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Geographic information — Metadata —

Part 2: Extensions for acquisition and processing

Information géographique — Métadonnées —

Partie 2: Extensions pour l'acquisition et le traitement

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 211, *Geographic information/Geomatics*.

This second edition cancels and replaces the first edition (ISO 19115-2:2009), which has been technically revised.

The following is a summary of major changes to this document during the revision process:

— The name and scope were changed to better describe the purpose of the document;

— QE_CoverageResult and QE_Useability were moved to ISO 19157;

— All extended classes now extend ISO 19115-1:2014;

— Whereas the XML Schema encoding for ISO 19115-2:2009 was provided in ISO/TS 19139-2; the link and information about the XML schema for this revision is provided in Annex C of this document;

— A specified class of MI_Instrument – MI_Sensor was defined. A list of all the parts in the ISO 19115 series, can be found on the ISO website.

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Introduction

This document replaces the previous edition (ISO 19115-2:2009) *Geographic information — Metadata — Extension for imagery and gridded data,* which focused on metadata for imagery and gridded data as they are important information sources and products used within a geospatial environment by geographic information systems. During the revision process it was noted that this metadata applied to the acquisition and processing of geographic information from all sources not just imagery and gridded data. Hence, the new title *Geographic information — Metadata — Extensions for acquisition and processing*. The production of all geographic information, including imagery and gridded data, follows one or more process chains that begins with remote sensing data, scanned maps, field data collection or other sensing methods and ends with the creation of the end data products. The production process needs to be documented to maintain quality control over the end products. In addition, metadata about the geometry of the measuring process and the properties of the measuring equipment need to be retained with the raw data to support the production process.

The object of this document is to provide the additional structure needed to more extensively describe the acquisition and processing of geographic information from all sources. This structure is intended to augment ISO 19115-1. This document also provides an XML schema for implementing this document using ISO/TS 19115-3.

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Geographic information — Metadata —

Part 2: Extensions for acquisition and processing

1 Scope

This document extends ISO 19115-1:2014 by defining the schema required for an enhanced description of the acquisition and processing of geographic information, including imagery. Included are the properties of measuring systems and the numerical methods and computational procedures used to derive geographic information from the data acquired by them. This document also provides the XML encoding for acquisition and processing metadata thereby extending the XML schemas defined in ISO/TS 19115-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19103:2015, *Geographic information — Conceptual schema language*

ISO 19115-1:2014, *Geographic information — Metadata — Part 1: Fundamentals*

ISO 19157:2013, *Geographic information — Data quality*

ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19115-1:2014 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
attribute
named property of an entity

Note 1 to entry: Describes a geometrical, topological, thematic, or other characteristic of an entity.

[SOURCE: ISO/IEC 2382:2015, 2121440, modified — Note 1 to entry replaces Notes 1 and 2 to entry.]

3.2
band
range of wavelengths of electromagnetic radiation that produce a single response by a sensing device

[SOURCE: ISO/TS 19101-2:2008, 4.1]

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3.3
class
description of a set of objects that share the same *attributes* (3.1), operations, methods, relationships, and semantics

[SOURCE: ISO 19103:2015, 4.7]

3.4
coverage
feature that acts as a function to return *values* (3.29) from its range for any direct position within its spatial, temporal or spatiotemporal *domain* (3.8)

EXAMPLE Raster *image* (3.18), polygon overlay, or digital elevation matrix.

[SOURCE: ISO 19123:2005, 4.1.7, modified — NOTE deleted.]

3.5
data type
specification of a *value domain* (3.30) with operations allowed on *values* (3.29) in this *domain* (3.8)

[SOURCE: ISO 19103:2015, 4.14, modified — EXAMPLE and Note 1 to entry deleted.]

3.6
dataset
identifiable collection of data

[SOURCE: ISO 19115-1:2014, 4.3, modified — Note 1 to entry deleted.]

3.7
dataset series
collection of *datasets* (3.6) sharing common characteristics

[SOURCE: ISO 19115-1:2014, 4.4]

3.8
domain
well-defined set

[SOURCE: ISO 19109:2015, 4.8, modified — Note 1 to entry deleted.]

3.9
event
action which occurs at an instant

[SOURCE: ISO 19108:2002, 4.1.6]

3.10
geolocation information
information used to determine geographic location corresponding to *image* (3.18) location

3.11
georectified
corrected for positional displacement with respect to the surface of the Earth

3.12
georeferencing
geopositioning an object using a Correspondence Model derived from a set of points for which both ground and *image* (3.18) coordinates are known

[SOURCE: ISO/TS 19130:2010, 4.37]

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3.13
grid
network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in an algorithmic way

Note 1 to entry: The curves partition a space into grid cells.

[SOURCE: ISO 19123:2005, 4.1.23]

3.14
grid coordinate system
coordinate system in which a position is specified relative to the intersection of curves

3.15
grid coordinates
sequence of two or more numbers specifying a position with respect to its location on a *grid* (3.13)

3.16
gridded data
data whose *attribute* (3.1) *values* (3.29) are associated with positions on a *grid coordinate system* (3.14)

3.17
ground control point
point on the earth that has an accurately known geographic position

3.18
image
gridded *coverage* (3.4) whose *attribute* (3.1) *values* (3.29) are a numerical representation of a physical parameter

Note 1 to entry: The physical parameters are the result of measurement by a *sensor* (3.27) or a prediction from a model.

