

Earth Observation Processing (EO-Processing)

Appendix 16 – EO Processing Technical Specifications

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1. Abbreviations

The following table includes a list of abbreviations commonly used in this Technical Specification.

Abbreviation	Definition
AIS	Automatic Identification System
API	Application Programming Interface
BCF	Business Continuity Facility
COTS	Commercial Off The Shelf
CTM	Criticality/Time Matrix
CSN	CleanSeaNet
CSNDC	CleanSeaNet Data Centre
CMC	Control Management Console
EICD	External Interface Control Document
EC	European Commission
EMSA	European Maritime Safety Agency
ENC	Electronic Nautical Chart
EO	Earth Observation
EODC	Earth Observation Data Centre
EU	European Union
FTP	File Transfer Protocol
FWC	Framework Contract
GIS	Geographic Information System
GML	Geography Markup Language
GUI	Graphic User Interface

Abbreviation	Definition
HTTP	Hypertext Transfer Protocol
ICD	Interface Control Document
ICM	Installation and Configuration Manual
ICT	Information and Communications Technology
IdM	Identity Manager (an Oracle application)
IHP	Incident Handling Procedures
INS	Installation Manual
IMDatE	Integrated Maritime Data Environment
IT	Information Technology
IPR	Intellectual Property Rights
LRIT	Long Range Identification and Tracking.
MAP	Maritime Application Portal
MARSURV	Maritime Surveillance
M5D	Message Digest Algorithm
MSS	Maritime Support Services
MSs	Member State(s)
NCA	National Competent Authority
NRT	Near Real Time
OMM	Operational and Maintenance Manual
RDF	Resource Description Framework
REST	REpresentational State Transfer
RPM	Red Hat Package Manager
ROA	Resource Oriented Architecture

Abbreviation	Definition
S2S	System to System
SO	Satellite Owner
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SP	Service Provider
SRS	Software Requirements Specifications
SSN	SafeSeaNet
STP	Software Test Plan
TDD	Technical Design Document
TF	TeamForge
TS	Technical Specification
UAV	Unmanned Aerial Vehicle
UML	Unified Modeling Language
VAS	Value-Added Service
VDS	Vessel Detection System
WWW	World Wide Web
XML	Extensible Markup Language

2. Glossary

2.1 Terms specific to Maritime domain

The following table includes a glossary of the relevant terms commonly used in this TS and specific to Maritime domain.

Term	Definition
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AIS	The Automatic Identification System (AIS) is an automatic tracking system used on ships and by vessel traffic services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites.
CSN	CSN is a satellite based monitoring system for marine oil spill detection and surveillance in European waters. The service is operated by EMSA and provides a range of detailed information including oil spill alerts to Member States, rapid delivery of available satellite images and oil slick positions. More information at: https://csndc.emsa.europa.eu/homepublic
EMSA	EMSA provides technical assistance and support to the European Commission and Member States in the development and implementation of EU legislation on maritime safety, pollution by ships and maritime security. To do this, one of EMSA's most important supporting tasks is to improve cooperation with, and between, MSs in all key areas. In addition, the Agency has also been given operational tasks in the field of oil pollution response, vessel monitoring and in long range identification and tracking of vessels. As a body of the EU, the Agency sits at the heart of the EU maritime safety network and collaborates with many industry stakeholders and public bodies, in close cooperation with the EC. More info at: www.emsa.europa.eu
ENC	ENC means the database, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation (IMO resolution A.817 (19)).

2.2 Terms specific to the Earth Observation domain

The following table includes a glossary of the relevant terms commonly used in this TS and specific to Earth Observation domain.

Term	Definition
Coverage	Coverages represent digital geospatial information representing space/time-varying phenomena.
Dataset	Dataset is a collection of data, vector or raster.
Dataset series	Dataset series is a temporal collection of datasets.
Earth Observation	Earth observation is the gathering of information via remote sensing technologies supplemented by earth surveying techniques, encompassing the collection, analysis and presentation of geospatial data.

Geospatial	Geospatial are data and software components which deal with a geographic attributes.
Geospatial service	Geospatial service is a web service that delivers geospatial data.
GML	The Geography Markup Language (GML) is the XML grammar defined by the Open Geospatial Consortium (OGC) to express geographical features. GML serves as a modelling language for geographic systems as well as an open interchange format for geographic transactions on the Internet.
Metadata	A Metadata is a document, typically in XML format, that describes the content of a dataset or a geospatial service.
Process	A process is a software component that transforms data, provides services, or extracts information.
Raster	Raster dataset is a representation of the plant Earth as a surface divided into a regular grid of cells. Raster models are useful for storing data that varies continuously, as in an aerial photograph, a satellite image, a surface of chemical concentrations, or an elevation surface.
Satellite Operators	Satellite Operators are organizations that operate satellites.
Satellite Owners	Satellite Owners are organizations that operate satellites.
Near-real-time	In the context of its use in CSN the term "near-real-time" refers the delay between the download of satellite images and the availability of this information through the CSNDC web services. This delay shall be less than 30 minutes.
SAR	(As Synthetic Aperture Radar). SAR is a form of radar in which multiple radar images are processed to yield higher-resolution images than would be possible by conventional means. Either a single antenna mounted on a moving platform (such as an airplane or spacecraft or satellite) is used to illuminate a target scene or many low-directivity small stationary antennas are scattered over an area near the target area. The many echo waveforms received at the different antenna positions are post-processed to resolve the target. SAR can only be implemented by moving one or more antennas over relatively immobile targets, by placing multiple stationary antennas over a relatively large area, or combinations thereof. SAR has been extensively used in remote sensing and mapping. SAR images are used in VDS.
Sensors	Sensors Within the context of earth observation, sensors are satellite, UAV, in situ or airborne devices which collect geospatial data.

Service Providers	“Service Providers” are the organizations in charge to analyse an Earth Observation product in order to extract the information expected by the EMSA’s EODC and deliver it to the EO-Processing.
Spatial Data Infrastructure	A Spatial Data Infrastructure a set of Geospatial services orchestrated in order to provide a Service.
Vector	Vector dataset is a representation of the planet Earth using points, lines, and polygons. Vector dataset are useful for storing data that has discrete boundaries, such as features, cost lines.

2.3 Terms specific ICT or Project Management domain

The following table includes a glossary of the relevant terms commonly used in this TS and specific to ICT or Project Management domain.

