# ENVRI

## Services for the Environmental Community

### Integration, Harmonisation and Publication software components – version 1

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**ABSTRACT**

The ENVRI Integration, Harmonisation and Publication software comprises a number of components, services and subsystems offering facilities enabling the integration and harmonization of data. The actual deliverable is thus the software realising such facilities. This document briefly describes the software components realising version 1 of these facilities and offers a series of links to the software itself and its accompanying documentation.

# 1. COPYRIGHT NOTICE

# 2. DELIVERY SLIP

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# 3. DOCUMENT LOG

| Issue | Date | Comment | Author/Partner |
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# 4. APPLICATION AREA

This document is a formal deliverable for the European Commission, applicable to all members of the ENVRI project, beneficiaries and Joint Research Unit members, as well as its collaborating projects.

## 5. DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the authors.

## 6. TERMINOLOGY

A complete project glossary is provided at the following page: http://www.envri.eu/glossary.

## 7. PROJECT SUMMARY

Frontier environmental research increasingly depends on a wide range of data and advanced capabilities to process and analyze them. The ENVRI project, "Common Operations of Environmental Research infrastructures" is a collaboration in the ESFRI Environment Cluster, with support from ICT experts, to develop common e-science components and services for their facilities. The results will speed up the construction of these infrastructures and will allow scientists to use the data and software from each facility to enable multi-disciplinary science.

The target is on developing common capabilities including software and services of the environmental e-infrastructure communities. While the ENVRI infrastructures are very diverse, they face common challenges including data capture from distributed sensors, metadata standardization, management of high volume data, workflow execution and data visualization. The common standards, deployable services and tools developed may be adopted by each infrastructure as it progresses through its construction phase.

The project will be based on a common reference model created by capturing the semantic resources of each ESFRI-ENV infrastructure. This model and the development driven by the test-bed deployments result in ready-to-use components that can be integrated into the environmental research infrastructures.

The project puts emphasis on synergy between advanced developments, not only among the infrastructure facilities, but also with ICT providers and related e-science initiatives. These links will facilitate system deployment and the training of future researchers, and ensure that the inter-disciplinary capabilities established here remain sustainable beyond the lifetime of the project.

## 8. EXECUTIVE SUMMARY

The goal of task T4.2 is to develop software components to enable integration and harmonization of data resources from the environmental cluster of research infrastructures and to republish those data according unifying views. Integration, harmonization and publishing are issues that almost all of the ENVRI cluster of Research Infrastructures have to address. In particular, the T4.2 task seeks to prototype a suite of software components addressing the most common and pressing needs of ENVRI cluster infrastructures for these issues. These developed components are expected to offer generic facilities that may be customized by specific implementations and plug-ins in order to adapt to the needs of specific ENVRI cluster infrastructures. The adoption of standards, the provision of a good quality of service, and the potential amortization of development costs are additional important criteria that these components have to meet.

This document reports on a given version of the software components resulting from this activity, i.e. *version 1*. It describes the set of facilities realized by the software components, lists the actual set of software components and packages, offers a set of links to the

documentation accompanying each component, and provides the reader with links for actually downloading the software artifacts.

# TABLE OF CONTENTS

# 1  INTRODUCTION

The ENVRI Data Integration, Harmonisation and Publication Facilities task is committed to developing software components to enable integration and harmonization of data resources from the ENVRI cluster of research infrastructures and publication of those data according unifying views. Integration, harmonization and publishing are issues that almost the whole of the ENVRI cluster of Research Infrastructures has to address. In particular, the task prototypes a suite of software components addressing the most common and pressing needs of those RI for these issues. These developed components are expected to offer generic facilities that may be customized by specific implementations and plug-ins in order to adapt to the needs of specific research infrastructures. The adoption of standards, the provision of a good quality of service, and overall cost reduction are additional important criteria that these components have to meet.

This document focuses on a given version of software components released during the project lifetime, i.e. *version 1*. It describes the set of functions realized by the software components belonging to such a version (Section 2), lists the actual set of software components and packages (Section 3), offers a set of links to the documentation accompanying each component (Section 4), and provides the reader with links for actually downloading the software artifacts (Section 5).

# 2  OBJECTIVES

The first release of ENVRI components dedicated to enable Data Integration, Harmonisation and Publications focuses on **geospatial data**. In particular, ENVRI components are conceived to enable the realisation of a scalable and reliable Spatial Data Infrastructure (SDI) capable to manage the large amount of data available in the research infrastructures participating the ENVRI cluster.

