

Heterogeneous Mission Accessibility - Follow-On - Online Data Access (HMA-FO_ODA)

Technical Specification (TS) - Software Requirements Specification (SRS)

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Authors: C.Schiller, S.Krause, S.Meissl, S.Smolders
Responsible for Document: C.Schiller

Prime Contractor



Thurngasse 8/4
1090 Wien
Österreich / Austria

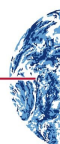
office@eox.at
www.eox.at

Subcontractors



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BIC BAWAATWW

Registered Vienna
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FN 312068z
UID ATU64265057

Approved by	Organisation	Date	Signature
Gerhard Triebnig	EOX	2010-11-26	
Pier-Giorgio Marchetti	ESA		

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Distribution List:

Authors: All
EOX: G. Triebnig
ESA: P.G. Marchetti
GIM: S. Desender
SPOT: D. Giacobbo, P.Merigot
Spacebel: Y. Coene

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1 Introduction

This document defines the software requirements for the HMA-FO Reference Implementation of the Heterogeneous Mission Accessibility – Follow On – Task 3, Online Data Access (HMA-FO_ODA) project, demonstrating the usage of a WCS 2.0 server applying the WCS Earth Observation Application Profile (WCS EO AP) for the online access to EO data, exploiting the characteristic information inherent in EO products. The presented software requirements include the needs for the enhancement of an Open-Source Software package to implement WCS 2.0 and the WCS EO AP.

The HMA-FO Reference Implementation (hereafter also called ODA system) shall demonstrate the following main functionalities:

- provide online access to EO datasets
- allow the subsetting of EO datasets
- allow the reprojection of EO dataset
- allow to access the EO datasets in different formats
- provide metadata for accessed EO datasets
- utilize OGC's WCS 2.0 standard
- utilize OGC's WCS EO AP (in its current draft version)
- prove the suitability of Open Source software tools

The combination of WCS 2.0 and WCS EO shall benefit satellite data providers, data refiner, and user alike by tearing down barricades hindering the online access to EO data. The easy and direct delivery of coverages, based on user requirements should be a commendable target.

This document (HMA-FO_ODA-TS-SRS_EOX) represents the Technical Specification (TS) - Software Requirements Specification (SRS) for the HMA-FO_ODA project and is the result of the work performed under the ESA ESRIN/Contract No. 22507/09/I-LG.

2 Applicable and Reference Documents

2.1 Applicable Documents

- [AD1] ECSS Standard: Space Engineering – Software, Ref. ECSS-E-ST40C, 6 March 2009
- [AD2] ECSS Standard: Space product assurance – Software product assurance, Ref. ECSS-Q-ST-80C, 6 March 2009
- [AD3] HMA-FO_ODA Requirements Baseline Document - Software System Specification (HMA-FO_ODA-RB-SSS_EOX, v1.4, 2010-11-03)
- [AD4] HMA-FO_ODA Requirements Baseline Document – Technical Note (HMA-FO_ODA-RB-TN_EOX, v1., 2010-05-27)
- [AD5] OGC 09-146r1, GML Application Schema Coverages , version 1.0.0, 2010-09-17
- [AD6] OGC 09-110r3, WCS Interface Standard: Core, version 2.0.0, 2010-09-15
- [AD7] OGC 09-147r1, Web Coverage Service 2.0 Interface Standard - KVP Protocol Binding Extension, version 1.0.0, 2010-09-17
- [AD8] OGC 09-148r1, Web Coverage Service 2.0 Interface Standard - XML/POST Protocol Binding Extension, version 1.0.0, 2010-09-17
- [AD9] OGC 09-149r1, Web Coverage Service 2.0 Interface Standard - XML/SOAP Protocol Binding Extension, version 1.0.0, 2010-09-17
- [AD10] OGC 09-153r1, WCS 2.0 Overview: Core and Extensions, Best Practice, version 1.0.0, 2010-04-14
- [AD11] OGC 07-118r7, User Management Interfaces for Earth Observation Services, version 0.3.1, 2010-07-08
- [AD12] OGC 07-140, OGC WCS 2.0 Application Profile - Earth Observation, v.0.1.0, 2010-10-27
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- [AD14] Invitation to Tender ESRIN/AO/1-5949/09/I-LG – HMA Follow on activities, Frascati, 19th of January 2009
- [AD15] OGC 06-131r6, Catalogue Services Specification 2.0, Extension Package for ebRIM Application Profile:, Earth Observation Products, version 0.2.4, 2009-05-07
- [AD16] OGC 07-038, Cataloguing of ISO Metadata CIM using the ebRIM profile of CS-W, Version 0.1.8 , 2007-11-21
- [AD17] OGC 06-141r2, Ordering Services for Earth Observation Products, v0.9.5, 2010-01-28, 180p
- [AD18] OGC 06-126r2, Compliance Test Language (CTL), version 0.6, 31/03/2009

- [AD19] OGC 06-080, GML Application Schema for EO Products, Version 0.9.3, 2008-07-21
- [AD20] OGC 07-011 The OpenGIS Abstract Specification Topic 6, Schema for coverage geometry and functions.

2.2 References

- [RD1] <http://www.mapserver.org/>, MapServer Homepage
- [RD2] <http://geoserver.org/display/GEOS/Welcome>, GeoServer Open Source
- [RD3] <http://www.deegree.org/>, deegree Homepage
- [RD4] <http://www.unidata.ucar.edu/projects/THREDDS/>, THREDDS Data Server Homepage
- [RD5] <http://www.osgeo.org/>, OSGeo Homepage
- [RD6] <http://www.osgeo.org/node/812>, News MapServer Incubation Graduation
- [RD7] <http://mapserver.org/introduction.html>, MapServer Introduction
- [RD8] <http://www.swig.org/>, SWIG Homepage
- [RD9] <http://www.python.org/>, Python Homepage
- [RD10] <http://svn.osgeo.org/mapserver/trunk/>, MapServer development source (svn)
- [RD11] <http://subversion.tigris.org/>, Subversion Homepage
- [RD12] <http://trac.osgeo.org/mapserver/>, MapServer issue tracker (trac)
- [RD13] <http://trac.edgewall.org/>, Trac Homepage
- [RD14] <http://www.mapserver.org/community/lists.html>, MapServer mailings lists
- [RD15] <http://www.gnu.org/software/mailman/>, Mailman Homepage
- [RD16] <http://www.mapserver.org/community/irc.html>, MapServer IRC
- [RD17] <http://sourceforge.net/>, SourceForge
- [RD18] <http://code.google.com/>, Google Code
- [RD19] <http://zeus.pin.unifi.it/projects/wcsClientLite/>, WCS Client of the University of Florence
- [RD20] HMA Operational Scenario Technical Note, Issue 1.8, HMA-TN-ASU-EN-0001_1.8.pdf, 2007, 177p.
- [RD21] HMA Requirement Baseline Document, HMA-RS-ASU-SY-0001, 1.6
- [RD22] OGC 06-042, OpenGIS Web Map Service (WMS) Implementation Specification,

version 1.3

- [RD23] OGC 07-063r1, OpenGIS Web Map Services – Application Profile for EO Products, Best practice, version 0.3.3, 2009-11-05
- [RD24] GSC Data Access System Operational Scenarios for GMES contributing Missions, ESA, GMES-GSEG_EOPG-TN-08-0005, 2008/05/27

3 Terms, definitions and abbreviated terms

AP	Application Profile
CDS	Coordinated Data access System (GSCDA)
EO	Earth Observation
EP	Extension Package
ESA	European Space Agency
GDAL	Geospatial Data Abstraction Library
GMES	Global Monitoring for Environment and Security
GML	Geographic Markup Language (OGC)
GSCDA	GMES Space Component - Data Access
HMA	Heterogeneous Mission Accessibility
HMA-FO	HMA – Follow On
ICD	Interface Control Document
KVP	Key-Value Pair
HMI	Human Machine Interface
ODA	Online Data Access
ODA system	HMA-FO Reference Implementation for Online Data Access utilizing WCS 2.0 and the WCS EO AP
OGC	Open Geospatial Consortium
OGR	OGR Simple Features Library
OSGeo	Open Source Geospatial Foundation
Reference Implementation	A reference implementation is a fully functional implementation of a specification in reference to which other implementations can be evaluated.
RB	Requirements Baseline
SOAP	Simple Object Access Protocol,
SSE	Service Support Environment
TN	Technical Note
TS	Technical Specification
TS-SRS	Technical Specification- Software Requirements Specification
WCPS	Web Coverage Processing Service (OGC)
WCS	Web Coverage Service (OGC)
WCS EO AP	Web Coverage Service Earth Observation Application Profile
WCS-T	Web Coverage Service – Transactional (OGC)
WCTS	Web Coordinate Transformation Service (OGC)
WMS	Web Mapping Service(OGC)
WPS	Web Processing Service (OGC)
XML	Extended Markup Language

4 Software overview

This section describes the function and purpose of the HMA-FO Reference Implementation for the Online Data Access System (ODA system) providing also the context in which it is used and the first level architectural decomposition.

4.1 Function and purpose

This section describes the function and purpose of the software system and of the components which will be used to build it.

WCS 2.0 introduces a modularized concept. A rather slender core specification [AD6] can be enlarged by developing extensions for specialized functionalities. Such extensions may represent special data models, file format encodings (e.g. GML [AD5], GeoTIFF [AD13]; Jpeg2000 , NetCDF), service models, projection regulations (e.g. CRS, scaling), protocols (e.g. GET/KVP [AD7], POST/XML [AD8], XML/SOAP [AD9]), or usability modules (e.g. multi-linguality).

