DigMap
DigMap – Digital Map Excerpt Software
FINODEX_048

Technical Design Document

Contact person	Krunoslav Hrnjak
E-mail	krunoslav@yottabyte.hr
Company	yottabyte j.d.o.o.

This project is co-funded by the European Union

Index

1 Summary

Technical Design Document gives overview on technical feasibility for DigMap software. Document describes handling, functionality and architecture of a DigMap product and basic use case scenarios. It provides guidance and material which is intended for business analysts, solution architects, application developer, reports developers and testers. It is also useful background reading for anyone involved in developing DigMap. It aims to provide enough information for a user to understand inner and outer dependencies of the product at hand.

Geospatial information systems are the most exciting development in information technology and systems in recent years. They use much of the conventional information technology integrated with maps and some of the techniques used in computer games to assist us in analysing, modelling and managing the world around us. Nowadays, even the major computer software and internet giants are investing in geospatial information systems and geo-information technology.

DigMap solution is an free and open source, cloud-based Geographic Information System (GIS) for public and private sector core-users to help them (1) to easier disseminate online spatial and non-spatial digital data (through digitally signed PDF report with excerpt maps and embedded data, excluding problem of any additional paper work and physical presence) and (2) standardized offline storage and printing on end-user's computer.

DigMap integrates open source technologies within a comprehensive toolkit promoting interoperability through the use of OGC (Open Geospatial Consortium) and other open standards for data exchange and services. This allows for independent development and functionality deployment provided by different web-services.

DigMap „digital map excerpt" goal is to enable easy distribution and use of spatial data as part of public or private sector for creation of value-added services through infrastructure powered by FIWARE GEs and enable "one stop shop" approach for geospatial data.

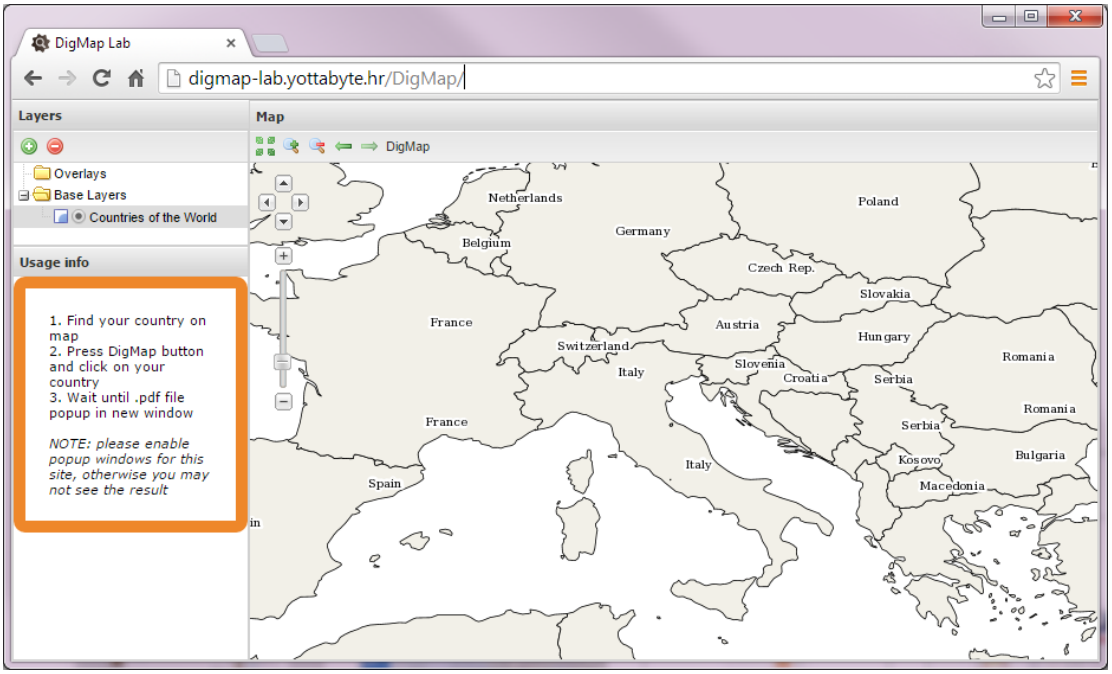

Figure 1 DigMap Lab at http://digmap-lab.yottabyte.hr/

Information about DigMap idea is also available online, divided into three main parts:

- General presentation: http://digmap.yottabyte.hr/
  - DigMap general presentation contains all relevant information about project, including project description, impacts, core team member and invitation to join.
- Tutorial: http://digmap.wordpress.com/
  - DigMap tutorial shows how to produce reports with maps using today's world leading free and open source software for web mapping and reports, GeoServer & JasperReport, respectively.
  - Tutorial goes through a series of steps increasing a level of complexity with various integration options: from command line application setup, over web application to GeoServer extension.
- Lab: http://digmap-lab.yottabyte.hr/
  - DigMap lab is made as a try out free to use demo. It is based on Boundless Open Geo Suite, consisting of PostGIS database, GIS web server named GeoServer, and OpenLayers front end framework. Additionally code is written in Java using JasperReport and GeoTools frameworks, Eclipse IDE (integrated development environment) and Maven build automation tool.

Proposed solution will contribute to making available harmonized information related to one or more of the specific themes enumerated in annexes I-III of the INSPIRE Directive and to fostering the development by the private sector of innovative value-added services based on this interoperable information on a cross-border or pan-European level.

2 Our technical objective(s)

2.1 Technical concept

Innovation is that an operational implementation is based on a new standardized open interface (OGC WPS – Open Geospatial Consortium Web Processing Service) which leads to interoperability and portability and is aligned with Open Data objective and Digital Agenda for Europe which promotes creation, production and distribution of Public Sector Information (PSI) as digital content and new value-added services on a free market. The DigMap state-of-the-art service components are re-usable, encapsulated and standardized pluggable extension and therefore can be broadly deployed in other applications and as a part of National Spatial Data Infrastructure.

2.2 Usability in real business life

Probably most widely and recognized usage would be for printing out digital cadastral map excerpt composed from several layers (most common digital orthophoto, land use, parcels and buildings) used to locate, inventory, and appraise all owner's property. Maps and map data are also important for other governmental agencies, the public, and the land information community (such as realtors, title companies, and surveyors). DigMap PDF enables easy view of geospatial data and feature attributes while DigMap embedded files can enhance the capability to manage, analyse, summarize, display, and disseminate geographically referenced information.

Support full online availability for many public services connected with delivery of geospatial data, full electronic case handling – where the user applies for and receives the service online, without any additional paper work. Enable online "one stop shop" approach to many public electronic services even when complexity of geospatial data is involved.

2.3 INSPIRE Directive

DigMap will contribute to making available harmonized information related to one or more of the specific themes enumerated in annexes I-III of the INSPIRE Directive and to fostering the development by the private sector of innovative value-added services based on this interoperable information on a cross-border or pan-European level.

Figure 2 List of INSPIRE themes

DigMap will offer wide range of predefined templates ready to use after setting basic configuration parameters (organization name, heading title, etc.) and more advanced custom design can also be easily done with user friendly GUI tools.

2.4 Project objectives

The specific Dig Map project objectives (POs) are to design, develop, test and demonstrate the use of tool for digital map excerpt that support:

- **PO1. Authenticity - use issued DigMap for legal purpose it must be signed with digital signature**
- **PO2. Standardization - enable sharing spatial data in standardized .pdf format embedding .gml**
- **PO3. Interoperability - based on wide accepted OGC SLD, WMS, WCS WFS and WPS standard**
- **PO4. Data billing – implement different billing rules (eg. by area, size in MB, number of points…)**
- **PO5. FOSS (free and open source software) - wide spread at low cost, no vendor lock**

To be able to use issued DigMap for legal purpose is must be signed with digital signature enabling authentication and non-repudiation. Many business transactions, including financial, legal, and other regulated transactions, require high assurance when signing documents. When documents are distributed electronically, it is important that recipients can:

- Verify document authenticity – confirming the identity of each person who signed the document
- Verify document integrity – confirming that the document has not been altered in transit

Certificate-based signatures provide both of these security services. Many businesses and governments have chosen to set up a certificate-based digital signature infrastructure within their organization – using third party certificate authorities to provide independent identity validation. [1]

[1] http://helpx.adobe.com/acrobat/kb/certificate-signatures.html

Also one very important aspect of data distribution is ordering and data billing. Many countries and institutions are charging for its geospatial data to enable income to cover their operational costs. There are many different billing rules that can be applied including but not limited to:

- number of points/ features
- area
- data size

DigMap will be built and published as a FOSS (free and open source software) enabling wide spread at low cost, enable integration and interoperability, further development according to users' needs and vendor independence. Also European interoperability framework for Pan-European eGovernment services is based on open standards and encourages the use of open source software.

