

**THE URBAN NAVIGATOR: A GEOGRAPHIC NAVIGATION INTERFACE
FOR THE INTRANET/INTERNET, TO SIMPLIFY ACCESS TO MUNICIPAL
SERVICES AND INFORMATION FROM THE CITY OF MONTRÉAL**

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People have always endeavoured to develop increasingly efficient means of rapidly communicating vast amounts of information. For centuries, printed maps were the tools of choice, a reliable and relatively inexpensive medium for conveying a huge quantity of spatial and descriptive data. They were once drawn by hand, but today all the steps in cartographic production are handled by powerful computer systems, and may include publication on the Internet.

Access to municipal services and information is an important concern for an organization the size of the City of Montréal, serving over one million residents in its geographic area. Customer satisfaction and the quality of services rendered depend on this accessibility. One of the means of communication that the organization uses is cartographic documents describing the municipal activities and services offered. It was with this in mind that a new cartographic tool, *Montréal à la carte*, was developed for outdoor display in 1993. When the second generation of the product was introduced, in 1996, a printed version for circulation and an electronic version in PDF format on the Internet were added. For the year 2000, a third generation of *Montréal à la carte* and an electronic version in FLASH format were produced.

As part of this initiative, the Urban Navigator (*Le Navigateur urbain*), a new geographic-based navigation system, was introduced by the City of Montréal for its Intranet and Internet clients. This "Urban Navigator" gives any authorized user on-line access to geographic information on the activities and services offered by the City of Montréal. The system uses JMap™, 100% Java client/server technology that allows georeferenced data to be disseminated and consulted using a Web browser such as Netscape Communicator or Internet Explorer, with no other modules. The navigation interface is highly user-friendly and requires no special training. Access to the Urban Navigator is managed through profiles describing the rights and privileges of member clients.

Montréal: an economic and cultural centre

The City of Montréal (Figure 1 – lower island) is the economic centre of the province of Quebec and is located in the eastern part of Canada. At present the city is being redefined, through the merger of some twenty municipalities on the Island of Montréal, surrounded by the St. Lawrence River and Rivière-des-Prairies. The dream of one of Montréal's most illustrious mayors, Jean Drapeau, will come true. The concept of “one island, one city” will take effect on January 1, 2002, nearly 40 years after the idea was first raised. Montréal will then have a population of 1.8 million.

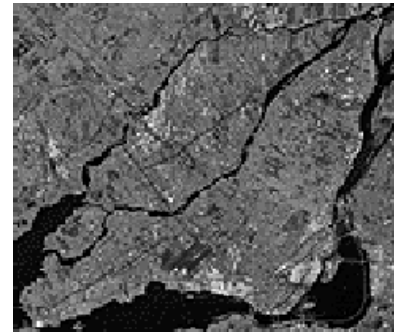


Figure 1: Montreal Island

Outdoor display units

This new situation makes it important that we have efficient means of communicating between the Montréal city administration and citizens. This is not a new goal, of course, and the City addressed this need back in 1993, by setting up a network of outdoor display units (Figure 2) with a neighbourhood map on one side. The map showed the street network, important buildings, the location of municipal services for citizens, tourist and cultural attractions, etc. This first generation of maps was produced for outdoor display only, using FreeHand/MAC software and with the output silk-screened for greater durability.



Figure 2: Urban display unit

“Montréal à la carte”

The second generation was born in 1996, when it was decided to strengthen links with the organization's spatial databases. In future, the data in the bases would be taken from the municipal cartographic production systems. This approach allowed us to give the product a longer useful lifetime. This is when we created “Montréal à la Carte” on the Internet. We made the product available over the Web in the form of PDF files (Figure 3) created with the Adobe Acrobat suite. These pages quickly became popular with visitors to our Website and were the most frequently downloaded pages from the City of Montréal's Website. Their popularity has continued unabated since then.

