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MLR Bindings

Part 1: OWL, RDFS, RDF & XML

Gilles Gauthier

Mission du GTN-Québec

La mission du Groupe de travail québécois sur les normes et standards pour l'apprentissage, l'éducation et la formation (GTN-Québec) est de fournir une expertise à la communauté éducative en matière de normalisation.

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1. Dans une perspective d'accompagnement, consulter les acteurs du milieu de l'éducation pour mieux définir comment les approches basées sur les normes et standards peuvent aider à concrétiser la mission éducative de leur organisation ;
2. Connaître des solutions basées sur des normes et standards, s'assurer qu'elles correspondent à la réalité et aux besoins du milieu et proposer, le cas échéant, des adaptations ou des guides d'utilisation de ces normes;
3. Faire connaître et encourager les pratiques normalisées de production et de description de ressources éducatives ;
4. Favoriser le développement d'une masse critique de REA numériques accessibles, pérennes et réutilisables au sein des établissements de chaque ordre d'enseignement ;
5. Maintenir l'expertise et la représentation québécoises en matière de développement de normes internationales et d'autres standards.

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Document history

Date	Comments	Contributor (s)
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Errata

Errors and their corrections will be posted at <http://gillesgauthier.net/normetic/bindings/errata.html>

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Introduction

This document provides bindings (OWL, RDF, XML and others) for various constructs introduced in ISO/IEC 19788-1 (Information technology – Learning, education and training – Metadata for learning resources – Part 1: Framework) International Standard.

First a quick reminder concerning the ISO/IEC 19788 (MLR) multipart standard:

The ISO/IEC 19788 multipart standard is concerned about the specification of data elements for the description of a learning resource and related resources participating in its description. ISO/IEC 19788 is **learning resource** centric.

ISO/IEC 19788 comprises different kind of parts:

- ✓ Part 1: The overall framework, for use by ISO/IEC JTC1 SC36/WG4 standards developers and by general users;
- ✓ Parts describing **data element specifications** (DESS): Part 2: Dublin Core elements, Part 4: Technical elements, Part 5: Educational elements, Part 6: Availability, distribution, and intellectual property elements...);
- ✓ Parts specifying application profiles (APs): Part 3: Basic application profile. Other similar parts are envisioned (for example in relation to the IEEE 1484.12.1-2002, IEEE Standard for Learning Object Metadata (LOM)) ;
- ✓ Parts that provide bindings: Part 7: Bindings...

[ISO/IEC 19788-1:2011](#) (MLR-1: Framework)^{1, 2}

1. MLR-1 provides principles governing the strategy and development of the multipart Standard "Metadata for Learning Resources (MLR)".
2. MLR-1 provides a way to precisely describe **data element specification** (through the use of a matrix template). MLR data element specifications are provided by MLR parts (e.g. parts 2, 4, 5, 6).
3. Communities and end users can also use the MLR-1 framework for the specification of data elements they need but that are not provided by the MLR multipart standard.
4. MLR-1 defines in a precise way what a **data element** is.
5. MLR-1 defines what a **MLR record** is.
6. MLR-1 provides **tables of content** for a) MLR parts providing data element specifications and b) for MLR parts specifying MLR application profiles.

A corrigendum for ISO/IEC 19788-1:2011 is under development at ISO/IEC JTC1 SC36/WG4. The present document takes into account the modifications introduced in the corrigendum ([ISO/IEC 19788-1:2011/CD Cor1](#)).

[ISO/IEC 19788-2:2011](#) (MLR-2: Dublin Core elements)

MLR-2 provides a set of core **data element specifications**, whose **data element** "instances" may be used to provide a basic description of a **learning resource**. It is essentially the DC metadata element set specialized to learning resources.

¹ The ISO/IEC 19788-1:2011 standard is freely available: <http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

² The constructs of the MLR-1 Framework can be used outside of the scope of the standard. For example, the DES mechanism can be used for the specification of data elements needed to describe any resource or entity (not only learning resources or related resources)

[ISO/IEC 19788-3:2011](#) (MLR-3: Basic application profile)

MLR-3 provide an **application profile** based on MLR data element specifications from MLR-2 and added MLR data element specifications introduced in part 3 itself. It is designed as a starting point for adopting the ISO/IEC 19788 multipart standard.

[ISO/IEC CD 19788-4](#) (MLR-4: Technical elements) – Under development

MLR-4 is to provide a pool of data element specifications for the description of the technical characteristics of a learning resource: location, digital format, hardware requirements...

[ISO/IEC 19788-5:2012](#) (MLR-5: Educational elements)

MLR-5 provides data element specifications related to educational aspects of learning resources across various educational, cultural and linguistic settings.

[ISO/IEC CD 19788-6](#) (MLR-6: Availability, distribution, and intellectual property elements) – Under development

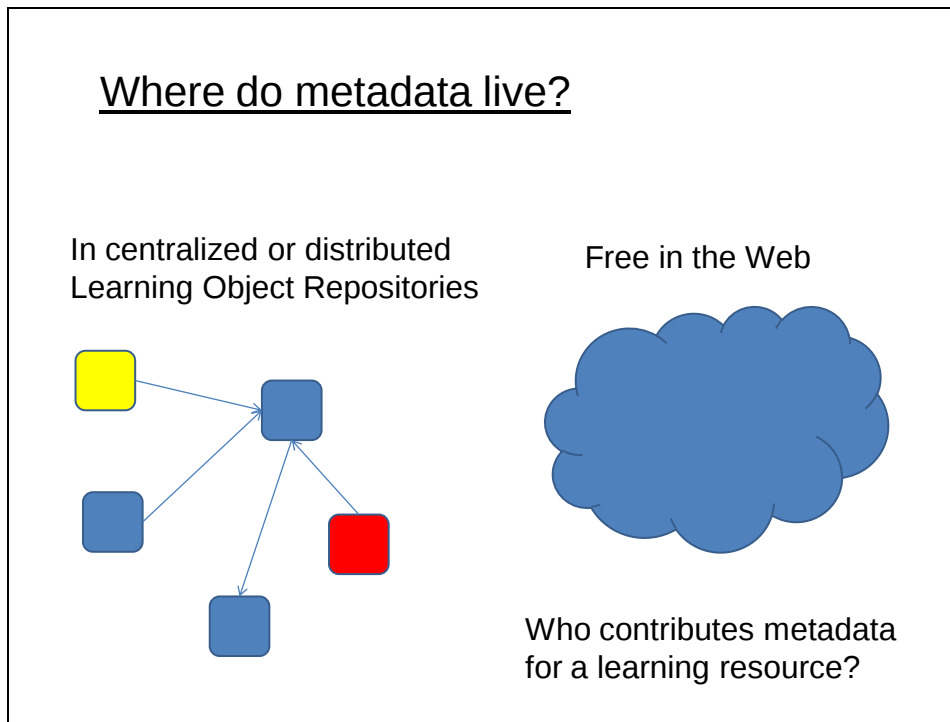
[ISO/IEC NP 19788-7](#) (MLR-7: Bindings) – Working Draft to be considered at the ISO/IEC JTC1 SC36/WG4 Busan meeting (September 2012)

[ISO/IEC 19788-8](#) (MLR-8: Data elements for MLR records) – Working Draft to be considered at the ISO/IEC JTC1 SC36/WG4 Busan meeting (September 2012)

[ISO/IEC 19788-9](#) (MLR-9: Data elements for Persons) – Working Draft to be considered at the ISO/IEC JTC1 SC36/IEEWG4 Busan meeting (September 2012)

Where do learning resources metadata live?

Traditionally in repositories but more and more, distributed (as linked data) on the World Wide Web.



The ISO/IEC 19788 multipart Standard has the potential to support those two approaches:

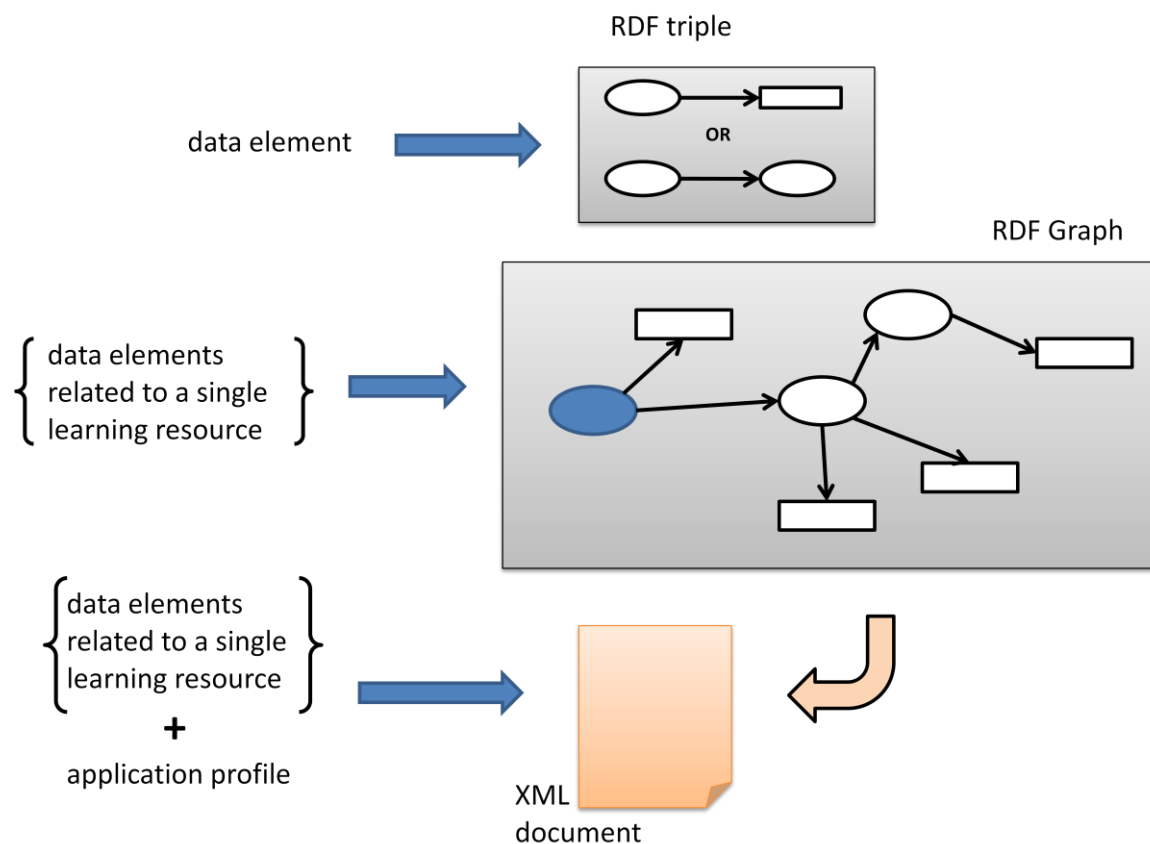
- support for a LOM like approach to metadata (MLR record, data element group and application profiles);
- support for a distributed (crowdsourcing) approach (RDF graphs, RDF datasets and linked data), that is the ISO/IEC multipart Standard is “Semantic Web enabled”.

Other parts?

- MLR Bindings – Part 2: Python
- MLR Bindings – Part 3: Java

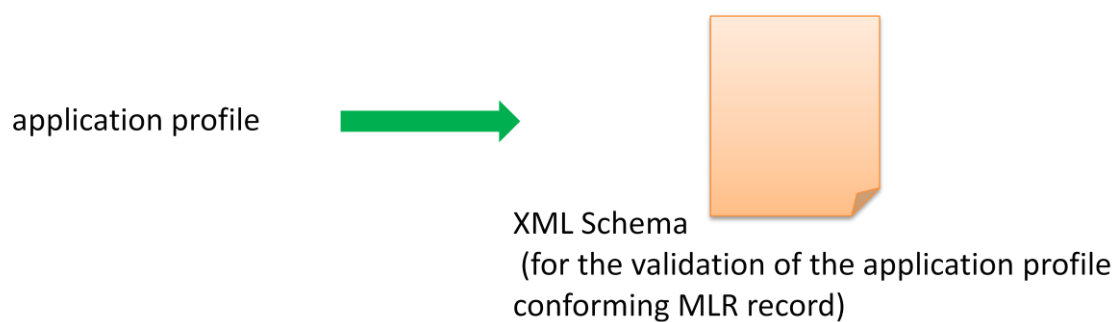
1 General

1.1 From MLR to RDF: At a glance



In the figure above, the rectangles stand for literals and ovals stand for resources/entities.

Moreover, given an application profile, one should be able to automate the generation of the XML Schema for validation of MLR records conforming to the application profile.



1.2 Data elements

A data element as introduced in clause 7.1 of the ISO/IEC 19788-1 (MLR-1) standard comprises three (3) or (4) components as illustrated in the following two examples of data elements related to the description of the following learning resource (that will be used in many of the examples).



Title: Turtles, Termites, and Traffic Jams
Author: Mitchel Resnick
Publisher: The MIT Press
Publication date: 1994
Copyright: ©1994 Massachusetts Institute of Technology
ISBN: 0-262-18162-2

Data element specification ID ³	ISO_IEC_19788-2:2011::DES0100 (title)
Subject	urn:isbn:0-262-18162-2
Content Value	Turtles, Termites, and Traffic Jams
Language Code	eng

Data element specification ID	ISO_IEC_19788-2:2011::DES0700 (date)
Subject	urn:isbn:0-262-18162-2
Content Value	1994

The value of the component:

- ✓ “Data element specification ID” of a data element is an identifier of a **data element specification** (DES);
- ✓ “Subject” of the data element is a global **identifier** for the resource being described;
- ✓ “Content Value” of a data element is the value for the “Subject” of the property defined by the “Data element specification”. It can be either a literal or a resource (entity). For the two examples presented, the content value are literals;
- ✓ “Language Code” of the data element is a code from ISO 639-3⁴ for the name of the language used in the content value component if that content is linguistically significant.

³ See Annex B

⁴ For information regarding the Registration Authority for ISO 639-3, see:
http://www.iso.org/iso/standards_development/maintenance_agencies.htm

2 Terms and definitions

2.1 ISO/IEC 19788-1

For the purposes of this document, the terms and definitions given in ISO/IEC 19788-1:2011, clause 3 apply.

For this document, the most important of those terms are the following:

- 3.11 data element
- 3.14 data element specification
- 3.10 content value
- 3.16 domain
- 3.28 range
- 3.19 identifier
- 3.35 string
- 3.30 resource
- 3.31 resource class
- 3.20 learning resource
- 3.24 MLR record
- 3.1 application profile
- 3.2 application profile record
- 3.3 application profile specification

2.2 Essential RDF notions

Excerpts from the "RDF: Concepts and Abstract Syntax" W3C Recommendation (see [10])

2.2.1 RDF Triples (from RDF: Concept and Abstract Syntax, section 6.1)

An **RDF triple** contains three components:

- the **subject**, which is an [RDF URI reference](#) or a [blank node](#)
- the **predicate**, which is an [RDF URI reference](#)
- the **object**, which is an [RDF URI reference](#), a [literal](#) or a [blank node](#) ⁵

An RDF triple is conventionally written in the order subject, predicate, object.

The predicate is also known as the **property** of the triple.

2.2.2 RDF Graph (from RDF: Concept and Abstract Syntax, section 6.2)

An **RDF graph** is a set of RDF triples.

The set of **nodes** of an RDF graph is the set of subjects and objects of triples in the graph.

2.2.3 RDF URI References⁶ (from RDF: Concept and Abstract Syntax, section 6.4)

A **URI reference** within an RDF graph (an RDF URI reference) is a Unicode string that:

- does not contain any control characters (#x00 - #x1F, #x7F-#x9F)

⁵ The MLR doesn't use blank nodes

⁶ The MLR multipart Standard uses URI (clause 3.44) as provided by the IETF RFC 3986 standard (Uniform Resource Identifier (URI): Generic Syntax). This standard obsoletes RFC 2396 and RFC 2782 stated in this section. A RDF URI reference corresponds to a RFC 3986 absolute URI with optional fragment.

- and would produce a valid URI character sequence (per RFC2396, sections 2.1) representing an absolute URI with optional fragment identifier when subjected to the encoding described below.

The encoding consists of:

1. encoding the Unicode string as UTF-8, giving a sequence of octet values.
2. %-escaping octets that do not correspond to permitted US-ASCII characters.

The disallowed octets that must be %-escaped include all those that do not correspond to US-ASCII characters, and the excluded characters listed in Section 2.4 of RFC 2396, except for the number sign (#), percent sign (%), and the square bracket characters re-allowed in RFC 2732.

Disallowed octets must be escaped with the URI escaping mechanism (that is, converted to %HH, where HH is the 2-digit hexadecimal numeral corresponding to the octet value).

Two RDF URI references are equal if and only if they compare as equal, character by character, as Unicode strings.

Note: RDF URI references are compatible with the [anyURI](#) datatype as defined by XML Schema Part 2: Datatypes, constrained to be an absolute rather than a relative URI reference.

Note: RDF URI references are compatible with International Resource Identifiers as defined by XML Namespaces 1.1.

2.2.4 RDF Literals (from RDF: Concept and Abstract Syntax, section 6.5)

A **literal** in an RDF graph contains one or two named components.

All literals have a **lexical form** being a Unicode string, which SHOULD be in Normal Form C.

Plain literals have a lexical form and optionally a **language tag** as defined by RFC-3066, normalized to lowercase.

Typed literals have a lexical form and a **datatype URI** being an RDF URI reference.

Note: RDF Literals are distinct and distinguishable from RDF URI references; e.g. `http://example.org` as an RDF Literal (untyped, without a language tag) is not equal to `http://example.org` as an RDF URI reference.

2.2.5 Blank Nodes (from RDF: Concept and Abstract Syntax, section 6.6)

The **blank nodes** in an RDF graph are drawn from an infinite set. This set of blank nodes, the set of all RDF URI references and the set of all literals are pairwise disjoint.

Otherwise, this set of blank nodes is arbitrary.

RDF makes no reference to any internal structure of blank nodes. Given two blank nodes, it is possible to determine whether or not they are the same.

3. Assigning URIs to ISO/IEC 19788 identifiers

3.1 MLR identifiers

The ISO/IEC 19788 multipart standard makes available **data element specifications** (DESSs), **resource classes** (RCs), **data element group specifications** (DEGSs) and **application profiles** (APs). The standard assigns globally unique, persistent identifiers to those objects, as specified using production rules (ISO/IEC 19788-1, clause B.2).

Examples of MLR identifier⁷:

- 1) **Data element specification** (DES) from ISO/IEC 19788-2 (Dublin Core elements) – ISO/IEC 19788-2:2011, clause 5.1:
ISO_IEC_19788-2:2011::DES0100 ([title](#))
- 2) **Resource class** (RC) from ISO/IEC 19788-1 (Framework) – ISO/IEC 19788-1:2011, clause 8.4.2:
ISO_IEC_19788-1:2011::RC0002 ([learning resource](#))
- 3) **Predefined rule set** (PRS) from ISO/IEC 19788-1 (Framework) – ISO/IEC 19788-1:2011, clause 9.4:
ISO_IEC_19788-1:2011::PRS0003 ([Date & Time](#))
- 4) **Data element group specification** (DEGS) from ISO/IEC 19788-3 (Basic application profile) – ISO/IEC 19788-3, clause 6.1:
ISO_IEC_19788-3:2011::DEGS0001 ([MLR Basic data element group specification](#))
- 5) **Application profile** (AP) from ISO/IEC 19788-3 (Basic application profile) – ISO/IEC 19788-3, clause 5:
ISO_IEC_19788-3:2011::AP0001 ([MRL Basic Application Profile](#))
- 6) **Vocabulary** (V) from ISO/IEC 19788-5:2012 (Educational elements) – ISO/IEC 19788-5, clause A.4:
ISO_IEC_19788-5:2012::VA.1 ([Agent role vocabulary](#))

As stated⁸ in ISO/IEC 19788-1:2011, MLR identifiers map to URIs as defined in IETF RFC 5141.

3.2 IETF Request for Comments 5141 (RFC 5141)

In the context of the World Wide Web and the Semantic Web there is a need to have global identifiers based on URIs for MLR identifiers. Fortunately, the ISO Central Secretariat has already published the specification of a syntax for URNs that identify documents developed (as per the ISO/IEC Directives) by the International Organization for Standardization (ISO): RFC 5141 – A Uniform Resource Name (URN) for the International Organization for Standardization (ISO)⁹.

RFC 5141 identifiers are globally unique, persistent and location-independent, and allow for the identification of any clause from an ISO standard. For a given item, the identifier is constructed considering the standard number, the part number, the edition number (instead of the publication year) of the ISO document containing the item, the number of the clause related to the item and some other information.

