Geoinformation Dissemination for the General Public through Multiple Clients

Paul VAN ASPEREN, Wim BLANKEN, The Netherlands

Key words: dissemination, WebMappingService, Google Earth, web publishing, communication guidelines, accessibility

SUMMARY

The directorate-general for Public Works and Water Management (RWS) is responsible for maintaining and administering the main roads and waterways in The Netherlands. RWS is an organization with a headcount of about 8,000 employees, an annual budget of € 4 billion and more than 200 offices throughout the country. A new Dutch government policy has urged RWS to deliver more value for money on the same budget and to simultaneously reduce its employees. To achieve these goals, the organization is moving from a decentralized approach to a centralized steering model using uniform working models and organization-wide standards.

The department of Geo-information and ICT (AGI) is working within RWS to meet the challenge of reducing ICT (information and communications technology) costs considerably. The strategy to meet this challenge is built on the principles of: uniform working models, open standards, server-based computing and central data hosting and maintenance. A geo-information infrastructure based on the Open Geospatial Consortium (OGC) Services Architecture has been established. This infrastructure has already enabled broad geo-information sharing throughout the organization and has proven to be cost effective.

The same infrastructure will be used for the dissemination of geoinformation to the general public. A few sites are already operational. The recent introduction of new clients like Google Earth and World Wind has increased the interest in and demand for geoinformation in general and from government agencies in particular. One may think for example of mapping the planning of major road works. AGI is studying the range of clients for the dissemination of geoinformation. Experiments are targeted on web clients as well as the new range of smart desktop clients. The paper will give the technical details on the experiments, including the production of a movie showing some possibilities of Google Earth. It gives the (dis)advantages of using these clients, both for the publishing agency as for the end-user. It is evident that the introduction of smart clients like Google Earth will boost the publication of governmental geoinformation on Internet.

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1. INTRODUCTION

This paper first describes the background of the Directorate-General for Public Works and Water Management (RWS) and sketches in brief an outline of this organization. Subsequently is explained how the demands of today require a new approach to geodata processing and management. At last the various options for the publication of geoinformation for the general public are discussed.

The Directorate-General for Public Works and Water Management, Rijkswaterstaat (RWS), is since 1798 responsible for maintaining and administering the main roads and waterways in The Netherlands. These tasks include protection of the country against floods from both the rivers and the sea. RWS is an organization having 8,000 employees, an annual budget of € 4 billion, and more than 200 offices throughout the country. Accurate and up-to-date geo-information has always been a necessity for administering the main water- and road networks of the Netherlands. The department of Geoinformation and ICT (AGI) is responsible for providing the organization with the IT and the (geospatial) information needed for its tasks.

RWS has a long and standing tradition of mapping and geospatial data processing. RWS, like many similar organizations, moved through the consequent stages in which the process of geospatial data management was automated. First the mapping process was automated using mostly CAD and automated drawing techniques. Then stand-alone desktop GI-Systems were introduced, first mainly for more complicated geoprocessing tasks like modelling and analysing data for policy making. When desktop GIS became more lightweight and easier to use and access, the use of GIS further spread throughout the organization. As it was relatively easy to develop add-ons, scripts and applications, and there was no strict policy for application development and maintenance, many smaller and larger GIS-applications popped up. Because on the one hand less emphasis was laid on data management and data distribution and on the other hand application maintenance was not embedded within the organization, a sub-optimal situation was created in which software maintenance was expensive and data management cumbersome.
At an early stage the responsible professionals recognized the drawbacks of the very bottom-up approach in which geospatial data processing was managed and developed. Single-use GIS applications were replaced by multi-user client-server type solutions but the bottom up steering (and funding) of development still blocked a more structural solution.

A new Dutch government policy has urged RWS in the last years to deliver “more value” on the same budget and to simultaneously reduce its number of employees. To achieve these goals, the organization is moving from a decentralized approach to a centralized steering

model using uniform working models and organization-wide standards. When the board of directors, alerted by the rising costs of IT and geodata management, recognized the problems in this field, a centralized steering model for IT was put in place. This makes it now possible to work on a Spatial Data Infrastructure (SDI) for the RWS Enterprise GIS in which geodata is well and securely managed but also accessible for everyone that needs it, anytime, anywhere. In this paper the components of this centralized solution and its benefits for general dissemination are discussed.

