

To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 29 July 2004
Subject: 04-218r1 SAT SPC-3 INQUIRY contents

Revision history

Revision 0 (8 July 2004) First revision

Revision 1 (29 July 2004) Incorporated comments from July 2004 SAT WG.

Related documents

T10/04-196r0 - SCSI to ATA Translation (SAT) revision 0.0 (Bob Sheffield, Intel)

T10/04-219r0 - SAT SPC-3 ATA Information VPD page (Rob Elliott, HP)

T13/ata7v1r4b - ATA/ATAPI-7 volume 1 revision 4b

T10/spc3r19 - SCSI Primary Commands - 3 revision 19

Overview

The INQUIRY command should return VENDOR IDENTIFICATION (8 bytes), PRODUCT IDENTIFICATION (16 bytes), and PRODUCT REVISION LEVEL (4 bytes) field values pertaining to the SCSI to ATA translator, rather than try to munge the ATA IDENTIFY DEVICE data.

The fields in IDENTIFY DEVICE that are possibly related are SERIAL NUMBER (20 bytes), FIRMWARE REVISION (8 bytes), and MODEL NUMBER (40 bytes). These 68 bytes does not fit into the 30 bytes of ASCII strings available in Standard INQUIRY data.

- a) There is no SERIAL NUMBER field in SCSI (although this can be mapped into a VPD page, as already described by 04-196r0 and expanded upon in this proposal).
- b) The FIRMWARE REVISION field is twice as big as SCSI's PRODUCT REVISION LEVEL field.
- c) Although there is no VENDOR IDENTIFICATION field in ATA, the ATA model number often starts with a vendor name. There's no guarantee that it complies with a T10 vendor ID, though, which sometimes have to be abbreviated due to the 8 byte length.

If the ATA device returns a valid WWN, it should be translated into the Device Identification VPD page 83h.

Suggested changes to SAT

8 SCSI Primary Commands (SPC) Mapping

8.1 INQUIRY command (12h)

The SCSI INQUIRY command requests general information about a target or component LUN. INQUIRY and certain vital product data pages have translations.

8.1.1 Command Summary

[For ATAPI devices, INQUIRY is intercepted by the SAT translator to add the ATA Information VPD page. Standard INQUIRY data and VPD pages other than the Supported VPD Pages VPD page and ATA Information VPD page are passed through unaltered.](#)

For ATA devices, the SATA translator replies to INQUIRY itself. Table 1 summarizes how the INQUIRY command is translated.

Table 1 — INQUIRY cCommand summary

Support Method	Emulated
ATA Opcodes	ECh, ATA Identify Device Command ECh, ATA IDENTIFY DEVICE command A1h, ATA IDENTIFY PACKET DEVICE command
Supported Vital Product Data pages	00h, Supported VPD pages 80h, Unit S serial N umber VPD page 83h, Device Identification VPD page 89h, ATA Information VPD page

8.1.2 SCSI INQUIRY CDB format and supported fields

A) ~~CMDDT~~

~~This bit is now obsolete and is not supported. If set to one, return a CHECK CONDITION with SENSE KEY set to ILLEGAL REQUEST and ADDITIONAL SENSE CODE set to INVALID FIELD IN CDB.~~

B) ~~EVPD~~

~~This bit must be set to request vital product data pages and the Page Code should indicate the page requested. Only two pages are supported currently: Supported VPD pages (00h) and Unit serial number (80h).~~

For ATA devices, the SAT translator shall support the EVPD bit, PAGE CODE field, ALLOCATION LENGTH field, and CONTROL byte.

For ATAPI devices, the SAT translator shall pass through the CDB unaltered. If the application client requests the Supported VPD Pages VPD page (see 8.1.3.2), the SAT translator shall alter the data to add the ATA Information VPD page to the parameter data. If the application client requests the ATA Information VPD page (see 04-219), the SAT translator shall provide it.

8.1.3 Data Returned

Standard inquiry data or vital product pages shall be returned depending on the request.

8.1.3.1 Standard INQUIRY data for translated ATA devices

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D) VERSION

~~This field is set to 03h to indicate that it supports SCSI-3 SPC specification.~~

The VERSION field indicates the version of SPC to which the SAT translator complies (see SPC-3) (e.g., 05h for SPC-3).

