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

Part 5:
Record 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 5: Structure d'enregistrement



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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 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.

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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 5:
Record 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 record structure by specifying:

- record structures intended for use when the information constituting a file is required to be interpreted as a set of records;
- the attributes of the records of a file;
- 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.

- Data space of a file (see 5/6.1).
- If the records of the file are to be interpreted according to 5/9.2.4, 5/9.2.5, 5/9.2.6, 5/9.2.7 or 5/9.2.8 or are intended to be displayed according to 5/9.3, specification of how characters, including the LINE FEED, VERTICAL TABULATION, FORM FEED, and CARRIAGE RETURN characters, are encoded within the data space of the file.

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3.2 Output

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

- Identification and specification of record types (see 5/9.2).
- Identification and specification of record display attributes (see 5/9.3).

4 Normative Reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Part of ISO/IEC 13346. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this Part of ISO/IEC 13346 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 1539:1991, *Information technology - Programming languages - FORTRAN*

5 Conformance

5.1 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 2/10, 3/11, and 4/15) to which the contents of those sectors of the medium conform.

5.2 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 2/12, 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.

6 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 definition apply.

6.1 Data space of a file

The set of bytes specified for a file shall be the data space of the file.

The bytes of the set shall be numbered with consecutive integers assigned in an ascending sequence. The numbering shall start from 0 which shall be assigned to the first, if any, byte of the file.

7 Notation

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

8 Basic types

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

8.1 16-bit unsigned numerical values (MSB)

A `Uint16MSB` value, represented by the hexadecimal representation #wxyz, shall be recorded in a two-byte field as #wx #yz.

NOTE 2 - For example, the decimal number 4 660 has #1234 as its hexadecimal representation and shall be recorded as #12 #34.

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Section 2: Requirements for the medium for record structure

9 Record structure

The information in a file may be organised as a set of records (see 1/5.8) according to this Part of ISO/IEC 13346. The length of a record shall be the number of bytes in the record. A record shall be recorded in a container which shall be recorded in the data space of a file. This container shall be referred to as a Measured Data Unit (MDU) (see 5/9.1).

9.1 Relationship to a file

Each MDU shall comprise a set of successive bytes of the data space of the file (see 5/6.1). The first or only MDU shall begin at the first byte of the data space of the file. Each successive MDU shall begin at the byte of the data space of the file immediately following the last byte of the preceding MDU.

If there are no bytes in the data space of the file, then no MDU shall be considered to have been recorded in the file.

9.2 Record type

A record of a file recorded according to this Part of ISO/IEC 13346 shall be one of the following types:

- padded fixed-length (5/9.2.1)
- fixed-length (5/9.2.2)
- variable-length-8 (5/9.2.3.1)
- variable-length-16 (5/9.2.3.2)
- variable-length-16-MSB (5/9.2.3.3)
- variable-length-32 (5/9.2.3.4)
- stream-print (5/9.2.4)
- stream-LF (5/9.2.5)
- stream-CR (5/9.2.6)
- stream-CRLF (5/9.2.7)
- stream-LFCR (5/9.2.8)

All records in a file shall be of the same type.

9.2.1 Padded fixed-length records

A padded fixed-length record shall be a record contained in a file that is assigned to contain records that shall have the same length. The minimum assigned length of a padded fixed-length record shall be 1.

An MDU containing a padded fixed-length record shall be recorded according to the schema shown in figure 5/1.

```
[MDU ]{
      <record>
      <#00 byte> 0+1
}
```

Figure 1 - Padded fixed-length record schema

The #00 byte shall be recorded only if necessary to give the MDU an even length.

9.2.2 Fixed-length records

A fixed-length record shall be a record contained in a file that is assigned to contain records that shall have the same length. The minimum assigned length of a fixed-length record shall be 1.

An MDU containing a fixed-length record shall be recorded according to the schema shown in figure 5/2.

