Big data – Requirements and conceptual model of metadata for data catalogue

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For further details, please refer to the list of ITU-T Recommendations.
Recommendation ITU-T Y.3603

Big data – Requirements and conceptual model of metadata for data catalogue

Summary
Recommendation ITU-T Y.3603 describes the general concept of metadata and its utilization in a big data ecosystem. Also, this Recommendation provides requirements and a conceptual model of metadata for data catalogue as well as the extensible markup language (XML) schema of metadata as an example. This metadata supports finding data easier, and is used for exchange, preservation, integration and provenance of data in a big data ecosystem.

History

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Recommendation ITU-T Y.3603

Big data – Requirements and conceptual model of metadata for data catalogue

1 Scope

This Recommendation introduces the metadata concept as well as its usages in a big data lifecycle. This Recommendation provides requirements and a conceptual model of metadata for a data catalogue to support the big data ecosystem defined in [ITU-T Y.3600]. The extensible markup language (XML) profiles based on the conceptual model described by the unified modelling language (UML) and examples of metadata are provided in the appendices.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.


3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 data catalogue [ITU-T Y.3601]: A listing of all metadata which a data broker makes available.

3.1.2 metadata [b-ITU-H.752]: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment and management of the described entities.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API Application Programming Interface
BDC Big Data Service Customer
5 Conventions

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

In the body of this document and its annexes, the words shall, shall not, should, and may sometimes appear, in which case they are to be interpreted, respectively, as is required to, is prohibited from, is recommended, and can optionally. The appearance of such phrases or keywords in an appendix or in material explicitly marked as informative are to be interpreted as having no normative intent.

The unified modelling language (UML) schema used in this Recommendation follows [ITU-T Z.109].

6 Overview of metadata

6.1 Introduction to metadata in the big data ecosystem

Metadata is structured, encoded data that describe characteristics of a dataset to aid in the identification, discovery, assessment and management of the dataset. Metadata summarizes overall information about data, making finding and working with particular data easier. Typically, the metadata structure is highly dependent on data format or application. Therefore, a metadata for big data is needed to provide an overarching model to cover the characteristics of big data. Figure 6-1 illustrates metadata in the big data ecosystem defined in [ITU-T Y.3600]. Metadata is used for data publication and search among roles and sub-roles of the big data ecosystem.
Regarding the data provider (DP), DP:data broker provides a meta-information registry (e.g., data catalogue registry) to DP:data suppliers for publishing their data sources, and DP:data suppliers are creating and publishing metadata information to DP:data broker. A big data service provider (BDSP) searches information through metadata stored in the DP:data broker's data catalogue registry.

According to [ITU-T Y.3600], metadata provides:

- critical information for identification, access right of data;
- information about creation, control, and update on data for the management purpose;
- additional information about data integration capabilities.

6.2 Introduction to big data lifecycle

Metadata is used for various purposes, such as preserving data, data distribution, data integration and data history management by continuously recoding and updating. Figure 6-2 shows the usages of metadata according to big data lifecycle.

NOTE – An example of big data lifecycle has a main cycle with creation/capture, storage, preparation, analysis, visualization, and also has branch cycles with retirement/deletion and share/exchange.

[ITU-T Y.3601] defines the functional requirements for big data exchange. In that Recommendation, DP:data broker provides a common data catalogue schema to exchange big data which covers various...
type of data sources. DP: data broker provides meta-information (data catalogue for dataset) registry to data source. A data source publishes metadata to an online registry for data sharing. This metadata includes:

- data type, format, size and its update frequency;
- category (area of data source);
- metadata and its access information (e.g., uniform resource identifier (URI));
- delivery mechanism, and electronic access methods to data (e.g., application programming interface (API)).

And, this metadata can optionally include:

- data rights (e.g. general agreement, copyrights, patents, licenses policies and pricing policies) (e.g. the applied functions with parameter);
- usage of data;
- quality of data (e.g., sales ranking, and data supplier's credit);
- related keywords; and
- sample data.

DP: data broker also supports data classification with commonly used data vocabulary and taxonomy, and it is recommended to support multiple data classifications by usage area.

[ITU-T Y.3602] defines the functional requirements for big data provenance. Provenance is information about the origin and creation process of data, including the metadata recording process of workflow, annotations and notes about processes. When data are imported from an outside data source and stored, the BDSP generates metadata based on the importing context, including:

- responsible party information;
- time stamp;
- size, etc.

The metadata can be used for recording provenance information according to [ITU-T Y.3602]. For storage efficiency and performance, the BDSP provides data preservation capabilities by monitoring information (e.g., time stamp) included in metadata. In addition, the BDSP uses metadata to retrieve the data for data preparation (e.g. data integration).

7 Requirements of metadata for data catalogue

7.1 Metadata for data catalogue

A data catalogue describes the requirements for searching a dataset. It helps the users of the data to evaluate the dataset to determine its suitability of usage of the data. This clause provides six elements and contents of a data catalogue for big data. Figure 7-1 shows the elements of metadata for a data catalogue.
A data catalogue **is required** to include the following elements:

- overview (see clause 7.2.1);
- responsible party (see clause 7.2.2);
- dataset information (see clause 7.2.3);
- domain information (see clause 7.2.4).

A data catalogue **is recommended** to include the following elements:

- data quality (see clause 7.2.5);
- catalogue record (see clause 7.2.6).

### 7.2 Requirements of metadata elements

#### 7.2.1 Overview element

The overview element provides overall information of the data catalogue and is required to include:

- information about the creation of the data catalogue;
  
  NOTE 1 – This may include the title, the language used in the text, and the version of data catalogue specification.

- an informal description of the data catalogue.
  
  NOTE 2 – An informal description is intended to give a short introduction to data catalogue and allow a human reader for better understanding.

#### 7.2.2 Responsible party element

The responsible party element provides authoritative reference information and is required to include:

- information to identify and communicate with person(s) and organizations associated with the data catalogue.
  
  NOTE 1 – This may include the role or function performed by the organization, the organization name, individual name and position name.

Responsible party element is recommended to include following:

- contact information.
  
  NOTE 2 – This may include the phone number, address, online resource such as URI and time period when individuals may contact the publisher of data catalogue.

