
Informacijsko modeliranje gradenj (BIM) - Semantični standard za modeliranje in povezovanje (SML)

Building Information Modelling (BIM) - Semantic Modelling and Linking (SML)

Semantischer Modellierungs- und Verknüpfungsstandard (SMLS) für die Datenintegration in der gebauten Umwelt

Modélisation d'informations de la construction (BIM) - Modélisation et liens sémantiques (SML)

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**Building Information Modelling (BIM) - Semantic
Modelling and Linking (SML)**

Modélisation d'informations de la construction (BIM) -
Modélisation et liens sémantiques (SML)

Semantischer Modellierungs- und
Verknüpfungsstandard (SMLS) für die
Datenintegration in der gebauten Umwelt

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 442.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 17632:2021) has been prepared by Technical Committee CEN/TC 422 “Building Information Modelling (BIM)”, the secretariat of which is held by SN - Norway.

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Introduction

The built environment is the context of this document. In the life cycle of buildings or infrastructure its assets need to be managed across their entire life cycle, involving programming, design, building and operation (as defined by ISO 19650 series), and the supply chain producing and delivering them. Vast amounts of valuable data about them are created, communicated in a diverse range of formats and data structures - and often lost again. In order to manage the assets efficiently and effectively according to the standards practised in asset management (as defined by ISO 55000 series), data needs to be findable, accessible, interoperable and reusable (FAIR)¹⁾.

The world wide web consortium (W3C) provides so-called linked data (LD) and semantic web (SW) technologies [1] which are capable of giving data common form (syntax) and meaning (semantics), making data FAIR in a vendor neutral fashion.

The aim of this document is to standardize the application of this technology for the built environment in order to enable the data becoming FAIR. This document specifies how the construction and software industries apply this linked data and semantic web technology.

It hereby follows the principle to keep semantic modelling as simple and as standard as possible (Table 1).

Table 1 — Aiming for standard and simple semantics

Semantic	Standard	Proprietary
Simple	OK	IF NEEDED
Complex	IF NEEDED	NOT OK

In others words, it is not the intention of this document to persuade anyone to shift the data structures they already have in place. On the contrary, it is the suggestion of this document to store, model, publish and link these data in a findable, accessible, interoperable and reusable manner (FAIR). To benefit the industry from planning and design to construction and operation.

This document complements other ISO standards without any overlap. In the Annex G, related ISO standards are listed and the exact relationship is described.

Application of this document to new or existing software will result in future proof, semantic data interoperability that is interoperability so that the meaning of the data model within the context of a subject area is understood by the participating systems [SOURCE: ISO/IEC 19941].

Furthermore, the data sets and data models become compatible, reusable, combinable and thereby integrally applicable. This document enables decision making in and over every life cycle phase and the supply chain involved.

1) A common principle by go-fair.org in today's data management.

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Data management in the built environment is characterized by three main categories:

- Terms and definitions of data (on object level and attribute level);
- Data exchange (transfer of data from one party to another party) and data sharing (publishing of data by one party where it can be accessed by other parties);
- Data integration involving linking all data together.

For each of these categories the interoperability approaches apply, as defined by the enterprise interoperability framework (EIF) (ISO 11354-1):

1. *Unified approach*, featuring some *common meta-model*;
2. *Integrated approach*, featuring some *common forms*;
3. *Federated approach*, no common forms or meta-model but dynamic accommodation/adjustment.

These approaches, according to the EIF, are valid for business, process, service and data aspects.

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1 Scope

This document discusses an integrated and unified approach for data aspects, specifically for assets in the built environment, using EIF terminology.

The following data architecture (Figure 1) applies within each category.