Term	Definition
API	In computer programming, an application programming interface (API) is a set of routines, protocols, and tools for building software applications. An API expresses a software component in terms of its operations, inputs, outputs, and underlying types
Application	An application is a software component designed to help the user perform specific tasks.
Building Blocks	A Building Block comprises a set of subsystem that can be configured to fit an application purpose.
Client	A client is a piece of computer hardware or software that accesses a service made available by a server.
Data Centre	A Data Centre is a facility used to house computer systems and associated components, such as telecommunications and storage systems.
JSON	JSON is a lightweight data-interchange format. It is based on a subset of the JavaScript Programming Language
Interfaces	An interface is a shared boundary across which two separate components of system exchange information.
Interoperability	Within this context is the ability of systems to exchange information and accept services from other systems, in order to enable them to operate effectively together.
MD5	The MD5 is a message-digest algorithm is a widely used cryptographic hash function producing a 128-bit (16-byte) hash value, typically expressed in text format as a 32 digit hexadecimal number. MD5 is utilized in this TS to verify data integrity.

Process	A process is a software component that transforms data, provides services, or extracts information.
RDF	RDF is a family of World Wide Web Consortium (W3C) specifications. It has come to be used as a general method for conceptual description or modelling of information that is implemented in web resources.
Server	A server is a running instance of an application (software) capable of accepting requests from a client and giving responses accordingly. Servers can run on any computer including dedicated computers, which individually are also often referred to as "the server"
Service	Service "Means of delivering value to the customer by facilitating the outcomes customer want to achieve, without the ownership of specific costs and risks" (ITIL definition).
System	A system is a set of interacting or interdependent building blocks forming an integrated whole.
System to System	System to system is a type of interaction between two systems governed by specified interfaces.
Solution	The solution is the system implemented by the contractor
Standard	A standard is an established norm or requirement in regard to technical systems. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices.
Subsystem	A subsystem is a self-contained software component that provides a set of functionalities.
SWOT	A SWOT analysis is a structured method used to evaluate the strengths, weaknesses, opportunities and threats of topic to address.
User interface	Everything designed into an IT system which includes one or more applications which a human being may interact with. This includes, but is not restricted to: display screen, keyboard, mouse, light pen, desktop appearance, illuminated characters, help messages, and how an application program or a Web site invites interaction and responds to it.
Web service	A web service a subsystem designed to support interoperable machine-to-machine interaction over internet.
Workflow	A workflow consists of an orchestrated and repeatable pattern of processes.
XML	XML is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. https://en.wikipedia.org/wiki/Machine-readable_data It is defined by the W3C's XML 1.0 Specification and by several other related specifications, all of which are free open standards.

3. Introduction

EO-Processing is a high-performance system responsible for the processing of satellite imagery and Value-Added Products (Satellite imagery derived products).

The Earth Observation Processing shall: Ingest, Transform and Deliver Earth Observation data to the SSN Ecosystem applications. It indeed comprises three building blocks that support several communities (multi-communities) and process several types of sensors (multi-sensors):

1. **Data Ingestion:** Once ordered by EMSA and consequently acquired by the relevant satellite and associated operator/service provider, the EO datasets need to be ingested into the EODC. This building block includes several steps such as: validate data integrity, check data quality, and record the timestamp of the information acquired.
2. **Data Transformation.** Ingested data shall be further transformed in different formats.
3. **Data Delivery:** Finally, EO datasets shall be delivered to several SSN Ecosystem applications that making use of EO information through geospatial standard services (W*S) can address EMSA's use cases. These applications could be web portals as well as web services (i.e. the EO product distribution).

The requirements described in this document were implemented in the scope of the 2016/EMSA/OP/25/2015.LOT1. The main objective of this document is to provide information on the EO-Processing functionalities that were implemented and will have to be maintained.

4. Requirements

4.1 User Communities

User communities	Informative
<p>The Earth Observation System (EO-Processing) will cater to the needs of a wide range of user communities in the maritime domain. These include:</p> <ul style="list-style-type: none"> ▪ Border Control. ▪ Fisheries Control. ▪ Maritime Security and Safety. ▪ Customs. ▪ General Law Enforcement. ▪ Marine Environment. ▪ Defence. <p>Within the context of the EO-Processing a “user community” could be also called “operation”.</p>	
User communities – high level needs	Informative

Requirements

Each user community has a wide set of operational needs that can be tackled using EO services:

- Border Control
 - Coastal monitoring (detection of points of departure).
 - Vessel detection activity.
- Fisheries Control
 - Fish cage and farm detection.
 - Detection of non-reporting vessels.
 - Characterization of fishing activities.
 - Detection of illegal activities.
 - Catch unloading and transshipment monitoring.
- Maritime Security and Safety
 - Location of vessels in distress.
 - Location of persons in distress.
 - Localization of non-reporting vessels.
 - SAR support.
 - Marine Environment conditions.
 - Location of missing vessels.
- Customs
 - Recognized maritime picture.
 - Detection and tracking of vessels of interest.
 - Detection of suspicious activities.
- Marine Environment
 - Pollution detection & Polluter identification (i.e. Oil Spill).
 - Slick evolution.
 - Pollution response support.
- Law enforcement
 - Detection and tracking of vessels of interest.
 - Detection of suspicious activities.
- Defence
 - Shoreline geospatial intelligence services.
 - Extended maritime surveillance.
 - The list of services is not limitative. New services may arise in the future. The system shall be designed in a way that it possible to configure new services.

4.2 Key Performance Indicators – KPIs

Product assumptions	Informative
<p>For the purpose of determining the EO-Processing KPIs, and as reference for the acceptance tests to be conducted, the following assumptions are made regarding size of the different products:</p> <ul style="list-style-type: none"> ▪ Imagery: <ul style="list-style-type: none"> ○ SAR images: 1 GB single band. ○ Optical image 3 GB multiple bands. ▪ Value added products <ul style="list-style-type: none"> ○ Vessel detection product (XML with points): 1 product includes 1000 individual vessel targets. ○ Activity detection product (XML with polygons + thumbnail images): 1 product includes up to 100 activity targets. ○ Vector Change detection (XML with polygons + thumbnail images): 1 product includes up to 10 change detection targets. It should be noted that change detection is a specific type of activity detection. <ul style="list-style-type: none"> ○ Raster Change Detection (output of a change detection algorithm comparing 2 or more images). The output can be a raster or a vector layer but in any case, it will be a single object. ○ Oil spill detection product (XML with polygons + thumbnail images): 1 product includes up to 30 oil spills. ○ SAR derived (Wind and Wave): (400x400 km with 50m resolution). ▪ User provided <ul style="list-style-type: none"> ○ Incidents (XML plus video and images): 1 product includes 1 individual incident with attached content up to 100MB. ○ CSN feedback (XML plus video and images): 1 product includes 1 individual feedback with attached content up to 200 MB. ○ Generic Reports (XML plus video and images): 1 product includes 1 individual report with attached content up to 100 MB. 	