3.19
imagery
representation of phenomena as *images* (3.18) produced by electronic and/or optical techniques

Note 1 to entry: In this document, it is assumed that the objects and phenomena have been sensed or detected by radar, cameras, photometers, and infrared and multispectral scanners, or similar devices.

[SOURCE: ISO 19101-2:2008, 4.14]

3.20
metadata
information about a resource

[SOURCE: ISO 19115-1:2014, 4.10]

3.21
pass
single instance of a remote, mobile measuring system going by a target of interest

Note 1 to entry: In this document, the measuring system will usually be a *remote sensing* (3.25) *platform* (3.23). In a navigation context, the measuring system might be a GPS satellite.

3.22
pixel
smallest element of a digital *image* (3.18) to which *attributes* (3.1) are assigned

Note 1 to entry: It is the smallest unit of display for a visible image.

[SOURCE: ISO/TS 19101-2:2008, 4.28, modified — Note 1 to entry replaces NOTES 1 and 2.]

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3.23
platform
structure which supports a *sensor* (3.27) or sensors

3.24
polarization
restricting radiation, especially light, vibrations to a single plane

3.25
remote sensing
collection and interpretation of information about an object without being in physical contact with the object

[SOURCE: ISO/TS 19101-2:2008, 4.33]

3.26
resolution (of a sensor)
smallest difference between indications of a *sensor* (3.27) that can be meaningfully distinguished

Note 1 to entry: For *imagery* (3.19), resolution refers to radiometric, spectral, spatial and temporal resolutions.

[SOURCE: ISO/TS 19101-2:2008, 4.34]

3.27
sensor
element of a measuring system that is directly affected by a phenomenon, body, or substance carrying a quantity to be measured

[SOURCE: ISO/IEC Guide 99:2007, 3.8, modified — EXAMPLES and NOTE deleted.]

3.28
spectral width
specific wavelength interval within the electromagnetic spectrum

EXAMPLE *Band* (3.2) 1 of Landsat TM lies between 0,45 µm and 0,52 µm in the visible part of the spectrum.

3.29
value
element of a type *domain* (3.8)

[SOURCE: ISO/IEC 19501:2005, 0000_5]

3.30
value domain
set of accepted *values* (3.29)

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

[SOURCE: ISO 19103:2015, 4.37]

4 Symbols and abbreviated terms

4.1 Abbreviated terms

IDL Interface Definition Language

OCL Object Constraint Language

UML Unified Modelling Language

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5 Conformance

5.1 Conformance requirements

Metadata shall be provided as specified in Clause 6 and Annex B of this document and ISO 19115-1:2014, Clause 6 and Annex B.

User-defined metadata extensions to this document shall be defined and provided as specified in ISO 19115-1:2014, Annex C.

Any metadata claiming conformance with this document shall pass the requirements described in Annex A of this document and the abstract test suite presented in ISO 19115-1:2014, Annex A.

5.2 Metadata profiles

Any profile conforming to this document shall conform to the rules for creating a profile given in ISO 19115-1:2014, C.6.

6 Acquisition and processing metadata

6.1 Metadata for acquisition and processing requirements

ISO 19115-1 identifies the metadata required to describe digital geographic resources. This document extends the metadata identified in ISO 19115-1 and identifies additional metadata required to describe the acquisition and processing of geographic resources.

6.2 Acquisition and processing metadata packages and dependencies

The ISO geographic information series of standards are defined using one or more UML packages and are maintained in a single integrated UML model. This document utilizes and extends concepts defined in several of these other standards' packages. Figure 1 illustrates the UML packages upon which this document is dependent. Dependencies between packages not defined in this document are not displayed. Metadata for acquisition and processing are defined and provided by one or more packages; each package provides a separate component of metadata information. There are four packages that are used to define and provide the metadata that is defined in this document: Acquisition information, Extended lineage information, Extended spatial representation information, and Extended content information.