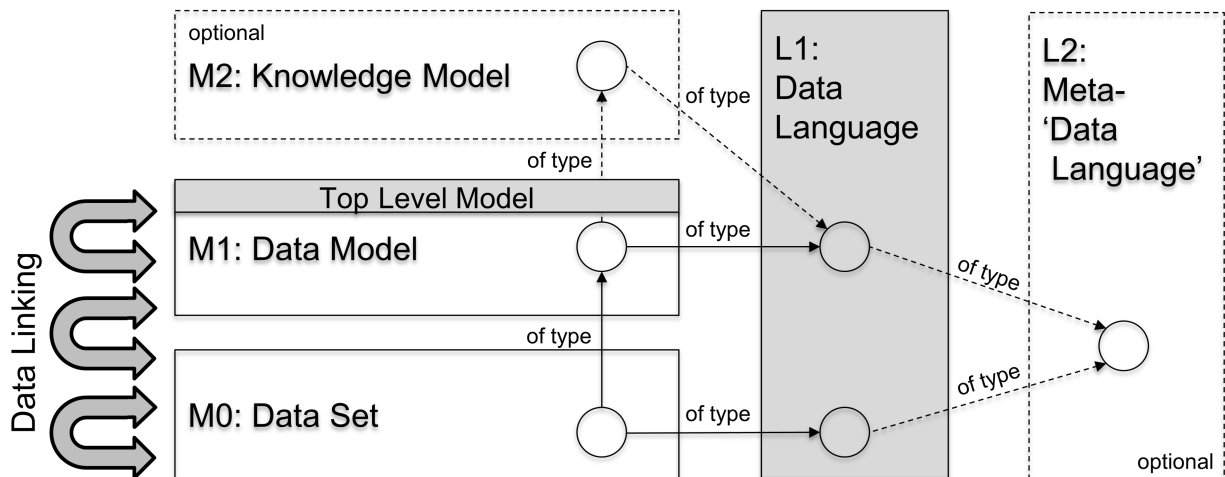


Figure 1 — Data architecture with typology (grey areas indicating the scope of this document)

This document specifies:

- a generic Top Level “M1: Data model” as common form;
- a conceptual “L1: Data language” as common meta-model with four (‘linked data’-based concrete language bindings (SKOS, RDFS, OWL and SHACL), including:
 - a choice of RDF-based formats (to be used for all modelling and language levels);
 - a set of data modelling patterns (for identification, naming, handling of enumeration types, quantity modelling, asset decomposition, grouping, etc.).
- a linking approach for interlinking data sets, interlinking data models and linking data sets and data models which are relevant within the built environment from many perspectives such as:
 - Building information modelling (BIM);
 - Geo-spatial information systems (GIS);
 - Systems engineering (SE) ²⁾;
 - Monitoring & control (M&C);
 - Electronic document management (EDM).

This document does not specify a knowledge model since this is already available in ISO 12006-3.

²⁾ The interdisciplinary approach governing the total technical and managerial effort required to transform a set of stakeholder needs, expectations, and constraints into a solution and to support that solution throughout its life [SOURCE: ISO/IEC/IEEE 12207:2017(en), 3.1.65].

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This document does not specify a meta-‘data language’ since this is already provided by the concrete RDF language bindings (being RDFS).

The scope of this document in general excludes the following:

- Business process modelling;
- Software implementation aspects;
- Data packaging and transportation/transaction aspects (handled by ISO TC59/SC13 Information container for document delivery (ICDD) respectively various information delivery manual (IDM) / information exchange requirements (EIR)-related initiatives);
- Domain-specific (here: built environment-specific) content modelling in the form of concepts, attributes and relations at end-user level (the actual ontologies themselves) beyond a generic upper ontology and modelling patterns.

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 for this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

JSON-LD 1.1, A JSON-based Serialization for Linked Data, W3C Candidate Recommendation, 17 April 2020, <https://www.w3.org/TR/json-ld11/>

OWL 2³⁾ Web Ontology Language, Document Overview (Second Edition), W3C Recommendation, 11 December 2012, <https://www.w3.org/TR/2012/REC-owl2-overview-20121211/>

RDF 1.1 Concepts and Abstract Syntax, W3C Recommendation, 25 February 2014, <https://www.w3.org/TR/rdf11-concepts/>

RDF 1.1 Turtle, W3C Recommendation, 25 February 2014, <https://www.w3.org/TR/turtle/>

RDF 1.1 XML Syntax, W3C Recommendation 25 February 2014, <https://www.w3.org/TR/rdf-syntax-grammar/>

RDF Schema 1.1, W3C Recommendation, 25 February 2014, <https://www.w3.org/TR/rdf-schema/>

SHACL (Shapes Constraint Language), W3C Recommendation, 20 July 2017, <https://www.w3.org/TR/shacl/>

SKOS Simple Knowledge Organization System Reference, W3C Recommendation, 18 August 2009, <https://www.w3.org/TR/skos-reference/>

SPARQL 1.1 Overview, 21 March 2013, W3C Recommendation, <https://www.w3.org/TR/sparql11-overview/> (referencing, among others, the next two, more specific, references)

SPARQL 1.1 Query Language, W3C Recommendation, 21 March 2013, <https://www.w3.org/TR/2013/REC-sparql11-query-20130321/>

3) From now referred to as just “OWL”.

SPARQL 1.1 Protocol, W3C Recommendation, 21 March 2013, <https://www.w3.org/TR/sparql11-protocol/>

XML Schema Part 2: Datatypes, Second Edition, W3C Recommendation, 28 October 2004, <https://www.w3.org/TR/xmlschema-2/>

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1 and the following apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

3.1

asset

item, thing or entity that has potential or actual value to an organization

[SOURCE: ISO 55000:2014, 3.2.1, modified — Note 1, 2 and 3 to entry have been removed.]

3.2

machine-readable

able to be read and processed by a computer

3.3

machine-interpretable

able to be semantically interpreted by a computer

3.4

level of capability

LoC

level of semantic level modelling power within a data model to fulfil a use case type

3.5

format

predetermined arrangement of data on a data medium

[SOURCE: ISO 5127:2017, 3.1.13.12]

3.6

ontology

formal, explicit specification of a shared conceptualization

Note 1 to entry: An ontology typically includes definitions of concepts and specified relationships between them, set out in a formal way so that a machine can use them for reasoning.

