Joint Use of Geographic Information – Cadastral Data, General and Topographic Map Data

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Key words: software interface, cadastral data, topographic map data, Web Map Service (WMS), Web Services

SUMMARY

This paper presents software interfaces offered by the National Land Survey of Finland (NLS). Based on international standards, these services make data for customers' applications accessible online.

All general and topographic raster maps produced by the NLS at scales between 1:8,000,000 and 1:20,000 are available through the software interface used for delivering raster map data. Cadastral data from the Land Information System (LIS), which provides national coverage, is delivered through the cadastral software interface. These software interface services for customers were launched in 2005 and 2006. Use of the services requires a licence, and a charge is made for supplying the data.

The software interfaces makes it possible for customers to design applications which use data from multiple resources. The number of applications of this type, however, is still quite small.

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1. INTRODUCTION

The Finnish National Council for Geographic Information has prepared a National Geographic Information Strategy for 2005 – 2010. This includes outlines for developing Finland's national spatial data infrastructure (NSDI).

One step in the implementation of the strategy states "*administrative organizations maintaining geographic datasets and associated services shall take measures to launch software interfaces compliant with the recommendations"*. Datasets consisting of basic geographic information (including general topographic data and cadastral data) should be among the first to be made available.

As part of its efforts to implement the strategy, the National Land Survey of Finland (NLS) developed two software interfaces for the joint use of geographic information.

2. SOFTWARE INTERFACE STRUCTURE

The term 'software interface' describes a technical mechanism which is both a protective shield for stored data and a service which handles the transfer of data through the shield between the stored databases and each customer's application.

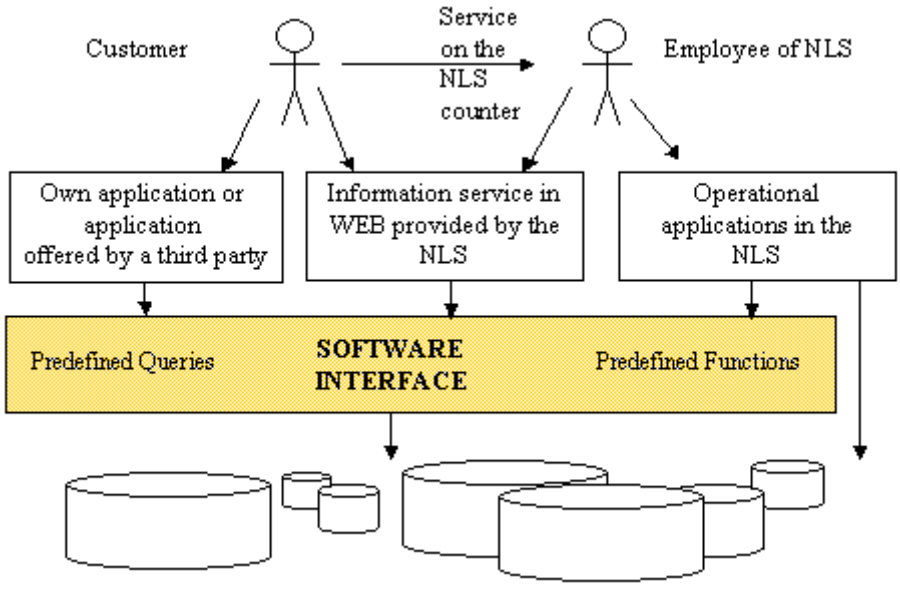

Figure 1. Example of operations carried out in connection with the software interface

The software interface incorporates predefined functions and predefined queries, both of which can be visualized as channels through which a customer's application can communicate with the data storage functions. This architecture allows the database administrator to alter the structure used for recording data without requiring that any changes be made to activities in customers' applications. (See Figure 1.)

3. SOFTWARE INTERFACE FOR GENERAL AND TOPOGRAPHIC MAP DATA

3.1 Data

Data on Finland's topography and the country's built environment is stored in the NLS topographic database. This is the most-accurate source of information about Finland's topography.