W) VENDOR IDENTIFICATION

~~This 8-byte field is created using the first 8 bytes of the 40-byte Model Number field from the device identify data retrieved from the device. Endianness is swapped to match the SCSI format.~~

[The VENDOR IDENTIFICATION field contains the string "ATA" left-justified and filled with spaces as described in table 3.](#)

Table 2 — VENDOR IDENTIFICATION field

Byte	Contents	
	Value	ASCII representation
0	41h	'A'
1	54h	'T'
2	41h	'A'
3	20h	' '
...
7	20h	' '

.

X) PRODUCT IDENTIFICATION

~~This 16 bytes field is created using the bytes 8 through 23 of the 40 byte Model Number field from the identify data. Endianness is swapped to match the SCSI format.~~

[The PRODUCT IDENTIFICATION field contains a representation of the first 16 bytes of the ATA device IDENTIFY DEVICE data MODEL NUMBER field, where each pair of bytes are swapped to create a valid ASCII string format as described in table 3.](#)

Table 3 — PRODUCT IDENTIFICATION field

Byte	Contents
0	IDENTIFY DEVICE word 27 bits 15:8 (i.e., byte 1)
1	IDENTIFY DEVICE word 27 bits 7:0 (i.e., byte 0)
2	IDENTIFY DEVICE word 28 bits 15:8 (i.e., byte 3)
3	IDENTIFY DEVICE word 28 bits 7:0 (i.e., byte 2)
...	...
14	IDENTIFY DEVICE word 34 bits 15:8 (i.e., byte 15)
15	IDENTIFY DEVICE word 34 bits 7:0 (i.e., byte 14)

Y) PRODUCT REVISION [LEVEL](#)

~~This field is created using the 8 byte firmware revision field of the device Identify data. The lower 4 bytes are used and the upper 4 bytes are lost since SCSI supports only 4 bytes for revision number. Endianness is swapped to match the SCSI format.~~

[The PRODUCT REVISION LEVEL field contains 20202020h \(i.e., four ASCII spaces\).](#)

z) IUS/QAS/CLOCKING/~~Vendor descriptors/ and vendor specific parameters of standard inquiry INQUIRY data fields~~ are not supported.

aa) Version descriptors

[Version descriptors shall be included for:](#)

- a) [the SCSI architecture model standard \(e.g., SAM-3\);](#)
- b) [this standard;](#)
- c) [the SCSI primary commands standard \(e.g., SPC-3\);](#)

- d) [the SCSI block commands standard \(e.g., SBC-2\);](#)
- e) [if the ATA commands are handled by a SAS STP initiator port, the version of SAS \(e.g., SAS-1.1\) to which the SAS initiator port was designed; and](#)
- f) [the version of ATA/ATAPI \(e.g., ATA/ATAPI-7\) to which the ATA device claims compliance in the IDENTIFY DEVICE data MAJOR VERSION NUMBER field \(i.e., word 80\) and MINOR VERSION NUMBER field \(i.e., word 81\).](#)

[NOTE 1 The encodings used by T10 for INQUIRY version descriptors \(see SPC-3\) and T13 for IDENTIFY DEVICE major and minor version numbers \(see ATA/ATAPI-7 V1\) differ, and the two standards organizations may not define values for the same revisions.](#)

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8.1.3.2 Vital Product data - Supported VPD pages

A) PERIPHERAL DEVICE TYPE

This bit field is set to 0 to indicate that a direct access device is connected.

B) PERIPHERAL QUALIFIER

This bit field is set to 0 to indicate that the specified peripheral device is currently attached to this logical unit.

C) PAGE CODE

This field is set to 0 to indicate 'supported VPD' pages page.

D) PAGE LENGTH

This field indicates the length of the supported VPD page list returned in number of bytes.

E) SUPPORTED VPD LIST

This list contains the page codes of the pages supported and is implemented in ascending order of page codes beginning with page code 00h.

