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Information technology — Multimedia framework (MPEG-21) —

Part 16: Binary Format

Technologies de l'information — Cadre multimédia (MPEG-21) —

Partie 16: Format binaire

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Foreword

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ISO/IEC 21000-16 was prepared by Technical Committee ISO/TC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 21000 consists of the following parts, under the general title *Information technology — Multimedia framework (MPEG-21)*:

— *Part 1: Vision, Technologies and Strategy* [Technical Report]

— *Part 2: Digital Item Declaration*

— *Part 3: Digital Item Identification*

— *Part 4: Intellectual Property Management and Protection Components*

— *Part 5: Rights Expression Language*

— *Part 6: Rights Data Dictionary*

— *Part 7: Digital Item Adaptation*

— *Part 8: Reference Software*

— *Part 9: File Format*

— *Part 10: Digital Item Processing*

— *Part 11: Evaluation Tools for Persistent Association Technologies*

— *Part 12: Test Bed for MPEG-21 Resource Delivery* [Technical Report]

— *Part 16: Binary Format*

The following parts are under preparation:

— *Part 14: Conformance Testing*

— *Part 15: Event Reporting*

— *Part 17: Fragment Identification of MPEG Resources*

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Introduction

Today, many elements exist to build an infrastructure for the delivery and consumption of multimedia content. There is, however, no “big picture” to describe how these elements, either in existence or under development, relate to each other. The aim for MPEG-21 is to describe how these various elements fit together. Where gaps exist, MPEG-21 will recommend which new standards are required. ISO/IEC JTC 1/SC 29/WG 11 (MPEG) will then develop new standards as appropriate while other relevant standards may be developed by other bodies. These specifications will be integrated into the multimedia framework through collaboration between MPEG and these bodies.

The result is an open framework for multimedia delivery and consumption, with both the content creator and content consumer as focal points. This open framework provides content creators and service providers with equal opportunities in the MPEG-21 enabled open market. This will also be to the benefit of the content consumer, providing them access to a large variety of content in an interoperable manner.

The vision for MPEG-21 is to define a multimedia framework *to enable transparent and augmented use of multimedia resources across a wide range of networks and devices* used by different communities.

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Information technology — Multimedia framework (MPEG-21) —

Part 16:
Binary Format

1 Scope

This part of ISO/IEC 21000 specifies the ISO/IEC 21000 binary format which is an alternative serialization format of descriptions as specified within other ISO/IEC 21000 parts, e.g. ISO/IEC 21000-2. This enables the efficient interchange or storage of ISO/IEC 21000 descriptions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 23001-1, *Information technology — MPEG systems technologies — Part 1: Binary MPEG format for XML*

ISO/IEC 21000 (all parts), *Information technology – Multimedia framework (MPEG-21)*

SCC14N, *Schema Centric XML Canonicalization Version 1.0, Organization for the Advancement of Structured Information Standards (OASIS) Universal Description, Discovery, and Integration (UDDI) Technical Committee (TC) Committee Specification, 19 July 2002, available at* <http://www.uddi.org/pubs/SchemaCentricCanonicalization-20020710.htm>

Extensible Markup Language (XML) 1.0 (Second Edition), 6 October 2000, http://www.w3.org/TR/2000/REC-xml-20001006

XML Schema: W3C Recommendation, 2 May 2001, http://www.w3.org/XML/Schema

- *XML Schema Part 0: Primer, W3C Recommendation, 2 May 2001, http://www.w3.org/TR/xmlschema-0/*
- *XML Schema Part 1: Structures, W3C Recommendation, 2 May 2001, http://www.w3.org/TR/xmlschema-1/*
- *XML Schema Part 2: Datatypes, W3C Recommendation 2 May 2001, http://www.w3.org/TR/xmlschema-2/*

xPath, XML Path Language, W3C Recommendation, 16 November 1999, http://www.w3.org/TR/1999/REC-xpath-19991116

Namespaces in XML, W3C Recommendation, 14 January 1999, http://www.w3.org/TR/1999/REC-xml-names-19990114

Canonical XML, W3C Recommendation, 15 March 2001, http://www.w3.org/TR/xml-c14n

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
binarization
process which consists of encoding a description in XML format into an equivalent and more compact binary form