2. GEOINFORMATION DISSEMINATION WITHIN THE ORGANISATION

The department of Geoinformation and ICT (AGI) is working within RWS to meet the challenge of reducing ICT (information and communications technology) costs considerably. The strategy to meet this challenge is built on the principles of: uniform working models, open standards, server-based computing and central data hosting and maintenance. A spatial data infrastructure (SDI) -based on the Open Geospatial Services Architecture- has been established using both open source software and proprietary components. This infrastructure has already enabled broad geoinformation sharing throughout the organization and has proven to be cost effective. Expected future developments include deployment of catalog services, integration of OGC-services within business-applications. and the implementation of a transactional web feature service for mobile and other clients.

About ten years ago, during the rapid bottom-up development of GIS within the organization there was an awareness that some form of standardization was necessary in order to be able to exchange data and share applications. By that time the only way to achieve this was to standardize on a vendor whose products were already often used within the organization.

Now there comes a need for open standards in order to prevent the so-called “vendor lock-in” and to be able to communicate with other organizations. In 2004 RWS made the decision to base this development on the Open Geospatial Consortium (OGC) standards. Especially the OGC Services Architecture was adopted. It turned out that these OGC-standards were very well supported in open source products. These products were then successfully deployed within the Open Source Framework (OSFW) for Geoservices.

Within the “Geoservices” project an OGC services architecture infrastructure has been implemented at AGI. The technical architecture of this infrastructure is sketched in figure 1.

It consist of three layers:
1. Data: published data which can be used. The data can be in different forms (raster, vector), in different formats and stored at various physical locations.
2. Application: services which can be used upon user request, based on one or more datasets from the data layer.
3. Presentation: results from the service are presented in the web browser.

Because the architecture is based on Open Standards, components of different vendors could be assembled to form the Geoservices infrastructure. The objectives of this infrastructure are

to provide a robust framework for delivering web applications and to serve the available (base) geodata to any client within the organization. For the construction of the Geoservices infrastructure a growth model was used. At first developments were focussed on internal services, however, external service delivery is gaining more and more attention.

