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Part 7: **Bindings**

Technologies de l'information — Apprentissage, éducation et formation — Métadonnées pour ressources d'apprentissage —

Partie 7: Liaisons

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 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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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 by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training.*

A list of all parts in the ISO/IEC 19788 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.

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Introduction

The primary purpose of the ISO/IEC 19788 series is to facilitate: (1) the description of a learning resource by providing a standards-based approach to the identification and specification of the metadata elements required to describe a learning resource, e.g. as a metadata learning resource (MLR) record; and (2) the search, discovery, acquisition, evaluation, and use of learning resources, for instance by learners, instructors or automated software processes.

The ISO/IEC 19788 series is modularly structured with all subsequent parts corresponding to a specified set of user requirements for the identification and specification of metadata elements having a particular focus and intended use in the description of a learning resource. This includes categories of metadata elements focused on technical perspectives, pedagogical aspects, availability and intellectual property aspects, bindings, etc.

This document maps the different ISO/IEC 19788-1 constructs to machine readable/understandable entities. This document also proposes global (non-linguistic) identifiers for MLR entities and localized (linguistic) identifiers for the same MLR entities.

The primary purpose of the ISO/IEC 19788 series is to specify elements and their attributes for the description of learning resources. This includes the rules governing the identification of data elements and the specification of their attributes.

The ISO/IEC 19788 series provides data elements for the description of learning resources and resources directly related to learning resources.

The ISO/IEC 19788 series provides principles, rules and structures for the specification of the description of a learning resource; it identifies and specifies the attributes of a data element as well as the rules governing their use. The key principles stated in ISO/IEC 19788-1 are informed by a user requirements-driven context with the aim of supporting multilingual and cultural adaptability requirements from a global perspective.

ISO/IEC 19788-1 is information technology neutral and defines a set of common approaches, i.e. methodologies and constructs, which apply to the development of the subsequent parts of the ISO/IEC 19788 series.

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Information technology — Learning, education and training — Metadata for learning resources —

Part 7: Bindings

IMPORTANT — All links that are in regular font and blue/underlined are true links. Any other links (especially in courier font) should not be considered functional.

1 Scope

This document provides RDF mappings of the different MLR entities introduced in the MLR framework (ISO/IEC 19788-1 and its amendment): data element specifications (DESs), resource classes (RCs), data elements (DEs), application profiles (APs), MLR records and data element group specifications (DEGSs).

This document associates HTTP IRIs (linguistically neutral and linguistic) to **conceptual** MLR entities denoted by MLR identifiers. This is needed for the management of MLR entities and their versions.

Moreover, this document provides excerpts of an OWL 2 DL ontology for the resource classes and data element specifications (properties) introduced in the ISO/IEC 19788 series.

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 639-2, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ISO 639-3,[1)] *Codes for the representation of names of languages — Part 3: Alpha-3 code for comprehensive coverage of languages*

ISO 3166-1,[2)] *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 15924,[3)] *Information and documentation — Codes for the representation of names of scripts*

ISO/IEC 11404, [4)], *Information technology — General-Purpose Datatypes (GPD)*

ISO/IEC 19788-1:2011,[5)] *Information technology — Learning, education and training — Metadata for learning resources — Part 1: Framework*

ISO/IEC 19788-1:2011/Amd 1:2014, *Information technology — Learning, education and training — Metadata for learning resources — Part 1: Framework/Amendment 1*

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1) The name and contact information of the Registration Authority for this ISO 639-3 can be found at http://www.iso.org/mara.

2) Alpha-2 codes available at http://www.iso.org/iso/country_codes/iso_3166_code_lists/country_names_and_code_elements.htm.

3) Codes available at http://www.unicode.org/iso15924/codelists.html.

4) Freely available at http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html.

5) Freely available at http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html.

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ISO/IEC 19788-2, *Information technology — Learning, education and training — Metadata for learning resources — Part 2: Dublin Core elements*

ISO/IEC 19788-2:2011/Amd 1:2016, *Information technology — Learning, education and training — Metadata for learning resources — Part 2: Dublin Core elements/Amendment 1: Non-literal content value data elements*

ISO/IEC 19788-5:2012, *Information technology — Learning, education and training — Metadata for learning resources — Part 5: Educational elements*

ISO/IEC 19788-8:2015, *Information technology — Learning, education and training — Metadata for learning resources — Part 8: Data elements for MLR records*

IETF BCP 47: 2009,[6] Tags for Identifying Languages

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19788-1 and ISO/IEC 19788-1:2011/Amd 1:2014 and the following apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
conceptual
<MLR entity> the qualified entity captures the "essence" of an MLR entity defined in an ISO/IEC 19788 part and further versioned in later parts of ISO/IEC 19788 (e.g. in later editions, amendments or corrigenda)

EXAMPLE 1 Conceptual DES.

EXAMPLE 2 Conceptual RC.

