ISO 19115

Geographic information — Metadata — Biological Extensions

Workbook

*Guide to implementing ISO 19115:2003(E),
the North American Profile (NAP), and
ISO 19110 Feature Catalogue
with Biological Extensions*

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Table of Contents

INTRODUCTION
ISO 19115
Geographic information — Metadata — Biological Extensions

Main Sections of ISO Metadata	
Metadata (MD_Metadata)	Root element that contains information about the metadata itself.
Spatial Representation Information (gmd:spatialRepresentationInfo)	Information about the geospatial representation of a resource.
Reference System Information (gmd:referenceSystemInfo)	Information about the spatial and temporal reference systems used in the resource.
Metadata Extension Information (gmd:metadataExtensionInfo)	Information about user-specified extensions to the metadata standard used to describe the resource.
Identification Information (gmd:identificationInfo)	Information required to uniquely identify a resource or resources.
Content Information (gmd:contentInfo)	Information about the physical parameters and other attributes contained in a resource
Distribution Information (gmd:distributionInfo)	Information about who makes a resource available and how to get it
Data Quality Information (gmd:dataQualityInfo)	Information about the quality and lineage (including processing steps and sources) of a resource
Portrayal Catalogue Information (gmd:portrayalCatalogueInfo)	Information that identifies portrayal catalogues used for the resource
Metadata Constraint Information (gmd:metadataConstraints)	Information about constraints on the use of the metadata and the resource it describes
Application Schema Information (gmd:applicationSchemaInfo)	Information about the application schema used to build a dataset
Metadata Maintenance Information (gmd:metadataMaintenanceInfo)	Information about maintenance of the metadata and the resource it describes

Comparing FGDC and ISO Standards

The content of ISO 19115 strongly resembles the sections of the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM). The following information is **new** with ISO/NAP:

- Is far more flexible.
- Depicts relationships between datasets and collection level (parent/child relationships).
- Standardizes descriptors through the use of codelists.
- Accommodates new technologies (such as the ability to document services).
- Accommodates international scope.

ISO 19115 → FGDC CSDGM (FGDC-STD-001-1998)
ISO 19115-2 → FGDC Remote Sensing Extensions (RSE) (FGDC-STD-012-2002)
ISO 19110 → FGDC CSDGM Section 5 (Entity & Attribute Info)
ISO 19111 → FGDC CSDGM Section 4 (Spatial Reference Info)
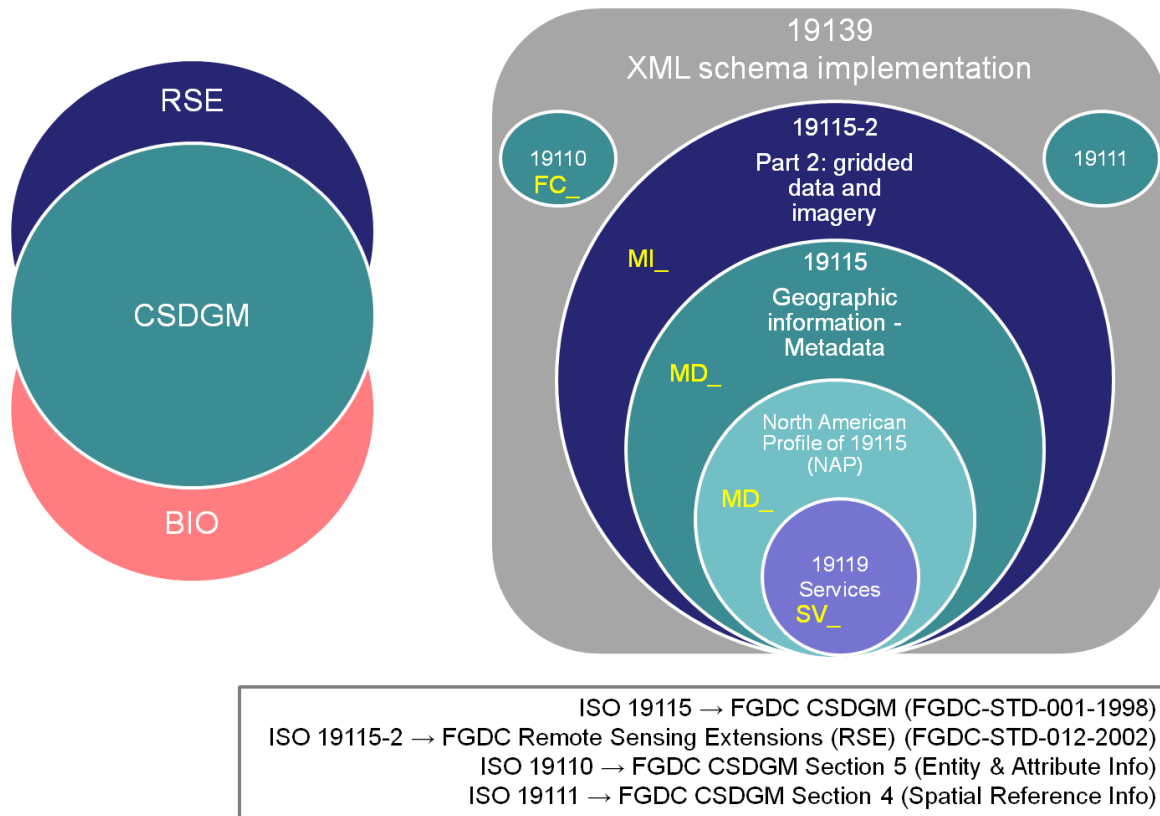
The CSDGM is the core, or base, of the FGDC standards for documenting geospatial data. Profiles and extensions to the core standard can shorten or extend the main standard and can change conditionality. The Biological Profile (BIO) extends the CSDGM in order to properly document biological information. The Remote Sensing Extensions (RSE) extends the CSDGM in order to document information about imagery and other remotely sensed data.

The core ISO standard for documenting geospatial data is ISO 19115 Geographic information – Metadata. ISO 19115-2 Geographic information – Metadata – Part 2: Extensions for imagery and gridded data extends the ISO 19115 in order to properly document information about imagery, gridded data, and remotely sensed data. The North American Profile (NAP) is a profile of ISO 19115. The NAP shortened the core and changed conditionality and multiplicity on several elements. ISO 19110 Geographic information – Methodology for feature cataloguing is a separate standard and separate document that ISO 19115 will reference if it exists. ISO 19110 is much like Section 5, Entity and Attribute Information, of the CSDGM. ISO 19111 Geographic information – Spatial referencing by coordinates is also a separate standard and separate document that can be referenced from ISO 19115. ISO 19111

is much like Section 4, Spatial Reference Information, of the CSDGM. ISO 19139 defines the XML encoding of the ISO metadata standards. ISO 19139 provides the structure and rules to which the validation should be set.

How ISO is Organized

The ISO workbook is organized in sections and packages. A section is a grouping of similar information (similar to FGDC sections). The main sections are listed in the Main Sections of ISO Metadata table above. A section may contain several packages. A package is a logical grouping of elements that maybe found in multiple locations within the main sections (similar to the "supporting sections" of the FGDC CSDGM). You may notice that some XML elements have a two-letter code followed by an underscore. These are packages.

> Ex:
> CI_ResponsibleParty

The package abbreviations are identified in the following table.

Package Abbreviations	
CI	Citation
DQ	Data Quality
DS	Dataset
EX	Extent
FC	Feature Catalogue
GM	Geometry
LE	Lineage Extended (added in ISO 19115-2)
LI	Lineage
MD	Metadata
MI	Metadata for Imagery (added in ISO 19115-2 and replace the root MD)
RS	Reference System
SV	Services
QE	Data Quality Extended

Using the Biological Profile

The Biological Profile of ISO extends ISO metadata. This profile can be used to extend either ISO 19115 Geographic information – Metadata or ISO 19115-2 Geographic information – Metadata – Part 2: Extensions for imagery and gridded data. For the ease of documentation, this workbook shows the Biological Profile extensions and its changes within ISO 19115. The same Biological Profile extensions can be applied to ISO 19115-2.

The Biological Profile extends the standard within MD_DataIdentification (again may use MD_Metadata or MI_Metadata root). New packages were added to the MD package for taxonomy. The new packages are *MD_TaxonCl*, *MD_TaxonSys*, and *MD_Vouchers*. These packages were added to facilitate the documentation of taxonomic sources, procedures, and treatments according to the National Biological Information Infrastructure (NBII). The Metadata Extension Information documents the use of the Biological Profile. An example is included in the proper section of this workbook. The Biological Profile also extends the MD_KeywordTypeCode domain to include *taxon*.

XML Basics

Note: All elements and attributes preserve the European spellings. Do not change (Americanize) them. Example: "organisation" is correct in these instances; "organization" is not.

Various views of metadata standards are text, HyperText Markup Language (HTML), and eXtensible Markup Language (XML).

The FGDC metadata that many are accustomed to seeing are the HTML or Text views. Text views are simple and easy to read, but are more of a legacy type of view. Text documents are often easily corrupted. HTML views can be customized for web viewing and other applications. Text and HTML views can be derived from the XML by applying a stylesheet, XSL or XSLT, over the base XML to display as you want.

XML is a set of rules for encoding documents in machine-readable form. XML's use emphasizes simplicity, interoperability, and usability over the Internet. XML consists of three main parts: tags, elements, and attributes.

Tag
A markup construct that begins with "<" and ends with ">".

      start-tags   **<**section**>**

      end-tags   **</**section**>** or **/>**

Element
An element is a logical component of a document that either begins with a start-tag and ends with a matching end-tag, or consists only of an empty-element tag. The characters between the start- and end-tags, if any, are the element's *content*, and may contain markup, including other elements, which are called child elements.

      <**Greeting**>*Hello, world.*</**Greeting**>

Attribute
An attribute is a markup construct consisting of a name/value pair that exists within a start-tag or empty-element tag. In the example (below), the element img has two attributes, *src* and *alt*:

      .

Another example would be <step *number*="3">Connect A to B.</step> where the name of the attribute is "number" and the value is "3". For more information about attributes, see *Using Attributes.*

Namespaces
You may notice in the XML that the element names have a three-letter code followed by a colon.

      Ex:

      gco:CharacterString

These codes are called namespaces. The namespace is a container that provides context and rules for elements. A definition of a term may change, depending on what namespace is applied. The namespace abbreviation table identifies namespaces that may be found in the XML.

Namespace Abbreviations	
gco	Geographic Common extensible markup language
gfc	Geographic Feature Catalogue extensible markup language
gmd	Geographic Metadata extensible markup language
gmx	Geographic Metadata XML schema
gss	Geographic Spatial Schema extensible markup language
gsr	Geographic Spatial Referencing extensible markup language
gts	Geographic Temporal Schema extensible markup language
gml	Geography Markup Language
xlink	XML Linking Language
xs	W3C XML base schemas

Using Attributes

XML elements can have attributes, as previously discussed. These attributes provide additional information about an element. Often, the additional information is not part of the data. Attribute values must contain either single or double quotes. Attributes tend to be "grouped" by certain types. Elements that are ISO roles (xml tags that start with lower case) will often allow XLinks, uuidref, and nilReason attributes. Elements that are ISO objects (xml tags that start with two upper case package abbreviations) will often allow ids and uuids. The frame, calendarEraName, and indeterminatePosition are gml attributes and found within time positions.

> Ex:
> <MD_Keywords> will allow the id and uuid attributes
> <gmd:thsaurusName> will allow the XLink attributes type, href, role, arcole, title, show, and actuate as well as the uuidref and nilReason attributes.
> <gml:beginPosition> will allow the gml attribues of frame, calendarEraName, and indeterminatePosition.

id
An identifier for the element, if specified, must be unique within the XML document. The value of the identifier must always start with a letter, an underline (_), or a colon (:). An XML element can have only one attribute of type ID. The identifiers used in the id attribute are XML Names that have significant restrictions. They must begin with a letter, an underline (_), or a colon (:), and, after the first character, be composed only of letters, digits, underlines, and hyphens (-). This attribute is often mandatory for such items as units and extents.

> Ex:
> <gml:BaseUnit gml:id="lengthUnit">
> <gml:identifier codeSpace="SI">meters</gml:identifer>
> <gml:unitsSystem xlink:href="http://www.bipm.org/en/si/"/>
> </gml:BaseUnit>

idref
A reference to an XML element in the XML document. The value must correspond to an attribute value of type ID in an existing XML element. The idref attribute allows an XML element to refer to another XML element within the same document that has a corresponding id attribute.

idrefs
A reference to one or more XML elements. The values must be separated by spaces and must correspond to existing XML element ID's.

<u>uuid</u>
Note: The uuid of any deleted object cannot be used again.

The uuids are Universally Unique Identifiers which also have special characteristics. A uuid is assigned to an object when it is created and is stable over the entire life span of the objects. uuids are required for long-term distributed data management and for realizing update mechanisms. These identifiers are also called persistent identifiers. A uuid is a 16-byte number that consists of 32 hexadecimal (0-9 and a-f) values. The values are split into five groups, separated by hyphens in the form 8-4-4-4-12 or 8-4-4-16 for a total of 36 characters (32 values and 4 hyphens).

Ex:
uuid="594D435F-954C-1022-78E7-D62F30CD0592"

<u>uuidref</u>
The uuidref attribute is used to refer to an XML element that has a corresponding uuid attribute.

Ex:
uuidref="594D435F-954C-1022-78E7-D62F30CD0592"

<u>uom</u>
The uom attribute provides an identifier of the unit of measure used. The uom attribute is often mandatory for the element that uses it.

Ex:
<gmi:groundResolution>
        <gco:Distance uom="meters">10.0</gco:Distance>
</gmi:groundResolution>

<u>frame</u>
The frame attribute is optional and allows the user to specify the temporal reference system to be used for interpretation of the value of the time position.

Ex:
<gml:timePosition frame="tcs.xml#geologyMA">-2500</gml:timePosition>

<u>calendarEraName</u>
The calendarEraName attribute is optional and provides the name of the calendar era to which the date is referenced (e.g. the Meiji era of the Japanese calendar).

Ex:
<gml:beginPosition calendarEraName="Seireki">1965</gml:beginPosition>
<gml:endPosition calendarEraName="Seireki">1990</gml:endPosition>

<u>indeterminatePosition</u>
The indeterminatePosition attribute is optional and is used in time posistions and can be used alone or it can quality a specific calue for a temporal position. This attribute is often used to document unknown and present dates. The valid values for indeterminatePosition are *"unknown", "after", "before"*, and *"now"*. If indeterminatePosition = "now" the best practice is to put the date and time of the instance of metadata creation.

Ex:
<gml:TimePeriod gml:id="boundingTemporalExtent">
        <gml:description>ground condition</gml:description>
        <gml:beginPosition>1990-11-03T00:00:00</gml:beginPosition>
        <gml:endPosition indeterminatePosition="now"/>

```
</gml:TimePeriod>
```

XLinks

The XML Linking Language (XLink) allows elements to be inserted into XML documents for creating and describing links between resources, similar to HTML hyperlinks. Linking elements are recognized based on the use of a designated attribute named xml:link and a set of accompanying global attributes. The global attributes are *type*, *href*, *role*, *arcrole*, *title*, *show*, and *actuate*. If an XLink is used, then the following ISO component is not used.

type

The type attribute indicates the XLink element type such as simple, extended, locator, arc, resource or title.

href

The value of the href attribute in linking elements contains a locator that identifies a resource, e.g., by a URI-reference or by an XPointer specification. The xlink href attribute is used to reference a component and the xlink title attribute is used to apply a human understandable name to the component. Components are snippets of XML that describe a specific piece of metadata content, such as information about people, websites, documents, archives, instruments, etc. A component is the finest level (atomic level) of granularity in a metadata record. Components are stored once and used as often as required within a metadata collection. Components provide significant storage and editing advantages over the traditional metadata management method of storing each record as a whole. XLinks can be used to reference a component from an unresolved metadata record (unresolved meaning that the metadata record contains xlinks). The xlink references a specific component by its unique identifier (UUID). During the resolve process, a component referenced via XLink is retrieved and embedded in the record (resolved metadata record).

> Ex:
> <gmd:contact xlink:href="http://www.ngdc.noaa.gov/docucomp/iso/8294BEE08AD7359FE040AC8C5AB460D1"/>

role

The role attribute specifies a part of the link's semantics. The value of this attribute indicates a property that the entire link has and identifies to the application software the meaning of the link. This allows the application to show different symbols for the different kinds of links.

arcrole

The arcrole attribute corresponds to the Resource Description Framework (RDF) notion of a property, where the role can be interpreted as stating that "*starting-resource* HAS *arc-role ending-resource*". This contextual role can differ from the meaning of an ending resource when taken outside the context of this particular arc. For example, a resource might generically represent a "person", but in the context of a particular arc it might have the role of "mother" and in the context of a different arc it might have the role of "daughter".

title

The title attribute indicates a human-readable description of the entire link.

> Ex:
> <gmd:contact xlink:href="http://www.ngdc.noaa.gov/docucomp/iso/8294BEE08AD7359FE040AC8C5AB460D1"
> xlink:title="Anna Milan"/>

Note: Often, the best practice that has emerged is to add the role in parenthesis to the xlink:title if the component is a contact. This aids in providing more "human readable" content.

> Ex:
> <gmd:contact xlink:href="http://www.ngdc.noaa.gov/docucomp/component/7c7d17a0-4d66-11df-9879-0800200c9a66" xlink:title="DOC/NOAA/NESDIS/NODC/NCDDC> National Coastal Data Development Center (pointOfContact)"/>

show
This attribute indicates the behavior policies to use when the link is traversed for the purpose of display or processing. The embed value indicates that the designated resource should be embedded in the body of the resource and at the location where the traversal started. The replace value indicates that the designated resource should replace the resource where the traversal started. The new value indicates that the designated resource should be displayed or processed in a new context.

actuate
The actuate attribute is used to express a policy as to when the traversal of a link should occur. The auto value indicates that the resource is automatically traversed. The user value indicates that the link is traversed only on the request of the user. The valid values for actuate are *"onLoad", "onRequest", "other"*, and *"none"*.

nilReason
The nilReason attribute is used to explain why an element is not included in the XML. This attribute allows a reason (explaining why the actual value cannot be provided) to exist in place of an actual value. It can have the values "inapplicable", "missing", "template", "unknown", and "withheld".

```
Ex:
<gmd:date>
    <gmd:CI_Date>
            <gmd:date gco:nilReason="unknown"/>
            <gmd:dateType>
                    <gmd:CI_DateTypeCode
                codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
            codeListValue="publication" codeSpace="002">publication</gmd:CI_DateTypeCode>
            </gmd:dateType>
    </gmd:CI_Date>
</gmd:date>
```

Using CodeLists

To standardize values for certain metadata elements, ISO metadata uses codelists. A codelist is an enumeration of values. It is a flexible mechanism that allows the extension of code lists as needed.

Use attributes to refer to a specific codelist value in a register. Codelists contain the attributes "*codeList*", "*codeListValue*", and "*codeSpace*". The *codeList* attribute is mandatory and contains a URL that references a codeList definition within a registry or a codeList catalogue. The *codeListValue* attribute is also mandatory and contains the name of the selected value. The *codeSpace* attribute is optional and refers to the alternative expression of the codeListValue. See Annex C for more information about specific ISO codelists.

CI_DateTypeCode – identification of when a given event occurred

Name	Domain code	Definition
creation	001	date identifies when the resource was brought into existence
publication	002	date identifies when the resource was issued
revision	003	date identifies when the resource was examined or re-examined and improved or amended

Ex:
```
<gmd:dateType>
        <gmd:CI_DateTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication" codeSpace="002">publication</gmd:CI_DateTypeCode>
</gmd:dateType>
```

Date and Time Formats

The proper date formats correspond to ISO 8601, Data elements and interchange formats – Information interchange – Representation of dates and times. See Annex A for more information and examples.

Calendar date is the most common date representation and is expressed as—

> *YYYY-MM-DD*

where *YYYY* is the year in the Gregorian calendar, *MM* is the month of the year between 01 (January) and 12 (December), and *DD* is the day of the month between 01 and 31.

Ex:
2010-08-11 represents August 11, 2010.

Time of the day is the time representation, uses the 24-hour timekeeping system and is expressed as—

> *hh:mm:ss*

where *hh* is the number of complete hours that have passed since midnight, *mm* is the number of complete minutes since the start of the hour, and *ss* is the number of complete seconds since the start of the minute.

Ex:
23:59:59 represents the time 1 second before midnight.

Date and time represent a specified time of a specified day. When using the calendar date, the representation is—

> *YYYY-MM-DDThh:mm:ss*

where *T* is used to separate the date and time components.

Ex:
2010-08-11T13:31:01 represents 31 minutes and 1 second after 1 o'clock in the afternoon of August 11, 2010.

Using the Workbook

The workbook is a resource for applying the ISO metadata standard and its profiles. It provides names and definitions, describes domain values (valid values that can be assigned to the data element), and uses a graphic representation of the production rules. The workbook is organized by main sections and supporting packages. The main sections are documented in the order in which they appear in the standard. The packages are referred to from various points within the main sections and other packages. The packages are documented in alphabetical order.
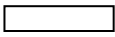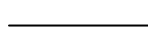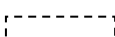
The workbook includes the selected geographic information metadata standard implementation guide, as well as the feature catalogue standard implementation guide. The workbook also documents differences between the ISO standard and the NAP. NAP compliancy is documented at "Multiplicity". The workbook is structured as follows; the fileIdentifier is an example of that structure.

Tag: XML tag
Definition: Definition of the tag
Type: Type or package
Domain: Format of the content
Multiplicity: If something is repeatable and if it is required
Attributes: XML attributes
Best Practices: Recommended implementation

---

fileIdentifier – A unique phrase or string that uniquely identifies the metadata file
       Type: gco:characterString
       Domain: free text
       Multiplicity: optional *This is NAP requirement*
       Attributes: nilReason
       Best Practices: Each metadata record shall have a universal unique identifier (UUID) to distinguish it from others.

Reading the Graphics

The graphics were generated automatically from the actual ISO schemas using Altova's XMLSpy software. The graphics were then cleaned up to provide easier-to-read graphical representations of the standard. The legend of symbols required to read the graphics is provided below. Additional symbols are the result of the automating software and are not considered necessary to the understanding of the standard. The actual Unified Modeling Language (UML) diagrams can be found in Annex E.

Graphic Legend	
(—▪▪▪—)	sequence
(—⊦—)	choice
▭ Or ———————	mandatory
⌐ - - - - ⌐ Or - - - - - - - -	optional
▭ (yellow)	conditional
0...∞	repeatability
⊞	closed but expands further
⊟	opened to show expansion

ISO 19115

MD_Metadata

- gmd:fileIdentifier
- gmd:language
- gmd:characterSet
- gmd:parentIdentifier
- gmd:hierarchyLevel
  0..∞
- gmd:hierarchyLevelName
  0..∞
- gmd:contact
  1..∞
- gmd:dateStamp
- gmd:metadataStandardName
- gmd:metadataStandardVersion
- gmd:dataSetURI
- gmd:locale
  0..∞
- gmd:spatialRepresentationInfo
  0..∞
- gmd:referenceSystemInfo
  0..∞
- gmd:metadataExtensionInfo
  0..∞
- gmd:identificationInfo
  1..∞
- gmd:contentInfo
  0..∞
- gmd:distributionInfo
- gmd:dataQualityInfo
  0..∞
- gmd:portrayalCatalogueInfo
  0..∞
- gmd:metadataConstraints
  0..∞
- gmd:applicationSchemaInfo
  0..∞
- gmd:metadataMaintenance

Metadata

0   MD_Metadata – Root entity that defines information about metadata.
>   Type: compound
>   Multiplicity: optional
>   Attributes: id, uuid
>   Best Practices: MD_Metadata refers to ISO19115, MI_Metadata refers to ISO19115-2.

0.1   fileIdentifier – A unique phrase or string which uniquely identifies the metadata file.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: optional *this is a NAP requirement*
>   Attributes: nilReason
>   Best Practices: Each metadata record shall have a universal unique identifier (UUID) to
>   distinguish it from others.

0.2   language – Language of the metadata composed of an ISO639-2/T three-letter language code and an
>   ISO3166-1 three-letter country code.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: optional *this is NAP requirement*
>   Attributes: nilReason
>   Best Practices: The language code and country code are documented in the following manner:
>   <ISO639-2/T three letter language code><;><blank space><ISO3166-1 three letter country code>
>   Country code is given in uppercase. See Annex B.

FAQ: How would you populate the element "language" for a dataset composed in English from the United States?

eng; USA

0.3   characterSet – Character coding standard in the metadata.
>   Type: MD_CharacterSetCode
>   Domain: ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2, 8859part3, 8859part4, 8859part5,
>   8859part6, 8859part7, 8859part8, 8859part9, 8859part10, 8859part11, 8859part13, 8859part14,
>   8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii, ebcdic, eucKR, big5, GB2312
>   Multiplicity: optional *this is a NAP requirement*
>   Attributes: nilReason
>   Best Practices: The character set for the metadata is set to "utf8" by default.

0.4   parentIdentifier – The unique name of the file or associated fileIdentifier, related in higher hierarchy to
>   the file.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: conditional
>   Attributes: nilReason
>   Best Practices: parentIdentifier is documented when the hierarchy of a higher level exists. If
>   there is more than one parent, see Aggregation Information.

0.5   hierarchyLevel – Level to which the metadata applies.
       Type: MD_ScopeCode
       Domain: attribute, attributeType, collectionHardware, collectionSession, dataset, series,
       nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession,
       software, service, model, tile
       Multiplicity: optional, repeatable *this is a NAP requirement*
       Attributes: nilReason
       Best Practices: Default repeatability is 1. If hierarchy is unknown, default value is "dataset".

0.6   hierarchyLevelName – Name of the hierarchy levels for which the metadata is provided
       Type: gco:CharacterString
       Domain: free text
       Multiplicity: optional, repeatable *this is not in NAP*
       Attributes: nilReason

0.7   contact – The responsible party for the metadata content.
       Type: CI_ResponsibleParty
       Multiplicity: mandatory, repeatable
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
       Best Practices: The organisation directly responsible for the metadata maintenance. Contact
       information shall be provided.

FAQ: Where are the data elements for "contact"?

Because the "contact" elements are required by another section, the elements were grouped in the citation package
(CI) at CI_ResponsibleParty.

0.8   dateStamp – Metadata creation date.
       Type: choice of gco:Date or gco:DateTime
       Domain: date
       Multiplicity: mandatory
       Attributes: nilReason
       Best Practices: Date of the metadata creation or the last metadata update. Refer to
       date format information.

0.9   metadataStandardName – Name of the metadata standard/profile used.
       Type: gco:characterString
       Domain: free text
       Multiplicity: optional *this is a NAP requirement*
       Attributes: nilReason
       Best Practices: ISO 19115 Geographic Information – Metadata or ISO 19115-2 Geographic
       Information – Metadata – Part 2: Extensions for Imagery and Gridded Data *reference NAP if
       NAP is used*

0.10   metadataStandardVersion – Version of the metadata standard/profile used.
       Type: gco:characterString
       Domain: free text
       Multiplicity: optional
       Attributes: nilReason
       Best Practices: ISO 19115:2003(E) or ISO 19115-2:2009(E) *reference NAP if NAP is used*

0.11   dataSetURI – Uniform Resource Identifier (URI) of the dataset to which the metadata applies.
          Type: gco:characterString
          Domain: free text
          Multiplicity: optional
          Attributes: nilReason
          Best Practices: This is NOT the place to link to the dataset. This should be the link to the metadata.

FAQ: Why is the dataSetURI a link to the metadata vs. the data?

The dataSetURI is found within MD_Metadata, defining information about the metadata. Because of where this element is contextually, it should describe the location of the metadata record, not the data set. This is similar to the way in which the CSDGM is used. Online Linkage gets you the URL for a Citation for the publication of which the data may be a part, since it is part of the Citation Information. A link to the dataset should be found within the Distribution Information. For ISO, to document the URL to the data, document so in the Distribution OnlineResource. Similarly, within the CSDGM, Network Resource Name is for the URL that gets you the data package, because it is part of the Standard Order Process.

0.12   locale – Other languages used in metadata free text descriptions.
          Type: PT_Locale
          Multiplicity: conditional, repeatable
          Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
          Best Practices: locale is mandatory when more than one language is used in free text descriptions

spatial Representation Information
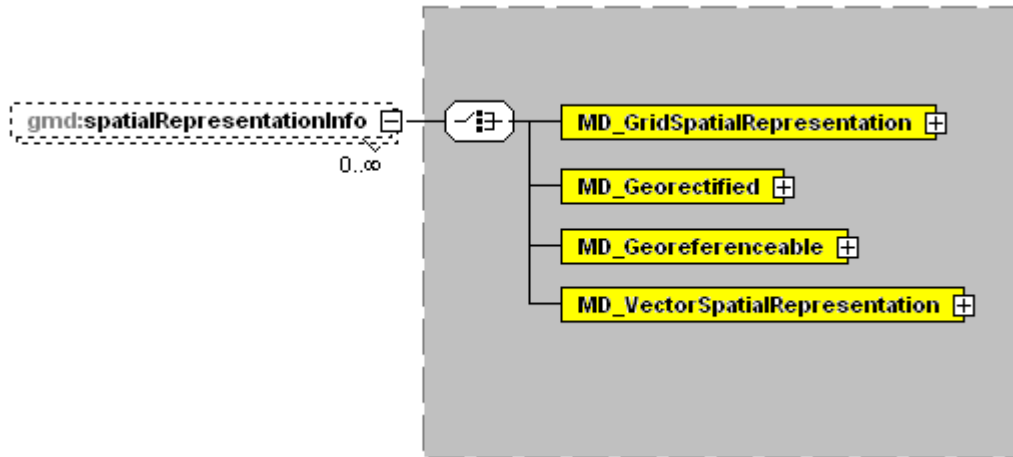
1   spatialRepresentationInfo – Digital representation of spatial information in the dataset.
              Type: MD_VectorSpatialRepresentation or MD_GridSpatialRepresentation or MD_Georectified
              or MD_Georeferenceable
              Multiplicity: optional, repeatable
              Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Reference System Information
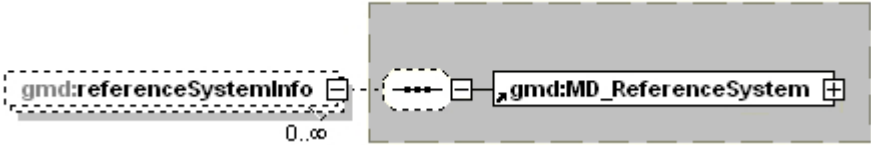
2   referenceSystemInfo – Identification of the spatial and temporal reference systems used.
            Type: MD_ReferenceSystem
            Multiplicity: conditional, repeatable
            Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
            Best Practices: Mandatory if spatialRepresentationType in dataIdentification is vector, grid, or
            tin.

Metadata Extension Information
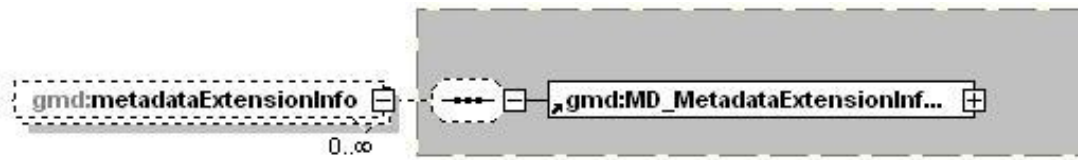
3   metadataExtensionInfo – Information describing metadata extensions
          Type: MD_MetadataExtensionInformation
          Multiplicity: optional, repeatable *this is not in NAP*
          Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Identification Information
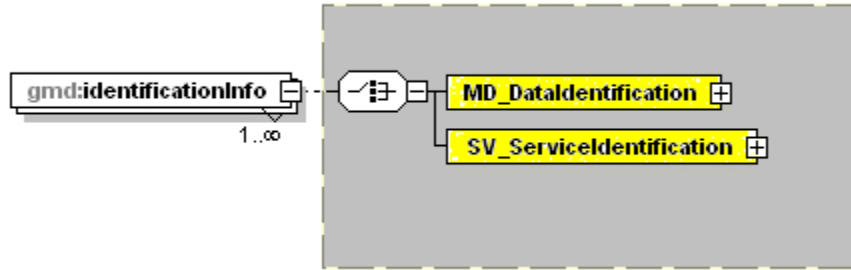
4   identificationInfo – Basic information about the dataset.
                Type: MD_DataIdentification or SV_ServiceIdentification
                Multiplicity: mandatory, repeatable
                Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
                Best Practices: There must be one occurrence of MD_DataIndentification or SV_ServiceIdentification

Content Information
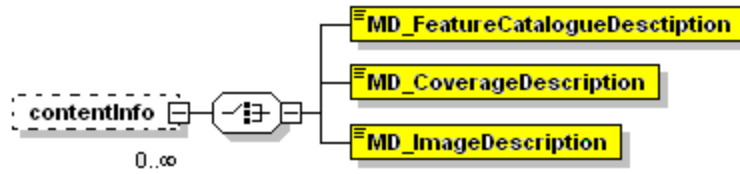
5   contentInfo – Characteristics describing the feature catalogue, the coverage, and the image data.
           Type: MD_FeatureCatalogueDescription or MD_CoverageDescription or MD_ImageDescription
           Multiplicity: optional, repeatable
           Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
           Best Practices: Must have MD_FeatureCatalogueDescription or MD_CoverageDescription or MD_ImageDescription

Distribution Information
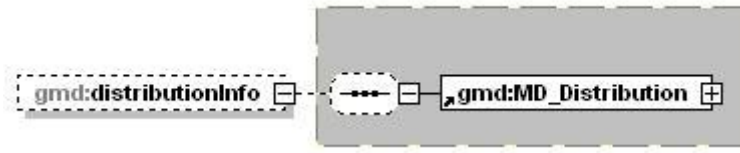
6   distributionInfo – Information about acquiring the dataset.
              Type: MD_Distribution
              Multiplicity: optional
              Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

---

FAQ: **When do you use Distribution Information vs. Service Information?**

If computers read it, the information goes in Services. If humans read it, the information goes in Distribution.

Data Quality Information

7   dataQualityInfo – Information on the quality of the data that is specified by a data quality scope.
         Type: DQ_DataQuality
         Multiplicity: optional, repeatable
         Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Portrayal Catalogue Information
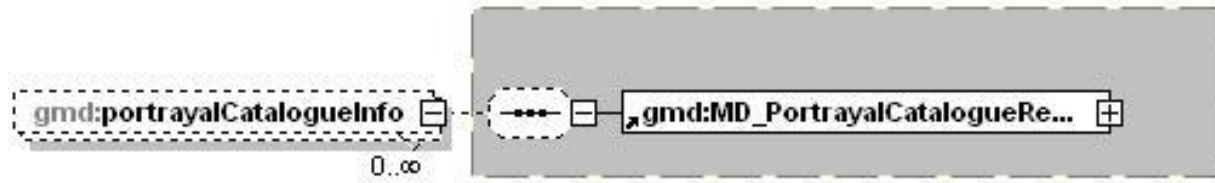
8   portrayalCatalogueInfo – A portrayal catalogue is a collection of defined symbols used to depict, to humans, features on a map.

>   Type: MD_PortrayalCatalogueReference
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Metadata Constraint Information
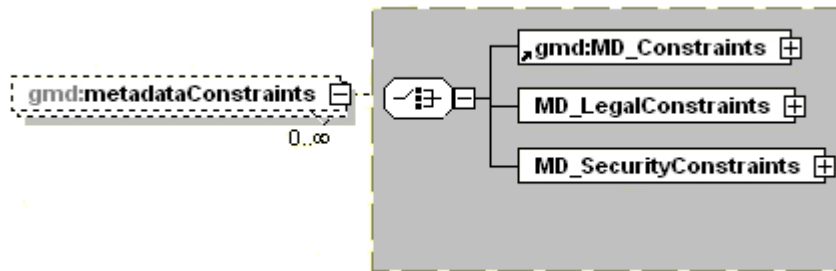
9   metadataConstraints – The limitations or constraints on the use of or access of the metadata.
                Type: MD_Constraints or MD_LegalConstraints or MD_SecurityConstraints
                Multiplicity: optional, repeatable
                Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Application Schema Information
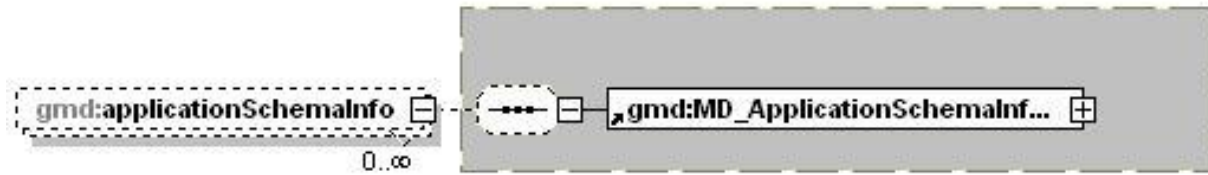
10   applicationSchemaInfo – Information about the conceptual schema of the dataset.
              Type: MD_ApplicationSchemaInformation
              Multiplicity: optional, repeatable
              Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Metadata Maintenance Information

11   metadataMaintenance – Information about metadata updates.
            Type: MD_MaintenanceInformation
            Multiplicity: optional
            Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

CI PACKAGE

CI_Address
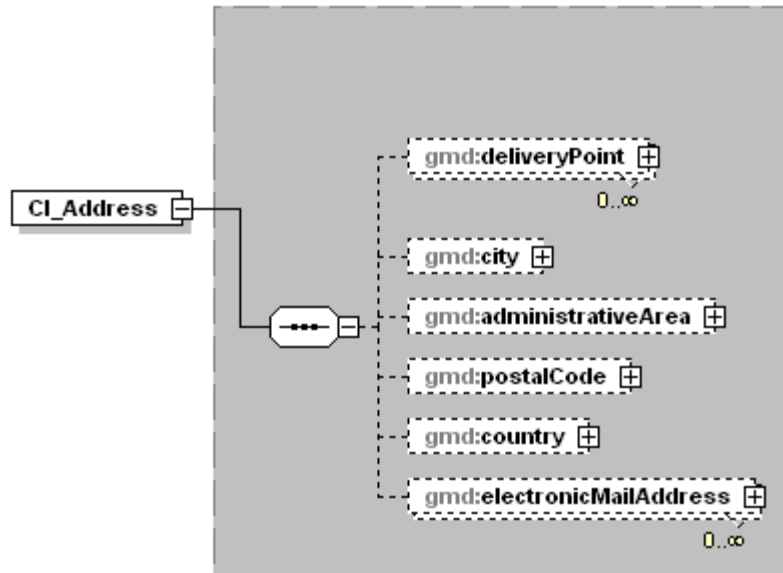
CI_Address – Physical and email address at which the organisation or individual may be contacted.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

deliveryPoint – Address line for the location.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable *this is not repeatable in NAP*
> Attributes: nilReason

city – City of the address
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

adminstrativeArea – State or province of the address.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

postalCode – Administrative spatial code which assists mail and parcel delivery.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

country – Country of the physical address.

Type: gco:characterString
Domain: free text
Multiplicity: optional
Attributes: nilReason
Best Practices: Refer to ISO3166. See Annex B.

electronicMailAddress – The electronic mailbox address of the responsible organisation or individual.
Type: gco:characterString
Domain: free text
Multiplicity: optional, repeatable
Attributes: nilReason

Ex:

```
<gmd:CI_Address>
        <gmd:deliveryPoint>
                <gco:CharacterString>Building 1100; Rm 101</gco:CharacterString>
        </gmd:deliveryPoint>
        <gmd:city>
                <gco:CharacterString>Stennis Space Center</gco:CharacterString>
        </gmd:city>
        <gmd:administrativeArea>
                <gco:CharacterString>MS</gco:CharacterString>
        </gmd:administrativeArea>
        <gmd:postalCode>
                <gco:CharacterString>39529</gco:CharacterString>
        </gmd:postalCode>
        <gmd:country>
                <gco:CharacterString>USA</gco:CharacterString>
        </gmd:country>
        <gmd:electronicMailAddress>
                <gco:CharacterString>ncddcmetadata@noaa.gov</gco:CharacterString>
        </gmd:electronicMailAddress>
</gmd:CI_Address>
```

CI_Citation
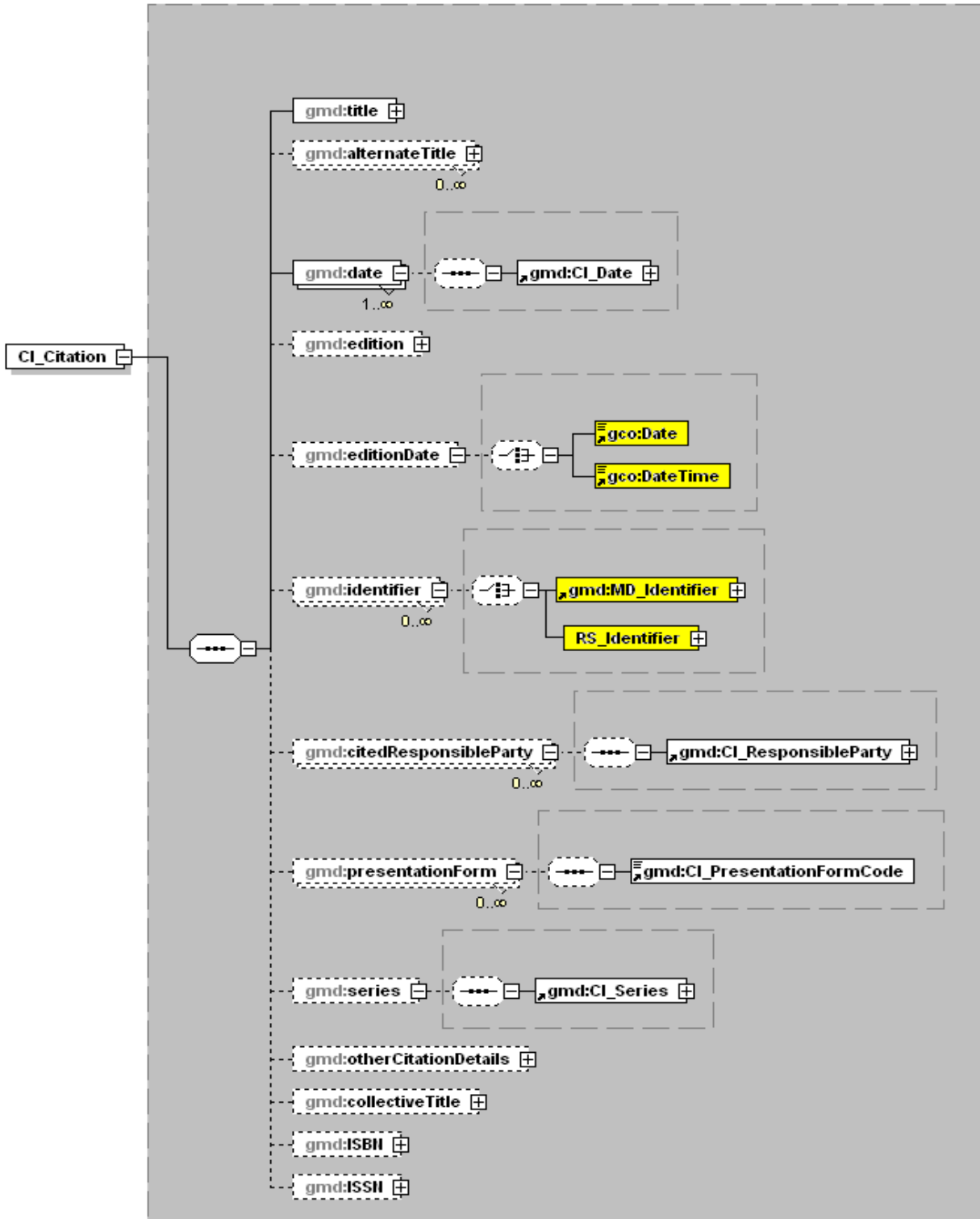
CI_Citation – Bibliographic information to reference the resource.
>> Type: compound
>> Multiplicity: mandatory
>> Attributes: id, uuid

> title – Name by which the cited resource is known.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: mandatory

> alternateTitle – Short name or other language name by which the cited information is known.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: optional, repeatable

> date – Reference date for the cited resource; reference date and event used to describe it.
>> Type: CI_Date
>> Multiplicity: mandatory, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>> Best Practices: Whenever possible, include both creation date and revision date.

> edition – Version of the cited resource.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: optional
>> Attributes: nilReason

> editionDate – Reference date for the cited resource.
>> Type: choice of gco:Date or gco:DateTime
>> Domain: date
>> Multiplicity: optional
>> Attributes: nilReason

> identifier – A unique value that identifies an object in a given namespace.
>> Type: MD_Identifier or RS_Identifier
>> Multiplicity: optional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> citedResponsibleParty – Identification of the contact for the resource.
>> Type: CI_ResponsibleParty
>> Multiplicity: optional, repeatable *this is a NAP requirement*
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> presentationForm – The form in which the resource is available.
>> Type: CI_PresentationFormCode
>> Domain: documentDigital, documentHardcopy, imageDigital, imageHardcopy, mapDigital,

mapHardcopy, modelDigital, modelHardcopy, profileDigital, profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy

Multiplicity: optional, repeatable

Attributes: nilReason

Best Practices: See Annex C.

series – Information about the series or collection of which the resource is a part.

Type: CI_Series

Multiplicity: optional

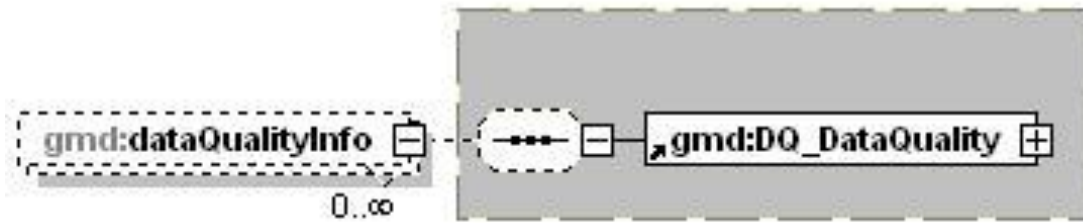Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
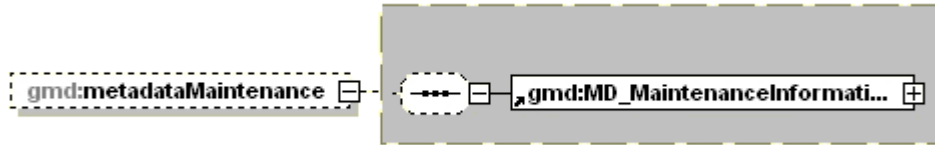
otherCitationDetails – Other information to complete a citation.

Type: gco:characterString

Domain: free text

Multiplicity: optional

Attributes: nilReason

collectiveTitle – Information about the combined resource of which the dataset is a part. The description may include information on other volumes which are also available.

Type: gco:characterString

Domain: free text

Multiplicity: optional

Attributes: nilReason

ISBN – The international standard book number (ISBN) assigned by an ISBN authority to a publication such as a book, a pamphlet, an educational kit, a microform, a CD-ROM or another digital or electronic publication.

Type: gco:characterString

Domain: free text

Multiplicity: optional

Attributes: nilReason

ISSN – The international standard serial number (ISSN) assigned by an ISSN authority to a serial publication such as a periodical, a newspaper, an annual, a journal, or a monographic series.

Type: gco:characterString

Domain: free text

Multiplicity: optional

Attributes: nilReason

CI_Contact
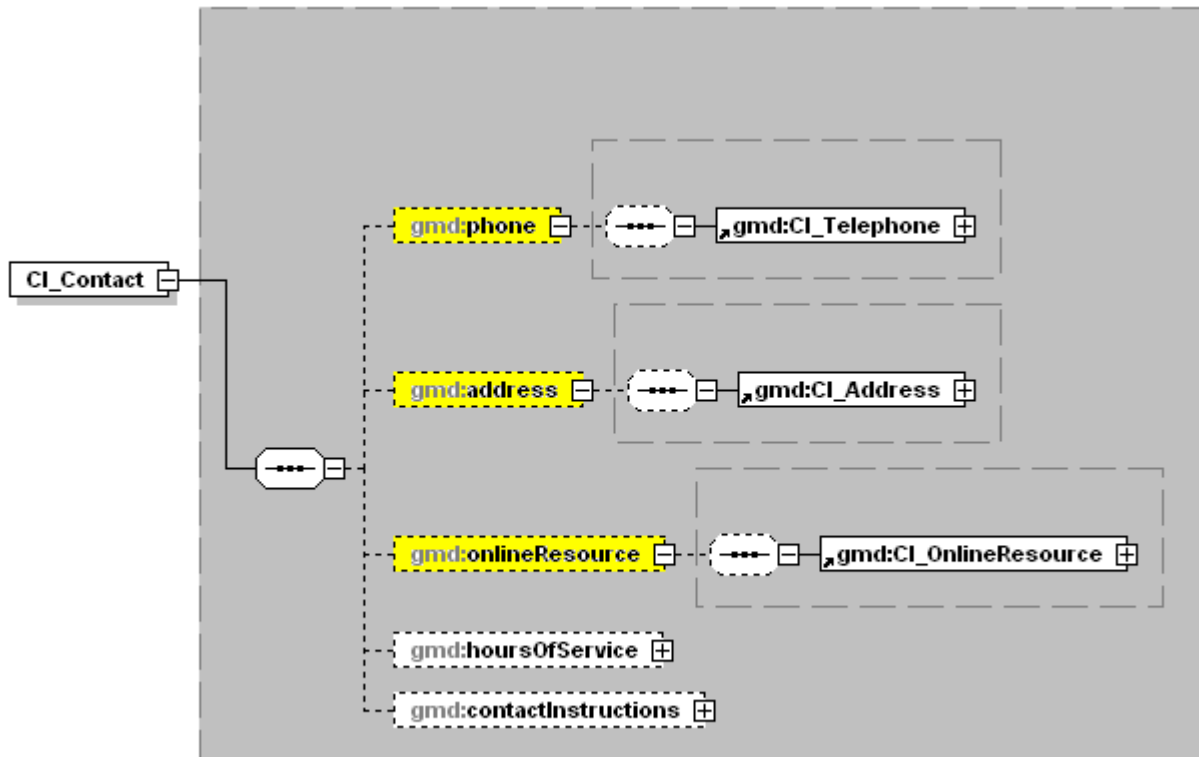
CI_Contact – Information which assists one to contact an individual or organisation.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid
        Best Practices: one of phone, address, or onlineResource shall be provided.

phone – Telephone numbers to contact the organisation or individual.
        Type: CI_Telephone
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: one of phone, address, or onlineResource shall be provided.

address – Physical and email address to contact the organisation or individual.
        Type: CI_Address
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: one of phone, address, or onlineResource shall be provided.

onlineResource – Information about Internet hosted resources: availability; URL; protocol used; resource name; resource description, and resource function.
        Type: CI_OnlineResource
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: one of phone, address, or onlineResource shall be provided.

hoursOfService – Time period (including time zone) when individuals can contact the organisation or individual.

        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason
   Best Practices: Refer to ISO 8601 for the representation of time.

contactInstructions – Supplemental instructions on how or when to contact the individual or organisation.

        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

CI_Date
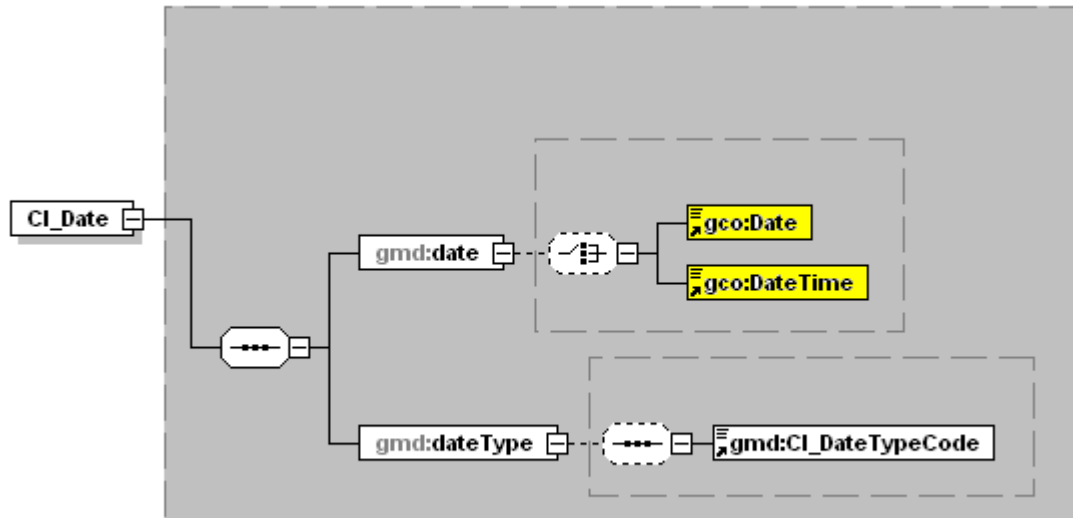
CI_Date – The date in which the event or action occurred.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

   date – The date in which the event or action occurred.
        Type: choice of gco:Date or gco:DateTime
        Domain: date
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: Date is represented minimally as a four digit representation for year- YYYY. Refer to FAQ for further format information.

   dateType – Identification of the event used for the temporal aspects in the resource.
        Type: CI_DateTypeCode
        Domain: creation, publication, revision
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

FAQ: **What is the proper date format for gco:Date and gco:DateTime?**

The proper date formats correspond to ISO 8601, Data elements and interchange formats – Information interchange – Representation of dates and times.

Calendar date is the most common date representation. It is—

      YYYY-MM-DD

where *YYYY* is the year in the Gregorian calendar, *MM* is the month of the year between 01 (January) and 12 (December), and *DD* is the day of the month between 01 and 31.
Ex:
2010-08-11 represents August 11, 2010.

Time of the day is the time representation, using the 24-hour timekeeping system. It is—

hh:mm:ss

where *hh* is the number of complete hours that have passed since midnight, *mm* is the number of complete minutes since the start of the hour, and *ss* is the number of complete seconds since the start of the minute.

Ex:
23:59:59 represents the time 1 second before midnight.

Date and time represents a specified time of a specified day. When use is made of the calendar date the representation is─

YYYY-MM-DDThh:mm:ss

where *T* is used to separate the date and time components.

Ex:
2010-08-11T13:31:01 represents 31 minutes and 1 second after one o'clock in the afternoon of August 11, 2010.

CI_OnlineResource
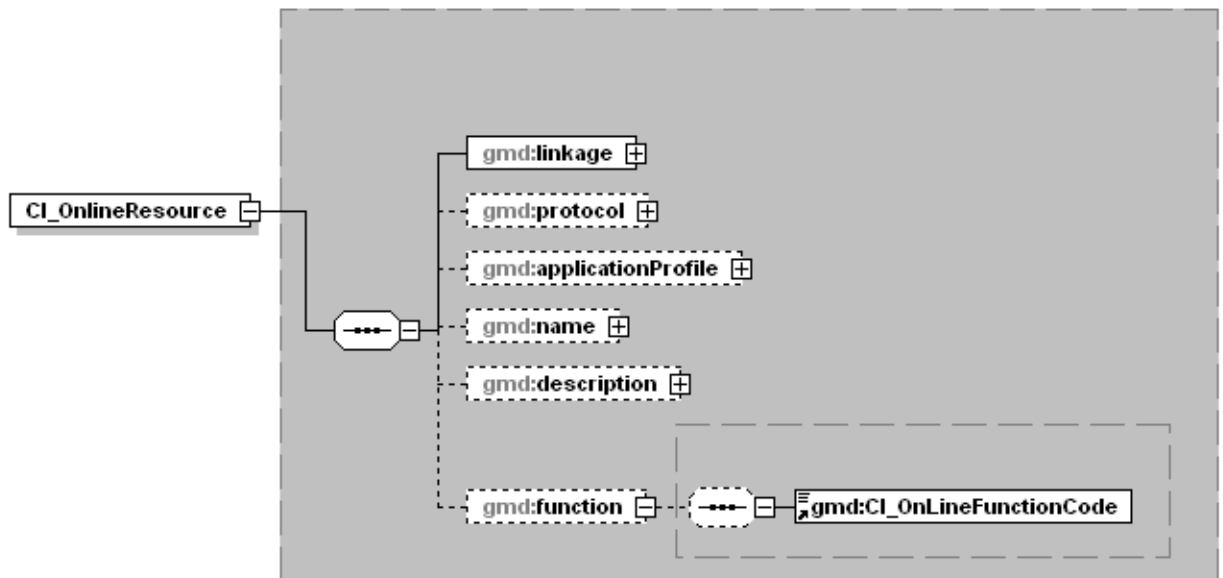
CI_OnlineResource – Information on the Internet available resource.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

linkage – Internet location (address) for on-line access which uses a Uniform Resource Locator address or similar addressing scheme.
> Type: URL
> Domain: any valid URL
> Multiplicity: mandatory
> Attributes: nilReason

protocol – The connection protocol to be used such as http, ftp, etc.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional *this is a NAP requirement*
> Attributes: nilReason
> Best Practices: The protocol should be taken from an official controlled list such as the Official Internet Protocol Standards or the Internet Assigned Numbers Authority (IANA).

applicationProfile – Name of an application profile that can be used with the online resource.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

name – Name of the online resource.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

description – Description of the online resource that provides the resource sought.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

function – Code for function performed by the online resource.
> Type: CI_OnlineFunctionCode
> Domain: download, information, offlineAccess, order, search
> Multiplicity: optional
> Best Practices: See Annex C.