[For ATAPI devices, the SAT translator shall modify the Supported VPD Pages VPD page data returned by the ATAPI device to including any pages it adds \(e.g., the ATA Information VPD page\).](#)

8.1.3.3 ~~Vital Product data~~—Unit ~~S~~serial ~~N~~number VPD page

~~A) PERIPHERAL DEVICE TYPE~~

~~This bit field is set to 0 to indicate that a direct access device is connected.~~

~~B) PERIPHERAL QUALIFIER~~

~~This bit field is set to 0 to indicate that the specified peripheral device is currently attached to this logical unit.~~

~~C) PAGE CODE~~

~~This field is set to 80h to indicate 'supported VPD' pages page.~~

~~D) PAGE LENGTH~~

~~This field indicates the length of the product serial number. Currently a 20-byte product serial number is being returned; hence the length is set to 20 bytes.~~

~~E) PRODUCT SERIAL NUMBER~~

~~The 20-byte field, serial number, found in the device identify data retrieved from the device shall be returned in this field. The serial number field shall be byte swapped to match the SCSI data format.~~

[\[All text that follows is new:\]](#)

Table 4 defines the Unit Serial Number VPD page (see SPC-3) returned by a SAT translator for a non-ATAPI device.

Table 4 — Unit Serial Number VPD page for SAT

Byte\Bit	7	6	5	4	3	2	1	0
0	PERIPHERAL QUALIFIER			PERIPHERAL DEVICE TYPE				
1	PAGE CODE (80h)							
2	Reserved							
3	PAGE LENGTH (20)							
4								
23	PRODUCT SERIAL NUMBER							

The PRODUCT SERIAL NUMBER field contains a representation of the SERIAL NUMBER field in the ATA IDENTIFY DEVICE data last retrieved from the ATA device. Each byte in the SERIAL NUMBER field set to 00h shall be converted to an ASCII space (20h). Each pair of bytes in the SERIAL NUMBER field shall be swapped to create a valid ASCII string format in the PRODUCT SERIAL NUMBER field as described in table 5.

Table 5 — PRODUCT SERIAL NUMBER field

Byte	Contents
0	IDENTIFY DEVICE word 10 bits 15:8 (i.e., byte 1)
1	IDENTIFY DEVICE word 10 bits 7:0 (i.e., byte 0)
2	IDENTIFY DEVICE word 11 bits 15:8 (i.e., byte 3)
3	IDENTIFY DEVICE word 11 bits 7:0 (i.e., byte 2)
...	...
18	IDENTIFY DEVICE word 19 bits 15:8 (i.e., byte 19)
19	IDENTIFY DEVICE word 19 bits 7:0 (i.e., byte 18)

Editor's Note 1: According to SPC-3 this field is supposed to be right-aligned. It is a variable length field, though, so right-aligned to what? ATA/ATAPI-7 doesn't explicitly say what the alignment is for the IDENTIFY DEVICE data SERIAL NUMBER field; its ASCII string overview hints that it is left-aligned. SAT translators should not be required to reformat the string to be right-aligned. Later, this proposal suggests that right-aligned be changed to left-aligned in SPC-3.

8.1.3.4 Device Identification VPD page

8.1.3.4.1 Device Identification VPD page overview

The SAT translator shall return the Device Identification VPD page (see SPC-3) as defined in table 6.

Table 6 — Device Identification VPD page for SAT

Byte\Bit	7	6	5	4	3	2	1	0
0	PERIPHERAL QUALIFIER			PERIPHERAL DEVICE TYPE				
1	PAGE CODE (83h)							
2	Reserved							
3	PAGE LENGTH (n - 3)							
4	Identification descriptor for logical unit							
n	Identification descriptors for target port (if any)							

The PERIPHERAL QUALIFIER field shall be set to 000b (i.e., currently connected).

The PERIPHERAL DEVICE TYPE field shall be set to 00h (i.e., direct-access block device).

The PAGE CODE field contains 83h.

The PAGE LENGTH field contains the length of the remaining bytes of the VPD page.

The identification descriptors are described in the rest of this subclause.

Figure 1 shows the identification descriptors used in a SAS environment.

