

MCV Ontology

Deliverable 2

ESSnet on SDMX - Work Package 2

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Introduction

The report was produced by the working group of the ESSnet on SDMX-Work Package 2-*MCV Ontology*, with the following participants: Isabel Morgado, Sérgio Bacelar, Luísa Saraiva, Olga Mendes, from Statistics Portugal, and by the consultants Prof. Christophe Roche (PhD) from Université de Savoie (France) and Prof. Rute Costa (PhD) from Universidade Nova de Lisboa (Portugal).

To begin with we refer the purpose, domain and scope of the ontology we are building and the work done so far. Secondly we unfold the methodology of work: the analysis of MCV and other supporting documents of SDMX initiative, the identification of key concepts and the choice of the sub-domain *data and metadata exchange* as a starting-point. Thirdly we show the respective results defining the concepts in formal and natural language, we evaluate the work done and forecast the work we intend to do in the next phase of the project. Finally we present two annexes: annex 1 displays the explanation of the type of definitions used in natural language, as well as the conventions to build concept maps diagrams using *IHMC CMapTools* in formal language; annex 2 displays the representation in OWL.

Purpose

This report is meant to present the sub-domain *data and metadata exchange*, bearing in mind that the final aim on building the ontology is to create conditions to develop a new version of the MCV.

Domain and scope

The broader framework of the work and goal is the statistical metadata domain.

Besides all other statistical processes that occur in a statistics organization, the main focus was settled by the working group in the usage of metadata within the process of *data and metadata exchange* in the context of the SDMX initiative, being aware that the correspondent concepts were grouped to help organizations in its implementation.

This report is thus meant to show the sub domain we chose to start to work *data and metadata exchange* and which we consider the core of the SDMX.

The prime target of the ontology will be as varied as *data providers*, *data consumers* and/or *maintenance agencies*, thus implying that the ontology is meant to be widely known and applied.

Methodology of work

The working group started with the analysis of the MCV version of 2009, namely the terms and definitions, aiming to grab the underlying conceptual structure of its organization. The heterogeneous and interdisciplinary nature of metadata available in the MCV, however, soon made it clear that the MCV alone would not be enough to develop our work.

The fact of MCV being a subset of the Content-oriented Guidelines meant to support the implementation of the SDMX standard on the exchange of statistical information led the working group to the conviction that other sources within the SDMX initiative should be consulted, such as the *User guide* as well as the *SDMX Information Model* (SDMX-IM).

The *SDMX Information Model* (SDMX-IM) is one of the documents of the SDMX standard that identifies the main concepts of SDMX and their relationships. In order to better understand its class diagrams, the working group analysed files stored in the SDMX registry, as a first approach to the ontology, which led us to the building of the concepts *Data structure definition* (DSD) and *Metadata structure definition* (MSD) according to a very detailed level of analysis and representation.

The choice and identification of the sub domain *data and metadata exchange* as the point of departure, led us to gather all the concepts we envisaged as being related to that subject, establishing and representing the correspondent relationships between them.

Results and evaluation

Results

a) Definitions of concepts in formal and natural language

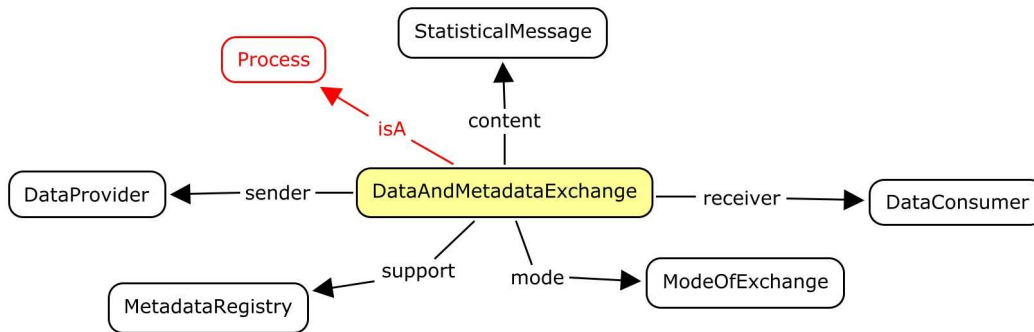


Diagram 1 – Data and metadata exchange

1. data and metadata exchange

definition: process of exchanging data and/or metadata statistical messages, between a data provider and a data consumer, supported by a metadata registry in accordance to a mode of exchange.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

note: new term

synonym: data interchange

2. process

definition: a complete set of procedures carried out in an activity.

source: SDMX (2009), ESSNET on SDMX, WP2, 2010

note: new term

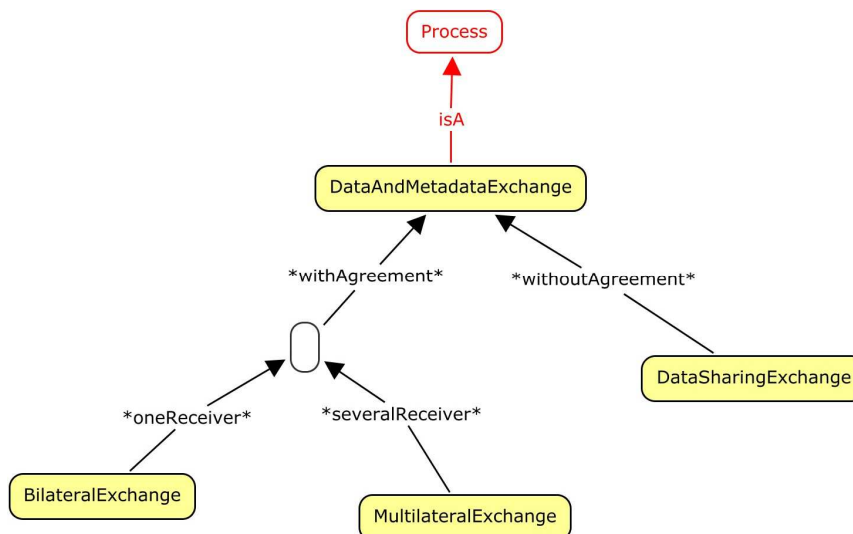


Diagram 2 – Data and metadata exchange process

3. bilateral exchange

definition: process of exchanging data and/or metadata between a data provider and a data consumer where all parties agree on all aspects of the exchange process.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

4. multilateral exchange

definition: process of exchanging data and/or metadata between a data provider and several data consumers where all parties agree on all aspects of the exchange.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

5. data sharing exchange

definition: process of exchanging data and/or metadata that do not require an agreement between data providers and data consumers but only the adherence to the standards.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition



Diagram 3 – Gateway exchange

6. gateway exchange

definition: an organized set of bilateral exchange processes.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

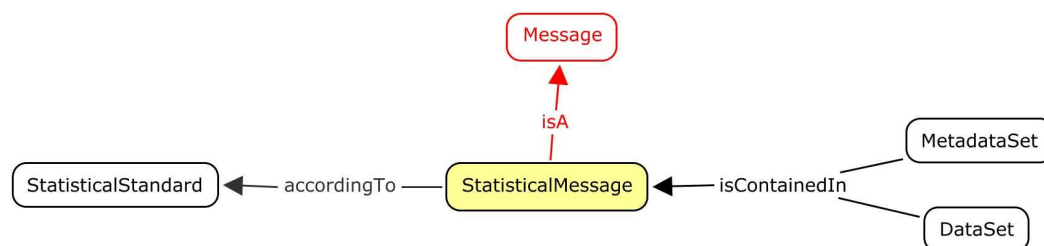


Diagram 4 – Statistical message

7. statistical message

Definition: message carrying a data set or a metadata set according to a statistical standard.

