A GEOGRAPHIC DATA EXCHANGE NETWORK FOR EMERGENCY MEASURES ON THE TERRITORY OF MONTREAL URBAN COMMUNITY

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ABSTRACT: The GEOGRAPHIC DATA EXCHANGE NETWORK FOR EMERGENCY MEASURES ON THE MONTREAL URBAN COMMUNITY TERRITORY is a project that has been launched successfully by 5 partners that started it two years ago. The project is described in its three phases, with all its difficulties and successes as a partnership adventure between two regional, one provincial and two federal organisations. It illustrates that the design of public management systems involved is not well suited to such a project and calls for simplification of procedures.

The openness of the system is such that many partners with different geomatic system in their organisations are able to be connected in real time so as to communicate geographic data that are accurate, updated and reliable. The network must perform during an emergency events, but it will be used in planning of emergency measures so as to fill in the system with the necessary data, to familiarize with the operation of the system and to debug it before the emergency arises.

The partners in the project think they have developed an original approach toward the technology applied to emergency measures management, technology that is not supposed to impose itself to the managers but to alleviate the uncertainties related with such situations without any drama or worries about the technology itself.

The management of emergency measures requires an accurate collection of information in order to take the best decisions within a very limited time framework and under high pressure. With means such as cellular telephone, fax, radio communications, information can be gathered, but in a fashion that is often dispersed, divergent, unclear and for the most part difficult to analyse so as to make accurate decisions.

This is why the Emergency Measures Office of the Montreal Urban Community decided in 1991 to use geomatics for the management of emergencies. The EMO has tried two types of software and came to the same conclusion: these systems were not open. They could not communicate with systems of other organisations, even if these organisations had the same software.

When the EMO had to fill up the system with data, we had to import it through different not too practical means: paper support, portable discs, etc. Most of the time, the data was not available with a geographical reference. Very early the conclusion sprung by itself that after having entered the data we needed, it was not possible to update it at a reasonable cost. The EMO would depend on the providers, without being sure that they would update their data at the pace we would need it. So we would have to update it ourselves in some cases at very prohibitive cost in person-hours.

This presentation is about our experience in answering these problems. I will discuss how we developped the project of a geographic data exchange network for emergency measures on the territory of Montreal Urban Community and what this project is up to as of today. I will explain the historical background, the experience of partnering with other organisations and the technical aspects. In a shell, we will see how we succeeded in puting together telecommunications and geomatics.

HISTORICAL BACKGROUND

First of all, we were not alone with the problem I have just described. The Public

Health Unit of the Regional Agency For Health And Social Services and Environnment Canada were in the same situation. Togheter with a provider of software specialised in management of emergency measures through geomatics, we developped in the Fall of 1993 the idea of a joint venture for a network for data exchange in geomatics.

On December 1993, we conveined a meeting of more than 60 persons representing nearly as many organisations related to emergency measures from all levels: federal, provincial governements departments, municipalities, school and college councils, public transportation companies, etc. From there on, five partners decided to form a Steering Committee and obtained a few month later a grant of 63 000 $ on expenditures of more than 146 000 $ from a Joint Emergency Project Program (JEPP) of Emergency Preparedness Canada through Quebec Ministry of Public Security. These two providers of funding were to join the Steering Comittee.

The partners on the Steering Comittee were: Emergency Measures Office of Montreal Urban Community, Public Health Regional Agency, Environnment Canada, Canadian Coast Guard and the Public Transport Authority for Montreal Urban Community. This last one abandonned the project after the first phase. But on the other hand, in the third phase, the Regional Office of the Ministry of Public Security joined as a member.

From May to December 1994, we mandated a firm to realize the first phase of the project which consisted in defining the needs in data of each partner, the data each one was able to supply, the concept of the future network, the estimated costs and the design of the next phases in the project.

From January to March 1995, we went on with the second phase in a partnership agreement with two firms that would provide the partners with a database platform and make a transfer of data between two partners. We made a successful demonstration on april 14 that year at the Canadian Coast Guard base in Quebec.

In April 1995, we recieved the confirmation of our JEPP grant of 102 000 $ on a projected total of 240 000 $ from Emergency Preparedness Canada for the third phase. From

that time on to July 1995, we entered in a period of difficulties.We had to make the tough decision of separating from our private partners. They had separated themselves on a different point of view about the openneness of the system, one confining the communication of data to their software exclusively, the other enabling the software to communicate with other types of software.

