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1 INTRODUCTION

1.1 Purpose

This document provides technical information about the interfaces required by FedEO to connect to external data provider systems and is intended to help data providers to make available their metadata and data through the FedEO Gateway.

Note: The current version of the document covers mainly the OpenSearch discovery interfaces of FedEO.

1.2 Scope

The Federated Earth Observation Missions (FedEO) initiative was initially an OGC pilot activity aimed to refine OGC specifications relevant to Earth Observation.

The same OGC specifications have subsequently been implemented in support of the Copernicus programme, in particular to provide interoperable access to catalogues from European Earth Observation Missions and support the subsequent ordering of data in support of the European Commissions’ Copernicus Service Projects.

The resulting interoperable catalogue is presented here as the FedEO Clearinghouse, providing discovery, ordering\(^1\) and on-line data access services for space based Earth Observation missions from over 25 years, as a potential contribution to GEO GEOSS. The FedEO Clearinghouse brings together the catalogues from ESA, e-GEOSS, EUMETSAT, DLR, DMC, DMI, MDA, SPOT and VITO, as well as access to Alaska Satellite Facility and the CEOS WGISS Integrated Catalog.

The development of the OGC specifications used are developed and maintained in a series of initiatives under an umbrella known as Heterogeneous Missions Accessibility. The HMA Projects are overviewed by the HMA Architecture Working Group and the Ground Segment Coordination Body (GSCB). The relevant links for the HMA community are available in [RD.1] for further reference.

\(^1\) The ordering interfaces available through the FedEO Clearinghouse are the subject of a separate document (to be published).
1.3 Glossary

1.3.1 Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AOI</td>
<td>Area of Interest</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>CCM</td>
<td>Copernicus (formerly GMES) Contributing Missions</td>
</tr>
<tr>
<td>CEOS</td>
<td>Committee on Earth Observation Satellites</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial Off The Shelf</td>
</tr>
<tr>
<td>CSCDA</td>
<td>Copernicus Space Component Data Access</td>
</tr>
<tr>
<td>CSV</td>
<td>Comma Separate Values</td>
</tr>
<tr>
<td>CSW</td>
<td>Catalogue Services for the Web</td>
</tr>
<tr>
<td>CWIC</td>
<td>CEOS WGISS Integrated Catalog</td>
</tr>
<tr>
<td>DC</td>
<td>Dublin Core</td>
</tr>
<tr>
<td>DLR</td>
<td>Deutschen Zentrums für Luft- und Raumfahrt</td>
</tr>
<tr>
<td>EO</td>
<td>Earth Observation</td>
</tr>
<tr>
<td>EOP</td>
<td>Earth Observation Product</td>
</tr>
<tr>
<td>ESA</td>
<td>European Space Agency</td>
</tr>
<tr>
<td>ESRIN</td>
<td>European Space Research Institute</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GCMD</td>
<td>Global Change Master Catalog</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>G-POD</td>
<td>Grid Processing on Demand</td>
</tr>
<tr>
<td>GMES</td>
<td>Global Monitoring for Environment and Security</td>
</tr>
<tr>
<td>GML</td>
<td>Geography Mark-up Language</td>
</tr>
<tr>
<td>GSCB</td>
<td>Ground Segment Coordination Body</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>HMA</td>
<td>Heterogeneous Missions Accessibility</td>
</tr>
<tr>
<td>HTML</td>
<td>Hyper Text Mark-up Language</td>
</tr>
<tr>
<td>HTTP</td>
<td>Hyper Text Transfer Protocol</td>
</tr>
<tr>
<td>I/F</td>
<td>Interface</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>IDN</td>
<td>International Directory Network</td>
</tr>
<tr>
<td>IETF</td>
<td>Internet Engineering Task Force</td>
</tr>
<tr>
<td>INSPIRE</td>
<td>Infrastructure for Spatial Information in Europe</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>JPEG</td>
<td>Joint Photographic Experts Group</td>
</tr>
<tr>
<td>JSP</td>
<td>Java Server Pages</td>
</tr>
<tr>
<td>KML</td>
<td>Keyhole Markup Language</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
### 1.3.2 Definition of Terms

For an extensive list of terms, we refer to [RD.1].

<table>
<thead>
<tr>
<th>Collection</th>
<th>Datasets sharing the same product specification. A collection typically corresponds to the series of products derived from data acquired by a sensor on board a satellite and having the same mode of operation. Source: [RD.1].</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dataset</td>
<td>Observations obtained by satellite instruments. Source: [RD.1].</td>
</tr>
<tr>
<td>Dataset series</td>
<td>Collection of datasets sharing the same product specification. In HMA, the term is used as a synonym for a collection of (Earth observation) data. Source: ISO 19113, ISO 19114, ISO19115 and [RD.1].</td>
</tr>
<tr>
<td>Granule</td>
<td>The smallest aggregation of data that can be independently managed (described, inventoried, and retrieved). Granules have their own metadata model and support values associated with the additional attributes defined by the owning collection. Source: [RD.17]. Same meaning as dataset.</td>
</tr>
<tr>
<td>Product</td>
<td>Same meaning as dataset.</td>
</tr>
</tbody>
</table>
## 1.4 References