Source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

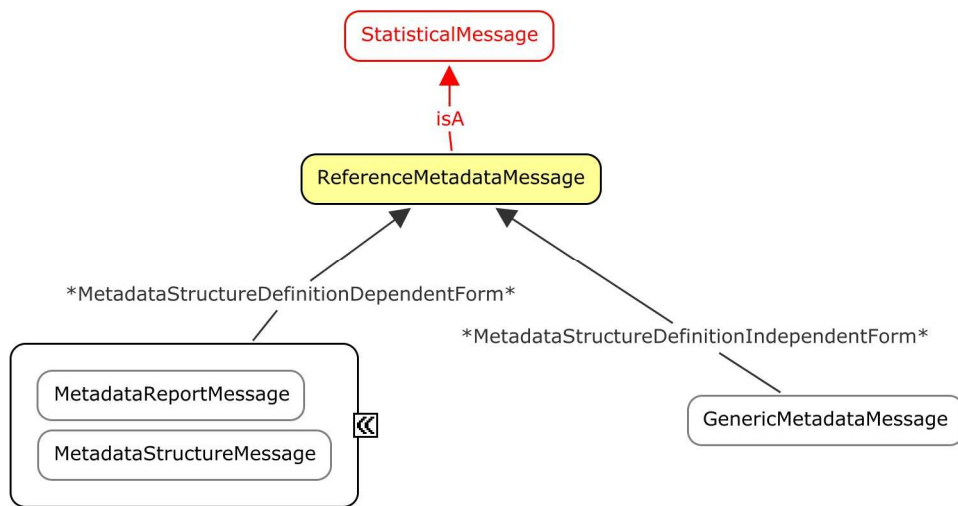


Diagram 5 – Reference metadata message

8. reference metadata message

definition: statistical message exchanged in the context of data and/or metadata exchange process.

source: SDMX, *User guide* (2009)

note: new term

9. metadata report message

definition: reference metadata message that provides the exchange of reference metadata according to a specific metadata structure definition.

source: SDMX, *User guide* (2009)

note: new term

10. metadata structure message

definition: reference metadata message that contains a metadata structure definition.

source: SDMX, *User guide* (2009)

note: new term

11. generic metadata message

definition: reference metadata message that conveys reference metadata in a metadata structure definition independent form.

source: SDMX, *User guide* (2009)

note: new term

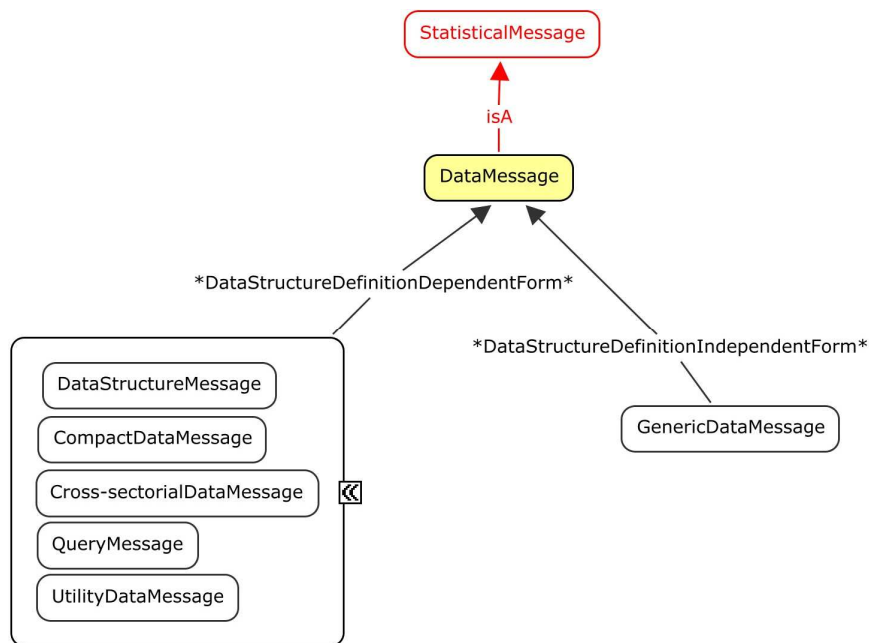


Diagram 6 – Data message

12. data message

definition: statistical message exchanged in the context of data and/or metadata exchange process.

source: SDMX, *User guide* (2009)

note: new term

13. data struture message

definition: data message that contains a data structure definition.

source: SDMX, *User guide* (2009)

note: new term

14. generic data message

definition: data message that conveys data in an data structure definition independent form.

source: SDMX, *User guide* (2009)

note: new term

15. compact data message

definition: data message that provides the exchange of large data sets in a data structure definition dependent form.

source: SDMX, *User guide* (2009)

note: new term

16. utility data message

definition: data message in a data structure definition dependent form that is used for schema-based functions.

source: SDMX, *User guide* (2009)

note: new term

17. query message

definition: data message aimed to query a database to obtain an SDMX-ML message as result.

source: SDMX, *User guide* (2009)

note: new term

18. cross-sectorial data message

definition: data message in a data structure definition dependent form aimed to exchange many observation types

source: SDMX, *User guide* (2009)

note: new term

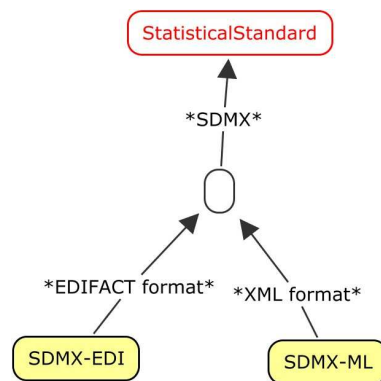


Diagram 7 – Statistical standard

19. statistical standard

definition: agreed rule or guideline on how one or more parts of the statistical business process should be carried out, conforming with requirements for professionalism.

source: SDMX (2009)

Note: updated definition

20. SDMX-EDI

Definition: EDIFACT format to exchange SDMX-structured data and metadata.

Source: SDMX (2009)

21. SDMX-ML

Definition: XML format to exchange SDMX-structured data and metadata.

Source: SDMX (2009)

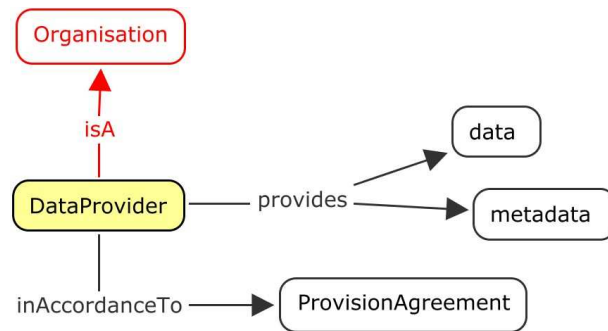


Diagram 8 – Data provider

22. organisation

definition: a unique framework of authority within which a person or person act, or are designated to act, towards some purpose.

Source: ISO/IEC Committee Draft 11179-3: 2007, Information technology - Metadata Registries (MDR) - Part 3: Registry Metamodel and basic attributes, August 2007

23. data provider

Definition: organisation which provides data and/or metadata in accordance to an established provision agreement.

