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CGDI Interoperability Pilot
Concept Plan, Initial Architecture, and RFQ/CFP

Warning

This document is a draft for Pilot participant review.

OGC Document Number 07-xxx

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1 Revision history

Date	version	Editor	Primary clauses modified	Description
August 2006	0.1	GeoConnections: Leah Howes, Mike Adair, Paula Rojas	0 to 3.2 3.3	Writing of sections 0 to 3.2 Writing of section 3.3
Sept. 7, 2006		Mike Adair		Added use cases #1 and #2
Oct. 3, 2006		Paula Rojas		Updated Project Schedule of Activities
Jan. 12, 2007		Matt Stella		Updated Schedule & Table of Contents
Feb. 21, 2007	0.2	Mike Adair, Joshua Lieberman		Re-formatted and expanded as OGC Pilot Concept Plan
Mar 1, 2007	0.9	Joshua Lieberman, Raj Singh		Complete Concept Plan draft
Mar 6, 2007	1.0	Terry Fisher		Minor updates to schedule of activities & Use Cases

1 Introduction

This concept plan outlines the context, goals, and essential concepts of the CGDI Feature Interoperability Pilot (CGDI IP). The CGDI IP will examine the suitability and performance of distributed Web Feature Service implementations for providing national access to provincial and local data and supporting applications such as the GeoBase Portal. Three use cases and supporting workflow are provided to motivate design of the pilot. The use cases involve both feature access and feature update capabilities, as well as associated OGC Web Service implementations such as Web Map Server. The organizational concept of the CGDI IP involves coordination assistance from the Open Geospatial Consortium together with federal GeoConnections organizations supporting a central GeoBase node / portal, as well as provincial / specialist data partners. Commercial partners will also be solicited to provide and deploy hardware / software as well as collaborating on the final technology design for the pilot network.

2 Reference Documents

The following documents are referenced in this document. In all cases the latest version of the referenced document will be used.

- OGC Intellectual Property Rights Policy and Procedures
- OGC Reference Model.
- OGC Adopted Technical Baseline.
- The OGC Interoperability Program
- ISO/IEC 10746, Information technology — Open Distributed Processing — Reference model (RM-ODP).
- IEEE Std 1471-2000 IEEE Recommended Practice for Architectural Description of Software-Intensive Systems
- AMEC, 2006 "Web Feature Services, Considerations for CGDI Government Partners" version 1.0
- Percivall, George. 2005 "OGC Interoperability Program Concept Development Policies and Procedures" (also available from http://www.opengeospatial.org/ogc/policies/ippp)

3 Glossary of Terms

3.1 Abbreviations and Acronyms

AMEC – AMEC Earth and Environmental Technology Business Unit

CCOG – Canadian Council on Geomatics (provincial/territorial agencies)

CGDI – Canadian Geospatial Data Infrastructure

IACG– Inter-agency Committee on Geomatics (federal agencies)

IP – Interoperability Program – a global, innovative, hands-on prototyping and testing program designed to accelerate interface development and validation, and bring interoperability to the market

NRCan – Natural Resources Canada

OGC – Open Geospatial Consortium Inc.

WFS – web feature service

3.2 Definitions from IEEE 1471-2000

acquirer: An organization that procures a system, software product, or software service from a supplier. (The acquirer could be a buyer, customer, owner, user, or purchaser.)

architect: The person, team, or organization responsible for systems architecture.

architecting: The activities of defining, documenting, maintaining, improving, and certifying proper implementation of an architecture.

architectural description (AD): A collection of products to document an architecture.

architecture: The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.

life cycle model: A framework containing the processes, activities, and tasks involved in the development, operation, and maintenance of a software product, which spans the life of the system from the definition of its requirements to the termination of its use.

system: A collection of components organized to accomplish a specific function or set of functions.

system stakeholder: An individual, team, or organization (or classes thereof) with interests in, or concerns relative to, a system.

view: A representation of a whole system from the perspective of a related set of concerns.

viewpoint: A specification of the conventions for constructing and using a view. A pattern or template from which to develop individual views by establishing the purposes and audience for a view and the techniques for its creation and analysis.

3.3 Other Terms

4 Purpose of Concept Development (IEEE 1471 Excerpt)

A system has one or more stakeholders. Each stakeholder typically has interests in, or concerns relative to, that system. Concerns are those interests which pertain to the system's development, its operation or any other aspects that are critical or otherwise important to one or more stakeholders. Concerns include system considerations such as performance, reliability, security, distribution, and evolvability.

A system exists to fulfill one or more missions in its environment. A mission is a use or operation for which a system is intended by one or more stakeholders to meet some set of objectives.

Every system has an architecture, in the terms of this recommended practice. An architecture can be recorded by an architectural description.This recommended practice distinguishes the architecture of a system, which is conceptual, from particular descriptions of that architecture, which are concrete products or artifacts. Architectural descriptions (ADs) are the subject of this recommended practice.

In the conceptual framework of this recommended practice, an architectural description is organized into one or more constituents called (architectural) views . Each view addresses one or more of the concerns of the system stakeholders. The term view is used to refer to the expression of a system's architecture with respect to a particular viewpoint.

Other information, not contained in any constituent view, may appear in an AD, as a result of an organization's documentation practices. Examples of such information are the system overview, the system context, the system stakeholders and their key concerns, and the architectural rationale.