CI_ResponsibleParty
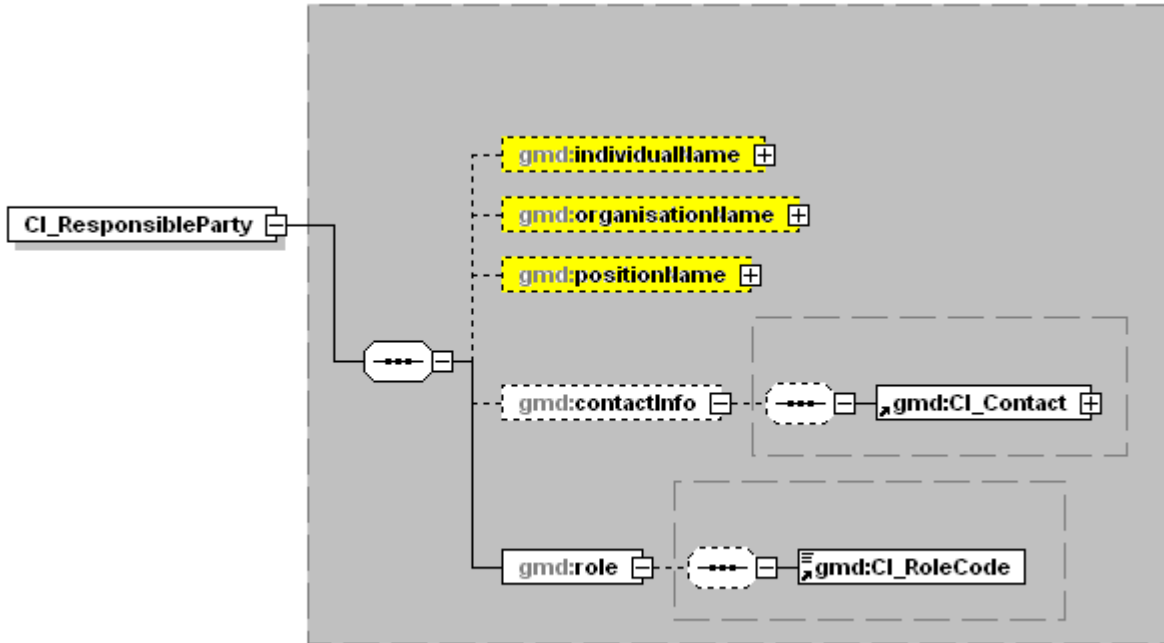
CI_ResponsibleParty – The identification of those responsible for the resource and the party's role in the resource.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid
> Best Practices: Must have one occurrence of either individualName, organisationName, and/or positionName.

individualName – The name of the responsible individual.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: individualName shall be provided if organisationName and/or positionName are not provided.

organisationName – Name of the responsible organisation.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: organisationName shall be provided if individualName and/or positionName are not provided.

postionName – Position of the responsible person.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason

Best Practices: positionName shall be provided if individualName and/or organizationName are not provided.

FAQ: **What should I do if I have information about a responsible party, such as contact information, but I do not know the name of the individual, organisation, or position?**

Document the information that you do know. To have a valid CI_ResponsibleParty, there must be one occurrence of either individualName, organisationName, and/or positionName. In this case, use the nilReason attribute.

Ex:
```xml
<gmd:CI_ResponsibleParty>
  <gmd:organisationName gco:nilReason="unknown"/>
  <gmd:contactInfo>
    <gmd:CI_Contact>
      <gmd:phone>
        <gmd:CI_Telephone>
          <gmd:voice>
            <gco:CharacterString>111-222-3333</gco:CharacterString>
          </gmd:voice>
        </gmd:CI_Telephone>
      </gmd:phone>
      <gmd:address>
        <gmd:CI_Address>
          <gmd:deliveryPoint>
            <gco:CharacterString>123 ABC Road</gco:CharacterString>
          </gmd:deliveryPoint>
          <gmd:city>
            <gco:CharacterString>City</gco:CharacterString>
          </gmd:city>
          <gmd:administrativeArea>
            <gco:CharacterString>State</gco:CharacterString>
          </gmd:administrativeArea>
          <gmd:postalCode>
            <gco:CharacterString>90210</gco:CharacterString>
          </gmd:postalCode>
          <gmd:country>
            <gco:CharacterString>United States</gco:CharacterString>
          </gmd:country>
          <gmd:electronicMailAddress>
            <gco:CharacterString>email@address.com</gco:CharacterString>
          </gmd:electronicMailAddress>
        </gmd:CI_Address>
      </gmd:address>
    </gmd:CI_Contact>
  </gmd:contactInfo>
  <gmd:role>
    <gmd:CI_RoleCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="pointOfContact" codeSpace="007">pointOfContact</gmd:CI_RoleCode>
  </gmd:role>
</gmd:CI_ResponsibleParty>
```

---

contactInfo – Information required enabling contact with the responsible person and/or organisation.
>   Type: CI_Contact

>   Multiplicity: optional
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

role – Function performed by the responsible party.
>   Type: CI_RoleCode
>   Domain: resourceProvider, custodian, owner, user, distributor, originator, pointOfContact, principalInvestigator, processor, publisher, author
>   Multiplicity: mandatory
>   Attributes: nilReason
>   Best Practices: See Annex C.

CI_Series
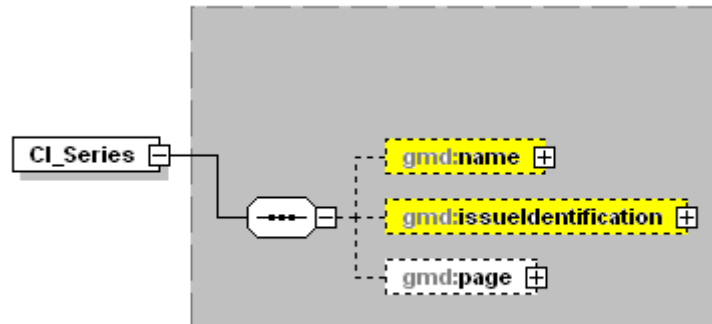
CI_Series – Information about a Series publication or dataset aggregation.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

name – Name of the publication series or aggregate dataset of which the referenced dataset is a part.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: name will be provided if issueIdentification is not provided.

issueIdentification – Identification of the series' issue information.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: issueIdentification will be provided if name is not provided.

page – Identification of the articles' page number(s).
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

CI_Telephone
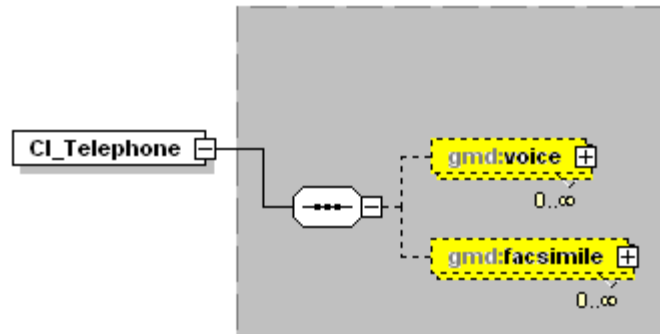
CI_Telephone – Information on the telephone numbers used to contact the responsible individual or organisation.
>> Type: compound
>> Multiplicity: mandatory
>> Attributes: id, uuid
>> Best Practices: At least one occurrence of voice or facsimile is required.

> voice – Telephone number of an organisation or individual.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: conditional, repeatable
>> Attributes: nilReason
>> Best Practices: voice is mandatory if facsimile is not documented.

> facsimile – Facsimile telephone number of an organisation or individual.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: conditional, repeatable
>> Attributes: nilReason
>> Best Practices: facsimile is mandatory if voice is not documented.

DQ PACKAGE

DQ_ConformanceResult
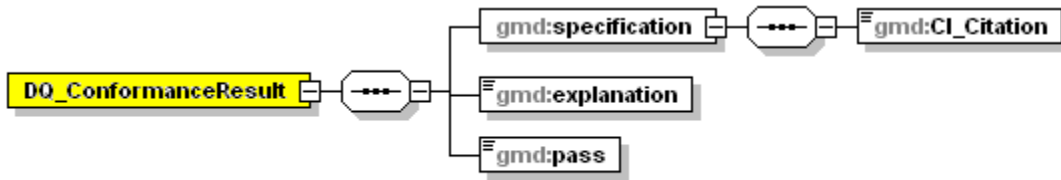
DQ_ConformanceResult – Information which describes the outcome from evaluating the value(s) against a set acceptable quality level.
> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid

specification – citation for the specification or user requirement used to evaluate the data.
> Type: CI_Citation
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

explanation – An explanation of the conformance result.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

pass – Notification of whether the data passed or failed the conformance test.
> Type: Boolean
> Domain: 0, 1 (0 = failed, 1 = passed)
> Multiplicity: mandatory
> Attributes: nilReason

DQ_DataQuality
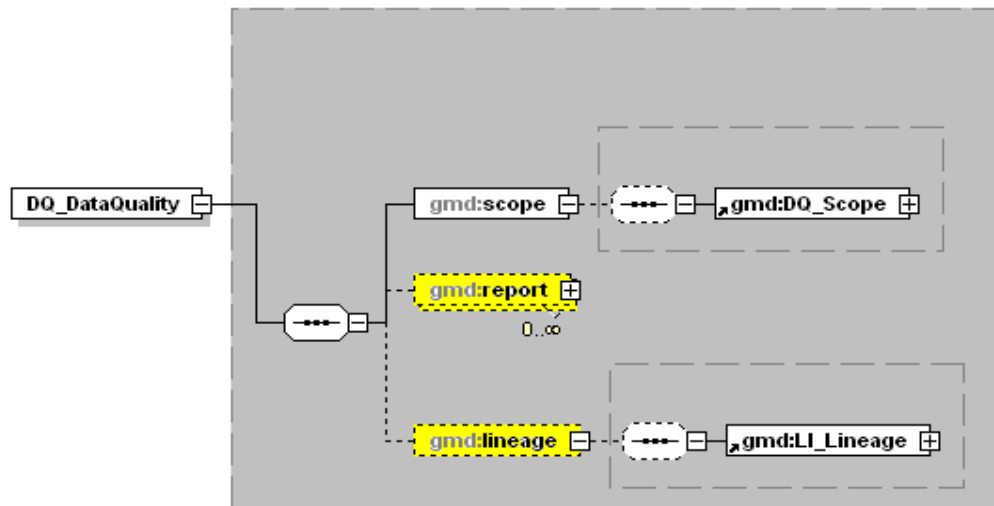
DQ_DataQuality – Information on the quality of the data that is specified by a data quality scope.
>   Type: compound
>   Multiplicity: mandatory
>   Attributes: id, uuid
>   Best Practices: The must be one occurrence of either report or lineage.

scope – The extent of characteristics for which data quality information is reported.
>   Type: DQ_Scope
>   Multiplicity: mandatory
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>   Best Practices: When the attribute level of scope is set to 'dataset", *Report* OR *Lineage* is mandatory. Both may be reported.

report – A statement of the quality of the resource specified by the scope.
>   Type: DQ_CompletenessCommission or DQ_CompletenessOmission or DQ_ConceptualConsistency or DQ_DomainConsistency or DQ_FormatConsistency or DQ_TopologicalConsistency or DQ_AbsoluteExternalPositionalAccuracy or DQ_GriddedDataPositionalAccuracy or DQ_RelativeInternalPositionalAccuracy or DQ_ThematicClassificationCorrectness or DQ_NonQuantitativeAttributeAccuracy or DQ_QuantitativeAttributeAccuracy or DQ_AccuracyOfATimeMeasurement or DQ_TemporalConsistency
>   Multiplicity: conditional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>   Best Practices: report is mandatory if lineage is missing.

lineage – Information or lack of information on the events and source data used to construct the dataset within the specified Scope
>   Type: LI_Lineage
>   Multiplicity: conditional
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>   Best Practices: Lineage shall be provided when Report is not reported.

DQ_QuantitativeResult
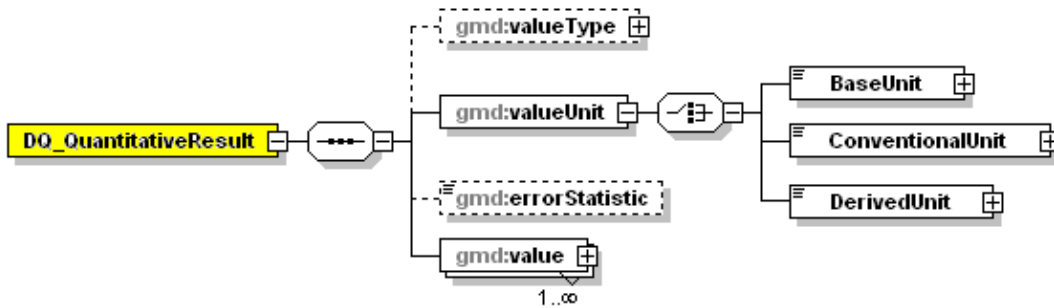
DQ_QuantitativeResult – Information on the value(s) resulting from applying a data quality measure.
    Type: compound
    Multiplicity: conditional
    Attributes: id, uuid

valueType – The class or classes used for the value type(s).
    Type: gco:RecordType
    Multiplicity: optional
    Attributes: nilReason

valueUnit – Any system devised to quantify a value such as length, time, angle, area, volume, velocity, or scale.
    Type: BaseUnit or ConventionalUnit or DerivedUnit
    Multiplicity: mandatory
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
    Best Practices: See Annex D.

errorStatistic– The statistical method used to estimate error in the value.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

value– The quantitative value(s) for the object measured.
    Type: gco:Record
    Multiplicity: mandatory, repeatable
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Ex:
```
<gmd:DQ_QuantitativeResult>
        <gmd:valueUnit>
                <gml:BaseUnit gml:id="meters">
                <gml:identifier codeSpace="SI">meters</gml:identifer>
                        <gml:unitsSystem xlink:href="http://www.bipm.org/en/si/"/>
                </gml:BaseUnit>
        </gmd:valueUnit>
        <gmd:value>
                <gco:Record>2</gco:Record>
        </gmd:value>
</gmd:DQ_QuantitativeResult>
```

DQ_Scope
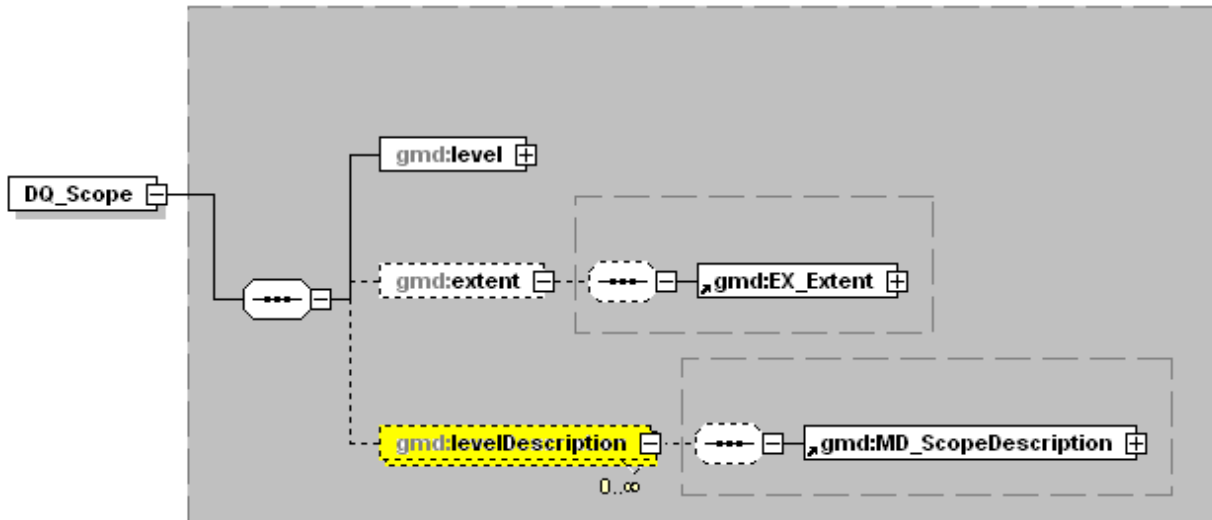
DQ_Scope – The extent of characteristics for which data quality information is reported.
  Type: compound
  Multiplicity: mandatory
  Attributes: id, uuid

  level – The data or application level for which data quality is described.
    Type: MD_ScopeCode
    Domain: attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile
    Multiplicity: mandatory
    Attributes: nilReason
    Best Practices: See Annex C. When "dataset" is selected, report or lineage is mandatory.

  extent – The spatial (horizontal and/or vertical) and the temporal delineation of the resource.
    Type: EX_Extent
    Multiplicity: optional
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

  levelDescription – Description of the level of the dataset.
    Type: MD_ScopeDescription
    Multiplicity: conditional, repeatable
    Attributes: nilReason
    Best Practices: When level is not "dataset" or "series" then levelDescription is mandatory.

DQ_CompletenessCommission
DQ_CompletenessOmission
DQ_ConceptualConsistency
DQ_DomainConsistency
DQ_FormatConsistency
DQ_TopologicalConsistency
DQ_AbsoluteExternalPositionalAccuracy
DQ_GriddedDataPositionalAccuracy
DQ_RelativeInternalPositionalAccuracy
DQ_ThematicClassificationCorrectness
DQ_NonQuantitativeAttributeAccuracy
DQ_QuantitativeAttributeAccuracy
DQ_AccuracyOfATimeMeasurement
DQ_TemporalConsistency
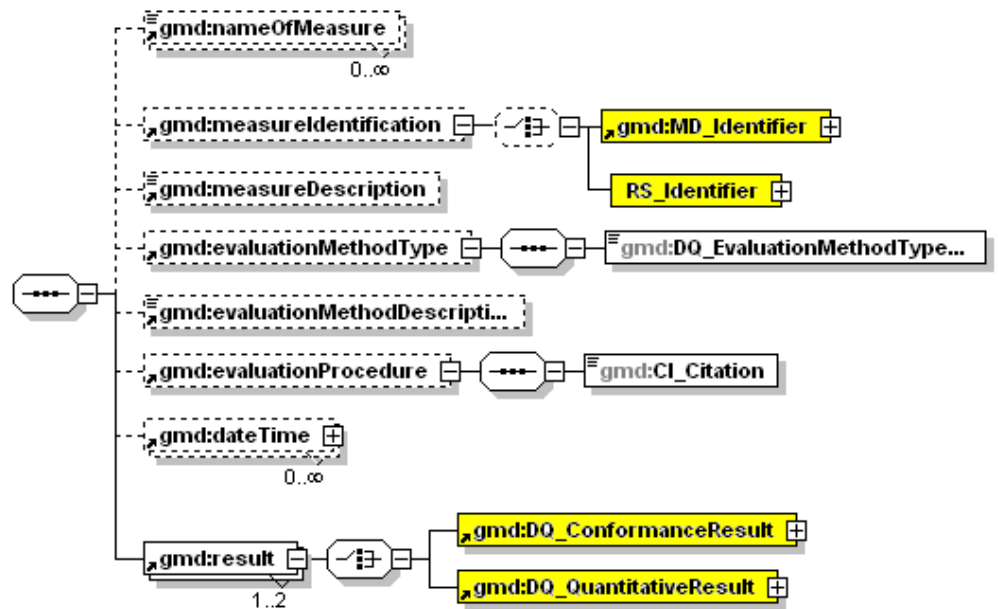
NOTE Each of the compounds below share the same elements pictured above and detailed below.*

DQ_CompletenessCommission – Notification of excess data present in the dataset beyond the extent defined in Scope.
>Type: compound
>Multiplicity: optional
>Attributes: id, uuid

DQ_CompletenessOmission – Notification of data absent from the dataset as defined by Scope.
>Type: compound
>Multiplicity: optional
>Attributes: id, uuid

DQ_ConceptualConsistency – The level to which the dataset adheres to the conceptual schema. For example, conceptual consistency might describe to which level the resource complies with the data structure and attributing of the conceptual schema, i.e., feature types, feature attributes, relationships between features, etc.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_DomainConsistency – The adherence of resource attribute values to conceptual schema specified values.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_FormatConsistency – The level of data storage agreement with the dataset physical structure as described by the attribute Scope.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_TopologicalConsistency – The testing for topological correctness of encoded characteristics in the dataset as delimited by Scope.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_AbsoluteExternalPositionalAccuracy– Description of the methods, procedures, conformance results or quantitative results and date stamp of the positional measurement in the dataset.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_GriddedDataPositionalAccuracy – The degree to which gridded data positions compare to values accepted as being true.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_RelativeInternalPositionalAccuracy – The degree to which all features in a given set meet a defined proximity threshold.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_ThematicClassificationCorrectness – Comparison of classes or attributes assigned to features or feature attributes respectively with respect to a recognized repository of features that pertain in a particular context.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_NonQuantitativeAttributeAccuracy – Degree to which qualitative attributes reflect the stated requirements.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

DQ_QuantitativeAttributeAccuracy – Degree to which quantitative attributes reflect the stated requirements.
  Type: compound
  Multiplicity: optional
  Attributes: id, uuid

DQ_AccuracyOfATimeMeasurement – Report on the accuracy or error in time measurement.
  Type: compound
  Multiplicity: optional
  Attributes: id, uuid

DQ_TemporalConsistency – The correctness of reported ordered events or sequences.
  Type: compound
  Multiplicity: optional
  Attributes: id, uuid

  nameOfMeasure – Name of the test applied to the data to assure data quality.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional, repeatable
    Attributes: nilReason

  measureIdentification – Code which identifies a registered standard data quality procedure.
    Type: MD_Identifier or RS_Identifier
    Multiplicity: optional
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

  measureDescription – Description of the measure applied to the dataset to assure quality.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

  evaluationMethodType – Method type used to evaluate data quality in the dataset.
    Type: DQ_EvaluationMethodTypeCode
    Domain: directInternal, directExternal, indirect
    Multiplicity: optional
    Attributes: nilReason
    Best Practices: See Annex C.

  evaluationMethodDescription – Description of the evaluation method applied to the dataset.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

  evaluationProcedure – Citation for the evaluation procedure.
    Type: CI_Citation
    Multiplicity: optional
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

  dateTime – Date and Time at which the test was completed.
    Type: gco:DateTime
    Domain: date
    Multiplicity: optional, repeatable
    Attributes: nilReason

result – Value(s) obtained from data quality test or outcome from applying data quality measure against a specified/acceptable quality conformance level.

        Type: DQ_QuantitativeResult or DQ_ConformanceResult

        Multiplicity: mandatory, repeatable twice

        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

EX PACKAGE

EX_BoundingPolygon
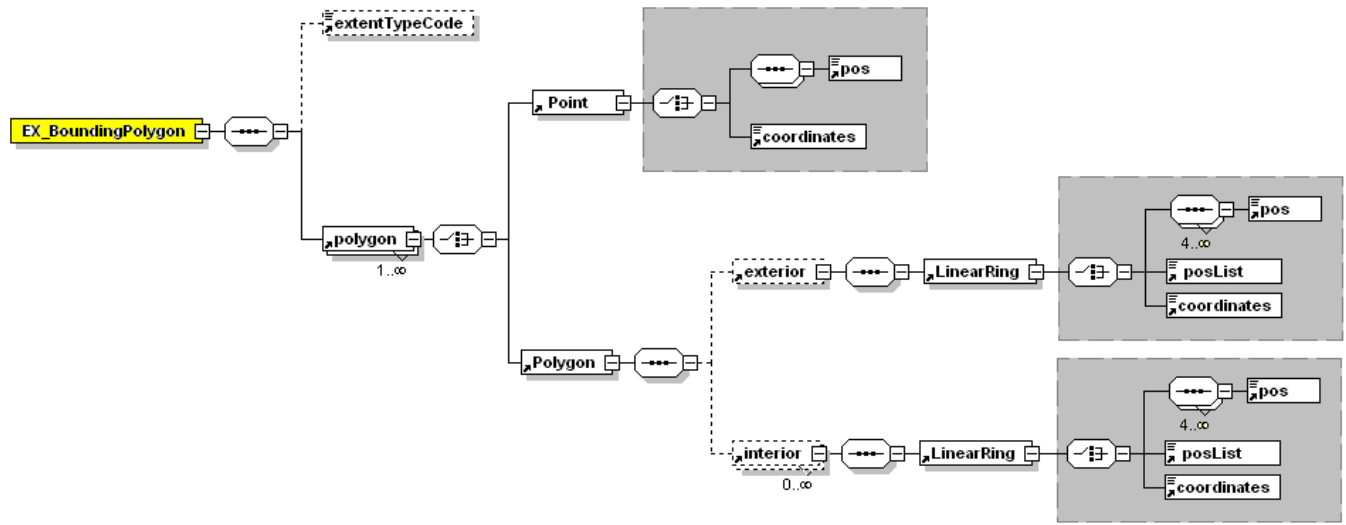
EX_BoundingPolygon – Boundary enclosing the dataset, expressed as the closed set of (x,y) coordinates of the polygon (last point replicates the first point).

> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid
> Best Practices: EX_BoundingPolygon is mandatory if EX_GeographicExtent or EX_GeographicBoundingBox or EX_GeographicDescription are not documented. The first point must equal the last point.

extentTypeCode – Indication of whether the bounding polygon encompasses an area covered by the data or an area where data is not present.

> Type: gco:Boolean
> Domain: 0, 1 (0 – exclusion, 1 – inclusion)
> Multiplicity: optional
> Attributes: nilReason

polygon – Coordinates defining the outline of an area covered by a dataset.

> Type: Point or Polygon
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Point – A point is defined by a single coordinate tuple. The direct position of a point is specified by the pos element.

> Type: pos or coordinates
> Multiplicity: mandatory
> Attributes: id, srsName, srsDimension, axisLabels, uomLabels
> Best Practices: The id attribute is mandatory.

Polygon – A special surface that is defined by a single surface patch. The elements exterior and interior describe the surface boundary of the polygon.

> Type: exterior and/or interior

Multiplicity: mandatory
Attributes: id, srsName, srsDimension, axisLabels, uomLabels

exterior – The exterior boundary of a ring.
Type: LinearRing
Multiplicity: optional

LinearRing – A LinearRing is defined by four or more coordinate tuples, with linear interpolation between them; the first and last coordinates shall be coincident.
Type: coordinates or pos or posList
Domain: coordinate tuple
Multiplicity: mandatory

interior – The interior area enclosed by the rings.
Type: LinearRing
Multiplicity: optional, repeatable

LinearRing – A LinearRing is defined by four or more coordinate tuples, with linear interpolation between them; the first and last coordinates shall be coincident.
Type: coordinates or pos or posList
Domain: coordinate tuple
Multiplicity: mandatory

Ex:
```xml
<gmd:EX_BoundingPolygon id="boundingPolygon">
    <gmd:polygon>
        <gml:Polygon>
            <gml:interior>
                <gml:LinearRing>
                    <gml:coordinates decimal=" 156.86274,71.34815 -156.87389,71.33893 -
                    156.88004,71.33883 -156.89144,71.33259 -156.89982,71.33182
                    156.86274,71.34815 "/>
                </gml:LinearRing>
            </gml:interior>
        </gml:Polygon>
    </gmd:polygon>
</gmd:EX_BoundingPolygon>
```

Ex:
```xml
<gmd:EX_BoundingPolygon>
    <gmd:polygon>
        <gml:LineString gml:id="leg1" srsName="EPSG:4326">
            <gml:posList>1.0 1.0 2.0 2.0 3.0 3.0</gml:posList>
        </gml:LineString>
    </gmd:polygon>
</gmd:EX_BoundingPolygon>
```

FAQ: **What is the srsName attribute and how is it used?**

An srsName attribute attached to a geometry object specifies the object's coordinate reference system (CRS). The value of the srsName attribute is a Uniform Resource Identifier (URI). It refers to a definition of the CRS that is used to interpret the coordinates in the geometry. The CRS definition may be in a document or in an online web service. Values of EPSG codes can be resolved by using the CRS Registry Service operated by the Oil and Gas Producers Association available at http://www.epsg-registry.org. The srsName URI may also be a Uniform Resource Name (URN) for referencing a common CRS definition.

Ex:
An object is located at the point 45.67 and 88.56 on a map is is referenced to WGS 84.

```
<gmd:geographicElement>
        <gmd:EX_BoundingPolygon>
                <gmd:polygon
                        <gml:Point gml:id="boundingPoint">
                                <gml:pos srsName="http://www.opengis.net/def/crs/EPSG/0/4326">45.67
88.56</gml:pos>
                        </gml:Point>
                </gmd:polygon>
        </gmd:EX_BoundingPolygon>
</gmd:geographicElement>
```

EX_Extent
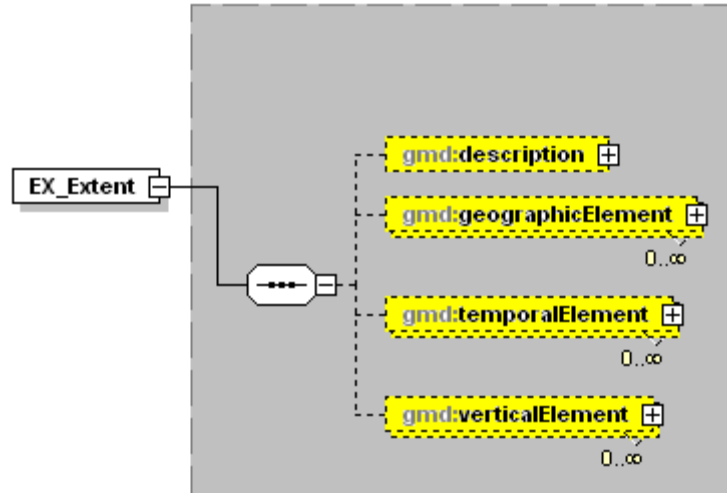
EX_Extent – Information about horizontal, vertical, and temporal extent
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid
> Best Practices: If EX_Extent exists, there must be one occurrence of gmd:description or gmd:geographicElement or gmd:temporalElement or gmd:verticalElement.

description – Spatial and temporal extent for the referring object.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: gmd:description is mandatory if gmd:geographicElement or gmd:temporalElement or gmd:verticalElement are not present.

geographicElement – Provides geographic component of the extent of the referring object.
> Type: EX_GeographicExtent or EX_BoundingPolygon or EX_GeographicBoundingBox or EX_GeographicDescription
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: gmd:geographicElement is mandatory if gmd:description or gmd:temporalElement or gmd:verticalElement are not present.

temporalElement – Provides temporal component of the extent of the referring object.
> Type: EX_TemporalExtent
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: gmd:temporalElement is mandatory if gmd:description or gmd:geographicElement or gmd:verticalElement are not present.

verticalElement – Provides vertical component of the extent of the referring object.
> Type: EX_VerticalExtent
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Best Practices: gmd:verticalElement is mandatory if gmd:description or gmd:geographicElement or gmd:temporalElement are not present.

EX_GeographicBoundingBox
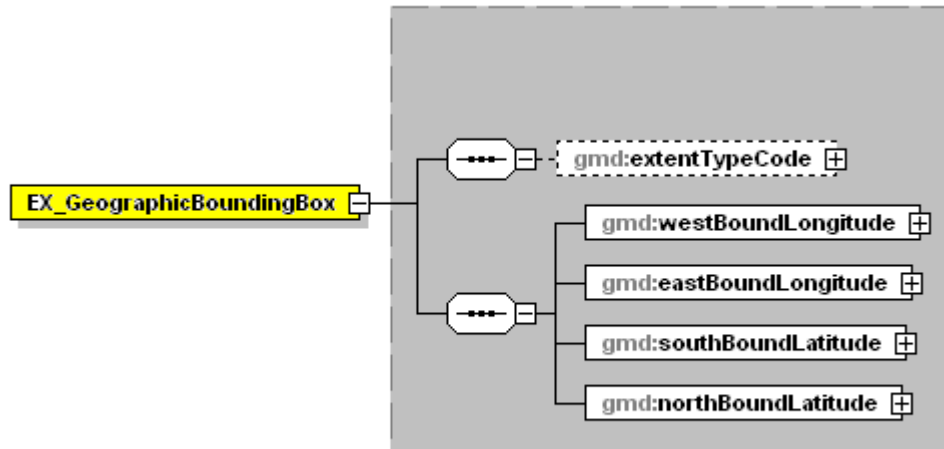
EX_GeographicBoundingBox – Geographic position of the dataset.
  Type: compound
  Multiplicity: conditional
  Attributes: id, uuid
  Best Practices: EX_GeographicBoundingBox is mandatory if EX_GeographicExtent or
  EX_BoundingPolygon or EX_GeographicDescription are not documented.

extentTypeCode – Indication of whether the bounding polygon encompasses an area covered by the data
or an area where data is not present.
  Type: gco:Boolean
  Domain: 0, 1 (0 – exclusion, 1 – inclusion)
  Multiplicity: optional
  Attributes: nilReason

westBoundingLongitude – Westernmost coordinate of the limit of the dataset extent, expressed in
longitude in decimal degrees.
  Type: gco:Decimal
  Domain: any decimal number
  Multiplicity: mandatory
  Attributes: nilReason

eastBoundingLongitude – Easternmost coordinate of the limit of the dataset extent, expressed in
longitude in decimal degrees.
  Type: gco:Decimal
  Domain: any decimal number
  Multiplicity: mandatory
  Attributes: nilReason

southBoundingLatitude – Southernmost coordinate of the limit of the dataset extent, expressed in
latitude in decimal degrees.
  Type: gco:Decimal
  Domain: any decimal number
  Multiplicity: mandatory
  Attributes: nilReason

northBoundingLatitude –Northernmost coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees.

       Type: gco:Decimal
       Domain: any decimal number
       Multiplicity: mandatory
       Attributes: nilReason

EX_GeographicDescription
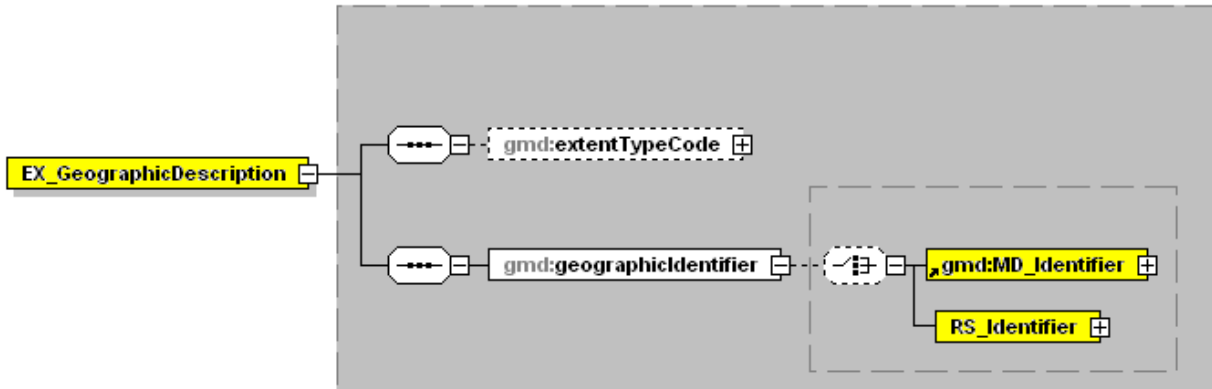
EX_GeographicDescription – Description of the geographic area using identifiers.
>>> Type: compound
>>> Multiplicity: conditional
>>> Attributes: id, uuid
>>> Best Practices: EX_GeographicDescription is mandatory if EX_GeographicExtent or
>>> EX_BoundingPolygon or EX_GeographicBoundingBox are not documented.

>> extentTypeCode – Indication of whether the bounding polygon encompasses an area covered by the data
>> or an area where data is not present.
>>> Type: gco:Boolean
>>> Domain: 0, 1 (0 – exclusion, 1 – inclusion)
>>> Multiplicity: optional
>>> Attributes: nilReason

>> geographicIdentifier – Identifier used to represent a geographic area.
>>> Type: MD_Identifier or RS_Identifier
>>> Multiplicity: mandatory
>>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

EX_GeographicExtent
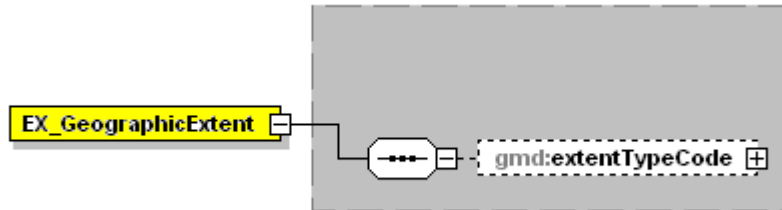
EX_GeographicExtent – Geographic area of the dataset.
>
> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid
> Best Practices: EX_GeographicExtent is mandatory if EX_BoundingPolygon or
> EX_GeographicBoundingBox or EX_GeographicDescription are not documented.

extentTypeCode – Indication of whether the bounding polygon encompasses an area covered by the data
or an area where data is not present.
>
> Type: gco:Boolean
> Domain: 0, 1 (0 – exclusion, 1 – inclusion)
> Multiplicity: optional
> Attributes: nilReason

EX_TemporalExtent
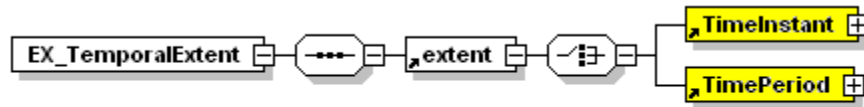
EX_TemporalExtent – Time period covered by the content of the dataset
        Type: Compound
        Multiplicity: mandatory
        Attributes: id, uuid
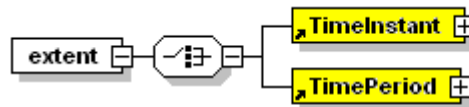
extent – Date and time for the content of the dataset
        Type: choice of TimeInstant or TimePeriod
        Multiplicity: mandatory
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
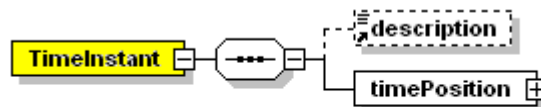
TimeInstant – Single date and Time
        Type: compound
        Multiplicity: conditional
        Attributes: id, frame
        Best Practices: TimeInstant is mandatory if TimePeriod is not documented. The
        TimeInstant attribute id is mandatory. Each TimeInstant id attribute must be
        unique within a record.

      description – description of the date and time documented.
        Domain: free text
        Multiplicity: optional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: The currentness reference (the basis on which the time period
        of content information is determined) is often documented here.

      timePosition – single date and time
        Domain: date
        Multiplicity: mandatory
        Attributes: frame, calendarEraName, indeterminatePosition
        Best Practices: Use indeterminatePosition to document unknown dates and
        present dates. The valid values for indeterminatePostion are "unknown",

"after", "before", and "now".

```
<gmd:EX_TemporalExtent id="boundingTemporalExtent">
        <gmd:extent>
                <gml:TimeInstant gml:id="tp_114854">
                        <gml:description>ground condition</gml:description>
                        <gml:timePosition>1990-11-03T00:00:00</gml:timePosition>
                </gml:TimeInstant>
        </gmd:extent>
</gmd:EX_TemporalExtent>
```
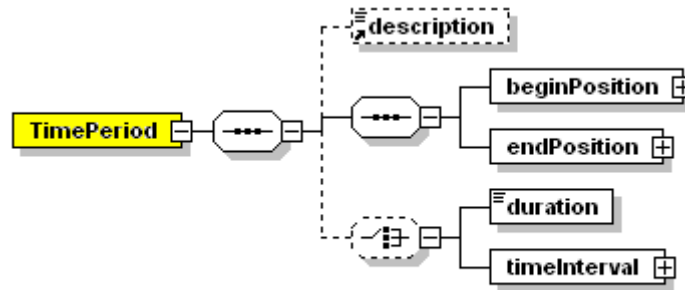

TimePeriod – Represents an identifiable extent in time.
> Type: compound
> Multiplicity: conditional
> Attributes: id, frame
> Best Practices: TimePeriod is mandatory if TimeInstant is not documented. The TimePeriod attribute id is mandatory. Each TimeInstant id attribute must be unique within a record.

description – description of the date and time documented.
> Domain: free text
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: The currentness reference (the basis on which the time period of content information is determined) is often documented here.

beginPostion – The beginning date and time of the dataset's content.
> Domain: date
> Multiplicity: mandatory
> Attributes: frame, calendarEraName, indeterminatePostion
> Best Practices: Use indeterminatePosition to document unknown dates and present dates. The valid values for indeterminatePostion are "unknown", "after", "before", and "now".

endPostion – The ending date and time of the content of the dataset.
> Domain: date
> Multiplicity: mandatory
> Attributes: frame, calendarEraName, indeterminatePostion
> Best Practices: Use indeterminatePosition to document unknown dates and present dates. The valid values for indeterminatePostion are "unknown", "after", "before", and "now".

duration – Length of time.
>Domain: date
>Multiplicity: optional
>Best Practices: Cannot document both duration and timeInterval.

timeInterval – Frequency between time events based on floating point values for temporal length.
>Type: float
>Domain: 32-bit floating point
>Multiplicity: optional
>Attributes: unit, radix, factor
>Best Practices: Cannot document both timeInterval and duration. The attribute unit is mandatory to document units of time.

Ex:

```
<gmd:temporalElement>
        <gmd:EX_TemporalExtent id="boundingTemporalExtent">
                <gmd:extent>
                        <gml:TimePeriod gml:id="tp_1234">
                                <gml:description>ground condition</gml:description>
                                <gml:beginPosition>1990-11-03T00:00:00</gml:beginPosition>
                                <gml:endPosition indeterminatePosition="now"/>
                        </gml:TimePeriod>
                </gmd:extent>
        </gmd:EX_TemporalExtent>
</gmd:temporalElement>
```

FAQ: How do I document multiple dates?

You must repeat at gmd:temporalElement.

EX_VerticalExtent
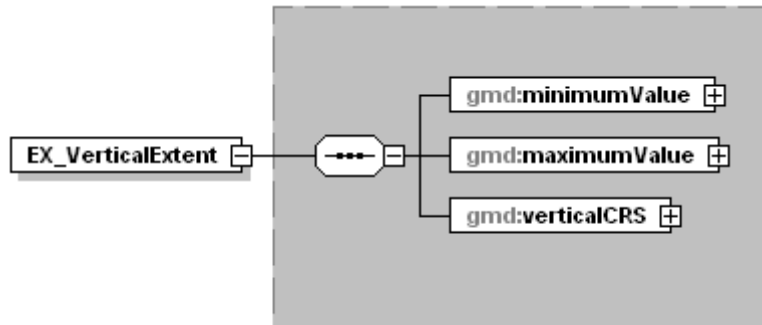
EX_VerticalExtent – Vertical domain of a dataset.
Type: compound
Multiplicity: mandatory
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

minimumValue – lowest vertical extent contained in the dataset.
Type: gco:Real
Domain: any number
Multiplicity: mandatory
Attributes: nilReason

maximumValue – Highest vertical extent containd in the dataset.
Type: gco:Real
Domain: any number
Multiplicity: mandatory
Attributes: nilReason

verticalCRS – Vertical coordinate reference system.
Type: compound
Multiplicity: mandatory
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
Best Practices: A coordinate reference system (CRS) should be taken from a publicly available register or document such as the EPSG Geodetic Parameter Dataset (http://www.epsg-registry.org/) or Spatial Reference (http://spatialreference.org). An identifier or well known name with an authority is defined and referenced here. If a coordinate reference system (CRS) is not available from a publicly available register or document and as such has no identifier or well known name, then that CRS shall be described according to ISO 19111.

FAQ: How do I document water depths and units? For example, water column samples taken between 3100 and 3600 meters?

```
<gmd:EX_VerticalExtent>
        <gmd:minimumValue>
                <gco:Real>3600</gco:Real>
        </gmd:minimumValue>
        <gmd:maximumValue>
                <gco:Real>3100</gco:Real>
        </gmd:maximumValue>
        <gmd:verticalCRS>
                <gml:VerticalCRS gml:id="verticalCRSforSamples">
                        <gml:description>Definition of water depth in meters for marine geosamples.</gml:description>
                        <gml:identifier codeSpace="NGDC">verticalCRSforSamples</gml:identifier>
                        <gml:remarks>Minimum and maximum values represent the start and end time of sample
collection.</gml:remarks>
                        <gml:scope>water</gml:scope>
                        <gml:usesVerticalCS>
                                <gml:VerticalCS gml:id="verticalCSforSamples">
                                        <gml:identifier codeSpace="NGDC">verticalCSforSamples</gml:identifier>
                                        <gml:axis>
                                                <gml:CoordinateSystemAxis uom="#meters"
gml:id="coordinateSystemAxisforSamples">
                                                        <gml:identifier
codeSpace="NGDC">coordinateSystemAxisforSamples</gml:identifier>
                                                        <gml:axisAbbrev>Water Depth</gml:axisAbbrev>
                                                        <gml:axisDirection
codeSpace="NGDC">down</gml:axisDirection>
                                                        <gml:minimumValue>0.0</gml:minimumValue>
                                                </gml:CoordinateSystemAxis>
                                        </gml:axis>
                                </gml:VerticalCS>
                        </gml:usesVerticalCS>
                        <gml:verticalDatum>
                                <gml:VerticalDatum gml:id="verticalDatumforSamples">
                                        <gml:identifier codeSpace="NGDC">verticalDatumforSamples</gml:identifier>
                                        <gml:scope>water</gml:scope>
                                        <gml:anchorPoint>water surface</gml:anchorPoint>
                                </gml:VerticalDatum>
                        </gml:verticalDatum>
                </gml:VerticalCRS>
        </gmd:verticalCRS>
</gmd:EX_VerticalExtent>
```

Or when there is something to reference in EPSG:

```
<gmd:verticalElement>
 <gmd:EX_VerticalExtent>
 <gmd:minimumValue>
  <gco:Real> 3600 </gco:Real>
 </gmd:minimumValue>
 <gmd:maximumValue>
  <gco:Real> 3100 </gco:Real>
 </gmd:maximumValue>
 <gmd:verticalCRS xlink:href="http://www.epsg-registry.org/export.htm?gml=urn:ogc:def:crs:EPSG::5715" xlink:title="msl depth in meters"
xlink:actuate="onRequest"/>
 </gmd:EX_VerticalExtent>
</gmd:verticalElement>
```

LI PACKAGE

LI_Lineage
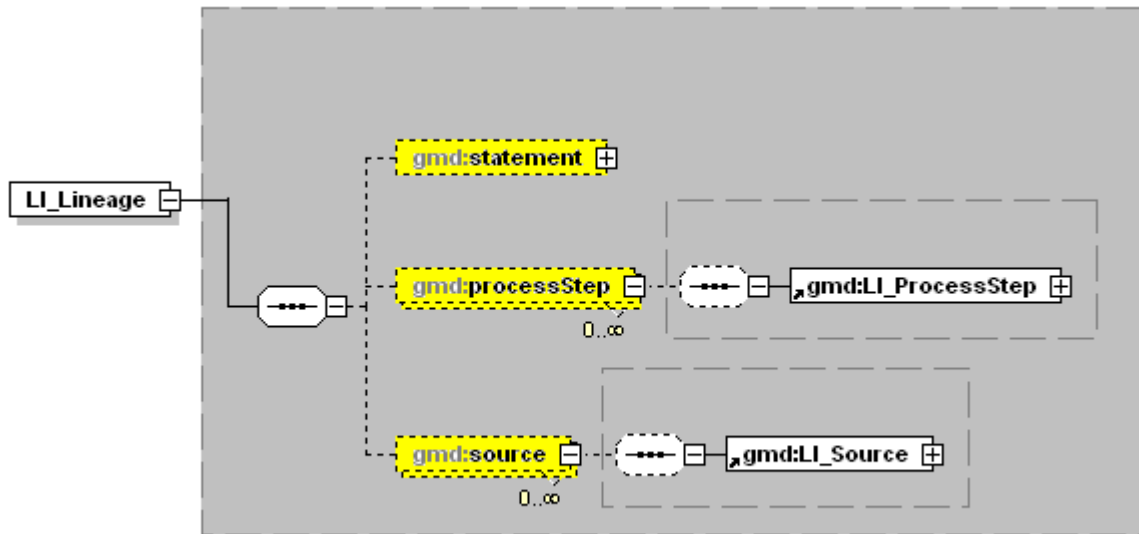
LI_Lineage – Information or lack of information on the events and source data use to construct the dataset within the specified Scope.
>	Type: compound
>	Multiplicity: mandatory
>	Attributes: id, uuid
>	Best Practices: There must be at least one occurrence of statement or source or processStep.

statement – General explanation of the data producer's knowledge of the dataset lineage.
>	Type: gco:characterString
>	Domain: free text
>	Multiplicity: conditional
>	Attributes: nilReason

processStep – The events in the development of the dataset.
>	Type: LI_ProcessStep
>	Multiplicity: conditional, repeatable
>	Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

source – Information on the sources used in the development of the dataset.
>	Type: LI_Source
>	Multiplicity: conditional, repeatable
>	Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>	Best Practice: source is provided when statement or processStep is not reported.

LI_ProcessStep
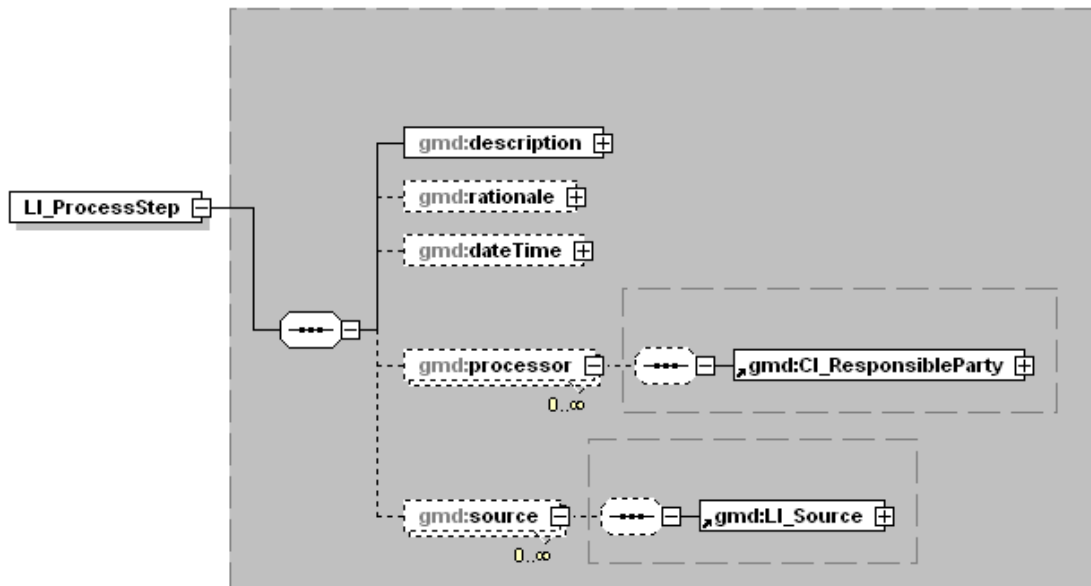
LI_ProcessStep – The events in the development of the dataset.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

description – Description of the processes performed on the data.
        Type: gco:characterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

rationale – Purpose for performing the process on the data.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

dateTime – The date and time when the process was completed.
        Type: gco:DateTime
        Domain: date
        Multiplicity: optional
        Attributes: nilReason

processor – Identification and means to contact the person or party that performed the process.
        Type: CI_ResponsibleParty
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

source – Information about the source data related to the creation of the data within the scope.
        Type: LI_Source
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

LI_Source
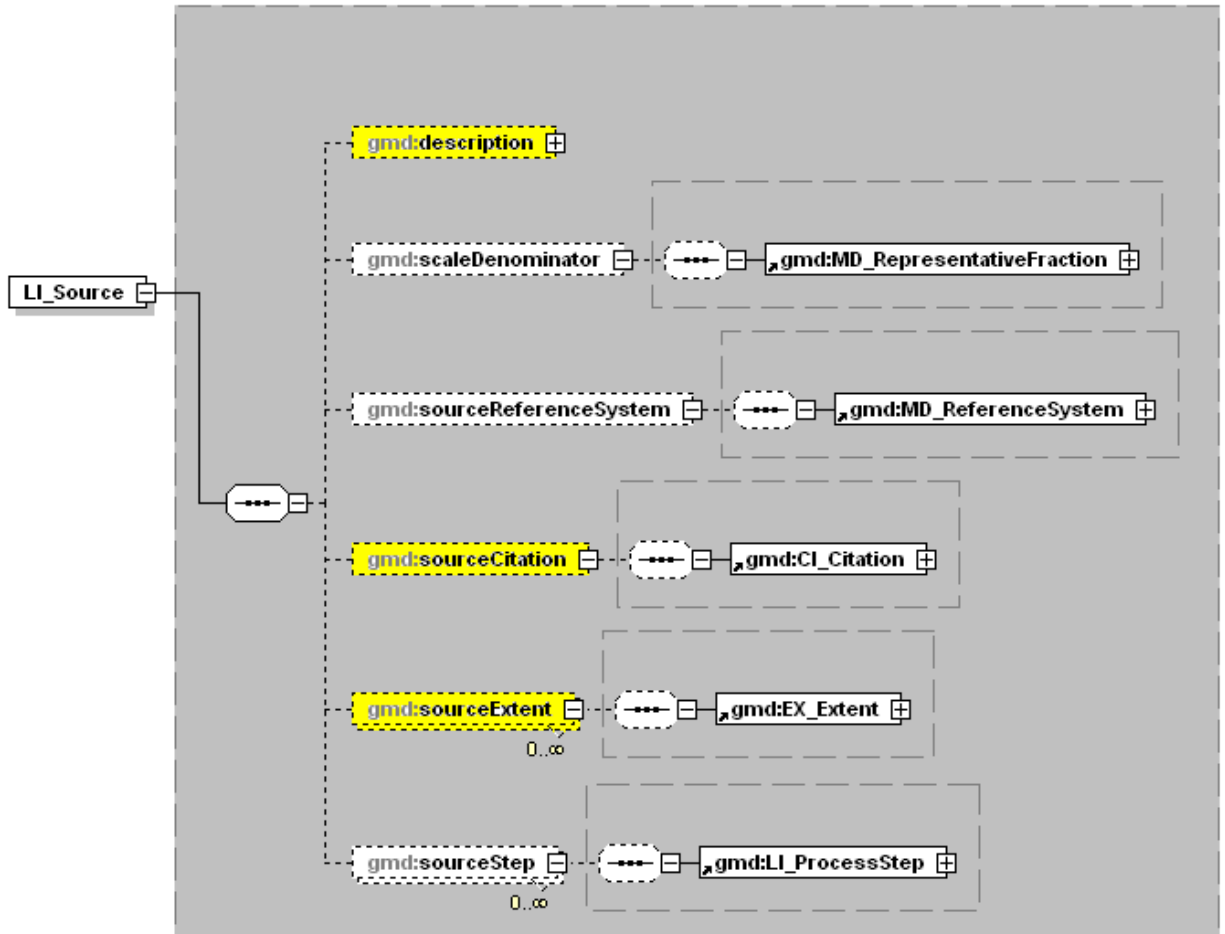
LI_Source – Information about the source data used in creating the data within the specified Scope.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

description – Statement that describes the source data.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: description is mandatory if sourceCitation and sourceExtent are not provided.
        description format is <MD_MediumNameCode codeList><;><blank space><free text>

FAQ: **How would you populate the description for a satellite image source that is on a DVD??**

dvd; source satellite image

---

scaleDenominator – The number below the line in a proper faction that the numerator is equal to 1.

