

PROJECT GEONETCAST WS 2009/2010

# eWater – SDI for water resource management

Final Report

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## 1. Background

The Institute for Geoinformatics (IFGI), University of Münster, is aiming at implementing a GEONETCast ground receiving infrastructure. The system will be able to receive and store data provided by GEONETCast (Level 1 data) and serve this content as well as derived information products (Level 2 data) via standardized web services (WMS, WCS, WFS) to users in the research and education domain within the university. This infrastructure will serve not only as a source of geospatial content, but also as an environment for developing and testing geospatial data processing techniques.

## 2. Objectives

As a part of GEONETCast project at IFGI, this project aims to set up the basic building blocks for a local SDI which includes:

- a. Set up a metadata server
- b. Set up a portal application
- c. Implement means for controlling access to the information products
  - Agree on a policy for securing information products (authentication, authorization, licensing, and accounting)
  - Agree on an implementation concept
  - Set up and configure security services

## 3. e-Water at a Glance

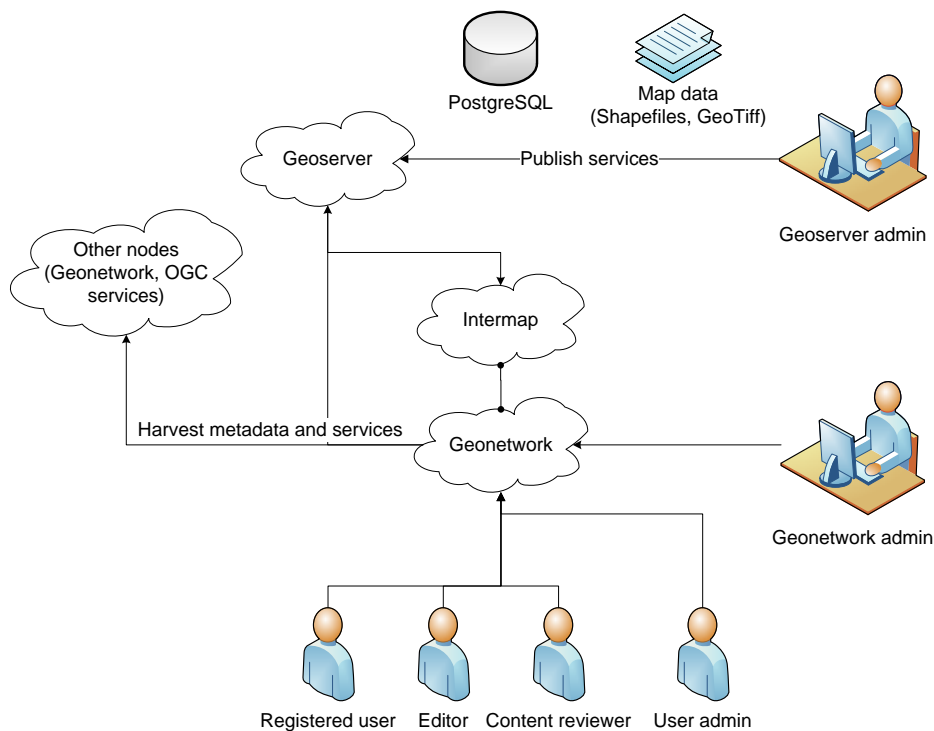
e-Water is a local Spatial Data Infrastructure (SDI) for water resource management. Local SDI is the lowest level of Global SDI, where data is maintained and updated at the level where it is produced, in this case, GEONETCast IFGI. As the name implied, e-Water will manage and improve access to spatial data and information that is related to water resource management, for example: hydrological and meteorological data. The scope of data is not strictly limited to certain regions, although it mainly focuses on European countries.

## 4. Software

e-Water is implemented on Windows XP Professional using this software:

- a. Web server
  - Apache Tomcat 6.0
- b. Geonetwork 2.4.2, bundled package
  - Geoserver 1.7.3 (web map server)
  - Intermap (map client)
- c. Database
  - PostgreSQL 8.3 + PostGIS 1.4.0

## 5. How It Works



GeoServer admin uploads the map data into Geoserver and publish it as OGC services. Map data could be in the form of shapefiles, GeoTIFF files, or vector data stored in PostgreSQL/PostGIS database. GeoNetwork admin harvests the dataset and service metadata from OGC services (including local OGC services in GeoServer), another GeoNetwork nodes, and CSW (Catalogue Service for Web). This harvesting process can be set up to run periodically so that GeoNetwork will keep up-to-date with the current data. Intermap provides interactive map viewer to combine various WMS layers and overlay certain dataset with the base map. To manage user access to restricted information or advanced functionality in GeoNetwork application, there are 5 predefined profiles with different access levels for users.

## 6. Functionalities

### 6.1. Searching of spatial data

When user searches for certain data, he will get the search result based on his group.

#### 6.1.1. Quick search

Quick search allows user to search data by categories. User just need to click on one of the predefined categories and all data belong to that category will be displayed.