A viewpoint establishes the conventions by which a view is created, depicted and analyzed. In this way, a view conforms to a viewpoint. The viewpoint determines the languages (including notations, model, or product types) to be used to describe the view, and any associated modeling methods or analysis techniques to be applied to these representations of the view. These languages and techniques are used to yield results relevant to the concerns addressed by the viewpoint. An architectural description selects one or more viewpoints for use. The selection of viewpoints typically will be based on consideration of the stakeholders to whom the AD is addressed and their concerns. A viewpoint definition may originate with an AD, or it may have been defined elsewhere. A viewpoint that is defined elsewhere is referred to in this recommended practice as a library viewpoint . A view may consist of one or more architectural models . Each such architectural model is developed using the methods established by its associated architectural viewpoint. An architectural model may participate in more than one view.

5 Concept Background

Commissioned to research WFS in the context of data management and dissemination, AMEC provided a report to NRCan detailing considerations for accommodating this new capability into the CGDI. Their review consisted of the WFS Standard (OGC/CGDI), how government organizations have implemented it and the resulting business and technical implications. Recommendations made in the 2006 report, "Web Feature Services, Considerations for CGDI Government Partners" included taking primary steps to properly adopt and effectively use WFS within the CGDI. Providing the implementers of WFS technology with a detailed operational architecture, compliancy tools and guidelines was the suggested starting place. In spring of this same year, some CCOG members had approached GeoConnections to enhance their current services in order to provide framework data to GeoBase in a distributed environment. As a follow-up to the AMEC report and CCOG requests, GeoConnections invited CCOG and IACG members to participate in an OGC pilot project to address the recommendations outlined in the report.

5.1 AMEC Recommendations & Considerations for WFS Implementation

1. **Performance**: WFS differs from WMS in that it contains attributes as well as features and therefore can contain more information than other OGC services. A server response will include attributes and geographic features sent in a vector format. It is the volume of information communicated that makes WFS valuable to users but requires more time for data processing. Size of area, density and complexity of the vectors in addition to the number of attributes associated with each vector effect WFS performance. AMEC has recommended implementation of a WFS cascading cache to address these issues.

2. **Version and Data Updates**: Both WFS 1.0.0 and 1.1.0 are currently endorsed by the CGDI, however the later is considered to be the new benchmark for vector based interoperability. This is based on the ability of 1.1.0 to separate geometry and attributes, an important factor in data maintenance. Most maintenance consists of updating attributes as opposed to geometry changes. This enables updates from a remote location will be associated to the geometries of locally hosted data.

3. **Security**: AMEC recommended further investigation detailing the impacts of a new services security architecture based on the peer-to-peer model and certificate authorization. However, security issues are out-of-scope for this pilot and will not be addressed. There is an OGC testbed activity taking place which will help to define the GeoDRM specifications for security.

4. **WFS Pilot Dataset Focus**: WFS 1.1.0 has an aptitude to handle transactional updates and maintenance of attribute information. Attribute data is created and stored in a vector format. AMEC has recommended that WFS should be implemented by organizations that maintain vector data and that initially it should be used for data process, transfer and access interface, not for client application interfaces.

5.2 Scope of Pilot Concept

For the CGDI, AMEC suggests relating WFS use back to specific functional processes where exchange of vector data and attributes results in maintenance of distributed data nodes. A WFS service which has been largely successful is the Geographic Names of Canada, which focused on point geometry. Based on this knowledge, the WFS pilot project proposed by GeoConnections in conjunction CCOG members will focus on three vector-based themes of data:

- Geographic Names;
- National Road Network;
- Administrative Boundaries

GeoConnections has outlined that the scope of this project to include:

- Testing and reporting on the viability of implementing WFS servers, identifying issues to be addressed in an operational environment such as performance, data volumes etc;
- Assessment and validation of the operationalization of a distributed access to framework (GeoBase) data;
- Establishing a pre-operational capability;
- Presentation of results to the project participants;
- Communication of the results to the Data Dissemination operational systems team responsible for the GeoBase portal
- Nominal implementation of geo rights framework including acceptance of a license text prior to downloading data from the portal, and identity-enforced WFS transaction rights.

For this pilot project, testing will occur in the following areas:

- Access by users to “closer to source” data;
- Transactional updates provided by data suppliers;
- Use of WFS services to support end-user online applications.

5.3 GeoConnections Objectives:

The renewed GeoConnections program is primarily focused on enhancing and applying the CGDI. This opportunity for working in collaboration with the OGC and provincial partners will address a common request for implementing WFS in the CGDI. This project intends to demonstrate and test the implementation of WFS for the distribution and updating of framework data, thus providing users with access to the most current and authoritative data.

5.4 CCOG Benefits:

Provincial partners have communicated interest in establishing WFS as a means to provide data that is distributed and closest to the source. As source data providers for GeoBase, provincial stakeholders will receive support with the implementation of onsite WFS, both in a technical and business sense. Assistance will be made available in the forms of financial contributions for labour, software, and data publishing. This will allow providers to maintain control over the data they own contributing at the same time to a national view.

Project results will aid CCOG members to plan the future operational implementation of distributed architecture for GeoBase management and distribution.

5.5 CGDI Benefits:

Implementing a distributed WFS will provide the following benefits to the CGDI user community:

- Access to data and information from a point closest to its source, thereby maintaining currency, avoiding versioning, and minimizing duplication;
- Timely and orderly propagation of geodata and metadata across the nodes of the WFS network, especially between local / regional WFS nodes and a central GeoBase node.
- GeoBase web services which support diverse and widely "globally" distributed end client applications.

