EO Product Collection, Service and Sensor Discovery
using the CS-W ebRIM Catalogue

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Abstract

This is an OGC Best Practice document describing the relations that exist between several metadata conceptual models (EO Product, EO Product Collections, Sensors and Services). The specification of the linking between different artifacts is important for the process of cataloguing and discovering those artifacts.

Keywords

ogc, ogc document, csw, catalogue, ebrim, sensors, discovery, eo
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EO Product Collection and Service Discovery using the CS-W ebRIM Catalogue

1 Introduction

This document is created within the SMAAD (Semantic-web Mediated Access Across Domains) project. This European Project aims at validating the technical choices concerning metadata and discovery within the Earth Observation domain made within the Heterogeneous Mission Accessibility series of projects.

This document proposes a technical guideline for implementing the discovery of EO Product Collections, EO Services and EO Sensors.

This document contains an analysis of the minimal EO Product collection and EO Services metadata that is to be supplied for meaningful and concise descriptions of EO Product Collections and EO Services and documents the effects on the existing CIM extension Package of the ebRIM Application Profile of CSW.

1.1 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frédéric Houbie</td>
<td>Intergraph</td>
</tr>
<tr>
<td>Philippe Mougnaud</td>
<td>ESA</td>
</tr>
<tr>
<td>Steven Smolders</td>
<td>GIM</td>
</tr>
</tbody>
</table>

1.2 Revision history

<table>
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<th>Release</th>
<th>Editor</th>
<th>Primary clauses modified</th>
<th>Description</th>
</tr>
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<tr>
<td>2011-10-06</td>
<td>1.0</td>
<td>S. Smolders, F. Houbie</td>
<td>All</td>
<td>Initial version</td>
</tr>
<tr>
<td>2012-03-30</td>
<td>1.1</td>
<td>F. Houbie</td>
<td>All</td>
<td>Add Sensor linking information</td>
</tr>
</tbody>
</table>
1.3 Future work

This document is a description of the relations that exist between different metadata models and their cataloguing process. Evolutions in the metadata models or catalogue specifications could have impact on the content of this document.

1.4 Forward

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Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

2 References

The following documents provide background reference. In the body of the text these documents are referenced as listed below.


21/06/2006,


[RD05] OGC 06-131r6, OGC Catalogue Services Specification 2.0, Extension Package for ebRIM Application Profile: Earth Observation Products, Version 1.0.0, 10/02/2010
http://portal.opengeospatial.org/files/?artifact_id=28152

[RD06] OGC 07-038r3, OGC Cataloguing of ISO Metadata (CIM) – Using the ebRIM profile of CS-W, Version 0.1.12

http://portal.opengeospatial.org/files/?artifact_id=21460
[RD08] DRAFT HMA EO Product Collection and Service Discovery using the ISO Metadata Application Profile of CSW 2.0.1, OGC 07-025 (not published)

[RD09] OGC 04-038r4 OpenGIS Catalogue Services Specification 2.0.1 (with Corrigendum) ISO Metadata Application Profile


3 Terms and definitions

**dataset**
identifiable collection of data (ISO19115)

**dataset series**
collection of datasets sharing the same product specification (ISO19115)

**EO product collection**
An EO product collection is equivalent to a dataset series as defined within the ISO 19XXX series of standards. It is a collection of datasets sharing the same product specification.

In the Earth Observation context, a collection typically corresponds to datasets (i.e. products) derived from data acquired by a single sensor onboard a satellite or series of satellites and having the same operation mode. Examples of EO Product Collections are “TerraSAR-X spotlight mode” or “ESA ENVISAT MERIS Full Resolution L1+2”

**EO Service**
Web Service that operates on the above mentioned EO product collections.

Examples of such services include catalogue services that allow discovery of EO data products, EO Product Collections, EO Sensors and EO Services, EO Feasibility Analysis services, EO Ordering services, on-line EO data access services and EO Web Map Services.

**interface**
named set of operations that characterize the behaviour of an entity (ISO19119)

**metadata**
data about data (ISO19115)

**metadata element**
discrete unit of metadata (ISO19115)

**metadata entity**
set of metadata elements describing the same aspect of data (ISO19115)

**model**
abstraction of some aspects of a universe of discourse (ISO19115)

**operation**
specification of a transformation or query that an object may be called to execute (ISO19119)

**resource**
asset or means that fulfils a requirement (ISO19115)
**service**
distinct part of the functionality that is provided by an entity through interfaces ([ISO/IEC TR 14252])

**service interface**
shared boundary between an automated system or human being and another automated system or human being [ISO 19101]

### 4 Conventions

#### 4.1 Abbreviated terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>Application Profile</td>
</tr>
<tr>
<td>CIM</td>
<td>Cataloguing of ISO Metadata</td>
</tr>
<tr>
<td>CSW</td>
<td>Catalogue Services for the Web</td>
</tr>
<tr>
<td>DLR</td>
<td>Deutsches Zentrum für Luft- und Raumfahrt</td>
</tr>
<tr>
<td>ebRIM</td>
<td>eBusiness Registry Information Model</td>
</tr>
<tr>
<td>EO</td>
<td>Earth Observation</td>
</tr>
<tr>
<td>ESA</td>
<td>European Space Agency</td>
</tr>
<tr>
<td>HMA</td>
<td>Heterogeneous Missions Accessibility</td>
</tr>
<tr>
<td>INSPIRE</td>
<td>Infrastructure for Spatial Information in Europe</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation for Standardisation</td>
</tr>
<tr>
<td>OGC</td>
<td>Open Geospatial Consortium</td>
</tr>
<tr>
<td>TBC</td>
<td>To Be Confirmed</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Defined</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language</td>
</tr>
</tbody>
</table>

#### 4.2 UML notation

Most diagrams that appear in this standard are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of [OGC 06-121r3].

### 5 Introduction

During the Heterogeneous Missions Accessibility (HMA) series of Projects managed by the European Space Agency (ESA), the HMA stakeholders defined a minimal set of metadata elements that are required to describe a Collection of Earth Observation Products.
This EO Production Collection metadata information model was based on the ISO 19115 metadata model which was adapted for use in the EO/HMA Context in the following manner:

- It was constrained by making some optional ISO1915 elements mandatory (e.g. fileIdentifier).

- It was constrained by fixing the values for some elements (e.g. hierarchyLevel fixed to series).

- In addition some additional metadata elements were defined that were not covered in ISO19115. The names of some of these elements were taken from the ISO19115/Part 2 Draft version available at that time without however adopting the full ISO19115-Part 2 information model.
6 Metadata models

6.1 EO Product Collection minimal information model

6.1.1 EO Product Collection information model

The following simplified UML class diagram shows the metadata elements that are minimally required for describing EO Product Collections. Other elements as permitted by ISO19115 may be added to obtain a more complete description:

Figure 1 EO Product Collection metadata (Simplified UML class diagram – using ISO19115 elements only – not all dataTypes/codelists included)

The following tables constitute the data dictionary. It only lists the mandated metadata elements with the changes and additional constraints with respect to ISO19115 indicated in **Bold**.