3 The proposed solution

DigMap support full online availability for many public services connected with delivery of geospatial data. According to the EU eGovernment benchmark method DigMap supports Interaction model.

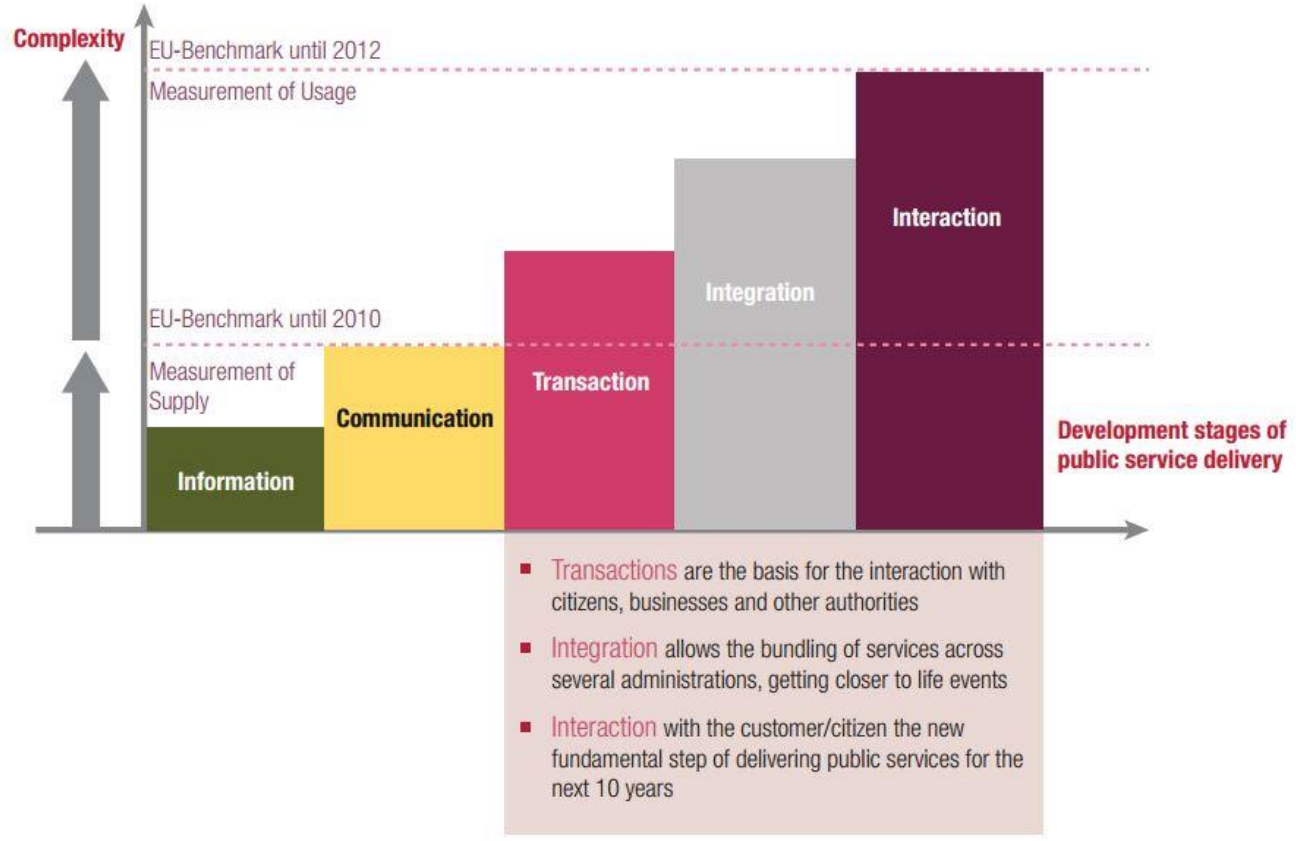

Figure 3 Complexity of services and steps of Digital Development

DigMap supports full electronic case handling – where the user applies for and receives the service online, without any additional paper work, which is increasingly becoming mainstream. DigMap also provides an indication of the extent by which front- and back-offices are integrated, data is reused and services are delivered proactively. DigMap allows online "one stop shop" approach for many public electronic services even when complexity of geospatial data is involved.

3.1 Architecture

Since DigMap is interoperable solution following established GIS ICT standards there are various software, programming languages and GIS solutions that could be used to produce DigMap. Rather exhaustive list of OGC WPS service implementation can be found at http://www.opengeospatial.org/resource/products/byspec by selecting Web Processing Service 1.0.0 specification. There are many proprietary solutions from world's leading GIS software providers like ESRI or Intergraph and also several Open Source Software products like GeoServer, ZOO-Project or PyWPS.

3.1.1 General Architecture

Proposed architecture is based on GeoTools framework, GeoServer mapping server and Java programming language since the author of the document is most familiar those products.

GeoTools is an open source (LGPL) Java code library which provides standards compliant methods for the manipulation of geospatial data, for example to implement Geographic Information Systems (GIS). The GeoTools library implements Open Geospatial Consortium (OGC) specifications as they are developed.

GeoServer is an open source server for sharing geospatial data. GeoServer is designed for interoperability; it publishes data from any major spatial data source using open standards. Additional open source tools for reporting and digital signature are used: JasperReports and iText.

JasperReports Library is the world's most popular open source reporting engine. It is entirely written in Java and it is able to use data coming from any kind of data source and produce pixel-perfect documents that can be viewed, printed or exported in a variety of document formats including HTML, PDF, Excel, OpenOffice and Word.

iText is an open source library for creating and manipulating PDF files in Java. iText is used to embed .gml data into PDF and add digital signatures to a PDF file.