EXAMPLE 3 Conceptual vocabulary.

EXAMPLE 4 Conceptual vocabulary term.

Note 1 to entry: MLR entities are identified with MLR identifiers, and conceptual MLR entities are identified with canonical MLR identifiers.

3.2
blank node
<rdf> element from a *blank node set* (3.3)

Note 1 to entry: In an *RDF graph* (3.14) a blank node indicates the existence of a thing, without using an *IRI* (3.8) or a *literal* (3.10) to denote it. A blank node may be thought of as referring to an anonymous resource.

Note 2 to entry: In concrete RDF syntaxes, when identified, blank node identifiers are locally scoped to their container and are NOT persistent.

Note 3 to entry: The MLR standard does not use blank nodes. Each blank node is replaced by a globally unique IRI (a Skolem IRI).

Note 4 to entry: In Turtle, a concrete syntax for RDF, blank nodes in triples are expressed as _: followed by a blank node label (e.g. `_:alice, _:0-34-abc`).

6) See http://tools.ietf.org/html/bcp47.

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3.3
blank node set
<rdf> infinite set disjoint from the set of all *IRIs* (3.8) and the set of all *literals* (3.10)

Note 1 to entry: Any blank node set, the set of all IRIs and the set of all literals are pairwise disjoint.

Note 2 to entry: No other conditions are imposed on a blank node set than being disjoint from IRIs and literals.

3.4
content negotiation
<web architecture> practice of providing multiple *representations* (3.20) available via the same URI

Note 1 to entry: Which representation is served depends on negotiation between the requesting agent and the agent serving the representations.

[SOURCE: Architecture of the World Wide Web, Volume One. W3C Recommendation. Available from: http://www.w3.org/TR/2004/REC-webarch-20041215/]

3.5
graph store
<rdf> mutable container of *RDF graphs* (3.14) managed by a single service

Note 1 to entry: Graph stores are similar to *RDF datasets* (3.12), but unlike an RDF dataset, named graphs can be added to or deleted from a graph store.

Note 2 to entry: A graph store can be viewed as a mutable RDF dataset.

[SOURCE: SPARQL 1.1 Update — W3C Recommendation 21 March 2013, Section 2. Available from: http://www.w3.org/TR/2013/REC-sparql11-update-20130321/]

3.6
information resource
<web architecture> resource which has the property that all of its essential characteristics can be conveyed in a message

EXAMPLE The information content of the book "Turtle, Termites, and Traffic Jams" by Mitchel Resnick (ISBN 0-262-18162-2) is an information resource. However, the physical object "Turtle, Termites, and Traffic Jams" book owned by Gilles Gauthier is not an information resource.

[SOURCE: Architecture of the World Wide Web, Volume One. W3C Recommendation. Available from: http://www.w3.org/TR/2004/REC-webarch-20041215/]

3.7
Internationalized Resource Identifier
IRI
<general> sequence of characters that conforms to the syntax defined in RFC 3987

Note 1 to entry: IRIs may be written on paper, read aloud, stored or transmitted digitally. The same IRI may be represented in many different ways.

3.8
Internationalized Resource Identifier
IRI
<rdf> Unicode/ISO/IEC 10646 string that conforms to the syntax defined in RFC 3987

Note 1 to entry: IRIs in the RDF abstract syntax MUST be absolute and MAY contain a fragment identifier.

Note 2 to entry: When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of RFC 3987. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

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[SOURCE: RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 3.2. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.9
language-tagged string
<rdf> *literal* (3.10) for which the third component is present

Note 1 to entry: Most concrete RDF syntaxes represent language-tagged strings without the datatype IRI because it always equals `http://www.w3.org/1999/02/22-rdf-syntax-ns#langString`.

3.10
literal
<rdf> entity comprising two or three elements:

— a **lexical form**, being a Unicode string, which should be in Normal Form C,

— a **datatype IRI**, being an *IRI* (3.8) identifying a datatype that determines how the lexical form maps to a literal value, and

— if and only if the datatype IRI is `http://www.w3.org/1999/02/22-rdf-syntax-ns#langString`, a non-empty language tag as defined by BCP 47. The language tag MUST be well-formed according to section 2.2.9 of BCP 47

[SOURCE: RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 3.3. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.11
media type
metadata for a *representation* (3.20), as per IETF RFC 6838, that provides format specification and preferred interpretation for the representation

EXAMPLE image/jpeg, image/svg+xml, text/plain, text/html, text/turtle, video/H264, application/xhtml+xml, application/trig, application/ld+json, application/json, application/rdf_xml.

Note 1 to entry: Media types, also called Internet media types, were previously called MIME types when used essentially for email sent through the SMTP protocol.

Note 2 to entry: Registry of Internet media type is available online at http://www.iana.org/assignments/media-types.

3.12
RDF dataset
collection of RDF graphs comprising of

— exactly one **default graph**, being an *RDF graph* (3.14), and

— zero or more **named graphs**

Note 1 to entry: The default graph does not have a name and MAY be empty.

