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Information technology — Volume and file structure of write-once and rewritable media using non-sequential recording for information interchange —

Part 3: Volume structure

Technologies de l'information — Structure de volume et de fichier de moyens d'écriture unique et de réécriture utilisant un enregistrement non séquentiel pour l'échange d'information —

Partie 3: Structure de volume

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialised system for worldwide standardisation. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organisation to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organisations, governmental and non-governmental, in liaison with ISO and IEC, also take part in this work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication of an International Standard requires approval by at least 75% of the national bodies casting a vote.

International Standard ISO/IEC 13346-3 was prepared by the European Association for Standardizing Information and Communication Systems, ECMA, (as Standard ECMA-167) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by National Bodies of ISO and IEC.

Introduction

ISO/IEC 13346 is a volume and file structure standard for interchanging files and as such, it is a peer to existing volume and file structure standards such as ISO 9293 and ISO 9660. It is rather different from those standards in at least two important ways. Firstly, it offers much more functionality, mainly because of user needs for increased character set support and for more powerful file system features. Secondly, it acknowledges the separate concerns of booting, volume structure and file system structure. Rather than bundling these different functions together, ISO/IEC 13346 carefully segregates these functions into separate parts and describes in detail how those parts fit together. It is expected that future volume and file structure standards will fit into this framework, rather than building other distinct and incompatible formats.

ISO/IEC 13346 is published in five Parts. Part 1 - general - specifies references, definitions, notations and basic structures used in the other four Parts. Part 2 - volume and boot block recognition - specifies formats and system requirements for recognising the volume structures on a medium and booting from a medium. Part 3 - volume structure - specifies how to record various volume-related entities such as volumes, volume sets and logical volumes. Part 4 - file structure - specifies how to record and interpret files, both file data and file attributes, and file hierarchies within logical volumes. Part 5 - record structure - specifies how to record and interpret file data encoded as records.

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Information technology - Volume and file structure of write-once and rewritable media using non-sequential recording for information interchange -

Part 3:
Volume structure

Section 1 : General

1 Scope

ISO/IEC 13346 specifies a format and associated system requirements for volume and boot block recognition, volume structure, file structure and record structure for the interchange of information on media between users of information processing systems.

The media shall be recorded as if the recording of sectors may be done in any order.

NOTE 1 - The medium is not restricted to being of only one type; the type of medium may be either write once, or read only, or rewritable, or a combination of these types.

ISO/IEC 13346 consists of the following five Parts:

Part 1: General

Part 2: Volume and Boot Block Recognition

Part 3: Volume Structure

Part 4: File Structure

Part 5: Record Structure

Annex A - ICB Strategies, is part of ISO/IEC 13346-4.

This Part of ISO/IEC 13346 specifies a format and associated system requirements for volume structure by specifying:

- the attributes of a volume and the descriptors recorded on it;
- the relationship among volumes of a volume set;
- the attributes of a partition of a volume;
- the attributes of a logical volume and the descriptors recorded on it;
- levels of medium interchange;
- requirements for the processes which are provided within information processing systems, to enable information to be interchanged between different systems; for this purpose, it specifies the functions to be provided within systems which are intended to originate or receive media which conform to this Part of ISO/IEC 13346.

2 Parts references

The first digit of a reference within ISO/IEC 13346 identifies the Part, e.g. 2/5 refers to clause 5 in ISO/IEC 13346-2, and figure 4/3 refers to figure 3 in ISO/IEC 13346-4.

3 Part interface

This clause specifies the interface of this Part of ISO/IEC 13346 to other standards or Parts.

3.1 Input

This Part of ISO/IEC 13346 requires the specification of the following by another standard or Part.

- A standard for recording (see 1/5.10).
- The size of a logical sector (see 3/8.1.2) of a volume.
- If the volume is recorded according to ISO/IEC 13346-2, a volume recognition sequence specified by ISO/IEC 13346-2 shall contain the descriptor described in 3/9.1 recorded at least once.

