To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
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Subject: T10/02-419r1 SAM-3 SPC-3 SAS FCP-3 SRP-2 Device identifiers and VPD data

Revision History
Revision 0 (2 November 2002) first revision
Revision 1 (31 December 2002) incorporated comments from November CAP WG.

Related Documents
sam3r03 - SCSI Architecture Model - 3 revision 3 (Ralph Weber)
spc3r09 - SCSI Primary Commands - 3 revision 9 (Ralph Weber)
sasr02c - Serial Attached SCSI revision 2c (Rob Elliott)
draft-ietf-ips-iscsi-18 - Internet SCSI revision 18 (Julian Satran)
draft-krueger-iscsi-name-ext-01 - Definition of an NAA naming format for iSCSI Node Names
    (Marjorie Krueger)
02-254r4 WWNs for WLUNs (George Penokie)
02-427r1 SAS device names (George Penokie)

Overview
The INQUIRY Device Identification VPD page (83h) returns logical unit, target port, and (with 02-254) target device related identifiers. However, it has several limitations for iSCSI, SRP, and SBP-2 devices, and for devices with target ports using more than one transport protocols:

1. iSCSI port names and device names use a string format for that cannot be represented in the current VPD formats. The strings approach 256 bytes in length; 02-303 expanded INQUIRY's allocation length to return such amounts of data.

Suggestion: A new VPD device identifier type for this string format is needed so iSCSI devices can report its target port (ASSOCIATION field set to 1h) and target device identifiers (ASSOCIATION field set to 2h).

2. iSCSI logical unit names are undefined. RAID controllers tend to name their logical units (reported with ASSOCIATION field set to 0h) by concatenating a self-generated number to the end of a port name (e.g. the NAA IEEE Registered Extended identifier is 64 bits concatenated onto an IEEE Registered identifier). An iSCSI-only RAID controller needs to do this based on the iSCSI device name; it may not have an NAA IEEE Registered identifier to use.

Suggestion: A logical unit name based on the iSCSI string format is needed.

3. SRP target port names use an EUI-64-based format - EUI-64 plus 8 byte extension - that cannot be represented with the current EUI-64 format (2h). Thus, there is no way to report its target port identifier (ASSOCIATION field set to 1h).

Suggestion: A 16 byte version of the EUI-64 identifier is needed (or the string format needs to be used; see below).

4. SBP-2/3 target port names use an EUI-64-based format - EUI-64 plus 3 byte extension - that cannot be represented with the current EUI-64 format (2h). Thus, there is no way to report its target port identifier (ASSOCIATION field set to 1h).

Suggestion: A 12 byte version of the EUI-64 identifier is needed (or the string format needs to be used; see below.

5. SAM-3 target device names. SAM-3 allows target devices with target ports of more than one protocol to have one device name per transport protocol. This is awkward for software, which would prefer one name rather than N names. Since device names are new, we have an opportunity to change this rule and get to one device name per device. The iSCSI string format is versatile enough to serve all the protocols. It can currently carry two formats:

   a) "iqn." A UTF-8 encoded string with a reverse domain name.

b) "eui." An EUI-64 identifier encoded into a hexadecimal string (e.g. "eui.ABCDEF0123456789")

Along with this proposal, HP has made a proposal to the IETF IPS WG to add a third format:

a) "naa." An NAA identifier (e.g. "naa.56789ABCDEF01234" for an IEEE Registered identifier or "naa.6789ABCDEF0123456789ABCDEF012345" for an IEEE Registered Extended identifier)

This covers the native name formats for FCP-3, SAS, SRP-2, and SBP-3.

Suggestion: Device names for all SCSI devices should follow this format, rather than protocol-specific formats.

Devices with NAA identifiers handy for their target ports may choose to use "naa." format for their device names; devices with EUI-64 identifiers handy may use "eui." format; iSCSI-only devices may use "iqn." Devices with multiple protocol support may choose the best device identifier format for their needs.

SAM-3 could become the home for defining this string format; IETF and iSCSI would just own the "iqn." subset.

6. Logical unit names (ASSOCIATION field set to 0h) have the same problem as device names for devices with multiple protocols. A combination FCP and SRP device would have trouble deciding to use NAA or EUI-64-based format for a logical unit name if each protocol requires only its own format.

