

Implementing an Election Management System

Desktop, Web Services, and Web Applications subsystems handle process

The province of Ontario in Canada wanted a comprehensive approach to managing the elections. The Election Management Solution (EMS) was built by a partnership of companies. See the companion article, "Geocentric Approach to the Election Process—System ties one voter to one address for one vote," for an overview of the development of EMS.

The Election Ontario (EO) project required the development of an enterprise-wide system for managing provincial elections for Canada's most populous province, Ontario. Key players in the project are Navantis Inc. of Toronto, Ontario, Canada, as the prime contractor; ESRI business partner Orion Technology Inc. of Markham, Ontario, Canada; and Microsoft.

The project began in July 2005 and was delivered to the elections agency for the October 10, 2007, Ontario provincial election. EO's objective was to develop an innovative, cost-effective EMS that would integrate all its electoral processes and procedures, raise the bar for this type of system by using leading-edge technology and supplying ongoing sustainability, and provide:

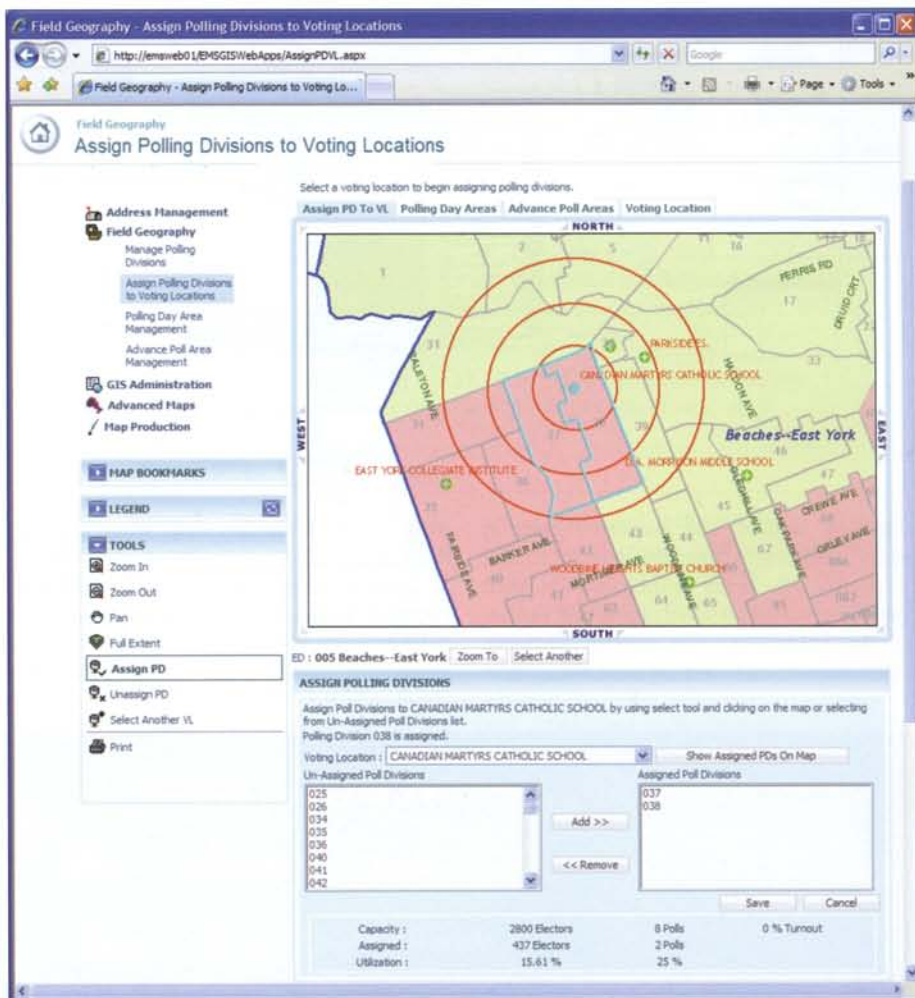
- Electoral event administration
- Elections finance administration
- Permanent Register of Electors (PREO)
- Legislative services
- Education, training, and information
- Administrative support

