



# Implementation of Geospatial services on Grid platform for Civil Protection applications

V. Angelini<sup>1</sup>, P. Mazzetti<sup>1</sup>, M. Verlato<sup>2</sup>, S. Nativi<sup>1</sup>

<sup>1</sup>Istituto di Metodologie per l'Analisi Ambientale (IMAA) - CNR  
 Contrada Santa Loja - 85050 Tito Scalco (PZ) - Italy  
 Phone +39 0971 427221, Fax +39 0971 427221  
 {angelini, mazzetti, nativi}@imaa.cnr.it

<sup>2</sup>Istituto Nazionale di Fisica Nucleare (INFN) - Sez. di Padova  
 Via Marzolo 8 - 35131 Padova - Italy  
 Phone +39 049 827 7165, Fax +39 049 827 7102  
 marco.verlato@pd.infn.it

## Linking two very different communities ...

**Civil Protection** procedures, as well as most of GMES applications, **require a strict integration** with research infrastructures providing **heterogeneous and distributed resources** (e.g. computing, data, services, knowledge, expertise, etc.) useful in the full cycle of emergency situations, from forecasting to post-emergency assessment. Moreover this kind of activities typically involves **many different actors** who need to **share resources** in a coordinated and effective way.

The **Grid** paradigm is a technological and economic revolution in high performance distributed computing, as the World Wide Web has been in the last ten years, for what concerns the meaning and the availability of a global information. Grid-based platforms will allow the implementation of a **widely distributed computing environment operated as a uniform service**.

Consequently the adoption of a **Grid-based infrastructure to support Civil Protection and GMES** applications seems a natural choice.

**Current Grid platforms** are mainly designed to support research and applications requiring **intensive processing and data management**, thus they offer high computing and storage capabilities. Grid research has only recently been faced with new problems like sensor interaction and communication quality of service. Enhancements are needed to support new kinds of applications such as those used by Civil Protection.

Moreover, **Civil Protection applications have specific requirements** that are not commonly satisfied by typical research infrastructures.

These requirements have a strong impact on **research strategies** and consequently on the enabling research infrastructures (i.e. new protocols, services and architectures must be designed and experimented).

## Civil Protection specific requirements for Grid :

- to access infrastructures, run models and search information in a **real-time (RT) or a near-real-time (NRT) way, privileging time of response instead of accuracy**
- to control sensor networks and acquisition systems and modify their acquisition strategy and processing chain
- to share geospatial information that has complex characteristics, huge amounts of remotely-sensed observations, which are multidimensional and frequently updated
- to formalise the knowledge required to analyse data and provide decision-makers with effective information
- to implement the strict data policy and the security requirements typical of dual systems (civil/military)