5.6 GeoBase Benefits:

Data users require authoritative geospatial information, accessible closest to the sources, in order to make timely and effective decisions. Evolving the GeoBase portal to be more distributed and making maintenance transactions more efficient will help to meet user requirements. This is realized through the development of partnerships, data standards and encouraging sharing. Working with data providers for the maintenance of framework data available through GeoBase is a priority for GeoConnections.

6 Pilot Concept Overview

This project will provide the following:

1. Data publishing servers: distributed publishing of GeoBase Framework data, from provincial sources (this will be done by establishing WFS servers at provincial sites);
2. Data access portal: portal access to the WMS server data (this will be done via WFS client and may also include a catalogue/discovery function);

3. Catalogue/repository: metadata repository used to “discover and evaluate” data and associated services uses within the pilot;
4. Best practices for future implementation of WFS servers and distributed WFS networks.

6.1 OGC Pilot Project Objective:

The objective of an OGC pilot is to create an environment where collaborative efforts apply OGC specifications to technology implementation in the real world. This is achieved by using existing, not emerging specifications, in this case WFS. The intent is to deliver a “near-operational” systems environment through delivery of technology via an OGC solicitation to industry (Call/Request for quotation).

6.2 Phases of an OGC Pilot Project

6.2.1 Concept Development

Determine needs, use cases, general architecture, general specifications, defining the pilot

6.2.2 RFQ/CFP Development

Architecture needs, requests to industry, evaluation of proposals

6.2.3 Kick-off

Plan for development and demo

6.2.4 Execution

Developing components, testing, integration

6.2.5 Deploy

Demo, pilot close, documentation of activities / outcomes / recommendations, operational pilot stage

7 Pilot Partner Participants

Organization	**Name**	**Contact**	**Use case**
Alberta Government	Phil Mackenzie Craig Barnes	Phil.Mackenzie@gov.ab.ca	#1, 2, 3
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Newfoundland and Labrador Government	Neil MacNaughton	nmacnaug@mail.gov.nf.ca	#1,2

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Ontario Government – Public safety community	John Galea	John.Galea@jus.gov.on.ca	#3
Saskatchewan EMO – Public safety community	Murray Sanders	msanders2@cps.gov.sk.ca	#3
Public Safety and Emergency Preparedness Canada – Public safety community	Ian Becking	Ian.Becking@PSEPC-SPPCC.gc.ca	#3

8 Proposed Pilot Schedule

GeoConnections WFS Pilot Project SCHEDULE of ACTIVITIES			
Project Initiation			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Initial meeting b/w GeoConnections, CCOG & IACG partners	GeoConnections	06-Jun-06	yes
Meeting b/w OGC Director, GeoConnections and interested CCOG partners	GeoConnections & OGC	08-Jun-06	yes
Individual telcoms b/w potential CCOG participants & GeoConnections	GeoConnections	July 13-31, 2006	yes
Proposal Template for CCOG/IACG members	GeoConnections	Sept 06 – March 07	yes
Letter of Participation Template for CCOG/IACG members (IN-KIND only)	GeoConnections	Sept 06 – March 07	yes
CCOG/IACG Proposal Completion CCOG/IACG Letter of Participation Completion	CCOG/IACG members, GeoConnections CCOG/IACG members, GeoConnections	March 2007 March 20007	
Agreements for Data Providers (CCOG/IACG)	GeoConnections	April 2007	
PHASE 1: OGC Pilot Project **Concept Development**			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Concept Development Document: Use Requirements Use Cases Architecture Operating Environment	GeoConnections CCOG, IACG,OGC	July 06 – March 07	yes yes yes initial

GeoConnections WFS Pilot Project SCHEDULE of ACTIVITIES			
PHASE 2: OGC Pilot Project **RFQ/CFP Development**			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Partners' Meeting	OGC, GeoConnections	March 28, 2007	
Release of RFQ/CFP	OGC, GeoConnections	April 2, 2007	
Bidders' Meeting at OGC TC Mtg	OGC, GeoConnections	April 18, 2007	
RFQ/CFP Responses Due	OGC, GeoConnections	April 25, 2007	
Technical evaluation of proposals/Meetings	OGC,GeoConnections	April - May 2007	
Selection of Contractors/Negotiation	OGC,GeoConnections	May 15, 2007	
Agreements with selected developers/contractors	OGC,GeoConnections	Jun, 2007	
PHASE 3: OGC Pilot Project **Kick-Off**			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Plan for development and demo	GeoConnections, CCOG, IACG, OGC	Jun 26-27 2007	
PHASE 4: OGC Pilot Project **Execution**			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Developing components, tests one-one, integration	CCOG/IACG GeoConnections, OGC	May-Sept 2007	

PHASE 5: OGC Pilot Project Deployment-Operationalization			
Task/Activities	**Leader/Collaborators**	**Start/End Date**	**Completed**
Demonstration	OGC, CCOG/IACG, GeoConnections	Oct 24-25, 2007	
Project close: reporting, best practices	GeoConnections, OGC, CCOG/IACG	November 15, 2007	
Operational Pilot Stage	CCOG, IACG, GeoConnections, OGC	March 31, 2008	

9 Initial CGDI Pilot Architecture

9.1 Enterprise Viewpoint

The enterprise viewpoint describes business perspective, purpose, scope and policies.

9.1.1 Overview

The goal of this project is to reduce the cost, effort, and complexity associated with shared spatial data management and delivery to stakeholders. There are two general cases under consideration. The first is one where data is needed on a seamless, nationwide level. The second is where data is needed at a larger scale—a region within a province, or a single municipality—and richer information is required than what is provided in the aggregated, nationwide product. In all cases, the goal is to make these data products represent the most current information available, and have them available digitally and immediately upon request.