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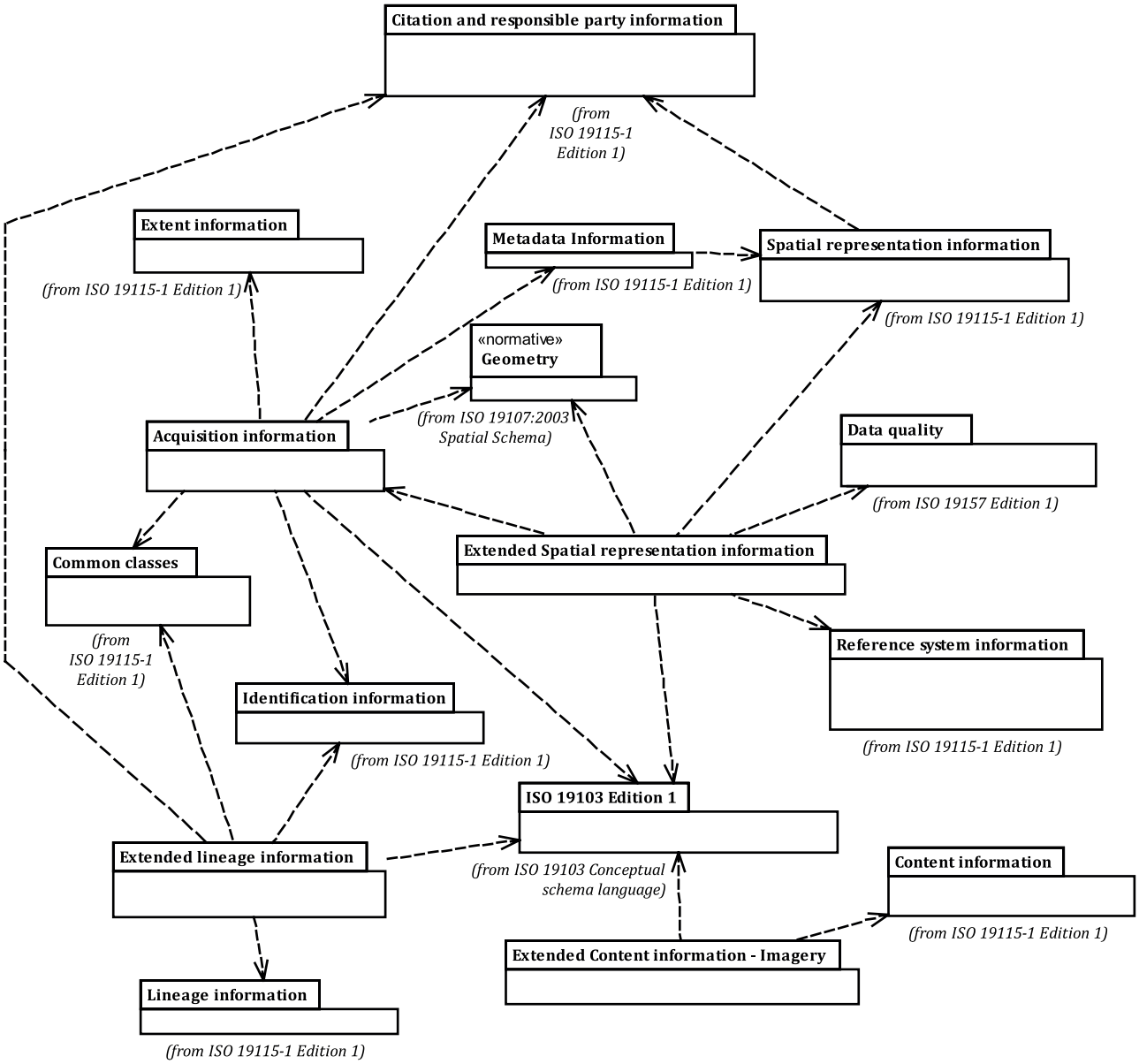

Figure 1 — Metadata packages

6.3 Acquisition and processing metadata class diagrams by package

6.3.1 Introduction

Metadata are composed of one or more metadata packages containing one or more metadata classes containing attributes. The relationships between metadata packages and between metadata classes are specified by composition and aggregation relationship symbols. Class attributes and relationships are referred to collectively as metadata elements. The diagrams in 6.3.2 through 6.3.5 provide "views", which are portions of the total abstract model for metadata. Each diagram defines a metadata UML package of related classes, elements, data types, and code lists. Related external classes are shown with attributes relevant for this document and the package where they are fully specified identified by the package name proceeding a double colon (::). In some cases, this package may be from another standard identified by a labelled boxed outline. Since the classes in ISO 19115-1 being extended cannot be modified the class being modified is redefined in this document using a similar name. To differentiate between ISO 19115-1 and entities of this document, this part uses different prefixes. The prefixes used are MI (to denote an extended MD class), LE (LI extended) and CE (CI_Extended).

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The classes from ISO 19115-1, being extended, are contained in a box labelled as such. The metadata are fully specified by the UML model diagrams and an associated data dictionary for each package in Annex B. Abstract classes (which are classes that are defined for schematic organization purposes, i.e. only their subclasses are implemented) are identified with their names in italic. Codelists and their values provided in this document are normative. User extensions to codelists shall follow the rules as described in ISO 19115-1:2014, Annex C.

NOTE In some cases, optional classes can have mandatory elements; those elements become mandatory only if the optional element is used.

6.3.2 Acquisition Information

6.3.2.1 Acquisition overview

This package extends MD_Metadata in ISO 19115-1 and provides details specific to the acquisition of geospatial data using imagery, sensors, and other acquisition methods. MI_AcquisitionInformation is an aggregate of the following entities:

— MI_Instrument, designations of the measuring instruments used to acquire the data;

— MI_Sensor, a specific type of MI_Instrument;

— MI_Operation, designations of the overall data gathering program to which the data contribute;

— MI_Platform, designations of the platform from which the data were taken;

— MI_InstrumentEventList, which lists events affecting MI_Platform and MI_Instrument;

— MI_InstrumentEvent which identifies events affecting MI_Platform and MI_Instrument;

— MI_Revision which identifies the revision history of events;

— MI_Objective, the characteristics and geometry of the intended object to be observed;

— MI_Requirement, the user requirements used to derive the acquisition plan;

— MI_Plan, the acquisition plan that was implemented to acquire the data.