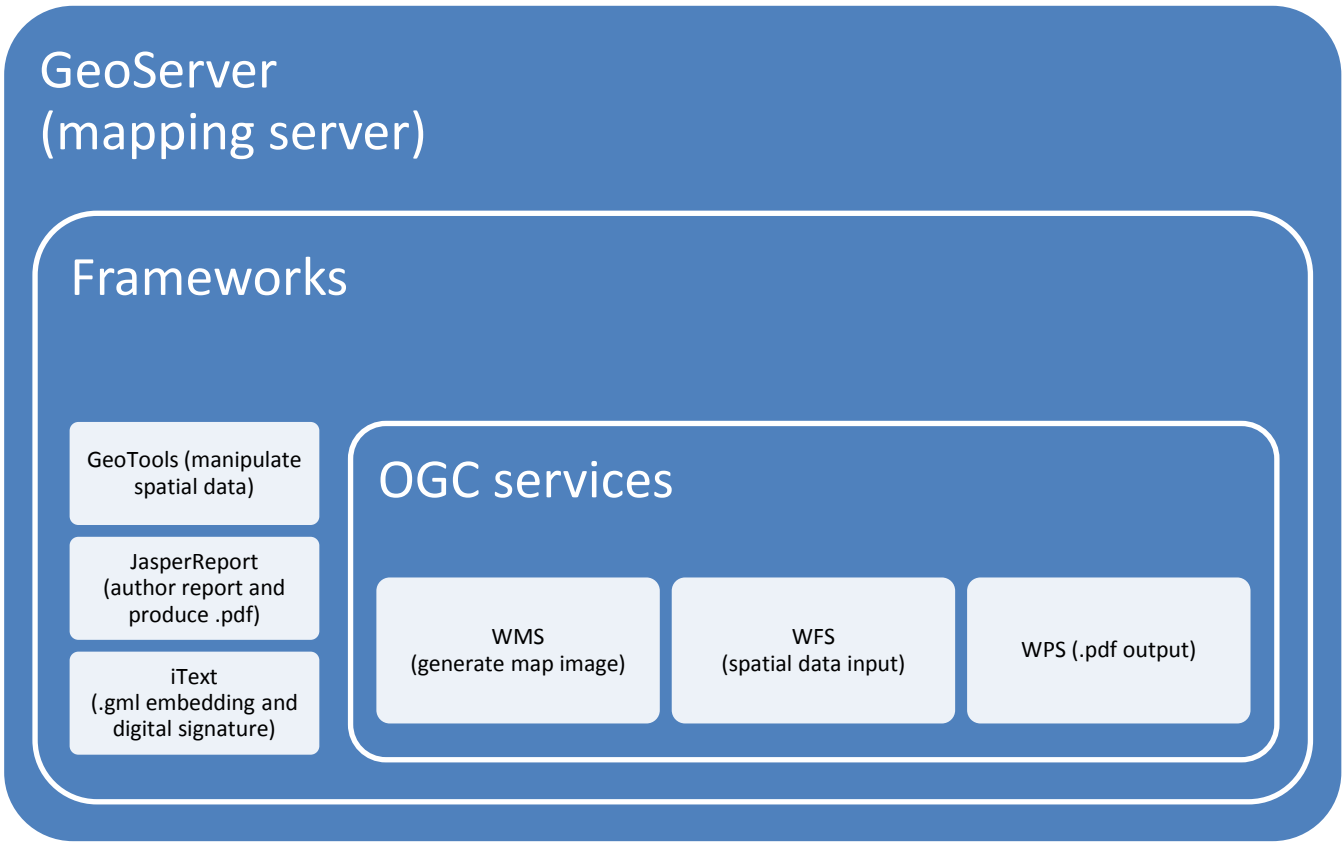

Figure 4 DigMap components

DigMap is primary backend service processed on server side. DigMap interface is published trough OGC WPS GetCapabilitiest request already available on DigMap Demo Lab.

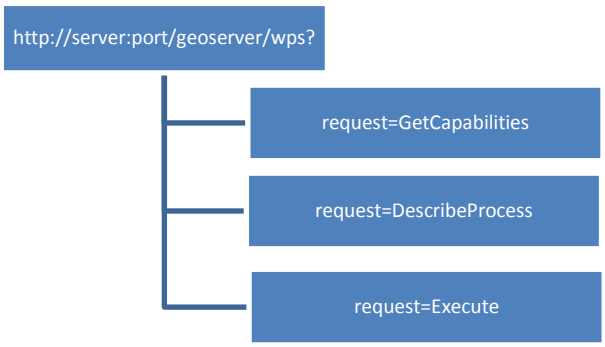

Figure 5 WPS basic requests

WPS API provides request for getting information about available processes, process definition and also process execution.

http://digmap-lab.yottabyte.hr/geoserver/wps?request=GetCapabilities

Figure 6 WPS GetCapabilities request

```
<wps:Process wps:processVersion="1.0.0">
      <ows:Identifier>gs:DigMap</ows:Identifier>
      <ows:Title>DigMap</ows:Title>
      <ows:Abstract>Digital map excerpt</ows:Abstract>
</wps:Process>
```

Figure 7 DigMap listing in WPS process offerings

http://digmap-lab.yottabyte.hr/geoserver/wps?service=WPS&request=DescribeProcess&identifier=gs:DigMap

Figure 8 WPS DigMap DescribeProcess request

```
<ProcessDescription wps:processVersion="1.0.0" statusSupported="true" storeSupported="true">
    <ows:Identifier>gs:DigMap</ows:Identifier>
    <ows:Title>DigMap</ows:Title>
    <ows:Abstract>Digital map excerpt</ows:Abstract>
    <DataInputs>
        <Input maxOccurs="1" minOccurs="1">
            <ows:Identifier>userName</ows:Identifier>
            <ows:Title>userName</ows:Title>
            <ows:Abstract>Your name</ows:Abstract>
            <LiteralData>
                <ows:AnyValue/>
            </LiteralData>
        </Input>
        <Input maxOccurs="1" minOccurs="1">
            <ows:Identifier>countryName</ows:Identifier>
            <ows:Title>countryName</ows:Title>
            <ows:Abstract>Country name</ows:Abstract>
            <LiteralData>
                <ows:AnyValue/>
            </LiteralData>
        </Input>
    </DataInputs>
    <ProcessOutputs>
        <Output>
            <ows:Identifier>digmap</ows:Identifier>
            <ows:Title>digmap</ows:Title>
            <LiteralOutput/>
        </Output>
    </ProcessOutputs>
</ProcessDescription>
```

Figure 9 DigMap process description

This project is co-funded by the European Union

Since WPS act as a web service over HTTP layer DigMap service can be called directly by entering necessary data into HTTP request. Using HTTP GET request it is possible to write down URL for generating digital map excerpt. A sample URL request can look like following:

http://digmap-lab.yottabyte.hr/geoserver/wps?

SERVICE=WPS&

REQUEST=Execute&

VERSION=1.0.0&

IDENTIFIER=gs:DigMapSimple&

RawDataOutput=digmap&

datainputs=geometry=POINT(16 46)

Presented URL consists of elements given in the table below.

Table 1 WPS URL elements for DigMap simple service

URL request element	Description
http://	Web service protocol - "Hyper Text Transfer Protocol"
digmap-lab.yottabyte.hr/	Name of the application server
geoserver/	Name of the application
wps?	Name of service
SERVICE=WPS&	Service parameter – define service type
REQUEST=Execute&	Service parameter – define request type
VERSION=1.0.0&	Service parameter – define service version
IDENTIFIER=gs:DigMapSimple&	Service parameter – define service name
RawDataOutput=digmap&	Service parameter – define service return value
datainputs=geometry=POINT(16 46)	Service parameter – define service input value

Point coordinates (WGS84 latitude 46 degrees and longitude 16 degrees) of place Modrovec in Republic of Croatia are sent as a service input. Service output is a string with URL for report download, in particular case return value was: http://digmap-dme.yottabyte.hr/2015-04-14_14:00:22.968-DigMap.pdf

GeoServer has WPS request builder to enable user friendly WPS process listing and GUI for process input.

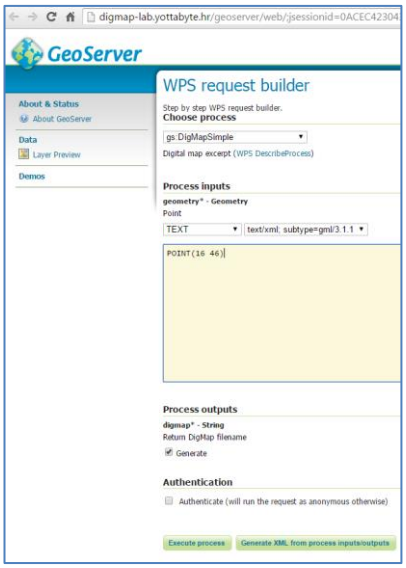

Figure 10 GeoServer (FIWARE GIS provider component) WPS request builder

Also users can interact with DigMap service in friendly way using any GIS client that supports WPS standard like desktop client QGIS or web GIS clients like OpenLayers.

DigMap could be built on GIS platform like OpenGeo Suite . OpenGeo Suite is a complete geospatial platform for managing data and building maps and applications across web browsers, desktops, and mobile devices. Built on leading open source geospatial software, OpenGeo Suite has a robust and flexible architecture that enables organizations to reliably manage and publish geospatial data.