### 1.4.1 Applicable Documents

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Title</th>
<th>Code</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>[AD.2]</td>
<td><a href="http://www.opensearch.org/Specifications/OpenSearch/1.1">http://www.opensearch.org/Specifications/OpenSearch/1.1</a></td>
<td></td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>[AD.11]</td>
<td><a href="http://www.opensearch.org/Community/Proposal/Specifications/OpenSearch/Extensions/">http://www.opensearch.org/Community/Proposal/Specifications/OpenSearch/Extensions/</a> SRU/1.0/Draft_1</td>
<td>1.0</td>
<td>DRAFT 1</td>
<td></td>
</tr>
<tr>
<td>[AD.12]</td>
<td><a href="http://www.opensearch.org/Community/Proposal/Specifications/OpenSearch/Extensions/Semantic/1.0/Draft_1">http://www.opensearch.org/Community/Proposal/Specifications/OpenSearch/Extensions/Semantic/1.0/Draft_1</a></td>
<td>1.0</td>
<td>DRAFT 1</td>
<td></td>
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<tr>
<td>[AD.16]</td>
<td><a href="http://www.opensearch.org/Specifications/OpenSearch/Extensions/Parameter/1.0/Draft_2">http://www.opensearch.org/Specifications/OpenSearch/Extensions/Parameter/1.0/Draft_2</a></td>
<td>1.0</td>
<td>DRAFT 2</td>
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Table 1: Applicable Documents
## 1.4.2 Reference Documents

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Title</th>
<th>Code</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>[RD.3]</td>
<td>OGC 06-131r5, Catalogue Services Specification 2.0 Extension Package for ebRIM (ISO/TS 15000-3) Application Profile.</td>
<td>0.2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[RD.5]</td>
<td>OGC 06-141r2, Ordering Services for Earth Observation Products.</td>
<td>0.9.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[RD.6]</td>
<td>OGC 07-141r2, OGC KML</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[RD.9]</td>
<td>OGC 07-038r3, OGC Cataloguing of ISO Metadata (CIM) – Using the ebRIM profile of CS-W.</td>
<td>Version 0.1.12</td>
<td>14/12/2009</td>
<td></td>
</tr>
<tr>
<td>[RD.13]</td>
<td>OGC 06-131r5, OGC Catalogue Services Specification 2.0, Extension Package for ebRIM Application Profile: Earth Observation Products.</td>
<td>Version 0.2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[RD.17]</td>
<td>CWIC Client Partner Guide</td>
<td>CWIC-DOC-12-006r1</td>
<td>V1.0</td>
<td>2012</td>
</tr>
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</table>
Table 2: Reference Documents

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Title</th>
<th>Code</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>[RD.20]</td>
<td><a href="https://portal.asf.alaska.edu/api/">https://portal.asf.alaska.edu/api/</a></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5 Document Overview

Chapter 1 of this document defines the information that can be found in the document and references the list of Applicable and Reference documents.

Chapter 2 provides a general description of the FedEO environment, its relation to other systems and provides contact information.

Chapter 3 contains guidelines for FedEO Data Partners. This chapter defines the interaction model including the main metadata models. It also lists the standard protocols which facilitate integration of data partner catalogs in the FedEO system.

Chapter 4 summarises the Data Partner Integration procedure.

Finally, the appendices provide the following reference information:

- Appendix A includes forms that Data Providers can use to provide information required to prepare organisation and dataset series related metadata.
- Appendix B includes a complete example of a dataset series metadata file.
2 GENERAL DESCRIPTION

2.1 Function and Purpose

The FedEO Clearinghouse provides a unique access point for discovering, ordering and accessing Earth Observation (EO) dataset series and datasets. The interfaces it provides to client applications are described in detail in the FedEO Client Partner Guide [AD.1].

2.2 Relation to Other Systems

The FedEO Clearinghouse (shown as FedEO in the diagram below) provides a unique access point to a growing number of scientific catalogues and services.
FedEO Gateway accesses the data providers through standard-based or custom Connectors shown in orange in the figure above. These Connectors accept OpenSearch requests from the Mediator Core and translate them into valid requests to be sent to the Data Partner. Results provided by the Data Partners are then converted into valid responses which are returned to the Mediator Core.

The data providers currently reachable through FedEO include:

- ESA EO-DAIL, part of the ESA CDS and the Copernicus Space Component Data Access (CSCDA), offering dataset series from Copernicus Contributing Missions (CCM),
- ESA G-POD,
- ESA M2CS+LDS offering dataset series from ESA missions including ERS, ENVISAT etc.
- ESA SuperSite Virtual Archive 4,
- ESA DISSHARM-LDS,
- DLR EO Web,
- EUMETSAT Catalogue,
- VITO Catalogue.

In addition, the following external systems are also made available through FedEO:

- CEOS WGISS Integrated Catalog,
- Alaska Satellite Facility²,
- NASA ECHO,
- ESA Sentinel-1 Scientific Data Hub³ (*)
- JAXA CATS-I⁴ (*)
- CNES THEIA (*)

(*) Expected soon.

The current list of Copernicus Contributing Missions (CCM) accessible through the ESA EO-DAIL is depicted below.

---

² https://www.asf.alaska.edu/
³ https://scihub.esa.int/
⁴ http://catsi.jaxa.jp/about-cats-i/
The table below gives an overview of the number of dataset series accessible as of April 2015.

<table>
<thead>
<tr>
<th>Dataset Series</th>
<th># Dataset Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESA EO-DAIL</td>
<td>61</td>
</tr>
<tr>
<td>ESA G-POD</td>
<td>390</td>
</tr>
<tr>
<td>ESA M2CS+LDS</td>
<td>32</td>
</tr>
<tr>
<td>ESA SuperSite Virtual Archive 4</td>
<td>20</td>
</tr>
</tbody>
</table>

**Figure 2: CCMs Accessible through ESA EO-DAIL**
2.3 FedEO Systems

There are two FedEO Clearinghouse instances you have as developer access to:

- FedEO Operational System: This is the currently operational system and is accessible to all users. It can be found at http://fedeo.esa.int.
- FedEO Test Environment: This is a test system area used by partners and FedEO developers to test before changes to the FedEO system go operational. It is currently located at http://geo.spacebel.be and will eventually become available at http://fedeo-test.esa.int.

