
STEP geometry visualization services

Services de visualisation de la géométrie STEP

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 documents 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared jointly by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*, in collaboration with Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 24, *Computer graphics, image processing and environmental data representation* and ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Document file formats, EDMS systems and authenticity of information*.

This second edition cancels and replaces the first edition (ISO/TS 23301:2021), which has been technically revised.

The main changes are as follows:

- addition of a new high-level business scenario: spatial query;
- addition of a new requirement: large model presentation: bounding boxes;
- addition of a new requirement: large model presentation: occurrence tree;
- addition of a new metadata: this URI defining the URI of the current data set;
- updates in the services definition;
- addition of a new service: `get_available_formats`.

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

There is a confirmed opportunity for industries to have a structured approach on 3D product visualization and to enable integration of product data in visualization applications, across the life cycle of the product in all areas of a company.

The integrated standard for the exchange of product model data (STEP) in the enterprise processes has great value to contribute to this goal.

Business scenarios exist related to the visualization of product data other than geometry (e.g. metadata, production data, financial data).

The ability to trustfully share, distribute, collect, store, maintain, transfer, process and present product data associated with its geometry to support business processes distributed in enterprise networks is a key component of the digital transformation of our industries.

As long as data sets are managed by a single management system, we can ensure quality and traceability of the data set. However, when data is shared with partners in a supply chain, the data sets are usually copied and extracted from their initial management system and they lose all the traceability and links with the other product data. This document provides a solution to this problem.

This document is the first of a series of documents to provide an integrated framework using the ISO 10303 series to allow the consumption of product data in supply-chains and in companies using geometries as human-computer interface to access these product data through visualization applications. This is realized by using metadata to support the audit trail of the transformation of a geometry definition, and web services based on the utilisation of these metadata. This framework can also be used for automated product data consumption by software.

[Annex A](#) contains an identifier that unambiguously identifies this document in an open information system.

STEP geometry visualization services

1 Scope

This document defines a set of metadata to support the audit trail of the transformation of a geometry definition, while it is distributed and shared in supply-chains, to ensure the traceability of geometric model data. It also defines a set of web services based on the utilisation of these metadata.

The following are within the scope of this document:

- metadata definitions for geometry transformation audit trail:
 - syntax for storing these metadata in geometry data sets in various formats;
 - conformance level for implementers and business processes;
 - definitions of web services to query the geometric model data set and its associated metadata.

The following are outside the scope of this document:

- service specifications for CAD operations;
- specifications of a cybersecurity infrastructure to enable web services;
- the technical implementation of a STEP geometry services client or server;
- any geometric model definition;
- any product and manufacturing information (PMI) definition;
- archiving.

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 8601-1, *Date and time — Representations for information interchange — Part 1: Basic rules*

ISO 10303-21, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*

ISO 14306:2017, *Industrial automation systems and integration — JT file format specification for 3D visualization*

ISO 16684-1:2019, *Graphic technology — Extensible metadata platform (XMP) — Part 1: Data model, serialization and core properties*

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

ISO 17506, *Industrial automation systems and integration — COLLADA™ digital asset schema specification for 3D visualization of industrial data*

ISO/IEC 19775-1, *Information technology — Computer graphics, image processing and environmental data representation — Extensible 3D (X3D) — Part 1: Architecture and base components*

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 boundary representation solid model

B-rep

type of geometric model in which the size and shape of a solid is defined in terms of the faces, edges and vertices which make up its boundary

[SOURCE: ISO 10303-2:20—¹], 3.3.5]

3.2 constructive solid geometry

CSG

type of geometric modelling in which a solid is defined as the result of a sequence of regularized Boolean operations operating on solid models

[SOURCE: ISO 10303-2:20—, 3.3.11]

3.3 derived geometry

geometric representation generated from another representation

Note 1 to entry: The derivation is realized by actions such as using another representation method, another format, approximations, simplification.

EXAMPLE A "6-face *B-rep*" ([3.1](#)) is derived from a *CSG* ([3.2](#)) "solid block".

3.4 converted geometry

result of changing the data format of a geometry

Note 1 to entry: The import and export operations in a CAD system, produce converted geometry.

Note 2 to entry: Converted geometry is a kind of *derived geometry* ([3.3](#)).

3.5 design intent

intentions of the designer of a model with regard to how it may be instantiated or modified

Note 1 to entry: The aspects of design intent relevant to ISO 10303-108 are concerned with the information represented in the parameters and constraints associated with a model. More generally, design intent also includes the procedural or construction history of a model, which is the subject of ISO 10303-55. All aspects of design intent influence the behaviour of a model under editing operations.

[SOURCE: ISO 10303-2:20—, 3.16.10]

1) Under preparation. Stage at the time of publication: ISO/FDIS 10303-2:2023.

3.6

geometry data set

serialized representation of geometry data which can be exchanged between two systems

Note 1 to entry: The geometry data set can be instantiated into a single file, a set of files, a web service payload or the result of a database query.

3.7

geometry service

web-service supporting retrieval of geometry-related data

Note 1 to entry: Geometry related data can be:

- a *geometry data set* (3.6) or one of its subsets;
- geometric properties of a geometry data;
- metadata related to a geometry data set;
- non-geometric product data related to a geometry identifier.

3.8

level of detail

LOD

description of detail and extent of geometric model information

3.9

native geometry

native CAD

data format used to write to memory using the authoring CAD application's CAD kernel

Note 1 to entry: This capability is used in order to save the *original geometry* (3.11) model as data and to reuse it without any loss with the original authoring tool. *Original geometry* is often considered to be replicated only by reading the *native geometry* from memory into the CAD / modelling application using the same system, version or installation, used to initially author the *original geometry*, although even this is not guaranteed.

3.10

occurrence tree

flat representation of an assembly structure where each individual is represented and has its own attributes, e.g. placement

Note 1 to entry: See an example of occurrence tree in [Annex H](#).

3.11

original geometry

geometry as defined by a modeler (human being) in a CAD tool using CAD authoring functions based on mathematical constructs

Note 1 to entry: The *original geometry* is the first initial geometry construction that holds the design intent.