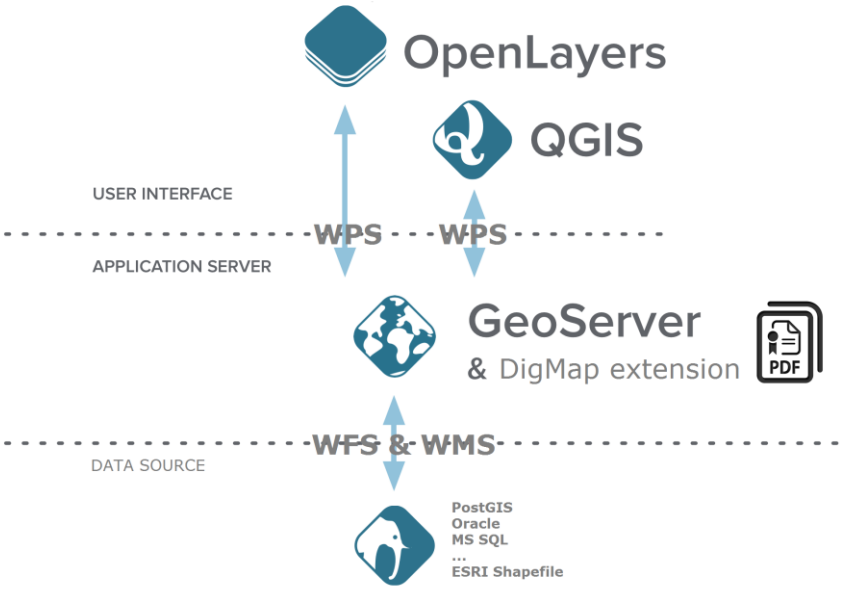

Figure 11 DigMap architecture based on OpenGeoSuite - interaction with DigMap services

OpenGeo Suite has a full GIS stack consisting of the following components:

- **Storage: r**aw data are managed in a consistent read/write data store, a relational database. Recommended spatial database is PostGIS. Other options include SQL Server, Oracle Spatial and DB2.
- **Application server:** The raw data are accessed using web services, and rendered into cartographic products using the GeoServer map/feature server.
- **User interface framework:** Targeted vertical applications serve one operational need and serve it well. GeoExt/ExtJS is a platform independent user interface toolkit.
- **User interface map component:** OpenLayers is a map component that understands spatial features and map layers.

DigMap service is primary build and executed on application server as a GeoServer extension, additionally with web based user interface.

3.1.2 Standards

DigMap is interoperable solution involving following standards:

- Geography Markup Language - GML - contains spatial data in digital format
- Portable Document Format - PDF - final widely spread document format
- Hypertext Transfer Protocol - HTTP - data transport layer

- Open Geospatial Consortium Web Map Service - OGC WMS - used for creation image map
- Open Geospatial Consortium Styled Layer Description - OGC SLD - used for styling the map
- Open Geospatial Consortium Web Feature Service - OGC WFS - used for spatial data delivery
- Open Geospatial Consortium Web Processing Service - OGC WPS - used to deliver PDF with map image, and embedded GML

More information about each standard can be found on Wiki pages in short and readable way or full documentation can be found on web pages of respective standardization body.

Using OGC standards enables DigMap to operate with any kind of spatial data, either vendor specific or open format, as long as data are published trough WMS and WFS services. GeoServer has a huge list of data storage connectors used to manipulate various data source.

3.1.3 DigMap prerequisites

Beneficiary institution or enterprise who would like to use DigMap solution should meet basic requirements:

1. Data are available and published over OGC services
2. Digital signature is legally valid in country of beneficiary institution/enterprise
3. There are clear specification regarding data billing rules
4. There are clear specifications regarding third's party payment gateway

3.1.4 DigMap tools and technologies

This section gives overview of basic tools and technologies used for DigMap development. Demo tutorial is available online https://digmap.wordpress.com, showing how to used numbered tools and technologies.

- Programming languages
  - Server side programming
    - Java
  - Client side programming
    - Html
    - Javascript
- Tools
  - IDE (integrated development environment)
    - Eclipse
  - Report tool
    - iReport
- Technology
  - Operating system
    - Linux/Windos
  - Application server
    - Tomcat
  - Map server
    - GeoTools
    - Geoserver
      - OGC
        - SLD
        - WMS
        - WFS
  - Reporting framework
    - JasperReport or Spago BI
  - Digital signature library

- iText
- Client GUI
  - OpenLayers
  - GeoExt
  - ExtJs
  -

3.1.5 DigMap configuration

- DigMap configuration parameters define DigMap default behavior. Configuration panel should at least offer basic configuration options like report template definition, digital signature key management, embedded data output format, excerpt cost, etc.
- GeoServer uses a web application framework known as Wicket for its user interface. DigMap configuration could be implemented as additional GeoServer Wicket. Apache Wicket, commonly referred to as Wicket, is a lightweight component-based web application framework for the Java programming language

3.1.6 DigMap processing

Basic steps for DigMap creation can be divided into several steps primary getting data, processing data and data delivery. Each primary step can be divided into two or more sub steps.

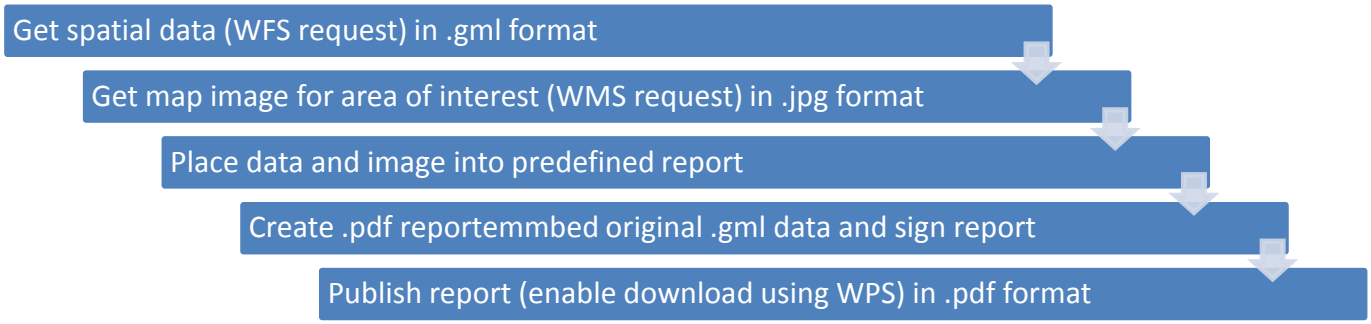

Figure 12 Steps for DigMap creation

3.1.7 DigMap composition algorithm

Simple DigMap composition algorithm can be expressed as follows:

1. Select map features/layers of interest
2. Select area of interest or select map object of interest
3. Calculate area/object bbox
4. Request area image over OGC WMS services
5. Request data in appropriate vector format (preferably GML) over OGC WFS service using appropriate CQL filter
6. Request data in appropriate raster format (preferably GeoTiff) over OGC WCS service
7. Populate report template fields
   a. Logo
   b. Header
   c. Scale
   d. Feature description
   e. Etc.
8. Insert selected area picture
9. Embed vector data format file
10. Embed raster data format file
11. Digitally sign document
12. Calculate resource price
13. Charge user account for calculated price

There are more advanced options that could include different steps like charge approval, or redirection to payment gateway in case of prepaid charge model or in case user account don't have enough credits for acquisition of selected resources. Such advanced scenarios also depend upon beneficiary environment.

3.1.8 DigMap billing rules

Data billing is important DigMap feature. It is used either to charge for data or for processing fee ie. value added service. Billing is made on selected features according to given cost of data.

Digital map excerpt cost = cost/excerpt +
cost/point * number of points
cost/line * number of lines
cost/polygon * number of polygons
cost/m^2 * area (in m^2)
cost/byte * size (in byte)

To be able to run billing rules each feature should have additional attribute with cost value. Cost value should be expressed as a decimal number. Cost value equal can be equal zero and eliminate data cost. Cost per excerpt is given in a DigMap configuration.

Table 2 Feature attributes used for billing

Attribute name	Description
cppoint	cost per point
cpline	cost/line * number of lines
cppoly	cost/polygon * number of polygons
cpsqm	cost/m^2 * area (in m^2)
cpbyte	cost/byte * size (in byte)

3.2 Functional description

The overall aim of the proposed project is to provide easy to use interoperable software for creation of digital map excerpt, digitally signed based on free and open source software.

DigMap will provide functionality for "printing" maps in portrait or landscape on the format up to A3. DigMap is not a real print out but a PDF file generated on server side and downloaded over HyperText Transfer Protocol on client computer's.