All general and topographic raster datasets are based on the topographic database. They are produced by use of partly-automated processes, generalization and other data resources.

General and topographic raster maps are stored as iTIFF files in the commercial raster map engine application.

3.2 Products

The software interface for raster maps makes a variety of map data covering the whole country available online:

- General map data at scales of 1:8,000,000, 1:4,000,000, 1:2,000,000, 1:1,000,000, 1:500,000, 1:250,000 and 1:100,000
- Topographic map data at scales of 1:50,000 and 1:20,000

Maps are available in both PNG and JPEG formats, and the maximum size of a single map query is 1024 x 1024 pixels.

3.3 Service Process

The software interface service which delivers data generated by the raster map engine to customers' applications is based on the WMS (*Web Map Service*) standard. WMS is a standard issued by OGC (the *Open Geospatial Consortium*).

WMS provides a standard method for requesting map images over an HTTP (*Hyper Text Transfer Protocol)* connection. Since the WMS standard does not include recommendations for authentication, NLS utilizes the basic HTTP authentication method. Connections are secured using the SSL (*Secure Socket Layer*) protocol.

In a typical case, a customer's application sends an information request (GetCapabilities) to the software interface service and receives an answer detailing information about the service

and available data. The customer's application then sends a search request (GetMap) specifying a parameter such as location and the map image is transmitted. (See Figure 2.)