There are a number of technologies that are required to realize a SDI. The key technologies that have been integrated are reported below:

- GeoServer [5] is the reference implementation of the Open Geospatial Consortium (OGC) Web Feature Service (WFS) [9] and Web Coverage Service (WCS) [8] standards, as well as a high performance certified compliant Web Map Service (WMS) [10];
- GeoNetwork [12] is the OGC recommended catalog supporting ISO19115, ISO19119, and ISO19110 metadata standards represented and transported via the ISO19139 standard;
- Thredds [13] uses the Common Data Model (CDM) to read datasets in various formats, and serves them through OPeNDAP, OGC Web Coverage Service (WCS), NetCDF subset, and bulk HTTP file transfer services. The Unidata's Common Data Model (CDM) merges the OPeNDAP, netCDF, and HDF5 data models to create a common API for many types of data. As currently implemented by the NetCDF Java library, it can read OPeNDAP, netCDF, HDF5, GRIB 1 and 2, BUFR, NEXRAD, and GINI, among others;
- 52° North Web Processing Service [1] is a pluggable framework for algorithms and data processing which supports the OGC WPS [11] specification. It is thus conceived to enable the deployment of geo-processes on the web in a standardised way. It supports GeoTiff, ArcGrid, GML 2 and 3, Shapefiles, KML and KWT data formats;
- GeoAPI [14] provides a set of Java language programming interfaces for geospatial applications. The interfaces include many of the data structures and manipulation

methods needed for metadata handling, for geodetic referencing, projection and conversion;

- GeoToolkit Metadata [15] is a set of Java modules for handling metadata according to the GeoAPI interfaces.

Overall, the set of components hereafter presented allow to simplify and rely on a functionally complete SDI allowing the user to publish, discover, access, visualize, and process large datasets. It relies on the gCube information system to gather information on which platforms are available in the current scope, balancing the load between the different platform instances. It provides solutions aiming at balancing the load between all instances of the services composing a scalable and fault-tolerant SDI, and it manages the replicas of the same services.

These components contribute to the gCube open source technology [2]. gCube is a comprehensive software system supporting the creation and management of an Hybrid Data Infrastructure [3]. The components developed in the ENVRI context contribute to realise the gCube Geospatial Data Facilities. These facilities are conceived to support the whole lifecycle of geospatial data management including data discovery, access, processing, visualisation and publishing.

The ENVRI components corresponding to this document and listed in detail in Section 3 support the following facilities.

### Geospatial Data Access

This functional area is dedicated to cater for users willing to have access to geospatial data. In particular, it relies on THREDDS Data Server [13] to realize a data service that give access to geospatial data though protocols including OPeNDAP and OGC WMS [10] and WCS [8].

In this context, ENVRI has developed a software library named **GIS Interface** to simplify the interaction with a cluster of GeoNetwork and GeoServer instances. In particular, such a software library relies on the REST interfaces of GeoNetwork and GeoServer to offer methods for storing and retrieving data and metadata from the instances of such technologies by abstracting over data distribution and replication details. To do that, it exploits the **GeoNetwork Software Library**, i.e. a Java library dedicated to interact with GeoNetwork.

### Geospatial Data Processing

This functional area is dedicated to cater for users willing to execute data processing tasks. In particular, it relies on 52° North Web Processing Service [1] to expose a number of processes through OGC WPS [11].

In this context, ENVRI has developed a software library enabling *Signal Processing*. This software library supports a number of facilities including signal reconstruction, spectrogram calculation and display, multi-signal analysis by means of summed spectrogram, delta and double delta features, center frequency calculation, cepstral coefficients calculation, spectrum frequency band cut, filterbanks, and mel filterbanks. These facilities are actually part of a richer software library that is named **Ecological Engine**.

In addition to that, ENVRI has developed a software library enabling *data mining* on geospatial data. This software library is named **EcologicalEngineGeoSpatialExtension**. This library allows to *(i)* compare two spatial probability / quantities distributions, *(ii)* retrieve spatiotemporal information from a remotely hosted geospatial layer, and *(iii)* perform data mining on geographical layers containing environmental information.

***Geospatial Data Publishing and Visualisation***

This functional area is dedicated to expose and make available geospatial data through well recognised protocols – including CSW [7], WCS [8], WFS [9] and WMS [10] – as well as to cater for human users willing to visualise available geospatial products. In particular, it relies on GeoNetwork [12] and GeoServer [5] to offer a catalogue service for data discovery and a repository service for data storage.

