WEB FEATURE SERVICE (WFS-T)-BASED GEOMETRY EDITING

Geoinformation for Water-Related Objects

The Dutch Directorate for Public Works and Water Management, Rijkswaterstaat (RWS) is an organisation scattered over numerous local districts. A Geo-Information Infrastructure (GII) has been implemented to reduce distributed data management whilst maintaining availability of geographical data to local offices. The authors describe user requirements and functionality, illustrating the Information and Communication Technology (ICT) architecture and technical aspects.

The existing infrastructure was extended with a web application for the maintenance and development of water-related objects, based on Open Geospatial Consortium (OGC) standards. The infrastructure has made it easier to publish geo-information throughout the organisation and, together with reusing standards, components and web services, made less complicated the implementation of applications. Not only can water-related objects be used and maintained in a uniform manner, application and data management is more straightforward and cost-effective.

Geoservices
In 2003 the RWS Geoinformation Department set up the service-oriented architecture Geoservices, which served as the starting point for restructuring the geoinformation supply in the wet sector. The first task of Geoservices was to define geodata needs and develop a uniform data model for Beheerkaart Nat (BKN), consisting of uniform registration of all the previously absent water-related objects maintained by RWS. By thus achieving standardisation and interoperability the aims of the original BKN project were met. Keeping the BKN dataset up to date is obviously important, both for daily maintenance work and for providing accurate management information. To ease the maintenance and management of this data RWS built a user-friendly web application for administrators and managers, rooted within the existing framework of Geoservices and making use of its IONIC Redspider (Enterprise) software.

User Requirements
There were many and varied user requirements. BKN data had to be accessible to local district data administrators for maintenance and management. It was important that the solution should fit within the architecture of existing Geoservices SDI. This meant reusing existing services: for example, for the base maps and gazetteer. Several OGC standards had to be implemented, including Web Map Service (WMS), Web Feature Service (WFS), Geo–graphy Markup Language (GML), Web Map Context (WMC) and Styled Layer Descriptor (SLD). The project had also to incorporate an ability to change attribute data and geometry, based on the OGC WFS-T standard (WFS that supports transactions). It was imperative that data and applications should be centrally hosted and that history and changes be held in the database for a period of time. (Oracle Spatial is used to manage the data and the transactions.) A final requirement was that the application have an intuitive web interface based on responsive techniques such as Asynchronous Javascript And XML (AJAX).

User Types
In addition to the general requirements, user-sp+ecific needs were identified during the BKN business study and the results specified in 'use cases' written in Unified Modelling Language (UML). Different types of users may be identified within the work process. For example, an application exists for RWS local district administrators responsible for the daily maintenance of water-related objects, including bridges, docks and water bodies. Minor changes to the objects are made on a daily basis. For more extensive changes in acreage, updates are completed at database level in separate projects, parallel to the daily work process. The BKN data is also intended to provide accurate and up-to-date management information. This is loaded into a Network Information System that provides corporate information about the RWS networks: major roads and waterworks and main water-system components. The maintenance and management budgets for RWS districts are based on this information.

Functionality
The functionality of the application may be subdivided into different areas according to user type. General GIS functions (such as using WMC files, measure distance, access to feature info, adding layers and navigation tools such as zoom, pan and search) are available to all users. Map layers (WMS of base maps, aerial photographs and boundaries) and the gazetteer service is available through the Geoservices framework. These and other map layers (BKN layers and sketch layer) can be added or removed, and the opacity of the layer set. To edit objects it is necessary to log in, increasing available functionality. After finding an object, and various criteria are available to help selecting objects, both the attribute information and the geometry can be adapted. Several types of new object can be created, including points, lines and (multi)polygons, and the vertices of an object can be deleted, added or moved. Snapping to an existing vertex is another possibility, for example, to close the gap between two objects. Changes made by the local district administrator are not directly

committed to the central database; edits are kept in a temporary sketch layer for the central database administrator to accept or decline.

Applications

The BKN web application architecture follows the Service-Oriented Architecture (SOA) philosophy: resources are made available as independent services that can be accessed without knowledge of their underlying platform implementation. The application can request the services to execute tasks without knowing how these are actually performed. This approach offers advantages like location independence, dynamic connectivity to other services, and reduction in hardware and management costs. For the BKN web application the resources are OGC interoperable web services from the Geo-information and ICT department (AGI) Geoservices framework. These include WFS/WMS for maps based on vector data (rendering of BKN objects), WCS/WMS for maps based on raster or coverage data such as the AGI Orthophoto data, and WFS-T, allowing BKN object editing. Following SOA philosophy, the BKN web application does not need to know which database the WFS-T is using, in our case, Oracle Spatial 10g. Some business processes, like object history management or topological checks are done at database level and so remain completely transparent to the BKN web application itself.

AJAX versus HTTP

The BKN web application, like most of the new generation of GIS web applications on the internet, Google Map being the most famous, is AJAX-based. In classic web applications most user actions in the interface trigger an HTTP request to a web server, which produces an html page and sends it back to the client. The disadvantage is that the user has to wait for the server to process each action. With its support for asynchronous calls to the server, client calls are actually managed by the AJAX engine that stands between client and server, AJAX brings richness and responsiveness that seemed out of reach in web applications. This allows the support of advanced functionality such as the edition of big geometries containing more than 40,000 vertices, without use of an applet.

Concluding Remarks

It is easy to make the BKN application available on a mobile platform. The WFS-T standard has proved valuable for performing changes to geographical objects and this has been ably demonstrated for the BKN application in a production environment. AJAX narrows the gap between desktop and web applications. The IONIC RedSpider Enterprise development kit used to build the BKN web application includes a set of AJAX components: Portable AJAX-based IONIC Component (PAIC). PAIC provided the GIS business logic browser and the highly responsive web applications.

Further Reading

• Van Asperen, P., de Vries, M. and Kabamba A., 2006, Data Modelling for Water Management, UML for better Communication among Stakeholders, GIM International, vol. 5, nr. 5, pp 21–23.

• Van Asperen, P., Grothe, M., Zlatanova, S., de Vries, M., Thijssen, T., van Oosterom P. and Kabamba, A., 2005, Specificatie datamodel Beheerkaart nat, RWS report AGI-2005-GPMP-017, Delft 2005, p 130. Accessed www.gdmc.nl/publications/reports/GISt31.pdf.