Source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

Synonym: sending organisation

24. data

definition: characteristics or information, usually numerical, that are collected through observation.

source: The International Statistical Institute, "The Oxford Dictionary of Statistical Terms", edited by Yadolah Dodge, Oxford University Press, 2003

25. metadata

definition: data that define and describe other data.

source: ISO/IEC FDIS 11179-1 : 2004. *Information technology - Metadata registries – Part 1: Framework.*

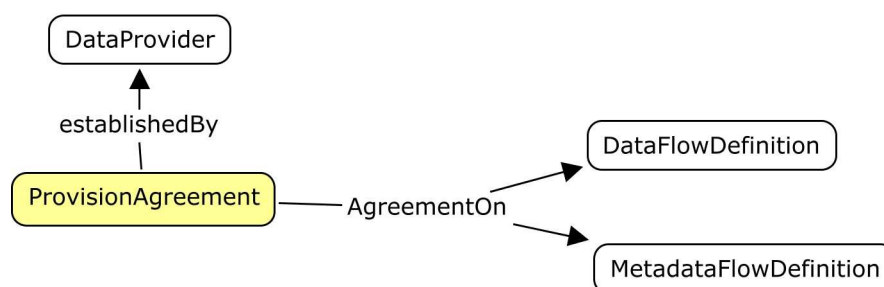


Diagram 9 – Provision agreement

26. provision agreement

definition: agreement on a dataflow definition or a metadataflow definition established by a data provider.

Source: SDMX (2009); ESSNET on SDMX, WP2, 2010

Note: updated definition

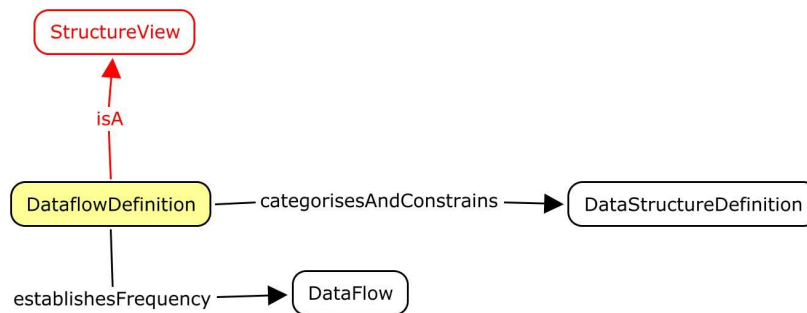


Diagram 10 – Dataflow definition

27. dataflow definition

definition: a structure view which establishes the frequency of a data flow and also categorises and constrains a data structure definition.

source: SDMX (2009); ESSNET on SDMX, WP2, 2010

note: updated definition

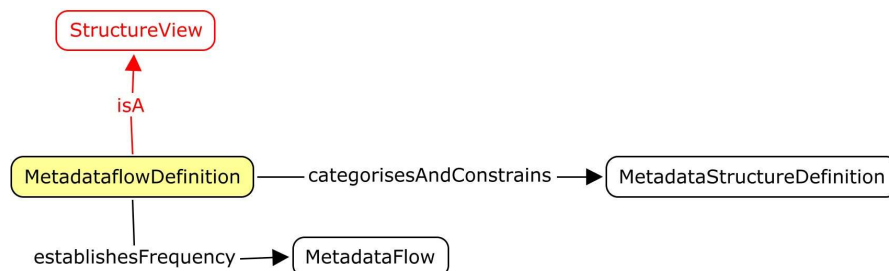


Diagram 11 – Metadataflow definition

28. metadataflow definition

definition: a structure view which establishes the frequency of a metadata flow and also categorises and constrains a metadata structure definition.

source: SDMX (2006); ESSNET on SDMX, WP2, 2010

note: updated definition

29. frequency

definition: the time interval at which observations occur over a given time period.

source: SDMX (2009)

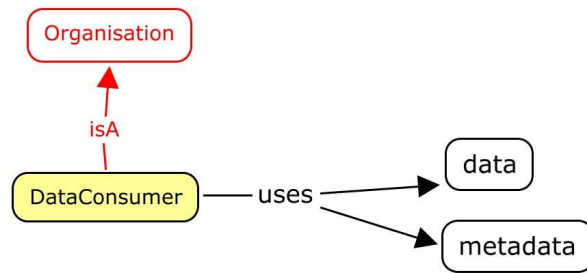


Diagram 12 – Data consumer

30. data consumer

definition: organisation which uses data and/or metadata as input for further processing.

source: SDMX (2009)

synonym: receiving organisation

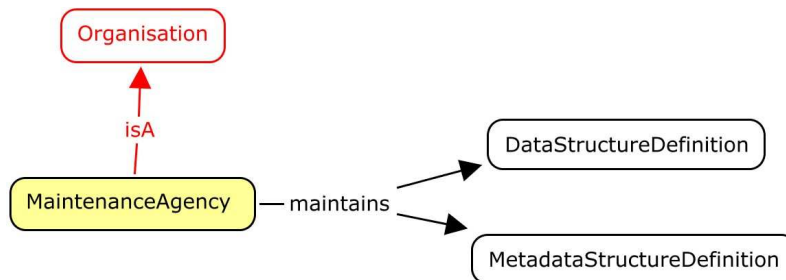


Diagram 13 - Maintenance agency

31. maintenance agency

definition: organisation that maintains domain-specific data and metadata structure definitions.

source: SDMX (2009)

Note: updated definition

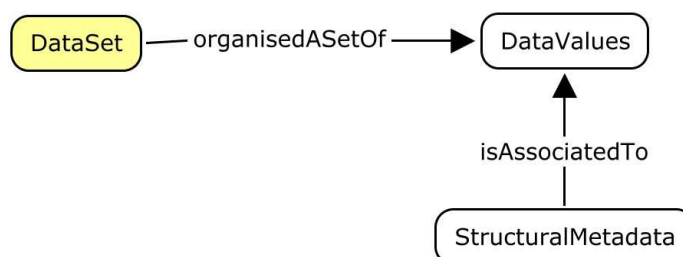


Diagram 14 – Data set

32. data set

definition: organised a set of data values and their associated structural metadata.

source: Economic Commission for Europe of the United Nations (UNECE), "Glossary of Terms on Statistical Data Editing", Conference of European Statisticians Methodological material, Geneva, 2000; updated by ESSNET on SDMX, WP2, 2010

Note: updated definition

33. structural metadata

definition: metadata that act as identifiers and descriptors of the data.

source: SDMX (2009)

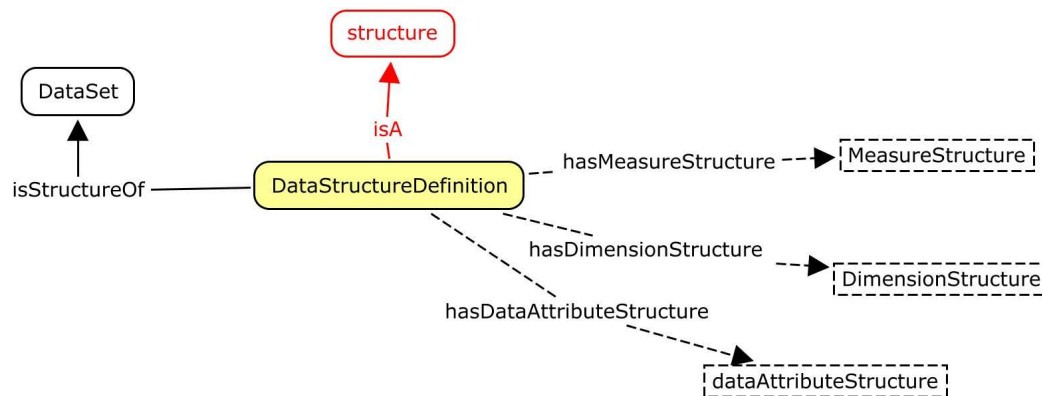


Diagram 15 - Data structure definition

34. data structure definition

definition: structure of a data set, composed by descriptor concepts organized in a measure structure, a dimension structure and a data attribute structure.