    Type: MD_RepresentativeFraction

    Multiplicity: optional

    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

sourceReferenceSystem – Information about the reference system.

    Type: MD_ReferenceSystem

    Multiplicity: optional

    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

sourceCitation – Citation for the sources for the dataset.

    Type: CI_Citation

    Multiplicity: conditional

    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    Best Practices: sourceCitation is mandatory if description is not provided. This is NOT a citation to a document about the source data, bit it is a dataset citation of the dataset.

sourceExtent – Describes the spatial, horizontal and/or vertical, and the temporal coverage in the source dataset.

    Type: EX_Extent

    Multiplicity: conditional, repeatable

    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    Best Practices: sourceExtent is mandatory if description is not provided

sourceStep – Information about an event related to the creation process for the source data.

    Type: LI_ProcessStep

    Multiplicity: optional, repeatable

    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD PACKAGE

MD_AggregateInformation
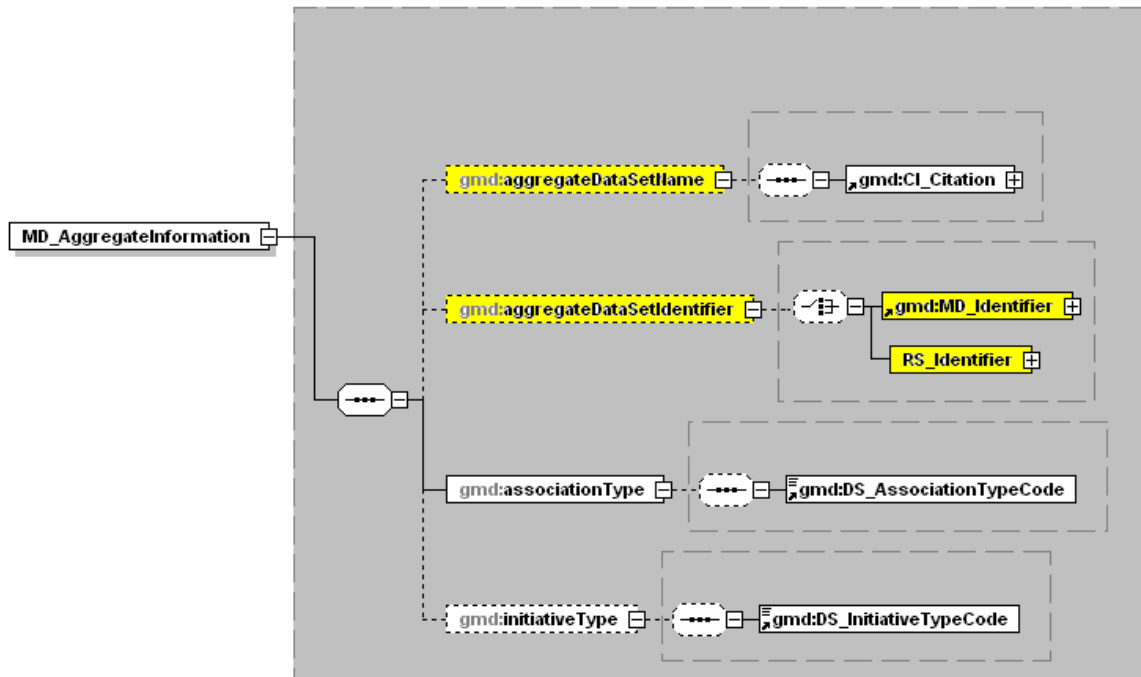
MD_AggregateInformation – The citation for or name of an aggregate dataset, the type of aggregate dataset, and optionally the activity which produced the dataset.

        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid
        Best Practices: Either aggregateDateSetName or aggregateDataSetIdentifier shall be provided.

aggregateDataSetName – Citation information for the aggregate resource or initiative.

        Type: CI_Citation
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: Strongly recommended to provide contact information under cited responsible party.

aggregateDataSetIdentifier – Identification of the aggregate dataset.

        Type: MD_Identifier or RS_Identifier
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

associationType – Association type of the aggregate dataset.

        Type: DS_AssociationTypeCode
        Domain: crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stereoMate
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

initiativeType – Type of initiative for which the dataset was developed.

      Type: DS_InitiativeTypeCode

      Domain: campaign, collection, exercise, experiment, investigation, mission, sensor, operation, platform, process, program, project, study, task, trial

      Multiplicity: optional

      Attributes: nilReason

      Best Practices: See Annex C.

MD_ApplicationSchemaInformation
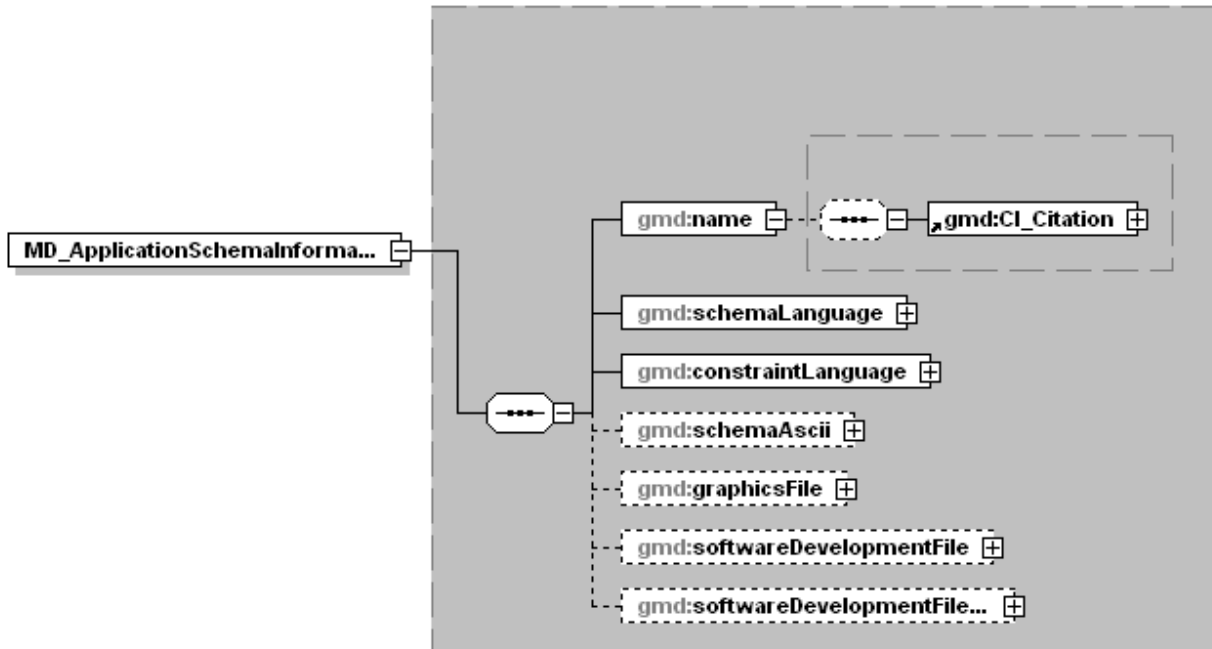
MD_ApplicationSchemaInformation – Information about the application schema used to develop the dataset.

> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

name – Citation for the application schema.

> Type: CI_Citation
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

schemaLanguage – Identification of the schema language.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

constraintLanguage – Identification of the formal language used to describe constraints in the application schema.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

schemaAscii – Full application schema given as an ASCII file.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: optional
>   Attributes: nilReason

graphicsFile – Full application schema given as a graphics file.
>   Type: gco:Binary
>   Multiplicity: optional
>   Attributes: nilReason

softwareDevelopmentFile – Full application schema given as a software development file.
>   Type: gco:Binary
>   Multiplicity: optional
>   Attributes: nilReason

softwareDevelopmentFileFormat – Software dependent format used for the application schema software dependent file.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: optional
>   Attributes: nilReason

MD_Band
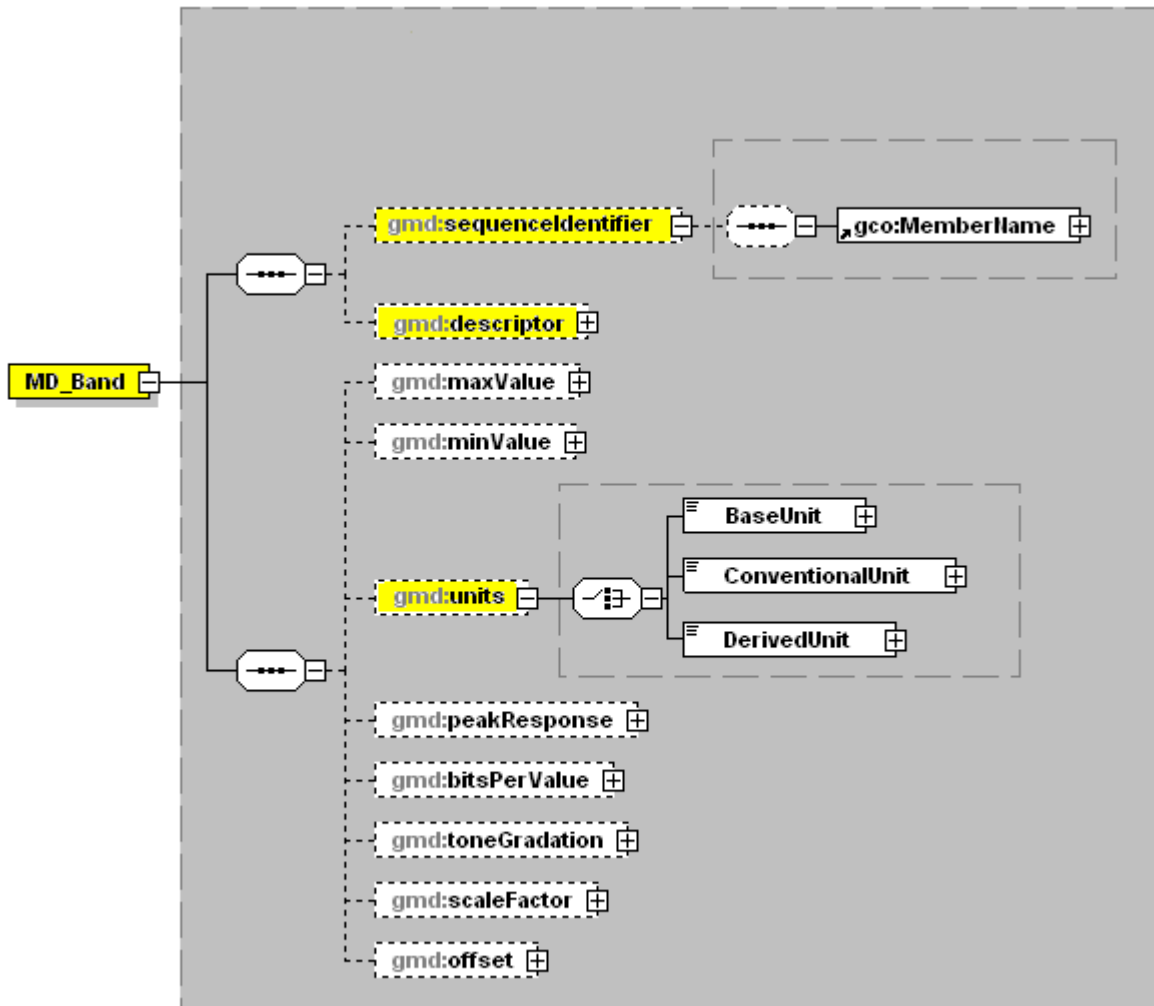
MD_Band – Range of wavelengths in the electromagnetic spectrum.
        Type: compound
        Multiplicity: conditional
        Attributes: id, uuid

sequenceIdentifier – Sensor band wavelengths.
        Type: gco:MemberName
        Multiplicity: conditional
        Attributes: id, uuid
        Best Practices: Either sequenceIdentifier or descriptor will be provided, or both.

descriptor – Description of cell value range.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: nilReason
        Best Practices: Either descriptor or sequenceIdentifier will be provided, or both.

maxValue – Longest wavelength the sensor is capable of collecting within the designated band.
> Type: gco:Real
> Domain: any number
> Multiplicity: optional
> Attributes: nilReason

minValue – Shortest wavelength the sensor is capable of collecting within the designated band.
> Type: gco:Real
> Domain: any number
> Multiplicity: optional
> Attributes: nilReason

units – Sensor wavelength units.
> Type: BaseUnit or ConventionalUnit or DerivedUnit
> Multiplicity: conditional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: Mandatory if maxValue or minValue is reported. See Annex D.

peakResponse – Highest wavelength response.
> Type: gco:Real
> Domain: any number
> Multiplicity: optional
> Attributes: nilReason

bitsPerValue – Maximum number of significant bits in the uncompressed representation for the value in each band of each pixel.
> Type: gco:Integer
> Domain: any whole number
> Multiplicity: optional
> Attributes: nilReason

toneGradation – Number of discrete numerical values in the grid data.
> Type: gco:Integer
> Domain: any whole number
> Multiplicity: optional
> Attributes: nilReason

scaleFactor – Scale factor applied to each cell value.
> Type: gco:Real
> Domain: any number
> Multiplicity: optional
> Attributes: nilReason

offset – The physical value corresponding to a cell value of zero.
> Type: gco:Real
> Domain: any number
> Multiplicity: optional
> Attributes: nilReason

MD_BrowseGraphic
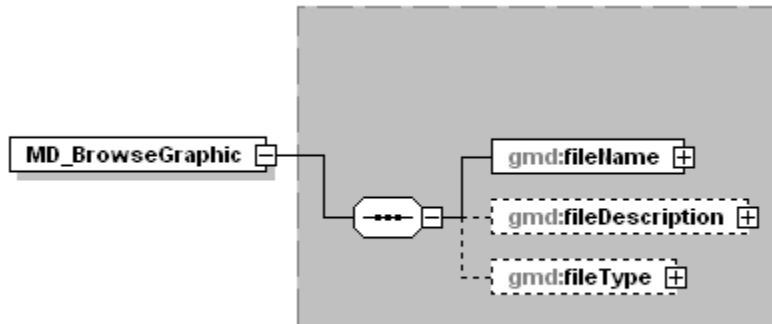
MD_BrowseGraphic – The name, description, and file type of an illustration of the resource.
  Type: compound
  Multiplicity: mandatory
  Attributes: id, uuid

  filename – Name of the graphic file provided to illustrate the resource.
    Type: gco:characterString
    Domain: free text
    Multiplicity: mandatory
    Attributes: nilReason
    Best Practices: The filename shall include the path or URL to access the graphic file and the file
    type extension.

  fileDescription – Text description of the graphic file's content.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

  fileType – Description of the graphic file format.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason
    Best Practices: If the file type requires a non common viewer, also provide instructions on
    acquiring that viewer.

MD_Constraints
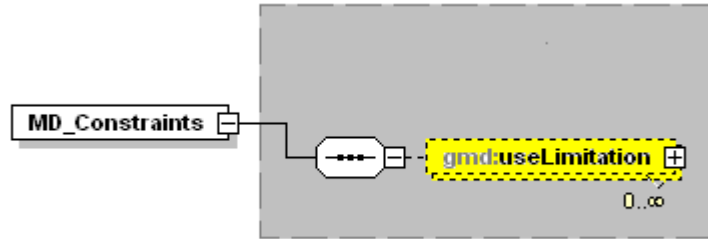
MD_Constraints – The limitations, restrictions, or statements on the resource fitness for use.
          Type: compound
          Multiplicity: conditional
          Attributes: id, uuid

       useLimitation – Statement on the fitness of use or limitations on the use of the resource or metadata.
          Type: gco:characterString
          Domain: free text
          Multiplicity: conditional, repeatable
          Attributes: nilReason
          Best Practices: useLimitation is mandatory unless MD_LegalConstraints or
          MD_SecurityConstraints is used.

MD_CoverageDescription
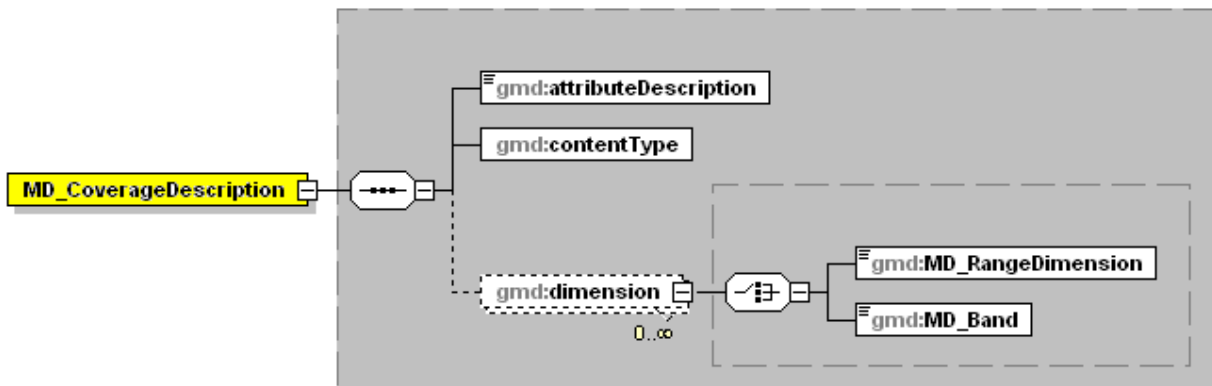
MD_CoverageDescription – Information about the content of grid data cells.
        Type: compound
        Multiplicity: conditional
        Attributes: id, uuid

    attributeDescription – Description of the cell measurement.
        Type: gco:RecordType
        Multiplicity: mandatory
        Attributes: nilReason

    contentType – Information represented by the cell.
        Type: MD_CoverageContentTypeCode
        Domain: image, thematicClassification, physicalMeasurement
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

    dimension – Information on the dimension of the cell measurement value.
        Type: MD_RangeDimension or MD_Band
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_DataIdentification
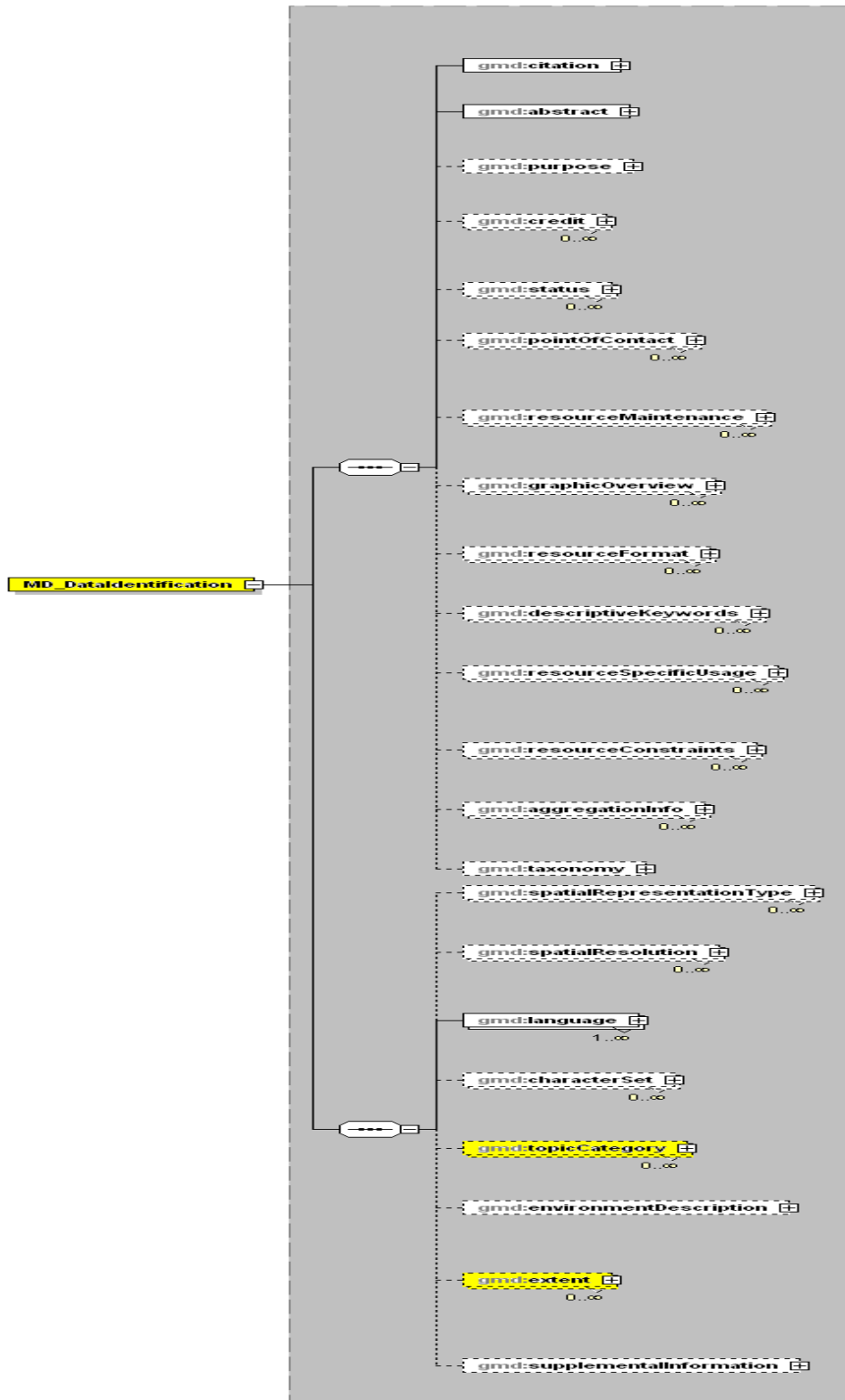
MD_DataIdentification – Information that describes a dataset.
Type: compound
Multiplicity: conditional
Attributes: id, uuid
Best Practices: identificationInfo must have at least one occurrence of Data Identification or Service Identification.

citation – Citation for the dataset.
Type: CI_Citation
Multiplicity: mandatory
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

abstract – Brief narrative summary of the dataset's contents.
Type: gco:characterString
Domain: free text
Multiplicity: mandatory
Attributes: nilReason

purpose – Summary of the intentions for which the dataset was developed.
Type: gco:characterString
Domain: free text
Multiplicity: optional
Attributes: nilReason

credit – Recognition of those who contributed to the dataset.
Type: gco:characterString
Domain: free text
Multiplicity: optional, repeatable
Attributes: nilReason

status – The development phase of the dataset.
Type: MD_ProgressCode
Domain: completed, historicalArchive, obsolete, ongoing, planned, required, underdevelopment
Multiplicity: optional, repeatable *this is a NAP requirement*
Attributes: nilReason

pointOfContact – Identification and means to contact people/organisations associated with the dataset.
Type: CI_ResponsibleParty
Multiplicity: optional, repeatable
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceMaintenance – Describes the frequency, scope, and responsible party for the updating of the dataset.
Type: MD_MaintenanceInformation
Multiplicity: optional, repeatable
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

graphicOverview – The name of, description of, and file type of an illustration of the dataset.
Type: MD_BrowseGraphic
Multiplicity: optional, repeatable
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceFormat – Provides a description of the format of the resource(s).
>Type: MD_Format
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

descriptiveKeywords – Commonly used words or phrases which describe the dataset. Optionally, the keyword type and a citation for the authoritative or registered resource of the keywords are also provided.
>Type: MD_Keywords
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceSpecificUsage – Provides basic information about specific application(s) for which the resource(s) has been or is being used by different users.
>Type: MD_Usage
>Multiplicity: optional, repeatable *this is not in NAP*
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceConstraints – The limitations or constraints on the use of or access to the resource.
>Type: MD_Constraints or MD_LegalConstraints or MD_SecurityConstraints
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

aggregationInfo – The citation for the aggregate dataset or the name of the aggregate dataset, the type of aggregate dataset, and optionally the activity which produced the dataset.
>Type: MD_AggregateInformation
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

taxonomy – Information on the taxa included in the data set, including keywords, taxonomic system and coverage information, and taxonomic classification system.
>Type: MD_TaxonSys
>Multiplicity: optional
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

spatialRepresentationType – Object(s) used to represent the geographic information.
>Type: MD_SpatialRepresentationTypeCode
>Domain: vector, grid, textTable, tin, stereoModel, video
>Multiplicity: optional, repeatable
>Attributes: nilReason

spatialResolution – The level of detail of the dataset expressed as equivalent scale or ground distance.
>Type: MD_Resolution
>Multiplicity: optional, repeatable
>Attributes: nilReason

language – Languages of the dataset using standard ISO three-letter codes. See Annex B.
>Type: gco:characterString
>Domain: free text
>Multiplicity: mandatory, repeatable
>Attributes: nilReason

characterSet – Character coding standard in the dataset.

> Type: MD_CharacterSetCode
> Domain: ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2, 8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10, 8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii, ebcdic, eucKR, big5, GB2312
> Multiplicity: optional, repeatable
> Attributes: nilReason
> Best Practices: The character set for the metadata is set to "utf8" by default.

topicCategory – The main theme(s) of the dataset.

> Type: MD_TopicCategoryCode
> Domain: farming, biota, boundaries, climatologyMeteorolgyAtmosphere, economy, elevation, environment, geoscientificInformation, health, imageryBaseMapsEarchCover, intelligenceMilitary, inlandWaters, location, oceans, planningCadastre, society, structure, transportation, utilitiesCommunication
> Multiplicity: conditional, repeatable
> Attributes: nilReason
> Best Practices: A topicCategory code shall be provided when hierarchyLevel is set to "dataset".

environmentDescription – Describes the dataset's processing environment. Includes information, such as software, computer operating system, filename, and dataset size.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

extent – Describes the spatial, horizontal and/or vertical, and the temporal coverage in the resource.

> Type: EX_Extent
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: Either Geographic Bounding Box or Geographic Description is required when hierarchyLevel is set to "dataset".

supplementalInformation – Other descriptive information about the dataset.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

MD_DigitalTransferOptions
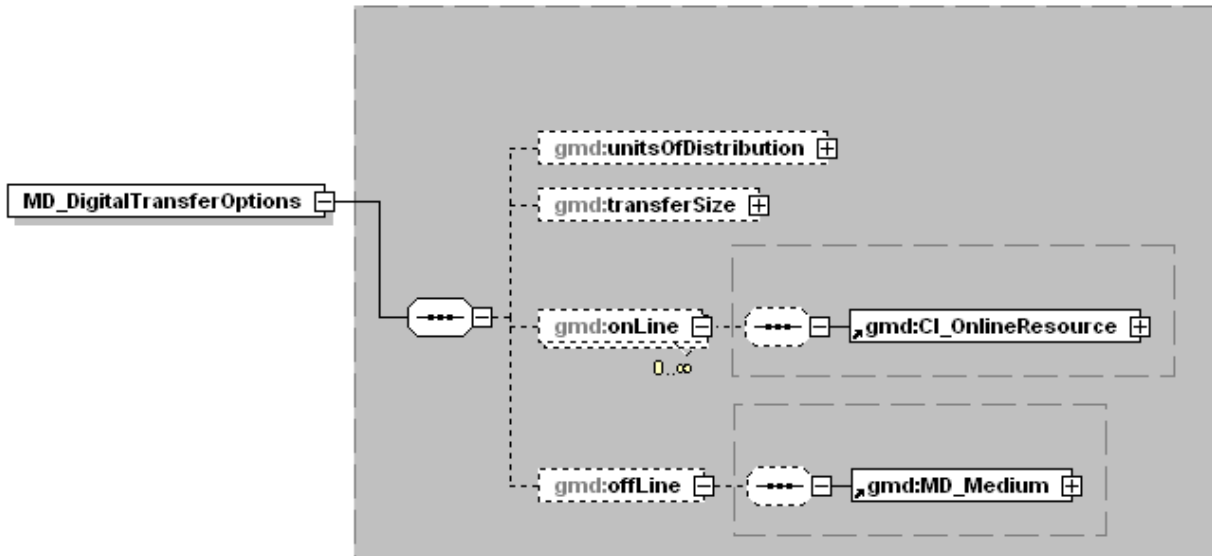
MD_DigitalTransferOptions – Technical means and media by which a resource is obtained from the distributor.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

    unitsOfDistribution – Tiles, layers, geographic areas, etc. in which the data is available.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

    transferSize – Estimated size of the transfer unit in the specified format, expressed in megabytes.
        Type: gco:Real
        Domain: any number
        Multiplicity: optional
        Attributes: nilReason
        Best Practices: Value greater that "0.0".

    onLine – Information about the online sources where the data/dataset may be obtained.
        Type: CI_OnlineResource
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    offLine – Information about the offline distribution media.
        Type: MD_Medium
        Multiplicity: optional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: Not sure why onLine is repeatable and offLine is not. This will be discussed at the
        next ISO review.

MD_Dimension
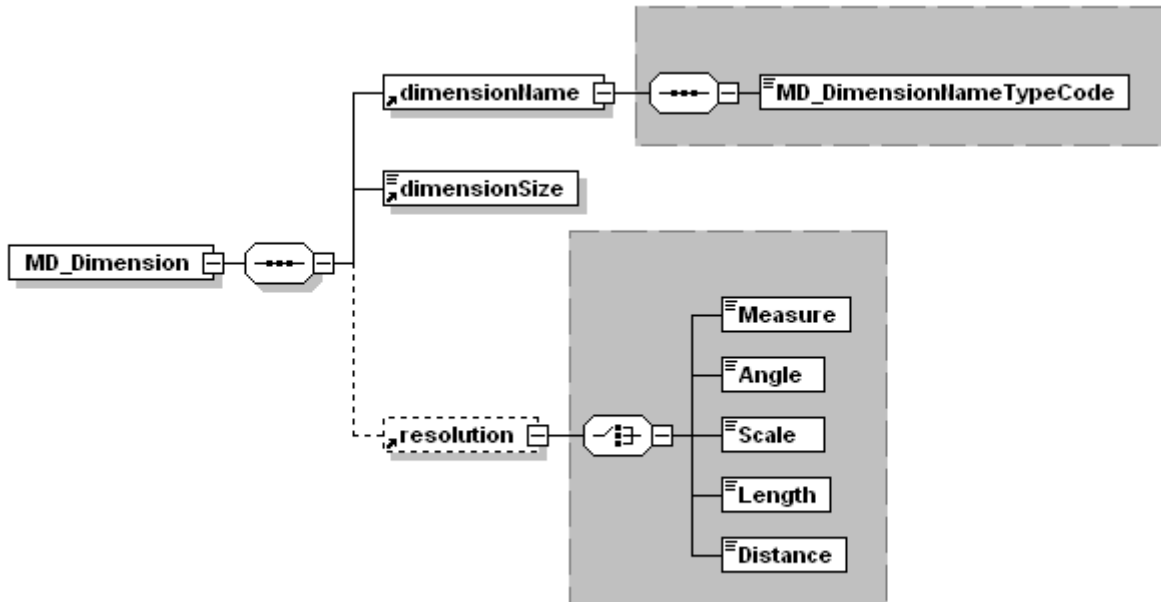
MD_Dimension – Information on the dimension name, size, and resolution used.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

    dimensionName – Axis name.
        Type: MD_DimensionNameTypeCode
        Domain: row, column, vertical, track, crossTrack, line, sample, time
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

    dimensionSize – Number of elements along the axes.
        Type: gco:Integer
        Domain: any whole number
        Multiplicity: mandatory
        Attributes: nilReason

    resolution – Degree of detail in the grid dataset.
        Type: gco:Measure or Angle or Scale or Length or Distance
        Multiplicity: optional
        Attributes: nilReason
        Best Practices: Document the type attribute uom (unit of measure).

Ex:
```
<gmd:MD_Dimension>
        <gmd:dimensionName>
                <gmd:MD_DimensionNameTypeCode
codeList="http://www.isotc211.org/2005/resources/codeList.xml#MD_DimensionNameTypeCode" codeListValue="row" >
                </gmd:MD_DimensionNameTypeCode>
        </gmd:dimensionName>
        <gmd:dimensionSize>
                <gco:Integer>1354</gco:Integer>
        </gmd:dimensionSize>
        <gmd:resolution>
                <gco:Measure uom="kilometer">2</gco:Measure>
        </gmd:resolution>
</gmd:MD_Dimension>
```

MD_Distribution
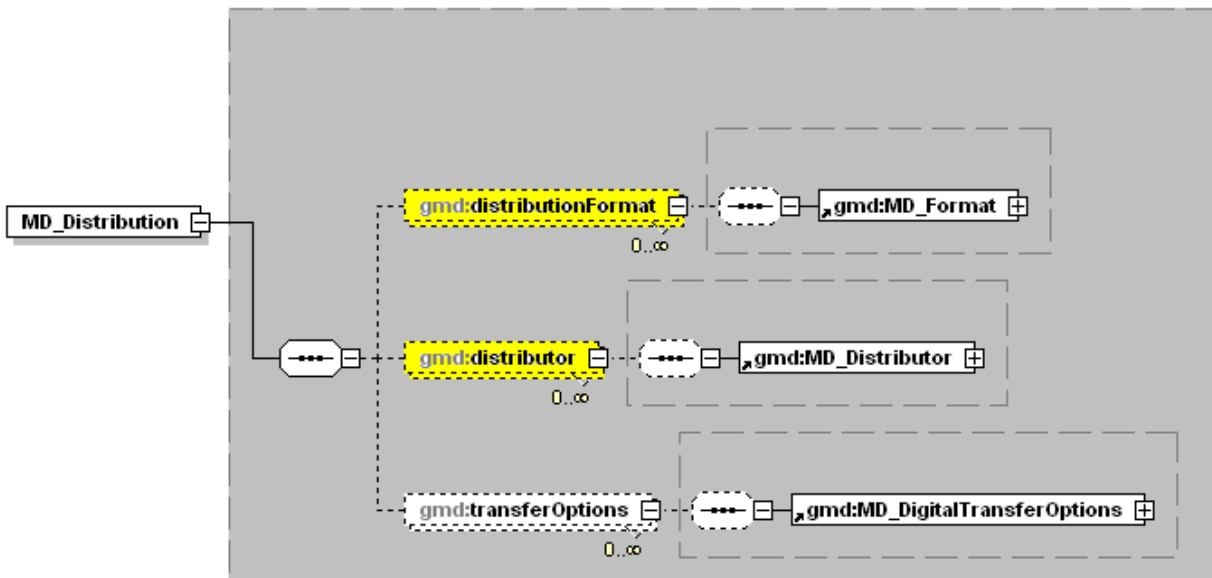
MD_Distribution – Information about the data distributor and options to obtain the dataset.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

distributionFormat – Description of distribution format.
> Type: MD_Format
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: distributionFormat is mandatory if distributor information is not provided.

distributor – Information about the data distributor.
> Type: MD_Distributor
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: distributor is mandatory if distributionFormat information is not provided.

transferOptions – The means and media by which the data/dataset is obtained from the distributor.
> Type: MD_DigitalTransferOptions
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_Distributor
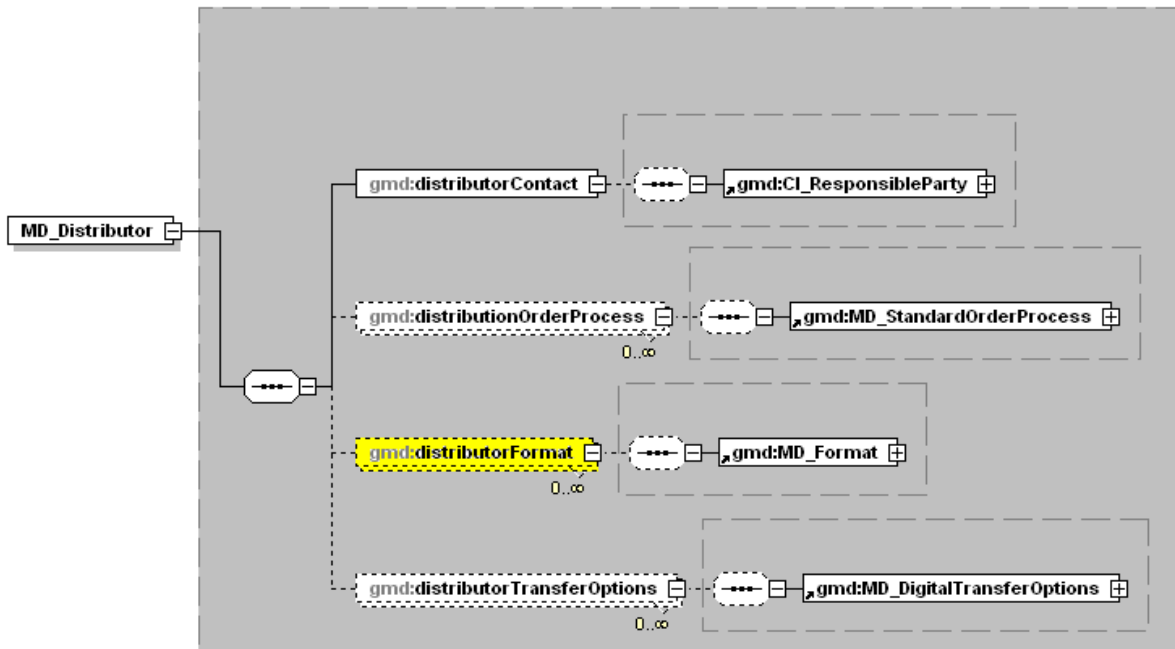
MD_Distributor – Information about the distributor.
>> Type: compound
>> Multiplicity: mandatory
>> Attributes: id, uuid

> distributorContact – Information on the party responsible for distribution.
>> Type: CI_ResponsibleParty
>> Multiplicity: mandatory
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> distributionOrderProcess – The process to follow when obtaining the data/dataset.
>> Type: MD_StandardOrderProcess
>> Multiplicity: optional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> distributorFormat – Provides information about the format used by the distributor.
>> Type: MD_Format
>> Multiplicity: conditional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>> Best Practices: Use if the distributionFormat is not documented.

> distributorTransferOptions – Provides information about the technical means and media used by the distributor.
>> Type: MD_DigitalTransferOptions
>> Multiplicity: optional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_ExtendedElementInformation
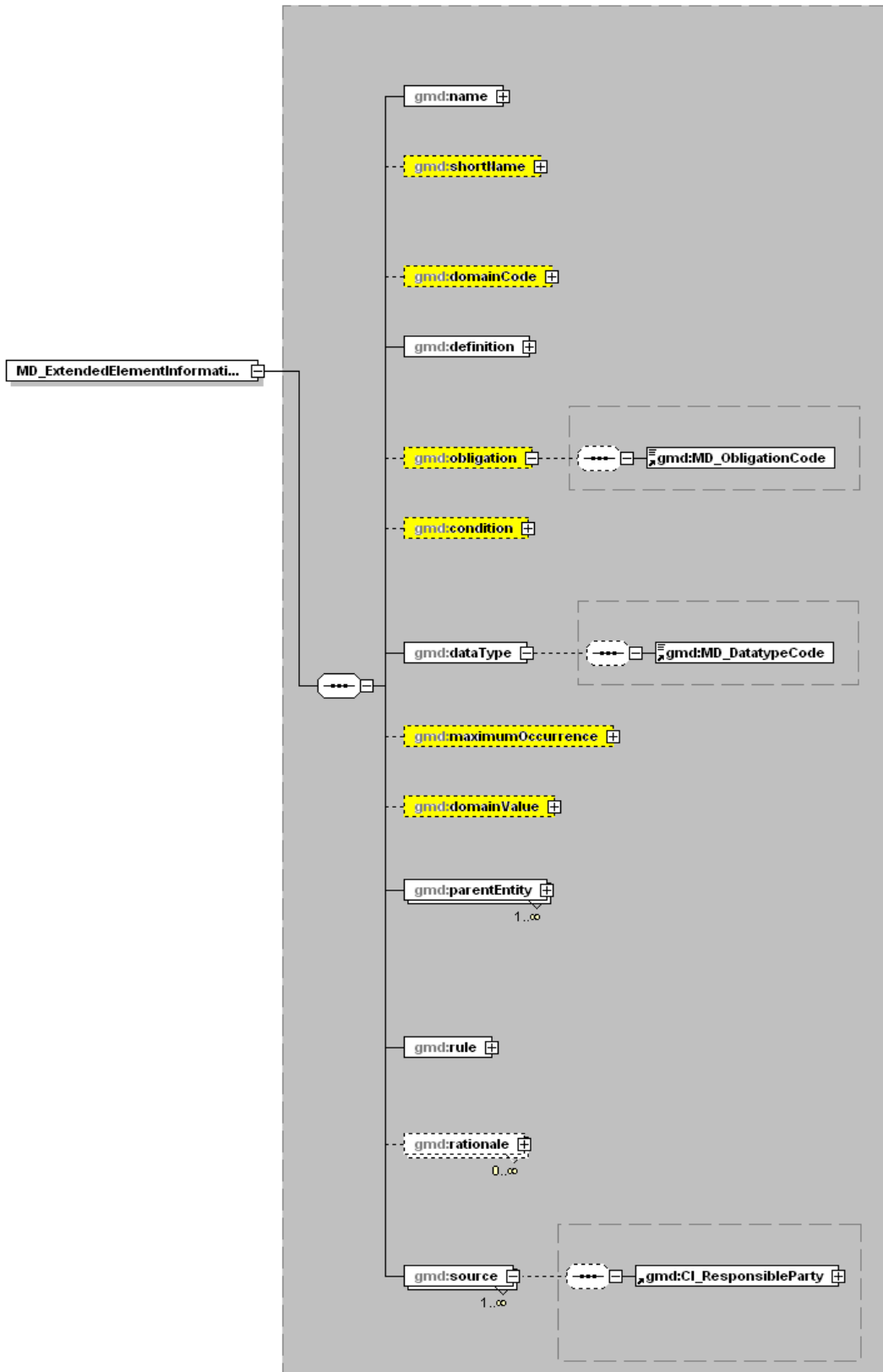
MD_ExtendedElementInformation – New metadata element, not found in ISO 19115 or ISO 19115-2.
   Type: compound
   Multiplicity: mandatory
   Attributes: id, uuid

   name – Name of the extended metadata element.
      Type: gco:CharacterString
      Domain: free text
      Multiplicity: mandatory
      Attributes: nilReason

   shortName – Short form suitable for use in an implementation method such a XML.
      Type: gco:CharacterString
      Domain: free text
      Multiplicity: conditional
      Attributes: nilReason
      Best Practices: shortName is mandatory if dataType is not equal to codeListElement.

   domainCode – Three-digit code assigned to the extended element.
      Type: gco:Integer
      Domain: any whole number
      Multiplicity: conditional
      Attributes: nilReason
      Best Practices: domainCode is mandatory if dataType equals codeListElement

   definition – Definition of the extended element.
      Type: gco:CharacterString
      Domain: free text
      Multiplicity: mandatory
      Attributes: nilReason

   obligation – Obligation of the extended element.
      Type: MD_ObligationCode
      Multiplicity: conditional
      Attributes: nilReason
      Best Practices: obligation is mandatory if dataType is not codelist, enumeration, or
      codelistElement.

   condition – Condition under which the extended element is mandatory.
      Type: gco:CharacterString
      Domain: free text
      Multiplicity: conditional
      Attributes: nilReason
      Best Practices: condition is mandatory if obligation equals conditional

   dataType – Code which identifies the kind of value provided in the extended element.
      Type: MD_DatatypeCode
      Domain: class, codelist, enumeration, codelistElement, abstractClass, aggregateClass,
      specifiedClass, datatypeClass, interfaceClass, unionClass, metaClass, typeClass, characterString,
      integer, association
      Multiplicity: mandatory
      Attributes: nilReason

maximumOccurrence – Maximum occurrence of the extended element.
>Type: gco:CharacterString
>Domain: free text
>Multiplicity: conditional
>Attributes: nilReason
>Best Practices: maximumOccurrence is mandatory if dataType is not codelist, enumeration, or codelistElement.

domainValue – Valid values that can be assigned to the extended element.
>Type: gco:CharacterString
>Domain: free text
>Multiplicity: conditional
>Attributes: nilReason
>Best Practices: domainValue is mandatory if dataType is codelist, enumeration, or codelistElement.

parentEntity – Name of the metadata entity(s) under which this extended metadata element may appear. The name(s) may be standard metadata elements or other extended metadata elements.
>Type: gco:CharacterString
>Domain: free text
>Multiplicity: mandatory, repeatable
>Attributes: nilReason

rule – Specifies how the extended element relates to other existing elements and entities.
>Type: gco:CharacterString
>Domain: free text
>Multiplicity: mandatory
>Attributes: nilReason

rationale – Reason for creating the extended element.
>Type: gco:CharacterString
>Domain: free text
>Multiplicity: optional, repeatable
>Attributes: nilReason

source – Name of the person or organisation creating the extended element.
>Type: CI_ResponsibleParty
>Multiplicity: mandatory, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

---

FAQ: How would I document extended element information for biological information?

Ex:
```
<gmd:MD_MetadataExtensionInformation>
<gmd:extendedElementInformation>
<gmd:MD_ExtendedElementInformation>
<gmd:name>
<gco:CharacterString>Taxonomy System</gco:CharacterString>
</gmd:name>
<gmd:shortName>
<gco:CharacterString>taxonomy</gco:CharacterString>
</gmd:shortName>
<gmd:definition>
```

```xml
<gco:CharacterString>Documentation of taxonomic sources, procedures, and treatments.</gco:CharacterString>
</gmd:definition>
<gmd:obligation>
<gmd:MD_ObligationCode>optional</gmd:MD_ObligationCode>
</gmd:obligation>
<gmd:dataType>
<gmd:MD_DatatypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_DatatypeCode"
codeListValue="class" codeSpace="001"> class</gmd:MD_DatatypeCode>
</gmd:dataType>
<gmd:maximumOccurrence>
<gco:CharacterString>1</gco:CharacterString>
</gmd:maximumOccurrence>
<gmd:parentEntity>
<gco:CharacterString>MD_Identification</gco:CharacterString>
</gmd:parentEntity>
<gmd:rule>
<gco:CharacterString>New Metadata section as a class to MD_Identification</gco:CharacterString>
</gmd:rule>
<gmd:rationale>
<gco:CharacterString>The set of data elements contained within this class element represents an attempt to provide better
documentation of taxonomic sources, procedures, and treatments.</gco:CharacterString>
</gmd:rationale>
<gmd:source>
<gmd:CI_ResponsibleParty>
<gmd:organisationName>
<gco:CharacterString>National Biological Information Infrastructure (NBII)</gco:CharacterString>
</gmd:organisationName>
<gmd:role>
<gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider" codeSpace="001"/>
</gmd:role>
</gmd:CI_ResponsibleParty>
</gmd:source>
</gmd:MD_ExtendedElementInformation>
</gmd:extendedElementInformation>
</gmd:MD_MetadataExtensionInformation>
```

MD_FeatureCatalogueDescription
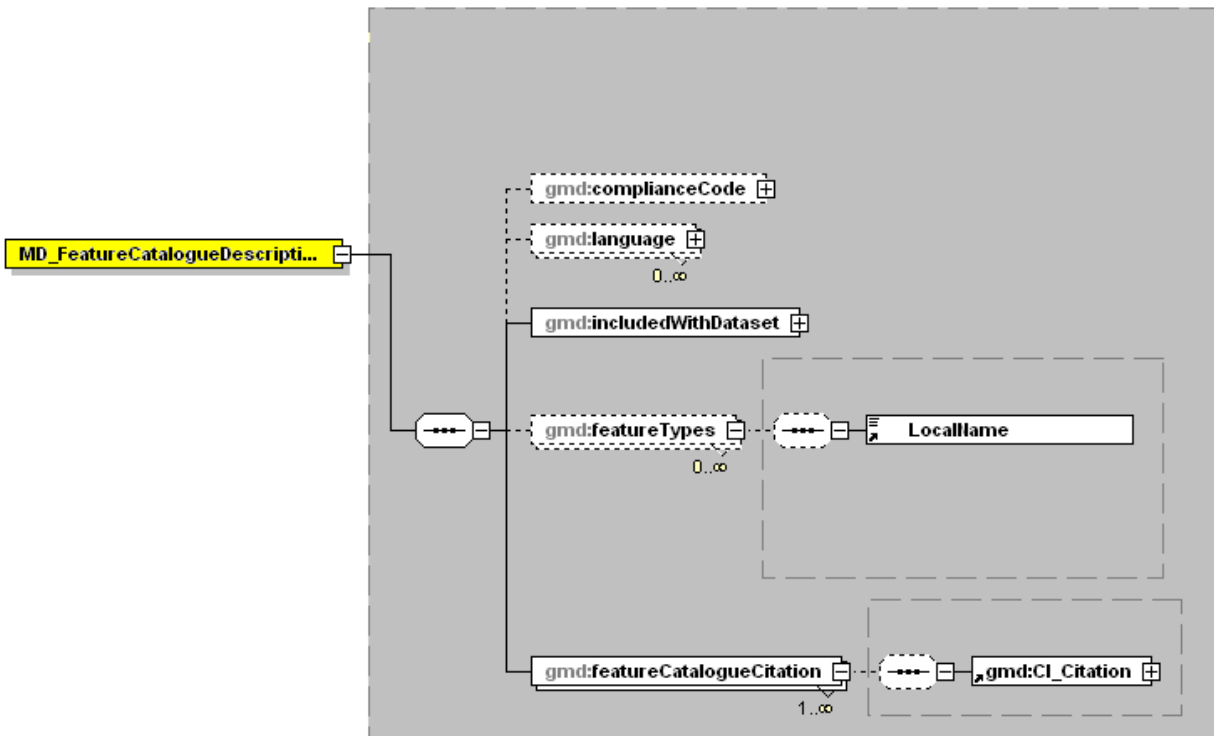
MD_FeatureCatalogueDescription – Identification of the feature catalogue or the conceptual schema.
>   Type: compound
>   Multiplicity: conditional
>   Attributes: id, uuid
>   Best Practices: Although features (attributes of the dataset) are normally documented in a
>   Feature Catalogue (ISO 19110), they should be a part of this metadata record.

complianceCode – Indication of whether the cited feature catalogue complies with ISO 19110.
>   Type: gco:Boolean
>   Domain: 0, 1 (0 = not compliant and 1 = compliant)
>   Multiplicity: optional
>   Attributes: nilReason

language – Language and character coding standards of the feature catalogue. See Annex B.
>   Type: gco:characterString
>   Domain: free text
>   Multiplicity: optional, repeatable
>   Attributes: nilReason

includedWithDataset – Is the feature catalogue included with the dataset?
>   Type: gco:Boolean
>   Domain: 0, 1 (0 = not included and 1 = included)
>   Multiplicity: mandatory
>   Attributes: nilReason

featureTypes – Feature type identifier and/or generic name of feature as listed in the feature catalogue.
>Type: LocalName
>Domain: free text
>Multiplicity: optional, repeatable * this is a NAP requirement *
>Attributes: nilReason
>Best Practices: LocalName has an optional attribute 'codeSpace'.

FAQ: **How would the feature type "building" be documented?**

Ex:
<featureTypes>
>   <LocalName codeSpace="http://www...">building</LocalName>
</featureTypes>

---

featureCatalogueCitation – Citation to reference the feature catalogue.
>Type: CI_Citation
>Multiplicity: mandatory, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>Best Practices: This citation should provide a link to the feature catalogue.

MD_Format
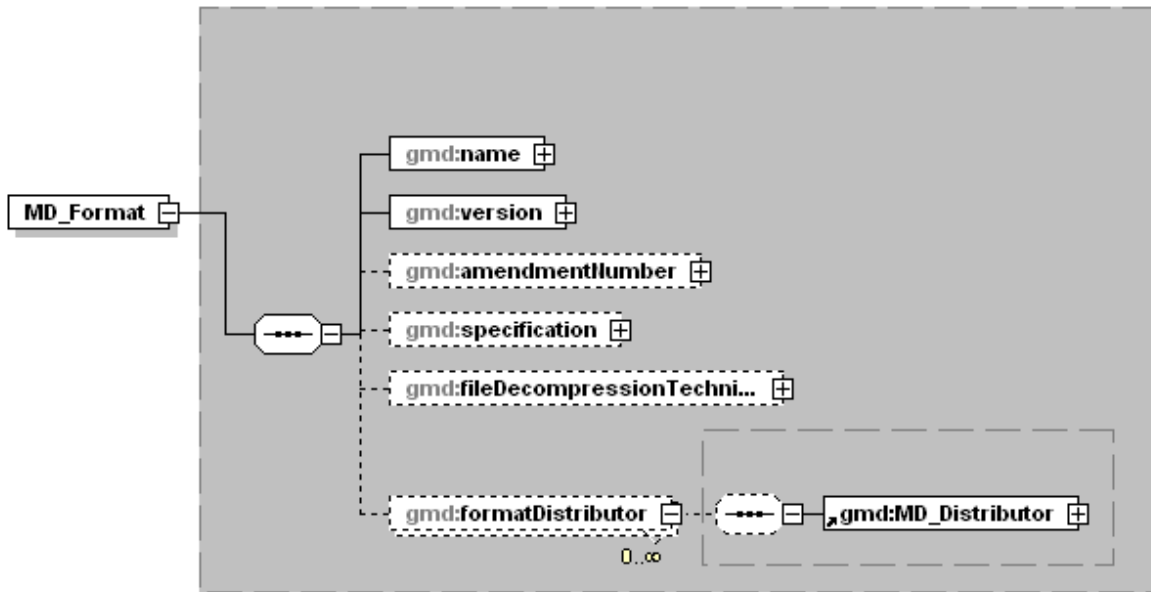
MD_Format – Description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device, or transmission channel.

> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

name – Name of the data transfer format.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

version – Version of the format (date, number, etc).

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

amendmentNumber – Format version amendment number.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

specification – The subset name, profile, or product specification of the format.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

fileDecompressionTechnique – Description of recommended processes or algorithms to apply to the compressed resource.