Suggestion: The iSCSI string format should be allowed for logical unit names ("iqn", "eui", or "naa" based regardless of protocol).

7. The current iSCSI identifier sizes in SAM-3 are unclear as to whether the **trailing NULL** is included in the size.

Suggestion: Remove trailing NULL from all sizes.

8. The SAM-3 informative annex entries for **iSCSI port name sizes** are too large; the rules on the formats slightly reduce the maximum lengths from 255.

Suggestion: Make the entries exact.

Summary
This is how the Device Identification VPD data for all the protocols line up with these suggestions:

Protocol	Logical unit name (ASSOCIATION field set to 0h)	Target port identifier (ASSOCIATION field set to 1h)	Target device identifier (ASSOCIATION field set to 2h)
Devices with more than one protocol shall use these formats	a) SCSI name string format "<name>,l, 0xABCDEF0123456789"; b) NAA format; or c) EUI-64-based format	Based on protocol of the port (see below for more details of each format) a) SCSI name string format; b) NAA format; or c) EUI-64-based format	SCSI name string format
Devices with only one protocol shall use these formats for logical unit names and device names:			
iSCSI	SCSI name string format "iqn.<iSCSI name>,l, 0xABCDEF0123456789"	SCSI name string format "iqn.<iSCSI name>,t, 0xABCD"	SCSI name string format "iqn.<iSCSI name>"
FCP-3	NAA format (with NAA = 2, 5, or 6)	NAA format (with NAA = 2, 5, or 6)	SCSI name string format "naa.[2 or 5]NNN..."
SAS	NAA format (with NAA = 5 or 6)	NAA format (with NAA = 5 or 6)	SCSI name string format "naa.[5]NNN..."
SRP-2	SCSI name string format "eui.ABCDEF0123456789,l, 0xABCDEF0123456789"	EUI-64-based 16 byte format	SCSI name string format "eui.NNNN"....
SBP-3	SCSI name string format "eui.ABCDEF0123456789,l, 0xABCDEF0123456789"	EUI-64-based 12 byte format	SCSI name string format "eui.NNNN..."

The SCSI name string format may have one of 3 fundamental formats based on the ASSOCIATION field:

a) *logical unit name* (with an ASSOCIATION value of 0h). The format is "<name>" concatenated with ",l,0xNNNNNNNNNNNNNNNN", defined in SPC-3.
b) *target port name* (with an ASSOCIATION value of 1h). The format is "<name>" concatenated with ",t," concatenated with "<transport protocol dependent>" (in iSCSI, the target portal group identifier), defined in SCSI and by the transport protocol.
c) *target device name* (with an ASSOCIATION value of 2h). The format is "<name>" (alone), defined in SPC-3.

Suggested Changes to SAM-3
3.1.93 SCSI device name: A name (see 3.1.68) of a SCSI device that is world wide unique within the SCSI transport protocol of a SCSI domain in which the SCSI device has SCSI ports (see 4.7.6). The SCSI device name may be made available to other SCSI devices or SCSI ports in that SCSI domain in SCSI transport protocol specific ways.

4.7.1 SCSI initiator device
A SCSI initiator device (see figure 11) contains:

a) Zero or more one initiator device names;
b) One or more SCSI initiator ports each containing an initiator port identifier and an optional initiator port name; and
c) One or more application clients.
An initiator port identifier is a value that is the SCSI port identifier (see 4.7.4) for an initiator port.

An initiator device name is a name (see 3.1.68) that is a SCSI device name (see 4.7.6) for a SCSI initiator device.

A SCSI initiator device shall have no more than one initiator device name ~~for each supported SCSI transport protocol. A SCSI transport protocol standard may place additional requirements on initiator device names.~~

An initiator port name is a name (see 3.1.68) that is the SCSI port name (see 4.7.7) for the initiator port. A SCSI transport protocol standard may place additional requirements on initiator port names.

Application clients are the sources of commands and task management functions.

4.7.2 SCSI target device

A SCSI target device (see figure 12) contains:
a) Zero or ~~more~~ one target device names;
b) One or more SCSI target ports each containing a task router, SCSI target port identifier, and an optional target port name; and
c) One or more logical units.
A SCSI target port identifier is a value that is a SCSI port identifier (see 4.7.4) for a SCSI target port.

