



**International
Standard**

ISO 16684-4

**Graphic technology — Extensible
metadata platform (XMP)
specification —**

**Part 4:
Use of XMP for semantic units**

**First edition
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Document file formats, EDMS Systems and authenticity of information*.

A list of all parts in the ISO 16684 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Traditional concepts and uses of metadata have been applied to describe a file or a collection, but this approach cannot meet the needs of flexible, sub-file and across-file level information exchange and sharing. Researchers, publishers, readers and machines require new approaches to describe content in flexible and multi-faceted ways for data sharing and data exchange (e.g. chapter, figure, image, table, formula). Specifically, in the linked data (either open or closed) web environment, any piece of information can be described, referenced and linked with or without relationships with any other data, objects, and/or files.

By implementing this document, textual and non-textual content can be described, used and shared at an atomic level, file level and across-file level. This information can be used for multiple purposes, including content access, digital preservation, scientific research and publishing. Recent developments in computer vision and machine learning make it possible to create, link and capture semantics from documents, videos and audios. Machines can learn and create meaningful metadata using a variety of artificial intelligence (AI) machine learning models. This enhances existing resources description and creates new opportunities in content generation, content use and content re-use. For instance, the general public benefits from semantic-rich content through enhanced knowledge access, discovery and integration (e.g. see the use cases in the [Annex A](#)), while scholars can utilize semantic-rich content for content discovery, integration and scholarly communication. For business, the availability of semantic-rich content creates new opportunities for lower cost, higher productivity, and better user satisfaction. Machines can also utilize semantic-rich content and metadata for a variety of purposes.

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Graphic technology — Extensible metadata platform (XMP) specification —

Part 4: Use of XMP for semantic units

1 Scope

This document:

- a) introduces the concept of the semantic unit (SU);
- b) provides requirements and guidance on how to define the target resource(s) in an SU by adopting the “target” syntax from the Web Annotation Model;
- c) provides requirements and guidance on the extensible metadata platform (XMP) serialization syntaxes for SU.

This document broadens the concept of XMP specified in ISO 16684-1 so that XMP can be used to describe an SU. A new flexible way of defining and describing SUs aims to bring innovation to textual and non-textual content, metadata, linked data, big data and artificial intelligence.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 16684-1:2019, *Graphic technology — Extensible metadata platform (XMP) — Part 1: Data model, serialization and core properties*

ISO 16684-3:2021, *Graphic technology — Extensible metadata platform (XMP) specification — Part 3: JSON-LD serialization of XMP*

Web Annotation Data Model *W3C Recommendation*, 2017, <https://www.w3.org/TR/annotation-model/>

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1
audio

frequency corresponding to a sinusoidal sound wave audible to the normal human ear (from about 16 Hz to 16 kHz)

[SOURCE: IEC 60050-702: 1992, 702-01-08]

Note 1 to entry: Audio content is primarily intended to be heard. Alternatively, it can be described by other expressions such as text, image, and video.

3.2
image

stored description of a graphic picture along with metadata, which is primarily intended to be seen

Note 1 to entry: Alternatively, it can be described by other content expressions such as text, audio, and video.

3.3
dataset

stored description of sets of data along with metadata, which is primarily intended to be processed by software

3.4
external resource

resource which is available outside of the current one

Note 1 to entry: It is de-referenceable from its Internationalized Resource Identifier (IRI).

3.5
selector

method used to select and describe the desired segment(s) from the source resource(s)

Note 1 to entry: The nature of a selector will be dependent on the types of resource, as the methods to select segments from various media-types will differ. Multiple selectors can be given to describe the same segment in different ways.

Note 2 to entry: See W3C Recommendation: 2017, 4.2 for further information.

3.6
semantic unit
SU

user-defined piece of information (content) consisting of one or more target(s) resources, which is logically, semantically or structurally separated from other information and can be meaningfully described as a unit

Note 1 to entry: An SU may be described by one or more extensible metadata platform (XMP) packets.

Note 2 to entry: An SU can be any piece of information (e.g. character, word, phrase, sentence, paragraph, chapter) across any information container (e.g. a file).

Note 3 to entry: An SU can be one of the following representations depending on its content.

- For content interpreted by visual systems (e.g. documents, maps), it can be an area containing content such as characters, figures, tables, images, and formulas.
- For content interpreted by hearing and/or visual systems (e.g. audio, video), it can be the length of starting and stopping time, or data containing such content.
- For content interpreted by smell, it can be the smell data (e.g. location, timestamp, chemical data), and/or interpretations of the smell.
- For content not sensible beyond the five human senses, it can be the data and/or its derivatives.

3.7

target

resource, which is a “specificResource” identified by “source”

Note 1 to entry: See W3C Recommendation: 2017, Section 4 for further information.