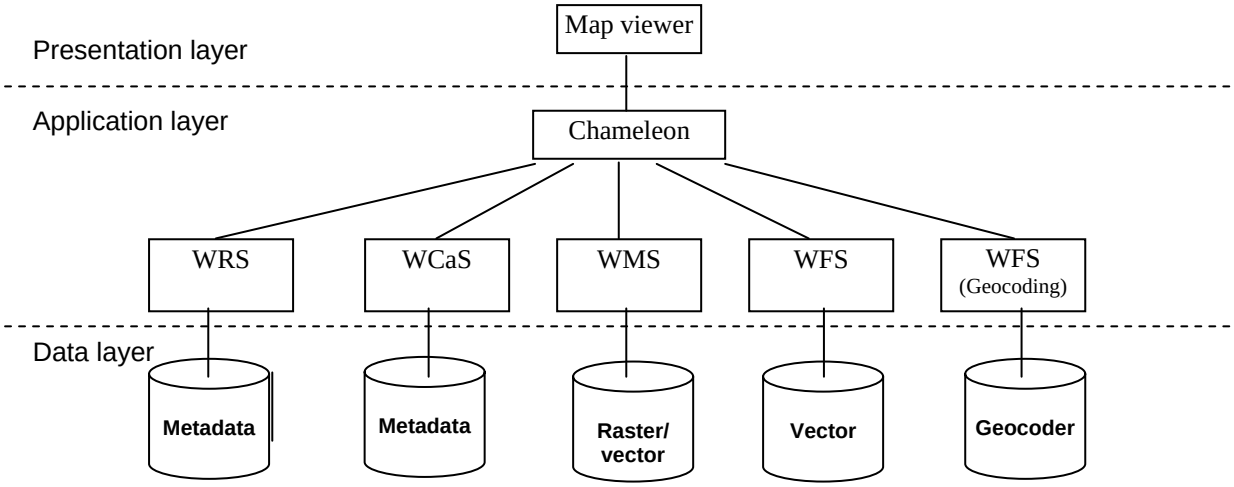

Figure 1 OGC Services Architecture implemented at RWS

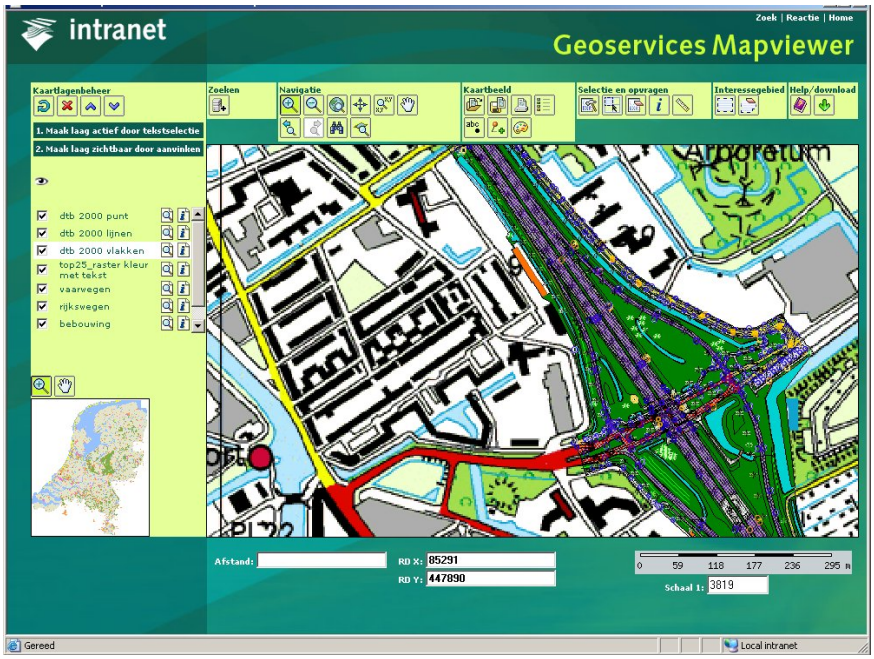

Figure 2 Standard Geoservices Mapviewer

The standard ‘Mapviewer’ application is presented in figure 2. It is a starting point for any employee within the Ministry to browse through geographic data. In figure 3 a map is shown based on topographic data acquired from the National Mapping Agency (Topografische

Dienst Kadaster) combined with detailed topography from the highway road database, produced for RWS specifically.

Open Standards and Open Source Software (OSS) paved the way to a more independent attitude towards the GI-software industry. This solution has proved to be competitive and was up and running in a relatively short period of time. Although the experiences with OSS are positive, the use of OSS will not be a decisive criterion in the deployment of web based GIS applications. The main criteria are: out of the box functionality, support for OGC-standards, robustness and flexibility, performance and compliancy with the RWS ICT-environment.

An important open source part of the services oriented application architecture is the 'Mapserver' software, originally developed by the University of Minnesota (UMN). The open standards WMS (Web Mapping Server), WFS (Web Feature Server) and WCS (Web Coverage Server) have been implemented into this product. The UMN Mapserver also supports SLD (Style Layer Descriptor) and WMC (Web Map Context). The open source product 'Deegree' (Latlon) is used to implement the support for Catalog services. For Client functionality the open source software product 'Chameleon' is used. Other open source software components on the central platform are 'Apache', 'PHP', 'Tomcat' and 'Linux'.

A strategy of uniform working models, open standards, server-based computing and central data hosting and maintenance is feasible and has many advantages. OGC standards are getting more and more mature therefore enabling the construction of an enterprise geo-infrastructure based on open standards. Advantages for the organization are a robust data management, the widespread availability of geodata and a low threshold for data sharing both internally and externally. Apart from this a more independent attitude towards GI-software suppliers is possible: the vendor which delivers the required features at acceptable conditions can be chosen.

Recently, IONIC Enterprise Edition has been purchased and will be used to implement a Proprietary FrameWork (PSFW). This will be a valuable addition to the open source framework, as it adds new or better support for existing OGC-services to the framework. This is a good example that open source and proprietary products can work together, because they are based on open standards (OGC).

3. GEOINFORMATION DISSEMINATION FOR THE GENERAL PUBLIC

There is an increase in awareness to inform the general public on the main activities of RWS. Geoinformation plays an important role in this process. In the past, some regional offices have autonomously developed several websites. As a result duplicate datasets were stored in a fragmented way and services were based on a range of different products. This process has lead to higher costs for development and maintenance. As said earlier, AGI is implementing an enterprise architecture, leading to efficient development and maintenance of the infrastructure. Besides that, standardisation and centralisation also supports the creation of a corporate image of RWS towards the public. RWS-AGI will be in the lead to standardise the use of geo-information for the general public.