The contents of the INSPIRE column indicates whether this is one of the metadata elements mandated by INSPIRE and gives the INSPIRE Metadata Element name as well as the reference to the paragraph of the Implementing Rule.

<table>
<thead>
<tr>
<th>Name / Role name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MI_Metadata | root entity which defines metadata about a resource or resources | M | 1 | Following lines in this table

fileIdentifier | unique identifier for this metadata file | M | 1 | Free text

Clarification for EO Product Collection metadata:
This fileIdentifier is equal to the identifier of the EO Product Collection

language | language used for documenting metadata | M | 1 | ISO 639-2, other parts may be used

Metadata language Part B 10.3

characterSet | full name of the character coding standard used for the metadata set | M | 1 | MD_CharacterSetCode <<CodeList>>

Part B1.3 Resource Type

hierarchyLevel | scope to which the metadata applies. | M | 1 | Fixed value “series”

Part B1.3 Resource Type

hierarchyLevel Name | name of the hierarchy level for which the metadata is provided. | M | 1 | Fixed value “EO Product Collection”

contact | party responsible for the EO Product Collection | M | 1 | CI_ResponsibleParty <<DataType>>

Metadata point of contact Part B 10.1

dateStamp | date that the metadata was created | M | 1 | Date

Metadata date Part B 10.2

metadataStandardName | name of the metadata standard (including profile name) used | M | 1 | Fixed value of OGC 11-035

metadataStandardVersion | version of the metadata standard (version of the profile) used | M | 1 | Free text

Role name: identificationInfo | basic information about the resource(s) to which the metadata applies | M | 1 | MD_DataIdentification

Role name: contentInfo | describes the coverage and image data characteristics | O | 1 | MD_ContentInformation <<Abstract>>

MD_CoverageDescription

Role name: dataQualityInfo | provides an overall assessment of quality of a resource(s) | M | 1 | DQ_DataQuality

Required for Lineage - B 6.1

| Name / Role name | Definition | Obligation/Condition | Maximum occurrence | Domain | INSPIRE
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_Responsible Party</td>
<td>identification of, and means of communication with, person(s) and organizations associated with the dataset</td>
<td>M</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Metadata entity set information (EO Product Collection Mandatory elements only)
<table>
<thead>
<tr>
<th>Name / Role name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD_Identification</td>
<td>citation data for the resource(s)</td>
<td>M</td>
<td>1</td>
<td>CI_Citation&lt;&lt;DataType&gt;&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>abstract</td>
<td>M</td>
<td>1</td>
<td>Free text</td>
<td>Part B1.2 Resource Abstract</td>
</tr>
<tr>
<td></td>
<td>language</td>
<td>M</td>
<td>N</td>
<td>ISO 639-2, other parts may be used</td>
<td>Part B 1.7 Resource Language</td>
</tr>
<tr>
<td></td>
<td>pointOfContact</td>
<td>M</td>
<td>N</td>
<td>CI_ResponsibleParty&lt;&lt;DataType&gt;&gt;</td>
<td>Responsible Party Role Part B 9.1 and Responsible Party Role Part B 9.2</td>
</tr>
<tr>
<td>Role name: graphicOverview</td>
<td>Reference to an image that illustrates the EO Product Collection.</td>
<td>M</td>
<td>N</td>
<td>MD_BrowseGraphic</td>
<td></td>
</tr>
<tr>
<td>Role name: resourceConstraints</td>
<td>provides information about constraints which apply to the resource(s)</td>
<td>M</td>
<td>1</td>
<td>MD_Constraint</td>
<td>Required for Part B 8.2 and B.8.1</td>
</tr>
<tr>
<td>Role name: descriptiveKeywords</td>
<td>provides category keywords, their type, and reference source</td>
<td>M</td>
<td>N</td>
<td>MD_Keywords</td>
<td>Required for Parts B 3.1 and B.3.2</td>
</tr>
</tbody>
</table>

1 compositeType is stored in ISO19115 using Keywords of Type Temporal that identifies a identifies a time period related to the dataset

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<table>
<thead>
<tr>
<th>Name / Role name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_Citation</td>
<td>standardized resource reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| date             | reference date for the cited resource  
Both creation and revision dates should be included | M                  | N                  | CI_Date |         |
<p>| title            | Name by which the cited resource is known | M                  | 1                  | Free Text | Part B1.1 Resource title |</p>
<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_Date</td>
<td>reference date and event used to describe it</td>
<td>Use obligation/condition from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td>CI_Citation DataType&gt;&gt;</td>
<td>INSPIRE</td>
</tr>
<tr>
<td>date</td>
<td>reference date for the cited resource</td>
<td>M</td>
<td>1</td>
<td>CI_Citation DataType&gt;&gt;</td>
<td>Creation, revision and publication</td>
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<tr>
<td>dateType</td>
<td>event used for reference date</td>
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<td>1</td>
<td>CI_Citation DataType Code &lt;&lt;CodeList&gt;&gt;</td>
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Table 5 CI_Date (EO Product Collection Mandatory elements only)

<table>
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<th>Definition</th>
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<th>Domain</th>
<th>INSPIRE</th>
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<tbody>
<tr>
<td>MD_Resolution</td>
<td>level of detail expressed as a ground distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>distance</td>
<td>ground sample distance</td>
<td>M</td>
<td>1</td>
<td>Distance (ISO/TS 19103)</td>
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Table 6 MD_resolution (EO Product Collection Mandatory elements only)

<table>
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<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
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</thead>
<tbody>
<tr>
<td>MD_Keywords*</td>
<td>keywords, their type and reference source</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>keyword*</td>
<td>commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject For INSPIRE the use of one keyword expressing the INSPIRE Data theme is required. Relevant INSPIRE data themes concerning EO Product collections are “Land cover” and “Orthoimagery”</td>
<td>M</td>
<td>N</td>
<td>Free Text</td>
<td>Part B 3.1</td>
</tr>
</tbody>
</table>

---

2 See INSPIRE metadata technical guidance for description on how to use the descriptive keywords to encode the INSPIRE data theme.
Table 7 MD_Keywords

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DQ_DataQuality</strong></td>
<td>quality information for the data specified by a data quality scope</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scope</td>
<td>the specific data to which the data quality information applies</td>
<td>M</td>
<td>1</td>
<td>DQ_Scope</td>
<td></td>
</tr>
<tr>
<td>Role name: Report</td>
<td>quantitative quality information for the data specified by the scope</td>
<td>M</td>
<td>1</td>
<td>DQ_Element</td>
<td>Required for Part B 7.1/B 7.2</td>
</tr>
<tr>
<td>Role name: lineage</td>
<td>non-quantitative quality information about the lineage of the data specified by the scope</td>
<td>M</td>
<td>1</td>
<td>LI_Lineage</td>
<td>Required for Part B 6.1</td>
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</table>