2.4 Contact Information

The FedEO Clearinghouse is operated by the RSS team at ESRIN which can be contacted at RSS_TEAM@esa.int.

Feel free to contact the following persons for more information:

- FedEO Operations Team: giancarlo.rivolta@esa.int
- FedEO Catalogue Population and Test: andrea.della.vecchia@esa.int, yves.coene@spacebel.be
- FedEO Evolutions: philippe.mougnaud@esa.int
- HMA standardisation: pier.giorgio.marchetti@esa.int
- Coordination and international cooperation: mirko.albani@esa.int

(*) Expected soon.
(**) Can be enabled/disabled.

5 Products from 19 different “platforms” according to the Web site https://portal.asf.alaska.edu/api/.
3 FEDEO PARTNER GUIDELINES

FedEO aims to harmonise the interface with the data partner systems by proposing a harmonised interaction model for dataset series and datasets discovery. Data partners either support one of the already supported metadata models, or provide custom metadata in which case FedEO will allow its clients to either obtain this custom metadata or another metadata type FedEO was able to generate based on the custom metadata received from the data partner.

FedEO clients can use the \{sru:recordSchema\} parameter of its OpenSearch interface to obtain different supported metadata types embedded in the search response as explained in the FedEO Client Partner Guide section 3.3.3.

3.1 Metadata Models

3.1.1 Dataset Series Metadata

FedEO can cope with various types of dataset series metadata made available by Data Providers either online or offline. The preferred format for dataset series metadata is OGC 11-035r1 [RD.11]. It is a profile of ISO19139:2007 [AD.9] enriched with specific elements from the gmi namespace ISO19139-2:2012 [AD.10].

Examples are available online: e.g. all dataset series returned by http://fedeo.esa.int/opensearch/request/?parentIdentifier=EOP:ESA:FEDEO:COLLECTIONS are described using OGC 10-035r1. See also Appendix B for an example.

FedEO will convert the custom metadata to OGC 11-035r1 compliant metadata if sufficient metadata elements are available.

FedEO support staff can make available sample dataset series XML records for data partners to complete and return or prepare the metadata using information provided by Data Partners.

The following options are available for data partners:

- Provide dataset series metadata online using one of the supported Protocol Connectors (See section 3.3).
- Edit ISO19139 dataset series files offline based on metadata examples provided by FedEO. FedEO will then host the dataset series metadata on behalf of the data partner.
- Fill out a dataset series form (See Appendix A) and have FedEO support create the corresponding dataset series metadata records. FedEO will then host the dataset series metadata on behalf of the data partner.

The following metadata elements are of particular importance:

- The unique identifier of the dataset series. We recommend an identifier with the structure EOP:<organisation>:<series> or simply <series>. For instance EOP:MDA-GSI:RSAT2_SEGMENTS, EOP:SPOT:MULTISPECTRAL_10m, EOP:VITO:VGT_S10,
ER02_SAR_RAW.OP. The list of already reserved identifiers available in FedEO can be found in the <configInfo> section at http://fedeo.esa.int/opensearch/request/. This identifier is returned by FedEO in dataset series search responses as the <dc:identifier> element and is to be used in subsequent dataset searches as {eo:parentIdentifier} search parameter.

- The temporal extent of the dataset series. This information is used by FedEO to return the <dc:date> element in the Atom search response as per [RD.23]. It is typically used by clients to constrain the search period for which datasets may exist.

- The geographical extent of the dataset series.

- The satellite (platform) name. Ideally, provide the GCMD URI for the platform as well. For example “Sentinel-1” corresponds to http://gcmdservices.gsfc.nasa.gov/kms/concept/c7279e54-f7c1-4ee7-a957-719d6021a3f6.

- The instrument name. Ideally, provide the GCMD URI for the instrument as well. For example “ASAR” corresponds to http://gcmdservices.gsfc.nasa.gov/kms/concept/912c3308-23bc-4e12-b7fb-9d82e9fc5fe9.

### 3.1.2 Dataset Metadata

The use of the following dataset metadata formats by the data partners facilitates their integration in FedEO. In addition to these formats, data partners can also have their own custom format which can be considered for integration with some additional effort.

#### 3.1.2.1 OGC 10-157 r3 - EOP O&M Version 1.0

This format is defined in [RD.8] and is slightly different from [RD.9] which is the recommended dataset metadata format.

#### 3.1.2.2 OGC 10-157 r4 - EOP O&M Version 1.1

This format is defined in [RD.9] and is the recommended dataset metadata format. It allows for specific attributes for optical, radar, atmospheric, altimetry, limb looking, synthesis and systematic products.

---

6 [http://gcmd.nasa.gov/learn/keyword_list.html](http://gcmd.nasa.gov/learn/keyword_list.html)
3.1.2.3 OGC 06-080 - EO GML

This format is defined in [RD.2] and contains similar attributes as [RD.9] which is the recommended dataset metadata format.