This project is co-funded by the European Union

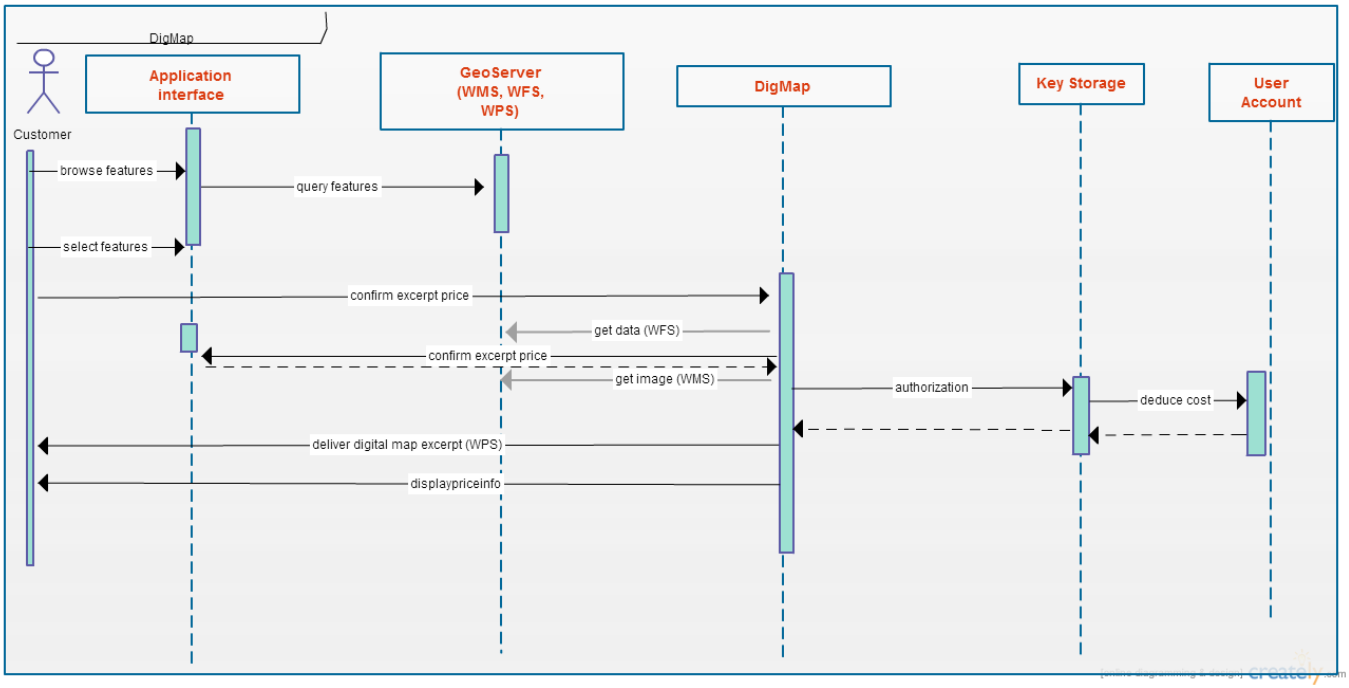

Figure 13 DigMap sequence diagram

3.2.1 User interface

Either desktop or web user interface can be used to interact with DigMap service. As recommended web user interface should be used to send DigMap request. Web user interface is build on highly interactive web GIS UI frameworks including GeoExt, Ext JS and OpenLayers utilizing JavaScript for high UI responsiveness and AJAX concept for user interaction with server backend to provide real-time control in a separate program, eliminating the need to refresh a traditional HTML based web browser.

3.2.2 Printing options

The printing shall utilize the resolution of the print unit not restricted by the resolution of the screen image. Print scale can be limited to the same scale as the one set on the screen zoom or by best fit zoom for particular map object. When activating the DigMap print button a print menu will appear with printing preferences as:

- Title: Option to write a title/header for the map
- Initials: Option to sign map by initials and name
- Text: A text field for optional text.
- Check boxes for:
    - Legend (shall legend be printed or not)
    - Map scale (shall Map Scale be printed on the map or not)
    - Date (shall current date be printed on the map or not)
- Format/orientation: A drop menu where the users can select between:
    - A4 portrait
    - A4 landscape
    - A3 portrait
    - A3 landscape
- Embedded data format:
    - GML
    - KML

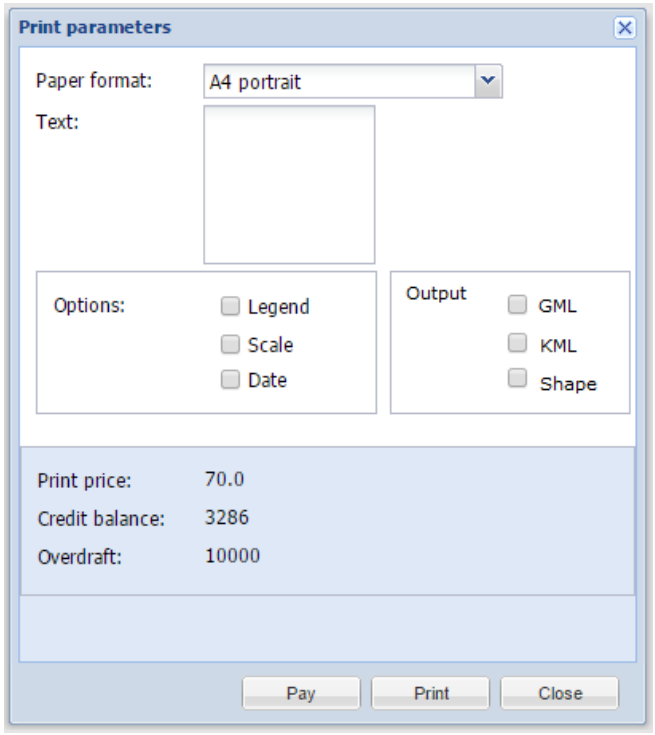

Figure 14 DigMap print out dialog mock-up

3.2.3 DigMap web application sample

Sample web application is available at: http://digmap-lab.yottabyte.hr/ . At the moment demo application doesn't support digital signature or embedding data into PDF file. It's primary purpose is to show possible look and feel and basic functionality covering the most straightforward use case scenario – report about particular Country shown on the map.

3.2.4 Digital signature sample

A digital signature confirms authenticity of a digital document. A valid digital signature gives a recipient reason to believe that the message was created by a known sender, such that the sender cannot deny having sent the message (authentication and non-repudiation) and that the message was not altered in transit (integrity). One can examine sample document available at http://digmap.yottabyte.hr/e_domovnica-Hrnjak.pdf This document contains Certificate of Citizenship issued by Croatian Ministry of Administration, using e-Citizens web portal. Document is digitally signed.

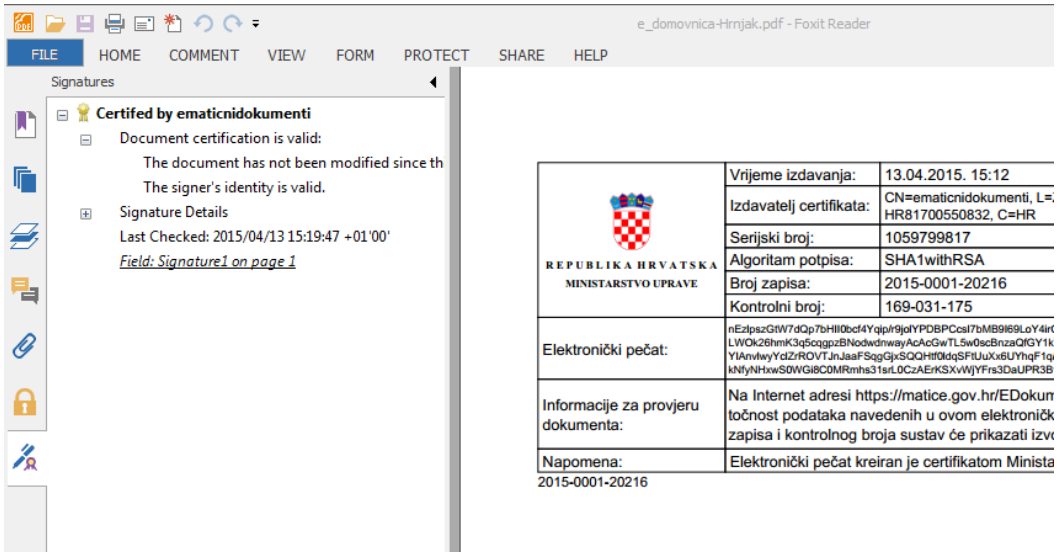

Figure 15 Certificate of Citizenship open in Foxit Reader showing document signature

3.2.5 Embedded xml sample

Europass CV (https://europass.cedefop.europa.eu) is well known application for creating standardized CV online.

