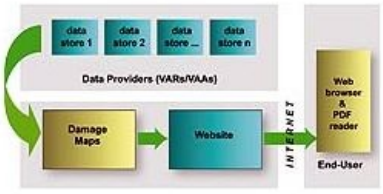
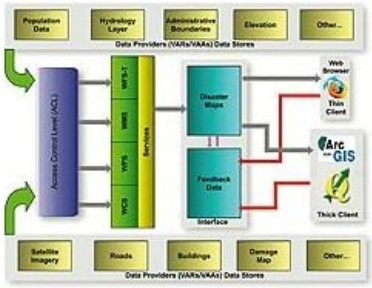
COLLABORATING VIA GIS AND GEO-WEBSERVICES

Disaster Mapping 2.0





There has been a recent increase in the incidence of major disasters and the damage caused, in terms both of human suffering and economic cost.

UNOSAT Mapping

The main goal of our research was to see how the current post-disaster mapping operations by the UN Institute for Training and Research (UNITAR) Operational Satellite Applications Programme (UNOSAT), under the International Charter ‘Space and Major Disasters', could benefit from modern GIS and collaborative web-based mapping technology. The charter aims at providing a unified system of space-data acquisition and delivery to those affected by natural or manmade disaster, and is widely considered a successful example of post-disaster international humanitarian assistance.

Since its inception in 1999 disaster-initiated charter activations have increased in number, helped by a recent growth in membership. The currently used technology means largely mono-directional data flow: post-disaster maps are produced at UNOSAT offices without any opportunity for inclusion of input from other stakeholders. The resulting map products are disseminated via a website where end users can view and download them in print-optimised PDF format (Figure 1).

Static Challenges

Because charter maps are static, one-off products, there is little possibility for augmenting them with additional validation and annotation of local knowledge and information. This approach is poorly suited to meeting the changing needs of increasingly specialised players in the disaster arena. It would be an important step forward to move away from static map data towards a more dynamic, distributed and collaborative environment. An appropriate application framework has thus to be developed to enable multiple stakeholders at various locations firstly to customise the post-disaster information, secondly to add value by providing feedback or access to their own additional information, and thirdly collaborate with other agencies involved in the disaster aftermath. This requires geospatial collaboration, which would seem technically feasible with the current state of spatial analysis and geo-processing tools. We wanted to see if and how this could be realised for the UNOSAT Charter situation by developing a proof-of-concept application using geo-webservices and Web 2.0 collaborative technology.

Collaborative Tools

Any collaborative environment requires the use of interoperable tools; interoperability among systems can be achieved using service-oriented architectures. Within the GIS world these are generally called geo-webservices. Examples of commercial, proprietary geo-webservices are Google Earth/Maps, Yahoo Maps and Microsoft Virtual Earth. For our project we looked into the use of non-proprietary systems, using the open standards developed for geo-webservices in the Open Geospatial Consortium (OGC). We think this approach can connect the various disaster-management agencies, allowing more customised delivery of data and information, as well as allowing stakeholders and end users to add value by providing their own, thus creating new synergies.

The notion of having end users contribute to the information flow of such a system is called user-generated content or neogeography and

is considered part of the second-generation World Wide Web: Web 2.0. We also wanted to test whether techniques from this new web world would be suitable for a collaborative disaster mapping system; we therefore decided to test whether it was possible to achieve a connection to geo-tagging tools such as Flickr.

Case Scenarios

We developed two scenarios. In the first, end users of post-disaster maps were allowed to spatially annotate them, using a simple web browser to add geo-tagged notes or remarks, i.e. linked to a fixed point in the map. These spatial annotations are made available in the web portal and can therefore be viewed by other users. A mapping agency can use geo-tagged remarks to improve and enrich its own data and actively seek help, for instance by posing questions such as does anybody know if this building is still standing, or is this road passable? The content of the spatial annotations is not limited to text; we also included links to existing photo-sharing services (such as Flickr) or other geo-webservices (such as Google Maps).

For the second scenario we imagined a more limited user group, such as stakeholders asked to actively collaborate in the production of post-disaster data. These users required a thick client (graphical client application that runs on the user's operating system), such as QGIS or ArcGIS, to help with data processing, in our use case, for delineation of damaged areas. These inputs are used to process the data for the final damage-maps; hence a secure access and validation mechanism needs to be in place.

Proof Prototype

We produced a proof-of-concept prototype (available for trial at 1) based on data from the May 2006 earthquake in Yogyakarta, Indonesia, (Figure 3) the general architecture of which is illustrated in Figure 2 (above). We built the implementation using open-source software throughout: the base data are raster images and a PostGIS database, served as OGC Web Map Services by the UMN MapServer middleware. The client was built using OpenLayers, an open-source JavaScript library for displaying map data in web browsers with no server-side dependencies. OpenLayers implements a JavaScript API for building rich web-based geographic applications.) Figure 4 shows it used for the scenario 1 use case. We think the prototype demonstrates how, using off-the-shelf open-source components, it is possible to quickly build geo-webservices and web clients that can help achieve the collaborative post-disaster mapping we set out for. Geo-webservices and Web 2.0 technology can swiftly mobilise different people from various organisations, help collect large volumes of heterogeneous data and integrate them.

Further Reading

Maiyo, L., Kerle, N. & Köbben, B. (2009), Collaborative Post-disaster Damage Mapping via Geo-webservices, in M. Konencny, et al. (eds), Cartography and Geoinformatics for Early Warning and Emergency Management: Towards Better Solution', no. Pr-1/09-02/58, Masaryk University, Prague, pp 386-395.