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https://…?REQUEST=GetMap&VERSION=1.1.1&FORMAT=image/png&BGCOLOR=0xffffff&LA
YERS=k_rk1_100&STYLES=normal&WIDTH=500&HEIGHT=180&SRS=EPSG:2392&BBOX=252830
0,6838900,2529300,6839260
```

Figure 2. Example GetMap query and result of the query

The latest service and data descriptions are available at: http://xml.nls.fi/

3.4 Pricing

Use of the software interface requires a licence issued by NLS. Once approved, each applicant is provided with a username and password.

Pricing is based on the number of pixels searched. If the end user intends to store the data, the unit price is significantly higher. Invoicing is carried out once or twice each year according to the number of searches registered in the log files. Licences also define the maximum number of searches per invoicing period to guarantee that the service is not overloaded. Testing of the service is free of charge.

The prices charged for map information are set by NLS.

3.5 Cases

3.5.1 Internet service for birdwatchers

The association for birdwatchers (BirdLife Finland) has published an open service (http://www.tiira.fi/), which is used to collect, modify, archive and publish bird observations made in Finland. This service uses the NLS software interface to obtain the required background maps.

Birdwatchers can store bird observations in a database by using the map to indicate the location of each observation. They can also search for observations already made and display them on a map. (See Figure 3.)

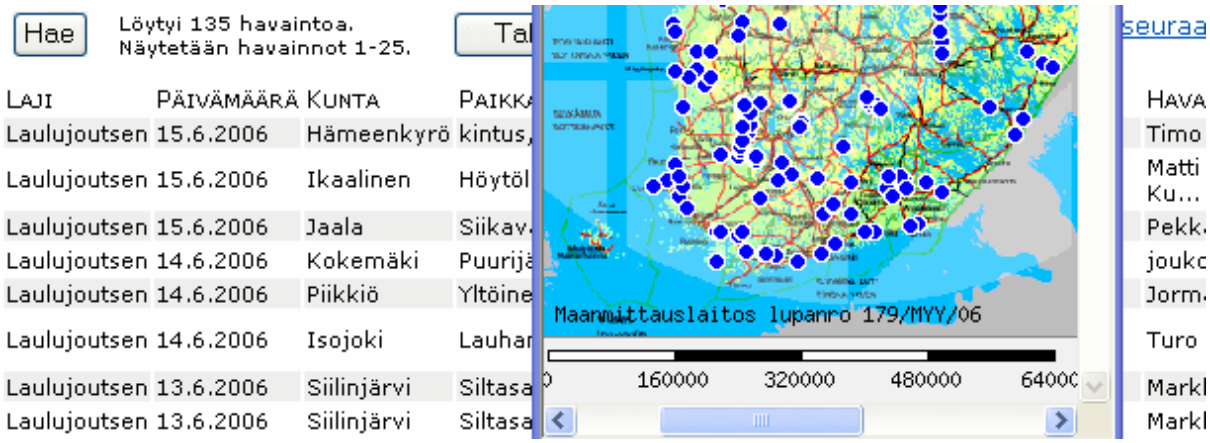

Figure 3. Swan observations during a week on June 2006

3.5.2 Service for locating hunting dogs

Ultrapoint is a company (http://www.ultrapoint.fi/) specializing in products based on high-frequency radio technology and system solutions for wireless data communications. One of these products is software for a mobile phone and a dog collar fitted with a GPS/GSM-based tracking device which together enable a hunter to track the movements of his dog. The software uses the NLS software interface to download background maps to the mobile phone either before each hunting expedition or as required. The location of the dog is displayed on the map (See Figure 4.)

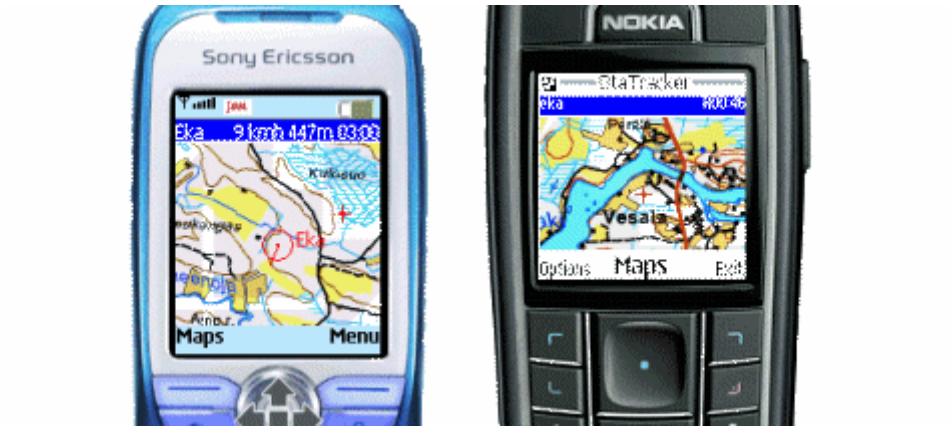

Figure 4. Two different mobile phones using service for locating hunting dogs

4. SOFTWARE INTERFACE FOR CADASTRAL DATA

4.1 Database

Finland's Land Information System contains data on both real estate and title to property. From a technical viewpoint, it consists of two separate registers: the cadastre and the land register. The cadastre is stored in a continuous database holding both attribute data and spatial data on all property located in Finland.

The cadastre contain not only basic data on each property unit, but also information on the constitution of each property, associated rights of way and other easements, shares in joint property units and other related decisions.

Spatial data is in vector format and the cadastre contains data on real estate, boundaries, boundary marks, easements and land-use plan coverage. From a legal viewpoint, the spatial data represents a digital cadastral index map.

The NLS and municipalities maintain the cadastre.

4.2 Products

Products offered by the NLS software interface for cadastral data include 'Basic content' or 'Complete content' concerning property. 'Basic content' can be requested by giving a position (point, line or area) or a property identifier. The reply consists of the core data concerning that property (for example its name, size and some other basic data).

'Complete content' can only be requested by using identifiers. The result of this type of query is all the essential spatial and attribute data concerning the property (spatial data includes boundaries and boundary marks, attribute data is information about associated rights of way and other easements, shares in joint property units and other related decisions).

Replies are in GML (*Geography Markup Language)* format. This structure allows the customer's application to generate data in the required form and with the desired content. GML is a standard published by OGC (the *Open Geospatial Consortium*) and ISO (the *International Organization for Standardization*). (See Figure 5.)

Figure 5. Example of the query result

4.3 Process

The software interface which offers data from the cadastral database to each customer's application is based on the W3C (*World Wide Web Consortium*) Web Services standard for data exchange between systems. This defines ways of constructing product packages consisting requests for database information and replies. Services (i.e. predefined functions) are detailed in WSDL (*Web Service Description Language*) documents. Predefined queries and replies are defined as XML schemas and are transmitted using the SOAP (*Simple Object Access Protocol*) protocol.