#### 6.1.2. Simple search

Simple search allows user to search text within the entire record, such as keywords of the metadata. There are two types of search, free text search (what) and geographic search (where). In free text search, user can type anything and use quotes around text to find exact combinations of words. Text and operators (and, or, not) are not case

sensitive. For the geographic search, two options are available for selecting a particular region to limit the search. User can select a region from a predefined list or drag and drop the frame of his own area of interest. There are several options to display the search result: sort by, hits per page, and the layout of the displayed result.

### **6.1.3. Advanced search**

The concept of advanced search is similar to simple search, with an addition of temporal search (when). Furthermore, each type of search has more optional parameters compared to simple search. In free text search, user can search directly in the title or abstract fields and add more keywords to customize the search further. There is also an option to specify the level of accuracy that the user wishes to reach in performing the search. In the geographic search, user can use free coordinates to define the lat-long geographic references of the desired area. User can also limit the search by choosing different options of spatial relationship, e.g. overlaps, encloses. For the temporal search, user can define the time range which refers to data creation or publication date.

## **6.2. Downloading of data**

User can download the data according to his privileges for each metadata.

## **6.3. Map viewer**

GeoNetwork comes with an embedded map client, Intermap. This map viewer can combine WMS from distributed servers around the world. Depending on user privileges for each metadata, there is also a possibility to overlay certain dataset with the base map.

## **6.4. Metadata management**

The metadata ISO 19139 profile used by GeoNetwork to describe the geographic data and services is based on the ISO standard 19115:2003 and provides information related to the identification, the maintenance and constraints, the spatial and temporal extent, the spatial representation and reference, the quality and distribution of a geographic dataset.

### **6.4.1. Categories**

There are 6 data categories in e-Water:

- a. Background datasets
- b. Geological data
- c. Hydrological data
- d. Meteorological data
- e. Proceedings
- f. Resources
- g. Water bodies

### **6.4.2. Create new metadata**

User can add a new metadata into GeoNetwork if he is registered as an Editor into the group he wants to add records to. For the metadata creation using the online editor, GeoNetwork provides a set of simplified metadata templates, for example: templates for raster and vector data based on the ISO 19139.

Here are the basic steps in creating new metadata records:

- a. Select the metadata template, if possible, using the preferred ones.
- b. Select the group the metadata will belong to.
- c. Enter metadata for the map.

There are mandatory, conditional, and optional metadata fields. Mandatory fields are required, whereas the optional fields can be provided but are not fundamental, depending on the metadata author. The conditional fields indicate that the presence of a specified data element is dependent on the value or presence of other data elements in the same section.
- d. Create a thumbnail; a small thumbnail to be displayed in search result and a large thumbnail with much more details which allows user to properly evaluate the data usefulness.
- e. Upload and link the data for download.

Files in whatever format can be uploaded: doc, PDF, images, vector layers, etc. User can also include any relevant information, for example: the legend or base data used to create the dataset specified. The size of a single file to upload can not exceed 100 Megabytes.
- f. Assign privileges for the map.

User needs to identify which groups have which privileges for a particular map. There are 6 privileges:

  - Publish: Users in the specified group can see the map in the search result.
  - Download: Users in the specified group can download the map.
  - Interactive Map: Users in the specified group can get an interactive map.
  - Featured: When selected, the map is placed in the Features Maps of the home page and it appears there randomly.
  - Editing: When selected, the Editors of the group concerned can edit the respective metadata records.
  - Notify: A notification email is send to the email address of the group, informing that the map has been downloaded.

Depending on their profile, users may have different access to these functions.
- g. Assign categories for the map.

### **6.4.3. Import metadata**

This procedure is particularly useful for users who already have metadata in XML format, for example created by some GIS applications. However the metadata must be in one of the standards used by GeoNetwork: ISO19115, FGDC and Dublin Core.

There are two methods to import metadata. Using metadata insert, user can import metadata records in a single XML or MEF file or copy/paste XML metadata, while using batch import, user can import all XML formatted metadata from a local directory. For each method, user can choose to apply a style sheet to convert the metadata input, for example: from OGC WXS GetCapabilities to ISO 19119/19139. User also needs to define the group and the category for the metadata.

## **6.5. Harvesting and synchronization of metadata**

### **6.5.1. Harvesting**

Harvesting is the process of collecting remote metadata and storing them locally for a faster access. User can do this process periodically, e.g. once a week. The smallest

value is 1 minute while the greatest value is 100 days. GeoNetwork is able to harvest from several sources.

In e-Water, we harvest metadata from these nodes:

- a. Another GeoNetwork node (version 2.1 or above).

This type of harvesting allows user to connect to a remote GeoNetwork node, to perform a standard search using the common query fields and to import all matching metadata. User needs to specify the GeoNetwork node he wants to harvest from (host, port and servlet). User can add several search criteria to limit the harvesting result. In this method, the protocol will try to keep both remote privileges and categories of the harvested metadata if they exist locally. Thus, there is an option to map remote group's privileges. User can also assign local categories to harvested metadata.