Type: gco:characterString
Domain: free text
Multiplicity: optional
Attributes: nilReason

formatDistributor – Provides information about the distributor's format.
Type: MD_Distributor
Multiplicity: optional, repeatable
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_GeometricObjects
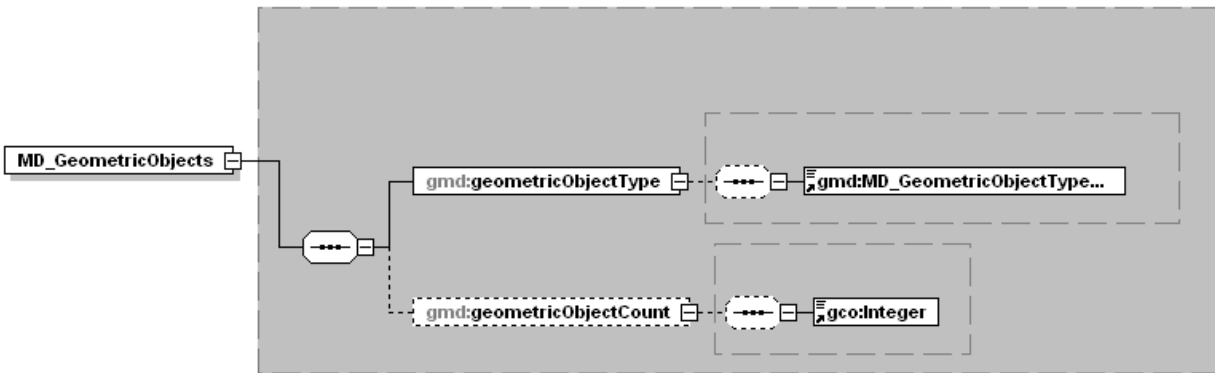
MD_GeometricObjects – Number of objects, listed by geometric object type, used in the dataset.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

    geometricObjectType – Name of point or vector objects used to locate zero, one-, two-, or three-dimensional spatial locations in the dataset.
        Type: MD_GeometricObjectTypeCode
        Domain: complex, composite, curve, point, solid, surface
        Multiplicity: mandatory
        Attributes: nilReason

    geometricObjectCount – Total number of the point or vector object type occurring in the dataset.
        Type: gco:Integer
        Domain: any whole number
        Multiplicity: optional
        Attributes: nilReason

MD_Georectified
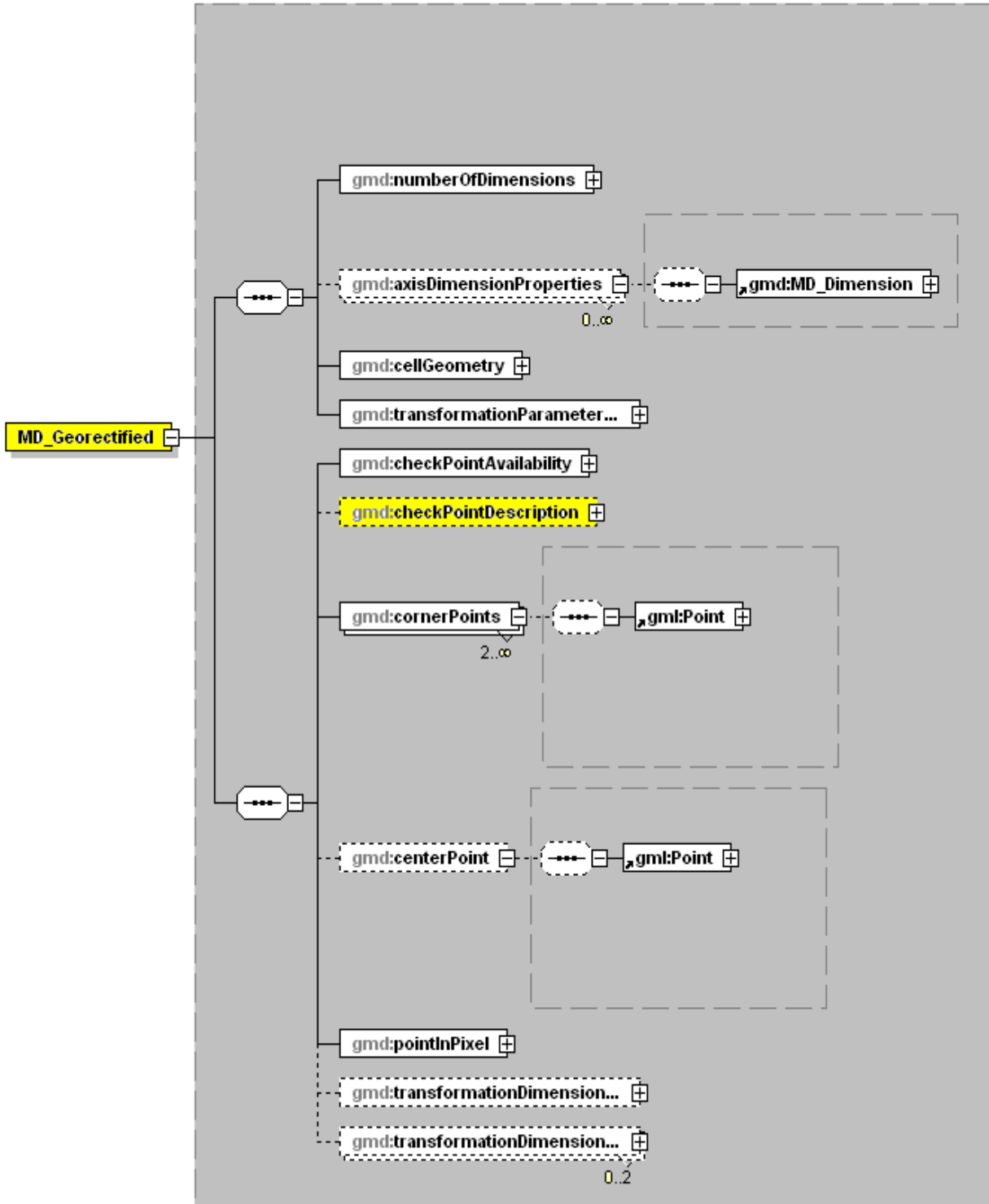
MD_Georectified – Information on the grid used to georectify the data.
>> Type: compound
>> Multiplicity: conditional
>> Attributes: id, uuid

numberOfDimensions – Number of independent spatial-temporal axes (x, y, or z).
>> Type: gco:Integer
>> Domain: any whole number
>> Multiplicity: mandatory
>> Attributes: nilReason

axisDimensionProperties – Information on the dimension name, size, and resolution used.
>> Type: MD_Dimension
>> Multiplicity: optional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

cellGeometry – Identification of grid data as point or cell.
>> Type: MD_CellGeometryCode
>> Domain: point, area
>> Multiplicity: mandatory
>> Attributes: nilReason
>> Best Practices: See Annex C.

transformationParameterAvailability – Indication of image coordinates and availability of geographic or map coordinates.
>> Type: gco:Boolean
>> Domain: 0, 1 (1 = Yes, 0 = No)
>> Multiplicity: mandatory
>> Attributes: nilReason

checkPointAvailability – Indication of availability of geographic position points in order to test the accuracy of the georeferenced grid data.
>> Type: gco:Boolean
>> Domain: 0, 1 (1 = Yes, 0 = No)
>> Multiplicity: mandatory
>> Attributes: nilReason

checkPointDescription – Description of geographic position points in order to test the accuracy of the georeferenced grid data.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: conditional
>> Attributes: nilReason
>> Best Practices: checkPointDescription is mandatory if checkPointAvailability = "1" (yes).

cornerPoints – Location in coordinate system defined by Spatial Reference System and grid coordinates of the cells at opposite ends of the grid coverage along two diagonals in the grid spatial dimension.
>> Type: gml:Point
>> Domain: single coordinate tuple
>> Multiplicity: mandatory, repeatable twice
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>> Best Practices: At a minimum, two corner points shall be provided along a diagonal. When providing more than two corner points, they shall be in the clockwise order.

centerPoint – Earth location, represented as a point, in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cell halfway between opposite ends of the grid.

> Type: gml:Point
> Domain: single coordinate tuple
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

pointInPixel – Point in a pixel corresponding to the Earth location of the pixel.

> Type: MD_PixelOrientationCode
> Domain: center, lowerLeft, lowerRight, upperLeft, upperRight
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: See Annex C.

transformationDimensionDescription – General description of the transformation.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

transformationDimensionMapping – Information about which grid axes are spatial axes.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable twice
> Attributes: nilReason

MD_Georeferenceable
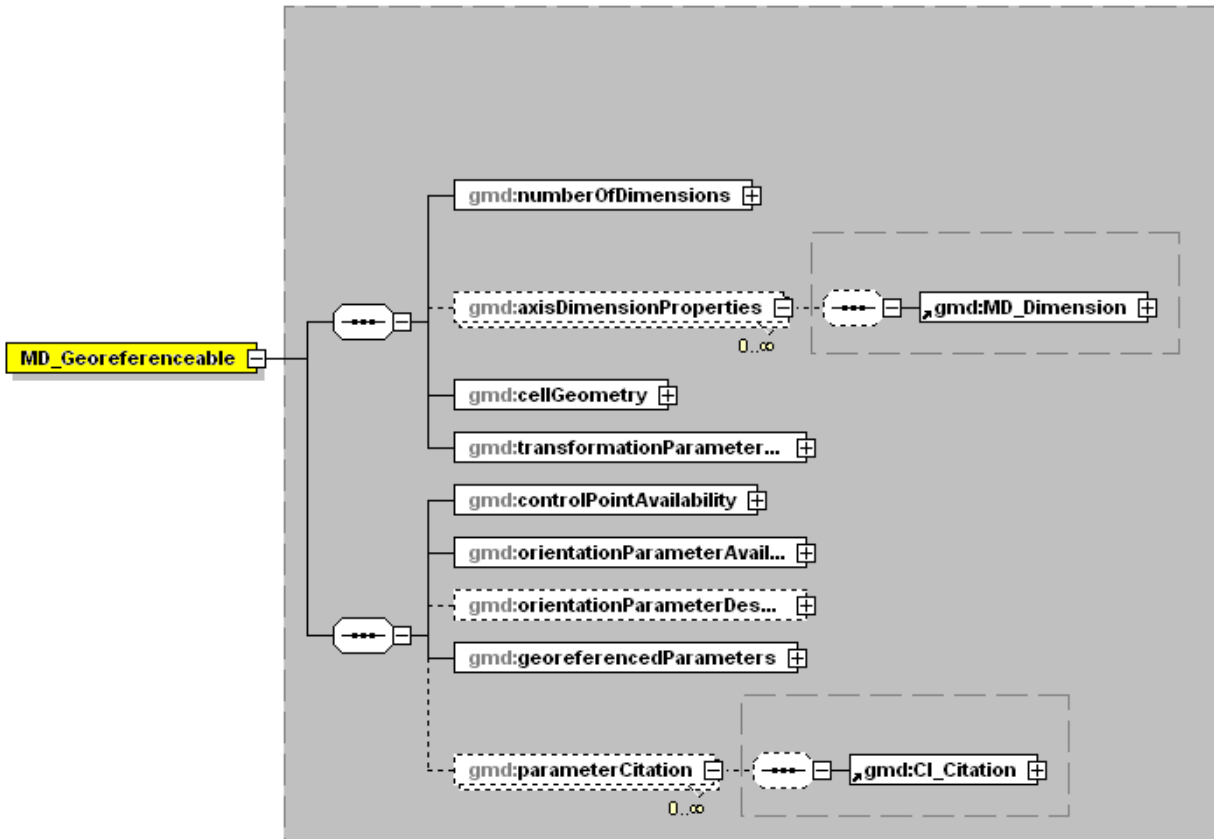
MD_Georeferenceable – Grid with cells irregularly spaced in any given geographic/map projection
coordinate system, whose individual cells can be geolocated using geolocation information supplied with
the data but cannot be geolocated from the grid properties alone.
> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid

numberOfDimensions – Number of independent spatial-temporal axes (x, y, or z).
> Type: gco:Integer
> Domain: any whole number
> Multiplicity: mandatory
> Attributes: nilReason

axisDimensionProperties – Information on the dimension name, size, and resolution used.
> Type: MD_Dimension
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> cellGeometry – Identification of grid data as point or cell.
> Type: MD_CellGeometryCode
> Domain: point, area
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: See Annex C.

transformationParameterAvailability – Indication of image coordinates and availability of geographic or map coordinates.

    Type: gco:Boolean
    Domain: 0, 1 (1 = Yes, 0 = No)
    Multiplicity: mandatory
    Attributes: nilReason

controlPointAvailability – Indication of control point existence.

    Type: gco:Boolean
    Domain: 0, 1 (1 = Yes, 0 = No)
    Multiplicity: mandatory
    Attributes: nilReason

orientationParameterAvailability – Indication of orientation parameters availability.

    Type: gco:Boolean
    Domain: 0, 1 (1 = Yes, 0 = No)
    Multiplicity: mandatory
    Attributes: nilReason

orientationParameterDescription – Description of parameters used to describe sensor orientation.

    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

georeferencedParameters – Terms which support grid data georeferencing.

    Type: gco:Record
    Multiplicity: mandatory
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

parameterCitation – Citation for the parameter reference.

    Type: CI_Citation
    Multiplicity: optional, repeatable
    Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_GridSpatialRepresentation
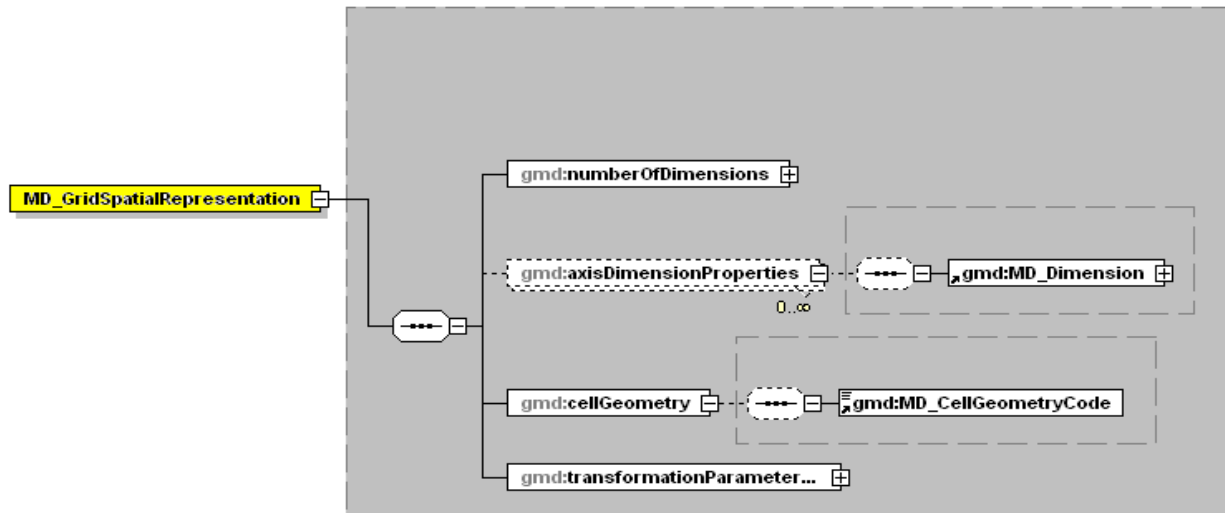
MD_GridSpatialRepresentation – Information about grid spatial objects in the dataset.
>   Type: compound
>   Multiplicity: conditional
>   Attributes: id, uuid
>   Best Practices: MD_GridSpatialRepresentation is mandatory if dataset objects are gridded and
>   MD_Georectified or MD_Georeferenceable are not used.

numberOfDimensions – Number of independent spatial-temporal axes (x, y, or z).
>   Type: gco:Integer
>   Domain: any whole number
>   Multiplicity: mandatory
>   Attributes: nilReason

axisDimensionProperties – Information on the dimension name, size, and resolution used.
>   Type: MD_Dimension
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

cellGeometry – Identification of grid data as point or cell.
>   Type: MD_CellGeometryCode
>   Domain: point, area
>   Multiplicity: mandatory
>   Attributes: nilReason
>   Best Practices: See Annex C.

transformationParameterAvailability – Indication of image coordinates and availability of geographic or
map coordinates.
>   Type: gco:Boolean
>   Domain: 0, 1 (1 = Yes, 0 = No)
>   Multiplicity: mandatory
>   Attributes: nilReason

MD_Identifier
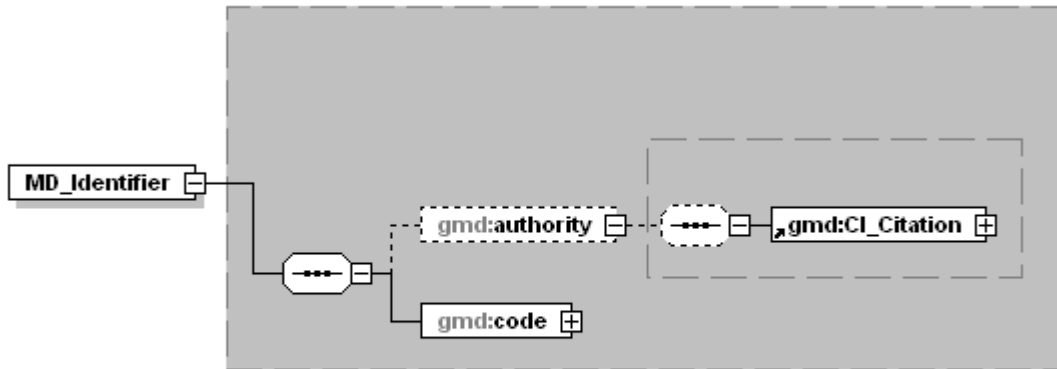
MD_Identifier – Information about the unique identification of an object.
>   Type: compound
>   Multiplicity: mandatory
>   Attributes: id, uuid
>   Best Practices: The namespace is stored in the attribute authority and the ID is stored in the attribute code.

>   authority – Recognized responsible party or organisation for a reference.
>>   Type: CI_Citation
>>   Multiplicity: optional
>>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

>   code – The alphanumeric value that identifies a resource.
>>   Type: gco:characterString
>>   Domain: free text
>>   Multiplicity: mandatory
>>   Attributes: nilReason

FAQ: What would the MD_Identifier look like for the 1:50,000 map sheet of Sherbrooke in Canada that is identified by the code "21E05" under the authority of "National Topographic System"?

```
Ex:
<gmd:MD_Identifier>
        <gmd:authority>
                <gmd:CI_Citation>
                        <gmd:title>
                                <gco:CharacterString>1:50,000 Topographic Map of
Sherbrooke, Canada</gco:CharacterString>
                        </gmd:title>
                        <gmd:date gco:nilReason="unknown"/>
                        <gmd:citedResponsibleParty>
                                <gmd:CI_ResponsibleParty>
                                        <gmd:organisationName>
                                                <gco:CharacterString>National Topographic
System (NTS)</gco:CharacterString>
```

```xml
            </gmd:organisationName>
            <gmd:role>
                <gmd:CI_RoleCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider" codeSpace="001">resourceProvider</gmd:CI_RoleCode>
            </gmd:role>
        </gmd:CI_ResponsibleParty>
    </gmd:citedResponsibleParty>
</gmd:CI_Citation>
</gmd:authority>
<gmd:code>
    <gco:CharacterString>21E05</gco:CharacterString>
</gmd:code>
</gmd:MD_Identifier>
```

MD_ImageDescription
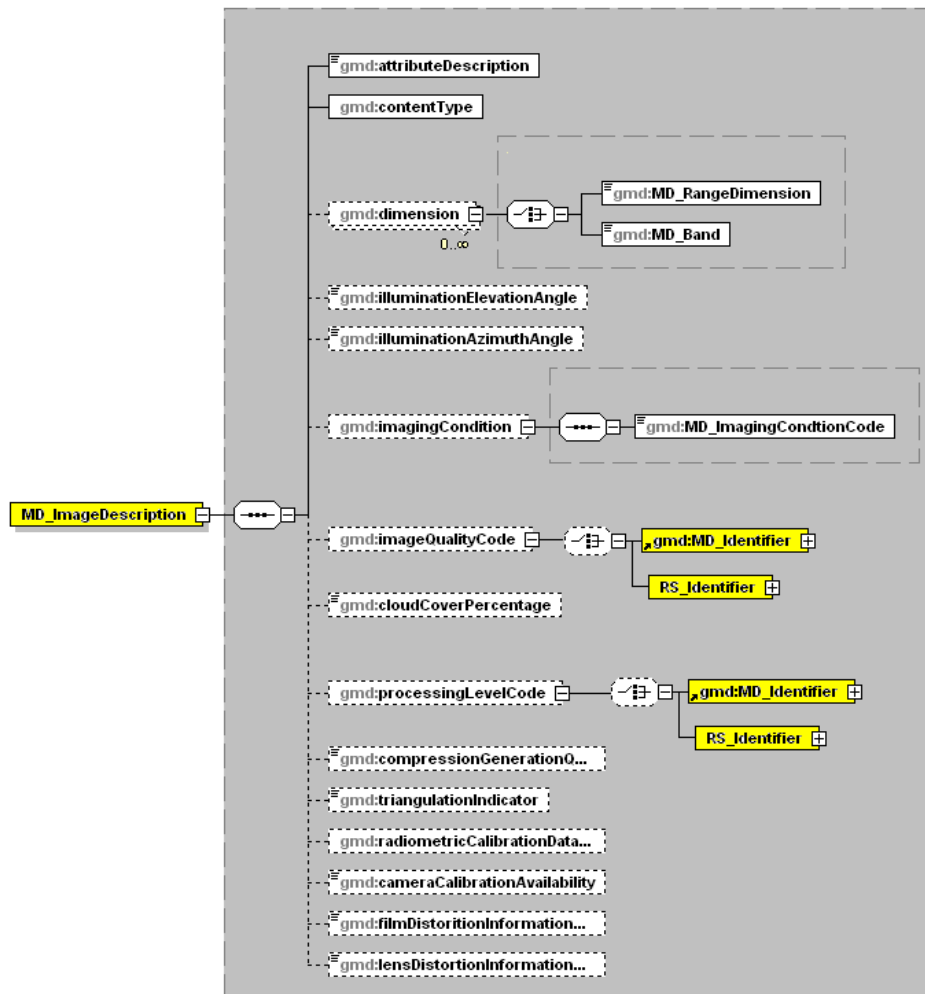
MD_ImageDescription – Information about image characteristics.
        Type: compound
        Multiplicity: conditional
        Attributes: id, uuid

attributeDescription – Description of the cell measurement.
        Type: gco:RecordType
        Multiplicity: mandatory
        Attributes: nilReason

contentType – Information represented by the cell.
        Type: MD_CoverageContentTypeCode
        Domain: image, thematicClassification, physicalMeasurement
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

dimension – Information on the dimension of the cell measurement value.
>   Type: MD_RangeDimension or MD_Band
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

illuminationElevationAngle – Illumination elevation measure in degrees clockwise for the target plane at intersection of the optical line of sight with the Earth's surface.
>   Type: gco:Real
>   Domain: any number [-90, 90]
>   Multiplicity: optional
>   Attributes: nilReason

illuminationAzimuthAngle – Illumination azimuth measured in degrees clockwise from true north at the time the image is taken.
>   Type: gco:Real
>   Domain: any number [0, 360]
>   Multiplicity: optional
>   Attributes: nilReason

imagingCondition – Conditions affecting the image.
>   Type: MD_ImagingConditionCode
>   Domain: blurredImage, cloud, degradingObliquity, fog, heavySmokeOrDust, night, rain, semidarkness, shadow, snow, terrainMasking
>   Multiplicity: optional
>   Attributes: nilReason
>   Best Practices: See Annex C.

imageQualityCode – Specifies the image quality.
>   Type: MD_Identifier or RS_Identifier
>   Multiplicity: optional
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

cloudCoverPercentage – Percentage of dataset area obscured by clouds.
>   Type: gco:Real
>   Domain: any number [0.0, 100.0]
>   Multiplicity: optional
>   Attributes: nilReason

processingLevelCode – Identification of the image processing level.

>   Type: MD_Identifier or RS_Identifier
>   Multiplicity: optional
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

compressionGenerationQuantity – The number of compression cycles performed on the image.
>   Type: gco:Integer
>   Domain: any whole number
>   Multiplicity: optional
>   Attributes: nilReason

triangulationIndicator – Indication if triangulation was performed on the image.
>   Type: gco:Boolean
>   Domain: 0,1 (0 = no and 1 = yes)
>   Multiplicity: optional
>   Attributes: nilReason

radiometricCalibrationDataAvailability – Indication if radiometric calibration information to generate radiometrically calibrated standard data product is available.
>   Type: gco:Boolean
>   Domain: 0,1 (0 = no and 1 = yes)
>   Multiplicity: optional
>   Attributes: nilReason

cameraCalibrationInformationAvailability – Indication of camera calibration constants availability.
>   Type: gco:Boolean
>   Domain: 0,1 (0 = no and 1 = yes)
>   Multiplicity: optional
>   Attributes: nilReason

filmDistortionInformationAvailability – Indication of Calibration Reseau information availability.
>   Type: gco:Boolean
>   Domain: 0,1 (0 = no and 1 = yes)
>   Multiplicity: optional
>   Attributes: nilReason

lensDistortionInformationAvailability – Indication of lens aberration correction information availability.
>   Type: gco:Boolean
>   Domain: 0,1 (0 = no and 1 = yes)
>   Multiplicity: optional
>   Attributes: nilReason

MD_Keywords
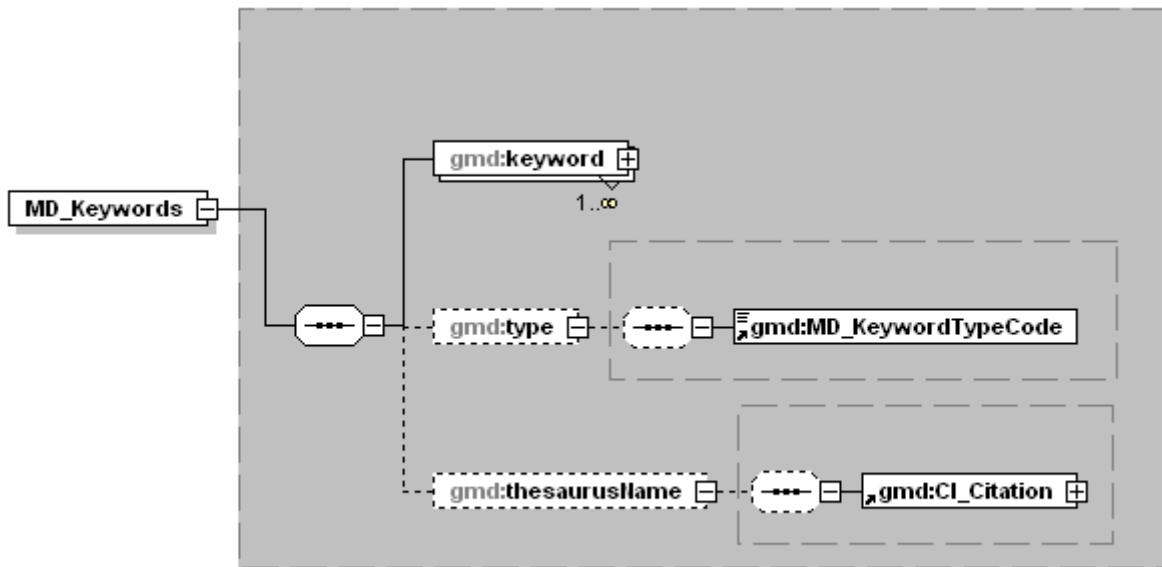
MD_Keywords – Commonly used words or phrases that describe the resource. Optionally, the keyword type and a citation for the authoritative or registered resource of the keywords are also provided.

> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid
> Best Practices: It is highly recommended that keywords from the authoritative source be used instead of using user defined keywords.

keyword – Commonly used words or phrases which describe the resource.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory, repeatable
> Attributes: nilReason

type – Terms or type used to group keywords.

> Type: MD_KeywordTypeCode
> Domain: discipline, place, stratum, temporal, theme, taxon
> Multiplicity: optional
> Attributes: nilReason
> Best Practices: See Annex C.

thesaurusName – The name of a registered authoritative keyword resource.

> Type: CI_Citation
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: It is strongly recommended to provide contact information.

MD_LegalConstraints
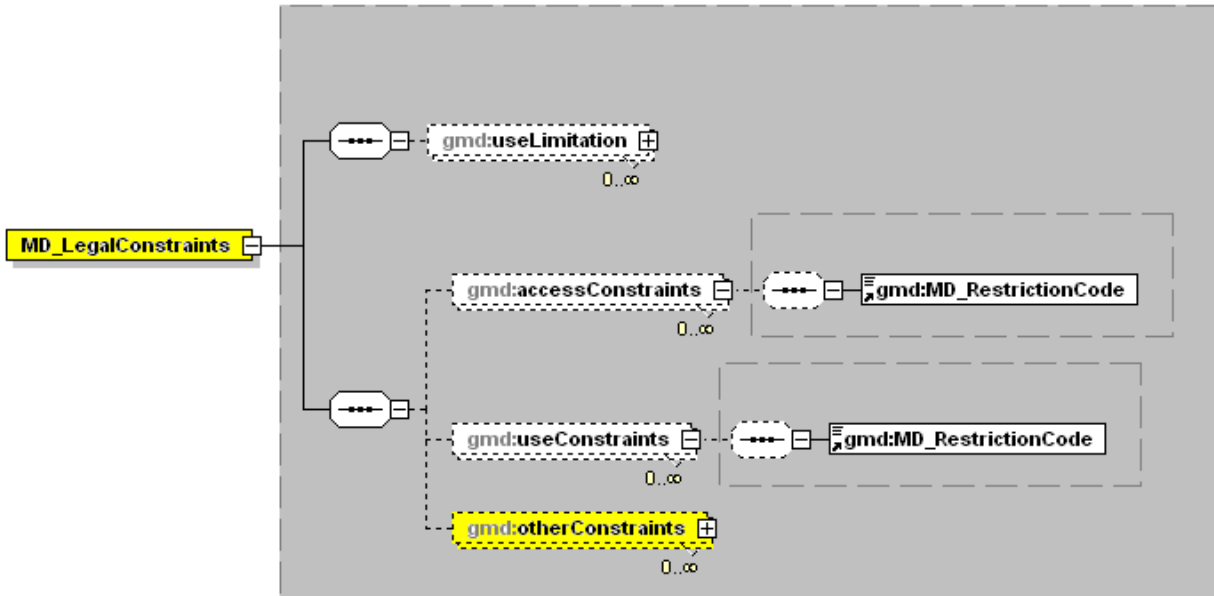
MD_LegalConstraints – The legal restrictions or prerequisites to using the resource or accessing the metadata.
> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid

useLimitation – Statement on the fitness of use or limitations on the use of the resource or metadata.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable
> Attributes: nilReason

accessConstraints – Limitations on access to the resource or metadata to protect privacy, intellectual property, or any special limitations.
> Type: MD_RestrictionCode
> Domain: copyright, patent, patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions
> Multiplicity: optional, repeatable
> Attributes: nilReason
> Best Practices: See Annex C.

useConstraints – Restrictions or limitations or warnings to protect privacy, intellectual property, or other special restrictions on the resource or the metadata.
> Type: MD_RestrictionCode
> Domain: copyright, patent, patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions
> Multiplicity: optional, repeatable
> Attributes: nilReason
> Best Practices: See Annex C.

otherConstraints – Other restrictions or legal prerequisites for accessing the resource or metadata.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional, repeatable
> Attributes: nilReason
> Best Practices: otherConstraints becomes mandatory when accessConstraints or useConstraints are set to "otherRestrictions".

FAQ: **Why are some use and access constraints found in "otherConstraints"?**

useConstraints and accessConstraints are restricted to only allow use of the codelist values. If none of the values can accurately describe the constraints, other constraints allows free text. Often, when translating from legacy metadata, it is difficult to translate to the codelist values with accuracy. To preserve the integrity of the content, the entire content, verbatim is mapped to 'otherConstraints.

Ex:

```
<gmd:resourceConstraints>
        <gmd:MD_LegalConstraints>
          <gmd:accessConstraints>
            <gmd:MD_RestrictionCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_RestrictionCode"
                        codeListValue="otherRestrictions"
                        codeSpace="008">otherRestrictions</gmd:MD_RestrictionCode>
          </gmd:accessConstraints>
          <gmd:useConstraints>
            <gmd:MD_RestrictionCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_RestrictionCode"
                        codeListValue="otherRestrictions"
                        codeSpace="008">otherRestrictions</gmd:MD_RestrictionCode>
          </gmd:useConstraints>
          <gmd:otherConstraints>
            <gco:CharacterString>Access Constraints: None   Use Constraints: The user is responsible for the results of
any application of this data for other than its intended purpose. Distribution Liability: NOAA makes no warranty
regarding these data, expressed or implied, nor does the fact of distribution constitute such a warranty. NOAA,
NESDIS, NODC and NCDDC cannot assume liability for any damages caused by any errors or omissions in these data,
nor as a result of the failure of these data to function on a particular system.</gco:CharacterString>
          </gmd:otherConstraints>
        </gmd:MD_LegalConstraints>
      </gmd:resourceConstraints>
```

MD_MaintenanceInformation
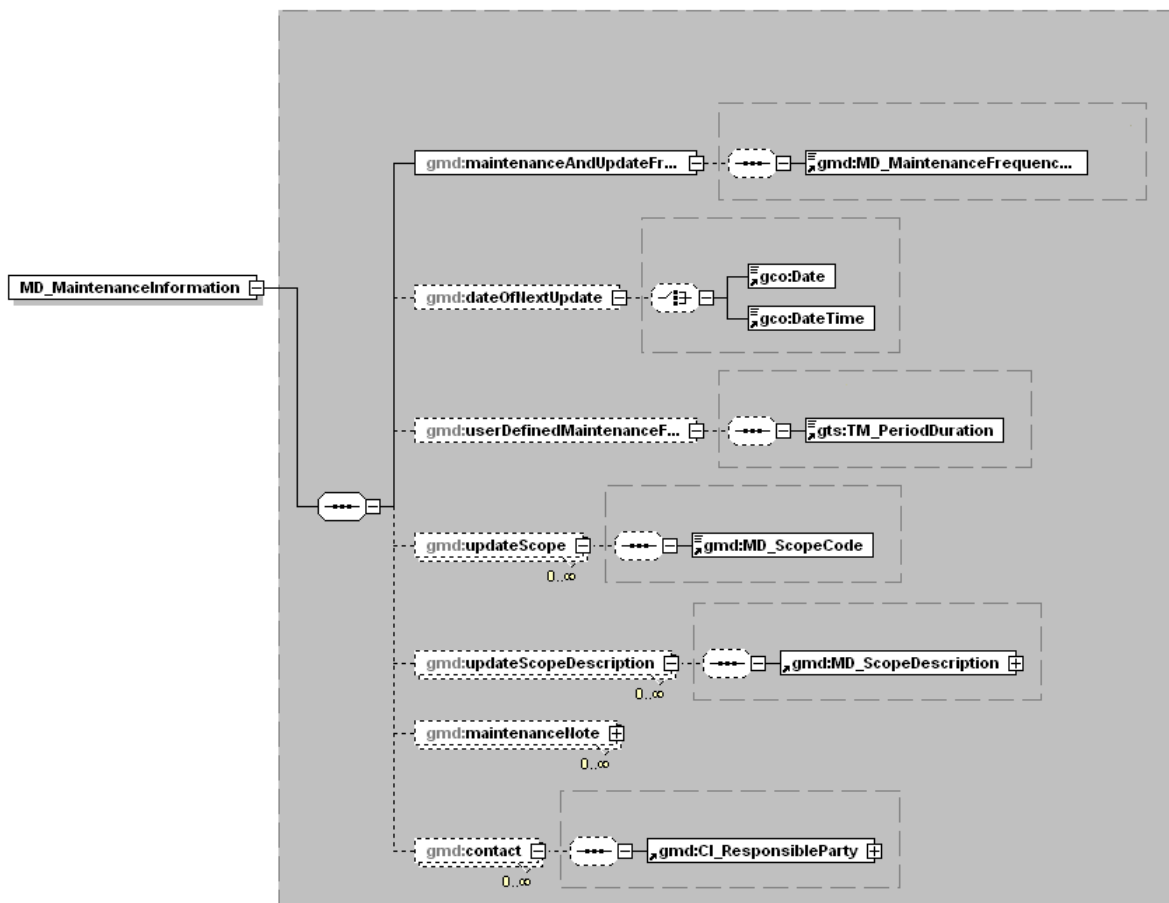
MD_MaintenanceInformation – Provides information about how the resources or metadata records are updated.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

    maintenanceAndUpdateFrequency – Frequency of changes and additions made to the resource after the initial completion.
        Type: MD_MaintenanceFrequencyCode
        Domain: continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: See Annex C.

    dateOfNextUpdate – The scheduled revision date for the resource.
        Type: choice of gco:Date or gco:DateTime
        Domain: date
        Multiplicity: optional
        Attributes: nilReason

userDefinedMaintenanceFrequency – The maintenance period other than those defined.
        Type: gts:TM_PeriodDuration
        Multiplicity: optional
        Attributes: nilReason

updateScope – Scope of data to which maintenance is applied.
        Type: MD_ScopeCode
        Domain: attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile
        Multiplicity: optional, repeatable
        Attributes: nilReason
        Best Practices: See Annex C.

updateScopeDescription – Additional information about the range or extent of the resource.
        Type: MD_ScopeDescription
        Multiplicity: optional, repeatable
        Attributes: nilReason

maintenanceNote – Information regarding specific requirements for maintaining the resource.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional, repeatable
        Attributes: nilReason

contact – Identification of and means of communicating with the person or organisation with responsibility for maintaining the resource.
        Type: CI_ResponsibleParty
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_Medium
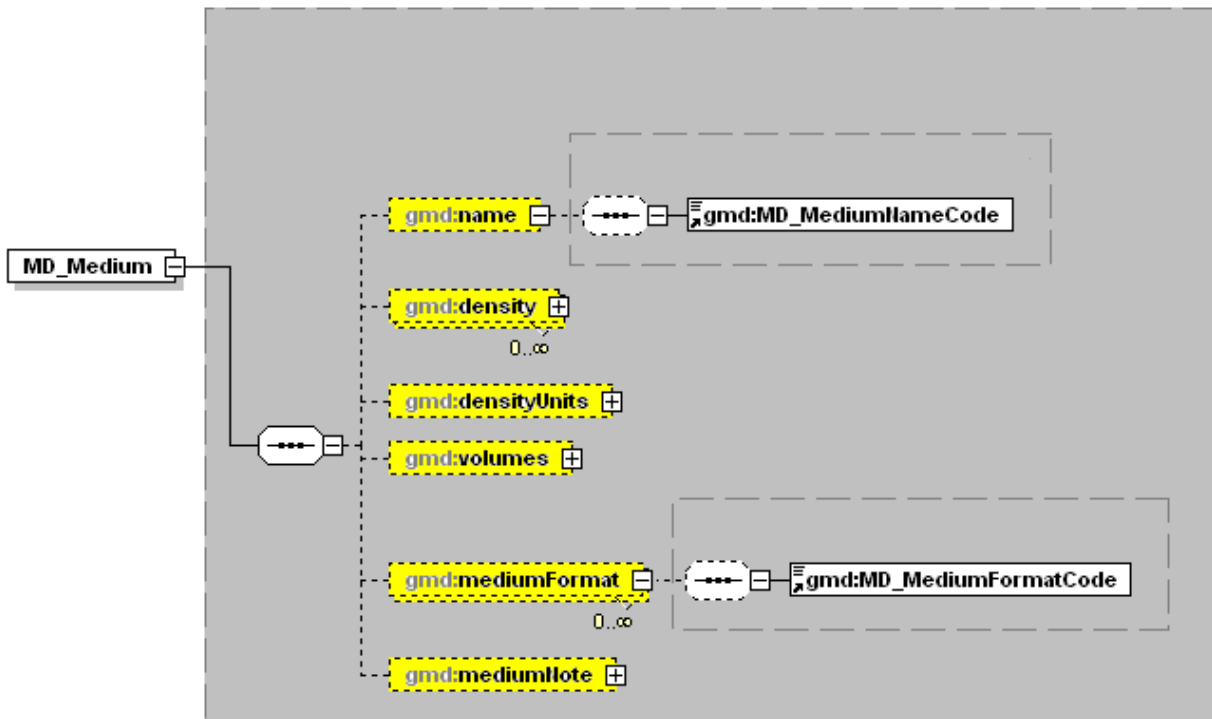
MD_Medium – Information on the name, density units, volumes, medium format, and medium note used to describe the transfer of data to a medium.

        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid
        Best Practices: At least one of name, density, volumes, mediumFormat, or mediumNote shall be provided. densityUnits is mandatory if density is provided.

name – Medium name code.

        Type: MD_MediumNameCode
        Domain: cdRom, dvd, dvdRom, 3halfInchFloppy, 5quarterInchFloppy, 7trackTape, 9trackTape, 3480Catridge, 3490Catridge, 3580Cartridge, 4mmCartridgeTape, 8mmCartridgeTape, 1quarterInchCartridgeTape, digitalLinearTape, onLine, satellite, telephoneLink, hardcopy
        Multiplicity: conditional
        Attributes: nilReason
        Best Practices: See Annex C.

density – The recording density on the specified media.

        Type: gco:Real
        Domain: any number
        Multiplicity: conditional, repeatable
        Attributes: nilReason
        Best Practices: Value greater than "0.0".

densityUnits – The recording density units.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: nilReason
        Best Practices: densityUnits is mandatory when density is documented.

volumes – Identification of the number of recorded items on the media.
        Type: gco:Integer
        Domain: any whole number
        Multiplicity: conditional
        Attributes: nilReason
        Best Practices: Value greater than "0".

mediumFormat – Method used to write to the medium.
        Type: MD_MediumFormatCode
        Domain: cpio, tar, highSierra, iso9660, iso9660RockRidge, iso9660AppleHFS
        Multiplicity: conditional, repeatable
        Attributes: nilReason
        Best Practices: See Annex C.

mediumNote – Description of limitations or requirements for using the medium.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: nilReason

MD_MetadataExtensionInformation
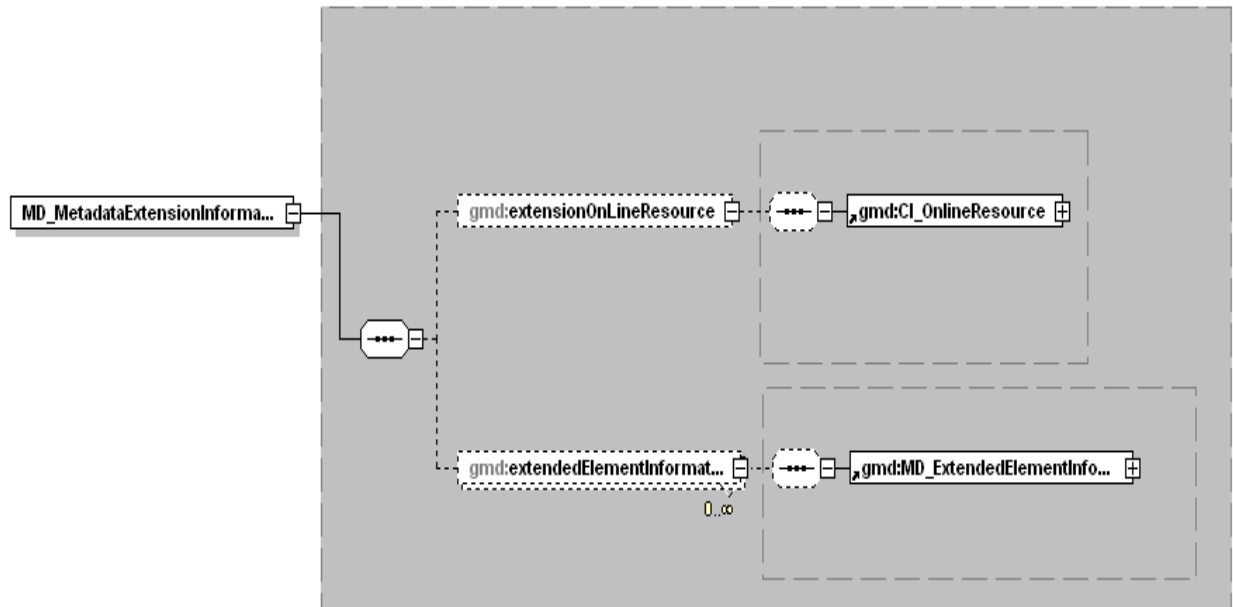
MD_MetadataExtensionInformation – Information describing metadata extensions.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

extensionOnlineResource – Information about on-line sources containing the community profile name and the extended metadata elements. Information for all new metadata elements.
> Type: CI_OnlineResource
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

extendedElementInformation – Provides information about a new metadata element.
> Type: MD_ExtendedElementInformation
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_PortrayalCatalogueReference

MD_PortrayalCatalogueReference – Information used to identify and located the portrayal catalogue.
> Type: portrayalCatalogueCitation
> Multiplicity: mandatory
> Attributes: id, uuid

> portrayalCatalogueCitation – Bibliographic citation for the portrayal catalogue.
>> Type: CI_Citation
>> Multiplicity: mandatory, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_RangeDimension
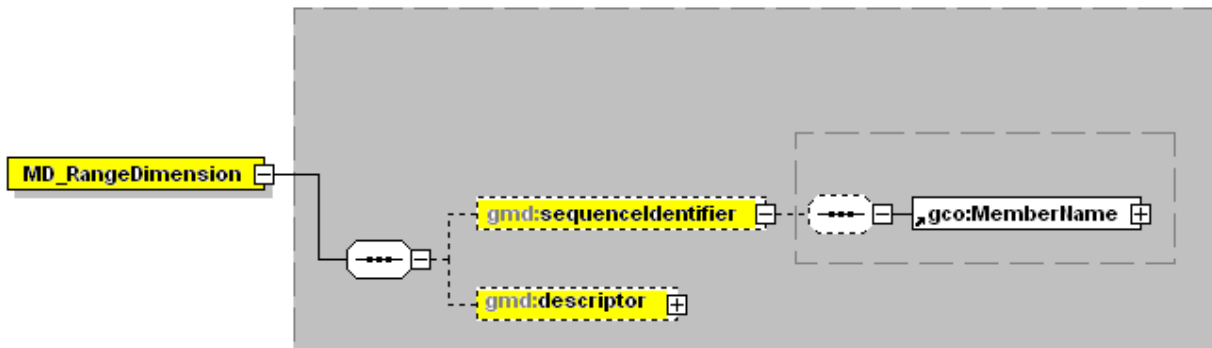
MD_RangeDimension – Information on the dimensions of the cell measurement value.
        Type: compound
        Multiplicity: conditional
        Attributes: id, uuid

      sequenceIdentifier – Sensor band wavelengths.
        Type: gco:MemberName
        Multiplicity: conditional
        Attributes: id, uuid
        Best Practices: Either sequenceIdentifier or descriptor shall be provided, or both.

      descriptor – Description of cell value range.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: nilReason
        Best Practices: Either descriptor or sequenceIdentifier shall be provided, or both.

MD_ReferenceSystem
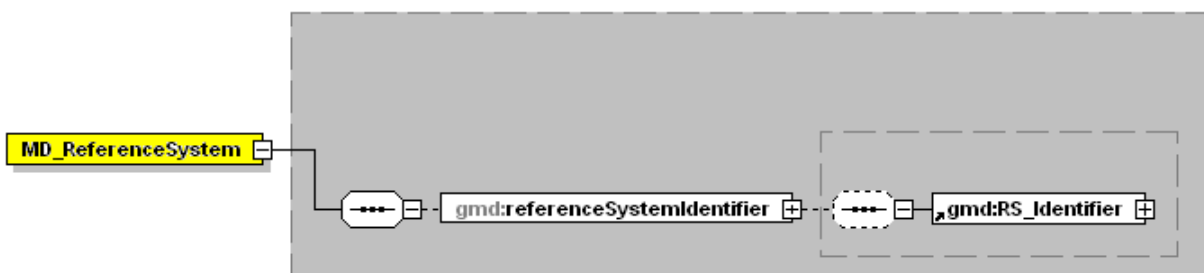
MD_ReferenceSystem – Describes the attributes that provide information about reference system information.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

> referenceSystemIdentifier – Identifier of the Reference System.
> > Type: RS_Identifier
> > Multiplicity: mandatory
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> > Best Practices: A coordinate reference system (CRS) should be taken from a publicly available register or document such as the EPSG Geodetic Parameter Dataset (http://www.epsg-registry.org/) or Spatial Reference (http://spatialreference.org). An identifier or well known name with an authority is defined and referenced here. If a coordinate reference system (CRS) is not available from a publicly available register or document and as such has no identifier or well known name, then that CRS shall be described according to ISO 19111.

FAQ: How would you document a map with a Mercator projection ?

Ex:
```
<gmd:referenceSystemInfo>
<gmd:MD_ReferenceSystem>
<gmd:referenceSystemIdentifier>
<gmd:RS_Identifier>
<gmd:authority>
<gmd:CI_Citation>
<gmd:title>
<gco:CharacterString>WGS 84 / World Mercator</gco:CharacterString>
</gmd:title>
<gmd:date>
<gmd:CI_Date>
<gmd:date>
<gco:Date>2006-06-02</gco:Date>
</gmd:date>
<gmd:dateType>
<gmd:CI_DateTypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
codeListValue="revision">revision</gmd:CI_DateTypeCode>
</gmd:dateType>
</gmd:CI_Date>
</gmd:date>
<gmd:citedResponsibleParty>
<gmd:CI_ResponsibleParty>
```

```xml
<gmd:contactInfo>
<gmd:CI_Contact>
<gmd:onlineResource>
<gmd:CI_OnlineResource>
<gmd:linkage>
<gmd:URL>http://www.epsg-
registry.org/indicio/query?request=getRepositoryitem&id=urn:ogc:def:crs:EPSG::3395</gmd:URL>
</gmd:linkage>
</gmd:CI_OnlineResource>
</gmd:onlineResource>
</gmd:CI_Contact>
</gmd:contactInfo>
<gmd:role>
<gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider" codeSpace="001">resourceProvider</gmd:CI_RoleCode>
</gmd:role>
</gmd:CI_ResponsibleParty>
</gmd:citedResponsibleParty>
</gmd:CI_Citation>
</gmd:authority>
<gmd:code>urn:ogc:def:crs:EPSG::3395</gmd:code>
</gmd:RS_Identifier>
</gmd:referenceSystemIdentifier>
</gmd:MD_ReferenceSystem>
</gmd:referenceSystemInfo>
```

MD_RepresentativeFraction
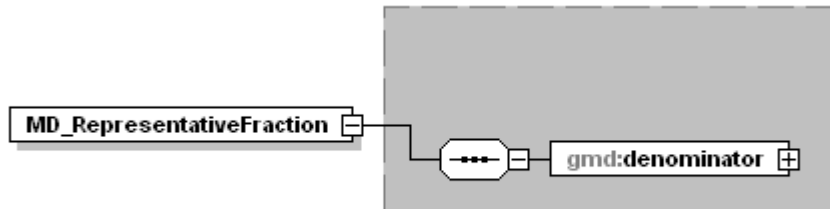
MD_RepresentativeFraction – The scale of a map or other cartographic object expressed as a fraction or ratio that relates unit distance on the map or other cartographic object to distance, measured in the same units, on the ground.

        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

denominator – The number below the line in a proper fraction that the numerator is equal to 1.

        Type: gco:Integer
        Domain: any whole number
        Multiplicity: mandatory
        Attributes: nilReason
        Best Practices: Value is greater than 0.
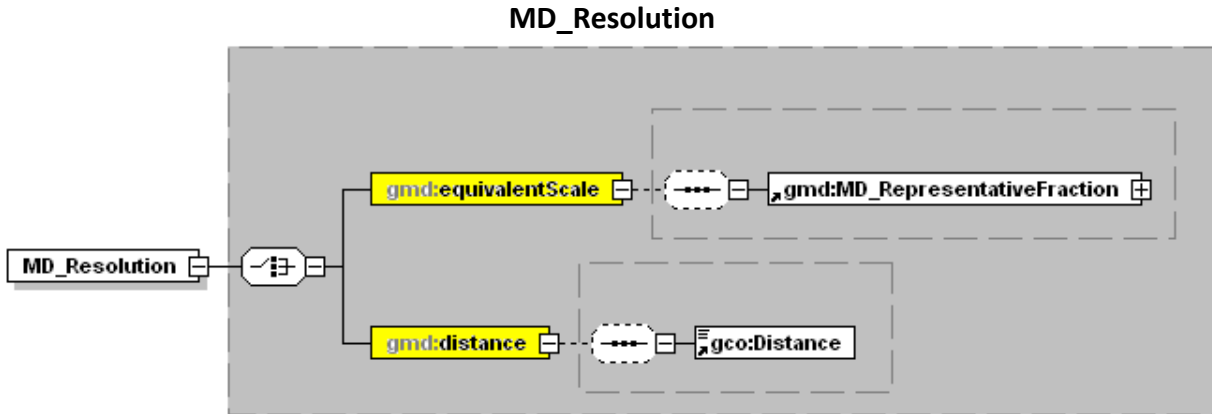
MD_Resolution

MD_Resolution – The level of detail in a dataset expressed as equivalent scale or ground distance.

> Type: compound
> Multiplicity: mandatory
> Best Practices: One and only one of the following must be entered: equivalentScale or distance.

> equivalentScale – Detail expressed as the numerical scale of a comparable hardcopy map or chart.
> > Type: MD_RepresentativeFraction
> > Multiplicity: conditional
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> distance – Ground sample distance.
> > Type: gco:Distance
> > Multiplicity: conditional
> > Attributes: nilReason
> > Best Practice: Distance is a measure of length between two points. A distance is made of a value and a unit of measure (uom). "uom" is an attribute of distance and is mandatory.

FAQ: How would you populate the element "distance" for a distance of 5 metres?

```
Ex:
<MD_Resolution>
  <distance>
    <gco:Distance uom="meters">5</gco:Distance>
  </distance>
</MD_Resolution>
```

MD_ScopeDescription
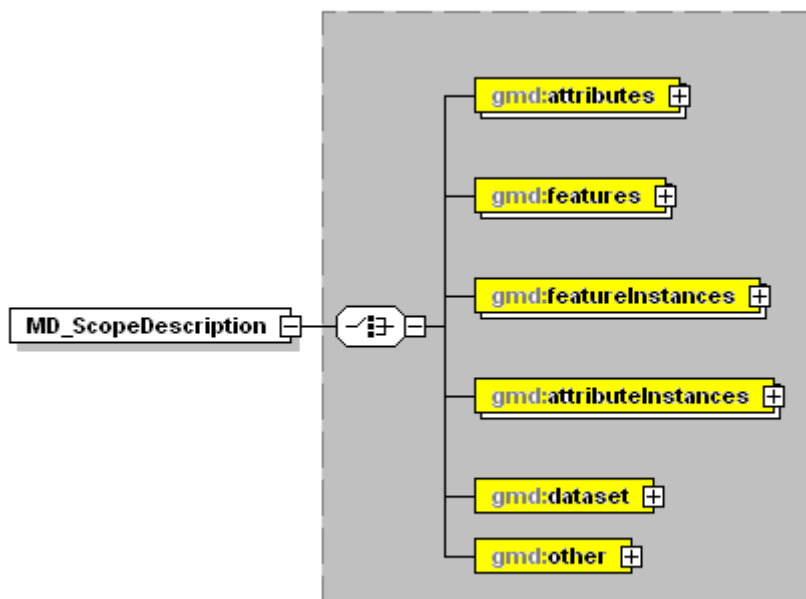
MD_ScopeDescription – Description of the class of information covered by the information.
        Type: compound
        Multiplicity: mandatory
        Best Practices: A choice must be made between attributes or features or featureInstances or attributeInstances or dataset or other.

    attributes – Attributes to which the information applies.
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    features – Features to which the information applies.
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    featureInstances – Feature instances to which the information applies.
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    attributeInstances – Attribute instances to which the information applies.
        Multiplicity: conditional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

    dataset – Dataset to which the information applies.
        Type: gco:characterString
        Domain: free text
        Multiplicity: conditional
        Attributes: nilReason

other – Class of information that does not fall into the other categories to which the information applies.
  Type: gco:characterString
  Domain: free text
  Multiplicity: conditional
  Attributes: nilReason

Ex:
```
<gmd:MD_ScopeDescription>
  <gmd:dataset>
          <gco:CharacterString>Name of the Parameter goes here</gco:CharacterString>
  </gmd:dataset>
</gmd:MD_ScopeDescription>
```

MD_SecurityConstraints
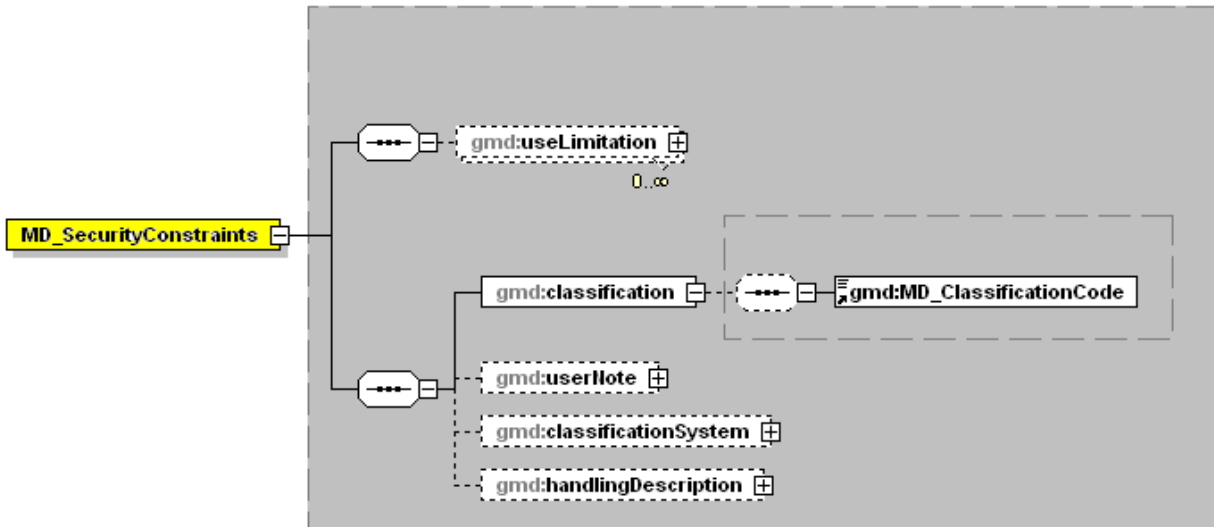
MD_SecurityConstraints – Restrictions applied to the resource or metadata to protect security concerns.
    Type: compound
    Multiplicity: conditional
    Attributes: id, uuid

useLimitation – Statement on the fitness of use or limitations on the use of the resource or metadata.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional, repeatable
    Attributes: nilReason

classification – Name of the handling restrictions on the resource or the metadata.
    Type: MD_ClassificationCode
    Domain: unclassified, restricted, confidential, secret, topSecret
    Multiplicity: mandatory
    Attributes: nilReason
    Best Practices: See Annex C.

userNote – An explanation of the classification level applied to the resource or metadata.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

classificationSystem – Name of the security classification system.
    Type: gco:characterString
    Domain: free text
    Multiplicity: optional
    Attributes: nilReason

handlingDescription – Additional information regarding security restrictions on handling the resource or metadata.