A target device name is a name (see 3.1.68) that is a SCSI device name (see 4.7.6) for a SCSI target device. A SCSI target device shall have no more than one target device name ~~for each supported SCSI transport protocol. A SCSI transport protocol standard may place additional requirements on target device names.~~

A target port name is a name (see 3.1.68) that is the SCSI port name (see 4.7.7) for the target port. A SCSI transport protocol standard may place additional requirements on target port names.

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4.7.3 SCSI target/initiator device

A SCSI target/initiator device (see figure 13) contains:
a) Zero or more target/initiator device names;
b) One or more SCSI target/initiator ports each containing a task router, target port identifier, an initiator port identifier, an optional target port name and an optional initiator port name;
c) One or more logical units; and
d) One or more application clients.
The target port identifier and the initiator port identifier are values containing a SCSI port identifier (see 4.7.4) for a SCSI target/initiator port. The target port identifier and the initiator port identifier may or may not be identical.

A target/initiator device name is a name (see 3.1.68) that is a SCSI device name (see 4.7.6) for a SCSI target/initiator device. A SCSI target/initiator device shall have no more than one target/initiator device name ~~for each supported SCSI transport protocol. A SCSI transport protocol standard may place additional requirements on target/initiator device names.~~

The target port name and initiator port name are names (see 3.1.68) that are the SCSI port name (see 4.7.7) for the target/initiator port when operating as a target port and initiator port, respectively. The target port name and the initiator port name may or may not be identical. A SCSI transport protocol standard may place additional requirements on target port names and initiator port names.

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4.7.6 SCSI device name

A SCSI device name is an optional name (see 3.1.68) for a SCSI device that is world wide unique ~~within the SCSI transport protocol of each SCSI domain in which the SCSI device has SCSI ports~~. ~~A SCSI device may have more than one name if that device has SCSI ports in different SCSI transport protocol domains.~~ A SCSI device shall have no more than one name ~~for each supported SCSI transport protocol~~. A SCSI device name shall never change and may be used to persistently identify a SCSI device in contexts where specific references to port names or port identifiers is not required.

A SCSI transport protocol standard may require that a SCSI device include a SCSI device name if the SCSI device has SCSI ports in a SCSI domain of that SCSI transport protocol. The SCSI device name may be made available to other SCSI devices or SCSI ports in a given SCSI domain in SCSI transport protocol specific ways.

[Editor's note: SAM-3 informative annex changes are at the end of this proposal]

Suggested Changes to SPC-3
3.1.78 SCSI device name: A name (see 3.1.57) of a SCSI device that is world wide unique within the protocol of a SCSI domain (see 3.1.79) in which the SCSI device has SCSI ports (see SAM-3). The SCSI device name may be made available to other SCSI devices or SCSI ports in that SCSI domain in protocol specific ways.

8.6 Vital product data parameters
8.6.4 Device Identification VPD page
8.6.4.1 Device Identification VPD page overview
The Device Identification VPD page (see table 268) provides the means to retrieve identification descriptors applying to the logical unit. Logical units may have more than one identification descriptor (e.g., if several types or associations of identifier are supported).

Device identifiers shall be assigned to the peripheral device (e.g., a disk drive) and not to the currently mounted media, in the case of removable media devices. Media identification is outside the scope of this standard. Operating systems are expected to use the device identifiers during system configuration activities to determine whether alternate paths exist for the same peripheral device.

NOTE 64 - In the case of virtual logical units (e.g., volume sets as defined by SCC-2), the IDENTIFIER field (see table 267) should be in the NAA IEEE Registered Extended name format as defined in 8.6.4.5.3.
A SCSI target device may have more than one SCSI target device name if the SCSI target device supports multiple SCSI transport protocols. If the returned Device Identification VPD page contains any SCSI target device names it shall contain all the SCSI target device names.

[Table 268 - Device Identification VPD page]

The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field in table 266 are as defined in 7.4.2.

Each Identification descriptor (see table 269) contains information identifying the logical unit, physical device, or access path used by the command and returned parameter data. The ASSOCIATION field indicates the entity that the Identification descriptor describes. If a physical or logical device returns an Identification descriptor with the ASSOCIATION field set to 0h, it shall return the same descriptor when it is accessed through any other path.