The CGDI "enterprise" consists of: data providers at the federal, provincial, and municipal levels; various other public agencies, commercial firms, and the public. Stakeholders in this Pilot include the data providers and users above, plus software vendors and systems integrators who will aid in building out this spatial data infrastructure.

9.1.2 Stakeholders and participants

9.1.2.1 Data providers

GeoConnections Canada

Natural Resources Canada

Public Safety and Emergency Preparedness Canada

Statistics Canada

Saskatchewan Government

Alberta Government

Newfoundland Government

Government of Ontario

Saskatchewan EMO

Gouvernement du Québec

Government of Nova Scotia

Government of Ontario

Government of Alberta

Government of Ontario

9.1.2.2 CGDI

The Canadian Geospatial Data Infrastructure (CGDI) is the underlying foundation needed to share geographic information (e.g. maps, satellite images) over the Internet. It consists of four key components:

- National framework data
- Common data policies
- Technical standards
- Enabling technologies

The CGDI supports the shared decision making necessary for resolving many horizontal and inter-jurisdictional challenges. With its four key components, the CGDI serves as a common foundation for key government information systems, as well as for third-party service delivery. The goals of the CGDI IP are closely aligned with the goals of the CGDI as a whole.

9.1.2.3 Portal Users

As a publicly accessible Web application, the CGDI IP Geobase Portal will support any users who wish to discover, browse, order, and download custom subsets of framework vector datasets, specifically placenames, street centerlines, and administrative boundaries. Users of this portal are expected to have a familiarity with digital geographic information.

9.1.2.4 Implementers

An important aim of OGC testbeds such as this CGDI IP is to involve vendors, developers, administrators, and others in collaboratively solving interoperability problems which arise in the course of actually applying OGC standards.

9.1.3 Use Cases

Use cases will capture the expected way users will interact with the system and are split into scenarios describing the steps taken to accomplish a required task, using the system as a tool. There will be 3 use cases, each demonstrating WFS capabilities in the following areas:

1. GeoBase portal-type data dissemination
2. Access and update using desktop GIS.
3. Public-safety scenario for data download and analysis

9.1.3.1 System Roles

There are a number of actors involved in the CGDI IP use cases. These include:

<u>Data Provider</u>

A data provider maintains a locally or regionally bounded vector dataset for their own use and wishes as well to contribute to regional or national dataset aggregation and/or access.

Portal Provider

A portal provider supports user access to nationwide feature datasets.

End User Application

End users with to discover, view, and obtain current feature datasets which may cover any part of Canada but which are customized to the user's area of interest.

Correspondent

An end user or other non-provider with access to feature data who provides feedback on data correctness, currency, or quality.

EM Analyst

An Emergency Management analyst accesses nationwide feature data for the purpose of both creating a local operational view of an emergency situation and alerting others to appropriate response actions such as mobilization and evacuation.

9.1.3.2 Use Case 1

#1 Data Dissemination Portal

Iteration

Summary

Use case describing an end user going to a web portal to discover/locate/select relevant data for download to the end user computer system.

Preconditions

End user has access to web browser and internet

Portal is accessible

Distributed WFS network is in place with most current data.

Triggers

End user wishes to obtain some data as GML

Basic course of events

1. User navigates to the portal website in his web browser
2. User accepts the unrestricted-use licence agreement
3. User executes a search function by entering a keyword to provide a list of feature types of stored in a registry
4. User selects the dataset that he is interested in
5. User clicks on a link to examine the metadata

6. User clicks on a link to bring up a map viewer which displays the dataset and checks the data for suitability to the task
7. User specifies styling parameters to display the dataset in a different colour - **optional**
8. User navigates to his area of interest by (one or more of these options)

- *draw a bounding box on the map*
- *query admin boundary dataset (via WFS) to return an envelope*
- *query NTS lookup service to return bounds of NTDB map sheet index*
- *query placename dataset (via WFS) to return a point (set zoom level appropriately*

9. User specifies filter parameters so select a subset of the dataset (*e.g.* road “class”) - **optional**
10. User selects a subset of attributes to be returned with the dataset (*i.e. element sets*) **- optional**
11. User clicks on an “obtain data” link and a WFS query is generated to the data dissemination service
12. A GML response is returned to the user which he saves on the disk

Alternative paths

Saving: user saves the map view in an OWS context document to share the document with another user

Post conditions

User has the data he is interested in in-hand

Notes

Author and date

Mike Adair, revised Jan. 26, 2007

9.1.3.3 Use Case 2

#2 Data update

Iteration

Summary

A use case to demonstrate the potential of WFS technology to meet data currency requirements by using closest-to-source data architecture.

An authorized user makes additions/deletions/modifications to the data being served via WFS. Changes may be the result of feedback from an end user, or from updates initiated by a source agency.

Preconditions

An operator trained in the use of the application.

A pre-established trust relationship between the systems in the network.

Technology in place to enforce the trust relationship and allow authenticated access.

Triggers

End user notices an error in the location and attribution of a feature

A municipality provides geometry and attributes describing a new subdivision

One municipality merges with another and municipal boundaries change

Basic course of events

1. Source agency receives notification of updates including geometries and attribution
2. Operator accesses an application with read/write access to the source database.
3. Operator validates the new information according to framework data standard
4. Operator updates the affected feature objects with the new information
5. Operator saves the changes
6. Updates are propagated to other systems using WFS-T
7. End-users have near real-time access to the data.