#### 7.2.3 Dataset information element

A data catalogue element contains one or more datasets. The dataset information of metadata represents the actual dataset as published by the DP: data provider, and is required to include:

- the title of the dataset;
an informal description of the dataset.
NOTE 1 – An informal description is intended to give a short introduction to the dataset and allow a human reader a better understanding.

The dataset information element is recommended to include:
– dataset distribution information;
   NOTE 2 – A dataset may have multiple distribution information.
   NOTE 3 – This information may include the distribute format of dataset, type of dataset (structured, semi-structured, unstructured), access information including data API, user's guide or its URI, size of dataset, sample data for user's preview and data rights.
– keywords representing dataset;
– contact point information.
   NOTE 4 – Contact point information is represented with the same contents of the responsible party described in clause 7.2.2, but its target is DP: data provider.

Dataset information may also include the following information optionally:
– the frequency at which the dataset is updated;
– temporal coverage of dataset which is described by period of time.

7.2.4 Domain information element
The domain information element provides the application area of dataset and is required to include:
– source domain of the dataset for classification.

The domain information element is recommended to include:
– usage domain of the dataset.

7.2.5 Data quality element
In a big data ecosystem, there are various types and formats of data, each having different quality requirements. Therefore, different quality evaluation methods are applied to different datasets. The data quality element is required to include:
– quality requirement on the dataset;
– unit of measure for data quality;
– quality evaluation result.

7.2.6 Catalogue record element
The catalogue record element provides date information for registration and modification for instances of the data catalogue. The catalogue record element is required to include:
– the most recent modified date of data catalogue.

The catalogue record element of data catalogue is recommended to include:
– the issued date of listing the dataset in the catalogue.
   NOTE – The issued date of listing a dataset in a data catalogue is different than the publication date of the dataset.

8 Conceptual model for data catalogue
8.1 Overall class diagram
This clause provides a UML model based on clause 7, which describes the requirements of metadata for a data catalogue. Figure 8-1 shows the overall class diagram of the data catalogue using UML to provide the design of a concept for a data catalogue.
Figure 8-1 – Overall class diagram of data catalogue using UML

8.2 Classes and data type

The following descriptors are used to explain the data dictionaries in the clauses that follow.

- **Name/Role name**: title of class (gray colored row in table), association (noted as role) and attribute;
- **Description**: short description about ‘Name/Role name’;
- **M/R/O**: the mandatory/recommended/optional (M/R/O) necessity of each class, association and attribute;
- **Cardinality**: the maximum number of instances that the metadata entity or metadata element may have. Single occurrences are shown by "1"; repeating occurrences are represented by "N".
- **Domain**: the values allowed, or the use of free text placed on the contents of the field. "Free text" indicates that no restrictions are placed on the contents of the field. Integer-based codes shall be used to represent values for domains containing codelists.
- **Domain code**: designated code used in place of the concept.

8.2.1 Class: BDC_Catalogue

Table 8-1 shows the data dictionary of *BDC_Catalogue* which describes the overview element information in clause 7.2.1.
Table 8-1 – Catalogue overview

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 BDC_Catalogue</td>
<td>root entity which defines metadata about dataset</td>
<td>M</td>
<td>1</td>
<td>Line 2 to 12</td>
</tr>
<tr>
<td>2 role: responsibleParty</td>
<td>responsible party information for the data catalogue</td>
<td>M</td>
<td>N</td>
<td>BDC_ResponsibleParty</td>
</tr>
<tr>
<td>3 role: dataset</td>
<td>dataset information for the data catalogue</td>
<td>M</td>
<td>N</td>
<td>BDC_Dataset</td>
</tr>
<tr>
<td>4 role: sourceDomain</td>
<td>source domain information for the data catalogue</td>
<td>M</td>
<td>N</td>
<td>BDC_Domain</td>
</tr>
<tr>
<td>5 role: usageDomain</td>
<td>usage domain information for the data catalogue</td>
<td>R</td>
<td>N</td>
<td>BDC_Domain</td>
</tr>
<tr>
<td>6 role: dataQuality</td>
<td>data quality information for the data catalogue</td>
<td>R</td>
<td>N</td>
<td>BDC_DataQuality</td>
</tr>
<tr>
<td>7 role: record</td>
<td>record information for the data catalogue</td>
<td>R</td>
<td>N</td>
<td>BDC_Record</td>
</tr>
<tr>
<td>8 role: hasRelation</td>
<td>related data catalogue of the data catalogue</td>
<td>O</td>
<td>N</td>
<td>BDC_Dataset</td>
</tr>
<tr>
<td>9 title</td>
<td>title of data catalogue</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>10 description</td>
<td>a short introduction to data catalogue</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>11 language</td>
<td>language used within the data catalogue</td>
<td>R</td>
<td>1</td>
<td>free text (RFC 5646)</td>
</tr>
<tr>
<td>12 versionInfo</td>
<td>version of data catalogue specification</td>
<td>R</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>

8.2.2 Class: BDC_ResponsibleParty

Table 8-2 shows the data dictionary of BDC_ResponsibleParty and its data type class BDC_ContactType which describes the responsible party in clause 7.2.2.

Table 8-2 – Responsible party information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 BDC_ResponsibleParty</td>
<td>name and position information for an individual or organization that is responsible for the data catalogue or dataset</td>
<td>M</td>
<td>N</td>
<td>Line 14 to 18</td>
</tr>
<tr>
<td>14 individualName</td>
<td>name of the responsible person: surname, given name, title</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>15 organisationName</td>
<td>name of the responsible organization</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>16 positionName</td>
<td>role or position of the responsible person</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>
Table 8-2 – Responsible party information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 function</td>
<td>function performed by the responsible party</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>18 contact</td>
<td>information required to enable contact with the responsible person and/or organization</td>
<td>R</td>
<td>N</td>
<td>BDC_ContactType</td>
</tr>
<tr>
<td>19 BDC_ContactType</td>
<td>information required to enable contact with the responsible person and/or organization</td>
<td>R</td>
<td>N</td>
<td>Line 20 to 23</td>
</tr>
<tr>
<td>20 phoneNumber</td>
<td>telephone numbers at which the organization or individual may be contacted</td>
<td>R</td>
<td>N</td>
<td>free text</td>
</tr>
<tr>
<td>21 address</td>
<td>physical and email address at which the organization or individual may be contacted</td>
<td>R</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>22 onlineResource</td>
<td>on-line information that can be used to contact the individual or organization</td>
<td>R</td>
<td>N</td>
<td>URI</td>
</tr>
<tr>
<td>23 hoursOfServices</td>
<td>time period (including time zone) when individuals can contact the organization or individual</td>
<td>R</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>