        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

MD_StandardOrderProcess
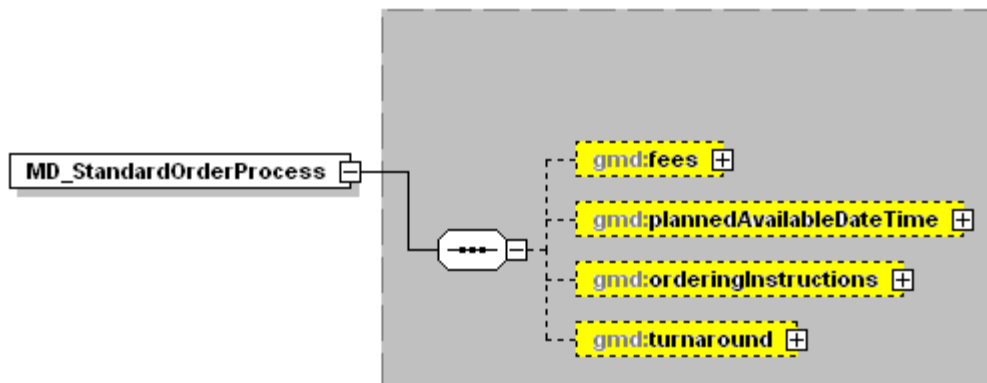
MD_StandardOrderProcess – The process in which the resource is obtained or received and other related instructions or fee information.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid
> Best Practices: At least one of fees, plannedAvailableDateTime, orderingInstructions, or turnaround shall be provided.

fees- Fees and terms for obtaining the data/dataset.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: Include at the end the monetary unit alphabetic code as specified in ISO 4217.
> (see http://www.iso.org/iso/support/faqs/faqs_widely_used_standards/widely_used_standards_other/currency_codes/currency_codes_list-1.htm) Common codes: United States = USD, Canada = CAD, Mexico = MXN or MXV

FAQ: How would you show that a dataset costs $45.00 ?

<gmd:fees>45.00USD</gmd:fees>

---

plannedAvailableDateTime – Date and time the resource will be available.
> Type: gco:DateTime
> Domain: date
> Multiplicity: conditional
> Attributes: nilReason

orderingInstructions – General instructions, terms, and services provided by the data distributor.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason

turnaround – Typical time required for filing a data request.
>Type: gco:characterString
>Domain: free text
>Multiplicity: conditional
>Attributes: nilReason

MD_TaxonCl
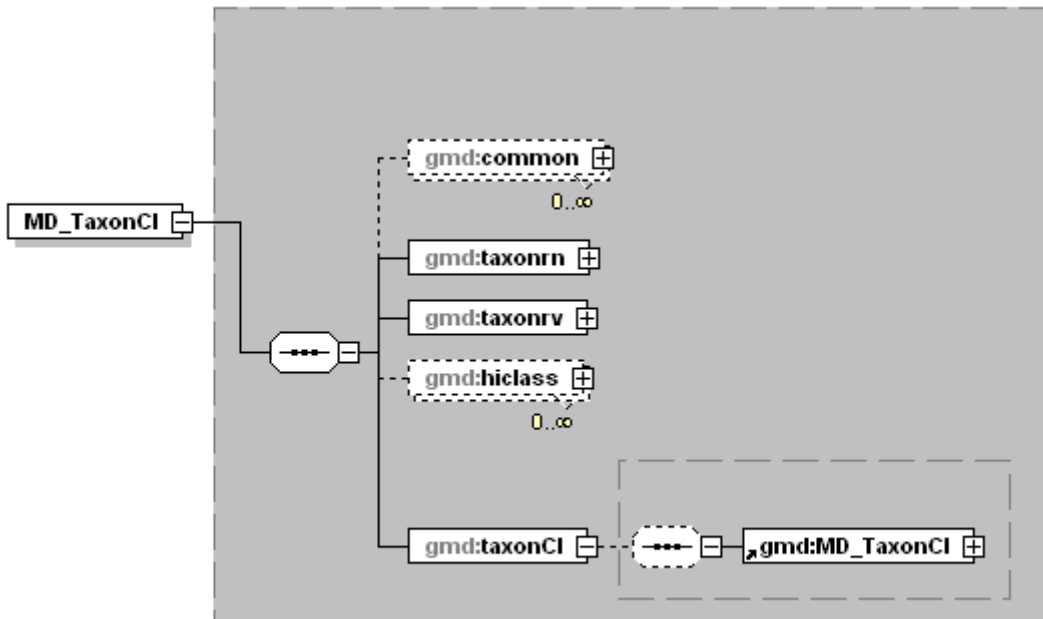
MD_TaxonCl – Information about the range of taxa addressed in the data set or collection.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid
        Best Practices: It is recommended to start from the taxonomic rank of kingdom.

common – Specification of applicable common names. These common names may be general descriptions of a group of organisms if appropriate.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional, repeatable
        Attributes: nilReason

taxonrn – Name of the taxonomic rank for which the Taxon Rank Value is provided.
        Type: gco:characterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

taxonrv – Name representing the taxonomic rank of the taxon being described.
        Type: gco:characterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

hiclass – Number of recursive sets of taxonomic classification systems.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional, repeatable
        Attributes: nilReason

taxonCl – Information about the taxonomic classification.

        Type: MD_TaxonCl

        Multiplicity: mandatory

        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_TaxonSys
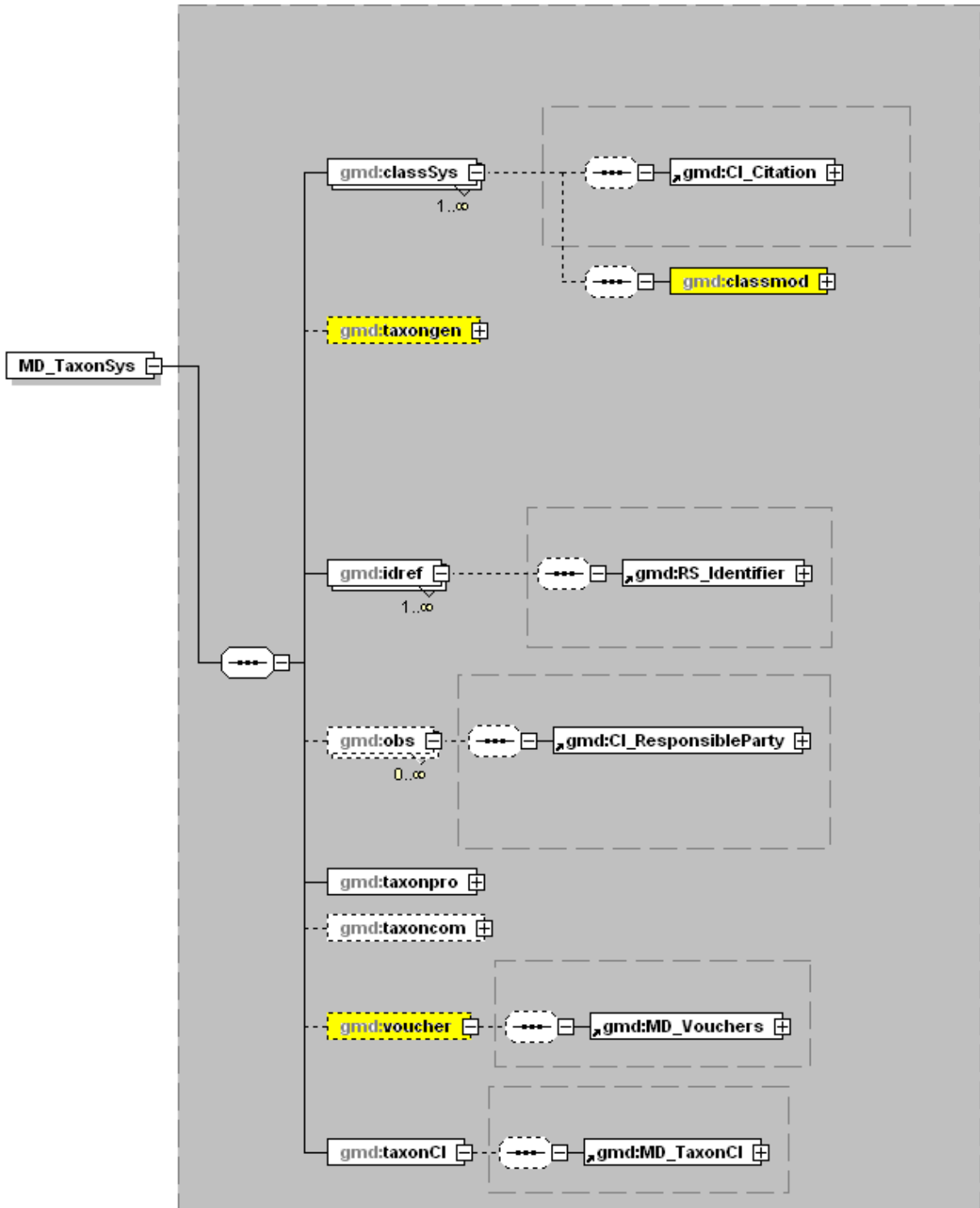
MD_TaxonSys – Documentation of taxonomic sources, procedures, and treatments.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

classSys – Documentation of taxonomic sources, procedures, and treatments.
> Type: CI_Citation and compound
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> > classmod – Description of any modifications or exceptions made to the Classification system or authority used.
> > > Type: gco:characterString
> > > Domain: free text
> > > Multiplicity: conditional
> > > Attributes: nilReason
> > > Best Practices: Mandatory if exceptions or modifications are made to a standard system.

taxongen – Description of the range of taxa addressed in the data set or collection. For example, "all vascular plants were identified to family or species, mosses and lichens were identified as moss or lichen.
> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason

idref – Information on any non-authoritative materials
> Type: RS_Identifier
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

obs – Information about the individual(s) responsible for the identification(s) of the specimens or sightings, etc.
> Type: CI_ResponsibleParty
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

taxonpro – Description of the methods used for taxonomic identification.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: taxonpro could include specimen processing, comparison with museum materials, keys, and key characters, chemical or genetic analyses, etc.

taxoncom – Information concerning the proportions and treatment of unidentified materials, estimates of the importance, and identities of misidentifications, uncertain determination, synonyms or other incorrect usages; taxa not well treated or requiring further work; and expertise of field workers.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

voucher – Information about the voucher.

      Type: MD_Vouchers

      Multiplicity: conditional

      Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

taxonCl – Information about the taxonomic classification.

      Type: MD_TaxonCl

      Multiplicity: mandatory

      Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_Usage
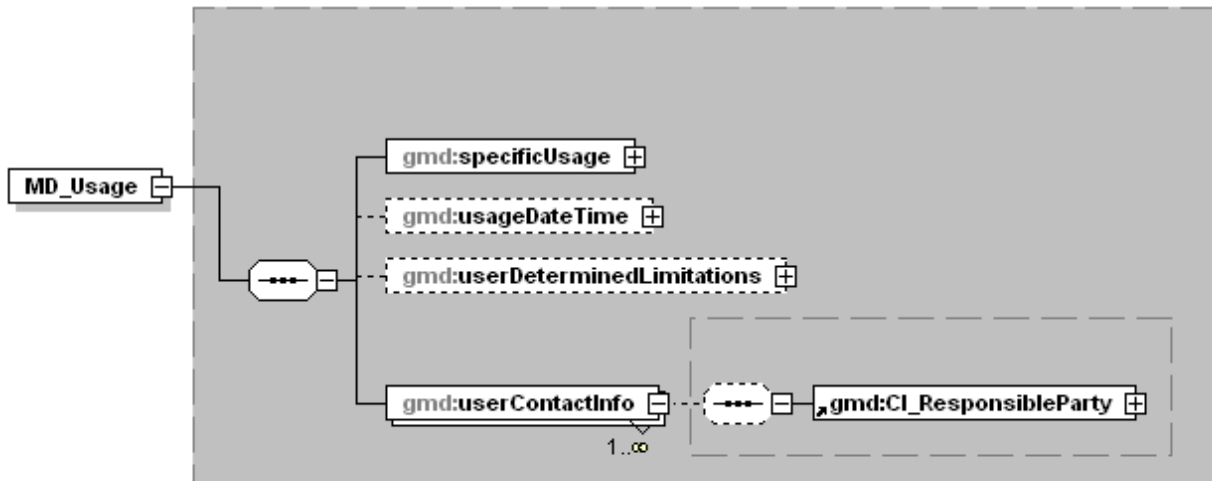
MD_Usage – Brief description of ways in which the resource(s) is/are currently or has been used
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

specificUsage – Brief description of the resource and/or resource series usage.
        Type: gco:CharacterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

usageDateTime – Data and time of the first use or range of uses of the resource and/or resource series.
        Type: gco:DateTime
        Domain: date
        Multiplicity: optional

userDeterminedLimitations – Applications determined by the user for which the resource and/or resource series is not suitable.
        Type: gco:CharacterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

userContactInfo – Identification of and means of communicating with the person(s) and organisation(s) using the resource(s).
        Type: CI_ResponsibleParty
        Multiplicity: mandatory, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_VectorSpatialRepresentation
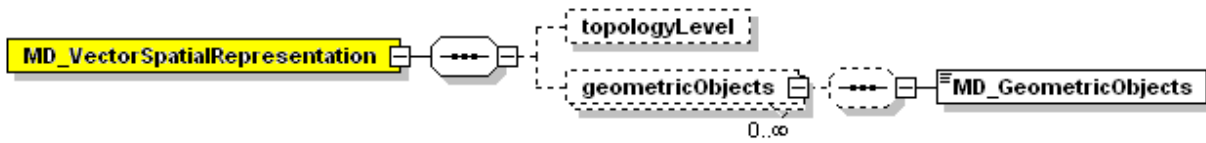
MD_VectorSpatialRepresentation – Information about the vector spatial objects in the dataset.
        Type: compound
        Multiplicity: conditional
        Attributes: id, uuid
        Best Practices: MD_VectorSpatialRepresentation is mandatory if the dataset objects are vectors.

toplogyLevel – Code which identifies the degree of complexity of the spatial relationships.
        Type: MD_TopologyLevelCode
        Domain: geometryOnly, topology1D, planarGraph, fullPlanarGraph, surfaceGraph, fullSurfaceGraph, topology3D, fullTopology3D, abstract
        Multiplicity: optional
        Attributes: nilReason
        Best Practices: See Annex C.

geometricObjects – Information about the geometric objects used in the dataset.
        Type: MD_GeometricObjects
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

MD_Vouchers
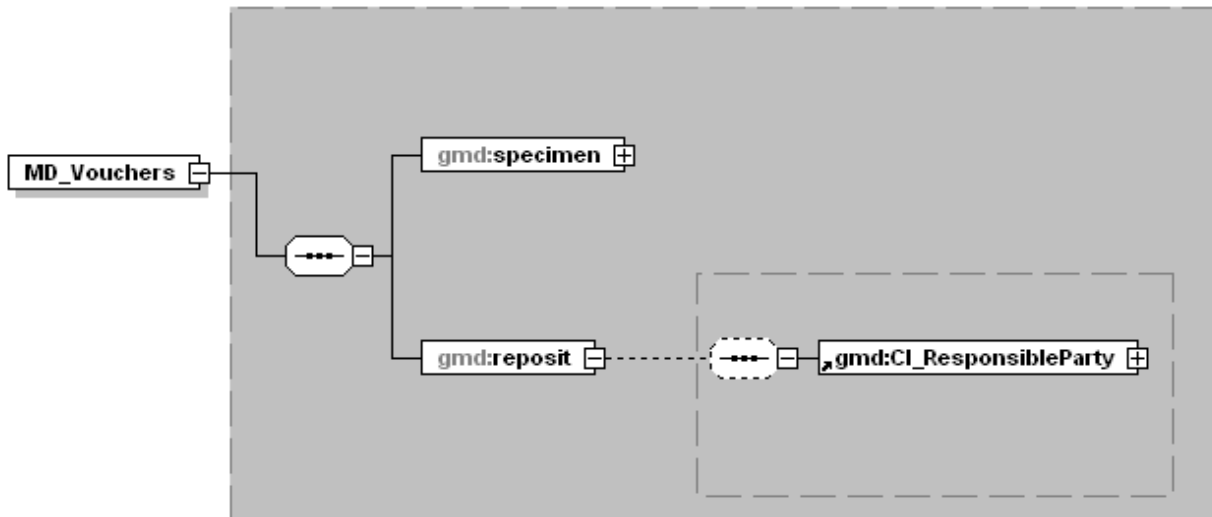
MD_Vouchers – Information on the types of specimen, the repository, and the individuals who identified the vouchers.

> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

specimen – Word or phrase describing the type of specimen collected.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

FAQ: What is an example of a specimen ?

Ex:
"herbarium specimens", "blood samples", "photographs"

---

reposit – Information about the curator or contact person and/or agency responsible for the specimens.
> Type: CI_ResponsibleParty
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

PT PACKAGE

PT_Locale
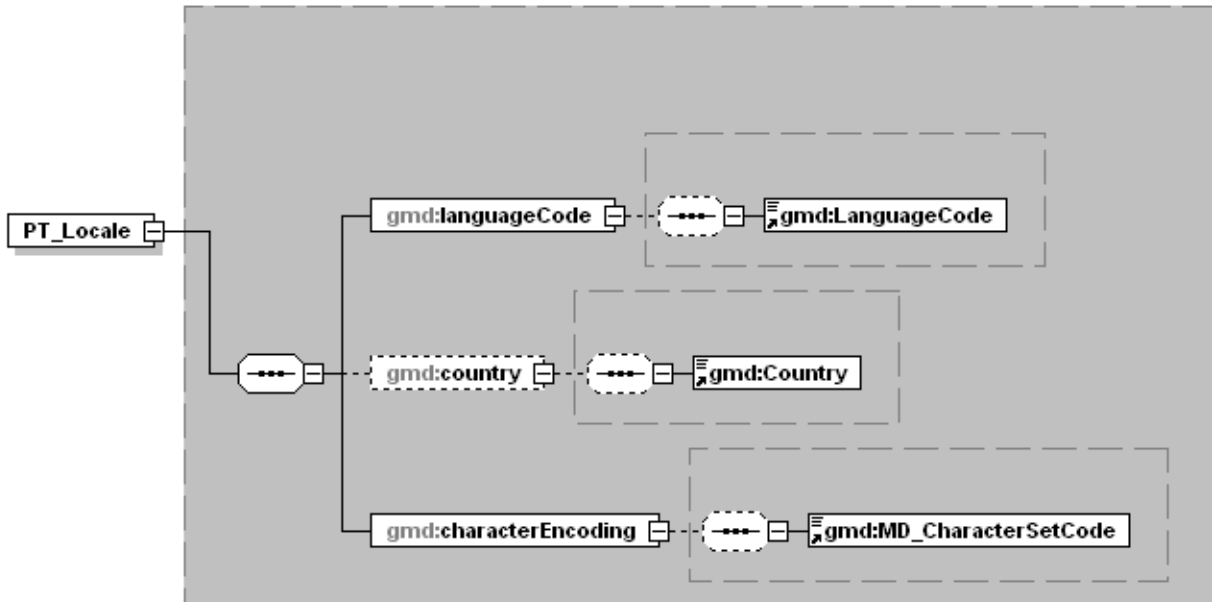
PT_Locale – Declared language properties.
>> Type: compound
>> Multiplicity: mandatory
>> Attributes: id, uuid

> languageCode – language codelist
>> Type: gmd:LanguageCode
>> Multiplicity: mandatory
>> Attributes: nilReason

>> LanguageCode – ISO 639-2/T three-letter terminology code
>>> Type: LanguageCodeList
>>> Multiplicity: mandatory
>>> Best Practices: Use the three-letter code in lowercase. See Annex B.

> country – country codelist
>> Type: gmd:Country
>> Multiplicity: optional
>> Attributes: nilReason

>> Country – ISO 3166-1 two-letter code
>>> Type: CountryCodeList
>>> Multiplicity: mandatory
>>> Best Practices: Use the two-letter code in uppercase. See Annex B.

> characterEncoding – Character coding standard.
>> Type: MD_CharacterSetCode
>> Domain: ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2, 8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10, 8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii, ebcdic, eucKR, big5, GB2312

Multiplicity: mandatory
Attributes: nilReason
Best Practices: Encoding shall be set to the recommended default value "utf8".

Ex:
```xml
<gmd:locale>
        <gmd:PT_Locale>
                <gmd:languageCode>
                        <gmd:LanguageCode codeList="../Codelist/ML_gmxCodelists.xml#LanguageCode"
codeListValue="eng">English</gmd:LanguageCode>
                </gmd:languageCode>
                <gmd:country>
                        <gmd:Country codeList="../Codelist/ML_gmxCodelists.xml#Country" codeListValue="US">US</gmd:Country>
                </gmd:country>
                <gmd:characterEncoding>
                        <gmd:MD_CharacterSetCode codeList="../Codelist/ML_gmxCodelists.xml#MD_CharacterSetCode"
codeListValue="utf8">utf8</gmd:MD_CharacterSetCode>
                </gmd:characterEncoding>
        </gmd:PT_Locale>
</gmd:locale>
```

RS PACKAGE

RS_Identifier
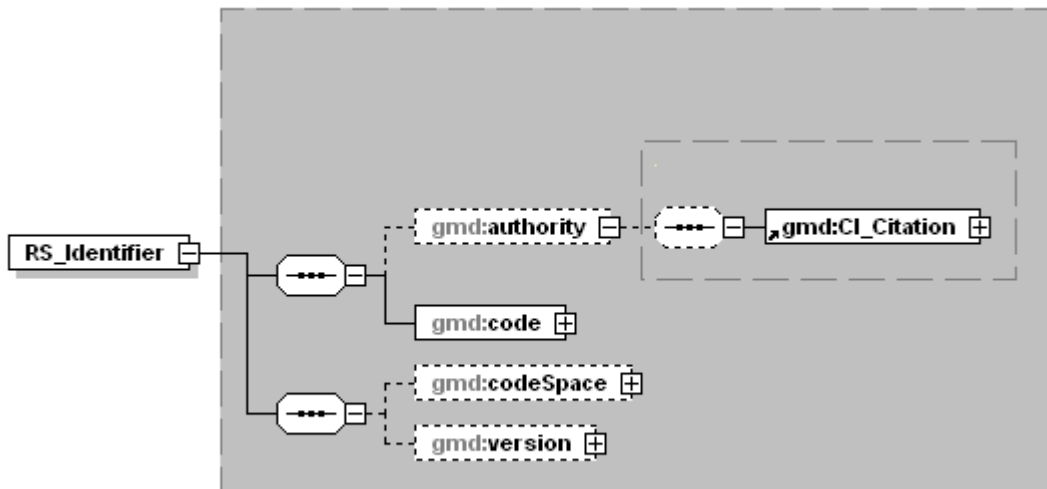
RS_Identifier – Information about the unique identification of an object.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

authority – Recognized responsible party or organisation for a reference.
> Type: CI_Citation
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

code – The alphanumeric value that identifies a resource.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

codeSpace – Identifier/namespace of the system in which the code is valid, e.g.,
"http://www.epsg.org/databases/Discv7_5.html"
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

version – The cited version, e.g., "7.5"
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

FAQ: What would RS_Identifier look like for the 1:50,000 map sheet of Sherbrooke in Canada that is identified by the code "21E05" under the authority of "National Topographic System"?

```xml
Ex:
<gmd:RS_Identifier>
        <gmd:authority>
                <gmd:CI_Citation>
                        <gmd:title>
                                <gco:CharacterString>1:50,000 Topographic Map of
Sherbrooke, Canada</gco:CharacterString>
                        </gmd:title>
                        <gmd:date gco:nilReason="unknown"/>
                        <gmd:citedResponsibleParty>
                                <gmd:CI_ResponsibleParty>
                                        <gmd:organisationName>
                                                <gco:CharacterString>National Topographic
System (NTS)</gco:CharacterString>
                                        </gmd:organisationName>
                                        <gmd:role>
                                                <gmd:CI_RoleCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider" codeSpace="001">resourceProvider</gmd:CI_RoleCode>
                                        </gmd:role>
                                </gmd:CI_ResponsibleParty>
                        </gmd:citedResponsibleParty>
                </gmd:CI_Citation>
        </gmd:authority>
        <gmd:code>
                <gco:CharacterString>21E05</gco:CharacterString>
        </gmd:code>
</gmd:RS_Identifier>
```

SV PACKAGE

SV_CoupledResource
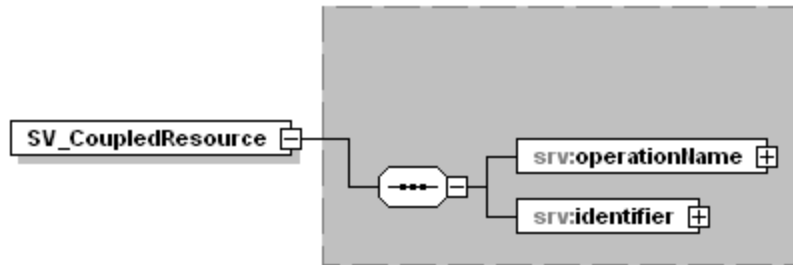
SV_CoupledResource – Information describing the linkage between a service operation and a tightly coupled dataset.

        Type: Compound
        Multiplicity: mandatory
        Attributes: id, uuid

    operationName – Designation of the operation
        Type: gco:characterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

    identifier – The dataset name or identifier of the associated dataset.
        Type: gco:characterString
        Domain: free text
        Multiplicity: mandatory
        Attributes: nilReason

SV_OperationMetadata
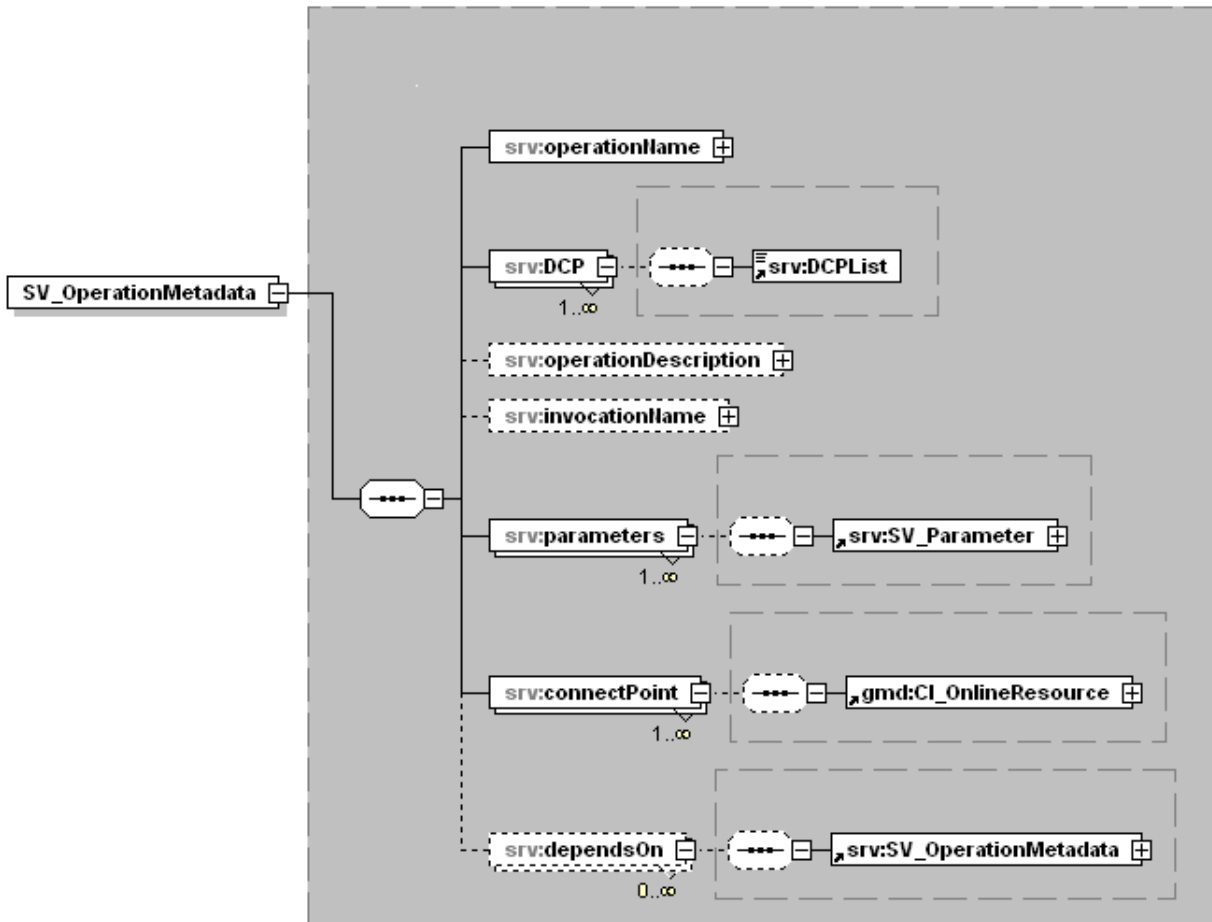
SV_OperationMetadata – Description of one's service operation to provide the signature of the operation.
> Type: compound
> Multiplicity: mandatory
> Attributes: id, uuid

operationName – An identifier that uniquely designates the operation.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

DCP – Distributed Computing Platforms that have been used to implement the operation.
> Type: srv:DCPList
> Domain: XML, CORBA, JAVA, COM, SQL, WebServices
> Multiplicity: mandatory, repeatable
> Attributes: nilReason
> Best Practices: See Annex C.

operationDescription – Description of the purpose of the operation and results obtained from the operation.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

invocationName – The name used to invoke the operation on all Distributed Computing Platforms.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

parameters – Values required for the interface invocation.
> Type: SV_Parameter
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

connectPoint – Reference to access the service interface.
> Type: CI_OnlineResource
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

dependsOn – The list of operations required prior to invoking the service; Structured as a list for capturing alternate or parallel predecessor paths.
> Type: SV_OperationMetadata
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

SV_Parameter
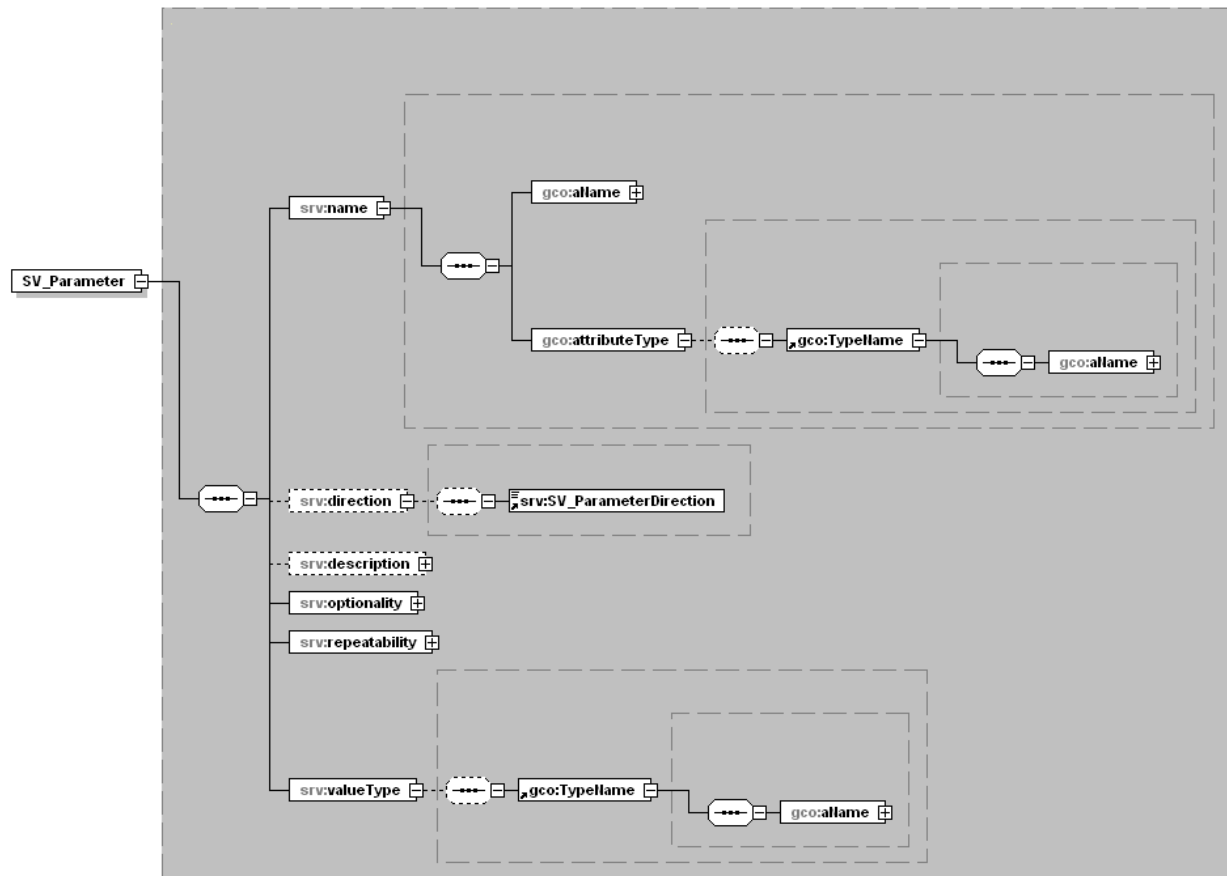
SV_Parameter – Information describing parameters of an operation.
        Type: compound
        Multiplicity: mandatory
        Attributes: id, uuid

    name – The name that the service uses for the parameter.
        Type: gco:MemberName
        Multiplicity: mandatory
        Attributes: id, uuid

    direction – Indication if the parameter serves as input, output, or both.
        Type: SV_ParameterDirection
        Domain: in, out, in/out
        Multiplicity: optional
        Attributes: nilReason

    description – Explanation of the purpose and function of the parameter.
        Type: gco:characterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

optionality – Indicates the necessity of the parameter.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: The default value is "Mandatory".

repeatability – Indication if one or more values for the parameter may be provided.
> Type: gco:Boolean
> Domain: 0,1 (0 = not repeatable, 1 = repeatable)
> Multiplicity: mandatory
> Attributes: nilReason

valueType – The class used for the value type.
> Type: gco:TypeName
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

SV_ServiceIdentification
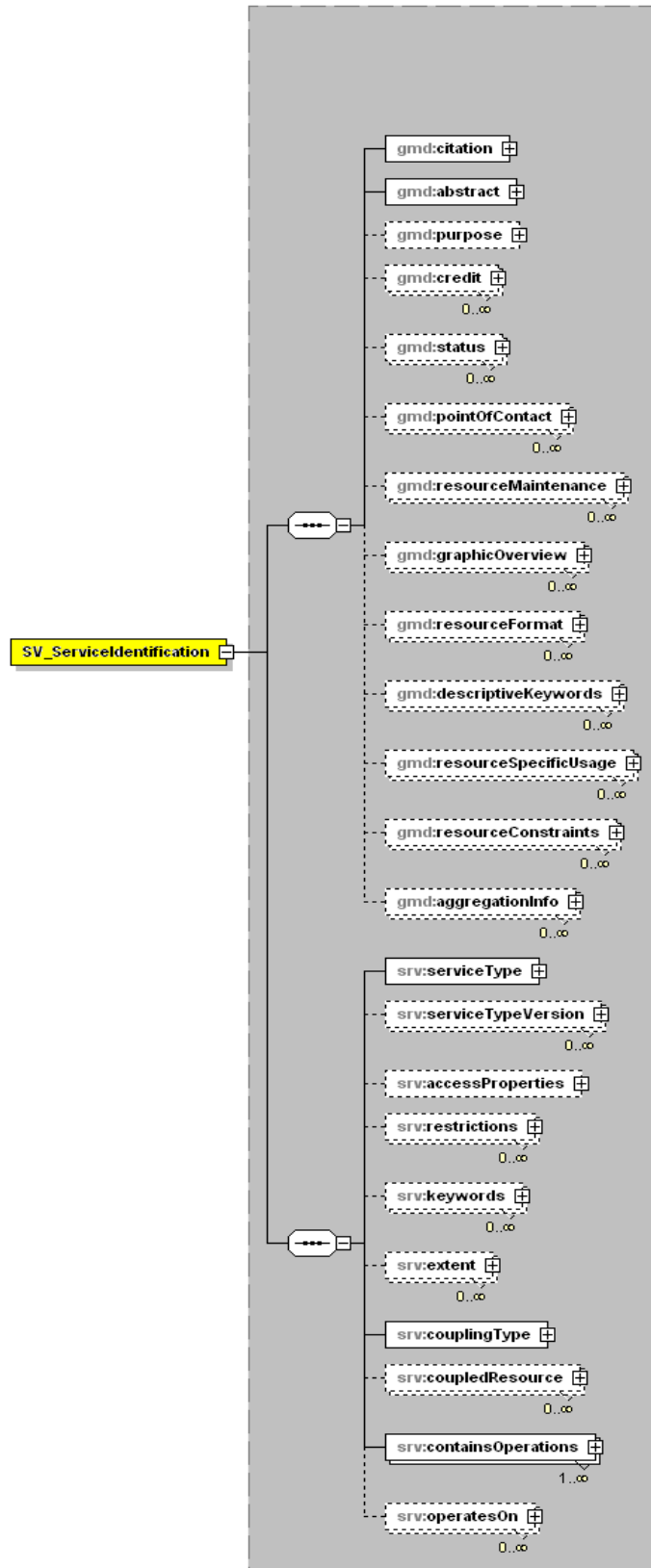
SV_ServiceIdentification – Service metadata describes the operation and address of an electronic geographic delivery system. This identifies capabilities which a service provider makes available to a service user through a set of interfaces.

> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid
> Best Practices: identificationInfo must have at least one occurrence of Data Identification or Service Identification.

citation – Citation for the dataset.

> Type: CI_Citation
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

abstract – Brief narrative summary of the dataset's contents.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

purpose – Summary of the intentions for which the dataset was developed.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

credit – Recognition of those who contributed to the dataset.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable
> Attributes: nilReason

status – The development phase of the dataset.

> Type: MD_ProgressCode
> Domain: completed, historicalArchive, obsolete, ongoing, planned, required, underdevelopment
> Multiplicity: optional, repeatable *this is a NAP requirement*
> Attributes: nilReason

pointOfContact – Identification and means to contact people/organisations associated with the dataset.

> Type: CI_ResponsibleParty
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceMaintenance – Describes the frequency, scope, and responsible party for the updating of the dataset.

> Type: MD_MaintenanceInformation
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

graphicOverview – The name of, description of, and file type of an illustration of the dataset.

> Type: MD_BrowseGraphic
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceFormat – Provides a description of the format of the resource(s).
> Type: MD_Format
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

descriptiveKeywords – Commonly used words or phrases which describe the dataset. Optionally, the keyword type and a citation for the authoritative or registered resource of the keywords are also provided.
> Type: MD_Keywords
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceSpecificUsage – Provides basic information about specific application(s) for which the resource(s) has been or is being used by different users.
> Type: MD_Usage
> Multiplicity: optional, repeatable *this is not in NAP*
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

resourceConstraints – The limitations or constraints on the use of or access to the resource.
> Type: MD_Constraints or MD_LegalConstraints or MD_SecurityConstraints
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

aggregationInfo – The citation for the aggregate dataset or the name of the aggregate dataset, the type of aggregate dataset, and optionally the activity which produced the dataset.
> Type: MD_AggregateInformation
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

serviceType – The service type name from a service registry.
> Type: gco:LocalName
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: serviceType should follow the format of <urn><:><domain-name><:><serviceType><:><unique name assigned by the vendor><:>version number>

FAQ: If I had an OGC map service, how would I document it?

The registry namespace would be "ogc" and the service type would be "WebMapService".

EX:
<srv:serviceType>
        <gco:LocalName>urn:ogc:serviceType:WebMapService:1.1</gco:LocalName>
</srv:serviceType>

---

serviceTypeVersion – The version of the service type.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable
> Attributes: nilReason

accessProperties – Information on the availability of the service which includes attributes from Standard Order Process.
>   Type: MD_StandardOrderProcess
>   Multiplicity: optional
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

restrictions – The limitations or constraints on the use of or access to the service.
>   Type: MD_Constraints or MD_LegalConstraints or MD_SecurityConstrians
>   Multiplicity: optional, repeatable *this is not in NAP*
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

keywords – Commonly used words or phrases which describe the service.
>   Type: MD_Keywords
>   Multiplicity: optional, repeatable *this is not in NAP*
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

extent – Describes the spatial, horizontal and/or vertical, and the temporal coverage in the resource.
>   Type: EX_Extent
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

couplingType – Qualitative information on the tightness with which the service and the associated data are coupled.
>   Type: SV_CouplingType
>   Domain: loose, mixed, tight
>   Multiplicity: mandatory
>   Attributes: nilReason

coupledResource – Further description of the coupling between the service and the data when they are tightly coupled.
>   Type: SV_CoupledResource
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

containsOperations – Operations performed by the service.
>   Type: SV_OperationMetadata
>   Multiplicity: mandatory, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

operatesOn – Information describing datasets on which the service operates.
>   Type: MD_DataIdentification
>   Multiplicity: optional, repeatable
>   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

BIOLOGICAL EXTENSION EXAMPLES

Biological Extension Example
XML View

```xml
<?xml version="1.0" encoding="UTF-8"?>
<gmi:MI_Metadata xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:srv="http://www.isotc211.org/2005/srv" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:gsr="http://www.isotc211.org/2005/gsr" xmlns:gss="http://www.isotc211.org/2005/gss"
xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gmx="http://www.isotc211.org/2005/gmx"
xmlns:gmi="http://www.isotc211.org/2005/gmi" xsi:schemaLocation="http://www.isotc211.org/2005/gmi
..\schemas\ISObio\schema.xsd">
 <gmd:fileIdentifier>
  <gco:CharacterString>gov.noaa.nodc.ncddc.Biotest</gco:CharacterString>
 </gmd:fileIdentifier>
 <gmd:language>
  <gco:CharacterString>eng; USA</gco:CharacterString>
 </gmd:language>
 <gmd:characterSet>
  <gmd:MD_CharacterSetCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_CharacterSetCode" codeListValue="utf8"
codeSpace="004">utf8</gmd:MD_CharacterSetCode>
 </gmd:characterSet>
 <gmd:hierarchyLevel>
  <gmd:MD_ScopeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_ScopeCode"
codeListValue="dataset" codeSpace="005">dataset</gmd:MD_ScopeCode>
 </gmd:hierarchyLevel>
 <gmd:contact>
  <gmd:CI_ResponsibleParty>
   <gmd:individualName>
    <gco:CharacterString>Chad King</gco:CharacterString>
   </gmd:individualName>
   <gmd:organisationName>
    <gco:CharacterString>Sanctuary Integrated Monitoring Network (SIMoN)</gco:CharacterString>
   </gmd:organisationName>
   <gmd:positionName>
    <gco:CharacterString>Research Specialist</gco:CharacterString>
   </gmd:positionName>
   <gmd:contactInfo>
    <gmd:CI_Contact>
     <gmd:phone>
      <gmd:CI_Telephone>
       <gmd:voice>
        <gco:CharacterString>(831) 647-4248</gco:CharacterString>
       </gmd:voice>
       <gmd:facsimile>
        <gco:CharacterString>(831) 647-4244</gco:CharacterString>
       </gmd:facsimile>
      </gmd:CI_Telephone>
     </gmd:phone>
     <gmd:address>
      <gmd:CI_Address>
       <gmd:deliveryPoint>
        <gco:CharacterString>299 Foam Street</gco:CharacterString>
       </gmd:deliveryPoint>
       <gmd:city>
        <gco:CharacterString>Monterey</gco:CharacterString>
       </gmd:city>
       <gmd:administrativeArea>
        <gco:CharacterString>CA</gco:CharacterString>
       </gmd:administrativeArea>
       <gmd:postalCode>
        <gco:CharacterString>93940</gco:CharacterString>
       </gmd:postalCode>
       <gmd:country>
        <gco:CharacterString>United States</gco:CharacterString>
       </gmd:country>
       <gmd:electronicMailAddress>
        <gco:CharacterString>chad.king@noaa.gov</gco:CharacterString>
       </gmd:electronicMailAddress>
```

```xml
      </gmd:CI_Address>
     </gmd:address>
     <gmd:hoursOfService>
      <gco:CharacterString>10:00am - 4:00pm Central Standard Time</gco:CharacterString>
     </gmd:hoursOfService>
    </gmd:CI_Contact>
   </gmd:contactInfo>
   <gmd:role>
    <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="pointOfContact" codeSpace="007">pointOfContact</gmd:CI_RoleCode>
   </gmd:role>
  </gmd:CI_ResponsibleParty>
 </gmd:contact>
 <gmd:dateStamp>
  <gco:Date>2008</gco:Date>
 </gmd:dateStamp>
 <gmd:metadataStandardName>
  <gco:CharacterString>ISO 19115-2 Geographic information - Metadata - Biological Extensions</gco:CharacterString>
 </gmd:metadataStandardName>
 <gmd:metadataStandardVersion>
  <gco:CharacterString>ISO 19115-2:2009(E) with Biological Extensions</gco:CharacterString>
 </gmd:metadataStandardVersion>
 <gmd:metadataExtensionInfo>
  <gmd:MD_MetadataExtensionInformation>
   <gmd:extensionOnLineResource/>
   <gmd:extendedElementInformation>
    <gmd:MD_ExtendedElementInformation>
     <gmd:name>
      <gco:CharacterString>Taxonomy System</gco:CharacterString>
     </gmd:name>
     <gmd:shortName>
      <gco:CharacterString>Taxonsys</gco:CharacterString>
     </gmd:shortName>
     <gmd:definition>
      <gco:CharacterString>Documentation of taxonomic sources, procedures, and treatments.</gco:CharacterString>
     </gmd:definition>
     <gmd:obligation>
      <gmd:MD_ObligationCode>optional</gmd:MD_ObligationCode>
     </gmd:obligation>
     <gmd:dataType>
      <gmd:MD_DatatypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_DatatypeCode"
codeListValue="class" codeSpace="&quot;001&quot;&gt; class"/>
     </gmd:dataType>
     <gmd:maximumOccurrence>
      <gco:CharacterString>1</gco:CharacterString>
     </gmd:maximumOccurrence>
     <gmd:parentEntity>
      <gco:CharacterString>MD_Identification</gco:CharacterString>
     </gmd:parentEntity>
     <gmd:rule>
      <gco:CharacterString>New Metadata section as a class to MD_Identification</gco:CharacterString>
     </gmd:rule>
     <gmd:rationale>
      <gco:CharacterString>The set of data elements contained within this class element represents an attempt to provide better
documentation of taxonomic sources, procedures, and treatments.</gco:CharacterString>
     </gmd:rationale>
     <gmd:source>
      <gmd:CI_ResponsibleParty>
       <gmd:organisationName>
        <gco:CharacterString>National Biological Information Infrastructure (NBII)</gco:CharacterString>
       </gmd:organisationName>
       <gmd:role>
        <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider" codeSpace="001"/>
       </gmd:role>
      </gmd:CI_ResponsibleParty>
     </gmd:source>
    </gmd:MD_ExtendedElementInformation>
   </gmd:extendedElementInformation>
  </gmd:MD_MetadataExtensionInformation>
```

```xml
 </gmd:metadataExtensionInfo>
 <gmd:identificationInfo>
  <gmd:MD_DataIdentification>
   <gmd:citation>
    <gmd:CI_Citation>
     <gmd:title>
      <gco:CharacterString>Monterey Bay Sanctuary: Marine Mammals Monitoring Project Information. Point Lobos State Reserve
Otter Survey</gco:CharacterString>
     </gmd:title>
     <gmd:date>
      <gmd:CI_Date>
       <gmd:date>
        <gco:Date>1989-08</gco:Date>
       </gmd:date>
       <gmd:dateType>
        <gmd:CI_DateTypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication" codeSpace="002">publication</gmd:CI_DateTypeCode>
       </gmd:dateType>
      </gmd:CI_Date>
     </gmd:date>
     <gmd:identifier>
      <gmd:MD_Identifier>
       <gmd:code>
        <gco:CharacterString>Point Lobos Otter Survey</gco:CharacterString>
       </gmd:code>
      </gmd:MD_Identifier>
     </gmd:identifier>
     <gmd:citedResponsibleParty>
      <gmd:CI_ResponsibleParty>
       <gmd:organisationName>
        <gco:CharacterString>Diane Dawson</gco:CharacterString>
       </gmd:organisationName>
       <gmd:role>
        <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="originator" codeSpace="006">originator</gmd:CI_RoleCode>
       </gmd:role>
      </gmd:CI_ResponsibleParty>
     </gmd:citedResponsibleParty>
     <gmd:citedResponsibleParty>
      <gmd:CI_ResponsibleParty>
       <gmd:organisationName>
        <gco:CharacterString>California State Parks</gco:CharacterString>
       </gmd:organisationName>
       <gmd:role>
        <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="originator" codeSpace="006">originator</gmd:CI_RoleCode>
       </gmd:role>
      </gmd:CI_ResponsibleParty>
     </gmd:citedResponsibleParty>
     <gmd:presentationForm/>
    </gmd:CI_Citation>
   </gmd:citation>
   <gmd:abstract>
    <gco:CharacterString>The collection of monthly land-based standardized surveys of southern sea otters (Enhydra lutris nereis)
have been conducted by experienced volunteer docents in Point Lobos State Reserve since 1989. This data is then compiled by the
U.S. Geological Survey (USGS) with other otter survey data ranging from Santa Barbara to Half Moon Bay. The surveyors record
the number of independent otters and pups observed, location and their behavior. Results are used as an indicator of the population
trend of California sea otters in this area.</gco:CharacterString>
   </gmd:abstract>
   <gmd:purpose>
    <gco:CharacterString>The primary purposes of these surveys have been to identify and illustrate changes in the local otter
population for Point Lobos Reserve visitors and to provide this information to the USGS. The Point Lobos surveys have been used
to generate images to illustrate the changes in local otter sightings for visitors to the State Reserve. The program has also been very
successful in contributing to the pool of otter population monitoring information gathered by the USGS. Data indicate a general
decrease in otter sightings over the last 15 years at Point Lobos. There was a decrease in both independent otter and pup sightings.
Typically the total count of adults and juveniles peaks during mid-summer which is towards the end of the pupping season. The
Point Lobos otter program is working with the Sanctuary Integrated Monitoring Network (SIMoN) to digitize historic data to be able to
develop summaries showing otter densities and abundance over the last fifteen years.</gco:CharacterString>
   </gmd:purpose>
   <gmd:status>
```

```xml
    <gmd:MD_ProgressCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_ProgressCode"
codeListValue="underDevelopment" codeSpace="007">underDevelopment</gmd:MD_ProgressCode>
   </gmd:status>
   <gmd:pointOfContact>
    <gmd:CI_ResponsibleParty>
     <gmd:individualName>
      <gco:CharacterString>Chad King</gco:CharacterString>
     </gmd:individualName>
     <gmd:organisationName>
      <gco:CharacterString>Sanctuary Integrated Monitoring Network (SIMoN)</gco:CharacterString>
     </gmd:organisationName>
     <gmd:positionName>
      <gco:CharacterString>Research Specialist</gco:CharacterString>
     </gmd:positionName>
     <gmd:contactInfo>
      <gmd:CI_Contact>
       <gmd:phone>
        <gmd:CI_Telephone>
         <gmd:voice>
          <gco:CharacterString>(831) 647-4248 phone</gco:CharacterString>
         </gmd:voice>
         <gmd:facsimile>
          <gco:CharacterString>(831) 647-4244 fax</gco:CharacterString>
         </gmd:facsimile>
        </gmd:CI_Telephone>
       </gmd:phone>
       <gmd:address>
        <gmd:CI_Address>
         <gmd:deliveryPoint>
          <gco:CharacterString>299 Foam Street</gco:CharacterString>
         </gmd:deliveryPoint>
         <gmd:city>
          <gco:CharacterString>Monterey</gco:CharacterString>
         </gmd:city>
         <gmd:administrativeArea>
          <gco:CharacterString>CA</gco:CharacterString>
         </gmd:administrativeArea>
         <gmd:postalCode>
          <gco:CharacterString>93940</gco:CharacterString>
         </gmd:postalCode>
         <gmd:country>
          <gco:CharacterString>U.S.</gco:CharacterString>
         </gmd:country>
         <gmd:electronicMailAddress>
          <gco:CharacterString>chad.king@noaa.gov</gco:CharacterString>
         </gmd:electronicMailAddress>
        </gmd:CI_Address>
       </gmd:address>
       <gmd:hoursOfService>
        <gco:CharacterString>10:00am - 4:00pm Central Standard Time</gco:CharacterString>
       </gmd:hoursOfService>
       <gmd:contactInstructions>
        <gco:CharacterString>http://www.sanctuarysimon.org/regional_sections/simon/simon_staff.php</gco:CharacterString>
       </gmd:contactInstructions>
      </gmd:CI_Contact>
     </gmd:contactInfo>
     <gmd:role>
      <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="pointOfContact" codeSpace="007">pointOfContact</gmd:CI_RoleCode>
     </gmd:role>
    </gmd:CI_ResponsibleParty>
   </gmd:pointOfContact>
   <gmd:resourceMaintenance>
    <gmd:MD_MaintenanceInformation>
     <gmd:maintenanceAndUpdateFrequency>
      <gmd:MD_MaintenanceFrequencyCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_MaintenanceFrequencyCode"
codeListValue="monthly" codeSpace="005">monthly</gmd:MD_MaintenanceFrequencyCode>
     </gmd:maintenanceAndUpdateFrequency>
    </gmd:MD_MaintenanceInformation>
```

```
    </gmd:resourceMaintenance>
    <gmd:resourceMaintenance/>
    <gmd:descriptiveKeywords>
     <gmd:MD_Keywords>
      <gmd:keyword>
       <gco:CharacterString>otter</gco:CharacterString>
      </gmd:keyword>
      <gmd:keyword>
       <gco:CharacterString>otter survey</gco:CharacterString>
      </gmd:keyword>
      <gmd:keyword>
       <gco:CharacterString>marine mammals</gco:CharacterString>
      </gmd:keyword>
      <gmd:keyword>
       <gco:CharacterString>marine mammal monitoring</gco:CharacterString>
      </gmd:keyword>
      <gmd:type>
       <gmd:MD_KeywordTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="theme"
codeSpace="005">theme</gmd:MD_KeywordTypeCode>
      </gmd:type>
      <gmd:thesaurusName>
       <gmd:CI_Citation>
        <gmd:title>
         <gco:CharacterString>None</gco:CharacterString>
        </gmd:title>
        <gmd:date gco:nilReason="Unknown"/>
       </gmd:CI_Citation>
      </gmd:thesaurusName>
     </gmd:MD_Keywords>
    </gmd:descriptiveKeywords>
    <gmd:descriptiveKeywords>
     <gmd:MD_Keywords>
      <gmd:keyword>
       <gco:CharacterString>Point Lobos State Reserve</gco:CharacterString>
      </gmd:keyword>
      <gmd:keyword>
       <gco:CharacterString>Monterey Bay Sanctuary</gco:CharacterString>
      </gmd:keyword>
      <gmd:keyword>
       <gco:CharacterString>California</gco:CharacterString>
      </gmd:keyword>
      <gmd:type>
       <gmd:MD_KeywordTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="place"
codeSpace="002">place</gmd:MD_KeywordTypeCode>
      </gmd:type>
      <gmd:thesaurusName>
       <gmd:CI_Citation>
        <gmd:title>
         <gco:CharacterString>None</gco:CharacterString>
        </gmd:title>
        <gmd:date gco:nilReason="Unknown"/>
       </gmd:CI_Citation>
      </gmd:thesaurusName>
     </gmd:MD_Keywords>
    </gmd:descriptiveKeywords>
    <gmd:descriptiveKeywords>
     <gmd:MD_Keywords>
      <gmd:keyword>
       <gco:CharacterString>Monthly</gco:CharacterString>
      </gmd:keyword>
      <gmd:type>
       <gmd:MD_KeywordTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="temporal"
codeSpace="004">temporal</gmd:MD_KeywordTypeCode>
      </gmd:type>
      <gmd:thesaurusName>
       <gmd:CI_Citation>
        <gmd:title>
```

```
    <gco:CharacterString>None</gco:CharacterString>
   </gmd:title>
   <gmd:date gco:nilReason="Unknown"/>
  </gmd:CI_Citation>
 </gmd:thesaurusName>
</gmd:MD_Keywords>
</gmd:descriptiveKeywords>
<gmd:descriptiveKeywords>
 <gmd:MD_Keywords>
  <gmd:keyword>
   <gco:CharacterString>animals</gco:CharacterString>
  </gmd:keyword>
  <gmd:type>
   <gmd:MD_KeywordTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="taxon"
codeSpace="006">taxon</gmd:MD_KeywordTypeCode>
  </gmd:type>
  <gmd:thesaurusName>
   <gmd:CI_Citation>
    <gmd:title>
     <gco:CharacterString>Integrated Taxonomic Information System (ITIS) https://www.itis.gov/</gco:CharacterString>
    </gmd:title>
    <gmd:date gco:nilReason="inapplicable"/>
   </gmd:CI_Citation>
  </gmd:thesaurusName>
 </gmd:MD_Keywords>
</gmd:descriptiveKeywords>
<gmd:descriptiveKeywords>
 <gmd:MD_Keywords>
  <gmd:keyword>
   <gco:CharacterString>Observation with binoculars</gco:CharacterString>
  </gmd:keyword>
  <gmd:type>
   <gmd:MD_KeywordTypeCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="discipline"
codeSpace="001">discipline</gmd:MD_KeywordTypeCode>
  </gmd:type>
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```xml
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otters sighted are plotted for each age class (i.e. adults, adults with pups, large pups, and/or small pups) for every year. The
observations are done by loyal volunteers. Study Parameters: Range/Biogeography Behavior Abundance Distribution Density Age
structure The data is then compiled into a data base where the following is classified: 1) total sea otter sightings, 2) annual mean
number of sea otter sightings, 3) standard deviation for the annual mean number of sea otter sightings, and 4) the standard error of
the mean. Entity and Attribute Detail Citation: An online chart representation of the data sets are generated and can be accessed
through a website url:
http://sanctuarysimon.org/monterey/sections/marineMammals/project_info.php?projectID=100219&amp;sec=mm</gco:CharacterStri
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```xml
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```xml
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conducted by experienced volunteer docents in Point Lobos State Reserve since 1989.</gco:CharacterString>
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spotted each month and counted again. A monthly total and yearly total are tallied on a consistent monthly basis. These data are
then compiled by the U.S. Geological Survey (USGS) with other otter survey data ranging from Santa Barbara to Half Moon
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range of months/years selected: 1) total sea otter sightings, 2) annual mean number of sea otter sightings, 3) standard deviation for
the annual mean number of sea otter sightings, and 4) the standard error of the mean. Note: Remember that these data are for
sightings, and they do not represent unique observations. Many of the same sea otters are spotted each month and counted
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```