source: SDMX (2009); updated by ESSNET on SDMX, WP2, 2010

Note: updated definition

35. structure

definition: pattern or model consisting of a group of elements that is specifically organized to identify and represent a set of features or categories.

source: SDMX (2009); updated by ESSNET on SDMX, WP2, 2010

Note: updated definition

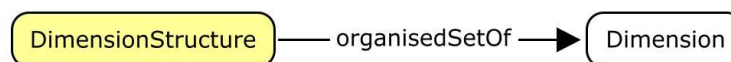


Diagram 16 - Dimension structure

36. dimension structure

definition: organised set of dimensions.

source: ESSNET on SDMX, WP2, 2010

note: new term



Diagram 17 - Dimension

37. dimension

definition: statistical concept used, in combination with other statistical concepts, to identify and describe a data object.

source: SDMX (2009), ESSNET on SDMX, WP2, 2010

Note: updated definition

38. statistical concept

definition: statistical characteristic of data

source: SDMX (2009)

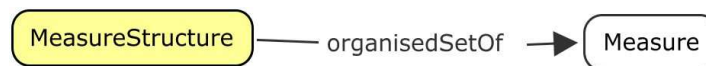


Diagram 18 - Measure structure

39. measure structure

definition: organised set of measures.

source: ESSNET on SDMX, WP2, 2010

note: new term

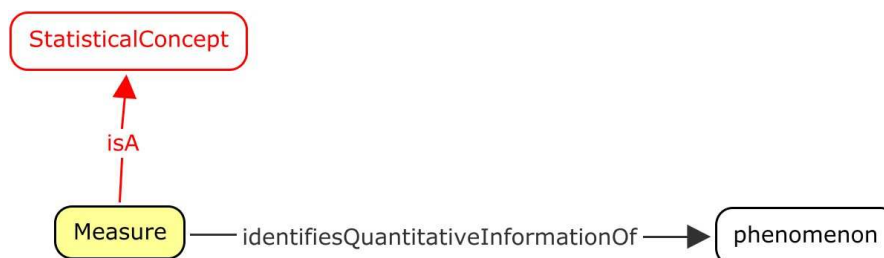


Diagram 19 - Measure

40. measure

definition: statistical concept identifying a phenomenon for which quantitative information is provided.

source: SDMX (2009); updated by ESSNET on SDMX, WP2, 2010

Note: updated definition

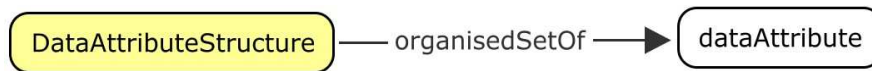


Diagram 20 - Data attribute structure

41. data attribute structure

definition: organised set of data attributes.

source: ESSNET on SDMX, WP2, 2010

note: new term

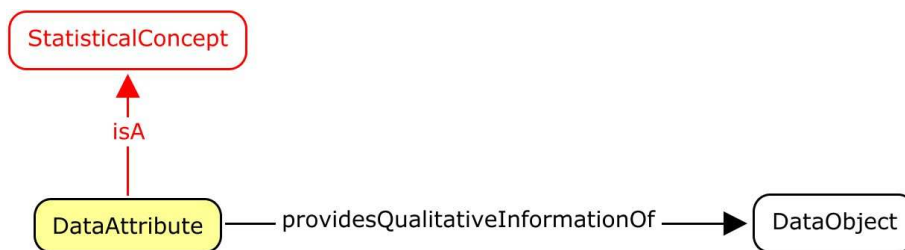


Diagram 21 - Data attribute

42. data attribute

definition: statistical concept providing qualitative information about a specific data object.

source: ESSNET on SDMX, WP2, 2010

Note: updated definition

synonym: attribute

Table 1 - SDMX Cross-domain concepts by use (2009)

data structure definitions – data attributes	
Adjustment	Index type
Adjustment - coded	Maintenance agency
Adjustment - detail	Observation
Age	Observation pre-break value
Base period	Observation status
Civil Status	Occupation
Comment	Originator data identifier
Compiling agency	Recording basis
Confidentiality	Reference area
Confidentiality - status	Reference period
Counterpart reference area	Reference period - weights
Coverage	Release calendar access
Currency	Release policy - user access
Data compilation	Reporting agency
Data dissemination agency	Sex
Data provider	Time format
Data set identifier	Time period
Data update	Time period - collection
Decimals	Timeliness
Dissemination format	Timeliness - source data
Dissemination format - news release	Title
Dissemination format - publications	Unit multiplier
Education level	Unit of measure
Embargo time	Unit of measure detail
Frequency	Valuation
Frequency detail	
Frequency of dissemination	



Diagram 22 - Metadata set

43. metadata set

definition: organised set of metadata.

source: ISO/IEC Committee Draft 11179-3: 2007, Information technology - Metadata Registries (MDR) - Part 3: Registry Metamodel and basic attributes, August 2007

note: updated definition

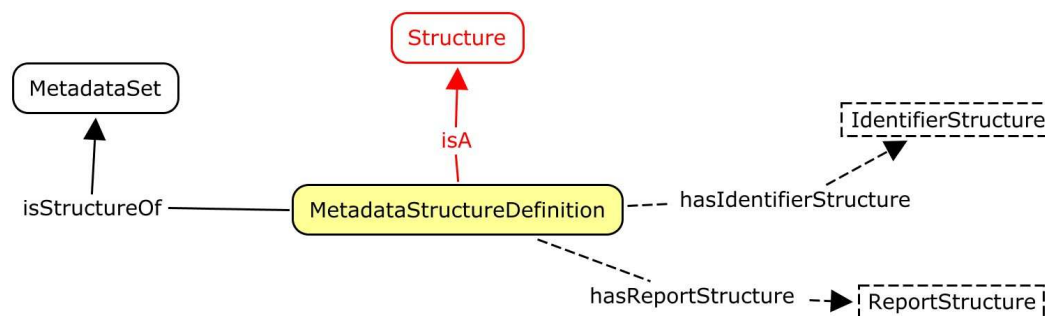


Diagram 23 - Metadata structure definition

44. metadata structure definition

definition: structure of a metadata set, composed by an identifier structure and a report structure

source: SDMX(2009); updated by ESSNET on SDMX, WP2, 2010

note: updated definition

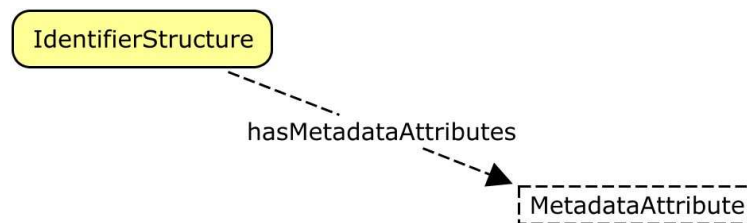


Diagram 24 - Identifier structure

45. identifier structure

definition: organised sequence of metadata attributes.