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```
[MDU ]{
      <record>
}
```

Figure 2 - Fixed-length record schema

9.2.3 Variable-length records

A variable-length record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A variable-length record shall be one of the following types:

- variable-length-8 (5/9.2.3.1)
- variable-length-16 (5/9.2.3.2)
- variable-length-16-MSB (5/9.2.3.3)
- variable-length-32 (5/9.2.3.4)

A maximum record length shall be assigned for a file. The length of any record in the file shall not exceed this value. The minimum length of a variable-length record shall be 0.

The length of a variable-length record shall be recorded in a Record Control Word (RCW). The length of a record does not include the size of the RCW. The interpretation of the value of the RCW shall be as given in figure 5/3, where *n* denotes the number of bits in the RCW of a record for the file:

RCW	Interpretation
$2^n - 1$	The RCW is the final RCW of the logical block in which the RCW is recorded.
0 to $2^n - 2$	The RCW specifies the length of the record.

Figure 3 - RCW interpretation

NOTE 3 - The length of the RCW is not included in the number recorded in the RCW.

9.2.3.1 Variable-length-8

An MDU containing a variable-length-8 record shall be recorded according to the schema shown in figure 5/4 where the RCW is recorded as an `Uint8` (1/7.1.1).

```
[MDU ]{
    <RCW>
    {
       <record>
    } 0+1
}
```

Figure 4 - Variable-length-8 record schema

9.2.3.2 Variable-length-16

An MDU containing a variable-length-16 record shall be recorded according to the schema shown in figure 5/5 where the RCW is recorded as an `Uint16` (1/7.1.3).

```
[MDU ]{
    <RCW>
    {
       <record>
       <#00 byte> 0+1
    } 0+1
}
```

Figure 5 - Variable-length-16 record schema

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The #00 byte shall be recorded only if necessary to give the MDU an even length.

9.2.3.3 Variable-length-16-MSB

An MDU containing a variable-length-16-MSB record shall be recorded according to the schema shown in figure 5/6 where the RCW is recorded as an `Uint16MSB` (5/8.1).

```
[MDU ]{
    <RCW>
    {
       <record>
       <#00 byte> 0+1
    } 0+1
}
```

Figure 6 - Variable-length-16-MSB record schema

The #00 byte shall be recorded only if necessary to give the MDU an even length.

NOTE 4 - The use of variable-length-16-MSB records is included only for compatibility with ISO 9660. It is recommended that variable-length-16 records be used instead.

9.2.3.4 Variable-length-32

An MDU containing a variable-length-32 record shall be recorded according to the schema shown in figure 5/7 where the RCW is recorded as an `Uint32` (1/7.1.5).

```
[MDU ]{
    <RCW>
    {
       <record>
    } 0+1
}
```

Figure 7 - Variable-length-32 record schema

9.2.4 Stream-print records

A stream-print record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A maximum record length shall be assigned for a file assigned to contain stream-print records. The length of any record in the file shall not exceed this value. The minimum length of a stream-print record shall be 0.

The first byte of a stream-print record shall not be a #00 byte.

An MDU containing a stream-print record shall be recorded according to the schema shown in figure5/8.

```
[MDU ]{
      <#00 byte> 0+
      {
            <record> <LINE FEED character>
          | <record> <VERTICAL TABULATION character>
          | <record> <FORM FEED character>
          | <record> <CARRIAGE RETURN character> <LINE FEED character>
      }
}
```

Figure 8 - Stream-print record schema

9.2.5 Stream-LF records

A stream-LF record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A maximum record length shall be assigned for a file assigned to contain stream-LF records. The length of any record in the file shall not exceed this value. The minimum length of a stream-LF record shall be 0.

An MDU containing a stream-LF record shall be recorded according to the schema shown in figure 5/9.

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```
[MDU ]{
      <record> <LINE FEED character>
}
```

Figure 9 - Stream-LF record schema

9.2.6 Stream-CR records

A stream-CR record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A maximum record length shall be assigned for a file assigned to contain stream-CR records. The length of any record in the file shall not exceed this value. The minimum length of a stream-CR record shall be 0.