The following paragraphs discuss the current websites hosted by AGI, and experiments carried out recently.

3.1 Public websites

The public websites are based on the described Geoservices concept which was used to create applications for the following projects:
- Ring road Eindhoven;
- Height benchmarks.

3.1.1 Ring road Eindhoven

This site is meant to inform the public about the planning of the reconstruction of the ring road of the city Eindhoven (fig. 3). Target group is stakeholder: neighbouring citizens. The planned situation is projected on several base layers (topographic maps and aerial photographs). Special attention is given to the height of the sound barriers as they are of special interest for the people living in the vicinity of the highway. Using the 'Identify-button', the height of the barriers can be queried. For this project, the map viewer and base layers where already available, only the planned situation had to be processed for publication. The web-application was therefore developed in a relatively short period of time.

Figure 3 Ring road Eindhoven

3.1.2 Height benchmarks

RWS-AGI maintains the height reference system (NAP) in the Netherlands. The site contains information of all height benchmarks in the country. Access is free, however restricted through login and password. There are currently more than 1,000 subscribers. They are mostly land surveyors from the public and private sector who use benchmarks in their daily land surveying practices.

3.2 Experiments

As said earlier, the dissemination of geoinformation to the public gains more attention. Public focus is one of the main policy elements within RWS for the coming years. The public should be well informed about the developments of the assets of RWS, as they are the main users of the highway and river infrastructure.

As the services infrastructure is more or less operational, the main issue for dissemination is the choice and functionality of the client. Two experiments have been carried out recently:

- Using the functionality of Google Earth;
- Improving the user interface of the Geoservices application framework..

3.2.1 Google Earth

The launch of Google Earth attracted a lot of attention and has become a major geotool for non-professionals. It even created geo-awareness amongst general management. The deputy director-general, Luc Kohsiek, told the national GI-conference last year: “My dream is having a Google Earth RWS, or a Google Earth Government, with cadastral boundaries, water pipes, sewerage networks, etc. We own the data, there is no problem. Additionally, I would like to have more data, and more up to date. Besides that, I want it faster.”

In order to demonstrate the capabilities of Google Earth, a movie had been produced. Key element was the connection between the RWS-infrastructure and Google Earth, i.e. to overlay Web Map Services on the Google Earth client. The Ring road Eindhoven was used as pilot area. The existing WMS was dynamically displayed in Google Earth. The 3D sketch module was then used to create the 3D objects of the sound barriers (fig. 4).

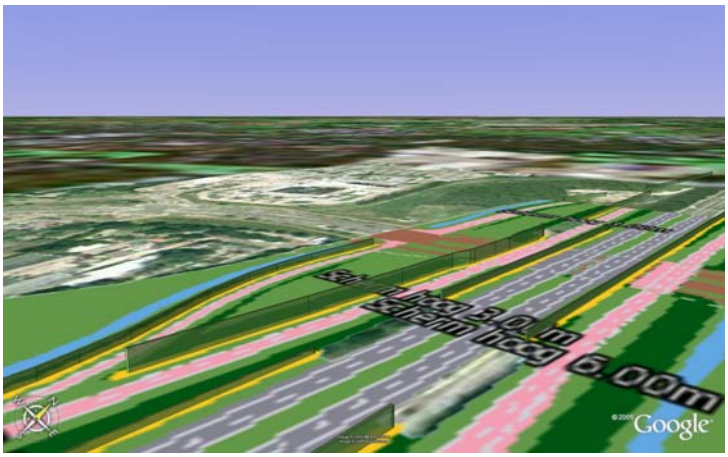

Figure 4 Ring road Eindhoven on Google Earth

The connection with the Web Mapping Services has been made through a php-script. The main drawback of this Google Earth OGC WMS connection is that it is not compatible with

the sophisticated streaming technology that Google uses to deliver it's own proprietary data to the client. Therefore, it takes a few seconds for each requested image to build up.

