



Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE)

Metadata (SDSFIE-M)

Version 2.0

Revision 4

FINAL

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Prepared By:

The IGI&S Governance Group

For:

The Assistant Secretary of Defense (Sustainment)

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Executive Summary

Metadata, data about data, is important and valuable because it enables discovery of information. It is also an aid to data and system interoperability. Metadata describes the source, methods, content and the appropriate use of a data or service. As archived data and imagery grow to enormous volumes, metadata is becoming even more critical. Without good metadata, a consumer cannot search and retrieve data containing the characteristics and content necessary to support their mission. Metadata instills data accountability and limits data liability. The timely capture of metadata is also fundamental to the quality of the data resource as a whole.

For geospatial datasets, accurate, complete and descriptive geospatial metadata is a key component of that dataset and is needed by a rapidly growing geospatial data market to locate available geospatial data and services and assess their quality and lineage, allowing the appropriate understanding, use and exploitation of that geospatial data. Certain geospatial metadata is also used in the DoD Energy, Installations and Environment (EI&E) community to specify the structure and characteristics of EI&E data.

In general, geospatial metadata describes the geospatial data elements used to specify information about features, events, coverages (including, images and elevation surfaces), datasets (collections of such information) and services (capabilities to create, access, display, and/or manipulate such information). Geospatial metadata also specifies characteristics of the values of data items (e.g., the accuracy of a measured height value or the analytic confidence that a type-assignment is correct) and characteristics of datasets (the producer, release date, content summary and the like). In order for a geospatial data resource to be discovered, assessed for its fitness of use, retrieved, and then exchanged, it must comply with certain DoD and international standards that mandate the structure and content of metadata for geospatial information. All the diverse metadata requirements within these various standards that are appropriate for compliance in EI&E systems have been brought together under a single umbrella reference standard for ease of use in the EI&E community. Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) Metadata (SDSFIE-M) is a standard which defines the conceptual schema profile for specifying geospatial metadata in and for the EI&E community. It is applicable to (and mandated for use by) the Installation Geospatial Information and Services (IGI&S) user community, as defined in DoD Instruction (DoDI) 8130.01. DoDI 8130.01 specifically requires that the Installation Geospatial Information & Services Governance Group establish guidelines for IGI&S portfolio management to ensure that existing and future EI&E functional business mission spatial information resources are identified, qualified, catalogued, and made visible and accessible to authorized DoD users by creating and associating metadata. This document defines the mandatory and common elements of the SDSFIE-M conceptual schema. It does not contain the implementation schema for SDSFIE-M. The XML schema implementation of SDSFIE-M, is defined and provided separately. Finally, this document does not contain implementation guidance. Implementation guidance is defined in a separate SDSFIE-M Implementation Guidance document.

Revision History

Description	Date	Version
Initial DISDI Group Approved Version	12 June 2013	1.0
Revision to include modifications as follows: • Changed the name from SMF to SDSFIE-M. • Fixed one typographical error. • Add PresentationFormCode codelist that was inadvertently left out of 1.0 specification • Remove ResourceAssociationType codelist that was duplicative of the AssociationType codelist and unused in the remainder of the specification • Remove the UnclassHandlingCode codelist as it duplicates many of the entries in the IC ISM • Add a free text handlingDescription element to allow for additional information about the restrictions on handling the resource or metadata • Updated the SMF_Feature data type to allow for alias name, model name, description, and note from SDSFIE. • Reintroduced BrowseGraphic element after discussions with the Metadata Working Group.	16 May 2014	1.0.1
Revision to include modifications as follows: • Aligned codelists (Table 3) to SMIS 1.0.1 document. • Set hierarchyLevel and heirarchyName to multiplicity N to align with NMF 2.2 (Table 7). • Changed SMF_RoleCode reference to RoleCode (Table 7). • Removed the default value on metadataStandardVersion (Table 7). • Changed the reference to the MetadataStandardNameCode value from sdsfieMetadataFoundation to sdsfieMetadata and the URL from http://metadata.ces.mil/dse/ns/GSIP/codelist/MetadataStandardNameCode/sdsfieMetadataFoundation to http://metadata.ces.mil/dse/ns/DISDI/codelist/MetadataStandardNameCode/sdsfieMetadata (Table 7 and footnote). • Changed MD_Keywords/Type element to MD_Keywords/type (Table 11).	28 August 2014	1.0.2
Revision to include modifications as follows: • Re-baselining of the entire conceptual model to National System for Geospatial-Intelligence (NSG) Application Schema (NAS) 8.0, and more, as follows: ○ ISO 19115-1:2014 (Metadata Fundamentals) and ISO 19115-1:2014/Amd1:2018 ○ ISO 19115-2:2019 (Acquisition and Processing Metadata) ○ ISO 19157:2013 (Quality Metadata) and ISO 19157:2013/Amd1: 2018 ○ Intelligence Community Abstract Data Definition Version 2 (IC.ADD.V2) as encoded by the Intelligence Community Technical Specification XML Data Encoding Specification for Information Security Marking (IC-ISM) • Aligned content with SDSFIE-Q • Added elements from the GeoPlatform Profile of ISO 19115-1	12 September 2018	2.0

Revision to include modifications as follows: • Updated the executive summary and introduction • Updated all references to 19115-2 to correct the publication year to 2019 • Updated all security related codelists in Table 3 that are profiled by SDSFIE for use with unclassified data • Added ReferenceSystemTypeCode and TelephoneTypeCode that were inadvertently left out of Table 3 in the 2.0 document • Corrected Figure 3 to properly reflect the included content • Added some of the changes made to the Metadata information set (6.1.1) that were not included in the 2.0 document • Corrected the obligations on dataQualityInfo and resourceLineage in Table 9 • Updated the example in 6.1.1.1 to correctly represent the metadataProfile and metadataStandard elements • Updated the example in 6.2.1.1 to correctly represent the author in the citation element • Updated section 6.3 to include the fact that the 'constraintApplicationScope' and 'graphic' attributes were profiled from SDS_Constraints • Updated Figure 8, Table 26, section 6.3.1.1, Table 27, section 6.3.1.2, and Table 28 to represent a simplification made to the model constraints model with respect to the carrying of security markings and notices. • Updated Table 30 to make the data quality report Mandatory	7 March 2019	2.0, Revision 1
Revision to include modifications as follows: • Updated the model to reflect the use of Controlled Unclassified Information (CUI) schema additions for IC ISM (changes to the security constraints model and the addition/modification of codelists).	11 September, 2019	2.0, Revision 2
Revision to adjudicate GWG comments, as follows: • Returned SDS_ prefixes to MD_ prefixes, where applicable: ○ SDS_Metadata to MD_Metadata ○ SDS_MetadataScope to MD_MetadataScope ○ SDS_Identification to MD_Identification ○ SDS_DataIdentification to MD_DataIdentification ○ SDS_ServiceIdentification to MD_ServiceIdentification ○ SDS_OnlineResource to MD_OnlineResource ○ SDS_Keywords to MD_Keywords ○ SDS_Constraints to MD_Constraints ○ SDS_SecurityConstraints to MD_SecurityConstraints • Replaced figures 3, 4, 5, 6, and 7 referencing the above items • Corrected incorrect profiling of MD_FeatureTypeInfo • Modified the Constraints model: ○ Subclassed MD_LegalConstraints with LegalConstraints per NAS X-1 and required it instead of MD_LegalConstraints ○ Replaced RestrictionCode with SDS_RestrictionCode so that ambiguous elements can be profiled to remove conflicts with ResourceConstraints ○ Replaced MD_SecurityConstraints with ResourceConstraints from NAS X-1 and required it instead of MD_SecurityConstraints ○ Added the type CuiAttributesGroupType per NAS X-1 ○ Deleted MD_Releasability as it is no longer used. ○ Replaced figure 8 to account for all of the changes to the Constraints model • Removed references to "NAS 8.0" and made them simply "NAS"	12 March, 2020	2.0, Revision 3

Revision to align with GWG NAS X-2 changes: - Removed MD_LegalConstraints and subclasses and adjust all references to MD_Constraints - Returned the useLimitation attribute to the MD_Constraints class - Added copyrightNotice attribute to the ResourceConstraints class per NAS X-2 - Added resourceAccUseDesigAuth attribute to the ResourceConstraints class per NAS X-2 - Added Resource Use Control and Resource Access Control (and related elements and codelist) to ResourceConstraints per NAS X-2	14 April, 2020	2.0, Revision 4
Fixed typos and remove MD_Identification.identifier (should have been removed previously)	10 June, 2020	2.0, Revision 4 FINAL

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1 Introduction

The term **Geospatial** refers to either an implicit or explicit reference to a location relative to the earth.

Metadata is information which captures the underlying characteristics of a resource. It represents the who, what, when, where, why and how of the resource.

The term **Geospatial Information & Services** – or **GI&S** – encompasses the concept for collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymical data accurately referenced to a precise location on the earth's surface¹. These data are used in the battlespace for military planning, training, and operations, including navigation, mission planning, mission rehearsal, modeling, simulation, and precise targeting, as well as in the basing space to provide situational awareness for force protection and management of the built and natural infrastructure.

For the purposes of this specification, **Installation GI&S (IGI&S)** refers to the subset of GI&S activities that apply to the management of DoD installations and environment to support military readiness in the Active, Guard, and Reserve Components with regard to facility construction, sustainment, and modernization, including the operation and sustainment of military test and training ranges, and which support DoD business enterprise priorities as defined in the DoD BEA. IGI&S supports and is enabled by geospatial engineering and general engineering². IGI&S are considered complimentary to but different from GEOINT and are managed as DoD information resources and information technology as defined in EO 12906, DoD Directives 8000.01 and 8115.01.

SDSFIE-M is applicable to (and mandated for use by) the Installation Geospatial Information and Services (IGI&S) user community, as defined in DoD Instruction (DoDI) 8130.01. DoDI 8130.01 specifically requires that the Installation Geospatial Information & Services Governance Group establish guidelines for IGI&S portfolio management to ensure that existing and future EI&E functional business mission spatial information resources are identified, qualified, catalogued, and made visible and accessible to authorized DoD users by creating and associating metadata.

Geospatial information provides the basic framework for IGI&S business mission support. It is information that can be produced by one or more sources to common interoperable data standards. It may be utilized in the form of printed maps, charts, and publications; in digital simulation and modeling databases; in photographic form; or in the form of digitized maps and charts or attributed centerline data. Geospatial services include tools that enable users to access and manipulate data and also include instruction, training, laboratory support, and guidance for its use.

SDSFIE-M defines a National System for Geospatial-Intelligence (NSG) Application Schema (NAS) Profile (and, specifically, profiles the ISO 19115-1:2014, ISO 19115-1:2014/Amd1:2018, ISO 19115-2:2019, ISO 19157:2013, and ISO 19157:2013/Amd1: 2018, includes elements added by the GeoPlatform Profile of ISO 19115-1, and incorporates the constraints model from NAS for specifying legal and security (Controlled Unclassified Information or CUI) constraints on geospatial metadata and resources in the EI&E business mission area.

The purposes of the SDSFIE-M are to promote the following:

- Common understanding of Geospatial metadata within and across EI&E business mission area;
- Conceptual specification standard for Geospatial metadata;
- Foundation standard defining business rules for specifying Geospatial metadata;
- Logical specification standard for Geospatial metadata;
- Re-use and standardization of Geospatial metadata in the EI&E business mission area;
- Harmonization of Geospatial metadata creation within and across EI&E business mission area, supporting varying business requirements and practices;

¹ Joint Publication (JP) 2-03, 31 Oct 2012.

² DoD Instruction 8130.01, Installation Geospatial Information and Services (IGI&S), 25 Oct 2017 (as amended).

- Physical specification(s) standard for Geospatial metadata with multiple COTS technologies, including standards-based exchange; and
- Geospatial metadata publication standard using externally-specified specifications and mechanisms.

A note on terminology

SDSFIE-M uses the Unified Markup Language (UML) to model a conceptual schema. This mixture of techniques may lead to some confusion of terms. A conceptual schema consists of metadata entities composed of elements. A UML model is composed of classes containing attributes. An effort has been made to use the terminology appropriate for the context. However, it is best to remember that:

- 1) Entities are concepts modeled by classes
- 2) Classes are models representing concepts
- 3) Elements are concepts modeled by attributes
- 4) Attributes are models representing elements.

2 Scope

Geospatial metadata is used in the IGI&S community to describe the characteristics and structure of IGI&S data and services. Geospatial metadata describes the geospatial data elements used to specify information about features, events, coverages (including images and elevation surfaces), datasets (collections of such information), measurements, observations and services (capabilities to create, access, display, and/or manipulate such information).

SDSFIE Metadata (SDSFIE-M) is a profile of the National System for Geospatial-Intelligence (NSG) Application Schema, or NAS. This Conceptual Schema Profile shall be used to document geospatial datasets for cataloguing, discovery and retrieval.

3 Relation to Other Standards

SDSFIE-M is a profile of the conceptual schema for metadata defined by Geospatial-Intelligence Standards Working Group (GWG)³. This specification profiles NAS and contains profiles of the conceptual model from ISO 19115-1:2014 (Geographic Information – Metadata). It updates that with the content of ISO 19115-1:2014/Amd1:2018. It replaces the NAS content from ISO 19115-2:2009 (Geographic information -- Metadata -- Part 2: Extensions for imagery and gridded data) with that from its replacement, ISO 19115-2:2019 (Geographic Information - Metadata - Part 2: Extensions for acquisition and processing). SDSFIE-M also contains profiles of other conceptual models from NAS, including:

- ISO 19157:2013 (Geographic Information – Data Quality) and adds amendments from ISO 19157:2013/Amd1:2018, and
- Portions of the NAS X-2 model for legal and resource (CUI) constraints.

Finally, SDSFIE-M adds elements from the GeoPlatform Profile of ISO 19115-1

As a profile of GEOINT and ISO standards, SDSFIE-M is only normative in those areas where the GEOINT and ISO standards have been profiled to address IGI&S requirements. The originating ISO standards continue to provide the normative definition of all elements not restricted or extended by SDSFIE-M. Information from those standards has been included solely to provide context.

This standard is a specification of the SDSFIE-M conceptual schema. A conceptual schema is agnostic to implementing technology. The XML Schema implementation of SDSFIE-M is available at SDSFIE Online (<https://www.sdsfieonline.org/Standards/Metadata>).

4 Requirements

4.1 General Resource Model

The SDSFIE-M Conceptual Schema Profile is intended to be applied in many EI&E community resource contexts. An important use case for the SDSFIE-M Conceptual Schema Profile is the publication of metadata documenting the content of IGI&S resources.

Figure 1 is a Unified Modelling Language (UML) class diagram adapted from ISO 19115-1:2104 that defines the classes of information to which SDSFIE metadata applies. It specifies that a resource (DS_Resource) and aggregations of resources must have one or more related Metadata sets (MD_Metadata). A dataset (DS_Dataset), aggregate (DS_Aggregate), and a service (SV_Service) are specializations (subtypes) of a resource (DS_Resource). Resource aggregations may be specified (subclassed) as a repository (such as an Authoritative Data Source) or a general

³ The GWG is an NSG forum that serves the Director, National Geospatial-Intelligence Agency and the NGA Chief Information Officer who is the delegated functional manager for GEOINT architecture and standards, in executing the functional management responsibilities authorized in NSG Directive ST 8100, 1 March 2007. The GWG provides the forum for the coordination of GEOINT standard activities. The GWG is led and chaired by the NGA's National Center for Geospatial Intelligence Standards (NCGIS).

collection of resources (DS_OtherAggregate). MD_Metadata applies to a wide variety of resources and services which are specified in MD_ScopeCode (Table 3).

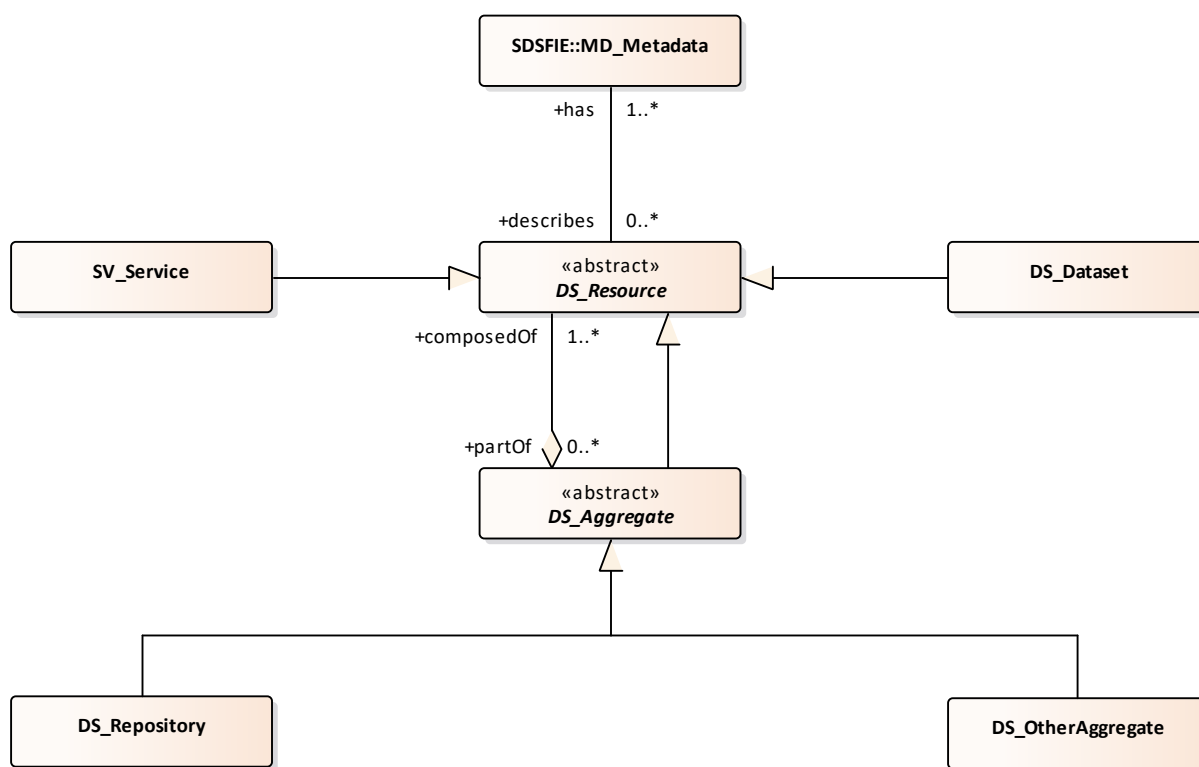


Figure 1: General Resource Model

4.2 Metadata Requirement for Geographic Data

This section focuses on the metadata packages specified in SDSFIE-M (section 6). These metadata packages are used to describe DoD Energy, Installations and Environment (EI&E) geospatial assets to support their discovery and end use. The requirement to have these metadata applies to all EI&E geospatial feature types and their aggregations. Figure 2 depicts all the SDSFIE-M metadata packages (the boxes in the figure) and the hierarchical relationships between the packages (the arrows).

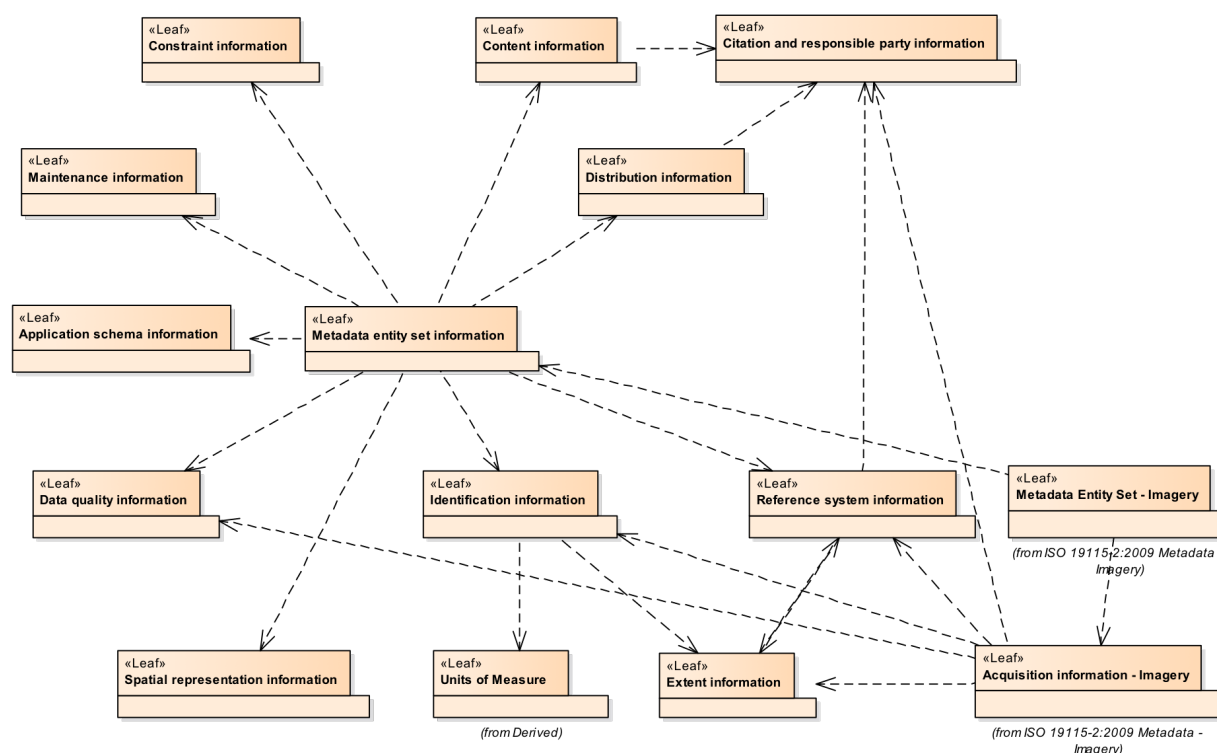


Figure 2: SDSFIE-M Metadata Packages

SDSFIE-M metadata packages are also listed in Table 1. This table provides a description of the metadata package and an indication as to whether it is mandatory for all data sets (Mandatory), if its inclusion in a metadata set is elective (Optional), or if its inclusion depends on a specific condition or value (Conditional). Any Optional SDSFIE-M metadata package can be mandated as required by policy at the Component or installation level for some or all geospatial data resources in their jurisdiction.

Table 1: SDSFIE-M metadata packages and their corresponding obligations.

Section	Name	Obligation	Description
6.1	Metadata Entity Set Information (MD_Metadata)	Mandatory	The Metadata Entity Set Information provides the overview descriptions necessary to establish understanding and use of the metadata entity.
6.2	Identification Information (MD_Identification)	Mandatory	Identification information is used to specifically identify the data being described by the metadata.
6.3	Constraints Information (MD_Constraint)	Mandatory	Constraint information is used to describe legal and security constraints placed on the resource to support access and use requirements.
6.4	Data Quality Information (DQ_DataQuality)	Optional	Data quality information.
6.5	Maintenance Information (MD_Maintenance)	Mandatory	Maintenance information provides a clear understanding of how the resource is managed.
6.6	Spatial Representation Information (MD_SpatialRepresentation)	Optional	Spatial representation information reports the spatial mechanisms of vector and gridded resources.
6.7	Reference System Information (MD_ReferenceSystem)	Conditional	Reference system information provides the necessary data to identify how a spatial resource is positioned relative to the earth.
6.9	Content Information (MD_ContentInformation)	Optional	Content information captures details relevant to a feature catalog and the description of the coverage.

6.10	Distribution Information (MD_Distribution)	Optional	Distribution information contains information about the distributor of, and options for obtaining, a resource.
6.11	Acquisition Information (MI_AcquisitionInformation)	Conditional	Designations for the measuring instruments, the platform carrying them, and the mission to which the data contributes.
6.12	Extent (EX_Extent)	Mandatory	Extent provides for various descriptions of the geographic, temporal, and vertical extent of the resource
6.13	Citation (CI_Citation)	Mandatory	Citation provides for description of authoritative reference information, including responsible party and contact information.

5 SDSFIE-M Conceptual Schema

5.1 Introduction

The SDSFIE-M Conceptual Schema Profile defines “*what we all must understand*” (as a set of metadata concepts) in the EI&E community regarding geospatial metadata in support of (e.g.) data discovery, determining data fitness for use, data access, data transfer, and mission-specific use of IGI&S information.

The SDSFIE-M Conceptual Schema Profile draws abstract metadata concepts from a broad community of International, National, DoD, and IC standards. These are used as the basis for establishing a coherent set of metadata concepts that meet EI&E community requirements for geospatial metadata.

ISO 19115-1:2014 serves as the primary source, specifically the “core metadata for geographic datasets” that is defined in that International Standard. NAS legal and resource (CUI) constraints are used to replace update the constraints information.

The ISO 19115-1:2014 standard is defined using Unified Modeling Language (UML) diagrams⁴. As the SDSFIE-M Conceptual Schema Profiles is a profile of NAS and, therefore, 19115-1:2014, it is also defined using UML diagrams. For an introduction on understanding UML notation, see Annex D of this document.

The SDSFIE-M Conceptual Schema Profile is specified as follows:

- Section 5.2 specifies the basic value domains (data types, codelists, and enumerations) used by the Conceptual Schema Profile;
- Section 5.3 specifies the structure of the tables used to specify the Conceptual Schema data dictionary;
- Section 6 specifies the resource metadata sections
- Section 6.1 specifies the metadata entity set metadata elements;
- Section 6.2 specifies the identification metadata elements;
- Section 6.3 specifies the constraints metadata elements;
- Section 6.4 specifies the data quality metadata elements;
- Section 6.5 specifies the maintenance metadata elements;
- Section 6.6 specifies the spatial representation system metadata elements;
- Section 6.7 specifies the reference system metadata elements;
- Section 6.8 specifies the identifier metadata elements;
- Section 6.9 specifies the content information metadata elements;
- Section 6.10 specifies the distribution information metadata elements;
- Section 6.11 specifies the acquisition information metadata elements;
- Section 6.12 specifies the extent metadata elements; and,

⁴ In fact, all ISO standards in the 1900 series are defined using UML.

- Section 6.13 specifies the citation and responsible party metadata elements.

5.2 Value Domains

In this SDSFIE-M Conceptual Schema Profile the specification of value domains provides a normalization of metadata values in order to ensure that two community members exchanging information “speak the same conceptual encoding language”.

The SDSFIE-M Conceptual Schema Profile draws on ISO/TS 19103 for its abstract types when specifying value domains; Section Annex C specifies the definitions for these data types. The SDSFIE-M Conceptual Schema Profile, however, requires additional types in order to unambiguously specify value domains that fall into four categories:

- **Data types** expressing complex content directly or indirectly in a *CharacterString* – these are specified in Table 2;
- **Codelists** expressing a resource-managed value in a *CharacterString* – these are specified in Table 3;
- **Enumerations** expressing fixed values in a *CharacterString* – these are specified in Table 4; and
- **Complex data types** consisting of multiple elements whose value domains are either abstract types, data types, Codelist, or Enumeration values.

5.2.1 Data types

The SDSFIE-M Conceptual Schema Profile specifies unique data types; each express complex content as a *CharacterString* whose allowed values are constrained to follow specific semantics (and syntax). These data types are specified in Table 2.

Table 2: SDSFIE-M Conceptual Schema Profile Data types

Name/Definition	Example(s)
<u>TelephoneNumber</u> An “internationalized” telephone number as specified in ITU-T Recommendation E.123 Clause 2. NOTE1: The <i>international prefix symbol</i> is a ‘+’ (plus) and should precede the country code in the international number. It serves to remind the subscriber to dial the international prefix which differs from country to country and also serves to identify the number following as the international telephone number. NOTE2: Spacing symbols are symbols that are used solely to separate parts of a telephone number from each other. They cannot be dial-able, procedural or information symbols. Grouping of digits in a telephone number should be accomplished only through the use of spaces in an international number. In the international number, spacing shall occur between the country code and the trunk code and between the trunk code and the subscriber number. NOTE3: A slash (/) may not be used to indicate alternate numbers; instead separate element(s) shall be populated.	“+1 703 555 1234” or “+22 607 123 4567”

Name/Definition	Example(s)
<u>CrsIdentifier</u> An identification of a spatial (coordinate) reference system. NOTE1: Represented as a single URL with two distinguishable components separated by a forward-slash ("/") character. NOTE2: The first component is a well-formed RestrictedURI expressing an authoritative namespace within which coordinate reference systems are designated; it may be treated as optional if its value can be determined from the context of use. NOTE3: The second component is an unambiguous identifier of a coordinate reference system in the authoritative namespace; it consists of a character string of length at least one and restricted such that it must not contain any of the following characters: ":" (colon), " " (space), "/" (forward slash), (new line), (carriage return), and (tab).⁵ NOTE4: Using the fully-qualified CharacterString as a URL it shall be possible to unambiguously identify and access (e.g., via a catalog or register) the parametric specification of the coordinate reference system being referenced.	"http://api.nsgreg.nga.mil/coord-ref-system/WGS84_EGM96_H" where the final substring designates the coordinate reference system. or "WGS84_EGM96_H" where the authoritative namespace URL can be determined in context.

5.2.2 Codelists

The SDSFIE-M Conceptual Schema Profile uses the Codelist type (literally, a "list of codes") to specify the value domains for many metadata elements. The use of Codelists instead of "free text" or a fixed enumeration has three principal advantages:

- They ensure that the lexical content of a metadata element is encoded in a consistent manner for a given concept. Even though the code may be a human-readable word or phrase, codelists eliminate variations in spelling, character case, spacing and other presentation factors to reduce the concept to a single unambiguous representation.
- They are independent of the conceptual schema and the metadata content. This allows Codelists to be profiled to meet evolving user needs without requiring changes to the conceptual schema.
- They provide a mechanism for encoding data for use in a multilingual environment. Because the codes provide a consistent representation for a given concept, supporting dictionaries containing definitions and human-readable labels in one or more languages can be developed for presentation of Codelist information in multiple languages.

Within a metadata instance document, the content of a metadata element that is specified as a Codelist value requires two pieces of information. In addition to the value itself, identification of the Codelist (value domain) is required in order for consumers of the metadata to interpret the value. One means to identify a value domain is publication and access of the values through a named register on common-access registry such as the National System for Geospatial Intelligence (NSG) Standards Registry (<https://nsgreg.nga.mil>).

The Codelists used to specify value domains in the SDSFIE-M Conceptual Schema shall be specified on the SDSFIE Online website (www.sdsfieonline.org); accordingly, their domains are not specified in this document, although example values are provided.

A Codelist value is an unambiguous identifier of a concept within a set of related concepts (e.g., country codes or geometry types). A Codelist value may be designated through the use of a URL, allowing for the identification of the Codelist value to be tied to a resource where the semantic of the value may be maintained.

For each Codelist, the following rules apply:

⁵ This restriction is efficiently specified by the XML Schema pattern "[^: \n\r\t]+".

- A domain value is represented as a `CharacterString` with two distinguishable components separated by a forward-slash ("/) character.
- The first component is a `RestrictedURI` expressing an authoritative namespace within which the Codelist value is designated; this first component may be treated as optional if its value can be determined from the context of use.
- The second component is an unambiguous identifier of a value in the authoritative Codelist namespace; it follows the XML schema pattern "[^: /\\n\\r\\t]+" – which ensures that the Codelist value excludes specific characters and is at least one character in length.
- Using the fully-qualified `CharacterString` as a URL, it shall be possible to unambiguously identify and access (e.g., via a catalog or register) the full specification of the Codelist value being referenced.

The Codelists used by the SDSFIE-M Conceptual Schema Profile are specified in Table 3. The examples provided in Table 3 are not all-inclusive.

Table 3: SDSFIE-M Conceptual Schema Codelists

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>BandDefinition</u> Designation of criterion for defining maximum and minimum wavelengths for a spectral band. NOTE: The allowed authoritative namespace is: • Metadata FG (An identical version of MI_BandDefinition from ISO 19115-2:2019): http://api.nsgreg.nga.mil/codelist/BandDefinition	"3dB" or "halfMaximum" or "fiftyPercent" etc.
<u>CellGeometryCode</u> A set of cell geometries individually identifying whether grid cells are based on either a point or area representation. NOTE: The allowed authoritative namespace is: • Metadata FG (An identical version of MD_CellGeometryCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/CellGeometryCode	"point" or "area" or "voxel" etc.
<u>CharacterSetCode</u> A set of character coding standards that may be individually used by the text of a resource. NOTE: The allowed authoritative namespace is: • Metadata FG (An identical version of MD_CharacterSetCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/CharacterSetCode	"utf8" etc.
<u>ContextCode</u> Designation of criterion for defining the context of the scanning process event. NOTE: The allowed authoritative namespace is: • Metadata FG (An identical version of MI_ContextCode from ISO 19115-2:2019): http://api.nsgreg.nga.mil/codelist/ContextCode	"acquisition" or "pass" or "wayPoint"
<u>CountryCode</u> 2- or 3-letter country code as specified by ISO 3166-1:1997. NOTE: The allowed authoritative namespace is: • ISO 3166-1 Digraph and Trigraph Country Codes: https://api.nsgreg.nga.mil/geo-political/ISO3166-1/3/VII-9	"us" or "usa" or "gb" or "gbr" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>CouplingType</u> A set of coupling types individually identifying a type of coupling between a service and associated data, if there is any. NOTE: The allowed authoritative namespaces are: Metadata FG (An identical version of SV_CouplingType from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/CouplingType	"loose" or "mixed" or "tight"
<u>CoverageContentTypeCode</u> A set of coverage content types individually identifying the specific type of information represented in a grid cell. NOTE: The allowed authoritative namespaces are: Metadata FG (An identical version of MD_CoverageContentTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/CoverageContentTypeCode	"image" or "thematicClassification" or "physicalMeasurement"
<u>DateTypeCode</u> A set of date types individually indicating the nature of the event indicated by a date. NOTE: The allowed authoritative namespaces are: Metadata FG (An augmented version of CI_DateTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/DateTypeCode	"creation" or "publication" or "revision" etc.
<u>DCPList</u> A set of distributed computing platform types individually identifying a distributed computing platform on which an operation has been implemented. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of DCPList from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/DCPList	"XML" or "WebServices" or "JAVA" etc.
<u>DimensionNameTypeCode</u> A set of dimension names individually identifying the name of a dimension. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_DimensionNameTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/DimensionNameTypeCode	"row" or "column" or "vertical" etc.
<u>EvaluationMethodTypeCode</u> A set of evaluation method types individually identifying a method for evaluating an identified data quality measure. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of DQ_EvaluationMethodTypeCode from ISO 19157:2013): https://api.nsgreg.nga.mil/codelist/EvaluationMethodTypeCode	"directInternal" or "directExternal" or "indirect"
<u>EventTypeCode</u> A codelist, each domain member of which denotes a type of event related to a platform, instrument, or sensor. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_EventTypeCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/EventTypeCode	"announcement" or "calibration" or "maneuver" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>GeometricObjectTypeCode</u> A set of geometric object types individually identifying a type of vector-based object representation that is used to locate zero-, one-, two-, or three dimensional spatial locations. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_GeometricObjectTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/GeometricObjectTypeCode	"complex" or "composite" or "curve" etc.
<u>GeometryTypeCode</u> Geometric description of the collection. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_GeometryTypeCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/GeometryTypeCode	"point" or "linear" or "areal" etc.
<u>ImagingConditionCode</u> A set of imaging conditions individually identifying conditions which may affect an image. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_ImagingConditionCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/ImagingConditionCode	"blurredImage" or "cloud" or "degradingObliquity" etc.
<u>InitiativeTypeCode</u> A set of dataset initiative types individually identifying a type of initiative under which an aggregate dataset was produced. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of DS_InitiativeTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/InitiativeTypeCode	"campaign" or "collection" or "exercise" etc.
<u>SDS KeywordTypeCode</u> A set of keyword types individually indicating the method used to group a set of similar keywords. NOTE: The allowed authoritative namespace is: IGG (An augmented version of MD_KeywordTypeCode from ISO 19115-1:2014. Five new items have been added: "audience", "subject", "community", "function", and "domain", all from the Geospatial Platform Profile): https://api.nsgreg.nga.mil/codelist/KeywordTypeCode_igg	"discipline" or "place" or "stratum" etc.
<u>LanguageCode</u> 3-letter language code as specified by ISO 639-2:1998. NOTE: The allowed authoritative namespace is: ISO 639-2 Trigraph Language Codes: http://api.nsgreg.nga.mil/codelist/ISO639-2	"eng" or "fre" etc.
<u>MaintenanceFrequencyCode</u> A set of maintenance frequency codes individually indicating the frequency with which modifications and deletions are made to the data after it is first produced. NOTE: The allowed authoritative namespace is: Metadata FG (An augmented version of MD_MaintenanceFrequencyCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/MaintenanceFrequencyCode	"continual" or "daily" or "weekly" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>MediumFormatCode</u> A set of data medium formats individually identifying a method used to read information from, and write information to, the data transfer medium. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_MediumFormatCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/MediumFormatCode	"continual" or "daily" or "weekly" etc.
<u>ObjectiveTypeCode</u> Temporal persistence of collection objective. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_ObjectiveTypeCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/ObjectiveTypeCode	"instantaneousCollection" or "persistentView" or "survey"
<u>OnlineFunctionCode</u> A set of online functions individually indicating a function performed by a resource. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of CI_OnlineFunctionCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/OnlineFunctionCode	"download" or "information" or "offlineAccess" etc.
<u>OperationTypeCode</u> Code indicating whether the data contained in this packet is real (originates from live-fly or other non-simulated operational sources), simulated (originates from target simulator sources), or synthesized (a mix of real and simulated data). NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_OperationTypeCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/OperationTypeCode	"real" or "simulated" or "synthesized"
<u>PolarisationOrientationCode</u> Polarisation of the antenna relative to the waveform. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_PolarisationOrientationCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/PolarisationOrientationCode	"horizontal" or "vertical" or "leftCircular" etc.
<u>PriorityCode</u> Ordered list of priorities. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_PriorityCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/PriorityCode	"critical" or "highImportance" or "mediumImportance" etc.
<u>PresentationFormCode</u> A set of data presentation forms individually identifying a mode in which the data is represented (for example: as a digital map or a hardcopy document). NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of CI_PresentationFormCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/PresentationFormCode	"documentDigital" or "documentHardcopy" or "imageDigital" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>ProgressCode</u> A set of resource progress statuses individually identifying a status of the dataset or progress of a review. NOTE: The allowed authoritative namespaces are: Metadata FG (An identical version of MD_ProgressCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/ProgressCode	"completed" or "historicalArchive" or "obsolete" etc.
<u>ReferenceSystemTypeCode</u> A set of spatio-temporal reference system types individually indicating a category of reference system based on its mathematical and parametric structure. NOTE: The allowed authoritative namespaces are: Metadata FG (An identical version of MD_ReferenceSystemTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/ReferenceSystemTypeCode	"compoundEngineeringParametric" or "geodeticGeographic2D" or "engineering" etc.
<u>ResClassification</u> A codelist, each domain member of which denotes the highest level of classification applicable to an information resource or portion within the domain of classified national security information. NOTE: The allowed authoritative namespace is: IGG (A profiled version of ResClassification from Metadata FG): http://api.nsgreg.nga.mil/codelist/ResClassification_Igg	"U"
<u>ResCuiBasicCategory</u> A codelist, each domain member of which denotes a Controlled Unclassified Information (CUI) basic category that is applicable to a resource. NOTE: The allowed authoritative namespace is: Metadata FG (from NARA CUI Registry content): http://api.nsgreg.nga.mil/codelist/ResCuiBasicCategory	"dodCritInfrastructSecurity" or "unclControlNuclearDefense" or "unclControlNuclearEnergy" etc.
<u>ResCuiDissemControlType</u> A codelist, each domain member of which denotes a type of Controlled Unclassified Information (CUI) limited dissemination control that is applicable to a resource. NOTE: The allowed authoritative namespace is: Metadata FG (from NARA CUI Registry content): http://api.nsgreg.nga.mil/codelist/ResCuiDissemControlType	"federalEmployeesOnly" or "federalEmployeesContractorsOnly" or "noForeignDissemination" etc.
<u>ResCuiDissemControlDiscloseTo</u> A codelist, each domain member of which denotes a foreign country or international organization to whom information has been predetermined by the designating agency to be able to be (or has been) disclosed through established foreign disclosure procedures and channels. NOTE: The allowed authoritative namespace is: Metadata FG (from NARA CUI Registry content): http://api.nsgreg.nga.mil/codelist/ResCuiDissemControlDiscloseTo	"koreaSouth" or "germany" or "unitedKingdom" etc.
<u>ResCuiSpecifiedCategory</u> A codelist, each domain member of which denotes a Controlled Unclassified Information (CUI) specified category that is applicable to a resource. NOTE: The allowed authoritative namespace is: Metadata FG (from NARA CUI Registry content): http://api.nsgreg.nga.mil/codelist/ResCuiSpecifiedCategory	"controlledTechnicalInfo" or "unclControlNuclearDefense" or "unclControlNuclearEnergy" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>ResourceSpecificAccessRestriction</u> A coded domain value denoting a specific type of restriction to a resource, or to a set of resource metadata, that limits access based on statutory or regulatory provisions. NOTE: The allowed authoritative namespace is: Metadata FG: https://api.nsgreg.nga.mil/codelist/ResourceSpecificAccessRestriction	"license" or "donated" or "otherAccessRestriction" etc.
<u>ResourceAssociationTypeCode</u> A set of resource association types individually indicating the basis (justification) for relating one resource to another. NOTE: The allowed authoritative namespace is: Metadata FG (An augmented version of DS_AssociationTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/ResourceAssociationTypeCode	
<u>ResourceSpecificUseRestriction</u> A coded domain value denoting a specific type of restriction to a resource, or to a set of resource metadata, that limits use or reproduction based on statutory or regulatory provisions. NOTE: The allowed authoritative namespace is: Metadata FG: https://api.nsgreg.nga.mil/codelist/ResourceSpecificUseRestriction	"copyright" or "donorRestrictions" or "license" etc.
<u>RoleCode</u> A set of roles individually identifying a function performed by a responsible party. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of CI_RoleCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/RoleCode	"resourceProvider" or "custodian" or "owner" etc.
<u>SDS_ScopeCode</u> A set of scopes individually identifying a grouping of information within a resource. NOTE: The allowed authoritative namespace is: IGG (A profiled and extended version of MD_ScopeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/ScopeCode_igg	"dataset" or "service" or "aggregate" etc.
<u>SequenceCode</u> Temporal relation of activation. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_SequenceCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/SequenceCode	"start" or "end" or "instantaneous"
<u>SpatialRepresentationTypeCode</u> A set of spatial representation types individually identifying a method used to represent geospatial information in a resource. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_SpatialRepresentationTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/SpatialRepresentationTypeCode	"vector" or "grid" or "textTable" etc.