An MDU containing a stream-CR record shall be recorded according to the schema shown in figure 5/10.

```
[MDU ]{
      <record> <CARRIAGE RETURN character>
}
```

Figure 10 - Stream-CR record schema

9.2.7 Stream-CRLF records

A stream-CRLF record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A maximum record length shall be assigned for a file assigned to contain stream-CRLF records. The length of any record in the file shall not exceed this value. The minimum length of a stream-CRLF record shall be 0.

An MDU containing a stream-CRLF record shall be recorded according to the schema shown in figure 5/11.

```
[MDU ]{
      <record> <CARRIAGE RETURN character> <LINE FEED character>
}
```

Figure 11 - Stream-CRLF record schema

9.2.8 Stream-LFCR records

A stream-LFCR record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A maximum record length shall be assigned for a file assigned to contain stream-LFCR records. The length of any record in the file shall not exceed this value. The minimum length of a stream-LFCR record shall be 0.

An MDU containing a stream-LFCR record shall be recorded according to the schema shown in figure 5/12.

```
[MDU ]{
      <record> <LINE FEED character> <CARRIAGE RETURN character>
}
```

Figure 12 - Stream-LFCR record schema

9.3 Record display attributes

This clause specifies the processing of the records in a file when they are displayed on a character-imaging device. If the file is not recorded with any of the record types (see 5/9.2) specified in this Part of ISO/IEC 13346, then the records of the file need not be processed according to the record display attributes specified by this clause.

A file recorded with records according to this Part of ISO/IEC 13346 shall be assigned one of the following types of record display attributes

- LF-CR (5/9.3.1)
- first byte position (5/9.3.2)
- implied (5/9.3.3)

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9.3.1 LF-CR display attribute

When displayed on a character-imaging device, each record of the file shall be preceded by a LINE FEED character and followed by a CARRIAGE RETURN character.

9.3.2 First byte position display attribute

When displayed on a character-imaging device, the first byte of each record of the file shall be interpreted as specified in ISO 1539 for vertical spacing.

9.3.3 Implied display attribute

When displayed on a character-imaging device, each record of the file shall be interpreted as containing the necessary control information for the imaging device.

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Section 3: Requirements for systems for record structure

10 Requirements for the description of systems

This Part of ISO/IEC 13346 specifies that certain information shall be communicated between a user and an implementation. Each implementation that conforms to this Part of ISO/IEC 13346 shall have a description that identifies the means by which the user may supply or obtain such information.

NOTE 5 - The specifics of the description and the means referred to above will vary from implementation to implementation. For example, an implementation might support two interfaces: a preferred, convenient interface which might vet user input, and a deprecated low level interface which allows any input specified by this Part of ISO/IEC 13346.

11 Requirements for an originating system

11.1 General

11.1.1 Files

If the implementation allows the user to specify that the information constituting a file is to be interpreted according to a record type specified in 5/9.2, the implementation shall obtain from the user the length of each record in the file.

If the implementation allows the user to specify that the information constituting a file is to be interpreted according to a record display attribute specified in 5/9.3, the implementation shall obtain from the user the record display attribute for the file.

11.1.2 Record length

The implementation may impose a limit on the length of a record that may be recorded in a file. The implementation is not required to record any byte beyond the first m bytes of a record, where m is the value of the imposed limit. The value of m shall be not less than 2 048.

12 Requirements for a receiving system

12.1 General

12.1.1 Files

If the implementation allows the user to specify that the information constituting a file is to be interpreted according to a record type specified in 5/9.2, the implementation shall make available to the user the length of each record in the file.

If the implementation allows the user to specify that the information constituting a file is to be interpreted according to a record display attribute specified in 5/9.3, the implementation shall make available to the user the record display attribute for the file.

12.1.2 Record length

The implementation may impose a limit on the length of a record to be made available to the user. The implementation is not required to make available to the user any byte beyond the first m bytes of a record, where m is the value of the imposed limit. The value of m shall be not less than 2 048.

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