Cataloguing your resources, a key element toward a valuable SDI

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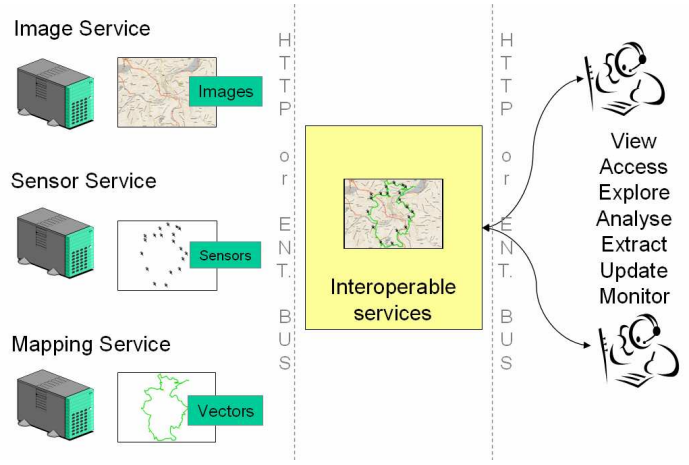
This document gives some information about cataloguing services, one of the key elements of a Spatial Data Infrastructure.

Introduction

To satisfy data exchanges between users, the EC INSPIRE initiative (INfrastructure for SPatial InfoRmation in Europe), intend to trigger the creation of Spatial Data Infrastructure (SDI) that delivers to the users integrated spatial information services. It also means observing ISO TC/211 and OGC[1] standards.



These services should allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an interoperable way for a variety of uses.

To implement a SDI, the users will have to face several challenges (following the INSPIRE principles) :

- **Heterogeneous sources** of information :
  - Data should be collected once and maintained at the level where this can be done most effectively
  - Construct semantics to allow the exchange of information
- **Combine seamlessly** spatial data from different sources
- **Share spatial data** between many users and applications
- Build a **discovery** mechanism :
  - which spatial data is available
  - evaluate its fitness for purpose
  - which conditions apply for its use

The implementation of ISO/OGC standards will facilitate the discovery, access, use and extraction of geospatial information from several different architectures, such as different vendor formats, in one common environment.

[1] The Open Geospatial Consortium, Inc (OGC), an international industry consortium of more than 330 companies, government agencies and universities participating in a consensus process to develop publicly available interface specifications, has invested in hundreds of man-years in defining these interoperable standard and achieving consensus.

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This white paper aims to focus on the standardization of discovery mechanism.

Service Oriented Architecture [2]

A service-oriented architecture is essentially a collection of services. These services communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity. Some means of connecting services to each other is needed.

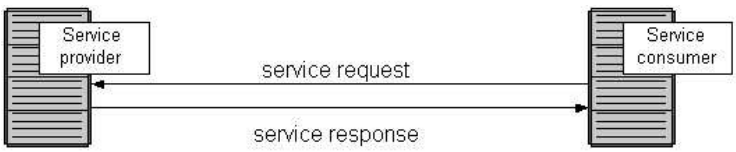
Service-oriented architectures are not a new thing. The first service-oriented architecture for many people in the past was with the use DCOM or Object Request Brokers (ORBs) based on the CORBA specification. For more on DCOM and CORBA, see Prior service-oriented architectures (new window).

A service is a function that is well-defined, self-contained, and does not depend on the context or state of other services. See Service (new window).

Web Services refers to the technologies that allow for making connections. Services are what you connect together using Web Services. A service is the endpoint of a connection. Also, a service has some type of underlying computer system that supports the connection offered. The combination of services - internal and external to an organization – makes up a service-oriented architecture.

Web services essentially use XML to create a robust connection.

The following figure illustrates a basic service-oriented architecture. It shows a service consumer at the right sending a service request message to a service provider at the left. The service provider returns a response message to the service consumer. The request and subsequent response connections are defined in some way that is understandable to both the service consumer and service provider. How those connections are defined is explained in Web Services explained (new window). A service provider can also be a service consumer.



Service Oriented Architecture (SOA), implemented by means of OGC Web Services, is particularly useful for setting up Spatial Data Infrastructure (SDI) for Geographic Information Systems. It enables to combine seamlessly spatial information from different sources through Web Services and share it between many users and applications, for many purposes.