Note 2 to entry: This is also often referred to as *native CAD* (3.9). However, a *native CAD* is in fact referring to the native CAD kernel and CAD format of the CAD tool manipulating the geometry. It therefore can also be any geometry derived from another CAD format.

Note 3 to entry: Geometry as initially authored in a CAD / modelling application using that tool's geometric modelling system, operations, and database. The author's *design intent* (3.5), as well as the characteristics and artefacts of the application's implementation of geometric and solid modelling algorithms, are present in the original geometry, thus distinguishing it from "exact geometry". *Original geometry* can take on many forms, e.g. *B-rep* (3.1), *CSG* (3.2), hybrid, tessellated, and be modelled using many modelling paradigms, e.g. procedural, explicit, dual, parametric features with construction history.

Note 4 to entry: While often misused and interchanged for each other, *original geometry* is distinguished from *native geometry* (3.9).

3.12

product and manufacturing information

PMI

non-geometric attributes in 3D CAD and collaborative product development systems necessary for manufacturing product components and assemblies

Note 1 to entry: PMI may include geometric dimensions and tolerances, symbols, notes, surface finish, and material specifications.

[SOURCE: ISO 10303-2:20—, 3.1.233]

3.13

tessellated geometry

geometry composed of a large number of planar tiles, usually of triangular shape

Note 1 to entry: Tessellated geometry is frequently used as an approximation to the exact shape of an object.

[SOURCE: ISO 10303-2:20—, 3.3.46]

3.14

3D visualization

visual presentation on a screen or another media of graphical and textual three-dimensional representations of a set of data representing an object, information or results of a computational process in order to facilitate capture of the understanding of the object, for visual information sharing with users and sometimes to promote decision process by a human looking at the data visualized in a medium

[SOURCE: ISO 14306:2017, 3.1.1]

4 High level business scenarios

4.1 General

Geometry services can be deployed in a large variety of business scenarios. Some of them are presented below.

4.2 Check for updates

A supplier receives, from an original equipment manufacturer (OEM), a 3D model of a part that the company has to manufacture.

During the development process, the supplier and the OEM can access the version information that the supplier has and confirm that it is the appropriate version through web services.

The following metadata shall be available: creator, name, ID and URI of the 3D model, from the 3D model owner and from the 3D model provider. It also needs the level of detail (LOD) of the data set to confirm that it can execute its task with the available information.

4.3 Visualization number 1

A user shall perform a review and receives a metadata file.

The user queries the repository with the product Id/version in the metadata file to get the data set to load and visualize.

The query specifies the format and LOD to review.

The following metadata shall be available: ID and URI of the 3D model from the 3D model provider.

4.4 Visualization number 2

From a large assembly data set already loaded for fast visualization, query the repository for a more detailed representation of a part with special concern [exact boundary representation (B-rep) with PMI].

The following metadata shall be available: ID and URI of the 3D model from the 3D model provider.

4.5 Retrieve product lifecycle management (PLM) data of a product

A user is viewing a part in a visualization software. The current data set contains only geometry.

Query the repository with the product ID/version to get PLM attributes of this product and display them in the viewer.

The following metadata shall be available: ID and URI of the 3D model from the 3D model owner.

4.6 Archiving

Ensure traceability from the original geometry data set in a Product Data Management (PDM) system and the geometry data set in an archiving system.

The following metadata shall be available: ID, URI, creation date, name, creator of the 3D model from the 3D model owner.

4.7 Spatial query

Retrieve a low LOD representation of a large assembly (e.g. aircraft, energy plant, ship) in a web viewer. Using this simplified representation, define a 3D spatial query to send to the server to get a sub-assembly with a more detailed geometry (tessellation or exact geometry).

The following metadata shall be available: ID and URI of the 3D model from the 3D model provider.

5 Information requirements

5.1 Review of geometry, topology and shape definitions

The concepts defined below are extracted from ISO 10303-41, ISO 10303-42, ISO 10303-43.

This document considers a geometry data set as a collection of geometric models as defined in ISO 10303-42.

The geometric models in ISO 10303-42 provide data specifications describing the precise size and shape of three-dimensional solid objects. The geometric shape models provide a complete representation of the shape, which in many cases includes both geometric and topological data. Included here are the two classical types of solid model, constructive solid geometry (CSG) and B-rep. Tessellation is another common representation for geometry which provides light-weight data sets but is less accurate than the two previous solid model types, but which other entities, providing a rather less complete description of the geometry of a product, and with less consistency constraints, are also included.

The geometric models are composed of geometric and topological data. Their primary application is for explicit representation of the shape or geometric form of a product model. The shape representation has been designed to facilitate stable and efficient communication when mapped to a physical file.

The geometry is exclusively the geometry of parametric curves and surfaces. It includes the point, curve and surface entities and other entities, functions and data types necessary for their definition. A common scheme has been used for the definition of both two-dimensional and three-dimensional geometry. All geometry is defined in a coordinate system which is established as part of the context of the item which it represents.

The topology is concerned with connectivity relationships between objects rather than with the precise geometric form of objects. ISO 10303-42 defines the basic topological entities and specialized subtypes of these. In some cases, the subtypes have geometric associations. Also included are functions, particularly constraint functions, and data types necessary for the definitions of the topological entities.