Name / Authoritative Namespace(s)	Example(s) (not all-inclusive)
<u>TelephoneTypeCode</u> A set of telephone types individually indicating a type of communications capability. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_TelephoneTypeCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/TelephoneTypeCode	“facsimile” or “voice” or “sms”
<u>TopologyLevelCode</u> A set of topology levels individually identifying the degree of complexity of the spatial relationships among geometry objects in a resource as represented in a topology. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MD_TopologyLevelCode from ISO 19115-1:2014): https://api.nsgreg.nga.mil/codelist/TopologyLevelCode	“geometryOnly” or “topology1D” or “planarGraph” etc.
<u>TransferFunctionTypeCode</u> Transform function to be used when scaling a physical value for a given element. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_TransferFunctionTypeCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/TransferFunctionTypeCode	“linear” or “logarithmic” or “exponential”
<u>TriggerCode</u> Mechanism of activation. NOTE: The allowed authoritative namespace is: Metadata FG (An identical version of MI_TriggerCode from ISO 19115-2:2019): https://api.nsgreg.nga.mil/codelist/TriggerCode	“automatic” or “manual” or “preProgrammed”

5.2.3 Enumerations

An Enumeration value is an unambiguous identifier of a concept within a fixed, finite set of related concepts. Unlike a Codelist, this set may not be extended without a schema modification. The following subsections specify the Enumerations used in the SDSFIE-M Conceptual Schema Profile. ***Enumerations are no longer specified using numeric “domain codes” as they were in ISO 19115:2003.***

5.2.3.1 Topic Category

The Enumeration TopicCategoryCode is as defined by ISO 19115-1:2014 which is as follows:

TopicCategoryCode A high-level geographic data thematic classification to assist in the grouping and search of available geographic data sets. NOTE 1 Can be used to group keywords as well. Listed examples are not exhaustive. NOTE 2: It is understood there are overlaps between general categories and the user is encouraged to select the one most appropriate.

Its domain members (enumerants) are specified in Table 4; for each the following information is specified:

- concept **Name** (English)—is the name of the item (English is this language of ISO 19115-1:2014);
- concept **Code**—a human-interpretable camel-case designation for the topic (same as **Name** for our case);
- concept **Definition**; and
- **Example Topic Members**—concepts that fall within the scope of the topic category.

Table 4: Enumeration TopicCategoryCode Domain Values

Name	Code	Definition	Example Topic Members
farming	farming	The rearing of animals and/or the cultivation of plants.	Agriculture, irrigation, aquaculture, plantations, herding, pests and diseases affecting crops and livestock.
biota	biota	Flora and/or fauna in the natural environment.	Wildlife, vegetation, biological sciences, ecology, wilderness, sea life, wetlands, and habitat.
boundaries	boundaries	Legal land descriptions.	Political and administrative boundaries.
climatologyMeteorology Atmosphere ⁶	climatologyMeteorology Atmosphere ⁷	Processes and phenomena of the atmosphere.	Cloud cover, weather, climate, atmospheric conditions, climate change, and precipitation.
economy	economy	Economic activities, conditions and employment.	Production, labor, revenue, commerce, industry, tourism and ecotourism, forestry, fisheries, commercial or subsistence hunting, exploration and exploitation of resources such as minerals, oil and gas.
elevation	elevation	Height above or below sea level.	Altitude, bathymetry, digital elevation models, slope, and derived products.
environment	environment	Environmental resources, protection and conservation	Environmental pollution, waste storage and treatment, environmental impact assessment, monitoring environmental risk, nature reserves, and landscapes.
geoscientificInformation	geoscientificInformation	Information pertaining to earth sciences.	Geophysical features and processes, geology, minerals, sciences dealing with the composition, structure and origin of the earth's rocks, risks of earthquakes, volcanic activity, landslides, gravity information, soils, permafrost, hydrogeology, and erosion.
health	health	Health, health services, human ecology, and safety.	Disease and illness, factors affecting health, hygiene, substance abuse, mental and physical health, and health services.
imageryBaseMaps EarthCover ⁷	imageryBaseMaps EarthCover ⁷	Base maps.	Land cover, topographic maps, imagery, unclassified images, and annotations.
intelligenceMilitary	intelligenceMilitary	Military bases, structures, and activities.	Barracks, training grounds, military transportation, and information collection.
inlandWaters	inlandWaters	Inland water features, drainage systems and their characteristics.	Rivers and glaciers, salt lakes, water utilization plans, dams, currents, floods, water quality, and hydrographic charts.
location	location	Positional information and services.	Addresses, geodetic networks, control points, postal zones and services, and place names.
oceans	oceans	Features and characteristics of salt water bodies (excluding inland waters).	Tides, tidal waves, coastal information, and reefs.
planningCadastre	planningCadastre	Information used for appropriate actions for future use of the land.	Land use maps, zoning maps, cadastral surveys, and land ownership.
society	society	Characteristics of society and cultures.	Settlements, anthropology, archaeology, education, traditional beliefs, manners and customs, demographic data, recreational areas and activities, social impact assessments, crime and justice, and census information.
structure	structure	Man-made constructions.	Buildings, museums, churches, factories, housing, monuments, shops, and towers.
transportation	transportation	Means and aids for conveying persons and/or goods.	Roads, airports/airstrips, shipping routes, tunnels, nautical charts, vehicle or vessel location, aeronautical charts, and railways.

⁶ Although split over two lines for presentation purposes this is a single string with no breaks.

⁷ Although split over two lines for presentation purposes this is a single string with no breaks.

Name	Code	Definition	Example Topic Members
utilitiesCommunication	utilitiesCommunication	Energy, water and waste systems and communications infrastructure and services.	Hydroelectricity, geothermal, solar and nuclear sources of energy, water purification and distribution, sewage collection and disposal, electricity and gas distribution, data communication, telecommunication, radio, and communication networks.

5.2.3.2 PixelOrientationCode

The Enumeration PixelOrientationCode is as defined by ISO 19115-1:2014:Amd.1:2018 which is as follows:

PixelOrientationCode A point in a pixel corresponding to the Earth location of the pixel
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Its domain members (enumerants) are specified in Table 5; for each the following information is specified:

- concept **Name** (English)—is the name of the item (English is this language of ISO 19115-1:2014:Amd.1:2018);
- concept **Code**—a human-interpretable camel-case designation for the topic (same as **Name** for our case); and
- concept **Definition**.

Table 5: Enumeration PixelOrientationCode Domain Values

Name	Code	Description
centre	centre	point halfway between the lower left and the upper right of the pixel
lowerLeft	lowerLeft	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	lowerRight	next corner counterclockwise from the lower left
upperRight	upperRight	next corner counterclockwise from the lower right
upperLeft	upperLeft	next corner counterclockwise from the upper right

5.2.3.3 ObligationCode

The Enumeration ObligationCode is as defined by ISO 19115-1:2014 which is as follows:

ObligationCode The obligation of the element or entity
--

Its domain members (enumerants) are specified in Table 6; for each the following information is specified:

- concept **Name** (English)—is the name of the item (English is this language of ISO 19115-1:2014);
- concept **Code**—a human-interpretable camel-case designation for the topic (same as **Name** for our case); and
- concept **Definition**.

Table 6: Enumeration ObligationCode Domain Values

Name	Code	Description
mandatory	mandatory	the element is always required
conditional	conditional	element is required when a specific condition is met
optional	optional	element is not required

5.2.3.4 ParameterDirection

The Enumeration ParameterDirection is as defined by ISO 19115-1:2014 which is as follows:

ParameterDirection

The class of information to which the referencing entity applies

Its domain members (enumerants) are specified in Table 7; for each the following information is specified:

- concept **Name** (English)—is the name of the item (English is this language of ISO 19115-1:2014);
- concept **Code**—a human-interpretable camel-case designation for the topic (same as **Name** for our case); and
- concept **Definition**.

Table 7: Enumeration ParameterDirection Domain Values

Name	Code	Description
in	in	the parameter is an input parameter to the service instance
out	out	the parameter is an output parameter to the service instance
in/out	in/out	the parameter is both an input and output parameter to the service instance

5.3 Element Table Structure

5.3.1 Introduction

Each subsection in Section 6 contains a UML diagram and a data dictionary table. The data dictionary tables provide definitions and explanations to go along with the UML diagram in order to fully define the metadata. The dictionary is specified in a hierarchy to establish relationships and an organization for the information.

The UML diagrams contained in Section 6 are profiled versions of the UML diagrams contained in ISO 19115-1:2014, ISO 19115-2:2019, and ISO 19157:2013. Some classes, attributes and association roles have been hidden and some have been extended because they do not apply to SDSFIE-M. For the full diagrams, consult the relevant ISO document.

For the data dictionary tables in Section 6, each UML model class equates to a data dictionary entity. Each UML model class attribute equates to a data dictionary element. The shaded rows define entities. The entities and elements within the data dictionary are defined by six attributes (as listed below). The term “dataset”, when used as part of a definition, is synonymous with all the types of aggregated geographic data attributes (all members from the SDS_ScopeCode codelist).

5.3.2 Name

A label assigned to a metadata entity or to a metadata element. Metadata entity names start with an upper-case letter. Spaces do not appear in a metadata entity name. Instead, multiple words are concatenated, with each new sub word starting with a capital letter (example: XnnnYmmm). Metadata entity names are unique within the entire data dictionary of this document. Metadata element names are unique within a metadata entity, not the entire data dictionary of this document. Metadata element names are made unique, within an application, by the combination of the metadata entity and metadata element names (example: MD_Metadata.characterSet). Role names are used to identify metadata abstract model associations and are preceded by “*Role name:*” to distinguish them from other metadata elements.

5.3.3 Definition

The metadata entity/element description.

5.3.4 Obligation/Condition

5.3.4.1 General

This is a descriptor indicating whether a metadata entity or metadata element shall always be documented in the metadata or sometimes be documented (i.e. contains value(s)). This descriptor may have the following values: M (mandatory), C (conditional), or O (optional).

5.3.4.2 Mandatory

The metadata entity or metadata element shall be documented.

5.3.4.3 Conditional

Specifies an electronically manageable condition under which at least one metadata entity or a metadata element is mandatory. 'Conditional' is used for one of the three following possibilities:

- Expressing a choice between two or more options. At least one option is mandatory and must be documented.
- Documenting a metadata entity or a metadata element if another element has been documented.
- Documenting a metadata element if a specific value for another metadata element has been documented. To facilitate reading by humans, the specific value is used in plain text (ex. "C/not defined by encoding?").

If the answer to the condition is positive, then the metadata entity or the metadata element shall be mandatory. The conditions are typically supplied as footnotes to make the table more legible.

5.3.4.4 Optional

A metadata record may or may not include a metadata entity from the SDSFIE-M and may or may not specify a value of a metadata element in SDSFIE-M. Optional metadata entities and optional metadata elements provide a guide to those looking to fully document their data when preparing a metadata record. (Use of this common set of defined elements will help promote interoperability among geographic data users and producers in the EI&E community.)

- If an optional metadata entity is not included in a metadata record, then the metadata elements contained within that entity (including mandatory elements) shall have no specified values.
- If an optional metadata entity is included in a metadata record, then the mandatory metadata elements contained within that entity shall have specified values.
- If a metadata entity (optional or otherwise) is included in a metadata record and there are no mandatory metadata elements contained within that entity, then at least one conditional or optional element contained within that entity shall have a specified value. The choice of which metadata element shall become mandatory is determined by a conditional expression in the context in which the metadata entity is referenced (the UML class whose association role references the metadata entity UML class).

5.3.5 Maximum occurrence

Specifies the maximum number of instances the metadata entity or the metadata element may have. Single occurrences are shown by "1"; repeating occurrences are represented by "N". Fixed number occurrences other than one are allowed and will be represented by the corresponding number (i.e. "2", "3" ...etc.).

Multiplicity should always be understood to apply to the specified metadata element "as a whole" – regardless of the nature (e.g., complex) of its value domain. Conversely, multiplicity should always be understood to be only applicable (meaningful) within the scope of the table within which the element is specified.

- For example, while a point of contact shall have exactly one postal address, that postal address may have multiple delivery point element values (e.g., a street address as well as a suite number).
- The multiplicity of the Contact (in whatever table it appears) would then be exactly one with a value domain of ContactPostalAddress, however the table specifying the Contact Postal Address would contain a line (element) specifying a Delivery Point with a multiplicity of one or more (with a value domain perhaps of CharacterString).

The types of possible multiplicity statements are listed in Table 8.

Table 8: Multiplicity and Implied Obligation

Multiplicity	Definition	Implied Obligation
Exactly one <i>Example: 1</i>	Exactly one value occurrence is permitted.	Minimum
At least one <i>Example: 1..*</i>	At least one value occurrence is required, and multiple value occurrences are permitted.	Minimum
Exact number <i>Example: 3</i>	Exactly the specified number of value occurrences must be present.	Minimum
Exact range <i>Example: 2..4</i>	At least the number of value occurrences specified in the lower range limit must be present; no more value occurrences than the specified upper range limit may be present.	Minimum
Zero or one <i>Example: 0..1</i>	Possibly one; zero or one value occurrence is permitted.	Additional
Zero or more <i>Example: 0..*</i>	A possibly empty range; zero or more value occurrences are permitted.	Additional
Exact range (possibly empty) <i>Example: 0..3</i>	No occurrences are permitted; no more occurrences than the specified upper range limit may be present.	Additional

5.3.6 Data type/Domain

Specifies a set of distinct values for representing the metadata elements; for example, integer, real, string, DateTime, and Boolean. The data type attribute is also used to define metadata entities, stereotypes, and metadata associations.

In cases where the value domain is complex, a reference is provided to the section that specifies its complex content requirement. When this occurs, no example is specified, that table cell grey-filled, and the example is instead specified in the referenced section.

The domain specifies the values allowed or the use of free text. "Free text" indicates that no restrictions are placed on the content of the field. Integer-based codes shall be used to represent values for domains containing codelists.

5.3.7 Business Rule

Business rules describe the operation of an enterprise and can relate to something as high-level as privacy or security, or as low-level as the derivation of a particular metadata element value. It is generally not appropriate to build such constraints routinely into implementation database structures or even interfaces. However, such rules are still important and must be discerned, documented and accommodated in such a way that implementers will not overlook their importance, requirements builders will fully understand their impact, and acquisition personnel will recognize their necessity.

6 Resource Metadata Sections

6.1 Metadata Information

This UML diagram presented in this section is a SDSFIE-M-specific version of the corresponding Metadata Information Package UML diagram found in ISO 19115-1:2014 (Figure 4). The diagram has been profiled, so some classes, attributes and association roles have been removed or modified. For the full diagram, consult ISO 19115-1. This diagram shows containment relationships with the other metadata classes which, in aggregate, define metadata for geographic data.

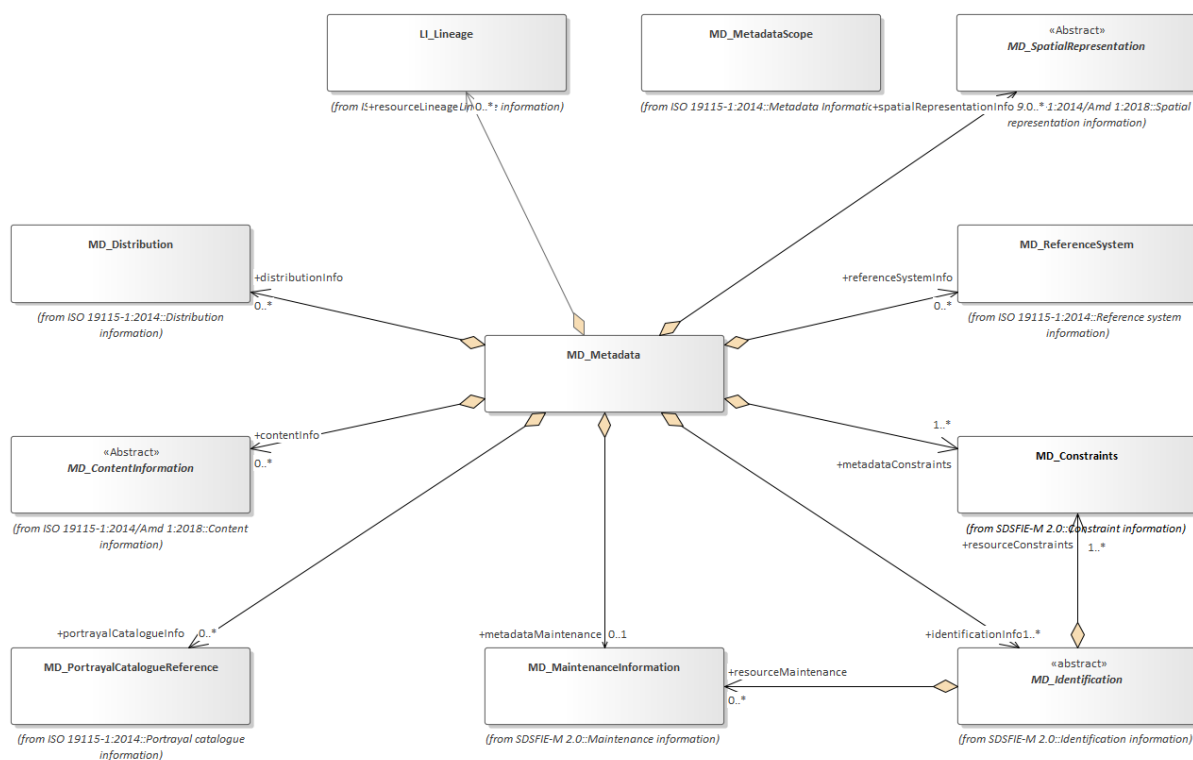


Figure 3: Metadata Entity Set

6.1.1 Metadata

The data dictionary (Table 9) presented in this section is an SDSFIE-M -specific version of the corresponding Metadata Entity Set data dictionary table found in ISO 19115-1:2014 (B.2.2.1). The table has been profiled, so some classes, attributes and association roles have been removed. Specifically, the following changes have been made from the ISO 19115-1:2014 MD_Metadata class:

- Profiled the alternativeMetadataReference, and otherLocale attributes from MD_Metadata;
- Profiled the MD_Metadata association with MD_MetadataExtensionInformation;
- Profiled the MD_Metadata association with MD_ApplicationSchemaInformation;
- Profiled the MD_Metadata association with MD_PortrayalCatalogueInformation;
- Changed the obligation on metadataIdentifier to Mandatory;
- Changed the obligation on defaultLocale to Mandatory;
- Changed the maximum occurrence on dateInfo to 1 and require that it be the metadata creation date;
- Changed the obligation on metadataStandard to Mandatory and require that the citation be set to either ISO19115-1 or ISO19115-2 (as shown in the example provided in section 6.1.1.1 and 6.1.2.1);

- Changed the obligation on metadataProfile to Mandatory and require that the citation be set to SDSFIE-M (as shown in the example provided in section 6.1.1.1);
- Changed the obligation on referenceSystemInfo to be Conditional when coordinates are referenced;
- Changed the obligation on dataQualityInfo and resourceLineage to be Conditional such that one or the other must always exist when the scope is a dataset, aggregate, or repository;
- Changed multiplicity on the metadataConstraints (MD_Constraints) association to 1..* to indicate that at least one metadata constraint is required (a ResourceConstraint);
- Changed multiplicity on the resourceConstraints (MD_Constraints) association on MD_Identification for 1..* to indicate that at least one resource constraint is required (a ResourceConstraint) for each identified resource; and
- Changed the obligation on metadataScope to Mandatory.

Table 9: Metadata Entity Set

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Metadata	root entity which defines metadata about a resource or resources	M	1	Class	
metadataIdentifier	unique identifier for this metadata file	M	1	Class / MD_Identifier <<DataType>> (6.8)	
defaultLocale	language and character set used for documenting metadata	M	1	Class / PT_Locale (6.1.2)	
parentMetadata	Identification of the metadata to which this metadata is a subset (child)	C	1	Class / CI_Citation <<DataType>> (6.13)	Obligation: Required if there is an upper hierarchy level.
contact	party responsible for the metadata information	M	N	Class / CI_Responsibility (6.13.1)	In the case of more than a single contact element then the first of the set shall use the RoleCode "pointOfContact".
dateInfo	date that the metadata was created	M	1	Class / CI_Date <<DataType>>	
metadataStandard	citation for the standard to which the metadata conforms NOTE Metadata standard citations should include an identifier.	M	1	Class / CI_Citation (6.13)	The citation shall reference ISO 19115-1 or -2 depending on the root element
metadataProfile	citation for the profile(s) of the metadata standard to which the metadata conforms NOTE Metadata profile citations should include an identifier.	M	1	Class / CI_Citation (6.13)	The citation shall reference this document.
metadataLinkage	online location where the metadata is available	O	N	Class / MD_OnlineResource <<DataType>> (6.13.5)	
Role name: spatialRepresentationInfo	digital representation of spatial information in the dataset	O	N	Association / MD_SpatialRepresentation (6.6)	

<i>Role name:</i> referenceSystemInfo	description of the spatial and temporal reference systems used in the dataset	C	N	Association / MD_ReferenceSystem (6.7)	Obligation: Required if the resource includes coordinates. ⁸
<i>Role name:</i> identificationInfo	basic information about the resource(s) to which the metadata applies	M	N	Association / MD_Identification (6.2)	
<i>Role name:</i> contentInfo	provides information about the feature catalogue and describes the coverage and image data characteristics	O	N	Association / MD_ContentInformation (6.9)	
<i>Role name:</i> dataQualityInfo	provides overall assessment of quality of a resource(s)	C	1	Association / DQ_DataQuality (6.4.1)	Obligation: Required if resourceLineage does not exist ⁹ AND the scope is dataset, aggregate, or repository
<i>Role name:</i> metadataConstraints	provides restrictions on the access and use of metadata	M	1	Association / MD_Constraints (6.3)	There shall be an instance of MD_Constraints, specifically a ResourceConstraints instance.
<i>Role name:</i> distributionInfo	provides information about the distributor of and options for obtaining the resource(s)	O	N	Association / MD_Distribution (6.10)	
<i>Role name:</i> metadataMaintenance	provides information about the frequency of metadata updates, and the scope of those updates	O	1	Association / MD_MaintenanceInformation (6.5)	
<i>Role name:</i> resourceLineage	information about the provenance, source(s), and/or the production process(es) applied to the resource	C	N	Aggregation / LI_Lineage (6.4.2)	Obligation: Required if dataQualityInfo does not exist ⁹ AND the scope is dataset, aggregate, or repository
<i>Role name:</i> metadataScope	the scope/type of resource for which metadata is provided	M	1	Aggregation / MD_MetadataScope (6.1.2.1)	

6.1.1.1 Metadata Example

An example of MD_Metadata is provided in a tabbed-outline format. The example illustrates the hierarchical structure of ISO 19115-1 metadata and is based on an implementation schema that governs the ordering of the elements within the metadata instance document. The example only addresses the elements contained within MD_Metadata and does not include any of the associated elements as examples of these will be included in the appropriate section of the document. Note that the metadataLinkage URL is entirely fictional.

(MD_Metadata)

metadataIdentifier: (MD_Identifier)

code: 16856646-4e3d-5f8f3-cde3b9fc006e4c8

defaultLocale: (PT_Locale)

language: (LanguageCode) eng

⁸ if spatialRepresentationType in MD_DataIdentification is "vector", "grid", or "tin"

⁹ one or the other of dataQualityInfo or resourceLineage is required when the metadataScope.MD_MetadataScope.resourceScope equals 'dataset'. Please refer to SDSFIE-Q for further requirements related to Common Installation Picture (CIP) submissions.

```

country: (CountryCode) us
characterEncoding: (CharacterSetCode) utf8
characterSet: (MD_CharacterSetCode) utf8
contact: (CI_Responsibility)
  role: (RoleCode) author
  party: (CI_Organisation)
    name: OASD(EI&E), BSI, DISDI Program
    contactInfo: (CI_Contact)
      phone: 571-372-6780
      address: (CI_Address)
        electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

dateInfo: (CI_Date)
  date: (DateTime) 20171111
  dateType: (CI_DateTypeCode) creation
metadataStandard: (CI_Citation)
  title: ISO 19115-1 Geographic information — Metadata — Part 1: Fundamentals
  date: (CI_Date)
    date: (DateTime) 2014-04
    dateType: (CI_DateTypeCode) published
  edition: ISO 19115-1:2014/Amd 1:2018
metadataProfile: (CI_Citation)
  title: Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) Metadata (SDSFIE-M)
  date: (CI_Date)
    date: (DateTime) 2018-09-12
    dateType: (CI_DateTypeCode) published
  edition: 2.0
  onlineResource: (MD_OnlineResource)
    linkage: https://www.sdsfieonline.org/Standards/Metadata#SDSFIE-M
metadataLinkage: (MD_OnlineResource)
  linkage: https://www.disdiportal.mil/metadata/i=16856646-4e3d-5f8f3-cde3b9fc006e4c8&format=xml

```

6.1.2 Acquisition and Processing Metadata

The MI_Metadata class is a specialization of MD_Metadata defined in ISO 19115-2:2019. This class is used, primarily, when documenting imagery or gridded data although it can be used to document other acquired data. No additional profiling of this class has been performed to address EI&E community requirements.

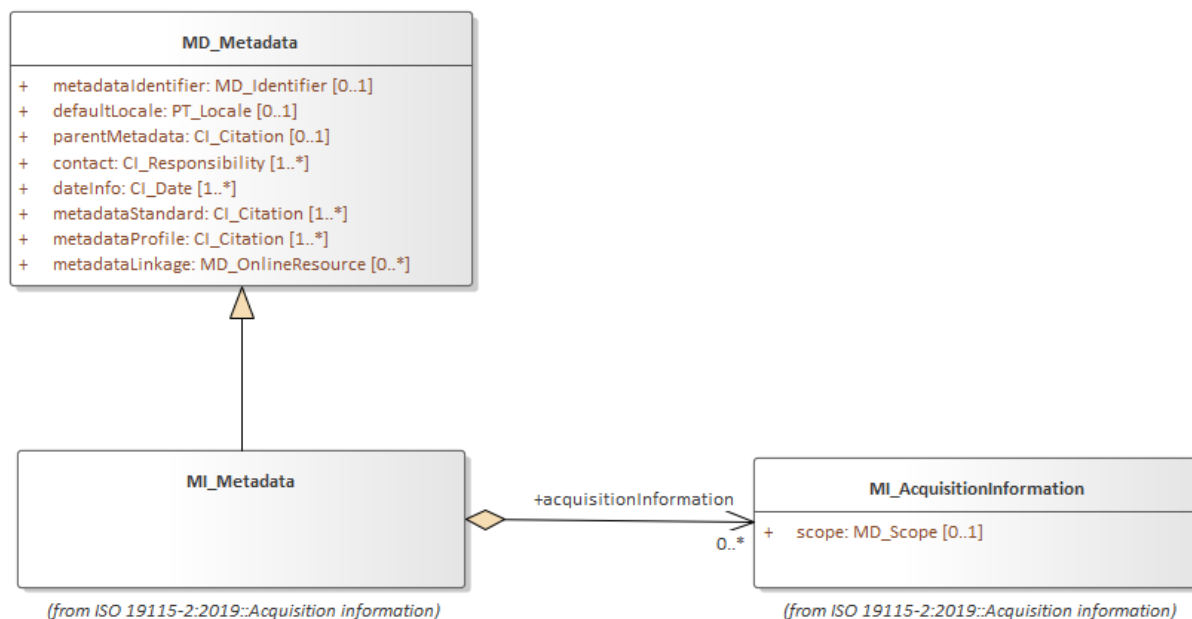


Figure 4: Metadata Entity Set, Extended for Acquisition and Processing Data

The data dictionary table in this section is from ISO 19115-2:2019. No additional profiling of this table has been performed to address EI&E community requirements. MI_Acquisition is defined in section 6.10.3.

Table 10: Metadata Entity Set, Extended for Acquisition and Processing Data

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_Metadata	root entity that defines information about imagery or gridded data (MD_Metadata extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Metadata)	
Role name: acquisitionInformation	provides information about the acquisition of the data	C ¹⁰	N	Association / MI_AcquisitionInformation (6.11)	<u>Obligation:</u> Required when documenting acquired or processed data, such as imagery or gridded data

6.1.2.1 Metadata Example

An example of MI_Metadata is provided in a tabbed-outline format. The example illustrates the hierarchical structure of ISO 19115-1/2 metadata and is based on an implementation schema that governs the ordering of the elements within the metadata instance document. The example only addresses the elements contained within MI_Metadata and does not include any of the associated elements as examples of these will be included in the appropriate section of the document. Note that the metadataLinkage URL is entirely fictional.

¹⁰ if spatialRepresentationType in MD_DataIdentification is "grid"

(MI_Metadata)

```

metadataIdentifier: (MD_Identifier)
    code: c9a24373-36e1-4433-bd82-50a1acb36c25
defaultLocale: (PT_Locale)
    language: (LanguageCode) eng
    country: (CountryCode) us
    characterEncoding: (CharacterSetCode) utf8
characterSet: (MD_CharacterSetCode) utf8
contact: (CI_Responsibility)
    role: (RoleCode) author
    party: (CI_Organisation)
        name: OASD(EI&E), BSI, DISDI Program
        contactInfo: (CI_Contact)
            phone: 571-372-6780
            address: (CI_Address)
                electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

dateInfo: (CI_Date)
    date: (DateTime) 20171111
    dateType: (CI_DateTypeCode) creation
metadataStandard: (CI_Citation)
    title: ISO 19115-2:2019 Geographic information — Metadata — Part 2: Extensions for acquisition and processing
    version: International Standard
metadataProfile: (CI_Citation)
    title: SDSFIE Metadata
    version: 2.0
    onlineResource: (MD_OnlineResource)+
        linkage: (URL) https://www.sdsfieonline.org/Standards/Metadata#SDSFIE-M
metadataLinkage: (MD_OnlineResource)
    linkage: (URL) https://www.disdiportal.mil/metadata/i= c9a24373-36e1-4433-bd82-50a1acb36c25&format=xml

```

6.1.3 Metadata About Metadata

In addition to the containment relationships detailed in Figure 3 is a relationship to a description of the scope of the resource being documented. This is captured by the MD_MetadataScope class depicted in Figure 5.

The SDS_ScopeCode codelist contains four scopes that have very important meaning in the EI&E community, as follows:

- dataset—shall be used for documenting vector datasets comprised of a single or multiple feature types and for raster data¹¹.
- service—shall be used for documenting geospatial services.
- repository¹²—shall be used for documenting an IGI&S data store (e.g. Authoritative Data Source (ADS)) as a whole.
- aggregate¹³— shall be used for documenting an aggregated dataset (e.g. Common Installation Picture (CIP) or Component CIP submissions) that may be extracted from a data repository.

¹¹ The dataset scope will not be used when measuring the overall quality of Common Installation Picture (CIP) aggregates and Authoritative Data Source (ADS) repositories.