```xml
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       <gco:CharacterString>1989 - 2008 Monthly/Yearly Otter Sightings</gco:CharacterString>
      </gmd:issueIdentification>
     </gmd:CI_Series>
     </gmd:series>
     <gmd:otherCitationDetails/>
    </gmd:CI_Citation>
   </gmd:sourceCitation>
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   <gmd:EX_Extent>
    <gmd:temporalElement>
     <gmd:EX_TemporalExtent>
      <gmd:extent>
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```

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     <gml:description>publication date</gml:description>
     <gml:timePosition>1990</gml:timePosition>
    </gml:TimeInstant>
   </gmd:extent>
  </gmd:EX_TemporalExtent>
 </gmd:temporalElement>
</gmd:EX_Extent>
   </gmd:sourceExtent>
  </gmd:LI_Source>
 </gmd:source>
</gmd:LI_Lineage>
 </gmd:lineage>
</gmd:DQ_DataQuality>
</gmd:dataQualityInfo>
<gmd:metadataMaintenance>
 <gmd:MD_MaintenanceInformation>
 <gmd:maintenanceAndUpdateFrequency gco:nilReason="Unknown"/>
 <gmd:dateOfNextUpdate>
  <gco:Date>2009</gco:Date>
 </gmd:dateOfNextUpdate>
 <gmd:maintenanceNote>
  <gco:CharacterString>This metadata was automatically generated from the FGDC Content Standard for Digital Geospatial
Metadata Biological Data Profile standard version FGDC-STD-001.0-1999 .</gco:CharacterString>
 </gmd:maintenanceNote>
 <gmd:contact>
 <gmd:CI_ResponsibleParty>
 <gmd:individualName>
  <gco:CharacterString>Chad King</gco:CharacterString>
 </gmd:individualName>
 <gmd:organisationName>
  <gco:CharacterString>Sanctuary Integrated Monitoring Network (SIMoN)</gco:CharacterString>
 </gmd:organisationName>
 <gmd:positionName>
  <gco:CharacterString>Research Specialist</gco:CharacterString>
 </gmd:positionName>
 <gmd:contactInfo>
 <gmd:CI_Contact>
  <gmd:phone>
   <gmd:CI_Telephone>
    <gmd:voice>
     <gco:CharacterString>(831) 647-4248</gco:CharacterString>
    </gmd:voice>
    <gmd:facsimile>
     <gco:CharacterString>(831) 647-4244</gco:CharacterString>
    </gmd:facsimile>
   </gmd:CI_Telephone>
  </gmd:phone>
  <gmd:address>
   <gmd:CI_Address>
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     <gco:CharacterString>299 Foam Street</gco:CharacterString>
    </gmd:deliveryPoint>
    <gmd:city>
     <gco:CharacterString>Monterey</gco:CharacterString>
    </gmd:city>
    <gmd:administrativeArea>
     <gco:CharacterString>CA</gco:CharacterString>
    </gmd:administrativeArea>
    <gmd:postalCode>
     <gco:CharacterString>93940</gco:CharacterString>
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    <gmd:country>
     <gco:CharacterString>United States</gco:CharacterString>
    </gmd:country>
    <gmd:electronicMailAddress>
     <gco:CharacterString>chad.king@noaa.gov</gco:CharacterString>
    </gmd:electronicMailAddress>
   </gmd:CI_Address>
  </gmd:address>
  <gmd:hoursOfService>
```

```xml
    <gco:CharacterString>10:00am - 4:00pm Central Standard Time</gco:CharacterString>
   </gmd:hoursOfService>
  </gmd:CI_Contact>
 </gmd:contactInfo>
 <gmd:role>
  <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="custodian" codeSpace="002">custodian</gmd:CI_RoleCode>
 </gmd:role>
 </gmd:CI_ResponsibleParty>
 </gmd:contact>
 </gmd:MD_MaintenanceInformation>
 </gmd:metadataMaintenance>
</gmi:MI_Metadata>
```

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Metadata:
  File identifier:
      gov.noaa.nodc.ncddc.Biotest
  Language:
      eng; USA
  Character set:
    Character set code:
      utf8
  Hierarchy level:
    Scope code:
      dataset
  Metadata author:
    Responsible party:
      Individual name:
          Chad King
      Organisation name:
          Sanctuary Integrated Monitoring Network (SIMoN)
      Position name:
          Research Specialist
      Contact info:
        Contact:
          Phone:
            Telephone:
              Voice:
                  (831) 647-4248
              Facsimile:
                  (831) 647-4244
          Address:
            Address:
              Delivery point:
                  299 Foam Street
              City:
                  Monterey
              Administrative area:
                  CA
              Postal code:
                  93940
              Country:
                  United States
              Electronic mail address:
                  chad.king@noaa.gov
          Hours of service:
              10:00am - 4:00pm Central Standard Time
      Role:
        Role code:
          pointOfContact
  Date stamp:
      2008
  Metadata standard name:
      ISO 19115-2 Geographic information - Metadata - Biological Extensions
  Metadata standard version:
      ISO 19115-2:2009(E) with Biological Extensions
  Metadata extension info:
    Metadata extension info:
```

Extension Online resource:
Extended element information:
  Extended elemen information:
    Name:
        Taxonomy System
    Short name:
        Taxonsys
    Definition:
        Documentation of taxonomic sources, procedures, and treatments.
    Obligation:
      Obligation code:
        optional
    Data type:
      Data type code:
        class
    Maximum occurrence:
        1
    Parent entity:
        MD_Identification
    Rule:
        New Metadata section as a class to MD_Identification
    Rationale:
        The set of data elements contained within this class element
represents an attempt to provide better
        documentation of taxonomic sources, procedures, and treatments.
    Source:
      Responsible party:
      Organisation name:
          National Biological Information Infrastructure (NBII)
      Role:
        Role code:
          resourceProvider
Identification info:
  Data identification:
    Citation:
      Citation:
        Title:
            Monterey Bay Sanctuary: Marine Mammals Monitoring Project
Information. Point Lobos State Reserve Otter
            Survey
        Date:
          Date:
            Date:
                1989-08
            Date type:
              Date type code:
                publication
        Identifier:
          Identifier:
            Code:
                Point Lobos Otter Survey
        Cited responsible party:
          Responsible party:
            Organisation name:
                Diane Dawson
            Role:
              Role code:

originator
          Cited responsible party:
            Responsible party:
              Organisation name:
                  California State Parks
              Role:
                Role code:
                    originator
          Presentation form:
        Abstract:
              The collection of monthly land-based standardized surveys of
    southern sea otters (Enhydra lutris nereis) have
              been conducted by experienced volunteer docents in Point Lobos
    State Reserve since 1989. This data is then
              compiled by the U.S. Geological Survey (USGS) with other otter
    survey data ranging from Santa Barbara to
              Half Moon Bay. The surveyors record the number of independent
    otters and pups observed, location and their
              behavior. Results are used as an indicator of the population trend
    of California sea otters in this area.
        Purpose:
              The primary purposes of these surveys have been to identify and
    illustrate changes in the local otter
              population for Point Lobos Reserve visitors and to provide this
    information to the USGS. The Point Lobos
              surveys have been used to generate images to illustrate the changes
    in local otter sightings for visitors to
              the State Reserve. The program has also been very successful in
    contributing to the pool of otter population
              monitoring information gathered by the USGS. Data indicate a
    general decrease in otter sightings over the
              last 15 years at Point Lobos. There was a decrease in both
    independent otter and pup sightings. Typically
              the total count of adults and juveniles peaks during mid-summer
    which is towards the end of the pupping
              season. The Point Lobos otter program is working with the Sanctuary
    Integrated Monitoring Network (SIMoN) to
              digitize historic data to be able to develop summaries showing
    otter densities and abundance over the last
              fifteen years.
        Status:
          Progress code:
            underDevelopment
        Point of contact:
          Responsible party:
            Individual name:
                Chad King
            Organisation name:
                Sanctuary Integrated Monitoring Network (SIMoN)
            Position name:
                Research Specialist
            Contact info:
              Contact:
                Phone:
                  Telephone:
                    Voice:
                        (831) 647-4248 phone

```
                Facsimile:
                     (831) 647-4244 fax
            Address:
              Address:
                Delivery point:
                     299 Foam Street
                City:
                     Monterey
                Administrative area:
                     CA
                Postal code:
                     93940
                Country:
                     U.S.
                Electronic mail address:
                     chad.king@noaa.gov
            Hours of service:
                 10:00am - 4:00pm Central Standard Time
            Contact instructions:

http://www.sanctuarysimon.org/regional_sections/simon/simon_staff.php
          Role:
            Role code:
                 pointOfContact
      Resource maintenance:
        Maintenance information:
          Maintenance and update frequency:
            Maintenance frequency code:
                 monthly
      Resource maintenance:
      Descriptive keywords:
        Keywords:
          Keyword:
                 otter
          Keyword:
                 otter survey
          Keyword:
                 marine mammals
          Keyword:
                 marine mammal monitoring
          Type:
            Keyword type code:
                 theme
          Thesaurus name:
            Citation:
              Title:
                     None
              Date:
                 Unknown
      Descriptive keywords:
        Keywords:
          Keyword:
                 Point Lobos State Reserve
          Keyword:
                 Monterey Bay Sanctuary
          Keyword:
                 California
```

Type:
  Keyword type code:
    place
  Thesaurus name:
    Citation:
      Title:
        None
      Date:
        Unknown
Descriptive keywords:
  Keywords:
    Keyword:
      Monthly
    Type:
      Keyword type code:
        temporal
    Thesaurus name:
      Citation:
        Title:
          None
        Date:
          Unknown
Descriptive keywords:
  Keywords:
    Keyword:
      animals
    Type:
      Keyword type code:
        taxon
    Thesaurus name:
      Citation:
        Title:
          Integrated Taxonomic Information System (ITIS)
https://www.itis.gov/
        Date:
          inapplicable
Descriptive keywords:
  Keywords:
    Keyword:
      Observation with binoculars
    Type:
      Keyword type code:
        discipline
    Thesaurus name:
      Citation:
        Title:
          None
        Date:
          inapplicable
Resource constraints:
  Legal constraints:
    Access constraints:
      Restriction code:
        otherRestrictions
    Use constraints:
      Restriction code:
        otherRestrictions

Other constraints:
Access Constraints: None Use Constraints: None Distribution
Liability: Privacy Statement: Available at the
web address below -http://www.noaa.gov/privacy.html
Taxonomy:
  Taxonomic System:
    Classification System Authority:
      Citation:
      Title:
Otter Record Survey
      Date:
        Date:
          Date:
2000
          Date type:
            Date type code:
publication
      Cited responsible party:
        Responsible party:
        Organisation name:
Sanctuary Integrated Monitoring Network (SIMoN)
        Contact info:
          Contact:
            Online Resource:
              Online Resource:
                Linkage:
                  URL:
http://sanctuarysimon.org/monterey/
        Role:
          Role code:
originator
    General Taxonomic Scope:
The otters observed were identified to the subspecies criterion
and identified as southern sea otters.
    Identification Reference:
  unknown
    Observer:
      Responsible party:
        Individual name:
Chad King
        Organisation name:
Sanctuary Integrated Monitoring Network (SIMoN)
        Position name:
Research Specialist
        Contact info:
          Contact:
            Phone:
              Telephone:
                Voice:
(831) 647-4248
                Facsimile:
(831)647-4244
            Address:
              Address:
                Delivery point:
299 Foam St.
                City:

```
                        Monterey
                Administrative area:
                    CA
                Postal code:
                    93940
                Country:
                    United States
                Electronic mail address:
                    chad.king@noaa.gov
            Hours of service:
                10:00am-4:00pm Central Standard Time
            Contact instructions:

http://www.sanctuarysimon.org/regional_sections/simon/simon_staff.php
            Role:
                Role code:
                    resourceProvider
        Taxonomic Procedures:
            Volunteers observed sea otters using binoculars in pairs.
        Taxonomic Classification Information:
          Taxonomic Classification:
            Taxonomic Rank Name:
                Kingdom
            Taxonomic Rank Value:
                Animalia
            Taxonomic Classification Information:
              Taxonomic Classification:
                Taxonomic Rank Name:
                    Phylum
                Taxonomic Rank Value:
                    Chordata
                Taxonomic Classification Information:
                  Taxonomic Classification:
                    Taxonomic Rank Name:
                        Subphylum
                    Taxonomic Rank Value:
                        Vertebrata
                    Taxonomic Classification Information:
                      Taxonomic Classification:
                        Taxonomic Rank Name:
                            Class
                        Taxonomic Rank Value:
                            Mammalia
                        Taxonomic Classification Information:
                          Taxonomic Classification:
                            Taxonomic Rank Name:
                                Subclass
                            Taxonomic Rank Value:
                                Theria
                            Taxonomic Classification Information:
                              Taxonomic Classification:
                                Taxonomic Rank Name:
                                    Infraclass
                                Taxonomic Rank Value:
                                    Eutheria
                                Taxonomic Classification Information:
                                  Taxonomic Classification:
```

Taxonomic Rank Name:
    Order
Taxonomic Rank Value:
    Carnivora
Taxonomic Classification Information:
  Taxonomic Classification:
    Taxonomic Rank Name:
        Suborder
    Taxonomic Rank Value:
        Caniformia
    Taxonomic Classification

Information:

        Taxonomic Classification:
        Taxonomic Rank Name:
            Family
        Taxonomic Rank Value:
            Mustelidae
        Taxonomic Classification

Information:

          Taxonomic Classification:
          Taxonomic Rank Name:
              Subfamily
          Taxonomic Rank Value:
              Lutrinae
          Taxonomic Classification

Information:

            Taxonomic Classification:
            Taxonomic Rank Name:
                Genus
            Taxonomic Rank Value:
                Enhydra
            Taxonomic

Classification Information:

              Taxonomic

Classification:

              Common Name:
                  Sea Otter
              Taxonomic Rank

Name:

                  Species
              Taxonomic Rank

Value:

                  Enhydra lutris
              Taxonomic

Classification Information:

                Taxonomic

Classification:

                Common Name:
                    Southern
Sea Otter
Name:
                Taxonomic Rank

                    Subspecies
                Taxonomic Rank
Value:

                    Enhydra
lutris nereis

Classification Information:

Language:
eng; USA
Topic category:
  Topic category code:
  biota
Extent:
  Extent:
  Geographic element:
    Geographic bounding box:
      West bound longitude:
        -121.56
      East bound longitude:
        121.94
      South bound latitude:
        -36.5171
      North bound latitude:
        36.31
  Temporal element:
    Temporal extent:
      Extent:
        Time period:
          Description:
            ground condition
          Begin date:
            1989
          End date:
            unknown

  Content info:
    Feature catalogue description:
      Included with dataset:
        true
      Feature types:
      Feature catalogue citation:
        Citation:
          Title:
            unknown
          Date:
            unknown
          Other citation details:
            Entity and Attribute Overview: The data set contains the
yearly/monthly sightings, the number of sea
            otters sighted are plotted for each age class (i.e. adults,
adults with pups, large pups, and/or small
            pups) for every year. The observations are done by loyal
volunteers. Study Parameters:
            Range/Biogeography Behavior Abundance Distribution Density Age
structure The data is then compiled into
            a data base where the following is classified: 1) total sea
otter sightings, 2) annual mean number of
            sea otter sightings, 3) standard deviation for the annual mean
number of sea otter sightings, and 4) the
            standard error of the mean. Entity and Attribute Detail
Citation: An online chart representation of the

data sets are generated and can be accessed through a website url:

http://sanctuarysimon.org/monterey/sections/marineMammals/project_info.php?projectID=100219&sec=mm
  Distribution info:
    Distribution:
      Distribution format:
        Format:
          Name:
              GIF
          Version:
            unknown
          File decompression technique:
              No compression applied
      Distributor:
        Distributor:
          Distributor contact:
            Responsible party:
              Individual name:
                  Chad King
              Organisation name:
                  Sanctuary Integrated Monitoring Network (SIMoN)
              Position name:
                  Research Specialist
              Contact info:
                Contact:
                  Phone:
                    Telephone:
                      Voice:
                          (831) 647-4248
                      Facsimile:
                          (831) 647-4244
                  Address:
                    Address:
                      Delivery point:
                          299 Foam Street
                      City:
                          Monterey
                      Administrative area:
                          CA
                      Postal code:
                          93940
                      Country:
                          United States
                      Electronic mail address:
                          chad.king@noaa.gov
                  Hours of service:
                      10:00 a.m - 4:00 p.m Central Standard Time
                  Contact instructions:
                      Please visit the online site
at:http://sanctuarysimon.org SIMoN Staff Member : Chad King
              Role:
                Role code:
                    distributor
          Distribution Order Process:
            Standard order process:

Fees:
                         None
          Transfer options:
            Digital transfer options:
              Online:
                Online Resource:
                  Linkage:
                    URL:

http://sanctuarysimon.org/monterey/sections/marineMammals/project_info.php?pr
ojectID=100219&sec=mm
              Online:
                Online Resource:
                  Linkage:
                    URL:
                       http://sanctuarysimon.org/monterey/
  Data quality info:
    Data quality:
      Scope:
         unknown
      Report:
        Completeness commission:
          Evaluation method description:
               The monthly land-based standardized surveys of southern sea
otters (Enhydra lutris nereis) have been
               conducted by experienced volunteer docents in Point Lobos State
Reserve since 1989.
          Result:
             unknown
      Report:
        Completeness omission:
          Evaluation method description:
               The monthly land-based standardized surveys of southern sea
otters (Enhydra lutris nereis) have been
               conducted by experienced volunteer docents in Point Lobos State
Reserve since 1989.
          Result:
             unknown
      Report:
        Conceptual consistency:
          Measure description:
               These data are for sightings, they do not represent unique
observations. Many of the same sea otters are
               spotted each month and counted again. A monthly total and
yearly total are tallied on a consistent
               monthly basis. These data are then compiled by the U.S.
Geological Survey (USGS) with other otter survey
               data ranging from Santa Barbara to Half Moon Bay.
          Result:
             unknown
      Report:
        Quantitative attribute accuracy:
          Name of measure:
             Quantitative Attribute Accuracy Assessment
          Measure description:
               The following are four summary statistics based on the set of
data collected for each age class over the

range of months/years selected: 1) total sea otter sightings, 2) annual mean number of sea otter
sightings, 3) standard deviation for the annual mean number of sea otter sightings, and 4) the standard
error of the mean. Note: Remember that these data are for sightings, and they do not represent unique
observations. Many of the same sea otters are spotted each month and counted again.

Evaluation method description:
When viewing monthly sightings, the number of sea otters sighted are plotted for each age class (i.e.
adults, adults with pups, large pups, and/or small pups)monthly.When viewing yearly sightings, the
number of sea otters sighted are plotted for each age class (i.e. adults, adults with pups, large pups,
and/or small pups) for every year you selected.

Result:
  Quantitative result:
    Value unit:
      unknown
    Value:
      Unknown

Lineage:
  Lineage:
    Process step:
      Process step:
        Description
          Recording numbers of independent otters and pups observed, location and behavior.
        Date and time:
          1990-12-11T08:30:52
    Process step:
      Process step:
        Description:
          Volunteers view the otters by observing them with binocalurs.
        Rationale:
          Field
    Source:
      Source:
        Description:
          Source Contribution: The contribution of the source is not known. chart
        Scale:
          Representative fraction:
          Denominator:
            1
        Source citation:
          Citation:
          Title:
            Point Lobos State Reserve Otter Survey
          Alternate title:
          Date:
            Date:
              Date:
                1989
              Date type:

```
                      Date type code:
                           publication
                  Edition:
                  Cited responsible party:
                    Responsible party:
                      Organisation name:
                           Diane Dawson
                      Role:
                        Role code:
                           resourceProvider
                  Presentation form:
                  Series:
                    Series:
                      Name:
                           Point Lobos State Reserve Otter Survey
                      Issue identification:
                           1989 - 2008 Monthly/Yearly Otter Sightings
                  Other citation details:
              Source extent:
                Extent:
                  Temporal element:
                    Temporal extent:
                      Extent:
                        Time instant:
                          Description:
                            publication date
                          Time position:
                            1990
  Metadata maintenance:
    Maintenance information:
      Maintenance and update frequency:
         Unknown
      Date of next update:
          2009
      Maintenance note:
          This metadata was automatically generated from the FGDC Content
Standard for Digital Geospatial Metadata
          Biological Data Profile standard version FGDC-STD-001.0-1999 .
    Metadata author:
      Responsible party:
        Individual name:
            Chad King
        Organisation name:
            Sanctuary Integrated Monitoring Network (SIMoN)
        Position name:
            Research Specialist
        Contact info:
          Contact:
            Phone:
              Telephone:
                Voice:
                    (831) 647-4248
                Facsimile:
                    (831) 647-4244
            Address:
              Address:
                Delivery point:
```

299 Foam Street
        City:
                Monterey
        Administrative area:
                CA
        Postal code:
                93940
        Country:
                United States
        Electronic mail address:
                chad.king@noaa.gov
    Hours of service:
        10:00am - 4:00pm Central Standard Time
Role:
  Role code:
    custodian

FC PACKAGE

FC_FeatureCatalogue
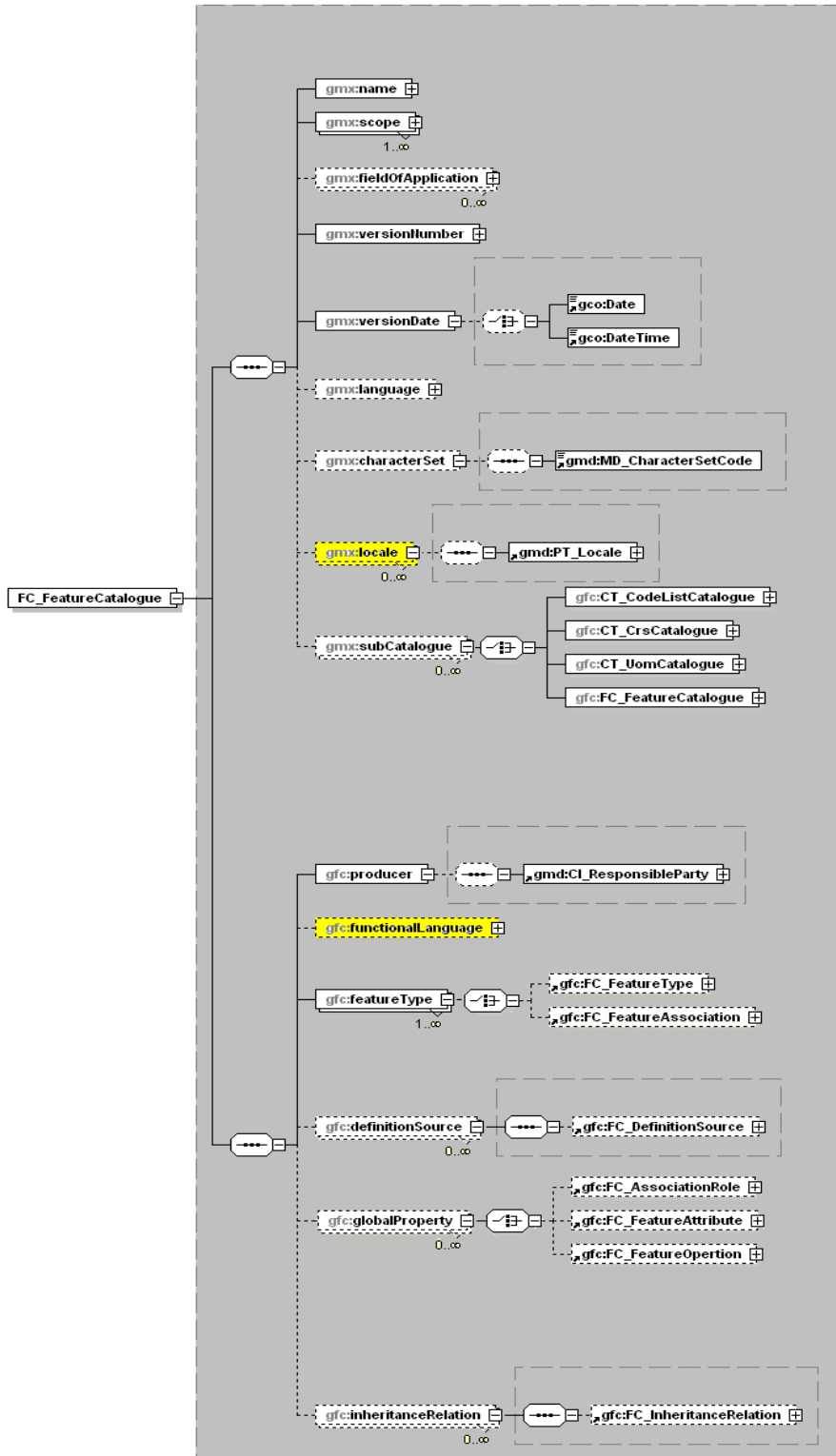
FC_FeatureCatalogue – A catalogue containing definitions and descriptions of the feature types, feature attributes, and feature associations occurring in one or more sets of geographic data, together with any feature operations that may be applied.

> Type: compound
> Multiplicity:
> Attributes: id, uuid

name – Name of the feature catalogue.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

scope – Subject domain(s) of feature types defined in the feature catalogue.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory, repeatable
> Attributes: nilReason

fieldOfApplication – Description of kind(s) of use to which the feature catalogue may be put.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional, repeatable
> Attributes: nilReason

versionNumber – Version number of the feature catalogue.

> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason
> Bets Practices: versionNumber may include a major version number or letter and a sequence of minor release numbers or letters such as "3.2.4a". Format may differ between cataloguing authorities.

versionDate – Effective date of the feature catalogue.

> Type: gco:Date or gco:DateTime
> Domain: date
> Multiplicity: mandatory
> Attributes: nilReason

language – Language of the metadata composed of an ISO639-2/T three-letter language code and an ISO3166-1 three-letter country code.

> Type: gco:characterString
> Domain: free text
> Multiplicity: optional *this is a NAP requirement*
> Attributes: nilReason
> Best Practices: The language code and country code are documented in the following manner: <ISO639-2/T three letter language code><;><blank space><ISO3166-1 three-letter country code> Country code is given in uppercase. See Annex B.

characterSet – Character coding standard in the metadata.

> Type: MD_CharacterSetCode
> Domain: ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2, 8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10, 8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii, ebcdic, eucKR, big5, GB2312
> Multiplicity: optional *this is a NAP requirement*
> Attributes: nilReason
> Best Practices: The character set for the metadata is set to "utf8" by default. See Annex C.

locale – Other languages used in metadata free text descriptions.

> Type: PT_Locale
> Multiplicity: conditional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: locale is mandatory when more than one language is used in free text descriptions

subCatalogue – A catalogue where the entries taken from a list of subject headings or an authority file are filed by subjects either in alphabetical or in classified order.

> Type: CT_CodelistCatalogue or CT_CrsSatalogue or CT_UomCatalogue or FC_FeatureCatalog
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

producer – Contact information of the person or organisation having primary responsibility for the intellectual content of the feature catalogue.

> Type: CI_ResponsibleParty
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

functionalLanguage – Language in which feature operations are formally specified.

> Type: gco:characterString
> Domain: free text
> Multiplicity: conditional
> Attributes: nilReason
> Best Practices: functionalLanguage is mandatory if featureOperation formal definition occurs in the feature catalogue.

featureType – Role that links this feature catalogue to the feature types that it contains.

> Type: FC_FeatureType or FC_FeatureAssociation
> Multiplicity: mandatory, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

definitionSource – Role that links this feature catalogue to the sources of definitions of feature types, property types, and listed values that it contains.

> Type: FC_DefinitionSource
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

globalProperty – Feature properties.

> Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

inheritanceRelation – Relationships that link a more generalized feature type (supertype) with a more specialized feature type (subtype).

        Type: FC_InheritanceRelation
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_AssociationRole
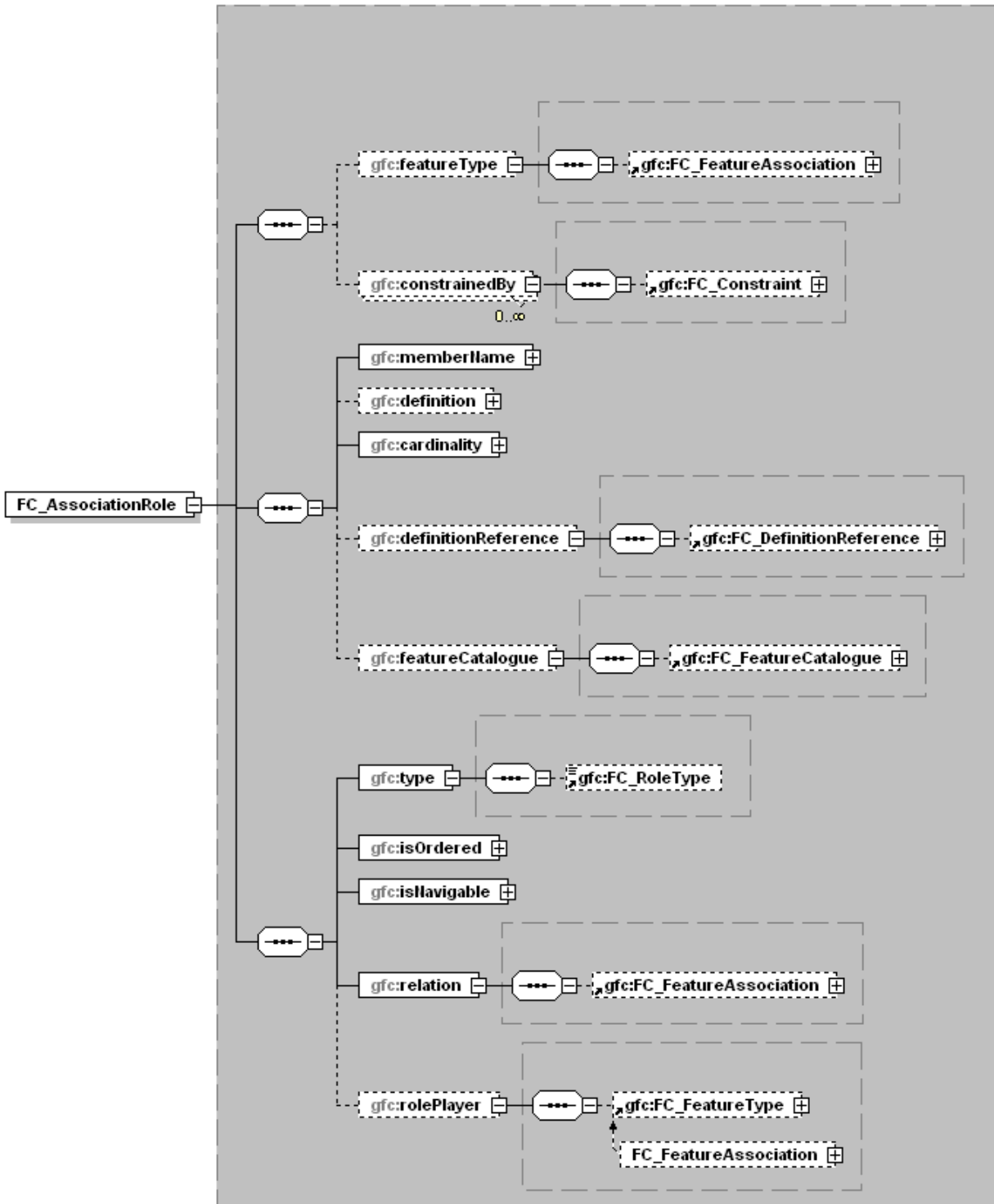
FC_AssociationRole – Real world phenomena with common properties.
>> Type: compound
>> Multiplicity: optional
>> Attributes: id, uuid
>> Best Practices: Association roles included in a feature catalogue shall be identified by a name that is unique within that feature catalog.

featureType – Role that links the operations with feature types that contain them.
>> Type: FC_FeatureType
>> Multiplicity: optional
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

constrainedBy – Role that links this property type to the constraints placed upon it.
>> Type: FC_Constraint
>> Multiplicity: optional, repeatable
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

memberName – Member name that located this member within a feature type.
>> Type: gco:LocalName
>> Multiplicity: mandatory
>> Attributes: nilReason

definition – Definition of the feature type in a natural language.
>> Type: gco:characterString
>> Domain: free text
>> Multiplicity: optional
>> Attributes: nilReason

cardinality – Cardinality of the member in a feature class.
>> Type: gco:Multiplicity
>> Multiplicity: mandatory
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>> Best Practices: Default value is "0…*".

definitionReference – Role that links this instance to the source of its definition.
>> Type: FC_DefinitionReference
>> Multiplicity: optional
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

featureCatalogue – Role that links this instance to the feature catalogue that it is found within.
>> Type:FC_FeatureCatalogue
>> Multiplicity: optional
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
>> Best Practices: This is mandatory but a bit recursive, use the nilReason attribute and fill in 'inapplicable' if this is not needed. If this is not the case, reference the feature catalogue identifier.

type – Type of association role, indicating whether this role acts as "is part of" or "is a member of" semantics.
>> Type: FC_RoleType
>> Multiplicity: mandatory
>> Attributes: nilReason

isOrdered – Indicates if the instances of this association role within the containing feature instance are ordered or not with FALSE = not ordered and TRUE = ordered.

> Type: gco:Boolean
> Domain: 0, 1 (0 = 'false', 1 = 'true')
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: Default value = FALSE.

isNavigable – Indicates whether this role is navigable from the source feature to the target feature of the association.

> Type: gco:Boolean
> Domain: 0, 1 (0 = 'false', 1 = 'true')
> Multiplicity: mandatory
> Attributes: nilReason
> Best Practices: Default value = TRUE.

relation – Relation of which this association role is a part.

> Type: FC_FeatureAssociation
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

rolePlayer – Type of the target value of this association role.

> Type: FC_FeatureType
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_Binding

FC_Binding – Class that is used to describe the specifics of how a property type is bound to a particular feature type.

> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

featureType – Describes particular information regarding the use of this property type within this feature type.

> Type: FC_FeatureType or FC_FeatureAssociation
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

constrainedBy – Role that links this property type to the constraints placed upon it.

> Type: FC_Constraint
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

description – Description of how a property is bound to a particular feature type.

> Type: gco:CharacterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

globalProperty – Role that links this to feature properties.

> Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

e

FC_BoundAssociationRole

FC_BoundAssociationRole –
        Type: compound
        Multiplicity: optional
        Attributes: id, uuid

featureType – Feature type involved in the binding
        Type: FC_FeatureType or FC_FeatureAssociation
        Multiplicity: optional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

constrainedBy – Role that links this property type to the constraints placed upon it.
        Type: FC_Constraint
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

description – Description of how a property is bound to a particular feature type.
        Type: gco:CharacterString
        Domain: free text
        Multiplicity: optional
        Attributes: nilReason

globalProperty – Role that links this to feature properties.
        Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation
        Multiplicity: mandatory
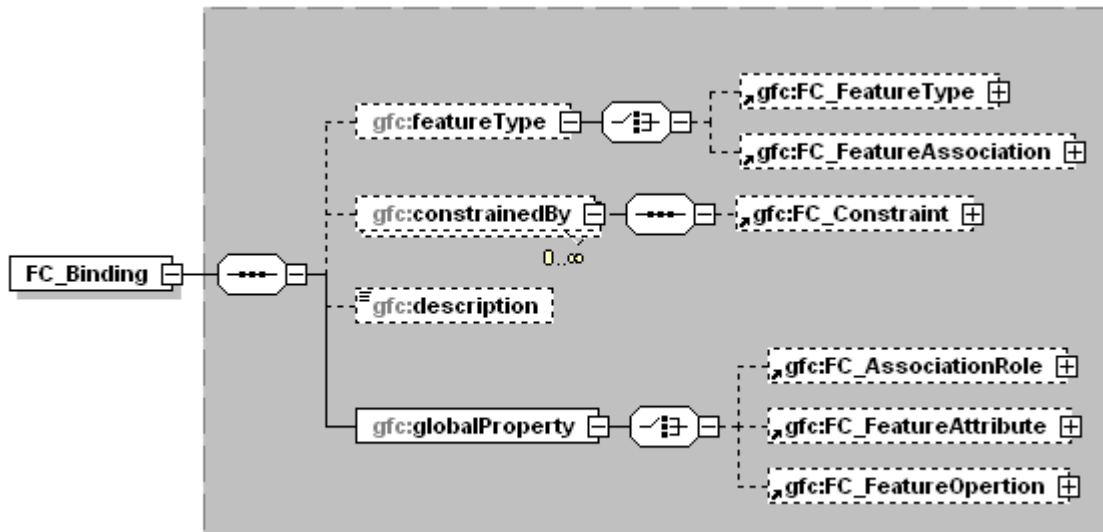   Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

rolePlayer –
        Type: FC_FeatureType or FC_FeatureAssociation
        Multiplicity: optional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_BoundFeatureAttribute
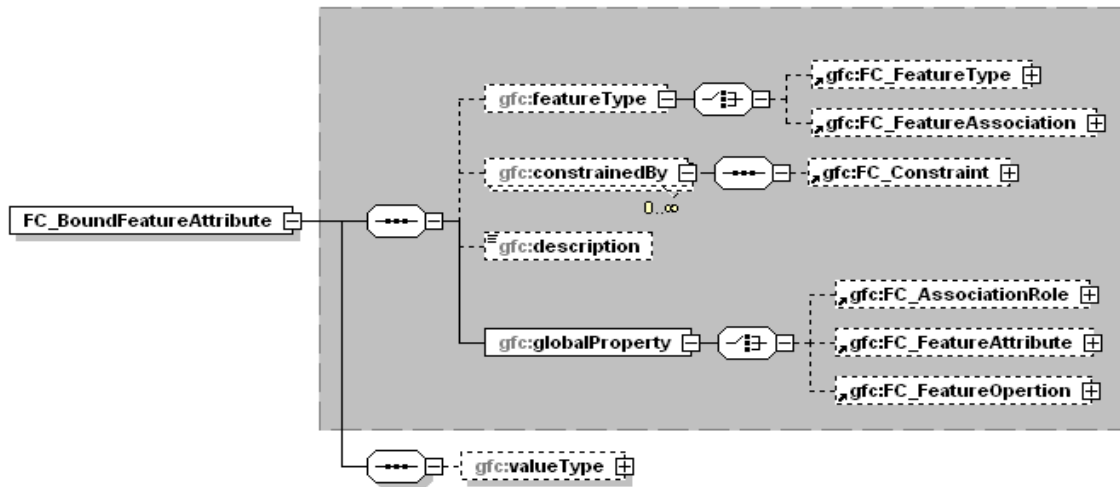
FC_BoundFeatureAttribute – Class that represents an association between a particular feature type and a particular property type, in order that operational effect information may be supplied for feature operations
> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

> featureType – Feature type involved in the binding
> > Type: FC_FeatureType or FC_FeatureAssociation
> > Multiplicity: optional
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> constrainedBy – Role that links this property type to the constraints placed upon it.
> > Type: FC_Constraint
> > Multiplicity: optional, repeatable
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

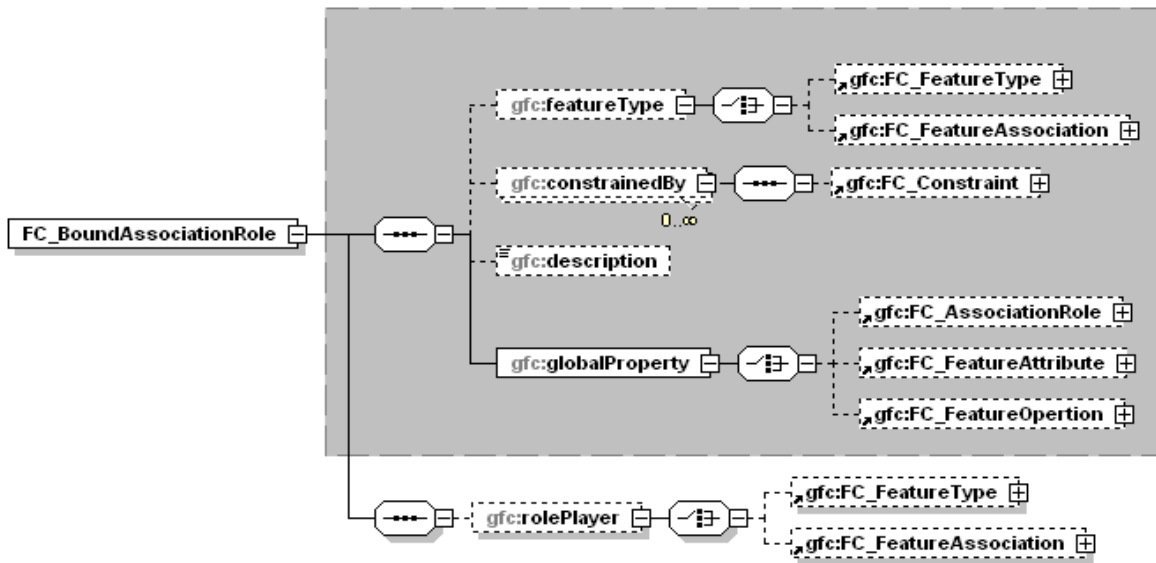> description – Description of how a property is bound to a particular feature type.
> > Type: gco:CharacterString
> > Domain: free text
> > Multiplicity: optional
> > Attributes: nilReason

> globalProperty – Role that links this to feature properties.
> > Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation
> > Multiplicity: mandatory
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

> valueType – Type of value of this feature attribute.
> > Type: gco:TypeName
> > Multiplicity: optional
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_Constraint
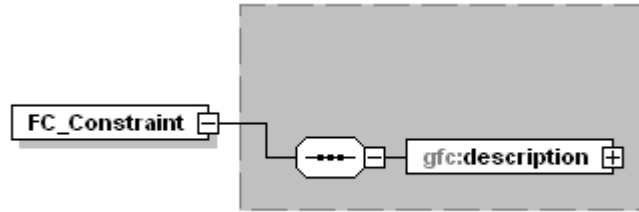
FC_Constraint – Class for defining constraints for types.
>
> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

description – Description of the constraint that is being applied.
>
> Type: gco:CharacterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

FAQ: **What is an example of a constraint?**

The example below shows that the measurement value of the 'depth' feature attribute is constrained as to direction of measurement.

Class FC_FeatureAttribute (identity = 4)	
Attribute FC_PropertyType.memberName	Depth
Attribute FC_PropertyType.definition	Distance measured from the highest point at surface level to the lowest point of the feature below the surface.
Attribute FC_PropertyType.cardinality	**1**
Role FC_PropertyType.featureType	**FC_FeatureType** (identity = 3)
	FC_Binding (identity = 6)
Role FC_PropertyType.constrainedBy	**FC_Constraint** (identity = 5)
Attribute FC_FeatureAttribute.code	DEP
Attribute FC_FeatureAttribute.valueMeasurementUnit	Meter
Attribute FC_FeatureAttribute.valueType	Real

Class FC_Constraint (identity = 5)	
Attribute FC_Constraint.description	Positive values represent distance below the reference point from which the measurement is made.

```
<gfc:FC_Constraint id="5">
        <gfc:description>
                <gco:CharacterString>Positive values represent distance below the reference point from which
the measurement is made.</gco:CharacterString>
        </gfc:description>
</gfc:FC_Constraint>
```

FC_DefinitionReference
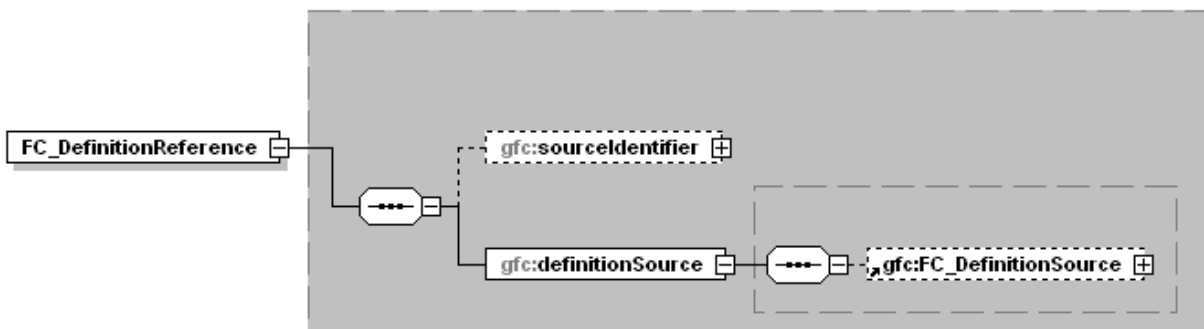
FC_DefinitionReference – Class that links a data instance to the source of its definition.
>	Type: compound
>	Multiplicity: optional
>	Attributes: id, uuid

>	sourceIdentifier – Additional information to help locate the definition in the source document.
>>		Type: gco:CharacterString
>>		Domain: free text
>>		Multiplicity: optional
>>		Attributes: nilReason
>>		Best Practices: The format of this information is specific to the structure of the source document.

>	definitionSource – Role that links this definition reference to the citation for the source document.
>>		Type: FC_DefinitionSource
>>		Multiplicity: mandatory
>>		Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_DefinitionSource
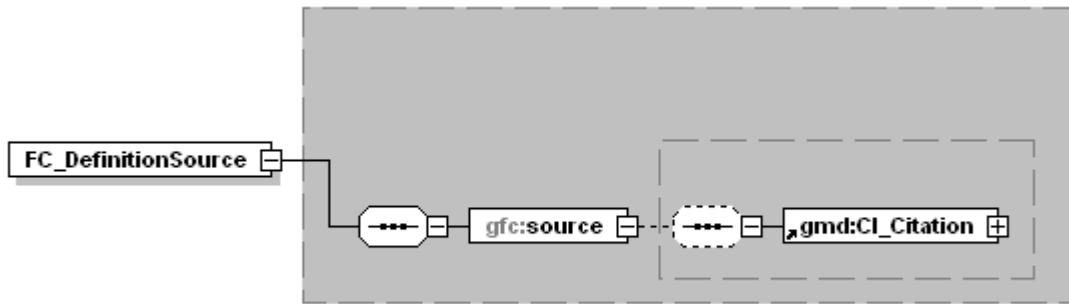
FC_DefinitionSource – Class that specifies the source of a definition.
Type: compound
Multiplicity: optional
Attributes: id, uuid

source – Actual citation of the source, sufficient to identify the document and how to obtain it.
Type: CI_Citation
Multiplicity: mandatory
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_FeatureAssociation
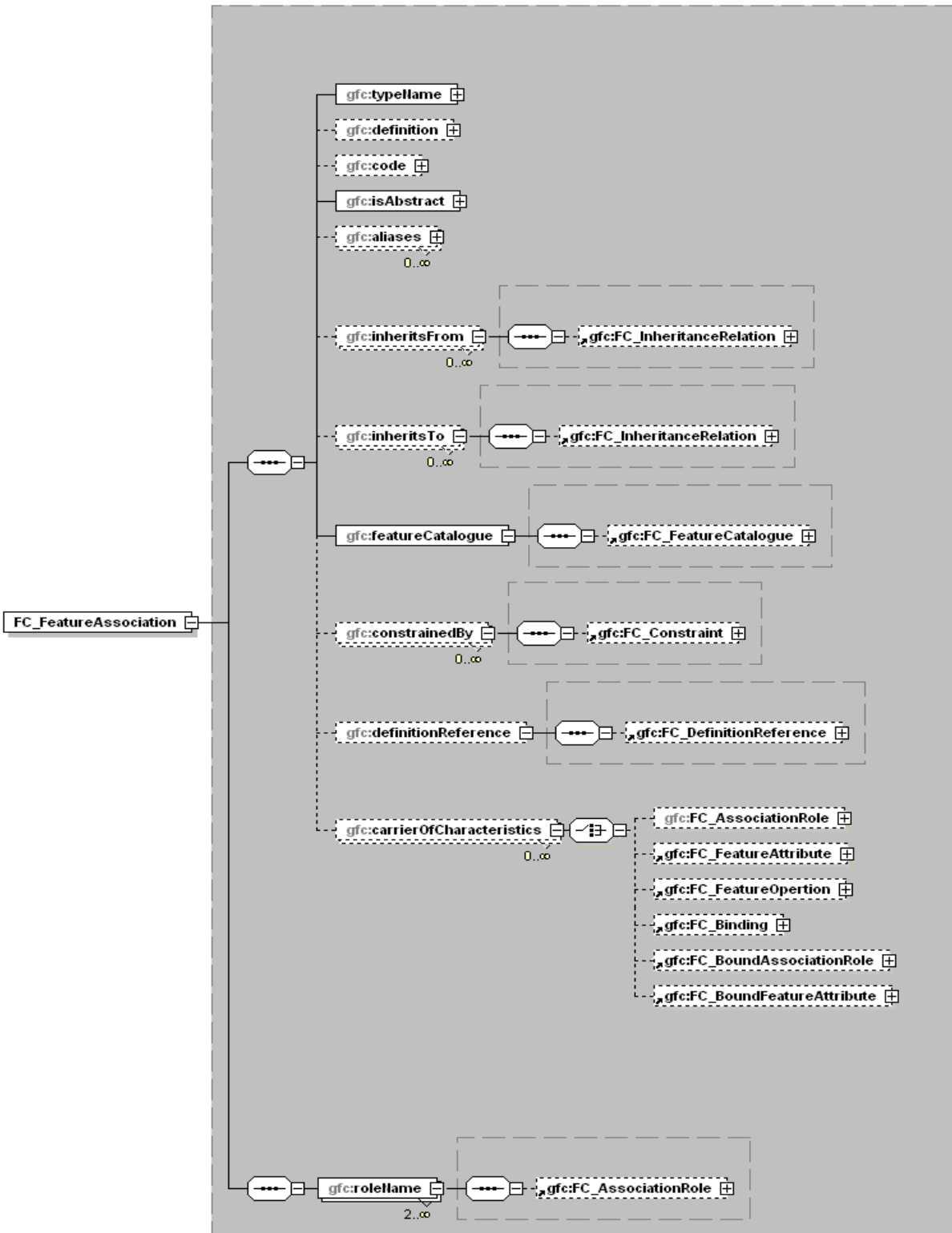
FC_FeatureAssociation – Relationship that links instances of this feature type with instances of the same or of a different feature type.
>Type: compound
>Multiplicity: optional
>Attributes: id, uuid
>Best Practices: All feature attributes included in a feature catalogue shall be identified by a name that is unique within that feature catalogue.

typeName – Name that uniquely identifies the feature type within the catalogue.
>Type: gco:LocalName
>Domain: free text
>Multiplicity: mandatory
>Attributes: nilReason

definition – Definition of the feature type in a natural language.
>Type: gco:characterString
>Domain: free text
>Multiplicity: optional
>Attributes: nilReason

code – Code that uniquely identifies the feature type within a catalogue.
>Type: gco:characterString
>Domain: free text
>Multiplicity: optional
>Attributes: nilReason

isAbstract – Boolean expression indicating if this is an abstract class.
>Type: gco:Boolean
>Domain: 0, 1 (0 = 'false', 1 = 'true')
>Multiplicity: mandatory
>Attributes: nilReason
>Best Practices: Default value is set to false.

aliases – Other names by which the association is known.
>Type: gco:LocalName
>Domain: free text
>Multiplicity: optional, repeatable
>Attributes: nilReason

inheritsFrom – Identifies one or more feature types from which the subject feature type inherits all properties, including feature operations, feature attributes, and feature associations.
>Type: FC_InheritanceRelation
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

inheritsTo – Identifies one or more feature types which inherit all properties from subject feature type, including feature operations, feature attributes, and feature associations.
>Type: FC_InheritanceRelation
>Multiplicity: optional, repeatable
>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

featureCatalogue – A feature catalogue contains its identification and contact information, and definition of some number of feature types with other information necessary for those definitions.