8.2.3 Class: BDC_Dataset

Table 8-3 shows the data dictionary of BDC_Dataset and its sub-classes (BDC_Distribution, BDC_DataRight) which describes dataset information in clause 7.2.3

Table 8-3 – Dataset information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 BDC_Dataset</td>
<td>a collection of data which is available for access and/or download</td>
<td>M</td>
<td>N</td>
<td>Line 25 to 32</td>
</tr>
<tr>
<td>25 role: contactPoint</td>
<td>contact point information for the dataset</td>
<td>R</td>
<td>N</td>
<td>BDC_ResponsibleParty</td>
</tr>
<tr>
<td>26 role: distribution</td>
<td>information about the distributor of and options for obtaining the dataset</td>
<td>R</td>
<td>N</td>
<td>BDC_Distribution</td>
</tr>
<tr>
<td>27 role: hasRelation</td>
<td>related dataset of the dataset</td>
<td>O</td>
<td>N</td>
<td>BDC_Dataset</td>
</tr>
<tr>
<td>28 title</td>
<td>title of the dataset</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>29 description</td>
<td>short introduction to the dataset</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>
### Table 8-3 – Dataset information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 keyword</td>
<td>commonly used word(s) used to describe the dataset</td>
<td>R</td>
<td>N</td>
<td>free text</td>
</tr>
<tr>
<td>31 temporalCoverage</td>
<td>time period (including time zone) when the dataset was captured</td>
<td>O</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>32 updateFrequency</td>
<td>rate of occurrence of dataset update</td>
<td>O</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>33 BDC_Distribution</td>
<td>information about the distributor of and options for obtaining the dataset</td>
<td>R</td>
<td>N</td>
<td>Line 34 to39</td>
</tr>
<tr>
<td>34 role: dataRight</td>
<td>information about limitation placed upon the use of the dataset</td>
<td>R</td>
<td>1</td>
<td>BDC_DataRight</td>
</tr>
<tr>
<td>35 dataType</td>
<td>type of information of the dataset</td>
<td>M</td>
<td>1</td>
<td>BDC_DataTypeCode</td>
</tr>
<tr>
<td>36 format</td>
<td>format of information of the dataset including a version</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>37 byteSize</td>
<td>information about the size of the dataset in bytes</td>
<td>M</td>
<td>1</td>
<td>int</td>
</tr>
<tr>
<td>38 accessInformation</td>
<td>access information to the dataset</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>39 sampleData</td>
<td>location information about a sample data including URI</td>
<td>R</td>
<td>N</td>
<td>URI</td>
</tr>
<tr>
<td>40 BDC_DataRight</td>
<td>information about limitation placed upon the use of the dataset</td>
<td>R</td>
<td>1</td>
<td>Line 41 to 42</td>
</tr>
<tr>
<td>41 rightStatement</td>
<td>information to the usage permissions being agreed to</td>
<td>R</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>42 license</td>
<td>links to the license document under which the catalog is made available and not the datasets</td>
<td>R</td>
<td>N</td>
<td>URI</td>
</tr>
</tbody>
</table>

8.2.4 **Class: BDC_Domain**  
Table 8-4 shows the data dictionary of `BDC_Domain` which describes domain information in clause 7.2.4.

### Table 8-4 – Domain information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 BDC_Domain</td>
<td>source and/or usage information for data catalogue</td>
<td>M</td>
<td>1</td>
<td>Line 44 to 46</td>
</tr>
<tr>
<td>44 title</td>
<td>a member item of taxonomy which used for identifying the domain of source and/or usage</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>
Table 8-4 – Domain information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 taxonomy</td>
<td>taxonomy information including classification system and authority</td>
<td>M</td>
<td>N</td>
<td>URI</td>
</tr>
<tr>
<td>46 comment</td>
<td>any additional information for the domain</td>
<td>O</td>
<td>N</td>
<td>free text</td>
</tr>
</tbody>
</table>

8.2.5 Class: BDC_DataQuality
Table 8-5 shows the data dictionary of BDC_DataQuality which describes data quality in clause 7.2.5.

Table 8-5 – Data quality information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>47 BDC_DataQuality</td>
<td>data quality information for the data catalogue</td>
<td>R</td>
<td>N</td>
<td>Line 48 to 50</td>
</tr>
<tr>
<td>48 qualityRequirement</td>
<td>requirement statement for evaluating quality of the dataset</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>49 unitOfMeasurere</td>
<td>standard unit or system of units by means of which a quantity is accounted for and expressed.</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
<tr>
<td>50 qualityResult</td>
<td>the result of quality evaluation described by the unit of measure</td>
<td>M</td>
<td>1</td>
<td>free text</td>
</tr>
</tbody>
</table>

8.2.6 Class: BDC_Record
Table 8-6 shows the data dictionary of BDC_Record which describes catalogue record in clause 7.2.6.

Table 8-6 – Catalogue record information

<table>
<thead>
<tr>
<th>Name/Role name</th>
<th>Description</th>
<th>M/R/O</th>
<th>Cardinality</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 BDC_Record</td>
<td>record information for the data catalogue</td>
<td>R</td>
<td>N</td>
<td>Line 52 to 53</td>
</tr>
<tr>
<td>52 modifiedDate</td>
<td>the most resent modified date of data catalogue</td>
<td>M</td>
<td>N</td>
<td>free text (e.g., ISO 8601 [b-ISO8601])</td>
</tr>
<tr>
<td>53 issuedDate</td>
<td>the issued date of listing the dataset in the catalogue</td>
<td>R</td>
<td>1</td>
<td>free text (e.g., ISO 8601 [b-ISO8601])</td>
</tr>
</tbody>
</table>

8.2.6 Data type: BDC_DataTypeCode
Table 8-7 shows the data dictionary of BDC_DataTypeCode describing the enumerated data type for data distribution.
Table 8-7 – Data type information

<table>
<thead>
<tr>
<th>Name</th>
<th>Domain code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURED</td>
<td>001</td>
<td>data that is organized in a format easily used by formatted repository</td>
</tr>
<tr>
<td>SEMI_STRUCTURED</td>
<td>002</td>
<td>data that is neither raw data, nor typed data in a conventional database system (e.g., XML, JavaScript Object Notation (JSON))</td>
</tr>
<tr>
<td>UNSTRUCTURED</td>
<td>003</td>
<td>data that either does not have a pre-defined data model or is not organized in a pre-defined manner</td>
</tr>
</tbody>
</table>
Appendix I

Examples of metadata profile for data catalogue

(This appendix does not form an integral part of this Recommendation.)