Alternative paths

Variations in how the operator is notified of changes: directly from end-users, or from source databases

Trusted end-users make the corrections directly in a secured application

Post conditions

Corrected data is available in near real-time after the update is saved.

Notes

The use case applies to all geometry types under test.

Author and date

Mike Adair, revised Jan. 26, 2007

9.1.3.4 Use Case 3

#3 COP application for analysis using vector data

Iteration

Summary

A Community of Practice decision support application accesses data via WFS and performs some analysis on the resulting vector data.

The scenario is a toxic plume emission that requires the evacuation of communities in its path over time. The requirement is to identify communities that must be evacuated, the evacuation routes and evacuation deadlines.

Preconditions

An operator trained in the use of the application.

Triggers

A sour gas well blowout in Southern Saskatchewan, near Estevan, emits a toxic plume.

Basic course of events

1. Provincial Emergency Operations Centre (EoC) receives notification of the event
2. Operator accesses the application and navigates an interactive map to the geographic area for the event.
3. Operator generates a plume model for the next 48 hours from meteorological data (canned model).
4. Operator loads the plume model into the mapping application
5. Operator performs an intersection of the plume with administrative boundaries and generates a list of municipal EoC telephone numbers.
6. Operator performs an intersection of the plume with roads and styles those roads differently in the mapping application. (roads closed)
7. Operator inverts the plume/road intersection and styles the highest capacity roads differently in the mapping application. (evacuation routes)
8. Operator saves the state of the map.
9. Operator performs an intersection of the plume with point place names and generates a list of municipalities to be evacuated, at one hour intervals.
10. Application updates a GeoRSS feed containing the products generated above (to be consumed by regional police headquarters and municipal EoCs)

Alternative paths

The municipal EoC in Estavan, SK, triggers the event by updating its own GeoRSS feed with a description of the event.

Add an application that consumes the GeoRSS feed.

Notification of events through alerts (e.g. CAP alerts)

Population and dwelling count data are also used to generate an additional information product (optional)

Post conditions

A map context is available and the EoC RSS feed is updated.

Notes

The above interaction should occur in less than 2 minutes.

Author and date

Mike Adair, Jan. 26, 2007

9.1.4 Policy Concerns

9.1.4.1 Feature and feature schema versioning

9.1.4.1.1 Schema versioning

For framework geodatasets in general and the three types of feature data in the CGDI IP in particular, there are differing local and national feature schemas. Schemas both vary between organizations and evolve over time. A concern of this project will be to respect local differences in feature schemas which address local needs, but work toward national feature schemas which are strict subsets of local ones, e.g. minus the attributes which are of more local concern.

9.1.4.1.2 Feature versioning

A challenge for the CGDI IP will be to balance accessibility with currency and accountability. This will require explicit rules and agreements for frequency and workflow of feature updates, as well as an update process which is both robust and transparent.

9.1.5 Geo Rights

A corollary goal of the CGDI IP is to successfully represent with distributed computing the business relationships which exist or are to be established between the GeoBase actors. The acknowledgement, transfer, reservation, and exercise of usage rights on geodata are an important but complex topic of numerous OGC testbed threads and other activities. Most of these concerns are beyond the scope of the IP; however there should be nominal coverage of some of these concerns, at least as a placeholder for future work.

9.1.5.1 Terms of Use

There are typically some rights reserved and liabilities disclaimed even for publicly accessible geodata. As an initial measure, end users will be asked in the portal application to agree an end user license agreement before downloading datasets of such data. This gate of license acknowledgement will not, however, be enforced in other clients which may query the Web services being provided in the IP.

9.1.5.2 Authentication

While read-only access to public geodata is reasonable provided on an anonymous basis, the capability to perform transactions again such geodata (e.g. WFS-T transaction requests) is clearly more sensitive even in a pilot. Particularly important is the identity of anyone contributing such transactions. An identity management regime, particularly a federated one, however, is clearly beyond the scope of this IP. Out-of-band allocation of usernames and passwords for HTTP Basic Authentication will be sufficient to represent this component of Geo Rights.

9.1.5.3 Access Control

Control of access to application functions and service operations is also a complex and “live” topic, particularly its spatial and granular aspects. For the purposes of this pilot program, a coarse-grained access control accomplished per WFS-T using the above Basic Authentication should suffice.

9.1.5.4 Confidentiality

For geodata which are not considered publicly available, there may also be confidentiality aspects to its distribution. To represent this, encrypted (server-side SSL) connection should be made available; however, any further degree of PKI (Public Key Infrastructure) is considered beyond the scope of the present pilot.

9.2 Information Viewpoint

9.2.1 Overview

The information viewpoint is concerned with the semantics of information and information processing. It defines conceptual schemas for geospatial information and methods for defining application schemas. The conceptual, or base, schemas are formal descriptions of the model of any geospatial information. Application schemas are information models for a specific information community. Applications schemas are built from the conceptual schemas.

In this case, the specifics of the information viewpoint will be developed as a work item of the Pilot. The information viewpoint will be augmented to take into account the existing information models/schema of GeoBase layers, namely GeoNames, administrative boundaries and National Roads Network (version 1).

9.2.2 Feature Schema

In order to mediate between local (sensu latu) and national views of geodata, stable feature schemas for each and mappings between them will be required.

9.2.2.1 Local schema

A local schema is defined as one which is maintained by a local data provider (province, locality, specialized community) which represents the same geographic feature types across multiple organizations, but includes geometries, attributes, and/or constraints which are particular to that locality.