3.1.2.4 ISO 19139


3.1.2.5 Dublin Core

A standard encoding schema for Dublin Core metadata is available at http://www.loc.gov/standards/sru/recordSchemas/dc-schema.xsd. It supports one or more of the following attributes:

- dc:title
- dc:creator
- dc:subject
- dc:description
- dc:publisher
- dc:contributor
- dc:date
- dc:type
- dc:format
- dc:identifier

---

7 http://dublincore.org/documents/dces/
3.1.2.6 Custom format

FedEO does also support custom metadata formats. Data partners can provide their metadata using their own XML, JSON, JSON-LD, RDF XML, Turtle or CSV (Comma-Separated-Values) formats.

FedEO dataset search responses will make available these custom formats as atom:links.

3.2 Interaction Model

FedEO provides a growing set of Connectors which aim to implement a common interaction model with the Data Provider backend systems. It is assumed that interactions between FedEO and the data partner infrastructure use the HTTP protocol.

3.2.1 Dataset Series Discovery (Optional)

The first step consists in retrieving dataset series metadata matching specific search criteria.

The dataset series metadata can be hosted by the data partner or by FedEO.

3.2.1.1 Data series metadata hosted by FedEO

If FedEO hosts the dataset series metadata, then all search parameters defined in the FedEO Client Partner Guide for the ISO Connector will be available.

3.2.1.2 Data series metadata hosted by Data Partner

If the data partner hosts his dataset series metadata, then the data partner is free to propose the set of search parameters supported by his catalog. This set is known by FedEO if the data provider implements a standard catalog protocol such as OGC 07-045 [RD.22] or OGC 13-084r2 [RD.10]. As a minimum, parameters equivalent to the following OpenSearch parameters are expected to exist in the interface provided by the data partner:

- searchTerms: to perform a free text search matching any metadata field including title, abstract, keywords etc.
- geo:uid: retrieve all available metadata for a given dataset series using a locally unique identifier.
- startIndex: start index of first result to be returned (used for paging of results).
- count: number of results to be returned (used for paging of results).
To offer the end-user a better search experience, it is also recommended to support the equivalent of the following search parameters as well and have this information available in the dataset series metadata:

- `eo:platform`: satellite name.
- `eo:instrument`: instrument short name.
- `eo:sensorType`.

The response format should at least contain the total number of results matching the query and the following information about the dataset series:

- Identifier
- Title
- Abstract
- Start Date (optional)
- End Date (optional)
- Keywords (optional)

If sufficient metadata elements are provided then FedEO will generate on-the-fly an ISO19139 metadata file for the dataset series to offer a harmonised metadata model to external clients.

If Start Date and End Date information for the dataset series is available, it will be used by FedEO to enrich the Dataset search OSDD for this dataset series with constraints for the `time:start` and `time:end` queryables using the Parameter extension [AD.16] as shown below.

**Example 1: Inclusion of time:start and time:end constraints in generated OSDD**

```xml
<param:Parameter name="startDate" value="{time:start}" min="0" minInclusive="2009-01-01T00:00:00Z"/>

<param:Parameter name="endDate" value="{time:end}" min="0" maxInclusive="2011-01-01T00:00:00Z"/>
```

Keywords (possibly with semantic annotations) which are provided will be automatically converted into the corresponding `atom:category` elements as defined in [RD.18].

**Example 2: Inclusion of atom:category in search response**

```xml
<entry>
```

---

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### 3.2.2 Dataset Discovery

The second step consists in retrieving dataset metadata which belong to a dataset series found in the previous step matching specific search criteria.

The data partner is free to propose the set of search parameters supported by his catalog. This set is often known by FedEO if the data provider implements a standard catalog protocol. As a minimum, parameters equivalent to the following OpenSearch parameters are expected to exist:

- **Spatial search**: providing for instance an area of interest as a bounding box.
- **Temporal search**: providing a time range which is to intersect with the start time / end time of individual datasets (i.e. products).
- **eo:parentIdentifier**: identifier of the dataset series to be searched.
- **geo:uid**: a locally unique product identifier which can be used to retrieve all available metadata for a given dataset (product), possibly in combination with the dataset series identifier.
- **startIndex**: start index of the first result to be returned.
- **count**: number of results to be retrieved.

The response format should at least contain:

- Total number of results matching the query
- Dataset identifier
- Start time, End time
- Geographical extent (i.e. footprint information)
- Platform name (optional)
- Instrument name (optional)
• Orbit number (optional)

It is highly recommended to include HTTP URL to (JPEG) thumbnail images, browse images (also called quicklooks) and possibly cloud masks for each dataset (product) in the metadata.

If the data provider provides these URL in the dataset metadata then FedEO will include these URL in the Atom search responses as shown below. FedEO, uses Atom link (rel="icon") and the “Media RSS Specification” [AD.17] to return this information inside Atom feeds.

**Example 3: Inclusion of Quicklook information**

```xml
<link href="http://geofuse.geoeye.com/static/browse/ikonos/2/kpms/2012/11/2012113010003790000011629261_0.jpg" rel="icon" type="image/jpeg"/>
<media:group>
  <media:content medium="image" type="image/jpeg" url="http://geofuse.geoeye.com/static/browse/ikonos/2/kpms/2012/11/2012113010003790000011629261_0.jpg">
    <media:category scheme="http://www.opengis.net/spec/EOMPOM/1.0">QUICKLOOK</media:category>
  </media:content>
</media:group>
```

**Example 4: Inclusion of Cloud mask information**

```xml
  <media:category scheme="http://www.opengis.net/spec/EOMPOM/1.0">CLOUD</media:category>
  <media:title type="plain">Cloud mask</media:title>
</media:content>
```

The scheme parameter reflects the thesaurus/codelist covering the various possibilities, e.g. the values allowed in the EOP O&M codelist for browse/BrowseInformation/type (THUMBNAIL, QUICKLOOK, ALBUM) and mask/MaskInformation/type (SNOW, CLOUD, QUALITY).