Concurrent satellite acquisitions	P1
<p><i>Requirements</i></p> <p>The EO-Processing shall be able to process the following concurrent acquisitions:</p> <ul style="list-style-type: none"> ▪ Number of parallel acquisitions for SAR imagery (including additional vessel detection, oil spill and SAR derived products): <u>4 concurrent acquisitions.</u> ▪ Number of parallel acquisition for optical imagery (including additional vessel detection, activity detection and change detection products): <u>6 concurrent acquisitions.</u> 	

- Number of parallel acquisitions for Optical and SAR (reflecting a potential scenario of both types of data being delivered, and including all the value added products as defined in: 8 concurrent acquisitions).

EO-Processing daily satellite acquisitions	P1
<p><i>Requirements</i></p> <p>The EO-Processing shall be able to process on a daily basis the following number of products:</p> <ul style="list-style-type: none"> ▪ Number of acquisitions for SAR imagery (including additional vessel detection, oil spill and SAR derived products): <u>20 acquisitions</u>. ▪ Number of acquisitions for optical imagery (including additional vessel detection, activity detection and change detection products): <u>15 acquisitions</u>. <p>Number of acquisitions for Optical and SAR (reflecting a potential scenario of both types of data being delivered, and including all the value added products): <u>35 acquisitions</u>.</p>	

EO-Processing– timeliness	P1
<p><i>Requirements</i></p> <p>The EO-Processing shall ingest (T0 is the beginning of the ingestion) and process the following products, including in the case of concurrent acquisitions, making them available at the respective web services for the delivery (T1), according to the following timeliness:</p> <ul style="list-style-type: none"> ▪ Ingestion of SAR images (EOP) <ul style="list-style-type: none"> ○ small size images (less than 300 MB) --> less than 30 seconds ○ medium size images (300-900 MB) ---> Less than 90 seconds ○ large size images (900-2048) ---> Less than 3 minutes ○ very large images (2048-4096) ---> Less than 7 minutes ○ Ingestion of SAR and optical value added products (including OSN, ACT, DER (SAR WIND and SAR WAVE), VDS, CDE): <ul style="list-style-type: none"> ▪ Less than 30 seconds. <p>T0 is defined as the moment were the products are available at the EO-Processing (i.e. at the EOProcessing FTP or at the W*S used for ingesting the information).</p>	

4.3 Data Sources

Data sources	P1
<p>There are four main data sources that need to be handled by the EO-Processing:</p> <ul style="list-style-type: none">• Optical imagery.<ul style="list-style-type: none">○ Image products.○ Value added products.• Radar imagery (Synthetic Aperture Radar).<ul style="list-style-type: none">○ Image products.○ Value added products.• User Provided information (including content from mobile).<ul style="list-style-type: none">○ User feedback (e.g.: feedback on CleanSeaNet oil spill detections).○ Incident data.○ Other reports.• External data from other systems.<ul style="list-style-type: none">○ Oil spill modelling information.○ External Standard Web Services and Data (i.e. from Copernicus Marine Services). <p>The following figure provides an overview of the different data sources</p>  <p>Figure 3 Data Sources</p>	

Data types	P1
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The EO-Processing needs to handle highly variable data types, stemming from the different data sources. These include:

- Vector data (point, line, and polygon).
- Raster data (single band, multiband).
- Coverage data (i.e. GeoTIFF, NetCDF, JPEG2000).
- (in future) Rich content (images /video) from users (CSN feedbacks and user provided mobile content).
- (in future) Other content (structured content (i.e. XML), text, etc.).

The following figure provides an overview of the different data sources

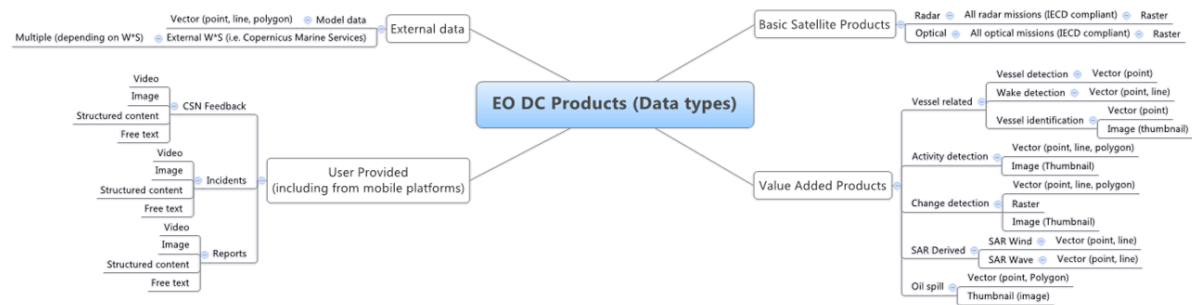


Figure 4 Data Types

EO Product	P1
<p><i>Requirements</i></p> <p>An EO product contains information provided or extracted through an observation on the surface of the planet Earth. For example, an EO product is a satellite image as well as an oil spill feature detected from a satellite image.</p>	

EO Package	P1
<p><i>Requirements</i></p> <p>EO product shall be bounded in packages, a package could contains both vector and raster data. Each package shall be self-contained usually bounded in a compressed file (zip, tar, etc.)</p>	

EO Acquisition	P1
<p>An EO Acquisition is a combination of different EO products delivered by the SP in a format of EO Packages.</p> <p>The contractor shall implement a system that it is capable to ingest all the EO products that belong to an EO Acquisition and control its completeness.</p> <p>More information about the packages received from EMSA's Service providers can be found in Appendix 11 - EODC Interface Control Document.</p>	

4.4 Data lifespan

Data retention – time span	P1
<p><i>Requirements</i></p> <p>The EO-Processing shall retain all ingested data, available for the delivery, for a configurable data retention period (by default 6 months). This data retention policy implies the immediate retrieval of the data for the abovementioned period. After this period the data shall be archived.</p>	

4.5 Data volume

Volume of data	P1
<p><i>Requirements</i></p> <p>It is expected that the EO-Processing shall be able to manage data, and maintain the defined performance. It is estimated that these levels reach:</p> <ol style="list-style-type: none"> 1) 4 Terabytes of SAR image products. 2) 10 Terabytes of Optical image products. 3) 600 GB of user uploaded content. <p>Please note that these values do not include intermediary products used for internal processing purposes and value adding information, for which the size is considered negligible when compared with the abovementioned categories.</p>	

4.6 Data Ingestion

Data Ingestion	Information
<p>Within the context of the Data Ingestion EO-Processing building block the contractor shall implement at least the following components:</p> <ul style="list-style-type: none"> - Data Integrity, to validate and data to be ingested in terms of the data model, format, and integrity. - Data Quality, to assess the quality of the data to be ingested against the operational need. - Timeliness, to record the timestamp of the relevant processes during the ingestion. 	