Due to its popularity, RWS will consider Google Earth as a channel for geoinformation dissemination. The following possibilities exist:
- RWS-data published by Google Earth: RWS can request Google to publish RWS-data for free (like high resolution imagery of the highways and main rivers). The advantage of this solution is that the data can use the streaming technology and therefore be delivered very fast to the client.
- Connected with Geoservices: using the php-scripts, existing WMS-services from RWS can be displayed in Google Earth.
- Download interface: the Google Earth interface can also be used as an interface for downloading files.
- Through publishing of native or processed KML: files can be locally transformed into KML and published on the web to be viewed in Google Earth.
- Through the use of WFS-services (Web Feature Services) in combination with some kind of parser technology that converts the resulting GML into KML to be viewed inside Google Earth.

Within the Netherlands other public organisations are using Google Earth:
- The municipality of Apeldoorn has sent imagery which is hosted through Google Earth;
- The municipality of Voorst is publishing geo-information through Google Earth for the public;
- The so-called 'New Map of Holland' publishes KML-files with all new planning projects within the Netherlands currently known.

In case of Voorst, a user has to be persistent and follow a few steps to make the connection. In case of the new map, large KML-files have to be downloaded (30 Mb). In both cases some computer literacy is required at the user side.

Google Earth will play an important role in the public domain for geo-applications on the web. It is still not clear which effect it will have on the professional GI-market.

3.2.2 Improved user interface for Geoservices OSFW

In 2006 and 2007 RWS executes a large road maintenance campaign. A large publicity campaign in the media and on the web supports this. The target group is road users. A pilot has been carried out to use the Geoservices concept to publish geoinformation of road works. A Flash module has been incorporated to enable users to choose a day or period for which the road works has to be shown. The implementation of this website (fig. 5) will be released later this year. Important aspect is the user friendliness of the interface, this needs to be improved.

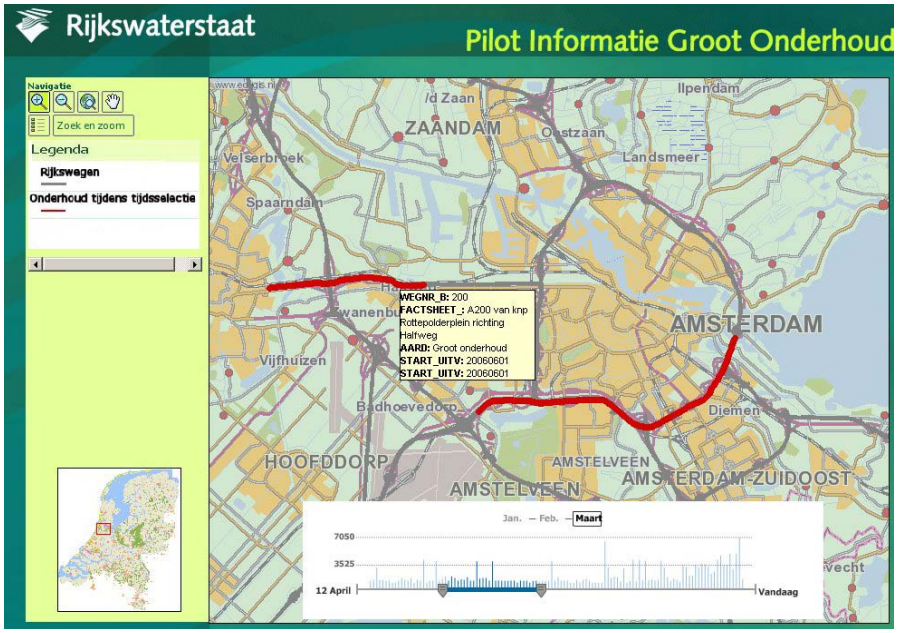

Figure 5 Road works published through Geoservices combined with Flash

4. GENERAL RULES FOR WEB PUBLISHING

In general, the following guidelines for web publishing have to be used:
- Corporate Communication strategies RWS;
- Guidelines on governmental publications on the web;
- Guidelines barriers free.