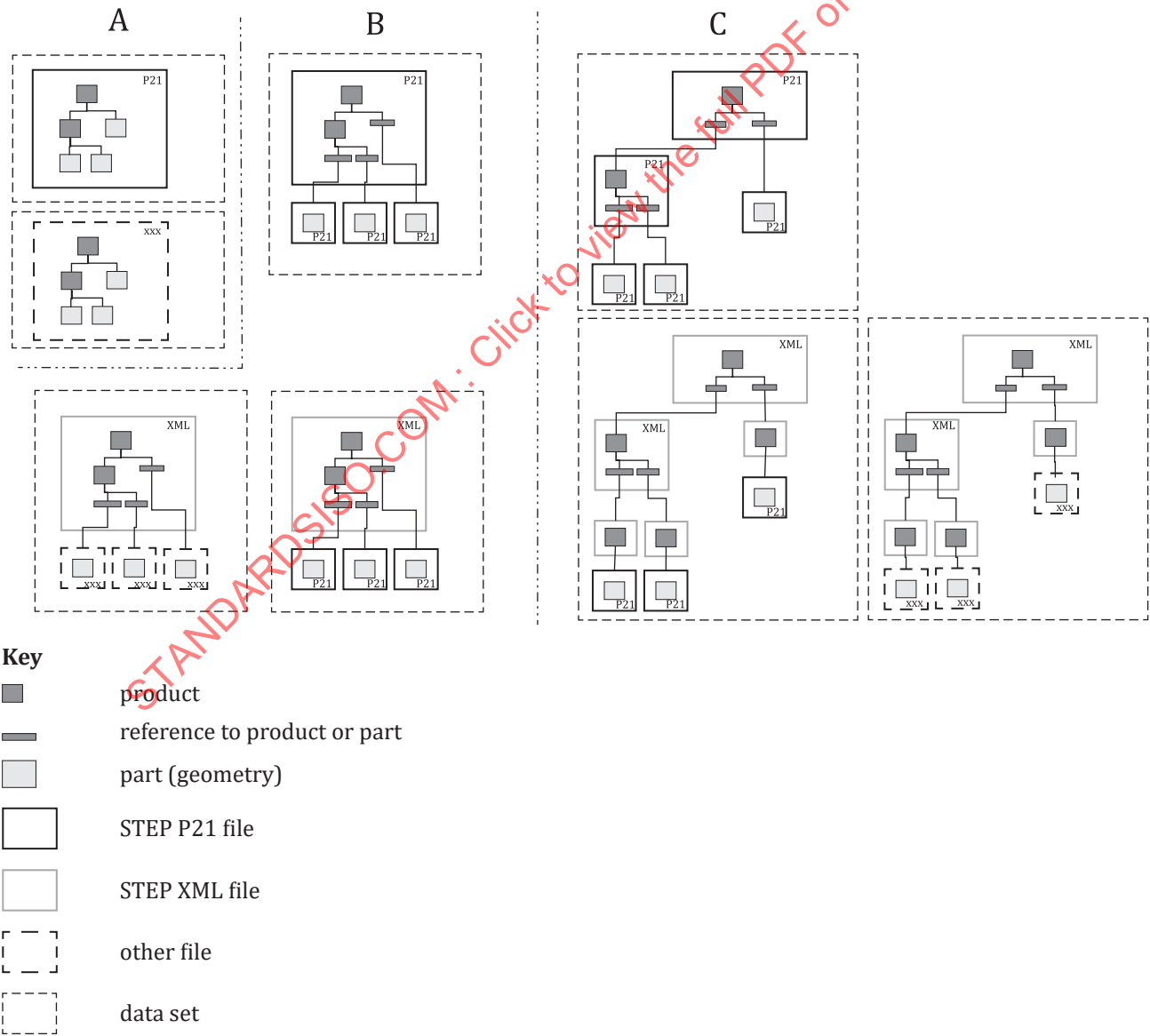
In addition to the geometric models, other product related information can be instantiated in a geometry data set, e.g. saved view and display attributes, e.g. colour, transparency, texture, PMI represented as graphical geometry helpers or semantic metadata, links to product metadata.

5.2 Geometry data set definition

The geometry data set is a collection of models as defined in ISO 10303-42 with or without assembly structure. In addition to the geometric models, other product related information can be instantiated in a geometry data set, e.g. PMI represented as graphical geometry helpers or semantic metadata, links to product metadata.

The geometry data set can be instantiated into a single file, a set of files (see [Figure 1](#)), a web service payload or by the result of a database query.

EXAMPLES Simple shape CSG, simple shape B-rep, complex part without PMI, complex part with PMI, assembly of parts with tessellated shapes and PMI.



- A single file
- B external references
- C nested assembly

Figure 1 — Examples of geometry data set file organization

5.3 Metadata for STEP geometry services

5.3.1 General

Geometry data sets can be linked together as long as they are under the management of a single PLM system. This allows audit trails and transformation processes to be controlled.

Once a geometry data set is taken out of a PLM system, the traceability to the evolution of this data set is lost. There is a need for a mechanism that allows keeping track of the geometry data set origins and evolutions. [Figure 2](#) illustrates how the metadata are added when a geometry data set leaves the management system of the original geometry data set owner and is modified by other actors before arriving in a destination system.