In Figure 1 an overview of the relationships between the WCS 2.0 Core and the WCS extensions is presented. Since not all needed extension for the WCS 2.0 will be available as official standards by the end of the HMA-FO project it is intended that, for the implementation, the parts which are missing in the current WCS 2.0 specification will be based on corresponding parts of WCS 1.1 and 1.0, assuming that there will be no major changes (e.g. for Coverage format encoding, GeoTIFF, EPSG based CRS, and Scaling & Interpolation) within WCS 2.0.

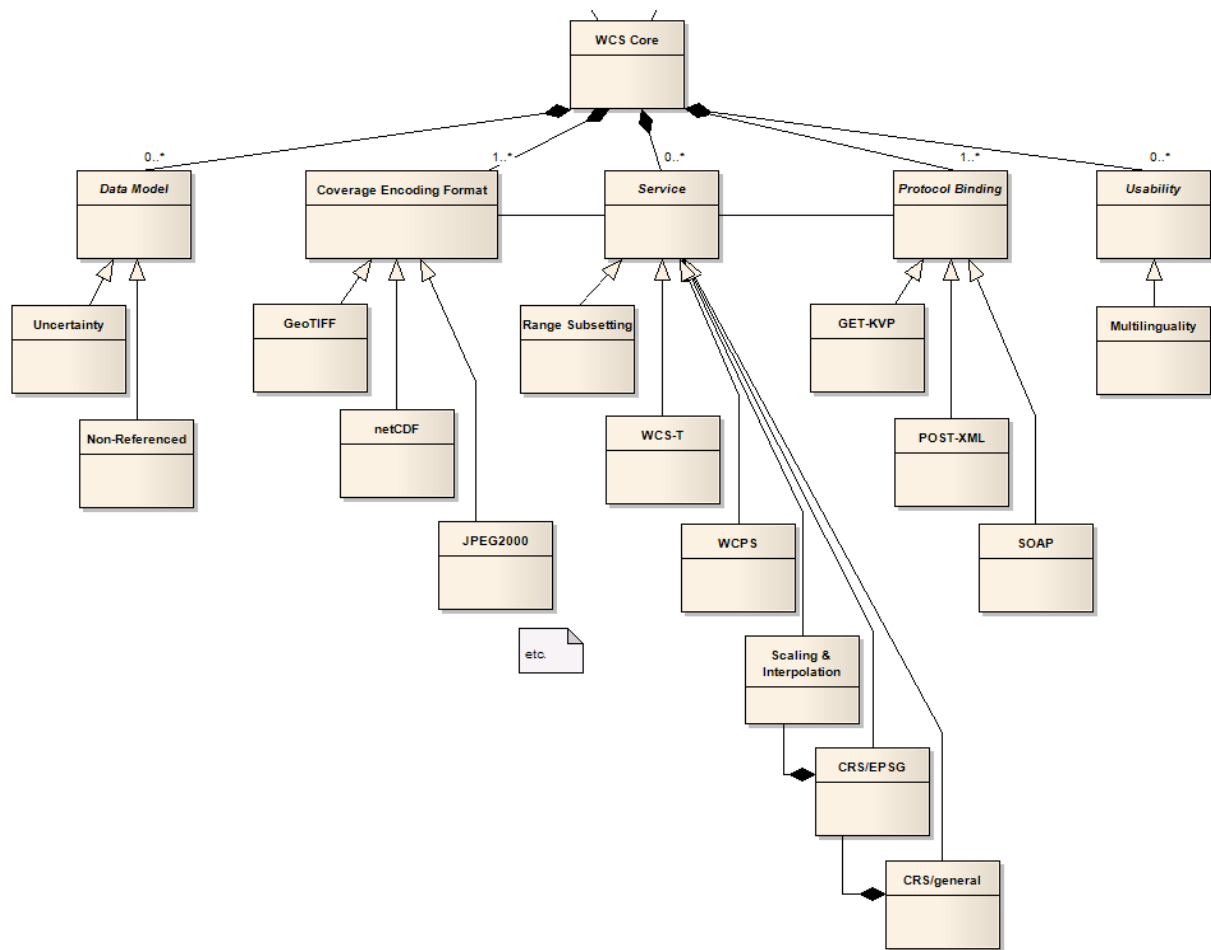


Figure 1: WCS 2.0 Overview - Core and Extensions

As described in the WCS EO AP [AD12] besides the Core at least one protocol extension (e.g. GET/KVP or SOAP), at least one coverage format encoding (GeoTIFF, NetCDF, or JPEG2000) needs to be supported.

Figure 5 shows the context where the ODA system (HMA-FO Reference Implementation) is placed and where entities having a relationship with it.

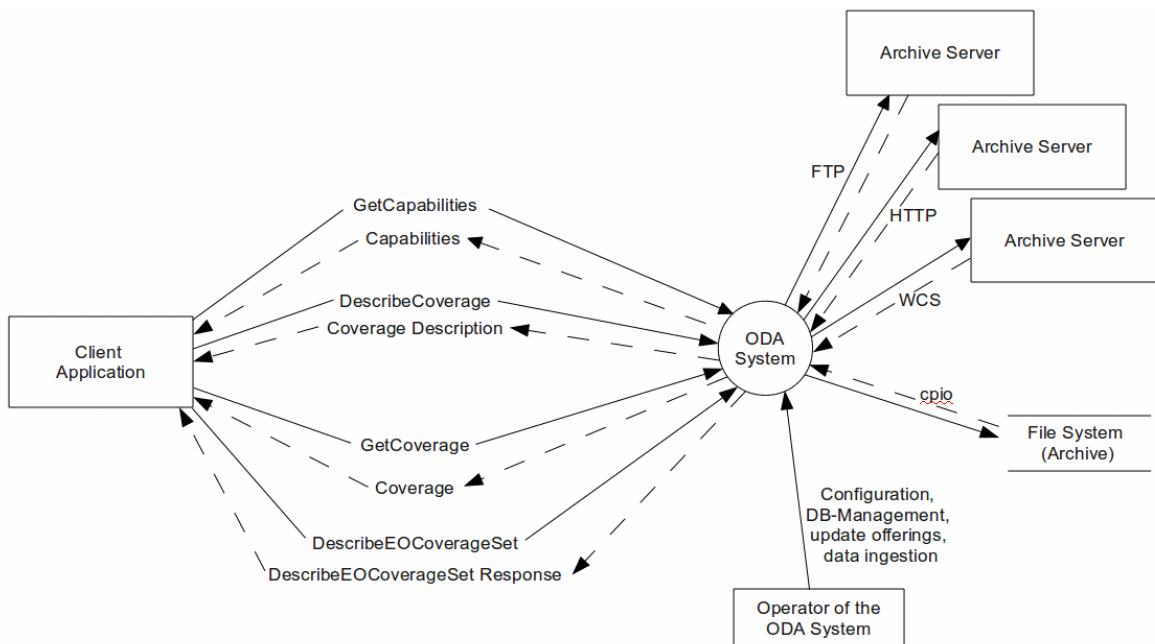


Figure 2: ODA system (Reference Implementation) Context Diagram

As shown in Figure 5 the ODA system interacts with the following entities:

- WCS Client application, able to send WCS 2.0 [AD6] and WCS EO AP [AD12] compliant request and handle the responses correctly.
- File System containing the datasets (Archive). This represents the possibility that a file system is directly connected (e.g. via NFS).
- Archive Server, these represent external Archives which can be accessed utilizing different protocols to access the datasets
- Operator of the ODA system is in charge of the operation and configuration of the system and for updating the dataset offerings, as well as for data ingestion into the ODA systems internal data storage.

The interfaces for communication between the listed components and entities are:

- Client Application vs. ODA system
 - WCS 2.0 [AD6] and WCS EO AP [AD12] act as ICD which define the request and responses available
 - The User Management Interface [AD11] is not mentioned in the above diagram since for the HMA-FO Reference Implementation, described in this

document, it shall not be applied.

- ODA system vs. Archive Server
 - To access external Archive Servers interfaces for FTP, HTTP, or WCS protocol are provided for communication and data access
- ODA system vs. File System
 - The ODA system also foresees that datasets are available on an internal or external File System which may be accessed by calls directly to the Operating System (e.g. cpio).
- Operator vs. ODA system
 - The Operator is in charge for the operation, configuration, and the DB-management of the ODA system. In addition, dataset may be ingested into an inherent data storage.

4.2 Environmental Considerations

This section describes the physical, hardware operating environment of the target system.

For the targeted Reference Implementation demonstrating the applicability of a WCS in combination with the WCS EO AP for enhanced online data access to EO data holdings no special hardware requirements are postulated.

4.2.1 ODA System server

A low-end server system with a broadband Internet connectivity should be sufficient. Requirements for the memory equipment of the server are moderate (e.g. 4 to 8GB). However, it has to be stated that the system has to process large amounts of data and therefore increased memory resources will result in shorter processing times.

Hard disk storage requirements are mainly for the operating system, the WCS server software and a geo-enabled database. The Reference Implementation scenario is based on the assumption that the test data sets are not stored directly on the system but are accessed through a network connection (TBC) providing a more realistic scenario. A direct storage of the test data set on the system in question is, however, possible.

For performance reasons a RAID-1 (or RAID-10) is recommended, providing improved access speed for reading operations and redundancy for stability.

