GOOGLE EARTH, MSN VIRTUAL EARTH 3D AND NASAÂ€™S WORLD WIND

Comparing 3D-Earth Viewers

A 3D-Earth viewer enables navigating through the virtual environment and can be easily downloaded from the internet. How might this rapid development support steady, long-term development of institutions such as Rijkswaterstaat, the roads and water regulatory authority of the Netherlands? The authors consider and compare three standard 3D-Earth viewers: Google Earth, MSN Virtual Earth 3D and NASAâ€™s World Wind. Each is combined with Open Geospatial Consortium (OGC) Services to examine their performance in disseminating geo-information to the general public. While Google Earth proves technically superior, other aspects must also be considered.<P>

Rijkswaterstaat (RWS) is the government organisation responsible for maintaining and administering main roads and waterways in the Netherlands. It wants to considerably reduce ICT costs. The strategy for meeting this challenge is built on principles of uniform working models, open standards, server-based computing and central data hosting and maintenance. A geo-information infrastructure referred to as Geoservices and based on OGC Services Architecture has been established for this purpose. RWS is currently publishing geo-information via Geoservices, but might certain characteristics of popular 3D-Earth viewers suit them to replace Geoservices?

Characteristics
Google Earth, MSN Virtual Earth 3D and NASA's World Wind are standard 3D-Earth viewers with differing properties. Each is easily accessible to the public. Google Earth (GE) contains high-resolution satellite and airborne images streamed via a dynamic internet desktop 3D-virtual-globe. The popularity of GE, the most downloaded viewer in the world, relies on its smooth interface and streaming for dynamic geo-visualisation. This interface, made possible through AJAX technology, uses Keyhole Markup Language (KML) or its zip version (KMZ), as a standard for external data sources. KML/KMZ is a XML data format that defines the viewing of information in Google's virtual terrain. Converting GIS files to KML, in combination with Google Sketchup drawing tools provides opportunities for file-based overlays. In response to Google Earth, Microsoft at the end of 2006 launched MSN Virtual Earth (VE) 3D within an Opensource API. This is a mapping/satellite imagery application that may be viewed in a simple web browser within a Windows operating system running .NET application environment. NASA's World Wind (WW) is a planet-visualisation globe that overlays satellite photographs, weather data, political boundaries and topological world maps. WW allows the viewer to experience earth terrain in virtual-3D, with panning and zooming capabilities. Although WW is supplied with relatively low-resolution satellite and aerial imagery, it is capable of importing higher-resolution images from other sources.

Geoservices vs Viewers
We coupled the Geoservices Web Mapping Server (WMS) infrastructure with GE, using the Network Link tool that adds RWS-AGI map servers and overlays raster-WMS maps on a GE client using a KML Ground Overlay element attribute. An existing Geoservices internet application was used as pilot WMS. Height information relating to planned sound barriers along a bypass at the Dutch town of Eindhoven was combined with WMS projections on GE. General users may click on the sound barrier to obtain information on its dimensions. The 3D-barriers were constructed using Google Sketchup. A WMS was added to MSN VE 3D interface by building a demo website that included four WMS layers; it uses the VEAddTileServer Specification as described in the online Software Development Kit (SDK) to run WMS GetMap request as a tile server. Only the WGS84 coordinate system was found suitable for proper projection in MSN VE 3D. WW has a ready-made WMS connectivity feature. Adding a WMS to WW simply required some configuration files to be adjusted. The wms_server_list.xml file had to be changed and new WMS requests added.

Connection Comparison
GE, MSN VE 3D and WW may all be connected to WMS (using GetMap request). However, these viewers have limitations regarding the projection of a WMS on a 3D surface. Table 2 compares various WMS–viewer connection properties. Each connection was tested using UMN Map Server and Geoserver, revealing significant differences.

WMS Connection
The WMS connection to MSN VE 3D is quite different from GE and World Wind. Both GE and World Wind use dynamic bounding box (BB) parameters to create an image of the WMS request. As the BB changes the WMS image is destroyed and a new image is created based on the current BB. But WMS connections to MSN VE work by applying the tile-server method. The entire map is divided into tiles defined by the latitude and longitude of each individual tile and the source WMS URL of these tiles are specified. Once the tiles are loaded they remain in the cache and on the computer screen while the Virtual Earth BB is changed through panning and zooming. The WMS images on MSN VE are created synchronously in the background of the MSN maps and satellite images on which the WMS image is overlaid. In the case of GE, the image is created independently of background satellite images.

Layer Management
As the coupling of WMS in GE is based on KML it is straightforward to manage different layers. Switching a layer off or changing their

transparency is also possible in GE. After such operations GE software saves the changes. As a result WMS layers can be accessed in their previously saved condition the next time the user accesses the program. NASA's World Wind is, however, poor in layer management. It does not let the user save transparency settings for WMS images; the order of the different WMS layers has to be changed in a configuration file (wms_server_list.xml). MSN VE works from a very different approach. A general user can change transparency level only if the data publisher provides the tool on the website. Changing layer order and adding more than one layer is possible with this viewer. The user can add and turn off WMS layers, making visualisation more effective. This is in direct contrast to World Wind, which cannot show more than one WMS image at a time, rendering geo-related decision making and visualisation difficult.

Concluding Remarks

Although Earth viewers share the aim of distributing geo-related information on the web, they differ considerably, making difficult the choice in terms of providing the general public with geo-information. Another factor in addition to technical properties and market penetration is the agency's policy on internet publications, i.e. download client or not. One obvious prerequisite is whether or not the viewer is compatible with OGC Services. RWS is to continue to publish through its own Geoservices infrastructure. The organisation has recently facilitated KML-support in Minnesota Mapserver, part of the Geoservices framework. This will enable RWS to also publish geo-information through Google Earth and Google Maps.

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