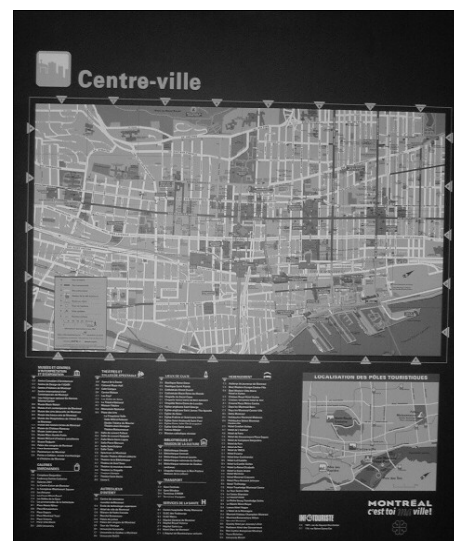


Figure 3: Downtown Montréal map

We also printed some 22,000 colour mini-maps for sale to the public through a network of points of sale, including Accès-Montréal offices. These products were the result of co-operation between the public and private sectors, going back to the first generation in 1993. A new version of these maps is now being produced. It will gradually be made available over the Internet in the form of FLASH files. In addition, these new maps will be printed by means of a direct printing process, for display in the outdoor display units.

While these maps were very informative in their electronic form, they had certain problems. The content was rather static, and difficult to update; each map covered only a specific part of the municipality; the content of the maps had to be reviewed carefully by the designers to ensure that they contained only the type of information that could be shown on the medium; Website visitors needed to install an external module (Adobe Acrobat Reader) on their computers; they also had to download a PDF file (800 kb – 1.2 Mb) before they could use the maps, etc.

The “Urban Navigator”

For all these reasons and many others, it was decided to add an interactive Web dimension to the product. At the very least, the product we were aiming for would have to meet or exceed the following criteria:

- Web technology based on industry standards;
- independent of geographic and descriptive data formats and able to accept CAD/GIS/DBMS industry standard formats;
- independent of the operating systems of physical platforms;
- include an integrated remote administration interface;
- include a complete application programming interface (API);
- not generate any costs for users or require the loading and installation of external modules;
- allow management of access to information by means of secure user profiles;
- use the usual Web browsers (IE and NC) on different platforms;
- fit into the municipal environment and support the existing geographic and descriptive information management philosophy;
- and, needless to say, the system had to respect budgetary and organizational constraints.

The geographic and descriptive information management philosophy

Diagram 1 shows the model adopted for the data flow and the interconnection of the systems involved in distributing data in the client-server environment chosen (Walker & Conry, 2000). We will briefly discuss the major points, below.

- Respect for prerogatives of data owners/producers

Most municipal departments have their own expertise and geographic and descriptive information management systems. The range of expertise and systems may vary widely from one department

to another. The same applies to the use of these systems in relation to the other systems in place. We had to implement a system that would allow access to all this mass of information, without necessarily having to combine it all on one central system.

For this purpose, we turned to the Intranet (Annitto & Elmore, 2000) linking municipal departments. This gives us access to data in the producer's format without interfering with the producer's prerogatives as to how this information is updated. Producers retain complete control over the means to be used to guarantee information quality up to the time it is distributed. For off-line distribution, we reach agreements with them on the frequency of access to the data source.