Compliance-Notification	P1
<p><i>Requirements</i></p> <p>A compliance-notification is an EODC component based on e-mail mechanism. The contractor shall implement a component to configure the EODC's compliance-notifications. The content of a compliance-notification (subject and body) and the list of recipients shall be configurable.</p> <ul style="list-style-type: none"> i. The following macro events trigger e-mail compliance-notifications: <ul style="list-style-type: none"> ○ Package rejection (see data integrity and quality controls). ○ Packages not ingested (due to technical issues). ○ Packages successfully ingested. • For each event there is dynamic distribution list to generate, which depends for example on the service providers that was in charge to deliver the EO packages. • A compliance-notification shall be issued within 3 seconds since the event is detected (recorded in a log). 	

4.7 Data Integrity

Integrity of incoming files	Informative
<p>The main scope of Data Integrity component is to check if the incoming EO packages are: uncorrupted, complete and compliant with EMSA protocols and data models and formats.</p> <p>The outcomes of the Data Integrity analyses will be used to ensure that corrupted or not adequate EO packages and files are promptly identified and rejected to avoid ingestion of unsuitable data into the system.</p>	
Completeness of acquisition	Informative

The contractor is in charge to implement a subsystem that shall control and report about the completeness of the ingestion against the expected set of EO packages. Detailed description of EO Acquisitions structure, naming convention and content shall be provided in ICD. For example currently, in case of SAR satellite acquisitions, EMSA could receive by the SP the following packages:

- EO product SAR-Native1 image (EOP).
- Oil spill notifications (OSN).
- SAR derived products (DER).
- SAR Vessel Detection layer (DER).
- Activity detection (ACT).
- Oil spill warnings (OSW).
- Quality notification (QNO).
- Quality Report (QUA).

Timeliness of packages arrival is not constant.

Integrity of incoming files	P1
<p><i>Requirements</i></p> <p>EO data are delivered to EMSA in compressed files using the following formats: .zip, .tar, .tgz.</p> <p>The contractor shall make available a software component capable to do the following:</p> <ul style="list-style-type: none"> ▪ Decompress in-coming compressed EO packages considering the mentioned formats. ▪ Identified and rejected corrupted files. ▪ Handle up to 5 GB compressed files. 	

Integrity of incoming files – Additional criteria	P2
<p>It will be considered advantageous if the contractor shall make available a software component capable to do the following:</p> <ul style="list-style-type: none"> ▪ Handle compressed files bigger than 5 GB. ▪ Handle additional compressing format than zip, .tar, .tgz. 	

Compliance of packages data schema	P1
<p><i>Requirements</i></p> <p>The contractor shall make available a software component capable to do the following:</p> <ul style="list-style-type: none"> ▪ Check the validity (well formed) of the XML schema for each EO in-coming package. 	

- Check that each EO package's XML is conformal with XML Schema Definition (XSD).
 - Identified and rejected packages that are not valid or non-compliant with the appropriate XSD.
- In case this test fails a compliancy-notification shall be issued.

List of EO package	P1
<p><i>Requirements</i></p> <p>The contractor shall implement a subsystem to be invoked by the Service Providers before starting the delivery of expected EO packages. The Service Providers shall declare the list of the EO packages that it is going to deliver to the EO-Processing.</p> <p>In case this test fails a compliancy-notification shall be issued.</p>	

EO product ingestion control	P1
<p><i>Requirements</i></p> <p>The contractor shall implement a control within the EO-Processing Acquisition building block where the EO products acquired by the ingestion can be evaluated against declared list of products to ingest.</p> <p>In case a product is not compliant against the above controls a compliancy-notification shall be issued.</p>	

EO data packages check based on Reference Identifiers	P1
<p><i>Requirements</i></p> <p>The contractor shall implement a subsystem which checks that EO data packages ingested correspond with EO data packages expected. The list of the expected EO data packages can be obtained using the Reference Identifier querying the Tasking and Ordering.</p> <p>This subsystem shall also perform spatial and temporal control, based on the metadata of the data packages, for example the time and location of the data package ingested are as ordered.</p> <p>In case this control fails a compliancy-notification shall be issued.</p>	

4.8 Data Quality

Main scopes	Informative
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The main scope of the Quality Component is two-folded:

- i. Check the quality of the EO basic products (optical and radar imagery) against defined image characteristics.
- ii. Verify the quality of in-coming EO data against ordering specifications defined within the EO-Provisioning building blocks.

Quality packages associated to EO satellite acquisitions	Informative
<p>Information regarding quality analyses conducted by EMSA contractors on EO products are contained in two packages:</p> <ol style="list-style-type: none"> i. Quality Notification (QNO). ii. Quality report (QUA). <p>Detailed definition of packages and associated XML schemas is available in the attached version of the EICD (see Appendix CSNDC-ICD).</p> <p>EMSA will require service providers to conduct additional and more stringent quality check before delivering EO products. The parameters defining the outcomes of quality analyses will be included in the quality packages.</p>	

Quality of the delivered EO products	Informative
<p>EO acquisitions and added value products are tasked and ordered in the Satellite Data Sourcing building block. During this phase several parameters are defined, such as (preliminary list of control):</p> <ol style="list-style-type: none"> i. Area of interest (Aol). ii. Acquisition time interval (start date/time – stop date time). iii. Requested satellite mission (platform, sensor). iv. Delivery category. v. Image Processing level. vi. Imaging Bands. vii. Mapping projection. viii. Cloud cover threshold. ix. Image Resolution. <p>These pieces of information are stored in the data provision interface (TOR) database. The contractor is in charge to implement a module to access to this information based on SOA approach. The list of these controls is considered preliminary and it could be extended by EMSA in the future. The implementation of this preliminary list of controls is considered part of this specific contract. Additional controls to implement on top of this preliminary list shall be considered as part of the system evolution, and therefore they are out of the scope of this specific contract.</p>	

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Quality checks based on the metadata	P1
<p><i>Requirements</i></p> <p>The contractor shall implement a subsystem that performs the following quality checks</p> <ul style="list-style-type: none"> i. Control quality parameters of EO basic products contained in QNO and QUA packages provided by EMSA EO service providers. This will be achieved by comparing quality values contained in QNO and QUA packages against reference values and thresholds (e.g. cloud coverage in an optical image shall be less than 20%). ii. Verify that the characteristics of a specific EO acquisition are aligned with ordering requirements. This will be achieved by comparing ordering parameters against acquisition parameters contained in image's metadata. <p>In case this control fails a compliancy-notification shall be issued.</p>	

Quality checks based on data	P2
<p><i>Requirements</i></p> <p>Quality checks rely on outputs of quality analysis conducted by third parties (i.e. EMSA EO service providers).</p> <p>The contractor shall implement a subsystem that performs additional checks on acquired EO products to verify quality parameters.</p> <p>The contractor can optionally propose a single or multiple software components capable to verify:</p> <ul style="list-style-type: none"> i. Cloud covers percentage. ii. Radiometric quality. iii. Positional accuracy considering given RCPs (Reference Control Points). iv. Matching coverage against defined Areas of Interest. <p>The contractor shall provide technical documentation describing how he intends to perform these controls.</p>	

4.9 Timeliness

TimeStamp	P1
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Requirements

The contractor shall implement a subsystem for recording the timestamp of all the EO-Processing processes when an ingestion of an EO product takes place. At least the following TimeStamp need to be processed.

