The EUMETSAT EO Portal and Clearinghouse Project

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ABSTRACT

The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) is implementing the Earth Observation (EO) Portal and Clearinghouse to facilitate the access to weather and climate-related satellite data, images and products. The EO Portal is the single online access point to all EUMETSAT services and data. It implements a user interface which allows users to discover, search, order / subscribe to data and dissemination services. Through the Clearinghouse, users will also be capable to discover, search and order/subscribe to earth observation data from partner agencies and vice versa the Clearinghouse will allow partner agencies to get access to EUMETSAT services and data. The Clearinghouse offers services, which are based on OGC/HMA[1] and INSPIRE specifications. The EO Collection Catalogue (called Product Navigator) is presently in routine operations. Its implementation is based on con terra´s terraCatalog. A harmonised (federated) Identity-/User-Management (based on SUN´s OpenSSO) and a first release of the Clearinghouse (based on the ESB 'Mule', integrating legacy systems and providing interfaces for User Administration, OGC/HMA EO Product Search and Order Services) are within the validation phase.

Keywords: EUMETSAT, Earth Observation Portal, Clearinghouse, HMA, Metadata, INSPIRE, Identity-/User-Management, ESB

INTRODUCTION

The EUMETSAT EO Portal project was initiated for the benefit of end users and also to be prepared for interoperable access to data. Key points for end users are a single / harmonised online access point to all EUMETSAT EO Services and Data. In the past several applications with self contained user management functionality did exist. EUMETSAT users had to register with every application and to memorise different user ids and passwords. The EO Portal encapsulates the legacy applications and offers a harmonised user interface for services and data (see Figure 1).

Further to this, programmatic access using interoperable interface specifications (OGC, INSPIRE,...) to provide capabilities to discover, search and order/subscribe to EO Data from partner agencies and in turn to allow partner agencies to get access to EUMETSAT services was also required to be offered through the portal project. This is achieved through the Clearinghouse.

Services used programmatically, such as product ordering, require for shipping of media end user details passed using security concepts. In order to implement this between different organizations, a harmonized, sophisticated, standard based security concept is required to be in place. This involves the

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[1]   ESA´s Heterogeneous Mission Accessibility Project (http://earth.esa.int/hma/)

operating of a federated Identity Management System, including IdentityProvider (IdP) and UserManagement.
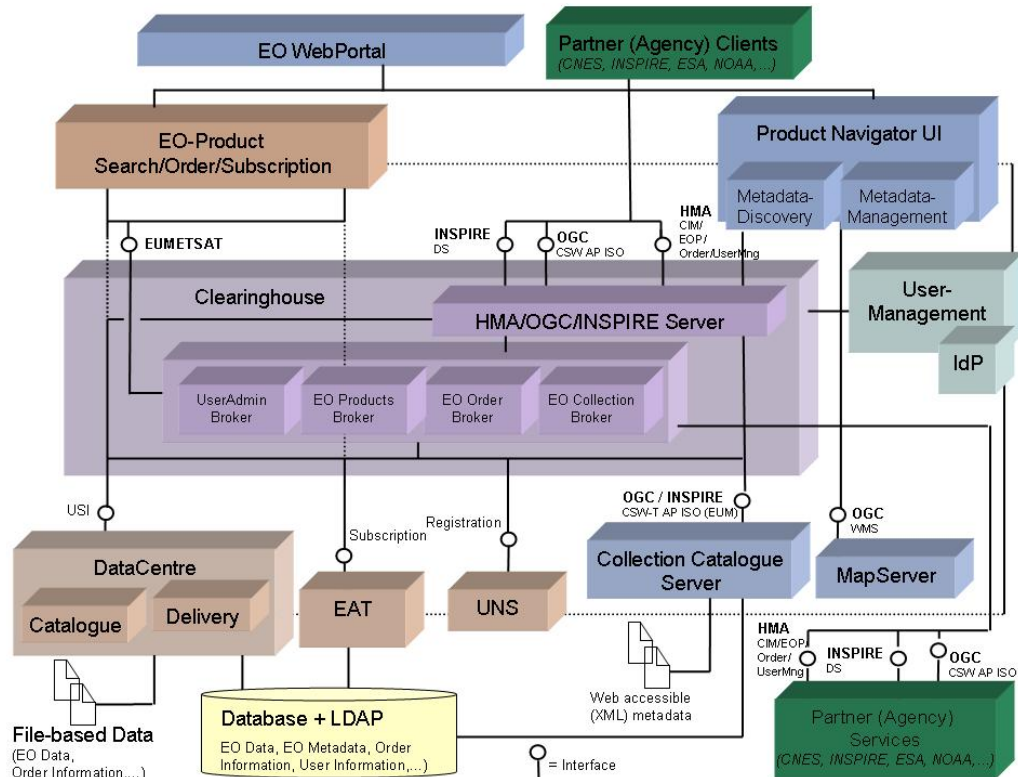