[2] http://www.service-architecture.com/index.html

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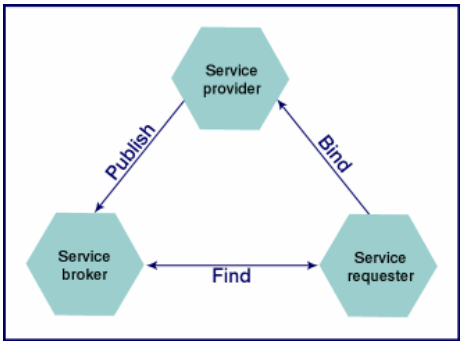
SOA adds strong internal consistency to «loosely coupled» configurations. The most important benefit is the separation of data from applications, by means of open but secured Service Oriented Architecture (SOA).

Catalogue services

Before serving geographical data (maps, features, coverages) through open web services, the users need to find if and where the concerned data is available.

One of the key elements of an SOA is the Service Registry : a record and description of all available services. It allows users not only to find and discover which services could be useful in providing solutions to their needs but also to integrate them into their business applications.



The methodology can thus be described as follows :

- « service providers » set up Web Services ;
- they then publish these Web Services in the service registry : « publish »;
- « consumers » then discover these services by means of queries… « find » ;
- … and integrate them into their applications « bind » ;

The OpenGIS® Catalogue Service Implementation Specification defines a common interface that enables diverse but conformant applications to perform discovery, browse and query operations against distributed heterogeneous catalog servers.

Catalogue services support the ability to publish and search collections of descriptive information (metadata) for data, services, and related information objects. Metadata in catalogues describe resource characteristics that can be queried and presented for evaluation and further processing by both humans and software. Catalogue services are required to support the discovery and binding to registered information resources within an information community.

This is the essence of the publish-find-bind model, but transposed to new IT architecture that are SOA. As illustrated here after, IONIC software are totally in line with the INSPIRE initiative, the OGC and ISO standards.

Application Schemas and Profiles for Catalogue Services

Specifications exist for interfaces, bindings, and frameworks for defining application profiles required to publish and access digital catalogues of metadata for geospatial data, services, and related resources. Metadata act as generalized properties that can be queried and returned through catalogue services for resource evaluation and, in many cases, invocation or retrieval of the referenced resource.

