_____

CentropeMAP and CentropeSTATISTICS –
Interoperable Cross-Border Geodata Infrastructure
for the Centrope Region

Manfred Schrenk[1], Clemens Beyer[1]

[1]CEIT ALANOVA – Institue of Urbanism, Transport, Environment and Information Society
Am Concorde-Park 2/F, 2320 Schwechat, Austria
m.schrenk@ceit.at, c.beyer@ceit.at

Abstract. Centrope is the name of the cross-border region around the boundary quadrangle between the Czech Republic, Slovakia, Hungary and Austria. For a common development of this region, cross-border access to adjusted and standardized spatial data sets is essential. The aim of CentropeMAP is to provide an interface for geodata stored in four different countries. The project was initiated in the year 2003 introducing a base map of the region on behalf of the public planning association PGO, a co-operation of the three Austrian federal provinces Lower Austria, Burgenland and Vienna. In the beginning, data exchange took place only offline by distributing CD-ROMs among the project partners.

The CentropeMAP map server client went on air in the year 2005. Since this time the user receives maps showing data from servers all over the region together in the same view. Having established and permanently improved the online CentropeMAP portal since 2006, there will be very soon an important extension: CentropeSTATISTICS which will also include statistic data for the whole region. Again, datasets come from local authorities and are put together in the same table. These data can be queried, exported, aggregated, and even visualised via the CentropeMAP portal. This paper has a short look at the history of CentropeMAP, but mainly deals with the current status of the project and its future challenges.

In the first step (2008/2009) of CentropeSTATISTICS the tables and datasets are stored centrally at the CentropeMAP server. There is no problem of realising distributed data storage from the technical point of view, however, the administrative structures in the four countries are still too different from each other so that distributed data storage still remains a dream of the future.

Regular meetings (approximately twice a year) with representatives from the statistic offices of the regions and countries help to ensure that all efforts are put on a solid, official ground. In an upcoming phase of CentropeSTATISTICS also spatial planning experts will be invited to these workshops to help specify the data demand. A prototype version is already running, the first release available for the public is expected at the beginning of 2009.

The CentropeMAP project is hosted on a Linux operated server. Geodata on the server are stored either as shapefiles or in a PostgreSQL geodatabase with PostGIS extension. The map application is powered by two open source software pieces: UMN Mapserver and the Mapbender Client, a PHP and Javascript web browser interface.

The CentropeSTATISTICS extension is a PHP and Javascript application that interacts with Mapbender and is developed by CEIT Alanova. Thematic maps are created using Styled Layer Descriptor (SLD), an XML standard defined by the Open Geospatial Consortium (OGC) to define the appearance of map layers. The statistic data is linked with an XML generator which allows the user to create chloroplethic thematic maps on the fly.

Keywords: web map service, GIS, Centrope, cross-border, geodata, statistics

1   The Centrope Region

1.1   Origin of the Centrope Region

Centrope is a cross-border region which consists of the border regions between Austria, the Czech Republic, Slovakia, and Hungary. Its member regions are:

- Austria: federal provinces Burgenland, Lower Austria, and Vienna;
- Czech Republic: South Moravia (Jihomoravsky), South Bohemia (Jihocesky) regions;
- Slovakia: Bratislava (Bratislavsky) and Trnava (Trnavsky) regions;

_____

- Hungary: Györ-Moson-Sopron county.

The region was officially founded in 2003 by the treaty of Kittsee (Austria) within the framework of an Interreg-IIIA project. The enlargement of the EU in the year 2004 has created new chances for integration, collaboration and developing synergies in the border quadrangle between the four countries. The Central European Region is to be seen as a common space and place to live in. It is constantly growing together towards a representative, attractive and strong region in numerous fields as

- economy,
- labour market,
- science, research and development,
- cultural activities,
- politics and administration,
- regional development and transportation.