[Table 269 - Identification descriptor]

The CODE SET field specifies the code set used for the IDENTIFIER field, as described in table 268. This field is intended to be an aid to software that displays the IDENTIFIER field.

Table 268 - Code set

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

The ASSOCIATION field specifies the entity with which the IDENTIFIER field is associated, as described in table 271.

Table 271 - Association

Value	Name	Description
0h	LOGICAL UNIT	The IDENTIFIER field is associated with the addressed logical unit.
1h	TARGET PORT	The IDENTIFIER field is associated with the port that received the request.
2h	TARGET DEVICE	The IDENTIFIER field is associated with the SCSI target device that contains the addressed logical unit.
3h		Reserved

The IDENTIFIER TYPE field (see table 272) specifies the format and assignment authority for the identifier.

Table 272 - Identifier type

Value	Description	Reference
0h	Vendor specific	8.6.4.2
1h	T10 vendor identification	8.6.4.3
2h	EUI-64-based	8.6.4.4
3h	NAA	8.6.4.5
4h	Relative target port	8.6.4.6
5h	Target port group	8.6.4.7
6h	Logical unit group	8.6.4.8
7h	MD5 logical unit identifier	8.6.4.9
8h	SCSI name string	8.6.4.x
8h 9h - Fh	Reserved	

For logical units that are not W-LUNs (see clause 9) at least one identification descriptor shall contain 1h, 2h, or 3h in the IDENTIFIER TYPE field and 0h in the ASSOCIATION field. At least one identification descriptor should contain 2h or 3h in the IDENTIFIER TYPE field and 0h in the ASSOCIATION field.

~~For W-LUNs at least one identification descriptor shall contain 2h, or 3h in the IDENTIFIER TYPE field and shall contain a 2h in the ASSOCIATION field.~~

The IDENTIFIER LENGTH field specifies the length in bytes of the IDENTIFIER field. If the <u>ALLOCATION LENGTH</u> field of the CDB is too small to transfer all of the identifier, the identifier length shall not be adjusted to reflect the truncation.

The IDENTIFIER field contains the identifier as described by the ASSOCIATION, IDENTIFIER TYPE, CODE SET, and IDENTIFIER LENGTH fields.

8.6.4.2new Device Identifier requirements [this section is entirely new]
8.6.4.2new.1 Logical unit identifier
Each logical unit that is not a well-known logical unit shall include one identification descriptor with the ASSOCIATION field set to LOGICAL UNIT (0h) and the IDENTIFIER TYPE field set to:

   a) T10 vendor identification (1h);
   b) EUI-64-based (2h);
   c) NAA (3h); or
   d) SCSI name string (8h).

This identification descriptor should contain an IDENTIFIER TYPE field set to:

   a) EUI-64-based (2h);
   b) NAA (3h); or
   c) SCSI name string (8h).

In the case of virtual logical units (e.g., volume sets as defined by SCC-2), the IDENTIFIER TYPE field should be set to either:
   a) NAA (3h), and the IDENTIFIER field should contain the IEEE Registered Extended name format defined in 8.6.4.5.3; or
   b) SCSI name string (8h), and the IDENTIFIER field should contain a target port name in SCSI name string format concatenated with "...,l,0x" concatenated with 16 hex characters that make the identifier worldwide unique..
   NOTE: In the SCSI name string format, "l" is a lowercase L.

8.6.4.2new.2 Target port identifiers
Each logical unit should include one identification descriptor with the ASSOCIATION field set to TARGET PORT (1h) and the IDENTIFIER TYPE field set to:

   a) EUI-64-based (2h);
   b) NAA (3h); or
   c) SCSI name string (8h).
If the transport protocol of the target port defines target port names, the identifier shall contain the target port name. If the transport protocol of the target port does not define target port names, the identifier shall contain the target port identifier.

Each logical unit should include one identification descriptor with the ASSOCIATION field set to TARGET PORT (1h) and the IDENTIFIER TYPE field set to relative target port (4h).

8.6.4.2new.3 Target device identifier
Each well-known logical unit shall include at least one identification descriptor with the ASSOCIATION field set to TARGET DEVICE (2h). Each logical unit that is not a well-known logical unit should include at least one identification descriptor with the ASSOCIATION field set to TARGET DEVICE (2h). This identification descriptor, if implemented, shall contain an IDENTIFIER TYPE field set to SCSI name string (8h).