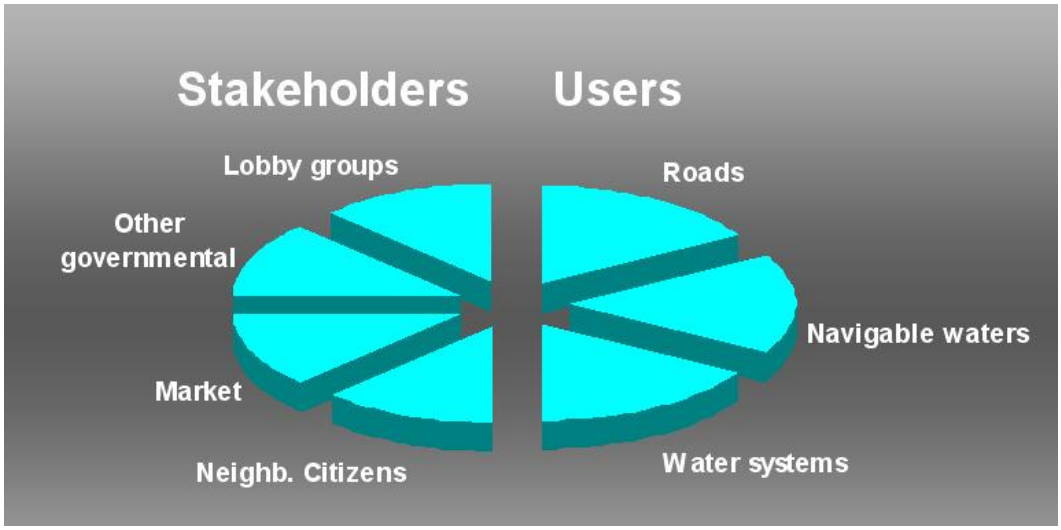

Figure 6 General public: different groups

The communication strategies provide general guidelines on content for each target group. They are differentiated as follows (see fig. 6):

1. Stakeholders:
- Lobby groups: environmental organisations, transport associations;
- Other governmental organisations and network managers: other ministries, provinces, municipalities, water boards;
- Market: contractors, Automobile Association;
- Neighbouring citizens: people affected by the execution of RWS-projects;

2. Users:
- Roads: motorists on the highways;
- Navigable waters: professional and recreational bargemen;
- Water systems: industries, harbour authorities, etc.

Guidelines on governmental publication aim at a maximum accessibility for all web visitors. Access should be possible for:
- Visitors who do not have proprietary or closed technologies (plug-ins);
- Visitors who do not have (or disabled) client side script support;
- Visitors using text browsers or alternative browsers.

On the last point, the following guidelines are commonly used for governmental web publications:
- MS Internet Explorer, (version 5 and higher), newest versions of Netscape, Opera, Mozilla and Safari;
- Older versions and non graphic devices are directed to a text version;
- Also usable in mobile clients (PDA, smart phones);
- The site should be usable at a screen resolution of 800 x 600 pixels.

Guidelines barrier free aim at maximum accessibility for visually handicapped and colour blind people. It is based on Web Content Accessibility Guidelines from W3C. It gives guidelines like:
- Deliver a text-equivalent for every non-textual element;
- All information delivered by colour should also be delivered without colour;
- Prevent the screen for flashing unless user control is available;
- Deliver text links for every active area of a server side image map;
- Pages should be useable when scripts and applets etc are disabled. When this is not possible, deliver equivalent information on an alternative page.
- Deliver client-side image maps instead of server-side image maps except in areas where cannot be defined with an available geometric model.

The above mentioned guidelines have not been used in developing the various Geoservices websites. The question arises if these guidelines can be applied to the geoinformation domain.

4.1 Maximum accessibility

In recent history the dissemination of geoinformation was mainly realised using static maps or client-image maps and sometimes by the use of specialised java-applets. Nowadays

specialised server software is used to create dynamic maps with advanced capabilities for querying, geocoding and even digitising. Not only server- but also client side technology has been developed making it possible for the user to use these advanced server capabilities in a user-friendly way. If we apply the first two guidelines (no plug-ins and no java script) on the development of a geo web client, the following functionality cannot be realised:

- Box zooming: Using a user generated box the user sets the extent of the new map;
- Box querying: Using a generated box the user wants to query information in a specific area;
- Measuring: Measure distanced and surfaces;
- Advanced Searching: Search geo-information with wildcards etc.;
- Digitising/annotation: Create new complex geometric objects or annotation.

Other functions would be not as user-friendly when java script or client-side plug-ins are forbidden.

The new paradigm of client design is AJAX (Asynchronous Java script / XML). Most of the new geo web clients are based on this technology that in short gives the web application the look and feel of a desktop application. As this technology makes heavy use of java script it cannot comply to most of the guidelines for web development.