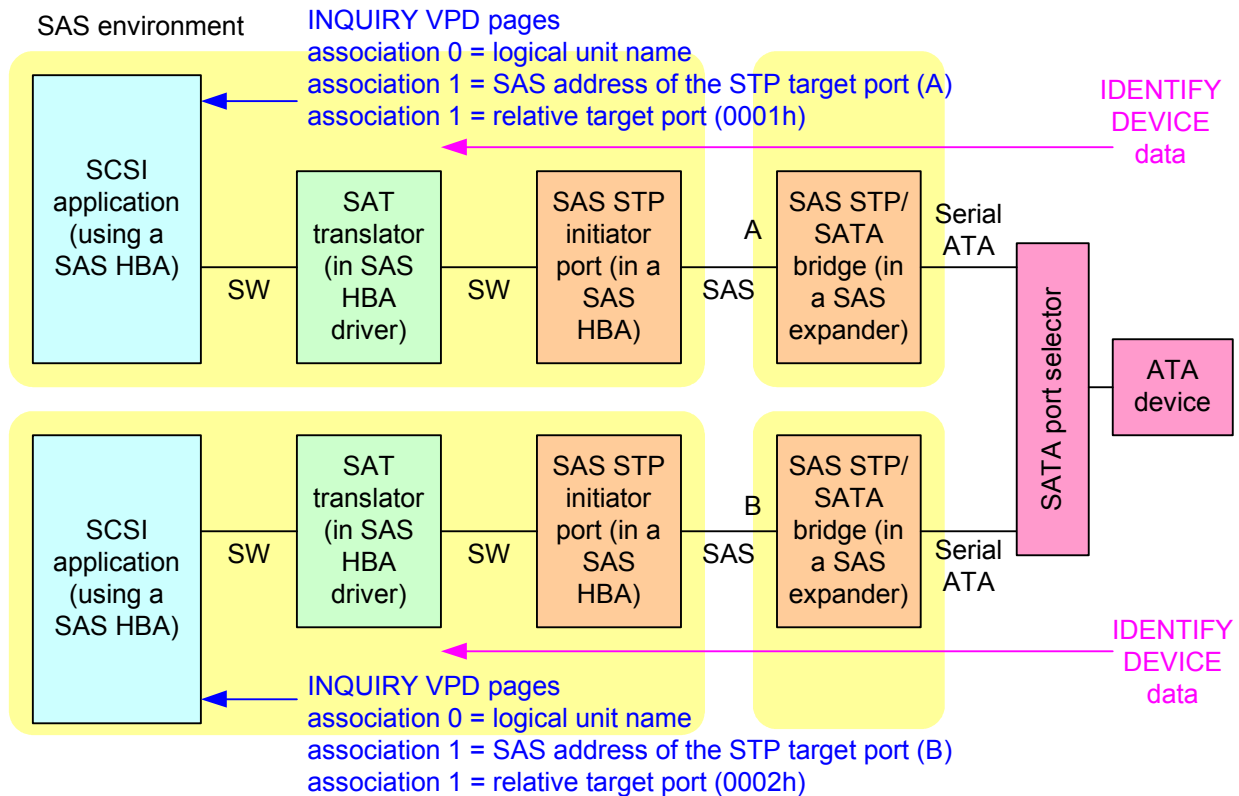


Figure 1 — SAS environment

Figure 2 shows the identification descriptors used in a SATA environment.