In this context, ENVRI has developed a software system named ***GIS Publisher Service***. This is web service that is conceived to enable the publication of geospatial data by relying on an open set of back-end technologies for the actual storage and retrieval of the data. Because of this, the service is designed with a plug-in-oriented approach where each plug-in interfaces with a given back-end technology. To enlarge the array of supported technologies it is sufficient to develop a dedicated plugin. The current release include one plug-in for interfacing with GeoServer instances (***GeoServer Publisher Plugin***). Such plug-in exploits the GIS Interface previously described.

In addition to that, ENVRI contributed to the development of ***Geo Explorer*** and ***GIS Viewer***, two components dedicated to support the browsing and visualisation of geospatial data. In particular, the *Geo Explorer* is a web application that allows users to navigate, organize, search and discovery layers from a GeoNetwork instance via the CSW protocol. The GIS Viewer is a web application that allows users to interactively explore, manipulate and analyse geospatial data. The two applications are conceived to work in tandem, i.e. trough the Geo Explorer it is possible to select a number of layers to be visualised and managed via the GIS Viewer. In addition to that, these components have been reused to produce components offering the same functionalities in the context of a gCube-based infrastructure, ***gCube Geo Explorer*** and ***gCube GIS Viewer***. Differently from the previous components, the gCube-oriented ones are conceived to retrieve details on the operational environment by interacting with gCube services, namely the Information System.

## 3   COMPONENTS

List of components released including their version number.

***Geospatial Data Access***
- GIS Interface v1.0.0
- GeoNetwork Library v1.0.1

***Geospatial Data Processing***
- Ecological Engine v1.6.1
- Ecological Engine Geospatial Extensions v1.0.0

***Geospatial Data Publishing and Visualisation***
- gCube Geo Explorer v2.1.0
- gCube GIS Viewer v2.0.0
- Geo Explorer v2.1.0
- GIS Publisher v1.0.0
- GeoServer Publisher Plugin v1.0.0
- GIS Viewer v3.0.1

# 4  DOCUMENTATION

A detailed specification of the services described by this document is made available via the dedicated Wiki pages available at:

http://envri.eu/group/envri/wiki/-/wiki/Main/Integration, Harmonisation and Publication software components - version 1

Moreover, for development purposes, each component is provided with a Javadoc documentation carefully describing every method and class the software is organised in. This Javadoc is included in each software artifact.

This documentation is an integral part of the actual deliverable.

# 5  DOWNLOAD

This document describes a deliverable of type "prototype". The actual deliverable consists of the software artefacts briefly presented in Sections 2 and 3.

These artefacts are available for download at http://envri.eu/group/envri/wiki/-/wiki/Main/Integration, Harmonisation and Publication software components - version 1

| GIS Interface 1.0.0 | |
|---|---|
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.spatial.data&a=gis-interface&v=1.0.0-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/gis-interface_1.0.0-2.14.0/ |
| Source Code | http://svn.d4science.research-infrastructures.eu/gcube/trunk/spatial-data/gis-interface |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/GIS_Interface |
| **Geonetwork Library 1.0.1** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.spatial.data&a=geonetwork&v=1.0.1-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/geonetwork_1.0.1-2.14.0 |
| Source Code | http://svn.d4science.research-infrastructures.eu/gcube/trunk/spatial-data/geonetwork |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Geonetwork_library |
| **Ecological Engine 1.6.1** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.dataanalysis&a=ecological-engine&v=1.6.1-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/ecological-engine_1.6.1-2.14.0 |
| Source Code | https://svn.d4science.research-infrastructures.eu/gcube/branches/data-analysis/EcologicalEngine/1.6 |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Ecological_Modeling |
| **Ecological Engine Geospatial Extensions 1.0.0** | |