- i. When the EO product is completely uploaded on the ftp service
- ii. When any of the EO-Processing Acquisition subsystems is completed
- iii. When the image-processing completed
- iv. When the Dissemination is completed

The recording of the timestamp can be configurable (ON/OFF). If it is OFF none of the processes timestamps are recorded. To switch from ON/OFF mode shall not require restarting neither the EO-Processing system nor any related components.

timeliness web service

P1

Requirements

The contractor shall implement a subsystem where it is possible to request the TimeStamp of each EO data package associated with a reference identifier.

The subsystem shall implement the following search criteria: by EO product filenames OR by range of date/time.

The timeliness subsystem shall return all the TimeStamp collected during the ingestion process of the all EO data packages that matches the search criteria.

The results of the search criteria shall be presented in HTML and they shall be also downloadable in XML format.

The subsystem shall reply in less than 1 second for search requests based on product filenames, reference identifier and package type, in less than 5 seconds for search request based on a range of 1 week.

The binding protocols to be supported by this service shall be REST.

Timeliness queue

P1

Requirements

The contractor shall implement a subsystem that provides the time stamps also through a message pattern architecture mechanism (i.e. Java Message Service - JMS) in order to provide the expected information to the Journaling (JOU) or its further evolution.

The exchange of the time stamp message shall be configurable (ON/OFF). If it is OFF none of the processes' timestamp is recorded and exchanged with the JOU. To switch from ON/OFF mode shall not require restarting neither the EO-Processing system nor any related components.

Re-ingestion timestamp

P1

Requirements

In case an EO product is re-ingested, the same EO package is acquired more than one time, and the timestamp recording is ON a new entry is created in the timeliness component without modify or overwriting the TimeStamp recorded of EO products already ingested. The first ingestion timestamp has to be tagged as reference timestamp, it might be used for the price and budget computation (out of the scope of this specific contract).

If there are more than one timestamp recorded for an EO product, the timeliness subsystem shall provide all the timestamps recorded for those products.

Performance Overview	P1
<p><i>Requirements</i></p> <p>The contractor shall implement a subsystem in order to return the following information based on date/time range search criteria:</p> <p>i. Total number of EO products within the search range.</p> <p>The subsystem shall reply in less than 5 seconds for a request based on a search range of 1 week.</p> <p>The results of the search criteria shall be presented in HTML and they shall be also downloadable in XML format.</p> <p>The binding protocols to be supported by this service shall be REST.</p>	

4.10 Data Transformation

Data Transformation	Information
<p>Within the context of the Data Ingestion EO-Processing building block the contractor shall implement at least the following components:</p> <ul style="list-style-type: none"> - Inventory to manage the data archiving policy. - Image-processing, to transform raster data. - Vector-processing, to transform vector data. - Disseminator, to feed the Data Delivery services with the data ingested into the EO-Processing Data Delivery building block. <p>Specific requirements for the abovementioned subsystems are described within the context of this chapter.</p>	

4.11 Inventory

EO-Processing data access policy	P1
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Requirements

The contractor shall implement the following data management policy (data are taken at time T0):

- i. Data with less than a configurable amount of days (T1, by default 6 months) shall be made available via DIRECT RETRIEVAL;
- ii. Data from T0 to a configurable amount of days (T2, T2>T1, by default 5 years) shall be made available via DELAYED RETRIEVAL;
- iii. Data older than T2 shall be made available via MANUAL RETRIEVAL.

DIRECT RETRIEVAL. Data can be accessed by EO-Processing's clients (either GUI or S2S) through the EO-Processing Delivery Services, the SLA applicable for this service are described in this technical specification.

DELAYED RETRIEVAL. Data is retrieved within a time delay which could reach several hours, up to a day. The data products are not necessarily directly accessible, but stored such, that they can be reconstructed and made available to the user with a certain delay. The user shall request to restore the data using a graphical user interface which again is mostly web based or via S2S communication ready to access the data through EO-Processing Delivery Services upon their restore. The system will provide the data automatically without any manual intervention.

MANUAL RETRIEVAL/ARCHIVING. Data is retrieved offline, with the manual intervention of an operator at EMSA, in a few days/weeks. In principle like delayed retrieval, but the request for the data will be made offline in a not standardised manner, e.g. via email to an EMSA account. This applies particularly, when products are requested which are of non-standard nature and need specific processing. However this manual retrieval can require a lot of resources and therefore it is good to design the systems such that most data retrievals will be performed via the immediate or delayed scheme.

MANUAL RETRIEVAL/ARCHIVING is considered data that is backed-up and is not directly accessible by the system. This data and related supporting systems are managed by EMSA and do not fall under the scope of this procurement.

The contractor shall implement a subsystem that allows the EO products and information ingested into the EO-Processing to be accessible via DIRECT RETRIEVAL (up to T1) and DELAYED RETRIEVAL (up to T2).

The status of the dataset shall be documented in the dataset metadata. When an EO product is eligible for been MANUAL TREIVAL/ARCHIVING the system shall move the product in a specific folder. EMSA is in charge to manage the EO products in such folder.

All the timings (i.e. T1 and T2) defined in this requirement shall be configurable. A new configuration shall not require the restarting of the system.

Inventory	P1
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Requirements

- i. The contractor shall implement a subsystem that inventories all the EO packages ingested into the EO-Processing in order to be accessible via DIRECT RETRIEVAL and DELAYED RETRIEVAL.
- ii. While the catalogue service deals with the description of the EO products ingested, this module deal with the storing capability of the physical files (for example in the current CSNDC implementation the storing capability is based on NetApp solution). These two services, inventory and catalogue shall contain consistent information. The catalogue metadata shall record the information where the EO products are stored.
- iii. The contractor shall propose an inventory that deals with DIRECT RETRIEVAL and DELAYED RETRIEVAL.