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8.6.4.2 Vendor specific identifier format [no changes]
8.6.4.3 T10 vendor identification format [no changes]
8.6.4.4 EUI-64-<u>based</u> identifier format [with modifications]

If the identifier type is EUI-64 -based identifier (2h) and the IDENTIFIER LENGTH field is set to 8h, the eight byte fixed length IDENTIFIER field has the format shown in table 273. The CODE SET field shall be set to BINARY (1h) and the IDENTIFIER LENGTH field shall be set to 8h.

Table 273 - EUI-64 -based IDENTIFIER field format

	7	6	5	4	3	2	1	0
0	(MSB)			IEEE COMPANY_ID				
2								(LSB)
3	(MSB)			VENDOR SPECIFIC EXTENSION IDENTIFIER				
7								(LSB)

The IEEE COMPANY_ID field contains a 24 bit OUI (see 3.1.60) assigned by the IEEE.

The VENDOR SPECIFIC EXTENSION IDENTIFIER field contains a 40 bit numeric value that is uniquely assigned by the organization associated with the IEEE company_id as required by the IEEE definition of EUI-64 (see D.2).

If the identifier type is EUI-64-based identifier (2h) and the IDENTIFIER LENGTH field is set to Ch, the IDENTIFIER field has the format shown in table 2730. The CODE SET field shall be set to BINARY (1h).

Table 2730 - EUI-64-based 12 byte IDENTIFIER field format

	7	6	5	4	3	2	1	0
0	(MSB)			IEEE COMPANY_ID				
2								(LSB)
3	(MSB)			VENDOR SPECIFIC EXTENSION IDENTIFIER				
7								(LSB)
8	(MSB)			DIRECTORY ID				
11								(LSB)

The DIRECTORY ID field contains a directory identifier, as specified by ISO/IEC 13213:1994.
> NOTE: The EUI-64-based 12 byte format may be used to report IEEE 1394 target port identifiers (see SBP-3).

If the identifier type is EUI-64-based identifier (2h) and the IDENTIFIER LENGTH field is set to 10h, the IDENTIFIER field has the format shown in table 2731. The CODE SET field shall be set to BINARY (1h).

Table 2731 - EUI-64-based 16-byte IDENTIFIER field format

	7	6	5	4	3	2	1	0
0	(MSB)			IDENTIFIER EXTENSION				
7								(LSB)
8	(MSB)			IEEE COMPANY_ID				
10								(LSB)
11	(MSB)			VENDOR SPECIFIC EXTENSION IDENTIFIER				
15								(LSB)

The IDENTIFIER EXTENSION field contains a 64 bit numeric value.

> NOTE: The EUI-64-based 16-byte format may be used to report SCSI over RDMA target port identifiers (see SRP).

[Editor's note: SRP formatted its port identifier with the identifier extension in the lower bytes so it looks like an IPv6 address]

8.6.4.5 NAA identifier format [no changes]
8.6.4.6 Relative target port identifier format [no changes]
8.6.4.7 Target port group identifier format [no changes]
8.6.4.8 Logical unit group identifier format [no changes]
8.6.4.9 MD5 logical unit identifier format [no changes]
8.6.4.10 Device identification VPD page example [no changes]
8.6.4.n SCSI name string identifier format [this section is entirely new; place before the example section]

If the identifier type is SCSI name string (8h) and the CODE SET field contains UTF-8 (3h), the IDENTIFIER field has the format shown in table xxx. If the PROTOCOL IDENTIFIER field does not contain iSCSI (5h), or the CODE SET field does not contain UTF-8 (3h), use of this identifier type is reserved.

Table xxx - SCSI name string IDENTIFIER field format

	7	6	5	4	3	2	1	0
0				SCSI NAME STRING				
n								
n + 1				NULL (00h)				
n + 2				PAD (if needed)				
4m - 1								

The SCSI NAME STRING field contains a UTF-8 format string. The SCSI NAME STRING field shall not include a byte set to 00h. The SCSI NAME STRING field shall be no larger than 255 bytes.