In the meantime, we had heard of Geoscope Network, which was a product that seemed to fulfill our expectations of data exchange without being tied up to a specific software. So from October 1995 to March 1996, the Consortium of Intelec Geomatique, LMSoft and Formatek was appointed to realize the third and last phase of development in this project. We will be back later in this presentation on the technical aspects of this venture. Suffice to say that we contracted for 86 000 $ in this phase while we had a projected budget of 240 000 $. The Consortium was also funded on governement grants and most of the development work had already been done. All was left to do was the application of the network they had developped to the field of emergency measures management.

PARTNERSHIP

The whole issue in this project was the will of each partner to really share on an open base all the information that others could need in an emergency situation and for that in the planning process in peace time. For public organisations used to hide information, this is a breakthrough.

But everything has not been easy. The most difficult part was to reach a common understanding of what we wanted, starting with our organisationnal culture which differed substantially: two in the field of direct intervention, two that work at a high level of coordination and one that is between the other two. The important part was the individuals directly implied in the project. The fact that they believed in it was the key factor in the success of the partnership.There was also a great deal of confidence between the partners.

Another part that was most challenging even if very trivial was the financial structure of the project. Our public system is not geared for partnering with the private sector. Even between the public partners the administrative rules and regulations are so far apart that it was a hard task to merge for a common administration of the project. The most difficult part was due to the conditions related to the grants from Emergency Preparedness Canada.

The main point of partnering was the exchange of data. As long as the data were in the hand of each partner it did not cause any problem. But for the data belonging to the larger organisations where the partners were members, the most difficult part arose. Let's take for example Montreal Urban Community with its Geobase (Database of the streets of MUC). The administrative unit responsible for the Geobase was not very keen about letting EMO being an internal partner of this Geobase and then allowing the partners of emergency measures to share it. After long discussions, they accepted to let us share the MUC Database on the following principles:

- That the other parners would have something equivalent to share from their own larger organisation, which became the case with the Provincial and the Federal Government.

- That the Data would only be used for public security purposes in the emergency measures field.

- That the parners would not use the data for any commercial activity inside or outside their own organisations.

- That the other parners would accept to sign an agreement on all of these conditions.

- That this kind of data transfer would not be called free data dissemination, but data exchange on a par with each other.

- That if the network would grow out to eventual private partners (particularily in

the field of risk generators), that all these rules be revised so that at least they would pay a fee for the information they get from the public organisations, unless they would have something equivalent to share.

TECHNICAL ASPECTS

In an overall objective of improving public safety, the partners have agreed to improve the exchange of geographic data using a network system combining Data Base Management System, geomatics telecommunications and hypermedia technologies.

The concept is based on a wide-area system (see Figure 1) connecting a group of data-server nodes managed by each organization and providing replication, and a set of workstations accessing exchange services (inventory, exchange, ordering, etc.).

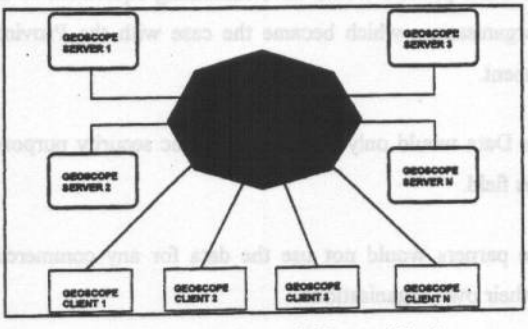

Figure 1: Concept Diagram for Geoscope Network

System development included the installation of a first server using the capabilities offered by the Geoscope Network products (client and server versions).

The system, shown on Figure 2, includes three sub-systems:

1) Data storage and update: this sub-system allows the organizations to store and update the data-sets they wish to share, on the Network.

2) Data access: this sub-system allows users to access the vast amount of data using tools developed to help explore, search and order (on-line or off-line) data. This has been made possible by using Hypermedia concepts. Functionalities of this sub-system correspond to services proposed in the CEOS guidelines for an International Interoperable Catalogue System.