### 3.2.3 Online Data Access (Optional)

Allowing a client application access to the actual data products is an optional capability for which FedEO offers a number of alternatives.

#### 3.2.3.1 Product Viewing link provided in metadata (Optional)

If Data Partners can make available browse image URLs as WMS URLs, then FedEO will make these URL accessible in the Atom search responses and sophisticated catalog clients can exploit the WMS links to allow zooming in/out.

```xml
<media:group>
  <media:content url="http://eoos.pisa.intecs.it/DREAM/instance01/ows?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=$coordinates.getContainingBBOXFromPolygon($coordinates.wkt2oem($metadata.RDF_DataSet_spatial))&CRS=EPSG:4326&WIDTH=600&HEIGHT=600&">
```

---

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3.2.3.2 Product Download link provided in metadata (Optional)

Data Partners typically make available their data products for download on an online server at their Product Facilities through HTTP, FTP, SFTP or other protocols and possibly apply local authentication before end-users can download their product.

We recommend partners in such case to include the download URL in the dataset metadata record. FedEO will then extract this URL and include it in the corresponding Atom entry of the OpenSearch response as an atom:link “enclosure”.

```xml
<entry>
  <link href="http://archive.daac.asf.alaska.edu:80/L1.0/A3/ALPSRP206802580-L1.0.zip" length="470034678" rel="enclosure" title="Download" type="application/x-binary"/>
  ...
</entry>
```

3.2.3.3 Redirection to dedicated Web Page (Optional)

If Data Partners want users to be redirected to a custom Web page for dataset (product) download or ordering for a given dataset series, they can provide this fixed URL or the URI template\(^8\) taking two parameters corresponding to dataset series and product identifier respectively.

For instance: http://example.org/order.html{?parentIdentifier,uid} would be converted by FedEO to http://example.com/order.html?parentIdentifier=EOP\%3AVITO\%3AVGT_S10\&uid=AV2KRNS10__20130801F according to the rules defined in RFC6570.

FedEO will then return the information to clients in the following ways:

- As atom:link with relation “order” and type “text/html” in the <entry> of the dataset search response.
- As Resource Locator in the dataset series ISO19139 metadata returned by FedEO for this dataset series with gmd:function “order”.

3.2.3.4 Product Ordering service (Optional)

If Data Partners want client applications to be informed about the existence of an OGC 06-141 [RD.5] compliant ordering services for dataset (product) ordering for a given dataset series, they can provide the URL of the corresponding Capabilities document.

FedEO will then return the information to clients in the following ways:

- As atom:link with relation “order” and type “application/vnd.ogc.oseo.capabilities.response_xml” in the <entry> of the dataset search response.
- As Resource Locator in the dataset series ISO19139 metadata returned by FedEO for this dataset series with <gmd:function> “order”.

3.3 Supported Protocol Connectors

The current section contains material about the Configuration of the OpenSearch Gateway which is also available in the FedEO OSGW SCF Document (PDGS-FEDEO-OSGW-SPB-SCF-14-0646). It allows Data Providers to understand which minimum information is required by FedEO and will be extracted from their OSDD or Capabilities documents. It also provides information about the supported backend protocols.

3.3.1 OGC 06-131 – EOP EP of CSW

FedEO can connect directly to your OGC 06-131 catalog if a correct Capabilities document is available via HTTP GET. FedEO will extract the following information from this file:

- Location of the GetRecords and GetRecordById endpoints.
- Protocol binding for access: only <ows:HTTP><ows:Post> is allowed which is interpreted as a SOAP binding.
- List of supported dataset series from the <ows:OperationsMetadata> element in the Capabilities file as shown below.

Example 5: Extract of OGC 06-131 Capabilities Document

The endpoint can be added to the FedEO Gateway by the Administrator by adding the following section to the $OPENSEARCH_HOME/resource/conf.xml Configuration File:

**Example 6: Configuration file extract for OGC 06-131**
3.3.2 OGC 07-045 - ISO AP of CSW

FedEO can connect directly to your OGC 07-045 [RD.22] catalog if a correct Capabilities document is provided or accessible via HTTP GET. FedEO will extract the following information from this file:

- Location of the GetRecords and GetRecordById endpoints.
- Protocol binding: only <ows:HTTP><ows:Post> is allowed which is interpreted as a HTTP/Post binding

Example 7: Extract of OGC 07-045 Capabilities Document

```xml
<?xml version="1.0" encoding="UTF-8"?>
<csw:Capabilities version="2.0.2" xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:ows="http://www.opengis.net/ows"
xmlns:xlink="http://www.w3.org/1999/xlink">
  ...
  ...
  <ows:OperationsMetadata>
    ...
    <ows:Operation name="GetRecords">
      <ows:DCP>
        </ows:DCP>
      </ows:Operation>
    ...
    <ows:Operation name="GetRecordById">
      ...
    </ows:DCP>
  </ows:OperationsMetadata>
</csw:Capabilities>
```
The endpoint can be added to the FedEO Gateway by the Administrator by adding the following section to the $OPENSEARCH_HOME/resource/conf.xml Configuration File:

**Example 8: Extract of configuration file for OGC 07-045 endpoint**

```xml
<dcat:Dataset rdf:about="#EOP:ESA:REFERENCEDATA">
  <rdfs:label>ESA RSS Catalogue</rdfs:label>
  <dcat:distribution>
    <dcat:Distribution>
      <dcat:accessURL type="OGC 07-045" supportCollection="true" supportService="false" searchPriority="4">./resource/iso-capabilities.xml</dcat:accessURL>
    </dcat:Distribution>
  </dcat:distribution>
</dcat:Dataset>
```

The above configuration file defines the dataset series EOP:ESA:REFERENCEDATA, as valid FedEO {eo:parentIdentifier} value.

