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Title of Paper:

Increasing the Use of GIS in the Federal Government

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Abstract

This presentation will introduce a cooperative approach aimed at increasing the use of GIS in the federal government in Norway. The approach focuses on using ArcIMS and data sharing to better utilize the potential of GIS to resolve diverse management tasks. The cooperation uses the most up-to-date geographic data sources from national data producers as well as data from the local government. Access to geographic data is organized by the Norwegian spatial data infrastructure. This gives access to a large range of standardized data and services from both different management levels and different GIS software systems. Special attention is given to the implementation of Web Map Services (WMS).

Introduction

In Norway, access to geographic data and services is organised by the Norwegian spatial data infrastructure (NSDI). This infrastructure plays an important role in a formalised national program named "*Digital Norway*" which involves important users and/or producers of geographic information. "*Digital Norway*" is based upon a White paper initiated by the Norwegian Government and approved by the Parliament in June 2003. "*Digital Norway*" is coordinated by the Norwegian Mapping Authority and includes a cooperative approach for data collection, maintenance and distribution of digital geographic information, both at national, regional and local governmental levels and authorities. The main focus of the "*Digital Norway*" initiative is to achieve easier access to geospatial data, organise better products and services, and which in turn, will support increased efficiency and modernisation of the society. The concept of "*Digital Norway*" is in conjunction with the principles of the European "INSPIRE" initiative.

Use of national and international standards are of vital importance for the implementation of the Norwegian spatial data infrastructure and for achieving interoperability of data and services. The infrastructure is based on standards, technology and architecture that will lead towards distributed server GIS where updated data is accessed over the Internet directly from the data owners in the form of WMS (Web Map Service) and WFS (Web Feature Service). Interoperability of data and reusable components in the form of services is important. This leads to a realization of the high potential of using geographic information.

In Norway, standardisation for data collection and data distribution has evolved over a long period of time and since 1987 we use our national standard named "*SOSI*" - *a standardised format and description of digital geographic data*. This national standard is in the process of being translated into GML (Geographic Markup Language). In addition, the international standards and specifications that are used are developed by the ISO/TC 211 and OGC (Open Geospatial Consortium).

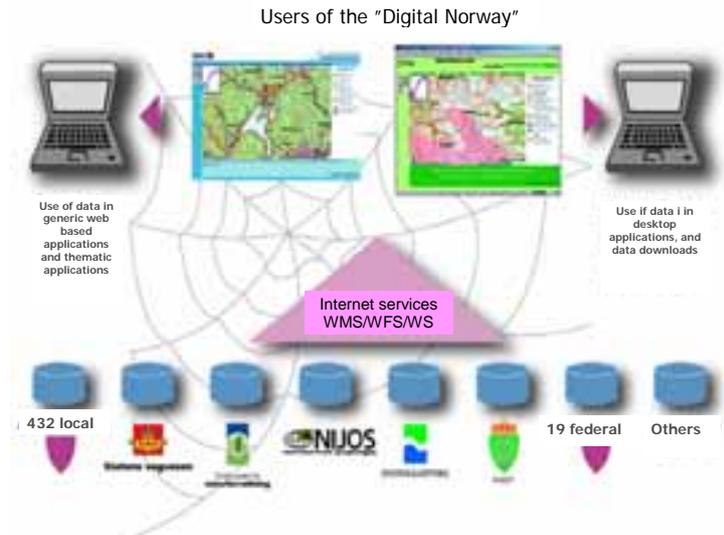


Figure 1: The concept of the "Digital Norway" that includes a cooperative approach for data collection, maintenance and distribution of digital geographic information, both at national, regional and local governmental levels and authorities. The infrastructure is based on standards, technology and architecture where updated data is accessed over the Internet directly from the data owners, and where interoperability of data and reusable components is important. Access is organised by the Portal – www.geoNorge.no (Statens kartverk, 2005)

WMS and WFS

Web Map Service (WMS) and Web Feature Service (WFS) are standardised services for geographical information that are dynamically accessible over the internet. The services can be used in web browsers without having to install software (thin clients) or in more powerful software with Internet access (thick clients). It is also possible to make use of several services of this kind simultaneously to cover complicated requirements. The services make it possible to combine seamlessly spatial information from different sources across platforms and between users and applications. (Geological Survey of Norway, 2004)

The WMS specification is composed of two parts, a server and a client. The server receives a request from the client. The response from the server to the client is a raster image or an XML document. The raster image is defined as a Map Layer. This is a graphic representation of the data (for example, in png or jpeg format), and not the actual data.. Clients request maps from a WMS instance in terms of named layers and provide parameters such as the size of the returned map as well as the spatial reference system to be used in drawing the map. (OGC, 2006)

The WMS allows a client to overlay map images for display served from multiple WMS on the Internet. In a similar fashion, the Web Feature Service (WFS) allows a client to retrieve and update geospatial data encoded in GML from multiple Web Feature Services. The GML Specification describes an encoding specification for geodata in XML (Extensible Markup Language) that enables the storage, transport, processing, and transformation of geographic information. (OGC, 2005)