EO-Processing data access functionalities

P1

Requirements

In order to limit the data to be managed for the DIRECT delivery, the subsystem that implements the EO-Processing data access policy shall implement the following functionalities:

ON-DEMAND

- 1- Disable for the EO packages the DIRECT RETRIEVAL based on data/time criteria:
 - a. Move all the EO packages older than T1 from the DIRECT RETRIEVAL inventory to the DELAYED RETRIEVAL inventory.
 - b. Remove from the EO-Processing Data Delivery services all the EO information, raster and vector explicitly needed for DIRECT RETRIEVAL and which are older than T1.
 - c. Update the metadata of the EO products catalogued with the status and inventory information (only DELAYED RETRIEVAL).
- 2- Disable the EO packages as specified in the point 1 based on package file name.
- 3- Disable the EO package as specified in the point 1 based on EO Acquisition (therefore all the EO products and EO information associated to a satellite order form identifier).

AUTOMATIC

- 4- If the automatic mode is set ON the functionalities specified in the point 1 shall be executed at regular interval (every day at 01:00 AM UTC). The data management automatic mode shall be configurable (ON/OFF). To switch from one mode to the other shall not require restarting neither the EO-Processing system nor any related components.

Restore of data

P1

Requirements

The contractor shall implement restore functionalities as following:

- i. The EO-Processing shall develop the functionalities of restoring the data from the DELAYED RETRIEVAL to the DIRECT RETRIEVAL.
- ii. This restore functionality shall ensure that once the data is back in the DIRECT RETRIEVAL, the data provides the same information as when it was originally in the DIRECT RETRIEVAL.
- iii. The restore functionality can be executed based on the data/time interval (for example all the EO acquisition that took place from 18/09/2014 13:30 to 28/09/2014 17:45).
- iv. The restore functionality can be executed based on EO acquisition (order form identifier) or also based on the EO package file name.
- v. Two types of notifications have to be generated when a restoring is requested. A notification that informs the user that the restoring request is accepted (within 10 minutes), and a notification that informs the users that the restoration is completed.

4.12 Image Processing

Image processing	Informative
<p>The main scope of the image processing component is to create all the conditions for an optimized display of EO products. This includes:</p> <ul style="list-style-type: none"> ▪ Appropriate and efficient visual representation of raster pixels values. ▪ Corrected geo-location in a geo-referenced environment. 	

Brief description of EO SAR products utilized by EMSA	Informative
<p>SAR acquisitions are level 1 (SAR-Native1) product consisting of native, geo-referenced SAR images with azimuthal resolution ranging from 100m to 1m or less. SAR images are available in all possible combinations of polarisations e.g. either single (HH or VV), dual (HH+VV or VV+VH) or cross polarisation (HV or VH), according to the tasking of the satellite. Satellite platforms currently utilized by EMSA include: Radarsat-2, CosmoSky-Med, TerraSAR-X, Sentinel-1. Additional Radar satellites may shortly enter in the portfolio of EMSA.</p>	

Brief description of EO optical products utilized by EMSA	Informative
<p>Optical satellite acquisitions are panchromatic or multispectral with resolutions ranging from 30m to 0.3m or less. The processing levels range from geo-referenced to ortho-rectified. Optical satellites currently utilized by EMSA are: Worldview-1, Wordview-2, Worldview-3, GeoEye-1, SPOT 6/7 and Pleiades 1A/1B, DEIMOS-1 and 2, FORMOSAT-2, and LANDSAT-8.</p>	

Formats	Informative
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Formats requested for the representation of satellite imagery include:

- i. GeoTIFF (including BigTIFF).
- ii. JPG2000 (ISO/IEC 15444 Lossless).
- iii. SAR Level-1 B (Sentinel-1, RS-2, TSX and Cosmo SkyMed).
- iv. Raw images and other satellite native formats as defined by satellite operators (to be defined).

EMSA may also request EO service providers to provide Pyramidal Views (PVs) instead of original image. Note: PV files are GeoTIFFs that contain a pyramidal structure used to enhance visualization.

Image characteristics	Informative
<p>Satellite acquisitions are represented by single-band raster datasets (e.g. panchromatic images) or multi-band raster datasets (e.g. multi-spectral images).</p> <p>Pixel depth of the images is 8-bit and 16-bit although, exceptionally, 32-bit-images may be utilized by EMSA.</p> <p>All the images utilized by EMSA are in WGS84 system.</p>	

Creation of pyramid visualization of EO basic products in GeoTIFF format	P1
<p><i>Requirements</i></p> <p>Pyramidal visualizations (PVs) of EO products in GeoTIFF format (optical and radar) shall be produced to enhance performance of raster datasets visualization. The following characteristics for the creation of PVs are to be considered as reference, however, the contractor can propose different solutions for ensuring the EO-Processing processing performance:</p> <ul style="list-style-type: none"> i. The interpolation for the creation of the lower resolution levels shall be bilinear convolution. ii. The minimum number of pyramidal levels for each band shall be equal to three. iii. PVs of multispectral images shall be supported. <p>The PVs shall be created with pixel depth of 8bit or higher.</p> <p>PVs layers shall be created in a compressed format unless this processing step severally impacts the performance of the system. The contractor shall define the most appropriate compressing format (e.g. Jpeg).</p> <p>PVs shall be created in case of BigTIFF</p> <p>Information provided in Brief description of EO basic products utilized by EMSA shall be considered in the design of the software component.</p>	

Creation of enhanced visualization strategies/processes for EO basic products in Jpeg2000 format	P1
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Requirements

- i. Wavelet-compressed raster file formats, such as JPEG 2000, are flexible and scalable due to fast access to various resolutions of the image without having to create and store pyramids (standard optimization structures for GeoTIFF images).
- ii. It will be considered advantageous if the contractor proposes visualization enhancement strategies / processes for JP2000 format.
- iii. These enhancement should abide to the characteristics reported in Brief description of EO basic products is considered and ensure that the necessary KPIs are respected.
- iv. The contractor shall, in any case, provide a description of the considered approaches.

Creation of GeoTIFF images from satellite native products

P1

Requirements

The contractor shall implement a software component that can process into GeoTIFF or JPEG 2000:

- i. SAR Satellite images in native format.
- ii. Native proprietary formats, such as MrSid and ECW.

The incidence angle radiometric correction shall be part of the processing.

Management of raw images, satellite native format and other image compression formats

P2

Requirements

It is considered an advantageous if the contractor is able to implement a software component that can handle:

- iii. Raw images (e.g. non-pansharpened multi-spectral bands).
- iv. Native proprietary formats, such as MrSid and ECW.