The RFC 5141 identifiers corresponding to the MLR identifiers for the examples above are respectively:

- 1) urn:iso:std:iso-iec:19788:-2:ed-1:clause:5.1
- 2) urn:iso:std:iso-iec:19788:-1:ed-1:clause:8.4.2
- 3) urn:iso:std:iso-iec:19788:-1:ed-1:clause:9.4
- 4) urn:iso:std:iso-iec:19788:-3:ed-1:clause:6.1
- 5) urn:iso:std:iso-iec:19788:-3:ed-1:clause:5

⁷ Text in [blue](#) is not part of the identifiers, it is only provided to ease the reading of the present document.

⁸ ISO/IEC 19788-1:2011, page 9, footnote 1

⁹ RFC 5141: <http://tools.ietf.org/html/rfc5141>

6) urn:iso:std:iso-iec:19788:-5:ed-1:clause:A.1

The RFC 5141 URN schema has been developed with the intent that a URN identifying an ISO document item can be transformed to a valid HTTP URI by replacing the URN namespace prefix ("iso") and the "std:" prefix with the domain name "standards.iso.org", replacing all occurrences of ":" within the identifier with "/", and converting characters to lowercase.

The HTTP URI¹⁰ identifiers corresponding to the URN identifiers from the previous page are respectively:

- 1) <http://standards.iso.org/iso-iec/19788/-2/ed-1/clause/5.1>
- 2) <http://standards.iso.org/iso-iec/19788/-1/ed-1/clause/8.4.2>
- 3) <http://standards.iso.org/iso-iec/19788/-1/ed-1/clause/9.4>
- 4) <http://standards.iso.org/iso-iec/19788/-3/ed-1/clause/6.1>
- 5) <http://standards.iso.org/iso-iec/19788/-3/ed-1/clause/5>
- 6) <http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/a.1>

3.3 Problems with the RDF/XML serialization

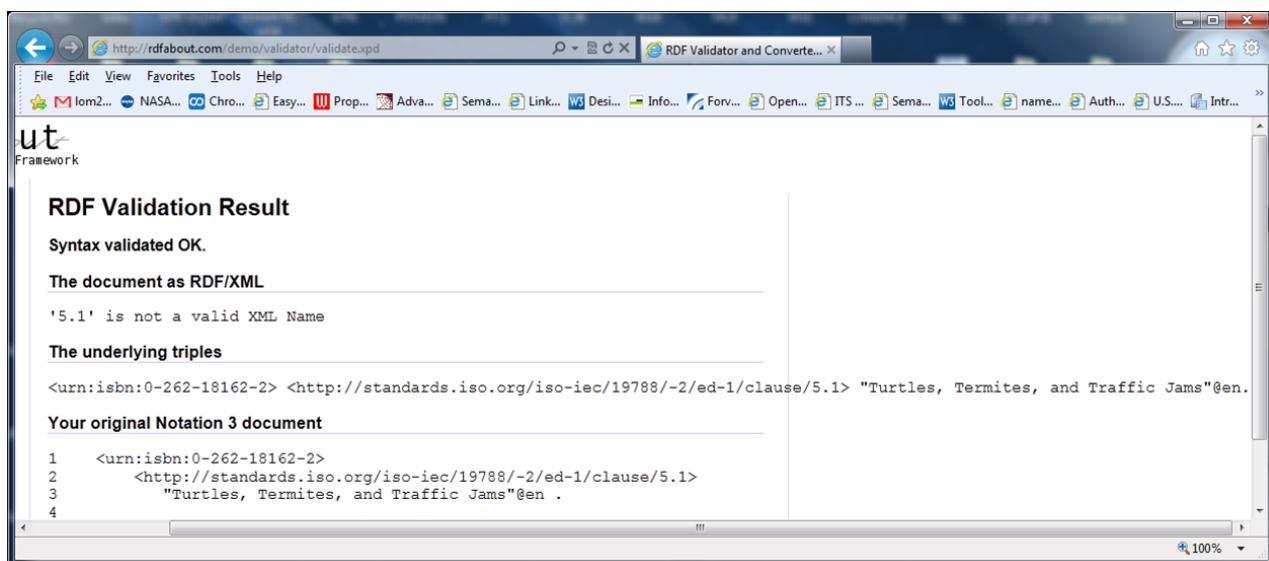
There is a problem with the above urn: or http: identifiers provided as per RFC 5141. The problem comes from the fact that not all valid RDF triples can be serialized using RDF/XML.

The triple

```
<urn:isbn:0-262-18162-2> <http://standards.iso.org/iso-iec/19788/-2/ed-1/clause/5.1>  
"Turtles, Termites, and Traffic Jams"@en.
```

associated with the first data element of section 1.2 is perfectly valid, but cannot be expressed using the RDF/XML serialization.

Result using the RDF Validator and Converter¹¹

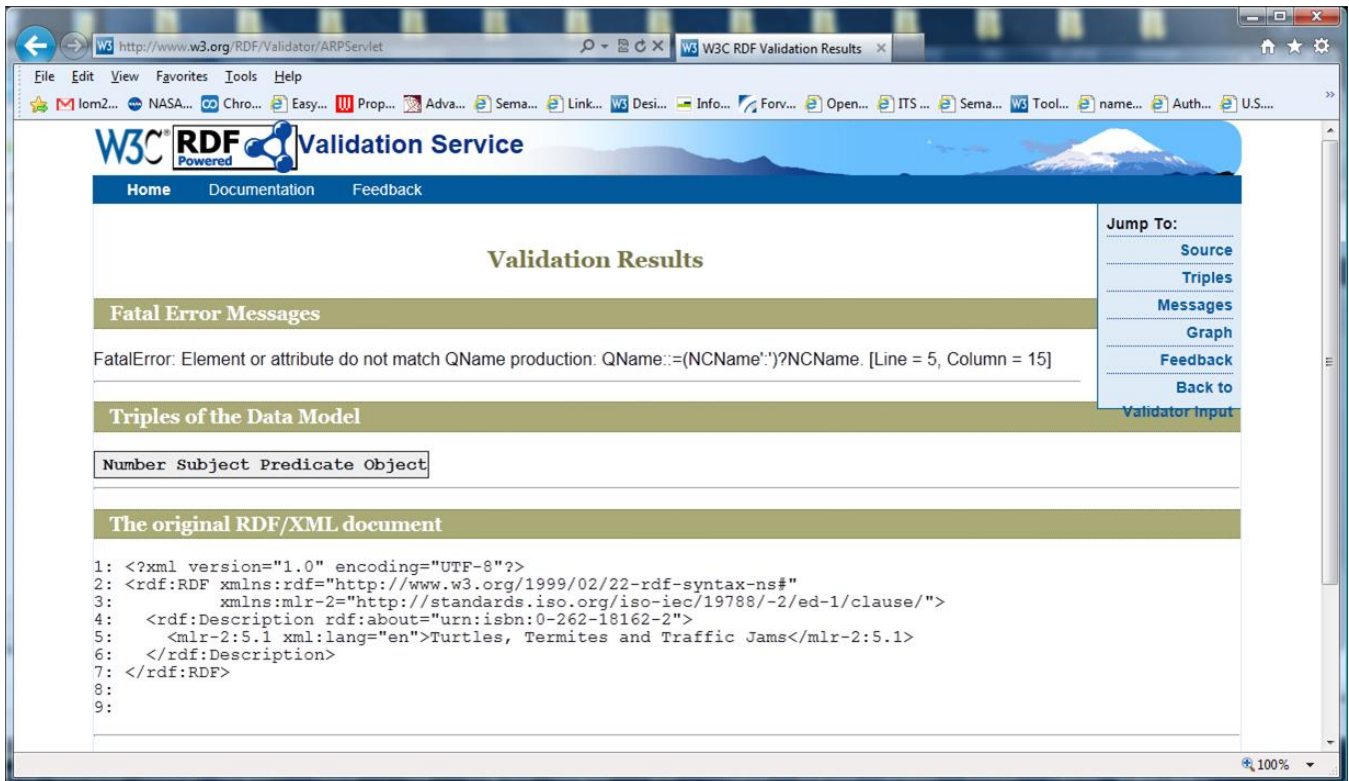


Using the W3C RDF Validation Service¹²

¹⁰ MLR identifiers HTTP URI should be dereferenceable: looking at those URIs should return human and machine readable description, using content negotiation, of the entity identified. [A request at this effect will be presented at the next ISO/IEC JTC1 SC36/WG4 meeting in Busan, Korea \(September 2012\).](#)

¹¹ <http://rdfabout.com/demo/validator/>

¹² <http://www.w3.org/RDF/Validator/>



Solution:

1) Mint another set of identifiers for ISO/IEC 19788 **data element specifications** (DES), **resource classes** (RC), **predefined rule sets** (PRS), **data element group specifications** (DSGS), **application profiles** (AP) and **vocabularies** (V). These identifiers will be composite and built from two components: the first component providing an identifier for the standard containing the entity (DES, RC, PRS, DSGS, AP or V) and the second component is a URI fragment using the local identifier of the entity (e.g. DES0100, RC0004) which are unique within a given standard, and

2) Using owl:sameAs to state that two related identifiers (RFC 5141 identifiers and those defined here) denote the same entity.

Example:

Consider the **data element specification** ISO_IEC_19788-2:2011::DES0100 (**title**) from ISO/IEC 19788-2 (Dublin Core elements) – ISO/IEC 19788-2:2011, clause 5.1.

Identification of the standard:

<http://normetic.org/iso-iec/19788-2/2011>

(GTN-Québec)

<http://standards.iso.org/iso-iec/19788/-2/ed-1>

(as per IETF RFC 5141)

Local identifier (within the standard):

DES0100

➔ URI for the DES ISO_IEC_19788-2:2011::DES0100

<http://normetic.org/iso-iec/19788-2/2011#DES0100>

(GTN-Québec)

It would be useful if ISO/IEC adopted this scheme for identification of ISO/IEC 19788 multipart standard entities. This scheme will be used in the WD for ISO/IEC 19788-7 Bindings, to be discussed at the ISO/IEC JTC1 WG4 next meeting (Busan, September 2012). The DES above would map to the URI¹³

<http://standards.iso.org/iso-iec/19788/-2/ed-1#DES0100>

In summary:

Data element specification ISO_IEC_19788-2:2011::DES0100 (title) from ISO/IEC 19788-2 (Dublin Core elements) – ISO/IEC 19788-2:2011, clause 5.1

will be identified with the URI

<http://normetic.org/iso-iec/19788-2/2011#DES0100>

and we state (using N-Triples syntax)

```
<http://normetic.org/iso-iec/19788-2/2011#DES0100>  
  <http://www.w3.org/2002/07/owl#sameAs>  
    <http://standards.iso.org/iso-iec/19788/-2/ed-1/clause/5.1> .
```

3.4 Contextualization (c15n) of MLR identifiers

When working in the context of a natural language (English, French, Russian, Chinese...) it is possible to replace the global HTTP URI MLR identifiers with localized versions.

Given a language, global HTTP URI identifiers are mapped to contextualized identifiers by replacing the fragment part of the global identifier by

`/<id_kind>#<xml_property_name>`

where

`<id_kind>` has to be replaced by `des` for DES identifiers, by `rc` for Resource classes identifiers, by `deg`s for data element group specification and by `ap` for application profile specification. For vocabularies identifiers, only the local term `Id` is replaced by the term for the designation in the stated language (see section 8)

`<xml_property_name>` is a property name (in the stated language) transformed so as to be a valid XML element name. This is language dependent and shall be as provided in http://normetic.org/iso-iec/19788/c15n_des.ttl

For English: MLR-5/DES0200 (annotation text) → `annotationText`

For French: MLR-5/DES0200 (texte de l'annotation) → `texte_de_l_annotation`

Example:

```
http://normetic.org/iso-iec/19788-2/2011#DES0100  
  
→ http://normetic.org/iso-iec/19788-2/2011/des#title    (eng)  
  
or  
  
→ http://normetic.org/iso-iec/19788-2/2011/des#titre    (fra)
```

¹³ The reason such an identifier was not used in this document is related to legal considerations, even if this author thinks that anyone can legally append any fragment to a (fragmentless) URI, even if that person doesn't own the domain name used in the authority part of the URI. This problem should be solved when **ISO/IEC 19788-7 Bindings** is published.

For DESs identifiers, this is possible because, when the language is fixed, the mapping is a one-to-one between the set of global HTTP URI DES identifiers and the set of c15n contextualized HTTP URI DES identifiers. Same for other kind of MLR identifiers.

The correspondences, for DES identifiers) are provided by the file

http://normetic.org/iso-iec/19788/c15n_des.ttl¹⁴

Excerpt from that file:

```
@prefix rdf:      <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs:     <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos:     <http://www.w3.org/2004/02/skos/core#> .
@prefix mlr-1:    <http://normetic.org/iso-iec/19788-1/2011#> .
@prefix mlr-2:    <http://normetic.org/iso-iec/19788-2/2011#> .
@prefix mlr-3:    <http://normetic.org/iso-iec/19788-3/2011#> .
@prefix mlr-5:    <http://normetic.org/iso-iec/19788-5/2012#> .
@prefix mlr-8:    <http://normetic.org/iso-iec/19788-5/2012#> .
@prefix mlr-9:    <http://normetic.org/iso-iec/19788-5/2012#> .

http://normetic.org/iso-iec/19788#c15n
  rdf:type skos:ConceptScheme ;
  rdfs:label "From global MLR identifiers to localized MLR identifiers, and back
(within a language)" .

# Data element specifications

# -----

# ---- MLR-2

mlr-2:DES0100
  rdf:type skos:Concept ;
  skos:annotation "ISO_IEC_19788-2:2011::DES0100" ;
  skos:prefLabel "title"@en ,
    "titre"@fr ,
    "заголовок"@ru .

mlr-2:DES0200
  rdf:type skos:Concept ;
  skos:annotation "ISO_IEC_19788-2:2011::DES0200" ;
  skos:prefLabel "creator"@en ,
    "créateur"@fr ,
    "автор"@ru .
```

IMPORTANT:

These c15n identifiers are LOCAL (the context is a given language), they cannot be guaranteed to be GLOBAL. Under the above correspondence, it is possible to map a same MLR identifier to more than one c15n identifier

<http://normetic.org/iso-iec/19788-5/2012/va.4#t110>

➔ <http://normetic.org/iso-iec/19788-5/2012/va.4#guide> (eng)

➔ <http://normetic.org/iso-iec/19788/-5/ed-1/clause/va.4#guide> (fra)

¹⁴ There are similar files for MLR resources classes (c15n_rc.ttl), MLR data element group specifications (c15n_degs.ttl) and MLR application profiles (c15n_ap.ttl).

and the following situation is also possible:

<http://normetic.org/iso-iec/19788-99/2047/des#résumé> (eng)

➔ <http://normetic.org/iso-iec/19788-99/2047#DES1234>

and

<http://normetic.org/iso-iec/19788-99/2047/des#résumé> (fra)

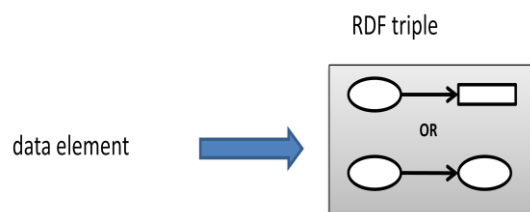
➔ <http://normetic.org/iso-iec/19788-99/2047#DES6789>

4 Mapping data elements to RDF¹⁵

4.1 General

This section provides mappings (by way of examples) of data elements to RDF triples. Data elements come in two flavors:

- ✓ data element with a literal as content value
 - Linguistic data element
 - Non-linguistic data element
 - Range = *MLR String*
 - Range is proper subset of *MLR String*
- ✓ data element with a resource as content value (denoted by a RDF URI reference)



See also ISO/IEC 19788-1, clause 7.

4.2 Namespaces

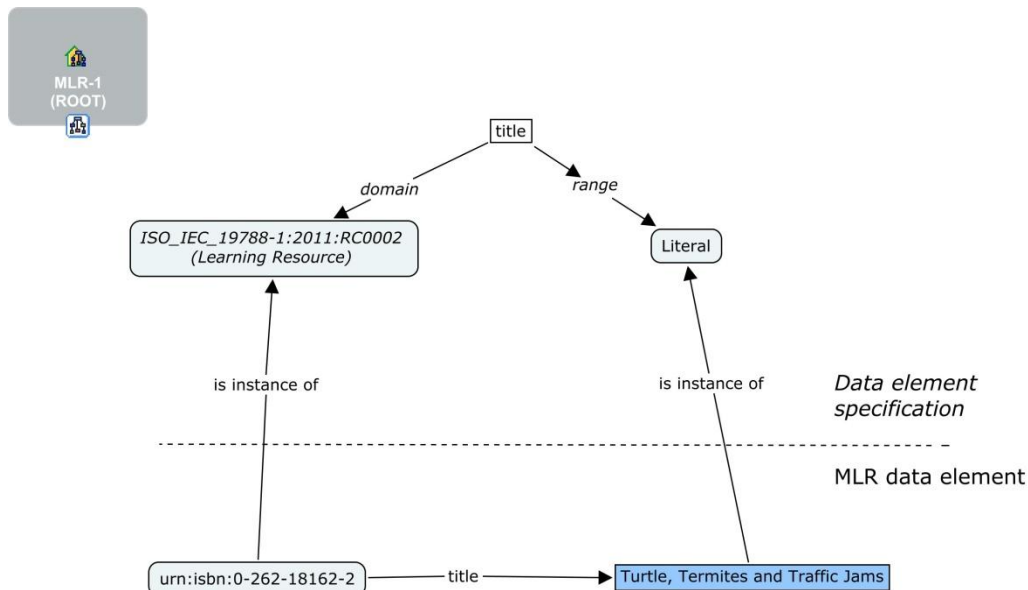
Examples in this document make use of the following prefixes and their associated namespaces.

Prefix	Namespace URI
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
dc	http://purl.org/dc/elements/1.1/
dct	http://purl.org/dc/terms/
xsd	http://www.w3.org/2001/XMLSchema-datatypes#
foaf	http://xmlns.com/foaf/0.1/
rdfs	http://www.w3.org/2000/01/rdf-schema#
owl	http://www.w3.org/2002/07/owl#
gpd ¹⁶	http://normetic.org/iso-iec/11404/2007#
skos	http://www.w3.org/2004/02/skos/core#
mlr	http://normetic.org/iso-iec/19788#
mlr-1	http://normetic.org/iso-iec/19788-1/2011#
mlr-2	http://normetic.org/iso-iec/19788-2/2011#
mlr-3	http://normetic.org/iso-iec/19788-3/2011#
mlr-4	http://normetic.org/iso-iec/19788-4/2013#
mlr-5	http://normetic.org/iso-iec/19788-5/2012#
mlr-6	http://normetic.org/iso-iec/19788-6/2013#
mlr-8	http://normetic.org/iso-iec/19788-8/2013#

¹⁵ Examples in this document have been validated using the W3C Validation Service (<http://www.w3.org/RDF/Validator/>) and the rdf:about Validator & Converter (<http://rdfabout.com>). RDF Graphs have been generated using the W3C RDF Validation Service (RDF Graph generator).

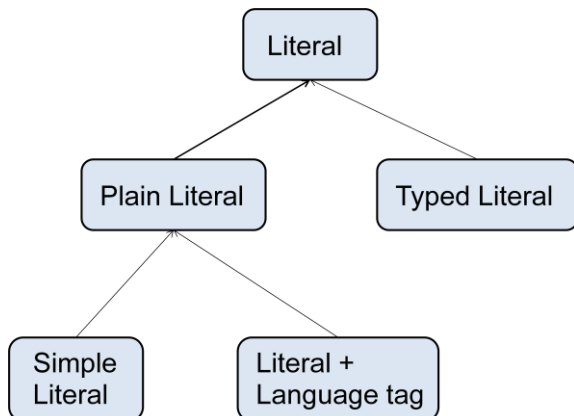
¹⁶ <http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

4.3 Data element with literal content value



4.3.1 Different types of literals

Literals are used to denote values such as strings, numbers, dates and Booleans. In this section we show how to map data elements with range set to *literal* to RDF triples whose objects are RDF literals.



See section 2.2.4 concerning literals, plain literals and typed literals.

Simple literals correspond to MLR String (ISO/IEC 19788-1, clause 9.2).

See also the W3C Working Draft for “RDF 1.1 Concepts and Abstract Syntax”¹⁷

4.3.2 Linguistic data element

A data element is said to be linguistic if the “linguistic indicator” of its associated DES has value “linguistic”.

Data element example

Data element specification ID	ISO_IEC_19788-2:2011::DES0100 (title) ¹⁸
-------------------------------	---

¹⁷ <http://www.w3.org/TR/rdf11-concepts/>

¹⁸ See Annex B

Subject	urn:isbn:0-262-18162-2
Content Value	Turtles, Termites and Traffic Jams
Language Code	eng

The RDF statement for the above example is the triple (Subject, Predicate, Object) where

Subject: urn:isbn:0-262-18162-2
 Predicate: http://normetic.org/iso-iec/19788-2/2011#DES0100
 Object: "Turtles, Termites, and Traffic Jams"@en

The ISO 639-3 language code “eng” was replaced by “en” as per IETF Best Current Practice document 47¹⁹ (section 2.2.1). The rule here is: for any ISO 639-3 code for an individual language, replace that code with the shortest equivalent code from ISO 639-1, ISO 639-2/T and ISO 639-3.