1.2   The Strategy of the Region

In St. Pölten (Austria) a memorandum was stated in April 2005 where the Centrope region partners agreed to provide mutual support, activate their local governments and the EU, and intensify cross-border co-operation. The next meeting took place 2006 in Vienna. There the vision "Centrope 2015" was presented to the public:

"The Vision CENTROPE 2015 highlights the development process achieved so far and shows where CENTROPE is currently at and what CENTROPE aims to attain in the future. It reflects the progress made over the past two years; at the same time, it provides a basis for discussion in order to deepen the joint efforts in coming years.
An image of tomorrow as a task for today
Looking ahead to 2015 permits us to engage in considerations that go beyond the requirements of day-to-day politics. At the same time, strategically speaking, 2015 does not seem all that far away – thus the visions formulated in this document in fact acquire a high degree of plausibility. […] The Vision CENTROPE 2015 is to function as a kind of snapshot to inform about findings and possible perspectives proposed so far; it wants to provide suggestions, trigger reflections, generate new impulses and offer a framework for the creative and productive evolution of CENTROPE, in keeping with the motto 'we grow together – together we grow'." [1]

1.3   Future Perspectives of Centrope

Since the foundation of Centrope many new contacts have been established, many projects have been started – each of them following the aim of creating a basis for sustainable co-operation. The region is already growing together, not only in terms of tourism and economic co-operation. Also people have started realising that living at the border is more and more becoming living across the border.

The 2007 meeting was held in Bratislava (Slovakia). Following the vision "Centrope 2015" there are works on a detailed business plan for the whole region. A memorandum called "Long-term and Professional Cooperation was stated where the partners agree to introduce a co-operation management ("basis co-operation") as well as numerous thematic projects ("alliance co-operation").

"CENTROPE 2008 plus" is a transnational EU programme *that "will open yet another phase of cooperation. On an equal footing all participating partners will take responsibility for the common endeavour by contributing personally, institutionally and financially. This will result in renewed dynamism and awareness for CENTROPE, and will crucially contribute to the implementation of the common projects."* [2]

2   The CentropeMAP Project

2.1   Goals of CentropeMAP

As a result of the increasing competition between European regions, providing a high-quality spatial data infrastructure and efficient tools for spatial analysis with new information and communication technologies have become fundamental to the support of political and economic decisions. For a

_____

common development of the Centrope region, harmonised cross-border geographic data sets are crucial.

Centrope MAP must be viewed as a long-term development process and not as a single project. It comprises:

- development and further extension of spatial and attribute data for the entire Centrope region;
- harmonisation of data formats and procedures for common data use;
- implementation of a basic online data catalogue;
- configuration of an internet map server for the visualisation of regional spatial data;
- networking and international communication with stakeholders from all parts of the Centrope region.

In a long-term development, the initiative aspires to achieve a distributed spatial data management with full interoperability of systems and formats, based on international standards and considering all regional stakeholders. The data catalogue also has to include a consistent metadata documentation as well as general agreements on data provision and use, regarding both spatial and statistical data.

2.2   History and Background of CentropeMAP

The project was initialized in the year 2003 introducing a base map of the region on behalf of the public planning association PGO, a co-operation of the three Austrian federal provinces Lower Austria, Burgenland and Vienna. In the beginning, data exchange took place only offline by distributing CD-ROMs among the project partners to guarantee that the same datasets are used within the whole region. All datasets had to be collected centrally in order to produce up-to-date versions of the CD-ROM. This approach had two significant disadvantages:

- The process of data collection was very slow and the whole CD-ROM was permanently dependent on the weakest link.
- It could not be guaranteed that all local authorities use the current datasets because it was impossible to force people to delete all the old datasets when receiving an updated version.

At this time, for people without having experience in geodata processing, print-ready maps were generated and made available for download from the CentropeMAP website which was also launched in the year 2003. Furthermore, some basic statistic datasets were put together in a download area on http://www.centropemap.org.