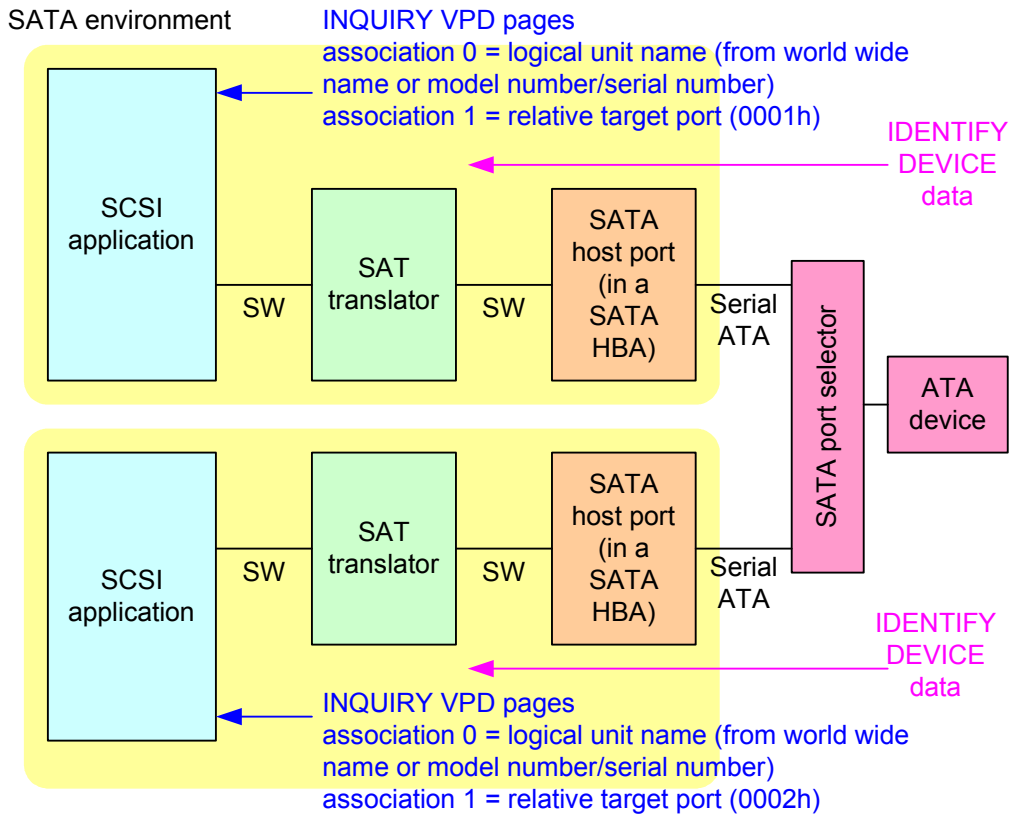


Figure 2 — SATA environment

Figure 3 shows the identification descriptors used in other SCSI transport protocol environments.

Other SCSI transport protocol environment

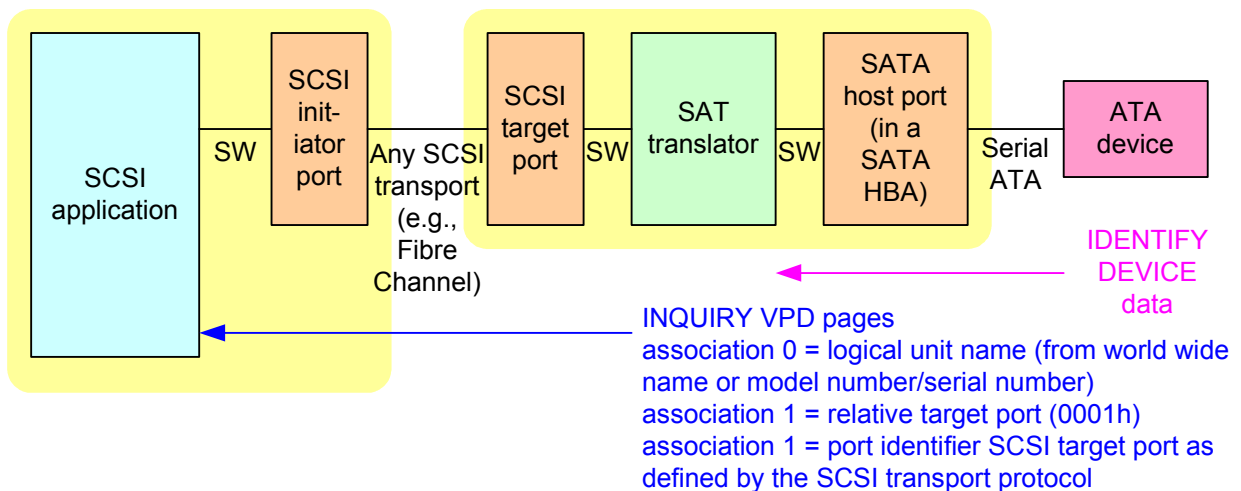


Figure 3 — Other SCSI transport protocol environment

8.1.3.4.2 Logical unit name

If the ATA device reports a nonzero WORLD WIDE NAME field (i.e., words 108-111) in its IDENTIFY DEVICE data, the SAT translator shall include an identification descriptor containing a logical unit name as defined in table 7.

