Building a Standards Based Collaborative GIS

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Introduction

As MacEachren (2001) points out geographic research, decision making and education are group activities. However existing GIS programs are designed for single users and sharing maps between them is a time consuming and difficult process. These problems increase by a order of magnitude when the group is spatially distributed and possibly working at different times. This paper will discuss how a collaborative GIS can be constructed using techniques based on Open Geospatial Consortium standards such as WMS, WFS, WCS, XIMA, SLD and Catalogues. An initial discussion of types of collaboration, existing techniques will be followed by a series of case studies demonstrating the use of collaborative tools. The authors feel it is imperative that geocollaborative tools are based on open standards to allow interoperability between clients. If proprietary services are used then participants will be required to learn a new tool for each meeting they "attend" leading to greatly reduced productivity, defeating the very aim of the collaboration.

Types of Collaboration

MacEachren (2001) defines 4 types of collaboration, we consider only different place collaboration below as we consider collaboration where all the participants are in the same place as a simpler special case of the different place collaborations. MacEachren *et al (2001)* summarize the findings from Brewer *et al*, (2000), as five system characteristics that were identified as important for supporting different place collaboration: (1) facilitating dialogue: ability to talk/chat while viewing and interacting with tools; (2) group member behaviours: ability to know what others were doing; (3) drawing the group's attention: ability to indicate objects, places, and regions and to alert others to the indications; (4) private work: ability to work ideas out individually before sharing them with others; (5) asynchronous collaboration: ability to save and share sessions and to initiate new analysis from any point.

Synchronous Different Place Collaboration

A synchronous different place meeting is where all participants are on line at the same time and are interacting with the same shared map. A trivial example of this type of meeting is where two people wish to collaborate across space. This type of meeting can be solved by using a simple client server shared whiteboard. However it would be beneficial if a standards based client could be used to avoid learning a new client when communicating with a different partner; it also allows other participants to join the meeting if required. Many person meetings require tools that provide the ability to pull down multiple data sets from web servers and act as a server for local datasets that are to be shared. These tools could either use a peer to peer type network or a

central server or a combination of the two.

Many "physical" meetings involve participants studying a paper or electronic map. In a virtual meeting it is equally important that participants are all able to view the same map to add comments and view other's comments. In some cases it may make more sense for users to see different maps based on the same data but produced using a local style so that they see a map using conventions they are familiar with. For example in a cross border meeting the way in which roads or rock types are presented may differ considerably from country to country.

In a multi-national military action it is often necessary to combine data from disparate sources and make decisions based on this information quickly. One of the ways to make this possible is to add the information to a geographic data server and use a shared mapping environment to facilitate the decision making process. Once a solution has been found it is possible to distribute the relevant information to combat units either electronically or on paper maps. In these cases it is desirable to style each map in a national style to avoid confusion in the heat of battle.

Asynchronous Different Place Collaboration

An asynchronous collaboration involves many users storing results on a server where they can be viewed by other (authorised) users at different times. This is particularly useful for collecting comments or results from many different users to a single processing centre. This technique of mapping can also be used to facilitate discussion on an asynchronous discussion forum.

For example a public participation GIS (PPGIS) allows participants to provide comments about issues at a point or in an area with out restricting them to a pre-existing polygon. A good example of this technique is Virtual Slaithwaite (Carver et al, 2001), who comment on the need for such tools because traditional methods of public participation at planning meetings quite often involves a confrontational atmosphere. This can discourage participation by an often less vocal majority causing public meetings to be dominated by individuals who may have extreme views which may not necessarily represent the wider view of local people. Physical access to such meetings can also cause problems for the disabled, the elderly and infirm as well as those who maybe deaf, any method that can overcome this discrimination is now legally essential in many countries. There are many advantages to a web based approach at local, regional and national public participation events. The meetings are neither restricted by geographical location or time. Access to the information about the issues being discussed is available from any location with web access. The information is also available at any time of the day thus avoiding the problems associated with holding meetings only in evenings. The concept of a "24/7", i.e. 24 hours a day, 7 days a week access opens up opportunities for more people to participate in public consultations.

Another use of this type of tool is in education, it allows a class to all produce individually annotated maps to store on a server. The instructor can then review solutions on line without need to download background data many times or review many paper documents (which can be very time consuming).

Building a Standards Based Geocollaboration Tool

As can be seen from the above there is potential for a standards based toolkit that can support both synchronous and asynchronous collaboration. We propose that this system should be built using open standards from the OGC to allow the interoperation of clients and servers from different vendors and to leverage on existing developments in the world of geospatial interoperability.

The OGC specifications which we consider the most useful are

1. WMS, WFS, WCS etc: These are discussed at length in the literature and will only be briefly described in this paper.
2. SLD: The ability to pass out a predefined style to all participants (GeoVISTA Studio) or to allow participants in different countries to view map in their preferred style (e.g. Geologists)
3. Annotation (XIMA): Allows participants to draw attention to interesting parts of the map.

Using XIMA the location associated with the annotation need not be defined internally, instead an external reference can be made to features located in a separate GML document, or indeed, stored in a Web Feature Server. By using references to features stored in an accessible WFS server the annotations can remained linked to the correct feature even if the feature is modified or moved. This is especially useful in a consensus building exercise in which the feature or location under discussion might be frequently updated as part of the decision making process.

To provide a peer to peer type network the collaboration tool should include a server package (e.g. GeoServer) that can publish geographic features, map layers and annotations to other users. Alternatively if a central server is used then the client can be much simpler (e.g. web browser). In either case the client should be able to add annotations to the map(s) that are being worked on, an annotation can be anything from a simple text note to complex content such as video, recorded voice message or existing web pages. The system should allow users to develop their notes and maps in private before publishing them to other users.

The use of open standards has advantages beyond the duration of the collaboration process itself as it allows the final result to be easily distributed to a wide variety of compatible clients or published via the web though the use of a conventional Web Map Server.

References

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