memorandum

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T10/05-259r1

To	From	Subject	Date
INCITS T10 Committee	Curtis Ballard, HP Michael Banther, HP	Read Element Media Descriptor	6 January 2006

Revision History

Revision 0 – Initial document.

Revision 1 – Changes from September and November T10 meetings

Related Documents

smc3r00 – SCSI Media Changer Commands - 3 revision 00

spc3r22a – SCSI Primary Commands -3 revision 22a

05-153 – Read Element Multi-identifiers

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.

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

Currently READ ELEMENT STATUS provides the MEDIA TYPE field to report the type of media in an element. The defined media types do not contain all media types commonly found in media changers so this field has not relieved the need for vendor unique methods of reporting media type.

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 adding a media descriptor to each of the element descriptors returned by the READ ELEMENT STATUS command. The new descriptor provides reporting of the media type and the physical location. A new command leveraged from the SSC REPORT DENSITY CODES command is proposed for reporting the compatible media types that can be reported in the Read Element Status data.

This proposal presents one solution to the problems described above. An alternative solution appears in 05-153 – Read Element Multi-identifiers.

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

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					MD	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 media descriptor (MD) bit is set to one, the device server shall return the media descriptor with each element returned. If the MD bit is set to zero, the device server shall not return the media descriptor for any element.

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	Reserved	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)							
. . .								
(1 byte)	Reserved				CODE SET			
(1 byte)	Reserved				IDENTIFIER TYPE			
(1 byte)	Reserved							
(1 byte)	IDENTIFIER LENGTH (x)							
(x bytes)	IDENTIFIER							
(w bytes)	Media descriptor							
. . .								
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
~~3~~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 IDENTIFIER field provides a device identifier for this medium transport element as defined in SPC-3. If no device identifier is available for this element~~,~~ or the DVCID bit in the CDB is zero, this field shall be omitted.

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The media descriptor describes the medium in the medium transport element (see 6.10.9). If the MD bit in the READ ELEMENT STATUS or READ ELEMENT STATUS ATTACHED CDB is set to one, the device server shall return the media descriptor. If MD bit is set to zero, the device server shall not return the media descriptor.

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	Reserved	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)							
. . .								
(1 byte)	Reserved				CODE SET			
(1 byte)	Reserved				IDENTIFIER TYPE			
(1 byte)	Reserved							
(1 byte)	IDENTIFIER LENGTH (x)							
(x bytes)	IDENTIFIER							
(w bytes)	Media descriptor							
. . .								
To z-1	Vendor-specific							

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)							
. . .								
(1 byte)	Reserved				CODE SET			
(1 byte)	Reserved				IDENTIFIER TYPE			
(1 byte)	Reserved							
(1 byte)	IDENTIFIER LENGTH (x)							
(x bytes)	IDENTIFIER							
(w bytes)	Media descriptor							
. . .								
To z-1	Vendor-specific							

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

Byte \ Bit	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)							
. . .								
(1 byte)	Reserved				CODE SET			
(1 byte)	Reserved				IDENTIFIER TYPE			
(1 byte)	Reserved							
(1 byte)	IDENTIFIER LENGTH (x)							
(x bytes)	IDENTIFIER							
(w bytes)	Media descriptor							
. . .								
To z-1	Vendor-specific							

For fields not defined in this subclause, see 6.10.4.

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6.10.9 Media descriptor

Table y defines the media descriptor.

Table y - Media descriptor format

Bit / Byte	7	6	5	4	3	2	1	0
0	PF	LENGTH (w)						
1	Reserved				CODE SET			
2	MEDIUM PRIMARY MEDIA TYPE CODE							
3	MEDIUM SECONDARY MEDIA TYPE CODE							
4	ELEMENT COMPATIBLE PRIMARY MEDIUM TYPE CODE 1							
5	ELEMENT COMPATIBLE PRIMARY MEDIUM TYPE CODE 2							
	:							
n+3	ELEMENT COMPATIBILE PRIMARY MEDIA TYPE CODE n							
w-1	LOCATION							

A Page Format (PF) bit set to one indicates that the fields of the media descriptor conform to this standard. A PF bit set to zero indicates that the device server reports the media type descriptor using a vendor-specific format.

Comment: This proposal includes the PF bit because multiple tape libraries currently use the bit defined here as MD and return the data in the bytes defined here to return media descriptors, but these tape libraries do not report their data in the proposed format. However these tape libraries always set the PF bit to zero. Technically these libraries return their data in the vendor unique section so the PF bit is not required provided ISV software uses the length fields correctly. However some applications have hard coded RES data byte locations.

The CODE SET field indicates the code set used for the LOCATION field, as described in table y+1. This field is intended to be an aid to software that displays the LOCATION field.

Table y+1 – CODE SET field

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

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

The MEDIUM PRIMARY MEDIUM TYPE CODE field and the MEDIUM SECONDARY MEDIUM TYPE CODE field contain values returned in a medium type supported descriptor by the REPORT MEDIUM TYPES SUPPORTED command. The value of the MEDIUM PRIMARY MEDIUM TYPE CODE field and MEDIUM SECONDARY MEDIUM TYPE CODE field shall indicate the type of medium currently in the element. If the element does not contain a medium, the device server shall return unknown medium type, FFh.

The ELEMENT COMPATIBLE PRIMARY MEDIUM TYPE CODE fields 1-n shall return values returned in a medium types supported descriptor by the REPORT MEDIUM TYPES SUPPORTED command for PRIMARY MEDIUM TYPE. Any element with a PRIMARY MEDIUM TYPE matching one of the ELEMENT COMPATIBLE PRIMARY MEDIUM TYPE codes 1-n may be stored in this element. No element may report the unknown medium type, FFh, in a compatible medium type codes list. All medium types currently installed in the media changer that are may be stored in this element shall be listed unless the universal medium type, 00h, is reported as the first COMPATIBLE PRIMARY MEDIUM TYPE CODE.

The LOCATION field contains a vendor-specific value describing the location of the element. It may be a text description of the location suitable for an end user or may be a coordinate value or other value suitable for programmatic use.

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6.x REPORT MEDIum TYPES SUPPORTED command

The REPORT MEDIUM TYPES SUPPORTED command (see table y+2) requests that information regarding the supported medium types for the logical unit be sent to the application client.

Table y+2 – 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+3) followed by one of more medium type supported descriptors (see table y+4).

Table y+3: Medium types supported header

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

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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 MEDIA TYPE CODE. The device server shall order the media 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+4: 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+5) 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.

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.

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Table y+5 – 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 media type with this PRIMARY MEDIUM TYPE CODE and SECONDARY MEDIUM TYPE CODE values.