Several open-source implementations of OGC 07-045 exist, for instance:

- GeoNetwork\(^9\)

### 3.3.3 OpenSearch

Endpoints of an OpenSearch catalog can be added to the FedEO Gateway. However, OpenSearch catalogs exist in various flavours and all implement different portions of the related specifications OpenSearch 1.1 [AD.2], OGC 10-032r8 [AD.3] and OGC 13-026 [AD.4].

Several open-source implementations of OGC 13-026r5 exist which Data Partners can deploy, for instance:

- Earth Observation OpenSearch Catalog\textsuperscript{10}.
- RESTo\textsuperscript{11}

Data Partners implementing their own OpenSearch interfaces may use the following open-source conformance tests which run on the OGC TEAM Engine\textsuperscript{12}:

- Executable Test Suite for OGC OpenSearch Geo and Time Extensions (OGC 10-032r8)\textsuperscript{13}
- Executable Test Suite for OGC OpenSearch Earth Observation Extension (OGC 13-026r5)\textsuperscript{14}

The endpoint of an OpenSearch catalog can be added to the FedEO Gateway by the Administrator by following the section to the Configuration File:

**Example 9: Extract of configuration file for an OpenSearch endpoint**

```xml
<dcat:Dataset rdf:about="#EOP:ESA:GPOD-EO">
  <!-- Label shown in Explain document. -->
  <rdfs:label>ESA G-POD</rdfs:label>
  <!-- Fixed dataset series metadata fields -->
  <!-- applicable to all records in the catalog -->
  <!-- represented by this dcat:Dataset. -->
  <dc:type>collection</dc:type>
  <dc:publisher>ESA</dc:publisher>
  <eo:organisationName>ESA</eo:organisationName>

  <dcat:distribution>
    <dcat:Distribution>
      <dcat:accessURL ../ type="OGC 10-032">./resource/grid-eo-catalog-esrin-esa-int.osdx</dcat:accessURL>
    </dcat:Distribution>
  </dcat:distribution>
</dcat:Dataset>
```

The above configuration file defines the dataset series EOP:ESA:GPOD-EO, as valid FedEO `{eo:parentIdentifier}` value.

\textsuperscript{10} https://github.com/IntecsSPA/eoos
\textsuperscript{11} https://github.com/jjrom/resto2/
\textsuperscript{12} https://github.com/opengeospatial/teamengine
\textsuperscript{13} https://github.com/opengeospatial/ets-osxgeotime10
\textsuperscript{14} https://github.com/opengeospatial/ets-osxeo10
FedEO can connect directly to your OpenSearch catalog if a correct OSDD document is available via HTTP GET which complies with OGC 10-032r8 [AD.3] and OGC 13-026r5 [AD.4]. FedEO will extract the following information from this file:

- URL template of the OpenSearch endpoint (for dataset series) returning Atom responses: i.e. `<Url rel="collections" template="http://...." type="application/atom+xml"/>`. Is only required if the endpoint supports dataset series search.

- URL template of the OpenSearch endpoint (for datasets) returning Atom responses: i.e. `<Url rel="results" template="http://...." type="application/atom+xml"/>`. Is only required if the endpoint supports dataset search.

- Optionally: List of supported dataset series from the `<param:Parameter value="{eo:parentIdentifier}"/>` element in the OSDD file as shown below.

The dataset series which are searchable via this endpoint are extracted by FedEO from the OSDD description in which they can also be described using the Parameter extension [AD.16] as shown below.

**Example 10: Extract of OSDD Document for OpenSearch Dataset catalog**

```xml
<opensearchdescription>
  <Url rel="collection" template="http://...." type="application/atom+xml"/>
  <Url rel="results" template="http://...." type="application/atom+xml"/>
  ...  
  <param:Parameter name="parentIdentifier" value="{eo:parentIdentifier}"/>
    <param:Option label="ASA_IM__0P" value="ASA_IM__0P"/>
    <param:Option label="TLM_MIRA0_" value="TLM_MIRA0_"/>
  </param:Parameter>
</Url>
  ...  
</opensearchdescription>
```

The above OSDD file defines the dataset series `ASA_IM__0P` and `TLM_MIRA0_` as valid FedEO `{eo:parentIdentifier}` values which can be used for dataset search without a previous series search. If only a two-step search is required, then these identifiers do not need to be defined separately.