¹² A repository is a collection of datasets that is stored and maintained in a location (e.g. enterprise database(s), system, server, etc.). A repository should include well-defined, curated content. [SDSFIE-Q, R1]

¹³ An aggregate is a collection of ephemeral datasets that may have been extracted from a data repository. [SDSFIE-Q, R1]

Additionally, two other scopes are provided for use by the EI&E community:

- metadata—shall be used documenting metadata.
- document—shall be used for documenting documents.
- application—shall be used for documenting information resources hosted on a specific set of hardware and accessible over a network (for example, interactive story map applications)

Finally, three more scopes are provided to align SDSFIE-M with the Geoplatform Profile of ISO 19115-1:2014:

- map— shall be used to document a map resource
- mapDocument— shall be used to document a map resource whose georeferencing is not directly exploitable by GIS software (for example, a scanned map)
- layer—shall be used to document a layer resource

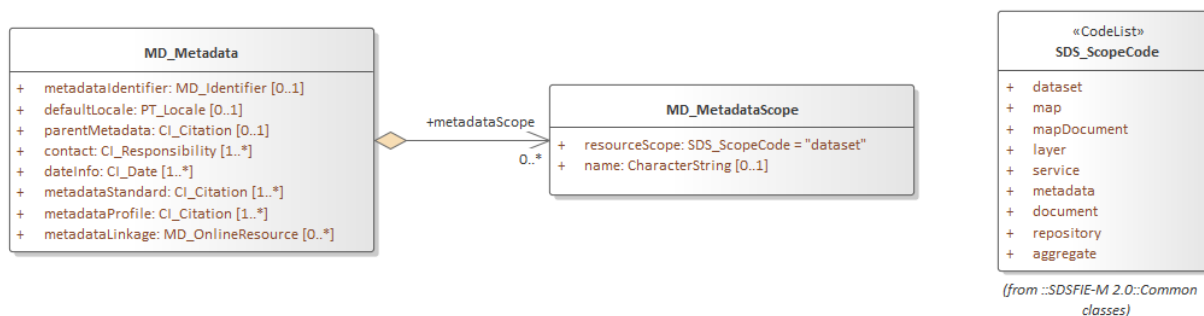


Figure 5: Metadata on Metadata

The data dictionary table in this section is from ISO 19115-1:2014. No additional profiling of this table has been performed to address EI&E community requirements.

Table 11: MetadataScope

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_MetadataScope	information about the scope of the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	
resourceScope	code for the scope	M	1	Class / SDS_ScopeCode <<CodeList>> See Table 3 (SDS_ScopeCode)	
name	description of the scope	O	1	CharacterString	ISO 19115-1:2014 has a constraint that requires a name if the resourceScope is not equal dataset

6.1.4 Locale

The data dictionary table presented in this section is from ISO 19115-1:2014 (B.3.4.3). No additional profiling of this table has been performed to address EI&E community requirements. Default values have been selected to reflect common usage in the EI&E community.

Table 12: Locale

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
PT_Locale	identification of the human language(s), language country(ies), and character set(s) used in the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
language	identification of the human language that is used in the text	M	1	Class / LanguageCode <<CodeList>> See Table 3 (LanguageCode)	Default value: "eng"
country	national localization of the language that is used in the text	M	1	Class / CountryCode <<CodeList>> See Table 3 (CountryCode)	Default value: "us"
characterEncoding	identification of the character set that is used in the text	M	1	Class / CharacterSet <<CodeList>> See Table 3 (CharacterSetCode)	Default value: "utf8"

6.2 Identification Information

The UML diagram in Figure 6 is a simplified version of Figure A.2 found in ISO 19115-1:2014.

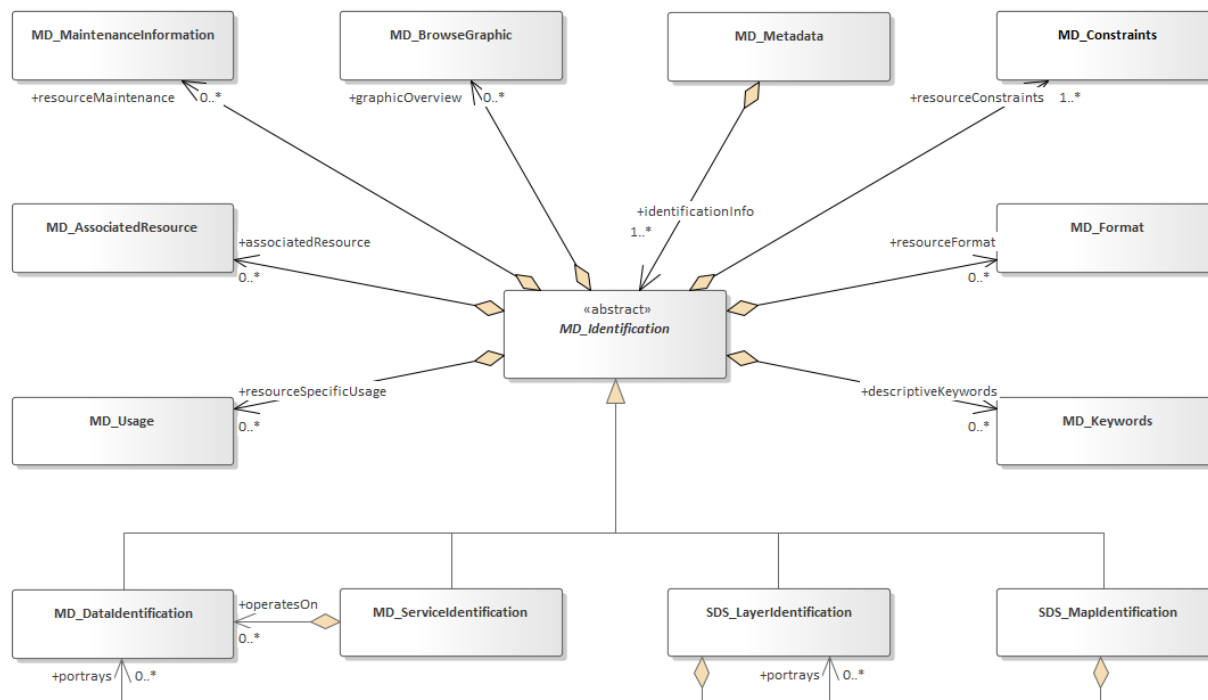


Figure 6: Identification information

This diagram defines the metadata classes required to identify a resource. MD_Identification can be specified as MD_DataIdentification or SV_ServiceIdentification and is an aggregate of seven classes of metadata which aid in resource identification. The diagram had been expanded to depict two new elements coming from the

GeoPlatform Profile of ISO 19115-1:2014, SDS_LayerIdentification and SDS_MapIdentification. Additionally, the following change has been made from the ISO 19115-1:2014 MD_Metadata class:

- Changed multiplicity on the resourceConstraints (MD_Constraints) association on MD_Identification for 1..* to indicate that at least one constraint is required (one ResourceConstraints) for each identified resource.

The UML diagram in Figure 7 is a simplified version of Figure 18 from ISO 19115-1:2014 and depicts the classes required to represent service metadata.

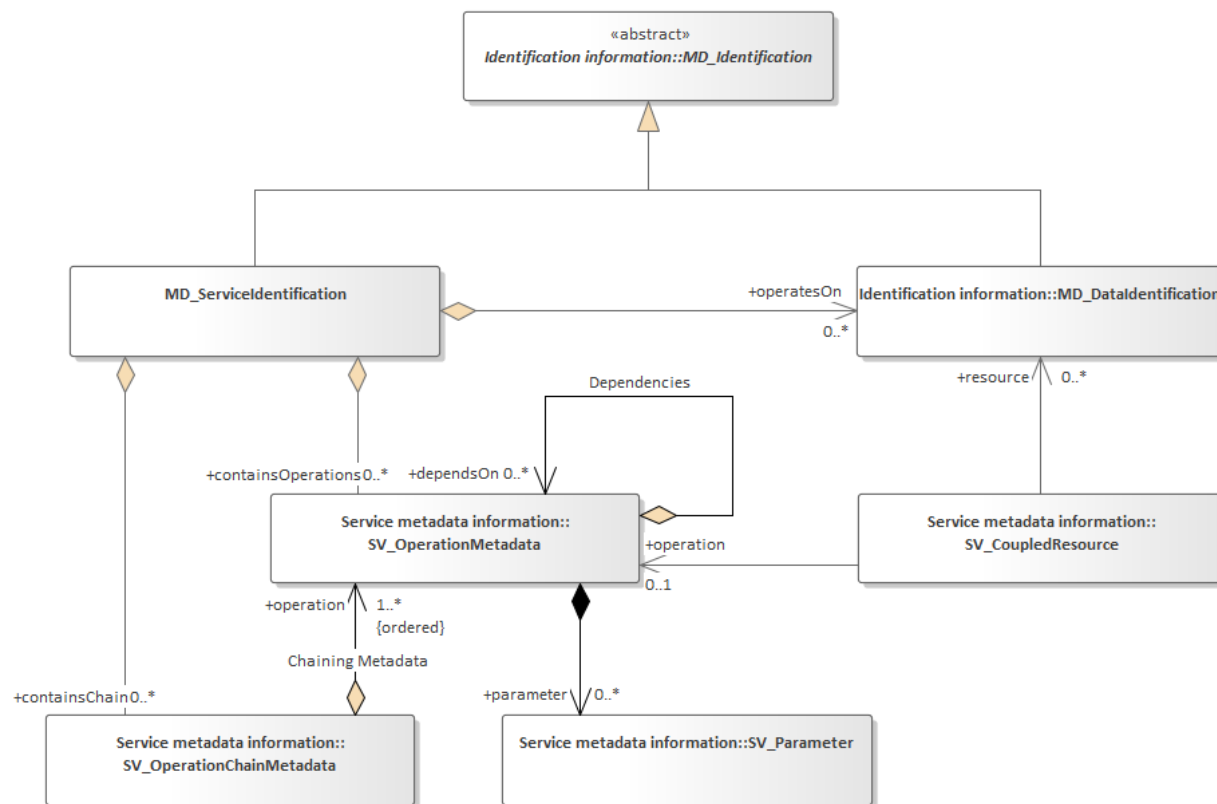


Figure 7: Service Identification Context

6.2.1 Identification

The data dictionary table presented in this section is a SDSFIE-M -specific version of the corresponding Identification data dictionary table found in Section B.2.3.1 and B.2.14.1 of ISO 19115-1:2014. The following attributes have been profiled because they are not required to address EI&E community requirements:

- credit and processingLevel from MD_Identification
- otherLocale from MD_DataIdentification

An identifier attribute was added to align with the addition of the same attribute by the GeoPlatform Profile of ISO 19115-1:2014.

The MD_ServiceIdentification element has been extended by adding the serviceDocumentation attribute from the GeoPlatform Profile of ISO 19115-1. The SDS_LayerIdentification and SDS_MapIdentification elements were added from the GeoPlatform Profile of ISO 19115-1. The SDS_LayerIdentification is extended to allow for an internal reference (within the metadata document) to an MD_DataIdentification elements describing the data used by the layer. Similarly, the SDS_MapIdentification element is extended to allow for an internal reference (within the metadata document) to an SDS_LayerIdentification elements describing the layers used by the map.

Table 13: Identification

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Identification	basic information required to uniquely identify a resource or resources	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	
citation	citation data for the resource(s)	M	1	Class / CI_Citation (6.13)	
abstract	brief narrative summary of the content of the resource(s)	M	1	CharacterString / Free text	Abstract narrative should include information on general content, thematic features (e.g., geology; climatology; etc.), and features; dataset application: GIS, CAD, image, database; geographic coverage: county/city name; time period of content: begin and end date or single date; and special data characteristics or limitations
purpose	summary of the intentions with which the resource(s) was developed.	O	1	CharacterString / Free text	
status	status of the resource(s)	M	N	Class / ProgressCode <<CodeList>> See Table 3 (ProgressCode)	
pointOfContact	identification of, and means of communication with, person(s) and organization(s) associated with the resource(s)	M	N	Class / CI_Responsibility (6.13.1)	In the case of more than a single pointOfContact element then the members of the set shall be ordered in descending priority of their recommended use, however not all implementations will necessarily honor the ordering. Note: this element is optional in 19115.
spatialRepresentationType	method used to spatially represent geographic information	O	N	Class / SpatialRepresentationTypeCode <<CodeList>> See Table 3 (SpatialRepresentationTypeCode)	

spatialResolution	factor which provides a general understanding of the density of spatial data in the dataset	O	N	Class / MD_Resolution <<Union>> (6.2.6)	
temporalResolution	smallest resolvable temporal period in a resource	O	N	Class / TM_Duration <<DataType>>(Annex C)	
topicCategory	main theme(s) of the dataset	C / see footnote ¹⁴	N	Class / TopicCategoryCode (Table 4)	
extent	extent information including the bounding box, bounding polygon, vertical, and temporal extent of the dataset	C / see footnote ¹⁵	N	Class / EX_Extent <<DataType>> (6.11.8)	Note that this may not necessarily be the full extent of the content of the resource as multiple instances of this class may be specified.
additionalDocumentation	other documentation associated with the resource EXAMPLE: Related articles, publications, user guides, data dictionaries.	O	N	Class / CI_Citation (6.13)	
<i>Role name:</i> resourceMaintenance	provides information about the frequency of resource updates, and the scope of those updates	O	N	Association / MD_MaintenanceInformation (6.4.6)	
<i>Role name:</i> graphicOverview	provides a graphic that illustrates the resource(s) (should include a legend for the graphic)	O	N	Association / MD_BrowseGraphic (6.2.4)	
<i>Role name:</i> resourceFormat	provides a description of the format of the resource(s)	O	N	Association / MD_Format (6.10.2)	
<i>Role name:</i> descriptiveKeywords	provides category keywords, their type, and reference source	M	N	Association / MD_Keywords (6.2.2)	
<i>Role name:</i> resourceSpecificUsage	basic information about specific application(s) for which the resource has been or is being used by different users	O	N	Association / MD_Usage (6.2.5)	
<i>Role name:</i> resourceConstraints	provides information about constraints which apply to the resource(s)	M	1	Association / MD_Constraints (6.3)	There shall be an instance of MD_Constraints, specifically a ResourceConstraints instance.
<i>Role name:</i> associatedResource	provides associated resource information	O	N	Association / MD_AssociatedResource (6.2.8)	

¹⁴ if MD_Metadata.metadataScope.MD_MetadataScope.resourceScope equals "dataset" then topicCategory is mandatory

¹⁵ if MD_Metadata.metadataScope.MD_MetadataScope.resourceScope equals "dataset" then either extent.geographicElement.EX_GeographicBoundingBox or extent.geographicElement.EX_GeographicDescription is required

MD_DataIdentification	information required to identify a dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	
defaultLocale	language and character set used within the dataset	M	N	Class / PT_Locale (6.1.2)	
environmentDescription	description of the dataset in the producer's processing environment, including items such as the software, the computer operating system, file name, and the dataset size	O	1	CharacterString / Free text	
supplementalInformation	any other descriptive information about the dataset	O	1	CharacterString / Free text	
MD_ServiceIdentification	identification of capabilities which a service provider makes available to a service user through a set of interfaces that define a behaviour - See ISO 19115-1 for further information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	
serviceType	a service type name from a registry of services. For example, the values of the nameSpace and name attributes of GeneralName may be "OGC" and "catalogue".	M	1	GenericName (Annex C)	
serviceTypeVersion	provides for searching based on the version of serviceType. For example, we may only be interested in OGC Catalogue V1.1 services. If version is maintained as a separate attribute, users can easily search for all services of a type regardless of the version.	O	N	CharacterString / Free text	
accessProperties	information about the availability of the service, including, - fees - planned available date and time - ordering instructions - turnaround	O	1	Class / MD_StandardOrderProcess (6.10.3)	
couplingType	qualitative information on the tightness with which the service and the associated data are coupled	M	1	Class / CouplingType <<CodeList>> See Table 3 (CouplingType)	

coupledResource	further description of the coupling between the service and the data when they are tightly coupled	O	N	Class / SV_CoupledResource (6.2.13)	
operatedDataset	provides a reference to the dataset on which the service operates	O	N	Class / CI_Citation (6.13)	
profile	profile to which the service adheres	O	N	Class / CI_Citation (6.13)	
serviceStandard	standard to which the service adheres	O	N	Class / CI_Citation (6.13)	
serviceDocumentation	information about online sources from which the service can be obtained	C	1	Class / MD_OnlineResource (6.13.5)	This attribute is mandatory if the resource is accessible via GeoPlatform.
<i>Role name:</i> containsOperations	provides information about the operations that comprise the service	M	N	Association / SV_OperationMetadata (6.2.9)	
<i>Role name:</i> operatesOn	provides information on the datasets that the service operates on	O	N	Association / MD_DataIdentification (6.2)	
<i>Role name:</i> containsChain	provide information about the chain applied by the service	O	N	Aggregation / SV_OperationChainMetadata (6.2.11)	
SDS_LayerIdentification	information required to identify a layer resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	
dataset	reference to the data associated with the layer	M	1	Class / CI_Citation (6.13)	
layerName	request identifier of the layer used by the map service	O	1	CharacterString / Free text	
style	reference to the portrayal information by which a data is portrayed in the layer	O	N	Class / CI_Citation (6.13)	
<i>Role name:</i> portrays	provides information about data in the layer and applies to data documented as resources within the same metadata document	O	N	Aggregation / MD_DataIdentification (6.2)	This elements is only used when the data identification elements are included in the metadata document
SDS_MapIdentification	information required to identify a map resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	
layer	references to the layer(s) of which a map is comprised	O	N	Class / CI_Citation (6.13)	

<i>Role name:</i> portrays	provides information about layers in the map and applies to layers documented as resources within the same metadata document	O	N	Aggregation / SDS_LayerIdentification (6.2)	This elements is only used when the layer identification elements are included in the metadata document
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6.2.1.1 Identification Example

An example of MD_Identification is provided in a tabbed-outline format for an SDSFIE-V AccessControl feature class dataset. The example illustrates the hierarchical structure of ISO 19115-1 metadata and is based on an implementation schema that governs the ordering of the elements within the metadata instance document. The example only addresses the elements contained within MD_Identification (and MD_DataIdentification) and includes a couple of the associated elements as examples (CI_Citation, EX_Extent, PT_Locale).

(MD_Identification)

citation: (CI_Citation)

title: AccessControl

date: (DateTime) 20171111

dateType: (CI_DateTypeCode) revision

citedResponsibleParty: (CI_Responsibility)

role: (RoleCode) author

party: (CI_Organisation)

name: OASD(EI&E), BSI, DISDI Program

contactInfo: (CI_Contact)

phone: 571-372-6780

address: (CI_Address)

electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

presentationForm: (PresentationFormCode) mapDigital

onlineResource: (MD_OnlineResource)

linkage: http://maps.osd.mil

abstract: The location of a feature, manned or unmanned, intended to selectively restrict entrance to or use of a place or other resource.

purpose: This entity is supported by policy directives and/or indirect drivers (DoDI 8130.01, DoDI 4165.14, DoDI 6055.17, DoDD 3020.45, UFC 2-100-01) in these functional area categories: Real Property, Master Planning, JLUS, Emergency Response, DCIP. The CIP will include a geospatial feature representing each DoD real Property asset as required by DoDI 4165.14. According to DoDI 4165.14, it is DoD policy that the MILDEPs and WHS maintain and report accurate information about real property assets in which they hold a legal interest on behalf of the United States. The real property inventory report shall include the "minimum asset information" described in Enclosure 3, which includes a "geospatial feature" to establish the asset's location in GIS format. DoDI 6055.17 requires installations to identify and manage critical assets. Installations are required to provide a common operating picture for emergency response. According to DoDI 3020.45, it is DoD policy that a comprehensive program be implemented that provides centralized program management of common requirements and capabilities (e.g. standardized analytic methods and tools, geospatially reference infrastructure data and visualization technology). Presidential Policy Directive 21 includes the requirement "Coordinate with and utilize the expertise of Sector Specific Agencies (SSAs) and other appropriate Federal departments and agencies to map geospatially, image, analyze, and sort critical infrastructure by employing commercial satellite and airborne systems, as well as existing capabilities within other departments and agencies." Identified in UFC 2-100-01 as a typical data layer essential for Master Planning. Installations must meet GCC AT requirements for access control points (2-5.2).

status: (ProgressCode) completed

pointOfContact: (CI_Responsibility)

role: (RoleCode) pointOfContact

party: (CI_Organisation)

name: OASD(EI&E), BSI, DISDI Program

contactInfo: (CI_Contact)

phone: 571-372-6780

address: (CI_Address)

electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

spatialRepresentationType: (SpatialRepresentationTypeCode) vector

topicCategory: (TopicCategoryCode) intelligenceMilitary

extent: (EX_Extent)

geographicElement:

extentTypeCode: true

westBoundLongitude: -145.768803

eastBoundLongitude: 167.726592

southBoundLatitude: 9.002075

northBoundLatitude: 64.008435

descriptiveKeywords: (MD_Keywords)

keyword: Access Control

keyword: gate

(MD_DataIdentification)

defaultLocale: (PT_Locale)

language: (LanguageCode) eng

country: (CountryCode) us

characterEncoding: (CharacterSetCode) utf8

supplementalInformation: This feature class dataset was created as a roll-up of datasets of the same feature classes from all of the Components provided in the 2018 CIP data call.

6.2.2 Keywords

The data dictionary table presented in this section contains content from the corresponding Keywords data dictionary table found in ISO 19115-1:2014 (Section B.2.3.2). It also contains the concept attribute added by the GeoPlatform Profile of ISO 19115-1 as well as the addition of allowing multiple keyword classes (instead of the one allowed by ISO 19115-1:2014).

Table 14: Keywords

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Keywords	keywords, their type and reference source	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	
keyword	commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject	M	N	CharacterString / Free text	
type	subject matter used to group similar keywords	O	1	Class / SDS_KeywordTypeCode <<CodeList>> See Table 3 (SDS_KeywordTypeCode)	
thesaurusName	name of the formally registered thesaurus or a similar authoritative source of keywords	M	1	Class / CI_Citation (6.13)	Note: this element is optional in 19115
Role name: concepts	idea or notion or unit of thought	O	N	Class / MD_Concept (6.2.9)	

<i>Role name:</i> keywordClass	association of a MD_Keywords instance with a MD_KeywordClass to provide user-defined categorization of groups of keywords that extend or are orthogonal to the standardized SDS_KeywordTypeCodes and are associated with an ontology that allows additional semantic query processing ¹⁶	O	N	Aggregation / MD_KeywordClass (6.2.3)	
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6.2.3 Keyword Class

The data dictionary table presented in this section is identical to the corresponding KeywordClass data dictionary table found in ISO 19115-1:2014 (Section B.2.3.3).

Table 15: Keyword Class

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_KeywordClass	keywords, their type and reference source	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Keywords)	
className	character string to label the keyword category in natural language	M	1	CharacterString / Free text	
conceptIdentifier	URI of concept in the ontology specified by the next element (ontology) and labelled by the previous element (className)	O	1	Class / URI (IETF RFC 3986)	
ontology	reference that binds the keyword class to a formal conceptualization of a knowledge domain for use in semantic processing	M	1	Class / CI_Citation (6.13)	

6.2.4 Browse Graphic

The data dictionary table presented in this section is identical to the corresponding Browse Graphic data dictionary table found in ISO 19115-1:2014 (Section B.3.3.4).

Table 16: Browse Graphic

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
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¹⁶ The thesaurus citation specifies a collection of instances from some ontology, but is not an ontology. It might be a list of places that include rivers, mountains, counties and cities. There might be a Laconte county, the city of Laconte, the Laconte River, and Mt. Laconte; when searching it is useful for the user to be able to restrict the search to only rivers.

MD_BrowseGraphic	graphic that provides an illustration of the dataset (should include a legend for the graphic)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	
fileName	name of the file that contains a graphic that provides an illustration of the dataset	M	1	CharacterString / Free text	
fileDescription	text description of the illustration	O	1	CharacterString / Free text	
fileType	format in which the illustration is encoded. Examples: CGM, EPS, GIF, JPEG, PBM, PS, TIFF, XWD	O	1	CharacterString / Free text	
imageConstraints	restriction on access and/or use of browse graphic	O	N	Class / MD_Constraints (6.3)	
linkage	link to browse graphic	O	N	Class / CI_OnlineResource <<DataType>>(6.13.5)	

6.2.5 Usage

The data dictionary table presented in this section is identical to the corresponding Usage data dictionary table found in ISO 19115-1:2014 (Section B.2.3.6).

Table 17: Usage

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Usage	brief description of ways in which the resource(s) is/are currently or has been used	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	
specificUsage	brief description of the resource and/or resource series usage	M	1	CharacterString / Free text	
usageDateTime	date and time of the first use or range of uses of the resource and/or resource series	O	N	Class / TM_Primitive (Annex C)	
userDeterminedLimitations	applications, determined by the user for which the resource and/or resource series is not suitable	O	1	CharacterString / Free text	
userContactInfo	identification of and means of communicating with person(s) and organisation(s) using the resource(s)	O	N	Class / CI_Responsibility (6.13.1)	
response	response to the user-determined limitations EXAMPLE "This has been fixed in version x."	O	N	CharacterString / Free text	
additionalDocumentation	publications that describe usage of data	O	N	Class / CI_Citation (6.13)	
identifiedIssues	citation of a description of known issues associated with the resource along with proposed solutions if available	O	N	Class / CI_Citation (6.13)	

6.2.6 Resolution

The data dictionary table presented in this section is identical to the corresponding Resolution data dictionary table found in ISO 19115-1:2014 (Section B.2.3.5).

Table 18: Resolution

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Resolution	level of detail expressed as a scale factor or a ground distance	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	UNION – one and only one attribute should be populated
equivalentScale	level of detail expressed as the scale of a comparable hardcopy map or chart	C / distance, vertical, angularDistance, or levelOfDetail not documented?	1	Class / MD_RepresentativeFraction <<DataType>> (6.2.7)	
distance	ground sample distance	C / distance, equivalentScale or angularDistance, or levelOfDetail not documented?	1	Class / Distance (Annex C)	Distance is used as a type for returning the length between two points. (defined in ISO/TS 19103)
vertical	vertical sampling distance	C / distance, equivalentScale or angularDistance, or levelOfDetail not documented?	1	Class / Distance (Annex C)	
angularDistance	angular sampling measure	C / distance, equivalentScale, vertical, or levelOfDetail not documented?	1	Class / Angle (Annex C)	
levelOfDetail	brief textual description of the spatial resolution of the resource	C / distance, equivalentScale or vertical not documented?	1	CharacterString / Free text	

6.2.7 Representative Fraction

The data dictionary table presented in this section is identical to the corresponding Representative Fraction data dictionary table found in ISO 19115-1:2014 (Section B.2.3.4).

Table 19: Representative Fraction

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_RepresentativeFraction	derived from ISO 19103 Scale where MD_RepresentativeFraction.denominator = 1 / Scale.measure And Scale.targetUnits = Scale.sourceUnits	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
denominator	the number below the line in a vulgar fraction	M	1	Integer / Integer > 0	

6.2.8 Associated Resource

The data dictionary table presented in this section is identical to the corresponding Association information data dictionary table found in ISO 19115-1:2014 (Section B.2.3.7).

Table 20: Associated Resource Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_AssociatedResource	associated resource information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	
name	citation information about the associated resource	C / if aggregateData SetIdentifier not documented?	1	Class / CI_Citation (6.13)	
associationType	association type of the aggregate dataset	M	1	Class / ResourceAssociationTypeCode <<CodeList>> See Table 3 (ResourceAssociationTypeCode)	
initiativeType	type of initiative under which the associated resource was produced	O	1	Class / InitiativeTypeCode <<CodeList>> See Table 3 (InitiativeTypeCode)	
metadataReference	reference to the metadata of the associated resource	C / if name not documented?	1	Class / CI_Citation (6.13)	

6.2.9 Concept Information

The data dictionary table presented in this section is identical to the corresponding MD_Concept data dictionary table found in the GeoPlatform Profile of ISO 19115-1 (Section 3.3.2.8).

Table 21: Concept Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Concept	idea or notion or unit of thought	Use obligation from referencing object		Class	
conceptIdentifier	the URI of the concept (effort should be done to make it resolvable)	M	1	Class / URI (IETF RFC 3986)	
preferredLabel	the preferred label of the concept	M	1	CharacterString / Free Text	
alternateLabel	other labels of the concept; may be used for parallel language versions of the label	O	N	CharacterString / Free Text	

description	the definition of the concept; may be repeated for parallel language versions of the definition	O	N	CharacterString / Free Text	
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6.2.10 Operation Information

The data dictionary table presented in this section is identical to the corresponding Operation Metadata data dictionary table found in ISO 19115-1:2014 (Section B.2.14.2).

Table 22: Operation Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
SV_OperationMetadata	describes the signature of one and only one method provided by the service.	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (SV_ServiceIdentification)	
operationName	a unique identifier for this interface	M	1	CharacterString / No specified domain	
distributedComputingPlatform	distributed computing platforms on which the operation has been implemented	M	N	Class / DCPList <<CodeList>> See Table 3 (InitiativeTypeCode)	
operationDescription	free text description of the intent of the operation and the results of the operation	O	1	CharacterString / Free text	
invocationName	the name used to invoke this interface within the context of the DCP. The name is identical for all DCPs.	O	1	CharacterString / Free text	
connectPoint	handle for accessing the service interface	M	N	Class / MD_OnlineResource <<DataType>> (6.13.5)	
Role name: parameters	the parameters that are required for this interface in sequence	O	N	Association / SV_Parameter (6.2.12)	
Role name: dependsOn	list of operations that must be completed immediately before current operation is invoked, structured as a list for capturing alternate predecessor paths and sets for capturing parallel predecessor paths	O	N	Association / SV_OperationMetadata (6.2.9)	

6.2.11 Operation Chain Information

The data dictionary table presented in this section is identical to the corresponding Operation Chain Information data dictionary table found in ISO 19115-1:2014 (Section B.2.14.3).

Table 23: Operation Chain Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
SV_OperationChainMetadata	Operation Chain Information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (SV_ServiceIdentification)	
name	the name, as used by the service for this chain	M	1	CharacterString / FreeText	
description	a narrative explanation of the services in the chain and resulting output	O	1	CharacterString / FreeText	
Role name: operation	(ordered) information about the operations applied by the chain	M	N	Association / SV_OperationMetadata (6.2.9)	

6.2.12 Parameter Information

The data dictionary table presented in this section is identical to the corresponding Parameter Information data dictionary table found in ISO 19115-1:2014 (Section B.2.14.4).

Table 24: Parameter Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
SV_Parameter	describes a parameter of a service	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (SV_ServiceIdentification)	
name	the name, as used by the service for this parameter	M	1	MemberName (Annex C)	
direction	indication if the parameter is an input to the service, an output or both	O	1	Class / ParameterDirection <<Enumeration>> See section 5.2.3.4 (ParameterDirection)	
description	description a narrative explanation of the role of the parameter	O	1	CharacterString	
optionality	indication if the parameter is required	M	1	Boolean	0 = no 1 = yes
repeatability	indication if more than one value of the parameter may be provided	M	1	Boolean	0 = no 1 = yes

6.2.13 Coupled Resource Information

The data dictionary table presented in this section is identical to the corresponding Coupled Resource Information data dictionary table found in ISO 19115-1:2014 (Section B.2.14.5).

Table 25: Coupled Resource Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
SV_CoupledResource	information describing the linkage between a service operation and a tightly coupled dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (SV_ServiceIdentification)	
scopedName	scoped identifier of the resource in the context of the given service instance ¹⁷	O	1	Class / ScopedName (Annex C)	
resourceReference	reference to the dataset on which the service operates ¹⁸	O	N	Class / CI_Citation (6.13)	
Role name: resource	the tightly coupled dataset. This attribute should be implemented by reference	O	N	Association / MD_DataIdentification (6.2)	
Role name: operation	The service operation. This attribute should be implemented by reference	O	1	Association / SV_OperationMetadata (6.2.9)	

6.3 Constraint Information

This UML diagram depicted in Figure 8 is an SDSFIE-M-specific version of the corresponding Constraint Information classes diagram found in ISO 19115-1:2014 (Figure 8). Attributes and associations that have not been included in this SDSFIE-M profile have been hidden. Likewise, classes, attributes and associations which extend the base standard have been added. For the original diagram consult ISO 19115-1:2014.

SDSFIE-M modifies the ISO 19115-1 model of MD_Constraints as follows:

- Profile the 'constraintApplicationScope', 'reference', 'responsibleParty', and 'releasability' attributes from MD_Constraints.

SDSFIE-M modifies the ISO 19115-1 constraints model by:

- Disallowing the use of MD_SecurityConstraints and MD_LegalConstraints and replaces them with the NAS X-2 ResourceConstraints class.

¹⁷ name of the resources (i.e. dataset) as it is used by a service instance (e.g. layer name or featureTypeName).

¹⁸ for one resource either resource or resourceReference should be used (not both for the same resource).

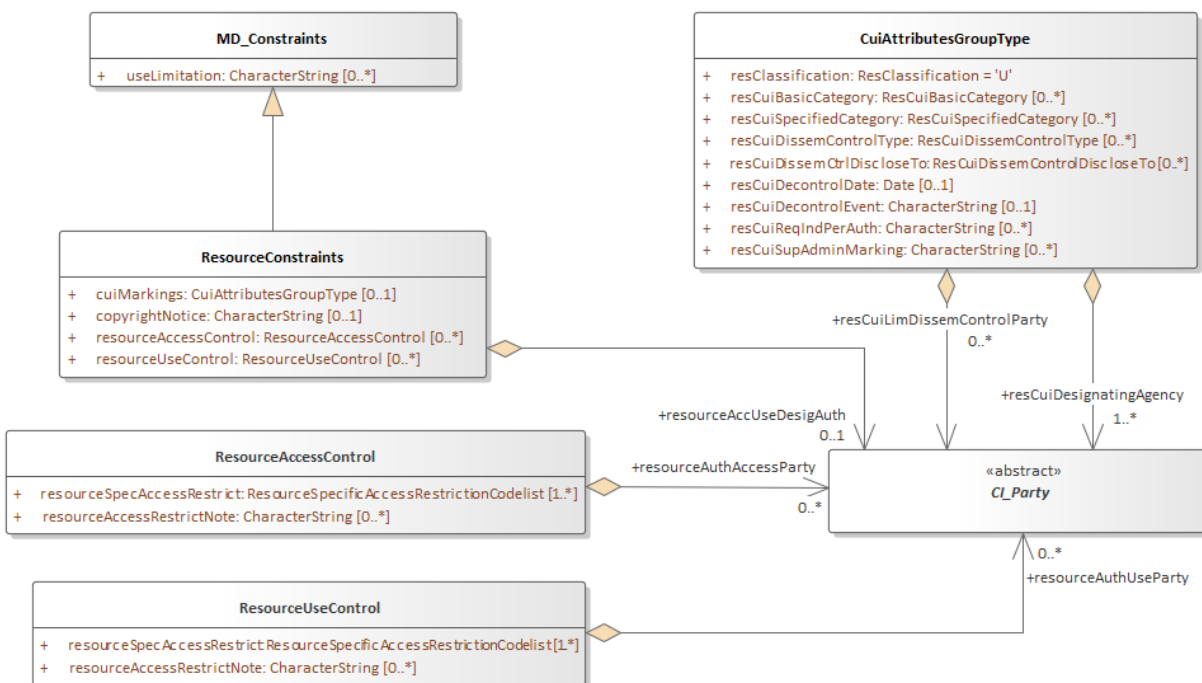


Figure 8: Constraint Information

6.3.1 Constraint

The data dictionary table presented in this section is an SDSFIE-M -specific version of the corresponding Constraints data dictionary table found in ISO 19115-1:2014 (Section B.2.4.1).

The SDSFIE-M modifies the ISO 19115-1 as follows:

- Constraints are mandatory for MD_Metadata and MD_Identification instances.
- The MD_SecurityConstraints and MD_LegalConstraints subclasses have been disallowed as they have been replaced by a NAS subclass, ResourceConstraints. The ResourceConstraints class has been designed to allow the proper designation of CUI, use controls, or access controls as defined by the National Archive and Records Administration (as well as the DoD application of CUI according to DoDI 5200.48) and solves the ambiguity inherent in the ISO elements
- The constraintApplicationScope attribute of MD_Constraints has been profiled because the scope should always clear from the context of the SDSFIE-M metadata or identification element to which the constraint refers.
- The reference attribute of MD_Constraints has been profiled because the statutory reason for designating a resource or metadata as CUI is implicit in the CUI category. Additionally, if the resource or metadata is designated as use- or access-controlled, then the reason is implicit in the statutory or regulatory provision defined by the restriction.
- The releaseability attribute of MD_Constraints has been profiled because that party(ies) that has access are defined in the cuiMarkings, resourceUseControls, or the resourceAccessControls.
- The responsibleParty attribute of MD_Constraints has been profiled in favor of the much more specific designation attributes in the elements within the ResourceConstraints class or its contained elements.

Table 26: Constraint Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain
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MD_Constraints	restrictions on the access and use of a resource or metadata	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)
useLimitation	A limitation affecting the fitness for use of the resource or a set of resource metadata for a specific use or application.	0	N	CharacterString / Free text
ResourceConstraints	Restrictions may take the form of handling restrictions imposed on a resource or metadata associated with a resource because of national security and/or other security concerns.	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Constraints)
copyrightNotice	A notice of prescribed form as specified by title 17 of the U.S. Code that informs users of the underlying claim to copyright ownership of a resource.	0	1	CharacterString / Free text
cuiMarkings	U.S. Government Federal Executive branch markings for Controlled Unclassified Information (CUI) that requires safeguarding or dissemination controls pursuant to and consistent with applicable law, regulations, or government-wide policies.	0	1	Class / CuiAttributesGroupType (6.3.1.1)
resourceAccessControl	A control based on statutory or regulatory provisions that restrict access to a resource, or to a set of resource metadata.	0	N	Class / ResourceAccessControl (6.3.1.2)
resourceUseControl	A control based on statutory or regulatory provisions that restrict use or reproduction of a resource, or of a set of resource metadata.	0	N	Class / ResourceUseControl (6.3.1.3)
<i>Role name:</i> resourceAccUseDesigAuth	Information about the designating authority that has determined the conditions under which the content of the resource may be accessed and/or used.	0	1	Association / CI_Party (6.13.1)

6.3.1.1 Controlled Unclassified Information Marking

The data dictionary table presented in this section is not found in ISO 19115-1:2014. This metadata element encapsulates and represents the controlled unclassified information security markings from NAS X-2. These marking are intended to be encodable into future implementations of CUI from either the DoD or from NARA.