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| SW Artifact | http://maven.research-infrastructures.eu/nexus/content/repositories/gcube-snapshots/org/gcube/dataanalysis/ecological-engine-geospatial-extensions/1.0.0-SNAPSHOT/ecological-engine-geospatial-extensions-1.0.0-20130430.164644-1.jar |
| Javadoc | http://maven.research-infrastructures.eu/nexus/content/repositories/gcube-snapshots/org/gcube/dataanalysis/ecological-engine-geospatial-extensions/1.0.0-SNAPSHOT/ecological-engine-geospatial-extensions-1.0.0-20130430.164644-1-javadoc.jar |
| Source Code | https://svn.d4science.research-infrastructures.eu/gcube/trunk/data-analysis/EcologicalEngineGeoSpatialExtension |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Geospatial_Data_Mining |
| **gCube Geo Explorer 2.1.0** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.portlets.user&a=gcube-geo-explorer&v=2.1.0-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/gcube-geo-explorer_2.1.0-2.14.0 |
| Source Code | http://svn.d4science.research-infrastructures.eu/gcube/trunk/portlets/user/gcube-geo-explorer |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Geo_Explorer |
| **gCube GIS Viewer v2.0.0** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.portlets.user&a=gcube-gis-viewer&v=2.0.0-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/gcube-gis-viewer_2.0.0-2.14.0 |
| Source Code | http://svn.d4science.research-infrastructures.eu/gcube/trunk/portlets/user/gcube-gis-viewer |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Gis_Viewer |
| **Geo Explorer 2.1.0** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.portlets.user&a=geo-explorer&v=2.1.0-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/geo-explorer_2.1.0-2.14.0 |
| Source Code | http://svn.d4science.research-infrastructures.eu/gcube/trunk/portlets/user/geo-explorer |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Geo_Explorer |
| **Geo Explorer 2.1.0 (portlet)** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.portlets.user&a=geo-explorer-portlet&v=2.1.0-2.14.0&e=war |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/geo-explorer-portlet_2.1.0-2.14.0 |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/branches/portlets/user/geoExplorerPortlet/2.1 |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Geo_Explorer |
| **GIS Publisher 1.0.0** | |
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube- |

| | |
|---|---|
| | snapshots&g=org.gcube.data.publishing&a=gis-publisher-service&v=1.0.0-SNAPSHOT&e=jar |
| Javadoc | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=gis-publisher-service&v=1.0.0-SNAPSHOT&e=jar&c=javadoc |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/trunk/data-publishing/gis-publisher/gis-publisher-service |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/GIS_Publisher_service |

### GIS Publisher 1.0.0 (Stubs)

| | |
|---|---|
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=gis-publisher-stubs&v=1.0.0-SNAPSHOT&e=jar |
| Javadoc | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=gis-publisher-stubs&v=1.0.0-SNAPSHOT&e=jar&c=javadoc |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/trunk/data-publishing/gis-publisher/gis-publisher-stubs |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/GIS_Publisher_service |

### GIS Publisher 1.0.0 (Plugin Framework)

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|---|---|
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=gis-publisher-plugin-framework&v=1.0.0-SNAPSHOT&e=jar |
| Javadoc | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=gis-publisher-plugin-framework&v=1.0.0-SNAPSHOT&e=jar&c=javadoc |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/trunk/data-publishing/gis-publisher-plugin-framework/ |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/GIS_Publisher_service |

### GeoServer Publisher Plugin 1.0.0

| | |
|---|---|
| SW Artifact | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=geoserver-publisher-plugin&v=1.0.0-SNAPSHOT&e=jar |
| Javadoc | http://maven.research-infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-snapshots&g=org.gcube.data.publishing&a=geoserver-publisher-plugin&v=1.0.0-SNAPSHOT&e=jar&c=javadoc |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/trunk/data-publishing/geoserver-publisher-plugin/ |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/GIS_Publisher_service |

### GIS Viewer 3.0.1

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| SW Artifact | http://maven.research- |

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|---|---|
| | infrastructures.eu/nexus/service/local/artifact/maven/redirect?r=gcube-staging&g=org.gcube.portlets.user&a=gis-viewer&v=3.0.1-2.14.0&e=jar |
| Javadoc | http://www.gcube-system.org/javadocs/2-14-0/gis-viewer_3.0.1-2.14.0 |
| Source Code | http://svn.research-infrastructures.eu/public/d4science/gcube/branches/portlets/user/GISViewer/3.0 |
| Wiki | https://gcube.wiki.gcube-system.org/gcube/index.php/Gis_Viewer |

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[10] Open Geospatial Consortium. Web Map Service. http://www.opengeospatial.org/standards/wms

[11] Open Geospatial Consortium. Web Processing Service. http://www.opengeospatial.org/standards/wps

[12] Open Source Geospatial Foundation. GeoNetwork Opensource http://geonetwork-opensource.org/

[13] Unidata. THREDDS Data Server. http://www.unidata.ucar.edu/software/tds/

[14] GEOAPI. http://www.geoapi.org/

[15] GeoToolkit. http://www.geotoolkit.org/modules/metadata/index.html