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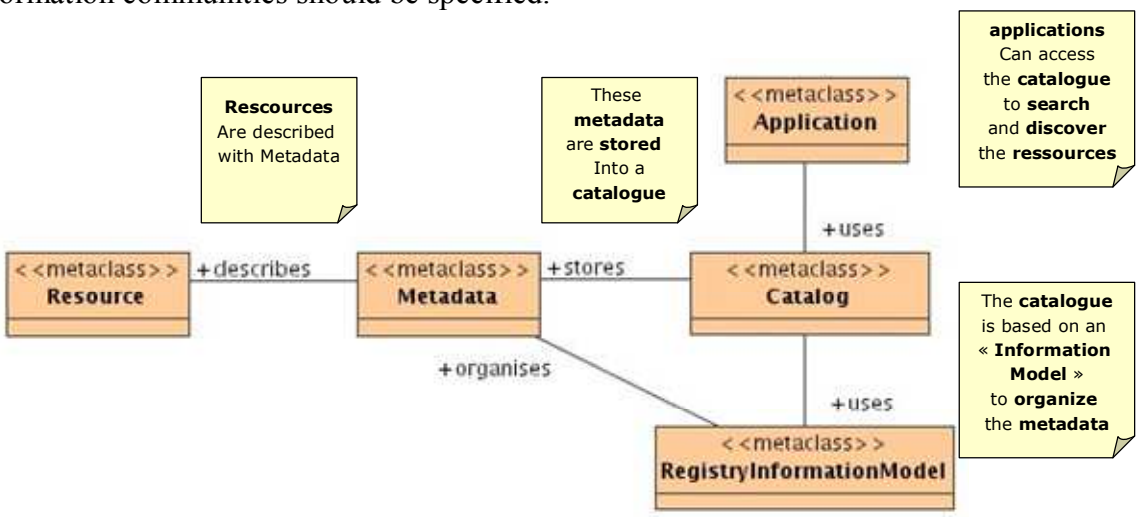
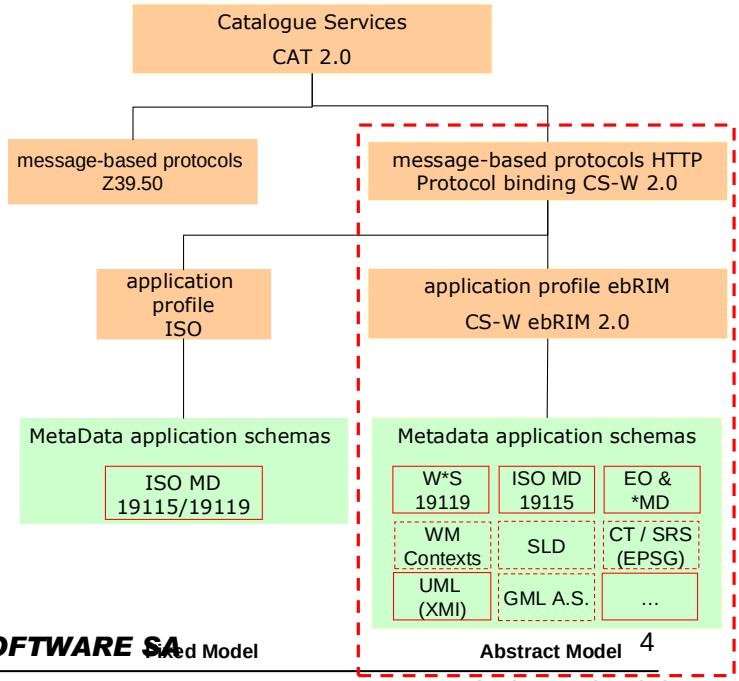
Catalogue services support the use of one of several identified query languages to find and return results using well-known content models (metadata schemas) and encodings.

The definition of application profiles according to ISO 19106 (Geographic information – Profiles) has an overall goal to improve interoperability between systems conforming to a specific profile. Experience has shown that the need for application profiles results from the fact that in practice, there is no single solution for catalogue services that fits every user's needs. As stated in CS 2.0, a base profile that provides a basic set of information objects has to be supported by each catalogue instance; in addition, application profiles for different information communities should be specified.



Catalogue Services based on the ISO19115/ISO19119 Application Profile

This catalogue implementation is based an application profile for ISO 19115/ISO 19119 metadata with support for XML encoding per ISO 19139 and HTTP protocol binding. It relies on requirements coming from the CS/CSW 2.0 specification. A catalogue implementation that conforms to this application profile can serve OGC web services and their ISO MD descriptions.



Catalogue Services based on ebRIM Application profile

A catalogue implementation that conforms to this application profile can serve many purposes in a variety of domains; it provides facilities for discovering and advertising shared resources. While such resources are often labelled as "metadata", it is rarely possible to maintain an absolute distinction—what counts as data in one

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context may be considered metadata in another. The catalogue information model is a general and flexible one that can be employed to handle many kinds of resources including but not limited to: service offers, interface definitions, dataset descriptions, application schemas, and classification schemes. The service may be used to catalogue resources located in both local and remote repositories. Representations of these resources are exchanged using the HTTP protocol.