3.2
current description
description that is conveyed by the initial description and all access units up to a given composition time

3.3
binary current description tree
XML tree that represents the current description

3.4
binary description stream
XML stream consisting of binary access units

3.5
delivery layer
abstraction of any underlying transport or storage functionality

3.6
ISO/IEC 21000 description (abbreviated description or MPEG-21 description)
ISO/IEC 21000 XML-based document following syntax and semantics as specified within other ISO/IEC 21000 parts, e.g. ISO/IEC 21000-2, ISO/IEC 21000-5, or ISO/IEC 21000-7

4 Symbols and abbreviated terms

AU	Access Unit
BiM	Binary format for document streams
DL	Delivery Layer
FU	Fragment Update
FUU	Fragment Update Unit
SU	Schema Update
SUU	Schema Update Unit
XML	Extensible Markup Language
XPath	XML Path Language

5 ISO/IEC 21000 Binary Format Overview

5.1 BiM Overview (informative)

This clause describes the methods to binarize MPEG-21 descriptions. This specification consists in additions and constraints applied on ISO/IEC 23001-1 specification clauses 5, 6, 7, 8 and 9 (so-called BiM).

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5.1.1 23001-1 terminal architecture

In ISO/IEC 23001-1, there are three main layers outlined: the application, the normative systems layer, and the delivery layer. ISO/IEC 23001-1 is not concerned with any storage and/or transmission media (whose behaviours and characteristics are abstracted by the delivery layer) or the way the application processes the XML document. ISO/IEC 23001-1 does make specific assumptions about the delivery layer, and those assumptions are outlined in subclause 5.1.3.3. The systems layer, which is the subject of ISO/IEC 23001-1, defines a decoder whose architecture is described here to provide an overview and to establish common terms of reference.

5.1.2 General characteristics of the ISO/IEC 23001-1 decoder

5.1.2.1 General characteristics of description streams

An ISO/IEC 15938 terminal consumes XML streams and outputs a – potentially dynamic – representation of an XML document called the binary current description tree. Binary description streams shall consist of a sequence of one or more individually accessible portions of data named access units. An Access Unit (AU) is the smallest data entity to which “terminal-oriented” timing information can be attributed. This timing information is called the “composition” time, meaning the point in time when the resulting binary current description tree corresponding to a specific access unit becomes known to the application for further processing. The timing information, if necessary, shall be carried by the delivery layer (see ISO/IEC 23001-1 subclause 5.6). The current description tree shall be schema-valid after the processing of each access unit. In this specification further validity requirements are applied to the binary description stream to cope with the specifics of MPEG-21 descriptions.

An XML stream consisting of binary access units is termed a binary description stream and is processed by a binary decoder (see ISO/IEC 23001-1 subclause 5.2.2, and clauses 6 and 7).

5.1.2.2 Principles of the binary decoder

Using the ISO/IEC 23001-1 generic method for binary encoding, called BiM, a description (nominally in a textual XML form) can be compressed, partitioned, streamed, and reconstructed at terminal side. The reconstructed description will not be byte-equivalent to the original description. Namely, the binary encoding method does not preserve processing instructions, attribute order, comments, or non-significant whitespace.

The BiM, in order to gain its compression efficiency, relies on a schema analysis phase. During this phase, internal tables are computed to associate binary codes to XML elements, types and attributes. This principle mandates the full knowledge of the same schema by the decoder and the encoder for maximum interoperability. If this schema information is not known by the decoder, BiM defines a mechanism to transmit it. To further improve compression, BiM allows the association of specific codecs to specific data types. These encoding schemes can be optimised with the full knowledge of the properties of that data type.

The resulting binary current description tree may be topologically equivalent to the original description if desired by the encoder, but it may also exhibit dynamic characteristics such that certain parts of the description are present at the decoder only at chosen times, are never present at all, can be acquired on application demand.

5.1.3 Issues in encoding descriptions

5.1.3.1 Fragmenting descriptions

In this specification, a description stream serves to convey MPEG-21 descriptions, as available from a (non-normative) sender or encoder, to the receiving terminal, possibly by incremental transmission in multiple access units. Any number of decompositions of the source description may be possible in ISO/IEC 23001-1. Figure 1 illustrates an example of a description, consisting of a number of nodes, that is broken into two description fragments.