The team (Navantis, Orion, Microsoft) provided an integrated cost-effective solution with a 15-year vision that would supply proven and effective practices and systems and a robust service-oriented architecture. It would be XML based and would integrate business processes with internal and external systems and allow for future growth and planning. This solution would empower EO to achieve process excellence by providing outstanding infrastructure for maintaining a PREO and leveraging partners such as Elections Canada and Municipal Property Assessment Corporation (MPAC).

EMS Design Overview

EMS was designed as an end-to-end solution. It manages all facets of the election process from election preparedness, preevent, and postevent operations to election results delivery.

Orion was the geospatial technology subcontractor for Navantis. While developing the solution, Orion spent time with EO to understand its issues and vision. Orion leveraged its experience with building large-scale GIS solutions for clients worldwide when architecting the EO geospatial subsystems. The



The Field Electoral Geography Web application provides Web-based capabilities to search on, map, and edit electoral geography such as polling divisions and voting locations.

ESRI GIS software used in this solution included ArcSDE 9.1 for SQL Server 2005, ArcGIS Server 9.1 Enterprise edition, ArcIMS 9.1 for Windows, and ArcGIS Desktop 9.1. Much of the solution involved extending Orion's core products to EO's specific needs. The Orion team worked on the following aspects of the solution.

- Designed and built the geodatabase in partnership with Navantis
- Developed complex extract and translate (ETL) scripts for migrating spatial and nonspatial data and updating migrated data with data received from partners
- Deployed Orion's OnPoint application for publishing GIS over the Web
- Developed Web-based GIS tools for field elector and electoral geography management

- Developed Web services for exposing spatial functionality to applications

Given the province's wide distribution of users for this system, Orion provided three subsystems: Desktop, Web Services, and Web Applications. The Desktop subsystem handles data management and quality assurance. The Web Services subsystem handles data loads from EO partners and provides the Find Web control. The Web Application subsystem manages address and electoral geography data, supplies the Where do I vote and interactive maps, and supplies cartographic-quality map production. Data security was also an important issue. In order to operate intuitively, given data inconsistencies (especially the many variations in addresses), the data model and application were designed with significant complexity.

Desktop Subsystem

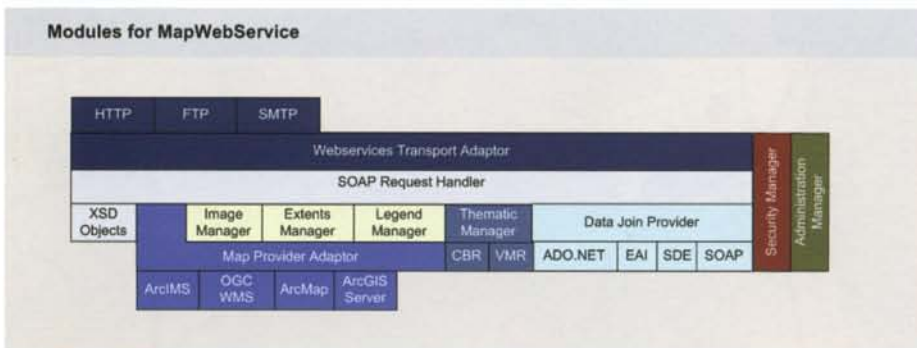
Tools in the Desktop subsystem were developed for

- Finding addresses, electoral districts, polling divisions, parcels, streets, and places
- Interactive editing
- Edit queue browser
- Street analysis
- Place analysis

