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To: X3T9.2 SCSI-2 Working Group and X3T9.2 Committee Members

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Subj: Inquiry Command with VPD Information

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Attached for your review is the Inquiry command with the Vital Product Data information from Greg Floryance incorporated.

The incorporation of VPD was already accepted by the committee but did not make it into the Rev 2 draft due to the time frame. This document is the Inquiry command from the Rev 2 draft with VPD that will be included in the next revision of the SCSI-2 draft spec.

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INQUIRY Command

Peripheral Device Type: All
Operation Code Type: Mandatory

INQUIRY Command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number			Reserved				
2	EVPD	T/L	Reserved			Desired Data Format		
3	VPD Identifier			Reserved				
4	Allocation Length							
5	Control Byte							

The INQUIRY command (Table 7-11) requests that information regarding parameters of the target and its attached peripheral device(s) be sent to the initiator. Several options allow the initiator to request detailed Vital Product Data (VPD) information about the target or associated LUN (see section 7. . .).

[the DDF is still under debate]

The desired data format field specifies the desired format for the INQUIRY data. This field is analogous to the response data format field in the INQUIRY data. A desired data format of zero indicates that the INQUIRY data should be returned in the format specified by ANSI X3.131-1986 if the target supports this format. A desired data format of one indicates that the INQUIRY data should be returned in a format that is compatible with an interim document (commonly called, CCS), which was developed prior to the generation of this standard, if the target supports this format. A desired data format of two indicates that the INQUIRY data shall be returned as specified in this standard. Desired data formats of 3h through Fh are reserved.

IMPLEMENTORS NOTE: The only mandatory format is 2h. If the target does not support the requested format, it should return another supported format. In any case, the response data format field identifies the actual format returned.

An Enable Vital Product Data (EVPD) bit of one specifies that the target shall return the optional vital product data (VPD) specified by the Target/LUN bit and the Vital Product Data Identifier field. If the target does not support VPD information and this bit is set to one the target shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and an additional sense code of Illegal Field in CDB.

An EVPD bit of zero specifies that the target shall return the standard inquiry data. If the Target/LUN bit and the Vital Product Data Identifier field are not zero the target shall return CHECK CONDITION status with the sense key set to to ILLEGAL REQUEST and an additional sense code of Illegal Field in CDB.
[Should the T/L bit be valid for normal mode too?]

A Target/LUN (T/L) bit of one specifies that the requested VPD shall correspond to the target (not the LUN) specified by the initiator during the selection phase. If VPD information for the target is not supported the target shall return CHECK CONDITION status with the sense key set to to ILLEGAL REQUEST and an additional sense code of Illegal Field in CDB.

A T/L bit of zero specifies that the requested VPD shall correspond to the LUN specified in the identify message sent immediately after the selection phase. If VPD information for the LUN is not supported the target shall return CHECK CONDITION status with the sense key set to to ILLEGAL REQUEST and an additional sense code of Illegal Field in CDB.

The Vital Product Data Identifier field specifies which page of VPD information the target shall return (see section 7. . .).

The allocation length specifies the maximum number of bytes that the initiator has allocated for returned INQUIRY data. An allocation length of zero indicates that no INQUIRY data shall be transferred. This condition shall not be considered as an error. The target shall terminate the DATA IN phase when allocation length bytes have been transferred or when all available INQUIRY data have been transferred to the initiator, whichever is less.

The INQUIRY command shall return a CHECK CONDITION status only when the target cannot return the requested INQUIRY data.

IMPLEMENTORS NOTE: It is recommended that the INQUIRY data be returned even though the peripheral device may not be ready for other commands.

If an INQUIRY command is received from an initiator with a pending unit attention condition (i.e., before the target reports CHECK CONDITION status), the target shall perform the INQUIRY command and shall not clear the unit attention condition. (See 6.1.3.)