3.8

text

sequence of characters or glyphs, or a visual representation thereof

Note 1 to entry: Textual content is primarily intended to be read. Alternatively, it can be expressed by other means such as *audio* (3.1), *image* (3.2), or *video* (3.10) with metadata.

3.9

user

person or machine who defines, describes, and/or uses a *semantic unit* (3.6)

3.10

video

recording of an *image* (3.2) or set of images; content consists of moving images with or without *audio* (3.1)

4 Semantic unit

4.1 General

A semantic unit (SU) is a user-defined content that can be associated with one or more XMP packets. The user can apply this document to encapsulate sufficient information (including semantics) for the SU. ISO 16684-1 specified a way to declare an XMP packet but applies to the entire resource stored as a file.

This document specifies a way to create and to define any resource that can be a piece of information in a file container or cross-file boundary.

4.2 Types of semantic units

An SU can be any piece of information such as zero or more characters, an image, a video frame, a resource on the internet, or a combination of these.

An SU can be a content area inside an image, table, page, file, bitstream, and Internationalized Resource Identifier (IRI). It can enable content cross images, tables, pages, files, bitstreams, and IRIs boundary (e.g. inside a file, outside a file, or a combination of multiple files), and a combination of the above.

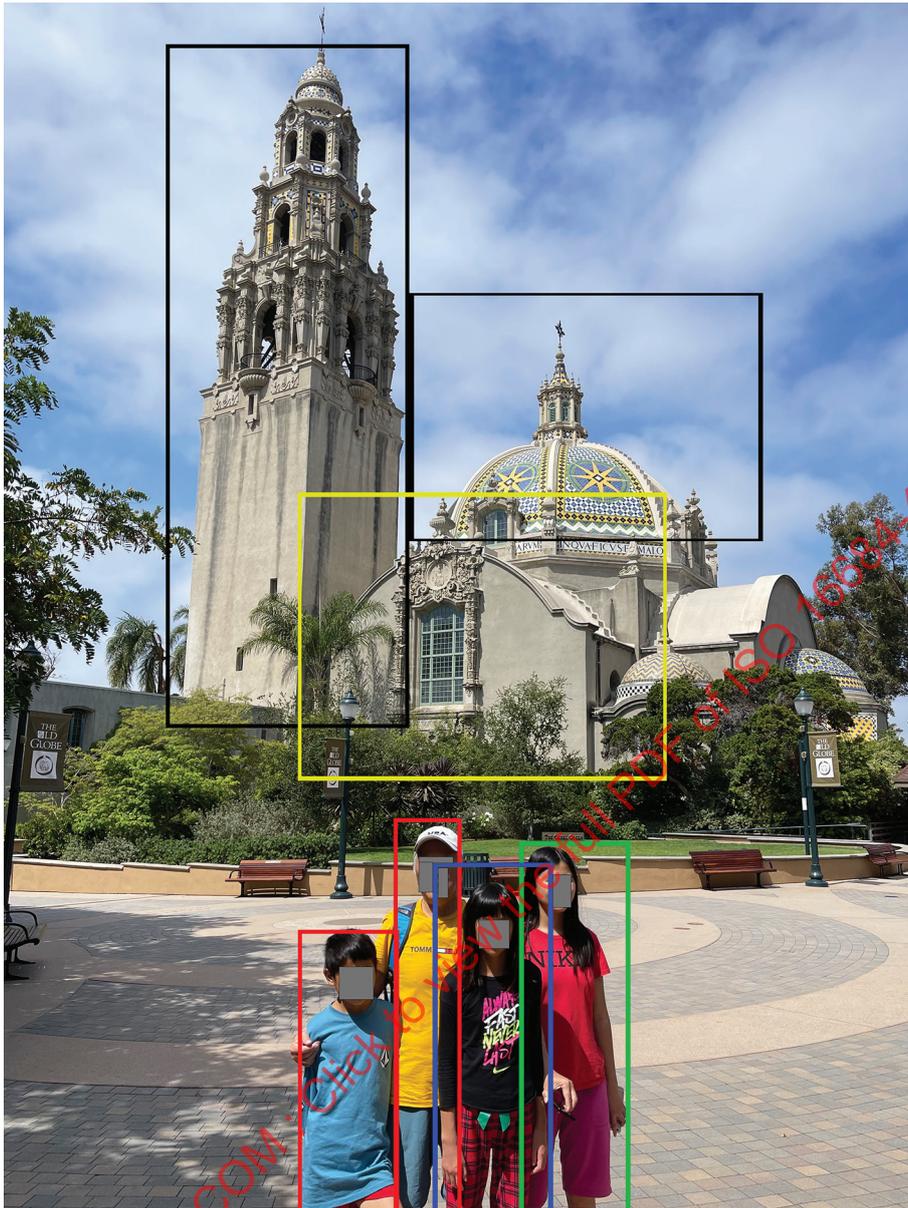
An SU can include an ordered or unordered set of resources.