Figure 1: EO Portal System Architecture

The EO Portal project was initiated in 2008 with the architectural design phase accomplished by con terra with the drawing up of a 'High Level Architectural Design' based on the Reference Model for Open Distributed Processing (RM-ODP) [12][13]. The comparison and selection of COTS/ Open Source software products for the implementations of the EO Portal was exercised and documented in a trade-off analysis. After this the implementation of the Collection Catalogue (called "Product Navigator") was performed. The Product Navigator is based on con terra´s "terraCatalog", dealing with extended ISO 19115-2 collection metadata. The Product Navigator provides out of the box OGC/INSPIRE catalogue interfaces. Then a sophisticated security concept including IdentityProvider (IdP)- and UserManagement based on SUNs OpenSSO was developed. This included the development of software libraries to be used within the EO Portal for the enabling of advanced security concepts. Also a first release of the Clearinghouse (based on the Enterprise Service Bus Mule) was launched, integrating legacy systems for orchestrated user administration service calls and OGC/HMA based EO Product Search. Presently the conception and implementation of the Order Service providing the OGC/HMA Order Service Interface is underway.

INFORMATION MODELS

Within the EO Portal different types of information are used, especially (meta-)data for EO Product discovery and ordering.

EO Metadata

EO Metadata is provided and managed at Collection and Product level. EO Collection Metadata is based on the conceptual models of ISO19115 [9] and ISO19115-2 [10] and on the encoding model of ISO19139 [11]. The specific requirements concerning the delivery of EO Data via the EUMETSAT "Data Centre", EUMETCast or other dissemination services are described in ISO conformant extensions

to ISO19115-2 and ISO19139-2. The conceptual metadata model within the Clearinghouse for describing EO Products is based on a common matured schema defined within ESA´s HMA project. This schema is called "OGC GML Application Schema for EO Products" [6] (EO GML). A mapping between EO GML and the Data Centre EO Product information model for the targeted products has been defined. Both types of metadata can be discovered using the OGC/HMA CSW profiles [2][3][5].

Order Information

Ordering / subscription and access to the EO products within the Clearinghouse will be covered based on the information model of the OGC/HMA Order Services [7]. Internally different information models are used by the Order-, Subscription and Registration-legacy systems. For OGC/HMA a mapping between HMA Order Services and the EUMETSAT "Data Centre" order information model has already been defined.

MAIN COMPONENTS AND TECHNOLOGY

System Overview

Figure 1 gives an overview of the most important applications and services of the EO Portal:

- **EO WebPortal:** the main web–based user interface for accessing all other applications.
- **Product Navigator User Interface (UI):** the web-based user-interface for Metadata Discovery and Management of the EO Collection Catalogue.
- **EO Product Search/Order/Subscription:** user-interface for browsing, discovery and ordering/subscription of EO Products. Follow-up of the progress of ongoing orders is also provided.
- **UserManagement/IdP:** identity- and user-management component (including user profiles).
- **Clearinghouse:** provides EUMETSAT- and interoperable interfaces for the exchange of information. Brokers communicate with EUMETSAT legacy systems and external partner agencies.
- **MapServer:** provides maps via an OGC WMS interface for the definition of spatial extents (for discovery) and the visualization of spatial extend of collections and products found.
- **Data Centre, EAT, UNS:** EUMETSAT legacy systems used for the EO Product Discovery, Ordering Subscription and Registration.
- **Partner Agencies:** external agencies providing functionality as web services (ESA/HMA).
- **EO Portal Datastore:** Database Components (relational database, LDAP registry, files).