Standard Inquiry Data

The standard INQUIRY data (Table 7-12) contains 36 required bytes, followed by a variable number of vendor-unique parameters. Bytes 56 68 through 95, if returned, are reserved for future standardization. The target shall return the standard inquiry data when the EVPD bit is set to zero.

IMPLEMENTORS NOTE: The INQUIRY command is typically used by the initiator at reset or power-up to determine the device types for system configuration. To minimize delays after a reset or power-up the standard Inquiry Data should be available without incurring any media access delays.

Standard INQUIRY Data Format

Byte \ Bit	7	6	5	4	3	2	1	0
0	Qualifier			Peripheral Device Type				
1	RMB	Device-Type Qualifier						
2	ISO Version		ECMA Version		ANSI-Approved Version			
3	Reserved				Response Data Format			
4	Additional Length (n-4)							
5	Reserved							
6	Reserved							
7	Reserved							
8 - 15	(MSB) Vendor Identification (LSB)							
16 - 31	(MSB) Product Identification (LSB)							
32 - 35	(MSB) Product Revision Level (LSB)							
36 - 55	Vendor Unique							
56 - 67	Product Serial Number							
68 - 95	Reserved							
	Vendor Unique Parameters							
96 to n	Vendor Unique Parameter Bytes							

The peripheral device type and qualifier fields identifies the physical device currently connected to the logical unit. If the Target is not capable of supporting a physical device on this logical unit this field shall be set to 7Fh (qualifier set to 0 1 1 and peripheral device type set to 1Fh). The peripheral device type qualifiers are shown in table 7-13 and the peripheral device types are shown in table 7-14.

Peripheral Device Type Qualifier

Qualifier	Description
0 0 0	The peripheral device type identified in bits 0 through 4 (defined in table 7-11) is currently connected to this logical unit. If the Target cannot determine whether or not a physical device is currently connected it shall also use this qualifier when returning the Inquiry data. Note: This qualifier does not imply that the device is ready for access by the Initiator.
0 0 1	The Target is capable of supporting the peripheral device type identified in bits 0 through 4 (defined in table 7-11) on this logical unit. However, the physical device is not currently connected to this logical unit.
0 1 0	Reserved
0 1 1	The logical unit is not capable of supporting a physical device. For this qualifier the peripheral device type in bits 0 through 4 must be set to 1Fh to provide compatibility with previous versions of SCSI. All other peripheral device type values in bits 0 through 4 are reserved for this qualifier.
1 X X	Vendor Unique

Peripheral Device Type

Code	Description
00h	Direct-access device (e.g., magnetic disk)
01h	Sequential-access device (e.g., magnetic tape)
02h	Printer device
03h	Processor device
04h	Write-once read-multiple device (e.g., some optical disks)
05h	Read-only direct-access device (e.g., some optical disks)
06h	Scanner devices
07h	Optical memory devices (e.g., some optical disks)
08h	Changer devices (e.g., jukeboxes)
09h	Communications devices
0Ah - 1Dh	Reserved
1Eh	Target Device (valid only when the EVPD and T/L bits are set to one)
1Fh	Unknown Device Type

A removable medium (RMB) bit of zero indicates that the medium is not removable. A RMB bit of one indicates that the medium is removable.

The device-type qualifier is a seven-bit user-specified code. This code may be set with switches or by some other means by the target or peripheral device. SCSI devices that do not support this feature shall return all zero bits. This feature allows each user to assign unique codes to each specific type of peripheral device that is supported on the system being used. These codes may then be used by self-configuring software to determine what specific peripheral device is at each logical unit number. This is especially valuable for systems that support multiple types of removable medium.

The usage of nonzero code values in the ISO version and ECMA version fields are defined by the International Organization for Standardization and the European Computer Manufacturers Association, respectively. A zero code value in these fields shall indicate that the target does not claim compliance to the ISO version of SCSI (ISO DP 9316) or the ECMA version of SCSI (ECMA-111). It is possible to claim compliance to more than one of these SCSI standards.

The ANSI-approved version indicates the implemented version of this standard and is defined as shown in Table 7-15.