Hardware resources:

- CPU: low-end server machine, x86 based PC
- RAM: 4 to 8 GB
- Graphic Adapter: no specific needs

- Disks: RAID-10 Array with a "hot spare" (size depending on test data set storage location - TBD)

Software resources:

- Operating System: Linux, preferentially Debian lenny/squeeze/sid (or Ubuntu)
- Apache HTTP server $\geq 2.2.0$
- MapServer 5.6.5
- PostgreSQL ≥ 8.1 & PostGIS extension $\geq 1.3.0$
- Django Framework ≥ 1.2 (also including GeoDjango)
- GDAL/OGR ≥ 1.4
- Python 2.6
- mod_wsgi 3.3
- various libraries like libxml2, libtiff, libgeotiff, etc.

For the Reference Implementation system, no special considerations on the operating environmental are required.

The final decision on which physical hardware this installation will be hosted will be taken together with the ESA Technical Officer during the project.

However, we propose to install the server software at two different locations to:

- demonstrate the interoperability of the solution;
- simulate real life scenarios where two servers talk to each other (see e.g. HMA-FO_ODA-RB-SSS_EOX Use cases)

4.2.2 WCS client Software

We recommend the following minimal hardware configuration for running the WCS client application

- CPU: 3.7 GhZ dual Core
- RAM: 4 GB
- Disk Size 70GB RAID

The following auxiliary software should be installed on the machine before deploying the WCS client war file

- OS: Windows, Solaris or Linux (CentOS or Debian or equivalent – both 32 & 64 bits versions supported)
- Servlet container (e.g. Tomcat 6)
- JDK 6
- JAI: JAI version 1.1.3 and JAI imageIO 1.1.0
- RDBMS like Oracle or PostGreSQL/PostGIS for storing the map configurations

- GDAL Version 1.4.0

4.3 Relationship with other Systems

This section describes the relationship of the ODA system to other systems.

In general the ODA system will be designed to work as a stand-alone system. This means that any Web Service shall be able to utilize the ODA functionality provided that it follows the standards defined for the WCS 2.0 and WCS EO AP.

However, several relationships with other systems are envisaged, especially for the usage of the HMI client interface planned for the demonstration system. The following is the list of systems having relationships with the ODA system. However, they are not prerequisites for the general functioning of the ODA system.

WCS Client

For the HMA-FO Reference Implementation the WCS Client represents the HMI (Human Machine Interface) between the ODA system and a human user [AD14]. The SSE WebMapView, forms a logical choice for a demonstration client platform as the ESA SSE portal with its integrated WebMapView already acts as a client to OGC Web Map-, Web Feature-, Web Coverage-, and Sensor Observation Services. As agreed during the previous milestone reviews, the WCS 2.0 and WCS EO AP client will be developed on the basis of the latest WebMapView developments by GIM.

EO Catalogs

The requirements state interaction with EO catalogs. However, the interactions present in the Reference Implementation are not in the form of full catalog queries or direct request by the ODA system, but rather represent a limited demand of metadata for offering coverages in the WCS. The required range of functions are part of the ODA Admin functionalities covering DB Management, update data and metadata ingestion as well as configuration of datasets.

Ordering & Programming Gateway (OPGW)

Interactions of ODA with the HMA Ordering & Programming Gateway is limited. When a user issues a *DescribeResultAccess* to the OPGW it provides the user with the *ResultsAccess* information. This *ResultsAccess* information is a valid WCS call prepared as URL. It contains all the information and processing parameters necessary to process the data and to provide access to the final product.

HMA Security Gateway (SGW)

For the HMA Reference Implementation the User Management Interface [AD11] will not be considered.

Note: For an operational system, however, the ODA system shall interact with the HMA security system in such way that it accepts and honors Tokens and will act accordingly.

An operational ODA system, however, shall not manage access rules by itself or check if a user is restricted by certain access limitations (AOI, layers, timeframe, resolution, etc.). It will merely enforce the rules. The actual check for access restrictions has to be done elsewhere (e.g. SGW)

4.4 Constraints

None are foreseen for the HMA-FO Reference Implementation

5 Requirements

5.1 General

The Requirements Identifiers basically corresponds to the Identifiers used in the RB-SSS [AD3], allowing easy traceability of the requirements. To ensure differentiation "SR_" is put in front of the Identifiers (i.e. SR_ODA_GEN_010 --> SR_SR_ODA_GEN_010

The requirements in this document follow a common table format with the following notation.

Identifier	Description	Val.M.	Sig.
SR_ODA_GEN_010	Here is the description of the requirement.	D	E-Y

Identifier Unique identifier composed of
 "SR_" Software Requirements
 "SR_ODA_" Online Data Access
 Section Code e.g. GEN, IF
 3-digit Number Reference Number within Section (initially increasing by 10, to allow for later insertion in case of missing requirements).

Val.M. Validation Method:
 D Demonstration: This verification method may be used when actual conduct can verify achievement of requirements such as service and access, and when the requirements have been implemented.
 T Test: A requirement may be verified by test alone if the form of the specification is such that the requirement can be directly measured.
 A Analyzes: This verification method implies use of analytical techniques (such as system engineering analysis, statistics, mathematical modeling, and simulations) and shall be used to verify such requirements. This includes requirements which are not implemented in the demonstrator.
 I Inspection: Verification by inspection is only done when testing is insufficient or inappropriate. This method of verification is for those requirements that are normally performed by some form of visual inspection.

Sig. Significance & Implementation:
 E_Y Requirement is considered as essential and shall be implemented within the ODA demonstrator.
 E_B Requirement is considered as essential but a decision on implementation cannot be taken yet. It will be implemented on a best effort basis.

E_N Requirement is considered as essential, it will have to be considered for the architectural design, but it is not going to be implemented in the ODA demonstrator.

D_Y Requirement is considered as desirable for the ODA demonstrator and shall be implemented within the ODA demonstrator.

D_B Requirement is considered as desirable but a decision on implementation cannot be taken yet for the ODA demonstrator; it will be implemented on a best effort basis.

D_N Requirement is considered as desirable, it is not included in the ODA demonstrator implementation and shall only be considered for the architectural design on a best effort basis.

For the requirement specification the following terms are used:

- a) shall – verb form used to indicate a requirement to be strictly followed to conform to this specification, from which no deviation is permitted
- b) should – verb form used to indicate desirable ability or use, without mentioning or excluding other possibilities
- c) may – verb form used to indicate an action permissible within the limits of this specification

5.2 Functional requirements

The Functional requirements specify "what" the system has to do. They define the purpose of the software/hardware. The functional requirements are derived from the logical model, which is in turn derived from the user’s capability requirements.

5.2.1 WCS server requirements

Identifier	Description	Val.M.	Sig.
SR_ODA_GEN_010	The Online Data Access System (ODA) shall be accessible over the network.	D	E_Y
SR_ODA_GEN_011	The ODA system shall be implemented using standardized interfaces.	A	E_Y
SR_ODA_GEN_012	The ODA system shall allow the communication and data exchange with other online services (e.g. service chaining with web service)	D	D_N

SR_ODA_GEN_020	The ODA system shall allow SOAP binding.	D	E_N
SR_ODA_GEN_030	The ODA system shall be usable in subscription scenarios.	D	E_Y
SR_ODA_GEN_040 (SR_ODA_SER_010)	The ODA system shall respect security and access control mechanisms based on [AD11].	D	E_B
SR_ODA_GEN_050	The ODA system shall respect the WCS EO AP as far as currently defined. <i>Note: The definition of the WCS EO AP is part of this project and is currently under revision by OGC's WCS.SWG.</i>	D	E_Y
SR_ODA_GEN_070	The ODA system shall be able to be configured to work in a stand-alone mode. <i>Note: Stand-alone mode, in this respect, means it should be configurable to work in a restricted environment with a limited access to data resources.</i>	D	E_Y
SR_ODA_GEN_130	ODA shall provide access to the data content with at least one set of metadata. <i>Note: The amount and the content of metadata provided for a Dataset depends on the type of Dataset.</i>	D	D_Y
SR_ODA_GEN_140	The ODA system shall provide at least one interface to be integrated with an End User environment. <i>Note: The data is accessible directly out of End User's application (e.g. a GIS system) using either Web Service, API, or Add-on depending on the respective client.</i>	D	D_Y
SR_ODA_CAP_010	The ODA system shall allow the download of full datasets.	D	E_Y
SR_ODA_CAP_020	The ODA system shall allow the selection of AOIs (sub-datasets).	D	E_Y
SR_ODA_CAP_030	The ODA system shall allow the download of sub-datasets (i.e. trim functionality - extract data from	D	E_Y

	files and mosaics).		
SR_ODA_CAP_040	The ODA system shall allow the selection of time-slots.	D	E_Y
SR_ODA_CAP_041	The ODA system shall allow the download of selected time-slots.	D	E_B
SR_ODA_CAP_050	The ODA system shall allow the selection of time series. <i>Note: sub-setting within a time range e.g files between a start and an end date set by the use</i>	D	E_Y
SR_ODA_CAP_051	The ODA system shall allow the download of time series.	D	E_B
SR_ODA_CAP_060	The ODA system shall allow to combine the ODA system with other services. <i>Note: This includes receiving an input from a service, either by Reference or the real values, as well as forwarding the output of the ODA system to a service, either by Reference or the real values.</i>	D	E_B
SR_ODA_CAP_070	The ODA system shall allow to download the datasets in different projections and datums.	D	E_Y
SR_ODA_CAP_080	The ODA system shall allow to download the datasets in various file formats. <i>Note: In particular one of GeoTIFF, netCDF, or JPEG2000 shall be supported at least.</i>	D	E_B
SR_ODA_CAP_090	The ODA system shall allow the download of different channels (bands) of a dataset (e.g. cloud coverage, and other masks)	D	E_B
SR_ODA_CAP_100	When used as a view service the ODA system shall allow the access of different channels of a dataset (e.g. bitmasks).	D	E_B
SR_ODA_CAP_110	The ODA system shall be able to access Grid coverages (more precisely, quadrilateral grid coverages).	D	E_Y
SR_ODA_CAP_120	The ODA system shall be able to receive/handle	D	E_B