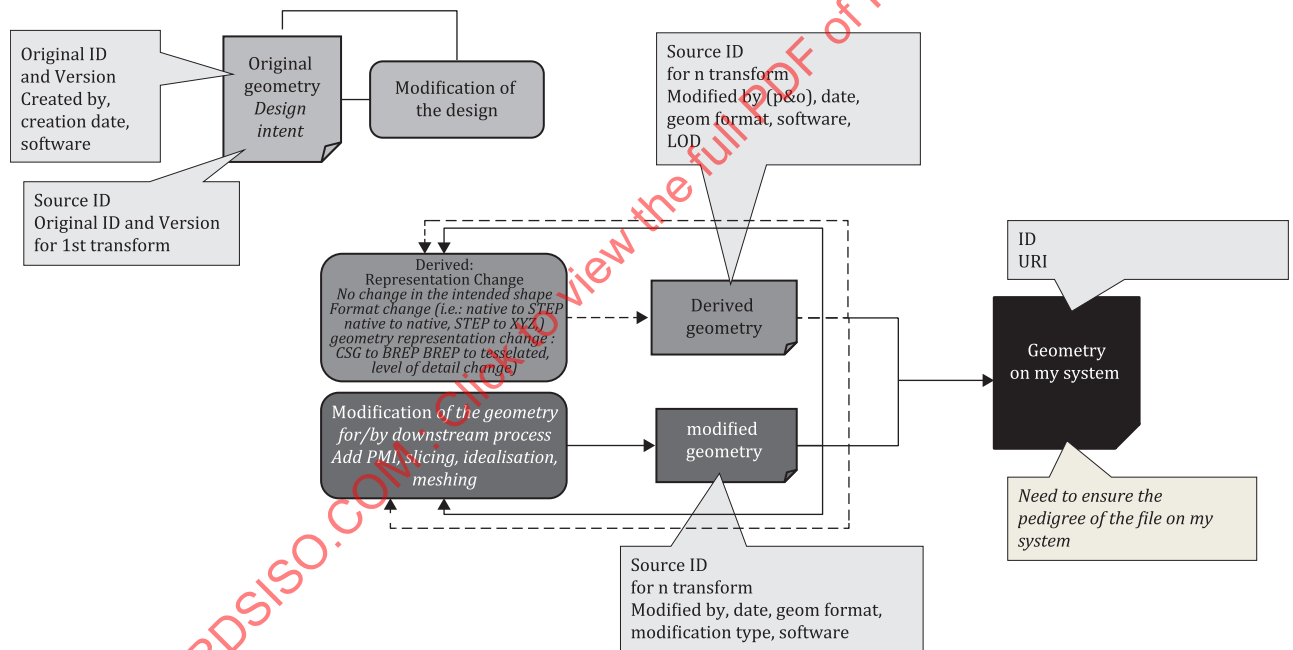


Figure 2 — Updates of metadata

In addition to data traceability, information searching and big data analysis, especially in the web environment, benefit from using semantic metadata to index information from geometry data sets in a multiplicity of formats.

5.3.2 Extensible metadata platform (XMP)

Metadata shall be represented in Extensible Markup Language (XML) and the grammar of the XML representing the metadata shall be defined according to the extensible metadata platform (XMP) specification ISO 16684-1. XMP is a technology for embedding metadata into documents and was first published in ISO 16684-1 in 2012.

5.3.3 Included namespaces

XMP metadata is organized into namespaces (see ISO 16684-1:2019, 6.2) and may include properties from one or more namespace. There is no requirement that all properties from a namespace shall be present. The namespaces definitions included in this document are given in [Table 1](#).

Table 1 — Included namespaces

Namespace	Property
Dublin Core	dc:contributor dc:creator dc:format dc:title
XMP basic	xmp:CreateDate xmp:CreatorTool xmp:ModifyDate
XMP media management	xmpMM: InstanceID xmpMM: DocumentID xmpMM: OriginalDocumentID

5.3.4 sgs namespace

This document describes the STEP geometry services namespace that contains the additional characteristics needed to satisfy the audit trail requirement.

- The field namespace URI is <https://standards.iso.org/iso/23301/ed-2/en>
- The preferred field namespace prefix is sgs.

The properties defined in the STEP Geometry Services namespace are provided in [Table 2](#).

The list of ISO 23301 (this document) metadata and their description is given in [Table 3](#).

Table 2 — sgs namespace

Namespace	Property
STEP Geometry Services	sgs:level-of-detail sgs:modification-type sgs:modification-comments sgs:original-URI sgs:SHA3-256 sgs:source-URI

Table 3 — Metadata name and description

23301 name	XMP	Description
created-by	dc:creator	Reference of the organization responsible for the original geometry data set
creation-date	xmp:CreateDate	Validation date of the original geometry data set
format	dc:format	Reference to the standards serialization format of the current data set, mime-type
id	xmpMM:InstanceID	Uniquely identifies the current geometry data set in the management system of the organisation modifying the data set. Different versions of geometry data set shall have different InstanceID but may have the same DocumentID .

Table 3 (continued)

23301 name	XMP	Description
Level-of-detail	sgs:level-of-detail	Multi-valued enumeration describing the type of LOD of the geometry as defined in the geometry descriptions of EN 17412-1. Reference Data Library https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301.owl classes shall be used to specify this attribute. Annex C describes the valid values, their identifications and their definitions.
modification-type	sgs:modification-type	Multi-valued enumeration describing the type of the modifications, transformations or additions made to the data set. The valid values for this enumeration are defined in the ISO 23301 (this document) Reference Data Library in https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301.owl . Annex B describes the valid values, their identifications and their definitions.
modification-comments	sgs:modification-comments	Free text providing details on the modification
modified-by	dc:contributor	Reference of the organization responsible for the last modification of the geometry data set
modified-date	xmp:ModifyDate	Last modification date of the geometry data set as defined in the management system of the organization modifying the data set
name	dc:title	Name of the geometry data set
original-id	xmpMM:OriginalDocumentID	Identifier of the geometry data set in the management system of the organisation issuing the original geometry representing the design intent This value links a geometry data set to its original source.
original-URI	sgs:original-URI	URI to the OriginalDocumentID
software	xmp:CreatorTool	Software used to generate the current data set
source-id	xmpMM:DocumentID	Uniquely identifies the geometry data issued by the management system of the organisation which has provided the data set. Different versions of a geometry data set may have the same DocumentID .
source-URI	sgs:source-URI	URI of the DocumentID
this-URI	rdf:about	URI of the current data set
SHA3-256	sgs:SHA3-256	Hash key of the geometry data set

The data format for each metadata value is defined in [Table 4](#).

In the metadata sets the URI elements have two specific purposes within a distributed services architecture that operates on STEP defined geometry.

One purpose is to ensure integrity and validity of the product of the service, giving the user of the service confidence that the correct and expected input was used to the service. A common use case would be a product whose geometric definition changes with successive revisions. Each revision should have a unique URI that both the producer of the original data and the user of the service can agree on; the knowledge of this URI can be shared even if the service user does not have authority to view the original data. The service user can examine the metadata packet, either embedded in the product or in a sidecar file, to verify that the correct revision was used as original data.

An additional purpose of the metadata is to allow the service user to retrieve the original data. In this case, the URI identifier, should also be a URL. As a global URL, it is irrelevant to the user whether the URL is served by the same service provider or by another data provider. The use case for which this purpose is applicable is a search application, in which the service product is used to determine if the original data should be retrieved. A specific case is a 3D visualization application that allows a user to select a product part and retrieve the original geometry for further analysis.