Table 7 — Logical unit name derived from world wide name

Byte\Bit	7	6	5	4	3	2	1	0
0	PROTOCOL IDENTIFIER				CODE SET (1h)			
1	PIV (0b)	Reserved	ASSOCIATION (0h)		IDENTIFIER TYPE (3h)			
2	Reserved							
3	IDENTIFIER LENGTH (8h)							
4	NAA				(MSB)			
5	IEEE COMPANY_ID							
6								
7					(LSB)		(MSB)	
8								
11	VENDOR SPECIFIC IDENTIFIER							(LSB)

The PROTOCOL IDENTIFIER field shall be set to 0h.

The CODE SET field shall be set to 1h (i.e., binary).

The PIV bit shall be set to 0b.

The ASSOCIATION field shall be set to 0h (i.e., logical unit).

The IDENTIFIER TYPE field shall be set to 3h (i.e., NAA).

The NAA field, IEEE COMPANY_ID field, and VENDOR SPECIFIC IDENTIFIER field shall be based on the IDENTIFY DEVICE data WORLD WIDE NAME field as described in table 8.

Table 8 — Fields in the logical unit name

Field	Specific bits in the logical unit name	Contents
NAA	Byte 6 bits 7:4	IDENTIFY DEVICE word 108 bits 15:8 ^a
IEEE COMPANY_ID	Byte 6 bits 3:0	IDENTIFY DEVICE word 108 bits 11:8
	Byte 7	IDENTIFY DEVICE word 108 bits 7:0
	Byte 8	IDENTIFY DEVICE word 109 bits 15:8
	Byte 9 bits 7:4	IDENTIFY DEVICE word 109 bits 7:4
VENDOR SPECIFIC IDENTIFIER	Byte 9 bits 3:0	IDENTIFY DEVICE word 109 bits 3:0
	Byte 10	IDENTIFY DEVICE word 110 bits 15:8
	Byte 11	IDENTIFY DEVICE word 110 bits 7:0
	Byte 12	IDENTIFY DEVICE word 111 bits 15:8
	Byte 13	IDENTIFY DEVICE word 111 bits 7:0

^a This 4-bit field is required to be set to 5h by ATA/ATAPI-7 V1.

If the ATA device does not report a nonzero WORLD WIDE NAME field (i.e., words 108-111) in its IDENTIFY DEVICE data, the SAT translator shall include an identification descriptor containing a logical unit name as defined in table 9.

Table 9 — ILogical unit name derived from model number and serial number

Byte\Bit	7	6	5	4	3	2	1	0
0	PROTOCOL IDENTIFIER				CODE SET (3h)			
1	PIV (0b)	Reserved	ASSOCIATION (0h)		IDENTIFIER TYPE (8h)			
2	Reserved							
3	IDENTIFIER LENGTH (44h)							
4								
71	SCSI NAME STRING							

The PROTOCOL IDENTIFIER field shall be set to 0h.

The CODE SET field shall be set to 3h (i.e., UTF-8).

The PIV bit shall be set to 0b.

The ASSOCIATION field shall be set to 0h (i.e., logical unit).

The IDENTIFIER TYPE field shall be set to 8h (i.e., SCSI name string).

The SCSI NAME STRING field shall be set to "ata." concatenated with a representation of the IDENTIFY DEVICE data MODEL NUMBER field concatenated with a representation of the IDENTIFY DEVICE data SERIAL NUMBER field as described in table 10.

Table 10 — iSCSI name string for ATA devices

Byte	Contents	
0	'a'	61h
1	't'	74h
2	'a'	61h
3	':'	2Eh
4	MODEL NUMBER field	IDENTIFY DEVICE word 27 bits 15:8
5		IDENTIFY DEVICE word 27 bits 7:0
6		IDENTIFY DEVICE word 28 bits 15:8
		...
43		IDENTIFY DEVICE word 46 bits 7:0
44	SERIAL NUMBER field	IDENTIFY DEVICE word 10 bits 7:0
45		IDENTIFY DEVICE word 10 bits 15:8
46		IDENTIFY DEVICE word 11 bits 15:0
...		...
63		IDENTIFY DEVICE word 19 bits 7:0
64	NULL	00h
65	NULL	00h
66	NULL	00h
67	NULL	00h

NOTE 2 The SCSI NAME STRING field is not guaranteed to be worldwide unique, since ATA/ATAPI-7 only requires the combination of the MODEL NUMBER field and SERIAL NUMBER field to be unique for a given manufacturer but defines no manufacturer identification field.