	information from an [AD17] compliant Order service.		
SR_ODA_CAP_140	The ODA system shall allow access to the data in its original coordinate reference system.	D	E_Y
SR_ODA_CAP_150	The ODA system shall support the use of CRS defined by official EPSG codes (version <i>TBD</i>) (for transformations during the download of datasets).	D	E_Y
SR_ODA_CAP_160	Downloading shall allow transfer with CRS transformation. The product downloaded is transformed into another CRS than that of the source. The product is transformed "on the fly".	D	E_Y
SR_ODA_CAP_190	The ODA system shall be able to be reconfigured (e.g. based on DB input) to enable the instantiation of the "rolling archive" (flowing dataset e.g. FIFO) concept.	D	E_B
SR_ODA_CAP_200	The ODA system shall be able to be configured dynamically (e.g. based on DB input) to enable the instantiation of "virtual WCS" (timely limited availability) concept.	D	E_B
SR_ODA_CAP_210	The system shall be designed to be able to hold multi-layer raster datasets, e.g. multispectral EO ortho-imagery, error layers, bitmasks.	D	E_B
SR_ODA_CAP_230	The ODA system shall handle data at various processing levels as defined by CEOS.	D	E_B
SR_ODA_CAP_250	The ODA system shall not break the general usage e.g. <i>GetCoverage</i> of the implemented solution. <i>Note: Result shall be viewable in a client e.g. Browsers</i>	D	E_Y
SR_ODA_CAP_260	It shall be possible for an ODA system to reuse available EO metadata (e.g. from a catalog).	D	E_B
SR_ODA_CAP_270	The ODA system shall be able to add a new datasets (file/mosaic) to a repository.	D	E_Y
SR_ODA_CAP_280	The ODA system shall be able to partially update a stitched mosaic - i.e. upload and replacement of a	A	D_N

	data subset (<i>UpdateDataPart</i>) or update a full data set (<i>UpdateAll</i>).		
SR_ODA_CAP_290	The ODA system shall be able to update non-rectangular data subsets i.e. has to consider the CRS of the input and the target	A	D_N
SR_ODA_CAP_300	For the update of stitched mosaics the ODA system shall be able to keep track of the data history i.e. at any time the data source of each pixel shall be known (recoverable).	A	D_N
SR_ODA_CAP_310	The ODA system shall maintain traceability. <i>Note: Provide capability to identify all the data used for building any single or any stitched mosaic product. This information shall be part of the metadata delivered with the coverage.</i>	A	D_N
SR_ODA_CAP_320	The ODA system shall provide TBD information to ensure the identification of a dataset (or a sub-dataset) and all the processes applied to it. This information shall be provided with the datasets metadata. <i>Note: The End User accesses a dataset and wants to know who is the owner of the product, the date and the quality. This information shall be part of the metadata delivered with the coverage.</i>	A	D_N
SR_ODA_CAP_330	A delivered stitched mosaic (or any subset thereof) shall provide, for every location in the delivered dataset, at least, the unique product identifier element (i.e. <eop:identifier>) of the original dataset used at this location. <i>Note: This shall enable the user to look up the full metadata record in a catalog for each location of the delivered dataset. The shall be enabled to understand from which resources the stitched mosaic has been made of. This information shall be part of the metadata delivered with the coverage.</i>	A	D_N
SR_ODA_CAP_331	A delivered stitched mosaic (or any subset thereof) should provide the acquisition time of the original datasets for every location in the delivered dataset.	A	D_N

	<i>Note: This should enable the user investigate the delivered dataset, regarding any possible time constrains (actuality of the data) he might have, without the need to contact a catalog.</i>		
SR_ODA_CAP_360	<p>ODA shall allow transforming; mainly for re-projection purpose taken into account original data information.</p> <p><i>Note: This capability would allow to use radiometric sampling algorithms that minimize the re-projection effect on the information feature.</i></p>	D	D_N
SR_ODA_CAP_370	<p>ODA should allow the processing of the data.</p> <p><i>Note: The data is accessible on line with the minimum (TBD) metadata description that allows understanding the raster part of the data and all the parameters required for further processing as histogram stretching, classification, geometric enhancement. Such processing could also include the extraction of e.g. value added information to be used e.g. as filter for further data extraction.</i></p> <p><i>Note: this functionality requires a WCPS or WPS</i></p>	A	D_N
SR_ODA_CAP_380	<p>Downloading shall allow the transfer of an extraction or of the complete dataset with a minimum set (TBD) of metadata.</p> <p><i>Note: The End User discovers and visualizes the product. The End User wants either a complete download of the product or only an extract for final publishing off line. This final publishing should be a paper map or a backdrop display on a device (PDA/Mobile...). The minimum metadata required shall provide copyright, acquisition date and CRS.</i></p>	D	D_Y
SR_ODA_CAP_390	The ODA system shall allow the download of the data in its original unmodified data type.	D	D_Y
SR_ODA_CAP_400	The ODA system shall support dataset collections.	D	E_Y

5.2.2 WCS client requirements

Identifier	Description	Val.M.	Sig.
SR_ODA_CAP- CLI_010	The WCS client shall be able to visualize datasets that are offered via Web Coverage Services.	D	E_Y
SR_ODA_CAP- CLI_020	Datasets shall be shown in the clients layer manager. <i>Note: The following general layer management functions shall be available for datasets:</i> <ul style="list-style-type: none"> • Hide/Show dataset layers • Change transparency • Re-order layers • Zoom to extent of layers 	D	E_Y
SR_ODA_CAP- CLI_030	The layer manager shall contain a button that allows the visualization of the dataset metadata that is offered via the <i>DescribeCoverage</i> operation. Both presentation in HTML and downloading in GML/XML shall be provided.	D	D_Y
SR_ODA_CAP- CLI_040	The dataset layer shall be visualized on the WCS client's map whereby the WCS client will request the image with the appropriate extent and resolution from the WCS. <i>Note: In other words, the WCS client will only download the part of the image that is required for presentation of the result.</i>	D	E_Y
SR_ODA_CAP- CLI_050	The WCS client shall offer a "Coverage Parameters" form where the user can specify several options with respect to the visualization of the datasets.	D	E_Y
SR_ODA_CAP- CLI_060	In addition, the "Coverage Symbology" form shall allow the user to specify the bands which shall be mapped to Red, Green and Blue values if the dataset is to be presented in (true or false) color.	D	E_Y
SR_ODA_CAP- CLI_070	The "Coverage Symbology" form shall allow the user to specify the dataset band to be used if the image is to be presented in gray scales.	D	E_Y
SR_ODA_CAP- CLI_080	The "Coverage Symbology " form shall allow the user to specify the (background) color that shall be made transparent.	D	E_Y

SR_ODA_CAP- CLI_090	The "Coverage Symbology " form shall allow the user to specify simple "image enhancements" (histogram stretches).	D	E_Y
SR_ODA_CAP- CLI_100	The "Coverage Parameters" form shall allow the user to specify the time of interest in case the offered dataset allows this.	D	E_N
SR_ODA_CAP- CLI_110	The "Coverage Download" form shall allow the user to download the dataset, by specifying: <ul style="list-style-type: none"> • the extent of the dataset to be downloaded via choosing either the full dataset extent, via specifying an AOI on the map or alternatively by the specification of the current map view • the output format (from the list of formats that the dataset supports) • the resolution in X and Y direction (default values presented in non-exponential notation and given in the native CRS) • or the width and height expressed in pixels • the output CRS (default value being the native CRS) • the interpolation method • the time of interest 	D	E_Y
SR_ODA_CAP- CLI_120	The user shall be offered the possibility to add dataset layers to the WCS client by using the add layer functionality of the layer manager. <i>Note: A form shall be presented to the user where he needs to provide the base URL of the Service, set the Service Type to WCS, select the appropriate WCS Version and select the appropriate WCS profile or extension.</i>	D	E_Y
SR_ODA_CAP- CLI_130	If the WCS Service exposes individual datasets in its capabilities, the WCS client shall list these to the user, to allow the selection of one or more datasets which shall be added to the map.	D	E_Y
SR_ODA_CAP- CLI_140	If the WCS Service exposes dataset series, the client application will allow to define an AOI and specify the range. Subsequently a list of matching datasets will be shown.[AD15][AD16]	D	E_Y

SR_ODA_CAP- CLI_150	The Service provider shall be offered the same WCS symbology functionality as the end user when setting up a WCS client configuration.	D	D_Y
SR_ODA_CAP- CLI_160	The Service provider shall be equipped with a JavaScript API that allows the service provider to configure a Web Portal Service instance in order to add WCS dataset(s) at run time by passing a Web Map Context Document that contains the references to the coverage(s). To be used for instance from within a CIM (services or data) or EO EP of ebRIM CSW catalog ([AD15], [AD16]).	T	D_Y
SR_ODA_CAP- CLI_170	The Service provider shall be equipped with a mechanism that allows the service provider to configure a Web Portal Service installation to add datasets upon start-up of the WCS client viewer. <i>Note: To be used for instance to allow display of datasets that are the result of Web Coverage Processing Services.</i>	T	D_Y

5.3 Performance requirements

The Performance requirements shall list any specific requirement to the specified performance of software item under definition.