ISO 639-3 ²⁰	ISO 639-2/T	ISO 639-1
eng	eng	en
fra	fra	fr
fsc ²¹		
rus	rus	ru
tlh ²²	tlh	

For the case of macrolanguage, such as Chinese²³, the situation is somewhat more complicated and will not be considered here (for more information, see BCP 47).

Triples of the Data Model

#	Subject	Predicate	Object
1	urn:isbn:0-262-18162-2	http://normetic.org/iso-iec/19788-2/2011#DES0100	"Turtles, Termites and Traffic Jams"@en

N-Triples Format (Sub, Pred, Obj)

```
<urn:isbn:0-262-18162-2>
  <http://normetic.org/iso-iec/19788-2/2011#DES0100>
    "Turtles, Termites and Traffic Jams"@en.
```

¹⁹ <http://tools.ietf.org/html/bcp47>

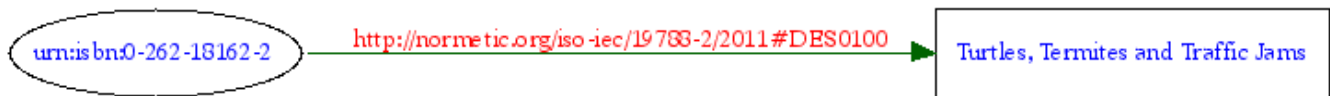
²⁰ <http://www.sil.org/iso639-3/codes.asp>

²¹ Quebec Sign Language

²² Klingon (constructed language)

²³ <http://www.sil.org/iso639-3/documentation.asp?id=zho>

RDF Graph



N3 / Turtle Syntax

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix mlr-2: <http://normetic.org/iso-iec/19788-2/2011#>.
<urn:isbn:0-262-18162-2> mlr-2:DES0100 "Turtles, Termites and Traffic Jams"@en .
```

RDF/XML syntax

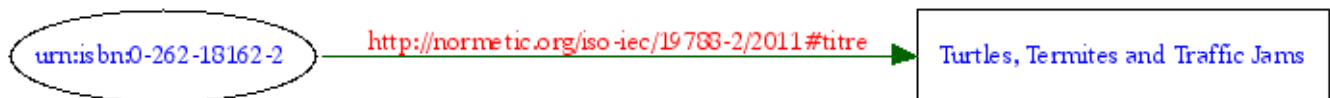
```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:mlr-2="http://normetic.org/iso-iec/19788-2/2011#">
  <rdf:Description rdf:about="urn:isbn:0-262-18162-2">
    <mlr-2:DES0100 xml:lang="en">Turtles, Termites and Traffic Jams</mlr-2:DES0100>
  </rdf:Description>
</rdf:RDF>
```

or, if either for [local²⁴ use in Québec](#) or seen [through a user interface](#) (HIEs) for a given human language (here French) and using the RDF/XML syntax

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:mlr-2="http://normetic.org/iso-iec/19788-2/2011#">
  <rdf:Description rdf:about="urn:isbn:0-262-18162-2">
    <mlr-2:titre xml:lang="en">Turtles, Termites and Traffic Jams</mlr-2:titre>
  </rdf:Description>
</rdf:RDF>
```

Using the default namespace for the ISO/IEC 19788-2 Dublin Core elements:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns="http://normetic.org/iso-iec/19788-2/2011#">
  <rdf:Description rdf:about="urn:isbn:0-262-18162-2">
    <titre xml:lang="en">Turtles, Termites and Traffic Jams</titre>
  </rdf:Description>
</rdf:RDF>
```



²⁴ The ISO/IEC 19788 multipart standard provides the property names of DES in English, French and Russian. Given one of those languages, it is possible to recover the DES local identifiers from the property name. For example, for "ISO_IEC_19788-2:2011::DES1000" (or "mlr-2:DES1000") is associated with each of "mlr-2:identifier" (en), "mlr-2:identifiant" (fr) and "mlr-2: идентификатор" (ru). If the term associated with a local identifier is compound, see section 3.4.

4.3.3 Non-linguistic data element

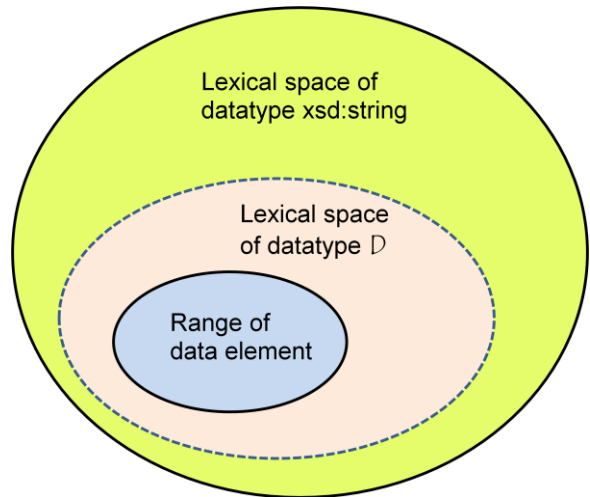
A data element is said to be non-linguistic if the “linguistic indicator” of its associated DES has value “non-linguistic”.

The **range** of the data element is described by the rule set that is the value of the “Content value rules” of its associated DES. If that rule set is the predefined rule set ISO_IEC_19788-1:2011::PRS0001 (MLR STRING), then the data elements maps to a RDF triple with a simple literal as object.

Otherwise, the data elements maps to a RDF triple with a typed literal as object.

What is the datatype of that typed literal?

- (1) If the rule set for the “Content value rules” is of the form “lexical space of a given datatype denoted by a URI”, then use that datatype;
- (2) If not, then either use xsd:string or a datatype D that contains the range of the data element (and is contained in the lexical space of xsd:string). That datatype could either be user defined or come from such places as the W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes (section 3.3) or the ISO/IEC 11404:2007 Information Technology – General-Purpose Datatypes (GPD)²⁵standard.



The lexical space²⁶ of a datatype is the set of literals used to denote values of the datatype.

4.3.3.1 Data element example (Simple Literal)

Data element specification ID	ISO_IEC_19788-2:2011::DES1000 (identifier)
Subject	urn:isbn:0-262-18162-2
Content Value	ISBN 0-262-68093-9

The RDF statement for the above example is the triple (Subject, Predicate, Object) where

Subject: urn:isbn:0-262-18162-2
Predicate: http://normetic.org/iso-iec/19788-2/2011#DES1000
Object: "ISBN 0-262-68093-9"

²⁵ <http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

²⁶ <http://www.w3.org/TR/xmlschema11-2/#datatype> (section 2.1)

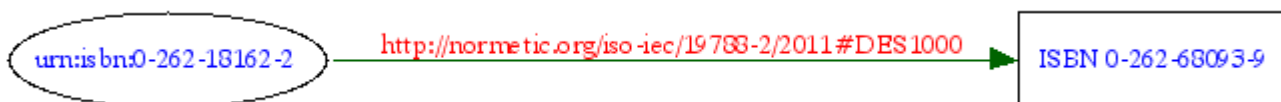
Triples of the Data Model

#	Subject	Predicate	Object
1	<code>urn:isbn:0-262-18162-2</code>	<code>http://normetic.org/iso-iec/19788-2/2011#DES1000</code>	<code>"ISBN 0-262-68093-9"</code>

N-Triples Format (Sub, Pred, Obj)

```
<urn:isbn:0-262-18162-2>  
<http://normetic.org/iso-iec/19788-2/2011#DES1000> "ISBN 0-262-68093-9" .
```

RDF Graph



Turtle Syntax

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.  
@prefix mlr-2: <http://normetic.org/iso-iec/19788-2/2011#>.  
<urn:isbn:0-262-18162-2> mlr-2:DES1000 "ISBN 0-262-68093-9".
```

RDF/XML syntax

```
<?xml version="1.0" encoding="UTF-8"?>  
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"   
  xmlns:mlr-2="http://normetic.org/iso-iec/19788-2/2011#">  
  <rdf:Description rdf:about="urn:isbn:0-262-18162-2">  
    <mlr-2:DES1000>ISBN 0-262-68093-9</mlr-2:DES1000>  
  </rdf:Description>  
</rdf:RDF>
```

4.3.3.2 Data element example (Typed Literal)

Data element specification ID	ISO_IEC_19788-5:2012::DES0700 (contribution date)
Subject	tag:gillesgauthier.me,2012-08-26:note-23 ²⁷
Content Value	1996-07-13

The RDF statement for the above example is the triple (Subject, Predicate, Object) where

Subject: tag:gillesgauthier.me,2012-08-26:note-23
Predicate: http://normetic.org/iso-iec/19788-5/2011#DES0700
Object: "1996-07-13" (ISO_IEC_19788-1:2011::PRS0002 (DATE))

²⁷ See Annex A for information concerning the 'tag' URI Scheme.

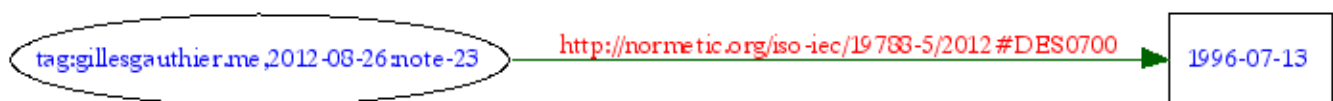
Triples of the Data Model

#	Subject	Predicate	Object
1	tag:gillesgauthier.me,2012-08-26:note-23	http://normetic.org/iso-iec/19788-5/2012#DES0700	"1996-07-13"^^< http://www.w3.org/2001/XMLSchema-datatypes#date >

N-Triples Format (Sub, Pred, Obj)

```
<tag:gillesgauthier.me,2012-08-26:note-23>
  <http://normetic.org/iso-iec/19788-5/2012#DES0700>
    "1996-07-13"^^<http://www.w3.org/2001/XMLSchema-datatypes#date> .
```

RDF Graph



Turtle Syntax

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema-datatypes#> .
@prefix mlr-5: <http://normetic.org/iso-iec/19788-5/2012#> .
<tag:gillesgauthier.me,2012-08-26:note-23> mlr-5:DES0700 "1996-07-13"^^xsd:date .
```

RDF/XML syntax

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema-datatypes#"
  xmlns:mlr-5="http://normetic.org/iso-iec/19788-5/2012#">
  <rdf:Description rdf:about="tag:gillesgauthier.me,2012-08-26:note-23">
    <mlr-5:DES0700 rdf:datatype="xsd:date">1996-07-13</mlr-5:DES0700>
  </rdf:Description>
</rdf:RDF>
```

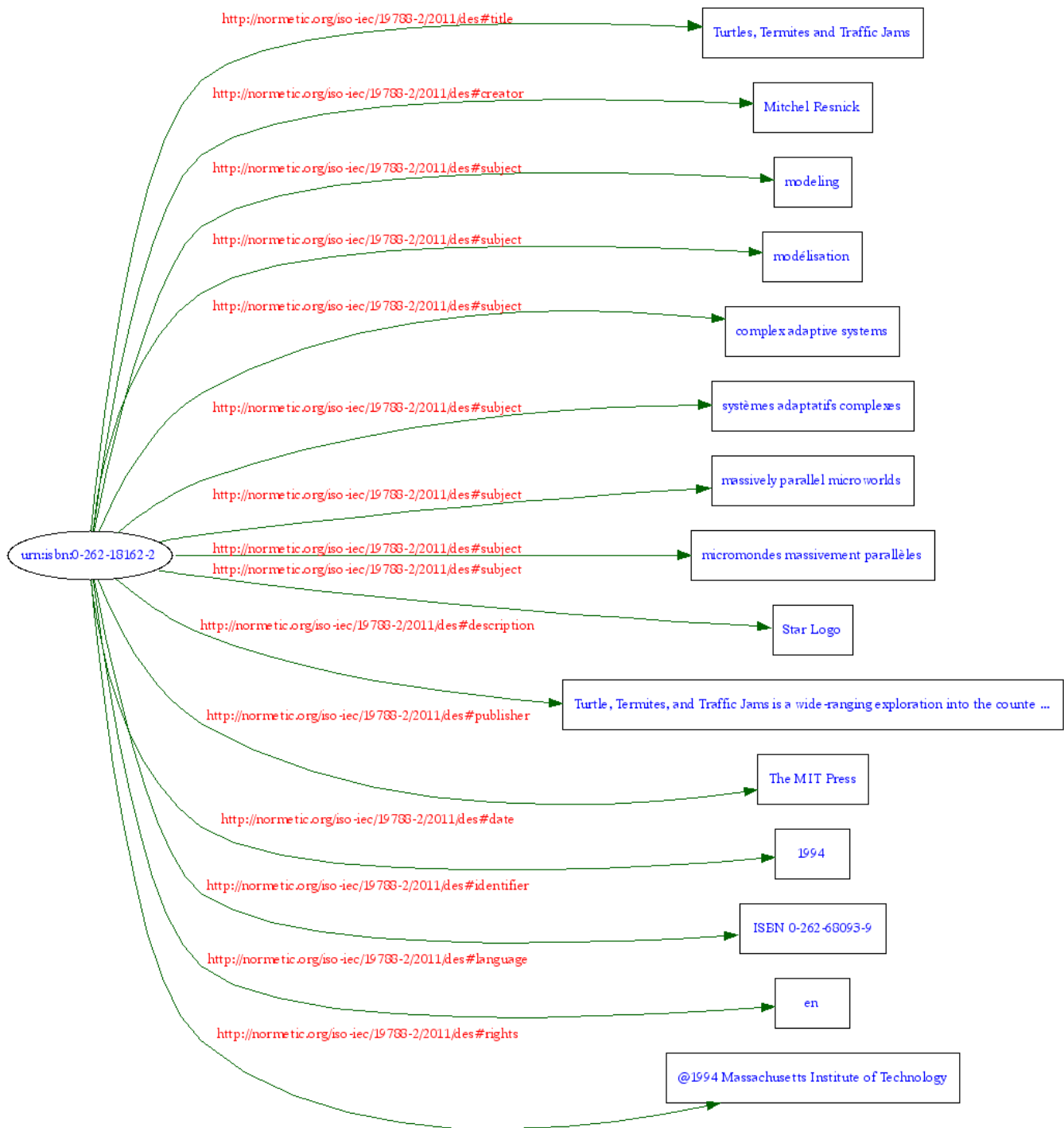
4.4 A complete ISO/IEC 19788-2:2011 based example

This section provides, as an example, a description of the book “Turtle, Termites, and Traffic Jams”, by Mitchel Resnick.

The RDF graph providing the description will be provided with two serialization: Turtle and RDF/XML. To make the example more readable, English conceptualized identifiers will be used.



4.4.1 RDF Graph



4.4.2 Turtle serialization

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix mlr2: <http://normetic.org/iso-iec/19788-2/2011/des#> .
<urn:isbn:0-262-18162-2> mlr2:creator "Mitchel Resnick"@en ;
    mlr2:date "1994" ;
    mlr2:description "Turtle, Termites, and Traffic Jams is a wide-ranging
exploration into the counterintuitive world of decentralized systems and self-
organizing phenomena"@en ;
    mlr2:identifier "ISBN 0-262-68093-9" ;
    mlr2:language "en" ;
```

```

mlr2:publisher "The MIT Press"@en ;
mlr2:rights "@1994 Massachusetts Institute of Technology"@en ;
mlr2:subject "complex adaptive systems"@en ,
    "massively parallel microworlds"@en ,
    "micromondes massivement parallèles"@fr ,
    "modeling"@en ,
    "modélisation"@fr ,
    "Star Logo"@en ,
    "systèmes adaptatifs complexes"@fr ;
mlr2:title "Turtles, Termites and Traffic Jams"@en .

```

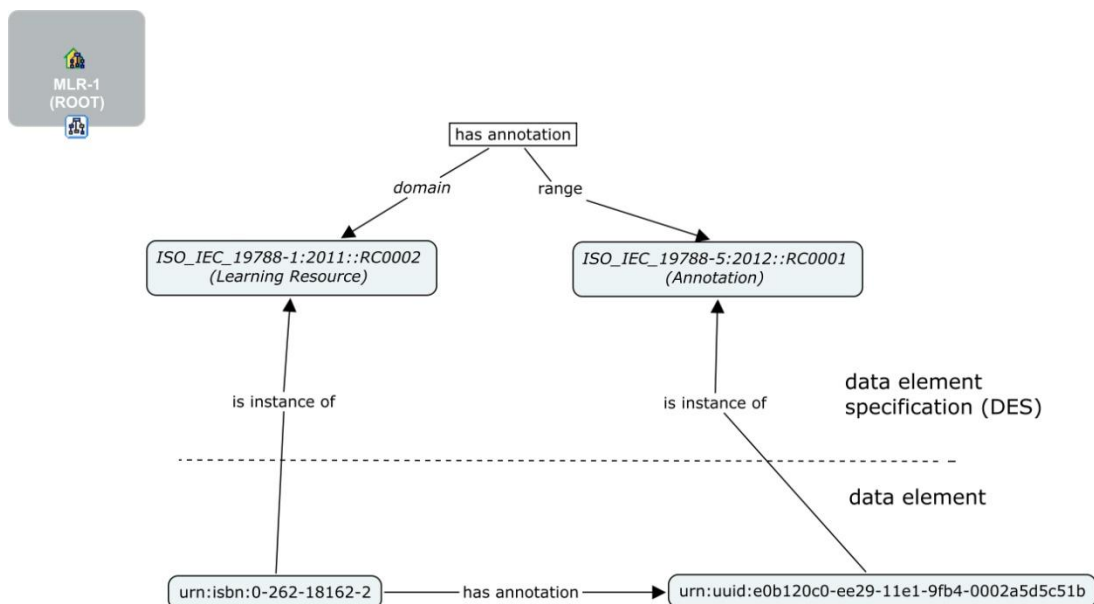
4.4.3 RDF/XML serialization

```

<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:mlr2="http://normetic.org/iso-iec/19788-2/2011/des#"
    <rdf:Description rdf:about="urn:isbn:0-262-18162-2">
        <mlr2:title xml:lang="en">Turtles, Termites and Traffic Jams</mlr2:title>
        <mlr2:creator xml:lang="en">Mitchel Resnick</mlr2:creator>
        <mlr2:subject xml:lang="en">modeling</mlr2:subject>
        <mlr2:subject xml:lang="fr">modélisation</mlr2:subject>
        <mlr2:subject xml:lang="en">complex adaptive systems</mlr2:subject>
        <mlr2:subject xml:lang="fr">systèmes adaptatifs complexes</mlr2:subject>
        <mlr2:subject xml:lang="en">massively parallel microworlds</mlr2:subject>
        <mlr2:subject xml:lang="fr">micromondes massivement parallèles</mlr2:subject>
        <mlr2:subject xml:lang="en">Star Logo</mlr2:subject>
        <mlr2:description xml:lang="en">Turtle, Termites, and Traffic Jams is a wide-
ranging exploration into the counterintuitive world of decentralized systems and
self-organizing phenomena</mlr2:description>
        <mlr2:publisher xml:lang="en">The MIT Press</mlr2:publisher>
        <mlr2:date>1994</mlr2:date>
        <mlr2:identifier> ISBN 0-262-68093-9</mlr2:identifier>
        <mlr2:language>en</mlr2:language>
        <mlr2:rights xml:lang="en">@1994 Massachusetts Institute of Technology</mlr2:rights>
    </rdf:Description>
</rdf:RDF>

```

4.5 Data element with a resource as content value



Data element example

Data element specification ID	ISO_IEC_19788-5:2012::DES1300 (has annotation)
Subject	urn:isbn:0-262-18162-2
Content Value	urn:uuid:e0b120c0-ee29-11e1-9fb4-0002a5d5c51b ²⁸

The RDF statement for the above example is the triple (Subject, Predicate, Object) where

Subject: urn:uuid:e6fe7ac0-864b-11de-9a7c-0002a5d5c51b
 Predicate: <http://normetic.org/iso-iec/19788-5/2012#DES1300>
 Object: urn:uuid:eb8ef940-a07f-11de-99a1-0002a5d5c51b

Triples of the Data Model

#	Subject	Predicate	Object
1	urn:isbn:0-262-18162-2	http://normetic.org/iso-iec/19788-5/2012#DES1300	urn:uuid:eb8ef940-a07f-11de-99a1-0002a5d5c51b

N-Triples Format (Sub, Pred, Obj)

```
<urn:isbn:0-262-18162-2>
  <http://normetic.org/iso-iec/19788-5/2012#DES1300>
    <urn:uuid:eb8ef940-a07f-11de-99a1-0002a5d5c51b> .
```

²⁸ See Annex A for information concerning the 'uuid' URI Scheme.

Turtle Syntax

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix mlr-5: <http://normetic.org/iso-iec/19788-5/2012#>.
<urn:isbn:0-262-18162-2> mlr-5:DES1300 <urn:uuid:eb8ef940-a07f-11de-99a1-0002a5d5c51b> .
```