One can examine sample document available at http://digmap.yottabyte.hr/Europass-CV-20130117-Hrnjak-EN.pdf . Created PDF file contains embedded XML file with data. In similar manner DigMap will produce PDF that each user can easily open and see map with attribute data in form of excerpt or report and have XML file with GML grammar containing spatial data.

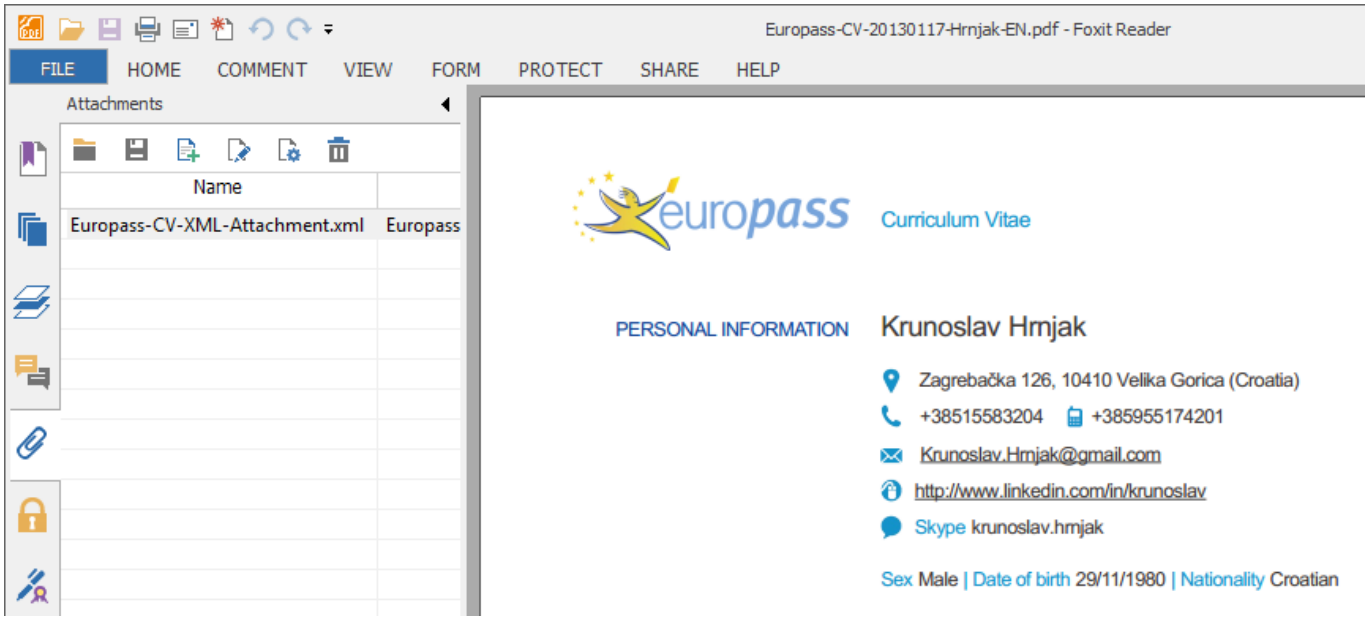

Figure 16 Europass CV open in Foxit Reader showing document attachments

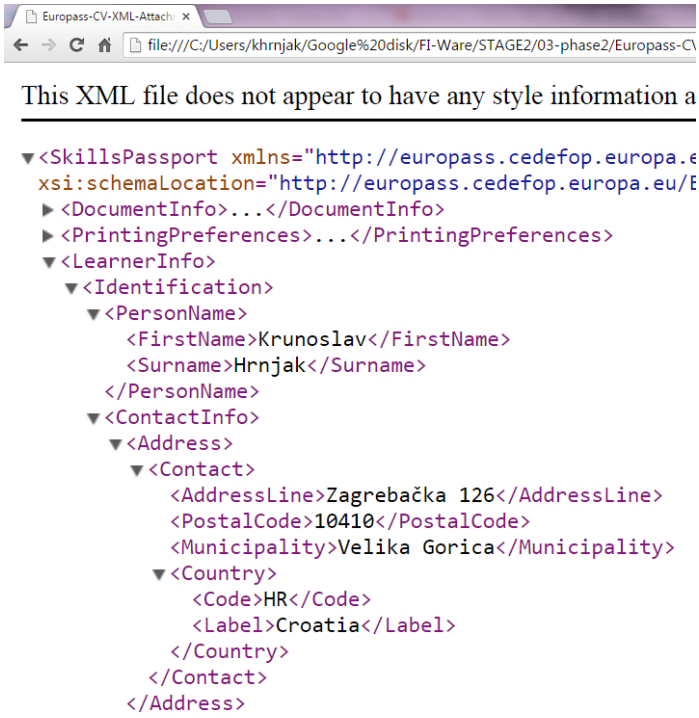

Figure 17 Europass CV XML file presentation

3.2.6 Basic use cases

Several possible basic use cases scenarios are described in next few scenarios. Scenarios are described primary through user experience by explaining necessary input done using web based GUI. Result of given request is served over WPS delivering digital map excerpt build on predefined PDF layout embedding GML data and digital signature.

Map selection sample is available online at OpenLayers example page:

http://openlayers.org/en/v3.2.1/examples/

- http://openlayers.org/en/v3.2.1/examples/select-features.html?q=select
- http://openlayers.org/en/v3.2.1/examples/box-selection.html?q=filter

Attribute selection sample is available online at GeoExt example page:

http://geoext.org/examples.html

- http://api.geoext.org/1.1/examples/search-form.html
- http://api.geoext.org/1.1/examples/feature-grid.html
- http://api.geoext.org/1.1/examples/attribute-form.html

DigMap sample application is available at:

http://digmap-lab.yottabyte.hr

Please visit link and try out.

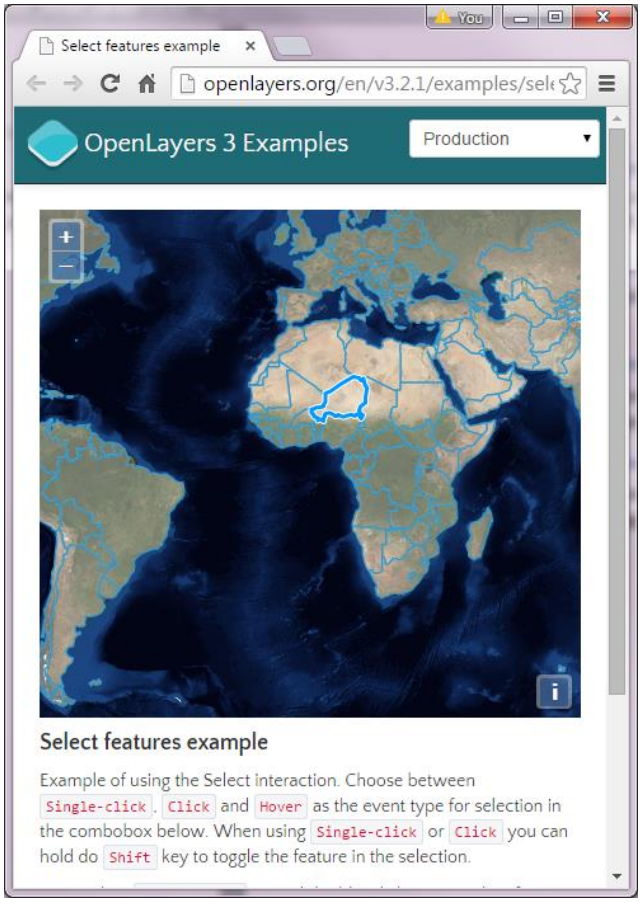

Figure 18 Feature selection examples

3.2.6.1 Generate DigMap by selecting feature(s) on map

Map is shoving layer with features of interest. User can select one or more features using single click option, press DigMap button and produce a produce digital map excerpt.

3.2.6.2 Generate DigMap by bounding box on map

Map is shoving layer with features of interest. User can create arbitrary rectangular bounding box, press DigMap button and produce a map.

3.2.6.3 Generate DigMap using point on map

Map is shoving layer with features of interest. User can select feature by click on point inside the feature, press DigMap button and produce report.