Identifier	Description	Val.M.	Sig.
SR_ODA_PE_010	The total response time of a GetCapabilities request shall not exceed 5 seconds.	T	D_Y
SR_ODA_PE_020	The total response time of a DescribeCoverage request shall not exceed 5 seconds.	T	D_Y
SR_ODA_PE_030	Since the total response time of a DescribeEOCoverageSet request strongly depends on the size of the targeted Dataset Series a total response time can not be provided. However, it is recommended that the response time should not exceed 20 seconds.	T	D_Y

SR_ODA_PE_040	Since the total response time of a GetCoverage strongly depends on the size of the requested coverage; therefore a total response time can not be provided.	A	--
SR_ODA_GEN_120	ODA shall allow Near Real Time visualization. Access to the data for visualization shall be with a minimum delay (no delay greater than <i>TBD</i> second for reload).	A	D_N

5.4 Interface requirements

The external interfaces are covered by the OGC specifications, WCS 2.0 [AD6], [AD7], [AD8], [AD9], [AD5], [AD13], and WCS EO AP [AD12].

In addition the protocols to access the Archive Servers, namely FTP, and HTTP are defined by Internet standards.

The internal interfaces are corresponding to interfaces between the WCS software implementation, namely MapServer, PostgreSQL/PostGIS, GDAL, OGR, etc. and the operation system.

The platform for the EOX based HMA-FO Reference Implementation will be based on the freely available Debian-GNU/Linux Operating system. For this platform all required packages and source code for the MapServer, PostgreSQL/PostGIS database, libraries (GDAL, OGR, etc.) as well as general development tools are available and already in use by EOX. The whole software package required for the HMA-FO Reference Implementation will be provided and configured by EOX for installation at other sites (e.g. at ESA, SPOT).

For the HMA-FO Reference Implementation the hardware interfaces will depend on the amount of the test data sets provided by ESA and/or other providers (e.g. DLR, SPOT, etc.).

The HMI is represented by the interfaces between an interactive user and the selected WebMapView provided by GIM.

Identifier	Description	Val.M.	Sig.
SR_ODA_IF_010	The ODA system shall support the access via HTTP KVP [AD7].	D	E_Y
SR_ODA_IF_020	The ODA system should support the access via XML plus SOAP binding [AD9].	A	E_N
SR_ODA_IF_050	The ODA system shall support the following output	D	E_Y

	<p>formats:</p> <ul style="list-style-type: none"> • GeoTIFF [AD13] <p>according to the OGC WCS 2.0 file format extensions [AD13]</p>		
SR_ODA_IF_060	<p>The ODA system shall support the following output formats:</p> <ul style="list-style-type: none"> • GML/Multipart MIME 	D	E_Y
SR_ODA_IF_070	<p>The ODA system shall allow to access Archive Servers using the following protocols:</p> <ul style="list-style-type: none"> • FTP • HTTP • WCS 	D	E_B
SR_ODA_IF_080 (SR_ODA_GEN_050)	<p>see SR_ODA_GEN_050 in section 5.2.1</p> <p>The ODA system shall support the requests defined in WCS EO AP [AD12].</p>	D	E_B
SR_ODA_IF_090 (ODA_DEM_030)	<p>The ODA system shall support the requests defined in WCS 2.0 [AD6]</p>	D	E_Y

5.4.1 Human-Machine-Interface (HMI)

For the HMI (Human-Machine-Interface) an enhanced version of the WebMapView provided by GIM is to be used [AD14] as the Reference Implementation WCS client.

Identifier	Description	Val.M.	Sig.
SR_ODA_IF-CLI_030	The WCS client shall support WCS 1.0.0 with the HTTP Get Binding.	D	D_Y
SR_ODA_IF-CLI_040	The WCS client should support WCS 2.0 Core with the HTTP Get Binding.	D	E_Y
SR_ODA_IF-CLI_050	The WCS client should support WCS 2.0 Core with the SOAP 1.2 Binding.	D	D_N
SR_ODA_IF-CLI_060	The WCS client shall support the following image	D	E_Y

	<p>formats:</p> <ul style="list-style-type: none"> • GeoTIFF (as per the limitations of SUN JAI libraries in handling TIFFs) • Other coverage formats as supported by the Open Source GDAL library including JPEG2000 (GMLJP2 and GeoJP2) 		
SR_ODA_IF-CLI_070	The WCS client should support GML Rectified Grids as format in combination with the WCS 2.0 Core.	D	D_N
SR_ODA_IF-CLI_080	<p>The WCS client should support the WCS EO Application Profile</p> <p><i>Note: Extent of support to be confirmed after definition of extension if all aspects of this EO Extension can be covered.</i></p>	D	D_B

5.4.2 Security gateway

For the HMA Reference Implementation the requirements defined in [AD11] (User Management) will not be considered.

5.4.3 WCS EO Application Profile

The WP EO AP is part of the current developments within this project and is "work in progress. The HMA-FO Reference Implementation shall be implemented the support of the WCS EO AP on a "Best Effort" basis to the extent what is available at the time of writing.

Identifier	Description	Val.M.	Sig.
SR_ODA_IF_090	see SR_ODA_IF_090 in section 5.4		
SR_ODA_GEN_050	see SR_ODA_GEN_050 in section 5.2.1		

5.4.4 Interface towards Catalogue services

None are foreseen for the HMA-FO Reference Implementation

5.4.5 Interface towards Ordering services

None are foreseen for the HMA-FO Reference Implementation

5.4.6 Interfaces to other services and/or service chains (e.g. WPS, WCPS, WCTS, ...)

None are foreseen for the HMA-FO Reference Implementation

5.5 Operational requirements

This section lists specific requirements related to the operation of the software in its intended environment.

Identifier	Description	Val.M.	Sig.
SR_ODA_SOR_070	The ODA system shall log received request and provided responses.	D	E_Y
SR_ODA_SOR_080	The ODA system shall provide the operator with an interface allowing checking of logs of received requests	D	D_B
SR_ODA_SOR_090	The configuration data needed for the ODA system shall be kept within text files.	D	D_Y
SR_ODA_SOR_100	The ODA system shall provide the operator with an interface allowing the configuration and update of the ODA system	D	D_Y
SR_ODA_SOR_110	The ODA system shall provide the operator with an interface allowing the upload and ingestion of datasets	D	D_B
SR_ODA_SOR_150	The ODA system shall provide the operator with an interface allowing DB Management	D	D_B

5.6 Resources requirements

All the resource requirements related to the software and the hardware requirements (target hardware on which the software is specified to operate); sizing and timing requirements are described.

Identifier	Description	Val.M.	Sig.
SR_ODA_SOR_010	The ODA system should be made available utilizing an instantiation of Debian based Linux (possibly Linux-HA - TBC) (version TBD).	D	E_Y
SR_ODA_SOR_020	The PostgreSQL DB with the PostGIS extension shall be available (version TBD).	D	E_Y
SR_ODA_SOR_030	The GDAL library shall be available (version TBD).	D	E_Y
SR_ODA_SOR_040	Python programming language shall be available (version TBD).	D	E_Y
SR_ODA_SOR_050	GCC compiler and Linux header files shall be available (version TBD).	D	E_Y
SR_ODA_SOR_060	A series of EPSG codes to be supported, and which GDAL must be able to handle, shall be agreed upon.	D	E_Y
SR_ODA_SOR_120	The ODA system shall run on a low end server machine, x86 based PC	D	D_Y
SR_ODA_SOR_130	The ODA system shall run on a PC with at least 4GB RAM (preferentially 8GB)	D	D_Y
SR_ODA_SOR_140 (ODA_CRR_010)	The ODA system shall run on a PC with a RAID-10 Disk Array with a "hot spare" (size is dependent on data holding for the demonstration - TBD)	D	D_B
SR_ODA_SSOR_010	The platform where the ODA System is installed shall be connected to the Internet.	D	E_Y
SR_ODA_SSOR_020	The platform where the ODA System is installed shall be secured with a firewall (TBC).	D	E_B
SR_ODA_SSOR_040	The platform where the ODA System is installed	D	E_B

	should operate an intrusion-detection software (<i>TBC</i>).		
SR_ODA_SSOR_050	The platform where the ODA System is installed should operate a system-wide logging system (<i>TBD</i>).	D	E_Y
SR_ODA_SSOR_060	The platform where the ODA System is installed should operate a logging analyzes tool (<i>TBD</i>).	D	E_Y

5.7 Design requirements and implementation constraints

This section lists any requirements driving the design of the software item under specification and any identified implementation constraint. This may include software standards; design requirements; specific design methods to be applied; requirements relevant to numerical accuracy; specific constraints induced by reused software (e.g. COTS, free software and open source).

Identifier	Description	Val.M.	Sig.
SR_ODA_DRC_010	OGC standards shall be applied where applicable.	D	E_Y
SR_ODA_DRC_020	Standards and Recommendations developed in the frame of the HMA project shall be applied on request (where applicable).	D	E_Y
SR_ODA_DRC_030	In case JPEG-2000 datasets have to be created utilizing proprietary transformation formats or libraries (e.g. ECW, MrSID, Kakadu) the license has to be provided as <i>Customer Furnished Item</i> .	A	D_N
SR_ODA_DRC_040	Computer and storage Hardware for the Reference Implementation has to be provided as Customer Furnished Item.	A	E_Y
SR_ODA_DRC_050	A WebMapView client software shall be used as WCS client for the demonstration setup.	D	E_Y
SR_ODA_DRC_060	The protocols used for ODA should not require additional ports to be opened.	D	E_Y
SR_ODA_DRC_070	The enhancements needed for the implementation of	D	E_Y

	the Reference Implementation server shall be based on OpenSource software tools.		
SR_ODA_DRC_080 (ODA_GEN_060)	The Reference Implementation server shall be based on OpenSource software tools	D	E_Y

5.8 Security and privacy requirements

This section describes any security and privacy requirements.