Visualization requirements for EO products

P1

Requirements

The contractor shall consider the following requirements in terms of EO product visualization:

- i. Single band images shall be represented in greyscale.
- ii. A histogram stretch solution to enhance the appearance of the single-band image. While a histogram-equalized stretching is to be considered as reference solution, the contractor can propose a different solution for ensuring the EO-Processing processing performance.
- iii. Multiband images shall be represented in RGB composite render. If the raster datasets has wavelength information and/or band indexing then it shall be displayed accordingly.
- iv. No data (background colour) shall be visualized as transparent (no colour).
- v. Each band participating in the composite shall be properly stretched to enhance the appearance of the image. While a histogram-equalized stretching is to be considered as reference, the contractor can propose a different solution for ensuring the EO-Processing processing performance.

If an image has internally stored stretch, this information shall be used to perform stretching.

Geometrical corrections of SAR images using a displacement vector

P1

Requirements

Geometrical corrections are needed to correct distortions present in SAR images.

- i. Raster images shall be shifted using a correction vector (displacement vector) provided in the QNO package according to the ICD.

4.12.1.1 Vector Processing

Vector processing

P1

Requirements

- i. The default data encoding for the EO products ingested into the EO-Processing is described in the ICD. The current implementation largely uses the XML encoding (or GML in case of spatial information). The contractor shall implement the necessary tasks to transform the default encoding format to another format (i.e. from GML to JSON).
- ii. The contractor shall provide a tool that provides the means transform vector data in different format (mainly from GML to JSON)

This transformation can be processed on-fly or cached. On-fly means the data is transformed when the services that expose the data is invoked. Pre-processed means the transformation is pre-processed and cached. In case of cached transformation the contractor shall guarantee that changes on a source data are propagated to the transformed data.

4.13 Dissemination

Dissemination Service	P1
<p><i>Requirements</i></p> <ul style="list-style-type: none"> i. The outcomes of the Acquisition process shall feed one or more Delivery Services. The type of Delivery service to feed depends on the EO product type, for example raster data has to be delivered through the WMS service, and this software component is in charge to feed the EO-Processing Map Service. ii. The contractor shall describe in the Technical Design Document the dissemination interaction among the Dissemination and the Delivery services. Furthermore the contractor shall specify for each of the EO products the service that is going to be used for the delivery of the data. iii. The contractor shall design and implement the interactions among Data Ingestion, Transformation and Delivery building blocks in a manner that they are decoupled. In order to implement this requirement the contractor shall use a SOA integration approach (preferable web services or queue based). 	

EO information	Informative
<p>When an EO package is ingested, processed, transformed the information that contains is delivered through one or several EO-Processing Data Delivery services. For example the EOP package contains satellite images to be delivered as a Map Service and the metadata of the satellite images to be delivered as a catalogue Service. The information delivered through the EO services is called EO information.</p>	

4.14 Data Delivery

– Delivery Services	Informative
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Requirements

The Delivery Service is in charge to provide the EO information to the EO-Processing's clients through Standard Web Services.

The services deployed into the EO-Processing Delivery Services building block can be invoked by both Graphical User Interfaces (GUI) (see Appendix SEG) and other Systems in order to establish a System to System communication.

The type of EO data delivered by the EO-Processing Delivering services is described in the chapter 7.2.1.

The type of standard services to be deployed into the EO-Processing Delivery Services comprise:

Map service

- i. Raster data ingested into the EO-Processing shall be delivered by this service and/or a tile version of this service (at least Satellite Images)
- ii. For multi-polarisation SAR images or multi-spectral images, it shall be possible to access, any of the images
- iii. For added values products based on multiple acquisitions such as change detection, it shall be possible to access all images used as input or output of the process.

Coverage service

- iv. Coverage data ingested into EO-Processing shall be delivered by this service (at least Satellite Images)

Feature service

- v. Vector data ingested into the EO-Processing shall be delivered by the service (at least Oil Spill, Vessel Detected, Derived products, Activity Detection, User Feedback, and Incident Data).

Catalogue Service

- vi. Metadata ingested into, or created by the EO-Processing, shall be delivered by this service (all the data ingested into the EO-Processing)

Notification Service

- vi. When an acquisition takes place a notification can be sent DataSet Service
- viii. All the EO products (dataset) ingested into the EO-Processing shall be accessible by a REST interfaces top download or visualize their metadata.

Standard Service Broker ix. This service federates external standard services (for example Map, Coverage, Feature, Catalogues, Notification and DataSet services) invoke-able by the EOProcessing clients.

User uploaded content service

- x. This service will have to handle user uploaded content (CSN feedbacks, reports from mobile devices and all other uploaded content from users). The content includes: a. XML information coming from web services (SOAP, REST, etc.).
- xi. Data packages (these included attached information to the reports and are usually associated with rich content types (images, videos, documents, etc.).

Quality of Service	Informative
<p>The quality of service shall be evaluated against the following criteria:</p> <p>Performance - The maximum response time for sending the initial response in normal situation for a defined set of requests.</p> <p>Capacity - The minimum number of simultaneous requests to be served in accordance with the quality of service performance criteria.</p> <p>Availability - The probability that the service is available is a percentage of the overall time. It is computed based on the following criteria: 24 hours per days, 7 days per week, and 365 days per years.</p> <p>Compliance against the standard - Within the context of the EO-Processing tender the interoperability of the geospatial products is measured against the compliance of Open Geospatial Consortium (OGC) specifications, and the INSPIRE Implementing Rules. When applicable the compliance of the COTS against other standards shall be assessed (i.e. OASIS or W3C standards).</p>	

OGC compliance	P1
<p><i>Requirements</i></p> <p>The OGC Testing Facility web page (http://cite.opengeospatial.org/teamengine) lists the OGC standards for which certification tests are available and explains the procedure for running those tests. The contractor is in charge to test the compliance of the geospatial products proposed against OGC specifications using the OGC testing facilities.</p>	

INSPIRE compliance	P1
<p><i>Requirements</i></p> <p>The compliance against INSPIRE shall be reported in a document. The contractor shall draft a document that assesses the compliance of the geospatial solution proposed against the relevant INSPIRE Implementing Rules, and the Technical Guidelines. In case it is applicable the contractor shall make use of the INSPIRE metadata validator (see http://inspire-geoportal.ec.europa.eu/).</p>	

Other Standards compliance	P1
<p><i>Requirements</i></p> <p>If a COTS proposed within the solution of the contractor is declared compliant against a standard, the contractor shall draft a document that assess the compliance of the declared standard. In case it is applicable the contractor shall make use of tools to validate the compliance against the declared standard.</p>	

Reference Coordinate System	P1
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Requirements

All positions data shall be stored in Latitude and Longitude WGS84.