- If the volume is recorded according to ISO/IEC 13346-2, the volume recognition space (see 2/8.2) shall be the entire volume.
- If the volume is recorded according to ISO/IEC 13346-2, the initial sector in the volume (see2/3.1) shall be the first sector of the volume.
- Information to be recorded in the Partition Contents Use field of a Partition Descriptor (see 3/10.5.6).
- Information to be recorded in the Logical Volume Contents Use field of a Logical Volume Descriptor (see 3/10.6.7).

3.2 Output

This Part of ISO/IEC 13346 specifies the following which may be used by other standards or Parts.

- Volume sets of one or more volumes (see 3/8.6).
- A volume space for a volume (see 3/8.2).
- Logical sectors of a fixed size for a volume (see 3/8.1.2).
- Partitions (see 3/8.7).
- Logical volumes composed of partitions (see 3/8.8).
- Numeric identification of the partitions within a logical volume (see 3/8.8).
- Logical blocks of a fixed size for a logical volume.
- The logical block size for a logical volume.
- Attributes of a volume.
- Attributes of a logical volume.
- Attributes of a partition.
- An indication that a volume may have been recorded to this Part (see 3/9.1).

4 Conformance

4.1 Conformance of a medium

A medium shall be in conformance with ISO/IEC 13346 when it conforms to a standard for recording (see 1/5.10) and information recorded on sectors of the medium conform to the specifications of ISO/IEC 13346-1 and one or more of Parts 2, 3, 4 and 5. A statement of conformance shall identify the sectors of the medium on which information is recorded according to the specifications of ISO/IEC 13346, and the Parts and the levels of medium interchange (see 1/10, 3/11, and 4/15) to which the contents of those sectors of the medium conform.

4.2 Conformance of an information processing system

An information processing system shall be in conformance with ISO/IEC 13346 if it meets the requirements specified in ISO/IEC 13346-1 and one or more of Parts 2, 3, 4 and 5 either for an originating system (see 2/13, 3/13, 4/17 and 5/11) or for a receiving system (see 2/13, 3/14, 4/18 and 5/12) or for both types of system. A statement of conformance shall identify the Parts, and the levels of the requirements for each of those Parts, which can be met by the system.

5 Definitions

For the purposes of this Part of ISO/IEC 13346, the definitions given in ISO/IEC 13346-1 (see 1/5) and the following definitions apply.

5.1 **anchor point:** One of a specified set of logical sector numbers at which descriptors, that identify an extent of a Volume Descriptor Sequence, may be recorded.

5.2 **Cyclic Redundancy Check (CRC):** A method for computing a signature of a sequence of bytes.

5.3 **extent:** A set of logical sectors whose logical sector numbers (see 3/8.1.2.1) form a continuous ascending sequence. The address, or location, of an extent is the first logical sector number in that sequence.

5.4 **logical block:** The unit of allocation of a logical volume.

5.5 **logical sector**: The unit of allocation of a volume.

5.6 **logical volume:** A nonempty set of partitions.

5.7 **partition:** An extent of logical sectors within a volume.

6 Notation

The notation of ISO/IEC 13346-1 (see 1/6) applies to this Part of ISO/IEC 13346.

7 Basic types

In addition to the basic types of ISO/IEC 13346-1 (see 1/7), the following basic types apply for this Part of ISO/IEC 13346.

7.1 Extent Descriptor

An Extent Descriptor, hereafter designated as `extent_ad`, shall be recorded in the format shown in figure 3/1.

RBP	Length	Name	Contents
0	4	Extent Length	`Uint32` (1/7.1.5)
4	4	Extent Location	`Uint32` (1/7.1.5)

Figure 1 - `extent_ad` format

7.1.1 Extent Length (RBP 0)

This field shall indicate the length of the extent, in bytes, identified by the Extent Location field. The length shall be less than 2^{30}. Unless otherwise specified, the length shall be an integral multiple of the logical sector size.

7.1.2 Extent Location (RBP 4)

This field shall specify the location of the extent, as a logical sector number. If the extent's length is 0, no extent is specified and this field shall contain 0.