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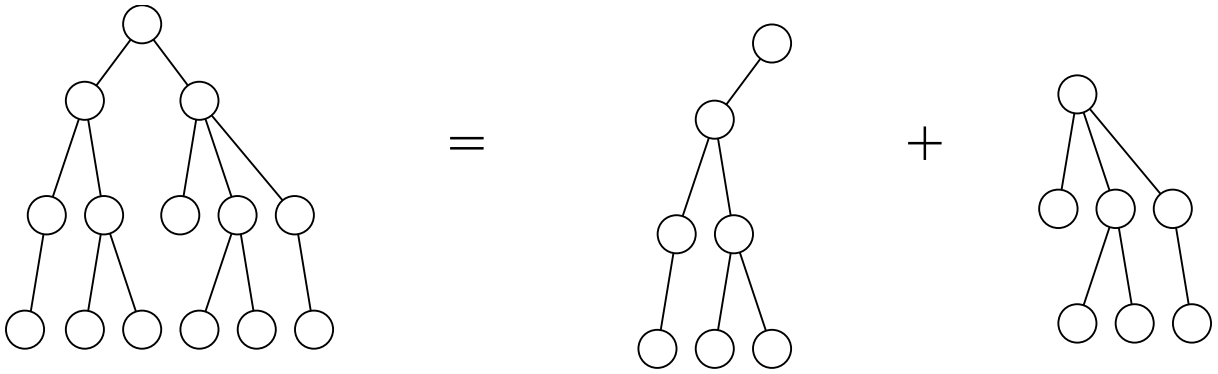

Figure 1 — Decomposition of a description into two description fragments

5.1.3.2 Deferred nodes and fragment references

There exists the possibility for the encoder to indicate that a node in the current description tree is “Deferred.” A deferred node is addressable on the current binary description tree, but it shall not be passed on to any further processing steps, such as a parser or an application. In other words, a deferred node is a placeholder that is rendered “invisible” to subsequent processing steps. Some deferred nodes are marked with a fragment reference marker that specifies where the fragment can be acquired. It is then left to the application to decide when to acquire it through the fragment reference marker.

5.1.3.3 Reference consistency

The standard itself cannot guarantee reference (link) consistency in all cases. In particular, XPath-style references cannot be guaranteed to point to the correct node, especially when the topology of the tree changes in a dynamic or progressive transmission environment. With ID/IDRef, the system layer itself cannot guarantee that the ID element will be present, but during the validation phase, all such links are checked, and thus their presence falls under the directive that the current binary description tree must always be schema-valid. URI and HREF links typically refers to external documents, and should be understood not to be under control by the referrer (and therefore not guaranteed).

5.2 Binarization of MPEG-21 descriptions

5.2.1 Binarization

Binarization of MPEG-21 descriptions shall be performed according to the rules described in ISO/IEC 23001-1 Clauses 5, 6, 7 and 8, (so-called BiM) and further refined by this specification.

NOTE This specification defines means to binary decode and reconstruct fragmented ISO/IEC 21000 descriptions. It however does not give hints on how and when to consume these descriptions.

Additionally, the decoding process shall ensure that the Schema Centric XML Canonical (SCC14N) representation of the reconstructed description is bit-for-bit identical to the Schema Centric XML Canonical representation of the original description.

NOTE This does not guarantee the preservation of namespace prefixes through the encoding process.

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5.2.2 Specific rules applied on BiM (informative)

Some specific constraints are applicable on the BiM depending on the MPEG-21 descriptions to be carried and their typical use:

— **Validation constraints**: The BiM requires the current description tree to be XML Schema valid after the decoding of each access unit. In some cases, further constraints are necessary to cope with the specific validation rules of MPEG-21 descriptions which are specified in Clause 6.

6 Specifics of ISO/IEC 21000 Part 2 binarization

6.1 Introduction

This clause describes the specifics of DID encoding and transmission. Specifically it addresses the progressive transmission of DID items.

6.2 Validity constraints in case of progressive transmission

After the decoding of each AU, an ISO/IEC 21000 DID shall be both schema valid and conformant to the validity rules defined in ISO/IEC 21000-2.

6.3 Resource and Statement element support constraints

BiM allows the encoding of Resource and Statement elements in case schema information is available at decoder side.

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