

To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
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Subject: T10/02-419r0 SAM-3 SPC-3 SAS FCP-3 SRP-2 Device identifiers and VPD data

Revision History

Revision 0 (2 November 2002) first revision

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 different transport protocols:

1. iSCSI uses a string format for port names and device names 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. 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 uses an EUI-64 based format for its target port names - 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 uses an EUI-64 based format for its target port names - 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 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).

8. 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.

9. 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 all the protocols line up:

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	SCSI name string format “<name>,l, 0xABCDEF0123456789” or NAA format or EUI-64 based format	SCSI name string format or NAA format or EUI-64-based format	SCSI name string format
Devices with only one protocol shall use these formats:			
iSCSI	SCSI name string format “<iSCSI name>,l, 0xABCDEF0123456789”	SCSI name string format “<iSCSI name>,t, 0xABCD”	SCSI name string format “<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]...”
SAS	NAA format (with NAA = 5 or 6)	NAA format (with NAA = 5 or 6)	SCSI name string format “naa.[5]...”
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 has 3 fundamental formats based on the ASSOCIATION field:

- c) logical unit name (with an ASSOCIATION value of 0h (logical unit)). The format is “<name>+ “,l,0xNNNNNNNNNNNNNNNNNN”, defined in SPC-3.
- d) target device name (with the proposed ASSOCIATION value of 2h (target device association)). The format is “<name>” (alone), defined in SPC-3.
- e) target port name (with an ASSOCIATION value of 1h (target port association)). The format is “<name>” + “,t,” + “<transport protocol dependent>” (in iSCSI, the target portal group identifier), defined in SCSI and by the transport protocol.

The port names are shortened from the current limit of 255, and non-inclusion of the terminating NULL in the sizes is clarified.

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: more SAM-3 changes below]

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 266) 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.~~

[Table 266 - 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 267) 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 267 - 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	<u>BINARY</u>	The IDENTIFIER field shall contain binary values.
2h	<u>ASCII</u>	The IDENTIFIER field shall contain ASCII graphic codes (i.e., code values 20h through 7Eh)
<u>3h</u>	<u>UTF-8</u>	<u>The IDENTIFIER field shall contain ISO/IEC 10646-1 (UTF-8) codes.</u>
3h-4h - Fh		Reserved

The ASSOCIATION field specifies the entity with which the IDENTIFIER field is associated, as described in table 269.

[Table 269 - Association]

The IDENTIFIER TYPE field (see table 270) specifies the format and assignment authority for the identifier.

Table 270 - Identifier types

Value	Description	Reference
0h	Vendor specific	8.6.4.2
1h	T10 vendor identification	8.6.4.3
2h	EUI-64	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
<u>8h</u>	<u>SCSI name string</u>	<u>8.6.4.x</u>
8h-9h - Fh	Reserved	

~~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.~~

The IDENTIFIER LENGTH field specifies the length in bytes of the IDENTIFIER field. If the allocation length 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.

8.6.4.2 Device Identifier requirements [this section is entirely new]

8.6.4.2.1 Logical unit identifier

Each 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 (2h);

- c) NAA (3h); or
- d) SCSI name string (8h).

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

- a) EUI-64 (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:

- 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 the "...I,MMM..." name format defined in TBD.

8.6.4.2.2 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 (2h);
- b) NAA (3h); or
- c) SCSI name string (8h).

If the transport protocol of the target port defines target port names and this identification descriptor is included, the identifier shall contain the target port name; otherwise, it 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).

8.6.4.2.3 Target device identifier

Each 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-based 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 1h and the IDENTIFIER LENGTH field shall be set to 8h.

Table 273 - EUI-64 IDENTIFIER field format

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

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

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

The DIRECTORY ID field contains a 24 bit numeric value.

NOTE: The EUI-64 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 1h.

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

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

The IDENTIFIER EXTENSION field contains a 64 bit numeric value.

NOTE: The EUI-64 extended 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.n SCSI name string identifier format [this section is entirely new]

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	SCSI NAME STRING							
n + 1	NULL (00h)							
n + 2	PAD (if needed)							
4m - 1	PAD (if needed)							

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:

- d) "iqn." + iSCSI Name for an iSCSI-name based identifier (see iSCSI);
- e) "naa." + 16 or 32 hex characters for an NAA identifier (see 8.6.4.5)
- f) "eui." + 8, 12, or 16 hex characters for an EUI-64 based identifier (see 8.6.4.4).

When the ASSOCIATION field is set to logical unit (0h), the SCSI NAME STRING field ends with ",l,0x" + 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" + hex characters (see the appropriate transport protocol standard).

When the ASSOCIATION field is set to target port (1h), 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 use SCSI name string format (with "naa" "eui" or "iqn" type).

The target device name shall use 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 use SCSI name string format (with "naa" "eui" or "iqn" type).

The target device name shall use SCSI name string format.

Proposed changes for SRP-2

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

The target device name shall use 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 use 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 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 + “,l,0x” + logical unit name extension in hex ^(a) _(b)	SCSI Target Port Name	SCSI Device Name	
^a “l” 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 Identifiers and names for objects**[Editor's note: More changes will be needed here...]**

iSCSI entry	Current	New
A.3 Initiator port identifier size	255 bytes	Equivalent to initiator port name size in Table A.5
A.3 Target port identifier size	255 bytes	Equivalent to target port name size in Table A.5
A.4 Initiator port identifier format	iSCSI name + “,i,” + Initiator Session Identifier (ISID) b c	Equivalent to initiator port name format in Table A.6
A.4 Target port identifier format	iSCSI name + “,t,” + Target Portal Group Tag b d	Equivalent to target port name format in Table A.6
A.4 Identifier format note b	b The iSCSI name should be worldwide unique, 223 bytes maximum in UTF-8 format with null termination.	[remove]
A.4 Identifier format note c	c The Initiator Session Identifier (ISID) is a non-zero six byte integer.	[remove]
A.4 Identifier format note d	d The Target Portal Group Tag is a non-zero two byte integer.	[remove]
A.5 Initiator device name size	223 bytes	[no change]
A.5 Target device name size	223 bytes	[no change]
A.5 Initiator port name size	255 bytes	245 bytes *
A.5 Target port name size	255 bytes	232 bytes * not including null termination
A.6 Initiator device name format	iSCSI name a	[no change]
A.6 Target device name format	iSCSI name a	[no change]
A.6 Initiator port name format	iSCSI name + “,i,” + Initiator Session Identifier a c	iSCSI name + “,i,0x” + Initiator Session Identifier a c
A.6 Target port name format	iSCSI name + “,t,” + Target Portal Group Tag a d	iSCSI name + “,t,0x” + Target Portal Group Tag a d
A.6 Name format note a	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. *
A.6 Name format note c	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. *
A.6 Name format note d	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