9.2.2.2 National schema

A national schema represents a more or less strict common subset of all the local schemas which are to be aggregated and/or viewed in a national context.

9.2.2.3 Mapping

A mapping describes either the element subset or more involved rules for translating geodata from a local schema to the corresponding national schema.

9.2.3 Feature Datasets

The CGDI Pilot information viewpoint will mainly be concerned with the GML application schemas developed to model three classes of geographic features:

- Geographic Names
- Roads
- Administrative Boundaries

These will each have an information model designed for expression as seamless, nationwide data sets which is generally a subset of the locally available information model. Data providers may choose to design a richer information model for local use if the national model does not satisfy all their specific needs (e.g. feature-level management metadata).

9.2.4 Feature Metadata

Metadata is data about data. Data producers use metadata elements and schema to characterize their geographic data. Metadata enables the use of geographic data in the most appropriate and efficient way by knowing its basic characteristics. Metadata facilitates data discovery, retrieval and reuse. Metadata also enables users to determine whether geographic data in a holding will be of use to them.

Metadata is applicable to independent datasets, aggregations of datasets, individual geographic features, and the various classes of objects that compose a feature, as well as their state and appropriate behavior.

Pilot participants will design and implement the feature metadata needed to facilitate the business processes described in the use cases above. In particular, metadata will be used to document the update, correction, or distribution status of local, regional, and national datasets, as well as the relationships (e.g. schema mapping) between feature types between various scales of aggregation and betweem various organizations.

9.2.5 Service Metadata

The most basic operation an information service must provide is the ability to describe itself. The services implemented in this project shall follow the OGC standard of providing a service operation called *GetCapabilities* that offers a rich set of service-level metadata to the caller. This is described generally in the *OGC Web Services Common Specification*. Service-specific metadata is described in the specification document for the particular service being implemented. For example, Web Feature Service implementations shall implement the service metadata described in the *Web Feature Service Specification*.

9.2.6 Transactions

Update and propagation of feature data is envisioned to be accomplished using WFS-T transactions. The transaction requests themselves serve very well as the information structure to represent such feature dataset transactions. Additional information may be required, however, to represent both the new data produced by a transaction, the status / process of the transaction, and the prior state of the dataset which has been altered (older feature versions and/or deleted features). Such additional information serves both to document dataset updates and make earlier versions of features and feature datasets retrievable through reverse application of the transaction record.

9.2.7 Events & Notifications

A number of asynchronous interactions are expected in the operation of the CGDI IP, e.g. “there is an update”, “an error has been discovered”, “an update has been applied”, “a view of an emergency situation is available”. These require the exchange of additional information beyond the usual synchronous interactions of OGC Web Services requests and responses. Both publish-subscribe interactions and notification-action interactions require persistent event information as provided by such information structures as Web feeds (e.g. RSS or Atom). In addition, alert information such as in CAP alerts may be important for serving additional notification channels (e.g. email, SMS).

9.2.8 Application State or Map View Context Documents

OWS Context documents represent the view state of an application or a dynamic map, such as the layers and their datasources, ordering, styling, annotation, etc. They function both as a way of persisting (e.g. storing, discoverying, recovering) such views, and a way of collaborating by exchanging the context of a feature or features being communicated from one user to another.

9.3 Computational Viewpoint

The computational viewpoint is concerned with the functional decomposition of the system into a set of services which allow clients and servers to interact at interfaces. This viewpoint captures the details of these components and interfaces without regard to actual distribution.

9.3.1 Overview

This Pilot is primarily concerned with vector data dissemination, update and search. These requirements are fulfilled by the OGC Web Feature Service (with transactional support) and the OGC Catalog Service for the Web. There is also an ancillary requirement for web mapping, and a mechanism for publishing information about data updates. At this time we expect that mechanism to be an Atom feed service.

9.3.2 Service Interfaces

9.3.2.1 Web Feature Service (WFS)

The OpenGIS® Web Feature Service (WFS) Implementation Specification allows a client to retrieve geospatial data encoded in Geography Markup Language (GML) from multiple Web Feature Services. The specification defines interfaces for data access and manipulation operations on geographic features, using HTTP as the distributed computing platform. Via these interfaces, a Web user or service can combine, use and manage geodata -- the feature information behind a map image -- from different sources.

9.3.2.2 Web Feature Service with Transactions (WFS-T)

A Transactional Web Feature Service allows a client to send messages relating to making changes to a geospatial database.

The following WFS-T operations are available to manage geographic features and elements:

- Create a new feature instance
- Delete a feature instance
- Update a feature instance
- Lock a feature instance

9.3.2.3 Catalog Service for the Web (CS/W)

The OpenGIS® Catalogue Service Implementation Specification defines a common interface that enables diverse but conformant applications to perform discovery, browse and query operations against distributed heterogeneous catalog servers.

Catalogue services support the ability to publish and search collections of descriptive information (metadata) for data, services, and related information objects. Metadata in catalogues describe resource characteristics that can be queried and presented for evaluation and further processing by both humans and software. Catalogue services are required to support the discovery and binding to registered information resources within an information community.

The document specifies the interfaces, bindings, and a framework for defining application profiles required to publish and access digital catalogues of metadata for geospatial data, services, and related resources. Metadata act as generalized properties that can be queried and returned through catalogue services for resource evaluation and, in many cases, invocation or retrieval of the referenced resource. Catalogue services support the use of one of several identified query languages to find and return results using well-known content models (metadata schemas) and encodings.

9.3.2.4 Web Mapping Service (WMS)

The OpenGIS® Web Map Service (WMS) Implementation Specification enables the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple remote and heterogeneous sources.