Two additional classes are required to provide information on the acquisition of the data. These are:

— MI_Event, describes a significant event that occurred during data acquisition. An event can be associated with an operation, objective, or platform pass, and

— MI_PlatformPass, identifies a particular pass made by the platform during data acquisition. A platform pass is used to provide supporting identifying information for an event and for data acquisition of a particular objective.

Figure 2 defines an overview of the metadata classes required to define the acquisition of data. The data dictionary for this diagram is provided in B.2.1.

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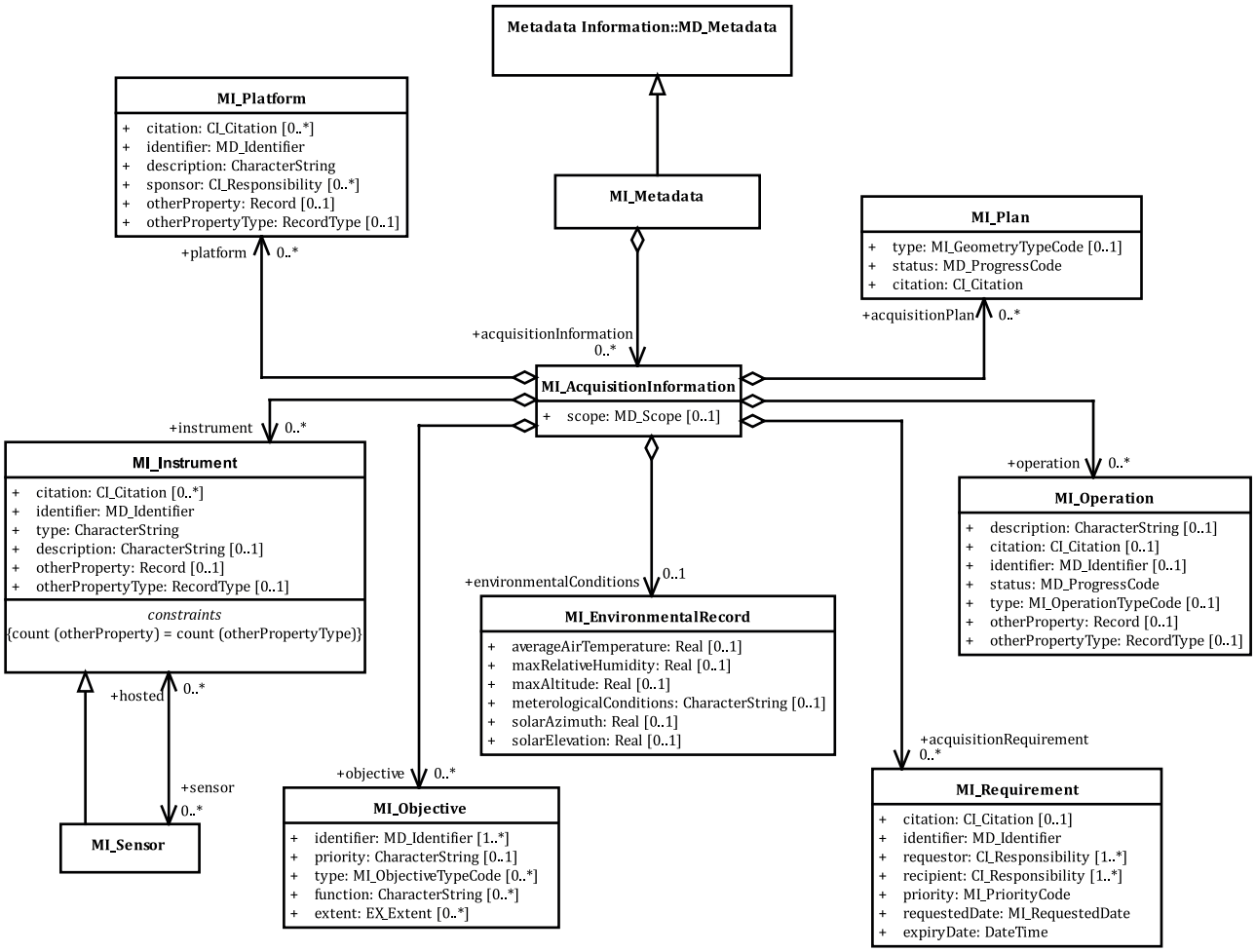

Figure 2 — Acquisition Overview

6.3.2.2 Acquisition Details

Figure 3 defines, in additional detail, the metadata classes necessary to define the acquisition of data. The data dictionary for this diagram is provided in B.2.1.