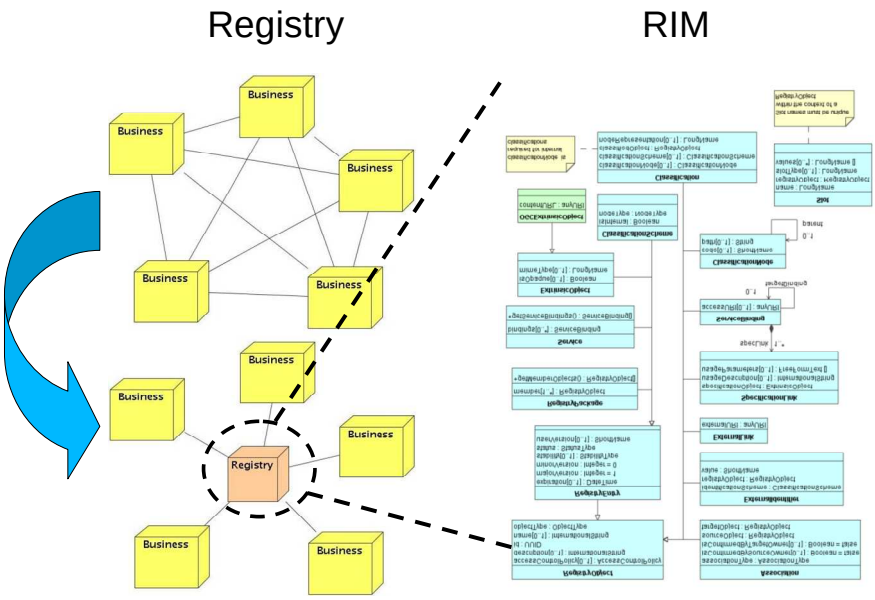
Why ebRIM as the IONIC implementation choice ?

The OASIS standard ebXML Registry Information Model [ebRIM] specifies a standard way to describe the registry content and to provide the input/output XML format.

The OASIS standards do not explicitly provide mechanism to specify semantics, associations and classification of stored content.

Nevertheless, different schemas of metadata can be represented in the Registry Information Model for different Application domains (GI Data, communities like EO, GeoScML, Defense, …).

ebRIM is in effect a meta model on which various metadata application schemas can be constructed and deployed.



Specific features of the RIM include:

- Registry/Repository
- Life cycle metadata (status attribute)
- User-defined classification schemes
- User-defined associations between registered objects
- Audit trail
- User-defined packages (collections) of registry objects

The RIM provides a set of foundation registry capabilities that can support the management of a wide range of "artefacts" including imagery, datasets, application schemas, symbol libraries, map styles, coordinate reference system definitions, units of measure definitions, etc.

Between the « artefacts » (say « OGC Resources ») that can be represented :

- ISO19115 Metadata (+ any profile of it)

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… but also ...

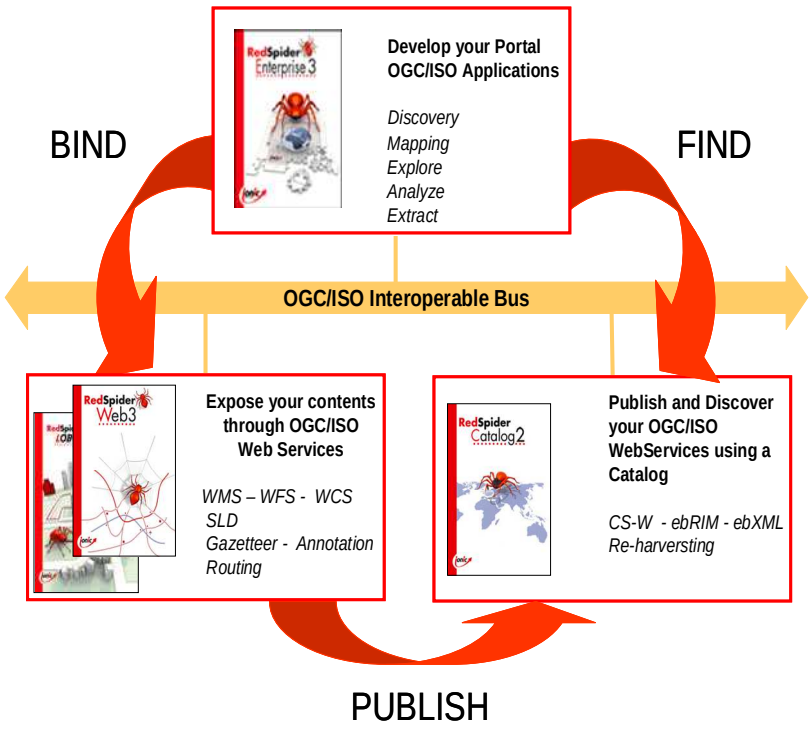
- FGDC, Anzlic, etc. Metadata
- Community Metadata profiles (EO, …)
- OGC Web Services (OWS W*S)
- OGC WM Contexts
- SLD rules
- GML Application Schema
- Coordinate Transform & SRS's (EPSG)
- …

During the last OGC Technical Committee in San Diego, California, December 2006, the ebRIM Application Profile has been adopted at the OGC as the **preferred cataloguing Implementation**, comforting the IOINIC implementation choice made 4 years ago.