RDF Graph

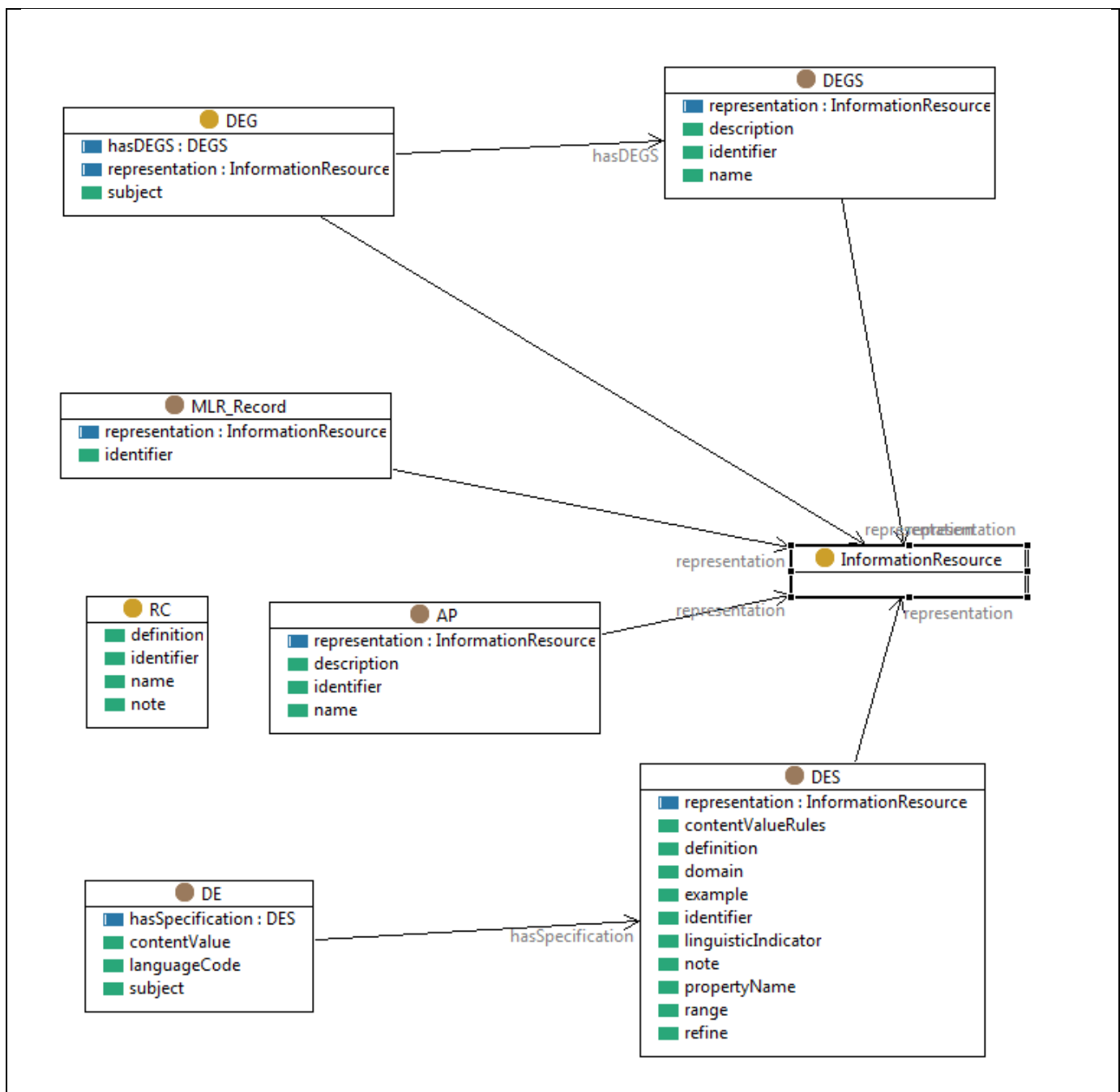


RDF/XML syntax

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:mlr-5="http://normetic.org/iso-iec/19788-5/2012#">
  <rdf:Description rdf:about="urn:isbn:0-262-18162-2">
    <mlr-5:DES1300 rdf:resource="urn:uuid:eb8ef940-a07f-11de-99a1-0002a5d5c51b"/>
  </rdf:Description>
</rdf:RDF>
```

5 OWL ontology for the ISO/IEC 19788 multipart Standard

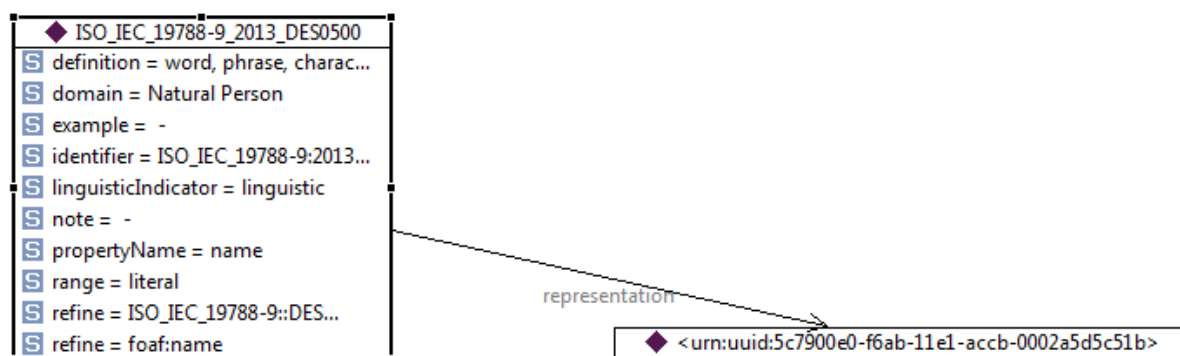
5.1 Class diagram for the MLR Ontology



This class diagram was drawn using the TopBraid Composer Ontology tool²⁹.

²⁹ http://www.topquadrant.com/products/TB_Composer.html

5.2 Instance of DES class



6 MLR record

6.1 General

As stated in ISO/IEC 19788-1, definition 3.24, a **MLR record** is a set of data elements describing a **learning resource** and resources directly related to that learning resource. The goal here is to provide the description of a specific learning resource.

What does “directly related to” means?

Answer: A resource s is directly related to the learning resource r , if there exist a sequence of resources

$$s_0, s_1, s_2, s_3, \dots, s_{n-1}, s_n \quad (n \geq 1)$$

and a sequence of data elements

$$d_1, d_2, d_3, \dots, d_{n-1}, d_n \quad \text{all member of the MLR record}$$

such that:

- 1) $r = s_0$
- 2) s_{i-1} is the subject of d_i and s_i is the object of d_i , for $1 \leq i \leq n$
- 3) $s_n = s$

As a consequence, if there exist a data element in the MLR record describing a resource s , then $s \in \text{BD}(r)$ (see Annex C).

In this section we are interested in representations of MLR records that are machine understandable.

As per ISO/IEC 19788-1 (framework), a MLR record has three (3) components (ISO/IEC 19788-1, clause 10.2):

Identifier	<i>Identifier for the MLR record (URI)</i>
Resource	<i>Identifier for the learning resource under description (URI)</i>
Content	<i>Set of MLR data elements describing the resource and directly related resources</i>

MLR record will be encoded as a dataset^{30, 31}, using the TriG syntax (see [19]). TriG is an extension of the Turtle format. This will make it possible to provide information related to the provenance.

RDF Dataset (see [11])

a collection of RDF graphs and comprises:

- Exactly one default graph, being an RDF graph. The default graph doesn't have a name and may be empty.
- Zero or more named graphed. Each named graph is a pair consisting of an IRI³² (the graph name), and an RDF graph. Graph name are unique within an RDF dataset.

³⁰ Comprising exactly one (1) named graph.

³¹ Examples of datasets can be found at those locations: <http://rdfabout.com/demo/census/>, <http://www.data.gov/>, <http://data.gov.uk/>

³² See [23].

The default graph uses data elements based on DESs from the ISO/IEC 19788-8 Data elements for MLR records (see Annex D), in particular:

ISO_IEC_19788-8:2013::DES0100 (record identifier)
<http://normetic.org/iso-iec/19788-8/2013#DES0100>

ISO_IEC_19788-8:2013::DES0200 (describe)
<http://normetic.org/iso-iec/19788-8/2013#DES0200>

ISO_IEC_19788-8:2013::DES1700³³ (provenance)
<http://normetic.org/iso-iec/19788-8/2013#DES1700>

6.2 TriG serialization of a MLR record

As an example, let us consider the following MLR record:

Identifier	tag:normetic.org,2012-09-01:record-340987
Resource	urn:isbn:0-262-18162-2
Content	Set of data elements illustrated by the graph in section 4.4.1

The TriG document representing this MLR record is (using English property name for better readability):

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix mlr-2: <http://normetic.org/iso-iec/19788-2/2011#> .
@prefix mlr-8: http://normetic.org/iso-iec/19788-8/2013#> .

# default graph (mandatory identification of MLR record and learning resource
# described by the MLR record, description of provenance may be added here.
{
  <tag:normetic.org,2012-09-01:record-340987>
    mlr-8:recordIdentifier "tag:normetic.org,2012-09-01:record-340987" ;
    mlr-8:describe "urn:isbn:0-262-18162-2" ;
    mlr-8:provenance <gillesgauthier.net/me> .
}

<tag:normetic.org,2012-09-01:record-340987> {
  <urn:isbn:0-262-18162-2> mlr-2:creator "Mitchel Resnick"@en ;
  mlr-2:date "1994" ;
  mlr-2:description "Turtle, Termites, and Traffic [...] phenomena"@en ;
  mlr-2:identifier "ISBN 0-262-68093-9" ;
  mlr-2:language "en" ;
  mlr-2:publisher "The MIT Press"@en ;
  mlr-2:rights "@1994 Massachusetts Institute of Technology"@en ;
  mlr-2:subject "complex adaptive systems"@en ,
    "massively parallel microworlds"@en ,
    "micromondes massivement parallèles"@fr ,
    "modeling"@en ,
    "modélisation"@fr ,
    "Star Logo"@en ,
    "systèmes adaptatifs complexes"@fr ;
  mlr-2:title "Turtles, Termites and Traffic Jams"@en . }
```

³³ Not yet available in the Working draft for MLR-8, but should be added,

7 Data element group

7.1 General

First, some definitions from ISO/IEC 19788-1 clause 3:

3.12

data element group

identified, named set of related **data elements** and/or **data element groups** as described in a **data element group specification**

NOTE A data element group is a structured set of data elements.

3.13

data element group specification

description of the **data elements** or **data elements groups** constituting the data element group under consideration

3.1

application profile

defined structured collection of **data element specifications** chosen to satisfy the particular needs of a community or communities

NOTE The data element specification are from various parts of ISO/IEC and from other sources.

The examples in this section come from the GTN-Québec Application Profile for Learning Opportunities (see [20]) (a kind of MLR-based version on CEN EN 15982:2011 Metadata for Learning Opportunities – Advertising).

We will use as example the OEAF v1.0 application profile and its associated data element specification:

Spécification d'un profil d'application	
Identifiant (Identifiant_PA)	http://normetic.org/profil_application/oeaf/v1.0
Nom (ISO français)	OEAF v1.0
Description	Profil d'application québécois pour la description des opportunités d'étude, d'apprentissage et de formation. Ce profil d'application est basé sur la norme internationale ISO/IEC 19788.
Spécification du groupe d'éléments de données sous-jacent	http://normetic.org/uri/profil_oeaf/v1.0

The associated data element group specification can be expressed as (see ISO/IEC 19788-1, clause 11.5), where the parts in blue are identifiers of data element group specifications (DEGSs):

```
[http://normetic.org/uri/profil\_oeaf/v1.0]  
  [http://normetic.org/uri/profil\_oeaf/v1.0/sged0001]  
    [http://normetic.org/uri/profil_oeaf/v1.0/ns#sed0100]  
    [http://normetic.org/uri/profil_oeaf/v1.0/ns#sed0200]  
    [http://normetic.org/uri/profil_oeaf/v1.0/ns#sed0300]  
    [http://normetic.org/uri/profil_oeaf/v1.0/ns#sed0400]  
  [http://normetic.org/uri/profil\_oeaf/v1.0/sged0002]  
    [ISO_IEC_19788-9:2012::DES0100]  
    [ISO_IEC_19788-9:2012::DES0200]  
    [ISO_IEC_19788-9:2012::DES0300]  
    [ISO_IEC_19788-9:2012::DES0400]  
    [ISO_IEC_19788-9:2012::DES0500]  
    [ISO_IEC_19788-9:2012::DES0900]
```

```

[ISO_IEC_19788-9:2012::DES1000]
[ISO_IEC_19788-9:2012::DES1300]
[ISO_IEC_19788-9:2012::DES1800]
[http://normetic.org/uri/profil_oef/v1.0/ns#sed0700]
[http://normetic.org/uri/profil_oef/v1.0/ns#sed0800]
[http://normetic.org/uri/profil\_oef/v1.0/sged0005]
  [ISO_IEC_19788-9:2012::DES1400]
  [ISO_IEC_19788-9:2012::DES1500]
  [ISO_IEC_19788-9:2012::DES1700]
[http://normetic.org/uri/profil\_oef/v1.0/sged0003]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed0900]
  [ISO_IEC_19788-2:2011::DES0100]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1000]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1100]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1200]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1300]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1400]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1500]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1600]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1700]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1800]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1900]
[http://normetic.org/uri/profil\_oef/v1.0/sged0004]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed0900]
  [ISO_IEC_19788-2:2011::DES0100]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1000]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed1100]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2000]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2100]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2200]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2300]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2400]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2500]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2600]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2700]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2800]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed2900]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed3000]
  [http://normetic.org/uri/profil_oef/v1.0/ns#sed3100]
  [http://normetic.org/uri/profil\_oef/v1.0/sged0005]
    [ISO_IEC_19788-9:2012::DES1400]
    [ISO_IEC_19788-9:2012::DES1500]
    [ISO_IEC_19788-9:2012::DES1700]
  [http://normetic.org/uri/profil\_oef/v1.0/sged0006]
    [ISO_IEC_19788-9:2012::DES0500]
    [ISO_IEC_19788-9:2012::DES0900]
    [ISO_IEC_19788-9:2012::DES1000]

```

or, in the context of a given language (here French), can be expressed as:

```

[OEAF v1.0 SGED]
  [Relations entre classes de ressources] (mandatory/non-repeatable)
    [offre] (optional/repeatable)
    [offerte par] (mandatory/repeatable)
    [composant générique] (mandatory/non-repeatable)
    [composé de] (optional/repeatable)
  [Fournisseurs d'opportunités d'étude] (mandatory/non-repeatable)
    [identifiant] (optional/repeatable)
    [nom (1)] (conditional/non-repeatable)
    [nom de famille] (optional/non-repeatable)
    [prénom] (optional/repeatable)
    [nom (2)] (mandatory/non-repeatable)

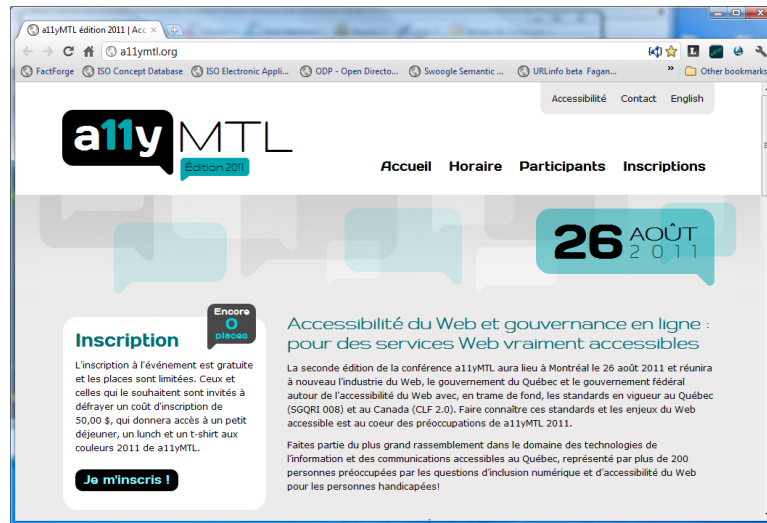
```

- [courriel] (optional/repeatable)
- [téléphone au travail] (conditional/repeatable)
- [localisation] (optional/repeatable)
- [site Web] (conditional/non-repeatable)
- [type] (optional/non-repeatable)
- [personne contact] (optional/repeatable)
- [Localisation] (conditional/non-repeatable)
 - [longitude] (mandatory/non-repeatable)
 - [latitude] (mandatory/non-repeatable)
 - [description] (optional/non-repeatable)
- [Opportunités génériques] (mandatory/non-repeatable)
 - [identifiant] (conditional/repeatable)
 - [titre] (conditional/repeatable)
 - [date de publication] (optional/non-repeatable)
 - [description] (optional/non-repeatable)
 - [sujet] (mandatory/repeatable)
 - [préalable] (optional/repeatable)
 - [type d'opportunité] (mandatory/non-repeatable)
 - [niveau éducationnel] (mandatory/repeatable)
 - [crédit] (optional/repeatable)
 - [stratégie d'évaluation] (optional/repeatable)
 - [objectif] (optional/repeatable)
 - [qualification à la sortie] (optional/repeatable)
- [Opportunités concrètes] (conditional/non-repeatable)
 - [identifiant] (optional/repeatable)
 - [titre] (conditional/repeatable)
 - [date de publication] (optional/non-repeatable)
 - [description] (optional/non-repeatable)
 - [géolocalisation] (conditional/non-repeatable)
 - [date de début] (conditional/non-repeatable)
 - [date de fin] (optional/non-repeatable)
 - [durée] (conditional/non-repeatable)
 - [date de prestation] (conditional/non-repeatable)
 - [nombre de places] (optional/non-repeatable)
 - [coût] (optional/non-repeatable)
 - [langue de prestation] (mandatory/repeatable)
 - [mode de livraison] (optional/repeatable)
 - [prestataire] (optional/repeatable)
 - [modalités d'inscription] (mandatory/non-repeatable)
 - [infos de dernière minute] (optional/non-repeatable)
 - [Localisation] (conditional/non-repeatable)
 - [longitude] (mandatory/non-repeatable)
 - [latitude] (mandatory/non-repeatable)
 - [description] (optional/non-repeatable)
- [Prestataire]
 - [nom] (obligatoire/non-repeatable)
 - [courriel] (optional/repeatable)
 - [téléphone au travail] (optional/repeatable)

7.2 Conformant data element group

Let us represent a conformant data element group describing the concrete learning opportunity

<urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b>



in a human readable format. We will express the same data element group in a machine readable format in the next section. The Turtle format is used (without the prefixes).

[OEAF v1.0 SGED]

[Relations entre classes de ressources]

```
<urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b>
  oeaf:offerte_par <urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b> ;
  oeaf:composant_générique <urn:abdc9260-d5ae-11e0-8e00-0002a5d5c51b> .
```

[Fournisseurs d'opportunités d'étude]

```
<urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b>
  oeaf:personne_contact <urn:35caaa80-d635-11e0-a076-0002a5d5c51b> .
```

```
<urn:9bd6bd60-d634-11e0-a0c3-0002a5d5c51b>
  mlr9:nom "Coopérative AccessibilitéWeb ;
  mlr9:siteWeb "http://accessibiliteweb.com/" .
```

```
<urn:35caaa80-d635-11e0-a076-0002a5d5c51b>
  mlr9:nom "Denis Boudreau" .
```

[Opportunités génériques]

```
<urn:abdc9260-d5ae-11e0-8e00-0002a5d5c51b>
  oeaf:identifiant "a11yMTL" ;
  mlr2:titre "a11yMLT - Accessibilité du Web" ;
  oeaf:description ""Conférence annuelle réunissant l'industrie du
    Web, le gouvernement du Québec et le gouvernement fédéral
    autour de l'accessibilité du Web"" ;
  oeaf:sujet "Web accessible, ally, standards" ;
  oeaf:type_d_opportunité
    "http://normetic.org/uri/profil_oeaf/v1.0/va2.4#congrès" ;
  oeaf:niveau_éducatif
    "http://normetic.org/uri/profil_oeaf/v1.0/va2.2#tous" .
```

[Opportunités concrètes]

```
<urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b>
  oeaf:identifiant "a11yMLT2011" ;
  mlr2:titre ""Accessibilité du Web et gouvernance en ligne pour les
    services Web vraiment accessibles"" ;
```

```

oeaf:géolocalisation <urn:effce580-d649-11e0-82bb-0002a5d5c51b> ;
oeaf:nombre_de_places "200"^^xsd:nonNegativeInteger ;
oeaf:coût ""L'inscription à l'événement est gratuite. Ceux et celles
    qui le souhaitent sont invités à défrayer un coût d'inscription
    de 50,00$, qui donnera accès à un petit déjeuner, un lunch et
    un t-shirt aux couleurs 2011 de allyMTL."" ;
oeaf:langue_de_la_prestation "fra" ;
oeaf:langue_de_la_prestation "eng" ;
oeaf:mode_de_livraison
    "http://normetic.org/uri/profil_oeaf/v1.0/va2.5#présentiel" ;
oeaf:mode_de_livraison
    "http://normetic.org/uri/profil_oeaf/v1.0/va2.5#webdiffusion" ;
oeaf:prestataire <urn:fb98b920-d651-11e0-8f0c-0002a5d5c51b> ;
oeaf:prestataire <urn:1e24b7a0-d652-11e0-ab2f-0002a5d5c51b> ;
oeaf:prestataire <urn:302665c0-d652-11e0-8032-0002a5d5c51b> ;
oeaf:prestataire <urn:3a0ce1e0-d652-11e0-b2c2-0002a5d5c51b> ;
oeaf:prestataire <urn:447203e0-d652-11e0-ae89-0002a5d5c51b> ;
oeaf:prestataire <urn:4e219180-d652-11e0-af75-0002a5d5c51b> ;
oeaf:prestataire <urn:56d55a00-d652-11e0-9023-0002a5d5c51b> ;
oeaf:modalité_d_inscription
    "Site Web: http://allymtl.org/inscriptions" .