> Type: FC_FeatureCatalogue
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
> Best Practices: This is mandatory but a bit recursive, use the nilReason attribute and fill in 'inapplicable' if this is not needed. If this is not the case, reference the feature catalogue identifier.

constrainedBy – Role that links this feature type to the constraints placed upon it.

> Type: FC_Constraint
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

definitionReference – Role that links this feature type to the source of its definition.

> Type: FC_DefinitionReference
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

carrierOfCharacteristics – Property types that the feature type contains.

> Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation or FC_Binding or FC_BoundAssociationRole or FC_BoundFeatureAttribute
> Multiplicity: optional, repeatable
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

roleName – Roles that are a part of this association.

> Type: FC_AssociationRole
> Multiplicity: mandatory, repeatable, minimum of two
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_FeatureAttribute
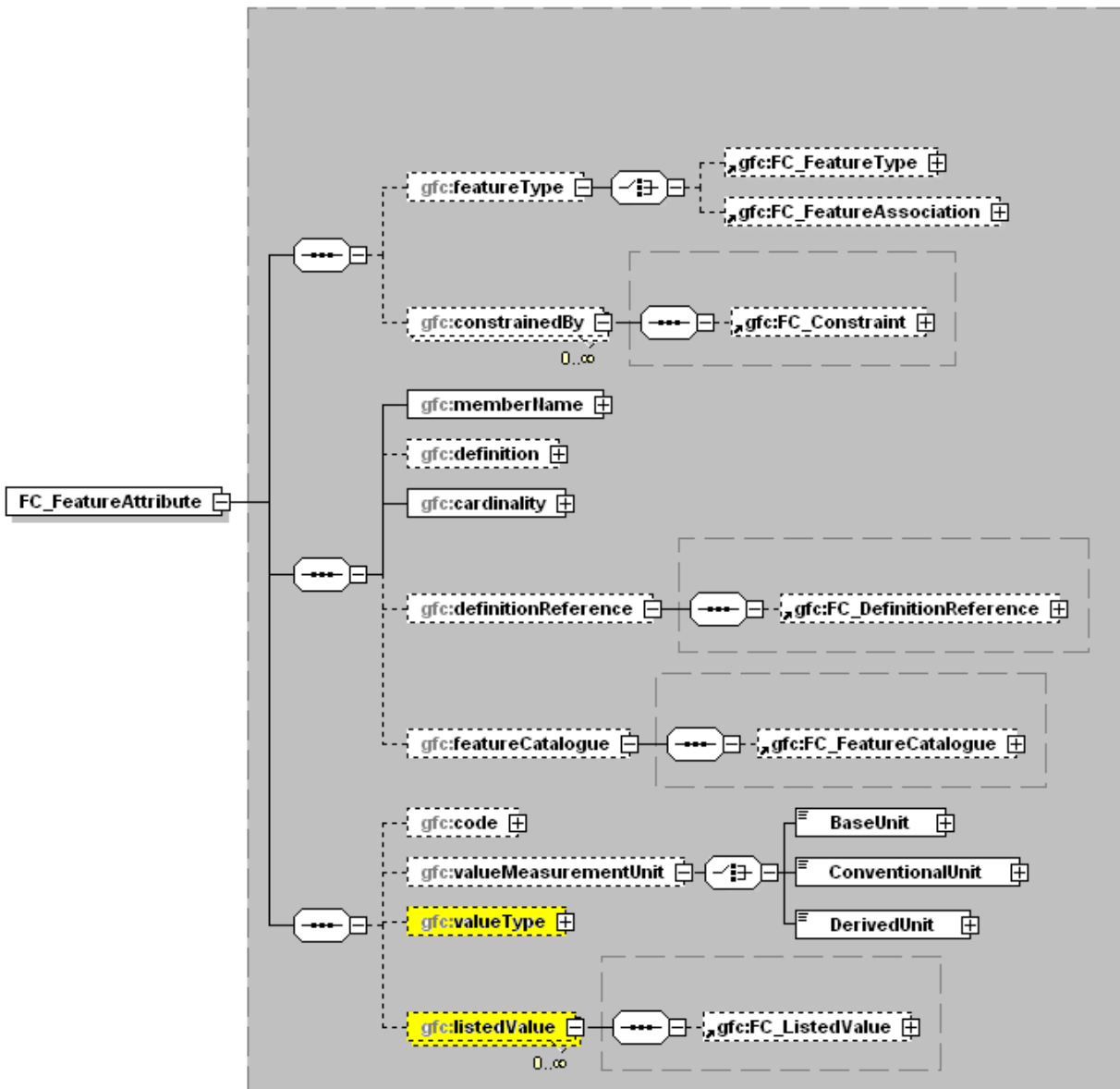
FC_FeatureAttribute – Characteristic of a feature type.
>Type: compound
>Multiplicity: optional
>Attributes: id, uuid
>Best Practices: Feature attributes included in a feature catalogue shall be identified by a name that is unique within that feature catalog.

>featureType – Role that links the operations with feature types that contain them.
>>Type: FC_FeatureType or FC_FeatureAssociation
>>Multiplicity: optional
>>Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

constrainedBy – Role that links this property type to the constraints placed upon it.
Type: FC_Constraint
Multiplicity: optional, repeatable
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

memberName – Member name that located this member within a feature type.
Type: gco:LocalName
Multiplicity: mandatory
Attributes: nilReason

definition – Definition of the feature type in a natural language.
Type: gco:characterString
Domain: free text
Multiplicity: optional
Attributes: nilReason

cardinality – Cardinality of the member in a feature class.
Type: gco:Multiplicity
Multiplicity: mandatory
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
Best Practices: Default value is "1".

definitionReference – Role that links this instance to the source of its definition.
Type: FC_DefinitionReference
Multiplicity: optional
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

featureCatalogue – Role that links this instance to the feature catalogue that it is found within.
Type: FC_FeatureCatalogue
Multiplicity: optional
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
Best Practices: This is mandatory but a bit recursive, use the nilReason attribute and fill in 'inapplicable' if this is not needed. If this is not the case, reference the feature catalogue identifier.

code – Numeric of alphanumeric code that uniquely identifies the feature attribute within the feature catalogue.
Type: gco:CharacterString
Domain: free text
Multiplicity: optional
Attributes: nilReason

valueMeasurementUnit – Unit of measure used for values of this feature attribute.
Type: BaseUnit or ConventionalUnit or DerivedUnit
Multiplicity: optional
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
Best Practices: See Annex D.

valueType – Type of the value of this feature attribute; a name from some namespace.
Type: gco:TypeName
Multiplicity: conditional
Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
Best Practices: valueType is mandatory if feature attribute listedValue is empty.

listedValue – Permissible values of this feature attribute. If present, then this feature attribute is enumerated.

        Type: FC_ListedValue
        Multiplicity: conditional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: listedValue is mandatory if valueType is not given.

FAQ: **What is an example of a feature attribute?**

A feature attribute can have a name, a data type, and a value domain associated to it. A feature attribute for a feature instance also has an attribute value taken from the value domain.

Ex:
A feature named 'color' may have an attribute value 'green'.

A feature named 'length' may have an attribute value '54.6'.

A feature type of 'Roads' may have several attributes such as 'Number of Lanes' and 'Road Surface', etc.

FC_FeatureOperation
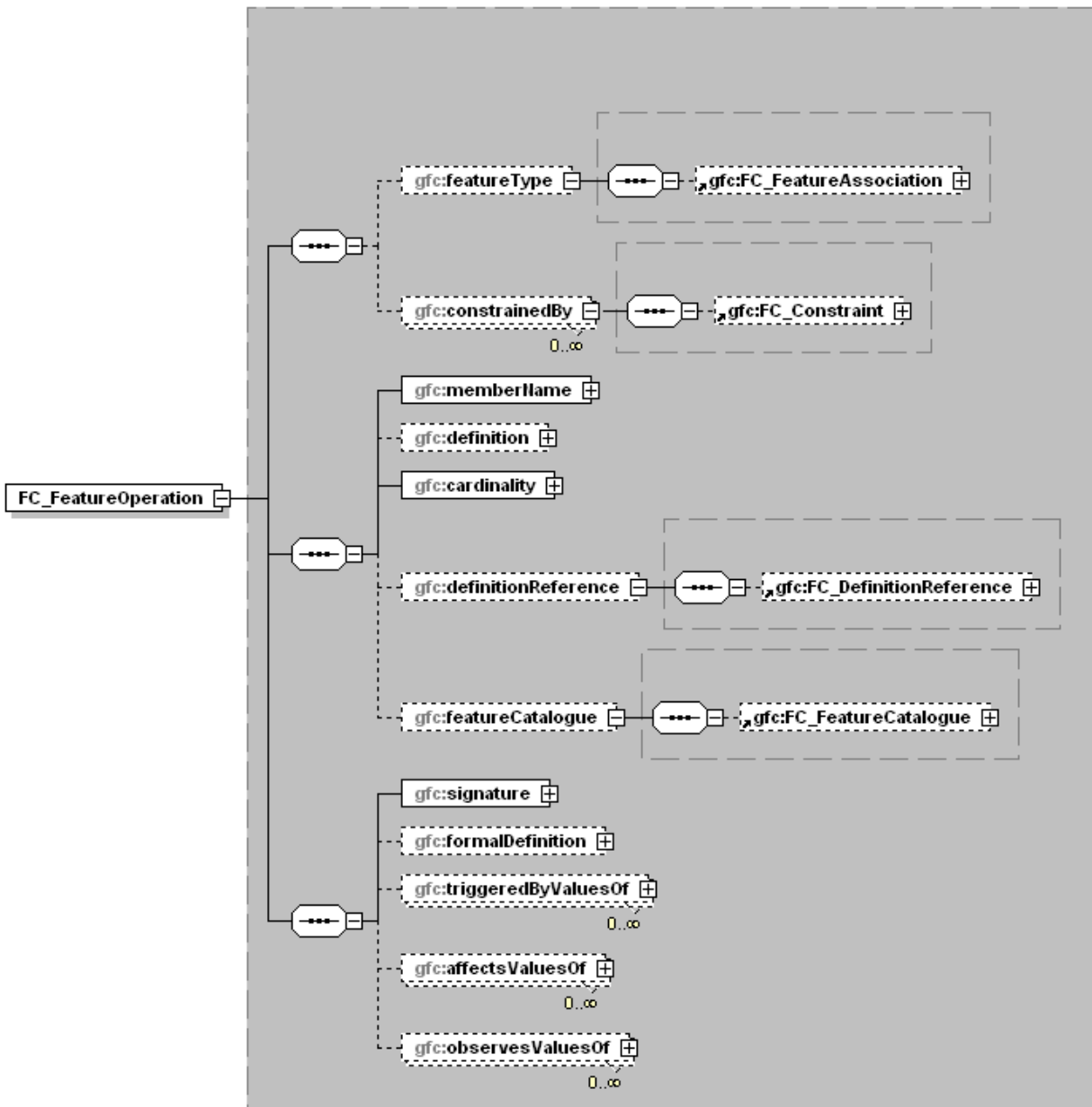
FC_FeatureOperation – Operation that every feature of a feature type may perform.

> Type: compound
> Multiplicity: conditional
> Attributes: id, uuid
> Beat Practices: Mandatory if feature operation name occurs in feature operations names list. All feature operations included in a feature catalogue shall be identified by a name that is unique within that feature catalogue.

> featureType – Role that links the operations with feature types that contain them.
>> Type: FC_FeatureType
>> Multiplicity: optional
>> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

constrainedBy – Role that links this property type to the constraints placed upon it.
       Type: FC_Constraint
       Multiplicity: optional, repeatable
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

memberName – Member name that located this member within a feature type.
       Type: gco:LocalName
       Multiplicity: mandatory
       Attributes: nilReason

definition – Definition of the feature type in a natural language.
       Type: gco:characterString
       Domain: free text
       Multiplicity: optional
       Attributes: nilReason

cardinality – Cardinality of the member in a feature class.
       Type: gco:Multiplicity
       Multiplicity: mandatory
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
       Best Practices: Default value is "1".

definitionReference – Role that links this instance to the source of its definition.
       Type: FC_DefinitionReference
       Multiplicity: optional
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

featureCatalogue – Role that links this instance to the feature catalogue that it is found within.
       Type:FC_FeatureCatalogue
       Multiplicity: optional
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
       Best Practices: This is mandatory but a bit recursive, use the nilReason attribute and fill in 'inapplicable' if this is not needed. If this is not the case, reference the feature catalogue identifier.

signature – Name and parameters for this operation.
       Type: gco:characterString
       Domain: free text
       Multiplicity: mandatory
       Attributes: nilReason
       Best Practices: The signature of an operation must be unique. The signature is usually derived from the formal definition.

formalDefinition – Formal description of the behavior of the member.
       Type: gco:characterString
       Domain: free text
       Multiplicity: optional
       Attributes: nilReason

triggeredByValuesOf – Specifies attributes which may trigger an operation.
       Type: FC_BoundFeatureAttribute
       Multiplicity: optional, repeatable
       Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

affectsValuesOf – Specifies attributes that will be affected by an operation.

 Type: FC_BoundFeatureAttribute
 Multiplicity: optional, repeatable
 Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

observesValuesOf – Specifies attributes that may be used as input to perform an operation.

 Type: FC_BoundFeatureAttribute
 Multiplicity: optional, repeatable
 Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_FeatureType
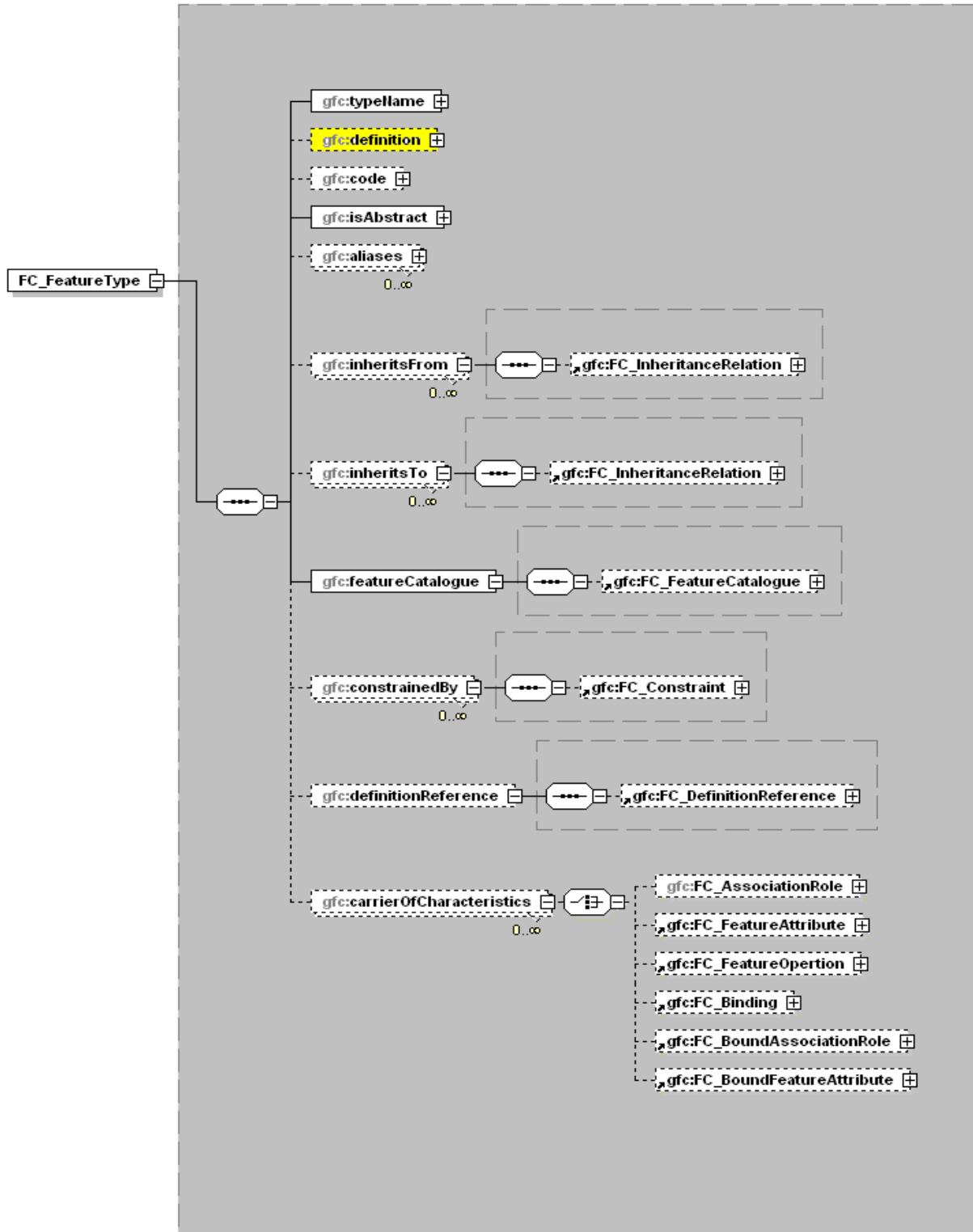
FC_FeatureType – Real world phenomena with common properties.
>	Type: compound
>	Multiplicity: optional
>	Attributes: id, uuid
>	Best Practices: All feature types included in a feature catalogue shall be identified by a name that
>	is unique within that feature catalogue.

typeName – Name that uniquely identifies the feature type within the catalogue.
>	Type: gco:LocalName
>	Domain: free text
>	Multiplicity: mandatory
>	Attributes: nilReason

definition – Definition of the feature type in a natural language.
>	Type: gco:characterString
>	Domain: free text
>	Multiplicity: conditional
>	Attributes: nilReason
>	Best Practices: definition is mandatory if definition is not provided by definition source.

code – Code that uniquely identifies the feature type within a catalogue.
>	Type: gco:characterString
>	Domain: free text
>	Multiplicity: optional
>	Attributes: nilReason

isAbstract – Boolean expression indicating if this is an abstract class.
>	Type: gco:Boolean
>	Domain: 0, 1 (0 = 'false', 1 = 'true')
>	Multiplicity: mandatory
>	Attributes: nilReason
>	Best Practices: Default value is set to false.

aliases – Other names by which the type is known.
>	Type: gco:LocalName
>	Domain: free text
>	Multiplicity: optional, repeatable
>	Attributes: nilReason

inheritsFrom – Identifies one or more feature types from which the subject feature type inherits all
properties, including feature operations, feature attributes, and feature associations.
>	Type: FC_InheritanceRelation
>	Multiplicity: optional, repeatable
>	Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

inheritsTo – Identifies one or more feature types which inherit all properties from subject feature type,
including feature operations, feature attributes, and feature associations.
>	Type: FC_InheritanceRelation
>	Multiplicity: optional, repeatable
>	Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

featureCatalogue – A feature catalogue contains its identification and contact information, and definition of some number of feature types with other information necessary for those definitions.

        Type: FC_FeatureCatalogue
        Multiplicity: mandatory
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason
        Best Practices: This is mandatory but a bit recursive, use the nilReason attribute and fill in 'inapplicable' if this is not needed. If this is not the case, reference the feature catalogue identifier.

constrainedBy – Role that links this feature type to the constraints placed upon it.

        Type: FC_Constraint
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

definitionReference – Role that links this feature type to the source of its definition.

        Type: FC_DefinitionReference
        Multiplicity: optional
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

carrierOfCharacteristics – Property types that the feature type contains.

        Type: FC_AssociationRole or FC_FeatureAttribute or FC_FeatureOperation or FC_Binding or FC_BoundAssociationRole or FC_BoundFeatureAttribute
        Multiplicity: optional, repeatable
        Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

FC_InheritanceRelation
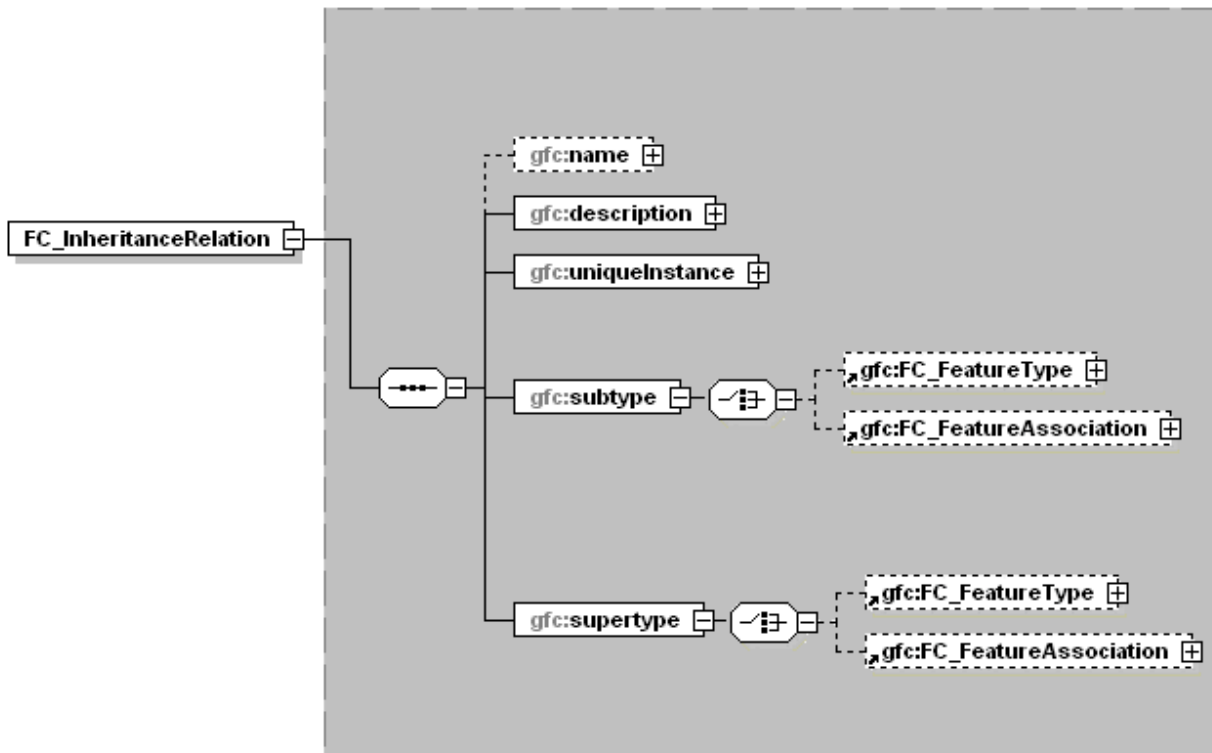
FC_InheritanceRelation – Links a more generalized supertype with a more specialized subtype.
> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

name – Name that uniquely identifies this inheritance relationship within the feature catalogue that contains this inherited relation.
> Type: gco:characterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

description – Natural language description of the inheritance relationship.
> Type: gco:characterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

uniqueInstance – Indicates if an instance of the supertype can be an instance of at most one of its subtypes.
> Type: gco:Boolean
> Domain: 0,1 (0 = false, 1 = true)
> Multiplicity: mandatory
> Attributes: nilReason

subtype – Identifies one feature type to which the associated Superclass feature type supplies inherence properties, associations, and operations.

> Type: FC_FeatureType
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

supertype – Identifies one feature type from which the associated subtype class inherits properties, associations, and operations.

> Type: FC_FeatureType
> Multiplicity: mandatory
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

---

FAQ: **What is an example of an inheritance relation?**

Below is an example of a feature catalogue that contains the **"is a"** inheritance relation relating the two feature types "building" and "lighthouse". An instance of a "lighthouse" feature type is also an instance of a "building" feature type; feature properties, feature associations, and feature operations to the "building" feature type in the example feature catalogue also apply to the "lighthouse" feature type. Pay special attention to the identities.

Class FC_FeatureType (identity = 25)	
Attribute FC_FeatureType.typeName	Building
Attribute FC_FeatureType.definition	A relatively permanent structure, roofed and usually walled and designed for some particular use.
Attribute FC_FeatureType.code	AL015
Attribute FC_FeatureType.isAbstract	FALSE
Role FC_FeatureType.inheritsTo	**FC_FeatureInheritanceRelation** (identity = 27)
Role FC_FeatureType.featureCatalogue	**FC_FeatureCatalogue** (identity = 1)

Class FC_FeatureType (identity = 26)	
Attribute FC_FeatureType.typeName	Lighthouse
Attribute FC_FeatureType.definition	A distinctive structure exhibiting light(s) designed to serve as an aid to navigation.
Attribute FC_FeatureType.code	BC050
Attribute FC_FeatureType.isAbstract	FALSE
Role FC_FeatureType.inheritsFrom	**FC_FeatureInheritanceRelation** (identity = 27)
Role FC_FeatureType.featureCatalogue	**FC_FeatureCatalogue** (identity = 1)

Class FC_InheritanceRelation (identity = 27)	
Attribute FC_InheritanceRelation.name	is a (see above)
Attribute FC_InheritanceRelation.description	An object is classified as a specialization of another object.
Attribute FC_InheritanceRelation.uniqueInstance	TRUE
Role FC_InheritanceRelation.subtype	**FC_FeatureType** (identity = 26)
Role FC_InheritanceRelation.supertype	**FC_FeatureType** (identity = 25)

FC_ListedValue
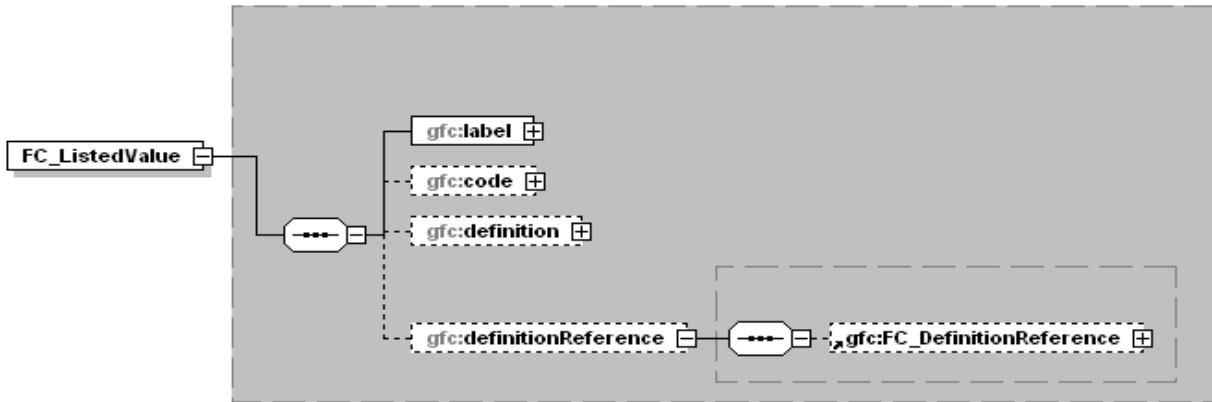
FC_ListedValue – Value for an enumerated feature attribute domain, including its codes and interpretation.
> Type: compound
> Multiplicity: optional
> Attributes: id, uuid

label – Descriptive label that uniquely identifies one value of the feature attribute.
> Type: gco:CharacterString
> Domain: free text
> Multiplicity: mandatory
> Attributes: nilReason

code – Numeric or alphanumeric code that uniquely identifies this value of the feature attribute.
> Type: gco:CharacterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason

FAQ: **What is an example of a listed value attribute code?**

A country code would be an example of an alphanumeric code that uniquely identifies a value.

---

definition – Definition of the attribute value in a natural language.
> Type: gco:CharacterString
> Domain: free text
> Multiplicity: optional
> Attributes: nilReason
> Best Practices: If definition is not provided, the definitionReference may specify a citation where the definition may be found as well as any additional information.

definitionReference – Role that links this instance to the source of its definition.
> Type: FC_DefinitionReference
> Multiplicity: optional
> Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

---

FAQ: What is an example of FC_ListedValue and how is it used?

If I have a feature type named "Roads" and a feature attribute of that type named "Road Surface", I will want to document the domain that identifies the road surface materials.

Ex:

Label	Code
Gravel	001
Concrete	002
Dirt	003
Asphalt	004

```xml
<gfc:listedValue>
        <gfc:FC_ListedValue>
                <gfc:label>
                        <gco:CharacterString>gravel</gco:CharacterString>
                </gfc:label>
                <gfc:code>
                        <gco:CharacterString>001</gco:CharacterString>
                </gfc:code>
                <gfc:definition>
                        <gco:CharacterString>unpaved road surfaced with gravel</gco:CharacterString>
                </gfc:definition>
        </gfc:FC_ListedValue>
</gfc:listedValue>
<gfc:listedValue>
        <gfc:FC_ListedValue>
                <gfc:label>
                        <gco:CharacterString>concrete</gco:CharacterString>
                </gfc:label>
                <gfc:code>
                        <gco:CharacterString>002</gco:CharacterString>
                </gfc:code>
                <gfc:definition>
                        <gco:CharacterString>road paved with concrete, includes jointed plain (JPCP), jointed reinforced (JRCP) and continuously
                reinforced (CRCP)</gco:CharacterString>
                </gfc:definition>
        </gfc:FC_ListedValue>
</gfc:listedValue>
<gfc:listedValue>
        <gfc:FC_ListedValue>
                <gfc:label>
                        <gco:CharacterString>dirt</gco:CharacterString>
                </gfc:label>
                <gfc:code>
                        <gco:CharacterString>003</gco:CharacterString>
                </gfc:code>
                <gfc:definition>
                        <gco:CharacterString>unpaved road made from subgrade material</gco:CharacterString>
                </gfc:definition>
        </gfc:FC_ListedValue>
</gfc:listedValue>
<gfc:listedValue>
        <gfc:FC_ListedValue>
                <gfc:label>
                        <gco:CharacterString>asphalt</gco:CharacterString>
                </gfc:label>
                <gfc:code>
                        <gco:CharacterString>004</gco:CharacterString>
                </gfc:code>
                <gfc:definition>
                        <gco:CharacterString>road paved with the petroleum based asphalt concrete</gco:CharacterString>
                </gfc:definition>
        </gfc:FC_ListedValue>
</gfc:listedValue>
```

FEATURE CATALOG EXAMPLE

Feature Catalog Example – Transportation96

Feature Catalogue *id=_1*	
Name:	Transportation96
Scope:	Road network in Urbana-Champaign surveyed in 1996 for all transportation facilities within the twin cities.
Field of Application:	Transportation planning, Land use planning
Version Number:	1.1
Version Date:	1996-10-01
Definition Source:	Transportation Survey Guide in 1996
Feature Catalogue Producer:	CCRPC 10 Main St. Urbana, IL 61801 Telephone: +1 217 488-3331 Fax: +1 217 482-9331 Email: landuse96@urbana.net

Feature Catalog Example – Transportation96

Feature Type *id=_2*	
Name:	Roads
Definition:	Open way for the movement of motor vehicles on land
Code:	TR96-02
Feature Attribute Names:	Number of lanes *(id=_3)*, Road Surface *(id=_4)*

Feature Attribute *id=_3*	
Name:	Number of Lanes
Definition:	Number of lanes of the road, including both directions
Code:	15942
Value Data Type:	Long
Value Measurement Unit:	lanes
Value Domain Type:	0 = "not enumerated"
Value Domain:	N/A

Feature Attribute *id=_4*	
Name:	Road Surface
Definition:	Road surface material
Code:	19586
Value Data Type:	text
Value Domain Type:	1 = "enumerated"

Value Domain:

Label	**Code**
gravel	**001**
concrete	**002**
dirt	**003**
asphalt	**004**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<gfc:FC_FeatureCatalogue id="_1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gfc="http://www.isotc211.org/2005/gfc" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:gmx="http://www.isotc211.org/2005/gmx" xsi:schemaLocation="http://www.isotc211.org/2005/gfc
Q:\users\mize.jacqueline\ISO\gfc\gfc.xsd">
<gmx:name>
 <gco:CharacterString>Transportation96</gco:CharacterString>
</gmx:name>
<gmx:scope>
 <gco:CharacterString>Road network in Urbana-Champaign surveyed in 1996 for all transportation facilities within the twin
cities.</gco:CharacterString>
</gmx:scope>
<gmx:fieldOfApplication>
 <gco:CharacterString>Transportation planning, Land use planning</gco:CharacterString>
</gmx:fieldOfApplication>
<gmx:versionNumber>
 <gco:CharacterString>1.1</gco:CharacterString>
</gmx:versionNumber>
<gmx:versionDate>
 <gco:Date>1996-10-01</gco:Date>
</gmx:versionDate>
<gmx:language>
 <gco:CharacterString>eng; US</gco:CharacterString>
</gmx:language>
<gmx:characterSet>
 <gmd:MD_CharacterSetCode
codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_CharacterSetCodeType" codeListValue="utf8"/>
</gmx:characterSet>
<gfc:producer>
 <gmd:CI_ResponsibleParty>
  <gmd:organisationName>
   <gco:CharacterString>CCRPC</gco:CharacterString>
  </gmd:organisationName>
  <gmd:contactInfo>
   <gmd:CI_Contact>
    <gmd:phone>
     <gmd:CI_Telephone>
      <gmd:voice>
       <gco:CharacterString>+1 217 488-3331</gco:CharacterString>
      </gmd:voice>
      <gmd:facsimile>
       <gco:CharacterString>+1 217 482-9331</gco:CharacterString>
      </gmd:facsimile>
     </gmd:CI_Telephone>
    </gmd:phone>
    <gmd:address>
     <gmd:CI_Address>
      <gmd:deliveryPoint>
       <gco:CharacterString>10 Main St.</gco:CharacterString>
      </gmd:deliveryPoint>
      <gmd:city>
       <gco:CharacterString>Urbana</gco:CharacterString>
      </gmd:city>
      <gmd:administrativeArea>
       <gco:CharacterString>IL</gco:CharacterString>
      </gmd:administrativeArea>
      <gmd:postalCode>
       <gco:CharacterString>61801</gco:CharacterString>
      </gmd:postalCode>
      <gmd:country>
       <gco:CharacterString>US</gco:CharacterString>
      </gmd:country>
      <gmd:electronicMailAddress>
       <gco:CharacterString>landuse96@urbana.net</gco:CharacterString>
      </gmd:electronicMailAddress>
     </gmd:CI_Address>
    </gmd:address>
   </gmd:CI_Contact>
  </gmd:contactInfo>
```

```xml
   <gmd:role>
    <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode"
codeListValue="resourceProvider"/>
   </gmd:role>
  </gmd:CI_ResponsibleParty>
 </gfc:producer>
 <gfc:featureType>
  <gfc:FC_FeatureType id="_2">
   <gfc:typeName>
    <gco:LocalName>Roads</gco:LocalName>
   </gfc:typeName>
   <gfc:definition>
    <gco:CharacterString>Open way for the movement of motor vehicles on land</gco:CharacterString>
   </gfc:definition>
   <gfc:code>
    <gco:CharacterString>TR96-02</gco:CharacterString>
   </gfc:code>
   <gfc:isAbstract>
    <gco:Boolean>false</gco:Boolean>
   </gfc:isAbstract>
   <gfc:featureCatalogue gco:nilReason="unknown"/>
   <gfc:carrierOfCharacteristics>
    <gfc:FC_FeatureAttribute id="_3">
     <gfc:memberName>
      <gco:LocalName>Number of Lanes</gco:LocalName>
     </gfc:memberName>
     <gfc:definition>
      <gco:CharacterString>Number of lanes of the road, including both directions</gco:CharacterString>
     </gfc:definition>
     <gfc:cardinality>
      <gco:Multiplicity>
       <gco:range>
        <gco:MultiplicityRange>
         <gco:lower>
          <gco:Integer>1</gco:Integer>
         </gco:lower>
         <gco:upper>
          <gco:UnlimitedInteger xsi:nil="true" isInfinite="true"/>
         </gco:upper>
        </gco:MultiplicityRange>
       </gco:range>
      </gco:Multiplicity>
     </gfc:cardinality>
     <gfc:code>
      <gco:CharacterString>15942</gco:CharacterString>
     </gfc:code>
     <gfc:valueMeasurementUnit>
      <gml:UnitDefinition gml:id="lanes">
       <gml:identifier codeSpace="lanes"/>
      </gml:UnitDefinition>
     </gfc:valueMeasurementUnit>
     <gfc:valueType>
      <gco:TypeName>
       <gco:aName>
        <gco:CharacterString>Long</gco:CharacterString>
       </gco:aName>
      </gco:TypeName>
     </gfc:valueType>
    </gfc:FC_FeatureAttribute>
   </gfc:carrierOfCharacteristics>
   <gfc:carrierOfCharacteristics>
    <gfc:FC_FeatureAttribute id="_4">
     <gfc:memberName>
      <gco:LocalName>Road Surface</gco:LocalName>
     </gfc:memberName>
     <gfc:definition>
      <gco:CharacterString>Road surface material</gco:CharacterString>
     </gfc:definition>
     <gfc:cardinality>
      <gco:Multiplicity>
```

224

```xml
      <gco:range>
       <gco:MultiplicityRange>
        <gco:lower>
         <gco:Integer>1</gco:Integer>
        </gco:lower>
        <gco:upper>
         <gco:UnlimitedInteger xsi:nil="true" isInfinite="true"/>
        </gco:upper>
       </gco:MultiplicityRange>
      </gco:range>
     </gco:Multiplicity>
    </gfc:cardinality>
    <gfc:code>
     <gco:CharacterString>19586</gco:CharacterString>
    </gfc:code>
    <gfc:valueType>
     <gco:TypeName>
      <gco:aName>
       <gco:CharacterString>text</gco:CharacterString>
      </gco:aName>
     </gco:TypeName>
    </gfc:valueType>
    <gfc:listedValue>
     <gfc:FC_ListedValue>
      <gfc:label>
       <gco:CharacterString>gravel</gco:CharacterString>
      </gfc:label>
      <gfc:code>
       <gco:CharacterString>001</gco:CharacterString>
      </gfc:code>
      <gfc:definition>
       <gco:CharacterString>unpaved road surfaced with gravel</gco:CharacterString>
      </gfc:definition>
     </gfc:FC_ListedValue>
    </gfc:listedValue>
    <gfc:listedValue>
     <gfc:FC_ListedValue>
      <gfc:label>
       <gco:CharacterString>concrete</gco:CharacterString>
      </gfc:label>
      <gfc:code>
       <gco:CharacterString>002</gco:CharacterString>
      </gfc:code>
      <gfc:definition>
       <gco:CharacterString>road paved with concrete, includes jointed plain (JPCP), jointed reinforced (JRCP) and continuously
reinforced (CRCP)</gco:CharacterString>
      </gfc:definition>
     </gfc:FC_ListedValue>
    </gfc:listedValue>
    <gfc:listedValue>
     <gfc:FC_ListedValue>
      <gfc:label>
       <gco:CharacterString>dirt</gco:CharacterString>
      </gfc:label>
      <gfc:code>
       <gco:CharacterString>003</gco:CharacterString>
      </gfc:code>
      <gfc:definition>
       <gco:CharacterString>unpaved road made from subgrade material</gco:CharacterString>
      </gfc:definition>
     </gfc:FC_ListedValue>
    </gfc:listedValue>
    <gfc:listedValue>
     <gfc:FC_ListedValue>
      <gfc:label>
       <gco:CharacterString>asphalt</gco:CharacterString>
      </gfc:label>
      <gfc:code>
       <gco:CharacterString>004</gco:CharacterString>
      </gfc:code>
```

```xml
    <gfc:definition>
     <gco:CharacterString>road paved with the petroleum based asphalt concrete</gco:CharacterString>
    </gfc:definition>
   </gfc:FC_ListedValue>
  </gfc:listedValue>
  </gfc:FC_FeatureAttribute>
 </gfc:carrierOfCharacteristics>
 </gfc:FC_FeatureType>
</gfc:featureType>
<gfc:definitionSource>
 <gfc:FC_DefinitionSource>
  <gfc:source>
   <gmd:CI_Citation>
    <gmd:title>
     <gco:CharacterString>Transportation Survey Guide in 1996</gco:CharacterString>
    </gmd:title>
    <gmd:date>
     <gmd:CI_Date>
      <gmd:date>
       <gco:Date>1996</gco:Date>
      </gmd:date>
      <gmd:dateType>
       <gmd:CI_DateTypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
codeListValue="creation"/>
      </gmd:dateType>
     </gmd:CI_Date>
    </gmd:date>
   </gmd:CI_Citation>
  </gfc:source>
 </gfc:FC_DefinitionSource>
 </gfc:definitionSource>
</gfc:FC_FeatureCatalogue>
```

ANNEX A. DATA TYPES

A.1 Binary
Any binary data (e.g., image, sound) encoded as a sequence of bits (see *ISO/TS19133:2005, Geographic information – Location based services – Tracking and navigation*, clause 10.2.3).

A.2 Boolean
Truth value representing true or false. True can be represented by {true, 1} and false by {false,0} (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.11).

A.3 CharacterString
An arbitrary-length sequence of characters, including accents and special characters from the identified character set. CharacterStrings provide an area for free text. If an element has a characterString allowing free text, and you want to restrict this to using a controlled vocabulary, substitute gco:CharacterString with gmx:Anchor.

A.4 Date
Date gives values for the representation of:

1. year, e.g., 2006
2. year and month, e.g., 2006-10;
3. year, month, and day, e.g., 2006-10-01-05:00;
4. year, month, day, and time, e.g., 2006-10-01T12:00:00-05:00 (see A.5 DateTime).

Case 3 and 4 include optionally a time zone representation showing the time shift related to Coordinated Universal Time (UTC) origin. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.8, and *ISO/TS19139:2007, Geographic information – Metadata – XML schema implementation*, clause 8.5.8.4.7)

A.5 DateTime
Date gives values for the representation of year, month, day, and time of the day in terms of hours, minutes, and second, with an optional time zone. Example 2006-10-01T12:00:00-05:00 corresponds to noon on October 1st, 2002, Eastern Standard Time in the U.S. NAP – Metadata, version 1.0.1 (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.8, and *ISO/TS19139:2007, Geographic information – Metadata – XML schema implementation*, clause 8.5.8.4.7)

A.6 Decimal
A number that represents an exact value, e.g., 2.5, 5.25, 12.125 (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.4).

A.7 Distance
Measure of length between two points. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.7.7).

A.8 GenericName
Abstract class for the representation of a name in a namespace. A GenericName can be either a LocalName of a ScopedName. A LocalName is either a MemberName (see A.15) or a TypeName. A TypeName is a name that references either a RecordType or an object in a schema. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.6.3).

A.9 GF_AttributeType
ISO19109:2005, Geographic information – Rules for application schema metaclass used for the representation of an attribute of a class of features, e.g., "numberOfLane", and "buildingUsage". (see *ISO19109:2005, Geographic information – Rules for application schema*, clause 7.3.6).

A.10 GF_FeatureType

ISO19109:2005, Geographic information – Rules for application schema metaclass used for the representation of a class of features, e.g., "road", "river", and "building". (see *ISO19109:2005, Geographic information – Rules for application schema*, clause 7.3.4).

A.11 GM_Object

ISO19107:2003, Geographic information – Spatial schema abstract classes standing for any geometric objects (e.g., GM_Point, GM_Curve, GM_Surface) for the representation of the geometry of objects. (see *ISO19107:2003, Geographic information – Spatial schema*, clause 6.2.2).
NAP – Metadata, version 1.0.1

A.12 GM_Point

ISO19107:2003, Geographic information – Spatial schema data type for the representation of a single point (see *ISO19107:2003, Geographic information – Spatial schema*, clause 6.3.11).

A.13 Integer

A signed number with no fractional part, e.g., -12, 125, 12000963. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.3).

A.14 Measure

A value resulting from the process to evaluate an amount or a quantity expressed in a unit of measure. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.7.2).

A.15 MemberName

Name that references an attribute in a record, a RecordType, an attribute, an operation, or an association role. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.6.7).

A.16 Real

A signed floating point number composed of a mantissa and an optional exponent, e.g., -2E5, 364.236E8, 15.32e-3, 24, -0, 0. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.2.5).

A.17 Record

A structure of logically related elements. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.5).

A.18 RecordType

Specification of the content and structure of a Record. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.5). NAP – Metadata, version 1.0.1

*The usage of the RecordType and Record is described in ISO 19139. A RecordType element refers to a definition a type. The RecordType is implemented in XML as an xlink to the definition of that type. A Record is an instance of that type. The content of the tags RecordType and Record are free text. In the example below, the RecordType is an xlink to the definition of a netCDF variable type from the NcML schema. The Record is an xlink to an instance of the variable provided by a web service (ncmlService).

```
Ex.
<gmd:dimension>
  <gmd: SampleDimension >
    <gmd:otherAttributeType>
      <gco:RecordType xlink:href="http://www.unidata.ucar.edu/schemas/netcdf/ncml-2.2.xsd
        #xpointer(//element[@name='variable'])">netCDF Variable Type</gco:RecordType>
    </gmd:otherAttributeType>
    <gmd: otherAttributeValue>
      <gco:Record xlink:href="http://www.ngdc.noaa.gov/ncmlService/granuleIdentifier
```