Table 8 DQ_DataQuality

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DQ_Element</strong></td>
<td>aspect of quantitative quality information</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>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</td>
<td>M</td>
<td>N</td>
<td>DQ_Result</td>
<td>Required for Part B7.1/B7.2</td>
</tr>
</tbody>
</table>

Table 9 DQ_Element

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DQ_Result</strong></td>
<td>generalization of more specific result classes</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DQ_ConformanceResult | Information about the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level
| Use obligation from referencing object | Use maximum occurrence from referencing object

specification | citation of product specification or user requirement against which data is being evaluated
| M | 1 | Cl_Citation | Part B 7.1

explanation | explanation of the meaning of conformance for this result
| M | 1 | Free Text

Pass | indication of the conformance result where 0 = fail and 1 = pass
| M | 1 | true/false (as per INSPIRE ISO19139 instead of ISO19115 0,1) | Part B 7.2

Table 10 DQ_Result

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LI_Lineage</td>
<td>information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>statement</td>
<td>general explanation of the data producer’s knowledge about the lineage of a dataset</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td>Part B 6.1</td>
</tr>
<tr>
<td>LI_ProcessStep.description</td>
<td>information about an event or transformation in the life of a dataset including the process used to maintain the dataset</td>
<td>C as statement is provided</td>
<td>N</td>
<td>Free Text</td>
<td></td>
</tr>
</tbody>
</table>

Table 11 LI_Lineage

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD_Constraints</td>
<td>restrictions on the access and use of a resource or metadata</td>
<td>Use obligation from referencing object</td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>useLimitation</td>
<td>limitation affecting the fitness for use of the resource or metadata. Example, “not to be used for navigation”</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td>Condition applying to access and use Part B 8.1</td>
</tr>
<tr>
<td>MD_LegalConstRaints</td>
<td>restrictions and legal prerequisites for accessing and using the resource or metadata</td>
<td>Use obligation from referencing object</td>
<td>N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
accessConstraints | access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource or metadata | M | 1 | MD_RestrictionCode <<CodeList>> | Limitations on public access Part B 8.2

otherConstraints | other restrictions and legal prerequisites for accessing and using the resource or metadata | C / accessConstraints equal “otherRestrictions”? | N | Free Text | Limitations on public access Part B 8.2

MD_SecurityConstraints | or metadata for national security or similar security concerns | Use obligation from referencing object | Use maximum occurrence from referencing object

Classification | name of the handling restrictions on the resource or metadata | M | 1 | MD_ClassificationCode <<CodeList>> | Limitations on public access Part B 8.2

| Table 12 MD_Constraints/LegalConstraints |

6.1.2 Non ISO 19115 elements for eo product collection discovery

In addition to the ISO19115 subset described above, [RD08] also defined a set of metadata elements for EO Product Collection Discovery that could not be directly mapped on ISO19115. That information can be described in other metadata documents, like a sensorML XML file. ISO19115:2003 does not have a generic metadata element to provide additional documentation, but define a rather precise structure of metadata elements with well-defined semantic.

To represent the platform and instrument identifiers and allow linking to sensorML description, it is required to use some extensions from ISO19115-2 metadata model. The sensorML document will be based on the Annex A of [RD04] which describes the profile of sensorML for Earth Observation domain.
Figure 2 EO Product Collection metadata (Simplified UML class diagram – using ISO19115-2 extension for Platform & Instrument elements only)
The most relevant observations are:

- The distinction that is made between the platformShortName and platformSerialIdentifier does not map well on ISO19115-2 and SensorML. Both properties should be combined to obtain a unique identification of a platform instance.

- For cross-model linkage it is better to use identifiers than shortnames for identifying platforms and instruments.

- In Earth Observation domain, an Instrument can be configured with specific parameters. It can be seen as a customization of a generic Instrument for a specific usage. In SensorML, this is described as a specific System (called Instrument Mode) referencing the generic Instrument ID.

4 In ISO 19115-2, only Platform and Instrument properties exist to reference external document.
The PA+XS mode is used to acquire 5m resolution multispectral images by pan sharpening the 10m resolution multispectral data with the 5m resolution panchromatic data.

The processing information could potentially be added in an unstructured manner within a single descriptive field LI_ProcessStep.description of ISO19115. The ISO19115-Part 2 provided LE_ProcessStep provides additional fields to better structure the processing information.

6.2 EO Services minimal information model

During the Heterogeneous Missions Accessibility Project series of ESA, the HMA stakeholders also defined the minimal set of metadata elements that are required to describe the different Web Service Instances that are being deployed throughout the Ground Segments of the GMES Contributing Missions.

These Web Services include Catalogue Services for discovery of EO Products, EO
Product Collections and EO Services, Ordering Services, Feasibility Analysis, Web Map Services and Web Coverage Services.

The information model employed was based on the ISO 19119 metadata model which was adapted for use in the EO Context in the following manner:

- a number of optional elements are not included in this minimum element set. These elements mainly relate to the chaining of operations and the parameters that are associated with the operations.
- a number of optional elements have been declared mandatory.

It is to note that the original document defined a set of minimal elements required for EO Service discovery hereby not excluding the use of additional optional ISO19119 metadata elements for obtaining a more complete description of EO Services.

The information model proposed in this section started from the information model proposed in OGC07-025 but applies the following changes:

- With the adoption of the INSPIRE Directive and the INSPIRE Metadata Implementing Rules, it is desirable for EO Services metadata to contain all the minimal information elements required by the INSPIRE Metadata Implementing Rule and following the INSPIRE technical guidelines. The Elements mandated by INSPIRE have been added to the minimal set of ISO19119 elements.
- Minor corrections to elements occurring in the original table.

6.2.1 EO Services information model

The following simplified UML class diagram shows the minimal elements that are required for describing EO Product Collections. Other elements as permitted by ISO19119 may be added to obtain a more complete description:
The following tables constitute the data dictionary. The tables are based on the corresponding ISO19115/19119 tables with changes/additional constraints with respect to ISO19119 are highlighted in Bold.

The contents of the INSPIRE column indicates whether this is one of the metadata elements mandated by INSPIRE and gives the INSPIRE Metadata Element name as well as the reference to the paragraph of the Implementing Rule.