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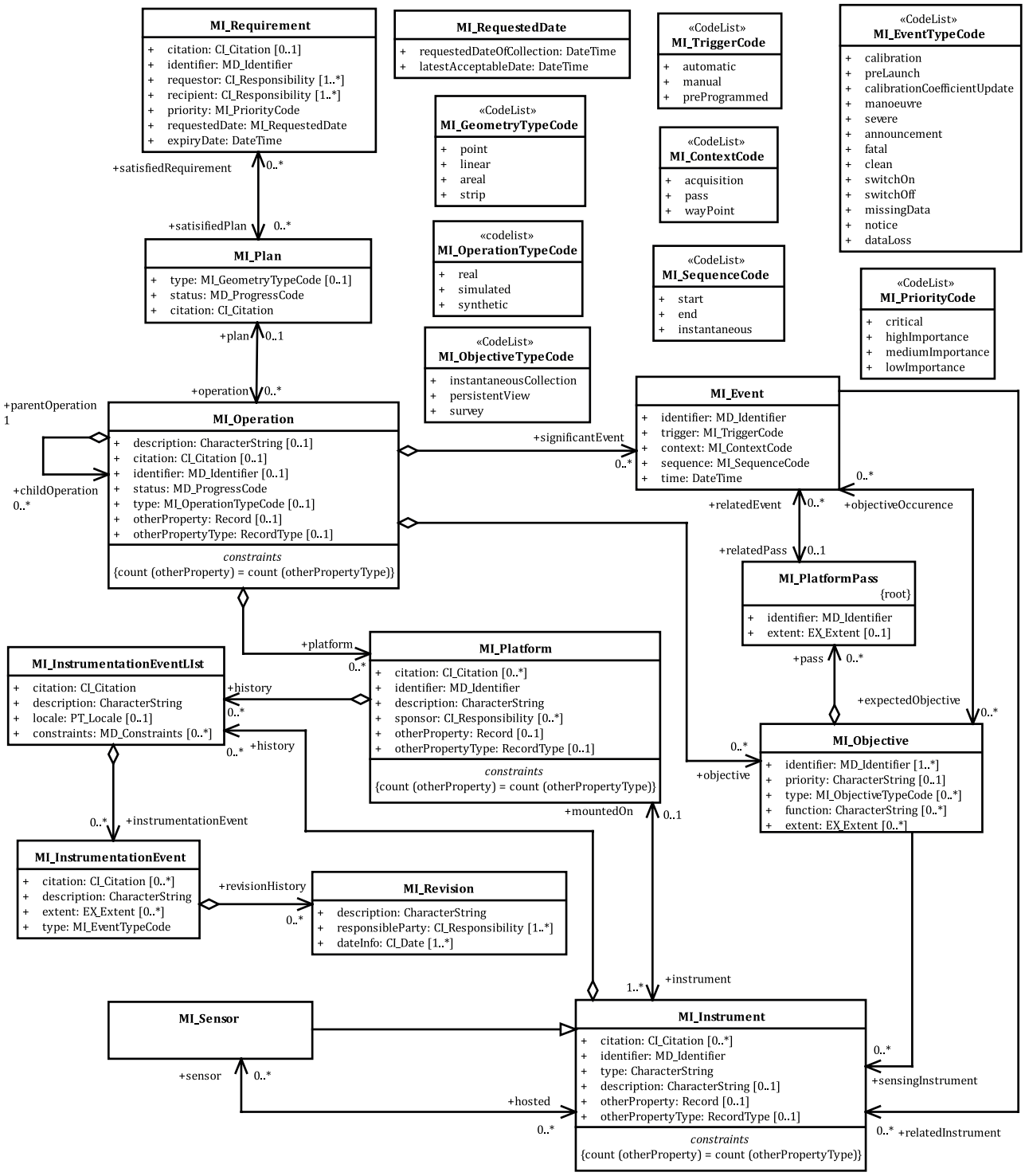

Figure 3 — Acquisition Details

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6.3.3 Extended Lineage information

This package extends Lineage information (LI_Lineage) defined in ISO 19115-1; it supports the provision of additional information about the sources and production processes used in producing geospatial data.

— LE_ProcessStep is a specified subclass of LI_ProcessStep and contains additional information on the history of the algorithms used and processing performed to produce the data. LE_ProcessStep aggregates the following entities:

  — LE_Processing, describes the procedure (such as software used, parameters, and processing documentation) by which the algorithm is applied to generate the data from the source data. LE_Processing aggregates LE_Algorithm, which describes the methodology used to derive the data from the source data and LE_ProcessingParameter which provides information about the parameters affecting the processing;

  — LE_ProcessStepReport identifies external information describing the processing of the data;

— LE_Source, is a specified subclass of LI_Source and describes the output of a process step.

Figure 4 defines the extensions required to specify additional lineage information. The additional elements provide information about the processing of the raw data that was performed to produce the data in the data set. The data dictionary for this diagram is given in B.2.2.

