

City of Kingston, Ontario, Canada

Right Tool Right Job – Migration from CAD to GIS

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Paper Abstract

The city of Kingston in Eastern Ontario, Canada has implemented an enterprise Web GIS system aimed at increasing local economic development, improving local government efficiency, and increasing access to land information. Over several years many divisions within the city acquired GIS and CAD-related software/hardware, converted data, and acquired or developed applications to support various needs within their groups. This presented many problems including lack of resources to maintain data and duplication of efforts in maintaining multiple datasets. To ensure GIS technology was established as an integral part of Kingston's business and to facilitate movement away from isolated planning and implementation of GIS initiatives, the city selected ESRI as the standard for its enterprise GIS platform with Orion Technology's OnPoint Software as its Web GIS program. This paper will focus on the data issues related to migrating from AutoCad to ArcSDE, staff training, creating standards associated with the migration, and providing Web GIS solutions to overcome data sharing issues.

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The Situation

The City of Kingston, Ontario is considered one of Canada's top 25 cities, and the hub of eastern Ontario. With a population of 113,000 and growing, Kingston is considered the fresh-water sailing capital of North America and is a major port for cruises of the scenic Thousand Islands. With its growing population base and booming tourism industry, the City of Kingston was looking to develop a GIS system that would help them to increase local economic development, improve local government efficiency and increase access to land information for both internal and public users. They wanted a GIS program that would be enterprise focused and designed to integrate into the varied business requirements of all divisions across the city.

In the early 1990's the City's Planning and Development Department and the Public Utilities (PUC) shared the first GIS initiative, based on the Hunter GIS system. The City component consisted of some spatial datasets; however, GIS as a system did not reach a fully functional level. While the PUC made progress with the Hunter GIS package, creating a first version of a fully functional GIS in 1994, the City renewed its interest in GIS in 1997 and began building some linkages into its sewer infrastructure data as well as its sewage video inspection data. In 1998, a GIS Group was established under Strategic Planning to assume responsibility for all GIS activities within the new organization. This group adopted the Autodesk GIS framework as the City was already using these products and had staff with appropriate skills and training. From 1998 to 2002, the focus of the GIS Data Services Group was to build and maintain spatial datasets, to develop and implement a Web based Intranet GIS viewing application, and to provide mapping services to other departments of the City. In late 2000, as part of a reorganization, the GIS Data Services Group was integrated with the Information Systems division. In 2001, the City retained Prior and Prior (P&P) to conduct a GIS needs assessment, interviewing over 50 Kingston employees through a combination of individual and group interviews. In 2004, the City built upon the recommendations of the P&P report and commissioned EMA Canada to prepare a management report, making recommendations on technical architecture, GIS data conversion requirements, hardware and software procurement, recommended support structure and staffing, and GIS budget and related cost justification.

The Challenges

The 2004 Implementation Plan identified a number of challenges, finding that over 80% of the data necessary to support Kingston business needs was spatially related with a large portion being paper based, particularly for infrastructure related data. The study also found that GIS was

being used mainly to support traditional mapping functions and not core business needs, and that most divisions had a limited understanding and awareness of GIS and the function of the GIS Data Services Group. Additionally they found that instead of sharing common spatial data, many groups indicated that they duplicated efforts by updating their own versions of a similar data set and maps. As well, a number of divisions had, over the last several years, acquired GIS and Computer Aided Drafting (CAD) related software and hardware, converted data, and acquired or developed applications to support various needs within their respective groups. However, most divisions lacked the resources to maintain their data and were forced to manage their operations with out-of-date data. The GIS Data Services Group within the IS Division, in addition to staff performing GIS functions in other areas, were focused to a great extent on providing both paper and on-line mapping services to internal City departments. As such, GIS staff in all areas were more skillful in providing mapping related services than in assessing and analyzing end-user business requirements and programming applications. Staffing the data maintenance workload was an ongoing issue, resulting in large backlogs, and maintenance of data occurring on a priority basis only. They also found there was inconsistent data quality and currency because of varying standards for spatial data.

Choosing a System and Securing Funding

Based on their findings, EMA ultimately recommend migrating to a comprehensive Enterprise GIS designed to integrate into the varied business requirements of all divisions across the City. The Enterprise GIS would ensure that GIS technology would be an integral part of Kingston's business and facilitate the movement away from, or prevention of, isolated "stove pipe" planning and implementation of GIS initiatives. As part of this migration, EMA made a number of recommendations related to staffing, software, hardware, data and training. ESRI was selected as the core GIS framework for the city, providing the building blocks for establishing GIS applications and tools that would be used by the City of Kingston end user community.