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD_Metadata</td>
<td>root entity which defines metadata about a resource or resources</td>
<td>M 1</td>
<td>Following lines in this table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fileIdentifier</td>
<td>unique identifier for this metadata file</td>
<td>M 1</td>
<td>Free text</td>
<td></td>
<td></td>
</tr>
<tr>
<td>language</td>
<td>language used for documenting metadata</td>
<td>M 1</td>
<td>ISO 639-2, other parts may be used</td>
<td>Metadata language Part B 10.3</td>
<td></td>
</tr>
<tr>
<td>hierarchyLevel</td>
<td>scope to which the metadata applies.</td>
<td>M 1</td>
<td>Fixed value “service”</td>
<td>Part B1.3 Resource Type</td>
<td></td>
</tr>
<tr>
<td>hierarchyLevel Name</td>
<td>name of the hierarchy level for which the metadata is provided.</td>
<td>M 1</td>
<td>Fixed value “EO Service”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 EO Services Minimal Information Model
Table 13 Metadata entity set information (EO Services Mandatory elements only)

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_ResponsibleParty</td>
<td>identification of, and means of communication with, person(s) and organizations associated with the dataset</td>
<td>M</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>individualName</td>
<td>name of the responsible person- surname, given name, title separated by a delimiter</td>
<td>M</td>
<td>1</td>
<td>Free text</td>
<td></td>
</tr>
<tr>
<td>organisationName</td>
<td>name of the responsible organization</td>
<td>M</td>
<td>1</td>
<td>Free text</td>
<td></td>
</tr>
<tr>
<td>positionName</td>
<td>role or position of the responsible person</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>contactInfo</td>
<td>contactInfo</td>
<td>M</td>
<td>1</td>
<td>CI_Contact</td>
<td></td>
</tr>
<tr>
<td>Role</td>
<td>function performed by the responsible party</td>
<td>M</td>
<td>1</td>
<td>CI_RoleCode</td>
<td>Responsible Party Role Part B 9.2</td>
</tr>
</tbody>
</table>

Table 14 CI_ResponsibleParty (EO Services Collection Mandatory elements only)

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD_Identification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Part B1.2 Resource Abstract</td>
</tr>
<tr>
<td>Citation</td>
<td>citation data for the resource(s)</td>
<td>M</td>
<td>1</td>
<td>CI_Citation</td>
<td></td>
</tr>
<tr>
<td>abstract</td>
<td>brief narrative summary of the content of the resource(s)</td>
<td>M</td>
<td>1</td>
<td>Free text</td>
<td></td>
</tr>
<tr>
<td>Role name: pointOfContact</td>
<td>identification of, and means of communication with, person(s) and organization(s) associated with the resource(s)</td>
<td>M</td>
<td>1</td>
<td>CI_ResponsiblParty &lt;&lt;DataType &gt;&gt;</td>
<td>ResponsiblParty Part B.9.1 and ResponsiblParty Role Part B 9.2</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Role name: resourceConstrain ts</td>
<td>provides information about constraints which apply to the resource(s)</td>
<td>M</td>
<td>N</td>
<td>MD_Constraints</td>
<td>Required for Part B.8.2 and B.8.1</td>
</tr>
<tr>
<td>Role name: descriptiveKeywor ds</td>
<td>provides category keywords, their type, and reference source</td>
<td>M</td>
<td>N</td>
<td>MD_Keywords</td>
<td>Required for Parts B 3.1 and B.3.2</td>
</tr>
<tr>
<td>Extent</td>
<td>the geographic/temporal region where the service is valid, including the bounding box, bounding polygon, vertical, or temporal extent of the service</td>
<td>C/ if couplingType equals &quot;mixed&quot; or &quot;tight&quot;</td>
<td>1</td>
<td>EX_Extent</td>
<td>Required for Geographical Bounding Box Part B4.1) And Temporal Extent (Part B.5.1) Optional for Services</td>
</tr>
<tr>
<td>accessProperties</td>
<td>Information about the availability of the service, including, - Fees - Planned available date and time - Ordering instructions - Turnaround</td>
<td>O</td>
<td>1</td>
<td>MD_StandardProces s</td>
<td></td>
</tr>
<tr>
<td>restrictions</td>
<td>Legal and security constraints on accessing the service and distributing data generated by the service.</td>
<td>O</td>
<td>1</td>
<td>MD_Constraints</td>
<td></td>
</tr>
<tr>
<td>serviceType</td>
<td>A service type name from a registry of services. For example, the values of the nameSpace and name attributes of GeneralName may be &quot;OGC &quot; and &quot;catalogue.&quot;</td>
<td>M</td>
<td>1</td>
<td>GenericNa me</td>
<td>Spatial data service type Part B 2.2</td>
</tr>
<tr>
<td>serviceTypeVersio n</td>
<td>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.</td>
<td>O</td>
<td>N</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>coupledResource</td>
<td>further description of the data coupling in the case of tightly coupled services</td>
<td>O</td>
<td>N</td>
<td>SV_CoupledRe source</td>
<td></td>
</tr>
</tbody>
</table>
### Table 15 ServiceIdentification Information

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation / Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV_CoupledResource</td>
<td>further description of the data coupling in the case of tightly coupled services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>operationName</td>
<td>name of the service operation</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>identifier</td>
<td>name of the identifier of a given tightly coupled dataset</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>scopedName</td>
<td>e.g. the name of the layer in the WMS or the featureTypeName of the WFS</td>
<td>M</td>
<td>1</td>
<td>Free text</td>
<td></td>
</tr>
</tbody>
</table>

### Table 16 SV_CoupledResource

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation / Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV_OperationMetadata</td>
<td>describes the signature of one and only one method provided by the service.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>operationName</td>
<td>name of the service operation</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>DCP</td>
<td>Distributed Computing Platforms on which the operation has been implemented</td>
<td>M</td>
<td>N</td>
<td>DCPList</td>
<td></td>
</tr>
<tr>
<td>operationDescription</td>
<td>Free text description of the intent of the operation and the results of the operation.</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>connectPoint</td>
<td>Handle for accessing the service interface</td>
<td>M</td>
<td>N</td>
<td>CI_OnlineResource</td>
<td></td>
</tr>
</tbody>
</table>

### Table 17 SV_OperationMetadata

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation / Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
</table>
MDStandardOrderProcess describes the signature of one and only one method provided by the service.

Fees fees and terms for retrieving the resource. Include monetary units M 1 Free Text

orderingInstructions general instructions, terms and services provided by the distributor 0 1 Free Text

**Table 18 MD_StandardOrderProcess**

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDIdentifier</td>
<td>value uniquely identifying an object within a namespace</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>authority</td>
<td>person or party responsible for maintenance of the namespace</td>
<td>O</td>
<td>1</td>
<td>Cl_Citation</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>alphanumeric value identifying an instance in the namespace</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_Citation</td>
<td>standardized resource reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>reference date for the cited resource Both creation and revision dates should be included</td>
<td>M</td>
<td>N</td>
<td>Cl_Date</td>
<td></td>
</tr>
<tr>
<td>title</td>
<td>Name by which the cited resource is known</td>
<td>M</td>
<td>1</td>
<td>Free Text</td>
<td></td>
</tr>
<tr>
<td>identifier</td>
<td>value uniquely identifying an object within a namespace</td>
<td>M</td>
<td>1</td>
<td>MD_Identifier</td>
<td></td>
</tr>
</tbody>
</table>