A metadata packet (i.e. XMP packet) for an SU can contain any type of metadata (descriptive, structural, technical, administrative) and data.

An SU can be independent or have relations with other SUs.

Examples include:

- Digitized textual documents (see [Annex A](#));
- Images: SUs defining parts of an image can be separated, connected, overlapped, or covered. [Figure 1](#) shows that multiple SUs can be defined within a single image.



SOURCE: Reference [1], reproduced with permission from the author.

Figure 1 — Multiple SUs in an image

- Several multimedia resources and related resources can be combined as part of one SU. For example, a sheet music fragment (see [Figure 2](#)) can be augmented with a video clip of a performance, or a webpage describing the history of the piece.

28. Row, row, row your boat

Sing with marked rhythm, especially in the first and third parts. Close at a signal when all parts are singing, thus producing the full chord.

E.O. Lyte
(American)

Row, row, row your boat gent - ly down the stream;

mer - ri - ly, life is but a dream!

Figure 2 — SU containing part of music notation and remote resources

5 Defining and referencing semantic unit

5.1 Defining semantic units with target resources

An SU is referred to by one or more “@id” (defined in 5.2) with one or more “targets” resources (defined in 5.2).

An SU shall include one or more “target” resources, (where “target” is specified by the Web Annotation Data Model, 2017, Section 4). Often selecting the target resources relies on specific media types and their formal specifications. These specifications have their own specific syntax and can vary. For example, to select a paragraph of a HTML webpage, it is possible to screen capture the paragraph as an image as a representation. It is also possible to use certain HTML tags to select the paragraph.

There are typically multiple ways of selecting target resources for an SU. To promote interoperability, this document adopts the mechanism defined in the Web Annotation Data Model (W3C Recommendation). The Web Annotation Data Model defines a comprehensive standard syntax for “target” resources that covers various media types (e.g. HTML, PDF, XML, and SVG) and segment(s) of these media.

Each “target” resource of an SU that conforms to this document shall be a “specificResource”, in accordance with the definition given in the Web Annotation Data Model, 2017, Section 4.

The “target” resource shall be enumerated using the “target” and related qualifier(s) in accordance with the provisions of the Web Annotation Data Model.

Examples of defining semantic units can be found in Annex A.

XMP and the Web Annotation Model are independent to each other. The differences between the two are discussed in Annex B.

5.2 Required Keywords

ISO 16684-3:2021, Clause 4 entitled “XMP-JSON-LD serialization” contains namespace prefix serialization and use of @type. The following required keywords of an XMP packet shall be in accordance with ISO 16684-3:2021, Clause 4.

- “@id”;
- “@context”;
- “@vocab”: controlled vocabulary schema;

- “@language”;
- “@type”;
- “target” and its related terms: the “target” and its qualifier(s) are defined in the Web Annotation Model, 2017, Section 4.

NOTE 1 The “specificResource” contains other terms such as “id”, “type”, “source”, and “selector”.

NOTE 2 Many SUs refer to part of a resource or a combination of parts of multiple resources. A selector is used to select the desired segments from the source resource. The nature of various media-type resources varies and therefore the selector and its types differ (see the Web Annotation Data Model, 2017, 4.2).

5.3 Simple valued XMP: selecting a target source resource

An SU can be defined by selecting a specific resource. Examples can be found in [Annex A](#).

5.4 Array valued XMP: selecting a set of specific resources

5.4.1 General

An SU can be defined with a set of specific resources. Values in the XMP data model shall be in accordance with ISO 16684-1 and ISO 16684-3, which have one of the three forms:

- simple;
- array;
- structure.

Array form can be one of the following: unordered array, ordered array and alternative array.

5.4.2 Array values

Array is unordered by default in JSON-LD.^[3] For unordered array value, “@set” keyword shall be used and the provisions specified in ISO 16684-3:2021 4.5.3.2 shall apply.

For ordered array value, a property “@list” shall be used and the provisions specified in ISO 16684-3:2021, 4.5.3.3 shall apply.

For alternative array value, the provisions specified in ISO 16684-3:2021, 4.5.3.4 shall apply.

5.4.3 Structure valued XMP properties

The provisions specified in ISO 16684-3:2021, 4.5.4 shall apply.

5.5 Identifying and dereferencing semantic unit

An SU is identified via its identifier “@id”.

Dereferencing an SU via “@id” allows applications to retrieve the SU’s XMP packet.

6 Serialization

The Resource Description Framework (RDF) is a framework for data interchange on the web. RDF 1.1 is the latest version of the RDF specification, published by the W3C in 2014.