```

[Localisation]

```

<urn:effce580-d649-11e0-82bb-0002a5d5c51b>
    mlr9:longitude "45.50973" ;
    mlr9:latitude "-73.57015" ;
    mlr9:description
        ""200 rue Sherbrooke Ouest, Montréal (Québec),
        H2X 3P2"" .

```

[Prestataire]

```

<urn:fb98b920-d651-11e0-8f0c-0002a5d5c51b>
    mlr9:nom "Michael Cooper" .

<urn:1e24b7a0-d652-11e0-ab2f-0002a5d5c51b>
    mlr9:nom "John Foliot" .

<urn:302665c0-d652-11e0-8032-0002a5d5c51b>
    mlr9:nom "Peter Lee" .

<urn:3a0ce1e0-d652-11e0-b2c2-0002a5d5c51b>
    mlr9:nom "Greg Pisoky" .

<urn:447203e0-d652-11e0-ae89-0002a5d5c51b>
    mlr9:nom "Yves Hudon" .

<urn:4e219180-d652-11e0-af75-0002a5d5c51b>
    mlr9:nom "Robert Peason" .

<urn:56d55a00-d652-11e0-9023-0002a5d5c51b>
    mlr9:nom "Catherine Roy" .

```

7.2 rTriG serialization of a data element group

In this section we propose a machine readable format to represent data element groups.

The format, which we call **rTriG** -- for “recursive TriG” --, is a small extension to TriG (see [19]) where the TrigG EBNF is changed from

```
[1] trigDoc ::= (graph_statement)*
```

```

[2] graph_statement ::= directive "." | graph
[3] graph ::= graphIri? "{" (triples ".")* "}"
[4] graphIri ::= IRIref
[5] ...

```

to

```

[1] trigDoc ::= (graph_statement)*
[2] graph_statement ::= directive "." | graph
[3] graph ::= graphIri? "{" (triples ".")* | graph "}"
[4] graphIri ::= IRIref
[5] ...

```

With the right set of prefixes, the above data element group can be represented as :

```

# default graph {
  <urn:8706a3e0-d5ae-11e0-91b0-0002a5d5c51b> # URI for data element group
    mlr8:identifiant_de_fiche "GTNQ-2011-08-31T134730" ;
    mlr8:décrit <urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b> ;
    mlr8:langue "fra" ;
    mlr8:profil_d_application
      "http://normetic.org/profil_application/v1.0" ;
    mlr8:dernière_mise_à_jour "2011-09-02" ;
    dc:creator "Gilles Gauthier" ;
    dcterms:created "2011-08-31" . }

# data element group
< http://normetic.org/uri/profil_oeaf/v1.0 > {

  http://normetic.org/uri/profil_oeaf/v1.0/sged0001 {

    <urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b>
      oeaf:offerte_par <urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b> ;
      oeaf:composant_générique <urn:abdc9260-d5ae-11e0-8e00-0002a5d5c51b> . }

    <http://normetic.org/uri/profil_oeaf/v1.0/sged0002> {
      <urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b>
        oeaf:personne_contact <urn:35caaa80-d635-11e0-a076-0002a5d5c51b> .

      <urn:9bd6bd60-d634-11e0-a0c3-0002a5d5c51b>
        mlr9:nom "Coopérative AccessibilitéWeb ;
        mlr9:siteWeb "http://accessibiliteweb.com/" .

      <urn:35caaa80-d635-11e0-a076-0002a5d5c51b>
        mlr9:nom "Denis Boudreau" . }

    <http://normetic.org/uri/profil_oeaf/v1.0/sged0003> {
      <urn:abdc9260-d5ae-11e0-8e00-0002a5d5c51b>
        oeaf:identifiant "allyMTL" ;
        mlr2:titre "allyMLT - Accessibilité du Web" ;
        oeaf:description ""Conférence annuelle réunissant l'industrie du
          Web, le gouvernement du Québec et le gouvernement fédéral
          autour de l'accessibilité du Web"" ;
        oeaf:sujet "Web accessible, ally, standards" ;
        oeaf:type_d_opportunité
          "http://normetic.org/uri/profil_oeaf/v1.0/va2.4#congrès" ;
        oeaf:niveau_éducatif
          "http://normetic.org/uri/profil_oeaf/v1.0/va2.2#tous" . }

```

```

http://normetic.org/uri/profil_oeaf/v1.0/sged0004 {
  <urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b>
    oeaf:identifiant "allyMLT2011" ;
    mlr2:titre ""Accessibilité du Web et gouvernance en ligne pour les
      services Web vraiment accessibles"" ;
    oeaf:géolocalisation <urn:effce580-d649-11e0-82bb-0002a5d5c51b> ;
    oeaf:nombre_de_places "200"^^xsd:nonNegativeInteger ;
    oeaf:coût ""L'inscription à l'événement est gratuite. Ceux et celles
      qui le souhaitent sont invités à défrayer un coût d'inscription
      de 50,00$, qui donnera accès à un petit déjeuner, un lunch et
      un t-shirt aux couleurs 2011 de allyMTL."" ;
    oeaf:langue_de_la_prestation "fra" ;
    oeaf:langue_de_la_prestation "eng" ;
    oeaf:mode_de_livraison
      "http://normetic.org/uri/profil_oeaf/v1.0/va2.5#présentiel" ;
    oeaf:mode_de_livraison
      "http://normetic.org/uri/profil_oeaf/v1.0/va2.5#webdiffusion" ;
    oeaf:prestataire <urn:fb98b920-d651-11e0-8f0c-0002a5d5c51b> ;
    oeaf:prestataire <urn:1e24b7a0-d652-11e0-ab2f-0002a5d5c51b> ;
    oeaf:prestataire <urn:302665c0-d652-11e0-8032-0002a5d5c51b> ;
    oeaf:prestataire <urn:3a0ce1e0-d652-11e0-b2c2-0002a5d5c51b> ;
    oeaf:prestataire <urn:447203e0-d652-11e0-ae89-0002a5d5c51b> ;
    oeaf:prestataire <urn:4e219180-d652-11e0-af75-0002a5d5c51b> ;
    oeaf:prestataire <urn:56d55a00-d652-11e0-9023-0002a5d5c51b> ;
    oeaf:modalité_d_inscription
      "Site Web: http://allymtl.org/inscriptions" .

http://normetic.org/uri/profil_oeaf/v1.0/sged0005 {
  <urn:effce580-d649-11e0-82bb-0002a5d5c51b>
    mlr9:longitude "45.50973" ;
    mlr9:latitude "-73.57015" ;
    mlr9:description
      ""200 rue Sherbrooke Ouest, Montréal (Québec),
      H2X 3P2"" . }

http://normetic.org/uri/profil_oeaf/v1.0/sged0006 {
  <urn:fb98b920-d651-11e0-8f0c-0002a5d5c51b>
    mlr9:nom "Michael Cooper" .

  <urn:1e24b7a0-d652-11e0-ab2f-0002a5d5c51b>
    mlr9:nom "John Foliot" .

  <urn:302665c0-d652-11e0-8032-0002a5d5c51b>
    mlr9:nom "Peter Lee" .

  <urn:3a0ce1e0-d652-11e0-b2c2-0002a5d5c51b>
    mlr9:nom "Greg Pisoky" .

  <urn:447203e0-d652-11e0-ae89-0002a5d5c51b>
    mlr9:nom "Yves Hudon" .

  <urn:4e219180-d652-11e0-af75-0002a5d5c51b>
    mlr9:nom "Robert Peason" .

  <urn:56d55a00-d652-11e0-9023-0002a5d5c51b>
    mlr9:nom "Catherine Roy" . } } }

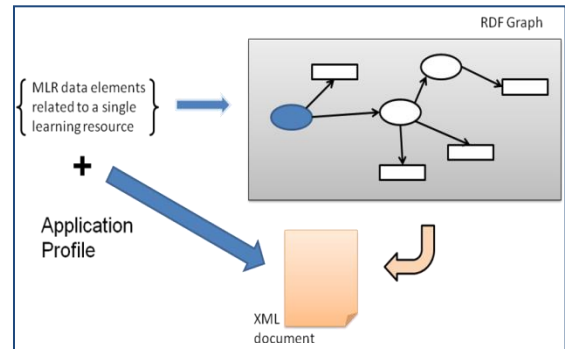
```

7.3 XML serialization of a data element group

Given an application profile, it is easy to express any conforming data element group as an XML document.

The document below was generated using the French name of the DEGSs participating to the specification of the application profile OEAF v1.0.

Note: In the image below, from document [20], the namespaces are not conformant with the actual document. The image is only provided as an example.



```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:mlr-2="http://standards.iso.org/iso-iec/19788/-1/ed-1/en/" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:mlr-8="http://standards.iso.org/iso-iec/19788/-8/ed-1/en/" xmlns:mlr-9="http://standards.iso.org/iso-iec/19788/-9/ed-1/en/" xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:oeaf="http://normetic.org/uri/profil_oeaf/v1.0/ns#" xmlns:dcterms="http://purl.org/dc/dcterms/">
  <mlr-8:Enregistrement_MLR rdf:about="urn:8706a3e0-d5ae-11e0-91b0-0002a5d5c51b">
    <mlr-8:identifiant_enregistrement>GTNQ-2011-08-31T134730</mlr-8:identifiant_enregistrement>
    <mlr-8:décrit>
      <oeaf:Opportunité_d'étude_concrète rdf:about="urn:646b6320-d5ae-11e0-ae4c-0002a5d5c51b">
        <mlr-8:enregistrement rdf:resource="urn:8706a3e0-d5ae-11e0-91b0-0002a5d5c51b"/>
        <oeaf:offre_par rdf:resource="urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b"/>
        <oeaf:composant_générique>
          <oeaf:identifiant>a11yMLT2011</oeaf:identifiant>
          <mlr-2:titre>Accessibilité du Web et gouvernance en ligne pour les services Web vraiment accessibles</mlr-2:titre>
          <oeaf:géolocalisation>
            <mlr-9:Localisation_géographique rdf:about="urn:effce580-d649-11e0-82bb-0002a5d5c51b">
              <mlr-9:longitude>45.50973</mlr-9:longitude>
              <mlr-9:latitude>-73.57015</mlr-9:latitude>
              <mlr-9:description>200 rue Sherbrooke Ouest, Montréal (Québec), H2X 3P2</mlr-9:description>
            </mlr-9:Localisation_géographique>
          </oeaf:géolocalisation>
          <oeaf:date_de_prestation>2011-08-26</oeaf:date_de_prestation>
          <oeaf:nombre_de_places rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">200</oeaf:nombre_de_places>
          <oeaf:coût>L'inscription à l'événement est gratuite. Ceux et celles qui le souhaitent sont invités à défrayer un coût d'inscription de 50,00 $, qui donnera accès à un petit déjeuner, un lunch et un t-shirt aux couleurs 2011 de a11yMTL.</oeaf:coût>
          <oeaf:langue_de_la_prestation>fra</oeaf:langue_de_la_prestation>
          <oeaf:langue_de_la_prestation>eng</oeaf:langue_de_la_prestation>
          <oeaf:mode_de_livraison>http://normetic.org/uri/profil_oeaf/v1.0/va2.5#T010</oeaf:mode_de_livraison>
          <oeaf:mode_de_livraison>http://normetic.org/uri/profil_oeaf/v1.0/va2.5#T040</oeaf:mode_de_livraison>
        </oeaf:Opportunité_d'étude_concrète>
      </mlr-8:décrit>
      <mlr-8:langue>fra</mlr-8:langue>
      <mlr-8:profil_d'application>http://normetic.org/profil_application/v1.0</mlr-8:profil_d'application>
      <mlr-8:dernière_mise_à_jour>2011-09-02</mlr-8:dernière_mise_à_jour>
      <dc:creator>Gilles Gauthier</dc:creator>
      <dcterms:created>2011-08-31</dcterms:created>
    </mlr-8:Enregistrement_MLR>
    <oeaf:Fournisseur_d'opportunité_d'étude rdf:about="urn:9a737ac0-d5ae-11e0-963f-0002a5d5c51b">
      <oeaf:personne_contact>
        <oeaf:Fournisseur_d'opportunité_d'étude>
      </oeaf:Fournisseur_d'opportunité_d'étude>
    </rdf:RDF>
```

8 MLR vocabularies - SKOS

8.1 General considerations

Using the “Content value rules” attribute of a DES, one can constrain the content values of associated **data elements** to belong to a particular set (identifier of) terms from a vocabulary. For example, the values of a data element with **data element specification** ISO_IEC_19788-5:2012::DES0600 (audience role) are (global identifiers of) terms from the MLR vocabulary ISO_IEC_19788-5:2012::VA.2 (Audience role). More below concerning the use of “global identifier of terms” instead of “terms”: this is needed because the ISO/IEC 19788 principle “5.3 Multilingual equivalencies and multicultural requirements support”.

First, some terms and definitions (some adapted) from ISO/IEC 1087-1:2000³⁴:

vocabulary
terminological dictionary which contains **designations** and **definitions** from one or more specific domain

NOTE The vocabulary may be monolingual, bilingual or multilingual

terminology
set of **designations** belonging to one subject field

designation
representation of a concept by a sign which denotes it

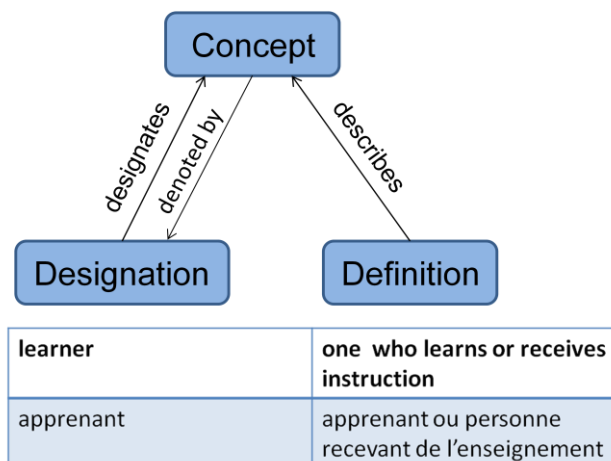
definition
representation of a **concept** by a descriptive statement which serves to differentiate it from related concepts

concept
unit of knowledge created by a unique combination of **characteristics**

characteristic
abstraction of a property of an object or a set of objects

object
anything perceivable or conceivable

ISO_IEC_19788-5:2012::VA.2:T010 (Audience role)



Excerpt from the MLR vocabulary ISO_IEC_19788-5:2012:VA.2:

ISO English Language			ISO French Language	
ID	Term	Definition	Term	Definition
T010	learner	one who learns or receives instruction	apprenant	apprenant ou personne recevant de l'enseignement

³⁴ See the ISO 1087-1:2000 for more details

T020	mediator	person, other than teacher, who participates in the production, management and delivery of educational activities	médiateur	personne, autre qu'un enseignant, qui participe à la production, la gestion et la prestation d'activités éducatives
T030	mentor	experienced person who provides guidance	mentor	expert agissant comme guide

The first column provides a single identifier for the terms in any language designating a concept. This local identifier is used with the vocabulary identifier to get a globally unique identifier for the concept denoted by a term.

Example 1: ISO_IEC_19788-5:2012::VA.2#T010 identifies the concept denoted by **learner** (eng) or **apprenant** (fra).

The other way around: from the identifier of a concept (from a MLR vocabulary) one can get a designation and definition of the concept in English and French.

The same approach for identifying concepts in vocabularies can be used with any vocabulary:
<vocabulary identifier>#<local term ID>

This approach is needed because ISO/IEC is global and all languages shall have equal status (in particular, English is not to be used as the dominant language).

Example 2: ISO_IEC_19788-5:2012::VA.5 (Annotation type) provide an example of the use of a terminology in an ISO/IEC 19788 part.

Excerpt from the MLR terminology ISO_IEC_19788-5:2012::VA.5:

	ISO English Language	ISO French Language
ID	Term	Term
T010	global	globale
T020	content quality	qualité du contenu
T030	suggestion for use	suggestion d'utilisation
T040	reliability	fiabilité
T050	usability	convivialité

8.2 Vocabulary related templates

Unfortunately, the ISO/IEC 19788-1 did not mandate a template for the specification of vocabularies and the template used do not exactly conform to MLR-1 corrigendum that state that terms and definitions from the MLR vocabularies should be provided in English, French and Russian. Moreover, there is a need to indicate relationships between concepts (such as broader, narrower term and related term).

Proposed template (illustrated with an example adapted from “Profil d'application québécois de métadonnées pour les opportunités d'étude, d'apprentissage et de formation, see document WG4 N1917).

The proposed template make it easy for any NBs to add the terms and definitions for its languages.

Vocabulary Opportunity types				
Identifier	ISO_IEC_19788-63:2032::VA.7			
Name	Opportunity types (eng) Types d'opportunités (fra) Возможность типов ³⁵ (rus)			
Extension of	-			
ID	Related concept	Term	Definition	Language code ³⁶
T010		lecture	<to be complete>	eng
		cours	<to be completed>	fra
		течение	<to be completed>	rus
T020		program	<to be completed>	eng
		programme	<to be completed>	fra
		программа	<to be completed>	rus
T030		event	<to be completed>	eng
		événement	<to be completed>	fra
		событие	<to be completed>	rus
T040	(broader ³⁷) T030	conference	<to be completed>	eng
		conférence	<to be completed>	fra
		конференция	<to be completed>	rus
T050	(broader) T030	congress	<to be completed>	eng
		congrès	<to be completed>	fra
		съезд	<to be completed>	rus
T060	(broader) T030	meeting	<to be completed>	eng
		rencontre	<to be completed>	fra
		совещание	<to be completed>	rus
T070	(broader) T010	lecture + workshop	<to be completed>	eng
		cours + atelier	<to be completed>	fra
		течение + мастерская	<to be completed>	rus
T080		workshop	<to be completed>	eng
		atelier	<to be completed>	fra
		мастерская	<to be completed>	rus
T090		seminar	<to be completed>	eng
		séminaire	<to be completed>	fra
		научная конференция	<to be completed>	rus

³⁵ As an example only: all translations to Russian was make using Google Translate. To be validated.

³⁶ From ISO 639-3

³⁷ Other possibilities: narrower, related, broaderTransitive, narrowerTransitive (see the SKOS semantic relations: <http://www.w3.org/TR/skos-reference/#semantic-relations>)

T100		excursion	<to be completed>	eng
		excursion	<to be completed>	fra
		экскурсия	<to be completed>	rus
T999		other	<to be completed>	eng
		autre	<to be completed>	fra
		другой	<to be completed>	rus

Note : The same template can be used by users for specifying vocabularies for DESs introduced in application profiles (APs).

8.3 User extensions of MLR vocabularies

Within an application profile or otherwise, it may be necessary to extend MLR vocabularies to satisfy the needs of an organization or community.

Consider a DES $\mathcal{D}$ where

- 1) The value of its attribute “Range” is “literal”, and
- 2) The value of its attribute “Content value rules” is the identifier of a MLR vocabulary $\mathcal{V}$

Data element specification	
Identifier	ISO_IEC_19788-99:2047::DES9999 ³⁸
Data element attributes	
Range	literal
Content value rules	ISO_IEC_19788-63:2032::VA.7

We will consider two cases: (1) **closed** MLR vocabularies and, (2) **open** MLR vocabularies³⁹.

- 1) If the MLR vocabulary $\mathcal{V}$ is declared to be **close** then only designations from $\mathcal{V}$ can be used as “Content Value” for data elements with Data element specification $\mathcal{D}$
- 2) If the MLR vocabulary $\mathcal{V}$ is declared to be **open** then any Vocabulary publisher⁴⁰ can choose to (locally) extend the MLR vocabulary, using the same vocabulary template used above. The extended vocabulary designations should be semantically linked to the designation of the core MLR vocabulary $\mathcal{V}$.
Any designation from the extended vocabulary can be used as “Content Value” for data elements with Data element specification $\mathcal{D}$

³⁸ Only an example, no such DES exists (actually) in the ISO/IEC 19788 multipart standard.