**Table 19 CI_Citation**

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name / Role Name</td>
<td>Definition</td>
<td>Obligation/Condition</td>
<td>Maximum occurrence</td>
<td>Domain</td>
<td>INSPIRE</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>--------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| **MD_Keywords**
| keywords, their type and reference source | Use obligation from referencing object | Use maximum occurrence from referencing object | | | |
| **keyword**
| commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject | M | N | Free Text | Part B 3.1 |
| **Type**
| subject matter used to group similar keywords | O | 1 | MD_Keyword TypeCode | | |
| **thesaurusName**
| name of the formally registered thesaurus or a similar authoritative source of keywords | O | 1 | CI_Citation | Part B 3.2 |

Table 21 MD_Keywords

<table>
<thead>
<tr>
<th>Name / Role Name</th>
<th>Definition</th>
<th>Obligation/Condition</th>
<th>Maximum occurrence</th>
<th>Domain</th>
<th>INSPIRE</th>
</tr>
</thead>
</table>
| **MD_Constraints**
| restrictions on the access and use of a resource or metadata | Use obligation from referencing object | Use maximum occurrence from referencing object | | | |
| **useLimitation**
| limitation affecting the fitness for use of the resource or metadata. Example, “not to be used for navigation” | M | 1 | Free Text | Condition applying to access and use Part B 8.1 |

---

5 One of the keywords used should indicate the spatial data service type
6 See [RD19] for best practice proposal for using Semantic Annotation in ISO19115 Metadata
<table>
<thead>
<tr>
<th>MD_LegalConstraints</th>
<th>restrictions and legal prerequisites for accessing and using the resource or metadata</th>
<th>Use obligation from referencing object</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>accessConstraints</td>
<td>access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource or metadata</td>
<td>M</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>limitCode</td>
<td>MD_LimitationCode</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Limitations on public access Part B 8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>otherConstraints</td>
<td>Other restrictions and legal prerequisites for accessing and using the resource or metadata</td>
<td>C / accessConstraints equal &quot;otherRestrictions&quot;?</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>limitCode</td>
<td>MD_LimitationCode</td>
<td>Free Text</td>
</tr>
<tr>
<td></td>
<td>Limitations on public access Part B 8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD_SecurityConstraints</td>
<td>or metadata for national security or similar security concerns</td>
<td>Use obligation from referencing object</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>Use maximum occurrence from referencing object</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>limitCode</td>
<td>MD_LimitationCode</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Limitations on public access Part B 8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>classification</td>
<td>name of the handling restrictions on the resource or metadata</td>
<td>M</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>limitCode</td>
<td>MD_LimitationCode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limitations on public access Part B 8.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22 MD_Constraints/LegalConstraints

6.2.2 INSPIRE mapping notes

The table in section Error! Reference source not found. includes mapping notes for EO Services.

6.3 SensorML minimal information model

6.3.1 SensorML Discovery Profile

The SensorML data model specifies a majority of its elements as optional. It allows expressing the same information in several, differently structured ways. This open and flexible structure was one of the main aims of the SensorML design in order to make it possible to apply the data model to nearly any type of sensor. For ensuring that SensorML documents which are intended for discovery purposes can be reliably handled by automatic harvesting mechanisms, it is necessary to create a profile for SensorML that define the information which shall be contained in a SensorML document as well as the structure in which the metadata shall be encoded. This profile called Discovery Profile of SensorML is currently specified in the OGC document 09-163r2, SensorML Extension Package for ebRIM.

To constrain the flexibility of the SensorML data model, a set of Schematron rules have been defined. These rules check that the mandatory information are present in an instance of SensorML (System or Component).

The list of properties of which the presence is verified is:
The most important elements are the uniqueID and the shortName, as they are used to make the link between the different entities involved (EO Series, sensors, EO Product).

7 Discovery strategy in EO Community

7.1 EO Community Metadata model

As seen before, there are various data models that are used in order to describe components of EO product acquisition systems. Figure 3 tries to illustrate in a simplified sketch the major EO data models (left-hand side) and what they describe (right-hand side).
7.1.1 Link between EO product metadata and the acquiring sensor

Each EO Product described using the Earth Observation Metadata profile of Observations & Measurements [RD20] contains an EarthObservationEquipment section grouping information about the platform, instrument and sensor used to produce this EO product. SensorML defines all the information about platform, instrument and sensor. So there clearly is a conceptual relationship between EO Product and Sensors. But with the current metadata model, there is currently no definition on how to express this linkage between an EO Product (EO GML) and a SensorML.

A snippet of the eop:EarthObservationEquipment of an EO Product taken by the SPOT-4 platform using the instrument HRVIR-Nb2 is given here:

```xml
<eop:EarthObservationEquipment>
  <eop:platform>
    <eop:Platform>
      <eop:shortName>SPOT</eop:shortName>
      <eop:serialIdentifier>4</eop:serialIdentifier>
      <eop:orbitType>LEO</eop:orbitType>
    </eop:Platform>
  </eop:platform>
  <eop:instrument>
    <eop:Instrument>
      <eop:shortName>HRVIR-Nb2</eop:shortName>
    </eop:Instrument>
  </eop:instrument>
  <eop:sensor>
    <eop:Sensor>
      <eop:sensorType>OPTICAL</eop:sensorType>
    </eop:Sensor>
  </eop:sensor>
</eop:EarthObservationEquipment>
```

<sml:SensorML version="1.0.1">
  <sml:member>
    <sml:System gml:id="SPOT4_HRVIR">
      <!-- ============================================================== -->
      <!--                  System Description                             -->
      <!-- ============================================================== -->
      <gml:description>…</gml:description>
      <!-- ============================================================== -->
      <!--                  System Identifiers                               -->
      <!-- ============================================================== -->
      <sml:identification>
        <sml:IdentifierList>
          <sml:identifier name="uniqueID">
            <sml:Term definition="urn:ogc:def:identifier:OGC:1.0:uniqueID">
            </sml:Term>
          </sml:identifier>
          <sml:identifier name="Platform UID">
            <sml:Term definition="urn:ogc:def:property:CEOS:eop:PlatformID">
            </sml:Term>
          </sml:identifier>
          <sml:identifier name="shortName">
            <sml:Term definition="urn:ogc:def:identifier:OGC:1.0:shortName">
              <sml:value>SPOT-4 HRVIR1</sml:value>
            </sml:Term>
          </sml:identifier>
          <sml:identifier name="parentSystemUniqueID">
            <sml:Term definition="urn:ogc:def:identifier:OGC:1.0:parentSystemUniqueID">
            </sml:Term>
          </sml:identifier>
          ...
        </sml:IdentifierList>
      </sml:identification>
      <!-- ============================================================== -->
      <!--                  System Classifiers                              -->
      <!-- ============================================================== -->
      <sml:classification>
        <sml:ClassifierList>
          <sml:classifier name="sensorType">
            <sml:Term definition="urn:ogc:def:classifier:OGC:1.0:sensorType">
              <sml:value>Imaging Multispectral Radiometer</sml:value>
            </sml:Term>
          </sml:classifier>
        </sml:ClassifierList>
      </sml:classification>
    </sml:System>
  </sml:member>
</sml:SensorML>
To express the linkage between EO Product metadata and the acquiring platform and sensor, we need to add the unique identifier of the platform, the instrument and perhaps the detector to the EOProduct metadata. Unfortunately, in the current version of OGC10-157 there are no elements to store these identifiers.

