INTERNATIONAL STANDARD

**ISO/IEC 20919**

Second edition
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# Information technology — Linear tape file system (LTFS) Format specification

*Technologies de l'information — Spécification du format de système de fichier à bande magnétique*



**PROOF/ÉPREUVE**

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This document was prepared by the Storage Networking Industry Association (SNIA) (as Linear Tape File System (LTFS) Format Specification, Version 2.5) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO/IEC 20919:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Volume Advisory Locking — a method of marking a volume as locked against future modification;

— Percent Encoding — method of including previously reserved characters in names of files and directories;

— Incremental Indexes — a method of recording a smaller index containing only changes since the last index;

— File hashes — a method of recording fils hash information in the index in an interchangeable manner;

— Open For Write — a method of noting files in the index which were still open at the time the index is written to tape.

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# Revision History

| Revision | Date | Sections | Originator | Comments |
|---|---|---|---|---|
| 2.3.0 rev 1 | 3/18/14 | Add section F.3 | SNIA LTFS TWG | Edits during TWG F2F |
| 2.3.0 rev 2 | 12/15/14 | Add Changes per TWG | SNIA LTFS TWG | Edits adding Volume Advisory Locking, Volume UUID and LTFS Name Encoding |
| 2.3.0 rev 3 | 3/18/15 | Add changes per TWG | SNIA LTFS TWG | Edits Advisory Locking, Sha512,Media Pool Extended Attributes &MAM |
| 2.3.0 rev 4 | 3/24/15 | Add edits from TWG review | SNIA LTFS TWG | Cleanup some reference errors and minor editorial changes |
| 2.3.0 rev 5 | 9/15/15 | Add example 3 to Appendix F.1.6 | SNIA LTFS TWG | Added additional description and example to describe reclamation of spanned file segments |
| 2.3.0 rev 6 | 9/15/15 | Add edits from TWG review | SNIA LTFS TWG | Revised wording in Appendix F.1.6 example 3 |
| 2.4.0 rev 0 | 11/14/15 | Add work from TWG | SNIA LTFS TWG | Added changes listed in Change history |
| 2.4.0 rev 1 | 1/12/17 | Add edits from TWG review | SNIA LTFS TWG | Cleaned up some hyperlinks and minor editorial changes |
| 2.4.0 rev 2 | 1/17/17 | Add edits from TWG F2F | SNIA LTFS TWG | Minor editorial changes |
| 2.4.0 rev3 | 6/12/17 | Add edits from TWG | SNIA LTFS TWG | Added Advisory Locking changes |
| 2.4.0 rev 4 | 6/13/17 | Add Media Pool changes per TWG | SNIA LTFS TWG | Added additional extended attributes for Media Pool |
| 2.4.0 rev 5 | 6/19/17 | Add edits per TWG | SNIA LTFS TWG | Cleaned up a couple of typographical errors |
| 2.4.0 rev 6 | 10/10/17 | Add edits per TWG | SNIA LTFS TWG | Incorporated public review editorial comments |
| 2.4.0 rev 7 | 10/18/17 | Add edits per TWG | SNIA LTFS TWG | Minor editorial changes |
| 2.4.0 rev 8 | 10/24/17 | Annex G | SNIA LTFS TWG | Minor editorial change |
| 2.4.0 rev 9 | 11/14/17 | Annex G | SNIA LTFS TWG | Minor editorial change |
| 2.5.0 rev 0 | 12/04/18 | Sections 5 & 9, Annex B, etc. | SNIA LTFS TWG | Add incremental indexes; changes for sync behavior |
| 2.5.0 rev 1 | 02/11/19 | Add Annex H; edits per TWG | SNIA LTFS TWG | New Annex describing incremental indexes |
| 2.5.0 rev 2 | 04/02/19 | Section 9.2; Annex H | SNIA LTFS TWG | Corrected typos in example XML, updated flowchart in Annex H to clarify intent |
| 2.5.1 rev 0 | 08/18/20 | Section 3; Annex I | SNIA LTFS TWG | Editorial changes to References per feedback from ISO |

Suggestion for changes or modifications to this document should be sent to the SNIA Linear Tape File System Technical Work Group at http://www.snia.org/feedback/.