3.2.6.4 Generate DigMap by selecting feature(s) based on attribute

User can enter several attributes and conditions to filter features and press DigMap button to produce digital map excerpt.

3.2.6.5 Generate DigMap using map scale and central point

User can select predefined map scale and request DigMap be entering central point for map report. DigMap automatically calculate map coverage.

3.2.6.6 Generate DigMap using map scale and predefined bounding box

User can select predefined map scale and request DigMap be entering central point for map report. DigMap automatically calculates map coverage and produces produce digital map excerpt.

This project is co-funded by the European Union

3.2.6.7 Sample digital map excerpt document

AREC (Agency For Real Estate Cadastre of Republic of Macedonia) web GIS portal has feature to print out the excerpt in PDF format using the system for electronic payment. In similar manner, based on interoperable and standardized approach DigMap will enable users to take digital map excerpt.

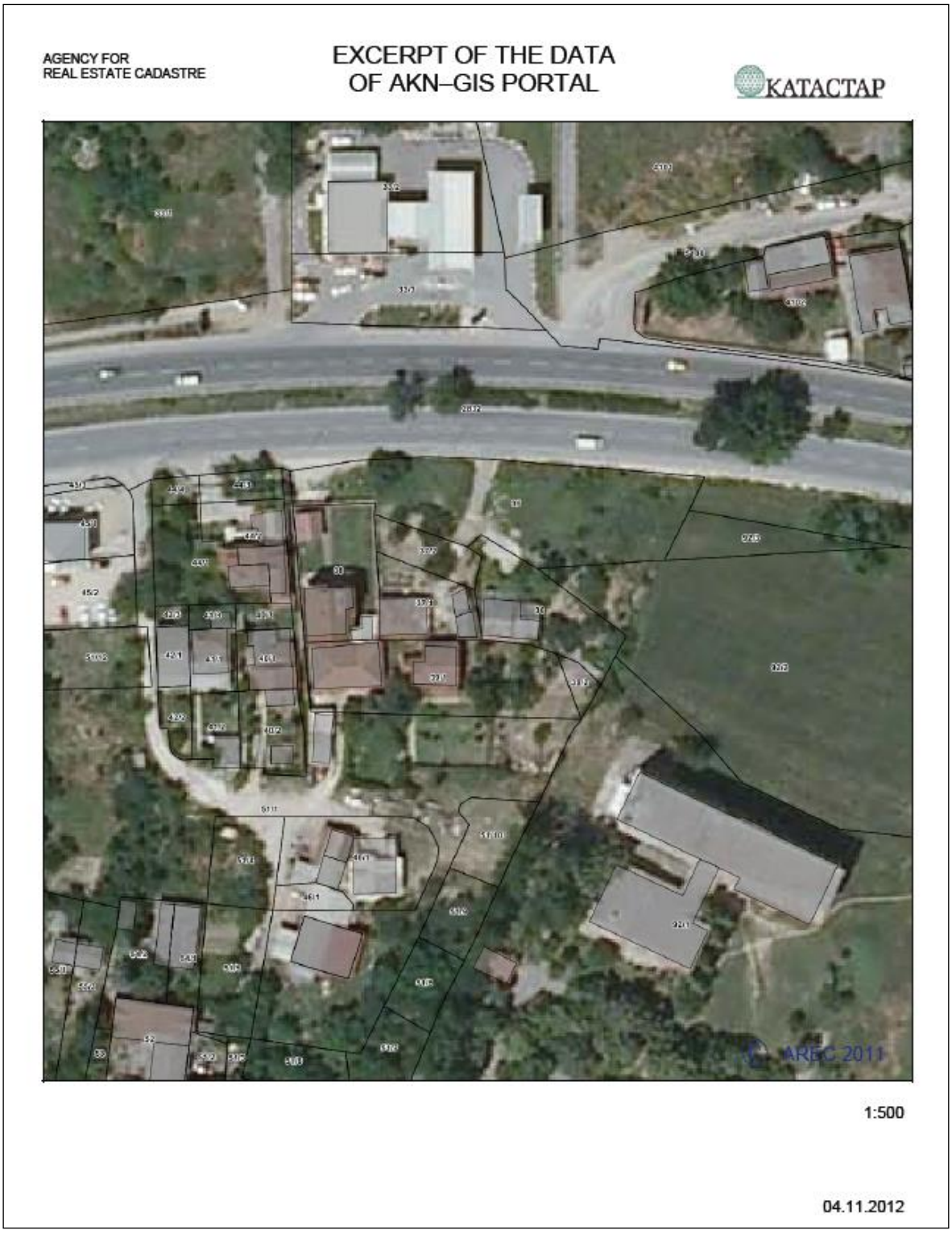

Figure 19 Digital cadastre excerpt taken from AREC Web GIS application

DigMap will offer wide range of predefined templates ready to use after setting basic configuration parameters (organization name, heading title, etc.) and more advanced custom design can also be easily done with iReport tool or other reporting tool.

3.3 FIWARE technology

DigMap can use any geo-data source trough OGC services. DigMap is focused on data dissemination, regardless of information model or data format. DigMap can reuse OGC services from third-party systems. DigMap can consume datasets provided by a third party (as Open Data or not) using third party data access drivers or generic access over OGC services. DigMap process and publishes only one part of original datasets. Access controls to these datasets are handled through OGC service setup. DigMap can reuse those services to provide new WPS service for digital map excerpt delivery. However there is FIWARE GEs - GIS Data Provider - Geoserver/3D that can be used for publishing OGC services, since DigMap can be deployed as Geoserver extension. In that case it is possible to modify existing FIWARE GE to provide additional functionality for data dissemination.

DigMap require additional component to represent GIS information through a Web 2D or 3D User Interface. GIS Data Provider - Geoserver/3D is just a perfect fit for that purpose. User can visualize whole GIS dataset and select area or object (feature) of interest using Geoserver/3D and request map excerpt for selected area/object by issuing WPS call to DigMap application/Geoserver extension.

DigMap itself represent part of GIS cloud infrastructure. DigMap is designed as interoperable application and can be build using different technologies (using GeoTools and Geoserver, or PyWPS or ZOO Project) and different programming languages (like Java or Pyton). In case of Java development it would require only Geoserver/3D GE, and additional GeosTools framework combined with reporting tool like JasperReport. It is planned to deploy DigMap on the FIWARE Lab Cloud in order to perform development and testing. DigMap itself can be used as additional FIWARE GE for spatial and non-spatial data dissemination.

Table 3 List of FIWARE GE for DigMap implementation

FIWARE Technology	Role of Enabler	Interaction with other GEs
Name of Enabler	What is its role in the project?	How is the interaction with other GEs?
GIS Data Provider - Geoserver/3D	Providing out of the box OGC services and UI	Using Data Visualization and Analysis service or library for PDF creation
Data Visualization and Analysis	Create digital map excerpt as PDF report	Providing PDF document to GIS Data Provider - Geoserver/3D
Revenue Settlement and Sharing System - RSS RI	Distributing the revenues originated by the usage of a DigMap service	Measure GE usage and perform billing
IaaS Resource Management	High efficient infrastructure management	Manage cloud environment

3.4 Architecture Diagram

DigMap is Cloud based service. It is necessary to utilize Generic Enablers that comprise the foundation for cloud hosting infrastructure and hosting management. Primary affected GE is GIS Data provider based on GeoServer. Initially JasperReport java reporting framework was used for experimenting, but also the FIWARE Data Visualization and Analysis GE (reference implementation: SpagoBI) can be used for this purpose by publishing signed PDF with embedded GIS dataset in form of image and GML data inside PDF file using SpagoBI capabilities combined with third party open source framework like iText for creating digital signature. DigMap require additional component to represent GIS information through a Web 2D or 3D User Interface. GIS Data Provider - Geoserver/3D is just a perfect fit for that purpose. User can visualize whole GIS dataset and select area or object (feature) of interest using Geoserver/3D and request map excerpt for selected area/object by issuing WPS call to DigMap application/Geoserver extension.

