exactly one medium types supported descriptor in the parameter list contains this combination of PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values. A DUP bit set to one specifies that more than one medium types supported descriptors in the parameter list contains this combination of PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values. If the DUP bit is set to one, more than one data transfer device type is capable of reading the described medium type.

A DEFLT bit set to zero specifies that this medium type is not the default medium type of the described data transfer device. A DEFLT bit set to one specifies that this medium type is the default medium type of the described data transfer device.

A MAM bit set to zero specifies that the medium type does not support Medium Auxiliary Memory (MAM, see SPC-3). A MAM bit set to one specifies that the medium type, when used with the described data transfer device type, supports MAM.

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

The MODE SELECT MEDIUM TYPE field shall be the MEDIUM TYPE value reported by the data transfer device in the mode select header (see SPC-3).

The MODE SELECT DENSITY CODE field shall be the DENSITY CODE value reported by the data transfer device in the mode select block descriptor (see SPC-3).

The DATA TRANSFER DEVICE VENDOR ID field contains eight bytes of left-aligned ASCII data (see SPC-3) identifying the vendor of the data transfer device that supports medium with this PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values. This parameter shall have the same value as the T10 VENDOR IDENTIFICATION field reported by the data transfer device in its standard INQUIRY data (see SPC-3).

The DATA TRANSFER DEVICE PRODUCT ID field contains sixteen bytes of left-aligned ASCII data (see SPC-3) identifying the data transfer device that supports medium with this PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values. This parameter shall have the same value as the PRODUCT IDENTIFICATION field reported by the data transfer device in its standard INQUIRY data (see SPC-3).

The DESCRIPTION field contains thirty two bytes of left-aligned ASCII data (see SPC-3) describing the medium type with this PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values.