When it is not differently specified the following projections needs to be implemented in the delivery services:

- Mercator
- Universal Transverse Mercator (UTM)
- Polar

4.15 Map Service

Map Service	P1
<i>Requirements</i> <ol style="list-style-type: none"> i. For serving georeferenced raster images, as such satellite images, the contractor shall implement a Web Map Service (WMS) as part of the EO-Processing architecture. ii. By default all the raster images ingested into EO-Processing shall be automatically delivered through a WMS. iii. Due to the high amount of the EO products that are going to be ingested into the EOProcessing. The contractor shall describe the solution that it intends to implement for efficiently managing the capabilities of this service. iv. The request shall be based on varying format (at least PNG, GeoTIFF, and JPEG) parameters. v. The binding protocols to be supported by this service are: GET-KVP (mandatory), REST (mandatory), POST-XML (optional), and SOAP-XML (optional). 	
Map Tile Service	P1

Requirements

- i. For serving georeferenced raster images, as such satellite images, the contractor shall implement a Web Map Tile Service (WMTS) as part of the EO-Processing architecture. ii. All the raster images ingested into EO-Processing shall be automatically delivered through a WMTS. However EMSA can define specific criteria to implement for feeding this service,
- iii. The request shall be based on varying format (at least PNG, GeoTIFF, and JPEG) parameters.
- iv. Due to the high amount of the EO products that are going to be ingested into the EOProcessing. The contractor shall describe the solution that it intends to implement for efficiently managing the capabilities of this service.

The binding protocols to be supported by this service are: GET-KVP (mandatory), and REST (mandatory).

4.16 Coverage Service

Coverage Service	P1
<i>Requirements</i> <ul style="list-style-type: none"> i. For serving georeferenced coverage images, as such satellite images, the contractor shall implement a Web Coverage Service (WCS) as part of the EO-Processing architecture. ii. All the raster images ingested into the EO-Processing shall be automatically delivered through a Web Coverage Service (WCS). However EMSA can define specific criteria to implement for feeding this service. iii. Due to the high amount of the EO products that are going to be ingested into the EOProcessing. The contractor shall describe the solution that intends to implement for efficiently managing the capabilities of this service. iv. The binding protocols to be supported by this service are: GET-KVP (mandatory), POSTXML (mandatory), REST (mandatory), and SOAP-XML (optional). 	

4.17 Feature Service

Feature Service	Informative
<i>Requirements</i> <ul style="list-style-type: none"> i. For serving geographical features, as such georeferenced points, polygons, etc., the contractor shall include a Web Feature Service (WFS) as part of the solution architecture. ii. All the feature ingested into the EO-Processing shall be automatically delivered through WFS. iii. The binding protocols to be supported by this service are: GET-KVP (mandatory), POSTXML (mandatory), REST (mandatory), and SOAP-XML (optional). 	

4.18 Catalogue Service

Catalogue Service	P1
<p><i>Requirements</i></p> <ul style="list-style-type: none"> i. The contractor shall define the EO-Processing metadata profile to be used in order to manage the description of all the EO products ingested into the EO-Processing. ii. For all the EO products ingested a description (metadata) shall be created based on point 1. iii. The metadata of the EO products ingested shall be inserted into an OGC - Catalogue Service Web (CSW). iv. The following preliminary list of possible status for the EO products shall be managed in the metadata: pending, catalogued, archived, anomaly. A product is pending if its acquisition is planned in the future; a product is catalogue when the metadata is ingested; a product is archived when it is removed from the on-line services, and finally the product is in anomaly if the acquisition went wrong or will not take place. This list of possible status for the EO products shall be configurable and extensible. As soon as a product is pending a metadata shall be recorded into the catalogue, the contractor shall extract this information from the Satellite Data Provision subsystem. The metadata of the EO products shall record the status for its lifespan into the EO-Processing. v. The catalogue service shall support OpenSearch specification. vi. The binding protocols to be supported by this service are: GET-KVP (mandatory), POSTXML (mandatory), REST (mandatory), and SOAP-XML (optional). 	

4.19 Packages Notification

Packages Notification	P1
<p><i>Requirements</i></p> <ul style="list-style-type: none"> i. There are two different types of notification: metadata and data. The metadata notification sends the metadata of the EO packages ingested or created by the EO-Processing. The data notification sends the EO packages ingested. ii. The notification service shall push a notification to one or multiple end points (URL). iii. The binding protocols to be supported by this service are: POST-XML (mandatory), REST (mandatory), SMTP (mandatory), SMS (optional), and SOAP-XML (optional). iv. The encoding of the notification shall support: text (UTF-8), Atom, and RSS (or geoRSS). <p>All the EO packages ingested into the EO-Processing shall be automatically notified by a metadata notification.</p>	

4.20 DataSet Service

DataSet Service	P1
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Requirements

- i. All the EO products ingested into the EO-Processing shall be automatically exposed by REpresentational State Transfer (REST) interface over HTTP protocol.
- ii. The contractor shall specify both Uniform Resource Name (URN) and Uniform Resource Locator (URL) (therefore Uniform Resource Identifier URIs) to univocally identify and expose all the EO products delivered by the EO-Processing. In order to make the URIs not tightly coupled to a specific URI structure, the contractor, upon the agreement with EMSA, shall adopt a standard approach to describe REST services.
- iii. The REST service shall take into account:
 - a. The concept of operations.
 - b. The spatial concept as area of interest, as for example the water sovereignty of the EU Member States.
 - c. The temporal concepts based on dates, weeks, months and years.
 - d. The EO products specified in the ICD (see the ICD).
- iv. The REST URL to access at the EO products shall be recorded in the metadata of the EO products catalogued.
- v. All the EO products (dataset) ingested into the EO-Processing shall be accessible by a REST interfaces to download, and visualize in different formats: HTML and RDF.
- vi. The contractor shall keep the information published through this service up-to-date (for example when an EO product is achieved its accessibility through the REST interface needs to be removed). In case the EO product requested is archived a web form for restoring the EO product is visualized, if the user request to restore the EO product an email is sent to a configurable e-mail account.

4.21 Broker Service

Standard Service Broker	P1
<i>Requirements</i> This service federates standard external services (for example Map, Coverage, Feature, Catalogues) to be invoked by the EO-Processing clients: <ol style="list-style-type: none"> i. The contractor shall provide the means to federate instances of standard external services. 	

Business Continuity Facilities	P1
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Requirements

In terms of Business Continuity, the contractor shall implement a system be BCF complaint as specified within the EMSA's System and Application Technical Landscape. Overall the EOProcessing must have:

- i. SLA of 24/7 with 97.5% of availability.
- ii. Resolution time for Incidents: 4 hours.
- iii. Release Point Objective (RPO) of 8 hours.
- iv. Total recovery time: 12 hours.