³⁹ At the moment, ISO/IEC 19788 doesn't have the notion of open/closed vocabularies. It should!

⁴⁰ Organization, Community, Standards' Body of a country...

8.4.1 URIs for vocabularies

Using RFC 5141, for each MLR vocabulary, one can identify that vocabulary using a URN and also using an HTTP URI (see section 3.2).

Example: To identify the MLR vocabulary ISO_IEC_19788-5:2012::VA.2 (Audience role) one can use:

- 1) `urn:iso:std:iso-iec:19788:-5:ed-1:clause:VA.2` (URN), or
- 2) <http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2> (HTTP URI)

8.4.2 URIs for concepts in a vocabulary

Concept associated with a vocabulary are identified with a composite identifier:
<Identifier of the vocabulary, (local) ID>

Example: <ISO_IEC_19788-5:2012::VA.2, T010> identifies the concept with designation learner (in English) from the vocabulary ISO_IEC_19788-5:2012::VA.2.

Proposed solution to identify concepts in a vocabulary: Use RFC 5141 to identify the vocabulary (ISO_IEC_19788-5:2012::VA.1) and append the local term identifier (T010), converted to lowercase, as a URI fragment⁴⁴ to get an identifier for the concept:

<http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2#t010>⁴⁵

For the needs of GTN-Québec, let us use

<http://normetic.org/iso-iec/19788-5/2012/va.2#t010>

Note: It is not possible here to use owl:sameAs as we did in section 3.3 as RFC 5141 is not applicable here: no clause numbers for the different designation of concepts.

8.4.3 From MLR vocabularies to SKOS

The mapping will be as follow:

MLR vocabularies → SKOS Concept Schemes
MLR vocabulary concepts → SKOS Concepts

Note: this approach also works for any user vocabulary specified using the MLR vocabulary templates.

8.4.3.1 Example : The MLR vocabulary “ISO_IEC_19788-5:2012:VA.2”

Turtle serialization

The following is an excerpt of the file ISO_IEC_19788-5_2012_VA.2.ttl (corresponding to the excerpt presented in section 8.1):

```
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix rdfs:   <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix skos:   <http://www.w3.org/2004/02/skos/core#> .  
@base <http://normetic.org/iso-iec/19788-5/2012/va.2> .
```

⁴⁴ <http://tools.ietf.org/html/rfc3986#page-24>

⁴⁵ This approach will be discussed at the next SC36/WG4 meeting in Busan (September 2012)

```

<http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2>
  rdf:type skos:ConceptScheme ;
  rdfs:label "ISO_IEC_19788-5:2012::VA.2" ;
  rdfs:label "Audience role"@en .

<#t010>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2> ;
  skos:prefLabel "learner"@en , "apprenant"@fr ;
  skos:definition "one who learns or receives instruction"@en , "apprenant ou personne recevant de
l'enseignement"@fr ;
  skos:note "The English definition is taken from IEEE 1484.12.1-2002, IEEE Standard for Learning Object
Metadata" .

<#t020>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2> ;
  skos:prefLabel "mediator"@en , "médiateur"@fr ;
  skos:definition "person, other than teacher, who participates in the production, management and delivery of
educational activities"@en , "personne, autre qu'un enseignant, qui participe à la production, la gestion et la
prestation d'activités éducatives"@fr ;
  skos:note "The English definition is taken from IEEE 1484.12.1-2002, IEEE Standard for Learning Object
Metadata" .

<#t030>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-5/ed-1/clause/va.2> ;
  skos:prefLabel "mentor"@en , "mentor"@fr ;
  skos:definition "experienced person who provides guidance"@en , "expert agissant comme guide "@fr .

```

RDF/XML serialization

Same excerpt (with RDF/XML serialization):

```

<?xml version="1.0"?>
<rdf:RDF xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
        xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:skos="http://www.w3.org/2004/02/skos/core#"

  <skos:ConceptScheme rdf:about="http://standards.iso.org/iso-iec/19788/-5/ed-
1/clause/va.2">
    <rdfs:label>ISO_IEC_19788-5:2012::VA.2</rdfs:label>
    <rdfs:label xml:lang="en">Audience role</rdfs:label>
  </skos:ConceptScheme>

  <skos:Concept rdf:about="http://normetic.org/iso-iec/19788-5/2012/va.2#t010">
    <skos:inScheme rdf:resource="http://standards.iso.org/iso-iec/19788/-5/ed-
1/clause/va.2" />
    <skos:prefLabel xml:lang="en">learner</skos:prefLabel>
    <skos:prefLabel xml:lang="fr">apprenant</skos:prefLabel>
    <skos:definition xml:lang="en">one who learns or receives
instruction</skos:definition>
    <skos:definition xml:lang="fr">apprenant ou personne recevant de
l'enseignement</skos:definition>
    <skos:note>The English definition is taken from IEEE 1484.12.1-2002, IEEE
Standard for Learning Object Metadata</skos:note>
  </skos:Concept>

  <skos:Concept rdf:about="http://normetic.org/iso-iec/19788-5/2012/va.2#t020">

```

```

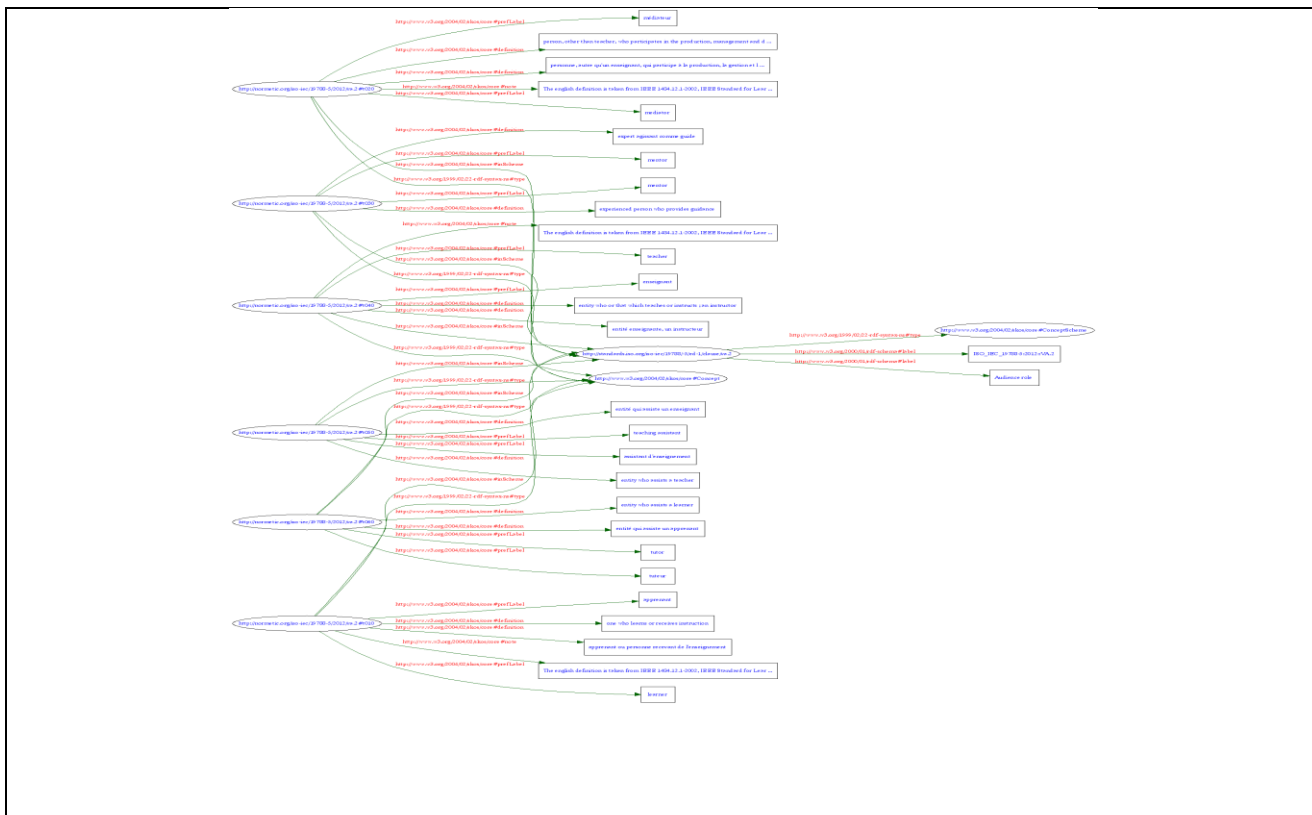
    <skos:inScheme rdf:resource="http://standards.iso.org/iso-iec/19788/-5/ed-1/
clause/va.2" />
    <skos:prefLabel xml:lang="en">mediator</skos:prefLabel>
    <skos:prefLabel xml:lang="fr">médiateur</skos:prefLabel>
    <skos:definition xml:lang="en">person, other than teacher, who participates
in the production, management and delivery of educational
activities</skos:definition>
    <skos:definition xml:lang="fr">personne, autre qu'un enseignant, qui
participe à la production, la gestion et la prestation d'activités
éducatives</skos:definition>
    <skos:note>The English definition is taken from IEEE 1484.12.1-2002, IEEE
Standard for Learning Object Metadata</skos:note>
</skos:Concept>

<skos:Concept rdf:about="http://normetic.org/iso-iec/19788-5/2012/va.2#t030">
    <skos:inScheme rdf:resource="http://standards.iso.org/iso-iec/19788/-5/ed-1/
clause/va.2" />
    <skos:prefLabel xml:lang="en">mentor</skos:prefLabel>
    <skos:prefLabel xml:lang="fr">mentor</skos:prefLabel>
    <skos:definition xml:lang="en">experienced person who provides
guidance</skos:definition>
    <skos:definition xml:lang="fr">expert agissant comme guide </skos:definition>
</skos:Concept>

```

RDF Graph

RDF Graph corresponding to the same excerpt:



8.4.3.2 Example: The vocabulary “Opportunity types” (see section 8.2)

Turtle serialization

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

@base <http://normetic.org/iso-iec/19788-63/2032/va.7> .

<http://example.net/vocab/opportunity_types>
rdfs:type skos:ConceptScheme ;
rdfs:label "Audience role vocabulary"@en ;
rdfs:label "Types d'opportunités"@fr ;
rdfs:label "Возможность типов"@ru .

<#t010>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

<#t020>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "program"@en , "programme"@fr , "программа"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

<#t030>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "event"@en , "événement"@fr , "событие"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

<#t040>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "conference"@en , "conférence"@fr , "конференция"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader <#t030> .

<#t050>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "congress"@en , "congrès"@fr , "съезд"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader <#t030> .

<#t060>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "meeting"@en , "rencontre"@fr , "совещание"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader <#t030> .

<#t070>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "lecture + workshop"@en , "cours + atelier"@fr , "течение + мастерская"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader <#t010> .

<#t080>
rdfs:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "workshop"@en , "atelier"@fr , "мастерская"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

```

<#t090>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "seminar"@en , "séminaire"@fr , "научная конференция"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

<#t100>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "excursion"@en , "excursion"@fr , "экскурсия"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

<#t999>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "other"@en , "autre"@fr , "другой"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

```

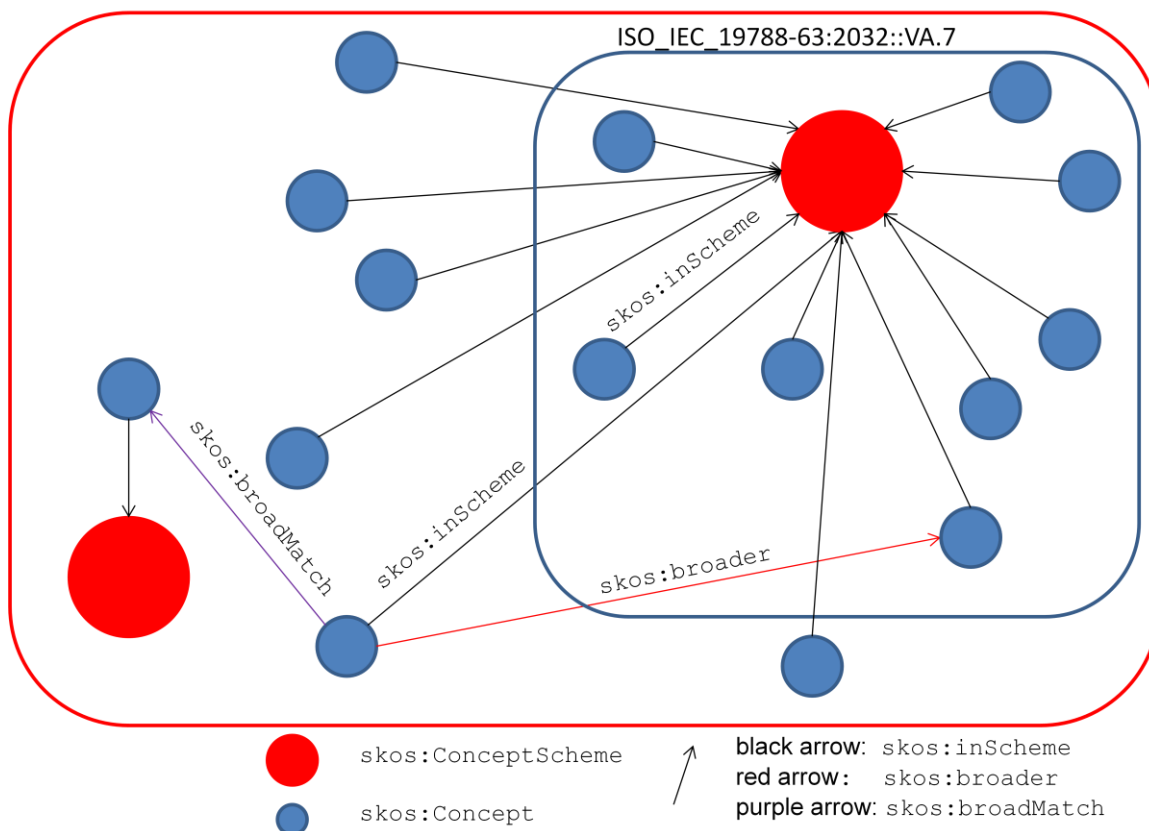
8.4.3.3 Example: The vocabulary “Extended opportunity types” (see section 8.3.2)

How to represent an extension of a SKOS vocabulary in SKOS?

All that is needed is to extend the concept scheme $\mathcal{C}$ associated with the core/source vocabulary, by simply asserting the new concepts to be in the concept scheme $\mathcal{C}$.

If the core/source vocabulary has been published as a SKOS document on the Web, then the vocabulary publisher doesn't have to replicate the information contained in that document. A Web application could easily retrieve it.

Vocabulary Extended opportunity types



Turtle serialization (without replication)

```
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs:   <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos:   <http://www.w3.org/2004/02/skos/core#> .

@prefix core:   <http://normetic.org/iso-iec/19788-63/2032/va.7> .
@base           <http://example.net/vocab/extended_opportunity_types> .

# ----- Extended concepts -----
<#t010>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
  skos:broader core:t030 .

<#t020>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
  skos:broader <#t010> .

<#t030>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
  skos:broader <#t010> .
```

Turtle serialization (with replication)

```
@prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs:   <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos:   <http://www.w3.org/2004/02/skos/core#> .

@prefix core:   <http://normetic.org/iso-iec/19788-63/2032/va.7> .
@base           <http://example.net/vocab/extended_opportunity_types> .

# ----- Extended concepts -----
<#t010>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
  skos:broader core:t030 .

<#t020>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
  skos:broader <#t010> .

<#t030>
  rdf:type skos:Concept ;
  skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
  skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
  skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
```

skos:broader <#t010> .

---- Core concepts ----

core:t010

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "lecture"@en , "cours"@fr , "течение"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

core:t020

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "program"@en , "programme"@fr , "программа"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

core:t030

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "event"@en , "événement"@fr , "событие"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

core:t040

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "conference"@en , "conférence"@fr , "конференция"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader core:t030 .

core:t050

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "congress"@en , "congrès"@fr , "съезд"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader core:t030 .

core:t060

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "meeting"@en , "rencontre"@fr , "совещание"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader core:t030 .

core:t070

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "lecture + workshop"@en , "cours + atelier"@fr , "течение + мастерская"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru ;
skos:broader core:t010 .

core:t080

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "workshop"@en , "atelier"@fr , "мастерская"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

core:t090

rdf:type skos:Concept ;
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;
skos:prefLabel "seminar"@en , "séminaire"@fr , "научная конференция"@ru ;
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .

core:t100

```
rdf:type skos:Concept ;  
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;  
skos:prefLabel "excursion"@en , "excursion"@fr , "экскурсия"@ru ;  
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .
```

core:t999

```
rdf:type skos:Concept ;  
skos:inScheme <http://standards.iso.org/iso-iec/19788/-48/ed-2/clause/va.7> ;  
skos:prefLabel "other"@en , "autre"@fr , "другой"@ru ;  
skos:definition "-- To be completed --"@en , "-- À être complété --"@fr , "-- Чтобы быть завершены --"@ru .
```

ANNEX A

Globally unique identifiers

A.1 Resources identifiers

In order to describe resources and share those descriptions globally, each of those resources shall be identified by at least one globally unique⁴⁶ across space and time identifier.

In Section 3 we discussed the assignment of URIs to ISO/IEC 19788 entities specified in the ISO/IEC 19788 multipart standard. The schemes considered generated globally unique identifiers. There are many other things/entities/resources that need to be globally identified: instances of *Learning resources*, instances of *Resource classes* and instances of MLR records, RDF datasets...

A given resource may have many (local or global) identifiers and those identifiers can either be opaque or have embedded semantics. Identifiers considered in section 3 clearly have embedded semantics.

We will now provide two ways to easily generate URIs that can serve as globally unique identifiers: opaque identifiers based on RFC 4122⁴⁷ and human-readable semantic identifiers based on RFC 4151⁴⁸. Both approaches do not require registration or a centralised authority, such as for ISBN, ISSN or DOI identifiers.

A.1.1 The UUID URN approach

In fact, UUID URN are ‘practically’ globally unique: it is extremely likely that two generated UUIDs will be different. For more information concerning UUIDs, see <http://www.itu.int/ITU-T/asn1/uuid.html#registration>.

How to get UUID URIs?

- 1) Go to the ITU-T Web site http://www.itu.int/ITU-T/asn1/cgi-bin/uuid_generate and get one; and
- 2) Add the prefix `urn:uuid:` in front of the UUID (in hexadecimal):

UUID: 3dea7c00-f09b-11e1-9dec-0002a5d5c51b

UUID URN: `urn:uuid:3dea7c00-f09b-11e1-9dec-0002a5d5c51b`

There are many UUID generators available, some of them allowing bulk generations of UUIDs. For more information concerning UUIDs, see <http://www.itu.int/ITU-T/asn1/uuid.html#registration>

A.1.2 The ‘tag’ URI scheme approach

What if your organization already uses a local identification system and you would like to make it global? It may be possible to use the ‘tag’ URI approach. For more information concerning this scheme, see IETF RFC 4122.

The syntax of a tag URI is:

`tag:<authorityName>, <date>:<specific> [#<fragment>]`

where the parts between <> must be provided and the part between [] is optional.

Examples:

`tag:gillesgauthier.me,2012-08-26:note-23`

`tag:gauthier.gilles@uqam.ca,2012-08-27:INF2101#H12`

⁴⁶ assigned to at most one resource and not reassigned

⁴⁷ <http://tools.ietf.org/html/rfc4122>

⁴⁸ <http://tools.ietf.org/html/rfc4151>

A.2 Skolemization of blank nodes in RDF graphs

Another situation where there is a need to have globally unique identifiers is the need to identify blank nodes (bNodes) in RDF graphs. Blank nodes could occur, for example, when converting a LOM metadata record to a set of MLR data elements.

Blank nodes are anonymous resources, such resources can be distinguished only within the graph containing them. As we want to expose those anonymous resources to external systems (in fact to the whole world) we need to mint a globally unique identifier for each blank node: that is replace the bNode with a Skolem URI. Moreover, we would like to be able to recognize those URIs that came from bNodes.

Suggestion:

For a bNode, construct a Skolem URI by appending a UUID to “<http://normetic.org/normetic/bnode/>”

UUID: 20ff1a20-f0bd-11e1-88d8-0002a5d5c51b

Skolem URI: <http://normetic.org/normetic/bnode/20ff1a20-f0bd-11e1-88d8-0002a5d5c51b>

ANNEX B

Data element specifications (DESSs)

B.1 Matrix template

Data element specification are provided by way of table templates to fill up.