5.4 Large model presentation — Bounding boxes

To support use cases for large models such as a full car or airplane section, it is necessary to provide services and data allowing a simplified view of the full model.

See the description of a typical use case in [Annex G](#).

The objective is to provide bounding boxes in the assembly structure for all nodes of the assembly.

A bounding box is defined by two corner points. The bounding box has its edges parallel to the part coordinate system.

Using this information, a viewer can display an overview of the model without needing to load the geometry (tessellated geometry or precise geometry). Then the user can identify the parts they need with a more precise representation.

This also allows a viewer to optimize the visualization of a large model by loading the parts which are closer to the camera first.

5.5 Large model presentation — Occurrence tree

For very large models, such as a full airplane, a submarine or an energy plant, an assembly structure with bounding boxes (AP242 XML with bounding boxes) will be very large and provide a lot of information which is useless for many use cases.

For a light overview of a very large model, the objective is to provide an occurrence tree of the model, with bounding boxes.

The targeted format is JSON to ease online and distributed scenarios.

The minimum information that shall be provided for this occurrence tree is:

- The list of all products, with either their part name or identifier, or both, the name of the file that contains the definition of the product, and the bounding box of the product in its coordinate system.
- Occurrence tree, providing for each occurrence:
 - its depth in the tree;
 - the rank of the product in the products list;
 - the position matrix, or rotation and translation, of the occurrence in the referential of the root of the assembly. This placement is the composition of the relative placements of its parents.

Using this information, the application can compute the bounding box of each occurrence in the referential of the root of the assembly.

5.6 Cybersecurity context and requirements

The specifications shall be implemented within the cybersecurity industry context and requirements needed for a specific use case.

This document does not specify any cybersecurity requirements related to the implementation of this document.

The specification of the web services in [Clause 7](#) shall be associated with a cybersecurity infrastructure.

6 Implementation requirements

6.1 General principles

The metadata shall be provided as a set of property-value pairs within the data set, either embedded in the files forming the data set, using the geometry description format chosen for data serialization, or in a separate file called sidecar file in XMP format.

The following clauses describe how to implement the metadata either in a sidecar file or embedded in existing standards format.

6.2 XMP sidecar file

When the geometry description format cannot embed the metadata, an XMP “sidecar” file can be used to store and transfer the metadata. This XMP file can also be used when the geometry files already exist in the repository and cannot or should not be modified.

XMP sidecar files are written in XML or JSON.

The sidecar file can include a SHA3-256 hash key of the geometry data set. This hash shall not be computed on a set of files which includes the side car file. It shall only cover the geometry files.

An example of the sidecar file is available in [Annex C](#).

[Figure 3](#) shows an assembly with XMP sidecar files.

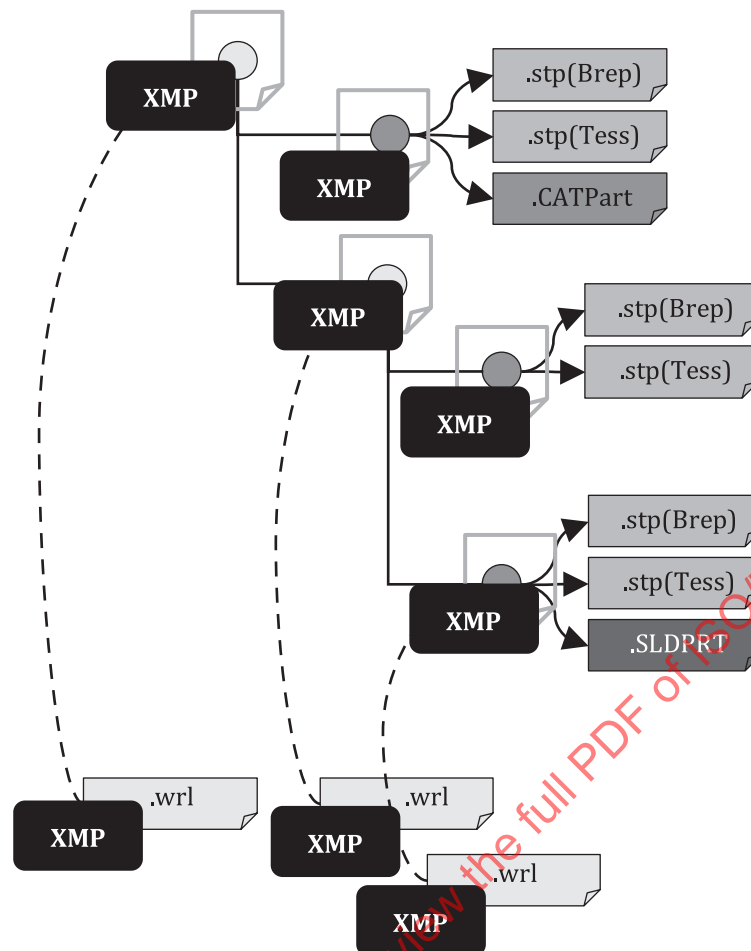


Figure 3 — XMP sidecar files with fully shattered assembly

6.3 ISO/IEC 21778:2017 JSON

For a geometry data set serialized as JSON format, the metadata shall conform to ISO 16684-3.

6.4 ISO 10303-21

For ISO 10303-42 and ISO 10303-242 geometries in ISO 10303-21 ASCII implementations, metadata shall be defined either in:

- the ANCHOR section of the ISO 10303-21 file as simple type anchor items. An example is provided in [Annex D](#), or
- XMP sidecar file.

6.5 10303 XML implementations

Use XMP sidecar file.

6.6 QIF-XML

The following XML schema shall be referenced by the data that shall be provided as a set of property-value pairs in the header part of the data set, using the geometry description format chosen for data serialization.

Use XMP sidecar file.

6.7 ISO/IEC 19775-1 (X3D)

The metadata are contained in a MetadataSet element. This MetadataSet element shall be a child node of the X3D CADAssembly node containing the converted geometry data set.

Each metadata is represented by a MetadataString element with a containerField attribute set to “value”, the name attribute to the metadata name and the value attribute to the value of the metadata.