IONIC RedSpider Catalog

RedSpider Catalog is a software that enables the users to reference and discover geographic information based on content indexation and search processes. Thanks to its use of open standards and its following of OGC and ISO standards makes RedSpider Catalog is a key element in establishing a geospatial Data Infrastructure (in line with INSPIRE).

This products offers a pre-configured service enabling the automatic registration of a wide number of resources such as WFS, WMS and WCS, Contexts (WMC) using their metadata. Once a resource has been registered, the automatic update procedures mean that the information is kept up to date.



The product is accompanied by a client which allows the discovery of resources online. Using the client allows the user to discover the different services available and to show their use in a data visualisation client.

Based on the ISO ebXML standard and the latest OGC Catalog standards, the product is the first step towards building a successful geospatial e-business.

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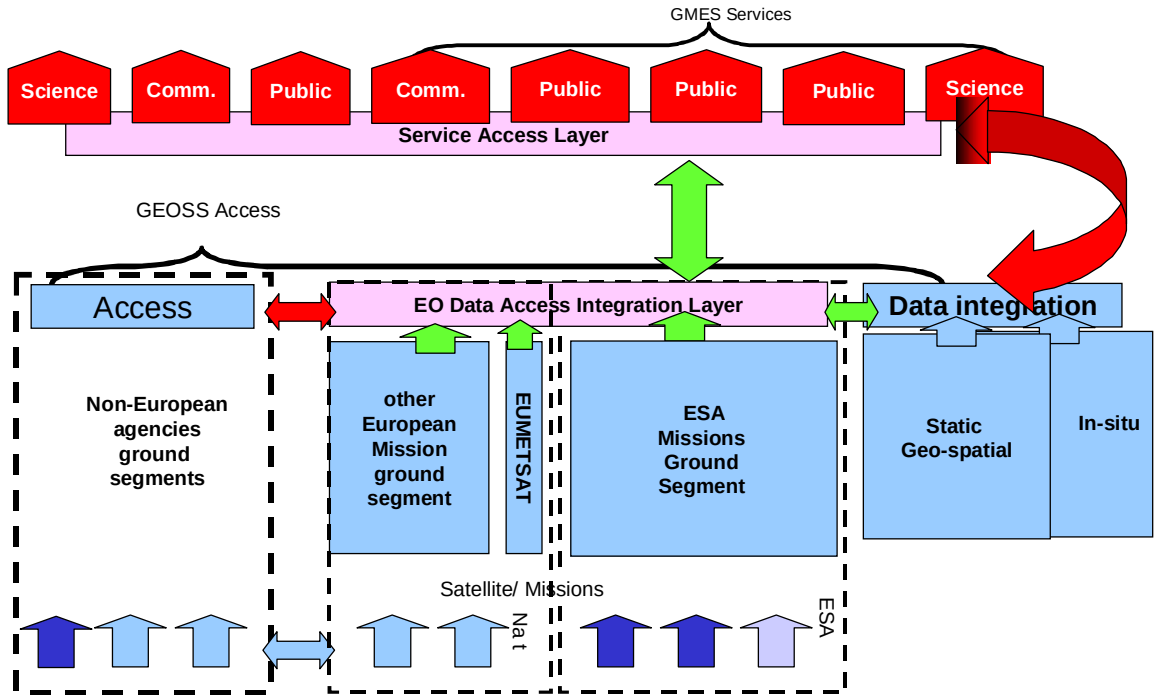
Toward a federation of Catalog

Introduction to the HMA Project

IONIC is deeply involved in the HMA[3] project supported by the ESA. On high level requirements, the GMES ground segment provides the "necessary interfaces for requesting and accessing data from national and Eumetsat missions forming part of GMES". HMA shall permit to integrate EO products, space data with all kinds of other data and information.