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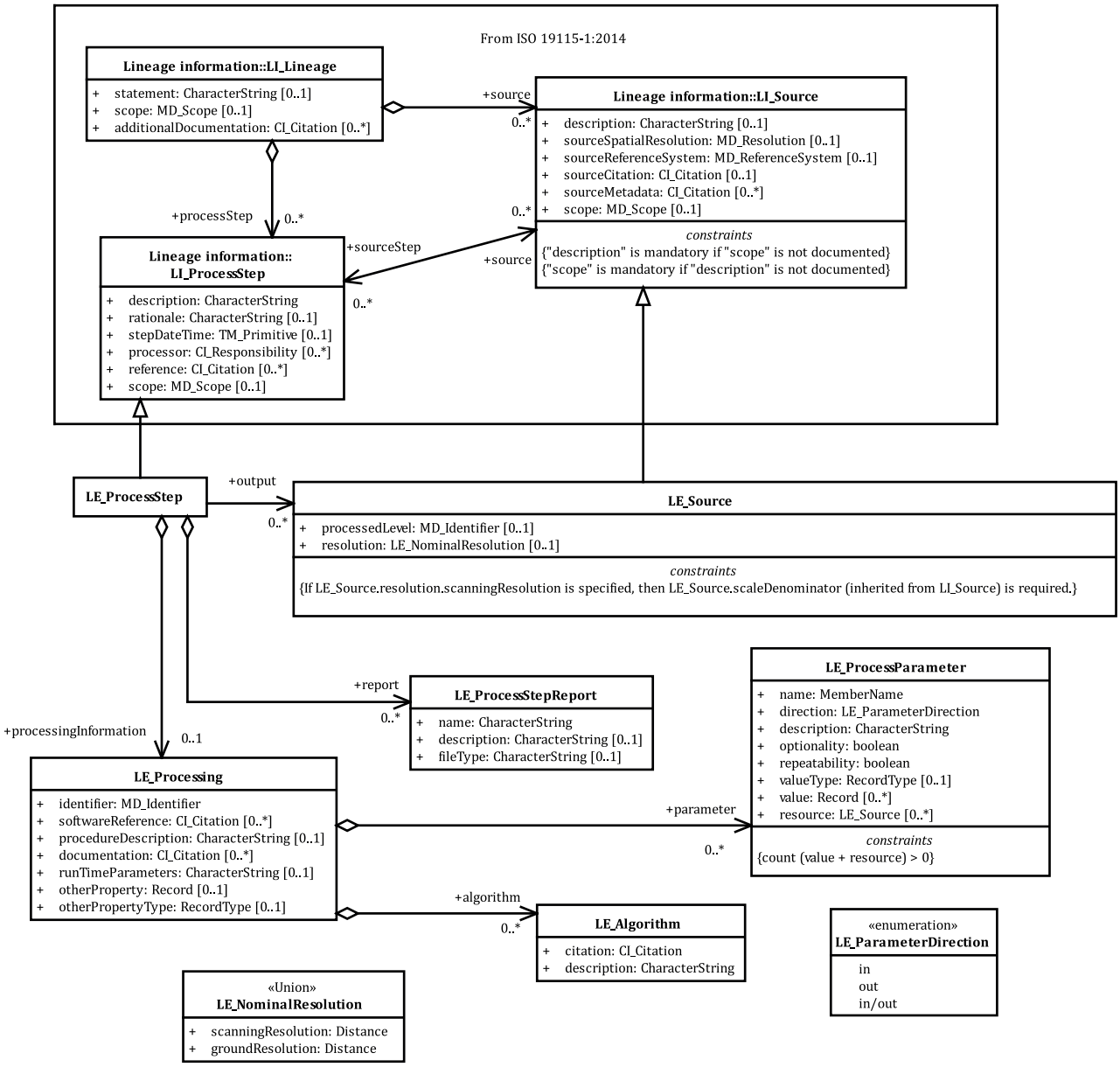

Figure 4 — Lineage extensions

6.3.4 Extended spatial representation information — Geolocation information

The spatial representation package contains information concerning the mechanisms used to represent spatial information. This extension supports the addition of metadata about the ground control points used to geo-locate data and consists of the following entities:

— MI_Georectified is an extension of MD_Georectified that contains check point information to further specify georectification details of the data. MI_Georectified aggregates MI_GCP;

— MI_Georeferenceable is an extension of MD_Georeferenceable that includes additional information that can be used to geo-locate data. MI_Georeferenceable aggregates MI_GeolocationInformation which can be specified as a MI_GCPCollection.

Figure 5 defines the extensions required to provide metadata about the ground control used for geo-locating data. The data dictionary for this diagram is given in B.2.3.