Note 2 to entry: Applied in this document as a set of concepts, (reference) individuals, value types, (reference) values, attributes, relations, constraints and derivations.

[SOURCE: ISO 5127:2017, 3.1.2.03, modified — added Note 2 to entry]

prEN 17632:2021 (E)**3.7****typology**

hierarchy related to classification/instantiation relations

[SOURCE: ISO/IEC 11179-3:2013, 3.2.135, modified — The words "type of" have been removed. The words "which deals with" have been changed to "related to". The word relationships has been changed to relations.]

3.8**taxonomy**

hierarchy related to generalization/specialization relations

[SOURCE: ISO/IEC 11179-3:2013, 3.2.135, modified — The words "type of" have been removed. The words "which deals with" have been changed to "related to". The word relationships has been changed to relations. Not mixing concepts, attributes and relations.]

3.9**meronomy**

hierarchy related to part-whole (decomposition) relations

[SOURCE: ISO/IEC 11179-3:2013, 3.2.135, modified — The words "type of" have been removed. The words "which deals with" have been changed to "related to". The word relationships has been changed to relations.]

3.10**built environment**

collection of man-made or induced physical objects located in a particular area or region

[SOURCE: ISO 6707-3:2017, 3.1.3]

3.11**triple**

statement in the form subject-predicate-object that expresses a relation

3.12**level of capability**

modelling power related to the needs of a specific use case type, provided by the linked data languages

3.13**object**

any part of the perceivable or conceivable world

Note 1 to entry: An object is something abstract or physical toward which thought, feeling, or action is directed.

Note 2 to entry: Within this draft, the terms instance and individual, are used as synonyms of object.

[SOURCE: ISO 12006-2:2015, 3.1.1, modified — added Note 2 to entry.]

3.14**concept**

abstract entity for determining category membership

[SOURCE: ISO/IEC 2382 :2015, 2122971]

3.15**property**

inherent or acquired feature of an object

3.16**attribute**

data element for the computer-sensible description of a property, a relation or a class

[SOURCE ISO 22274:2013, 3.2]

3.17**relation**

sense in which concepts can be connected, via constituent roles

EXAMPLE Causality is a relation with two constituent roles: cause and effect.

[SOURCE: ISO/IEC 11179-3:2013, 3.2.119]

3.18**data set**

group of data instances directly specifying or describing something you can or could point at in reality

3.19**data model**

specification/description of the organization of data giving meaning (semantics) to a data set

3.20**exchange information requirement****EIR**

information requirement in relation to an appointment

[SOURCE: ISO 19650-1:2018, 3.3.6]

3.21**systems engineering****SE**

interdisciplinary approach governing the total technical and managerial effort required to transform a set of stakeholder needs, expectations, and constraints into a solution and to support that solution throughout its life

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.65]

prEN 17632:2021 (E)**3.22****metadata**

data about data (documents, data sets, data models or elements in those)

3.23**top level data model**

most generic taxonomy as part of a data model

4 Symbols and abbreviated terms**4.1 Symbols**

This document does not contain any symbols.

4.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

API	application programming interface
BIM	building information modelling
DT	data template [CEN TC 442]
ECMA	European computer manufacturers association international
EDM	electronic data management
EIF	enterprise interoperability framework
EIR	exchange information requirements
FAIR	findable, accessible, interoperable, reusable [go-fair.org]
FO	functional object
GIS	geo-spatial information systems
GUID	globally unique identifier (typically assigned)
ICDD	information container for linked document delivery [ISO]
ID	identifier
IDM	information delivery manual
IFC	industry foundation classes [ISO]
IETF	internet engineering task force
IO	imaginary object
JSON	JavaScript object notation [ECMA]
JSON-LD	JavaScript object notation - linked data [W3C]
LBD CG	linked building data community group [W3C]

LD	linked data technology [W3C]
LoC	level of capability
M&C	monitoring & control
OMG	object management group
OWL	web ontology language [W3C]
QUDT	quantities, units & data types [qudt.org]
RDF	resource description framework [W3C]
RDFS	resource description framework schema [W3C]
RFC	request for comments [IETF]
RO	real object
SE	systems engineering
SHACL	shapes constraints language [W3C]
SML	semantic modelling and linking [CEN]
SPARQL	SPARQL protocol and RDF query language [W3C]
SPFF	STEP physical file format [STEP]
STEP	standard for the exchange of product model data [ISO]
SSoF	single source of facts
SW	semantic web technology [W3C]
TO	technical object
UML	unified modelling language [OMG]
URI	uniform resource identifier [W3C]
UUID	universally unique identifier [IETF]
XML	extensible markup language [W3C]
XSD	extensible markup language schema definition [W3C]
W3C	world wide web consortium
WWW	world wide web [W3C]