Authentication is carried out using the basic HTTP authentication specification. Connections are secured using the SSL protocol.

The most-recent service and data descriptions are available at: http://www.ktj.fi/ -> Kiinteistötietojärjestelmän esittely -> Sanomarajapintapalvelu.

4.4 Pricing

Use of the software interface requires a licence issued by NLS. Each user is provided with a username and password.

Data concerning all transactions are stored in an invoicing database and users are invoiced on a monthly basis. Prices for the 'Basic content ' product are per query and for the 'Complete

content' product they are per property. To ensure that the service is not overloaded, there are limits on the number of properties that can feature in each query.

The price of cadastral information is governed by law.

4.5 Cases

4.5.1 Internet service for data produced by companies and public authorities

Eportti ('electronic gateway') is an Internet service (http://www.eportti.fi/) for business users and authorities which offers a wide range of data and documents held on several public and business registers.

The *Eportti* service utilizes the software interface for cadastral data to produce property boundaries and boundary marks on map printouts, something which was not possible earlier. (See Figure 6.)

Figure 6. Real estate boundaries on a map printout

5. CONCLUSIONS

5.1 The current situation

Both software interfaces have been in trial use since 2004. The software interface used for delivering raster map data was officially launched in autumn 2005, the software interface for cadastral data was opened in spring 2006. NLS has granted seven licences for the use of raster map data in product applications and three licences for the use of cadastral data in this way. More than 30 agreements relating to trials involving both software interfaces have been made (these figures cover the period up to June 2006).

5.2 Benefits

The majority of user feedback has been positive.

Users have been pleased that there is no need to either store or update data. A licence to use the software interface guarantees them access to up-to-date data at all times. They have stated that the WMS connection in particular has been easy to construct and to use.

5.3 Problems

Implementation of authentication has in some cases caused problems. NLS has to identify users but the standards provide no recommendations for authentication. Commercial software that is compatible with WMS may require reprogramming to be able to support authentication.

The WMS standard provides an easy way of delivering raster map data, but the quality of the resulting raster maps may be poor. As the standard allows free scaling of the output in customer's application, pixels might not be resampled in an ideal manner. Coordinate transformation can also result in pixel resampling problems. Use of the WMS interface requires knowledge of geographical maps, but end-user applications are often constructed by people who are professionals in other fields than GIS. Supplying additional information concerning the software interface in addition to the actual standards is therefore very important.

5.4 The future

The scale of marketing activity by NLS in connection with the software interfaces has until now been modest. The positive feedback received means that marketing efforts will grow.

Data offered by NLS through the software interfaces will be more extensive in the future. The software interface for delivering raster map data will soon be expanded to include orthophotos. There is also demand for new kinds of cadastral data products.

Demand for products featuring topographical vector data is at very high levels. A thorough discussion of how to organize the distribution of such data is called for.

If the quantity of data provided via standard software interfaces increases, this will enable the true joint use of geographic data. This will create demand for new services, with a probable focus on the customisation of styles and data content.

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BIOGRAPHICAL NOTES

Teija Tarvainen is a Master of Science (Surveying). She is responsible for Internet Services in the Sales and Marketing Department of the National Land Survey of Finland and handles the marketing of services and the organisation of customer support and licenses. She has been involved in projects to develop Internet Services since 1996 (including the Citizen's and Professional's MapSite and software interfaces, among others).

Tarja Myllymäki is a Master of Science (Surveying). She has worked in the National Land Survey of Finland since 1988 on several development projects (land-consolidation systems, the JAKO cadastral system, the Real Estate Purchase Price registration system, the Land Information System). She has been the Finnish delegate to FIG Commission 3 since 1998.

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