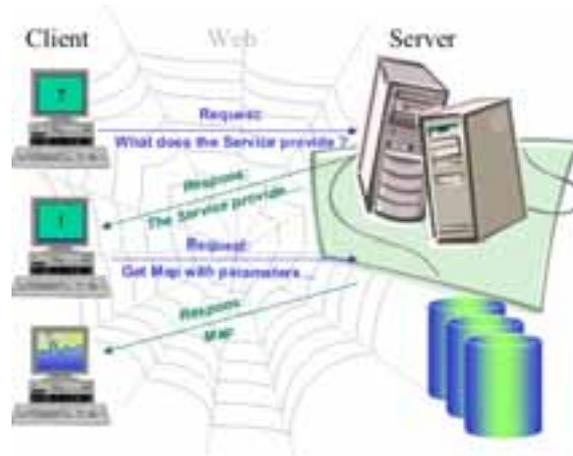


Figure 2: Client-server communication using WMS. The WMS specification defines three WMS operations: *GetCapabilities* returns service-level metadata, which is a description of the service's information content and acceptable request parameters; *GetMap* returns a map image whose geospatial and dimensional parameters are well-defined; *GetFeatureInfo* (optional) returns information about particular features shown on a map. (Geological Survey of Norway, 2004)

National Portal

A national portal (www.geoNorge.no) aiming at organising the access to data and services owned by national, regional and local data producers have been established as part of the Norwegian spatial data infrastructure. The portal is based on ArcIMS Portal toolkit and includes base maps, thematic information and property information. The prototype was launched in January 2004, and has since then been developed further to satisfy the needs. The success of the Portal and subsequently increased use of geographic information is totally dependent upon its content and reliability.

A critical aspect of the portal is metadata. Metadata makes geographic information searchable, adds an informative aspect to the data, as well as documenting quality aspects. Norway has derived profiles from the international metadata standard (ISO 19115) resulting in 'The Norwegian metadata profile for thematic vector data.'

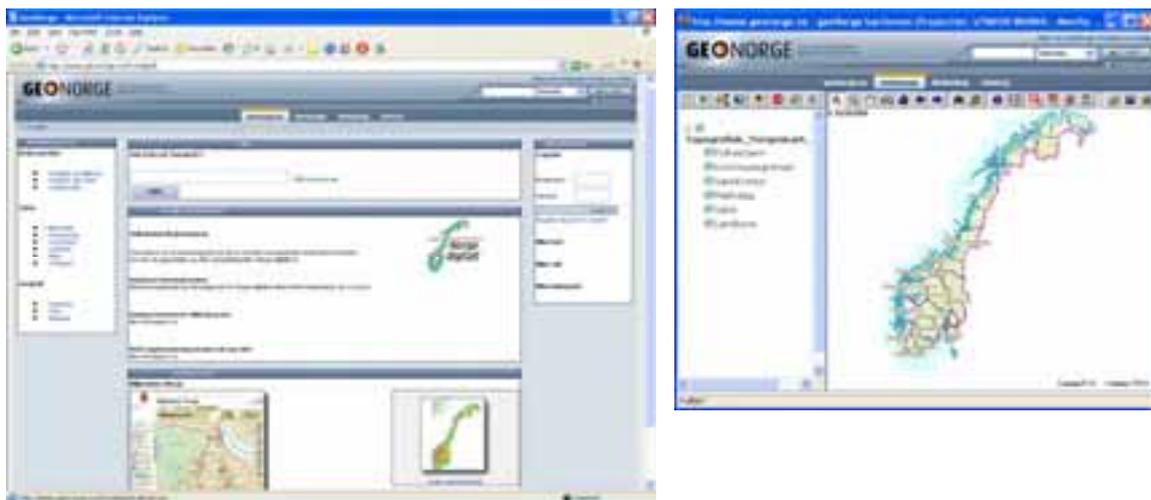


Figure 3: The portal – www.geoNorge.no aiming at organising the access to data and services owned by national, regional and local data producers. The portal is an important brick stone for implementing the Norwegian spatial infrastructure.

GIS use at the federal level

The concept of “*Digital Norway*” includes users and producers of geographic data on a national, regional and local level. At the regional level the federal government are an important user, acting as a part connecting the local and national levels. The federal government is mainly using ESRI products and has potentially many new users of GIS. However, there have been difficulties in getting started. This has mainly been due to a combination of factors such as high costs of GIS licenses, high demand for support and generally a too high level of expertise to be able to use the applications that has been developed. In addition, there is a potentially high number of people within the organisation that are not aware of there needs for geographic information and the benefit they can have from using GIS. Studies have shown that 80% of the total administrative work within an organisation is used to find documents and 20% is then used to interpret the content (Gyland, 2006). It is obvious that using maps and integrating systems as the path-finder to the information will result in higher efficiency and better decisions.