Table 27: Controlled Unclassified Information Marking Details

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain
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CuiAttributesGroupType	A U.S. Government Federal Executive branch marking for Controlled Unclassified Information (CUI).	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class
resClassification	The highest level of classification applicable to an information resource or portion within the domain of classified national security information.	M	1	Class / ResClassification <<CodeList>> See Table 3 (ResClassification)
resCuiBasicCategory	A Controlled Unclassified Information (CUI) Category or Subcategory marking which identifies the "Basic" subset of CUI for which the U.S. authorizing law, regulation, or government-wide policy does not set out specific handling or dissemination controls for the content of a resource (specific items of information).	O	N	Class / ResCuiBasicCategory <<CodeList>> See Table 3 (ResCuiBasicCategory)
resCuiSpecifiedCategory	A Controlled Unclassified Information (CUI) Category or Subcategory marking which identifies the "Specified" subset of CUI for which the U.S. authorizing law, regulation, or government-wide policy sets out specific handling or dissemination controls that it requires or permits agencies to use for the content of a resource (specific items of information) where those differ from those defined for CUI "Basic".	O	N	Class / ResCuiSpecifiedCategory <<CodeList>> See Table 3 (ResCuiSpecifiedCategory)
resCuiDissemControlType	The type of limit imposed on the dissemination of the content of a resource (specific items of information) identified as containing Controlled Unclassified Information (CUI).	O	1	Class / ResCuiDissemControlType <<CodeList>> See Table 3 (ResCuiDissemControlType)
resCuiDissemCtrlDiscloseTo	A foreign country or international organization to whom Controlled Unclassified Information (CUI) has been predetermined by the designating agency to be able to be (or has been) disclosed through established foreign disclosure procedures and channels.	O	N	Class / ResCuiDissemControlDiscloseTo <<CodeList>> See Table 3 (ResCuiDissemControlDiscloseTo)
resCuiDecontrolDate	A specific date when the content of a resource (specific items of information) identified as containing Controlled Unclassified Information (CUI) is considered to be decontrolled.	O	1	Date

resCuiDecontrolEvent	A specific event after which the content of a resource (specific items of information) identified as containing Controlled Unclassified Information (CUI) is considered to be decontrolled.	O	1	CharacterString / Free text
resCuiReqIndPerAuth	An additional required indicator, including marking, dissemination, informational, distribution-limiting, or warning statements, that is mandated by U.S. authorizing law, regulation, or government-wide policy that designates the content of a resource (specific items of information) as Controlled Unclassified Information (CUI).	O	N	CharacterString / Free text
resCuiSupAdminMarking	A supplemental administrative marking for the content of a resource (specific items of information) which may be used in conjunction with Controlled Unclassified Information (CUI) markings where required by U.S. law, regulation, or government-wide policy.	O	N	CharacterString / Free text
<i>Role name:</i> resCuiDesignatingAgency	An identification of an authorized holder of Controlled Unclassified Information (CUI) that has determined that the content of a resource (specific items of information) is appropriately described by a CUI Category or Subcategory.	M	N	Association / CI_Party (6.13.1)
<i>Role name:</i> resCuiLimDissemControlParty	Information about party(ies) to which dissemination of a resource is authorized in an accompanying dissemination list.	O	N	Association / CI_Party (6.13.1)

6.3.1.2 Resource Access Control

The data dictionary table presented in this section is not found in ISO 19115-1:2014. This metadata element encapsulates and represents the resource access control markings from NAS X-2.

Table 28: Resource Access Control Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain
ResourceAccessControl	The control may include the identification of one or more parties who are authorized (for example, licensed) for access.	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class

resourceSpecAccessRestrict	A specific type of restriction to a resource, or to a set of resource metadata, that limits access based on statutory or regulatory provisions.	M	N	Class / ResourceSpecificAccessRestriction <<CodeList>> See Table 3 (ResourceSpecificAccessRestriction)
resourceAccessRestrictNote	Significant information pertaining to access to a resource, or a set of resource metadata.	0	N	CharacterString / Free text
<i>Role name:</i> resourceAuthAccessParty	Information about party(ies) for which the resource is authorized (for example, licensed) for access.	0	N	Association / CI_Party (6.13.1)

6.3.1.3 Resource Use Control

The data dictionary table presented in this section is not found in ISO 19115-1:2014. This metadata element encapsulates and represents the resource use control markings from NAS X-2.

Table 29: Resource Use Control Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain
ResourceUseControl	The control may include the identification of one or more parties who are authorized (for example, licensed) for use.	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Class
resourceSpecUseRestrict	A specific type of restriction to a resource, or to a set of resource metadata, that limits use or reproduction based on statutory or regulatory provisions.	M	N	Class / ResourceSpecificUseRestriction <<CodeList>> See Table 3 (ResourceSpecificUseRestriction)
resourceUseRestrictNote	Significant information pertaining to the use or reproduction of a resource, or a set of resource metadata.	0	N	CharacterString / Free text
<i>Role name:</i> resourceAuthUseParty	Information about party(ies) for which the resource is authorized (for example, licensed) for use.	0	N	Association / CI_Party (6.13.1)

6.3.1.4 Constraints Examples

An example of several MD_Constraints (one legal and two security) is provided in a tabbed-outline format for a feature class dataset that has a few dissemination controls on the resource but whose metadata is releasable to the public;. The example illustrates the hierarchical structure of ISO 19115-1 metadata and is based on an implementation schema that governs the ordering of the elements within the metadata instance document.

Example Legal Constraint (Metadata)

metadataConstraints: (LegalConstraints)

accessConstraints: (SDS_RestrictionCode) unrestricted

useConstraints: (SDS_RestrictionCode) unrestricted

Example Resource Constraint (Metadata)

metadataConstraints: (ResourceConstraints)

cuiMarkings: (CuiAttributesGroupType)

resClassification: (ResClassification) U

resCuiDesignatingAgency : (CI_Organisation)

name: OASD(EI&E), BSI, DISDI Program

contactInfo: (CI_Contact)

phone: 571-372-6780

address: (CI_Address)

electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

resCuiSupAdminMarking: DISTRIBUTION A. Approved for public release: distribution unlimited.

Example Resource Constraint (Resource)

resourceConstraints: (ResourceConstraints)

cuiMarkings: (CuiAttributesGroupType)

resClassification: (ResClassification) U

resCuiSpecifiedCategory: (ResCuiSpecifiedCategory) controlledTechnicalInfo

resCuiDissemControlType: (ResCuiDissemControlType) federalEmployeesContractorsOnly

resCuiSupAdminMarking: DISTRIBUTION STATEMENT B. Distribution authorized to U.S. Government agencies only. Operations Security, 23 January 2018. Other requests for this document shall be referred to OASD(EI&E), BSI, DISDI Program, 571-372-6780, osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil.

resCuiDesignatingAgency : (CI_Organisation)

name: OASD(EI&E), BSI, DISDI Program

contactInfo: (CI_Contact)

phone: 571-372-6780

address: (CI_Address)

electronicMailAddress: osd.pentagon.ousd-atl.mbx.disdi-help-desk@mail.mil

6.4 Data Quality and Lineage

6.4.1 Data Quality

The DQ_DataQuality class is the root of the SDSFIE-M Quality metadata. This class defines the scope of the quality assessment, aggregates quality measurements (DQ_Element) and standalone quality reports for the referenced resource. ***Please refer to the most current revision of SDSFIE-Q for for discussion, requirements, and examples of the use of this element.***

Figure 9 depicts the metadata required to give a general assessment of the quality of a resource.

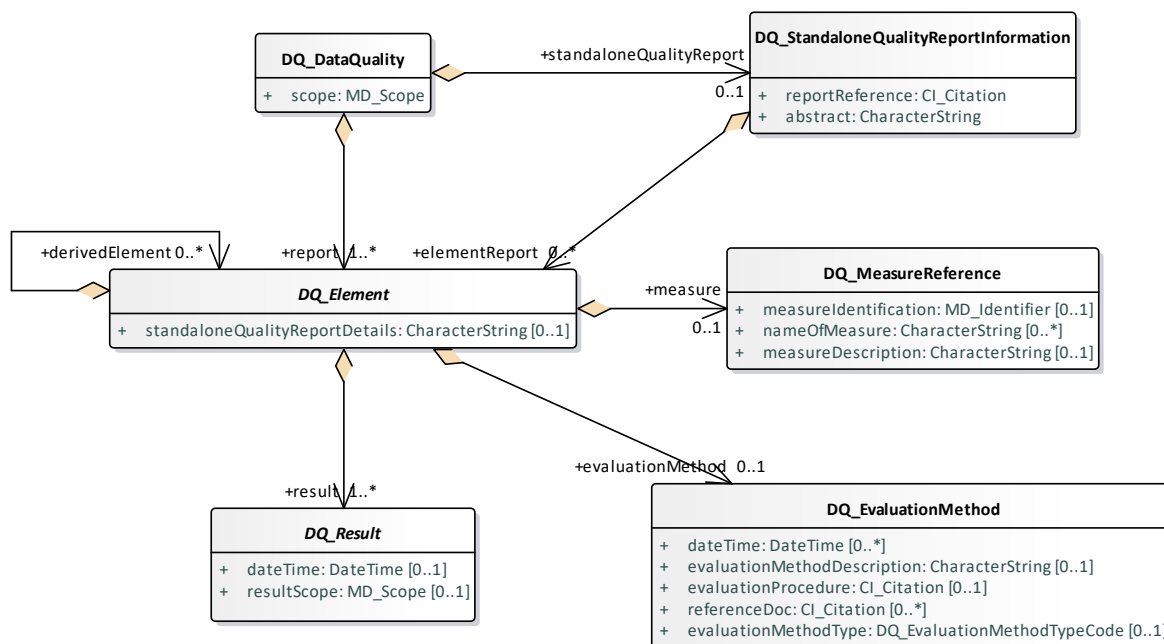


Figure 9: Data Quality

The data dictionary table presented in this section is the same corresponding Data Quality data dictionary table found in ISO 19157:2013 (Section C.2.1.1). No profiling was required to address EI&E community requirements. Additional text to clarify business rules has been added to assist users in the use of these elements.

Table 30: Data Quality

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_DataQuality	quality information for the data specified by a data quality scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	
scope	the specific data to which the data quality information applies	M	1	Class / MD_Scope <<DataType>> (6.4.2)	"report" or "lineage" role is mandatory if scope. DQ_Scope.level = "aggregate", "repository", or "dataset"

<i>Role name:</i> report	quantitative quality information for the data specified by the scope	M	N	Aggregation / DQ_CompletenessCommission and/or DQ_CompletenessOmission and/or DQ_ConceptualConsistency and/or DQ_DomainConsistency and/or DQ_FormatConsistency and/or DQ_TopologicalConsistency and/or DQ_AbsoluteExternalPositionalAccuracy and/or DQ_GriddedDataPositionalAccuracy and/or DQ_RelativeInternalPositionalAccuracy and/or DQ_ThematicClassificationCorrectness and/or DQ_NonQuantitativeAttributeAccuracy and/or DQ_QuantitativeAttributeAccuracy and/or DQ_AccuracyOfATimeMeasurement and/or DQ_TemporalValidity and/or DQ_TemporalConsistency (6.4.8.2)	
<i>Role name:</i> standaloneQualityReport	reference to external standalone quality report	O	1	Aggregation / DQ_StandaloneQualityReportInformation (6.4.8.2)+	

6.4.2 Data Quality Scope

MD_Scope specifies the extent of the resources that are described by the reported quality metadata. Extent can be described in terms of spatial, temporal, hierarchy level and resource type properties.

The data dictionary table presented in this section is an SDSFIE-M -specific version of the corresponding Scope data dictionary table found in ISO 19115-1:2014 (Section B.3.3.1). The table has been modified, as follows:

- The levelDescription attribute has been profiled.

Table 31: Data Quality Scope

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Scope	extent of characteristic(s) of the data for which quality information is reported	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
level	hierarchical level of the data specified by the scope	M	1	Class SDS_ScopeCode <<CodeList>> See Table 3 (SDS_ScopeCode)	Best Practice: This element should match the MD_Metadata hierarchyLevel element

extent	information about the horizontal, vertical and temporal extent of the data specified by the scope	0	1	Class EX_Extent <<DataType>> (6.13)	/
--------	---	---	---	---	---

6.4.3 Data Quality Element

DQ_Element is the root class for all quantifiable measures of quality. When a quality measurement is performed, this class captures the quality measurement technique used and the resulting measurement values. ISO 19157:2013 defines the semantics of this information by subclassing the DQ_Element class. In effect, the inheritance tree from DQ_Element forms a taxonomy of quality measurement types.

A register of quality measurement techniques has been established on the NSG Standards Registry to help capture this information in a standard repeatable form. Detailed descriptions of a measurement technique can be retrieved from the register using the “measureIdentification” element of DQ_Element.

This UML diagram is an SDSFIE-M -specific version of the corresponding Data Quality Classes and Subclasses UML diagram (Figure 10) found in ISO 19157:2013.

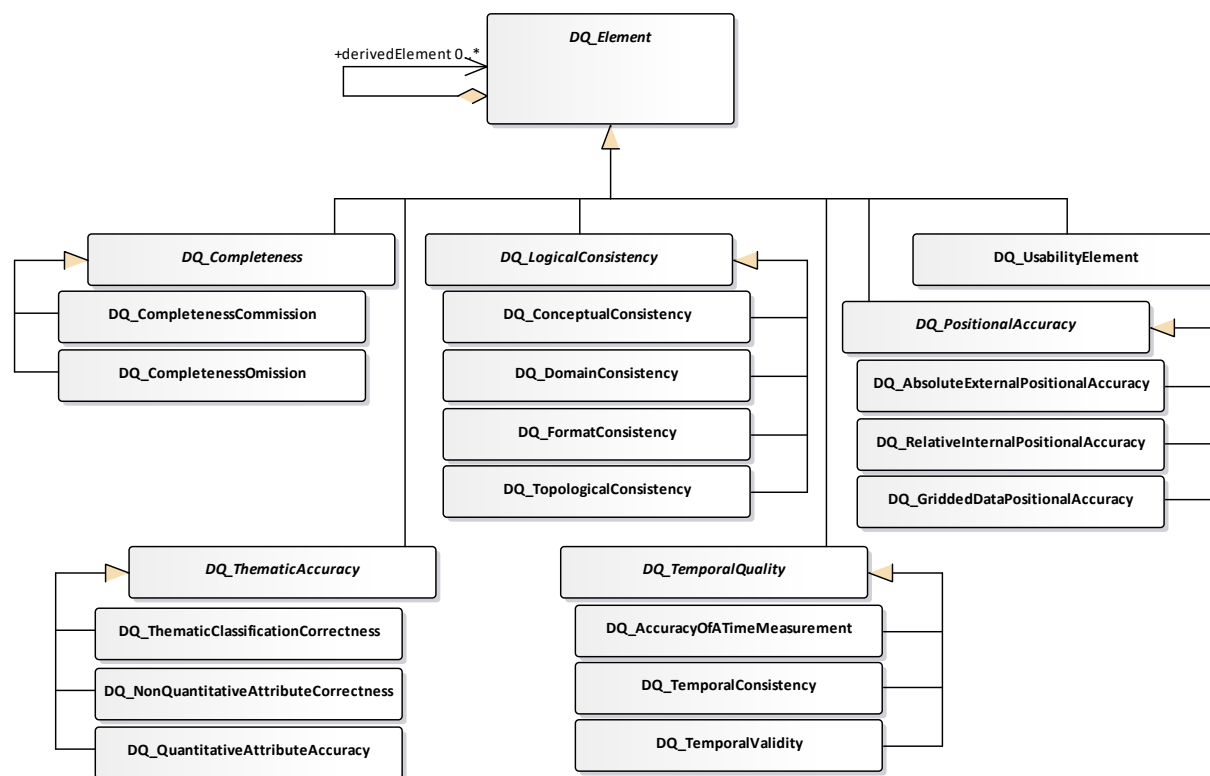


Figure 10: Data Quality Element

DQ_Element is the root class for all measurements of quantifiable quality. When a quality measurement is performed, this class identifies the quality measurement process used and the resulting measurement values. ISO 19157 has constructed a taxonomy of quality measurement types by subclassing DQ_Element.

The data dictionary presented in this table includes SDSFIE-M-specific extensions to the Quality Element Data Dictionary table found in ISO 19157:2013 (Section C.2.1.2).

DQ_Element provides six elements that describe the measurement and how it was performed.

Implementations of the SDSFIE-M shall reference the appropriate register entry for a measurement technique using the measureIdentification element. Use of the other five elements should be avoided except as allowed under the business rules.

Table 32: Data Quality Element

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_Element	aspect of quantitative quality information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality) <<Abstract>>	
Role name: measure	reference to measure used	C / As specified by SDSFIE-Q	1	Aggregation / DQ_MeasureReference	
Role name: evaluationMethod	evaluation information	O	1	Aggregation / DQ_EvaluationMethod	
result	value (or set of values) obtained from applying a data quality measure or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	M	2	Aggregation / DQ_Result <<Abstract>> (6.4.4)	No more than one instance of each DQ_Result subclass shall be provided
<i>Generalization of DQ_Element for completeness with no additional attributes or operations</i>					
DQ_Completeness	presence and absence of features, their attributes and their relationships	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	
Generalization: DQ_CompletenessCommission	excess data present in the dataset, as described by the scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	
Generalization: DQ_CompletenessOmission	data absent from the dataset, as described by the scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	
<i>Generalization of DQ_Element for consistency with no additional attributes or operations</i>					
DQ_LogicalConsistency	degree of adherence to logical rules of data structure, attribution and relationships (data structure can be conceptual, logical or physical)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	
Generalization: DQ_ConceptualConsistency	adherence to rules of the conceptual schema	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
Generalization: DQ_DomainConsistency	adherence of values to the value domains	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	
Generalization: DQ_FormatConsistency	degree to which data is stored in accordance with the physical structure of the dataset, as described by the scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	
Generalization: DQ_TopologicalConsistency	correctness of the explicitly encoded topological characteristics of the dataset as described by the scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	
<i>Generalization of DQ_Element positional quality with no additional attributes or operations</i>					
DQ_PositionalAccuracy	accuracy of the position of features	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	
Generalization: DQ_AbsoluteExternalPositionalAccuracy	closeness of reported coordinate values to values accepted as or being true	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	
Generalization: DQ_GriddedDataPositionalAccuracy	closeness of gridded data position values to values accepted as or being true	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	
Generalization: DQ_RelativeInternalPositionalAccuracy	closeness of the relative positions of features in the scope to their respective relative positions accepted as or being true	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	
<i>Generalization of DQ_Element for temporal quality with no additional attributes or operations</i>					
DQ_TemporalQuality	accuracy of the temporal attributes and temporal relationships of features	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	
Generalization: DQ_AccuracyOfATimeMeasurement	correctness of the temporal references of an item (reporting of error in time measurement)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
Generalization: DQ_TemporalConsistency	correctness of ordered events or sequences, if reported	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	
Generalization: DQ_TemporalValidity	validity of data specified by the scope with respect to time	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	
<i>Generalization of DQ_Element thematic quality with no additional attributes or operations</i>					
DQ_ThematicAccuracy	accuracy of quantitative attributes and the correctness of non-quantitative attributes and of the classifications of features and their relationships	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	
Generalization: DQ_ThematicClassificationCorrectness	comparison of the classes assigned to features or their attributes to a universe of discourse	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	
Generalization: DQ_NonQuantitativeAttributeCorrectness	correctness of non-quantitative attributes	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	
Generalization: DQ_QuantitativeAttributeAccuracy	accuracy of quantitative attributes	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	
<i>Generalization of DQ_Element for usability with no additional attributes or operations</i>					
DQ_UsabilityElement	degree of adherence of a dataset to a specific set of requirements	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element)	

6.4.4 Standalone Quality Report Information

The data dictionary table presented in this section is based on the corresponding Standalone Quality Report Information data dictionary table (Section C.2.1.6) found in ISO 19157.

Table 33: Standalone Quality Report Information

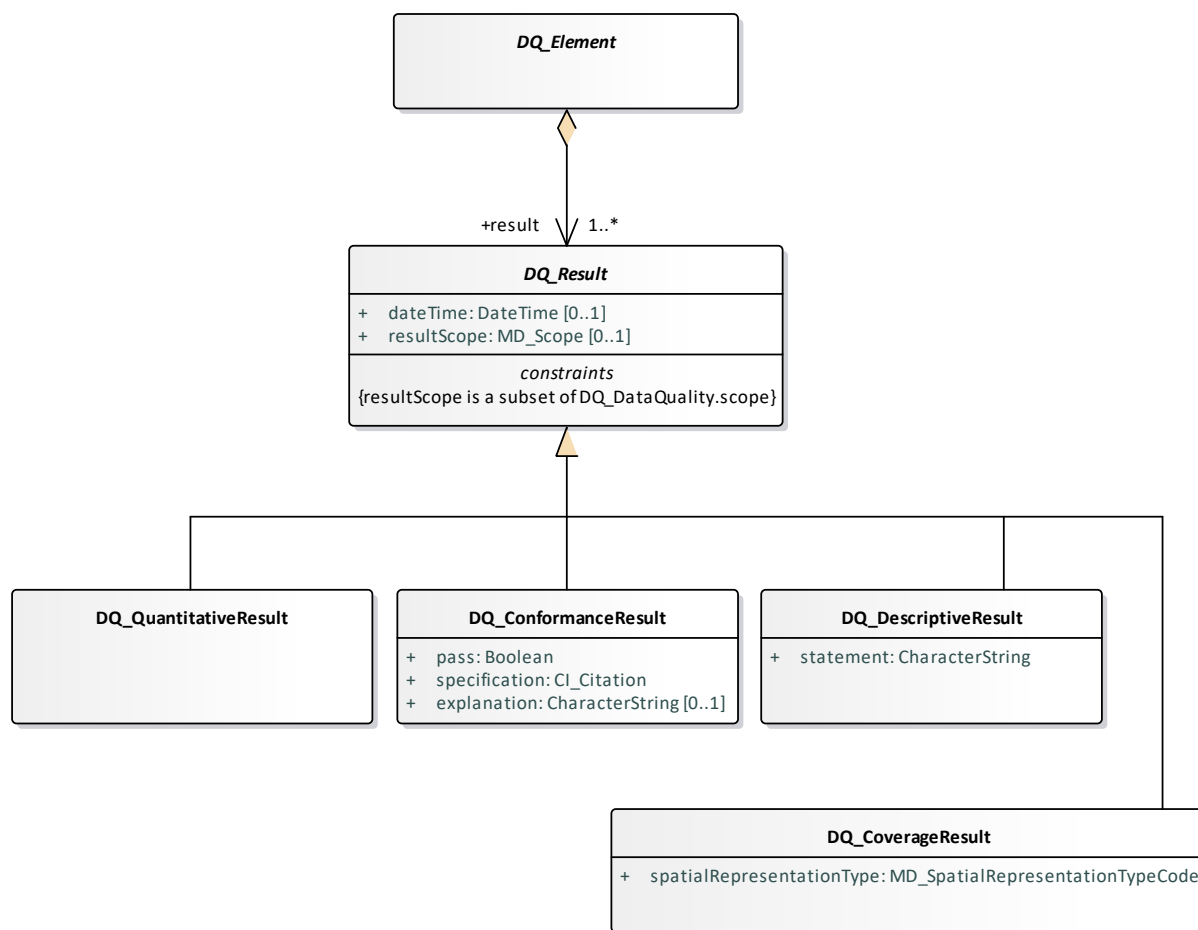
Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
------------------	------------	------------------------	-----------	------------------	---------------

DQ_StandaloneQualityReportInformation	reference to an external standalone quality report	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified class (DQ_Result)	
reportReference	reference to the associated standalone quality report	M	1	Class / CI_Citation (6.13)	
abstract	abstract for the associated standalone quality report	M	1	CharacterString / Free Text	
<i>Role name:</i> elementReport	Data quality elements covered by the standalone quality report	O	N	Aggregation / DQ_Element (6.4.3)	

6.4.5 Data Quality Result

Figure 11 defines the metadata classes required to capture the value (or set of values) obtained from applying a quality measure technique. This diagram is based on Figure 8 in ISO 19157:2013/Amd1:2018. This diagram has not been profiled to address EI&E community requirements.

DQ_Result is used by DQ_Element to capture the value (or set of values) obtained from applying a quality measure technique or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level.

**Figure 11: Data Quality Result**

The data dictionary table presented in this section is based on the corresponding Quality Result data dictionary table (Section C.2.1.5) found in ISO 19157.

Table 34: Data Quality Result

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_Result	generalization of more specific result classes	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Abstract>>	
DQ_ConformanceResult	Information about the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	
specification	citation of product specification or user requirement against which data is being evaluated	M	1	Class / CI_Citation (6.13)	
explanation	explanation of the meaning of conformance for this result	M	1	CharacterString / Free text	

pass	indication of the conformance result where 0 = fail and 1 = pass	M	1	Boolean / 1 = yes, 0 = no	
DQ_QuantitativeResult	the values or information about the value(s) (or set of values) obtained from applying a data quality measure	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	
valueRecordType	value type for reporting a data quality result	O	1	Class / RecordType (Annex C)	
valueUnit	value unit for reporting a data quality result	M	1	Class / UnitOfMeasure (Annex C)	Defined in ISO/TS 19103: 2005
value	quantitative value or values, content determined by the evaluation procedure used	M	N	Class / Record (Annex C)	
DQ_DescriptiveResult	data quality descriptive result	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	
statement	textual expression of the descriptive result	M	1	CharacterString / Free text	

6.4.5.1 Data Quality Result with Coverage Quality Extension

Figure 12 defines an extension required to specify the reported quality for coverage data and is from from ISO 19157:2013/Amd 1:2018. The additional elements provide information about the representation of the quality result documenting the data in the dataset.

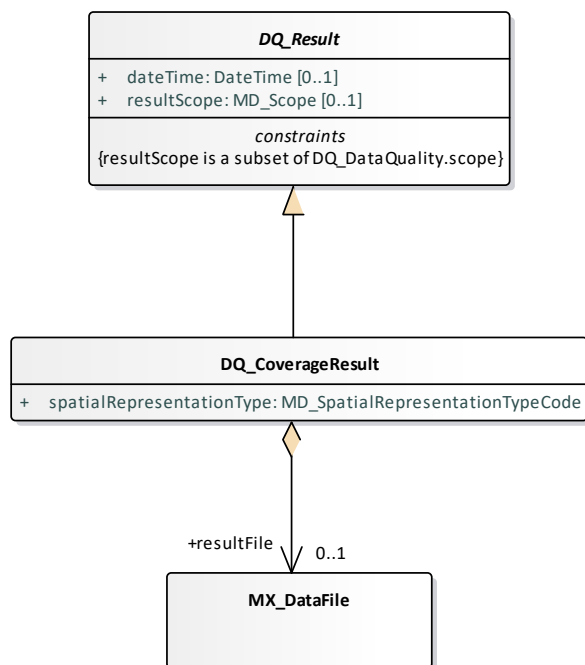


Figure 12: Data quality result with coverage quality extension

The data dictionary presented in this table corresponds to the DQ_CoverageResult Data Dictionary table found in ISO 19157:2013/Amd 1:2018. No profiling of this table was required to address EI&E community requirements.

Table 35 : Coverage Result Extension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_CoverageResult	result of a data quality measure organising the measured values as a coverage	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified class (DQ_Result)	
spatialRepresentationType	Description: method used to spatially represent the coverage result	M	1	Class / SpatialRepresentationTypeCode <<CodeList>> See Table 3 (SpatialRepresentationTypeCode)	
Role name: resultFile	provides information about the data file containing the result coverage data	O	1	Association / MX_DataFile	

6.4.5.2 Transfer Files

Figure 13 describes the support and data files concept and is based on the corresponding figure from ISO/TS 19139:2005 (Figure 9). The data files are potentially related to one or many feature types. Each data file has its own format which is generally described within the metadata of the dataset.

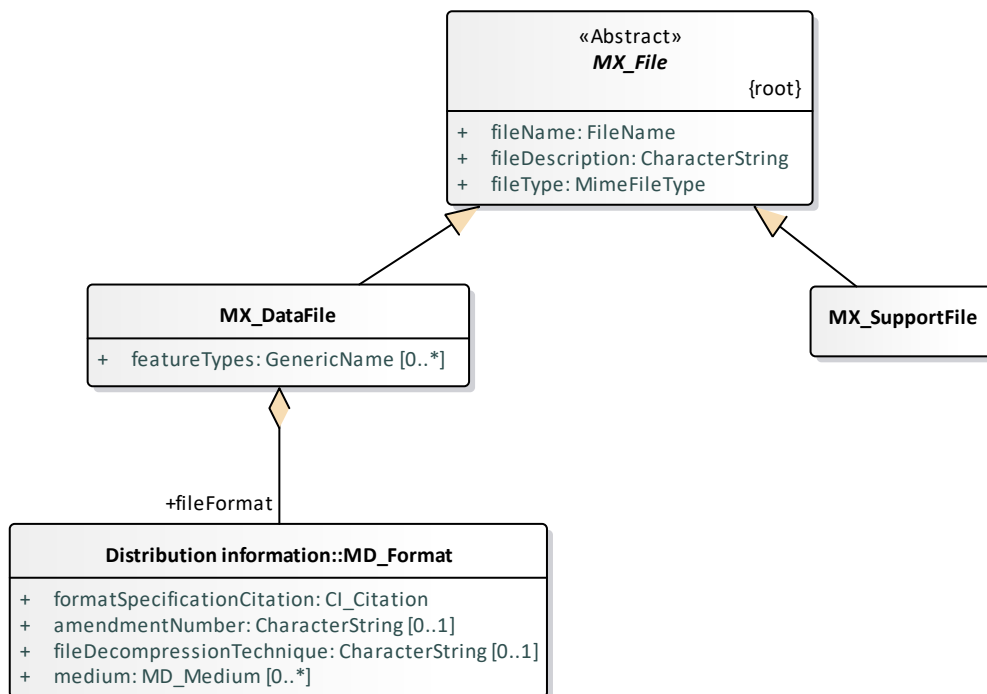


Figure 13: Transfer Files

The MX_File data dictionary presented in this table is based on the corresponding data dictionary found in ISO/TS 19139:2005 section B.2.3.3. No profiling of this table was required to address EI&E requirements.

Table 36: Transfer Files

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MX_File	Description of a transfer file	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Abstract>>	
fileName	Name of the transfer data file. This name is associated with a path to the physical file	M	1	FileName (Annex C)	
fileDescription	General description of the transfer data file	M	1	CharacterString / Free text	
fileType	Type of the transfer data file. The textual description of the file type is associated with an indication of the MIME Type.	M	1	MimeType (Annex C)	
MX_DataFile	Description of a transfer data file	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MX_File)	
featureType	Provides the list of Feature Types concerned by the transfer data file. Depending on the transfer choices, a data file may contain data related to one or many feature types. This attribute may be omitted when the dataset is composed of a single file and/or the data does not relate to a feature catalogue	O	N	GenericName (Annex C)	
Role name: fileFormat	Defines the format of the transfer data file	M	1	Association / MD_Format (6.10.2)	
MX_SupportFile	Description of a transfer support file	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MX_File)	

6.4.6 Data Quality Measurement

The data dictionary table presented in this section is the same corresponding Measure Reference data dictionary table found in ISO 19157:2013 (Section C.2.1.3). No profiling was required to address EI&E community requirements.

Table 37: Data Quality Measurement

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_MeasureReference	reference to the measure used	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	

measureIdentification	Identifier of the measure, value uniquely identifying the measure within a namespace	O ¹⁹	1	Class / MD_Identifier <<DataType>> (6.8)	
nameOfMeasure	name of the test applied to the data	O	N	CharacterString / Free Text	
measureDescription	description of the measure	O	1	CharacterString / Free Text	

6.4.7 Data Quality Evaluation

Data quality evaluation method describes those procedures and methods²⁰ which are applied to the geographic data to arrive at a data quality result, see Figure 14. Different evaluations are often used for the various data quality elements.

Data quality evaluation method should be included for each applied data quality measure. Data quality evaluation method is used for describing, or for referencing documentation²¹ describing, the methodology used to apply a data quality measure to the data specified by a data quality scope.

One date or range of dates should be included for each evaluation. If the evaluation was carried out on non-consecutive dates, each single date should be included. The dates shall be in conformance with ISO 19108:2002.

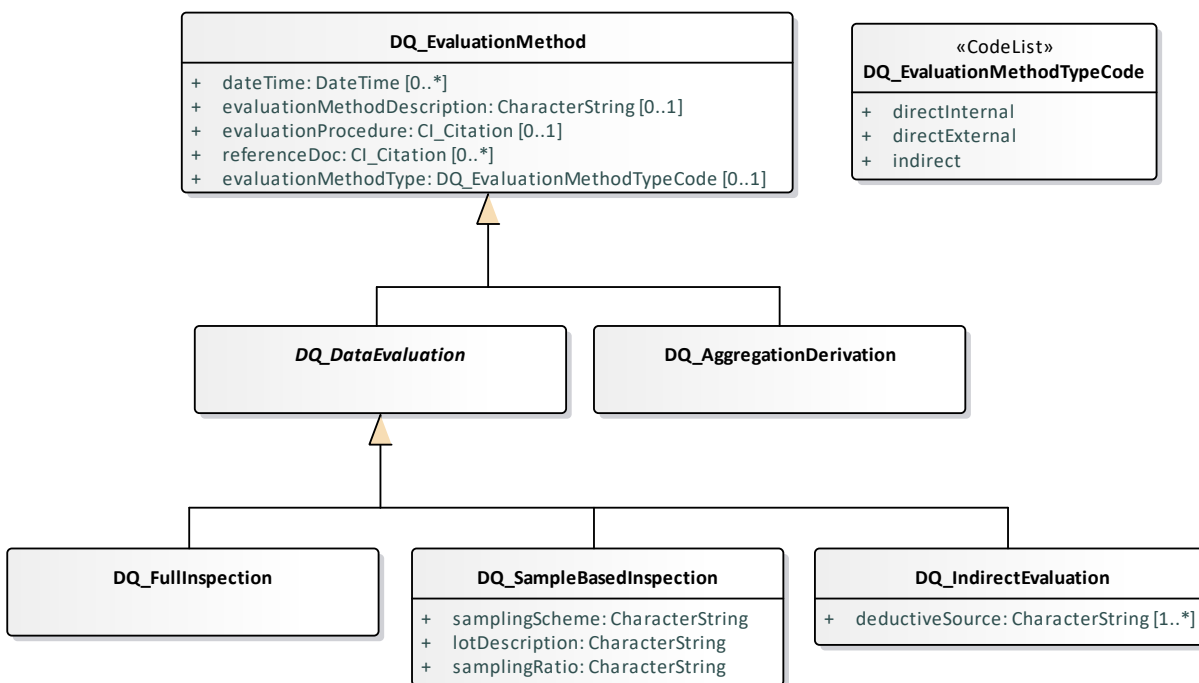


Figure 14: Data quality evaluation method classification

The data dictionary table presented in this section is the same corresponding Data Quality Evaluation data dictionary table found in ISO 19157:2013 (Section C.2.1.4). No profiling was required to address EI&E community requirements.

¹⁹ This element is made mandatory by SDSFIE-Q for documenting resources evaluated using SDSFIE-Q measures.

²⁰ Data quality evaluation is further described in Clause 9 of ISO 19157

²¹ Examples of documentation are data product specifications, published articles or accepted industry standards.

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
DQ_EvaluationMethod	description of the evaluation method and procedure applied	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	
dateTime	date or range of dates on which a data quality measure was applied	O	N	DateTime (see ISO/TS 19103:2005)	
evaluationMethodDescription	description of the evaluation method	O	1	CharacterString / Free Text	
evaluationProcedure	reference to the procedure information	O	1	Class / CI_Citation (6.13)	
referenceDoc	Information on documents which are referenced in developing and applying a data quality evaluation method	O	N	Class / CI_Citation (6.13)	
evaluationMethodType	type of method used to evaluate quality of the data	O	1	Class / EvaluationMethodTypeCode <<CodeList>> See Table 3 (EvaluationMethodTypeCode)	
DQ_DataEvaluation	data evaluation method	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_EvaluationMethod) (Abstract class)	
DQ_FullInspection	full inspection	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_DataEvaluation)	
DQ_SampleBasedInspection	sample based inspection	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_DataEvaluation)	
samplingScheme	information of the type of sampling scheme and description of the sampling procedure	M	1	CharacterString / Free Text	
lotDescription	information of how lots are defined	M	1	CharacterString / Free Text	
samplingRatio	information on how many samples on average are extracted for inspection from each lot of population	M	1	CharacterString / Free Text	
DQ_IndirectEvaluation	indirect evaluation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_DataEvaluation)	

deductiveSource	information on which data are used as sources in deductive evaluation method	M	N	CharacterString / Free Text	
DQ_AggregationDerivation	aggregation or derivation method	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_EvaluationMethod)	

6.4.8 Data Lineage

6.4.8.1 Lineage Information

When assessing the quality of a data resource, it is important to know how that resource was created; what source material was used, and what processing was applied to that source. Lineage metadata entities provide that information.