The goal of HMA is to define a standardised, harmonised set of interfaces that support a service oriented view of the heterogeneous mission ground segments, that can enable the construction value added services from our basic interfaces, that can be implemented in a cost-effective manner.

Based on OGC Strategy, HMA will define a set of "best practices" documenting the HMA interfaces, breaking out and refining and updating the current status of OGC Catalogue Services.

IONIC is deeply involved in the standardisation of the contents of the catalog related to EO products.

The following points describe the result of IONIC HMA involvements.

[3] Heterogeneous Missions Accessibility Overview Federation of GMES Earth Observation Missions

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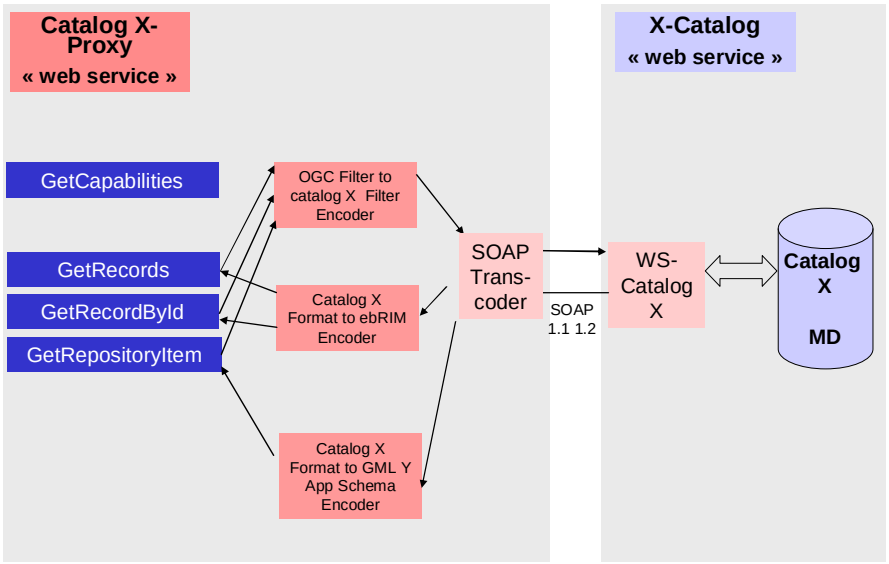
Standardisation of the catalogue services and contents

In order to be interoperable in a federation of catalog, IONIC has been responsible, in the HMA project, of the following tasks :

- ebRIM Extension Package for EO Products : IONIC has been involved in the OGC Draft Specification document describing the ebRIM components for support of Earth Observation Products;
- Creation of Catalog Earth Observation Platform : IONIC is developing a Java Framework allowing the rapid development of connectors to add the CSW ebRIM abilities to any EO Legacy Catalog;



- ISO 19115/ISO 19119 extension package of ebRIM : IONIC is involved is defining and implementing the extension package of the ebXML Registry Information Model (ebRIM) compatible with the OGC ebRIM application profile of CS-W for the cataloguing of metadata sets compliant with ISO 19119 for services and ISO 19115 for datasets and dataset collections.

Theses efforts will be integrated in the product road map of the RedSpider Suite.

IONIC Software

IONIC Software, a Liege-based company, is renowned for its products and services that enable the diffusion of geographic information on the Internet as well as facilitate the creation and implementation of a Spatial Data Infrastructure (SDI), following the forthcoming Inspire directive in Europe.

Comprising the biggest and most influential team dedicated to interoperable products in the world, IONIC Software in Belgium, France and the USA employs 45 full-time staff members.

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The implementation of international standards for geospatial information, such as the Open Geospatial Consortium (OGC) and the International Standards Organisation (ISO), essentially forms the core of IONIC's technology.

IONIC commitment is to design, develop and market software components which adhere to emerging international geospatial specifications and standards and use new information technologies to their best advantage.

The IONIC product line includes :

- **RedSpider Web** used to publish geographical information via OGC web services;
- **RedSpider Catalog** used to publish and discover geographical resources (data broadcasting services, data queries, etc.);
- **Red**Spider Enterprise, used to build geographical applications within an enterprise and to develop geospatial gateways based on OGC distributed services;
- **RedSpider Image Archive**, the solution used to index, manage and publish and access imagery.

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