NOTE 1 The complete specification of the X3D Metadata Nodes is available at <https://www.web3d.org/documents/specifications/19775-1/V3.3/Part01/components/core.html#Metadata>

NOTE 2 The complete specification of the X3D CADGeometry Component is available at <https://www.web3d.org/documents/specifications/19775-1/V3.3/Part01/components/CADGeometry.html>

An example of the metadata implementation in X3D is available in [Annex E](#).

6.8 ISO 17506 (COLLADA)

Use XMP side car.

6.9 3D PDF

XMP metadata format is used to store the metadata in a 3D PDF data set.

Provide the instantiation of the metadata using XMP.

6.10 ISO 14306

Use XMP side car.

7 Geometry services specification

7.1 Description

A service in conformance with this document provides access to the following resources:

- geometry data set or one of its subsets;
- geometric properties of a geometry data set;
- metadata related to a geometry data set;
- non-geometric product data related to a geometry identifier.

EXAMPLE

Give me the 3D visualization representation of this STEP part with this ID. Is the 3D visualization format [AP242|X3D|JT|COLLADA]?

Tell me what the visualization formats are that you can deliver to me for this part.

Give information (quality metadata) about this geometry data set.

The pilot described in [Annex F](#) was used to demonstrate the applicability of the web services.

7.2 REST API

There are three types of responses:

- a single geometry file with ISO 23301 (this document) metadata and the mime-type of the file;

- an AP242 XML product data file without geometry;
- an AP242 XML product data file with external references to geometry files [with ISO 23301 (this document) metadata].

The query can include the response mime-type for single geometry files.

NOTE Assembly structures are described in AP242 XML files.

7.3 Service definition

Service 1 : `get_data_set` (list of identifiers)
 Purpose : Get a set of parts of the identifiers specified
 HTTP request : `GET {base_url}/parts`
 Parameters : `start-index: integer`
 `page-size: integer`
 Request Body : `part-ids: List<uuid>`
 `format: List<format>`
 `LOD: level_of_detail`
 `with-sub-parts: Boolean`
 `with-meta-data: String ("NONE", "XML", "JSON")`
 `Filtering conditions (any): JSON`
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 2 : `get_data_set` (`http://mycompanyname/uuid`)
 Purpose : Get a part of the identifier specified
 HTTP request : `GET {base_url}/parts/{part_id}`
 Parameters : N/A
 Request Body : `format: List<format>`
 `LOD: level_of_detail`
 `with-sub-parts: Boolean`
 `sub-parts-depth: integer`
 `with-meta-data: String ("NONE", "XML", "JSON")`
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 3 : `get_data_set` (`http://mycompanyname/uuid/top1/child2/grandchild3`)
 Purpose : Get a part that is located in the path as specified in an assembly of the identifier specified.
 HTTP request : `GET {base_url}/parts/{part_id}`
 Parameters : N/A
 Request Body : `format: List<format>`
 `LOD: level_of_detail`
 `with-sub-parts: Boolean`
 `sub-parts-depth: integer`
 `with-meta-data: String ("NONE", "XML", "JSON")`
 `Filtering conditions (Path in the assembly {part_id})`
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 4 : `get_data_set` (`http://mycompanyname/uuid/*`)
 Purpose : Get all parts in an assembly of the identifier specified.
 HTTP request : `GET {base_url}/parts/{part_id}`
 Parameters : N/A
 Request Body : `format: List<format>`
 `LOD: level_of_detail`
 `with-sub-parts: boolean = TRUE`
 `sub-parts-depth: integer`
 `with-meta-data: String ("NONE", "XML", "JSON")`
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 5 : `get_data_set` (`identifier, filter, format`)
 Purpose : Get all parts filtered and of format as specified in an assembly of the identifier specified.
 HTTP request : `GET {base_url}/parts/{part_id}`
 Parameters : N/A
 Request Body : `format: List<format>`
 `LOD: level_of_detail`
 `with-sub-parts: Boolean`
 `sub-parts-depth: integer`

with-meta-data: String ("NONE", "XML", "JSON")
 Filtering conditions (any): JSON
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 6 : get_data_set(identifier, in bounding box, format)
 Purpose : Get all parts in the bounding box and of format as specified in an assembly of the identifier specified.
 HTTP request : GET {base_url}/parts/{part_id}
 Parameters : N/A
 Request Body : format: List<format>
 LOD: level_of_detail
 with-sub-parts: Boolean
 sub-parts-depth: integer
 with-meta-data: String ("NONE", "XML", "JSON")
 Filtering conditions (Bounding box): JSON
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 7 : get_data_set(identifier, PDM query filter, format)
 Purpose : Get all parts filtered by "PDM query filter" and of format as specified in an assembly of the identifier specified.
 HTTP request : GET {base_url}/parts/{part_id}
 Parameters : N/A
 Request Body : format: List<format>
 LOD: level_of_detail
 with-sub-parts: Boolean
 sub-parts-depth: integer
 with-meta-data: String ("NONE", "XML", "JSON")
 Filtering conditions (PDM query filter): JSON
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 8 : get_child(identifier)
 Purpose : Get direct child parts of an assembly of the identifier specified.
 HTTP request : GET {base_url}/parts/{part_id}
 Parameters : N/A
 Request Body : format: List<format>
 LOD: level_of_detail
 with-meta-data: String ("NONE", "XML", "JSON")
 Filtering conditions (PDM query filter): JSON
 Response Body: Single file or ZIP file containing stpx and requested parts

Service 9 : get_geom_property(identifier)
 Purpose : Get geometry properties of the types specified of a part of the identifier specified.
 HTTP request : GET {base_url}/parts/{part_id}/geom-props
 GET {base_url}/parts/{part_id}/geom-props/center-of-gravity
 GET {base_url}/parts/{part_id}/geom-props/bounding-box
 GET {base_url}/parts/{part_id}/geom-props/surface-area
 GET {base_url}/parts/{part_id}/geom-props/volume
 Parameters : N/A
 Request Body : N/A
 Response Body: Property value(s): JSON