Lineage is described in terms of Sources and Process Steps. Sources and Process Steps, in turn are associated with each other. This structure allows discovery of the lineage of a resource from both the processing and source perspective. Examples of how this structure can be used are provided in Table 32.

Table 38: Using Lineage

User Question	Class Path
What sources were used to create this resource?	Lineage→Source
What processing was applied to those sources to create this resource?	Lineage→Source→ProcessStep
Were all of the required process steps executed in the production of this resource?	Lineage→ProcessStep
Was appropriate source used in each process step?	Lineage→ProcessStep→Source
Is the lineage metadata complete?	Lineage→ProcessStep→Source == Lineage→Source <i>and</i> Lineage→Source→ProcessStep == Lineage→ProcessStep

LI_Lineage is the base lineage class defined in ISO 19115-1:2014. It associates the sources used to produce a data resource with the process steps performed on those sources. This model assumes a compilation environment typical of cartographic production. Under this model a number of sources are compiled into the final product (the data resource). Each source may be processed in some manner prior to being applied to the product. Any intermediate data created by this processing was discarded. As such, output from that processing is considered the data resource itself.

The examples above reflect a rather simple lineage, where sources are processed directly (or at least without persistent intermediate products) into a product. That model is supported by the LI_Lineage entity. The lineage extension model from ISO 19115-2:2019 extends LI_Lineage to address more complex cases. In these cases, sources may go through several stages of processing before being used on the final product. Capturing this lineage requires more robust metadata, including details about intermediate sources (process step outputs), processing parameters and algorithms.

In short; LI_Lineage provides a flat lineage model, typical of cartographic production and the lineage extension model provides a deep lineage model, typical of image processing workflows. LI_Lineage and the lineage extension model are profiled from ISO 19115 and 19115-2 respectively.

This UML diagram corresponds to the Lineage Package UML diagram (Figure 9) found in ISO 19115-1:2014.

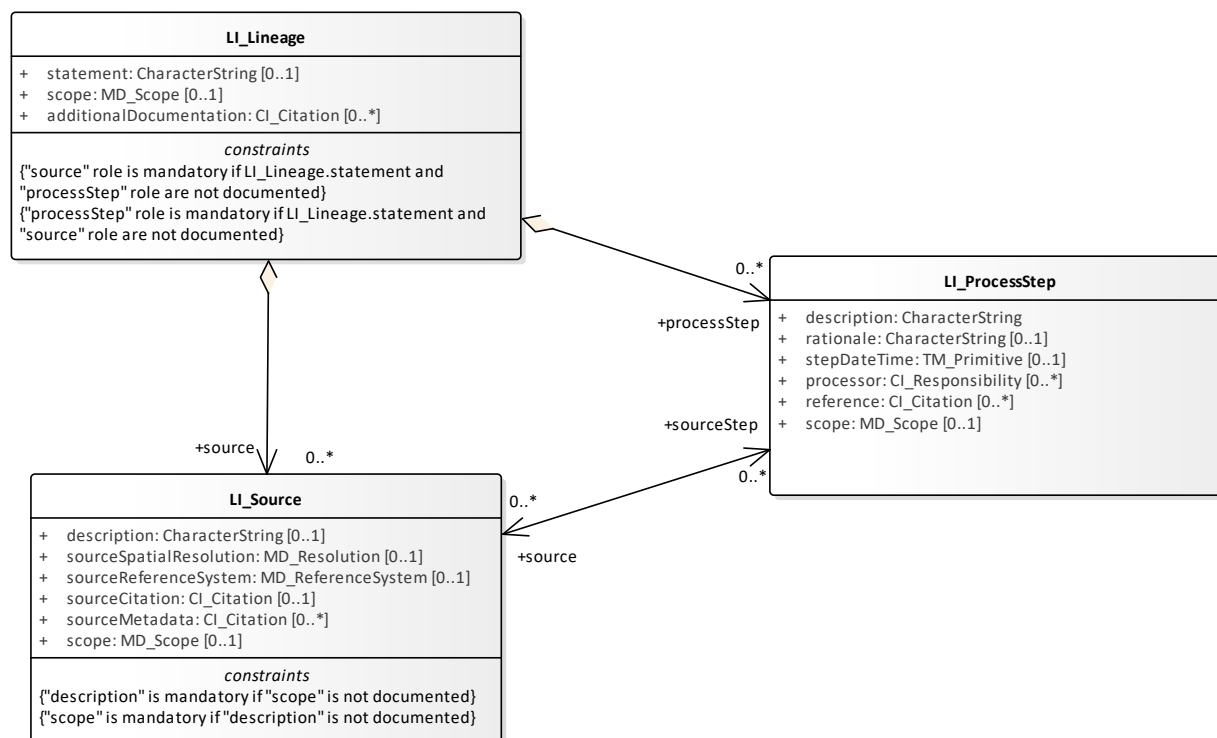


Figure 15: Lineage Metadata

LI_Lineage provides information on the sources and processing that was performed to create the described resource.

The data dictionary in Table 34 is based on the corresponding data dictionary found in ISO 19115-1:2014 (Section B.2.5.1). No profiling of this table was required to address EI&E community requirements.

Table 39: Lineage Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LI_Lineage	information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality)	
statement	general explanation of the data producer's knowledge about the lineage of a dataset	C / If(count(source) + count(processStep) =0) and (DQ_DataQuality.scope.level = "aggregate", "repository", or "dataset") then statement is mandatory	1	CharacterString / Free text	The "statement" element of LI_Lineage is mandatory if DQ_DataQuality.scope . DQ_Scope.level has a value of "aggregate", "repository", or "dataset" and the LI_Lineage roles of "source" and "processStep" are not documented.
scope	type of resource and/or extent to which the process step applies	O	1	Class / MD_Scope <<DataType>> (6.4.2)	

additionalDocumentation	resource (e.g. a publication) that describes the whole process to generate this resource (e.g. a dataset)	O	N	Class / CI_Citation (6.13)	
Role name: processStep	information about events in the life of a dataset specified by the scope	C / mandatory if LI_Lineage. statement and "source" role are not documented	N	Association / LI_ProcessStep (6.4.8.2)	The "processStep" role of LI_Lineage is mandatory if the "statement" element and the "source" role of LI_Lineage are not documented.
Role name: source	information about the source data used in creating the data specified by the scope	C / mandatory if LI_Lineage. statement and "processStep" role are not documented	N	Association / LI_Source (6.4.8.3)	The "source" role of LI_Lineage is mandatory if the "statement" element and the "processStep" role of LI_Lineage

6.4.8.2 Process Step Information

LI_ProcessStep describes an instance of the processing that was performed on a source or sources to create the described resource. Sources and process steps that worked together are linked by the metadata to provide a history of how the resource was created.

The data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-1:2014 (Section B.2.5.2). No profiling of this table was required to address EI&E community requirements.

Table 40: Process Step Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LI_ProcessStep	information about an event or transformation in the life of a dataset including the process used to maintain the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage and LI_Source)	
description	description of the event, including related parameters or tolerances	M	1	CharacterString / Free Text	
rationale	requirement or purpose for the process step	O	1	CharacterString / Free Text	
stepDateTime	date, time, range or period of process step	O	1	Class / TM_Primitive (Annex C)	
processor	identification of, and means of communication with, person(s) and organisation(s) associated with the process step	O	N	Class / CI_Responsibility(6.13.1)	
reference	process step documentation	O	N	Class / CI_Citation (6.13)	
scope	type of resource and/or extent to which the process step applies	O	1	Class / MD_Scope <<DataType>> (6.4.2)	
Role name: source	information about the source data used in creating the data specified by the scope	O	N	Association / LI_Source (6.4.8.3)	

6.4.8.3 Source Information

LI_Source describes a source that was used to create the described resource. Sources and process steps that worked together are linked by the metadata to provide a history of how the resource was created.

The data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-1:2014 (Section B.2.5.3). No profiling of this table was required to address EI&E community requirements.

Table 41: Source Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LI_Source	information about the source data used in creating the data specified by the scope	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage and LI_ProcessStep)	
description	detailed description of the source	C / scope not provided?	1	CharacterString / Free Text	Either the “description” or “scope” element of LI_Source must be documented.
sourceSpatialResolution	spatial resolution expressed as a scale factor, a distance, an angle or a level of detail	O	1	Class / MD_Resolution <<Union>> (6.2.6)	
sourceReferenceSystem	spatial reference system used by the source resource	O	1	Class / MD_ReferenceSystem (6.7)	
sourceCitation	recommended reference to be used for the source resource	O	1	Class / CI_Citation (6.13)	
sourceMetadata	reference to metadata for the source	O	N	Class / CI_Citation (6.13)	
scope	type of resource and/or extent to which the process step applies	C / description not provided?	1	Class / MD_Scope <<DataType>> (6.4.2)	Either the “description” or “scope” element of LI_Source must be documented.
Role name: sourceStep	information about an event in the creation process for the source data	O	N	Association / LI_ProcessStep (6.4.8.2)	

6.4.8.4 Lineage for Acquisition and Processing Resources

6.4.8.4.1 Lineage Extensions

The lineage entities defined in Section 6.4 model a history which is wide but shallow. Many data resources, however, are the result of a long chain of processing applied to a small number of raw sources. ISO 19115-2:2019 addresses this case by extending the lineage entities defined in ISO 19115. A key change is the addition of an “output” association to the process step class. Distinguishing between input (source) and output data allows process steps to be assembled into long processing chains. These chains describe the original source, every processing step applied and all intermediate products. Since these process chains are by necessity automated, this model expands the

process step class to describe the automated resources used and to capture reports on the work done at each process step.

Figure 10 defines the extended metadata classes required to specify the lineage of imagery and gridded data. This diagram is based on Figure 4 in ISO 19115-2:2019. No profiling of this diagram was required to address EI&E community requirements.

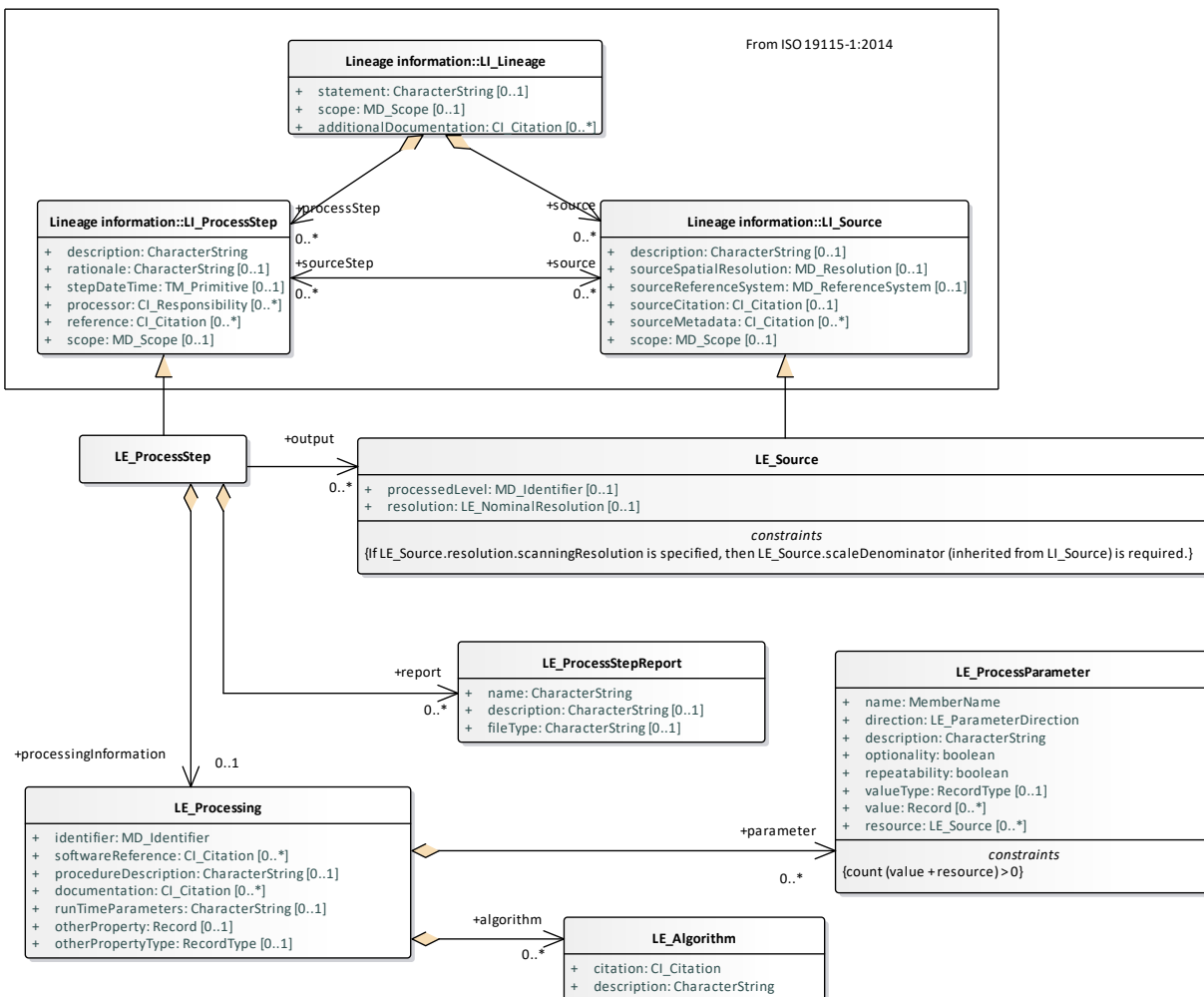


Figure 16: Lineage Metadata Extensions

6.4.8.4.2 Source Extension

The LE_Source data dictionary table presented in this section is an extension of the LI_Source dictionary found in Table 35 of this document. The extensions are described in ISO 19115-2:2019 section B.2.2.7.

This data dictionary includes additional SDSFIE-M -specific profiling of the parent LI_Source class:

- Obligation of “scaleDemoninator” element has been changed to conditional.

Table 42: Source Extension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule

LE_Source	information on data sets input to or output by the processing step (LI_Source extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	SpecifiedClass (LI_Source)	
<i>Inherited from LI_Source</i>					
description	detailed description of the source	C / scope not provided?	1	CharacterString / Free Text	Either the "description" or "scope" element of LI_Source must be documented.
sourceSpatialResolution	spatial resolution expressed as a scale factor, a distance, an angle or a level of detail	O	1	Class / MD_Resolution <<Union>> (6.2.6)	
sourceReferenceSystem	spatial reference system used by the source resource	O	1	Class / MD_ReferenceSystem (6.7)	
sourceCitation	recommended reference to be used for the source resource	O	1	Class / CI_Citation (6.13)	
sourceMetadata	reference to metadata for the source	O	N	Class / CI_Citation (6.13)	
scope	type of resource and/or extent to which the process step applies	C / description not provided?	1	Class / MD_Scope <<DataType>> (6.4.2)	Either the "description" or "scope" element of LI_Source must be documented.
<i>Role name:</i> sourceStep	information about an event in the creation process for the source data	O	N	Association / LI_ProcessStep (6.4.8.2)	
<i>LE_Source-specific attributes</i>					
processedLevel	processing level of the source data	O	1	Class / MD_Identifier (6.8)	
resolution	distance between consistent parts (centre, left side, right side) of two adjacent pixels	O	1	Class / LE_NominalResolution <<Union>> (6.4.8.4.3)	

6.4.8.4.3 Nominal Resolution

LE_NominalResolution provides a means to capture the resolution of an image. Since resolution can be in terms of ground resolution or scanning resolution, this class serves to combine those two mutually exclusive measures into a single element.

The LE_NominalResolution data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-2:2019 section B.2.2.3. No profiling of this table was required to address EI&E community requirements.

Table 43: Nominal Resolution

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
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LE_NominalResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	UNION – one and only one attribute should be populated
scanningResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels in the scan plane	M	1	Class / Distance	Defined in ISO 19103
groundResolution	distance between consistent parts of (centre, left side, right side) adjacent pixels in the object space	M	1	Class / Distance	Defined in ISO 19103

6.4.8.4.4 Process Step

The LE_ProcessStep data dictionary table presented in this section is an extension of the LI_ProcessStep dictionary found in Table 34 of this document. The extensions are described in ISO 19115-2:2019 section B.2.2.5.

Table 44: Process Step

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LE_ProcessStep	information about an event or transformation in the life of the dataset including details of the algorithm and software used for processing (LI_ProcessStep extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage)	
<i>Inherited from LI_ProcessStep</i>					
description	description of the event, including related parameters or tolerances	M	1	CharacterString / Free Text	
rationale	requirement or purpose for the process step	O	1	CharacterString / Free Text	
stepDateTime	date, time, range or period of process step	O	1	Class / TM_Primitive (Annex C)	
processor	identification of, and means of communication with, person(s) and organisation(s) associated with the process step	O	N	Class / CI_Responsibility (6.13.1)	
reference	process step documentation	O	N	Class / CI_Citation (6.13)	
scope	type of resource and/or extent to which the process step applies	O	1	Class / MD_Scope <<DataType>> (6.4.2)	
Role name: source	information about the source data used in creating the data specified by the scope	O	N	Association / LI_Source (6.4.8.3)	
<i>LE_ProcessStep-specific attributes</i>					
Role name: output	description of the product generated as a result of the process step	O	N	Association / LE_Source (6.4.8.4.2)	

<i>Role name:</i> processingInformation	comprehensive information about the procedure by which the algorithm was applied to derive geographic data from the raw instrument measurements, such as datasets, software used, and the processing environment	O	1	Association / LE_Processing (6.4.8.4.6)	
<i>Role name:</i> report	report generated by the process step	O	N	Association / LE_ProcessStepReport (6.4.8.4.5)	

6.4.8.4.5 Image Process Step Report

Processing systems often generate a report on what was done, issues encountered and the level of quality achieved. LE_ProcessStepReport provides a way to capture that report for latter reference.

The LE_ProcessStepReport data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-2:2019 section B.2.2.6. No profiling of this table was required to address EI&E community requirements.

Table 45: Process Step Report

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LE_ProcessStepReport	report of what occurred during the process step	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_ProcessStep)	
name	name of the processing report	M	1	Character String / Free Text	
description	textual description of what occurred during the process step	O	1	Character String / Free Text	
fileType	type of file that contains the processing report	O	1	Character String / Free Text	

6.4.8.4.6 Processing

LE_Processing provides information about how an output product was derived from source data. This entity is useful to describe automated processing where established algorithms, software and procedures are used.

The LE_Processing data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-2:2019 section B.2.2.4. No profiling of this table was required to address EI&E community requirements.

Table 46: Processing

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LE_Processing	comprehensive information about the procedure(s), process(es) and algorithm(s) applied in the process step	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_ProcessStep)	
identifier	information to identify the processing package that produced the data	M	1	Class / MD_Identifier (6.8)	

softwareReference	reference to document describing processing software	O	N	Class / CI_Citation <<DataType>> (6.13)	
procedureDescription	additional details about the processing procedures	O	1	CharacterString / Free text	
documentation	reference to documentation describing the processing	O	N	Class / CI_Citation <<DataType>> (6.13)	
runTimeParameters	parameters to control the processing operations, entered at run time	O	1	CharacterString / Free text	
otherProperty	instance of other property type not included in processing	O	1	Class / Record <<Abstract>> (ISO/TS 19103)	
otherPropertyType	type of other property description	O	1	Class / RecordType <<Abstract>> (ISO/TS 19103)	
<i>Role name:</i> algorithm	details of the methodology by which geographic information was derived from the instrument readings	O	N	Association / LE_Algorithm (6.4.8.4.7)	

6.4.8.4.7 Algorithm

LE_Algorithm describes an algorithm used for automated processing of source data.

The LE_Algorithm data dictionary presented in this table is based on the corresponding data dictionary found in ISO 19115-2:2019 section B.2.2.2.1. No profiling of this table was required to address EI&E requirements.

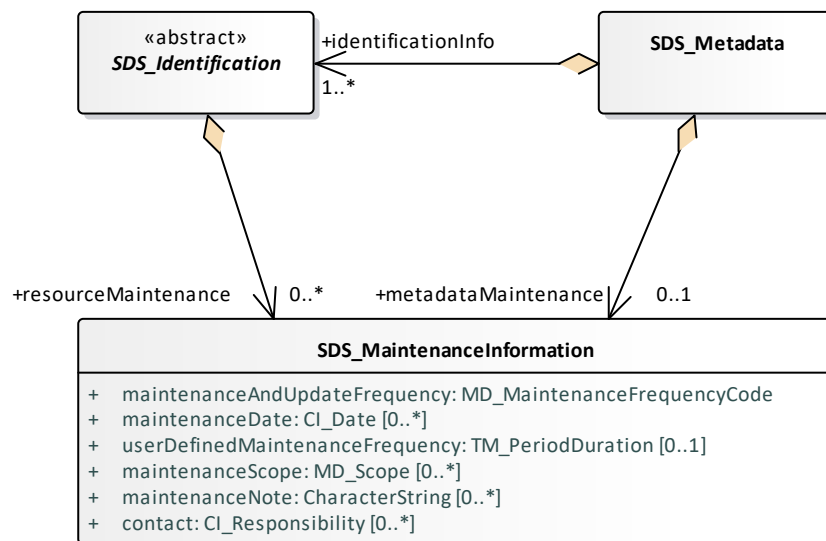
Table 47: Algorithm

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
LE_Algorithm	details of the methodology by which geographic information was derived from the instrument readings	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LE_Processing)	
citation	information identifying the algorithm and version or date	M	1	Class / CI_Citation <<DataType>> (6.13)	
description	information describing the algorithm used to generate the data	M	1	CharacterString / Free text	

6.5 Maintenance Information

Maintenance information is used to describe the maintenance and update practices (scope and frequency) for the documented resource.

Figure 17 is based on the corresponding Maintenance Information Package UML diagram (Figure A.7) found in 19115-1:2014. No profiling of this diagram was required to address EI&E requirements.

**Figure 17: Maintenance Information**

The data dictionary table presented in this section is based on the corresponding Maintenance Information data dictionary table (Section B.2.6) found in ISO 19115-1:2014.

- MD_MaintenanceInformation has been modified in that the obligation of the maintenanceAndUpdateFrequency property is mandatory.

Table 48: Maintenance Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_MaintenanceInformation	information about the scope and frequency of updating	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated (MD_Metadata Class and MD_Identification)	
maintenanceAndUpdateFrequency	frequency with which changes and additions are made to the resource after the initial resource is completed	M	1	Class / MaintenanceFrequencyCode <<CodeList>> See Table 3 (MaintenanceFrequencyCode)	
maintenanceDate	date information associated with maintenance of resource	O	N	Class / CI_Date <<DataType>>	
userDefinedMaintenanceFrequency	maintenance period other than those defined	O	1	Class / TM_PeriodDuration <<DataType>> (Annex C)	
maintenanceScope	type of resource and/or extent to which the maintenance information applies	O	N	Class / MD_Scope <<DataType>>	
maintenanceNote	information regarding specific requirements for maintaining the resource	O	N	CharacterString / Free text	

contact	identification of, and means of communicating with, person(s) and organisation(s) with responsibility for maintaining the resource	O	N	Class / CI_Responsibility (6.13.1)	
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6.6 *Spatial Representation Information*

The MD_SpatialRepresentation entity captures information about the mechanisms used to represent spatial information in a data set.

Figure 18 is based on Figure 11 from ISO 19115-1:2014/DAmD 1:2018. No profiling of this diagram was required to address EI&E requirements.

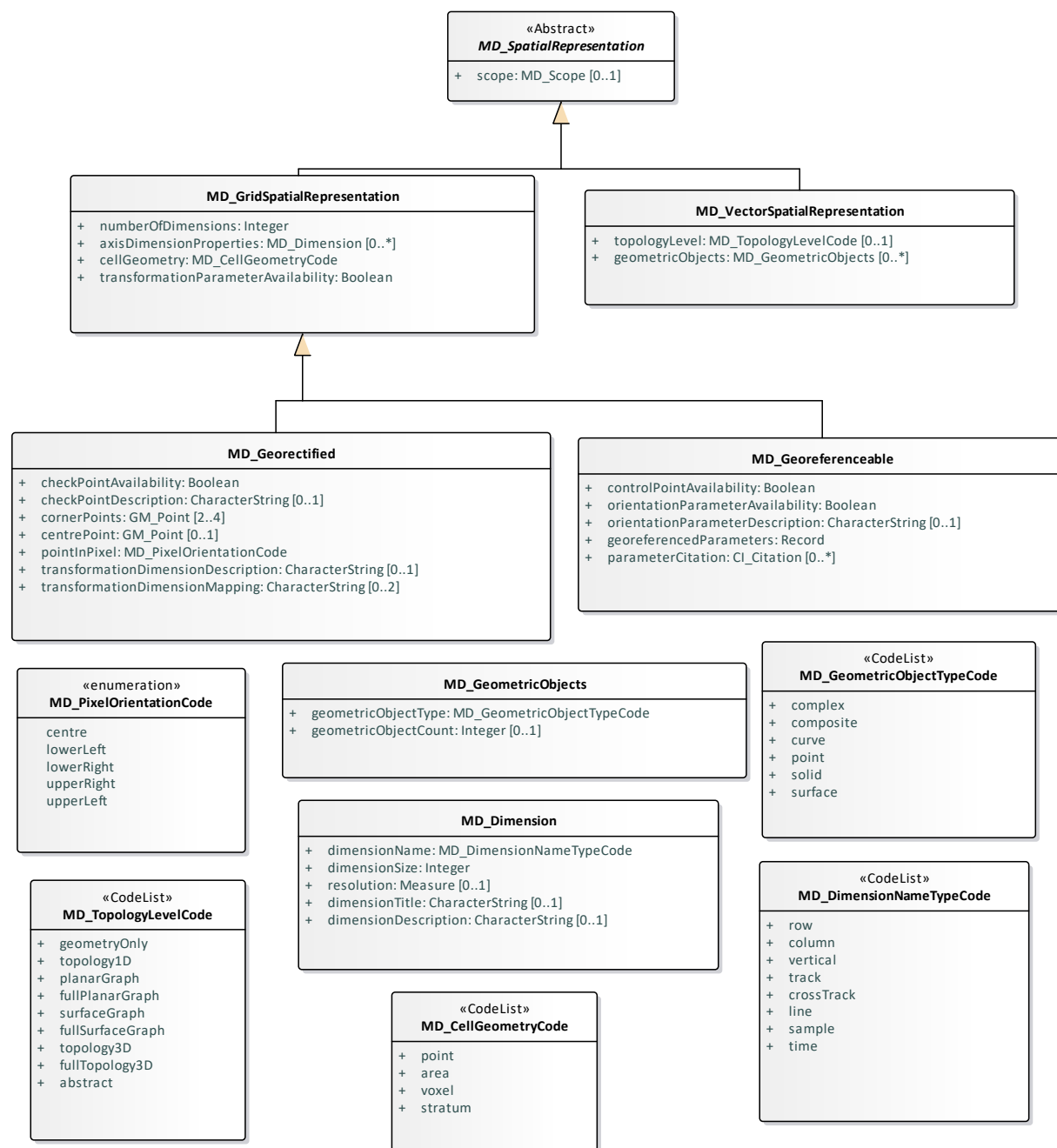


Figure 18: Spatial Representation

The data dictionary table presented in this section is based on the corresponding Scope Description data dictionary found in ISO 19115-1:2014/Amd1:2018.

Table 49: Spatial Representation Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
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MD_SpatialRepresentation	digital mechanism used to represent spatial information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	
scope	level and extent of the spatial representation	O	1	Class / MD_Scope <<DataType>> (6.4.2)	
MD_GridSpatialRepresentation	information about grid spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	
numberOfDimensions	number of independent spatial-temporal axes	M	1	Class / Integer <<Abstract>>	
axisDimensionsProperties	information about spatial-temporal axis properties	M	1	Sequence (Annex C) / MD_Dimension (6.6.1)	
cellGeometry	identification of grid data as point or cell	M	1	Class / CellGeometryCode <<CodeList>> See Table 3 (CellGeometryCode)	
transformationParameterAvailability	indication of whether or not parameters for transformation between image coordinates and geographic or map coordinates exist (are available)	M	1	Boolean / 1 = yes, 0 = no	
MD_Georectified	grid whose cells are regularly spaced in a geographic (i.e., lat / long) or map coordinate system defined in the Spatial Referencing System (SRS) so that any cell in the grid can be geolocated given its grid coordinate and the grid origin, cell spacing, and orientation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified (MD_GridSpatialRepresentation)	
checkPointAvailability	indication of whether or not geographic position points are available to test the accuracy of the georeferenced grid data	M	1	Boolean / 1 = yes, 0 = no	
checkPointDescription	description of geographic position points used to test the accuracy of the georeferenced grid data	C / checkpoint Availability equals "yes"?	1	Class / CharacterString / Free text <<Abstract>>	
cornerPoints	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cells at opposite ends of grid coverage along two diagonals in the grid spatial dimensions. There are four corner points in a georectified grid; at least two corner points along one diagonal are required. The first corner point corresponds to the origin of the grid.	M	1	Sequence (Annex C) GM_Point <<Type>> (Annex C)	

centerPoint	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cell halfway between opposite ends of the grid in the spatial dimensions	O	1	Class / GM_Point <<Type>> (Annex C)	
pointInPixel	point in a pixel corresponding to the Earth location of the pixel	M	1	Class / MD_PixelOrientationCode (5.2.3.2)	
transformationDimension Description	general description of the transformation	O	1	Class / CharacterString / Free text <<Abstract>>	
transformationDimension Mapping	information about which grid axes are the spatial (map) axes	O	2	Class / CharacterString / Free text <<Abstract>>	
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	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_GridSpatialRepresentation)	
controlPointAvailability	indication of whether or not control point(s) exists	M	1	Boolean / 1 = yes, 0 = no	
orientationParameter Availability	indication of whether or not orientation parameters are available	M	1	Boolean / 1 = yes, 0 = no	
orientationParameter Description	description of parameters used to describe sensor orientation	O	1	Class / CharacterString / Free text <<Abstract>>	
georeferencedParameters	terms which support grid data georeferencing	M	1	Class / Record <<Abstract>> (Annex C)	
parameterCitation	reference providing description of the parameters	O	N	Class / CI_Citation(6.13)	
MD_VectorSpatial Representation	information about the vector spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	
topologyLevel	code which identifies the degree of complexity of the spatial relationships	O	1	Class / TopologyLevelCode <<CodeList>> See Table 3 (TopologyLevelCode)	
geometricObjects	information about the geometric objects used in the dataset	O	N	Class / MD_GeometricObjects (6.6.2)	

6.6.1 Dimension

The data dictionary table presented in this section is based on the corresponding MD_Dimension data dictionary table (Section B.2.7.2) found in ISO 19115-1:2014. No profiling of this table was required to address EI&E requirements.

Table 50: Dimension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Dimension	axis properties	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
dimensionName	name of the axis	M	1	Class / DimensionNameTypeCode <<CodeList>> See Table 3 (DimensionNameTypeCode)	
dimensionSize	number of elements along the axis	M	1	Integer / Integer	
resolution	degree of detail in the grid dataset	O	1	Class / Measure (Annex C)	

6.6.2 Geometric Objects

The data dictionary table presented in this section is based on the corresponding Geometric Objects data dictionary table (Section B.2.7.3) found in ISO 19115-1:2014. No profiling of this table was required to address EI&E requirements.

Table 51: Geometric Objects

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_GeometricObjects	number of objects, listed by geometric object type, used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
geometricObjectType	name of point or vector objects used to locate zero-, one-, two-, or three-dimensional spatial locations in the dataset	M	1	Class / GeometricObjectTypeCode <<CodeList>> See Table 3 (GeometricObjectTypeCode)	
geometricObjectCount	total number of the point or vector object type occurring in the dataset	O	1	Integer / > 0	

6.6.3 Spatial Representation Extensions

Figure 19 depicts extensions made by ISO 19115-2:2019 for acquisition and processing.

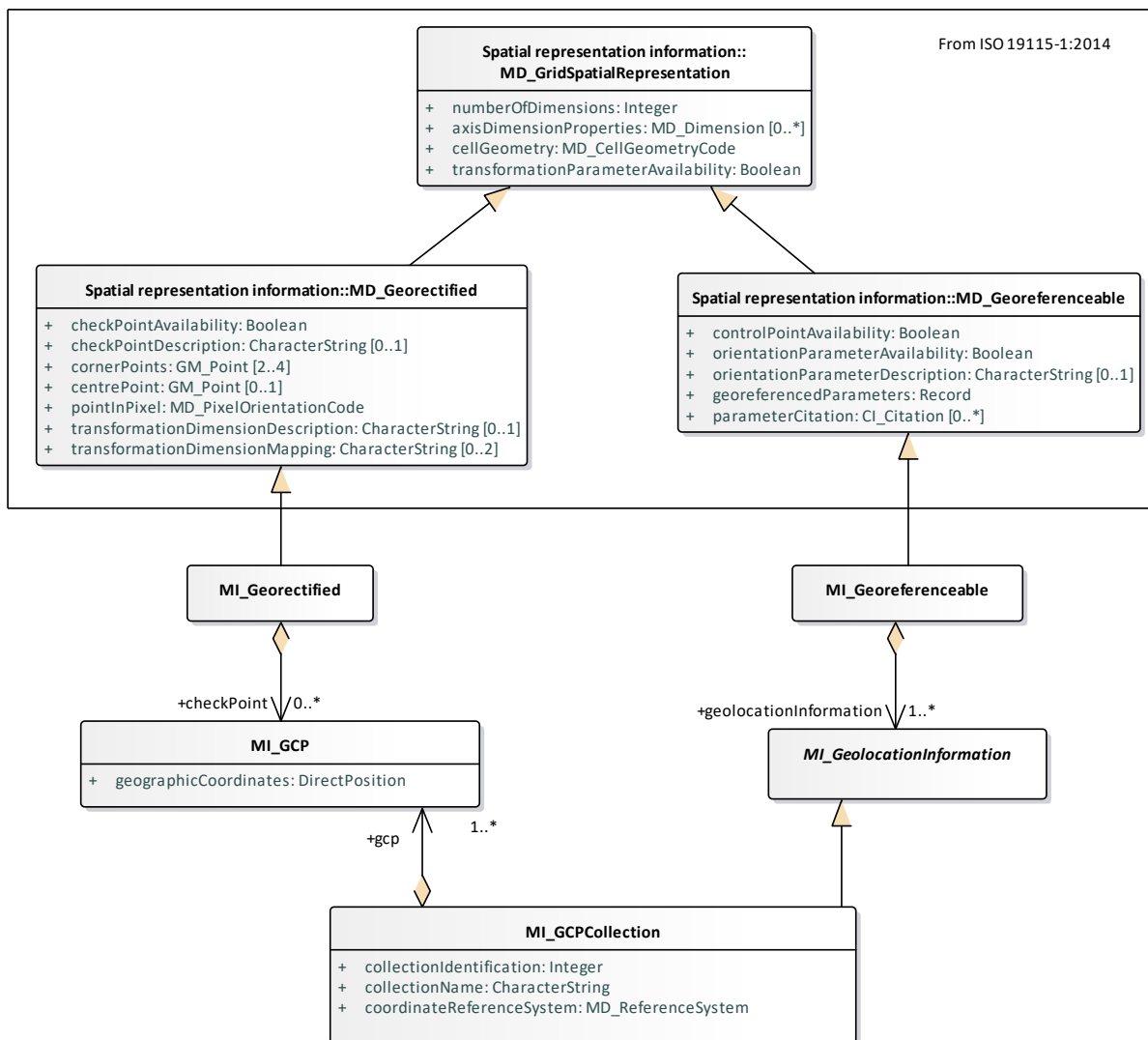


Figure 19: Spatial representation extension for acquisition and processing

6.6.3.1 Georectified – Extension

The data dictionary table presented in this section is based on the corresponding Georectified - Extension data dictionary table (B.22) found in ISO 19115-2:2019. No profiling of this table was required to address EI&E requirements.

Table 52: Georectified Extension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_Georectified	extends georectified grid description to include associated checkpoints (MD_Georectified extended)	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Georectified)	
Role name: checkPoint	geographic references used to validate georectification of the data	O	N	Association / MI_GCP (6.6.3.4)	

6.6.3.2 Georeferenceable – Extension

The data dictionary table presented in this section is based on the corresponding Georeferenceable- Extension data dictionary table (B.23) found in ISO 19115-2:2019. No profiling of this table was required to address EI&E requirements.

Table 53: Georeferenceable Extension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_Georeferenceable	description of information provided in metadata that allows the geographic or map location of the raster points to be located (MD_Georeferenceable extended)	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Georeferenceable)	
<i>Role name:</i> geolocationInformation	information that can be used to geolocate the data	M	N	Association / MI_GeolocationInformation (6.6.3.4)	

6.6.3.3 Ground Control Point Collection

The data dictionary table presented in this section is based on the corresponding Ground Control Point Collection data dictionary table (Section B.24) found in ISO 19115-2:2019. No profiling of this table was required to address EI&E requirements.

