

## String Profile for Internet Small Computer Systems Interface (iSCSI) Names

### Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

### Copyright Notice

Copyright (C) The Internet Society (2004). All Rights Reserved.

### Abstract

This document describes how to prepare internationalized iSCSI names to increase the likelihood that name input and comparison work in ways that make sense for typical users throughout the world.

The Internet Small Computer Systems Interface (iSCSI) protocol provides a way for hosts to access SCSI devices over an IP network. The iSCSI end-points, called initiators and targets, each have a globally-unique name that must be transcribable, as well as easily compared.

### 1. Introduction

The iSCSI protocol [RFC3720] provides a way for hosts to access SCSI [SAM2] devices over an IP network. The iSCSI end-points, called initiators and targets, each have a globally-unique name, defined in [RFC3721].

An iSCSI name is a string of UTF-8 [RFC3629] characters that includes a type designator, a naming authority based on domain names, and a unique part within the naming authority. The unique part may be generated based on anything the naming authority deems useful, and may include user input.

These names may need to be transcribed (sent between two administrators via email, voice, paper, etc), so a case-insensitive comparison would be desirable. However, these names must often be

compared by initiator and target implementations, most of which are done in simple, embedded software. This makes case-sensitive comparison highly desirable for these implementors.

However, a completely case-sensitive implementation would result in identifiers such as "example-name" and "Example-Name" being different, which could lead to confusion as these names are transcribed.

The goal, then, is to generate iSCSI names that can be transcribed and entered by users, and also compared byte-for-byte, with minimal confusion. To attain these goals, iSCSI names are generalized using a normalized character set (converted to lower case or equivalent), with no white space allowed, and very limited punctuation.

For those using only ASCII characters (U+0000 to U+007F), the following characters are allowed:

- ASCII dash character ('-' = U+002d)
- ASCII dot character ('.' = U+002e)
- ASCII colon character (':' = U+003a)
- ASCII lower-case characters ('a'..'z' = U+0061..U+007a)
- ASCII digit characters ('0'..'9' = U+0030..U+0039)

In addition, any upper-case characters input via a user interface **MUST** be mapped to their lower-case equivalents.

This document specifies the valid character set for iSCSI names, along with the rules for normalizing and generating iSCSI names based on user input or other information that contains international characters.

In particular, it defines the following, as required by [RFC3454]:

- The intended applicability of the profile: internationalized iSCSI names.
- The character repertoire that is the input and output to stringprep: Unicode 3.2, specified in section 3.
- The mappings used: specified in section 4.
- The Unicode normalization used: specified in section 5.
- The characters that are prohibited as output: specified in section 6.

This profile **MUST** be used with the iSCSI protocol.

## 2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

Examples in this document use the notation for code points and names from the Unicode Standard [Unicode3.2] and ISO/IEC 10646 [ISO10646]. For example, the letter "a" may be represented as either "U+0061" or "LATIN SMALL LETTER A". In the lists of prohibited characters, the "U+" is left off to make the lists easier to read. The comments for character ranges are shown in square brackets (such as "[SYMBOLS]") and do not come from the standards.

## 3. Character Repertoire

This profile uses Unicode 3.2, as defined in [RFC3454] Appendix A.

## 4. Mapping

This profile specifies mapping using the following tables from [RFC3454]. The following mapping tables **MUST** be used when generating iSCSI names from Unicode characters.

Table B.1  
Table B.2

## 5. Normalization

Unicode normalization form KC **MUST** be used with this profile, as described in [RFC3454].

## 6. Prohibited Output

This profile specifies prohibiting using the following tables from [RFC3454]. Characters appearing within these tables **MUST NOT** be used within an iSCSI name.

Table C.1.1  
Table C.1.2  
Table C.2.1  
Table C.2.2  
Table C.3  
Table C.4  
Table C.5  
Table C.6

Table C.7  
Table C.8  
Table C.9

Important note: this profile **MUST** be used with the iSCSI protocol. The iSCSI protocol has additional naming rules that are checked outside of this profile.

In addition, this profile adds the following prohibitions. The full set of prohibited characters are those from the tables above plus those listed individually below.

#### 6.1. Inappropriate Characters from Common Input Mechanisms

u+3002 is used as if it were u+002e in many domain name input mechanisms used by applications, particularly in Asia. The character u+3002 **MUST NOT** be used in an iSCSI name.

3002; ideographic full stop

#### 6.2. Currently-prohibited ASCII characters

Some of the ASCII characters that are currently prohibited in iSCSI names by [RFC3721] are also used in protocol elements such as URIs. Some examples are described in [RFC2396] and [RFC2732]. Note that there are many other RFCs that define additional URI schemes.