3) System control: this sub-system is used to ensure the data integrity and security of the system.

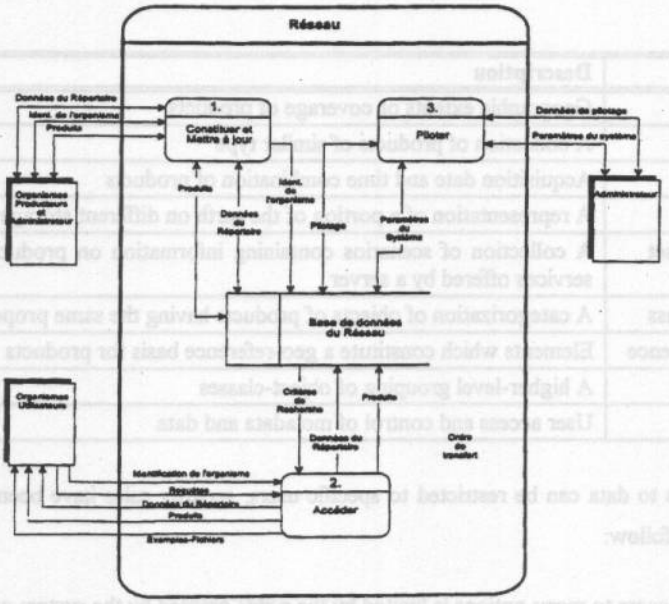

Figure 2 - System model

The system uses a client-server architecture over a Wide Area Network. The server is based on the UNIX Operating System and is accessed using TCP/IP (using LAN, Internet or dial-up lines). Data is managed by the Oracle Data Base Management System.

Users access the server using Windows based clients. The Data Storage and updating sub-system uses Oracle Forms while the Data Access sub-system uses Hyperpage. Hyperpage allows users and data-managers to customize access to the server.

The data model is composed of about 40 entities, regrouping over 550 metadata elements. These elements are correspond to the Canadian General Standard Board specifications for describing digital geographic data-sets. The entities are grouped in nine (9) domains (see Figure 3), a brief description of these domains is presented in the following table.

Domain	Description
Region	Geographic extents or coverage of products
Data set	A collection of products of similar type
Time	Acquisition date and time combination of products
Product	A representation of a portion of the earth on different storage media
Scenario set	A collection of scenarios containing information on products and services offered by a server
Object-class	A categorization of objects of products having the same properties
Geo-reference	Elements which constitute a geo-reference basis for products
Theme	A higher-level grouping of object-classes
User	User access and control of metadata and data

Since access to data can be restricted to specific users, security rules have been established. They are as follow:

- access to menu options is limited by the rights granted by the system manager:
    - High priority: the user has access to every option of the menu. He can insert new data sets or products in the system, create new clients or users,

modify user's rights, and can even modify the system validation tables;

- Data administrator: the user can insert new data sets or products in the system and modify the system validation tables and general parameters (objects, themes, etc.);
- Partner: the user is limited to inserting and modifying data sets and products that belong to the organization he is part of;

- a user can only get information on data sets that have a security level lower or equal to his own security level;

- access to a specific product can be restricted to specific users.

CONCLUSION

Now the project is closed. We have made a test of the system and everything works up to expectations. Our network has to be managed on a regular basis and to keep improving itself over the years. For that purpose we have created a bona fide Association of partners and separated between ourselves some common work that has to be done; like the upkeeping of the shared server and the data management.

On a whole, we have an R&D project of more than 380 000 $ that cost no more than 57 000 $ for each partner over a two year period. This project has allowed the partners to validate both the functional feasibility of exchanging geographic data using Wide Area Network and the technical feasibility of such a venture using a generic catalogue system GEOSCOPE Network.

It has also allowed the partners to experiment a number of proposed standards (metadata, exchange formats, geographic reference, features ,etc.). Over the next months, the system will be used in the real world and expansion will be planned according to findings from

this period. Proposed expansion include additional servers for data replication and system backup and interoperability between servers .

Now one of the most important things is to publicise the system for its expansion to new partners within the region of Greater Montreal, especially the municipalities. This network will be effective only if all the most important partners in sharing the management of emergency measures within our territory are linked to it. This network can also be used anywhere in Quebec and Canada and we hope it will be!