source: ESSNET on SDMX, WP2, 2010

note: new term

46. metadata attribute

definition: statistical concept providing qualitative information about a specific statistical object.

source: ESSNET on SDMX, WP2, 2010

Note: updated definition

synonym: attribute

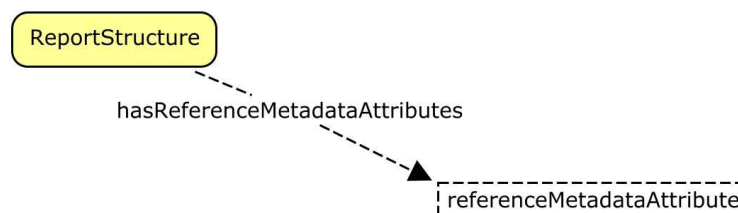


Diagram 25 - Report structure

47. report structure

definition: organized list of reference metadata attributes.

source: Euro-SDMX Metadata Structure Definition – Message implementation guidelines (2009)

note: new term

48. reference metadata

definition: metadata describing the contents and the quality of the statistical data.

source: SDMX (2009)

Table 2 - SDMX cross-domain concepts by use (2009)

Metadata structure definitions - reference metadata attributes	
Accessibility	Documentation on methodology
Accuracy	Documentation on methodology - advance notice
Accuracy - overall	Frequency
Non-sampling error	Frequency of data collection
Sampling error	Frequency of dissemination
Adjustment	Grossing / Netting
Adjustment - detail	Index type
Base period	Institutional mandate
Clarity	Institutional Mandate - data sharing
Classification system	Institutional Mandate - legal acts and other agreements
Coherence	Institutional Mandate - respondent relations
Coherence - cross domain	Maintenance agency
Coherence - internal	Metadata update
Comment	Metadata last certified
Comparability	Metadata last posted
Comparability - between domains	Metadata last update
Comparability - geographical	Professionalism
Comparability - over time	Professionalism - code of conduct
Confidentiality	Professionalism - impartiality
Confidentiality - data treatment	Professionalism - methodology
Confidentiality - policy	Professionalism - statistical commentary
Confidentiality - status	Punctuality
Contact	Quality management
Contact email address	Quality assessment
Contact fax number	Quality assurance
Contact mail address	Quality documentation
Contact name	Recording basis
Contact organisation	Reference area
Contact organisation unit	Reference period
Contact person function	Reference period - weights
Contact phone number	Release policy
Cost and burden	Release calendar
Cost and burden - efficiency management	Release calendar access
Cost and burden - resources	Release policy - commentary
Coverage	Release policy - legal acts and other agreements
Coverage - sector	Release policy - transparency
Coverage - time	Release policy - user access
Data collection	Relevance
Data compilation	Completeness
Data editing	Relevance - user needs
Data presentation	Relevance - user satisfaction
Data description	Reporting agency
Disseminated detail	Sampling
Data provider	Source data
Data revision	Statistical concepts and definitions
Data revision - policy	Statistical population
Data revision - practice	Statistical unit
Data revision - studies	Time period - collection
Data validation	Timeliness
Data validation – intermediate	Timeliness – output
Data validation – output	Timeliness – source data
Data validation - source	Unit of measure
Dissemination format	Valuation
Dissemination format - microdata access	
Dissemination format - news release	
Dissemination format - online database	
Dissemination format - other	
Dissemination format - publications	

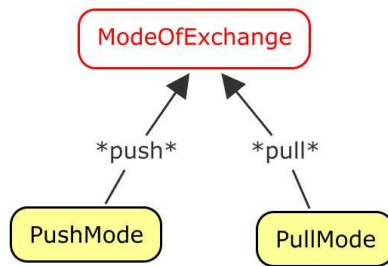


Diagram 26 – Mode of exchange

49. mode of exchange

definition: interaction between organisations using different operating systems and programming languages.

Source: SDMX, *User guide* (2009)

note: new term

50. push mode

definition: mode by which data providers take action to send data to the organisation that collects them, using different means, such as e-mail or file transfer.

source: SDMX, *User guide* (2009)

note: new term

51. pull mode

definition: mode by which data providers make the data available for download in an SDMX-conformant file, or retrieved from a database in response to an SDMX-conformant query, via Internet technology and a web service running on the provider's server.

source: SDMX, *User guide* (2009)

note: new term

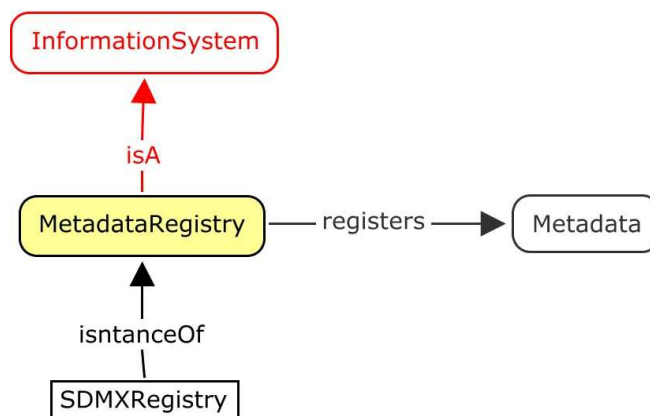


Diagram 27 – Metadata Registry

52. information system

definition: system which supports decision-making concerning some piece of reality, the object system, by giving decision makers access to information concerning relevant aspects of the object system and its environment.

source: Economic Commission for Europe of the United Nations (UNECE), "Terminology on Statistical Metadata", Conference of European Statisticians Statistical Standards and Studies, No. 53, Geneva, 2000

53. metadata registry

definition: an information system for registering metadata

source: SDMX (2009)

54. SDMX registry - See "Registry"

55. registry

definition: application which stores metadata for querying and which can be used by any other application in the network with sufficient access privileges.

source: SDMX (2009)