As an example, here is such a template filled: this is the template for the data element specification ISO_IEC_19788-2:2011::DES00100 (Title):

Data element specification	
Identifier	ISO_IEC_19788-2:2011::DES00100
Data element attributes	
Property name	title
Definition	name given to the learning resource
Linguistic indicator	linguistic
Domain	<i>Learning Resource</i> (ISO_IEC_19788-1:2011::RC0002)
Range	literal
Content value rules	MLR String (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	Example 1 金葉和歌集 (jpn) Example 2 Collection of Golden Leaves (eng)
Note(s)	This element refines the element “title” described in table 1 of ISO 15836:2009(E) <i>Information and documentation — The Dublin Core metadata element set</i> .

The attributes in blue are said to be “essential attributes”, the other three (3) attributes are said to be non-essentials. Two DESSs that differ only by non-essential attributes are considered to be the same DES. According to the corrigendum (under adoption) for ISO/IEC 19788-1:2011,, the values for the attributes “Property name” and “Definition” shall be provided in English, French and Russian.

B.2 Other data element specifications used in this document

This section contains DESSs used in this document, presenting only the essential attributes. For the complete descriptions or other DESSs, see the ISO/IEC 19788-2:2011 standard.

B.2.1 MLR-2/DES1000 (identifier)

Data element specification	
Identifier	ISO_IEC_19788-2:2011::DES1000
Data element attributes	

Property name	identifier
Definition	unambiguous reference to the learning resource within a given context
Linguistic indicator	non-linguistic
Domain	<i>Learning Resource</i> (ISO_IEC_19788-1:2011::RC0002)
Range	literal
Content value rules	MLR String (ISO_IEC_19788-1:2011::PRS0001)

B.2.2 MLR-5/DES0700 (contribution date)

Data element specification	
Identifier	ISO_IEC_19788-5:2012::DES0700
Data element attributes	
Property name	contribution date
Definition	date of the contribution
Linguistic indicator	non-linguistic
Domain	<i>Contribution</i> (ISO_IEC_19788-5:2012::RC0003)
Range	literal
Content value rules	DATE (ISO_IEC_19788-1:2011::PRS0002)

B.2.3 MLR-5/DES1300 (has annotation)

Data element specification	
Identifier	ISO_IEC_19788-5:2012::DES1300
Data element attributes	
Property name	has annotation
Definition	brief textual comment or explanation about the learning resource by a user or contributor
Linguistic indicator	non-linguistic
Domain	<i>Learning Resource</i> (ISO_IEC_19788-1:2011::RC0002)

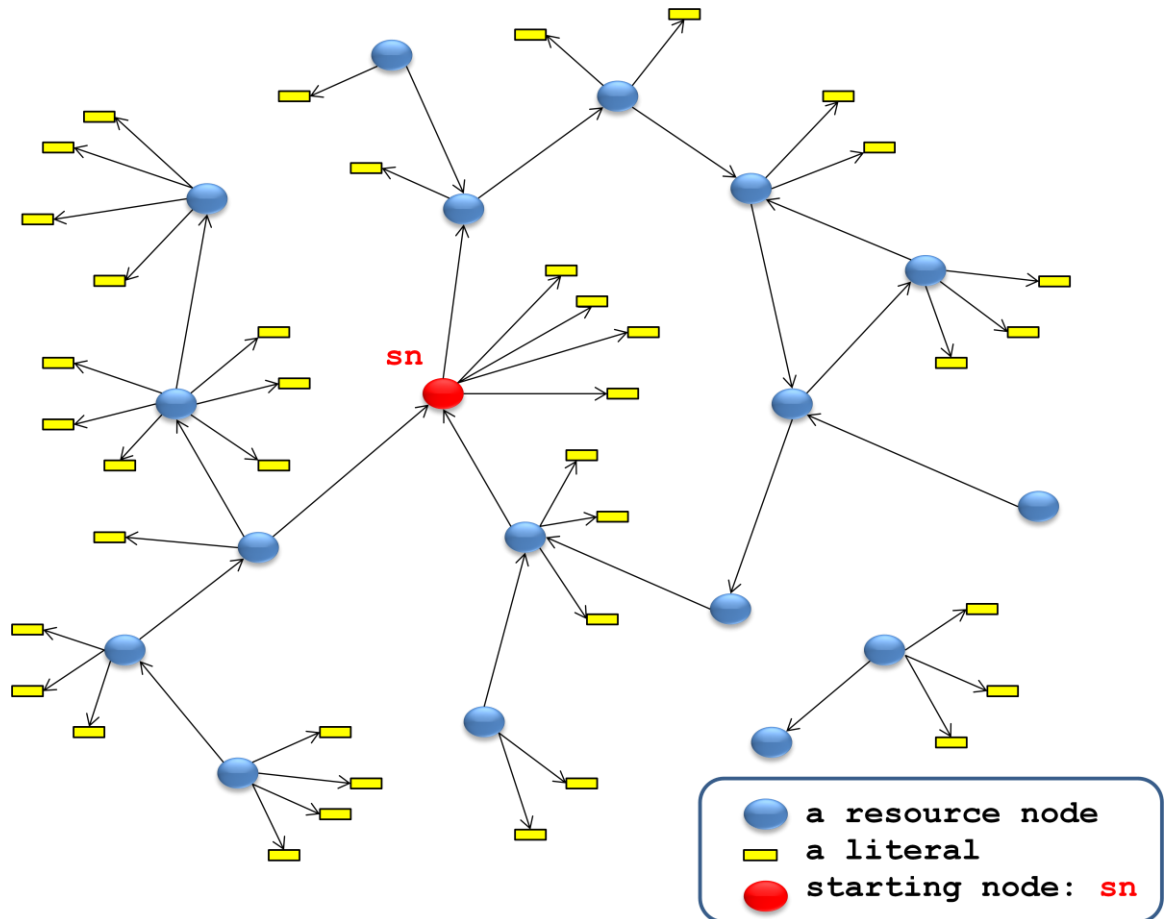
Range	<i>Annotation</i> (ISO_IEC_19788-5:2012::RC0001)
Content value rules	-

ANNEX C

Bounded description of a learning resource

We are interested by the description of a particular learning resource represented by a node in an RDF graph. Which RDF triples from the graph should constitute the description of the learning resource? The approach considered here is adapted from CBD – Concise Bounded Description [22].

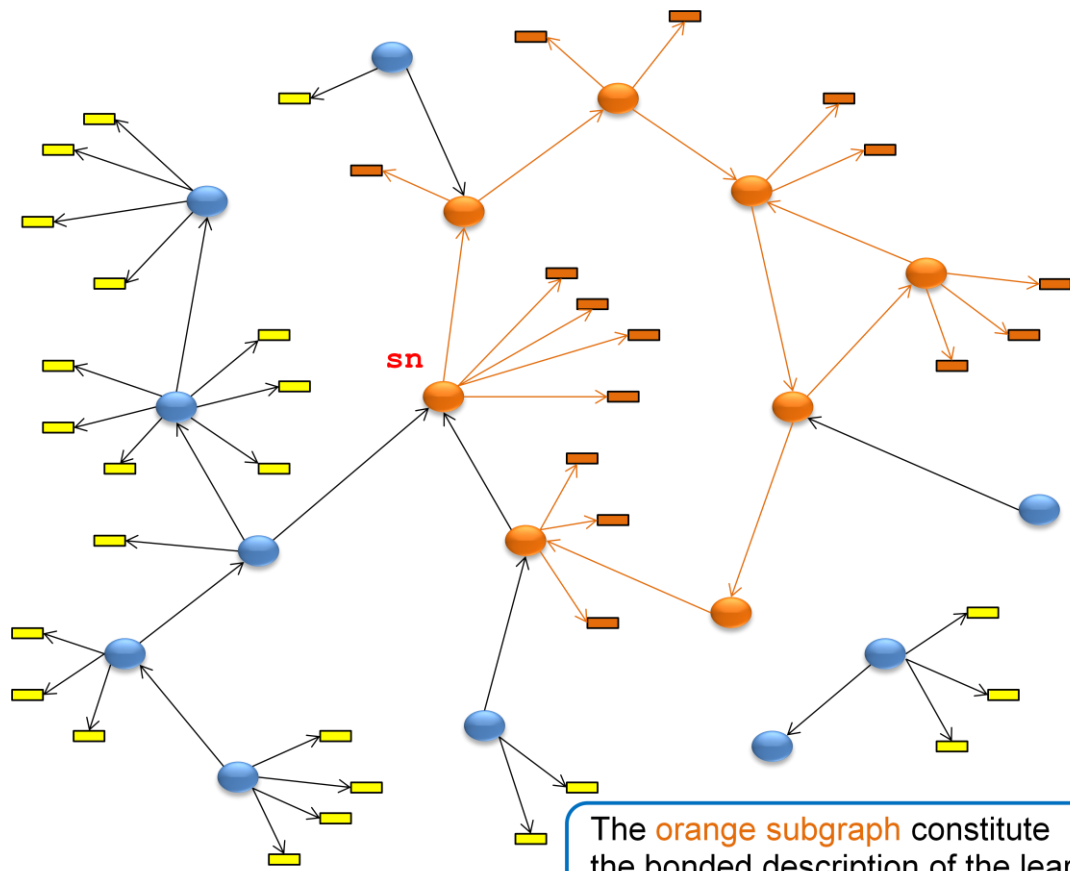
Consider the following RDF graph (the source graph) where the particular learning resource r under consideration is represented by the red node:



The RDF graph, subgraph of the above graph, that we will retain as the description of the learning resource r is noted by $BD(r)$ and is constructed recursively as:

1. Include in $BD(r)$ all statements (triples) in the source graph where the subject of the statement is the starting node sn representing the learning resource r
2. Recursively: for all stm (statement) in $BD(r)$ so far, if the object of stm is a resource then add to $BD(r)$ any statement st of the source graph whose subject is the object of stm , unless the object of st is the resource r
3. When the set $BD(r)$ stabilizes, that is no more statements can be added): Stop!

The following graph illustrate the bounded description $BD(r)$ of the resource r :



Note: if the source graph is VERY large, one could consider limiting the depth of the description and define, for any integer $n \geq 0$, $BD(\mathbf{r}, n)$ as the subset of $BD(\mathbf{r})$ consisting of any statement $s \mathbf{t}$ of the source graph for which there is a path of length $\leq n$ from the node **sn** to the subject of $s \mathbf{t}$.

ANNEX D

Data element specifications for MLR records

D.1 Data element specifications

Record Identifier (DES0100)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0100
<i>Data element specification attributes</i>	
Property name	record identifier
Definition	identifier for the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	URI3986 (ISO_IEC_19788-8:2013::PRS0001)
Refines	-
Example(s)	-
Note(s)	An HTTP URI is the preferred form of URI

Describes (DES0200)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0200
<i>Data element specification attributes</i>	
Property name	describe
Definition	the learning resource described by the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	<i>Learning Resource</i> (ISO_IEC_19788-1:2011::RC0002)

Content value rules	N/A
Refines	-
Example(s)	-
Note(s)	-

Has Record (DES0300)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0300
Data element specification attributes	
Property name	has record
Definition	a <i>MLR Record</i> instance describing the learning resource
Linguistic indicator	non-linguistic
Domain	<i>Learning Resource</i> (ISO_IEC_19788-1:2011::RC0002)
Range	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Content value rules	N/A
Refines	-
Example(s)	-
Note(s)	There may be more than one MLR record describing a learning resource

Language (DES0400)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0400
Data element specification attributes	
Property name	language
Definition	default language code for all literal values in the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic

Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	RS_DES0400
Refines	-
Example(s)	-
Note(s)	-

ID: RS_DES0400

Rule_ID	Rule statement / Example(s) & Note(s)
01	Alpha-3 code from ISO 639-2 or ISO 639-3 as per IETF BCP 47 – Tags for Identifying Languages (see http://tools.ietf.org/html/bcp47)

Type (DES0500)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0500
Data element specification attributes	
Property name	is mutable
Definition	indicates if the <i>MLR Record</i> instance (the MLR record) is a container for data element instances or if it must be considered as a non modifiable object
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	BOOLEAN (ISO_IEC_19788-8:2013::PRS0002)
Refines	-
Example(s)	ISO_IEC_19788-8:2013::VA.2.1:T02 (false)
Note(s)	-

Has Application Profile (DES0600)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0600
Data element specification attributes	
Property name	has application profile
Definition	an application profile the <i>MLR Record</i> instance (the MLR record) under consideration is to be conformant with.
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	URI3986 (ISO_IEC_19788-8:2013::PRS0001)
Refines	-
Example(s)	-
Note(s)	1) An HTTP URI is the preferred form of URI 2) There may be more than one such application profile

Contribution (DES0700)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0700
Data element specification attributes	
Property name	contribution
Definition	a contribution (creation, modification...) to the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	<i>Contribution</i> (ISO_IEC_19788-8:2013::RC0002)
Content value rules	N/A
Refines	-
Example(s)	-

Note(s)	-
---------	---

Record Repository (DES0800)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0800
Data element specification attributes	
Property name	record repository
Definition	a repository containing the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	Le monde en image http://www.ccdm.qc.ca/monde/
Note(s)	-

Record Last Update (DES0900)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES0900
Data element specification attributes	
Property name	record last update
Definition	date/time of the most recent modification to the <i>MLR Record</i> instance (the MLR record)
Linguistic indicator	non-linguistic
Domain	<i>Mutable Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	DATE (ISO_IEC_19788-1:2011::PRS0002)

Refines	-
Example(s)	-
Note(s)	-

Entity (DES1000)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1000
Data element specification attributes	
Property name	entity
Definition	an entity (i.e. person, organization) contributing to the <i>Contribution</i> instance (the contribution)
Linguistic indicator	non-linguistic
Domain	<i>Contribution</i> (ISO_IEC_19788-8:2013::RC0002)
Range	<i>Person</i> (ISO_IEC_19788-1:2011::RC0003)
Content value rules	N/A
Refines	-
Example(s)	-
Note(s)	-

Role (DES1100)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1100
Data element specification attributes	
Property name	entities
Definition	entities (i.e. person, organization) contributing to the <i>Contribution</i> instance (the contribution)
Linguistic indicator	non-linguistic
Domain	<i>Contribution</i> (ISO_IEC_19788-8:2013::RC0002)

Range	Seq(Person) ⁴⁹
Content value rules	N/A
Refines	-
Example(s)	-
Note(s)	-

[R0001] All entities in an instance of the Resource class Seq(Person) play the same role (see DES1200).

[R0002] Entities in an instance of Seq(Person) are ordered according to the importance of their contribution.

Role (DES1200)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1200
Data element specification attributes	
Property name	role
Definition	nature of contribution made by the entity/entities participating to this <i>Contribution</i> instance
Linguistic indicator	non-linguistic
Domain	<i>Contribution</i> (ISO_IEC_19788-8:2013::RC0002)
Range	literal
Content value rules	RS_DES1200
Refines	-
Example(s)	ISO_IEC_19788-8:2013::VA2.2:T001 (creator)
Note(s)	-

ID: RS_DES1200	
Rule_ID	Rule statement / Example(s) & Note(s)
01	A term identifier for vocabulary ISO_IEC_19788-8:2013::VA.2

⁴⁹ For the construct Seq(Person) see document WG4 N0340, annex F

Date (DES1300)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1300
<i>Data element specification attributes</i>	
Property name	date
Definition	date of the contribution
Linguistic indicator	non-linguistic
Domain	<i>Contribution</i> (ISO_IEC_19788-8:2013::RC0002)
Range	literal
Content value rules	DATE (ISO_IEC_19788-1:2011::PRS0002)
Refines	-
Example(s)	-
Note(s)	-

Original Record (DES1400)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1400
<i>Data element specification attributes</i>	
Property name	original record
Definition	when a record is the result of a crosswalk mapping, identification of the original record
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-

Example(s)	-
Note(s)	-

Original Record Format (DES1500)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1500
Data element specification attributes	
Property name	original record format
Definition	when a record is the result of a crosswalk mapping, format of the original record
Linguistic indicator	non-linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

Conversion Software (DES1600)

Data element specification	
Identifier	ISO_IEC_19788-8:2013::DES1600
Data element specification attributes	
Property name	conversion software
Definition	when a record is the result of a crosswalk mapping, indication of the conversion software used for the conversion
Linguistic indicator	linguistic
Domain	<i>MLR Record</i> (ISO_IEC_19788-8:2013::RC0001)
Range	literal

Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

D.2 Resource classes

D.2.1 Predefined rule sets from Part 1 and other Parts

For the purposes of this Part, the following resources classes from ISO/IEC 19788-1 apply:

ISO_IEC_19788-1:2011::RC0002 (*Learning Resource*)

ISO_IEC_19788-1:2011::RC0003 (*Person*)

D.2.2 Resource classes defined in this Part

Resource class “MLR Record”

Identifier	ISO_IEC_19788-8:2013::RC0001
Name	<i>MLR Record</i>
Definition	Set/Class of all MLR records
SubclassOf	ISO_IEC_19788-1:2011::RC0001 (<i>Resource</i>)
Note	-

Resource class “Contribution”

Identifier	ISO_IEC_19788-8:2013::RC0002
Name	<i>Contribution</i>
Definition	Set of all activities that affects the state of a project/work during its life cycle (e.g., creation, validation).
SubclassOf	ISO_IEC_19788-1:2011::RC0001 (<i>Resource</i>)
Note	-

Resource class “Mutable Record”

Identifier	ISO_IEC_19788-8:2013::RC0003
Name	<i>Mutable Record</i>

Definition	Subset/Subclass of <i>MRL Record</i> consisting of the mutable MLR records
SubclassOf	ISO_IEC_19788-8:2013::RC0001 (<i>MLR Record</i>)
Note	-

D.3 Predefined rule sets

D.3.1 Predefined rule sets from Part 1 and other Parts

For the purposes of this Part, the following predefined rule sets from ISO/IEC 19788-1 apply:

ISO_IEC_19788-1:2011::PRS0001 (MLR STRING)

ISO_IEC_19788-1:2011::PRS0002 (DATE)

D.3.2 Rule sets defined in this Part

URI3986

ID: ISO_IEC_19788-8:2013::PRS0001 Name: URI3986	
Rule_ID	Rule statement / Example(s) & Note(s)
01	A character string constructed according to RFC 3986, that is a URI

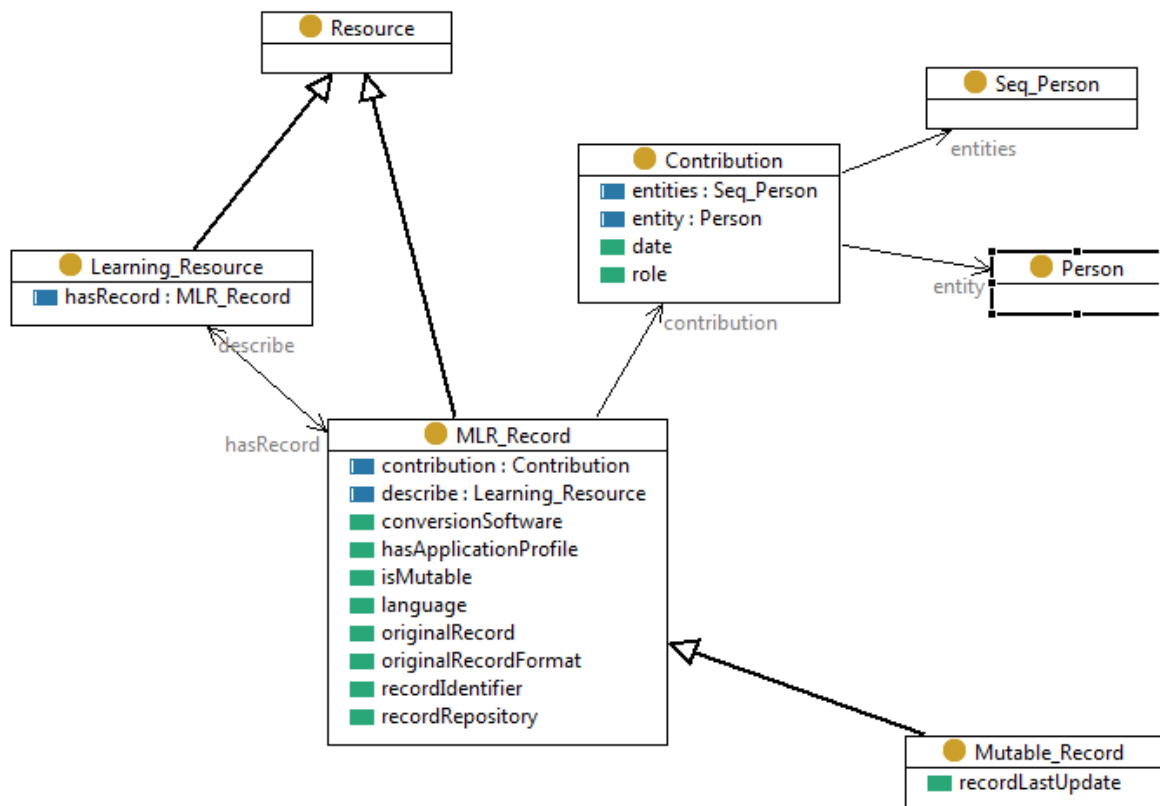
BOOLEAN

ID: ISO_IEC_19788-8:2013::PRS0002 Name: BOOLEAN	
Rule_ID	Rule statement / Example(s) & Note(s)
01	A character string representing the logical value true or false, using identifiers for the vocabulary ISO_IEC_19788-8:2013::VA.2 (Boolean literals)

