

# A DCAP to promote easy-to-use data for multi-resolution and multi-temporal satellite imagery analysis

I. Mougenot, J.C. Desconnets & H. Chahdi

**Espace-Dev**

(**Université de Montpellier - Institut de Recherche pour le Développement**)

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- 3 Earth Observation Application Profile : A RDF compliant DSP
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# Introduction & Motivations

## Satellite images are great !

Satellite images are a valuable source of information. The increasing number of Satellite sensors as well as their diversity produces a huge amount of satellite images.

Satellite images can be used to address multiple environmental issues quickly, repeatedly and in a reliable way :

- Understanding the dynamic of ecosystems
- Urban evolution
- The monitoring of environmental changes
- ...

# Introduction & Motivations

## However ...

### Images

- Come from different satellite sensors : Landsat series, SPOT series, PLEIADES...
- Are described using different standards : Standards of the producers, ISO19115, ISO19115-2, O&M...
- Are encoded in different formats : Tiff, GeoTiff, JPG2000...
- The size of satellite image can go from 50 MB (low resolution) to 15 GB (very high resolution)

# Introduction & Motivations

## Objective

In this context, how to provide accessibility to a variety of expert and non-expert users using the metadata of the different satellite images

Implementing a *common* tool for discovering satellite images that provides an **open and extensible model** facilitating the sharing and management of distributed images.  
This model has to cover the needs of **discovery**, **localization**, **processing** and **consulting** satellite images

# Introduction & Motivations

GEOSUD : [www.equipex-geosud.fr](http://www.equipex-geosud.fr)

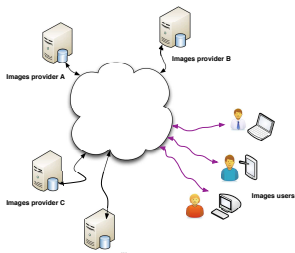


FIGURE : GEOSUD : Spatial Data Infrastructure

## GEOSUD context

Acquiring , each year, about 600 images, estimated at a volume of 1 to 2 TB/year for high resolution products and about 12 Tbytes/year for the very high resolution products

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# DCAP guidelines : Singapore framework

## One size does not fit all

### Principles

Application profiles **reuse** metadata standards to respond either to new requirements, or to more specific ones

- Functional requirements
- Domain model
- Description Set Profile
- Usage guidelines

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# EOAP : A RDF compliant DSP

## RDF : *Resource Description Framework*

RDF is a framework for representing resources and metadata. Where the information is structured into a set of subject-predicate-object triples (Hayes, 2004).

## RDFS : *RDF Schema*

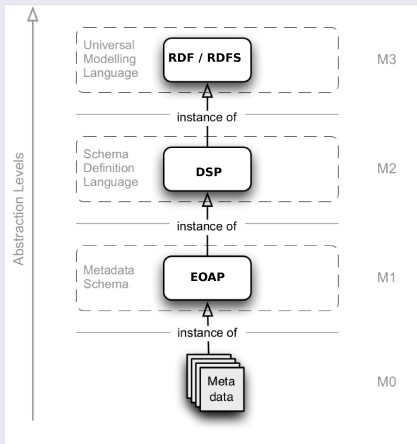
RDF Schema is a semantic extension of RDF. It provides data-modelling vocabulary and introduce primitives to determine characteristics of other resources (Brickley, 2004).

## DSP : *Description Set Profile*

DSP is a language that is intended to represent the overall structure of a metadata description set by means of constraints that apply either on resources, properties used or values of those properties (Nilsson, 2008).

## EOAP : RDF compliant DSP

## Modelling DSP using a three level hierarchy



# EOAP : RDF compliant DSP

Example : Representing n-ary relation

Associating the class *DescriptionTemplate* with *StatementTemplate*, *Property* and *Constraint*