For OpenSearch requests, the dataset series identifier of the dataset series catalog (in this case `EOP:ESA:GPOD-EO`) can be used as prefix to distinguish dataset series with identical names belonging to different dataset series catalogs, e.g. `EOP:ESA:GPOD-EO:ASA_IM__0P`. 
3.3.4 **OGC 13-084r2 – I15 EP of CSW**

FedEO can connect to your OGC 13-084r2 [RD.10] catalog if a correct Capabilities document is provided or made accessible via HTTP GET. FedEO will extract the following information from this file:

- Location and binding for the GetRecords endpoint. Only `<ows:HTTP><ows:Post>` is allowed which is interpreted as a SOAP binding

**Example 11: Extract of OGC 13-084r2 Capabilities Document**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<csw:Capabilities version="2.0.2" xmlns:ows="http://www.opengis.net/ows">
...
<ows:Operation name="GetRecords">
  <ows:DCP>
    <ows:HTTP>
    </ows:HTTP>
  </ows:DCP>
...
</ows:Operation>
...
</ows:OperationsMetadata>
...
</csw:Capabilities>
```

The endpoint of an OGC 13-084r2 compliant (dataset series) catalog can be added to the FedEO Gateway by the Administrator by adding the following section to the `$OPENSEARCH_HOME/resource/conf.xml` Configuration File:

**Example 12: Extract of configuration file for OGC 13-084r2 endpoint**

```xml
<dcat:Dataset rdf:about="#EOP:ESA:FEDEO:COLLECTIONS">
  <!-- Label shown in Explain document. -->
  <rdfs:label>FEDEO I15 Collection Catalogue</rdfs:label>
  <!-- Fixed dataset series metadata fields -->
  <!-- applicable to all records in the catalog -->
  <!-- represented by this dcat:Dataset. -->
  <dc:type>collection</dc:type>
```
The above configuration file defines the dataset series EOP:ESA:FEDEO:COLLECTIONS, as valid FedEO {eo:parentIdentifier} value.

Open-source implementations of OGC 13-084r2 exist, for instance:

- Buddata\textsuperscript{15}.

### 3.3.5 OGC CSW (CWIC-style)

FedEO can connect to a CWIC-style CSW catalog if a correct Capabilities document is available via HTTP GET. FedEO will extract the following information from this file:

- Location of the GetRecords and GetRecordById endpoints.
- Protocol binding: only \texttt{ows:HTTP}<\texttt{ows:Post} is allowed which is interpreted as a HTTP/Post binding
- List of supported dataset series from the \texttt{<cwic:FederationMetadata>} element in the Capabilities file as shown below.

#### Example 13: Extract of CWIC-Style CSW Capabilities Document

```xml
<ows:OperationsMetadata>
  <ows:Operation name="GetRecords">
    <ows:DCP>
      . . .
    </ows:DCP>
  </ows:Operation>
  . . .
</ows:OperationsMetadata>
```
The above Capabilities file defines the dataset series LANDSAT_ETM_PLUS, LANDSAT_MSS and LANDSAT_TM as valid FedEO {eo:parentIdentifier} values.

The endpoint can be added to the FedEO Gateway by the Administrator by adding the following snippet to the $OPENSEARCH_HOME/resource/conf.xml Configuration File:

```xml
<dcat:Dataset>
  <!-- Snippet goes here -->
</dcat:Dataset>
```
3.3.6 Custom HTTP-based API

Other API (over HTTP or HTTPS) can be considered on a case by case basis. The data partner is free to propose response formats (including Atom, RSS, RDF or custom XML) and can offer metadata in various formats (EOP O&M, EO GML, ISO19139, Dublin Core, .CSV, RDF or custom XML) as long as they can be mapped on the Interaction Model presented in section 3.2.
4 DATA PARTNER INTEGRATION PROCEDURE

The current section summarizes the steps to be undertaken to add a new Data Provider or Data Provider dataset series to the FedEO Clearinghouse.

4.1 Step-1: Data Partner provides access to Dataset catalog

The Data Partner provides on-line access to his dataset catalog which supports a standard protocol (See Section 3.3) or has a custom HTTP-based interface.

4.2 Step-2: Send endpoint to ESA FedEO team for integration

Please provide:

- Examples of successful search requests (including area of interest / time period).
- List of dataset series identifiers i.e. {eo:parentIdentifier}.
- List of supported search parameters if different from formal (OGC) specifications and actual values, including search parameter to be used to pass dataset series identifier (e.g. parentIdentifier) in request.
- Optional: mechanism to discover list of allowed dataset series identifiers automatically.

4.3 Step-3: Data Partner provides dataset series metadata

The Data Partner provides ISO19139 files as described in 3.1.2.4 (See example in Appendix B) or provides the necessary information to prepare such files using the forms included in Appendix A.

The dataset series metadata files can be created with support of the FEDEO support team (e.g. through answers to a questionnaire). Sample metadata files can be provided as well.

The FedEO support team can also help adding semantic annotations in the dataset series metadata.

The way the administrator is to insert dataset series metadata in the FedEO Dataset Series catalog is explained in the FEDEO Software Configuration File (PDGS-FEDEO-SPB-SCF-14-0645) section 8.4.
4.4 Step-4: FedEO team provides test endpoint

After integrating the Data Partner catalog in the FedEO test environment, the FedEO support team will make available the OpenSearch endpoint to the Data Partner for verification and feedback. A list of findings, issues to be resolved to improve integration can be provided as well.
APPENDIX A  DATASET SERIES FORM

A.1 Organisation Form

This form is to be filled once for each data partner. It collects the dataset series properties common to all dataset series of the data partner.

<table>
<thead>
<tr>
<th>Identification Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point of Contact</td>
<td></td>
</tr>
<tr>
<td>Organisation Name (M)</td>
<td>ESA</td>
</tr>
<tr>
<td>Phone</td>
<td></td>
</tr>
<tr>
<td>Fax</td>
<td></td>
</tr>
<tr>
<td>Street / Number</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>Postal Code</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td></td>
</tr>
<tr>
<td>Web site</td>
<td><a href="http://www.esa.int">http://www.esa.int</a></td>
</tr>
<tr>
<td>Role</td>
<td>originator (default)</td>
</tr>
</tbody>
</table>

A.2 Dataset Series Form

This form is to be filled for each dataset series for which dataset series metadata is to be prepared and hosted by FedEO on behalf of the data partner. It collects the main dataset series properties required to generate OGC 11-035r1 [RD.11] compliant dataset series metadata.

<table>
<thead>
<tr>
<th>Identification Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier (M)</td>
<td>EOP:VITO:VGT_S10</td>
</tr>
<tr>
<td>Title (M)</td>
<td></td>
</tr>
<tr>
<td>Abstract (M)</td>
<td></td>
</tr>
<tr>
<td>Temporal extent</td>
<td>Start date (M) 2014-04-03T00:00:00 Z</td>
</tr>
<tr>
<td>End date</td>
<td>unconstrained (default)</td>
</tr>
<tr>
<td>Geographical constraints</td>
<td>West (longitude) (M) -180</td>
</tr>
<tr>
<td></td>
<td>East (longitude) (M) 180</td>
</tr>
<tr>
<td></td>
<td>South (latitude) (M) 90</td>
</tr>
<tr>
<td><strong>Keywords (1)</strong></td>
<td>North (latitude) (M)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Satellite / Platform (1)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Instrument short name (1)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sensor type (OPTICAL, RADAR, ...)</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Distribution Information**

<table>
<thead>
<tr>
<th><strong>Format</strong></th>
<th>GEOTIFF, ZIP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online Resource 1</strong></td>
<td>e.g. URL of ordering Web page.</td>
</tr>
<tr>
<td><strong>Online Resource 2</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Data Quality Information**

<table>
<thead>
<tr>
<th><strong>Lineage (free text)</strong></th>
<th></th>
</tr>
</thead>
</table>
APPENDIX B  DATASET SERIES METADATA EXAMPLE

Data Partners can download example ISO19139 metadata files from FedEO. All metadata returned by http://fedeo.esa.int/opensearch/request/?parentIdentifier=EOP:ESA:FEDEO:COLLECTIONS are described using OGC 10-035r1.

A complete example is included below.

Example 14: Dataset Series Metadata file