In order to increase the use of GIS in the federal government, a cooperative project as been developed between four organisations from the federal governmental level in the counties of Hedmark and Oppland. The project started about a year ago in 2005 and its aims of increasing the use of GIS are in the setting of the “*Digital Norway*” concept. The project has a two step approach towards increasing the use of GIS within the organisation. As a first step an Internet application (www.InnlandsGIS.no) based on ArcIMS has been implemented with a common server structure and administration. This is to accommodate the new user to GIS and the day-to- day needs of geographic information.



Figure 4. The county of Hedmark and Oppland in Norway and 44 municipalities.

The second step, which is in its planning stage, is to organise ArcGIS applications for the more advanced users and tasks, in the form of thin-clients. The use of a licence pool for different GIS software to reduce costs will be implemented. The need for database management system will be considered, but the demand is very low, since the organisations manage and produce very few data by themselves.

The Internet application

The Internet application is based on JSP (Java Server Pages) and Apache Tomcat as an application server. The content of the application is administered by XML (Extensible Markup Language) and property files as well as JS (JavaScript) and CSS (Cascading Style Sheets).

The application gives access to seamless and updated base map and thematic data as WMS and uses Web services for searches in national databases. Some data are organised locally as shape files but it is a temporary solution until more data producers supply there data as standardised map services. The integration with the document filing system and the Internet application using WFS requests and http communication is defined and just about to be implemented.

The Internet application is easy to use and a couple of hours tutorial will accommodate the needs for a brand new user to GIS and Internet applications. More advanced users will easily find them self comfortable in the lay out and functionality. The data is divided into themes that give access to predefined thematic maps for specific management needs. For specific tasks, there is functionality for routing capabilities.

The communication and data exchange with the municipalities are important to ensure a complete and comprehensive national infrastructure. The municipalities are part of the “*Digital Norway*” and carries the major costs for establishing detailed base map data and cadastral information. In the counties of Hedmark and Oppland there are a strong focus on using GIS and groups of municipalities work together in cooperation for best benefits. The municipalities use other GIS platform than ESRI and the most common are Intergraph and GISLine, which is a Norwegian GIS company. The use of different platforms enhances the need for standardised data and the use of standardised services for interoperability of data and exchange.



Figure 5: Example from the Internet application based on ArcIMS for the federal government (to the left). The application gives access to seamless and updated base map and thematic data as WMS and uses Web services for searches in national databases. The federal government and the municipalities play an important role in building the national spatial infrastructure. The municipalities (to the right) use other GIS systems than ESRI.

Conclusion

In Norway, the coordinated initiative “*Digital Norway*” play an important role in implementing the national spatial data infrastructure. Access to data, both base map and thematic data, is organised by the initiative. The national Portal is an important brick stone in the infrastructure. The success of the Portal is totally dependant on its content and the metadata.

A national infrastructure is dependent upon standardised data and services for implementation and for achieving interoperability of data and services. To day, the technological development is moving very fast from desktop GIS towards distributed GIS and this leads to increased use and potentially new users.

At a regional level, a cooperative project aiming at increasing the use of GIS, has developed an sophisticated Internet application for easy access to geographic information. The application uses WMS and Web Services together with locally stored data. The project team wish to use more data as WMS, but some cartographic issues arise when combining many different services. There are also issues in respect to transformation between coordinate systems. Over time, this will harmonise and more information may be obtained and combined in a viewer as WMS layers.

This cooperative approach has values not only in regards to cost/benefits, but also in regards to teambuilding and knowledge exchange. The application will be developed further, and applications for advanced users will be organised. Further work will also focus on access and administration of management plans, which is an important data set produced by the municipalities.

Acknowledgments

Thanks to the organisation named “*geoForum*” that provided scholarship that enabled me to attend the User conference in San Diego. Thanks go also to the project team behind interesting and resourceful work of the www.lnlandsGIS.no

End notes

“...The Spatial Data Infrastructure is about to change our lives by documenting the real world and integrating that information into our lifestyle..”
(*Director of Norwegian Mapping Authority*)

Appendixes

Internet links:

www.geonorge.no

www.ogc.org

www.iso.org

www.statkart.no

www.norgedigitalt.no

Norwegian geoPortal

OGC

ISO

Norwegian Mapping Authority

Digital Norway

References

Geological Survey of Norway (2004): Web Map Server (WMS) - A guide for new digital users of WMS in Norway <http://www.geonorge.no/geoportal>

Gyland, Lars Fredrik (2006): Integrasjon mellom saksbehandlingssystemer og kartsystemer – Åpen kommunikasjon basert på WFS standarden. Statens kartverk 2006, <http://www.geonorge.no/geoportal>

OGC WMS (2006): Open GIS Web Map Service Implementation Specification Version 1.3.0, Wayland, Massachusetts: Open Geospatial Consortium, <http://www.opengeospatial.org/specs/?page=specs>

OGC WFS (2005): Open GIS Web Feature Service Implementation Specification Version 1.1.0. Wayland, Massachusetts: Open Geospatial Consortium, <http://www.opengeospatial.org/specs/?page=specs>

Statens kartverk (2005): Norge digitalt - nasjonal geografisk infrastruktur www.norgedigitalt.no

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