This appendix uses the W3C data catalog vocabulary (DCAT) in the XML profile and terse resource description framework triple language (Turtle) profile (see [b-W3C DCAT]). The namespace for DCAT is http://www.w3.org/ns/dcat#, but DCAT makes extensive use of terms from other vocabularies. The extended prefix and its namespace for this appendix are "bdc" and "http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#".

I.1 RDF profile

This clause provides the XML schema with resource description framework (RDF) format corresponding to the UML model in clause 8.

```xml
<?xml version="1.0"?>
<rdf:RDF xmlns="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#"
    xml:base="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue"
    xmlns:schema="http://schema.org/"
    xmlns:bdc="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#"
    xmlns:owl="http://www.w3.org/2002/07/owl#"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
    xmlns:rdfschema="http://www.w3.org/2000/01/rdf-schema#"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:terms="http://purl.org/dc/terms/"
    xmlns:dcat="http://www.w3.org/ns/dcat#"
    xmlns:dc="http://purl.org/dc/elements/1.1/">
    <owl:Ontology rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue">
        <owl:imports rdf:resource="http://www.w3.org/ns/dcat#"/>
        <owl:imports rdf:resource="https://www.w3.org/2002/07/owl#"/>
        <owl:imports rdf:resource="http://www.w3.org/2002/07/owl#"/>
    </owl:Ontology>

    <!-- http://www.w3.org/2002/07/owl#versionInfo -->

    <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#versionInfo">
    </rdf:Description>

    <!-- http://www.w3.org/ns/dcat#byteSize -->

    <owl:AnnotationProperty rdf:about="http://www.w3.org/ns/dcat#byteSize">
        <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Distribution"/>
    </owl:AnnotationProperty>

    <!-- // // Object Properties -->
```
<owl:ObjectProperty>
</owl:ObjectProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#distribution -->

<owl:ObjectProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#distribution">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Dataset"/>
  <rdfs:range rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Distribution"/>
  <rdfs:comment>information about the distributor of and options for obtaining the dataset</rdfs:comment>
</owl:ObjectProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#record -->

<owl:ObjectProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#record">
  <rdfs:range rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Record"/>
  <rdfs:comment>record information for the data catalogue</rdfs:comment>
</owl:ObjectProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#responsibleParty -->

<owl:ObjectProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#responsibleParty">
  <rdfs:range rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ResponsibleParty"/>
  <rdfs:comment>responsible party information for the data catalogue</rdfs:comment>
</owl:ObjectProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#sourceDomain -->

<owl:ObjectProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#sourceDomain">
  <rdfs:range rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Domain"/>
  <rdfs:comment>source domain information for the data catalogue</rdfs:comment>
</owl:ObjectProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#usageDomain -->

<owl:ObjectProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#usageDomain">
  <rdfs:range rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Domain"/>
  <rdfs:comment>usage domain information for the data catalogue</rdfs:comment>
</owl:ObjectProperty>

<owl:DatatypeProperty rdf:about="http://purl.org/dc/elements/1.1/description">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Dataset"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>

<!-- http://purl.org/dc/elements/1.1/format -->

<owl:DatatypeProperty rdf:about="http://purl.org/dc/elements/1.1/format">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Dataset"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
</owl:DatatypeProperty>
<rdfs:comment>physical and email address at which the organization or individual may be contacted</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#hoursOfServices -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#hoursOfServices">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ContactType"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment>time period (including time zone) when individuals can contact the organization or individual</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#individualName -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#individualName">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ResponsibleParty"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment>name of the responsible person- surname, given name, title</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#issuedDate -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#issuedDate">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Record"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
  <rdfs:comment>the issued date of listing the dataset in the catalogue</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#license -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#license">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataRight"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#anyURI"/>
  <rdfs:comment>This links to the license document under which the catalog is made available and not the datasets</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#modifiedDate -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#modifiedDate">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Record"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#date"/>
  <rdfs:comment>the most resent modified date of data catalogue</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#onlineResource -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#onlineResource">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ContactType"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#anyURI"/>
  <rdfs:comment>online information that can be used to contact the individual or organization</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#organizationName -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#organizationName">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ContactType"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#anyURI"/>
  <rdfs:comment>organization name</rdfs:comment>
</owl:DatatypeProperty>
<rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Distribution"/>
<rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#anyURI"/>
<rdfs:comment>location information about a sample data including URI</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#taxonomy -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#taxonomy">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Domain"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#anyURI"/>
  <rdfs:comment>taxonomy information including classification system and authority</rdfs:comment>
</owl:DatatypeProperty>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#unitOfMeasure -->

<owl:DatatypeProperty rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#unitOfMeasure">
  <rdfs:domain rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataQuality"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment>standard unit or system of units by means of which a quantity is accounted for and expressed</rdfs:comment>
</owl:DatatypeProperty>

!/-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Catalogue -->

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Catalogue">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>Root entity which defines metadata about dataset resource</rdfs:comment>
</owl:Class>

!/-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ContactType -->

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ContactType">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>information required to enable contact with the responsible person and/or organization</rdfs:comment>
</owl:Class>

!/-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataQuality -->

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataQuality">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>data quality information for the data catalogue</rdfs:comment>
</owl:Class>