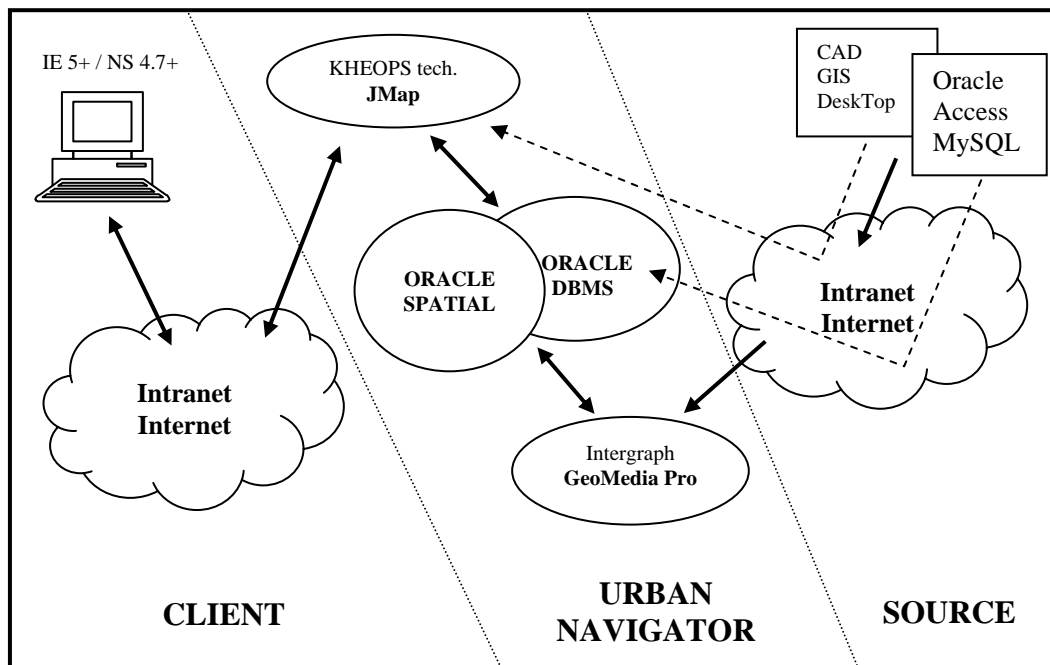


Diagram 1: Data flow between inter-connected systems (Spatial and DBMS)

- Respect for target clients and confidentiality of data

The producer and/or owner of the information tells us what audience it is intended for. In the server portion of the Urban Navigator we set up an access profile with a user name and associated password. The members of a given profile are granted access to geographic and descriptive information of common interest to them. Each case is governed by a specific agreement between the group responsible for the Urban Navigator and the data owner/producer.

- Universal warehouse for spatial data: Oracle/Spatial

The Urban Navigator is based on a group of technologies that co-ordinate with each other to reach our objectives (Markham* & Rix, 1998): an intranet communication network (TCP/IP)

linking the different municipal departments. This network allows us to directly access data on remote systems. Various techniques can be used, such as FTP access, e-mail, access to file servers, etc. This allows us to automate access to the data so that it can be done outside peak network hours.

In the first phase of the Urban Navigator, we are using a spatial data warehouse to store geographic and descriptive data with a unified access method. We chose Oracle for our warehouse (Cory* & Ratchinsky, 2000) and GeoMedia Pro as the spatial warehouse manager. Combining these two tools allows us to manage not only the geographic data but also the associated descriptive data as we wish. Oracle's great versatility with huge databases allows us to easily manage the great volumes of data, and its high-performance data access methods guarantee us that the data will be accessible for as many users as possible in both a corporate and departmental context. Oracle is supported on a SUN machine.

- The universal spatial data warehouse manager: GeoMedia Pro

The manager for the spatial warehouse runs under Windows NT/2000 and allows us to manage all the spatial entities in the different database tables. We can also program the spatial manager to parameterize its behaviour to meet our needs. GeoMedia Pro interfaces with Oracle/Spatial, among others, for the permanent or temporary storage of spatial entities. With the set of GDO (Graphic Data Objects) available in GeoMedia Pro, we can import/export geographic data from all the CAD/GIS systems in use in the City administration.

In the second phase of the project, we will set up spatial warehouses in the other main municipal departments, in co-operation with them. This will give us access to spatial warehouses managed independently by each Department. They will be interconnected with each other in real time over the city's intranet telecommunications network. Consequently, we can avoid having duplicate spatial data warehouses and ensure that the data are completely up to date and of the highest possible quality.

- The spatial Web server: JMap Server

This technology is based entirely on JAVA, on both the server and client sides. The JMap manager can interface with different spatial and descriptive data formats, including Oracle/Spatial. It allows us to list the sources of data resident on files or remote servers. It can be used to manipulate different types of vector and raster data, and allows us to manage data access profiles. The links between the geographic entities and descriptive data for each occurrence are also handled by JMap.