RDF 1.1 introduces the concept of RDF data set, which is a collection of RDF Graphs. RDF 1.1 recommends the serialization syntaxes for storing and exchanging RDF such as Turtle, JSON-LD, RDFa, and RDF/XML.

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JavaScript Object Notation (JSON) is a lightweight data interchange format. A JavaScript Object Notation for Linked Data (JSON-LD) is a JSON-based format to serialize linked data. JSON-LD has advantages such as ease of use and clean implementation for the web. The JSON-LD specification discusses its data model and its relationship to RDF [JSON-LD]. A JSON-LD document is both an RDF and a JSON document.

ISO 16684-1 and ISO 16684-3 define two serialization formats for RDF graphs. ISO 16684-1 specifies how to serialize an XMP packet using RDF/XML, while ISO 16684-3 specifically describes the other serialization format using JSON-LD. Both serialization formats produce the same graph, and thus they are logically equivalent.

This document recommends the JSON-LD serialization of ISO 16684-3.

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Annex A (informative)

Use case – Digitized books

A.1 General

This annex illustrates a typical use case for digitized materials. Currently millions of published books have been digitized for preservation and access.

A.2 Goal

This use case demonstrates the use of XMP for creating a SU with semantic information for Reference [4]. The semantics is important for a variety of uses such as linked open data, machine learning and knowledge discovery.

The code was validated via JSON-LD validators.

```
{
  "@context": {
    "rdf": "https://www.w3.org/1999/02/22-rdf-syntax-ns#",
    "xmp": "http://ns.adobe.com/xap/1.0/",
    "dc": "https://purl.org/dc/elements/1.1/",
    "viaf": "https://viaf.org/",
    "@vocab": "http://schema.org",
    "@language": "zho",
    "su": "https://www.iso.org/su/1.0/"
  },
  "@type": "Book",
  "@id": "daodejing version1",
  "name": "道德經",
  "alternativeName": "Tao Te Ching",
  "url": "https://lccn.loc.gov/2021666446",
  "author": {
    "@type": "Person",
    "name": "laozi",
    "url": "https://viaf.org/viaf/101089774/"
  }
}
```

```

“dataCreated”: “400 B.C.”,
“dc:subject”: [ “Taoism”, “Taoist philosophy”],
“hasPart”: {
  “@id”: “#version1”,
  “@type”: “Book”,
  “name”: “老子道德經”,
  “url”: “https://ctext.org/library.pl?if=en&file=77889”,
  “version”: “景常熟瞿氏鐵琴銅劍樓藏宋刊本”,
  “datePublished”: “1279 A.D.”,
  “publisher”: {
    “@type”: “Organization”,
    “name”: “景常熟瞿氏鐵琴銅劍樓藏宋刊本”,
    “location”: “changsu, Jiangsu,China”,
    “@id”: “”
  },
  “hasPart”: [
    {
      “@id”: “#chapter42”,
      “name”: “chapter 42”,
      “url”: “https://ctext.org/library.pl?if=en&file=77889&page=57”,
      “text”: “道生一, 一生二, 二生三, 三生萬物。”,
      “pagination”: “57-58”
    }
  ]
},
“mentions”: [
  {
    “@id”: “#version2”,
    “@type”: “Book”,
    “name”: “道经”,
    “version”: “Yu Family School”,
    “url”: “https://lccn.loc.gov/2021666446”,
    “datePublished”: “1127 A.D.”,

```

```

“publisher”: {
  “@type”: “Organization”,
  “name”: “Yu Family School”,
  “location”: “Jian'an, Fujian, China”,
  “@id”: ""
},
“hasPart”: [
{
  “@id”: “#chapter1”,
  “name”: “chapter 1”,
  “url”: “https://www.loc.gov/resource/gdcwdl.wdl\_13543/?sp=14&q=Dao+de+jing”,
  “text”: “道可道,非常道。名可名,非常名。无名天地之始;有名万物之母。故常无欲以观其妙;常有欲以观其徼。此两者,同出而异名,同谓之玄。玄之又玄,众妙之门。”
  “pagination”: “14-15”
},
{
  “@id”: “#chapter2”,
  “name”: “chapter 2”,
  “url”: “https://www.loc.gov/resource/gdcwdl.wdl\_13543/?sp=15&q=Dao+de+jing”,
  “pageStart”: “15”
}
]
},
{
  “@id”: “#version3”,
  “@type”: “Book”,
  “name”: “老子道德經”,
  “version”: “欽定四庫全書”,
  “url”: “https://ctext.org/library.pl?if=en&file=221228”,
  “datePublished”: “1782 A.D.”,
  “publisher”: {
    “@type”: “Organization”,
    “name”: “欽定四庫全書”,

```