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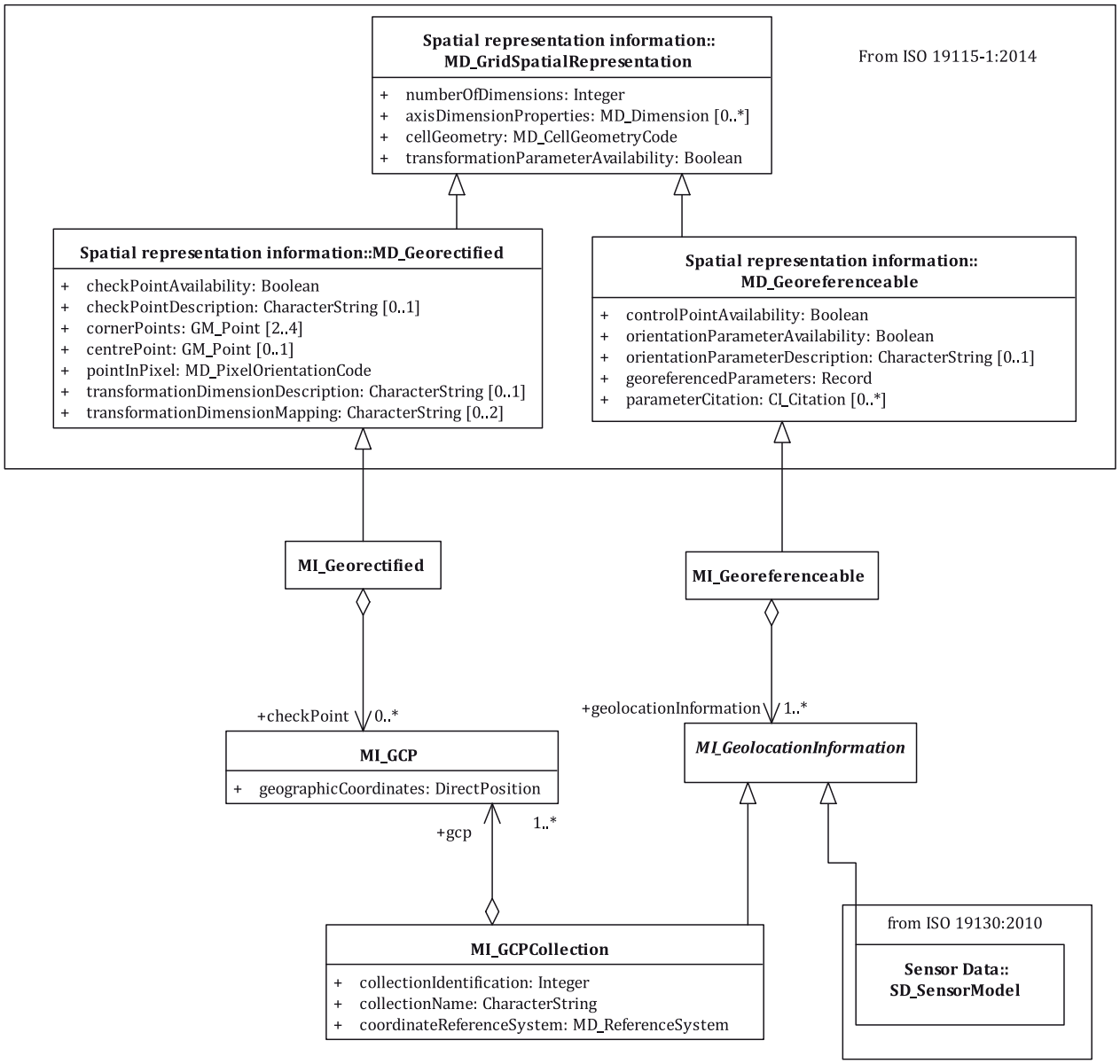

Figure 5 — Spatial representation information

6.3.4.1 Ground control point quality

Figure 6 defines the extensions required to describe the quality of ground control points using data quality classes from ISO 19157. The data dictionary for this diagram is given in B.2.4.

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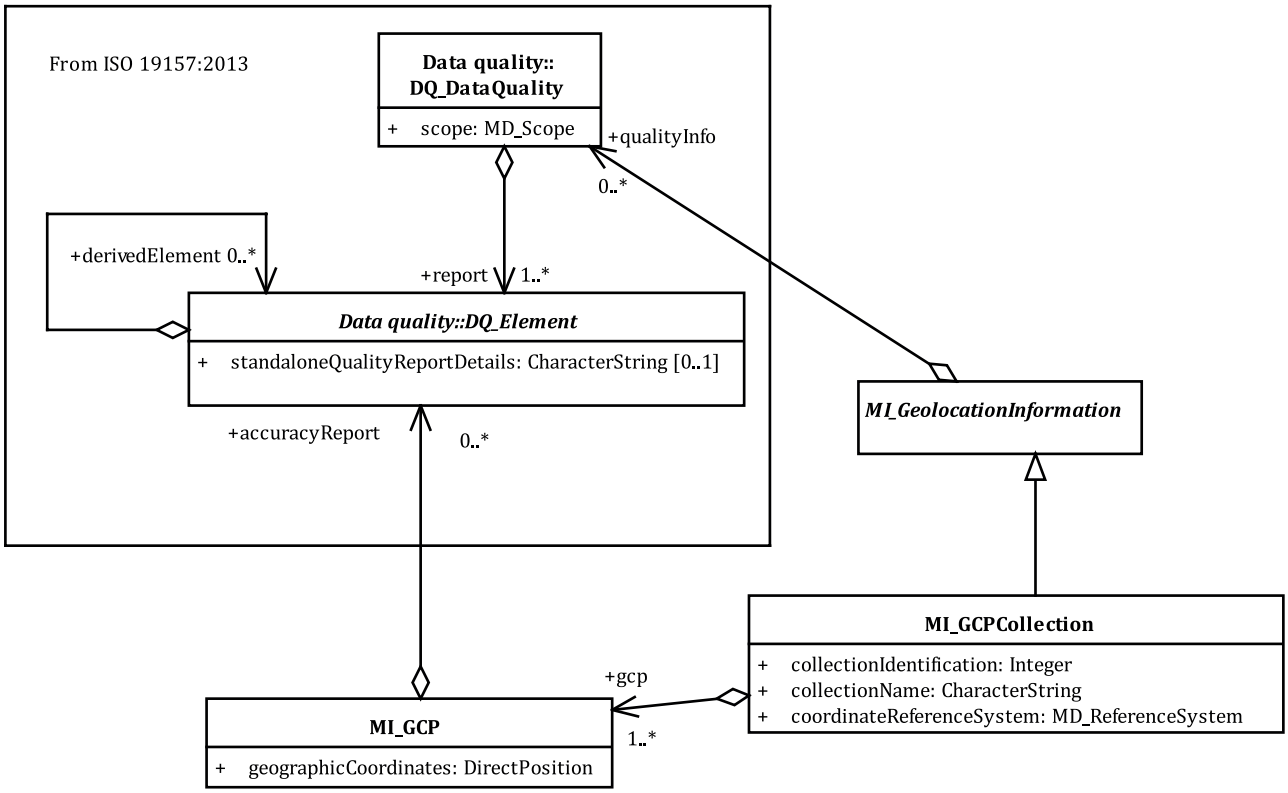