The guidelines relating to the functionality of the internet browser are feasible except the second one, which states that redirection to a text version should be possible. We simply cannot make a text version of a map in most cases. Locations and relationships cannot be described in text easily. However, exemptions are for example thematic data and route descriptions. A table could then be used as replacement for showing these in a map.

As safety problems with internet-browsers are very common they are resolved in new versions of an internet browser by restricting the use of certain technology (for example popup, Active-x, specific java script commands). So it is possible that a new version of a browser does not fully support the specific functionality of the geo web client. This problem cannot totally be prevented. However, if less sophisticated technology (less java script, and no browser specific scripting) is used, this problem will occur less frequently.

Of course, clients should be developed for most popular browsers, like MS Internet Explorer. However, if a geo web client should be usable within many internet browsers, extra costs have to be made for development, testing and maintenance.

As the use of PDA's is still growing, the demand for georelated information for this medium is high. If the extra value for the support of a PDA client is clear and the application can be made simple and small, it is a big advantage. However, often the extra value of using a PDA can only be achieved by combining it with a GPS device.

The guidelines cannot be applied to Google Earth as it is a smart desktop client, and not a web client. Despite this remark, it is obvious that Google Earth is a very popular client within the general public for geoinformation.

4.2 Barrier free

These guidelines have similar effects like the guidelines on maximum accessibility. A text representation of a map is not possible in most cases. The guideline for colour blind people can be given more attention: all information delivered by colour should also be delivered without colour. In most cases, the developer of a geowebclient is also responsible for the symbology used in the map. A developer often has only limited knowledge of cartography and there are limited resources available for good symbology. A good cartographer should be able to make alternative maps using no colours. The cartographic abilities of most server side map generators could also facilitate this. So it is possible to implement this guideline, however at extra costs of course.

4.3 Geoservices

The RWS geoclients are not even close to complying with the guidelines. The OSFW cannot fully be used with other browsers than Internet Explorer. Some of the out-of-the-box PSFW clients are using java-applets. These are concerned plug-ins and should not be used when applying the guidelines on maximum accessibility. The use of Flash is even more problematic as many governmental organisations are preventing the user the installation of a flash plug-in. As the demand for geo web clients with a flashy look and feel is growing, this may be a problem.

At the moment, RWS is doing research into the design of a geo web client for the general public. Experiments with flash clients and client frameworks are currently carried out. The results have not been published yet. The only options to comply to the described demands are the use of very sophisticated AJAX or Flash/SVG technology. The guidelines can only partly be met by producing alternative clients which would result in higher costs for development and management.

5. CONCLUSIONS

Having set-up the Geoservices infrastructure, it is relatively easy for RWS to publish geoinformation on the web. The use of open standards is supported by RWS as it will improve interoperability internally but also towards other institutions and the general public.

The use of advanced technologies for web based publication of geoinformation does in general not comply with the guidelines for web publications. However the following recommendations can be made:

- To carry out a cost benefit analysis in order to define an optimum set of web browsers to be supported;
- To support a number of clients for publication in all cases (web and desktop);
- To include guidelines for geoinformation especially in the general guidelines and/or to involve communication experts for the development of geo web clients;
- To involve cartographers for the design of maps within the clients, for the general public but also specifically for visually handicapped people.

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BIOGRAPHICAL NOTES

Paul van Asperen is currently a project leader within the Ministry of Transport, Public Works and Water Management of The Netherlands. He holds a M.Sc in Geodesy from Delft University of Technology. He has been working as a lecturer at the University of Zambia and ITC. He also worked for the National Mapping Agency in the Netherlands.

Wim Blanken is a technical consultant working for a dutch company called ‘GEON bv’ that specialises in geo-information management. Currently he is working as a project leader within the Ministry of Transport, Public Works and Water Management. His work is mainly focused on the implementation of the RWS Spatial Data Infrastructure.

CONTACTS

Ir Paul van Asperen
Ministry of Transport, Public Works and Water Management
PO Box 5023
2600 GA Delft
THE NETHERLANDS
Tel. + 31 15 2757080

Fax + 31 15 2757576
Email: p.vasperen@rws.nl
Web site: http://www.rijkswaterstaat.nl/rws/agi/home/

drs ing. Wim Blanken
GEON bv
Steenhouwerskade 8
9718 DA Groningen
THE NETHERLANDS
Tel. +31 50 311 16 60
Fax +31 50 589 23 02
Email: w.blanken@geon.nl
Web site: http://www.geon.nl