The SCSI NAME STRING field starts with either:

a) "eui." concatenated with 8, 12, or 16 hex characters for an EUI-64-based identifier (see 8.6.4.4); or
b) "naa." concatenated with 16 or 32 hex characters for an NAA identifier (see 8.6.4.5); or
c) "iqn." concatenated with an iSCSI Name for an iSCSI-name based identifier (see iSCSI).

When the ASSOCIATION field is set to LOGICAL UNIT (0h), the SCSI NAME STRING field ends with ",l,0x" concatenated with 16 hex characters for the logical unit name extension. The logical unit name extension is a UTF-8 string containing no more than 16 hexadecimal digits (i.e,, '0' through '9' and 'A' through 'F'). The logical unit name extension is assigned by the target device vendor and shall be assigned so the logical unit name is worldwide unique.

When the ASSOCIATION field is set to TARGET PORT (1h), the SCSI NAME STRING field ends with ",t,0x" concatenated with hex characters (see the appropriate transport protocol standard).

When the ASSOCIATION field is set to TARGET DEVICE (2h), the SCSI NAME STRING field has no additional characters.

The NULL field contains 00h.

The PAD field shall consist of zero to three bytes set to 00h such that the total length of the IDENTIFIER field is a multiple of four. The PAD field shall be ignored.

Proposed changes for SAS

A target device containing only SAS target ports shall use the NAA format for its logical unit names. Otherwise, the logical unit names should use SCSI name string format (with "naa" "eui" or "iqn" type).

A target device containing only SAS target ports shall use the NAA format for its target port identifiers. Otherwise, the target port identifiers should be in SCSI name string format (with "naa" "eui" or "iqn" type).

The target device name shall use the SCSI name string format.

Proposed changes for FCP-3

A target device containing only FCP target ports shall use the NAA format for its logical unit names. Otherwise, the logical unit names should use SCSI name string format (with "naa", "eui", or "iqn" type).

A target device containing only FCP target ports shall use the NAA format for its target port identifiers. Otherwise, the target port identifiers should be in SCSI name string format (with "naa", "eui", or "iqn" type).

The target device name shall use the SCSI name string format.

Proposed changes for SRP-2

A target device containing only SRP target ports shall use the EUI-64-based format [or SCSI name string format] for its logical unit names. Otherwise, the logical unit names should use SCSI name string format (with "naa", "eui", or "iqn" type).

A target device containing only SRP target ports shall use the EUI-64-based format for its target port identifiers. Otherwise, the target port identifiers should be in SCSI name string format (with "naa", "eui", or "iqn" type).

The target device name shall use the SCSI name string format.

Proposed changes for iSCSI

Define the "naa." format for names. The hex string consumes 16 bytes for IEEE Registered and IEEE Extended names, but needs 32 bytes for an IEEE Registered Extended name.

A target device containing only iSCSI target ports shall use the SCSI name string format for its logical unit names. Otherwise, the logical unit names should be in SCSI name string format (with "naa", "eui", or "iqn" type).

A target device containing only iSCSI target ports shall use the SCSI name string format for its target port identifiers (with "naa", "eui", or "iqn" type).

The target device name shall use the SCSI name string format.

Table xxx - ISCSI NAME-BASED IDENTIFIER field format

Field in IDENTIFICATION DESCRIPTOR	Identifier type			
	Logical unit name	Target port name	Target device name	Reserved
ASSOCIATION	LOGICAL UNIT (0h)	TARGET PORT (1h)	TARGET DEVICE (2h)	3h
CODE SET	UTF-8 (2h)	UTF-8 (2h)	UTF-8 (2h)	
PROTOCOL IDENTIFIER	N/A	N/A	iSCSI (5h)	
IDENTIFIER LENGTH	245	233	224	
SCSI NAME STRING	iSCSI name concatenated with ",I,0x" concatenated with logical unit name extension in hex ([a][b])	SCSI Target Port Name	SCSI Device Name	

[a] "I" is a lowercase L; "0" is a zero

[b] "x" may be a lowercase or uppercase X; they shall be considered identical.

The iSCSI name contains the iSCSI name of the target device.

The logical unit name extension is a UTF-8 string containing no more than 16 hexadecimal digits (i.e,, '0' through '9' and 'A' through 'F'). The logical unit name extension is assigned by the target device vendor and shall be assigned so the logical unit name is worldwide unique.