Identifier	Description	Val.M.	Sig.
SR_ODA_SER_010 (SR_ODA_GEN_040)	The ODA System shall respect security and access control mechanisms based on [AD11]	A	D_N
SR_ODA_SER_020	The ODA System shall respect security and access control mechanisms for transactions ([AD11]).	A	D_N
SR_ODA_SER_030	ODA shall maintain security on the dataset level. <i>Note: Data shall be protected by copyright and security processes that block illegal use or downloading.</i>	A	D_N
SR_ODA_SER_040	The data accessible online shall be protected for illegal downloading. <i>Note: The End User shall have accesses to the data for discovery and visualization purpose. When he wants to process or download the data, the platform shall identify the user and check his rights as defined on SLA.</i>	D	E_B
SR_ODA_SER_050	The security constraint shall not be a barrier to the commercial activity. <i>Note: The End User accesses the data online and the security is applied only when necessary with a non significant impact of ease access to the data for authorized users.</i>	D	E_B
SR_ODA_SER_060	The security level shall be in line with the threat.	D	E_B

	<p><i>Note: The End User accesses free online data (free sub sampling data of commercial product), no security applied for normal use. Nevertheless, in case of massive request that demonstrate no real user connected, the platform should apply a minimum security process as authoritarian disconnection and blacklisted user action.</i></p>		
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5.9 Portability requirements

None are foreseen for the HMA-FO Reference Implementation

5.10 Software quality requirements

This section lists any quality requirements.

Identifier	Description	Val.M.	Sig.
SR_ODA_QR_010	The ODA system shall be developed to operate under a Linux Operating System	D	E_Y
SR_ODA_QR_030	The software development shall follow ECSS standards [AD1]	A	E_Y

5.11 Software reliability requirements

None are foreseen for the HMA-FO Reference Implementation

5.12 Software maintainability requirements

This section lists any maintainability requirements.

Identifier	Description	Val.M.	Sig.
SR_ODA_SMR_010	The developers and maintainers require a user	D	E_Y

	account on the installation platform.		
SR_ODA_SMR_020	The system shall provide access via a SSH connection for the developers and maintainers.	D	E_Y
SR_ODA_SMR_030	Root access or superuser (sudo) access rights will be required for the developers and maintainers (at least during initial setup and operations).	D	E_Y

5.13 Software safety requirements

This section lists any safety requirements

Identifier	Description	Val.M.	Sig.
SR_ODA_SFR_010	Access to the ODA Hardware shall be limited.	D	D_B

5.14 Software configuration and delivery requirements

None are foreseen for the HMA-FO Reference Implementation

5.15 Data definition and database requirements

This section lists any requirement related to specific data format or structure to be exchanged with other systems or any database requirements allowing to take into account e.g. mission and product specific constraints.

Identifier	Description	Val.M.	Sig.
SR_ODA_DDD_010 (ODA_SOR_020)	PostgreSQL with the PostGIS extension shall be used for the Reference Implementation Server and the WCS client	D	E_Y

5.16 Human factors related requirements

None are foreseen for the HMA-FO Reference Implementation

5.17 Adaptation and installation requirements

None are foreseen for the HMA-FO Reference Implementation

6 Validation requirements

This section describes the validation approach applicable to each uniquely identified requirement, utilizing a validation matrix (requirements to validation approach correlation table).

6.1 Approach

To allow the validation of the WCS 2.0 and WCS EO AP specification and the validation of the developed server and client side software a Reference Implementation of the ODA system is foreseen.

System tests will verify the correct functioning and validate the requirements using an end-to-end approach by demonstration and/or running test procedures prepared in order to cover all meaningful operative scenarios.

The validation approach of each specified requirement has been already specified in section 5. The validation matrix is provided as a column of each requirement table (see column with the heading "Val.M.")

The first instantiation will be installed at EOX for development and testing. The second instantiation is to be installed at ESA premises (e.g. to simulate the CDS component of the GSCDA). A third installation could be hosted by the consortium member Spot (e.g. acting as GCM at their premises). This set-up would allow the simulation of a possible adoption of the developed WCS EO AP in the course of GSCDA both at ESA and at contributing missions.

The WCS client for demonstration purposes will be deployed at GIM.

6.1.1 Installation and Configuration

The aim of this test design is to verify the completeness and correctness of the deliverable software, installation and operation documents.

This test design deals with the building of the software, installation on run time environment, configuration and then start-up of the system. Once the ODA system software is properly installed and configured the ODA system will be started-up.

6.1.2 Online Data Access validation

The aim of this test design is to verify the correct functioning of the supported WCS 2.0 and WCS EO AP interface:

- GetCapabilities

- DescribeCoverage
- DescribeEOCoverageSet
- GetCoverage

The User access control for the Reference Implementation will be implemented as the default Web Server login (Username Password pair).

6.2 Test Platform Validation Requirements

This section lists the requirements the test platform shall comply with.

Identifier	Description	Val.M.	Sig.
SR_ODA_VA_100	The ODA system will be provided with an ATPI document .	D	E_Y
SR_ODA_VA_110	The ATPI shall allow to test the functionality to access offered datasets	D	E_Y
SR_ODA_VA_120	<p>The ATPI shall include tests against the following product collections (TBC):</p> <ul style="list-style-type: none"> • SPOT GeoTIFF (DIMAP) • Envisat ASAR Level 1 and above products <p><i>Note: In general all product formats supported by GDAL are potentially possible (but some might need extra integration effort)</i></p>	D	E_Y
SR_ODA_VA_130	A test platform as defined by the requirements SR_ODA_SOR_120 and SR_ODA_SOR_130 in section 5.6 should be used	A	E_Y

7 Traceability

The following Table 1 provides a traceability matrix of the requirements provided in the HMA-FO_ODA-RB-SSS_EOX_1.4 (left column) and HMA-FO_ODA-TS-SRS_EOX_1.2 (right column – this document). The requirements in the right column are arranged according to the appearance in the document.

HMA-FO_RB-SSS-1.4	HMA-FO_TS-SRS-1.2
ODA_GEN_010	SR_ODA_GEN_010
ODA_GEN_011	SR_ODA_GEN_011
ODA_GEN_012	SR_ODA_GEN_012
ODA_GEN_020	SR_ODA_GEN_020
ODA_GEN_030	SR_ODA_GEN_030
ODA_GEN_040	SR_ODA_GEN_040
ODA_GEN_050	SR_ODA_GEN_050
ODA_GEN_070	SR_ODA_GEN_070
ODA_GEN_130	SR_ODA_GEN_130
ODA_GEN_140	SR_ODA_GEN_140
ODA_CAP_010	SR_ODA_CAP_010
ODA_CAP_020	SR_ODA_CAP_020
ODA_CAP_030	SR_ODA_CAP_030
ODA_CAP_040	SR_ODA_CAP_040
ODA_CAP_041	SR_ODA_CAP_041
ODA_CAP_050	SR_ODA_CAP_050
ODA_CAP_051	SR_ODA_CAP_051
ODA_CAP_060	SR_ODA_CAP_060
ODA_CAP_070	SR_ODA_CAP_070
ODA_CAP_080	SR_ODA_CAP_080
ODA_CAP_090	SR_ODA_CAP_090
ODA_CAP_100	SR_ODA_CAP_100
ODA_CAP_110	SR_ODA_CAP_110
ODA_CAP_120	SR_ODA_CAP_120
ODA_CAP_140	SR_ODA_CAP_140
ODA_CAP_150	SR_ODA_CAP_150
ODA_CAP_160	SR_ODA_CAP_160
ODA_CAP_190	SR_ODA_CAP_190
ODA_CAP_200	SR_ODA_CAP_200

HMA-FO_RB-SSS-1.4	HMA-FO_TS-SRS-1.2
ODA_CAP_210	SR_ODA_CAP_210
ODA_CAP_230	SR_ODA_CAP_230
ODA_CAP_250	SR_ODA_CAP_250
ODA_CAP_260	SR_ODA_CAP_260
ODA_CAP_270	SR_ODA_CAP_270
ODA_CAP_280	SR_ODA_CAP_280
ODA_CAP_290	SR_ODA_CAP_290
ODA_CAP_300	SR_ODA_CAP_300
ODA_CAP_310	SR_ODA_CAP_310
ODA_CAP_320	SR_ODA_CAP_320
ODA_CAP_330	SR_ODA_CAP_330
ODA_CAP_331	SR_ODA_CAP_331
ODA_CAP_360	SR_ODA_CAP_360
ODA_CAP_370	SR_ODA_CAP_370
ODA_CAP_380	SR_ODA_CAP_380
ODA_CAP_390	SR_ODA_CAP_390
ODA_CAP_400	SR_ODA_CAP_400
ODA_CAP-CLI_010	SR_ODA_CAP-CLI_010
ODA_CAP-CLI_020	SR_ODA_CAP-CLI_020
ODA_CAP-CLI_030	SR_ODA_CAP-CLI_030
ODA_CAP-CLI_040	SR_ODA_CAP-CLI_040
ODA_CAP-CLI_050	SR_ODA_CAP-CLI_050
ODA_CAP-CLI_060	SR_ODA_CAP-CLI_060
ODA_CAP-CLI_070	SR_ODA_CAP-CLI_070
ODA_CAP-CLI_080	SR_ODA_CAP-CLI_080
ODA_CAP-CLI_090	SR_ODA_CAP-CLI_090
ODA_CAP-CLI_100	SR_ODA_CAP-CLI_100
ODA_CAP-CLI_110	SR_ODA_CAP-CLI_110
ODA_CAP-CLI_120	SR_ODA_CAP-CLI_120
ODA_CAP-CLI_130	SR_ODA_CAP-CLI_130
ODA_CAP-CLI_140	SR_ODA_CAP-CLI_140
ODA_CAP-CLI_150	SR_ODA_CAP-CLI_150
ODA_CAP-CLI_160	SR_ODA_CAP-CLI_160
ODA_CAP-CLI_170	SR_ODA_CAP-CLI_170
new	SR_ODA_PE_010
new	SR_ODA_PE_020
new	SR_ODA_PE_030