The long term solution is to add a new “identifier” element in the “eop:platform”, “eop:instrument” and “eop:sensor”. This solution would break backward compatibility.

Another solution that can be realized with the current version of OGC10-157, is to use the eop:platform:shortName and eop:instrument:shortName to make the linkage and fill them with the appropriate SensorML shortName. Note that this means that the platform shortname should include the platform serial identifier.

Here is the previous EO Product snippet updated to use the same platform and instrument short name.

```xml
<eop:EarthObservationEquipment>
  <eop:platform>
    <eop:Platform>
      <eop:shortName>SPOT4</eop:shortName>
      <eop:serialIdentifier>4</eop:serialIdentifier>
      <eop:orbitType>LEO</eop:orbitType>
    </eop:Platform>
    <eop:platform>
      <eop:platform>
        <eop:Instrument>
          <eop:shortName>SPOT-4 HRVIR1</eop:shortName>
        </eop:Instrument>
        <eop:instrument>
          <eop:Sensor>
            <eop:sensorType>OPTICAL</eop:sensorType>
          </eop:Sensor>
          <eop:sensor>
            ...
          </eop:Sensor>
        </eop:instrument>
      </eop:platform>
    </eop:platform>
  </eop:platform>
</eop:EarthObservationEquipment>
```
7.1.2 Link between EO product metadata and the metadata of the corresponding EO Product Collection

The link between an EO Product and the corresponding dataset series is done using the “parentIdentifier” element. The “parentIdentifier” contains the identifier (element fileIdentifier) of the dataset series.

Here is a snippet of the “parentIdentifier” of the EO Product.

```
<opt:EarthObservation version="1.2.1">
  <gml:metaDataProperty>
    <eop:EarthObservationMetaData>
      <eop:parentIdentifier>urn:ogc:def:EOP:ESA:EECF.ENVISAT_ASA_APx_xS</eop:parentIdentifier>
    </eop:EarthObservationMetaData>
  </gml:metaDataProperty>
</opt:EarthObservation>
```

Here is a snippet of a dataset series with the same fileIdentifier:

```
<gmd:MD_Metadata>
  <gmd:fileIdentifier>
    <gco:CharacterString>urn:ogc:def:EOP:ESA:EECF.ENVISAT_ASA_APx_xS</gco:CharacterString>
  </gmd:fileIdentifier>
</gmd:MD_Metadata>
```

7.1.3 Link between the EO Product Collection metadata and the sensors information

The EO Product Collection metadata can contain a link to the sensors information. The ISO 19115/2 defines the extension to store acquisition information.


```
<gmi:MI_Metadata>
  ...
  <gmi:acquisitionInformation>
    <gmi:MI_AcquisitionInformation>
      <gmi:platform>
        <gmi:MI_Platform>
          <gmi:identifier>
            <gmd:RS_Identifier>
              <gmd:code>
                <gco:CharacterString>urn:ogc:id:CEOS:platform:SPOT1:v01</gco:CharacterString>
              </gmd:code>
            </gmd:RS_Identifier>
          </gmi:identifier>
        </gmi:MI_Platform>
      </gmi:platform>
    </gmi:MI_AcquisitionInformation>
  </gmi:acquisitionInformation>
</gmi:MI_Metadata>
```
7.1.4 Identifier definition

The key point to be able to define a formal link between metadata of EO Products, EO Product Collections and Sensors is to define stable, unique, coherent identifiers for each metadata entity. These identifiers will be used to make the link between the different metadata models. These identifier will also be used to identify and retrieve the metadata in catalogue/registry.

7.2 Metadata cataloguing

To catalogue metadata corresponding to the three different metadata models, we need to have a catalog solution capable of handling “any” metadata model.

The CSW ISO Application Profile (OGC 07-045) catalogue is only able to store ISO 19115/ISO19119 Metadata i.e EO Product Collections.
The CSW ebRIM Application Profile (OGC 07-110) catalogue is based on the generic ebXML model that can be profiled to store any model. These profiles are called extension packages. Currently there is one extension package defined for each of the three metadata models:

- OGC 06-131: EO Product Extension Package
- OGC 10-189: EO Product Extension Package v2
- OGC 07-038: ISO 19115/19119 Extension Package
- OGC 09-163: SensorML Extension Package

Currently, there is no official document that defines the interlinkage between these extension packages. The following section proposes some ideas to implement these links.

### 7.2.1 How to link different extension packages in a CSW ebRIM catalog

There are two ways to make a link between extension packages.

#### 7.2.1.1 Link by association

The most obvious way to link objects (Registry Objects) in an ebRIM catalog is to create an Association between these objects. For instance, we can create a SubsetOf association between an EO product and its collection.

To create this association when an EO Product is harvested the identifier of the collection (the `parentIdentifier` element) needs to be extracted. Based on the collection identifier, we query the catalog to retrieve the Registry Object corresponding to this collection. If the Registry Object is found, the Association between the EO Product and the Collection Registry Object can be created.

This procedure can only work if the `parentIdentifier` within the EO Product metadata points to an existing collection. Hence the importance of a coherent identifier scheme.

#### 7.2.1.2 Link by equivalent slot

Another solution is to define equivalent slots between the different extension packages. For instance, the EO Product Registry Object contains a slot called “parentIdentifier” which is equal to the slot “identifier” of the Collection registry Object. A GetRecords request can search for all EO Product in the collections matching one or several constraints (like a keyword equal to a particular value…).

An example CSW GetRecords Query searching for all EO Products within a collection where the `topicCategory` equals « imageryBaseMapsEarthCover » is given below:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecords
xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
xmlns:ogc="http://www.opengis.net/ogc"
version="2.0.2"
resultType="RESULTS"`
maxRecords="10"
outputSchema="urn:oasis:names:tc:ebxml-regrep:xsd:rim:3.0">
  <csw:Query typeNames="RegistryPackage ExtrinsicObject__product ExtrinsicObject__collection">
    <csw:ElementName>/RegistryPackage</csw:ElementName>
    <csw:Constraint version="1.0.0">
      <ogc:Filter>
        <ogc:And>
          <ogc:PropertyIsEqualTo>
            <ogc:PropertyName>/RegistryPackage/RegistryObjectList/*/@id</ogc:PropertyName>
            <ogc:PropertyName>/product/@id</ogc:PropertyName>
          </ogc:PropertyIsEqualTo>
          <ogc:PropertyIsEqualTo>
            <ogc:PropertyName>/product/@objectType</ogc:PropertyName>
            <ogc:Literal>urn:ogc:def:objectType:OGC-CSW-ebRIM-EO::EOProduct</ogc:Literal>
          </ogc:PropertyIsEqualTo>
          <ogc:PropertyIsEqualTo>
          </ogc:PropertyIsEqualTo>
          <ogc:PropertyIsEqualTo>
            <ogc:PropertyName>/collection/@objectType</ogc:PropertyName>
            <ogc:Literal>urn:ogc:def:objectType:OGC-CSW-ebRIM-CIM::DataMetadata</ogc:Literal>
          </ogc:PropertyIsEqualTo>
          <ogc:PropertyIsEqualTo>
            <ogc:Literal>imageryBaseMapsEarthCover</ogc:Literal>
          </ogc:PropertyIsEqualTo>
        </ogc:And>
      </ogc:Filter>
    </csw:Constraint>
  </csw:Query>
</csw:GetRecords>

To have a more coherent slot naming, OGC recommends using HTTP URIs (http://www.opengis.net/def/property/OGC/). For instance the identifier of a platform should be http://www.opengis.net/def/property/OGC-EO/0/Platform. This slot name should be used in EO Product, Collection and Sensor RegistryObjects.