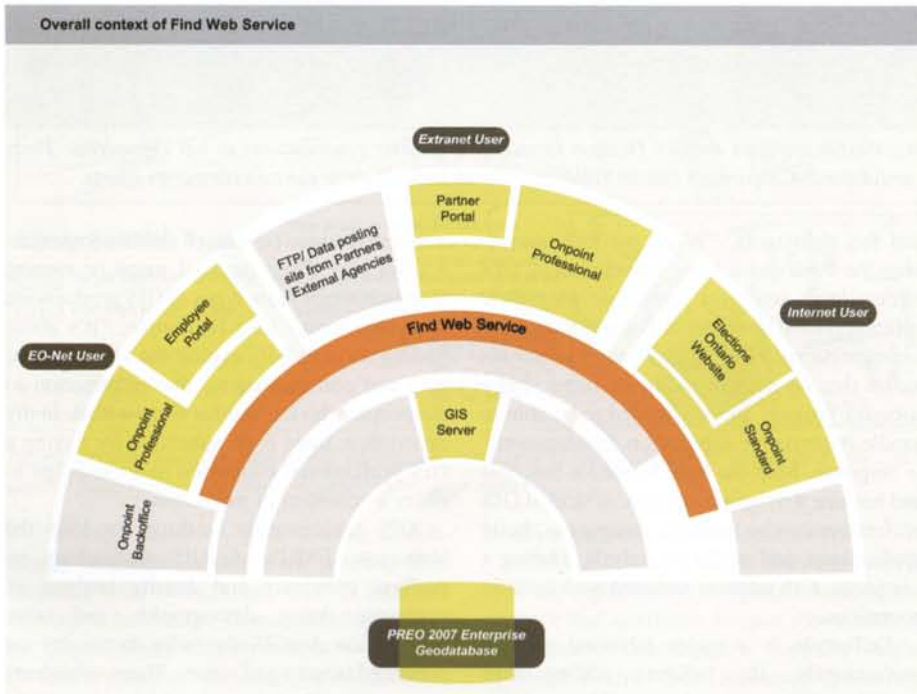
- Electoral geography management
- Cartography management

The EMS-EditAddress tool is an example of one of the EMS Desktop tools. These tools include custom object inspectors that provide a sophisticated attribute editing environment for the address, street, place, and electoral geography feature classes. When editing address attributes, the street and place attributes

can be derived from the address geometry or populated via a lookup. This window also allows users to validate the address using a configurable set of rules. The rules provide the ability to verify attribute values against lookup tables and spatially related features (e.g., street segments, land parcels, and places).



MapWebService is a SOAP-based document-style Web service that allows external applications to request maps from the enterprise map server without having to add infrastructural support for Web GIS applications. This diagram shows the modules of MapWebService.



Find Web Service is a SOAP-based document-style Web service that supports searching in an enterprise geodatabase using attribute and spatial queries. The Find Web Service results can be returned as a SOAP response that can be parsed by client applications and displayed to end users.

Web Services Subsystem

Web services are an important part of the overall solution architecture. To support the Web Application subsystem, the following Web services were developed:

- Find Web Service
- Edit Web Service
- Parse Web Service
- Location Web Service
- Maintain Web Service
- Version Web Service
- Membership Web Service
- Map Web Service

Find Web Service is an example of one of the Web services created for EMS. It is a SOAP-based document-style Web service that supports searching in an enterprise geodatabase using attribute and spatial queries. The Find Web Service results can be returned as a SOAP response that can be parsed by client applications and displayed to end users. Find Web Service was built as an infrastructural element capable of searching across data in production as well as data that was yet to be verified by EO staff. Find Web Service was integrated with the public-facing EO Web site; extranet applications for partner agencies, political parties, and media; and Web-based elector management tools.

Web Applications Subsystem

Web applications developed for EMS included

- EMS Web GIS Application
- Elector Management
- Location Management
- Event Management
- Address Inquiry Web Applications
- Address Management Web Applications
- Field Electoral Geography
- Where Do I Vote?
- Interactive Maps

Interactive mapping applications, such as the Polling Division Management application, provide Web-based capabilities to create map markups and generate individual cartographic print-quality maps using predefined templates.