```xml
<?xml version="1.0" encoding="utf-8"?>
  <gmd:fileIdentifier>
    <gco:CharacterString>EOP:ESA:ESA.EECF.ENVISAT_MER_FR_xS</gco:CharacterString>
  </gmd:fileIdentifier>
    <gmd:LanguageCode codeListValue="eng"/>
  </gmd:language>
    <gmd:MD_ScopeCode codeListValue="series"/>
  </gmd:hierarchyLevel>
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:organisationName>
        <gco:CharacterString>ESA/ESRIN</gco:CharacterString>
      </gmd:organisationName>
      <gmd:positionName>
        <gco:CharacterString>Earth Observation helpdesk</gco:CharacterString>
      </gmd:positionName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:address>
            <gmd:CI_Address>
              <gmd:electronicMailAddress>
                <gco:CharacterString>eohelp@eo.esa.int</gco:CharacterString>
              </gmd:electronicMailAddress>
            </gmd:CI_Address>
          </gmd:address>
        </gmd:CI_Contact>
      </gmd:contactInfo>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <gmd:dateStamp>
    <gco:Date>2009-09-02</gco:Date>
  </gmd:dateStamp>
  <gmd:metadataStandardName>
    <gco:CharacterString>ISO19115</gco:CharacterString>
  </gmd:metadataStandardName>
  <gmd:metadataStandardVersion>
    <gco:CharacterString>2005/Cor.1:2006</gco:CharacterString>
  </gmd:metadataStandardVersion>
</gmi:MI_Metadata>
```
The Medium Resolution Imaging Spectrometer (MERIS) is one of the instruments aboard the Environmental Satellite ENVISAT. The primary mission of MERIS is the measurement of sea colour in the oceans and in coastal areas. Knowledge of the sea colour can be converted into a measurement of chlorophyll pigment concentration, suspended sediment concentration and of aerosol loads over the marine domain. MERIS is also capable of retrieving cloud top height, water vapour total column, and aerosol load over land. Some examples of specific MERIS applications can be found [here](#). From this collection you may order products of the following types: - Level 1b Full Resolution (MER_FR__1P) - Level 2 Full Resolution (MER_FR__2P)
64Via Galileo Galilei CP.

64Frascati

6400044

64Italy

eohelp@eo.esa.int

http://www.earth.esa.int

Geology

Land cover

GEMET - INSPIRE Themes, Version 1.0

2008-06-01

Publication
Science Keywords > Earth Science > Spectral/Engineering > Visible Wavelengths > Visible Imagery

The conditions of data distribution depend on the Category of use the data products into:

1. use: Comprises data which are for research and applications,
research on long term issues of
System science, research and
in preparation for future
use and ESA internal use. ESA
Category 1 use data either at
costs or free of charge.

2 use: Comprises all other data
do not fall into Category 1 use,
operational and commercial data.
2 use data are provided by
Entities appointed by ESA.
The Medium Resolution Imaging Spectrometer (MERIS) (more info here) is one of the instruments aboard the Environmental Satellite ENVISAT (more info here). The primary mission of MERIS is the measurement of sea colour in the oceans and in coastal areas. Knowledge of the sea colour can be converted into a measurement of chlorophyll pigment concentration, suspended sediment concentration and of aerosol loads over the marine domain.
MERIS is also capable of retrieving cloud top height, water vapour total column, and aerosol load over land. Some examples of specific MERIS applications can be found here. From this collection you may order products of the following types:
- Level 1b Full Resolution (MER_FR_1P)
- Level 2 Full Resolution (MER_FR_2P)