D.4 Predefined Data Element Group Specifications (DEGS)

N/A

D.5 Diagram of classes and their properties



D.6 Human interface equivalents: English, French and Russian

D.6.1 DES property names

DES identifier	English	French	Russian
ISO_IEC_19788-8:2013::DES0100	record identifier	identifiant de fiche	<tbc>
ISO_IEC_19788-8:2013::DES0200	describe	décrit	<tbc>
ISO_IEC_19788-8:2013::DES0300	has record	fiche	<tbc>
ISO_IEC_19788-8:2013::DES0400	language	langue	<tbc>
ISO_IEC_19788-8:2013::DES0500	is mutable	est mutable	<tbc>
ISO_IEC_19788-8:2013::DES0600	has application profile	profil d'application	<tbc>
ISO_IEC_19788-8:2013::DES0700	contribution	contribution	<tbc>
ISO_IEC_19788-8:2013::DES0800	record repository	référentiel	<tbc>
ISO_IEC_19788-8:2013::DES0900	record last update	dernière mise à jour	<tbc>
ISO_IEC_19788-8:2013::DES1000	entity	entité	<tbc>
ISO_IEC_19788-8:2013::DES1100	entities	entités	<tbc>
ISO_IEC_19788-8:2013::DES1200	role	rôle	<tbc>
ISO_IEC_19788-8:2013::DES1300	date	date	<tbc>

ISO_IEC_19788-8:2013::DES1400	original record	fiche originale	<tb>
ISO_IEC_19788-8:2013::DES1500	original record format	format de la fiche originale	<tb>
ISO_IEC_19788-8:2013::DES1600	conversion software	logiciel de conversion	<tb>

D.6.2 Resource class names

Resource identifier	English	French	Russian
ISO_IEC_19788-8:2013::RC0001	MLR Record	Enregistrement MLR	<tb>
ISO_IEC_19788-8:2013::RC0001	Contribution	Contribution	<tb>
ISO_IEC_19788-8:2013::RC0001	Mutable Record	Enregistrement mutable	<tb>

D.6.3 Rule set names

Rule set identifier	English	French	Russian
ISO_IEC_19788-8:2011::PRS0001	URI3986	URI3986	URI3986

D.6.4 Predefined data element group specification names

N/A

D.7 MLR vocabularies

D.7.1 Boolean literals

Vocabulary				
Identifier		ISO_IEC_19788-8:2013::VA.1		
Name		Boolean literals		
Extension of		–		
ID	Related concept	Term	Definition	Language code ⁵⁰
T010		true	logical value true	eng
		vrai	valeur logique vrai	fra
		правда	логическое значение правда	rus
T020		false	logical value false	eng
		faux	valeur logique faux	fra
		ложных	логическое значение ложных	rus

⁵⁰ From ISO 639-3

D.7.2 Contribution role

Vocabulary				
Identifier		ISO_IEC_19788-8:2013::VA.2		
Name		Contribution role		
Extension of		–		
ID	Related concept	Term	Definition	Language code ⁵¹
T010		creator	<tbc>	eng
		créateur	<tbc>	fra
		<tbc>	<tbc>	rus
T020		validator	<tbc>	eng
		validateur	<tbc>	fra
		<tbc>	<tbc>	rus

⁵¹ From ISO 639-3

ANNEX E

Data element specifications for Persons

E.1 Data element specifications

Identifier (DES0100)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0100
Data element specification attributes	
Property name	identifier
Definition	an alphanumeric string uniquely associated with a person that serves to differentiate that person from other person (see [31], 9.18.1.1)
Linguistic indicator	linguistic
Domain	<i>Person</i> (ISO_IEC_19788-1:2011::RC0003)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	Library of Congress control number: nb2001032740
Note(s)	Precede the identifier with the name of the entity responsible for assigning the identifier

Name (DES0200)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0200
Data element specification attributes	
Property name	name of Person
Definition	word, phrase, character, or group of characters by which a person is known (see [31], 9.2.1.1)
Linguistic indicator	linguistic
Domain	<i>Person</i> (ISO_IEC_19788-1:2011::RC0003)
Range	literal

Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	سدينا ايدن
Note(s)	-

Family Name (DES0300)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0300
Data element specification attributes	
Property name	family name
Definition	a name used to identify the members of a family (as distinguished from each member's given name)
Linguistic indicator	linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	foaf:familyName
Example(s)	-
Note(s)	-

Given Name (DES0400)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0400
Data element specification attributes	
Property name	given name
Definition	a personal name that specifies and differentiates between members of a group of individuals, especially in a family, all of whose members usually share the same family name
Linguistic indicator	linguistic

Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	foaf:givenName
Example(s)	-
Note(s)	-

Name (DES0500)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0500
Data element specification attributes	
Property name	name
Definition	word, phrase, character, or group of characters by which a person is known (see [31], 9.2.1.1)
Linguistic indicator	linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	ISO_IEC_19788-9:2013::DES0200 (name of Person), foaf:name
Example(s)	-
Note(s)	-

SkypeID (DES0600)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0600
Data element specification attributes	
Property name	skypeID
Definition	account name of a Skype account of the person
Linguistic indicator	non-linguistic

Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001) ⁵²
Refines	foaf:SkypeID
Example(s)	gilles.gauthier3
Note(s)	-

vCard N (DES0700)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0700
<i>Data element specification attributes</i>	
Property name	vCard N
Definition	vCard structured person's name. A list of component separated by semi-colon as per the vCard 3.0 specification
Linguistic indicator	linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

vCard FN (DES0800)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0800
<i>Data element specification attributes</i>	
Property name	vCard FN

⁵² If there is a mandatory structure in the syntax of skype ID, this should be made more precise using a rule set.

Definition	vCard formatted person's name. The name by which the person is commonly known. It should conform to the naming conventions of the person's country or culture
Linguistic indicator	linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

Email (DES0900)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES0900
Data element specification attributes	
Property name	email
Definition	an Internet electronic address that belongs to the person
Linguistic indicator	non-linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

Work Telephone (DES1000)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1000
Data element specification attributes	

Property name	work telephone
Definition	person's telephone at work
Linguistic indicator	non-linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	-
Note(s)	-

Work For (DES1100)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1100
Data element specification attributes	
Property name	work for
Definition	an organization the person works for
Linguistic indicator	non-linguistic
Domain	<i>Natural Person</i> (ISO_IEC_19788-9:2013::RC0001)
Range	<i>Organization</i> (ISO_IEC_19788-9:2013::RC0002)
Content value rules	-
Refines	-
Example(s)	-
Note(s)	-

vCard ORG (DES1200)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1200
Data element specification attributes	

Property name	vCard ORG
Definition	organization with which the person is associated
Linguistic indicator	linguistic
Domain	<i>Organization</i> (ISO_IEC_19788-9:2013::RC0002)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001)
Refines	-
Example(s)	Université du Québec à Montréal, Département d'informatique
Note(s)	-

Location (DES1300)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1300
Data element specification attributes	
Property name	location
Definition	geographic location of the organization
Linguistic indicator	non-linguistic
Domain	<i>Organization</i> (ISO_IEC_19788-9:2013::RC0002)
Range	<i>Geographical Location</i> (ISO_IEC_19788-9:2013::RC0003)
Content value rules	-
Refines	-
Example(s)	-
Note(s)	-

Longitude (DES1400)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1400
Data element specification attributes	

Property name	longitude
Definition	angle, in degrees, of a position on Earth east or west from a reference line, the line running between the poles passing through Greenwich, England
Linguistic indicator	non-linguistic
Domain	<i>Geographical Location</i> (ISO_IEC_19788-9:2013::RC0003)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001) ⁵³
Refines	-
Example(s)	73°34' W
Note(s)	-

Latitude (DES1500)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1500
Data element specification attributes	
Property name	latitude
Definition	angle, in degrees, of a position on Earth above the equator. (Latitude is negative for a place below the equator.)
Linguistic indicator	non-linguistic
Domain	<i>Geographical Location</i> (ISO_IEC_19788-9:2013::RC0003)
Range	literal
Content value rules	MLR STRING (ISO_IEC_19788-1:2011::PRS0001) ⁵⁴
Refines	-
Example(s)	45°30' N
Note(s)	-

⁵³ A rule set prescribing a mandatory syntax for the latitude should be added here

⁵⁴ A rule set prescribing a mandatory syntax for the latitude should be added here

Representation (DES1600)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1600
Data element specification attributes	
Property name	representation
Definition	digital media providing a description of the location
Linguistic indicator	non-linguistic
Domain	<i>Geographical Location</i> (ISO_IEC_19788-9:2013::RC0003)
Range	<i>Digital Media</i> (ISO_IEC_19788-9:2013::RC0004)
Content value rules	-
Refines	-
Example(s)	-
Note(s)	-

Description (DES1700)

Data element specification	
Identifier	ISO_IEC_19788-9:2013::DES1700
Data element specification attributes	
Property name	description
Definition	document describing the location
Linguistic indicator	linguistic
Domain	<i>Geographical Location</i> (ISO_IEC_19788-9:2013::RC0003)
Range	literal
Content value rules	URI3986 (ISO_IEC_19788-8:2013::PRS0001)
Refines	-
Example(s)	http://www.ugam.ca/campus/pavillons/pk.htm
Note(s)	-

E.2 Resource classes

E.2.1 Predefined rule sets from Part 1 and other Parts

For the purposes of this Part, the following resources classes from ISO/IEC 19788-1 apply:

ISO_IEC_19788-1:2011::RC0003 (*Person*)

E.2.2 Resource classes defined in this Part

Resource class “*Natural PersonOrganization*”

Identifier	ISO_IEC_19788-9:2013::RC0001
Name	<i>Natural Person</i>
Definition	Subset/Subclass of resource class <i>Person</i> consisting of human persons
SubclassOf	ISO_IEC_19788-1:2011::RC0003 (<i>Person</i>)
Note	

Resource class “*Organization*”

Identifier	ISO_IEC_19788-9:2013::RC0002
Name	<i>Organization</i>
Definition	Subset/Subclass of resource class <i>Person</i> consisting of legal organizations
SubclassOf	ISO_IEC_19788-1:2011::RC0003 (<i>Person</i>)
Note	

Resource class “*Geographical Location*”

Identifier	ISO_IEC_19788-9:2013::RC0003
Name	<i>Geographical Location</i>
Definition	A geographical location on Earth
SubclassOf	
Note	

Resource class “*Digital Media*”

Identifier	ISO_IEC_19788-9:2013::RC0004
Name	<i>Digital Media</i>

Definition	Any electronic media that is created and displayed using computer technology, such as digital photos, digital audio, digital video...
SubclassOf	
Note	

E.3 Predefined rule sets

E.3.1 Predefined rule sets from Part 1 and other Parts

For the purposes of this Part, the following predefined rule sets from ISO/IEC 19788-1 apply:

ISO_IEC_19788-1:2011::PRS0001 (MLR STRING)

ISO_IEC_19788-8:2013::PRS0001 (URI3986)

E.3.2 Rule sets defined in this Part

N/A

E.4 Predefined Data Element Group Specifications (DEGS)

FOAF Data Element Group Specification

Data element group specification						
Identifier (DEGS_Identifier)	ISO_IEC_19788-9:2013::DEGS0001					
Name (ISO English)	FOAF Data Element Group Specification					
Description	Proposed set of DESG for the description of a natural person. Refines the FOAF vocabulary specification (see [29])					
Position	DES_Identifier / DEGS_Identifier	Name (ISO English)	Presence type indicator	Repeatability indicator	Order indicator	Order semantic
(01)	(02)	(03)	(04)	(05)	(06)	(07)
1	ISO_IEC_19788-9:2013::DES0300	family name	optional	repeatable	unordered	-
2	ISO_IEC_19788-9:2013::DES0400	given name	optional	repeatable	un ordered	-
3	ISO_IEC_19788-9:2013::DES0500	name	mandatory	repeatable	unordered	-
4	ISO_IEC_19788-9:2013::DES0600	skypeID	optional	repeatable	unordered	-

vCard 3.0 Data Element Group Specification

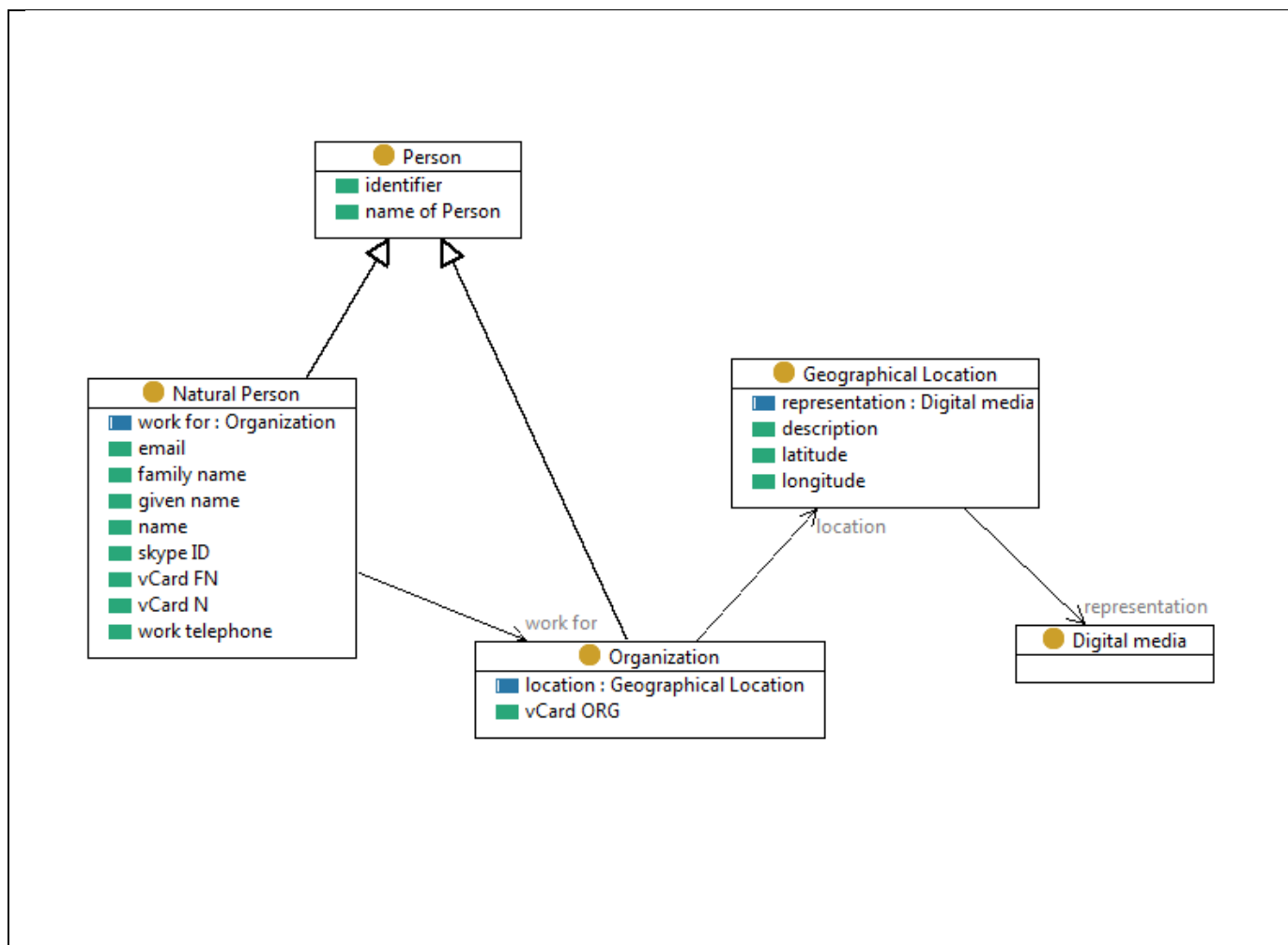
Data element group specification	
Identifier (DEGS_Identifier)	ISO_IEC_19788-9:2011::DEGS0002
Name (ISO English)	vCard 3.0 Data Element Group Specification
Description	Proposed set of DESG for the description of a natural person. Refines the FOAF vocabulary specification (see [30])

Position	DES_Identifier / DEGS_Identifier	Name (ISO English)	Presence type indicator	Repeatability indicator	Order indicator	Order semantic
(01)	(02)	(03)	(04)	(05)	(06)	(07)
1	ISO_IEC_19788- 9:2013::DES0700	vCard N	mandatory	repeatable	unordered	-
2	ISO_IEC_19788- 9:2013::DES0800	vCard FN	mandatory	repeatable	unordered	-
3	ISO_IEC_19788- 9:2013::DES1200	vCard ORG	conditional C0001	repeatable	unordered	-
4	ISO_IEC_19788- 9:2013::DES1100	work for	optional	repeatable	unordered	-

Condition Table

Code ID	Conditions
C0001	For all instance x of Person, if one has <x,work For, y> then one must provide the a vCard ORG content for y.

E.5 Diagram of classes and their properties



E.6 Human interface equivalents: English, French and Russian

E.6.1 DES property names

DES identifier	English	French	Russian
ISO_IEC_19788-9:2013::DES0100	identifier	identifiant	<tbc>
ISO_IEC_19788-9:2013::DES0200	name of Person	nom de la Personne	<tbc>
ISO_IEC_19788-9:2013::DES0300	family name	nom de famille	<tbc>
ISO_IEC_19788-9:2013::DES0400	given name	prénom	<tbc>
ISO_IEC_19788-9:2013::DES0500	name	nom	<tbc>
ISO_IEC_19788-9:2013::DES0600	skypeID	Identifiant Skype	<tbc>
ISO_IEC_19788-9:2013::DES0700	vCard N	vCard N	<tbc>
ISO_IEC_19788-9:2013::DES0800	vCard FN	vCard FN	<tbc>
ISO_IEC_19788-9:2013::DES0900	email	courriel	<tbc>
ISO_IEC_19788-9:2013::DES1000	work telephone	téléphone au travail	<tbc>
ISO_IEC_19788-9:2013::DES1100	work for	employeur	<tbc>
ISO_IEC_19788-9:2013::DES1200	vCard ORG	vCard ORG	<tbc>

ISO_IEC_19788-9:2013::DES1300	location	localisation	<tb>
ISO_IEC_19788-9:2013::DES1400	longitude	longitude	<tb>
ISO_IEC_19788-9:2013::DES1500	latitude	latitude	<tb>
ISO_IEC_19788-9:2013::DES1600	representation	représentation	<tb>
ISO_IEC_19788-9:2013::DES1700	description	description	<tb>

E.6.2 Resource class names

Resource identifier	English	French	Russian
ISO_IEC_19788-9:2013::RC0001	Natural Person		<tb>
ISO_IEC_19788-9:2013::RC0001	Organization		<tb>
ISO_IEC_19788-9:2013::RC0001	Geographical Location		<tb>
ISO_IEC_19788-9:2013::RC0001	Digital Media		<tb>

E.6.3 Rule set names

N/A

E.6.4 Predefined data element group specification names

DEGS identifier	English	French	Russian
ISO_IEC_19788-9:2013::DEGS0001	FOAF Data Element Group Specification		<tb>
ISO_IEC_19788-9:2013::DEGS0002	vCard 3.0 Data Element Group Specification		<tb>

E.7 MLR vocabularies

N/A

ANNEX F

From LOM records to MLR records

F.1 Normetic 2.0 application profile

GTN-Québec is working on Normetic 2.0 (see [24]), the second edition of its LOM based application profile Normetic 1.2 (see [25]). Normetic 2.0 is an example of an ISO/IEC 19788 Application profile.

In order for Normetic 2.0 to gain acceptance, it is necessary to be able to transform IEEE 1484.12.1-2002 (LOM) records into MLR records and to provide a tool to do so. It will also be necessary to transform LOM repositories into Normetic 2.0 compliant repositories.

F.2 LOM2MLR

First explorations for a crosswalk between LOM and MLR are to be found in MLR Bindings (RDF, XML and others): First exploration (see [26], sections 6.7 and 7).

GTN-Québec is working on a tool to transform a LOM record into a MLR record. Discussions concerning the different choices to be made and heuristics to be considered for the crosswalk, and the LOM2MLR tool under development (in Python) to automate the transformations is available in the github repository under the names GTN-Quebec and ggauthier:

<https://github.com/GTN-Quebec/lom2mlr>, and

<https://github.com/ggauthier/lom2mlr> (forked from GTN-Quebec/lom2mlr)

These two branches should be merged in the near future.

Collaboration on GTN-Quebec/lom2mlr is most welcome.

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