Table 54: Ground Control Point Collection

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_GeolocationInformation	information used to determine geographic location corresponding to image location	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Georeferenceable)	
<i>Role name:</i> qualityInfo	provides an overall assessment of quality of geolocation information	O	*	Association / DQ_DataQuality (6.4)	
MI_GCPCollection	information on ground control point collections used for geolocation	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MI_GeolocationInformation)	
collectionIdentification	identifier of the GCP collection	M	1	Integer / Integer	
collectionName	name of the GCP collection	M	1	CharacterString / Free text	
coordinateReferenceSystem	coordinate system in which the ground control points are defined	M	1	Class / MD_ReferenceSystem (6.7)	
<i>Role name:</i> gcp	ground control point(s) used in the collection	M	*	Aggregation / MI_GCP (6.6.3.4)	

6.6.3.4 Ground Control Points

The data dictionary table presented in this section is based on the corresponding Ground Control Points data dictionary table (Section B.25) found in ISO 19115-2:2019. No profiling of this table was required to address EI&E requirements.

Table 55: Ground Control Points

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_GCP	information on ground control points used for geolocation	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_GCPCollection)	
geographicCoordinates	geographic or map position of the control point, in either two or three dimensions	M	1	Class / Direct Position (ISO/TS 19103)	
Role name: accuracyReport	accuracy of a ground control point	O	*	Association / DQ_Element (6.4.3)	

6.7 Reference System

Figure 20 is an SDSFIE-M -specific version of the corresponding Reference System Package UML diagram (Figure A.9) found in ISO 19115-1:2014. This diagram defines metadata required to describe the spatial reference system used in the resource.

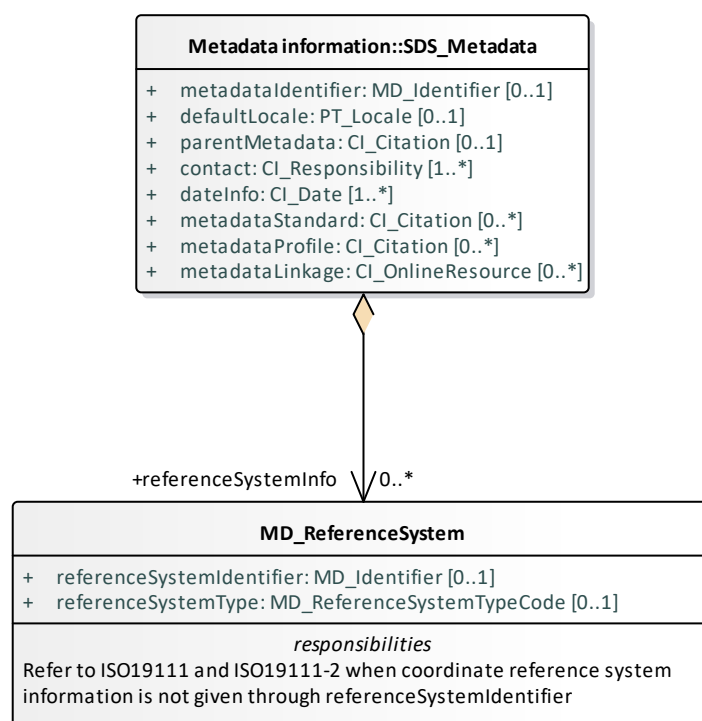


Figure 20: Reference System

The data dictionary table presented in this section corresponds to Reference System data dictionary table (Section B.2.8.1) found in ISO 19115-1:2014. No profiling of this table was required to address EI&E community requirements.

Table 56: Reference System

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_ReferenceSystem	information about the reference system	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Class	
referenceSystemIdentifier	identifier and codespace for reference system NOTE Refer to SC_CRS in ISO 19111 and ISO 19111-2 when coordinate reference system information is not given through reference system identifier. ::4326 e.g. EPSG::4326	O	1	Class / MD_Identifier <<DataType>>	
referenceSystemType	type of reference system identified e.g. geographic2D	O	1	Class / MD_ReferenceSystemTypeC ode <<CodeList>>	

6.8 Identifier

The MD_Identifier entity serves to unambiguously identify a resource. The data dictionary table presented in this section corresponds to the Identifier Information data dictionary table (Section B.3.3.3) found in ISO 19115-1:2014. No profiling of this table was required to address EI&E community requirements.

Table 57: Identifier

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Identifier	value uniquely identifying an object within a namespace	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
authority	person or party responsible for maintenance of the namespace	O	1	Class / CI_Citation (6.13)	
code	alphanumeric value identifying an instance in the namespace	M	1	CharacterString / Free text	
codeSpace	identifier or namespace in which the code is valid	O	1	CharacterString / No specified domain	
version	version identifier for the namespace	O	1	CharacterString / No specified domain	
description	natural language description of the meaning of the code value EXAMPLE For codeSpace = EPSG, code = 4326, description = WGS-84.	O	1	CharacterString / Free text	

MD_Identifier is a flexible construct supporting many different forms of identification. Flexibility, however, is often the enemy of interoperability. This standard addresses that issue by specifying the content of the MD_Identifier elements for each metadata element in this standard which is of type MD_Identifier.

Table 57 addresses the case where the identifier can be resolved to the referenced entity through automated means.

Table 58: Resolvable Resource Identifiers

Element	Authority (CI_Citation)	Code (CharacterString)
MD_AggregateInformation. aggregateDataSetIdentifier	Title: "ITU-T REC. X.667" Date: 08/2008 <i>or</i> Title: "IETF RFC 3986" Date: 2005	Hexadecimal UUID value per ITU-T REC. X.667 <i>or</i> URI per IETF RFC 3986
EX_GeographicDescription. geographicIdentifier	Title: "ITU-T REC. X.667" Date: 08/2008 <i>or</i> Title: "IETF RFC 3986" Date: 2005	Hexadecimal UUID value per ITU-T REC. X.667 <i>or</i> URI per IETF RFC 3986
CI_Citation. identifier	Title: "ITU-T REC. X.667" Date: 08/2008 <i>or</i> Title: "IETF RFC 3986" Date: 2005	Hexadecimal UUID value per ITU-T REC. X.667 <i>or</i> URI per IETF RFC 3986
NOTE: Implementation Specifications may specify another X.667 compliant encoding of the UUID as long as it conveys equivalent information to the specified hexadecimal encoding.		

Not all identifiers will be suitable for automated resolution. In those cases, it may be sufficient that the authority / code pair is unique, or human intervention may be required to perform the resolution. Table 58 addresses these case where the identifier cannot be resolved through automated means.

Table 59: Non-Resolvable Resource Identifiers

Element	Authority (CI_Citation)	Code (CharacterString)
MD_AggregateInformation. aggregateDataSetIdentifier	Not applicable – aggregateDataSetName provides dataset name	Not applicable
EX_GeographicDescription. geographicIdentifier	Title: title of the document where the identifier is described Date: date of the describing document	Textual identification of the geographic extent
CI_Citation. identifier	Title: title of the governing specification Date: date of the governing specification	Identifier (ex. card catalog number)

For acquisition and processing, many of the identifier metadata elements may be captured using one of the general purpose identifiers described in Table 59.

Table 60: General Purpose Identifiers for Acquisition and Processing

Element	Authority (CI_Citation)	Code (CharacterString)
UUID	Title: "ITU-T REC. X.667" Date: 08/2008	Hexadecimal UUID value per ITU-T REC. X.667
UUID URN encoding	Title: "IETF RFC 4122" Date: 2005	URN per IETF RFC 4122

URI	Title: "IETF RFC 3986" Date: 2005	URI per IETF RFC 3986
NOTE: Implementation Specifications may specify another X.667 compliant encoding of the UUID as long as it conveys equivalent		

For acquisition and processing, many of the identifier metadata elements may be captured using one of the identifiers described in Table 60.

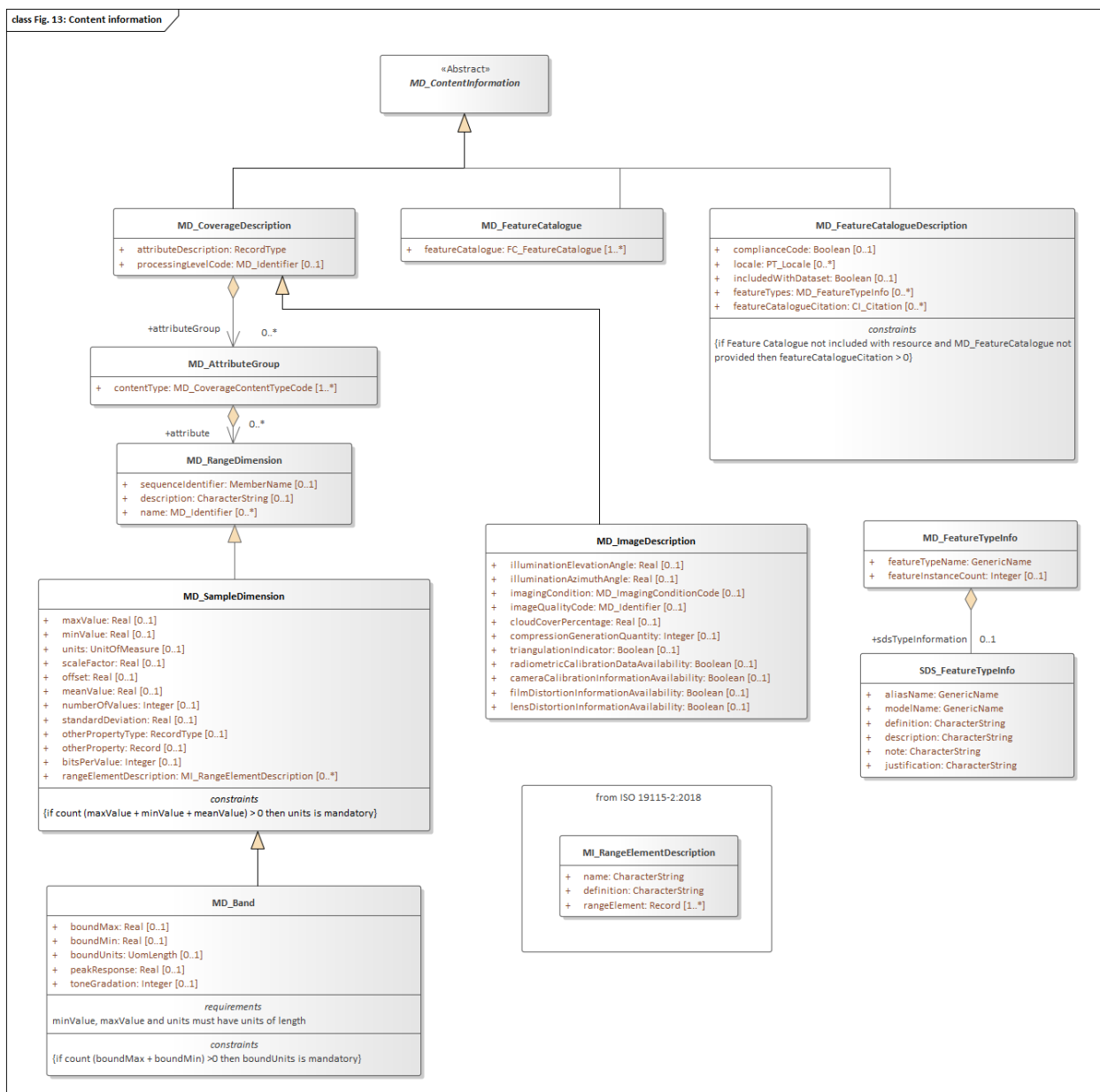
Table 61: Acquisition and Processing Identifiers

Element	Authority (CI_Citation)	Code (CharacterString)
MD_ImageDescription. imageQualityCode	Title: Name of the quality measurement specification Date: Date of the version used	Image quality code value
MD_ImageDescription. processingLevelCode	Title: Name of the processing specification Date: Date of the version used	Processing level value
MI_Requirement.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_Instrument.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_Objective.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_Operation.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_Platform.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_PlatformPass.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value
MI_Event.identifier	Title: Name of community standard Date: Date of the version used or A general purpose identifier	Community identifier value

6.9 Content Information

This UML diagram in Figure 21 corresponds to the Content Information Package UML diagram (Figure 13) found in ISO 19115-1:2014/Amd1:2018. It is extended with the SDS_FeatureTypeInfo class to allow for a more detailed description of SDSFIE feature types while still leaving the possibility for the description of non-SDSFIE feature types.

class Fig. 13: Content information



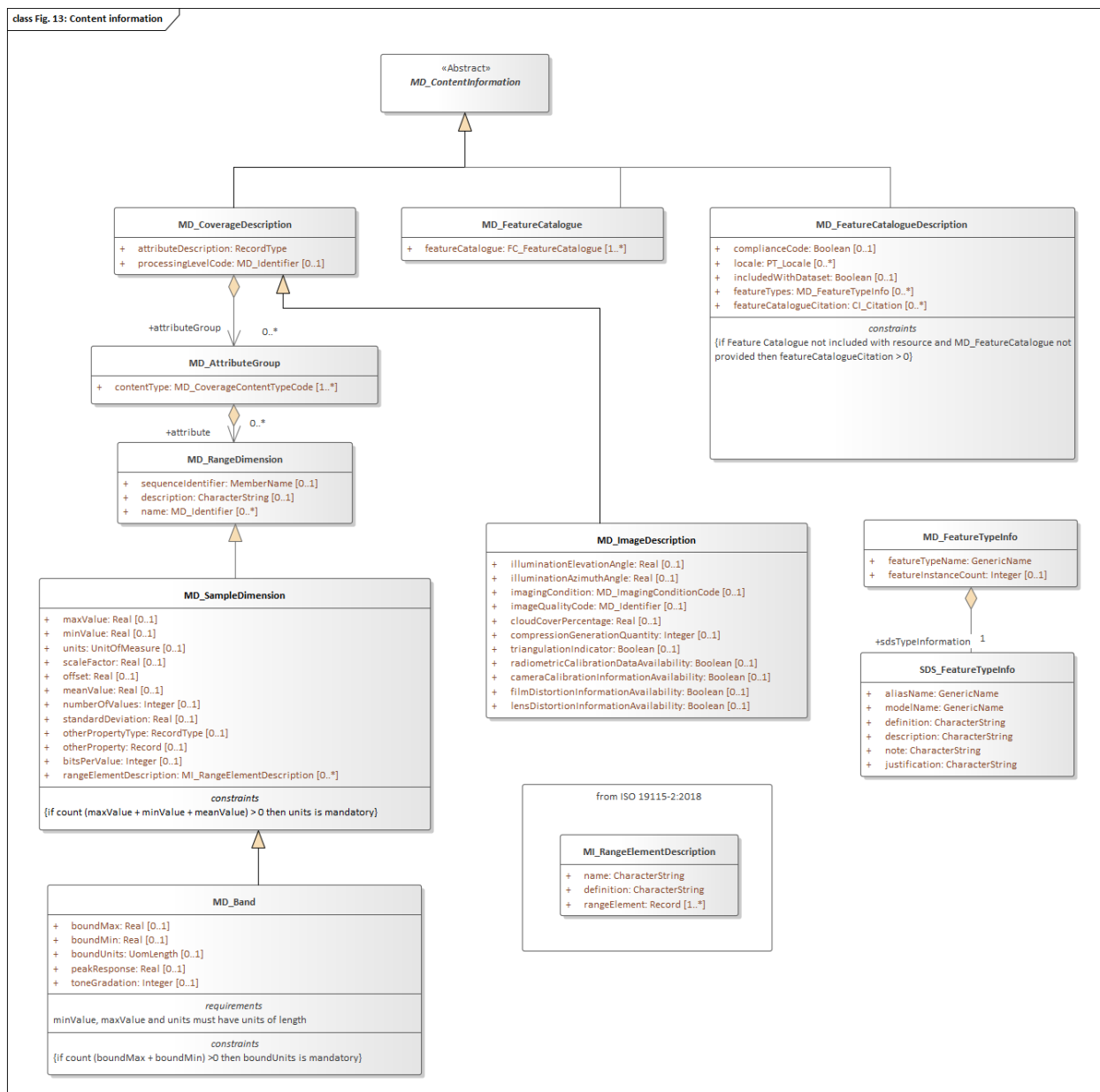


Figure 21: Content Information

The data dictionary table presented in this section corresponds to the Content Information data dictionary table (Section B.2.9.1) found in ISO 19115-1:2014:Amd1.

No profiling of this table has been performed to address EI&E community requirements.

Table 62: Content Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MD_ContentInformation	description of the content of a dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	

MD_FeatureCatalogue Description	information identifying the feature catalogue or the conceptual schema	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	
complianceCode	indication of whether or not the cited feature catalogue complies with ISO 19110	O	1	Boolean / 0=no, 1=yes	
locale	language(s) used within the catalogue	O	N	PT_Locale (6.1.2)	
includedWithDataset	indication of whether or not the feature catalogue is included with the resource	O	1	Boolean / 0=no, 1=yes	
featureTypes	indication of whether or not the feature catalogue is included with the resource	O	N	Class / MD_FeatureTypeInfo	
featureCatalogueCitation	complete bibliographic reference to one or more external feature catalogues	O	N	Class / CI_Citation (6.13)	
MD_FeatureCatalogue	information identifying the feature catalogue or the conceptual schema	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	
featureCatalogue	the catalogue of feature types, attribution, operations, and relationships used by the resource	M	N	FC_FeatureCatalogue (ISO 19110)	
MD_CoverageDescription	information about the content of a grid data cell	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	
attributeDescription	description of the attribute described by the measurement value	M	1	Class / RecordType <<Abstract> (Annex C)	
processingLevelCode	image distributor's code that identifies the level of radiometric and geometric processing that has been applied	O	1	Class / MD_Identifier <<DataType>> (6.8)	
Role name: attributeGroup	information on groups(s) of related attributes of the resource with the same type	O	N	Aggregation / MD_AttributeGroup	
MD_ImageDescription	information about an image's suitability for use	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_CoverageDescription)	

illuminationElevationAngle	illumination elevation measured in degrees clockwise from the target plane at intersection of the optical line of sight with the Earth's surface. For images from a scanning device, refer to the centre pixel of the image	0	1	Class / Real / -90.0 – 90.0 <<Abstract>>	
illuminationAzimuthAngle	illumination azimuth measured in degrees clockwise from true north at the time the image is taken. For images from a scanning device, refer to the centre pixel of the image	0	1	Class / Real / 0.00 – 360.0 <<Abstract>>	
imagingCondition	conditions affected the image	0	1	Class / ImagingConditionCode <<CodeList>> See Table 3 (ImagingConditionCode)	
imageQualityCode	specifies the image quality	0	1	Class / MD_Identifier <<DataType>> (6.8)	
cloudCoverPercentage	area of the dataset obscured by clouds, expressed as a percentage of the spatial extent	0	1	Class / Real / 0.0 – 100.0 <<Abstract>>	
compressionGenerationQuantity	count of the number of lossy compression cycles performed on the image	0	1	Class / Integer <<Abstract>>	
triangulationIndicator	indication of whether or not triangulation has been performed upon the image	0	1	Boolean / 0=no, 1=yes	
radiometricCalibrationDataAvailability	indication of whether or not the radiometric calibration information for generating the radiometrically calibrated standard data product is available	0	1	Boolean / 0=no, 1=yes	
cameraCalibrationInformationAvailability	indication of whether or not constants are available which allow for camera calibration corrections	0	1	Boolean / 0=no, 1=yes	
filmDistortionInformationAvailability	indication of whether or not Calibration Reseau information is available	0	1	Boolean / 0=no, 1=yes	
lensDistortionInformationAvailability	indication of whether or not lens aberration correction information is available	0	1	Boolean / 0=no, 1=yes	

6.9.1 Attribute group information

The data dictionary table presented in this section is based on the corresponding Attribute Group Information data dictionary table found in ISO 19115-1:2014 (Section B.2.9.1).

No profiling of this table has been performed to address EI&E community requirements.

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_Attribute Group	Information about contentType for groups of attributes for a specific MD_RangeDimension	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Coverage Description)	
contentType	type of information represented by the value(s)	M	N	Class / CoverageContentTypeCode <<CodeList>> See Table 3 (CoverageContentTypeCode)	
Role name: attribute	information on an attribute of the resource	O	N	Aggregation / MD_RangeDimension	

6.9.2 Range Dimension

The data dictionary table presented in this section is based on the corresponding Range Dimension data dictionary table found in ISO 19115-1:2014 (Section B.2.9.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 63: Range Dimension

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_RangeDimension	information on the range of attribute values	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CoverageDescription)	
sequenceIdentifier	unique name or number that identifies attributes included in the coverage	O	1	MemberName (Annex C)	
description	description of the attribute	O	1	CharacterString / Free text	
name	identifiers for each attribute included in the resource. These identifiers can be used to provide names for the resource's attribute from a standard set of names	O	N	Class / MD_Identifier <<DataType>> (6.8)	
MD_SampleDimension	the characteristics of each dimension (layer) included in the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_RangeDimension)	
maxValue	longest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	

minValue	shortest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	
units	units in which sensor wavelengths are expressed	O	1	UnitOfMeasure (Annex C)	
scaleFactor	scale factor which has been applied to the cell value	O	1	Real	
offset	the physical value corresponding to a cell value of zero	O	1	Real	
meanValue	mean value of data values in each dimension included in the resource	O	1	Real	
numberOfValues	number of values used in a thematicClassification resource EX.: the number of classes in a Land Cover Type coverage or the number of cells with data in other types of coverages	O	1	Integer	
standardDeviation	standard deviation of data values in each dimension included in the resource	O	1	Real	
otherProperty	instance of other property type not included in processing	O	1	Record (ISO/TS 19103)	
otherPropertyType	type of other property description	O	1	RecordType (ISO/TS 19103)	
bitsPerValue	number of values used in a thematicClassification resource EX.: the number of classes in a Land Cover Type coverage or the number of cells with data in other types of coverages	O	1	Integer	
rangeElementDescription	provides the description of the specific range elements of an image	O	N	Class / MI_RangeElementDescription (6.9.4.2)	
MD_Band	range of wavelengths in the electromagnetic spectrum	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SampleDimension)	
boundMax	longest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	
boundMin	shortest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	
boundUnits	units in which sensor wavelengths are expressed	O	1	UomLength (Annex C)	

peakResponse	wavelength at which the response is the highest	O	1	Real	
toneGradation	number of discrete numerical values in the grid data	O	1	Integer	

6.9.3 Feature Type Information

The data dictionary table presented in this section is based on the corresponding Feature Type Information data dictionary table found in ISO 19115-1:2014 (Section B.2.9.4). This table has been extended to capture SDSFIE-V specific feature type information as well as the ontologyURI attribute from the GeoPlatform Profile of ISO 19115-1..

Table 64: Feature Type Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_FeatureTypeInfo	Information about the occurring feature type	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_FeatureCatalogueDescription)	
featureTypeName	name of the feature type	M	1	GenericName (Annex C)	
featureInstanceCount	number of occurrence of feature instances for this feature type	O	1	Integer	
Role name: sdsTypeInfo	extended SDSFIE specific feature type information	C / an SDSFIE-V feature type?	1	Class / SDS_FeatureTypeInfo	
SDS_FeatureTypeInfo	Information about the occurring SDSFIE-V feature type	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_FeatureTypeInfo)	
ontologyURI	a unique URI that refers to the concept denoting the feature type	O	1	Class / URI (IETF RFC 3986)	
aliasName	the alias name of the SDSFIE feature class	M	1	GenericName (Annex C)	
modelName	the model name of the SDSFIE feature class	M	1	GenericName (Annex C)	
definition	the definition of the SDSFIE feature class	M	1	CharacterString / Free Text	
description	the description of the SDSFIE feature class	M	1	CharacterString / Free Text	
note	the note for the SDSFIE feature class	M	1	CharacterString / Free Text	
justification	information regarding the business justification and/or purpose for collection of this feature class	M	1	CharacterString / Free Text	

6.9.4 Content Information Extensions

This UML diagram is the corresponding Content Information Package UML diagram (Figure A.7) found in ISO 19115-2:2019. No profiling of this diagram has been performed to address EI&E community requirements.

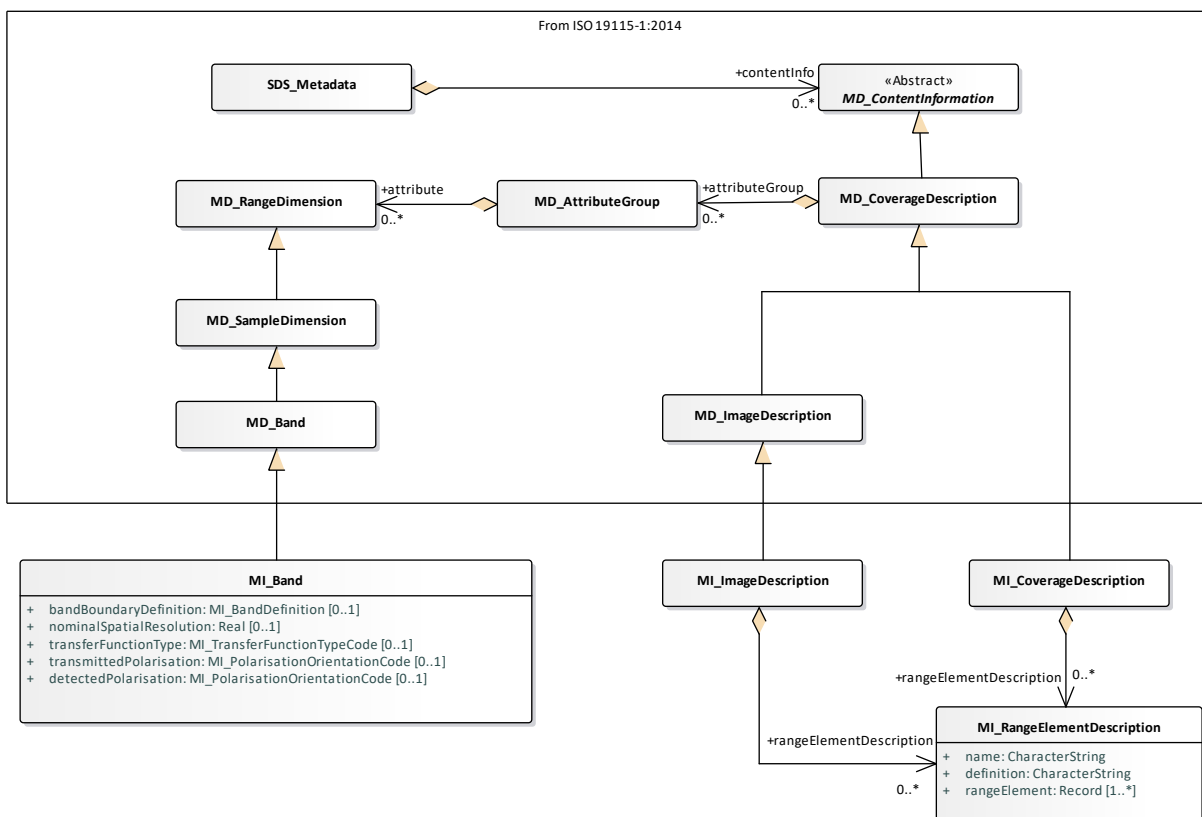


Figure 22: Content Information with imagery extensions

6.9.4.1 Coverage and Image Description – Extensions

The data dictionary table presented in this section is based on the corresponding section of the Coverage and Image Description – Extensions data dictionary table found in ISO 19115-2:2019 (Section B.2.4.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 65: Coverage Description

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_CoverageDescription	information about the content of a coverage, including the description of specific range elements (MD_CoverageDescription extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified class (MD_CoverageDescription)	
Role name: rangeElementDescription	provides the description of the specific range elements of a coverage	O	N	Association / MI_RangeElementDescription (6.9.4.2)	

The data dictionary table presented in this section is based on the corresponding section of the Coverage and Image Description – Extensions data dictionary table found in ISO 19115-2:2019 (Section B.2.4.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 66: Image Description

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
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MI_ImageDescription	information about the content of an image, including the description of specific range elements (MD_ImageDescription extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified class (MD_ImageDescription)	
<i>Role name:</i> rangeElementDescription	provides the description of the specific range elements of an image	O	N	Association / MI_RangeElementDescription (6.9.4.2)	

6.9.4.2 Range Element Description

The data dictionary table presented in this section is based on the corresponding section of the Coverage and Image Description – Extensions data dictionary table found in ISO 19115-2:2019 (Section B.2.4.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 67: Range Element Description

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_RangeElementDescription	description of specific range elements	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	
name	designation associated with a set of range elements	M	1	CharacterString / Free text	
definition	description of a set of specific range elements	M	1	CharacterString / Free text	
rangeElement	specific range elements, i.e. range elements associated with a name and their definition	M	N	Record (Annex C)	

6.9.4.3 Wavelength Band Information

The data dictionary table presented in this section is based on the corresponding Wavelength Band Information data dictionary table found in ISO 19115-2:2019 (Section B.2.4.2).

No profiling of this table has been performed to address EI&E community requirements.

Table 68: Wavelength Band Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MI_Band	extensions to electromagnetic spectrum wavelength description (MD_Band extended)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Band)	
bandBoundaryDefinition	designation of criterion for defining maximum and minimum wavelengths for a spectral band	O	1	Class / BandDefinition <<CodeList>> See Table 3 (BandDefinition)	

nominalSpatialResolution	smallest distance between which separate points can be distinguished, as specified in instrument design	0	1	Real	
transferFunctionType	type of transform function to be used when scaling a physical value for a given element	0	1	Class / TransferFunctionTypeCode <<CodeList>> See Table 3 (TransferFunctionTypeCode)	
transmittedPolarisation	polarisation of the radiation transmitted	0	1	Class / PolarisationOrientationCode <<CodeList>> See Table 3 (PolarisationOrientationCode)	
detectedPolarisation	polarisation of the radiation detected	0	1	Class / PolarisationOrientationCode <<CodeList>> See Table 3 (PolarisationOrientationCode)	

6.10 Distribution Information

This UML diagram is equivalent to the corresponding Distribution Information Package UML diagram (Figure 15) in ISO 19115-1:2014.

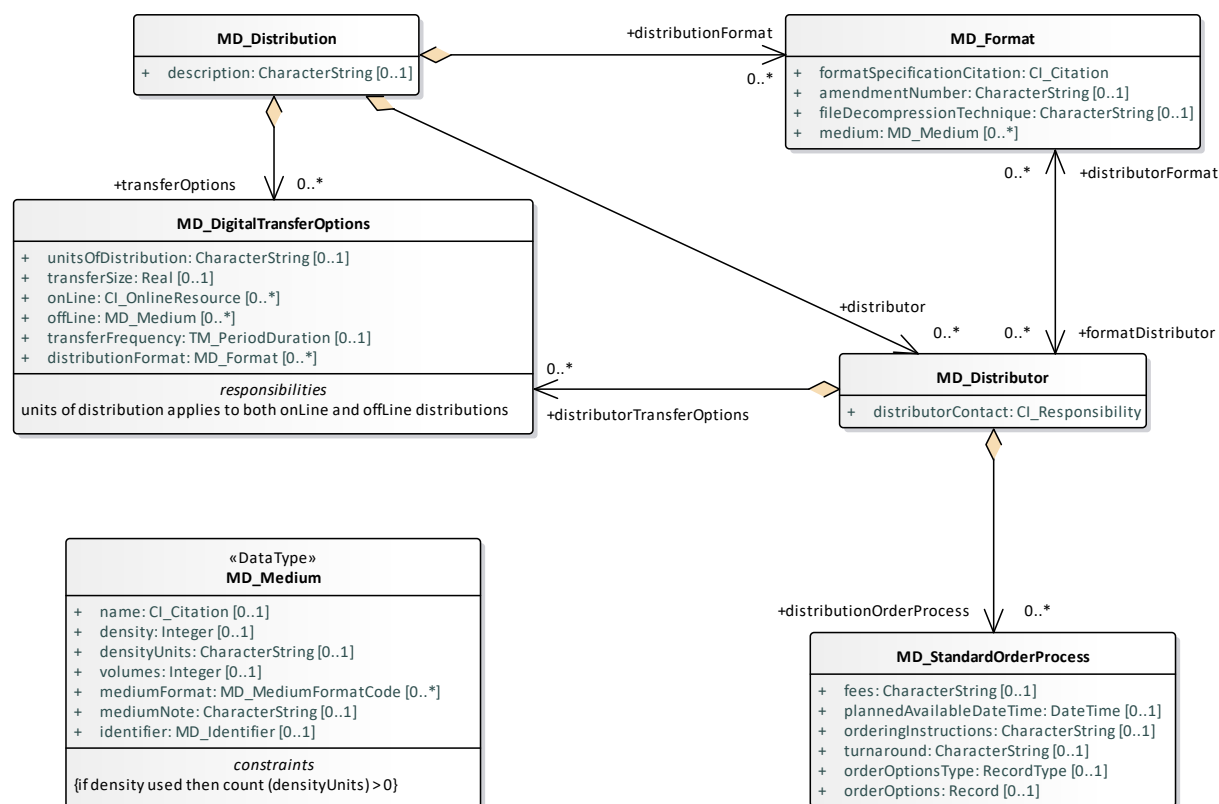


Figure 23: Distribution Information

The data dictionary presented in this section is based on the corresponding Distribution Information data dictionary table found in Section B.2.11.1, ISO 19115-1:2014.

No modifications have been made to its information content.

Table 69: Distribution Information

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
MD_Distribution	information about the distributor of and options for obtaining the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	
description	brief description of a set of distribution options	O	1	CharacterString / Free Text	
<i>Role name:</i> distributionFormat	provides a description of the format of the data to be distributed	C	N	Association / MD_Format (6.10.2)	Required if MD_Distributor.distribut orFormat is not documented
<i>Role name:</i> distributor	provides information about the distributor	O	N	Association / MD_Distributor (6.10.1)	
<i>Role name:</i> transferOptions	provides information about the technical means and media used by the distributor	O	N	Association / MD_DigitalTransferOptions (6.10.2)	

6.10.1 Distributor Information

The data dictionary table presented in this section is based on the corresponding Distributor data dictionary table found in Section B.2.11.3, ISO 19115-1:2014.

Table 70: Distributor Information

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
MD_Distributor	information about the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Format)	
distributorContact	party from whom the resource may be obtained. This list need not be exhaustive	M	1	Class / CI_Responsibility (6.13.1)	
<i>Role name:</i> distributionOrderProcess	provides information about how the resource may be obtained, and related instructions and fee information	O	N	Association / MD_StandardOrderProcess (6.10.3)	
<i>Role name:</i> distributorFormat	provides information about the format used by the distributor	C / MD_Distribution.distributionFormat not documented?	N	Association / MD_Format (6.10.2)	

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
<i>Role name:</i> distributorTransferOptions	provides information about the technical means and media used by the distributor	O	N	Association / MD_DigitalTransferOptions (6.10.2)	

6.10.2 Format

The data dictionary table presented in this section is identical to the corresponding Format data dictionary table found in ISO 19115-1:2014 (Section B.2.11.4).

Table 71: Format

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
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	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	
formatSpecificationCitation	Citation information for a subset, profile, or product specification of the data transfer format in which the resource is available.	M	1	Class / CI_Citation (6.13)	
amendmentNumber	amendment number of the format version	O	1	CharacterString / Free text	
fileDecompressionTechnique	recommendations of algorithms or processes that can be applied to read or expand resources to which compression techniques have been applied	O	1	CharacterString / Free text	
medium	medium used by the format	O	N	Class / MD_Medium <<DataType>> (6.10.4)	
<i>Role name:</i> formatDistributor	provides information about the distributor of the format	O	N	Association / MD_Distributor (6.10.1)	

6.10.3 Digital Transfer Options

The data dictionary table presented in this section is identical to the corresponding Digital Transfer Options data dictionary table found in Section B.2.11.2, ISO 19115-1:2014.

Table 72: Digital Transfer Options

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
MD_DigitalTransferOptions	technical means and media by which a resource is obtained from the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distributor) (6.10.1) (MD_Distribution) (6.10)	

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
unitsOfDistribution	tiles, layers, geographic areas, etc., in which data is available NOTE: unitsOfDistribution applies to both onLine and offLine distributions	O	1	Character String / Free Text	
transferSize	estimated size of a unit in the specified transfer format, expressed in megabytes. The transfer size is > 0.0	O	1	Real / Real	
onLine	information about online sources from which the resource can be obtained	O	N	Class / MD_OnlineResource <<DataType>> (6.13.5)	
offLine	information about offline media on which the resource can be obtained	O	N	Class / MD_Medium <<DataType>> (6.10.4)	
transferFrequency	rate of occurrence of distribution	O	1	Class / TM_PeriodDuration <<DataType>> (ISO TS 19103)	
distributionFormat	format of distribution	O	N	Class / MD_Format (6.10.2)	

6.10.4 Medium Information

The data dictionary table presented in this section is identical to the corresponding Medium Information data dictionary table found in Section B.2.11.5, ISO 19115-1:2014.