b) Definitions of concepts in formal language

Data structure definition and Metadata structure definition representation

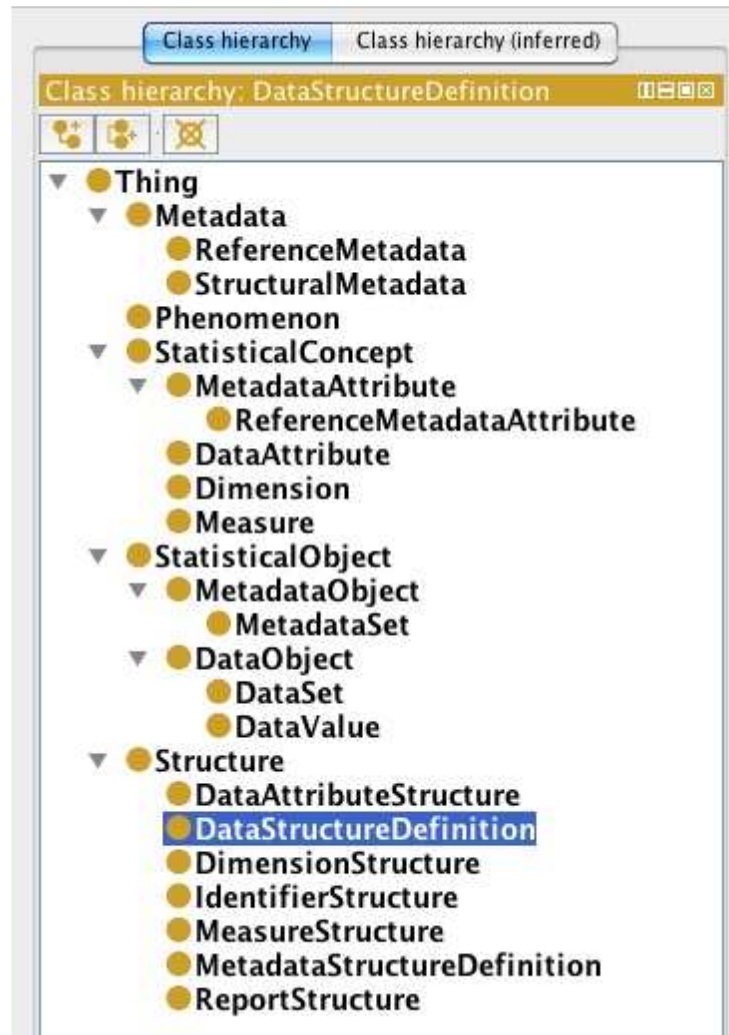


Figure 1 – Class hierarchy

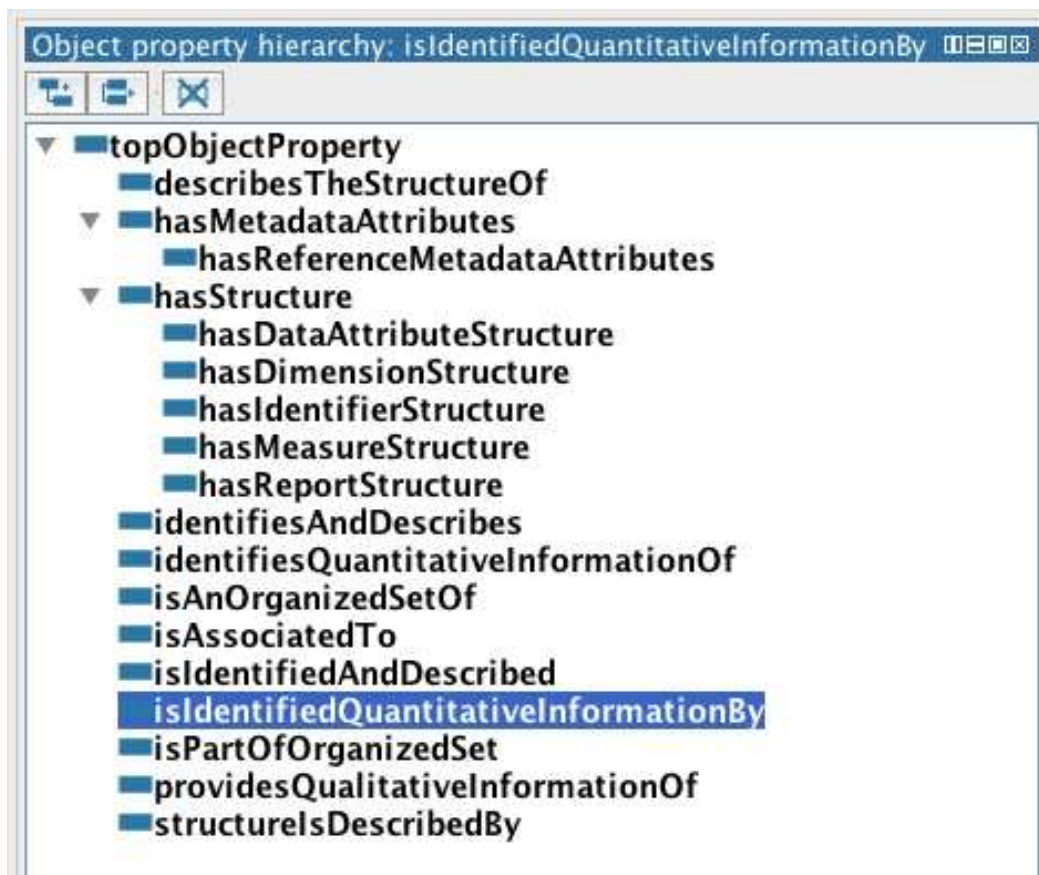


Figure 2 – Object property hierarchy

Evaluation

Concerning the accomplishment of the tasks that were planned, according to the “Work Package 2: MCV Ontology, we present an evaluation synthesis:

- a) Determine the domain and scope of the ontology: in the present report we address results for the sub-domain *data and metadata exchange*;
- b) Enumerate important terms of the ontology: within the sub-domain scope we identified 120 terms in total: 21 new terms, 20 updated definitions, 13 without changes and 66 terms belonging to the Cross-domain concepts.
- c) We used *IHMC CMapTools* for concept maps and *Protégé* to edit the ontology in OWL.

Considering the overall results there is a difference between the approach we followed for the analysis and representation of the concepts *data structure definition* and *metadata structure definition*, and the remaining concepts dealing with the sub-domain *data and metadata exchange*. We analysed the two first concepts in a very detailed way and adopted a broader perspective in the approach of the other concepts.

We are focused on the necessity to harmonize the approach in order to obtain a balanced representation of the domain.

Next steps

The working group will proceed with the following tasks:

1- classify the remaining concepts of MCV specifying the criteria mentioned in the Content-Oriented Guidelines as general concepts, concepts dealing with statistical methodologies, quality and data and metadata exchange, in order to support the following choices of the other ontology's sub-domains.

2- represent the other sub-domains of the ontology in CMaps and OWL and identify the correspondent definitions in natural language.

References

Software used:

- IHMC CMapTools - <http://cmap.ihmc.us/conceptmap.html>
- Protégé

Reference documents on SDMX: Source: <http://www.sdmx.org>

A - Standards:

1. Framework for SDMX technical standards
2. SDMX-EDI: syntax and documentation
3. SDMX-ML: schema and documentation
4. SDMX information model: UML conceptual design
5. SDMX implementor's guide
6. SDMX guidelines for the use of web services

B - Guidelines:

1. Content oriented guidelines:
 - Annex 1 – Cross domain concepts
 - Annex 2 – Cross domain code-lists
 - Annex 3 – List of subject matter domains
 - Annex 4 – Metadata common vocabulary
2. SDMX user guide

C - Tools:

SDMX Registry

D - Other documents:

GRUBER, T. R. (2009) - **Ontology**. In Ling Liu and M. Tamer Özsu (Eds.) *Encyclopedia of Database Systems*. Springer-Verlag.

GRUBER, T. R. (1993) - **A translation approach to portable ontologies**. *Knowledge Acquisition*, 5(2):199-220. Available online <URL : <http://tomgruber.org/writing/ontolingua-kaj-1993.htm>>

Institute for Human & Machine Cognition (n.d.) - **Ontology creation for the rest of us...** Retrieved August 2010. Available online: <URL : <http://www.ihmc.us/groups/coe/>>

OECD GST: Organisation for Economic Co-operation and Development (2007) - **Glossary of Statistical Terms**. Available online: <URL : <http://stats.oecd.org/glossary/index.htm>>

Annex 1

Definition and representation of concepts

We considered four types of definitions that can occur on their own or gathered in a same concept:

- an *essential* definition: we define the concept by its broader genus and indicating its specific differentia (e.g. a “*Metadata Structure definition*” is a “*Structure*” of metadata);
- a *functional* definition: describes the function of a concept (e.g. a “*Metadata Structure Definition*” has the function of producing a report about reference metadata);
- a *descriptive* definition: lists the attributes of a concept (which qualifies the objects comprised by the concept);
- a *constitutive* definition: identifies the concepts that are part of the definition of the concept specifying the relationships that they maintain with the concept: relationships of the type “part of”, “function”, etc. (e.g. a “*Metadata Structure Definition*” is composed of an object type, a report structure, etc.).