One of the special features of the server is its independence from its own platform. This has definite advantages when it comes time to migrate to more flexible or powerful platforms. It meant that we could migrate the Web server from a Linux platform to Windows 2000 Server with no major problems, in record time and with minimal effort.

- The spatial Web client: JMap Client

The client downloads an applet to his station via his preferred Web browser, either Internet Explorer 5 (with the JAVA virtual machine installed) or Netscape Communicator 4.7 on the platform of his choice. No external module is necessary to use the services of the Urban Navigator (Figure 4).

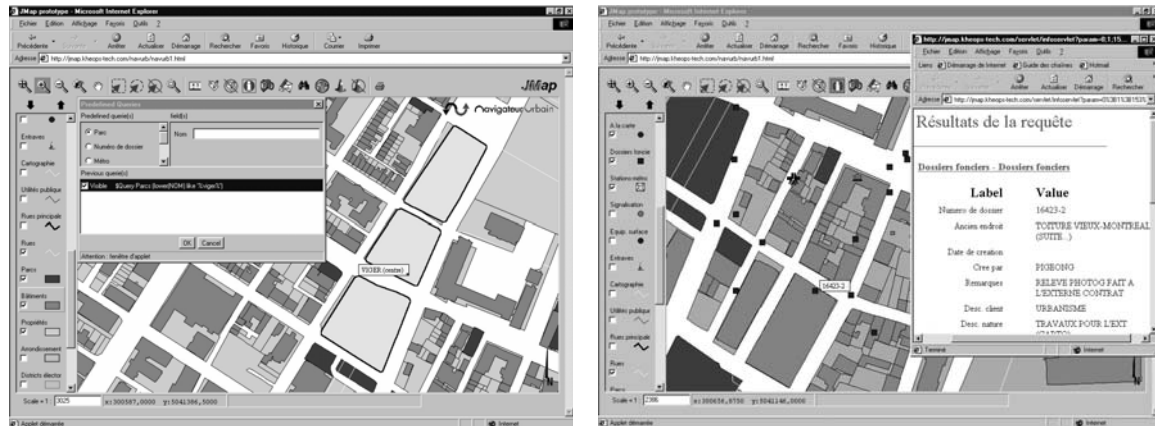


Figure 4 : Navigateur urbain client applet – public profile

When the applet is received and launched, the client must identify himself if he requests access to a secured profile; otherwise, he has access with no other formalities. Since these are vector data that are transferred to the client, rather than raster data (except for the aerial and satellite images), the behaviour of the client applet can be programmed with the API to suit specific needs.

- Applications using geomatic data in real time

In this connection, we are developing a system for managing the issuance of permits to occupy public property (managing street closures), where the JMap server and Oracle co-ordinate to allow the user to view the area in question with different information themes. Then it will be possible to issue a permit while specifying the location concerned, indicating the streets closed and suggested alternate routes. This geographic information is stored in the Oracle spatial warehouse at the same time as the other administrative information applying to the permit issued. The data are then made available through the Urban Navigator for anyone with the proper privileges to access this information.

Information technologies and geomatics go better together all the time

With the advent of technology for storing spatial data in DBMS combined with Web technologies, we are reaching far beyond digital cartography. Geomatics has become accessible in real time, in the same way as conventional database applications. It deals with the spatial aspects of objects managed by the organization, and does so in a way transparent to the user. The geographic aspect is becoming an indispensable component of management and decision-making tools.

The Urban Navigator and the system for issuing temporary permits for occupying public property are just some of the first applications of “geomatic engineering” for a municipal organization. It is both a particular means of expression (spatial aspect) and an opportunity for re-engineering (Hardester, 2000) allowing us to see in a new light some things that we have always taken for granted and seen as commonplace. The future of organizational systems will certainly never be the same, as it is increasingly shaped by geomatic engineering.

You can consult the public profile version of the Urban Navigator at <http://www.navurb.com> or by activating it on the Website of the City of Montréal, at <http://www.ville.montreal.qc.ca>. Have fun exploring Montréal!

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