Table 1. Projection parameters of the Austrian *Lambert Conformal Conic* projection.[3]

```
Projection LAMBERT
Units      METERS
Spheroid   BESSEL
Parameters
46 00 00  /* 1st standard parallel
49 00 00  /* 2nd standard parallel
13 20 00  /* central meridian
47 30 00  /* latitude of projection's origin
0         /* false easting (meters)
0         /* false northing (meters)
```

However, it soon turned out that direct online access to different servers is becoming more and more important dealing with cross-border data exchange, providing geodata as web map services and statistical data via online databases. Therefore, PGO and the then project partner multimediaPLAN.at set up the CentropeMAP web map server to give access to the current project data store by web map services which are hosted by the local authorities of the provinces and regions. Some datasets were purchased for the CentropeMAP project. As the datasets cover the whole region and were financed through CentropeMAP, they are hosted directly on the CentropeMAP web server.

The local authorities either configured separate web map services especially for use within the CentropeMAP project or gave access to already existing services. A great advantage of internet map servers is the automatic conversion of the data projection. Austria, Czech Republic, Slovakia, and Hungary use different cartographic projection systems. Working in a standard desktop GIS environment, one would have to convert the different geodatasets manually to join data from more than one country. The web map server does this conversion automatically, and even on the fly. As you have to agree on one common projection system, CentropeMAP has been set up to run in the Austrian Lambert projection system (see table 1).

_____

2.3   Current Project Status

The CentropeMAP web mapping application (see fig. 1) features about 600 different map layers from all parts of the Centrope region. Many fields of interest for spatial planning experts are covered: biota, boundaries, economy, earth cover, elevation, environment, farming, geoscientific information, imagery and base maps, inland waters, planning and cadastre, society, structure, transportation, utilities and communication.

All layers can be turned on and off separately. Most of the layers have legend items included; some remotely hosted web map services, however, do not support legend generation. Besides there is a printing function where PDF documents can easily be created. Two so-called gazetteers help the user when searching for points of interest or municipalities. This is a keyword search which is joined to the geodatabase so that the search results are highlighted in the map when placing the mouse pointer over a search result.
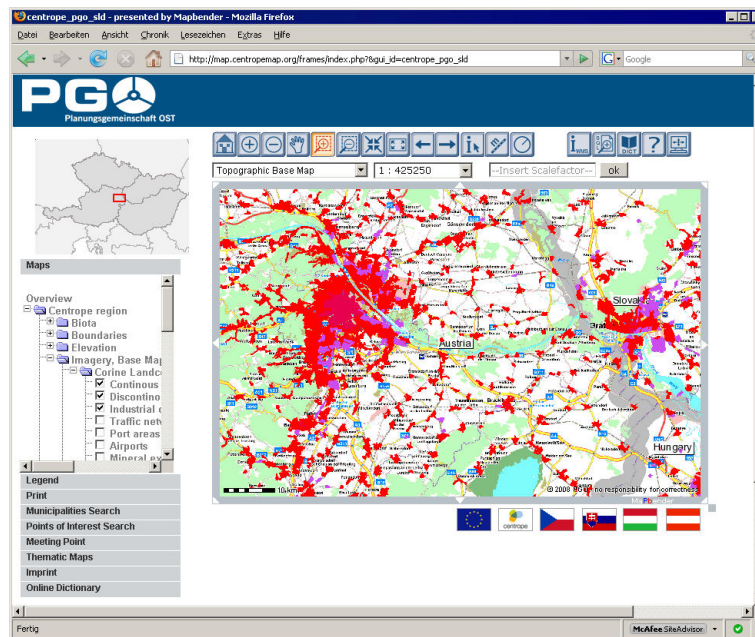

Fig. 1. The CentropeMAP web map service client.

There is also the possibility to draw a meeting point into the map and send this position to a friend by e-mail. An online dictionary allows the user to add translations of single expressions into one or more of the five languages English, German, Czech, Slovak, and Hungarian.