Service 10 : get_property(identifier)
 Purpose : Get properties of the types specified of a part of the identifier specified.
 HTTP request : GET {base_url}/parts/{part_id}/properties
 GET {base_url}/parts/{part_id}/properties/material
 GET {base_url}/parts/{part_id}/properties/texture
 GET {base_url}/parts/{part_id}/properties/color
 Parameters : N/A
 Request Body : N/A
 Response Body: Property value(s): JSON

Service 11 : get_meta_data(identifier)
 Purpose : Get meta data of a part of the identifier specified
 HTTP request : GET {base_url}/parts/{part_id}/meta-data
 Parameters : N/A
 Request Body : with-sub-parts: Boolean
 with-meta-data: String ("XML", "JSON")
 Response Body: XMP file or ZIP file containing several XMP files

Service 12 : `get_available_formats(identifier)`
 Purpose : Get the available formats/level of detail of the identifier specified
 HTTP request : `GET {base_url}/parts/{part_id}/available-formats`
 Parameters : N/A
 Request Body : N/A
 Response Body: `List<format;level_of_detail>` : JSON

8 Conformance requirements

[Table 4](#) provides the conformance requirement levels. The requirement levels are cumulative.

- Conformance level 1 shall provide all metadata values for level 1.
- Conformance level 2 shall provide all metadata values for level 1 and level 2.
- Conformance level 3 shall provide all metadata values for level 1, level 2 and level 3.
- Conformance level 4 shall provide all metadata values for level 1, level 2 and level 3 in a sidecar with a hash key of the data set.

Table 4 — Metadata format and conformance level

Metadata name	Conformance	Format
about	level1	UTF-8
created-by	level1	UTF-8
creation-date	level1	ISO 8601-1
format	level3	UTF-8
id	level1	UTF-8
level-of-detail	level3	enumeration of UTF-8
modification-type	level3	enumeration of UTF-8
modification-comments	level3	UTF-8
modified-by	level2	UTF-8
modified-date	level2	ISO 8601-1
name	level1	UTF-8
original-id	level1	UTF-8
original-URI	level1	UTF-8
software	level3	UTF-8
source-id	level1	UTF-8
source-URI	level1	UTF-8

Annex A

(informative)

Information object registration

To provide for unambiguous identification of an information object in an open system, the object identifier

{iso standard 23301 version (2)}

is assigned to this document. The meaning of this value is defined in ISO/IEC 8824-1 and is described in ISO 10303-1.

Annex B (informative)

Reference Data Library (RDL) listing

The RDL for this document is represented in [Figure B.1](#) and available in OWL syntax.

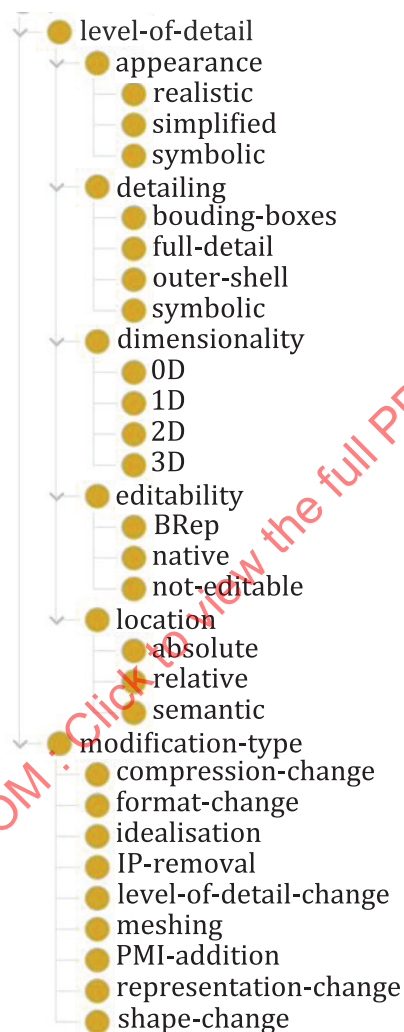


Figure B.1 — RDL data structure for this document

```

<?xml version="1.0"?>
<rdf:RDF xmlns="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#"
  xml:base="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:xml="https://www.w3.org/XML/1998/namespace"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
  <owl:Ontology rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301"/>

  <!--

  //////////////////////////////////////
  //
  
```



```

// Classes
//

////////////////////////////////////

-->

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#BRep -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#BRep">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#editability"/>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#IP-removal -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#IP-removal">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
    <rdfs:comment>modification which removes industrial property information for a
data set. EXAMPLE: transforming an exact geometry with features as a BREP with explicit
shapes definitions</rdfs:comment>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#PMI-addition -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#PMI-
addition">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
      <rdfs:comment>addition of PMI to the data set</rdfs:comment>
      </owl:Class>

      <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#absolute -->
      <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#absolute">
        <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#location"/>
        </owl:Class>

        <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#appearance -->
        <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#appearance">
          <rdfs:subClassOf rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#level-of-detail"/>
          </owl:Class>

          <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#bouding-boxes -->
          <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#bouding-
boxes">
            <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#detailing"/>
            </owl:Class>

            <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#compression-change -->
            <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#compression-change">
              <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
              <rdfs:comment>modification of the compression algorithm applied to the data set</
rdfs:comment>
              </owl:Class>

              <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#detailing -->
              <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#detailing">
                <rdfs:subClassOf rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#level-of-detail"/>
                </owl:Class>

                <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#dimensionality -->
                <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#dimensionality">
                  <rdfs:subClassOf rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#level-of-detail"/>