[Editor's note: Based on iSCSI revision 18 pages 46-47 section 2.4.2]

More proposed changes for SAM-3

Annex A
(informative)
Identifiers and names for objects

A.1 Identifiers and names overview
This annex summarizes SCSI identifiers and names.

The following SCSI architecture model objects have identifiers and names summarized in this annex:

a) SCSI initiator port (see 3.1.97);
b) SCSI target port (see 3.1.102);
c) Logical unit (see 3.1.60);
d) SCSI initiator device (see 3.1.96); and
e) SCSI target device (see 3.1.101).

A.2 Identifiers and names
This standard defines the identifiers and names for the objects listed in A.1. The size requirements placed on identifiers by this standard are as shown in table A.1. This standard places no requirements on the sizes of names.

Table A.1 also lists whether this standard or SPC-2 3 requires SCSI transport protocols and logical units to support identifiers and names for an object.

Table A.1 — Object size and support requirements

Object	Identifier		Name	
	Size	**Support Requirements**	**Size**	**Support Requirements**
Initiator device	n/a	n/a	~~not specified~~223 bytes (maximum) b	optional
Target device	n/a	n/a	~~not specified~~223 bytes (maximum) b	optional
Initiator port	not specified	mandatory	not specified	optional
Target port	not specified	mandatory	not specified a	optional
Logical unit	8 bytes (maximum)	mandatory	not specified a	mandatory
a Reported in the Device Identification VPD page (see SPC-2)				
b Not including null termination.				

Each SCSI transport protocol defines the size and format of identifiers and names for ~~each object~~the initiator port, target port, and logical unit objects. Initiator device and target device names are described in SPC-3.

See table A.2 for a list of the size of the identifiers for each SCSI transport protocol. See table A.3 for a list of the format of the identifiers for each SCSI transport protocol.

Table A.2 — Object identifier size for each SCSI transport protocol

Object	Identifier size					
	SPI-4	**FCP-2**	**SRP**	**iSCSI**	**SBP-3**	**SAS SSP**
Initiator port	4 bits a	3 bytes	16 bytes	~~255 bytes~~ Equivalent to iSCSI initiator port name (see Table A.4)	2 bytes	8 bytes
Target port	4 bits a	3 bytes	16 bytes	~~255 bytes~~ Equivalent to iSCSI target port name (see Table A.4)	11 bytes	8 bytes
Logical unit	6 bits (data group transfers) or 8 bytes (information unit transfers)	8 bytes	8 bytes	8 bytes	2 bytes	8 bytes
a SPI-4 uses a bit significant representation of the SCSI port identifier, therefore, the maximum number of SCSI ports is 16, a value that can be represented in 4 bits.						

Table A.3 — Object identifier format for each SCSI transport protocol

Object	Identifier format					
	SPI-4	**FCP-2**	**SRP**	**iSCSI**	**SBP-3**	**SAS SSP**
Initiator port	bit significant	~~binary value~~address identifier	EUI-64 + 8-byte extension	~~iSCSI name + "i" + Initiator Session Identifier (ISID) b c~~ Equivalent to iSCSI initiator port name (see Table A.4)	binary value	NAA IEEE Registered format ~~per SPC-3~~
Target port	bit significant	~~binary value~~address identifier	EUI-64 + 8-byte extension	~~iSCSI name + "t" + Target Portal Group Tag b d~~ Equivalent to iSCSI target port name (see Table A.4)	EUI-64 + Discovery ID e	NAA IEEE Registered format ~~per SPC-3~~
Logical unit	binary value (6 bit) or As specified in this standard (see 4.9)	As specified in this standard (see 4.9)	As specified in this standard (see 4.9)	As specified in this standard (see 4.9)	~~As specified in this standard~~ binary value (2 bytes)	As specified in this standard (see 4.9)
a Required to be worldwide unique and recommend to be EUI-64 + 8 byte extension.						
~~b The iSCSI name should be worldwide unique, 223 bytes maximum in UTF-8 format with null termination.~~						
~~c The Initiator Session Identifier (ISID) is a non-zero six byte integer.~~						
~~d The Target Portal Group Tag is a non-zero two byte integer.~~						
e See IEEE Std P1212 for more information on the Discovery ID.						

See table A.4 for a list of the size of the names for each SCSI transport protocol. See table A.5 for a list of the format of the names for each SCSI transport protocol.