The CentropeMAP website was relaunched 2007 and is now fully available in all five languages mentioned above (see Fig. 2). It features not only information about the region and the project, but also a lot of downloadable material (maps, tables, workshop protocols, power point shows and much more). CentropeMAP also offers a substantial help page (of course in five languages).

The upgrade of CentropeMAP including CentropeSTATISTICS is going on air in the beginning of the year 2009 (see chapter 5). The new version of the MAP portal now also includes the possibility to save the current map view (zoom level, coordinates, selected layers).

_____

Fig. 2. The CentropeMAP website: http://www.centropemap.org/.

3   CentropeSTATISTICS

3.1   The Main Idea of CentropeSTATISTICS

After having established CentropeMAP, the thought came up to integrate statistical data into this web portal. As a first step, there were only some tables available for download so that the data could be used in one's own desktop GIS. However, this solution did not prove user-friendly. People should have the possibility to see the statistical data directly as a map layer offering the same amount of functionality as every other layer of CentropeMAP. So the goal of CentropeSTATISTICS is to join statistical datasets with the web map portal in a way that the datasets are easy to administrate and the user has access to maps which are not only easy to create but also easy to change.

3.2   Workflow and Current Status

In 2007, the first few thematic maps were embedded into CentropeMAP. It was only a trial how the combination of the software used and SLD technology (see chapter 4.4 also) would work together. Only a few adjustments had to be made to the Mapbender software to bring SLD layers to life, but in this release it was very hard to apply changes to the statistical data from the back-end side. So this method could not be pursued further. It is still available for the public until the new version is published but no longer kept up to date.

The new SLD integration is an own software package developed by CEIT Alanova. It is based upon PHP/SQL/Javascript real-time interaction (see chapter 4 for details). In the final version there will be a choice between a basic (simple) mode and an advanced (expert) mode. Whereas the advanced mode offers full funcionality, the simple mode is for users who do not have much experience in creating maps and using GIS. The basic mode consists of two steps only – (1) selecting a topic and (2) creating the map. The theme table is not shown at all, the basic user who is only interested in easy map creation gets their map comfortably and fast.

4   Technical Implementation

4.1   Hardware and Operating System

The CentropeMAP project is hosted on a Linux operated server equipped with an uninterruptible power supply; a streamer device and an external harddisk are connected for regular back-ups to avoid data loss. Geodata on the server are stored either as shapefiles or in a PostgreSQL geodatabase with PostGIS extension. The map application is powered by two open source software pieces: UMN Mapserver and the Mapbender Client, a PHP and Javascript web browser interface (see next chapter).

4.2   Software used in CentropeMAP

"MapServer is an Open Source development environment for building spatially-enabled internet applications. MapServer is not a full-featured GIS system, nor does it aspire to be. Instead, MapServer excels at rendering spatial data (maps, images, and vector data) for the web." [4]
Mapbender software "provides web technology for managing spatial data services implemented in PHP, JavaScript and XML and licensed under the GNU GPL. It provides a data model and interfaces for displaying, navigating and querying OGC (Open Geospatial Consortium) compliant map services. The Mapbender framework also provides authentication and authorization services, OWS proxy functionality, management interfaces for user, group and service administration in WebGIS projects." [5]
The CentropeMAP Online Dictionary is a simple PHP/MySQL application which allows anyone to modify or add translations or to evaluate a translation whether it is right or wrong.
The CentropeMAP website has been made with Typo3, a content management system capable of hosting multi-language websites. The PHP scripts for the download area were written by CEIT Alanova as none of the existing Typo3 add-ons could fit the needs of the CentropeMAP download area.