Example: Harvesting from GeoNetwork node at International Water Management Institute (IWMI) <http://geonetwork.iwmi.org:8080/geonetwork>

- b. A CSW 2.0.1 or 2.0.2 catalogue server.

This type of harvesting is capable of connecting to a remote CSW server and retrieving all matching metadata. In order to be harvested, metadata must have one of the schema format handled by GeoNetwork. User needs to specify the connection parameters which point to the capabilities document of the CSW server. User can add several search criteria to limit the harvesting result. User can also assign privileges to user groups and assign local categories to harvested metadata.

Example: Harvesting from the Dutch SDI

<http://www.nationaalgeoregister.nl/geonetwork/srv/eng/csw?service=CSW&request=GetCapabilities&version=2.0.2>

- c. An OGC service using its GetCapabilities document. These include WMS, WFS, WPS and WCS services.

The GetCapabilities document of an OGC service provides information about the service and the layers/feature types/coverages served. GeoNetwork will convert it into ISO19139/119 format. User needs to specify the URL of the service to contact. User can assign privileges to user groups and assign local categories to harvested dataset and service metadata.

Example:

- Harvesting from local OGC service (GeoServer)  
<http://localhost:8080/geoserver/wms>
- Harvesting from external OGC service (UNEP)  
<http://na.unep.net/cgi-bin/Climate>

### 6.5.2. Synchronization

In harvesting, GeoNetwork uses the concept of a universally unique identifier (UUID). This id is not only unique locally to the node that generated it, but also unique across the entire world. Every time user creates a new metadata in GeoNetwork, a new UUID is generated and assigned to it.

Another important concept is the last change date. Every time user changes a metadata, its last change date is updated. Storing this parameter and comparing it with

a new one allows any system to find out if the metadata has been modified since last update.

These two concepts allow GeoNetwork to fetch a remote metadata, check if it has been updated and remove it locally if it has been removed remotely. This synchronization feature is integrated with harvesting function. Please also refer to the section of harvesting.

## **6.6. User and group management**

GeoNetwork provides a security features to manage access to restricted information or advanced functionality.

### **6.6.1. Profile**

Profile is used to restrict user access to application. Each profile will have different menus available on e-Water. GeoNetwork has 5 default user profiles:

a. Administrator

This profile is the super user. It has unlimited access to the application.

b. User administrator

This profile has the access right to create, import, and edit metadata records, transfer ownership, and user management for its own group. If the number of user is very large, it may be necessary to have a user assigned to this profile in each group.

c. Content reviewer

This profile has the access right to create, import, and edit metadata records within its own group.

d. Editor

This profile has the access right to create, import, and edit metadata records within its own group.

e. Registered user

This profile can only view metadata records that they have access right to.

### **6.6.2. Group**

Every authenticated user is assigned to a particular group and is only able to view data within that group. GeoNetwork does not limit the number of groups created.

For initial condition, we create 3 groups in e-Water.

a. Professor

b. Staff

c. Student

Apart from user-created groups, GeoNetwork has 3 default groups; All (Internet user), Intranet (internal user), and Guest.

### **6.6.3. User**

A user has only one profile and can be part of several groups. The combination of profile and group defines what tasks the user can perform on

the system or on specific metadata records. GeoNetwork does not limit the number of users created.

For initial condition, we create 12 users in e-Water and assign them to different profiles and groups to check the associated privileges.

	Administrator	User administrator	Content reviewer	Editor	Registered user
Professor	N/A	denise	freska	deborah	desiree
Staff	N/A	lena	jakob	karthik	jafar
Student	N/A	divya	volker	tracia	hansi

## 6.7. Publishing of OGC services

GeoServer publishes data to the web using open standards. It supports 3 different OGC services: WMS, WCS, and WFS. In e-Water, we only use the WMS features.

### 6.7.1. Shapefile

A shapefile is a collection of files (.shp, .dbf, .shx, .prj, and sometimes others). All of these files need to be present in the same directory in order for GeoServer to accurately read them. When creating the data store, user needs to indicate the data directory and filename.

### 6.7.2. PostGIS

To establish a connection to PostgreSQL/PostGIS database, user has to specify the connection parameters, including his PostgreSQL username and password. When properly loaded, all tables in the database will be visible to GeoServer, but they will need to be individually configured before being served by GeoServer.

### 6.7.3. GeoTIFF

A GeoTIFF is a georeferenced TIFF (Tagged Image File Format) file. When creating the coverage store, user needs to indicate the data directory and filename.

For each dataset, SRS (Spatial Reference System) and bounding box value is needed to correctly display the data. When adding a new dataset to GeoServer, user can choose from a list of predefined style to define how the data will be displayed. There is also a possibility to create user own style in a separate menu using the Styled Layer Descriptor (SLD) styling language.