!/-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataRight -->

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataRight">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>information about limitation placed upon the use of the dataset</rdfs:comment>
</owl:Class>
<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataTypeCode">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Dataset">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>dataset information for the data catalogue</rdfs:comment>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Distribution">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>information about the distributor of and options for obtaining the dataset</rdfs:comment>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Domain">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>source and/ or usage information for data catalogue</rdfs:comment>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Record">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>record information for the data catalogue</rdfs:comment>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#ResponsibleParty">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:comment>responsible party information for the data catalogue</rdfs:comment>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#SemiStructured">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Structured">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</owl:Class>

<owl:Class rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Unstructured">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
</owl:Class>
I.2 Turtle profile

This clause provides the Turtle format schema corresponding to the UML model in Appendix I.

```turtle
@prefix bdc: <http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix dcat: <http://purl.org/dc/elements/1.1/> .
@prefix dc: <http://purl.org/dc/terms/> .

dc:identifier bdc:Catalogue ;
 dc:format bdc:Distribution ;
```

---

// Individuals

```turtle
<owl:NamedIndividual rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#SemiStructured">
    <rdf:type rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataTypeCode"/>
    <rdfs:comment>data that is neither raw data, nor typed data in a conventional database system (e.g. XML, JSON)</rdfs:comment>
</owl:NamedIndividual>
```

```turtle
<owl:NamedIndividual rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Structured">
    <rdf:type rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataTypeCode"/>
    <rdfs:comment>data that is organized in a format easily used by formatted repository</rdfs:comment>
</owl:NamedIndividual>
```

```turtle
<owl:NamedIndividual rdf:about="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Unstructured">
    <rdf:type rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#DataTypeCode"/>
    <rdfs:comment>data that either does not have a pre-defined data model or is not organized in a pre-defined manner</rdfs:comment>
</owl:NamedIndividual>
```
bdc:hasRelation
  rdf:type rdf:Property ;
  rdfs:domain bdc:Catalogue ;
  rdfs:domain bdc:Dataset ;
  rdfs:range bdc:Catalogue ;
  rdfs:range bdc:Dataset ;

dc:keyword
  rdf:type rdf:Property ;
  rdfs:comment "commonly used word(s) used to describe the dataset" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

dc:language
  rdfs:domain bdc:Catalogue ;
  rdfs:range <http://purl.org/dc/terms/RFC5646> ;

dc:temporalCoverage
  rdf:type rdf:Property ;
  rdfs:comment "time period (including time zone) when the dataset was captured" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

dc:title
  rdfs:domain bdc:Catalogue ;
  rdfs:domain bdc:Dataset ;
  rdfs:domain bdc:Domain ;
  rdfs:range xsd:string ;

dc:updateFrequency
  rdf:type rdf:Property ;
  rdfs:comment "rate of occurrence of dataset update" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

<http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue>
  rdf:type owl:Ontology ;
  owl:imports <http://purl.org/dc/elements/1.1/> ;
  owl:imports <http://purl.org/dc/terms/> ;
  owl:imports <http://www.w3.org/ns/dcat#> ;
  owl:imports <https://www.w3.org/2002/07/owl#> ;

bdc:Catalogue
  rdf:type rdfs:Class ;
  rdfs:comment "Root entity which defines metadata about dataset resource" ;
  rdfs:subClassOf owl:Thing ;

bdc:ContactType
  rdf:type rdfs:Class ;
  rdfs:comment "information required to enable contact with the responsible person and/or organization" ;
  rdfs:subClassOf owl:Thing ;

bdc:DataQuality
  rdf:type rdfs:Class ;
  rdfs:comment "data quality information for the data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:DataRight
  rdf:type rdfs:Class ;
rdfs:comment "information about limitation placed upon the use of the dataset" ;
rdfs:subClassOf owl:Thing ;

bdc:DataTypeCode
rdf:type rdfs:Class ;
rdfs:subClassOf owl:Thing ;

bdc:Dataset
rdf:type rdfs:Class ;
rdfs:comment "dataset information for the data catalogue" ;
rdfs:subClassOf owl:Thing ;

bdc:Distribution
rdf:type rdfs:Class ;
rdfs:comment "information about the distributor of and options for obtaining the dataset" ;
rdfs:subClassOf owl:Thing ;

bdc:Domain
rdf:type rdfs:Class ;
rdfs:comment "source and/ or usage information for data catalogue" ;
rdfs:subClassOf owl:Thing ;

bdc:Record
rdf:type rdfs:Class ;
rdfs:comment "record information for the data catalogue" ;
rdfs:subClassOf owl:Thing ;

bdc:ResponsibleParty
rdf:type rdfs:Class ;
rdfs:comment "responsible party information for the data catalogue" ;
rdfs:subClassOf owl:Thing ;

bdc:SemiStructured
rdf:type bdc:DataTypeCode ;
rdfs:comment "data that is neither raw data, nor typed data in a conventional database system (e.g. XML, JSON)" ;
rdfs:subClassOf owl:Thing ;

bdc:Structured
rdf:type bdc:DataTypeCode ;
rdfs:comment "data that is organized in a format easily used by formatted repository" ;
rdfs:subClassOf owl:Thing ;

bdc:Unstructured
rdf:type bdc:DataTypeCode ;
rdfs:comment "data that either does not have a pre-defined data model or is not organized in a pre-defined manner" ;
rdfs:subClassOf owl:Thing ;

bdc:accessInformation
rdf:type owl:DatatypeProperty ;
rdfs:comment "access information to dataset" ;
rdfs:domain bdc:Distribution ;
rdfs:range xsd:string ;

bdc:address
rdf:type rdf:Property ;
rdfs:comment "physical and email address at which the organization or individual may be contacted" ;
rdfs:domain bdc:ContactType ;
rdfs:range xsd:string ;

bdc:contact
bdc:contactPoint
  rdf:type rdf:Property ;
  rdfs:comment "contact point information for the dataset" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range bdc:ResponsibleParty ;

bdc:dataQuality
  rdf:type rdf:Property ;
  rdfs:comment "data quality information for the data catalogue" ;
  rdfs:domain bdc:Catalogue ;
  rdfs:range bdc:DataQuality ;

bdc:dataRight
  rdf:type rdf:Property ;
  rdfs:comment "Information about limitation placed upon the use of the dataset" ;
  rdfs:domain bdc:Distribution ;
  rdfs:range bdc:DataRight ;