In the following are the key areas presented, on which work has been performed, since the project start.

Product Navigator

For the publication- and discovery of all EO Collections provided by EUMETSAT the so called "Product Navigator" ("Product" was used here because it is more common to users as "Collection") was developed. It consists of a public accessible web-based user-interface which allows the browsing/searching/discovery of EO Collection Metadata and protected web-based user-interfaces for the management of EO Collection Metadata. A third component is the service component (Collection Catalogue Server) which provides the server-side processing and which allows the discovery and management of EO Collections via programmatic service interfaces.
The only information the EO Portal stores is EO Collection Metadata (see Information Models). For the metadata management different methods are available:

- Manual insertion/editing of single metadata entries via the Metadata Editor.
- Batch-import of XML encoded metadata files from known locations.
- Periodically automatic harvesting of single XML encoded metadata files from known locations (it would also be possible to automatic harvest the whole (or partial) metadata content from other OGC CSW catalogues)
- Export of metadata

Different search methods are provided within the web based search interface to search across metadata attribute es. A number of combinations of spatial extent, content type, data format, keyword etc. can be used for the query definition. The spatial extent is defined using spatial selections within an interactive map. The interactive map is provided by an OGC WMS conformant map server. In the figure below the metadata details of a collection are shown (see Figure 2).
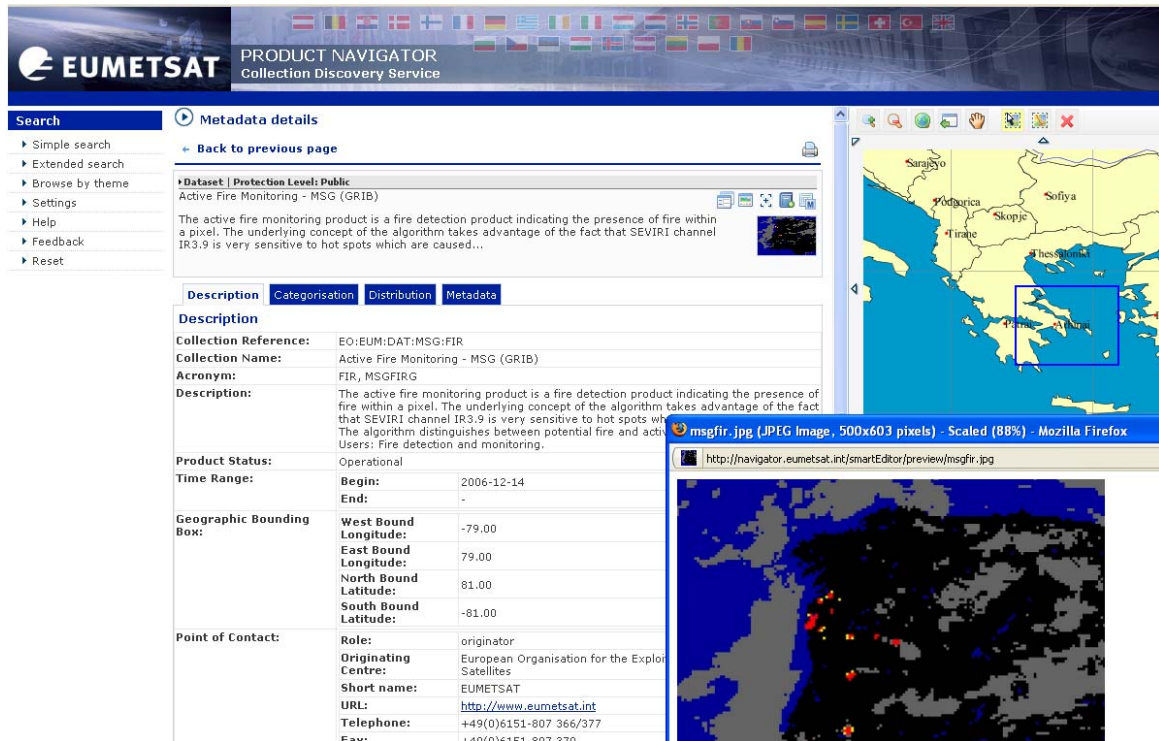