At OGC, the slot names are URI and are registered into the OGC registry of Naming Authority. Another way of making a semantic relation between two slots is to create a relation like a skos:exactMatch or a rdf:sameAs between two URIs.

### 7.2.2 Link between EO Product and EO Product Collection metadata

The link can be done by using the “parentIdentifier” slot from the EOProduct ExtrinsicObject (EO extension Package) and the “identifier” slot of the MetadataInformation ExtrinsicObject (CIM Extension Package).

### 7.2.3 Link between EO Product and Sensor metadata

For the platform, the link can be established using the “name” of the EOAcquisitionPlatform ExtrinsicObject and the “shortName” slot from the System
ExtrinsicObject describing the platform. The “name” must be identical in the 2 metadata records.

For the instrument, the link can be done between the “instrumentShortName » slot of the EOAcquisitionPlatform ExtrinsicObject and the “shortName” slot from the System ExtrinsicObject describing the Instrument. The “name” must be identical in the 2 metadata records.

What concerns the detector, there is no reference to the detector in the EO Product metadata model.

7.2.4 Link between Collection and Sensor

Currently, the ISO Extension package (CIM) does not support the ISO 19115/2 extensions. So we cannot establish the linkage with the current draft specification. To solve this issue, the proposal is to extend the current discovery model to take into account some part of ISO 19115/2.

For the platform, a suggestion is to extract the « gmi:MI_AcquisitionInformation/gmi:platform/gmi:MI_Platform/gmi:identifier/gmd:RS_Identifier/gmd:code/gco:CharacterString » property in the « platformIdentifier » slot of the MetadataInformation ExtrinsicObject. Then the link can be done with the “shortName” slot from the System ExtrinsicObject describing the platform.

For the instrument, a suggestion is to extract the « gmi:MI_AcquisitionInformation/gmi:instrument/gmi:MI_Instrument/gmi:citation/gmd:CI_Citation/gmd:identifier/gmd:RS_Identifier/gmd:code/gco:CharacterString » property in the « instrumentIdentifier » slot of the MetadataInformation ExtrinsicObject. Then the link can be done with the “shortName” slot from the System ExtrinsicObject describing the instrument.
Annex A
Informative
Example of EO Product Collection metadata

<?xml version="1.0" encoding="UTF-8"?>
<MI_Metadata xmlns="http://www.isotc211.org/2005/gmi"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/gmd/metadata
Application.xsd http://www.isotc211.org/2005/gmi
http://www.isotc211.org/2005/gmi/gmi.xsd">
  <gmd:fileIdentifier>
    <gco:CharacterString>urn:HMA:GS:F81D4FAE-7DEC-11D0-A765-00A0C91E6BF6</gco:CharacterString>
  </gmd:fileIdentifier>
  <gmd:language>
  </gmd:language>
  <gmd:characterSet>
    <gmd:MD_CharacterSetCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_CharacterSetCode" codeListValue="utf8"/>
  </gmd:characterSet>
  <gmd:hierarchyLevel>
    <gmd:MD_ScopeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_ScopeCode" codeListValue="series"/>
  </gmd:hierarchyLevel>
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:individualName>eoHelp</gmd:individualName>
      <gmd:organisationName>ESA</gmd:organisationName>
      <gmd:positionName>Order Desk</gmd:positionName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:address>
            <gmd:CI_Address>
              <gmd:electronicMailAddress>eohelp@esa.int</gmd:electronicMailAddress>
            </gmd:CI_Address>
          </gmd:address>
        </gmd:CI_Contact>
      </gmd:contactInfo>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
</MI_Metadata>
<gmd:contactInfo>
  <gmd:role>
    <gmd:CI_RoleCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodeList.xsd#CI_RoleCode"
      codeListValue="pointOfContact"/>
  </gmd:role>
  <gmd:CI_ResponsibleParty>
    <gmd:contactInfo>
      <gmd:role>
        <gmd:CI_RoleCode
          codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodeList.xsd#CI_RoleCode"
          codeListValue="pointOfContact"/>
      </gmd:role>
      <gmd:contact>
        <gmd:dateStamp>
          <gco:Date>2006-05-04</gco:Date>
        </gmd:dateStamp>
        <gmd:metadataStandardName>
          <gco:CharacterString>OGC 11-035</gco:CharacterString>
        </gmd:metadataStandardName>
        <gmd:metadataStandardVersion>
          <gco:CharacterString>1.0</gco:CharacterString>
        </gmd:metadataStandardVersion>
        <gmd:identificationInfo>
          <gmd:MD_DataIdentification>
            <gmd:citation>
              <gmd:CI_Citation>
                <gmd:title>
                  <gco:CharacterString>ASAR Image Mode Acquisitions</gco:CharacterString>
                </gmd:title>
                <gmd:date>
                  <gmd:CI_Date>
                    <gmd:date>
                      <gco:Date>2006-05-04</gco:Date>
                    </gmd:date>
                    <gmd:dateType>
                      <gmd:CI_DateTypeCode
                        codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodeList.xsd#CI_DateTypeCode"
                        codeListValue="creation"/>
                    </gmd:dateType>
                  </gmd:CI_Date>
                  <gmd:identifier>
                    <gmd:MD_Identifier>
                      <gmd:code>
                        <gco:CharacterString>urn:HMA:GS:F81D4FAE-7DEC-11D0-A765-00A0C91E6BF6</gco:CharacterString>
                      </gmd:code>
                    </gmd:MD_Identifier>
                  </gmd:identifier>
                </gmd:citation>
              </gmd:CI_Citation>
            </gmd:citation>
          </gmd:MD_DataIdentification>
        </gmd:identificationInfo>
        <gmd:abstract>
          <gco:CharacterString>![CDATA[The <a href=https://envisat.esa.int/instruments/asar/>Advanced Synthetic Aperture Radar (ASAR)</a> (more info <a href=https://envisat.esa.int/instruments/asar/CNTR3.htm>here</a>) is one of the instruments aboard the Environmental Satellite <a href=https://envisat.esa.int/m-s/>ENVISAT</a> ... br><br>From this collection you may order <a href=https://envisat.esa.int/instruments/asar/data-app/dataprod.html>products</a> of the following types:<br>- <a href=https://envisat.esa.int/instruments/asar/data-app/prodspread.html#pgfId=ASA.IM__0P>Image Mode Level 0 (ASA.IM__0P)</a><br>- <a href=https://envisat.esa.int/instruments/asar/data-app/prodspread.html#pgfId=ASA.IMP_1P>Image Mode Precision Image</a>]]></gco:CharacterString>
        </gmd:abstract>
      </gmd:contact>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
</gmd:contactInfo>
Image Mode Single Look Complex (ASA_IMP_1P)
Image Mode Ellipsoid Geocoded Image (ASA_IMG_1P)
Image Mode Medium Resolution (ASA_IMM_1P)