7.2 Descriptor tag

Certain descriptors specified in this Part of ISO/IEC 13346 have a 16 byte structure, or `tag`, recorded at the start of the descriptor. The `tag` shall be recorded with the format shown in figure 3/2.

NOTE 2 - There are two main motivations for using a generic tag structure. The first is that most descriptors need to handle common issues of CRCs and format versions. The second motivation is to support recovery after the medium has been damaged or corrupted in some (unspecified) way. With the tag described here, structures are self identifying and can be verified with very little context.

RBP	Length	Name	Contents
0	2	Tag Identifier	`Uint16` (1/7.1.3)
2	2	Descriptor Version	`Uint16` (1/7.1.3) = 2
4	1	Tag Checksum	`Uint8` (1/7.1.1)
5	1	Reserved	#00 byte
6	2	Tag Serial Number	`Uint16` (1/7.1.3)
8	2	Descriptor CRC	`Uint16` (1/7.1.3)
10	2	Descriptor CRC Length	`Uint16` (1/7.1.3)
12	4	Tag Location	`Uint32` (1/7.1.5)

Figure 2 - `tag` format

7.2.1 Tag Identifier (RBP 0)

This field shall specify an identification of the descriptor type. Type 0 shall specify that the format of this descriptor is not specified by this Part of ISO/IEC 13346. Types 1-7 and 9 are specified as shown in figure 3/3. Type 8 is specified identically in this Part of ISO/IEC 13346 and ISO/IEC 13346-4. Types 256-265 are specified in ISO/IEC 13346-4. All other types are reserved for future standardisation. The descriptor types specified by this Part of ISO/IEC 13346 are shown in figure 3/3.

Type	Interpretation
1	Primary Volume Descriptor (3/10.1)
2	Anchor Volume Descriptor Pointer (3/10.2)
3	Volume Descriptor Pointer (3/10.3)
4	Implementation Use Volume Descriptor (3/10.4)
5	Partition Descriptor (3/10.5)
6	Logical Volume Descriptor (3/10.6)
7	Unallocated Space Descriptor (3/10.8)
8	Terminating Descriptor (3/10.9 and 4/14.2)
9	Logical Volume Integrity Descriptor (3/10.10)

Figure 3 - Descriptor interpretation

7.2.2 Descriptor Version (RBP 2)

This field shall specify the version of this descriptor. The value 2 shall indicate the structure of this Part of ISO/IEC 13346.

7.2.3 Tag Checksum (RBP 4)

This field shall specify the sum modulo 256 of bytes 0-3 and 5-15 of the tag.

7.2.4 Reserved (RBP 5)

This field shall be reserved for future standardisation and shall be set to 0.

7.2.5 Tag Serial Number (RBP 6)

This field shall specify an identification of a set of descriptors. If the field contains 0, then no such identification is specified.

NOTE 3 - This field can be used to distinguish between groups of descriptors. For example, when reusing rewritable media, an implementation might choose a different serial number from the previous use when initialising a volume. Thus, a disaster recovery mechanism can avoid recovering prior and unintended data. The only alternative to this scheme would be to force volume initialisation to clear the volume.

7.2.6 Descriptor CRC (RBP 8)

This field shall specify the CRC of the bytes of the descriptor starting at the first byte after the descriptor tag. The number of bytes shall be specified by the Descriptor CRC Length field. The CRC shall be 16 bits long and be generated by the CRC-ITU-T polynomial (see ITU-T V.41):

$$x^{16} + x^{12} + x^5 + 1$$

NOTE 4 - As an example, the CRC of the three bytes #70 #6A #77 is #3299. Implementations can avoid calculating the CRC by setting the Descriptor CRC Length to 0, as then the Descriptor CRC shall be 0.

7.2.7 Descriptor CRC Length (RBP 10)

This field specifies how many bytes were used in calculating the Descriptor CRC.

7.2.8 Tag Location (RBP 12)

This field shall specify the number of the logical sector containing the first byte of the descriptor.

NOTE 5 - The location of the tag may appear to be redundant but its primary purpose is to make it extremely likely that if the first 16 bytes of a logical sector or logical block is a consistent descriptor tag, then it is a descriptor tag.