The other characters in the range U+0000 to U+007F that are not currently allowed are prohibited in iSCSI names to reserve them for future use in protocol elements. Note that the dash (U+002D), dot (U+002E), and colon (U+003A) are not prohibited.

The following characters **MUST NOT** be used in iSCSI names:

0000-002C; [ASCII CONTROL CHARACTERS and SPACE through ,]  
002F; [ASCII /]  
003B-0040; [ASCII ; through @]  
005B-0060; [ASCII [ through `]  
007B-007F; [ASCII { through DEL]

#### 7. Bidirectional Characters

This profile specifies checking bidirectional strings as described in [RFC3454] section 6.

## 8. Unassigned Code Points in Internationalized Domain Names

If the processing in [RFC3720] specifies that a list of unassigned code points be used, the system uses table A.1 from [RFC3454] as its list of unassigned code points.

## 9. Security Considerations

ISO/IEC 10646 has many characters that look similar. In many cases, users of security protocols might do visual matching, such as when comparing the names of trusted third parties. This profile does nothing to map similar-looking characters together.

iSCSI names may be used by an initiator to verify that a target it has discovered is the correct one, and by a target to verify that an initiator is to be allowed access. If these names are interpreted and compared differently by different iSCSI implementations, an initiator could gain access to the wrong target, or could be denied access to a legitimate target.

## 10. IANA Considerations

This is a profile of stringprep. It has been registered in the IANA "Stringprep Profiles" registry. This process is described in the IANA Considerations section of [RFC3454].

## 11. Summary

This document describes a stringprep profile to be used with programs generating names for iSCSI initiators and targets.

## 12. Acknowledgements

This document was produced as a result of discussions on iSCSI name formats with Joe Czap, Jim Hafner, Howard Hall, Jack Harwood, John Hufferd, Marjorie Krueger, Lawrence Lamers, Todd Sperry, Joshua Tseng, and Kaladhar Voruganti, as well as discussions on the normalization of names into identifiers with Paul Hoffman and Marc Blanchet.

Thanks also to Bob Snively for suggesting the use of the nameprep process for iSCSI name normalization.

Most of this document was copied from the stringprep profile for Internationalized Domain Names [RFC3491], written by Paul Hoffman and Marc Blanchet.

## 13. References

### 13.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC3454] Hoffman, P. and M. Blanchet, "Preparation of Internationalized Strings ("stringprep")", RFC 3454, December 2002.
- [RFC3720] Satran, J., Meth, K., Sapuntzakis, C. Chadalapaka, M. and E. Zeidner, "Internet Small Computer Systems Interface (iSCSI)", RFC 3720, April 2004.

### 13.2. Informative References

- [RFC2396] Berners-Lee, T., Fielding, R. and L. Masinter, "Uniform Resource Identifiers", RFC 2396, August 1998.
- [RFC2732] Hinden, R., Carpenter, B. and L. Masinter, "Format for Literal IPv6 Addresses in URL's", RFC 2732, December 1999.
- [RFC3491] Hoffman, P. and M. Blanchet, "Nameprep: A Stringprep Profile for Internationalized Domain Names", RFC 3491, March 2003.
- [RFC3629] Yergeau, F., "UTF-8, a transformation format of ISO 10646", STD 63, RFC 3629, November 2003.
- [RFC3721] Bakke, M., Hafner, J., Hufferd, J., Voruganti, K. and M. Krueger, "Internet Small Computer Systems Interface (iSCSI) Naming and Discovery", RFC 3721, April 2004.
- [SAM2] ANSI T10. "SCSI Architectural Model 2", March 2000.
- [Unicode3.2] The Unicode Standard, Version 3.2.0: The Unicode Consortium. The Unicode Standard, Version 3.2.0 is defined by The Unicode Standard, Version 3.0 (Reading, MA, Addison-Wesley, 2000. ISBN 0-201-61633-5), as amended by the Unicode Standard Annex #27: Unicode 3.1 (<http://www.unicode.org/unicode/reports/tr27/>) and by the Unicode Standard Annex #28: Unicode 3.2 (<http://www.unicode.org/unicode/reports/tr28/>).

[ISO10646] ISO/IEC 10646-1:2000. International Standard -- Information technology -- Universal Multiple-Octet Coded Character Set (UCS) -- Part 1: Architecture and Basic Multilingual Plane.

#### 14. Author's Address

Mark Bakke  
Cisco Systems, Inc.  
6450 Wedgwood Road  
Maple Grove, MN  
USA 55311

Voice: +1 763-398-1000  
EMail: mbakke@cisco.com

## 15. Full Copyright Statement

Copyright (C) The Internet Society (2004). This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at [ietf-ipr@ietf.org](mailto:ietf-ipr@ietf.org).

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.