bdc:dataType
  rdf:type rdf:Property ;
  rdfs:comment "the type information of the dataset" ;
  rdfs:domain bdc:Distribution ;
  rdfs:range bdc:DataTypeCode ;

bdc:dataset
  rdf:type rdf:Property ;
  rdfs:comment "dataset information for the data catalogue" ;
  rdfs:domain bdc:Catalogue ;
  rdfs:range bdc:Dataset ;

bdc:distribution
  rdf:type rdf:Property ;
  rdfs:comment "information about the distributor of and options for obtaining the dataset" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range bdc:Distribution ;

bdc:hoursOfServices
  rdf:type rdf:Property ;
  rdfs:comment "time period (including time zone) when individuals can contact the organization or individual" ;
  rdfs:domain bdc:ContactType ;
  rdfs:range xsd:string ;

bdc:individualName
  rdf:type rdf:Property ;
  rdfs:comment "name of the responsible person- surname, given name, title" ;
  rdfs:domain bdc:ResponsibleParty ;
  rdfs:range xsd:string ;

bdc:issuedDate
  rdf:type rdf:Property ;
  rdfs:comment "the issued date of listing the dataset in the catalogue" ;
  rdfs:domain bdc:Record ;
  rdfs:range xsd:date ;

bdc:license
bdc:modifiedDate
rdf:type rdf:Property;
rdfs:comment "the most resent modified date of data catalogue";
rdfs:domain bdc:Record;
rdfs:range xsd:date;
.

bdc:onlineResource
rdf:type rdf:Property;
rdfs:comment "online information that can be used to contact the individual or organization";
rdfs:domain bdc:ContactType;
rdfs:range xsd:anyURI;
.

bdc:organizationName
rdf:type rdf:Property;
rdfs:comment "name of the responsible organization";
rdfs:domain bdc:ResponsibleParty;
rdfs:range xsd:string;
.

bdc:phoneNumber
rdf:type rdf:Property;
rdfs:comment "telephone numbers at which the organization or individual may be contacted";
rdfs:domain bdc:ContactType;
rdfs:range xsd:string;
.

bdc:positionName
rdf:type rdf:Property;
rdfs:comment "role or position of the responsible person";
rdfs:domain bdc:ResponsibleParty;
rdfs:range xsd:string;
.

bdc:qualityRequirement
rdf:type rdf:Property;
rdfs:comment "requirement statement for evaluating quality of dataset";
rdfs:domain bdc:DataQuality;
rdfs:range xsd:string;
.

bdc:qualityResult
rdf:type rdf:Property;
rdfs:comment "the result of quality evaluation described by the unit of measure";
rdfs:domain bdc:DataQuality;
rdfs:range xsd:string;
.

bdc:record
rdf:type rdf:Property;
rdfs:comment "record information for the data catalogue";
rdfs:domain bdc:Catalogue;
rdfs:range bdc:Record;
.

bdc:responsibleParty
rdf:type rdf:Property;
rdfs:comment "responsible party information for the data catalogue";
rdfs:domain bdc:Catalogue;
rdfs:range bdc:ResponsibleParty;
.

bdc:rightStatement
rdf:type rdf:Property;
rdfs:comment "information to the usage permissions being agreed to";
rdfs:domain bdc:DataRight;
rdfs:range xsd:string;

bdc:function
rdf:type rdf:Property;
rdfs:comment "function performed by the responsible party";
rdfs:domain bdc:ResponsibleParty;
rdfs:range xsd:string;

bdc:sampleData
rdf:type owl:DatatypeProperty;
rdfs:comment "location information about a sample data including URI";
rdfs:domain bdc:Distribution;
rdfs:range xsd:anyURI;

bdc:sourceDomain
rdf:type rdf:Property;
rdfs:comment "source domain information for the data catalogue";
rdfs:domain bdc:Catalogue;
rdfs:range bdc:Domain;

bdc:taxonomy
rdf:type rdf:Property;
rdfs:comment "taxonomy information including classification system and authority";
rdfs:domain bdc:Domain;
rdfs:range xsd:anyURI;

bdc:unitOfMeasure
rdf:type rdf:Property;
rdfs:comment "standard unit or system of units by means of which a quantity is accounted for and expressed.";
rdfs:domain bdc:DataQuality;
rdfs:range xsd:string;

bdc:usageDomain
rdf:type rdf:Property;
rdfs:comment "usage domain information for the data catalogue";
rdfs:domain bdc:Catalogue;
rdfs:range bdc:Domain;

owl:versionInfo
rdfs:domain bdc:Catalogue;

dcat:byteSize
rdfs:domain bdc:Distribution;
Appendix II

Examples of metadata instance
(This appendix does not form an integral part of this Recommendation.)

For the better understanding of the conceptual model, this appendix provides the examples of a metadata instance about health care data [b-NHIS]. The UML object diagram, RDF instance and Turtle instances follow the UML and XML models in clause 8 and Appendix I, and these examples provide information on a dataset about 'Health Insurance'.

II.1 UML object diagram

An object diagram represents an instance of a class diagram. Figure II.1 is an object diagram derived from class diagram presented by Figure 8-1.

II.2 RDF instance

This clause provides an example of metadata instance based on the RDF schema which described in Appendix I.1.

```xml
<?xml version="1.0"?>
<rdf:RDF xmlns="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#"
xml:base="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue"
xmlns:schema="http://schema.org/"
xmlns:bdc="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#"
xmlns:owl="http://www.w3.org/2002/07/owl#"
```

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#quality -->


<qualityRequirements>under 1% missing fields</qualityRequirements>

<qualityResult>passed (99.3%)</qualityResult>

<unitOfMeasure>percent</unitOfMeasure>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#record1 -->


<issuedDate rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2018-03-01</issuedDate>

<modifiedDate rdf:datatype="http://www.w3.org/2001/XMLSchema#date">2018-04-15</modifiedDate>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#right -->


<license rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI">http://purl.obolibrary.org/obo/PDRO.owl</license>

<rightsStatement>Public access</rightsStatement>

<!-- http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#screenDist -->


<dataRight rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#right"/>

<dataType rdf:resource="http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#Structured"/>