(gmd:abstract>
    <gmd:CI_ResponsibleParty>
        <gmd:individualName>
            <gco:CharacterString> eoHelp</gco:CharacterString>
        </gmd:individualName>
        <gmd:organisationName>
            <gco:CharacterString> ESA</gco:CharacterString>
        </gmd:organisationName>
        <gmd:positionName>
            <gco:CharacterString> Order Desk</gco:CharacterString>
        </gmd:positionName>
        <gmd:contactInfo>
            <gmd:CI_Contact>
                <gmd:address>
                    <gmd:CI_Address>
                        <gmd:electronicMailAddress>
                            <gmd:electronicMailAddress>
                                <gco:CharacterString> eohelp@esa.int</gco:CharacterString>
                            </gmd:electronicMailAddress>
                        </gmd:CI_Address>
                    </gmd:address>
                </gmd:CI_Contact>
                <gmd:role>
                    <gmd:CI_RoleCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_RoleCode" codeListValue="originator"/>
                </gmd:role>
            </gmd:CI_ResponsibleParty>
        </gmd:pointOfContact>
        <gmd:descriptiveKeywords xmlns:gmd="http://www.isotc211.org/2005/gmd">
            <gmd:keyword>
                <gco:CharacterString> Orthoimagery</gco:CharacterString>
            </gmd:keyword>
            <gmd:type>
                <gmd:MD_KeywordTypeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode" codeListValue="theme"/>
            </gmd:type>
            <gmd:thesaurusName>
                <gmd:CITime> GEMET - INSPIRE themes, version 1.0</gmd:CITime>
            </gmd:thesaurusName>
        </gmd:descriptiveKeywords>
    </gmd:CI_ResponsibleParty>
</gmd:abstract>
<gmd:eastBoundLongitude>
    <gco:Decimal>120.0</gco:Decimal>
</gmd:eastBoundLongitude>
<gmd:southBoundLatitude>
    <gco:Decimal>17.5</gco:Decimal>
</gmd:southBoundLatitude>
<gmd:northBoundLatitude>
    <gco:Decimal>68.0</gco:Decimal>
</gmd:northBoundLatitude>
</gmd:EX_GeographicBoundingBox>
</gmd:geographicElement>
</gmd:EX_Extent>
</gmd:identificationInfo>
<gmd:DQ_DataQuality>
    <gmd:scope>
        <gmd:DQ_Scope>
            <gmd:level>
                <gmd:MD_ScopeCode codeListValue="series"
                      codeList=""/>
            </gmd:level>
        </gmd:DQ_Scope>
    </gmd:scope>
    <gmd:report>
        <gmd:DQ_DomainConsistency>
            <gmd:result>
                <gmd:DQ_ConformanceResult>
                    <gmd:specification>
                        <gmd:CI_Citation>
                            <gmd:title>
                                <gco:CharacterString>INSPIRE data specification concerning orthoimagery - exact reference TBC</gco:CharacterString>
                            </gmd:title>
                            <gmd:date>
                                <gmd:CI_Date>
                                    <gmd:date>
                                        <gco:Date>2001-01-01</gco:Date>
                                    </gmd:date>
                                    <gmd:dateType/>
                                </gmd:CI_Date>
                            </gmd:date>
                            <gmd:CI_Citation>
                                <gmd:explanation>
                                    <gco:CharacterString>INSPIRE Data specification for orthoimagery is not yet officially published so conformity has not yet been evaluated.</gco:CharacterString>
                                </gmd:explanation>
                                <gmd:pass/>
                            </gmd:DQ_ConformanceResult>
                            <gmd:DQ_DomainConsistency>
                                <gmd:report>
                                    <gmd:DQ_DataQuality>
                                        <acquisitionInformation>
                                            <MI_AcquisitionInformation>
                                                <platform>
                                                    <MI_Platform>
                                                        ...
                                                    </MI_Platform>
                                                </platform>
                                            </MI_AcquisitionInformation>
                                        </acquisitionInformation>
                                    </gmd:DQ_DataQuality>
                                </gmd:report>
                            </gmd:DQ_DomainConsistency>
                        </gmd:specification>
                        <gmd:explanation>
                            ...
                        </gmd:explanation>
                    </gmd:DQ_ConformanceResult>
                </gmd:result>
            </gmd:DQ_DomainConsistency>
        </gmd:report>
    </gmd:DQ_DataQuality>
</gmd:DQ_DataQuality>
</gmd:identificationInfo>
</gmd:MD_DataIdentification>
</gmd:EX_Extent>
</gmd:MD_Extent>
</gmd:MD_Envelope>
</gmd:Envelope>
</gmd:MD_Metadata>
Annex B:  
(Informative)  
Example of EO Service Metadata

<?xml version="1.0" encoding="UTF-8"?>
<MD_Metadata xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.isotc211.org/2005/gmd"
 xsi:schemaLocation="http://www.isotc211.org/2005/gmd
 http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd
http://www.isotc211.org/2005/srv
http://schemas.opengis.net/iso/19139/20060504/srv/srv.xsd">
  <fileIdentifier>
    <gco:CharacterString>F81D4FAE-7DEC-11D0-A765-00A0C91E6BF6</gco:CharacterString>
  </fileIdentifier>
  <language>
  </language>
  <hierarchyLevel>
    <MD_ScopeCode codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_ScopeCode" codeListValue="service">service</MD_ScopeCode>
  </hierarchyLevel>
  <hierarchyLevelName>
    <gco:CharacterString>EO Service</gco:CharacterString>
  </hierarchyLevelName>
  <contact>
    <CI_ResponsibleParty>
      <individualName>
        <gco:CharacterString>B. B.</gco:CharacterString>
      </individualName>
      <organisationName>
        <gco:CharacterString>DLR/DFD</gco:CharacterString>
      </organisationName>
      <positionName>
        <gco:CharacterString>DLR HMA System Engineer</gco:CharacterString>
      </positionName>
      <contactInfo>
        <CI_Contact>
          <phone>
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Abstract for TerraSAR-X EEC products

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