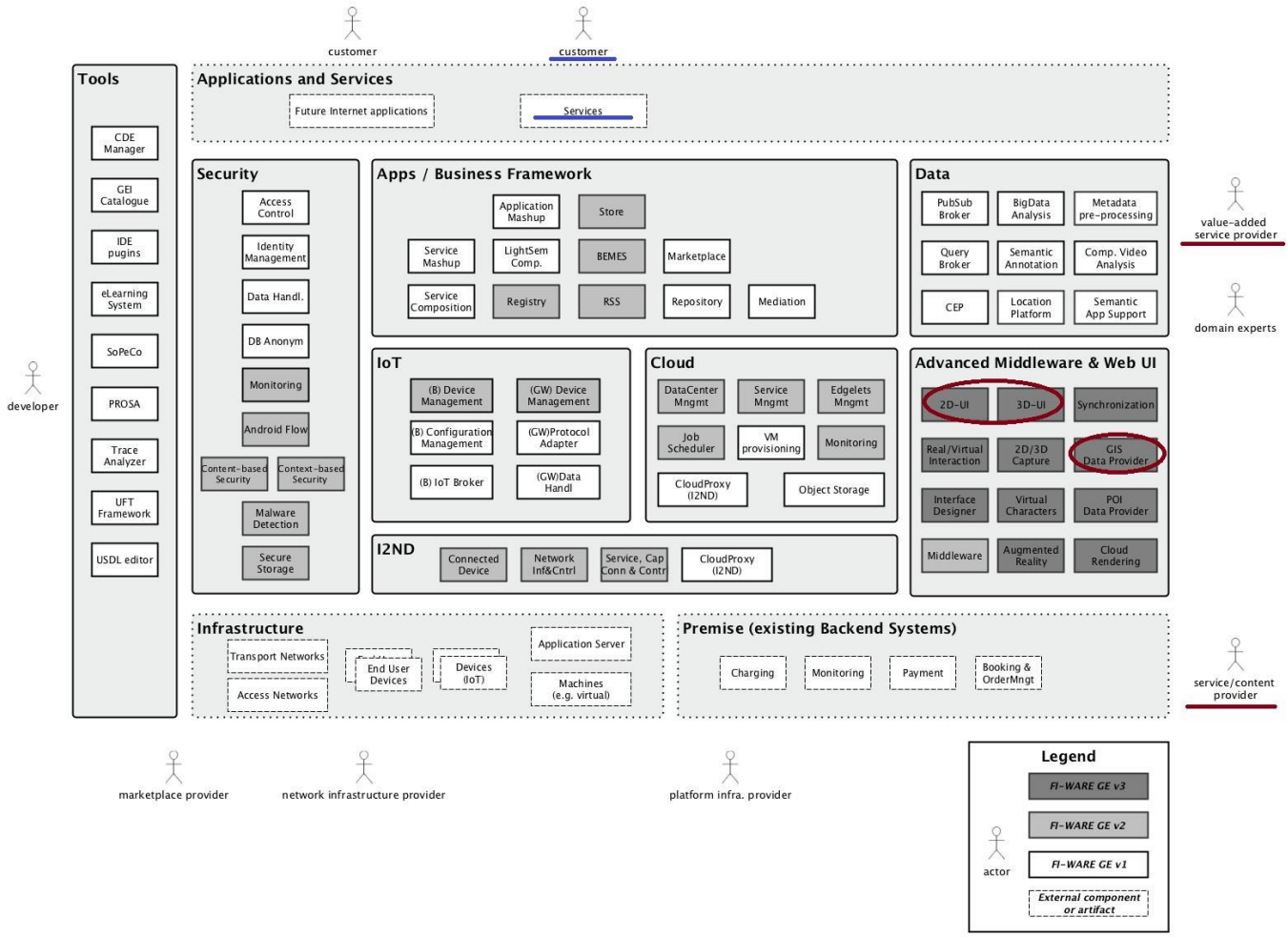

Figure 20 Affected FIWARE components

DigMap will use GIS Data Provider - Geoserver/3D general enabler as a mandatory component! Other named components may be used depending upon their suitability and ease of use. Primary affected FIWARE components are presented on FIWARE city map.

The fact is that the FIWARE Lab was mostly not working properly due to the fact that resources got exhausted. On 16th of April 2015 (four days before final proposal submit) FIWARE Lab recovery Task Force announcement was made about making FIWARE Lab stable. Due the short period for testing mentioned FIWARE GE was not tested but only analysed using available documentation. After testing all mentioned FIWARE GE final decision about usage of additional (since GIS Data Provider - Geoserver/3D is mandatory GE) will be done.

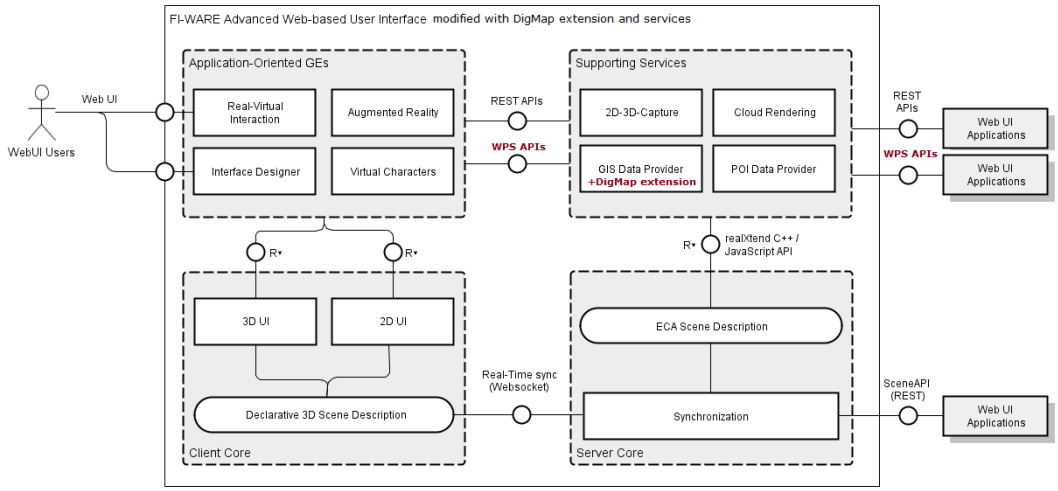

Figure 21 Additional WPS API and DigMap service provided by GIS Data Provider

3.5 Data usage

There are several interested customers from B2B and B2G segment for tuning & developing DigMap solution. So far, we have found strong interest for collaboration from Agency for environment protection (B2G), a Meteorology company Geo-Meteo (B2B) and several Real Estate Agencies (B2B) clients. They have also expressed willingness to help co-financing the initial development investment as a project partner.

There are several project partners interested in publishing data using digital map excerpt. In each case as base layer one could use following: satellite imagery, street map or topographic map. Depending on the customer layer of interest would be presented with data about whether forecast, real estate properties on sale or land cover.

Table 4 Data usage overview

Dataset name	Dataset origin	Dataset type	Usage
Transport data	Open Street Map https://www.openstreetmap.org	Public	Used as base layer for orientation.
Satellite imagery	Croatian State Geodetic Administration http://geoportal.dgu.hr/wms	Public	Used for base map layer showing terrain images.
Topographic map	Croatian State Geodetic Administration http://geoportal.dgu.hr/wms	Public	Used for base map layer showing topographic map.
Data on Meteorology	Open Meteo Forecast https://openmeteoforecast.org/	Public	Used to produce excerpt for weather forecast.
Data on Real Estates	Real Estate Agency -	Private	Used to show information about real estate on sale on the Adriatic coast.
Corine Land Cover	Agency for environment protection http://gis.azo.hr/gisapp/services/AZO_PublicData/Crne_Tocke/MapServer/WMSServer?	Public	Used to display black spots resulting from the long-term inappropriate management of industrial waste and hazardous to the environment and human health.

This project is co-funded by the European Union

4 Table of Figures

5 Abbreviations

API	Application Programming Interface
DigMap	Digital Map Excerpt
FOSS	free open source software
GE	Generic Enabler
GIS	Geographic Information System
GML	Geography Markup Language
GUI	Graphical user interface
ICT	Information and Communication Technology
IDE	Integrated Development Environment
INSPIRE	Infrastructure for Spatial Information in the European Community
KML	Keyhole Markup Language
OGC	Open Geospatial Consortium
PDF	Portable Document Format
SLD	Styled Layer Descriptor
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WPS	Web Processing Service