**Changes between v1.0 and v2.0.0**

- Incremented version number to 2.0.0 and updated date to March 11, 2011.
- Improvements in specification text to remove ambiguity and clarify intention of the specification. These changes were made at several locations throughout the document.
- Improvements to clarify description of MAM parameters in Section 10 Medium Auxiliary Memory.
- Removed reference to a specific version of the Unicode standard in Section 7.5 Name pattern format. This removes any requirement to use specific versions of Unicode support code in an implementation.
- Improved description of Name pattern format to remove ambiguity in Section 7.5 Name pattern format.
- Added description of LTFS Format specification version numbering in Section 2.1 Versions.
- Updated XML Schema for Label and Index to match version number format in Annex A and Annex B.
- Added specification of minimum and recommended blocksize value for LTFS Volumes to Section 8.1.2 LTFS Label.
- Added definition of allowed version numbers to Section 8.1.2 LTFS Label and Section 9.2 Index.
- Added definition of fileoffset tag in Section 9.2 Index.
- Extended description in Section 6 Data Extents to support addition of fileoffset tag and associated functionality.
- Added definition of highestfileuid tag in Section 9.2 Index.
- Added definition of fileuid tag in Section 9.2 Index.
- Added definition of backuptime tag in Section 9.2 Index.
- Incremented version number in Application Client Specific Information (ACSI) structure shown in Section 10.3 Use of Volume Coherency Information for LTFS. This increment allows identification of LTFS Volumes written with a LTFS v1.0 compliant implementation. A widely used v1.0 implementation wrote ambiguous ACSI values due to an implementation bug.
- Added definition of extended attributes in the ltfs.* namespace in Annex C.
- Added description for handling unknown XML tags in Index to Section 9.2.13 Managing LTFS Indexes.

**Changes between v2.0.0 and v2.0.1**

- Incremented specification version number to 2.0.1.
- Updated specification date to August 17, 2011.
- Expanded historical record of changes between revisions of LTFS Format Specification.
- Improved description of constraints for two Indexes having the same generation number in Section 5.4.1 Generation Number to make it clear that differences in access time values is permitted between Indexes that are otherwise except for self pointer and index pointer values.
- Added note in Section 5.4.1 Generation Number to explicitly state that Index generation numbers may increase by integer values other than 1.
- Expanded description of the ltfs.sync extended attribute in Annex C . The expanded description explicitly states that this extended attribute triggers a sync of the in-memory data to the storage media. That is, the operation is analogous to a POSIX sync operation.

**Changes between v2.0.1 and v2.1.0**

- Incremented specification version number to 2.1.0.

- Updated specification date to October 18, 2012.
- Added definition of symlink tag in Section 9.2 Index.
- Added example of symlink tag use in Annex E.
- Added symlink tag to Annex B.
- Added description of “ltfs.vendor.X.Y” extended attribute namespace in Annex C .
- Added description of software metadata section in Annex C.
- Added description of drive metadata section in Annex C.
- Added ”ltfs.labelVersion” extended attribute in Annex C.
- Added ”ltfs.indexVersion” extended attribute in Annex C
- Added ”ltfs.mediaEncrypted” extended attribute in Annex C .
- Improved description of ”ltfs.mediaStorageAlert” extended attribute in Annex C.

**Changes between v2.1.0 and v2.2.0**

- Incremented specification version number to 2.2.0.
- Updated specification date to July 16, 2013.
- Changed “2010” to “2013” in XML examples.
- Editorial Cleanup.
- Changed “extentinfo” definition in Section 9.2 Index.
- Changed “symlink” definition in Section 9.2 Index.
- Added additional paragraph to “symlink” definition in Section 9.2 Index.
- Added general comments at start of Section 10 Medium Auxiliary Memory.
- Added Section 10.4 Use of Host-type Attributes for LTFS.
- Removed Section 9 Certification from document.
- Added “ltfs.mamBarcode” extended attribute in Volume Metadata.
- Added “ltfs.mamApplicationVendor” extended attribute in Volume Metadata.
- Added “ltfs.mamApplicationVersion” extended attribute in Volume Metadata.
- Added “ltfs.mamApplicationFormatVersion” extended attribute in Volume Metadata.
- Added new Annex F Interoperability Recommendation and added File Spanning and File Permissions subsections



**Changes between v2.2.0 and 2.3.0 rev 1**

- Add section F.3 Storing File Hash Values in LTFS
- Add Section 10.5 Volume Advisory Locking to Section 10 Medium Auxiliary Memory
- Added Volume UUID to Section 10.4 and Section 10.4.8
- Added LTFS Name Encoding to Sections 3.1, 7.4, 9.2.1 and 9.2.2
- Added SHA512 to Section F.3 Storing Hash Values in LTFS
- ISO document formatting changes
- Add Media Pool Extended Attributes and MAM