Editor's Note 2: T13 should consider mandating that the model number field start with a manufacturer identification (e.g. a T10 vendor ID, or a new T13 vendor ID if the abbreviated 8-byte T10 IDs are deemed unsatisfactory). If that is done, then the model number and serial number fields would be truly worldwide unique since no manufacturer would use the same model number string as any other manufacturer.

8.1.3.4.3 Relative target port identifier for SAS

If the ATA device is being accessed with a SAS STP initiator port and is either:

- a) not located behind a SATA port selector; or
- b) located behind a SATA port selector, but the SAT translator knows which port of the SATA port selector it is using to access the ATA device,

the SAT translator shall include a relative target port identifier as defined in table 11. If a SATA port selector is present, how the SAT translator determines which port it is attached to is vendor-specific; if the SAT translator cannot make such a determination, it shall not include a relative target port identifier amongst the identification descriptors.

Table 11 — Identification descriptor: relative target port identifier (SAS)

Byte\Bit	7	6	5	4	3	2	1	0	
4	PROTOCOL IDENTIFIER (6h)				CODE SET (1h)				
5	PIV (1b)	Reserved	ASSOCIATION (1h)		IDENTIFIER TYPE (4h)				
2	Reserved								
3	IDENTIFIER LENGTH (4h)								
4	Obsolete								
5									
6	(MSB)	RELATIVE TARGET PORT (0001h or 0002h)							
7								(LSB)	

The PROTOCOL IDENTIFIER field shall be set to 6h (i.e., SAS).

The CODE SET field shall be set to 1h (i.e., binary).

The PIV bit shall be set to 1b.

The ASSOCIATION field shall be set to 1h (i.e., target port).

The IDENTIFIER TYPE field shall be set to 4h (i.e., relative target port).

The RELATIVE TARGET PORT field shall be set to 0001h if no SATA port selector is present. The RELATIVE TARGET PORT field shall be set to 0001h for one port on the SATA port selector and 0002h for the other port on the SATA port selector.

8.1.3.4.3 Target port identifier for SAS

If the ATA device is being accessed with a SAS STP initiator port, the SAT translator shall include a target port identifier as defined in table 12.

Table 12 — Target port identifier for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	PROTOCOL IDENTIFIER (6h)				CODE SET (1h)			
1	PIV (1b)	Reserved	ASSOCIATION (1h)		IDENTIFIER TYPE (3h)			
2	Reserved							
3	IDENTIFIER LENGTH (8h)							
4	SAS ADDRESS							
11								

The CODE SET field shall be set to 1h (i.e., binary).

The PIV bit shall be set to 1b.

The ASSOCIATION field shall be set to 1h (i.e., target port).

The IDENTIFIER TYPE field shall be set to 3h (i.e., NAA).

The SAS ADDRESS field shall be set to the SAS address of the STP target port providing the STP/SATA bridge functionality (i.e., the SAS address used to address the ATA device in the SAS domain).

8.1.3.4.3 Target port identifier for other SCSI transport protocols

If the ATA device is being accessed with a SCSI initiator using another SCSI transport protocol (e.g, Fibre Channel FCP-3 or iSCSI), the SAT translator shall include a target port identifier as defined by that SCSI transport protocol standard.

8.1.3.4.3 Relative target port identifier for SATA

If the ATA device is being accessed with a SATA HBA and is located behind a SATA port selector, and the SAT translator knows which port of the SATA port selector it is using to access the ATA device, the SAT translator shall include a relative target port identifier as defined in table 11. How the SAT translator determines which port it is attached to is vendor-specific; if the SAT translator cannot make such a determination, it shall not include a relative target port identifier amongst the identification descriptors.