The City chose to implement ESRI's suite of ArcGIS products including ArcEditor, ArcSDE, and ArcIMS for their enterprise GIS. The City chose ArcSDE within an Oracle environment to serve spatial data to the enterprise, along with ArcEditor seats for the display, query and maintenance of GIS data. ArcIMS provided the foundation for distributing dynamic maps, GIS data and mapping services via the Intranet/Internet. A core group of GIS users received Certified ESRI Technology Training to support the enterprise GIS implementation and maximize the power of GIS.

Orion Technology Inc., an ESRI Business Partner that provides web-based GIS applications built on ESRI's ArcIMS, was selected to support a citywide web-GIS portal. OnPoint™, Orion's off-

the-shelf web-GIS software product, was chosen to transition the City's existing intranet GIS site to a new GIS Web Portal, as well as for an internet web-GIS system to provide quick and easy access to the City's GIS data for external users.

To help realize the 2004 EMA Implementation Plan, the City applied for government funding (GeoSmart) and was awarded \$396,000 of matching funding to put toward realizing their GIS goals. As part of the GeoSmart Program, the city secured vendor partnerships from Orion Technology, ESRI Canada, Mapcon Mapping and Zycom Technology. With funding secured, the City was able to begin their Enterprise GIS implementation which was to take place over a 5 year period.

Hardware and Software Implementation

The City's GIS Data Services Group envisioned an enterprise system that would give both expert and casual users seamless access to mission-critical data in a variety of spatial and non-spatial formats. As a result, Orion Technology was contracted to build a data warehouse to integrate the various data sources containing spatial data. Orion oversaw the modeling of a new geodatabase, the migration of the entire dataset of spatial data, and the development of custom applications to automate some of the routine tasks associated with data updates to the GIS. The migration effort was complicated by the fact that the context of the project resulted in more than a simple data migration. All new web-based GIS applications and server architecture also had to be fully configured by Orion to work with the new geodatabase.

Phase I of the data migration focused on data conversion. At the start of phase I, it was soon evident that the existing City AutoCAD data lacked accuracy and the desired attribute information. The data acquired from external agencies also did not meet the standards of accuracy that were sought by the City. Much of the data had to be researched, recreated and/or adjusted to meet the City's needs. Although this process was time consuming and expensive, it facilitated data maintenance efforts that required the City to reevaluate their current methodologies and figure out better ways to manage the data to improve accuracy and accessibility.

Phase II of the migration focused on the tasks of installing and configuring the necessary information architecture. The integrated information architecture enables data sharing among the various business systems through an enterprise database management system. Oracle's 10g Relational database, together with ESRI's Spatial Database Engine (SDE) and ArcIMS technologies, carefully integrated with other products and applications, constitute the basic framework of the integrated information architecture. The integrated information environment brings together data from systems that manage information on all facets of City government,

including utility services, transportation, planning, land records, licenses, buildings, parks, police, fire, and emergency services. The City of Kingston GIS server architecture grew from one server to seven servers as part of this implementation.

With the infrastructure in place, Phase III focused on the implementation of the Kingston web-GIS portals through its OnPoint product suite. Three separate web-GIS portals were implemented:

1. “*KMaps*” web-GIS for the public – The city launched a unique and intuitive public web-GIS with a wealth of information for residents and tourists. Users can search for an address or intersection; find specific facilities or search for facilities near a particular address. Using drop down menus, Users can quickly and easily navigate to information on tourism, electoral districts, neighborhoods, and city services like recycling, garbage and snow removal among others.
2. “*KingMaps*” web-GIS for City staff – Orion’s OnPoint Professional provides users with live access to data stored in the centralized geodatabase and the ability to export and print maps for reports and presentations, query attribute data, buffering and notification. Web-based administration tools make it easier to maintain and update the system. This application also enables linking to external databases such as the Vailtech tax system, Cityview permit and licensing system and Cartegraph Asset Management Solution.
3. “*KEDCO’s Available Properties Search*” economic development - The City implemented Orion Technology’s OnSite™ Software, an Economic Development Tool and extension to OnPoint™ that allows visitors to search available properties in the City and to obtain site reports detailing zoning, utilities and other information. It also displays demographic information for a particular site or for a user specified radius around the site and generates business reports presenting a categorized listing of existing businesses within a user specified radius.

The Result & Future Directions

With help of GeoSmart funding and vendor support, the City of Kingston migrated to a sophisticated web-based enterprise GIS in the span of one year. The resulting Enterprise GIS implementation is a streamlined system whereby GIS supports organizational goals and objectives; improving the efficiency and effectiveness of City operations and enhancing investments made in digital data and GIS technology. In the future, a number of additional major business processes will be significantly supported by the enterprise GIS Program. While some of them have already been incorporated, the balance of these functions is more long-term and will come online as the system continues to develop. Some of these key business processes include,

parcel mapping and land management, address management, asset management, property ownership and valuation, property owner and customer notification, site assessments and selection, permitting and inspections, complaint management, public safety and emergency response.

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