When client and server software implements WMS, any client can access maps from any server. Any client can combine maps (overlay them like clear acetate sheets) from one or more servers. Any client can query information from a map provided by any server.

In particular WMS defines:

- How to request and provide a map as a picture or set of features (GetMap)
- How to get and provide information about the content of a map such as the value of a feature at a location (GetFeatureInfo)
- How to get and provide information about what types of maps a server can deliver (GetCapabilities)

9.3.2.5 Atom Publishing Protocol (AtomAPI)

The AtomAPI is an application level protocol for publishing and editing web resources. The protocol at its core is the HTTP transport of Atom-formatted Web feeds.

9.4 Engineering Viewpoint

The Enterprise, Information, and Computation viewpoints describe a system in terms of its purposes, its content, and its functions. The Engineering viewpoint relates these to specific components linked by a communications network. This viewpoint is concerned primarily with the interaction between distinct computational objects: its chief concerns are communication, computing systems, software processes and the clustering of computational functions at physical nodes of a communications network. The engineering viewpoint also provides terms for assessing the “transparency” of a system of networked components – that is, how well each piece works without detailed knowledge of the computational infrastructure.

In a sense, this viewpoint examines the specific engineering “solutions” to problems posed by applying the information and computation elements of the architecture to the requirements of the use cases. Aspects of these solutions involve choice of technology, but also involve development of specific component interactions and workflows which support the desired user interactions.

In the context of a concept plan, this viewpoint is largely schematic and outline in nature. Further details will be filled in and refined for the purposes of the RFQ/CFP and then as the result of design, implementation, experimentation, and problem-solving during the course of the pilot.

9.4.1 Components

The characteristics of classes of software component are defined here.

9.4.1.1 Provider Server

A provider server is the platform for generating and maintaining feature datasets and supporting local users, as well as for engaging in update notification (publication-subscription), propagation, feature roll-up, and metadata harvesting with larger-scale servers such as the Geobase or intermediate-level servers. It will generally consist of at least a WFS-T as well as various client functions for carrying out update workflow.

9.4.1.2 Geobase Server

The Geobase server acts as the central aggregating and/or cascading platform for national feature datasets. It also engages in notification, harvest, and update exchanges with provider servers and may cascade some larger-scale feature requests to more local feature servers. Its other function is to support the application portal with services such as WFS-T, WMS, and CS/W.

9.4.1.3 Application Portal

The Application Portal provides an enduser application for discovering, browsing, and downloading feature datasets, in support of the use cases described above.

9.4.1.4 Desktop GIS

Desktop GIS applications are expected to be the principal means of creating and updating feature datasets. It will be helpful to investigating the performance and suitability of WFS-T services for such desktop applications to be capable of interacting directly with a WFS-T to query and update its holdings.

It is also expected that EM analysts will largely use desktop GIS and/or image-processing applications to generate both alerts/notifications and new derived operating view datasets.

9.4.2 Protocols

9.4.2.1 HTTP Transport

Most interactions between distributed components in the CGDI IP will be via the HTTP protocol, using the HEAD, GET, or POST methods. This includes browser access to the Geobase Portal, Web service requests, and exchange of event notification feeds.

9.4.2.2 Authentication & Authorization

Relatively light requirements for authorization of WFS transactions in the CGDI IP will be met with an externally defined regime of usernames and passwords exchanged via HTTP Basic, possibly using SSL-encrypted http protocol for this purpose.

9.4.3 Workflows

9.4.3.1 Overview

Workflows are often the “solution” matching information transformations with user actions, particularly across distributed processing components

9.4.3.2 Examples

- Upflow from constituents

    Update Events

Metadata

Cached Features

- Downflow from respondents

Correction Events

Updated features

- Crossflow from analysts

Event features

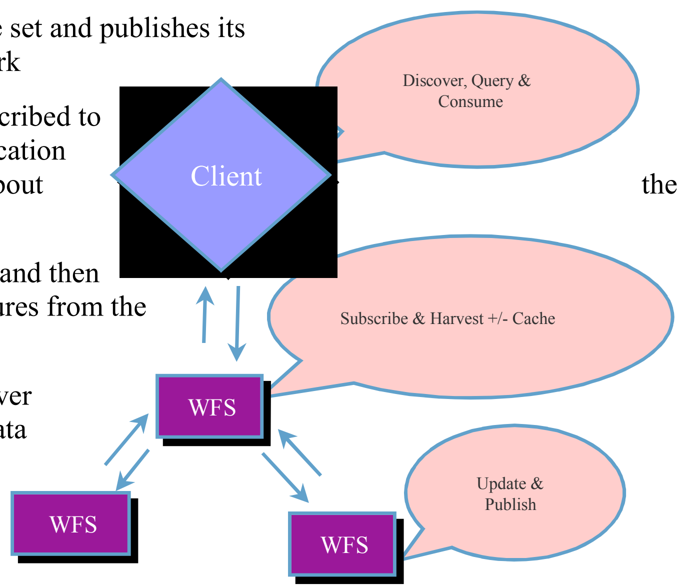
Derivative features

Contexts

9.4.3.3 Dataset Publish – Subscribe – Harvest

Description:

1. Partner updates a feature set and publishes its availability to the network
2. Geobase server has subscribed to the partner update notification and harvests metadata about updated features.
3. User discovers, queries, and then downloads updated features from the partner
4. Optionally, Geobase server aggregates the partner data locally in the national level feature schema for central access