Figure 2: Product Navigator: Metadata details

From the metadata details of a collection, the end user can find out how the individual products are distributed. A URL will lead the user to the various applications or servers such as the "Data Centre" for offline product search/ order or online registration for the subscription to real-time product reception.
The Collection Catalogue Server provides different programmatic catalogue (discovery) service interfaces as defined by the OGC [1][2] and by INSPIRE [8].
The implementation of the EUMETSAT Product Navigator is based on con terra's sdi.Suite mainly with the integrated terraCatalog version 2.3.

Clearinghouse

The Clearinghouse provides programmatic interfaces to discover, search and order/subscribe EO Data from EUMETSAT and partner agencies. The interfaces implement OGC/ESA/HMA- and INSPIRE-specifications (see Figure 3). The Clearinghouse interacts internally with the EUMETSAT legacy systems and externally via web-service interfaces with the partner agencies in order to provide EO services to the EUMETSAT EO Portal and EUMETSAT partners

The main focus in the first phase of the Clearinghouse development is on the integration of legacy-systems and the provision of OGC/HMA Interface implementations for EO Product Discovery (EOP) [5][6] (finished), EO Product Ordering (OOP) [7] (work in progress) and User-Management [4] (finished). The EUMETSAT legacy systems "Data Centre", EUMETCast Administration Tool (EAT) and User Notification System (UNS) are already or are going to be integrated into the Clearinghouse.

The OGC/HMA EOP Interface was the first being implemented. It is defined as so called "Adaptor" (see Figure 3). This EOP Adaptor translates the requests sent to the EOP interface, routes them through the

Legacy Abstraction Layer to the Data Centre and back to EOP interface. Currently under development is the implementation of the OOP Adaptor. This will process the requests similar to the EOP Adaptor.
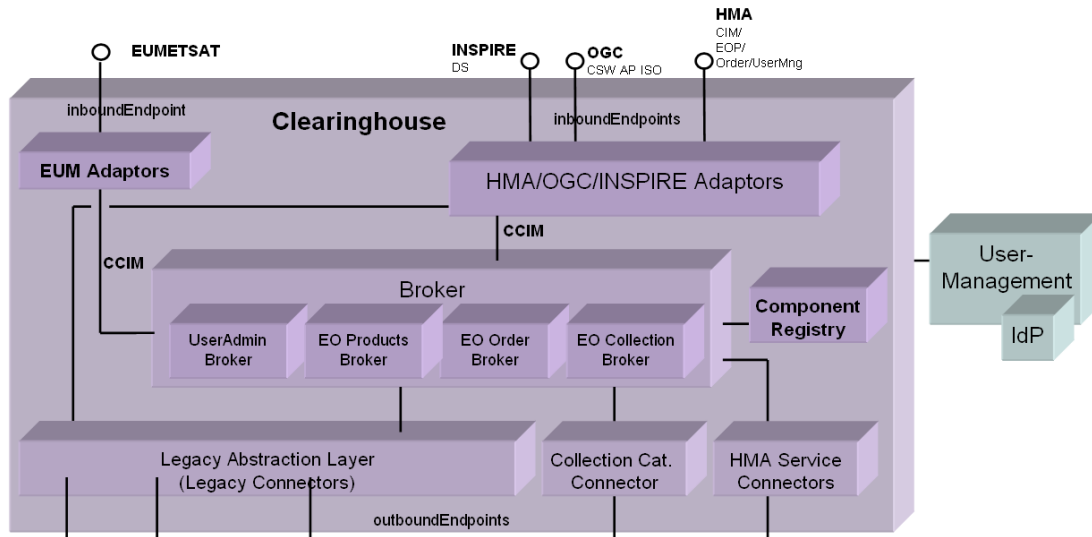