ANSI-Approved Version

Code	Description
0h	Used by products developed prior to X3.131-1986 approval.
1h	Current standard (ANSI X3.131-1986).
2h	This version. This code is reserved to designate this standard upon approval by ANSI.
3h - 7h	Reserved

A response data format value of zero indicates the INQUIRY data format is as specified in ANSI X3.131-1986. A response data format value of one indicates compatibility with some products that were designed prior to the development of this standard (i.e., CCS). A response data format value of two indicates that the data will be in the format specified in this document. Response data format values greater than two are reserved.

The additional length shall specify the length in bytes of the parameters. If the allocation length of the command descriptor block is too small to transfer all of the parameters, the additional length shall not be adjusted to reflect the truncation.

ASCII data fields shall contain only graphic codes (i.e., code values 20h through 7Eh). Left-aligned fields shall place any unused bytes at the end of the field (highest offset) and the unused bytes shall be filled with space characters (20h). Right-aligned fields shall place any unused bytes at the start of the field (lowest offset) and the unused bytes shall be filled with space characters (20h).

The vendor identification field contains eight bytes of ASCII data identifying the vendor of the product. The data shall be left aligned within this field. Vendor identification assignments are contained in appendix _. [Is this a reasonable way to do this? Or should we reference a separate document maintained by CBEMA? Or should we just make this field "big enough" to assure uniqueness? This issue has been sent to X3T9 for consideration; meanwhile this information will be maintained in document X3T9.2/87-125.]

The product identification field contains sixteen bytes of ASCII data as defined by the vendor. The data shall be left-aligned within this field.

The product revision level field contains four bytes of ASCII data as defined by the vendor. The data shall be left-aligned within this field.

The product serial number field contains twelve bytes of ASCII data as defined by the vendor. The data shall be right-aligned within this field.

INQUIRY Vital Product Data

[The Request Sense command needs to distinguish between Target and LUN for the FRU and error fields. Example is how to distinguish if both Target and LUN have loadable firmware and one fails. Another example is the confusion arising when a target from manufacturer 1 has the same FRU or error codes as an attached LUN from manufacturer 2. One other area of concern is stating that FRU numbers returned by Request Sense will either return valid VPD data when used in Inquiry or will not return any VPD data. They should not return VPD data that is not for the intended FRU. How to keep all this straight when various manufacturers drives are connected to a single controller has to be worked out. G. Floryance/P. Nitzal

The optional VPD information consists of individual pieces of information such as configuration data (vendor ID, product ID, model, serial number), manufacturing data (plant and date of manufacture), field replaceable unit (FRU) data and other vendor/device specific data. Each piece of information can be treated individually as well as included in one or more groups of related information.

The initiator requests the target to return VPD information using the EVPD bit, T/L bit and VPD Identifier field in the CDB. The VPD Identifier specifies which VPD page the target shall return as defined in table 7- . If the target does not support the requested VPD page it shall return CHECK CONDITION status with a sense key of ILLEGAL REQUEST and an additional sense code of Illegal Field in CDB.

IMPLEMENTORS NOTE: It is recommended that the target have the ability to execute the INQUIRY command even when a device error occurs which prohibits normal command execution. In such a degraded case, a CHECK CONDITION would be returned for a command (other than inquiry or request sense) and the sense data may contain the failing FRU ID. The VPD information could then be obtained for the failing device using the INQUIRY command.

IMPLEMENTORS NOTE: This document defines a format which allows device independent initiator software to display VPD information returned by the INQUIRY command. For example, the initiator may display the VPD information associated with a defective Field Replaceable Unit (FRU) returned in the sense data (byte 14). However, the contents of the VPD information is vendor unique and may not be usable by the initiator without detailed knowledge of the device.

IMPLEMENTORS NOTE: This document does not attempt to define the location or method of storing the VPD information. The initial availability of the data may require a motor spin-up, completion of diagnostics or other device dependent delay. Time critical requirements are an implementation consideration and are not addressed in this document.