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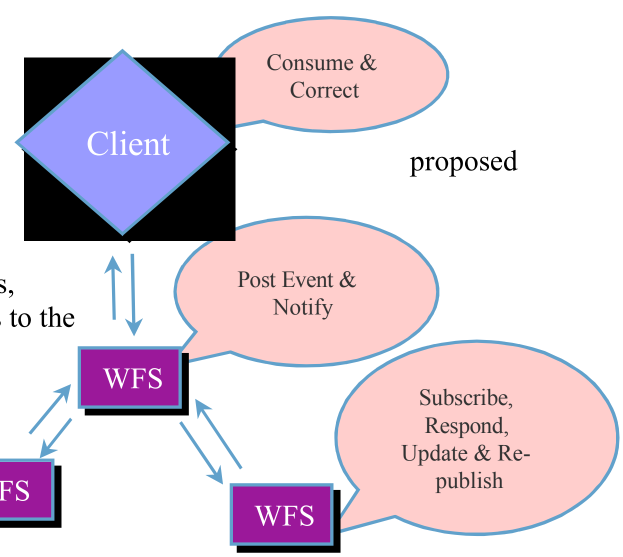
9.4.3.4 Correction submittal

Description:

1. User provides feedback and correction to a feature
2. Geobase server posts a correction event and feature update
3. Partner server has subscribed to corrections, fetches correction, considers it, then responds, updates its feature holdings, and re-publishes to the network

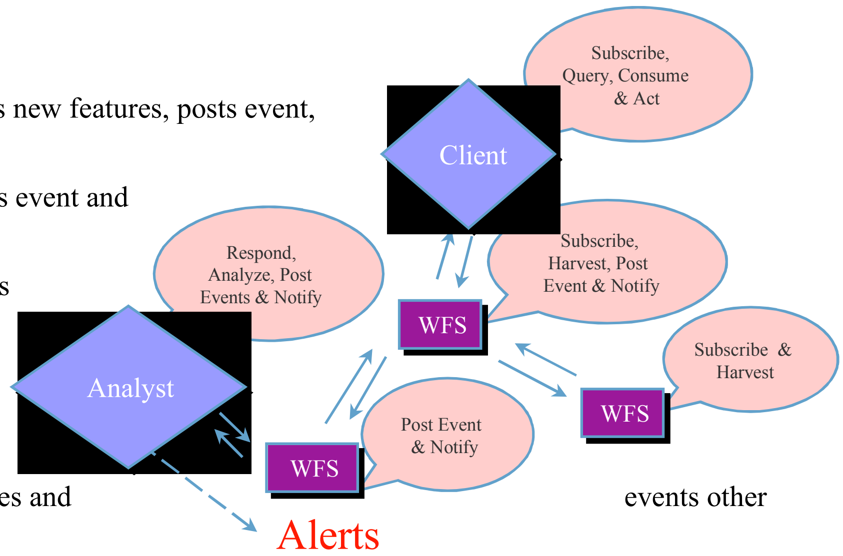


proposed

9.4.3.5 Event Notification

Description:

1. Analyst produces, posts new features, posts event, optionally issues alerts
2. Partner server publishes event and new features
3. Geobase server harvests features and event
4. Users receive event and query new features
5. Optional flow of features and events other partners



9.4.3.6 Context publication

An OWS Context is an XML document. Publication of such a document can be accomplished in many ways. Here we envision that a document will be made accessible via a URL, advertised via notification feed, and made discoverable through harvesting by the Geobase catalog.

9.4.3.7 License acknowledgement

The principle of acknowledgement to a usage license for geodata will be realised here through a simple click-through step when accessing the Geobase Portal at the beginning of a "session" or upon initiating a dataset download.

9.4.4 QoS and Performance Metrics

A number of the observations made in the AMEC report concerned the expected and achievable performance characteristics of Web Feature Service implementations. Evaluation of the quality-of-service and performance characteristics of WFS implementations within the CGDI IP will follow agreed-upon metrics which will consider both best practices for usage as well as characteristics of the particular implementations, architecture, and specification in general.

9.5 Technology Viewpoint

The technology viewpoint is concerned with the underlying infrastructure of a system, describing the hardware and software components used. Again, the specific details of this architectural view will continue to be filled out in the RFQ/CFP and then throughout the course of the pilot work, culminating in the completed pilot report at the end of the project. An outline of the viewpoint is sketched below.

9.5.1 Geobase Portal Deployment

9.5.2 Alberta Server Deployment

9.5.3 Ontario Server Deployment

9.5.4 Quebec Server Deployment

9.5.5 Statistics Canada Deployment

10 Demonstration of Pilot Capabilities

A live demonstration of the implemented CGDI IP capabilities will generally focus on exercising the use cases and spotlighting aspects of the collaborative workflows which have been developed. The demo may also include a view of WFS performance metrics. The demo will also be captured in some fashion in multimedia as a part of the project record.

11 Evaluation and Documentation

Evaluation of the CGDI IP results will focus on the areas highlighted by the AMEC report, including:

- Performance
- Versioning and data update workflow
- Security
- Appropriate use of WFS services

Documentation for the CGDI IP will include recommendations, best practices, final architecture, and demo presentations.

Annex A: Outline of RFQ/CFP

11.1 Introduction

11.2 Context

11.3 Participants' Roles in the Pilot

11.4 Proposal Submission Information

11.5 Evaluation Criteria

11.6 Annex: Work Breakdown and Requirements

11.7 Annex: Pilot Architecture

11.8 Annex: Concept of Operations

11.9 Annex: Pilot Communications Plan