Figure 3: EO Portal Clearinghouse Architecture

Beginning with 2010 the OGC/HMA interface for EO Collection discovery (CIM EP) [3] will additionally be provided by the Clearinghouse. Therefore a Collection Catalogue Connector will be integrated which sits on top of the INSPIRE DS service interface of the Product Navigators Collection Catalogue. The semantic mapping between INSPIRE DS and CIM EP interfaces is defined in [14]. It is further foreseen to start integrating partner agencies in 2010. Its access will be based on the OGC/HMA interfaces. The processing is done by so called 'brokers' (see Figure 3). A broker handles requests coming (via an InBoundEndpoint) from an Adaptor by delegating sub-requests (handling all or parts of the original request) to so called Connector(s). The Connector interacts with the connected service in the required format and interaction model (so it becomes fully transparent to the broker). The results of the sub-requests returned from the Connectors will be integrated by the broker and returned by the Adaptor in the common response format expected from the Clearinghouse interface.

Based on this concept we have already implemented the brokering (**UserAdmin Broker**) of user information retrieval- and management requests to the legacy systems (which were already integrated with the new Security- / UserManagement concept). In the final version of the Clearinghouse the following brokers will further be available:

- **EO Collection Broker**: proceeds searches for collection-metadata either from the local EOPortal's "Collection Catalogue" or from a partner agencies collection service.
- **EO Products Broker**: proceeds searches for EO Product metadata on the Data Centre and on one or more external catalogue servers.
- **EO Order Broker**: this service supports the ordering of EO data or subscription to (periodical reception) of EO data products or news using the targeted back-end system.

The Clearinghouse is fully integrated with the Security- / UserManagement concept (see below). Protected services are secured by WS-Security and expect SAML2 tokens. For the interaction with protected web services of other domains (e.g. partner companies) the Clearinghouse has to request security tokens from the EO-Portal UserManagement Security Token Service (STS). The implementation of the Clearinghouse is done with Java 6, XML/XSLT, Apache CXF and Mule 2. Mule is a lightweight Java-based messaging framework that allows to quickly and easily connect applications and enables them to exchange data. Mule is based on ideas from *Enterprise Service Bus* (ESB) architectures. For the integration with the UserManagement concept our own libraries had been developed.