The definition of each concept shall be then represented in:

- natural language definition
- formal language definition

Both, the natural language definition as well as the formal definition, represent the same concept which means that they should have the same composition.

The terms in MCV are defined in natural language, whereas concepts in ontology which represent term’s meaning are defined in formal language (in general, the concept name and the term are the same).

We are developing, simultaneously, a terminological database for the natural language definitions.

The formal language definition is represented in a concept map which is a diagram showing the relationships among concepts that can be seen as a first step in the ontology-building, once it provides a “human-centred interface to display the structure, content, and scope of an ontology” (Institute for Human & Machine Cognition, n.d.).

We have been using *IHMC CmapTools* open source software to build concept maps diagrams.

***CmapTools*: methodological and graphical conventions**

CmapTools is an editor of concept maps of the semantic networks type. It is based on a model only defined by a set of nodes and binary relationships linking the nodes between themselves. There is only one type of node, without any distinction between the types of concept, class, set or instance). As the notion of attribute is missing, they will be represented by relationships.

It is by the reasons mentioned above, that we will be following the next methodological and graphical conventions:

concept – for each concept to be defined we will build a concept map. The name of the map shall be the name of the concept. The core concept (the concept that is being defined) is framed in a different color, typeset in a bigger font and in bold. The name of the concept will be the more explicit possible, and we will not be using acronyms;

relationship – relationships link different objects between themselves; the predefined relationship of the type “is a”, “part of” and “function” are represented by different colors;

specific differences – we use asterisk to identify specific differences in essential definitions. Example: *withAgreement*

attribute – attributes belong to the object itself;

The attributes and the relationships of the conceptual model will be represented by edges in *CmapTools*. We will distinguish attributes and relationships by the following graphical conventions:

- attributes are represented by *CmapTools* edges where names are prefixed by “has”. For example: “has identifier”;
- *CmapTools* edges representing attributes are represented by dotted directed edges (arrows);
- the value type of the attribute is represented by a *CmapTools* inside a squared dotted box.

annotation – represents the terminological record including the natural language definition, the standardized terms and the terms in use.

Besides the methodological steps mentioned above, we adopt the convention of using one concept map by definition.

Annex 2

Data structure definition and Metadata structure definition in OWL (Turtle syntax)

```

@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix :
<http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl
#> .
@prefix xml: <http://www.w3.org/XML/1998/namespace> .
@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://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl
> .

<http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl
> rdf:type owl:Ontology .

#####
#
#   Annotation properties
#
#####

rdfs:label rdf:type owl:AnnotationProperty .
rdfs:comment rdf:type owl:AnnotationProperty .

#####
#
#   Object Properties
#
#####

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
describesTheStructureOf

:describesTheStructureOf rdf:type owl:ObjectProperty ;

                                rdfs:label "describes The Structure Of"
;

                                rdfs:domain :Structure ;

                                owl:inverseOf :structureIsDescribedBy ;

                                rdfs:subPropertyOf owl:topObjectProperty
.

```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
hasDataAttributeStructure
```

```
:hasDataAttributeStructure rdf:type owl:ObjectProperty ;

                                rdfs:label "has Data Attribute
Structure" ;

                                rdfs:range :DataAttributeStructure ;
                                rdfs:domain :DataStructureDefinition ;
                                rdfs:subPropertyOf :hasStructure .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
hasDimensionStructure
```

```
:hasDimensionStructure rdf:type owl:ObjectProperty ;

                                rdfs:label "has Dimension Structure" ;
                                rdfs:domain :DataStructureDefinition ;
                                rdfs:range :DimensionStructure ;
                                rdfs:subPropertyOf :hasStructure .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
hasIdentifierStructure
```

```
:hasIdentifierStructure rdf:type owl:ObjectProperty ;

                                rdfs:label "has Identifier Structure" ;
                                rdfs:range :IdentifierStructure ;
                                rdfs:domain :MetadataStructureDefinition
;

                                rdfs:subPropertyOf :hasStructure .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
hasMeasureStructure
```

```
:hasMeasureStructure rdf:type owl:ObjectProperty ;

                                rdfs:label "has Measure Structure" ;
                                rdfs:domain :DataStructureDefinition ;
                                rdfs:range :MeasureStructure ;
```

```
rdfs:subPropertyOf :hasStructure .
```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#  
hasMetadataAttributes
```

```
:hasMetadataAttributes rdfs:type owl:ObjectProperty ;
```

```
    rdfs:label "has Metadata Attributes" ;
```

```
    rdfs:domain :IdentifierStructure ;
```

```
    rdfs:range :MetadataAttribute ;
```

```
    rdfs:subPropertyOf owl:topObjectProperty .
```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#  
hasReferenceMetadataAttributes
```

```
:hasReferenceMetadataAttributes rdfs:type owl:ObjectProperty ;
```

```
    rdfs:label "has Reference  
Metadata Attributes" ;
```

```
    rdfs:range
```

```
:ReferenceMetadataAttribute ;
```

```
    rdfs:domain :ReportStructure ;
```

```
    rdfs:subPropertyOf
```

```
:hasMetadataAttributes .
```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#  
hasReportStructure
```

```
:hasReportStructure rdfs:type owl:ObjectProperty ;
```

```
    rdfs:label "has Report Structure" ;
```

```
    rdfs:domain :MetadataStructureDefinition ;
```

```
    rdfs:range :ReportStructure ;
```

```
    rdfs:subPropertyOf :hasStructure .
```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#  
hasStructure
```

```
:hasStructure rdfs:type owl:ObjectProperty ;
```



```

rdfs:label "has Structure" ;

rdfs:subPropertyOf owl:topObjectProperty .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
identifiesAndDescribes

```

```

:identifiesAndDescribes rdf:type owl:ObjectProperty ;

                        rdfs:label "identifies And Describes" ;

                        rdfs:subPropertyOf owl:topObjectProperty
.