<dc:format>json</dc:format>

<accessInformation rdf:datatype="http://www.w3.org/2001/XMLSchema#anyURI">http://www.nhis.or.kr/screen.csv</accessInformation>
II.3 Turtle instance

This clause provides an example of a metadata instance based on the Turtle format schema which was described in Appendix I.2.

```turtle
@prefix bdc: <http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue#> .
@prefix dc: <http://purl.org/dc/elements/1.1/> .
@prefix dcat: <http://www.w3.org/ns/dcat#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
```
dc:description
  rdfs:domain bdc:Catalogue ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

dc:format
  rdfs:domain bdc:Distribution ;
  rdfs:range xsd:string ;

dc:hasRelation
  rdf:type rdf:Property ;
  rdfs:domain bdc:Dataset ;
  rdfs:range bdc:Dataset ;

dc:hasRelation
  rdf:type rdf:Property ;
  rdfs:domain bdc:Catalogue ;
  rdfs:range bdc:Catalogue ;

dc:keyword
  rdf:type rdf:Property ;
  rdfs:comment "commonly used word(s) used to describe the dataset" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

dc:language
  rdfs:domain bdc:Catalogue ;
  rdfs:domain dct:RFC5646 ;

dc:temporalCoverage
  rdf:type rdf:Property ;
  rdfs:comment "time period (including time zone) when the dataset was captured" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

dc:title
  rdfs:domain bdc:Catalogue ;
  rdfs:domain bdc:Dataset ;
  rdfs:domain bdc:Domain ;
  rdfs:range xsd:string ;

dc:updateFrequency
  rdf:type rdf:Property ;
  rdfs:comment "rate of occurrence of dataset update" ;
  rdfs:domain bdc:Dataset ;
  rdfs:range xsd:string ;

<http://www.itu.int/xml-namespace/itut/Y.3603/bigdatacatalogue>
  rdf:type owl:Ontology ;
  owl:imports dc: ;
  owl:imports <https://www.w3.org/2002/07/owl#> ;

bdc:Catalogue
  rdf:type rdfs:Class ;
  rdfs:comment "Root entity which defines metadata about dataset resource" ;
  rdfs:subClassOf owl:Thing ;

bdc:ContactType
  rdf:type rdfs:Class ;
rdfs:comment "information required to enable contact with the responsible person and/or organization" ;
rdfs:subClassOf owl:Thing ;

bdc:DataQuality
  rdf:type rdfs:Class ;
  rdfs:comment "data quality information for the data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:DataRight
  rdf:type rdfs:Class ;
  rdfs:comment "information about limitation placed upon the use of the dataset" ;
  rdfs:subClassOf owl:Thing ;

bdc:DataTypeCode
  rdf:type rdfs:Class ;
  rdfs:subClassOf owl:Thing ;

bdc:Dataset
  rdf:type rdfs:Class ;
  rdfs:comment "dataset information for the data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:Distribution
  rdf:type rdfs:Class ;
  rdfs:comment "information about the distributor of and options for obtaining the dataset" ;
  rdfs:subClassOf owl:Thing ;

bdc:Domain
  rdf:type rdfs:Class ;
  rdfs:comment "source and/or usage information for data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:Record
  rdf:type rdfs:Class ;
  rdfs:comment "record information for the data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:ResponsibleParty
  rdf:type rdfs:Class ;
  rdfs:comment "responsible party information for the data catalogue" ;
  rdfs:subClassOf owl:Thing ;

bdc:SemiStructured
  rdf:type bdc:DataTypeCode ;
  rdfs:comment "data that is neither raw data, nor typed data in a conventional database system (e.g. XML, JSON)" ;
  rdfs:subClassOf owl:Thing ;

bdc:Structured
  rdf:type bdc:DataTypeCode ;
  rdfs:comment "data that is organized in a format easily used by formatted repository" ;
  rdfs:subClassOf owl:Thing ;

bdc:Unstructured
  rdf:type bdc:DataTypeCode ;
  rdfs:comment "data that either does not have a pre-defined data model or is not organized in a pre-defined manner" ;
  rdfs:subClassOf owl:Thing ;

bdc:accessInformation
  rdf:type owl:DatatypeProperty ;
  rdfs:comment "access information to dataset" ;
rdfs:domain bdc:Distribution ;
rdfs:range xsd:anyURI ;
.
bdc:address
  rdf:type rdf:Property ;
rdfs:comment "physical and email address at which the organization or individual may be contacted" ;
rdfs:domain bdc:ContactType ;
rdfs:range xsd:string ;
.
bdc:comment
  rdf:type rdf:Property ;
rdfs:comment "an additional information for domain" ;
rdfs:domain bdc:Domain ;
rdfs:range xsd:string ;
.
bdc:contact
  rdf:type rdf:Property ;
rdfs:comment "information required to enable contact with the responsible person and/or organization" ;
rdfs:domain bdc:ResponsibleParty ;
rdfs:range bdc:ContactType ;
.
bdc:contactPoint
  rdf:type rdf:Property ;
rdfs:comment "contact point information for the dataset" ;
rdfs:domain bdc:Dataset ;
rdfs:range bdc:ResponsibleParty ;
.
bdc:dataQuality
  rdf:type rdf:Property ;
rdfs:comment "data quality information for the data catalogue" ;
rdfs:domain bdc:Catalogue ;
rdfs:range bdc:DataQuality ;
.
bdc:dataRight
  rdf:type rdf:Property ;
rdfs:comment "Information about limitation placed upon the use of the dataset" ;
rdfs:domain bdc:Distribution ;
rdfs:range bdc:DataRight ;
.
bdc:dataType
  rdf:type rdf:Property ;
rdfs:comment "the type information of the dataset" ;
rdfs:domain bdc:Distribution ;
rdfs:range bdc:DataTypeCode ;
.
bdc:dataset
  rdf:type rdf:Property ;
rdfs:comment "dataset information for the data catalogue" ;
rdfs:domain bdc:Catalogue ;
rdfs:range bdc:Dataset ;
.
bdc:distribution
  rdf:type rdf:Property ;
rdfs:comment "information about the distributor of and options for obtaining the dataset" ;
rdfs:domain bdc:Dataset ;
rdfs:range bdc:Distribution ;
.
bdc:function
  rdf:type rdf:Property ;
rdfs:comment "function performed by the responsible party" ;
bdc:healthCatalogue
  rdf:type bdc:Catalogue;
  dc:description "Health data of prescription & screening";
  dc:language "ko_KR"^^dct:RFC5646;
  dc:title "Health Data";
  bdc:quality bdc:quality;
  bdc:prescriptionSet bdc:dataset;
  bdc:screenSet bdc:dataset;
  bdc:record bdc:record1;
  bdc:responsibleParty bdc:rParty;
  bdc:srcDomain bdc:sourceDomain;
  bdc:useDomain bdc:usageDomain;
  owl:versionInfo "1.0.0";