Table 13 — Relative target port identifier for SATA

Byte\Bit	7	6	5	4	3	2	1	0
4	PROTOCOL IDENTIFIER (9h)				CODE SET (1h)			
5	PIV (1b)	Reserved	ASSOCIATION (1h)		IDENTIFIER TYPE (4h)			
2	Reserved							
3	IDENTIFIER LENGTH (3h)							
4	Obsolete							
5								
4	(MSB)	RELATIVE TARGET PORT (0001h or 0002h)						(LSB)
5								

The PROTOCOL IDENTIFIER field shall be set to 9h (i.e., Translated ATA).

Editor's Note 3: 9h is a new protocol identifier. The existing 8h value could also be used, which would require changing SPC-3's description of 8h from "ATAPI" to "ATA/ATAPI." However,

[separate values let translated ATA devices \(returning 9h\) be differentiated from native ATAPI devices \(which can return 8h in their own INQUIRY data\), which may be useful.](#)

The CODE SET field shall be set to 1h (i.e., binary).

The PIV bit shall be set to 1b.

The ASSOCIATION field shall be set to 1h (i.e., target port).

The IDENTIFIER TYPE field shall be set to 4h (i.e., relative target port).

The RELATIVE TARGET PORT field shall be set to 0001h for one port on the SATA port selector and 0002h for the other port on the SATA port selector.

Suggested changes to SPC-3 (or SPC-4?)

[General: Add protocol identifier 9h - "Translated ATA \(see SAT\)" and a normative reference to SAT.](#)

7.6.4.10 SCSI name string identifier format

If the identifier type is 8h (i.e., SCSI name string), the IDENTIFIER field has the format shown in table 303. The CODE SET field shall be set to 3h (i.e., UTF-8).

...

The null-terminated, null-padded (see 4.4.2) SCSI NAME STRING field contains a UTF-8 format string. The number of bytes in the SCSI NAME STRING field (i.e., the value in the IDENTIFIER LENGTH field) shall be no larger than 256 and shall be a multiple of four.

The SCSI NAME STRING field starts with either:

- a) The four UTF-8 characters "eui." concatenated with 16, 24, or 32 hexadecimal digits (i.e., the UTF-8 characters 0 through 9 and A through F) for an EUI-64 based identifier (see 7.6.4.4). The first hexadecimal digit shall be the most significant four bits of the first byte (i.e., most significant byte) of the EUI-64 based identifier;
- b) The four UTF-8 characters "naa." concatenated with 16 or 32 hexadecimal digits for an NAA identifier (see 7.6.4.5). The first hexadecimal digit shall be the most significant four bits of the first byte (i.e., most significant byte) of the NAA identifier; ~~or~~
- c) The four UTF-8 characters "iqn." concatenated with an iSCSI Name for an iSCSI-name based identifier (see iSCSI); or
- d) [The four UTF-8 characters "ata." concatenated with an ATA device model number and serial number \(see SAT\).](#)

If the ASSOCIATION field is set to 0h (i.e., logical unit) and the SCSI NAME STRING field starts with the four UTF-8 characters "iqn.", the SCSI NAME STRING field ends with the five UTF-8 characters ",L,0x" concatenated with 16 hexadecimal digits for the logical unit name extension. The logical unit name extension is a UTF-8 string containing no more than 16 hexadecimal digits. The logical unit name extension is assigned by the SCSI target device vendor and shall be assigned so the logical unit name is worldwide unique.

If the ASSOCIATION field is set to 1h (i.e., SCSI target port), the SCSI NAME STRING field ends with the five UTF-8 characters ",t,0x" concatenated with two or more hexadecimal digits as specified in the applicable SCSI transport protocol standard (see 3.1.100).

If the ASSOCIATION field is set to 2h (i.e., SCSI target device), the SCSI NAME STRING field has no additional characters.

7.6.11 Unit Serial Number VPD page

This VPD page (see table 318) provides a product serial number for the target or logical unit.

...

The PRODUCT SERIAL NUMBER field contains ~~right~~left-aligned ASCII data (see 4.4.1) that is vendor-assigned serial number. If the product serial number is not available, the device server shall return ASCII spaces (20h) in this field.