## CYCLOPS

CYber-Infrastructure for Civil protection Operative Procedures

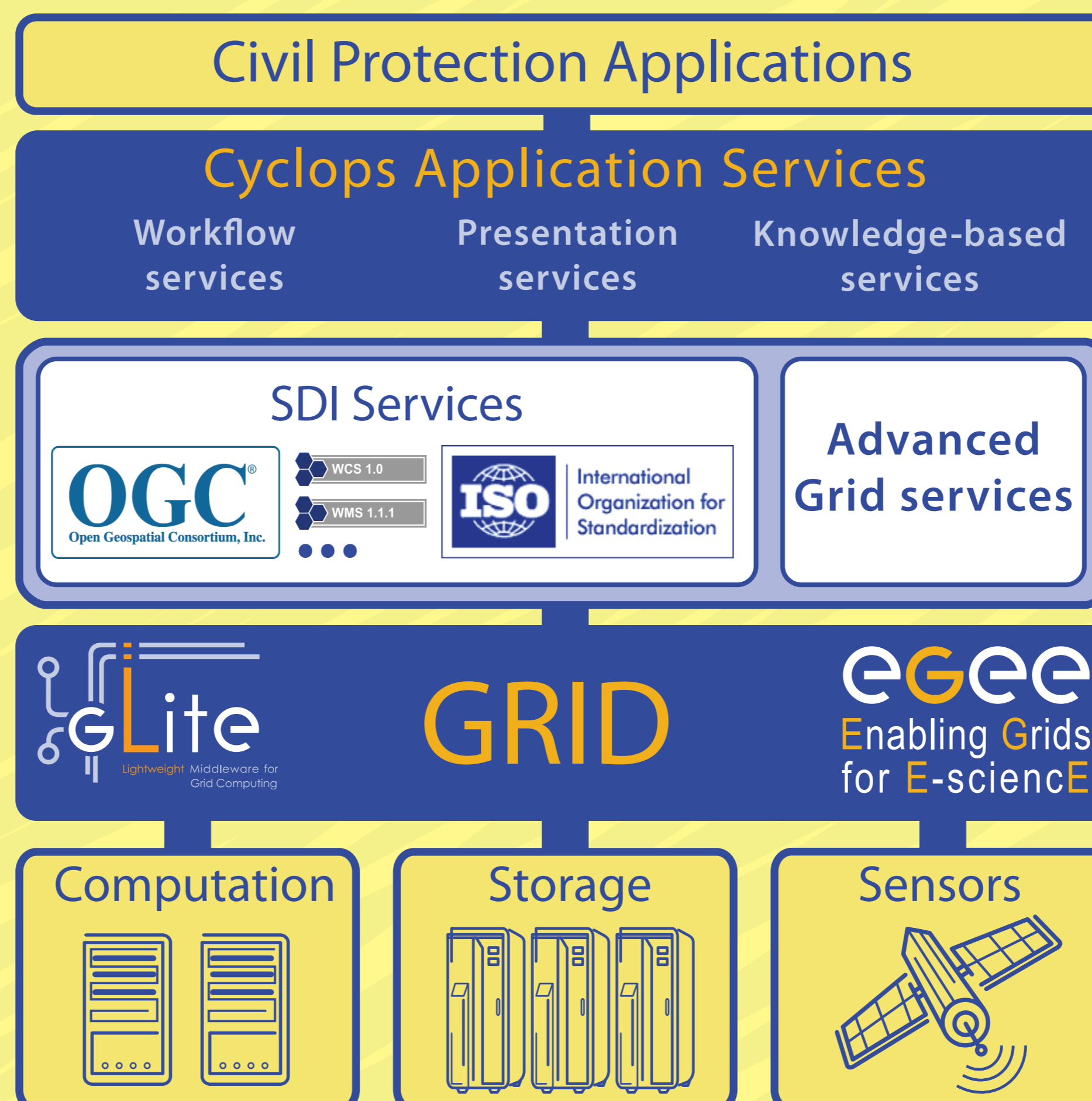
The CYCLOPS project is an EGEE Specific Support Action, funded under the FP6 (Contract no.: 031874). The CYCLOPS partners are:

### Civil protection agencies

- Dipartimento della Protezione Civile (IT)
- Direction de la Défence e de la Sécurité Civiles (FR)
- Civil Protection of Chania Prefecture (GR)
- Autoridade Nacional de Protecção Civil (PT)

### Technological partners

- Istituto Nazionale di Fisica Nucleare (IT)
- Istituto di Metodologie per l'Analisi Ambientale (IT)
- École des Mines d'Alès (FR)
- Technological Educational Institute of Crete (GR)
- Universidade do Minho (PT)



## ... using common standards

Cyclops project aims to **define a set of services** that are essential for GMES and in general for the Earth Science community.

On top of the Grid platform an intermediate layer of services will be defined. Such services will make use of well known solid standards and will be designed to **access and process data** using the advanced grid capabilities required by Civil Protection.

The Cyclops Application Services will be a further abstraction that allows to use **higher level services** like workflow, presentation and knowledge based services directly from Civil Protection applications.

## First example: a Grid implementation of a WCS service

The **Web Coverage Service (WCS)** is an OGC standard that defines how to implement **electronic retrieval of geospatial data** as coverages, digital geospatial information representing space-varying phenomena.

A WCS provides access to potentially detailed and rich sets of geospatial information, in forms that are useful for **client-side rendering, multi-valued coverages, and input into scientific models** and other clients.

In response to a user request, a typical WCS performs a set of basic computations on the selected dataset, like subsetting and resampling, and then sends the result, encoded in an appropriate format, back to the user.

The **Grid-enabled WCS** prototype, presenting to the web a standard WCS interface, is able to process a user request in a **distributed Grid environment**. It evaluates the request, splits it in an arbitrary number of sub-requests, generates a JDL file describing a Direct Acyclic Graph (DAG), and sends it to the WMPProxy component of the gLite-WMS using its Java API.

The WMPProxy submits the sub-jobs to the various Computing Elements close to the replicas of the requested initial data, and makes sure that all sub jobs are executed successfully.

When all requests have been computed, a node of the DAG acting as a "collector" job makes sure that all the results are correctly merged in a single file and sends it back to the WCS server.

This approach allows to handle a huge set of geographically distributed datasets and to process an arbitrary number of high demanding requests.