bdc:hoursOfServices
  rdf:type rdf:Property;
  rdfs:comment "time period (including time zone) when individuals can contact the organization or individual";
  rdfs:domain bdc:ContactType;
  rdfs:range xsd:string;

bdc:individualName
  rdf:type rdf:Property;
  rdfs:comment "name of the responsible person- surname, given name, title";
  rdfs:domain bdc:ResponsibleParty;
  rdfs:range xsd:string;

bdc:issuedDate
  rdf:type rdf:Property;
  rdfs:comment "the issued date of listing the dataset in the catalogue";
  rdfs:domain bdc:Record;
  rdfs:range xsd:date;

bdc:ko_KR
  rdf:type dct:LinguisticSystem;

bdc:license
  rdf:type rdf:Property;
  rdfs:comment "This links to the license document under which the catalog is made available and not the datasets";
  rdfs:domain bdc:DataRight;
  rdfs:range xsd:anyURI;

bdc:modifiedDate
  rdf:type rdf:Property;
  rdfs:comment "the most resent modified date of data catalogue";
  rdfs:domain bdc:Record;
  rdfs:range xsd:date;

bdc:myContact
  rdf:type bdc:ContactType;
  bdc:address "Seoul Korea";
  bdc:hoursOfServices "09:00-18:00";
  bdc:onlineResource "https://www.nhis.or.kr"^^xsd:anyURI;
  bdc:phoneNumber "012-123-3456";

bdc:onlineResource
  rdf:type rdf:Property;
  rdfs:comment "online information that can be used to contact the individual or organization";
rdfs:domain bdc:ContactType ;
rdfs:range xsd:anyURI ;

bdc:organizationName
rdf:type rdf:Property ;
rdfs:comment "name of the responsible organization" ;
rdfs:domain bdc:ResponsibleParty ;
rdfs:range xsd:string ;

bdc:phoneNumber
rdf:type rdf:Property ;
rdfs:comment "telephone numbers at which the organization or individual may be contacted" ;
rdfs:domain bdc:ContactType ;
rdfs:range xsd:string ;

bdc:positionName
rdf:type rdf:Property ;
rdfs:comment "role or position of the responsible person" ;
rdfs:domain bdc:ResponsibleParty ;
rdfs:range xsd:string ;

bdc:prescriptionDist
rdf:type bdc:Distribution ;
dc:format "csv" ;
bdc:accessInformation "http://www.nhis.or.kr/prescription.csv"^^xsd:anyURI ;
bdc:dataRight bdc:right ;
bdc:dataType bdc:Structured ;
bdc:sampleData "http://www.nhis.or.kr/prescription.sample.csv"^^xsd:anyURI ;
dcat:byteSize "3999200"^^xsd:unsignedLong ;

bdc:prescriptionSet
rdf:type bdc:Dataset ;
dc:description "Disease prescription data" ;
dc:keyword "prescription" ;
dct:temporalCoverage "2013.1.1 ~ 2017.12.31" ;
dct:title "Disease prescription" ;
dc:updateFrequency "weekly" ;
bdc:contactPoint bdc:rParty ;

bdc:quality
rdf:type bdc:DataQuality ;
bdc:qualityRequirements "under 1% missing fields" ;
bdc:qualityResult "passed (99.3%)" ;
bdc:unitOfMeasure "percent" ;

bdc:qualityRequirements
rdf:type rdf:Property ;
rdfs:comment "requirement statement for evaluating quality of dataset" ;
rdfs:domain bdc:DataQuality ;
rdfs:range xsd:string ;

bdc:qualityResult
rdf:type rdf:Property ;
rdfs:comment "the result of quality evaluation described by the unit of measure" ;
rdfs:domain bdc:DataQuality ;
rdfs:range xsd:string ;

bdc:rParty
rdf:type bdc:ResponsibleParty ;
bdc:contact bdc:myContact ;
rdfs:comment "source domain information for the data catalogue" ;
rdfs:domain bdc:Catalogue ;
rdfs:range bdc:Domain ;

bdc:srcDomain
  rdf:type bdc:Domain ;
  dc:title "Medical" ;
  bdc:comment "Prescription ontology" ;
  bdc:taxonomy "http://purl.obolibrary.org/obo/PDRO.owl"^^xsd:anyURI ;

bdc:taxonomy
  rdf:type rdf:Property ;
  rdfs:comment "taxonomy information including classification system and authority" ;
  rdfs:domain bdc:Domain ;
  rdfs:range xsd:anyURI ;

bdc:unitOfMeasure
  rdf:type rdf:Property ;
  rdfs:comment "standard unit or system of units by means of which a quantity is accounted for and expressed." ;
  rdfs:domain bdc:DataQuality ;
  rdfs:range xsd:string ;

bdc:usageDomain
  rdf:type rdf:Property ;
  rdfs:comment "usage domain information for the data catalogue" ;
  rdfs:domain bdc:Catalogue ;
  rdfs:range bdc:Domain ;

bdc:useDomain
  rdf:type bdc:Domain ;
  dc:title "Health" ;
  bdc:comment "HL7's health data exchange" ;
  bdc:taxonomy "http://hl7.org/fhir/"^^xsd:anyURI ;

owl:versionInfo
  rdf:type bdc:Catalogue ;
  rdfs:range xsd:string ;

dcat:byteSize
  rdf:type bdc:Distribution ;
  rdfs:range xsd:unsignedLong ;
Bibliography


[b-W3C DCAT] W3C Recommendation (2014), *Data Catalog Vocabulary (DCAT).*
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<td>Series Z</td>
<td>Languages and general software aspects for telecommunication systems</td>
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