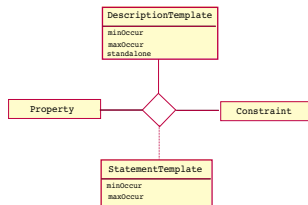


FIGURE : The association class *StatementTemplate*

## EOAP : RDF compliant DSP

## Refining the semantics of the DSP model

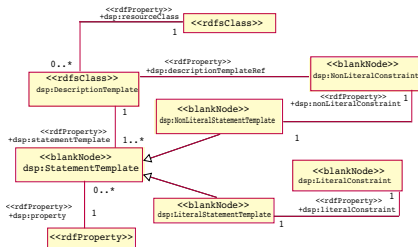


FIGURE : Simplified DSP diagram qualified with the RDF/RDFS UML profile

# EOAP : Earth Observation Application Profile

<http://purl.org/eoap/>

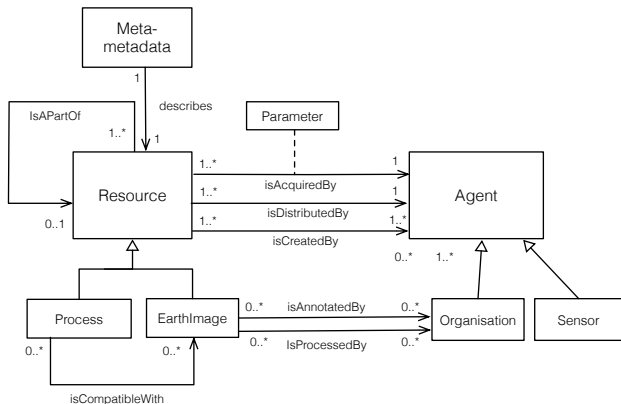


FIGURE : Domain model for Earth Observation

## EOAP : RDF compliant DSP

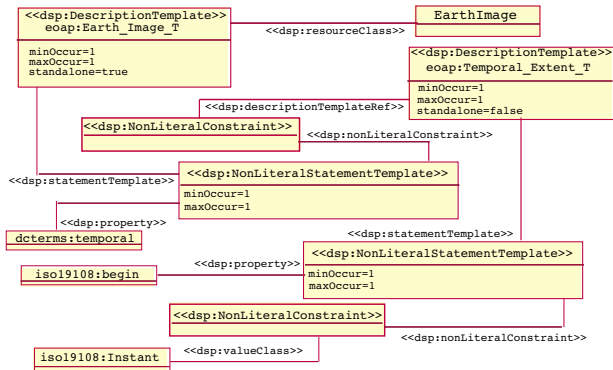


FIGURE : Excerpt of the EOAP model as a DSP profile instantiation

## EOAP : RDF compliant DSP

```

eoap:EarthImage_T
  a      dsp:DescriptionTemplate ;
  dsp:maxOccur "1"^^xsd:nonNegativeInteger ;
  dsp:minOccur "1"^^xsd:nonNegativeInteger ;
  dsp:resourceClass eoap:EarthImage ;
  dsp:standalone "true"^^xsd:boolean ;
  [...]
  dsp:statementTemplate
    [ a      dsp:NonLiteralStatementTemplate ;
      dsp:maxOccur "infinity" ;
      dsp:minOccur "1"^^xsd:nonNegativeInteger ;
      dsp:NonliteralConstraint
        [ a      dsp:NonLiteralConstraint ;
          dsp:DescriptionTemplate
            <eoap:GeographicalExtent_T>;
          dsp:valueStringOccurrence
            "disallowed"^^<dsp:Occurrence>;
          dsp:VocabularyEncodingSchemeOccurrence
            "disallowed"^^<dsp:Occurrence>;
        ] ;
      dsp:property dcterms:coverage
    ] .
eoap:GeographicalExtent_T
  a      dsp:DescriptionTemplate ;
  dsp:maxOccur "infinite" ;
  dsp:minOccur "1"^^xsd:nonNegativeInteger ;
  dsp:resourceClass iso19115:EX_GeographicalBoundingBox ;
  dsp:standalone "false"^^xsd:boolean .
  [...]

```

FIGURE : EOAP RDF excerpt in N3

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EOAP

<http://purl.org/eoap/>

## Targeted users

- Researcher : Studies on the structure , functioning or dynamics of ecosystems
- Governmental units : Cartographic products and monitoring governmental policies
- Local authorities : Management of the environment
- . . .

## Non expert use case : Enforce the regulations on exploitation of forest resources

- Production of a map identifying the clearcuts of the forest resource
- The map require two high-resolution images covering the same area acquired in the same season between an interval of one or two years

high-resolution images that were acquired during the period from April to May for the years 2014 and 2015, covering the area from latitudes 43,97 ; 45,06 longitudes -1,56 ; -0,133

EOAP

<http://purl.org/eoap/>

## Expert use case : Identifying wetlands in the Madagascan forest

- Using multi-source and multi-resolution images : Landsat 7 ETM+ 30m and SPOT 5 2.5m
- Using spatial extent of the images
- Using date of acquisition of the images

Images acquired by Landsat 7 platform and the images acquired by the SPOT5 in panchromatic mode whose spatial footprints are between the latitudes -20,58 ; -22,35 and longitudes 47,85 ; 46,44, which were acquired between the month May and June

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# Conclusion and future work

- Defined a DCAP for earth observation satellite images  
EOAP : <http://purl.org/eoap/>
- Initiate a work toward meta-modelling activities to complete the RDF-based DSP model with higher levels of abstraction to efficiently drive the building of a thematic DSP model

# Conclusion and future work

## On going work

- Developing a generic RDF-based editor to build DSP models from the defined UML profiles
- explore adding OCL(Clarck,2002) constraint to the DSP meta-model

EOAP:Earth  
Observation  
Application  
Profile

Mougenot,  
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Chahdi

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Thank you !  
Welcoming questions :)