**Changes between v2.3.0 rev 1 and v2.4.0**

- Incremented specification version number to 2.4.0.
- Added new text to Section 10.5 Volume Advisory Locking
- Added new text to Annex C.4 VolumeMetadata, ltfs.volumeLockState
- Added new text for “openforwrite” to Section 9.2.9
- Added new entry to the file element list in Annex B
- Added new descriptive text to Annex E
- Added new example file “partialfile.bin” to Annex E
- Updated the compliance statement to “version 2.4.0” in Section 7.4 Name Format
- Added new percentencoding text to Section 7.4 Name Format
- Removed percentencoding definition from Section 9.2.7
- Removed percentencoding definition from Section 9.2.9
- Added new text to symlink definition in Section 9.2.9
- Removed percentencoding paragraph(s) from Section 9.2.10
- Removed the percentencoded entry from the directory, file and extended attributes sections in Annex B
- Changed the name definition in the directory section of Annex B
- Changed the name definition in the file section of Annex B
- Changed the symlink definition in the file section of Annex B
- Changed the key definition in the extendedattributes section of Annex B
- Added new NameType definition to Annex B
- Changed the entry for fileuid “10” in Annex E



**Changes between v2.4.0 and v2.4.0 rev 1**

- Incremented specification version number to 2.4.0 rev 1.
- Changed version from 2.3.0 to 2.4.0 in Section 2.1 Versions
- Changed version from 2.3.0 to 2.4.0 in Annex E
- Cleaned up some hyperlinks and minor editorial changes

**Changes between v2.4.0 rev 1 and v2.4.0 rev 2**

- Changed version from 2.3.0 to 2.4.0 throughout document except for Section 9.2.19
- Changed updatetime in Annex E to reflect correct date/time value for example shown
- Changed highestfileuid in Annex E to reflect correct value for example shown
- Changed lockType to locktype throughout document
- Changed NameType to nametype throughout document

**Changes between v2.4.0 rev 2 and v2.4.0 rev 3**

- Updated the definition of the volumeLockState virtual extended attribute in Section 10.5 and Annex C.4

**Changes between v2.4.0 rev 3 and v2.4.0 rev 4**

- Updated the definition of the Media Pool MAM attribute in Section 10.4 and Annex F.4.1.1

**Changes between v2.4.0 rev 4 and v2.4.0 rev 5**

- Fixed a couple of typographical errors

**Changes between v2.4.0 rev 5 and v2.4.0 rev 6**

- Corrections to Annex B – XML Schema
- Added Annex G – character representations
- Clarified in Section 7.4 that percent encoding does not apply to Table 13, and added reference to Annex G
- Added two further IBM contributors to the Acknowledgements

**Changes between v2.4.0 rev 6 and v2.4.0 rev 7**

- Changed title and reference of table G.1 in Annex G – applies to 2.3 and later
- Added clarifying note for symlinks in Annex G

**Changes between v2.4.0 rev 7 and v2.4.0 rev 8**

- Changed column heading in tables G.1 and G.2 to “symlink target name”
- Improved wording of Note 3 in Annex G

**Changes between v2.4.0 rev 8 and v2.4.0 rev 9**

- Changed column heading in tables G.1 and G.2 to “File name, directory name, filename pattern”
- Added corresponding Note 4 in Annex G



**Changes between v2.4.0 rev 9 and v2.5.0**

- Incremented specification version number to 2.5.0.
- Added new text to describe Full and Incremental Indexes, in particular in 5.4 Index Layout and 9 Index Format.
- Added new virtual extended attributes related to Incremental Indexes in C.4.
- Specify required behavior in response to writing ltfs.commitMessage and ltfs.sync VEAs in Annex C.

**Changes between v2.5.0 rev 0 and v2.5.0 rev 1**

- Added new informative Annex H describing background information on Incremental Indexes
- Editorial changes to clarify required vs optional elements in Incremental Indexes in 9 Index Format.
- Clarified that the required behavior for ltfs.commitMessage and ltfs.sync applies only to implementations supporting those VEAs.

**Changes between v2.5.0 rev 1 and v2.5.0 rev 2**

- Corrected typos in Incremental Indexes example XML in 9.2.2 and 9.2.12
- Corrected typos in Annex H and amended flowchart H.1 to clarify the intent

**Changes between v2.5.0 rev 2 and v2.5.1 rev 0**

- Moved informative references from Section 3 to new Annex I Bibliography
- Amended all references to SPC-3 / SPC-4 to SPC-5

## Acknowledgements

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| | |
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