Table 73: Medium Information

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
MD_Medium	information about the media on which the resource can be distributed	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
name	information about the media on which the resource can be stored (resourceFormat) or distributed	O	1	Class / CI_Citation (6.13)	
density	density at which the data is recorded	O	1	Integer	
densityUnits	units of measure for the recording density	O	1	CharacterString / Free text	
volumes	number of items in the media identified	O	1	Integer	

Name / Role name	Definition	Obligation / Condition	Maximum occurrence	Data type / Domain	Business Rule
mediumFormat	method used to write to the medium	O	N	Class / MediumFormatCode <<CodeList>> See Table 3 (MediumFormatCode)	
mediumNote	description of other limitations or requirements for using the medium	O	1	CharacterString / Free text	
identifier	unique identifier for an instance of the MD_Medium	O	1	Class / MD_Identifier <<DataType>>	

6.10.5 Standard Order Process Information

The data dictionary table presented in this section is identical to the corresponding Standard Order Process Information data dictionary table found in ISO 19115-1:2014 (Section B.2.11.6).

Table 74: Standard Order Process Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type Domain	Business Rule
MD_StandardOrderProcess	common ways in which the resource may be obtained or received, and related instructions and fee information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distributor)	
fees	fees and terms for retrieving the resource. Include monetary units (as specified in ISO 4217)	O	1	CharacterString / Free text	
plannedAvailableDateTime	date and time when the resource will be available	O	1	DateTime (Annex C)	
orderingInstructions	general instructions, terms and services provided by the distributor	O	1	CharacterString / Free text	
turnaround	typical turnaround time for the filling of an order	O	1	CharacterString / Free text	
orderOptionsType	description of the order options record	O	1	RecordType (Annex C)	
orderOptions	request/purchase choices	O	1	Record (Annex C)	

6.11 Acquisition Information

The MI_AcquisitionInformation entity captures information about the measuring instruments and their bands, the platform carrying them, and the mission to which the data contributes. This information is added to SDSFIE-M through this entity.

Two UML diagrams have been presented in this section. The first diagram (Figure 24) is based on the Acquisition Overview UML diagram (Figure A.7) found in ISO 19115-2:2019. The second diagram (Figure 25) provides a detailed view of the Acquisition Information classes. It is based on the Acquisition Details UML diagram (Figure A.8) also found in ISO 19115-2:2019. Neither diagram has been modified for SDSFIE-M.

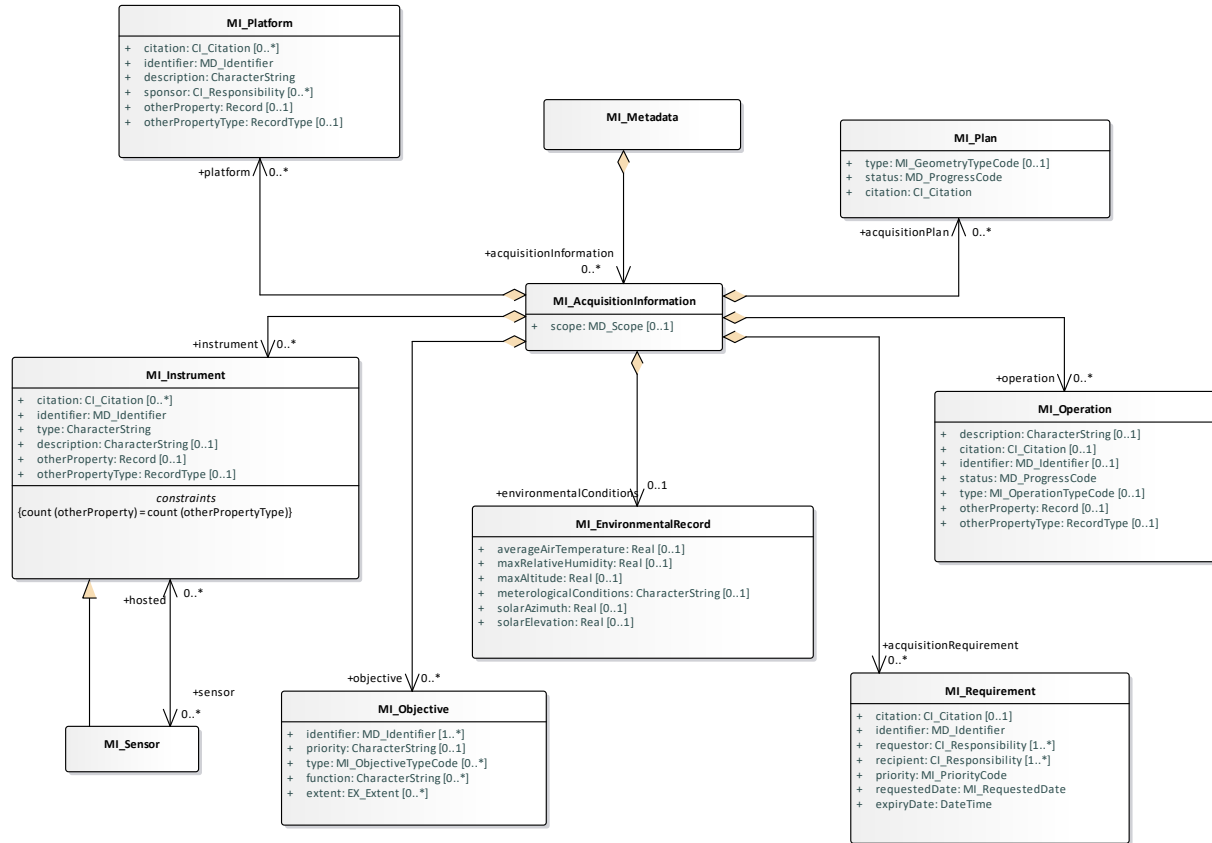


Figure 24: Acquisition Overview

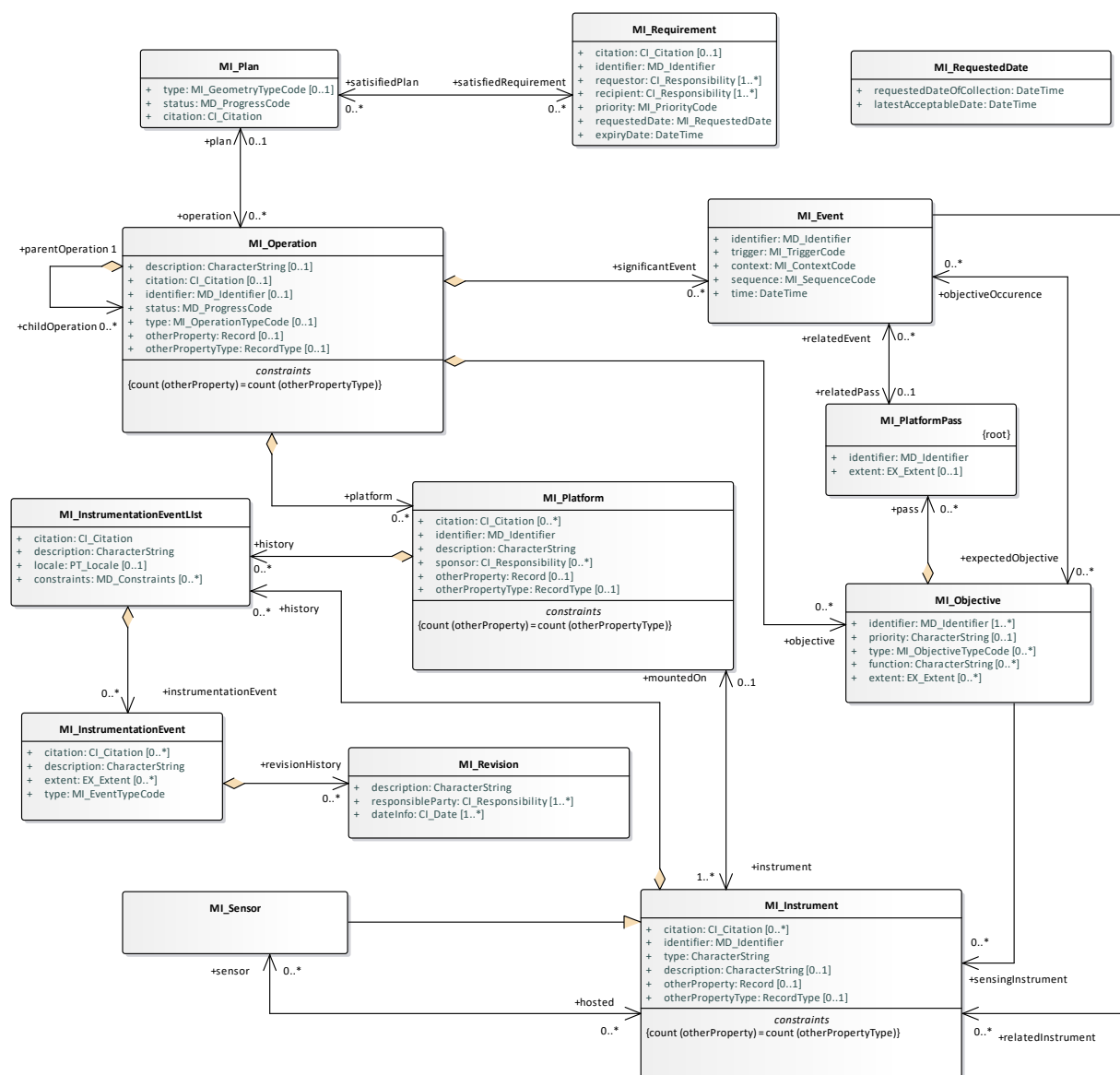


Figure 25: Acquisition Detail

6.11.1 Acquisition Information

The data dictionary table presented in this section is based on the corresponding Acquisition Information data dictionary table found in ISO 19115-2:2019 (Table B.2).

No profiling of this table has been performed to address EI&E community requirements.

Table 75: Acquisition Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_AcquisitionInformation	designations for the measuring instruments, the platform carrying them, and the mission to which the data contributes	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Metadata)	

scope	the specific data to which the acquisition information applies	O	1	Class / MD_Scope <<DataType>> (6.4.2)	
<i>Role name:</i> acquisitionPlan	Identifies the plan as implemented by the acquisition	O	N	Association / MI_Plan (6.11.6)	
<i>Role name:</i> acquisitionRequirement	Identifies the requirement the data acquisition intends to satisfy	O	N	Association / MI_Requirement (6.11.11)	
<i>Role name:</i> environmentalConditions	a record of the environmental circumstances during the data acquisition	O	1	Association / MI_EnvironmentalRecord (6.11.2)	
<i>Role name:</i> instrument	general information about the instrument used in data acquisition	O	N	Association / MI_Instrument (6.11.3)	
<i>Role name:</i> objective	identification of the area or object to be sensed	O	N	Association / MI_Objective (6.11.4)	
<i>Role name:</i> operation	general information about an identifiable activity which provided the data	O	N	Association / MI_Operation (6.11.5)	
<i>Role name:</i> platform	general information about the platform from which the data were taken	O	N	Association / MI_Platform (6.11.8)	

6.11.2 Environmental Record

The data dictionary table presented in this section is based on the corresponding Environmental Record data dictionary table found in ISO 19115-2:2019 (Table B.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 76: Environmental Record

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_EnvironmentalRecord	Information about the environmental conditions during the acquisition	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Operation)	
averageAirTemperature	average air temperature along the flight pass during the photo flight	M	1	Real	
maxRelativeHumidity	maximum relative humidity along the flight pass during the photo flight	M	1	Real	
maxAltitude	maximum altitude during the photo flight	M	1	Real	
meteorologicalConditions	meteorological conditions in the photo flight area, in particular clouds, snow and wind	M	1	CharacterString / Free Text	

solarAzimuth	Clockwise angle in degrees from north to the centre of the sun's disc. Note: This angle is calculated from the nadir point of the sensor, not at the centre point of the image.	O	1	Class / Real <<Abstract>>	
solarElevation	angle between the horizon and the centre of the Sun's disk	O	1	Class / Real <<Abstract>>	

6.11.3 Instrument Identification

The data dictionary table presented in this section is based on the corresponding Instrument Identification data dictionary table found in ISO 19115-2:2019 (Table B.4).

No profiling of this table has been performed to address EI&E community requirements.

Table 77: Instrument Identification

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Instrument	designations for the measuring instruments	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_AcquisitionInformation)	
citation	complete citation of the instrument	O	*	Class / CI_Citation <<DataType>> (6.13)	
identifier	unique identification of the instrument	M	1	Class / MD_Identifie (6.8)	
type	name of the type of instrument	M	1	CharacterString / Free text	
description	textual description of the instrument	O	1	CharacterString / Free text	
otherProperty	instance of other property type not included in processing	O	1	Class / Record <<Abstract>> (ISO/TS 19103)	
otherPropertyType	type of other property description	O	1	Class / RecordType <<Abstract>> (ISO/TS 19103)	
Role name: mountedOn	platform the instrument is mounted on	O	1	Association / MI_Platform (6.11.8)	
Role name: history	list of events associated with instrument	O	N	Aggregation / MI_InstrumentationEventList (6.11.8)	
Role name: sensor	instrument is a sensor	O	N	Association / MI_Sensor (6.11.3)	
MI_Sensor	specific type of instrument	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MI_Instrument)	

<i>Role name:</i> hosted	instrument on which sensors are hosted	O	N	Association / MI_Instrument (6.11.3)	
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6.11.4 Objective Information

The data dictionary table presented in this section is based on the corresponding Objective Information data dictionary table found in ISO 19115-2:2019 (Table B.5).

No profiling of this table has been performed to address EI&E community requirements.

Table 78: Objective Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Objective	describes the characteristics, spatial and temporal extent of the intended object to be observed	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_AcquisitionInformation, MI_Operation)	
identifier	code used to identify the objective	M	*	Class / MD_Identifier (6.11.8)	
priority	priority applied to the target	O	1	CharacterString / Free text	
type	collection technique for the objective	O	N	Class / ObjectiveTypeCode <<CodeList>> See Table 3 (ObjectiveTypeCode)	
function	role or purpose performed by or activity performed at the objective	O	N	CharacterString / Free text	
extent	extent information including the bounding box, bounding polygon, vertical and temporal extent of the objective	O	N	Class / EX_Extent (6.11.8)	
<i>Role name:</i> objectiveOccurrence	event or events associated with objective completion.	M	N	Association / MI_Event (6.11.6)	
<i>Role name:</i> pass	pass of the platform over the objective	O	N	Association / MI_PlatformPass (6.11.8)	
<i>Role name:</i> sensingInstrument	instrument which sensed the objective data	O	N	Association / MI_Instrument (6.11.3)	

6.11.5 Operation Information

The data dictionary table presented in this section is based on the corresponding Operation Information data dictionary table found in ISO 19115-2:2019 (Table B.6).

No profiling of this table has been performed to address EI&E community requirements.

Table 79: Operation Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
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MI_Operation	designations for the operation used to acquire the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_AcquisitionInformation, MI_Operation)	
description	description of the mission on which the platform observations are made and the objectives of that mission	O	1	CharacterString / Free text	
citation	identification of the mission	O	1	Class / CI_Citation <<DataType>> (6.13)	
identifier	unique identification of the operation	M	1	Class / MD_Identifier (6.8)	
status	collection technique for the operation	O	1	Class / OperationTypeCode <<CodeList>> See Table 3 (OperationTypeCode)	
type	status of the data acquisition	M	1	Class / ProgressCode <<CodeList>> See Table 3 (ProgressCode)	
otherProperty	instance of other property type not included in processing	O	1	Class / Record <<Abstract>> (ISO/TS 19103)	
otherPropertyType	type of other property description	O	1	Class / RecordType <<Abstract>> (ISO/TS 19103)	
<i>Role name:</i> childOperation	sub-missions that make up part of a larger mission	O	N	Association / MI_Operation (6.11.5)	
<i>Role name:</i> objective	object(s) or area(s) of interest to be sensed	O	N	Association / MI_Objective (6.11.4)	
<i>Role name:</i> parentOperation	heritage of the operation	M	1	Association / MI_Operation (6.11.5)	
<i>Role name:</i> plan	plan satisfied by the operation	O	1	Association / MI_Plan (6.11.6)	
<i>Role name:</i> platform	platform (or platforms) used in the operation	O	N	Association / MI_Platform (6.11.8)	
<i>Role name:</i> significantEvent	record of an event occurring during an operation	O	N	Association / MI_Event (6.11.6)	

6.11.6 Plan Information

The data dictionary table presented in this section is based on the corresponding Plan Information data dictionary table found in ISO 19115-2:2019 (Table B.7).

No profiling of this table has been performed to address EI&E community requirements.

Table 80: Plan Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
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MI_Plan	designations for the planning information related to meeting the data acquisition requirements	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	
type	manner of sampling geometry that the planner expects for collection of objective data	O	1	Class / GeometryTypeCode <<CodeList>> See Table 3 (GeometryTypeCode)	
status	current status of the plan (pending, completed, etc.)	M	1	Class / ProgressCode <<CodeList>> See Table 3 (ProgressCode)	
citation	identification of authority requesting target collection	M	1	Class / CI_Citation <<DataType>> (6.13)	
Role name: operation	identification of the activity or activities that satisfy a plan	O	N	Association / MI_Operation (6.11.5)	
Role name: satisfiedRequirement	requirement satisfied by the plan	O	N	Association / MI_Requirement (6.11.11)	

6.11.7 Event Identification

The data dictionary table presented in this section is based on the corresponding Event Identification data dictionary table found in ISO 19115-2:2019 (Table B.8).

No profiling of this table has been performed to address EI&E community requirements.

Table 81: Event Identification

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Event	identification of a significant collection point within an operation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Operation)	
identifier	event name or number	M	1	Class / MD_Identifier (6.8)	
trigger	initiator of the event	M	1	Class / TriggerCode <<CodeList>> See Table 3 (TriggerCode)	
context	meaning of the event	M	1	Class / ContextCode <<CodeList>> See Table 3 (ContextCode)	
sequence	relative time ordering of the event	M	1	Class / SequenceCode <<CodeList>> See Table 3 (SequenceCode)	
time	time the event occurred	M	1	DateTime (Annex C)	
Role name: expectedObjective	objective or objectives satisfied by an event	O	N	Association / MI_Objective (6.11.4)	

<i>Role name:</i> relatedPass	pass during which an event occurs	O	1	Association / MI_PlatformPass (6.11.8)	
<i>Role name:</i> relatedInstrument	instrument or instruments for which the event is meaningful	O	N	Association / MI_Instrument (6.11.3)	

6.11.8 Platform Identification

The data dictionary table presented in this section is based on the corresponding Platform Identification data dictionary table found in ISO 19115-2:2019 (Section B.9).

No profiling of this table has been performed to address EI&E community requirements.

Table 82: Platform Identification

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Platform	designation of the platform used to acquire the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information, MI_Operation)	
citation	source where information about the platform is described	O	1	Class / CI_Citation <<DataType>> (6.13)	
identifier	unique identification of the platform.	M	1	Class / MD_Identifier (6.8)	
description	narrative description of the platform supporting the instrument	M	1	CharacterString / Free text	
sponsor	organization responsible for building, launch, or operation of the platform	O	N	Class / CI_Responsibility (6.13.1)	
otherProperty	instance of other property type not included in processing	O	1	Class / Record <<Abstract>> (ISO/TS 19103)	
otherPropertyType	type of other property description	O	1	Class / RecordType <<Abstract>> (ISO/TS 19103)	
<i>Role name:</i> history	list of events associated with platform	O	N	Aggregation / MI_InstrumentationEventList (6.11.8)	
<i>Role name:</i> instrument	instrument(s) mounted on a platform	M	N	Association / MI_Instrument (6.11.3)	

6.11.9 Platform Pass Identification

The data dictionary table presented in this section is based on the corresponding Platform Pass Identification data dictionary table found in ISO 19115-2:2019 (Table B.10).

No profiling of this table has been performed to address EI&E community requirements.

Table 83: Platform Pass Identification

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
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MI_PlatformPass	identification of collection coverage	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Objective)	
identifier	unique name of the pass	M	1	Class / MD_Identifier (6.8)	
extent	area covered by the pass	O	1	Class / GM_Object (ISO 19107) <<DataType>>	
Role name: relatedEvent	occurrence of one or more events for a pass	O	N	Association / MI_Event (6.11.6)	

6.11.10 Request Date Range

The data dictionary table presented in this section is based on the corresponding Request Date Range data dictionary table found in ISO 19115-2:2019 (Table B.11).

No profiling of this table has been performed to address EI&E community requirements.

Table 84: Requested Date Range

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_RequestedDate	range of date validity	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
requestedDateOf Collection	preferred date and time of collection	M	1	DateTime (Annex C)	
latestAcceptableDate	latest date and time collection must be completed	M	1	DateTime (Annex C)	

6.11.11 Requirement Information

The data dictionary table presented in this section is based on the corresponding Requirement Information data dictionary table found in ISO 19115-2:2019 (Table B.12).

No profiling of this table has been performed to address EI&E community requirements.

Table 85: Requirement Information

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Requirement	requirement to be satisfied by the planned data acquisition	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MI_Acquisition Information)	
citation	identification of reference or guidance material for the requirement	O	1	Class / CI_Citation <<DataType>> (6.13)	

identifier	unique name, or code, for the requirement	M	1	Class / MD_Identifier (6.8)	
requestor	origin of requirement	M	N	Class / CI_Responsibility (6.13.1)	
recipient	person(s), or body(ies), to receive results of requirement	M	N	Class / CI_Responsibility (6.13.1)	
priority	relative ordered importance, or urgency, of the requirement	M	1	Class / PriorityCode <<CodeList>> See Table 3 (PriorityCode)	
requestedDate	required or preferred acquisition date and time	M	1	Class / MI_RequestedDate (6.11.10)	
expiryDate	date and time after which collection is no longer valid	M	1	DateTime (Annex C)	
<i>Role name:</i> satisfiedPlan	plan that identifies solution to satisfy the requirement	O	N	Association / MI_Plan (6.11.6)	

6.11.12 Instrumentation Event List Information

The data dictionary table presented in this section is based on the corresponding Instrument Event List data dictionary table found in ISO 19115-2:2019 (Table B.13).

No profiling of this table has been performed to address EI&E community requirements.

Table 86: Instrumentation Event List

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_InstrumentationEventList	list of events related to platform/ instrument/sensor	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Class	
citation	citation to the instrumentationEventList	M	1	Class / CI_Citation (6.13)	
description	description of the language and characterSet used for the instrumentationEventList	M	1	Class / CharacterString / Free Text <<Abstract>>	
locale	description of the language and characterSet used for the instrumentationEventList	O	1	Class / PT_Locale (6.1.2)	
constraints	use and access constraints	O	N	Class / MD_Constraints (6.3)	
<i>Role name:</i> instrumentationEvent	event(s) in the list of events	O	N	Aggregation / MI_InstrumentationEvent (6.11.12)	

6.11.13 Instrumentation Event Information

The data dictionary table presented in this section is based on the corresponding Instrument Event data dictionary table found in ISO 19115-2:2019 (Table B.14).

No profiling of this table has been performed to address EI&E community requirements.

Table 87: Instrumentation Event

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_InstrumentationEvent	an event related to a platform/instrument/sensor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	
citation	citation to the instrumentationEvent	O	N	Class / CI_Citation (6.13)	
description	description of the instrumentationEvent	M	1	Class / CharacterString / Free Text <<Abstract>>	
extent	extent of the instrumentation event	O	N	Class / EX_Extent <<DataType>> (6.11.8)	
type	type of the instrumentationEvent	M	1	Class / EventTypeCode <<CodeList>> See Table 3 (EventTypeCode)	
Role name: revisionHistory	history of revisions to the instrumentationEvent	O	N	Aggregation / MI_Revision (6.11.14)	

6.11.14 Revision

The data dictionary table presented in this section is based on the corresponding Revision data dictionary table found in ISO 19115-2:2019 (Table B.15).

No profiling of this table has been performed to address EI&E community requirements.

Table 88: Revision

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
MI_Revision	History of the revision of an event	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	
description	description of the revision	M	1	Class/ CharacterString / Free Text <<Abstract>>	
responsibleParty	individual or organization responsible for the revision	M	N	Class / CI_Responsibility (6.13.1)	
dateInfo	information about dates related to the revision	M	N	Class / CI_Date <<DataType>> (6.13.4)	

6.12 Extent

This UML diagram corresponds to the Extent Package UML diagram (Figure 19) found in ISO 19115-1:2014.

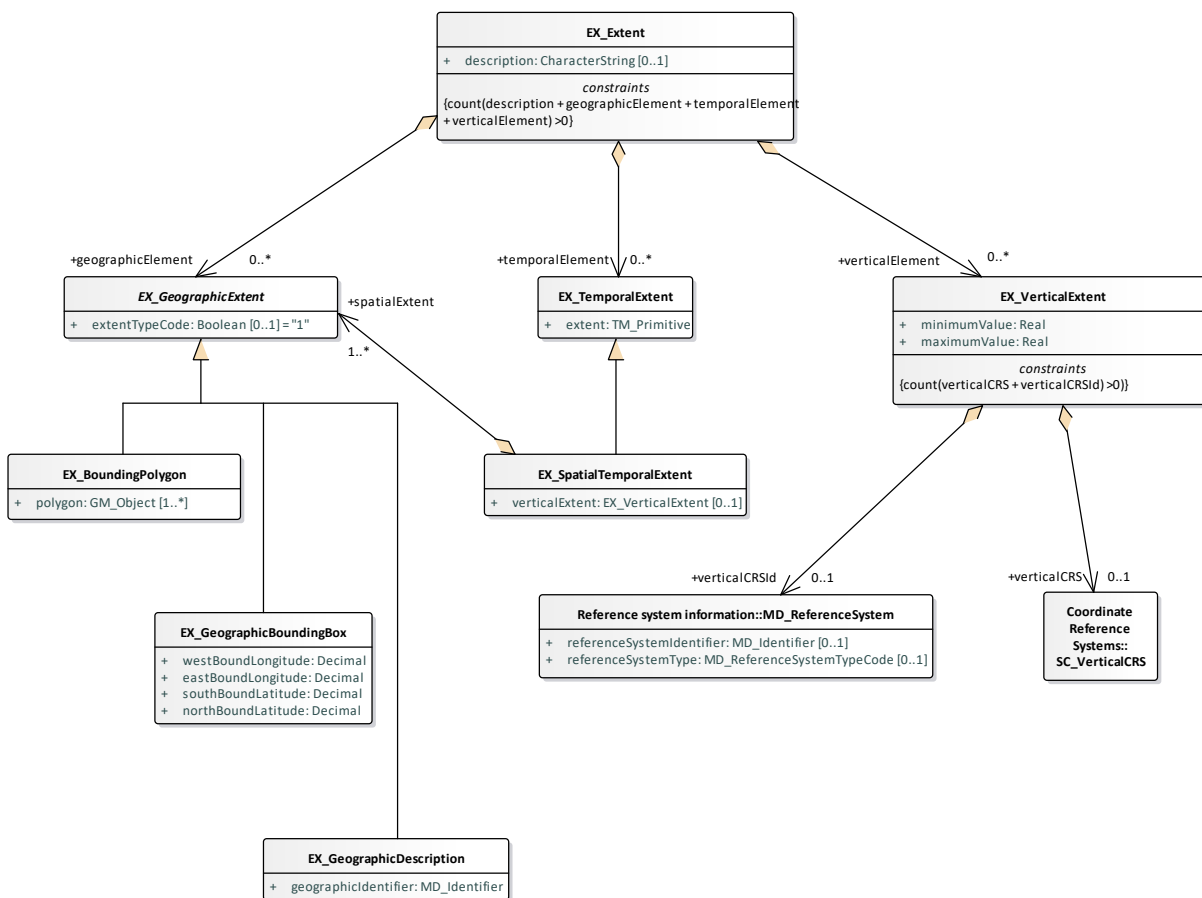


Figure 26: Extent

The data dictionary table presented in this section is based on the corresponding Extent data dictionary table found in ISO 19115-1:2014 (Section B.3.1.1).

No profiling of this table has been performed to address EI&E community requirements.

Table 89: Extent

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
EX_Extent	information about horizontal, vertical, and temporal extent	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
description	spatial and temporal extent for the referring object	C / geographicElement and temporalElement and verticalElement not documented?	1	CharacterString / Free text	
Role name: geographicElement	provides geographic component of the extent of the referring object	C / description and temporalElement and verticalElement not documented?	N	Association / EX_GeographicExtent <<Abstract>> (6.12.1)	

<i>Role name:</i> temporalElement	provides temporal component of the extent of the referring object	C / description and geographicElement and verticalElement not documented?	N	Association / EX_TemporalExtent (6.12.2)	
<i>Role name:</i> verticalElement	provides vertical component of the extent of the referring object	C / description and geographicElement and temporalElement not documented?	N	Association / EX_VerticalExtent (6.12.3)	

6.12.1 Geographic Extent

The data dictionary table presented in this section corresponds to the Geographic Extent data dictionary table (Section B.3.1.2) found in ISO 19115-1:2014.

Table 90: Geographic Extent

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
EX_GeographicExtent	geographic area of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent and EX_SpatialTemporalExtent) <<Abstract>>	
extentTypeCode	indication of whether the bounding polygon encompasses an area covered by the data or an area where data is not present	O	1	Boolean / 0 – exclusion, 1 – inclusion	
EX_BoundingPolygon	boundary enclosing the dataset, expressed as the closed set of (x,y) coordinates of the polygon (last point replicates first point)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	
polygon	sets of points defining the bounding polygon	M	N	GM_Object (Annex C)	
EX_GeographicBoundingBox	geographic position of the dataset. NOTE This is only an approximate reference so specifying the coordinate reference system is unnecessary	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	
westBoundLongitude	western-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Decimal / -180,0 <= West Bounding Longitude Value <= 180,0	

eastBoundLongitude	eastern-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Decimal / -180,0 <= East Bounding Longitude Value <= 180,0	
southBoundLatitude	southern-most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Decimal / -90,0 <= South Bounding Latitude Value <= 90,0; South Bounding Latitude Value <= North bounding Latitude Value	
northBoundLatitude	northern-most, coordinate of the limit of the dataset extent expressed in latitude in decimal degrees (positive north)	M	1	Decimal / -90,0 <= North Bounding Latitude Value <= 90,0; North Bounding Latitude Value >= South Bounding Latitude Value	
EX_GeographicDescription	description of the geographic area using identifiers	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	
geographicIdentifier	identifier used to represent a geographic area	M	1	Class / MD_Identifier <<DataType>> (6.8)	

6.12.2 Temporal Extent

The data dictionary table presented in this section is based on the corresponding Temporal Extent data dictionary table found in ISO 19115-1:2014 (Section B.3.1.3).

No profiling of this table has been performed to address EI&E community requirements.

Table 91: Temporal Extent

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
EX_TemporalExtent	time period covered by the content of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	
extent	date and time for the content of the dataset	M	1	Class / TM_Primitive (Annex C)	
EX_SpatialTemporalExtent	extent with respect to date/time and spatial boundaries	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_TemporalExtent)	
verticalExtent	vertical extent component	O	1	Class /. EX_VerticalExtent (6.12.3)	

<i>Role name:</i> spatialExtent	spatial extent component of composite spatial and temporal extent	M	N	Association / EX_GeographicExtent (6.12.1)	
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6.12.3 Vertical Extent

The data dictionary table presented in this section is based on the corresponding Vertical Extent data dictionary table found in ISO 19115-1:2014 (Section B.3.1.4).

No profiling of this table has been performed to address EI&E community requirements.

Table 92: Vertical Extent

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
EX_VerticalExtent	vertical domain of dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated (EX_Extent) Class	
minimumValue	lowest vertical extent contained in the dataset	M	1	Real	
maximumValue	highest vertical extent contained in the dataset	M	1	Real	
<i>Role name:</i> verticalCRSId	identifies the vertical coordinate reference system used for the minimum and maximum values	O	1	Aggregation / MD_ReferenceSystem (6.7)	
<i>Role name:</i> verticalCRS	provides information about the vertical coordinate reference system to which the maximum and minimum elevation values are measured. The CRS identification includes unit of measure.	M	1	Aggregation / SC_CRS (ISO 19111)	See Table 2 (CrsIdentifier) CrsIdentifier is a realization of the abstract functionality described by SC_CRS, and is the preferred realization. It is a Recommended Best Practice that when a Vertical CRS is used that it be in accordance with the Earth Gravity Model 1996 (EGM96), as specified in NIMA TR8350.2 (3rd Edition, Amendment 1). This Vertical CRS is identified by one of two URIs depending on whether the coordinate is a height or depth value: http://api.nsgreg.nga.mil/coord-ref-system/EGM96_H or http://api.nsgreg.nga.mil/coord-ref-system/EGM96_D

6.13 Citation

This UML diagram is an SDSFIE-M -specific version of the corresponding Citation Package UML diagram (Figure 20) found in ISO 19115-1:2014 (and as amended by ISO 19115-1:2014/Amd.1:2018).

This diagram defines metadata describing authoritative reference information, including responsible party and contact information.

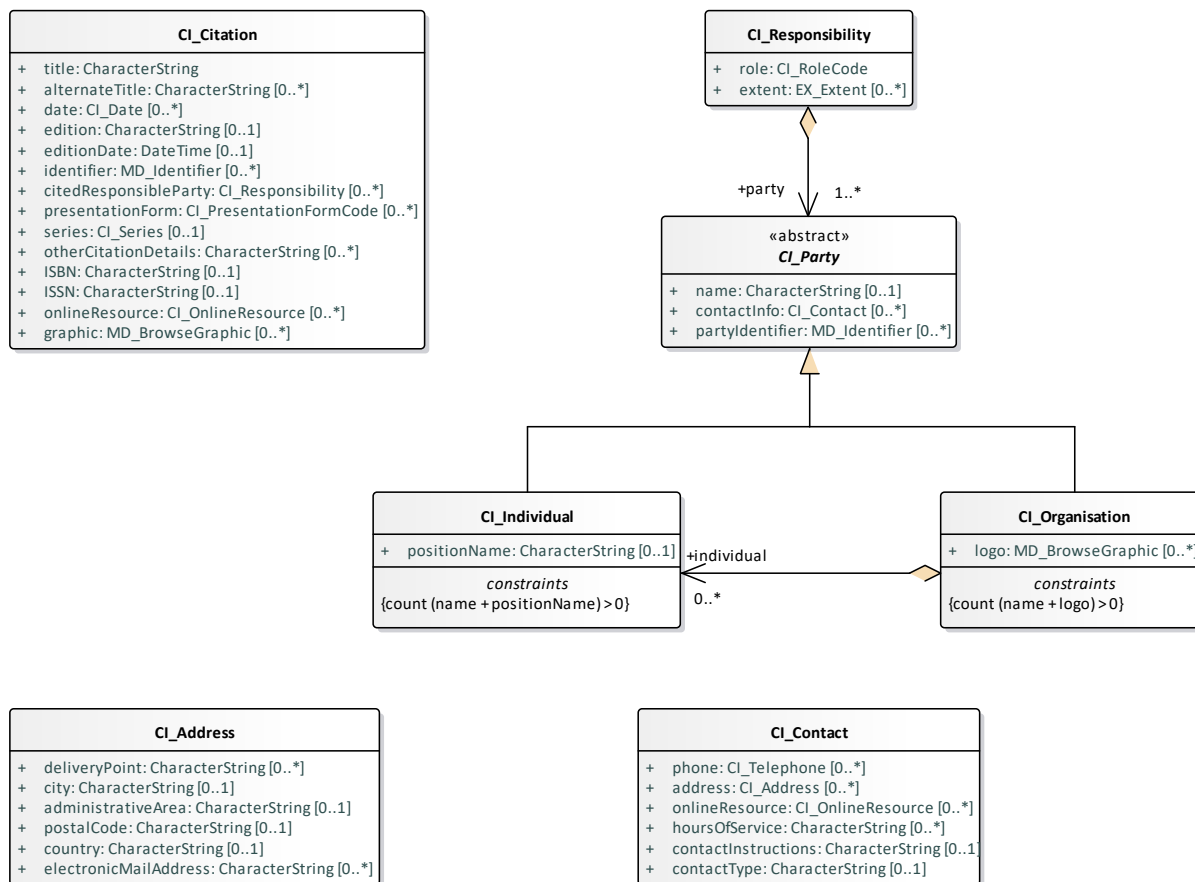


Figure 27: Citation and Responsible Party

The data dictionary table presented in this section is based on the corresponding Citation data dictionary table found in ISO 19115-1:2014 (Section B.3.2.1). The data type of the presentationForm element has been modified to align with the North American Profile of ISO 19115-1:2014 via the CodeList named SDS_PresentationFormCode.