```
        #xpointer(/netcdf/variable[@name=MemberName])"> Attributes for variable = memberName in granule =
        granuleIdentifier</gco:Record>
    </gmd: otherAttributeValue>
  </gmd: SampleDimension >
</gmd: dimension >
```

A.19 SC_CRS
Coordinate reference system documented according to *ISO/TS19111:2003, Geographic information – Spatial referencing by coordinates*.

A.20 TM_PeriodDuration
Time span of an object or an event. A TM_PeriodDuration of 5 year, 1 months, 6 days, 12 hours, and 35 minutes is represented by P5Y1M6DT10H35M. Any subset of this representation is allowed a long as one unit is represented, e.g., a period duration of minus 80 days is represented as –P80D (see *ISO19108:2003, Geographic information – Temporal schema*, clause 5.2.3.7).

A.21 TM_Primitive
TM_Primitive is an abstract data type for temporal geometric primitives (TM_Instant and TM_Period) and temporal topological primitives (TM_Node and TM_Edge), (see *ISO19108:2003, Geographic information – Temporal schema*, clause 5.2.2).

A.22 Type
Any acceptable data type.

A.23 UnitOfMeasure
A quantity adopted as a standard unit of measure, e.g., metre, degree, kilogram. (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.7.3).

A.24 UomLength
Reference quantities to express the value of a length, e.g., metre (see *ISO/TS19103:2005, Geographic information – Conceptual schema language*, clause 6.5.7.8).

A.25 URL
A uniform resource locator, e.g., http://napmetadata.org

A.26 Anchor
Anchor can be used as a substitute for a characterString when you want to restrict the free text to a controlled vocabulary.

Ex:
<gmx:Anchor xlink:href="http://www.rvdata.us/voc/port#101065">Pearl Harbor, HI</gmx:Anchor>

This restricts the field to the controlled vocabulary located at http://www.rvdata.us/voc/port and selects the term as defined.

ANNEX B. COMMONLY USED ISO CODES

B.1 ISO 639-2/T Three-letter Language Codes
English = eng
Spanish = spa
French = fre

B.2 ISO 3166-1 Country Codes
Canada
Short name: Canada
Alpha-2: CA
Alpha-3: CAN
Numeric: 124

United Mexican States
Short name: Mexico
Alpha-2: MX
Alpha-3: MEX
Numeric: 484

United States of America
Short name: United States
Alpha-2: US
Alpha-3: USA
Numeric: 840

ANNEX C. CODELISTS

ISO codeLists are located at http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml and are listed below. (For NAP codeLists, go to http://www.geoconnections.org/developersCorner/nap/metadata/register/registerItemClasses.html#IC_97).

C.1 CI_DateTypeCode – identification of when a given event occurred

Name	Domain code	Definition
creation	001	date identifies when the resource was brought into existence
publication	002	date identifies when the resource was issued
revision	003	date identifies when the resource was examined or re-examined and improved or amended

C.2 CI_OnlineFunctionCode – function performed by the resource

Name	Domain code	Definition
download	001	online instructions for transferring data from one storage device or system to another
information	002	online information about the resource
offlineAccess	003	online instructions for requesting the resource from the provider
order	004	online order process for obtaining the resource
search	005	online search interface for seeking out information about the resource

C.3 CI_PresentationFormCode – mode in which the data is represented

Name	Domain code	Definition
documentDigital	001	digital representation of a primarily textual item (can contain illustrations also)
documentHardcopy	002	representation of a primarily textual item (can contain illustrations also) on paper, photo-graphic material, or other media
imageDigital	003	likeness of natural or man-made features, objects, and activities acquired through the sensing of visual or any other segment of the electromagnetic spectrum by sensors, such as thermal infrared, and high resolution radar and stored in digital format
imageHardcopy	004	likeness of natural or man-made features, objects, and activities acquired through the sensing of visual or any other segment of the electromagnetic spectrum by sensors, such as thermal infrared, and high-resolution radar and reproduced on paper, photographic material, or other media for use directly by the human user
mapDigital	005	map represented in raster or vector form
mapHardcopy	006	map printed on paper, photographic material, or other media for use directly by the human user

modelDigital	007	multi-dimensional digital representation of a feature, process, etc.
modelHardcopy	008	3-dimensional, physical model
profileDigital	009	vertical cross-section in digital form
profileHardcopy	010	vertical cross-section printed on paper, etc.
tableDigital	011	digital representation of facts or figures systematically displayed, especially in columns
tableHardcopy	012	representation of facts or figures systematically displayed, especially in columns, printed on paper, photographic material, or other media
videoDigital	013	digital video recording
videoHardcopy	014	video recording on film

C.4 CI_RoleCode – function performed by the responsible party

Name	Domain code	Definition
resourceProvider	001	party that supplies the resource
custodian	002	party that accepts accountability and respon-sibility for the data and ensures appropriate care and maintenance of the resource
owner	003	party that owns the resource
user	004	party who uses the resource
distributor	005	party who distributes the resource
originator	006	party who created the resource
pointOfContact	007	party who can be contacted for acquiring knowledge about or acquisition of the resource
principalInvestigator	008	key party responsible for gathering information and conducting research
processor	009	party who has processed the data in a manner such that the resource has been modified
publisher	010	party who published the resource
author	011	party who authored the resource

C.5 DQ_EvaluationMethodTypeCode – type of method for evaluating an identified data quality measure

Name	Domain code	Definition
directInternal	001	method of evaluating the quality of a dataset based on inspection of items within the dataset, where all data required is internal to the dataset being evaluated
directExternal	002	method of evaluating the quality of a dataset based on inspection of items within the dataset, where reference data external to the dataset being evaluated is required
indirect	003	method of evaluating the quality of a dataset based on external knowledge

C.6 DS_AssociationTypeCode – justification for the correlation of two datasets

Name	Domain code	Definition
crossReference	001	reference from one dataset to another
largerWorkCitation	002	reference to a master dataset of which this one is a part
partOfSeamlessDatabase	003	part of same structured set of data held in a computer
source	004	mapping and charting information from which the dataset content originates
stereoMate	005	part of a set of imagery that when used together, provides three-dimensional images

C.7 DS_InitiativeTypeCode – type of aggregation activity in which datasets are related

Name	Domain code	Definition
campaign	001	series of organized planned actions
collection	002	accumulation of datasets assembled for a specific purpose
exercise	003	specific performance of a function or group of functions
experiment	004	process designed to find if something is effective or valid
investigation	005	search or systematic inquiry
mission	006	specific operation of a data collection system
sensor	007	device or piece of equipment which detects or records
operation	008	action that is part of a series of actions
platform	009	vehicle or other support base that holds a sensor
process	010	method of doing something involving a number of steps
program	011	specific planned activity
project	012	organized undertaking, research, or development
study	013	examination or investigation
task	014	piece of work
trial	015	process of testing to discover or demonstrate something

C.8 MD_CellGeometryCode – code indicating whether grid data is point or area

Name	Domain code	Definition
point	001	each cell represents a point
area	002	each cell represents an area

C.9 MD_CharacterSetCode – name of the character coding standard used for the resource

Name	Domain code	Definition
ucs2	001	16-bit fixed size Universal Character Set, based on ISO/IEC 10646
ucs4	002	32-bit fixed size Universal Character Set, based on ISO/IEC 10646
utf7	003	7-bit variable size UCS Transfer Format, based on ISO/IEC 10646

utf8	004	8-bit variable size UCS Transfer Format, based on ISO/IEC 10646
utf16	005	16-bit variable size UCS Transfer Format, based on ISO/IEC 10646
8859part1	006	ISO/IEC 8859-1, Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1
8859part2	007	ISO/IEC 8859-2, Information technology – 8-bit single-byte coded graphic character sets – Part 2: Latin alphabet No. 2
8859part3	008	ISO/IEC 8859-3, Information technology – 8-bit single-byte coded graphic character sets – Part 3: Latin alphabet No. 3
8859part4	009	ISO/IEC 8859-3, Information technology – 8-bit single-byte coded graphic character sets – Part 3: Latin alphabet No. 4
8859part5	010	ISO/IEC 8859-51, Information technology – 8-bit single-byte coded graphic character sets – Part 5: Latin/Cyrillic alphabet
8859part6	011	ISO/IEC 8859-6, Information technology – 8-bit single-byte coded graphic character sets – Part 6: Latin/Arabic alphabet
8859part7	012	ISO/IEC 8859-7, Information technology – 8-bit single-byte coded graphic character sets – Part 7: Latin/Greek alphabet
8859part8	013	ISO/IEC 8859-8, Information technology – 8-bit single-byte coded graphic character sets – Part 8: Latin/Hebrew alphabet
8859part9	014	ISO/IEC8859-9, Information technology – 8-bit single-byte coded graphic character sets – Part 9: Latin alphabet No. 5
8859part10	015	ISO/IEC 8859-10, Information technology – 8-bit single-byte coded graphic character sets – Part 10: Latin alphabet No. 6
8859part11	016	ISO/IEC 8859-11, Information technology – 8-bit single-byte coded graphic character sets – Part 11: Latin/Thai alphabet
(reserved for future use)	017	a future ISO/IEC 8-bit single-byte coded graphic character set (e.g., possibly 8859 part 12)
8859part13	018	ISO/IEC 8859-13, Information technology – 8-bit single-byte coded graphic character sets – Part 13: Latin alphabet No. 7
8859part14	019	ISO/IEC 8859-14, Information technology – 8-bit single-byte coded graphic character sets – Part 14: Latin alphabet No. 8 (Celtic)
8859part15	020	ISO/IEC 8859-15, Information technology – 8-bit single-byte coded graphic character sets – Part 15: Latin alphabet No. 9
8859part16	021	ISO/IEC 8859-16, Information technology – 8-bit single-byte coded graphic character sets – Part 16: Latin alphabet No. 10

Jis	022	japanese code set used for electronic transmission
shiftJIS	023	japanese code set used on MS-DOS based machines
eucJP	024	japanese code set used on UNIX based machines
usAscii	025	united states ASCII code set (ISO 646 US)
ebcdic	026	ibm mainframe code set
eucKR	027	korean code set
big5	028	traditional Chinese code set used in Taiwan, Hong Kong of China and other areas
GB2312	029	simplified Chinese code set

C.10 MD_ClassificationCode – name of the handling restrictions on the dataset

Name	Domain code	Definition
unclassified	001	available for general disclosure
restricted	002	not for general disclosure
confidential	003	available for someone who can be entrusted with information
secret	004	kept or meant to be kept private, unknown, or hidden from all but a select group of people
topSecret	005	of the highest secrecy

C.11 MD_CoverageContentTypeCode – specific type of information represented in the cell

Name	Domain code	Definition
image	001	meaningful numerical representation of a physical parameter that is not the actual value of the physical parameter
thematicClassification	002	code value with no quantitative meaning, used to represent a physical quantity
physicalMeasurement	003	value in physical units of the quantity being measured

C.12 MD_DatatypeCode – datatype of element or entity

Name	Domain code	Definition
class	001	descriptor of a set of objects that share the same attributes, operations, methods, relationships, and behavior
codelist	002	flexible enumeration useful for expressing a long list of values, can be extended
enumeration	003	data type whose instances form a list of named literal values, not extendable
codelistElement	004	permissible value for a codelist or enumeration
abstractClass	005	class that cannot be directly instantiated
aggregateClass	006	class that is composed of classes it is connected to by an aggregate relationship
specifiedClass	007	subclass that may be substituted for its superclass

datatypeClass	008	class with few or no operations whose primary purpose is to hold the abstract state of another class for transmittal, storage, encoding or persistent storage
interfaceClass	009	named set of operations that characterize the behavior of an element
unionClass	010	class describing a selection of one of the specified types
metaClass	011	class whose instances are classes
typeClass	012	class used for specification of a domain of instances (objects), together with the operations applicable to the objects. A type may have attributes and associations
characterString	013	free text field
integer	014	numerical field
association	015	semantic relationship between two classes that involves connections among their instances

C.13 MD_DimensionNameTypeCode – name of the dimension

Name	Domain code	Definition
row	001	ordinate (y) axis
column	002	abscissa (x) axis
vertical	003	vertical (z) axis
track	004	along the direction of motion of the scan point
crossTrack	005	perpendicular to the direction of motion of the scan point
line	006	scan line of a sensor
sample	007	element along a scan line
time	008	duration

C.14 MD_GeometricObjectTypeCode – name of point or vector objects used to locate zero-, one-, two-, or three-dimensional spatial locations in the dataset

Name	Domain code	Definition
complex	001	set of geometric primitives such that their boundaries can be represented as a union of other primitives
composite	002	connected set of curves, solids or surfaces
curve	003	bounded, 1-dimensional geometric primitive, representing the continuous image of a line
point	004	zero-dimensional geometric primitive, representing a position but not having an extent
solid	005	bounded, connected 3-dimensional geometric primitive, representing the continuous image of a region of space
surface	006	bounded, connected 2-dimensional geometric primitive, representing the continuous image of a region of a plane

C.15 MD_ImagingConditionCode – code which indicates conditions which may affect the image

Name	Domain code	Definition
blurredImage	001	portion of the image is blurred
cloud	002	portion of the image is partially obscured by cloud cover
degradingObliquity	003	acute angle between the plane of the ecliptic (the plane of the Earth's orbit) and the plane of the celestial equator
fog	004	portion of the image is partially obscured by fog
heavySmokeOrDust	005	portion of the image is partially obscured by heavy smoke or dust
night	006	image was taken at night
rain	007	image was taken during rainfall
semiDarkness	008	image was taken during semi-dark conditions—twilight conditions
shadow	009	portion of the image is obscured by shadow
snow	010	portion of the image is obscured by snow
terrainMasking	011	the absence of collection data of a given point or area caused by the relative location of topographic features which obstruct the collection path between the collector(s) and the subject(s) of interest

C.16 MD_KeywordTypeCode – methods used to group similar keywords

Name	Domain code	Definition
discipline	001	keyword identifies a branch of instruction or specialized learning
place	002	keyword identifies a location
stratum	003	keyword identifies the layer(s) of any deposited substance
temporal	004	keyword identifies a time period related to the dataset
theme	005	keyword identifies a particular subject or topic
taxon	006	Keyword identifies a taxonomy of the dataset

C.17 MD_MaintenanceFrequencyCode – frequency with which modifications and deletions are made to the data after it is first produced

Name	Domain code	Definition
continual	001	data is repeatedly and frequently updated
daily	002	data is updated each day
weekly	003	data is updated on a weekly basis
fortnightly	004	data is updated every two weeks
monthly	005	data is updated each month
quarterly	006	data is updated every three months
biannually	007	data is updated twice each year
annually	008	data is updated every year
asNeeded	009	data is updated as deemed necessary
irregular	010	data is updated in intervals that are uneven in duration
notPlanned	011	there are no plans to update the data
unknown	012	frequency of maintenance for the data is not known

C.18 MD_MediumFormatCode – method used to write to the medium

Name	Domain code	Definition
cpio	001	Copy In / Out (UNIX file format and command)
tar	002	Tape ARchive
highSierra	003	high sierra file system
iso9660	004	information processing – volume and file structure of CD-ROM
iso9660RockRidge	005	rock ridge interchange protocol (UNIX)
iso9660AppleHFS	006	hierarchical file system (Macintosh)

C.19 MD_MediumNameCode – name of the medium

Name	Domain code	Definition
cdRom	001	read-only optical disk
dvd	002	digital versatile disk
dvdRom	003	digital versatile disk, read only
3halfInchFloppy	004	3.5 inch magnetic disk
5quarterInchFloppy	005	5.25 inch magnetic disk
7trackTape	006	7 track magnetic tape
9trackTape	007	9 track magnetic tape
3480Cartridge	008	3480 cartridge tape drive
3490Cartridge	009	3490 cartridge tape drive
3580Cartridge	010	3580 cartridge tape drive
4mmCartridgeTape	011	4 millimeter magnetic tape
8mmCartridgeTape	012	8 millimeter magnetic tape
1quarterInchCartridgeTape	013	0.25 inch magnetic tape
digitalLinearTape	014	half inch cartridge streaming tape drive
onLine	015	direct computer linkage
satellite	016	linkage through a satellite communication system
telephoneLink	017	communication through a telephone network
hardcopy	018	Pamphlet/leaflet giving descriptive information

C.20 MD_ObligationCode – obligation of the element or entity

Name	Domain code	Definition
mandatory	001	element is always required
optional	002	element is not required
conditional	003	element is required when a specific condition is met

C.21 MD_PixelOrientationCode – point in a pixel corresponding to the Earth location of the pixel

Name	Domain code	Definition
center	001	point halfway between the lower left and the upper right of the pixel
lowerLeft	002	the corner in the pixel closest to the origin of the SRS; if two are at the same distance from the origin, the one with the smallest x-value
lowerRight	003	next corner counterclockwise from lower left
upperRight	004	next corner counterclockwise from lower right
upperLeft	005	next corner counterclockwise from upper right

C.22 MD_ProgressCode – status of the dataset or progress of a review

Name	Domain code	Definition
completed	001	production of the data has been completed
historicalArchive	002	data has been stored in an offline storage facility
obsolete	003	data is no longer relevant
onGoing	004	data is continually being updated
planned	005	fixed date has been established upon or by which the data will be created or updated
required	006	data needs to be generated or updated
underDevelopment	007	data is currently in the process of being created

C.23 MD_RestrictionCode – limitation(s) placed upon the access or use of the data

Name	Domain code	Definition
copyright	001	exclusive right to the publication, production, or sale of the rights to a literary, dramatic, musical, or artistic work, or to the use of a commercial print or label, granted by law for a specified period of time to an author, composer, artist, distributor
patent	002	government has granted exclusive right to make, sell, use or license an invention or discovery
patentPending	003	produced or sold information awaiting a patent
trademark	004	a name, symbol, or other device identifying a product, officially registered and legally restricted to the use of the owner or manufacturer
license	005	formal permission to do something
intellectualPropertyRights	006	rights to financial benefit from and control of distribution of non-tangible property that is a result of creativity
restricted	007	withheld from general circulation or disclosure
otherRestrictions	008	limitation not listed

C.24 MD_ScopeCode – class of information to which the referencing entity applies

Name	Domain code	Definition
attribute	001	information applies to the attribute class
attributeType	002	information applies to the characteristic of a feature
collectionHardware	003	information applies to the collection hardware class
collectionSession	004	information applies to the collection session
dataset	005	information applies to the dataset
series	006	information applies to the series
nonGeographicDataset	007	information applies to nongeographic data
dimensionGroup	008	information applies to a dimension group
feature	009	information applies to a feature

featureType	010	information applies to a feature type
propertyType	011	information applies to a property type
fieldSession	012	information applies to a field session
software	013	information applies to a computer program or routine
service	014	information applies to a capability which a service provider entity makes available to a service user entity through a set of interfaces that define a behaviour, such as a use case
model	015	information applies to a copy or imitation of an existing or hypothetical object
tile	016	information applies to a tile, a spatial subset of geographic data

C.25 MD_SpatialRepresentationTypeCode – method used to represent geographic information in the dataset

Name	Domain code	Definition
vector	001	vector data is used to represent geographic data
grid	002	grid data is used to represent geographic data
textTable	003	textual or tabular data is used to represent geographic data
tin	004	triangulated irregular network
stereoModel	005	three-dimensional view formed by the intersecting homologous rays of an overlapping pair of images
video	006	scene from a video recording

C.26 MD_TopicCategoryCode – high-level geographic data thematic classification to assist in the grouping and search of available geographic data sets. Can be used to group keywords as well. Listed examples are not exhaustive. **NOTE:** It is understood there are overlaps between general categories and the user is encouraged to select the one most appropriate.

Name	Domain code	Definition
farming	001	rearing of animals and/or cultivation of plants Examples: agriculture, irrigation, aquaculture, plantations, herding, pests and diseases affecting crops and livestock
biota	002	flora and/or fauna in natural environment Examples: wildlife, vegetation, biological sciences, ecology, wilderness, sealife, wetlands, habitat
boundaries	003	legal land descriptions Examples: political and administrative boundaries
climatologyMeteorologyAtmosphere	004	processes and phenomena of the atmosphere Examples: cloud cover, weather, climate, atmospheric conditions, climate change, precipitation
economy	005	economic activities, conditions and employment Examples: production, labour, revenue,

		commerce, industry, tourism and ecotourism, forestry, fisheries, commercial or subsistence hunting, exploration and exploita-tion of resources such as minerals, oil and gas
elevation	006	height above or below sea level Examples: altitude, bathymetry, digital elevation models, slope, derived products
environment	007	environmental resources, protection and conservation Examples: environmental pollution, waste storage and treatment, environmental impact assessment, monitoring environmental risk, nature reserves, landscape
geoscientificInformation	008	information pertaining to earth sciences Examples: geophysical features and processes, geology, minerals, sciences dealing with the composition, structure and origin of the earth's rocks, risks of earth-quakes, volcanic activity, landslides, gravity information, soils, permafrost, hydrogeology, erosion
health	009	health, health services, human ecology, and safety Examples: disease and illness, factors affecting health, hygiene, substance abuse, mental and physical health, health services
imageryBaseMapsEarthCover	010	base maps Examples: land cover, topographic maps, imagery, unclassified images, annotations
intelligenceMilitary	011	military bases, structures, activities Examples: barracks, training grounds, military transportation, information collection
inlandWaters	012	inland water features, drainage systems and their characteristics Examples: rivers and glaciers, salt lakes, water utilization plans, dams, currents, floods, water quality, hydrographic charts
location	013	positional information and services Examples: addresses, geodetic networks, control points, postal zones and services, place names
oceans	014	features and characteristics of salt water bodies (excluding inland waters) Examples: tides, tidal waves, coastal information, reefs
planningCadastre	015	information used for appropriate actions for future use of the land Examples: land use maps, zoning maps, cadastral surveys, land ownership
society	016	characteristics of society and cultures Examples: settlements, anthropol-ogy, archaeology, education, traditional beliefs,

		manners and customs, demographic data, recreational areas and activities, social impact assessments, crime and justice, census information
structure	017	man-made construction Examples: buildings, museums, churches, factories, housing, monuments, shops, towers
transportation	018	means and aids for conveying persons and/or goods Examples: roads, airports/airstrips, shipping routes, tunnels, nautical charts, vehicle or vessel location, aeronautical charts, railways
utilitiesCommunication	019	energy, water and waste systems and communications infrastructure and services Examples: hydroelectricity, geothermal, solar and nuclear sources of energy, water purification and distribution, sewage collection and disposal, electricity and gas distribution, data communication, telecommuni-cation, radio, communication networks

C.27 MD_TopologyLevelCode – degree of complexity of the spatial relationships

Name	Domain code	Definition
geometryOnly	001	geometry objects without any additional structure which describes topology
topology1D	002	1-dimensional topological complex, commonly called "chain-node" topology
planarGraph	003	1-dimensional topological complex that is planar. (A planar graph is a graph that can be drawn in a plane in such a way that no two edges intersect except at a vertex.)
fullPlanarGraph	004	2-dimensional topological complex that is planar. (A 2-dimensional topological complex is commonly called "full topology" in a cartographic 2D environment.)
surfaceGraph	005	1-dimensional topological complex that is isomorphic to a subset of a surface. (A geometric complex is isomorphic to a topological complex if their elements are in a one-to-one, dimensional- and boundary-preserving correspondence to one another.)
fullSurfaceGraph	006	2-dimensional topological complex that is isomorphic to a subset of a surface
topology3D	007	3-dimensional topological complex. (A topological complex is a collection of topological primitives that are closed under the boundary operations.)
fullTopology3D	008	complete coverage of a 3D Euclidean coordinate space
abstract	009	topological complex without any specified geometric realisation

ANNEX D. Units

D.1 BaseUnit

Name	Unit Symbol	Quantity
metre	m	length
kilogram	kg	mass
second	s	time
ampere	A	electric current
kelvin	K	thermodynamic temperature
candela	cd	luminous intensity
mole	mol	amount of substance

BaseUnit – A base unit is a unit of measure that cannot be derived by combination of other base units within a particular system of units. For example, in the SI system of units, the base units are metre, kilogram, second, ampere, kelvin, mole, and candela, for the physical quantity types length, mass, time interval, electric current, thermodynamic temperature, amount of substance and luminous intensity, respectively.

> Type: compound
> Multiplicity: optional
> Attributes: id
> Best Practices: The id attribute is mandatory. It is recommended to reference the International System of Units (SI) at http://www.bipm.org/en/si/.

> identifier – Special identifier assigned to the unit by the maintaining authority.
> > Multiplicity: mandatory
> > Attributes: codeSpace
> > Best Practices: The codeSpace attribute is mandatory.

> unitsSystem – Reference to the maintaining authority or system of the unit.
> > Multiplicity: mandatory
> > Attributes: type, href, role, arcrole, title, show, actuate, uuidref, nilReason

Ex:

```
<gml:BaseUnit gml:id="lengthUnit">
   <gml:identifier codeSpace="meters"/>
   <gml:unitsSystem xlink:href="http://www.bipm.org/en/si/"/>
</gml:BaseUnit>
```

D.2 DerivedUnit

DerivedUnit - Units formed from the multiplication and division of the seven base units.

> Type: compound
> Multiplicity: optional
> Attributes: id
> Best Practices: The id attribute is mandatory.

FAQ: **What is an example of a derived unit?**

Name	Unit Symbol	Quantity
metre per second	m/s	unit of speed
ohm	Ω ($m^2 * kg * s^{-3} * A^{-2}$)	electrical resistance

identifier - Special identifier assigned to the unit by the maintaining authority.
> Multiplicity: mandatory
> Attributes: codeSpace
> Best Practices: The codeSpace attribute is mandatory.

derivationUnitTerm - Describes a derived unit of measure. This unit term references another unit of measure (uom) and provides an integer exponent applied to that unit in defining the compound unit.
> Multiplicity: mandatory, repeatable
> Attributes: uom, exponent
> Best Practices: The uom attribute is mandatory. The exponent attribute may be positive or negative, but not zero.

FAQ: **How would you document mass density measured in kg/m^3?**
```
<gml:DerivedUnit gml:id="massDensity">
        <gml:identifier codeSpace="mass density"/>
        <gml:derivationUnitTerm uom="kg" exponent="1"/>
        <gml:derivationUnitTerm uom="m" exponent="-3"/>
</gml:DerivedUnit>
```

D.3 ConventionalUnit

ConventionalUnit - A unit of measure for which there is a conversion to a Base Unit.
> Type: compound
> Multiplicity: optional
> Attributes: id
> Best Practices: The id attribute is mandatory.

identifier - Special identifier assigned to the unit by the maintaining authority.
> Multiplicity: mandatory
> Attributes: codeSpace
> Best Practices: The codeSpace attribute is mandatory.

conversionToPreferredUnit – Parameters used to convert conventional units to preferred units.
> Type: factor or formula
> Multiplicity: conditional
> Attributes: uom
> Best Practices: There must be one occurrence of either conversionToPreferredUnit or roughConversionUnit. The uom attribute is mandatory.

factor – Scale factor for the conversion.
        Domain: any number
        Multiplicity: conditional
        Best Practices: There must be one occurrence of either factor or formula.

formula – Formula for the conversion.
        Type: compound
        Multiplicity: conditional
        Best Practices: There must be once occurrence of either factor or formula. Formula
        consists of the elements a, b, c and d. b and c are mandatory.

roughConversionToPreferredUnit – Parameters used to convert conventional units to preferred units.
        Type: factor or formula
        Multiplicity: conditional
        Attributes: uom
        Best Practices: There must be one occurrence of either conversionToPreferredUnit or
        roughConversionUnit. The uom attribute is mandatory.

factor – Scale factor for the conversion.
        Domain: any number
        Multiplicity: conditional
        Best Practices: There must be one occurrence of either factor or formula.

FAQ: How would you show the conversion for the unit 'foot' to 'meters' using the factor element?

```
<gml:ConventionalUnit gml:id="ft">
        <gml:identifier codeSpace="foot"/>
        <gml:conversionToPreferredUnit uom="m">
                <gml:factor>0.305</gml:factor>
        </gml:conversionToPreferredUnit>
</gml:ConventionalUnit>
```

In this case the factor element contains a scale factor of 0.305. The scale factor is multiplied by the value of the conventional unit of measure (foot) to obtain the corresponding value for the preferred unit of measure (meter).

---

formula – Formula for the conversion.
        Type: compound
        Multiplicity: conditional
        Best Practices: There must be once occurrence of either factor or formula. Formula
        consists of the elements a, b, c and d; b and c are mandatory.

FAQ: How would you show the conversion for the unit 'Celsius' to 'Kelvin' using the formula element?

```
<gml:ConventionalUnit gml:id="degC">
        <gml:identifier codeSpace="degree Celsius"/>
        <gml:conversionToPreferredUnit uom="K">
                <gml:formula>
```

```
                        <gml:a>273.15</gml:a>
                        <gml:b>1</gml:b>
                        <gml:c>1</gml:c>
                    </gml:formula>
                </gml:conversionToPreferredUnit>
            </gml:ConventionalUnit>
```

The formula element can contain the four elements, a, b, c, and d, whose values provide the parameters for converting the value of the conventional unit of measure (degrees Celsius) to the corresponding value for the preferred unit of measure (Kelvin). The values of the elements a, b, c and d are used in the formula y = (a + bx) / (c + dx), where x is a value using the current unit, and y is the corresponding value using the preferred unit. Elements a and d are optional. If those values are not provided, then those parameters are considered to be zero. The example above shows the conversion of Celsius to Kelvin so the formula becomes:

K = 273.15 + C

Unified Modeling Language (UML) is used to represent the relationships among classes and objects in object oriented programming.

E.1 UML Notation
Relationships can be represented in the ISO UML models as associations, aggregations, compositions, generalizations, and dependencies.
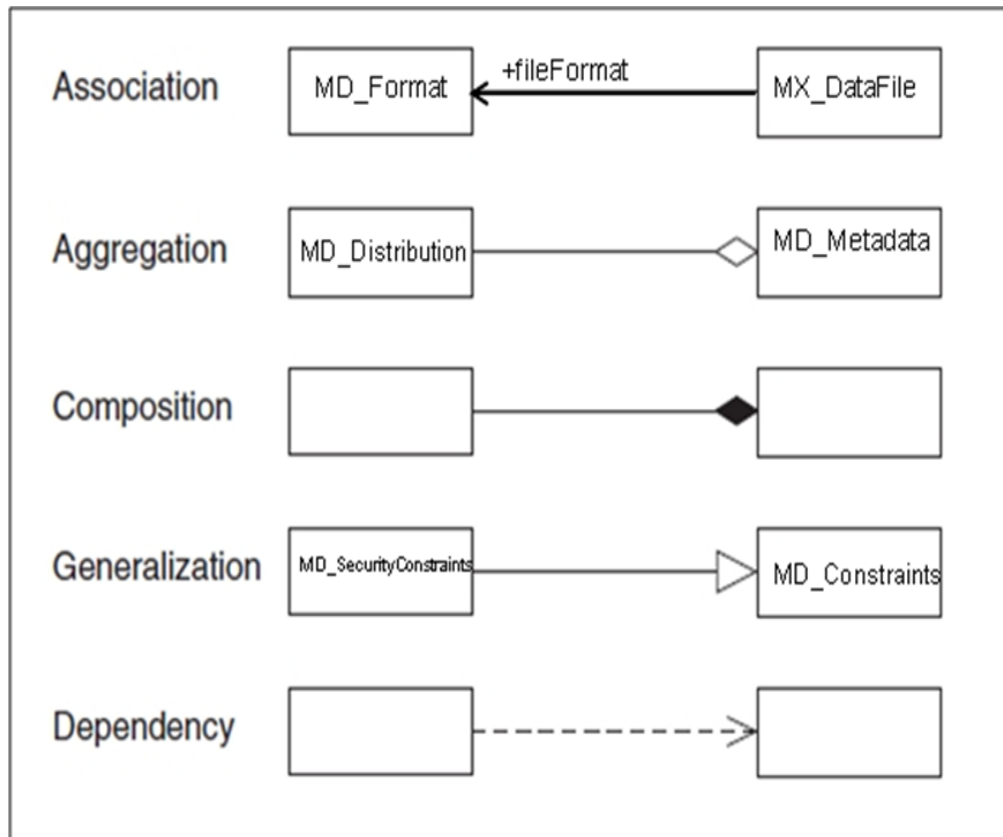
Association
Associations are general relationships between classes, if direction is not specified it is assumed to be a two-way association. Arrows marking an end of a line mark the direction of an association. The model will also show the 'role' of the target object in relation to the source object.

Aggregation
Aggregations are when one class is the 'container' and the other class is within/inside

   Ex: MD_Metadata 'contains' MD_Distribution

Composition
Compositions are also known as strong aggregations. Compositions are used when the parts inside the container cannot exist without the container. If the container is deleted, then all of the objects 'inside' the container are deleted as well.

Generalization
Generalizations show depict a superclass and subclasses that may be substituted for the superclass

Ex: General overall constraints are documents through MD_Constraints but the subclass MD_SecurityConstraints can substitute it's Superclass MD_Constraints (Security constraints has the same objects as MD_Constraints but also adds a few more objects to specifically deal with documenting constraints dealing with security.)
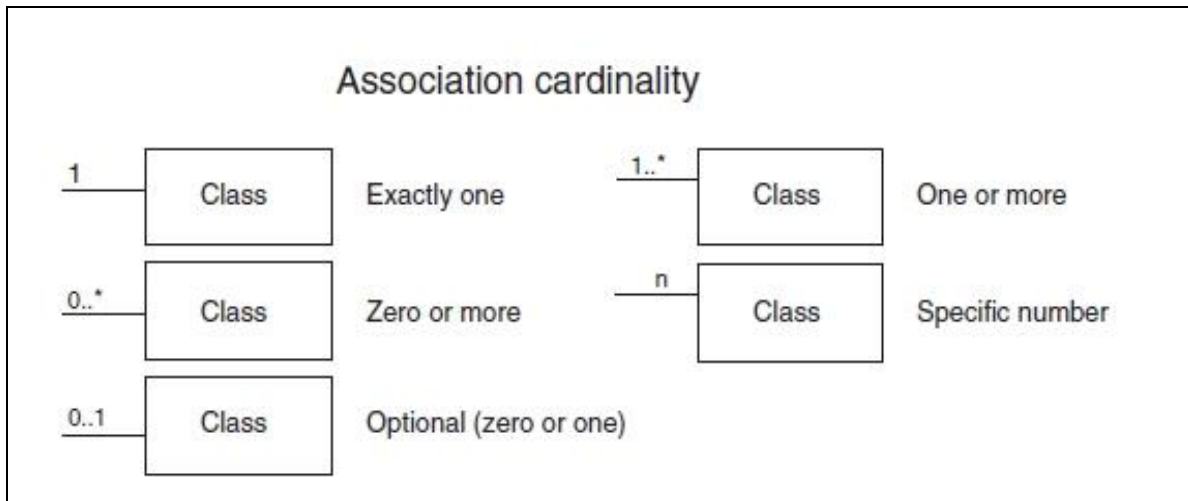
Dependency
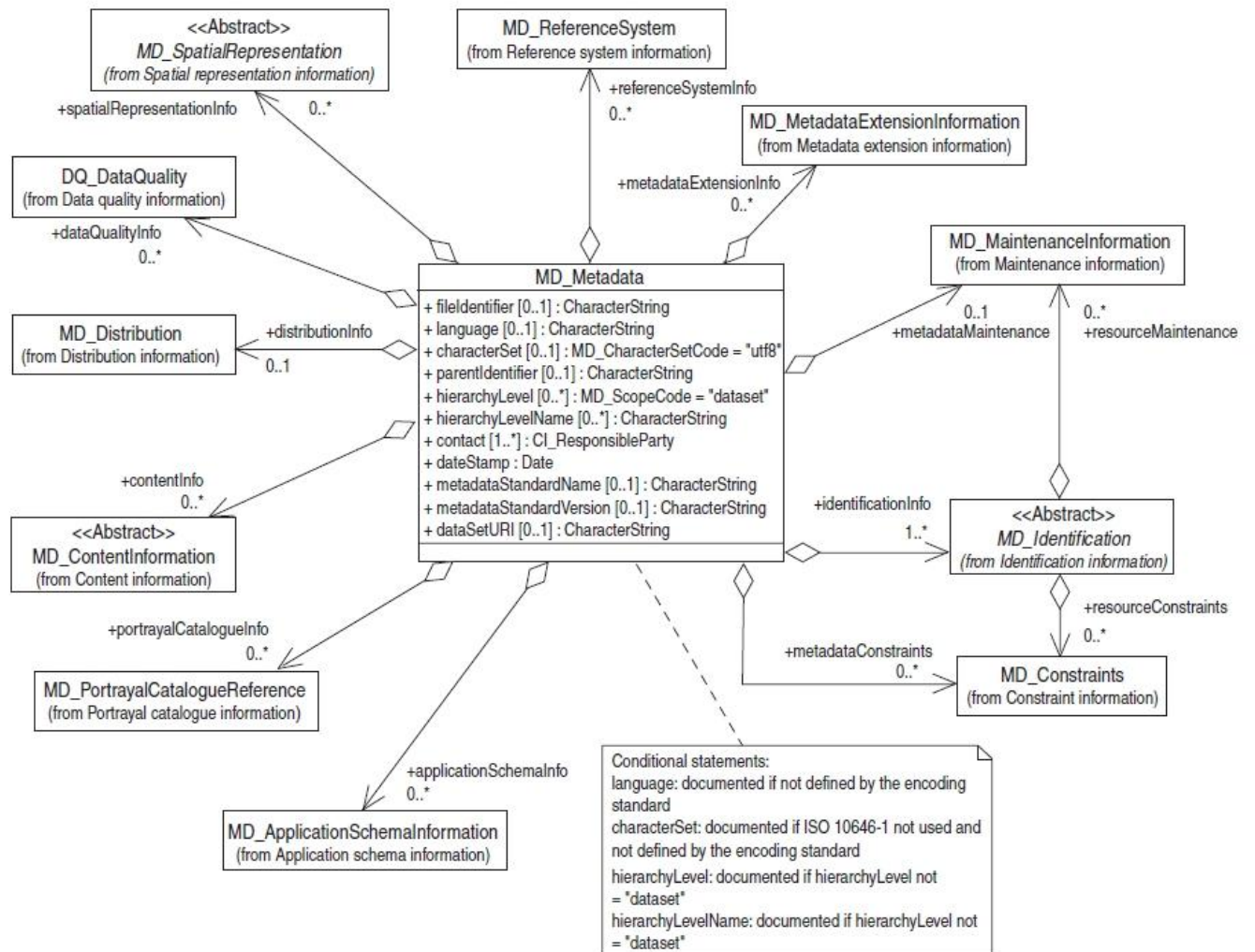Dependencies are also known as instantiation. Dependencies are kind of like an 'IF' statement.

Ex: If accessConstraints or useConstraints = "otherRestrictions" then "otherConstraints" must be used.

E.2 UML Cardinality
Multiplicity and cardinality are denoted on the UML associations to depict if classes are mandatory, optional, and how many times they may repeat as noted in the table below.
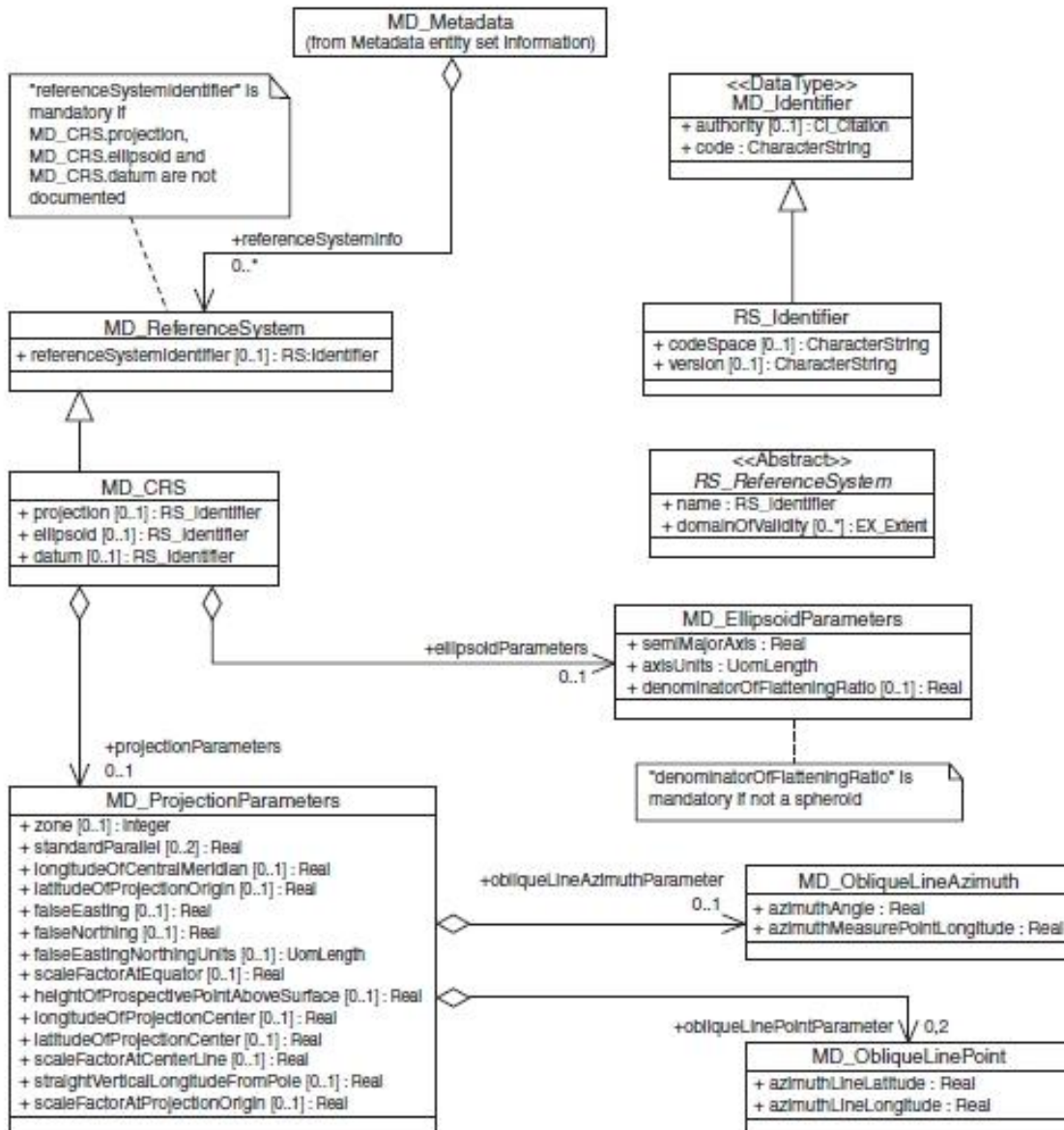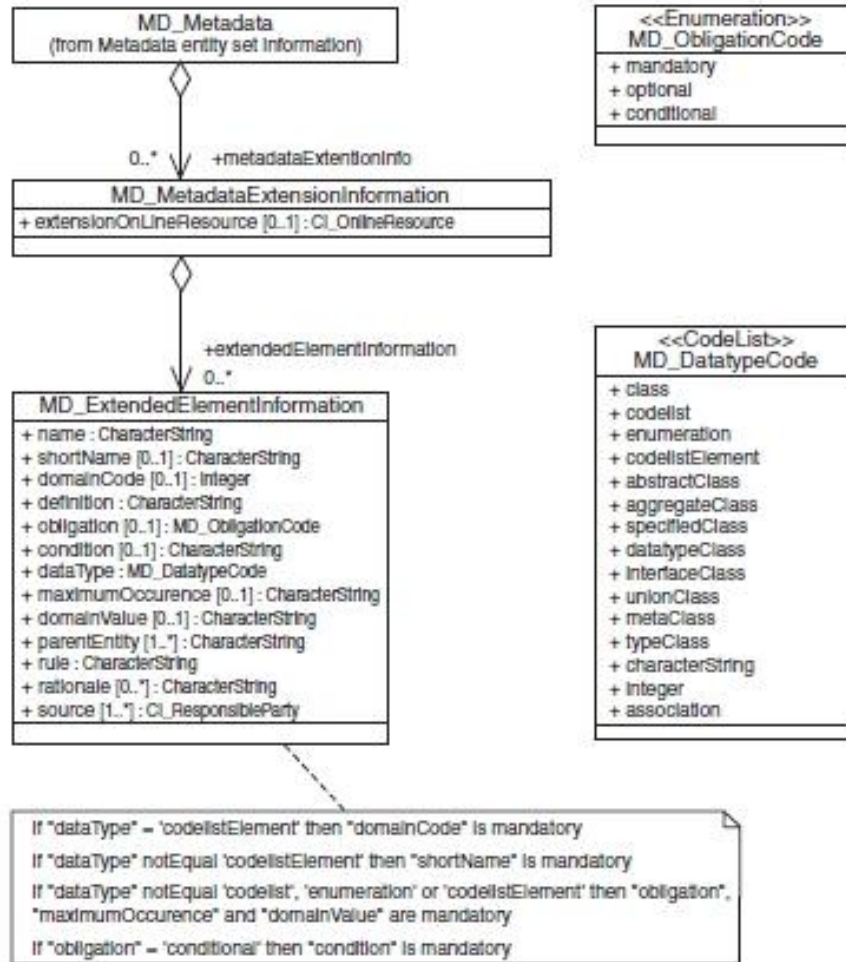
E.4 Spatial Representation UML

E.7 Identification (Data and Services) UML

MD_Identification
(from Identification information)

+ citation : CI_Citation
+ abstract : CharacterString
+ purpose [0..1] : CharacterString
+ credit [0..*] : CharacterString
+ status [0..*] : MD_ProgressCode
+ pointOfContact [0..*] : CI_ResponsibleParty

<<CodeList>>
DCPList

+ XML
+ CORBA
+ JAVA
+ COM
+ SQL
+ WebServices

<<enumeration>>
SV_ParameterDirection

+ in
+ out
+ in/out

<<CodeList>>
SV_CouplingType

+ loose
+ mixed
+ tight

characterSet: documented if ISO 10646-1 is not used
{MD_Metadata.hierarchyLevel = "dataset" implies count
(extent.geographicElement.EX_GeographicBoundingBox) + count
(extent.geographicElement.EX_GeographicDescription) >=1}
{MD_Metadata.hierarchyLevel notEqual "dataset" or "series"
implies topicCategory is not mandatory}

SV_ServiceIdentification

+ serviceType : GenericName
+ serviceTypeVersion[0..*] : CharacterString
+ accessProperties[0..1] : MD_StandardOrderProcess
+ restrictions[0..1] : MD_Constraints
+ extent[0..*] : EX_Extent
+ couplingType : SV_CouplingType
+ coupledResource[0..*] : SV_CoupleResource

+operatesOn

MD_DataIdentification
(from Identification information)

+ spatialRepresentationType [0..*] : MD_SpatialRepresentationTypeCode
+ spatialResolution [0..*] : MD_Resolution
+ language [1..*] : CharacterString
+ characterSet [0..*] : MD_CharacterSetCode = "utf8"
+ topicCategory [1..*] : MD_TopicCategoryCode
+ environmentDescription [0..1] : CharacterString
+ extent [0..*] : EX_Extent
+ supplementalInformation [0..1] : CharacterString

+dependsOn

+containsOperations 1..*   0..*

Dependencies

+operation

1..*
{ordered}

SV_OperationMetadata

+ operationName : CharacterString
+ DCP[1..*] : DCPList
+ operationDescription[0..1] : CharacterString
+ invocationName[0..1] : CharacterString
+ connectPoint[1..*] : CI_OnlineResource

name : MemberName

Chaining Metadata

SV_CoupledResource

+ identifier : CharacterString
+ operationName : CharacterString

SV_OperationChainMetadata

+ name : CharacterString
+ description[0..1] : CharacterString

+operation

1   +parameters

<<DataType>>
SV_Parameter

+ direction[0..1] : SV_ParameterDirection
+ description[0..1] : CharacterString
+ optionality : CharacterString = "Mandatory"
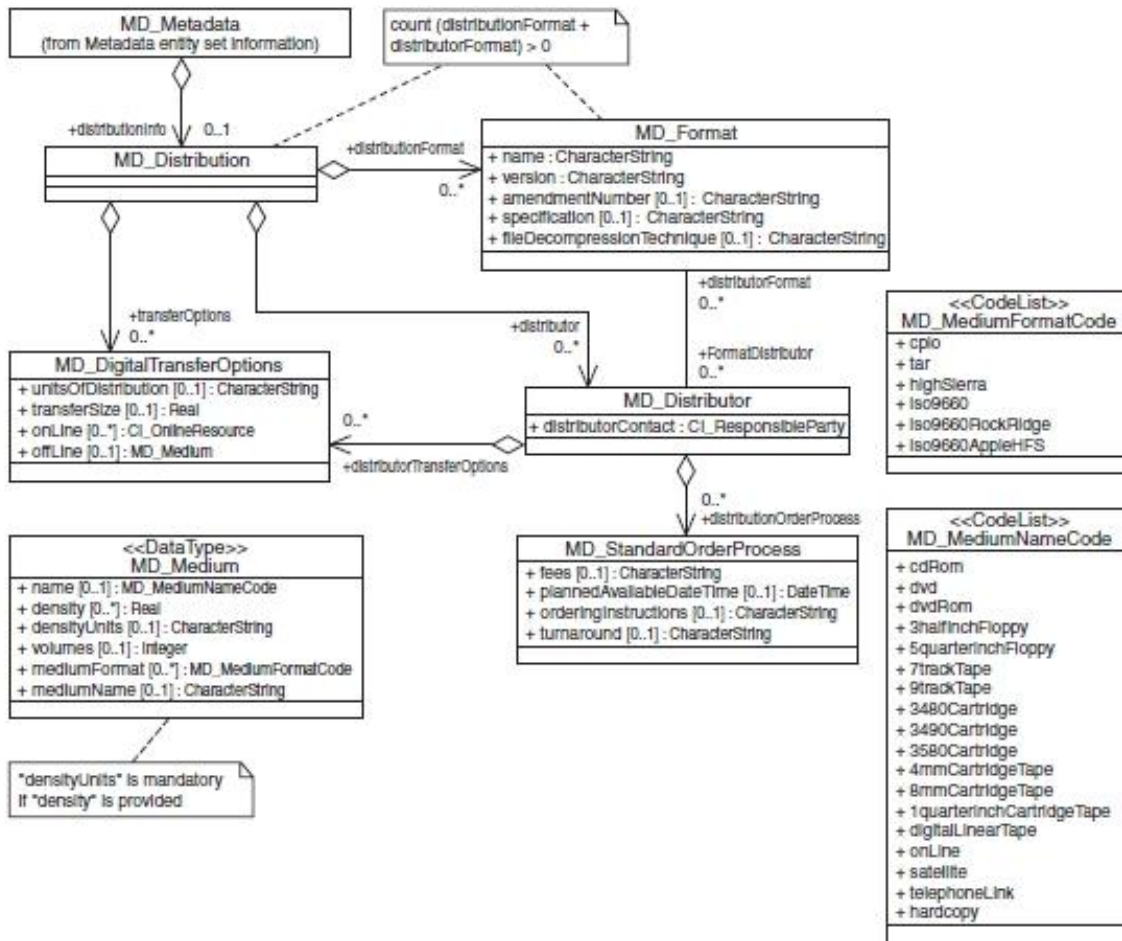+ repeatability : Boolean
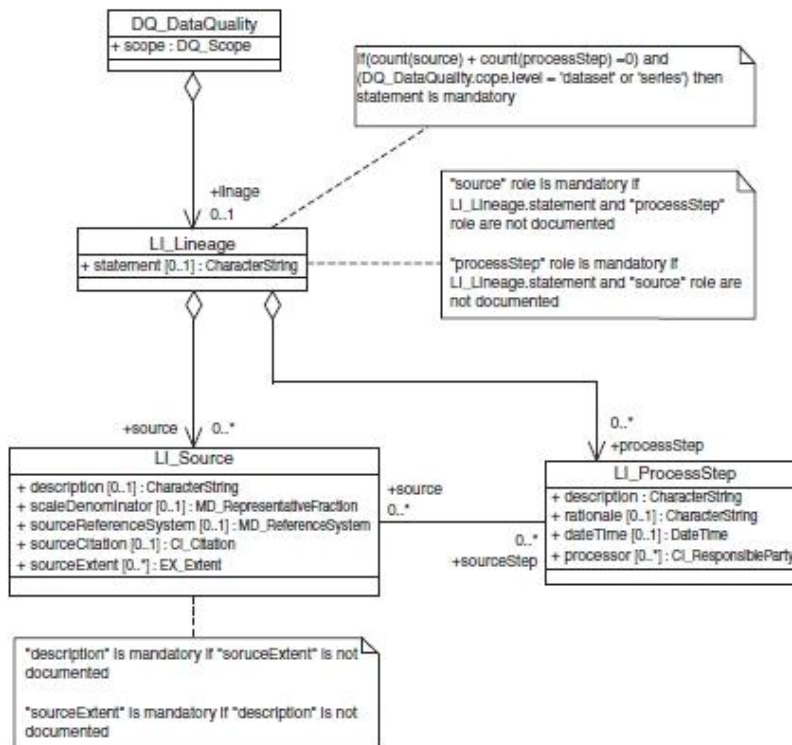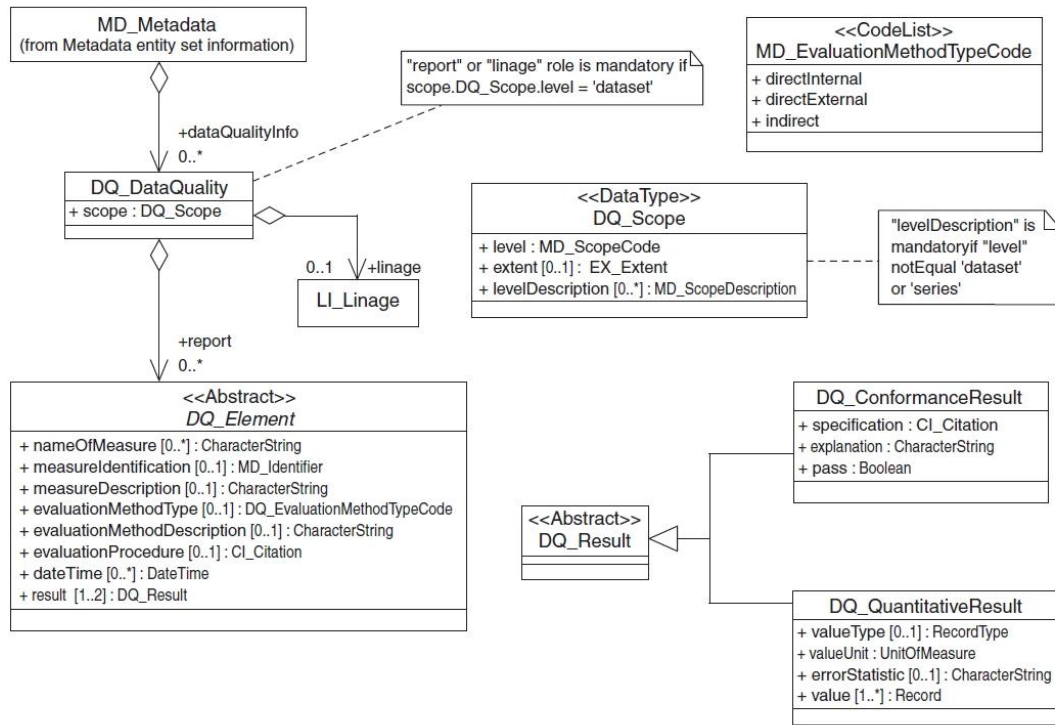
+valueType

<<Type>>
Type
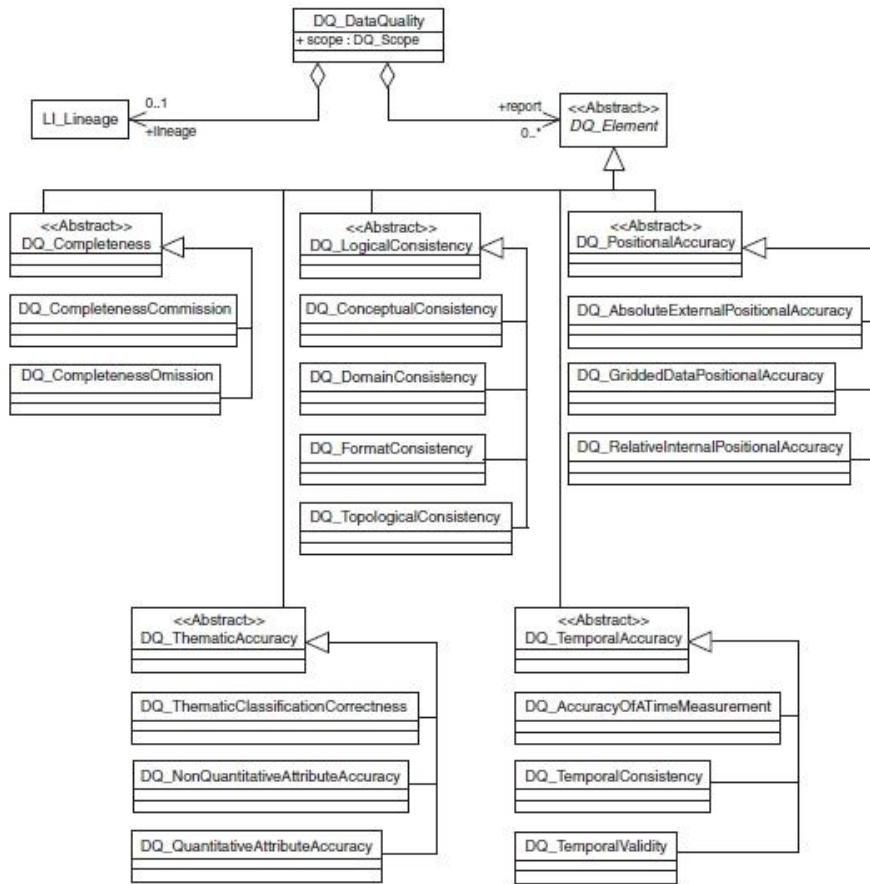*(from Records and Class Metadata)*
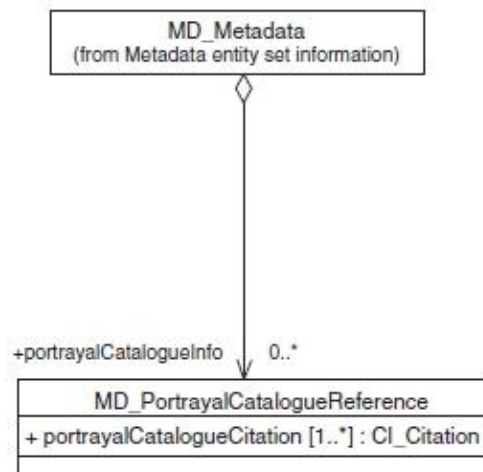
E.8 Content UML
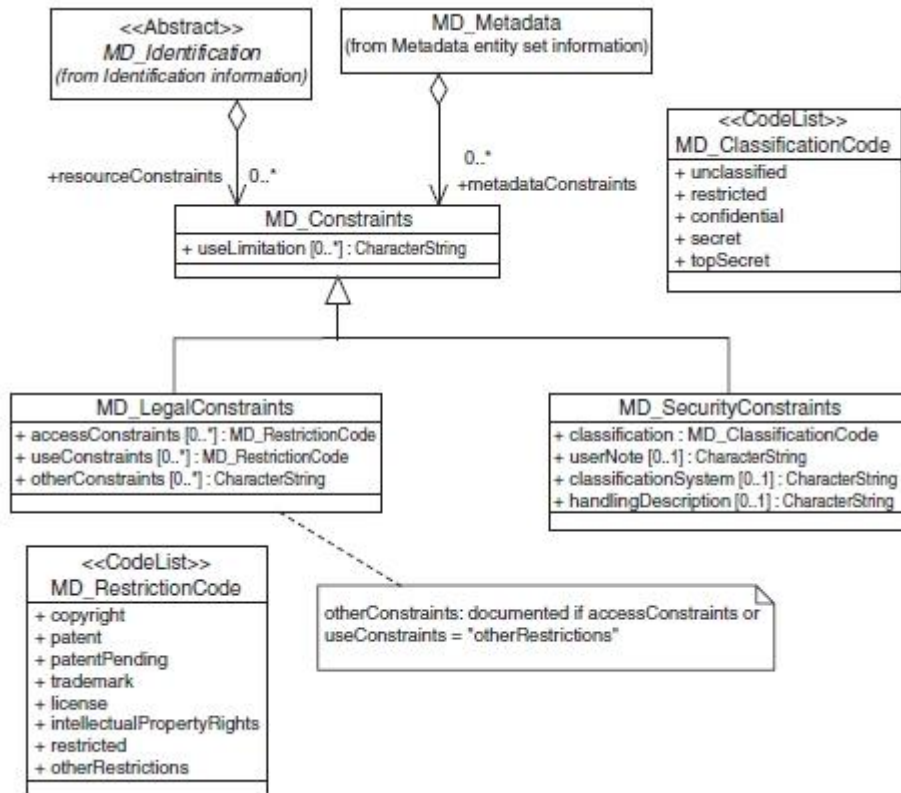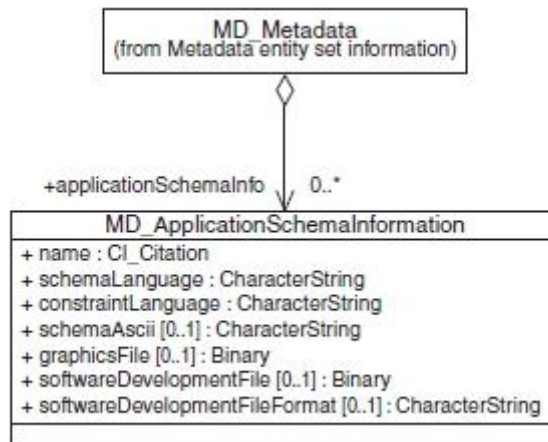
E.9 Distribution UML
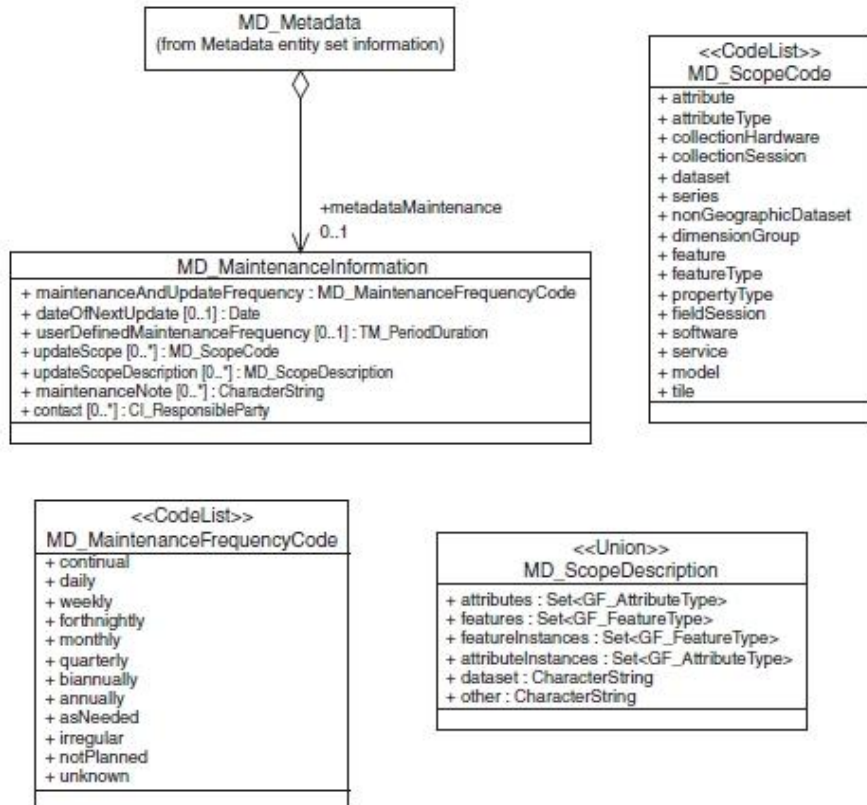
E.10 Data Quality UML
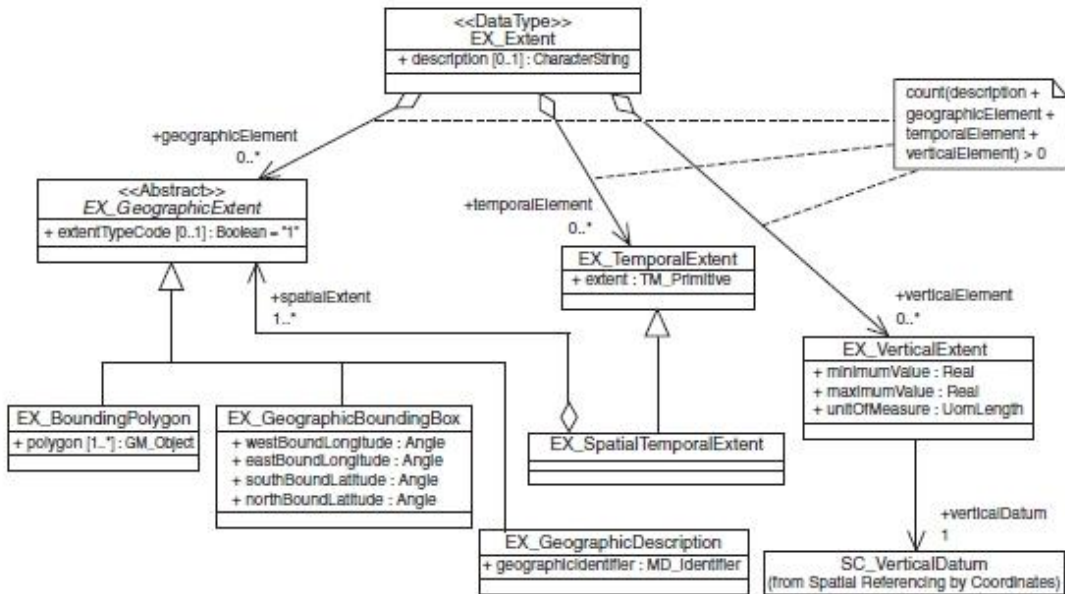
E.11 Portrayal Catalogue UML

E.12 Constraint UML

E.13 Application Schema UML

E.14 Maintenance UML

E.15 Extent UML

E.17 Biological Extensions UML

E.18 Feature Catalogue UML