Vital Product Data Identifiers

Identifier	Description
00h	Return a List of VPD Identifiers Supported by the target or LUN
01h - 7Fh	VPD information for the FRU code returned in the sense data
80h	ROM Software code Revision level
81h	RAM Software code Revision level
82h	Hardware Revision level
83h	Unit Serial Number
84h	Manufacturing Data (Manufacturer, Plant, Date, etc.)
85h - BFh	Reserved
C0h - FFh	Vendor Unique

Format for Supported VPD Identifiers Page (VPD Identifier 00h)

Bit / Byte	7	6	5	4	3	2	1	0
0	Qualifier			Peripheral Device Type				
1	Reserved							
2	Reserved							
3	Reserved							
4	EVPD	T/L	Reserved					
5	VPD Identifier							
6	Reserved							
7	Additional Length (n-7)							
8	First Supported VPD Identifier							
9	Second Supported VPD Identifier							
.	.							
.	.							
.	.							
n	Last Supported VPD Identifier							

The valid Peripheral Device Type Qualifiers are shown in table 7-13 and the valid Peripheral Device Types are shown in table 7-14.

The EVPD bit shall be set to the value of the EVPD bit in the CDB.

The T/L bit shall be set to the value of the T/L bit in the CDB.

The VPD Identifier field shall be set to the value of the VPD Identifier field in the CDB.

The Additional Length field shall specify the length in bytes of the parameters that follow the Additional Length field (byte 7). If the allocation length of the command descriptor block is too small to transfer all of the parameters, the additional length shall not be adjusted to reflect the truncation.

The additional parameters shall contain a list of all the VPD pages supported by the target or LUN. Each byte in the parameters contains the VPD Identifier for a VPD page supported by the target (T/L set to one) or LUN (T/L set to zero). This list shall be in ascending order.

Page Format for VPD Identifiers 01h through FFh

Bit / Byte	7	6	5	4	3	2	1	0
0	Qualifier			Peripheral Device Type				
1	Reserved							
2	Reserved							
3	Reserved							
4	EVPD	T/L	Reserved					
5	VPD Identifier							
6	Vendor Unique VPD Length							
7	ASCII VPD Length (n-7)							
8 - n	ASCII VPD Information							
n+1 - nn	Vendor Unique VPD Information							

The valid Peripheral Device Type Qualifiers are shown in table 7-13 and the valid Peripheral Device Types are shown in table 7-14.

The EVPD bit shall be set to the value of the EVPD bit in the CDB.

The T/L bit shall be set to the value of the T/L bit in the CDB.

The VPD Identifier field shall be set to the value of the VPD Identifier field in the CDB.

The Vendor Unique VPD Length field shall specify the length in bytes of the vendor unique VPD information that follows the ASCII VPD Information field. If the allocation length of the command descriptor block is too small to transfer all of the data, the vendor unique VPD length shall not be adjusted to reflect the truncation. A value of zero in this field indicates that no vendor unique VPD information is available for the specified VPD identifier.

The ASCII VPD Length field shall specify the length in bytes of the ASCII VPD information that follows this field (byte 7). If the allocation length of the command descriptor block is too small to transfer all of the ASCII VPD data, the ASCII VPD length shall not be adjusted to reflect the truncation. A value of zero in this field indicates that no ASCII VPD information is available for the specified VPD identifier.

The ASCII VPD Information field shall contain the ASCII VPD for the VPD Identifier and Target/LUN specified in the CDB. This data in this field shall be formatted in lines (or character strings) to allow it to be directly displayed on the system console. Each line shall contain only graphic codes (i.e., code values 20h through 7Eh) and shall be terminated with a NULL (00h) character.

IMPLEMENTORS NOTE: The data in this field allows device independent software to display VPD information for a target or LUN without requiring any interpretation of the data on the part of the initiator.

The contents of the Vendor Unique VPD Information field is not defined in this document. Consult the appropriate manufacturers documentation for the data contained in this field.