Figure 6 — Quality of ground control points

6.3.5 Extended Content information — Imagery

The package Content information is defined in ISO 19115-1 and describes the content of a coverage data set. This document extends:

— MI_Band is an extension of MD_Band defining additional attributes for specifying properties of individual wavelength bands in an imagery and gridded data set;

— MI_ImageDescription is an extension of MD_ImageDescription used to aggregate MI_RangeElementDescription;

— MI_CoverageDescription is an extension of MD_CoverageDescription used to aggregate MI_RangeElementDescription;

— MI_RangeElementDescription provides identification of the range elements used in a coverage data set.

Figure 7 defines the extensions required to further describe the content of coverages. The data dictionary for this diagram is given in B.2.4.

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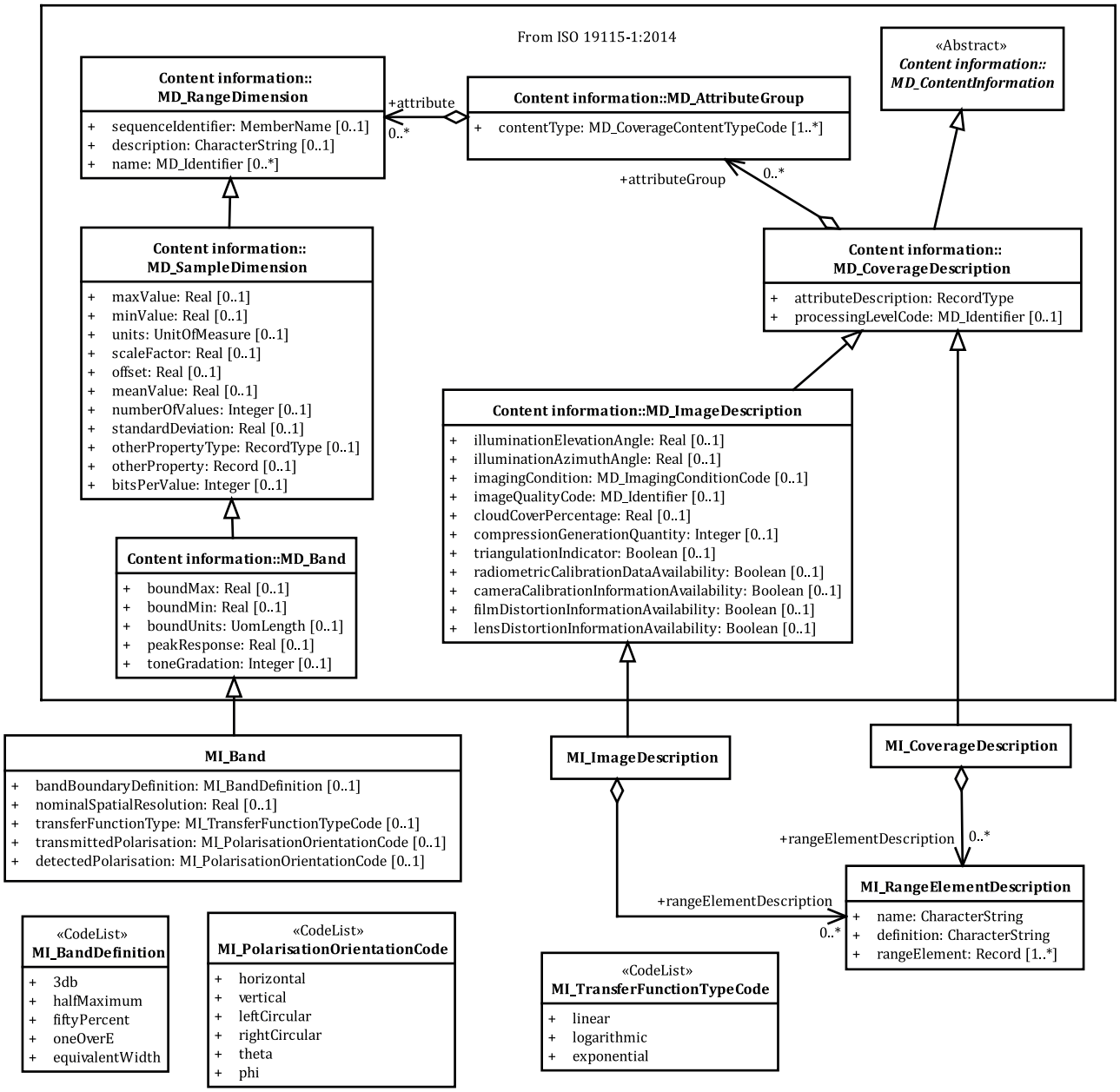

Figure 7 — Content information

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