IdentityProvider (IdP)- and UserManagement-Concept

The IdentityProvider (IdP)- and UserManagement-Concept builds up on the OASIS SAML 2 specification and uses SAML 2 for web application single sign on and to secure the web service access. The IdP-Concept uses a centralized authentication approach, while a user has different credentials at different providers. The advantage is that each business entity maintains own user accounts, there is no requirement for a global unique id. The Concept differentiates between SSO at web applications and the way how web services are secured. To perform an SSO process between web service consumer (WSC) and secured web service no global security token is required within the EO-Portal architecture, because each web service consumer is able to request new security tokens at the SAML2SecurityTokenService. This has to be done via the SAML2 AuthnRequest protocol and via private/public key mechanisms. The trust in a requesting entity at a web service requires two things. The first is a valid and trusted signature of the whole request and the second is a valid and trusted security token from an IdP.
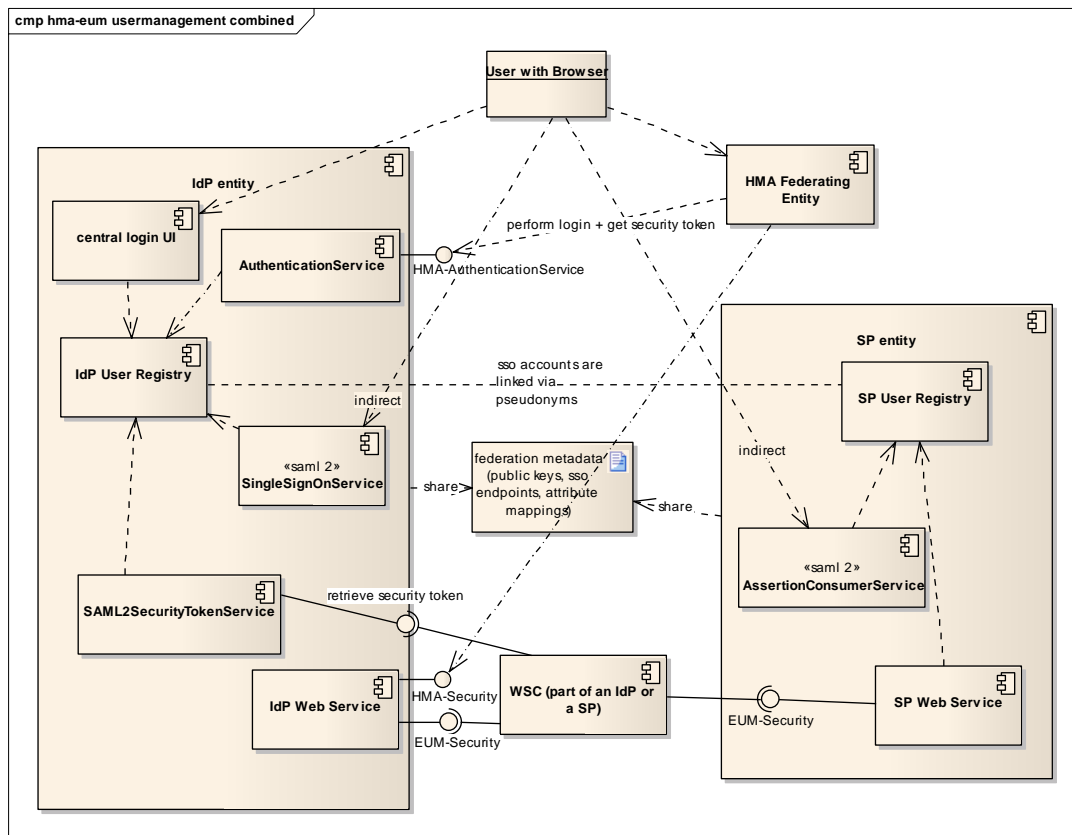

Figure 4: Components of the EO-Portal IdentityProvider (IdP) and UserManagement

The IdentityProvider (IdP)- and UserManagement-Concept defines different components for identity- and service-provider (SP) (see Figure 4). An IdP provides a central login UI where the user is authenticated via its username/password. A user can only consume services within the circle of trust, if he is authenticated at an IdP. The SingleSignOnService is used to perform an SSO process between web applications of different providers. The interface is specified in the SAML2 specification. The IdP User Registry maintains user profiles and a mapping table of local user ids to pseudonyms to provide the users privacy during communications with service providers. An IdP can also act as service provider: such a business web service (IdP WebService) is secured by the WS-Security specification. To communicate with these services a WSC needs to put a security token in the soap header.

A SP WebService is a business web service hosted by a SP. It is secured equally to IdP WebServices. The SP User Registry stores/reads/updates local user profiles. An AssertionConsumerService is the endpoint of an SSO process between web applications at the SP side. The interface is specified in the SAML2 specification.

The user management concept provides further support for the HMA UserManagement interfaces [4]. To support this the IdPs AuthenticationService validates the user credentials and creates an HMA security token (SAML1) on an authenticate request. This token can be used by federating entities to consume the web services provided by the EO-Portal. The federating entity is the central entity of the HMA UserManagement services and brokers every authentication and service access to external entities.

CONCLUSION

With the fast evolution of technologies and demands to provide interoperable access of climate/ meteorological data to different user communities/ portals, organizations such as EUMETSAT have to enhance their services and access means towards today's standards.

The effort to be undertaken for becoming familiar with all the available standards and migrating legacy systems towards those goals is quite of significant effort and risk. The introduction of new components towards an interoperable infrastructure is advisable to be taken with little steps. Prototyping of components and concepts are essential prior introducing those into operations.

With the complexity of standards (e.g. OGC, ISO, INSPIRE, HMA) expertise from external companies has to be used, if it is not possible to have staff completely allocated to such domains.

The approach taken by EUMETSAT towards a harmonized/ interoperable infrastructure will be continued in 2010. For this it is important that standards remain stable and partner organizations invest into an interoperable infrastructure so that an exchange of data is possible and beneficial to the end users.

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