```

```

</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#editability -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#editability">
  <rdfs:subClassOf rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#level-of-detail"/>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#format-change -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#format-
change">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
  <rdfs:comment>modification of the serialization format of the data set. EXAMPLE: a
CAD native data set is translated in the ISO 10303-242 in p21 format. a 10303-242 p21 data
set is transformed in 10303-242 xml + p21</rdfs:comment>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#full-detail -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#full-
detail">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#detailing"/>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#idealisation -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#idealisation">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
  <rdfs:comment>optimisation of the shape to answer the business needs , maily for
simulation and analysis purpose</rdfs:comment>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#level-of-detail -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#level-of-
detail"/>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#level-of-detail-change -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#level-of-
detail-change">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
  <rdfs:comment>modification of the data set level of detail</rdfs:comment>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#location -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#location">
  <rdfs:subClassOf rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#level-of-detail"/>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#meshing -->
<owl:Class
rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#meshing">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
  <rdfs:comment>geometric data set has been transformed into a mesh</rdfs:comment>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/
rdl/23301#modification-type">
  <rdfs:comment>the type of the modifications, transformations or additions made to
a data set</rdfs:comment>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#native -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#native">
  <rdfs:subClassOf

```

```

rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#editability"/>
</owl:Class>

<!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#not-editable -->
<owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#not-
editable">
  <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#editability"/>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#outer-shell -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#outer-
shell">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#detailing"/>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#realistic -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#realistic">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#appearance"/>
      <rdfs:label xml:lang="en">realistic</rdfs:label>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#relative -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#relative">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#location"/>
      </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#representation-change -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#representation-change">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
      <rdfs:comment>modification of the representation. this can include change of
geometry type like 2D or 3D , CSG or BREP, tessellation,</rdfs:comment>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#semantic -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#semantic">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#location"/>
      <rdfs:isDefinedBy>description of the complexity of the object geometry compared to
the real-world
object. This is expressed as a continuum ranging from symbolic over simplified to
detailed.
More refined geometric representations can contain more features, and/or be more
decomposed, thereby being a better approximation of the shape of the real-world object.
EXAMPLE 1: For facility management purposes the detailing of a boiler can be symbolic as a
box including the volume of the operational space.
EXAMPLE 2: For clash detection purpose the detailing of a boiler can be simplified and
reduced to outer shell.
EXAMPLE 3: For visualisation purpose the detailing of a boiler can use the detailed
geometry from the manufacturer.</rdfs:isDefinedBy>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#shape-change -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#shape-
change">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#modification-type"/>
      <rdfs:comment>the shape of the geometry has been changed</rdfs:comment>
    </owl:Class>

    <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#simplified -->
    <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#simplified">
      <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#appearance"/>

```

```

    <rdfs:label xml:lang="en">simplified</rdfs:label>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#symbolic -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#symbolic">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#appearance"/>
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#detailing"/>
    <rdfs:label xml:lang="en">symbolic</rdfs:label>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#0D -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#0D">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#dimensionality"/>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#1D -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#1D">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#dimensionality"/>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#2D -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#2D">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#dimensionality"/>
  </owl:Class>

  <!-- https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#3D -->
  <owl:Class rdf:about="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#3D">
    <rdfs:subClassOf
rdf:resource="https://standards.iso.org/iso/ts/23301/ed-2/rdl/23301#dimensionality"/>
  </owl:Class>
</rdf:RDF>
<!-- Generated by the OWL API (version 4.5.9 2019-02-01T07:24:44Z)
https://github.com/owlcs/owlapi -->

```

Annex C (informative)

XMP sidecar file example

This is an example of an XMP sidecar file written in XML.

```
<?xml version="1.0" encoding="UTF-8" ?>
<rdf:RDF      xmlns:rdf='http://www.w3.org/1999/02/22-rdf-syntax-ns#'
      xmlns:dc='http://purl.org/dc/elements/1.1/'
      xmlns:xmp='http://ns.adobe.com/xap/1.0/'
      xmlns:sgs='https://standards.iso.org/iso/ts/23301/'>

  <rdf:Description rdf:about='' xmlns:dc='http://purl.org/dc/elements/1.1/'>
    <dc:description>
      <rdf:Alt>
        <rdf:li xml:lang='x-default'>VRML visualization for STEP Geometry Services Pilot Project</rdf:li>
      </rdf:Alt>
    </dc:description>
    <dc:format>model/x3d-vrml</dc:format>
    <dc:rights/>
    <dc:title>
      <rdf:Alt>
        <rdf:li xml:lang='x-default'>l-bracket_20120725.134815</rdf:li>
      </rdf:Alt>
    </dc:title>
    <sgs:name>shape_233230.wrl</sgs:name>
    <sgs:id/>
    <sgs:original-id/>
    <sgs:original-URI>https://spri.kshell.com/sgs/pilot/l-bracket_20120725.134815_var.stp</sgs:original-URI>
    <sgs:source-id>abaparyyyx</sgs:source-id>
    <sgs:source-URI>https://spri.kshell.com/sgs/pilot/shape_27abaparyyyx_233230.wrl</sgs:source-URI>
    <dc:creator>
      <rdf:Seq>
        <rdf:li>vmarchetti@kshell.com</rdf:li>
      </rdf:Seq>
    </dc:creator>
    <xmp:CreateDate>2021-2-10</xmp:CreateDate>
    <sgs:modification-type>conversion</sgs:modification-type>
    <sgs:modification-comments>Conversion of STEP advanced_brep_representation to VRML; tessellation to IndexedFaceSet nodes</sgs:modification-comments>
    <sgs:software>STEP Prolog Restful Interface : https://spri.kshell.com</sgs:software>
    <sgs:level-of-detail/>
  </rdf:Description>
</rdf:RDF>
```

Annex D (informative)

Example of XMP metadata in ISO 10303-21

This is an example of XMP metadata embedded in an ISO 10303-21 file.

```
ANCHOR;  
<name> = 'sample1'  
<id> = '123456789'  
< xmpMM:OriginalDocumentID > = ''  
< sgs:original-URI > = 'http://myserver/design/sample1.xxx'  
< xmpMM:DocumentID > = ''  
< sgs:source-URI > = 'http://myserver/SGS/sample1.stp'  
< dc:creator > = 'Jean'  
< dc:contributor > = ''  
< xmp:CreateDate > = '2020-12-25T08:23:50'  
< xmp:ModifyDate > = '2021-02-15T12:00:00'  
< sgs:modification-type > = 'conversion'  
< dc:format > = 'step'  
< xmp:CreatorTool > = 'my_software rev 10'  
< sgs:level-of-detail > = ''  
ENDSEC;
```

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