4.3   Software additionally used in CentropeSTATISTICS

The CentropeSTATISTICS extension is a PHP, SQL and Javascript application that interacts with Mapbender and is developed by CEIT Alanova. Thematic maps are created using Styled Layer Descriptor (SLD), an XML standard defined by the OGC to define the appearance of map layers. The statistic data is linked with an XML generator which allows the user to create chloroplethic thematic maps on the fly (see chapter 4.4).

4.4   Using SLD (Styled Layer Descriptor) with Web Map Services

SLD is an XML-structured data format that describes the appearance of layers in a web map service. The SLD structure has been developed by the Open Geospatial Consortium and can therefore be applied with every OGC-compatible map server (if SLD interpretation is supported by the map server software). If a map layer has a default style (which, using UMN, can be defined in the map file), this style can be overruled by attaching a SLD document to this layer. In the GetMap request, the SLD code can either be directly added to the URL of the request, which may cause problems due to the length of the SLD code, or it can be saved in a separate file of which the URL is referred to in the GetMap request.
Having SLD support, one can become independent from the map server settings that may be stored on a remote server where one does not have access to. The layer and the SLD document may of course be provided on different servers so that, e. g., one can use a remote map layer with their own colours, outlines, and class definitions. It is therefore a great advantage of SLD to customize layers of web map services without influencing the way other users see this layer.
However, within the CentropeMAP project only a few map servers accept GetMap requests containing SLD information. If all servers of the CentropeMAP project partners interpreted SLD documents, there would not be any problems matching the styles of layers from different servers which contain the same information.If this can be changed, the cross-border geodata integration in CentropeMAP will make a big step forward.
SLD is also a very helpful tool for CentropeSTATISTICS: The user-defined maps are created through SLD only. The layer containing the geodata for the statistical map is set to a transparent style by

_____

default so that it cannot be seen without creating a thematic map. As the user creates their own map layer from statistic data, the user's selections are converted into a SLD file which is stored temporarily on the CentropeMAP server. The map view is updated then, containing the SLD URL as part of the GetMap request of the statistics layer. Because Mapbender only reloads a map image when the request has changed, the current timestamp is also added to the GetMap request of the statistics layer. This causes the request to be different from before so that the layer is also reloaded when changes within the same SLD document happen, e. g. when the user changes the number of classes or the colour ramp of the statistic indicator. The map server skips the time parameter within the request as it is not requested by the map server, and therefore not recognized.

5   Prospects of CentropeMAP and CentropeSTATISTICS

The CentropeMAP portal is running fine and is updated regularly. If SLD support is realised within the responsibility area of the project partners, cross-border datasets stored on different servers can be shown using the same layout without requiring its own web map service to be set up for the CentropeMAP project. The goal is to use web map services which are already online for multiple other purposes so that there is no additional effort necessary to feed CentropeMAP with geodata. The layer styles can then be adapted using SLD.
Regular meetings (approximately twice a year) with representatives from the statistic offices of the regions and countries help to ensure that all efforts are put on a solid, official ground. In an upcoming phase of CentropeSTATISTICS also spatial planning experts will be invited to these workshops to help specify the data demand. A prototype version is already running, the first release available for the public is expected at the beginning of 2009.
A powerful plan for the future could be to emphasize interactivity. There is the possibility to let the user draw directly into the map. This user-generated content can then be stored in the CentropeMAP geodatabase. Of course, if one thinks about extending the users' rights, user management becomes more important than before. If the digitizing tool is open to everyone, everyone will have the possibility to change or delete content generated by others, and the doors will be widely open for spam content. Therefore, it must be made sure by user management that only selected users are granted full rights.

Reference

1. Centrope.info. http://centrope.info/baernew/stories/3098.
2. Centrope.info. http://centrope.info/baernew/topics/Project_Conferences.
3. MapRef. http://www.mapref.org/, and own representation.
4. Welcome to MapServer – UMN MapServer. http://mapserver.gis.umn.edu/.
5. Main Page – MapbenderWiki. http://www.mapbender.org/Main_Page.