Note 2 to entry: Each named graph is a pair consisting of an *IRI* (3.8) or a *blank node* (3.2) (the ***graph name***), and an RDF graph. Graph names are unique within an RDF dataset.

Note 3 to entry: Blank nodes can be shared between graphs in an RDF dataset.

Note 4 to entry: RDF datasets are non-mutable (immutable): adding or removing RDF triples or RDF graphs from an RDF dataset yields a different RDF dataset.

Note 5 to entry: Despite the use of the word “name” in “named graph”, the graph name is not required to denote the graph. It is merely syntactically paired with the graph. RDF does not place any formal restrictions on what resource the graph name may denote, nor on the relationship between that resource and the graph.

[SOURCE: Adapted from RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 4. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

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3.13
RDF document
<rdf> document that encodes an *RDF graph* (3.14) or *RDF dataset* (3.12) in a concrete RDF syntax, such as Turtle, RDFa, JSON-LD or TriG

Note 1 to entry: RDF documents enable the exchange of RDF graphs and RDF datasets between systems.

[SOURCE: RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 1.8. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.14
RDF graph
set of *RDF triples* (3.18)

Note 1 to entry: RDF graphs are non-mutable (immutable): adding or removing RDF triples from an RDF graph yields a different RDF graph.

3.15
RDF node set
set of subjects and objects from all the *RDF triples* (3.18) of an *RDF graph* (3.14)

3.16
RDF source
persistent and mutable source or container for *RDF graphs* (3.14)

Note 1 to entry: An RDF source is a resource whose state can change over time.

Note 2 to entry: Examples of RDF sources are files containing a serialization of an RDF graph using a concrete RDF syntax and *triple stores* (3.22).

[SOURCE: Adapted from RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 1.5. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.17
RDF term
IRI (3.8), *literal* (3.10) or *blank node* (3.2)

Note 1 to entry: IRIs, literals and blank nodes are distinct and distinguishable. For example, `http://example.org/` as a string literal is neither equal to `http://example.org/` as an IRI, nor to a blank node with the blank identifier `http://example.org/`.

[SOURCE: RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 3.1. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.18
RDF triple
entity consisting of three ordered components, namely

— the **subject**, which is an *IRI* (3.8) or a *blank node* (3.2),

— the **predicate**, which is an IRI, and

— the **object**, which is an IRI, a *literal* (3.10) or a blank node

Note 1 to entry: Any IRI denotes an entity in the world (the “universe of discourse”).

Note 2 to entry: Triples are written in the order subject, predicate, object.

[SOURCE: Adapted from RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 3.1. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

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3.19
RDF vocabulary
collection of *IRIs* (3.8) intended for use in *RDF graphs* (3.14)

[SOURCE: RDF 1.1 Concepts and Abstract Syntax — W3C Recommendation 25 February 2014, Section 1.4. Available from: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/]

3.20
representation
<web architecture> data that encode information about resource state

Note 1 to entry: A resource may have more than one representation: The information resource "Turtle, Termites, and Traffic Jams" by Mitchel Resnick (ISBN 0-262-18162-2) could have textual representations (plain text, HTML, epub, portable document format (PDF), Microsoft Word, Braille, etc.), representations in various languages (English, French, etc.), audio representations, etc.

Note 2 to entry: Metadata such as character encoding (e.g. UTF-8, UTF-16, US-ASCII, ISO-8859-1) or content encoding (e.g. XML, HTML, JPEG video, JSON file) may be provided.

[SOURCE: Adapted from Architecture of the World Wide Web, Volume One. W3C Recommendation, 2004. Available from: http://www.w3.org/TR/2004/REC-webarch-20041215/]

3.21
simple literal
<rdf> *literal* (3.10) for which the datatype *IRI* (3.8) is `http://www.w3.org/2001/XMLSchema#string`

Note 1 to entry: Most concrete syntaxes represent simple literals without the datatype IRI because it always equals `http://www.w3.org/2001/XMLSchema#string`.

3.22
triple store
<rdf> specialized database for the storage and retrieval of *RDF triples* (3.18)

Note 1 to entry: A triple store is an *RDF source* (3.16).

3.23
Web resource
information resource (3.6) that "lives on the World Wide Web"

Note 1 to entry: A Web resource can be denoted by an HTTP IRI and under normal conditions (server not down), a representation of the resource (the exact representation retrieved might depend on content negotiation) can be retrieved using that IRI and the HTTP protocol.

4 Symbols and abbreviated terms

AP	Application Profile
DEGS	Data Element Group Specification
DES	Data Element Specification
FOAF	Friend of a Friend
HTTP	Hypertext Transfer Protocol
IRI	Internationalized Resource Identifier
JSON	JavaScript Object Notation
JSON-LD	JavaScript Object Notation for Linking Data

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