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
identifiesQuantitativeInformationOf

```

```

:identifiesQuantitativeInformationOf rdf:type owl:ObjectProperty
;

```

```

                        rdfs:label "identifies
Quantitative Information Of" ;

                        rdfs:domain :Measure ;

                        rdfs:range :Phenomenon ;

                        owl:inverseOf
:isIdentifiedQuantitativeInformationBy ;

                        rdfs:subPropertyOf
owl:topObjectProperty .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
isAnOrganizedSetOf

```

```

:isAnOrganizedSetOf rdf:type owl:ObjectProperty ;

                    rdfs:label "is An Organized Set Of" ;

                    owl:inverseOf :isPartOfOrganizedSet ;

                    rdfs:subPropertyOf owl:topObjectProperty .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
isAssociatedTo

```

```

:isAssociatedTo rdf:type owl:ObjectProperty ,

```

```

        owl:SymmetricProperty ,
        owl:TransitiveProperty ;

    rdfs:label "is Associated To" ;

    rdfs:subPropertyOf owl:topObjectProperty .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
isIdentifiedAndDescribed

:isIdentifiedAndDescribed rdf:type owl:ObjectProperty ;

                                rdfs:label "is Identified And
Described" ;

                                owl:inverseOf :identifiesAndDescribes ;

                                rdfs:subPropertyOf
owl:topObjectProperty .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
isIdentifiedQuantitativeInformationBy

:isIdentifiedQuantitativeInformationBy rdf:type
owl:ObjectProperty ;

                                rdfs:label "is Identified
Quantitative Information By" ;

                                rdfs:subPropertyOf
owl:topObjectProperty .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
isPartOfOrganizedSet

:isPartOfOrganizedSet rdf:type owl:ObjectProperty ;

                                rdfs:label "is Part Of Organized Set" ;

                                rdfs:subPropertyOf owl:topObjectProperty .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
providesQualitativeInformationOf

:providesQualitativeInformationOf rdf:type owl:ObjectProperty ;

                                rdfs:label "provides
Qualitative Information Of" ;

```

```

                                rdfs:subPropertyOf
owl:topObjectProperty .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
structureIsDescribedBy

:structureIsDescribedBy rdf:type owl:ObjectProperty ;

                                rdfs:label "structure Is Described By" ;

                                rdfs:subPropertyOf owl:topObjectProperty
.

### http://www.w3.org/2002/07/owl#topObjectProperty
owl:topObjectProperty rdf:type owl:ObjectProperty .

#####
#
#   Classes
#
#####

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataAttribute

:DataAttribute rdf:type owl:Class ;

                                rdfs:label "Data Attribute" ;

                                rdfs:subClassOf :StatisticalConcept ,
                                [ rdf:type owl:Restriction ;
                                  owl:onProperty
:providesQualitativeInformationOf ;
                                  owl:someValuesFrom :DataObject
] .

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataAttributeStructure

:DataAttributeStructure rdf:type owl:Class ;

                                rdfs:subClassOf :Structure ,
                                [ rdf:type
owl:Restriction ;
                                  owl:onProperty
:isAnOrganizedSetOf ;

```

```

                                owl:someValuesFrom
:DataAttribute
                                ] .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataObject

```

```

:DataObject rdf:type owl:Class ;

            rdfs:label "Data Object" ;

            rdfs:subClassOf :StatisticalObject .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataSet

```

```

:DataSet rdf:type owl:Class ;

            rdfs:label "Data Set" ;

            rdfs:subClassOf :DataObject ,
                [ rdf:type owl:Restriction ;
                  owl:onProperty :isAnOrganizedSetOf ;
                  owl:someValuesFrom :DataValue
                ] .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataStructureDefinition

```

```

:DataStructureDefinition rdf:type owl:Class ;

                        rdfs:subClassOf :Structure ,
                        [ rdf:type
owl:Restriction ;
                        owl:onProperty
:describesTheStructureOf ;
                        owl:someValuesFrom
:DataSet
                        ] .

```

```

###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DataValue

```

```

:DataValue rdf:type owl:Class ;

            rdfs:label "Data Value" ;

            rdfs:subClassOf :DataObject .

```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
Dimension
```

```
:Dimension rdf:type owl:Class ;

    rdfs:label "Dimension" ;

    rdfs:subClassOf :StatisticalConcept ,
        [ rdf:type owl:Restriction ;
          owl:onProperty
:identifiesAndDescribes ;
          owl:someValuesFrom :DataObject
        ] .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
DimensionStructure
```

```
:DimensionStructure rdf:type owl:Class ;

    rdfs:subClassOf :Structure ,
        [ rdf:type owl:Restriction ;
          owl:onProperty
:isAnOrganizedSetOf ;
          owl:someValuesFrom
:Dimension
        ] .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
IdentifierStructure
```

```
:IdentifierStructure rdf:type owl:Class ;

    rdfs:subClassOf :Structure .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
Measure
```

```
:Measure rdf:type owl:Class ;

    rdfs:label "Measure" ;

    rdfs:subClassOf :StatisticalConcept ,
        [ rdf:type owl:Restriction ;
          owl:onProperty
:identifiesQuantitativeInformationOf ;
          owl:someValuesFrom :Phenomenon
        ] .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
MeasureStructure
```

```
:MeasureStructure rdf:type owl:Class ;

    rdfs:subClassOf :Structure ,
        [ rdf:type owl:Restriction ;
          owl:onProperty
:isAnOrganizedSetOf ;
          owl:someValuesFrom :Measure
        ] .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
Metadata
```

```
:Metadata rdf:type owl:Class ;

    rdfs:label "Metadata" .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
MetadataAttribute
```

```
:MetadataAttribute rdf:type owl:Class ;

    rdfs:label "Metadata Attribute" ;

    rdfs:subClassOf :StatisticalConcept .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
MetadataObject
```

```
:MetadataObject rdf:type owl:Class ;

    rdfs:label "Metadata Object" ;

    rdfs:subClassOf :StatisticalObject .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
MetadataSet
```

```
:MetadataSet rdf:type owl:Class ;

    rdfs:label "Metadata Set" ;

    rdfs:subClassOf :MetadataObject ,
        [ rdf:type owl:Restriction ;
```

```

                                owl:onProperty :isAnOrganizedSetOf
;
                                owl:someValuesFrom :Metadata
] .

```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
MetadataStructureDefinition
```

```

:MetadataStructureDefinition rdf:type owl:Class ;

                                rdfs:subClassOf :Structure ,
                                [ rdf:type
owl:Restriction ;
                                owl:onProperty
:describesTheStructureOf ;
                                owl:someValuesFrom
:MetadataSet
                                ] .

```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
Phenomenon
```

```

:Phenomenon rdf:type owl:Class ;

                                rdfs:label "Phenomenon" .

```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
ReferenceMetadata
```

```

:ReferenceMetadata rdf:type owl:Class ;

                                rdfs:label "Reference Metadata" ;

                                rdfs:subClassOf :Metadata .

```

```
###
```

```
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
ReferenceMetadataAttribute
```

```

:ReferenceMetadataAttribute rdf:type owl:Class ;

                                rdfs:label "Reference Metadata
Attribute" ;

                                rdfs:subClassOf :MetadataAttribute .

```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
ReportStructure
```

```
:ReportStructure rdf:type owl:Class ;

                rdfs:subClassOf :Structure .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
StatisticalConcept
```

```
:StatisticalConcept rdf:type owl:Class ;

                    rdfs:label "Statistical Concept" .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
StatisticalObject
```

```
:StatisticalObject rdf:type owl:Class ;

                    rdfs:label "Statistical Object" .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
StructuralMetadata
```

```
:StructuralMetadata rdf:type owl:Class ;

                    rdfs:label "Structural Metadata" ;

                    rdfs:subClassOf :Metadata .
```

```
###
http://www.semanticweb.org/ontologies/2010/2/SDMX_Info_Model.owl#
Structure
```

```
:Structure rdf:type owl:Class ;

            rdfs:label "Structure" .
```

```
### http://www.w3.org/2002/07/owl#Thing

owl:Thing rdf:type owl:Class .
```

```
### Generated by the OWL API (version 3.0.0.1451)
http://owlapi.sourceforge.net
```