Table 93: Citation

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Citation	standardized resource reference	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
title	name by which the cited resource is known	M	1	CharacterString / Free text	

alternateTitle	short name or other language name by which the cited information is known. Example: "DCW" as an alternative title for "Digital Chart of the World"	O	N	CharacterString / Free text	
date	reference date for the cited resource	M	N	Class / CI_Date <<DataType>> (6.13.4)	If the CI_Citation is the citation on MD_IdentificationInfo, then at least two dates should be included, one with dateType pf "creation" and one with "revision". The later should refer to the last modification date of the data.
edition	version of the cited resource	O	1	CharacterString / Free text	
editionDate	date of the edition	O	1	Class / Date	
identifier	value uniquely identifying an object within a namespace	O	N	Class / MD_Identifier <<DataType>> (6.8)	If the resource is to be accessible via GeoPlatform, then this identifier should be a URI. The NSG is moving to mandatory unique identifiers. Due to the fact that SDFSIE-M is aligned with NSG requirements, this element will be mandatory in future versions of SDFSIE-M.
citedResponsibleParty	name and position information for an individual or organization that is responsible for the resource	M	N	Class / CI_Responsibility(6.13.1)	In the case of more than a single pointOfContact element then the members of the set shall be ordered in descending priority of their recommended use, however not all implementations will necessarily honor the ordering
presentationForm	mode in which the resource is represented	O	N	Class / PresentationFormCode <<CodeList>> See Table 3 (PresentationFormCode)	
series	information about the series, or aggregate dataset, of which the dataset is a part	O	1	Class / CI_Series <<DataType>>(6.13.6)	

otherCitationDetails	other information required to complete the citation that is not recorded elsewhere	O	1	CharacterString / Free text	
ISBN	international Standard Book Number	O	1	CharacterString / Free text	
ISSN	international Standard Serial Number	O	1	CharacterString / Free text	
onlineResource	online reference to the cited resource	O	N	Class / MD_OnlineResource <<DataType>> (6.13.5)	

6.13.1 Responsible Party

The data dictionaries table presented in this section are based on the corresponding Responsibility, Party, Individual, and Organisation data dictionary tables found in ISO 19115-1:2014 (Section B.3.2.2 and B.3.2.3). The data type of the role element has been modified to align with the North American Profile of ISO 19115-1:2014 via the CodeList named RoleCode.

Table 94: Responsible Party

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Responsibility	information about the party and their role	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
role	function performed by the responsible party	M	1	Class / RoleCode <<CodeList>>See Table 3 (RoleCode)	
extent	spatial or temporal extent of the role	O	N	Class / EX_Extent <<DataType>> (6.11.8)	
Role name: party	information about the party	M	N	Aggregation / CI_Party (6.13.1)	
CI_Party	information about the individual and/or organisation of the party	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Abstract>>	

name	name of the party (individual or organization)	C / logo and positionName not documented?	1	CharacterString / Free text	Wherever possible, avoid the use of personal names as they change more frequently than position name or organization and because their presence in a database or metadata record may make that record private as defined by various federal regulations.
contactInfo	contact information for the party	O	1	Class / CI_Contact (6.13.3)	
partyIdentifier	identifier for the party	O	N	Class / MD_Identifier <<DataType>> (6.8)	If the resource is to be accessible via GeoPlatform, then this identifier should be a URI.
CI_Individual	information about the party if the party is an individual	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (CI_Party)	
positionName	role or position of the responsible person	C / individualName and organisationName not documented?	1	CharacterString / Free text	
CI_Organisation	information about the party if the party is an organisation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (CI_Party)	
logo	Graphic identifying organization	O	N	Class / MD_BrowseGraphic (6.2.4)	
Role name individual	an individual in the named organisation	O	N	Aggregation / CI_Individual	

6.13.2 Address

The data dictionary table presented in this section is based on the corresponding Address data dictionary table found in ISO 19115-1:2014 (Section B.3.2.4).

Table 95: Address

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Address	location of the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	

deliveryPoint	address line for the location (as described in ISO 11180, annex A)	O	N	CharacterString / Free text	
city	city of the location	O	1	CharacterString / Free text	
administrativeArea	state, province of the location	O	1	CharacterString / Free text	
postalCode	ZIP or other postal code	O	1	CharacterString / Free text	
country	country of the physical address	O	1	CharacterString / Free text	
electronicMailAddress	address of the electronic mailbox of the responsible organization or individual	O	N	CharacterString / Free text	

6.13.3 Contact

The data dictionary table presented in this section is based on the corresponding Contact data dictionary table found in ISO 19115-1:2014 (Section B.3.2.5).

No profiling of this table has been performed to address EI&E community requirements.

Table 96: Contact

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Contact	information required to enable contact with the responsible person and/or organization	Use obligation/ condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
phone	telephone numbers at which the organization or individual may be contacted	O	1	Class CI_Telephone <<DataType>> (6.13.7)	
address	physical and email address at which the organization or individual may be contacted	O	1	Class CI_Address (6.13.2)	
onlineResource	on-line information that can be used to contact the individual or organization	O	1	Class MD_OnlineResource <<DataType>> (6.13.5)	
hoursOfService	time period (including time zone) when individuals can contact the organization or individual	O	1	CharacterString / Free text	
contactInstructions	supplemental instructions on how or when to contact the individual or organization	O	1	CharacterString / Free text	
contactType	type of the contact	O	1	CharacterString / Free text	

6.13.4 Date

The data dictionary table presented in this section is based on the corresponding Date data dictionary table found in ISO 19115-1:2014 (Section B.3.2.6). The data type of the dateType element has been modified to align with the North American Profile of ISO 19115-1:2014 via the CodeList named SDS_DateTypeCode.

Table 97: Date

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Date	reference date and event used to describe it	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
date	reference date for the cited resource	M	1	DateTime (Annex C)	
dateType	event used for reference date	M	1	Class / DateTypeCode <<CodeList>> See Table 3 (DateTypeCode)	

6.13.5 Online Resource

The data dictionary table presented in this section is based on the corresponding Online Resource data dictionary table found in ISO 19115-1:2014 (Section B.3.2.6). An extension class is provided, MD_OnlineResource, to capture elements from the GeoPlatform Profile of ISO 19115-1.

Table 98: Online Resource

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_OnlineResource	information about on-line sources from which the dataset, specification, or community profile name and extended metadata elements can be obtained	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
linkage	location (address) for on-line access using a Uniform Resource Locator address or similar addressing scheme such as http://www.statkart.no/iso/tc211	M	1	CharacterString / Free text	
protocol	connection protocol to be used	O	1	CharacterString / Free text	The protocol should be taken from an official controlled list such as the Official Internet Protocol Standards published on the Web at http://www.rfceditor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at http://www.iana.org/numbers.html .
applicationProfile	name of an application profile that can be used with the online resource	O	1	CharacterString / Free text	If the resource is to be accessible via GeoPlatform, then it is recommended that this attribute be used to differentiate between different encodings.

name	name of the online resource	O	1	CharacterString / Free text	If the resource is to be accessible via GeoPlatform, then it is recommended that the name be the same as the title (if used in the context of CI_Citation)
description	detailed text description of what the online resource is/does	O	1	CharacterString / Free text	
function	code for function performed by the online resource	O	1	Class / OnLineFunctionCode <<CodeList>> See Table 3 (OnLineFunctionCode)	
protocolRequest	protocol used by the accessed resource(to be used mainly for POST requests). Example POST/XML: <GetFeature service="WFS" version="2.0.0" outputFormat="application/gml+xml; version=3.2" xmlns=http://www.opengis.net/wfs/2.0 xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance xsi:schemaLocation="http://www.opengis.net/wfs/2.0 http://schemas.opengis.net/wfs/2.0.0/wfs.xsd"> <Query typeName="Roads"/> </GetFeature>	O	1	CharacterString	This attribute shall NOT be used if the resource is to be accessible via GeoPlatform.
MD_OnlineResource	Extension of online resources for use by GeoPlatform				
contentType	media type for the online resource	C	1	CharacterString / representing a value mime-type value per IETF RFC 2046	This attribute is mandatory if the resource is accessible via GeoPlatform.
format	a human description of the format of the online resource for example, XSLT, XML Schema, etc.	C	1	Class / MD_Format ()	This attribute is mandatory if the resource is accessible via GeoPlatform.
representationTechnique	the URI of the SKOS:Concept which provides the specification of how the distribution that is contained in the online resource is expressed	C	1	Class / URI (IETF RFC 3986)	This attribute is mandatory if the resource is accessible via GeoPlatform.

6.13.6 Series

The data dictionary table presented in this section is based on the corresponding Series data dictionary table found in ISO 19115-1:2014 (Section B.3.2.8).

No profiling of this table has been performed to address EI&E community requirements.

Table 99: Series

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Series	information about the series, or aggregate dataset, to which a dataset belongs	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
name	name of the series, or aggregate dataset, of which the dataset is a part	O	1	CharacterString / Free text	
issuidentification	information identifying the issue of the series	O	1	CharacterString / Free text	
page	details on which pages of the publication the article was published	O	1	CharacterString / Free text	

6.13.7 Telephone

The data dictionary table presented in this section is based on the corresponding Telephone data dictionary table found in ISO 19115-1:2014 (Section B.3.2.9).

No profiling of this table has been performed to address EI&E community requirements.

Table 100: Telephone

Name / Role name	Definition	Obligation / Condition	Max Occur	Data type / Domain	Business Rule
CI_Telephone	telephone numbers for contacting the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
number	telephone number by which individuals can contact responsible organisation or individual	M	1	CharacterString / Free text	
numberType	type of telephone number	O	1	Class / CI_TelephoneTypeCode <<CodeList>>	

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Annex A. Conformance and Compliance (Normative)

SDSFIE-M is a conceptual schema. The purpose of a conceptual schema is to capture the concepts and relationships of a domain model in a form which is agnostic to the eventual choice of an implementing technology. Due to this level of abstraction, compliance with SDSFIE-M cannot be tested directly. Therefore, developers seeking to implement an SDSFIE-M compliant system shall first locate the XML schema developed by the DISDI Program Office and located at SDSFIE Online (<https://www.sdsfieonline.org/Standards/Metadata>).

SDSFIE-M is a profile of NAS and several International Standards. Except where modified in SDSFIE-M, those International Standards are the normative authority for SDSFIE-M elements and entities.

A.1 Profiles and Conformance

The IGG has decided not to support the development of profiles and thus conformance amounts to implementation of the entire content of SDSFIE-M.

A.2 Compliance

Demonstration of compliance of the system with the DISDI Program developed XML Schemas shall constitute demonstration of compliance of the system with SDSFIE-M.

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Annex B. References

B.1 Normative References

The following referenced documents provide the basis for SDSFIE-M. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including amendments) applies.

- ISO 639-2:1998, Codes for the representation of names of languages – Part 2: Alpha-3 code
- ISO 3166 (all parts), Codes for the representation of names of countries and their subdivisions
- ISO 19103:2015, Geographic information — Conceptual schema language
- ISO 19107:2003, Geographic information — Spatial schema
- ISO 19108:2002, Geographic information — Temporal schema
- ISO 19108:2002/Cor 1:2006, Geographic information — Temporal schema, Technical Corrigendum 1
- ISO 19109:2015, Geographic information — Rules for application schema
- ISO 19110:2016, Geographic information — Methodology for feature cataloguing
- ISO 19111:2007, Geographic information — Spatial referencing by coordinates
- ISO 19111-2:2009, Geographic information -- Spatial referencing by coordinates -- Part 2: Extension for parametric values
- ISO 19115-1:2014, Geographic information — Metadata — Part 1: Fundamentals
- ISO 19115-1:2014/Amd 1:2018, Geographic information — Metadata — Part 1: Fundamentals, Amendment 1
- ISO 19115-2:2019, Geographic information — Metadata — Part 2: Extensions for acquisition and processing
- ISO/TS 19139:2007, Geographic information — Metadata — XML schema implementation
- ISO 19157:2013, Geographic information — Data quality
- ISO 19157:2013/Amd 1:2018, Describing data quality using coverages
- GeoPlatform Profile of ISO 19115-1 (<https://www.geoplatform.gov/gp-profile/>)
- NAS X-2 Application Schema spreadsheets

B.2 Informative References

The following publications were referenced to support the development of this Profile.

- DoD Instruction 8130.01, Installation Geospatial Information and Services (IGI&S), 9 April 2015
- NGA.STND.0022_8.0_NAS, National System for Geospatial Intelligence Application Schema (NAS) – Part 1: Platform Independent Model, Version 8.0
- Department of Defense Instruction 8320.02 Sharing Data, Information, and Information Technology (IT) Services in the Department of Defense, August 5, 2013, Department of Defense Chief Information Officer.
- ISO 19105:2000, Geographic information — Conformance and testing
- ISO 19106:2004, Geographic information — Profiles
- ISO 19118:2011, Geographic information — Encoding
- ISO 19123:2005, Geographic information — Schema for coverage geometry and functions
- ISO 19136:2007, Geographic information — Geography Markup Language (GML)

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Annex C. Terms, Definitions, and Acronyms

C.1 Data Types (Normative)

This section provides definitions for data types used in this document. Many of these types are documented by other external standards. References to those governing standards are included in the type definitions below.

Angle

Amount of rotation need to bring one line or plane into coincidence with another, generally measured in radians or degrees.

NOTE As specified by ISO /TS 19103.

Boolean

Truth enumeration whose domain of values are { TRUE, FALSE }, representing the true and false values in a two-valued logic system

CharacterString

Character string with optional character encoding and localization attributes

Codelist

Value domain including a code for each permissible value

NOTE It is an open enumeration that may be extended during system runtime by adding additional named literal values.

Date

Indication of date expressed as a year, year-month, or year-month-day

NOTE As specified by ISO 8601.

DateTime

Indication of time expressed as a year, year-month, year-month-day, or year-month-day and time of day

NOTE 1 As specified by ISO 8601.

NOTE 2 Time of day expressed using a 24-hour clock.

Distance

Number that is the length between two points

NOTE As specified by ISO /TS 19103.

FileName

A class needed to support explicitly referencing an external file corresponding to a property containing the name of the file. This is valuable in the case of ISO 19139's MX_File class with regards to the fileName attribute. A human readable file name might be a useful value for population of this attribute, but the additional src attribute provided by the FileName class can provide a machine-readable absolute path to the location of the file.

NOTE As specified by ISO/TS 19139:2005.

GenericName

An abstract class for the representation of a name in a namespace. A GenericName can be either a LocalName or a ScopedName. As defined in ISO19139:2007, the representation of generic names follows the following XML schema:

```
<xs:element name="featureTypes" type="gco:GenericName_PropertyType" minOccurs="0"
maxOccurs="unbounded"/>
```

```
<xs:element name="AbstractGenericName" type="gml:CodeType" abstract="true"/>
```

```
<xs:complexType name="GenericName_PropertyType">
```

```
<xs:sequence minOccurs="0">
```

```

<xs:element ref="gco:AbstractGenericName"/>
</xs:sequence>
<xs:attribute ref="gco:nilReason"/>
</xs:complexType>
<xs:element name="LocalName" type="gml:CodeType"
substitutionGroup="gco:AbstractGenericName"/>
<xs:element name="ScopedName" type="gml:CodeType"
substitutionGroup="gco:AbstractGenericName"/>

```

An instance corresponding to a featureTypes element might appear in the document as follows:

```

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

```

(see ISO/TS19103:2005, Geographic information - Conceptual schema language, clause 6.5.6.3).

GF_AttributeType

Class of attribute definitions of a feature type.

NOTE As specified by ISO 19109.

NOTE Part of the General Feature Model described in section 5.

GF_FeatureType

Textual information describing the concept of a feature type, containing all feature types.

NOTE As specified by ISO 19109.

NOTE Part of the General Feature Model described in section 5

GF_PropertyType

Textual information related to the feature type because its text comprises characteristics and behavior of any property of a feature type, as well as its roles within associations between features.

NOTE As specified by ISO 19109.

NOTE Part of the General Feature Model described in section 5

GM_Object

Root class of the geometric object taxonomy that supports interfaces common to all geographically referenced geometric objects.

NOTE As specified by ISO 19107.

GM_Point

0-dimensional geometric primitive, representing a position, but not having extent.

NOTE As specified by ISO 19107.

Integer

Whole number (a number that does not have a fractional part)

LocalName

References a local object directly accessible from the NameSpace

NOTE As specified by ISO 19103

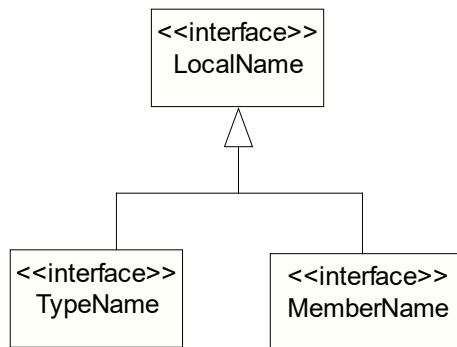


Figure 28: Local Name and Sub-types

MemberName

A MemberName (see Figure 28) is a LocalName that references either an attribute slot in a record or recordType, an attribute, operation, or association role in an object instance or a type description in some schema.

NOTE As specified by ISO 19103

Measure

Result from performing the act or process of ascertaining the extent, dimensions, or quantity of some entity. This class is documented in full in ISO/TS 19103.

MimeFileType

A class needed to support identification of the file type using the mime media type name and subtype name. This is useful in the case of ISO 19139's MX_File class with regards to the fileType attribute. The value of the fileType attribute might be "JPEG" and the type attribute of the MimeFileType class allows for the machine-readable Mime type content-type expression such as "image/jpeg".

NOTE As specified by ISO/TS 19139:2005.

Number

Abstract class that can be sub-typed to a specific number type (real, integer, decimal, double, float). This class is documented in full in ISO/TS 19103.

Real

Number that is either rational or irrational

Record

A structure of logically related elements. This class is documented in full in ISO/TS 19103.

RecordType

A specification of the content and structure of a Record. This class is documented in full in ISO/TS 19103.

Scale

The ratio of one quantity to another, often unitless. This class is documented in full in ISO/TS 19103.

SC_CRS

Coordinate reference system which is usually single but may be compound.

NOTE As specified by ISO 19111.

SC_VerticalDatum

Set of parameters describing the relation of gravity-related heights to the Earth.

NOTE As specified by ISO 19111.

Set

Finite collection of objects, where each object appears in the collection only once. A set shall not contain any duplicated instances. The order of the elements of the set is not specified.

NOTE As specified by ISO 19103.

Sequence

A collection with ordering between its elements. Sequences can be repeated and may be used as a list or an array.

NOTE As specified by ISO 19103.

TM_Duration

Describes length or distance in the temporal dimension. It has two subtypes TM_IntervalLength and TM_PeriodDuration.

NOTE As specified by ISO 19108.

TM_IntervalLength

Interval of time as specified by ISO/IEC 11404.

NOTE As specified by ISO 19108.

TM_PeriodDuration

Duration of a period as specified by ISO 8601.

NOTE As specified by ISO 19108.

TM_Primitive

Abstract class representing a non-decomposed element of geometry or topology.

NOTE As specified by ISO 19108.

Unit of Measure

A unit of measure is a quantity adopted as a standard of measurement for other quantities of the same kind.

NOTE As specified by ISO 19103.

UOMLength

any of the reference quantities used to express the value of the length, distance between two entities

NOTE As specified by ISO 19103.

NOTE Examples are the English System of feet and inches or the metric system of millimetres, centimetres and metres, also the System International (SI) System of Units.

URI

CharacterString containing a Uniform Resource Identifier.

NOTE As specified in IETF RFC 2396.

URL

CharacterString containing a Uniform Resource Locator.

NOTE As specified in IETF RFC 1738.

C.2 Definitions

This section provides definitions for terms used in this document. The standard or specification indicated in brackets is the authoritative source of the definition.

application schema

conceptual schema for data required by one or more applications [ISO 19101]

attribute

see feature attribute

base standard

ISO geographic information standard or other information technology standard that is used as a source from which a profile may be constructed [ISO 19106]

business rule

guidance and documentation to describe and standardize the use of metadata elements that best support a community's needs [DCMI]

business mission area

A defined area of responsibility with function and processes contributing to mission accomplishment.

class

description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [adapted from ISO/IEC 19501]

codelist

a codelist is a list of coded values that can be used to describe an open enumeration and shall be used if only the likely or an initial set of allowed values are known. This means that it may need to be represented and implemented in such a way that it can be extended during system runtime. [adapted from 19103]

component

The Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, and the Defense Agencies.

conceptual model

model that defines the concepts of a universe of discourse [ISO 19101]

conceptual schema

formal description of a conceptual model [ISO 19101]

conformance

fulfillment of specified requirements [ISO 19105]

content metadata

schema that defines data (including metadata) structures, including the types of elements, sub-elements, and values they can contain [Getty Library - Introduction to Metadata]

coordinate reference system

coordinate system that is related to an object by a datum [ISO 19111]

NOTE 1 A coordinate system is a set of mathematical rules for specifying how coordinates are to be assigned to points. [ISO 19111]

NOTE 2 A datum is a parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system. [ISO 19111]

NOTE 3 A coordinate is one of a sequence of n numbers designating the position of a point in n -dimensional space.²² [ISO 19111]

coverage

feature that acts as a function to return values from its range for any direct position within its spatiotemporal domain [ISO 19123]

EXAMPLES A raster image, a polygon overlay, and a digital elevation matrix. [ISO 19123, 5.1.1]

NOTE in other words, a coverage is a feature that has multiple values for each attribute type, where each direct position within the geometric representation of the feature has a single value for each attribute type; it associates positions within a bounded space (its domain) to feature attribute values (its range). It is both a feature and a function. [ISO 19123, 5.1.1]

dataset

identifiable collection of data [ISO 19115]

data type

specification of a value domain with operations allowed on values in this domain [ISO 19103]

EXAMPLES An Integer, a Real, a Boolean, a CharacterString, and a Date.

NOTE Data types include primitive predefined types and user-definable types.

entity

set of metadata elements describing the same aspect of data [ISO 19115]

event

action which occurs at an instant [ISO 19108]

extension

the addition of information not included in the content being extended [adapted from 19106]

externally-specified specification

a specification referenced by the SDSFIE Metadata (SDSFIE-M) document

feature

abstraction of real world phenomena [ISO 19101]

feature attribute

characteristic of a feature [ISO 19101]

geospatial

refers to either an implicit or explicit reference to a location relative to the earth.

geographic dataset

a dataset that represents physical geospatial features. Not to be confused with vendor- specific implementations (for example, ESRI dataset).

geospatial information

information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth, including statistical data; information derived from, among other things, remote sensing, mapping, and surveying technologies; and mapping, charting, and geodetic data, including “geodetic products.” [Title 10 US Code §467]

geospatial information & services

The concept for collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymical data

²² In a coordinate reference system, the n numbers shall be qualified by units.

accurately referenced to a precise location on the earth's surface. These data are used in the battlespace for military planning, training, and operations, including navigation, mission planning, mission rehearsal, modeling, simulation, and precise targeting, as well as in the basing space to provide situational awareness for force protection and management of the built and natural infrastructure. For the purposes of this specification, Installation GI&S (IGI&S) refers to the subset of GI&S activities that enhance the DoD EI&E business mission area and support EI&E business enterprise priorities as defined in the DoD Business Enterprise Architecture. IGI&S are considered complimentary to but different from GEOINT and are managed as DoD information resources and information technology as defined in EO 12906, DoD Directives 8000.1 and 8115.01. Geospatial information provides the basic framework for IGI&S. It is information produced by multiple sources to common interoperable data standards. It may be presented in the form of printed maps, charts, and publications; in digital simulation and modeling databases; in photographic form; or in the form of digitized maps and charts or attributed centerline data. Geospatial services include tools that enable users to access and manipulate data and also include instruction, training, laboratory support, and guidance for the use of geospatial data.

geospatial intelligence

(GEOINT) the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. [Title 10 U.S. Code §467]

NOTE Consists of imagery, imagery intelligence, and geospatial information

geospatial intelligence standard

documented agreement containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics to ensure that materials, products, processes, or services are fit for the analysis and visual representation of physical features and geographically referenced activities.

geospatial metadata

information which captures the basic characteristics of a data resource; represents the who, what, when, where, why and how of the resource.

image

gridded coverage whose attribute values are a numerical representation of a physical parameter [ISO 19115-2:2019]

NOTE The physical parameters are the result of measurement by a sensor or a prediction from a model.

imagery

representation of phenomena as images produced by electronic and/or optical techniques [ISO/TS 19101-2]

NOTE1 It is assumed that the objects and phenomena have been sensed or detected by camera, infrared and multispectral scanners, radar and photometers, or similar devices.

NOTE2 A likeness or presentation of any natural or manmade feature or related object of activity and the positional data acquired at the same time that the likeness or representation was acquired.

implementation

realization of a specification. In the context of the ISO geographic information standards, this includes specifications of geographic information services and datasets [ISO 19105]

information

knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning [ISO 19118]

measure

value described using a numeric amount with a scale or using a scalar reference system [ISO 19136]

NOTE 1 When used as a noun, measure is a synonym for physical quantity.

NOTE 2 A physical quantity is a quantity used for the quantitative description of physical phenomena.²³

²³ In GML a physical quantity is always a value described using a numeric amount with a scale or using a scalar reference system.

metadata

data about data [ISO 19115]

metadata element

discrete unit of metadata [ISO 19115]

NOTE 1 Metadata elements are unique within a metadata entity.

NOTE 2 Equivalent to an attribute in UML terminology.

metadata entity

set of metadata elements describing the same aspect of data [ISO 19115]

NOTE 1 May contain one or more metadata entities.

NOTE 2 Equivalent to a class in UML terminology.

metadata mapping

table that maps the relationships and equivalencies between two or more metadata schemes. Crosswalks or metadata mapping support the ability of search engines to search effectively across heterogeneous databases. [DCMI]

metadata package

metadata is presented in UML packages, called metadata packages. Each package contains one or more entities (UML Classes), which can be specified (sub classed) or generalized (super classed). [ISO 19115]

metadata section

subset of metadata which consists of a collection of related metadata entities and metadata elements [ISO 19115]

NOTE Equivalent to a package in UML terminology.

model

abstraction of some aspects of reality [ISO 19109]

national system for geospatial intelligence

the combination of technology, policies, capabilities, doctrine, activities, people, data, and communities necessary to produce geospatial intelligence in an integrated multi-intelligence, multi-security domain environment

profile

set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards, that are necessary for accomplishing a particular function [ISO/IEC TR 10000-1]

NOTE A profile is derived from base standards so that by definition, conformance to a profile is conformance to the base standards from which it is derived.

quality

totality of characteristics of a product that bear on its ability to satisfy stated and implied needs [ISO 19101]

raster

usually rectangular pattern of parallel scanning lines forming or corresponding to the display on a cathode ray tube [ISO 19123]

remote sensing

collection and interpretation of information about an object without being in physical contact with the object [ISO/TS 19101-2]

resource

asset or means that fulfills a requirement [ISO 19115]

specification

declarative description of what something is or does [adapted from ISO/IEC 19501]

unit of measure

reference quantity adopted as a standard of measurement for other quantities of the same kind. [adapted from ISO 19103]

EXAMPLE The unit of measure “metre” from the category “length”.

value domain

set of accepted values [ISO/IEC 19103:2005]

EXAMPLE The range 3-28, all integers, any ASCII character, enumeration of all accepted values (green, blue, white).

C.3 Acronyms

ADS – Authoritative Data Source
CIP –Common Installation Picture
CRS – Coordinate Reference System
DCMI – Dublin Core Metadata Initiative
DISDI – Defense Installation Spatial Data Infrastructure
DoD – Department of Defense
EI&E – Energy, Installations & Environment
EO – Executive Order
EPSG—European Petroleum Survey Group
GCP – Ground Control Point
GEOINT – Geospatial Intelligence
GIS – Geographic Information System
GI&S – Geospatial Information & Services
GWG – Geospatial-Intelligence Standards Working Group
IC – Intelligence Community
IEC -- International Electrotechnical Commission
IETF – Internet Engineering Task Force
IGI&S – Installation Geospatial Information & Services
IGG – Installation Geospatial Information & Services (IGI&S) Governance Group
ISM—see IC.ISM
ISO – International Organization for Standardization
ISO/TS— ISO technical specification
ITU-T – International Telecommunication Union Telecommunication Standardization Sector
JP – Joint Publication
NAS – NSG Application Schema
NATO – North Atlantic Treaty Organization
NGA – National Geospatial-Intelligence Agency
NSG – National System for Geospatial-Intelligence
OGC – Open Geospatial Consortium
POC – Point of Contact
RFC – Request for Comment
SDSFIE – Spatial Data Standards for Facilities, Infrastructure, and Environment
SDSFIE-M – Spatial Data Standards for Facilities, Infrastructure, and Environment - Metadata
SDSFIE-Q – Spatial Data Standards for Facilities, Infrastructure, and Environment - Quality
SDSFIE-V – Spatial Data Standards for Facilities, Infrastructure, and Environment - Vector
SKOS— Simple Knowledge Organization System
SME – Subject Matter Expert
SRS – Spatial Reference System
UML – Unified Modeling Language
URI – Uniform Resource Identifier
URL – Uniform Resource Locator

URN – Uniform Resource Name

UUID— universally unique identifier

WGS – World Geodetic System

XML – Extensible Markup Language

XSL – Extensible Stylesheet Language

XSLT – XSL Transformations

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Annex D. UML Primer (Informative)

D.1 UML notations

The diagrams that appear in this document are presented using the Unified Modeling Language (UML) static structure diagram with the ISO Interface Definition Language (IDL) basic type definitions and the UML Object Constraint Language (OCL) as the conceptual schema language. The UML notations used in this Standard are described in Figure 29.

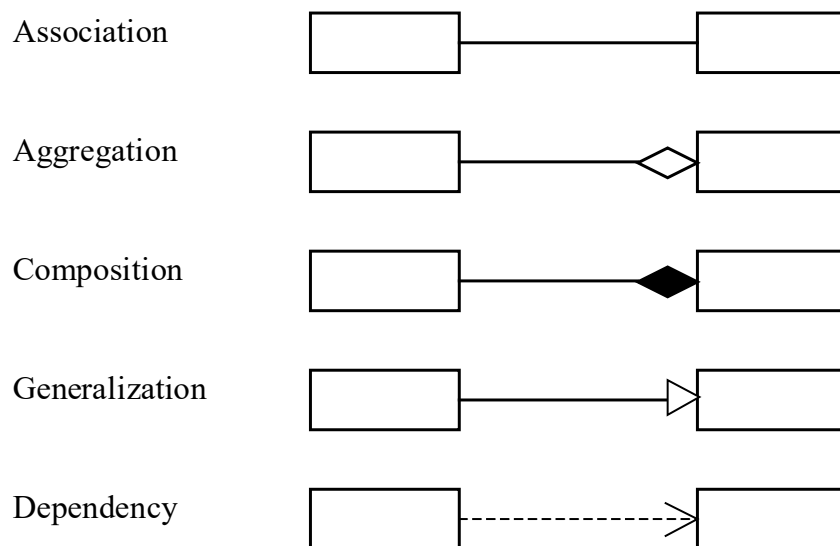


Figure 29: UML Notation

D.2 UML model relationships

D.2.1 Associations

An association is used to describe a relationship between two or more classes. UML defines three different types of relationships, called association, aggregation and composition. The three types have different semantics. An ordinary association shall be used to represent a general relationship between two classes. The aggregation and composition associations shall be used to create part-whole relationships between two classes. The direction of an association must be specified. If the direction is not specified, it is assumed to be a two-way association. If one-way associations are intended, the direction of the association can be marked by an arrow at the end of the line.

An aggregation association is a relationship between two classes in which one of the classes plays the role of container and the other plays the role of a containee.

A composition association is a strong aggregation. In a composition association, if a container object is deleted, then all of its containee objects are deleted as well. The composition association shall be used when the objects representing the parts of a container object cannot exist without the container object.

D.2.2 Generalization

A generalization is a relationship between a superclass and the subclasses that may be substituted for it. The superclass is the generalized class, while the subclasses are specified classes.

D.2.3 Instantiation/Dependency

A dependency relationship shows that the client class depends on the supplier class/interface to provide certain services, such as:

- Client class accesses a value (constant or variable) defined in the supplier class/interface;
- Operations of the client class invoke operations of the supplier class/interface;
- Operations of the client class have signatures whose return class or arguments are instances of the supplier class/interface.

An instantiated relationship represents the act of substituting actual values for the parameters of a parameterized class or parameterized class utility to create a specialized version of the more general item.

D.2.4 Roles

If an association is navigable in a particular direction, the model shall supply a “role name” that is appropriate for the role of the target object in relation to the source object. Thus, in a two-way association, two role names will be supplied. Figure 30 represents how role names and cardinalities are expressed in UML diagrams.

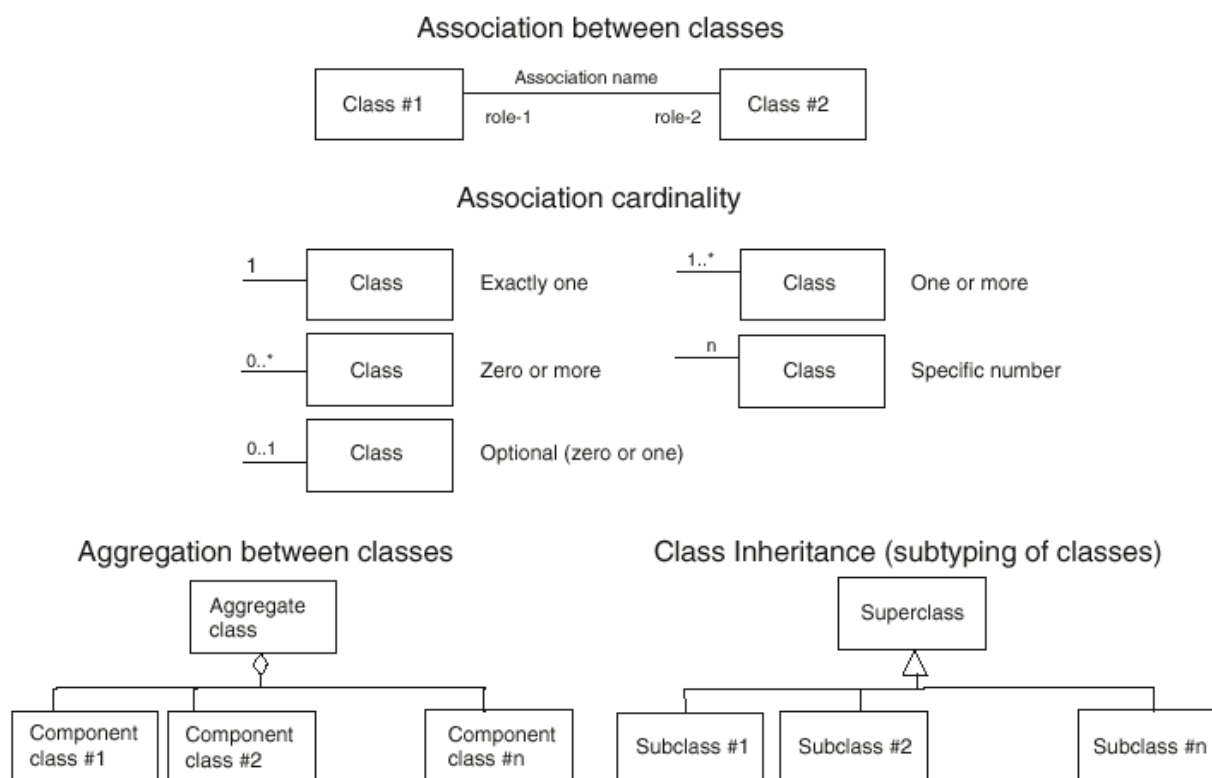


Figure 30: UML Roles

D.3 UML model stereotypes

A UML stereotype is an extension mechanism for existing UML concepts. It is a model element that is used to classify (or mark) other UML elements so that they in some respect behave as if they were instances of new virtual or pseudo metamodel classes whose form is based on existing base metamodel classes. Stereotypes augment the classification mechanisms on the basis of the built-in UML metamodel class hierarchy. Below are brief descriptions of the stereotypes used in this document.

In this document the following stereotypes are used:

- <<Type>>** 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.
- <<Enumeration>>** data type whose instances form a list of named literal values. Both the enumeration name and its literal values are declared. Enumeration means a short list of well-understood potential values within a class.

- c. <<DataType>> a descriptor of a set of values that lack identity and whose operations do not have side effects. Data types include primitive pre-defined types and user-definable types. Pre-defined types include numbers, string, and time. User-definable types include enumerations.
- d. <<CodeList>> used to describe a more open enumeration. <<CodeList>> is a flexible enumeration. Codelists are useful for expressing a long list of potential values. If the elements of the list are completely known, an enumeration should be used; if the only likely values of the elements are known, a codelist should be used.
- e. <<Union>> describes a selection of one of the specified types. This is useful to specify a set of alternative classes/types that can be used, without the need to create a common super-type/class.
- f. <<Abstract>> class (or another classifier) that cannot be directly instantiated. The UML notation for this is to show the name in italics.
- g. <<Leaf>> package that contains definitions, without any sub-packages.

D.4 Package abbreviations

Two letter abbreviations are used to denote the package that contains a class. Those abbreviations precede class names, connected by a “_”. The standard that those classes are located in is indicated in parentheses. A list of those abbreviations follows.

CC	Changing Coordinates (ISO 19111)
CI	Citation (ISO 19115)
DQ	Data quality (ISO 19115)
DS	Dataset (ISO 19115)
EX	Extent (ISO 19115)
FC	Feature Catalogue (ISO 19110)
FE	Feature (ISO 19109)
FT	Feature Topology (ISO 19107)
GF	General Feature (ISO 19109)
GM	Geometry (ISO 19107)
LI	Lineage (ISO 19115)
MD	Metadata (ISO 19115)
RS	Reference System (ISO 19115)
SC	Spatial Coordinates (ISO 19111)
SV	Services (ISO 19115-1)
TM	Temporal (ISO 19108)
TP	Topology (ISO 19107)

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