Table A.4 — Object name size for each SCSI transport protocol

Object	Name size					
	SPI-4	**FCP-2**	**SRP**	**iSCSI**	**SBP-3**	**SAS SSP**
~~Initiator device~~	~~not specified~~	~~not specified~~	~~not specified~~	~~223 bytes~~	~~not specified~~	~~8 bytes~~
~~Target device~~	~~not specified~~	~~not specified~~	~~not specified~~	~~223 bytes~~	~~not specified~~	~~8 bytes~~
Initiator port	not specified	8 bytes	16 bytes	~~255~~ 245 bytes a	8 bytes	not specified

Target port	not specified	8 bytes	16 bytes	255 232 bytes a	11 bytes	not specified
Logical unit	Reported in the Device Identification VPD page (see SPC-23).					

a Not including null termination.

Table A.5 — Object name format for each SCSI transport protocol

Object	Name format					
	SPI-4	**FCP-2**	**SRP**	**iSCSI**	**SBP-3**	**SAS SSP**
Initiator device	not specified	not specified	not specified	iSCSI name a	not specified	NAA IEEE Registered format per SPC-3
Target device	not specified	not specified	not specified	iSCSI name a	not specified	NAA IEEE Registered format per SPC-3
Initiator port	not specified	Fibre Channel name_identifier	EUI-64 + 8 byte extension b	iSCSI name + "i" + Initiator Session Identifier (ISID) a c iSCSI name concatenated with ",i,0x" concatenated with Initiator Session Identifier a c	EUI-64	not specified
Target port	not specified	Fibre Channel name_identifier	EUI-64 + 8 byte extension b	iSCSI name + "t" + Target Portal Group Tag a c iSCSI name concatenated with ",t,0x" concatenated with Target Portal Group Tag a d	EUI-64 + Discovery ID	not specified
Logical unit	Device Identification VPD page name (see SPC-23)					

a The iSCSI name should be worldwide unique, 223 bytes maximum in UTF-8 format with null termination.
a The iSCSI name is a worldwide unique UTF-8 string no more than 223 bytes long (not including null termination).
b Required to be worldwide unique and recommend to be EUI-64 + 8 byte extension.
c The Initiator Session Identifier (ISID) is a non-zero six byte integer.
c The Initiator Session Identifier (ISID) is a UTF-8 encoded hexadecimal representation of a non-zero six byte integer. The ISID is represented in no more than 12 bytes (not including null termination)..
d The Target Portal Group Tag is a non-zero two byte integer.
d The Target Portal Group Tag (TPGT) is a UTF-8 encoded hexadecimal representation of a non-zero two byte integer. The TPGT is represented in no more than 4 bytes (not including null termination)..
e See IEEE Std P1212 for more information on the Discovery ID.

A.3 SCSI transport protocol acronyms and bibliography

A.3.1 EUI-64 (Extended Unique Identifier, a 64-bit globally unique identifier): The IEEE maintains a tutorial describing EUI-64 at
http://standards.ieee.org/regauth/oui/tutorials/EUI64.html.

A.3.2 FCP-2: SCSI Fibre Channel Protocol -2 (see 1.3).

A.3.3 IEEE Std P1212: Standard for a Control and Status Register (CSR) Architecture for Microcomputer Buses. See http://www.ieee.org/.

A.3.4 iSCSI: As of this writing, the most recently published iSCSI internet draft is:
http://www.ietf.org/internet-drafts/draft-ietf-ips-iscsi-16.txt. Newer drafts may be identified at http://http://www.ietf.org/html.charters/ips-charter.html. The iSCSI internet draft is a standards track RFC specification.

A.3.5 NAA: Name Address Authority (see SPC-3).

A.3.6 SAS: Serial Attached SCSI (see 1.3).

A.3.7 SAS SSP: SAS (see A.3.6) Serial SCSI Protocol.

A.3.8 SBP-3: Serial Bus Protocol -3 (see 1.3).

A.3.9 SPI-4: SCSI Parallel Interface -4 (see 1.3).

A.3.10 SRP: SCSI RDMA Protocol (see 1.3).

A.3.11 UTF-8: See ISO/IEC 10646-1:2000, Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane. See http://www.iso.org/.