HMA-FO_RB-SSS-1.4	HMA-FO_TS-SRS-1.2
new	SR_ODA_PE_040
ODA_GEN_120	SR_ODA_GEN_120
ODA_IF_010	SR_ODA_IF_010
ODA_IF_020	SR_ODA_IF_020
ODA_IF_050	SR_ODA_IF_050
new	SR_ODA_IF_070
new	SR_ODA_IF_060
ODA_GEN_050	SR_ODA_IF_080
ODA_DEM_030	SR_ODA_IF_090
ODA_IF-CLI_030	SR_ODA_IF-CLI_030
ODA_IF-CLI_040	SR_ODA_IF-CLI_040
ODA_IF-CLI_050	SR_ODA_IF-CLI_050
ODA_IF-CLI_060	SR_ODA_IF-CLI_060
ODA_IF-CLI_070	SR_ODA_IF-CLI_070
ODA_IF-CLI_080	SR_ODA_IF-CLI_080
new	SR_ODA_SOR_070
new	SR_ODA_SOR_080
new	SR_ODA_SOR_090
new	SR_ODA_SOR_100
new	SR_ODA_SOR_110
new	SR_ODA_SOR_150
ODA_SOR_010 ODA_RA_010	SR_ODA_SOR_010
ODA_SOR_020	SR_ODA_SOR_020
ODA_SOR_030	SR_ODA_SOR_030
ODA_SOR_040	SR_ODA_SOR_040
ODA_SOR_050	SR_ODA_SOR_050
ODA_SOR_060	SR_ODA_SOR_060
new	SR_ODA_SOR_120
new	SR_ODA_SOR_130
ODA_SOR_140 ODA_CRR_010	SR_ODA_SOR_140
ODA_SSOR_010	SR_ODA_SSOR_010
ODA_SSOR_020	SR_ODA_SSOR_020
ODA_SSOR_040	SR_ODA_SSOR_040
ODA_SSOR_050	SR_ODA_SSOR_050
ODA_SSOR_060	SR_ODA_SSOR_060
ODA_DRC_010	SR_ODA_DRC_010
ODA_DRC_020	SR_ODA_DRC_020

HMA-FO_RB-SSS-1.4	HMA-FO_TS-SRS-1.2
ODA_DRC_030	SR_ODA_DRC_030
ODA_DRC_040	SR_ODA_DRC_040
ODA_DRC_050	SR_ODA_DRC_050
ODA_DRC_060	SR_ODA_DRC_060
new	SR_ODA_DRC_070
ODA_DRC_080 ODA_GEN_060	SR_ODA_DRC_080
ODA_SER_010	SR_ODA_SER_010
ODA_SER_020	SR_ODA_SER_020
ODA_SER_030	SR_ODA_SER_030
ODA_SER_040	SR_ODA_SER_040
ODA_SER_050	SR_ODA_SER_050
ODA_SER_060	SR_ODA_SER_060
ODA_QR_010	SR_ODA_QR_010
new	SR_ODA_QR_030
ODA_SMR_010	SR_ODA_SMR_010
ODA_SMR_020	SR_ODA_SMR_020
ODA_SMR_030	SR_ODA_SMR_030
ODA_SFR_010	SR_ODA_SFR_010
ODA_DDD_010 ODA_SOR_020	SR_ODA_DDD_010
new	SR_ODA_VA_000
new	SR_ODA_VA_100
new	SR_ODA_VA_110
new	SR_ODA_VA_120

Table 1: provides a traceability matrix of the requirements provided in the HMA-FO_ODA-RB-SSS_EOX_1.4 and HMA-FO_ODA-TS-SRS_EOX_1.2. The requirements in the right column are arranged according to the appearance in the document

The ODA system is structured in the following subcomponents:

- ODA WCS Reference Implementation
 - this functional unit listens to incoming HTTP requests and process them according to the requested protocol. The following operations, defined in the WCS 2.0 standard as well as defined in the are WCS EO AP are managed:
 - *GetCapabilities*
 - *DescribeCoverage*
 - *DescribeEOCoverageSet*
 - *GetCoverage*
 - upon requests arrival a data lookup is performed in the ODA DB
 - metadata is provided in response to data lookup
 - access to Storage-Backends to retrieve the datasets. The I/F supports the following protocols:
 - HTTP
 - FTP
 - WCS
 - direct file system access utilizing Operation System calls i.e. cpio
 - the ODA system provides an I/F to connect to other Web Services (e.g. to WCTS) and may provide data either byReference or byValue
- WCS client
 - this functional unit provides the HMI for interacting with the ODA WCS Reference Implementation for retrieving and visualisng coverages. It consist of a Javascript/AJAX based front-end running in the browser combined by a Server side portrayal Server and Content Management System.
- ODA DB & Configuration
 - contains the system configuration information which is managed by the operator via the ODA Admin Client
 - may possibly hold offered datasets
- ODA Admin Client
 - client to be utilized by the ODA operator to configure the ODA system. The HMI provides the following functionalities:
 - management of the ODA RDBMS
 - configuration of the coverage dataset series
 - update mechanism (e.g. after ingestion of new datasets or after configuration changes)
 - ingestion of datasets
- Storage-Backends (internal or external, which are not part of the ODA system)
 - holding the datasets

8.1 ODA system access scenarios

This section summarizes the main scenarios for accessing and operating the ODA system.

8.1.1 Accessing the ODA system utilizing WCS 2.0 compliant requests

The interactions between a User Client and the ODA system, as defined in [AD6], can be summarized as follows:

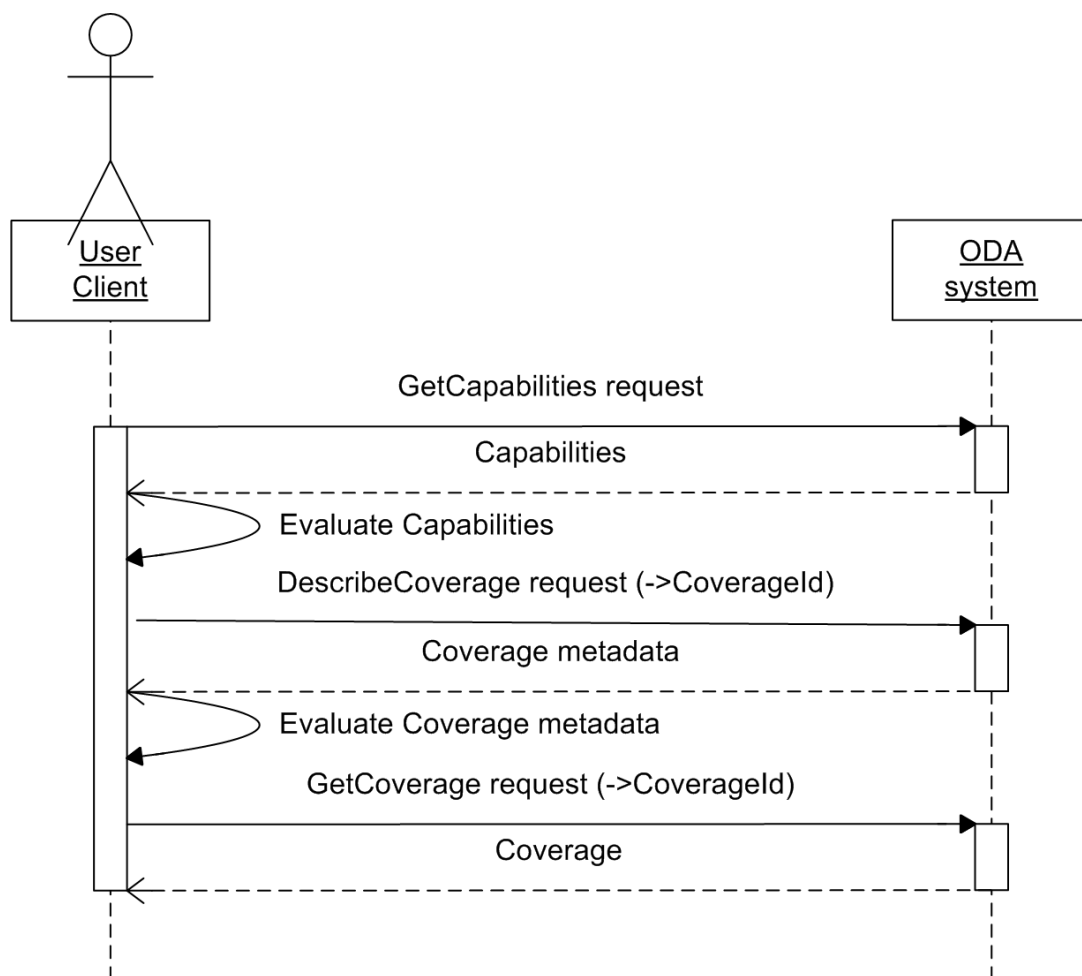


Figure 4: General request scenario to access the ODA system in a WCS 2.0 compliant way

The user disposes WCS 2.0 compliant requests to the ODA system. The ODA system honors valid requests with WCS 2.0 standard conform results.

The required syntax to issue a valid request is described in detail in [AD6] and in the

currently existing WCS 2.0 extensions supported by the Reference Implementation i.e. [AD7], [AD9], [AD5], [AD13].

- The User client issues a valid *GetCapabilities* request
- The ODA system processes the request and returns a Capabilities document
- The User evaluates the received Capabilities document
- The User selects a *CoverageID* of interest and submits a *DescribeCoverage* request providing the *CoverageID*
- The ODA system processes the request and returns the Coverage metadata for the respective *CoverageID*
- The User evaluates the received Coverage metadata
- The User submits a valid *GetCoverage* request providing the *CoverageID*
- The ODA system processes the request and return the respective coverage to the user

8.1.2 Accessing the ODA system utilizing WCS EO AP compliant requests to access a Dataset Series

This scenario summarizes the interactions between a User Client and the ODA system for valid requests utilizing the WCS EO AP as currently described in [AD12].

The WCS EO AP provides, besides the standard WCS 2.0 conformant request types, an addition request type named *DescribeEOCoverageSet*. This request type allows querying Dataset Series as defined in [AD12] and provides *CoverageDescription* on the items queried. Based on this information the user can issue valid *GetCoverage* requests to access the datasets contained or referenced in the Dataset Series. It therefore provides a mechanism to access e.g. coverages representing a Time-Series.

- The User client issues a valid *GetCapabilities* request
- The ODA system processes the request and returns a Capabilities document
- The User evaluates the received Capabilities document
- The User selects a *CoverageID* of interest and submits a *DescribeCoverage* request providing the *CoverageID*
- The ODA system processes the request and returns the Coverage metadata for the respective *CoverageID*
- The User evaluates the received Coverage metadata
- The User selects a *eoID* of a Dataset Series of interest and submits a valid *DescribeEOCoverageSet* providing the the *eoId*. The *DescribeEOCoverageSet* request further allows to specify spatial and temporal limits (I.e AOI and TOI) as constrains (see [AD12] for more details)
- The ODA system processes the request and provides *CoverageDescriptions* for the

datasets described by *eoId* and matching the the provided limits

- The User evaluates the received *CoverageDescription*
- The User repeatedly submits valid *GetCoverage* requests for each *CoverageID*
- The ODA system processes each request and returns the respective coverage to the user.

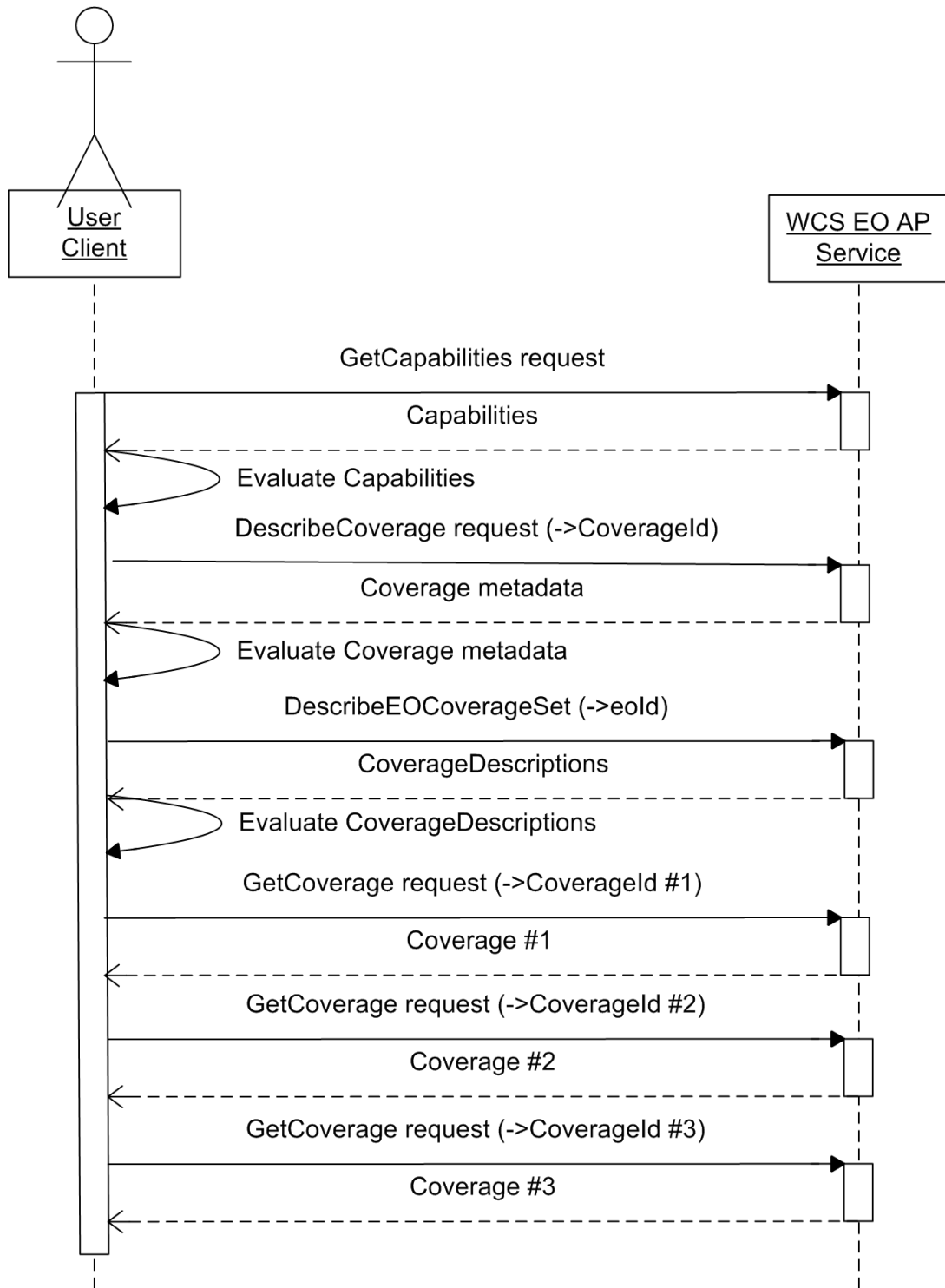


Figure 5: General request scenario to the ODA system to access a Dataset Series in a WCS EO AP compliant way

8.1.3 ODA system configuration and management

This scenario summarizes the configuration and management functionalities provided by the ODA system and accessible via the ODA Admin Client.

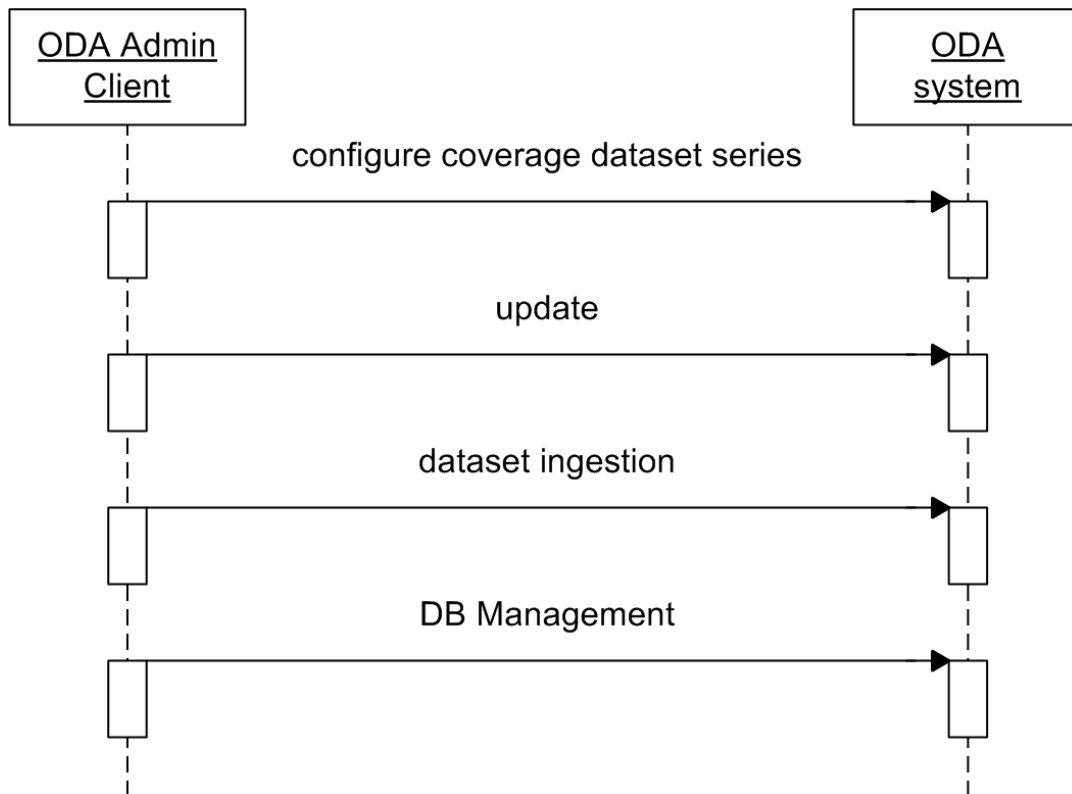


Figure 6: Configuration and Management scenario

The ODA Admin Client provides functionalities to:

- manage the geo-RDBMS
- ingest datasets into the ODA system
- update the information regarding the provided datasets
- configure coverage dataset series

**Heterogeneous Mission Accessibility - Follow-On
Technical Specification - Software Requirements Specification**

---- End of Document ----