Canadian Geospatial Data Infrastructure

Standards for the

Public Safety & Security Community

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Outline

1. GeoConnections Program & Canadian Geospatial Data Infrastructure
2. CGDI Continuum, Models and Standards
3. Public Safety & Security Community
4. Multi-Agency Situational Awareness
5. Multi-Agency Situational Awareness Progress and Momentum
6. Closing remarks
1. GeoConnections Program, CGDI

**GeoConnections Program** $120M (2000-2010)

A national partnership program led by Natural Resources Canada that collaborates and partners with all levels of government, private sector, NGO’s, academia and international organizations in order to build and evolve the **Canadian Geospatial Data Infrastructure (CGDI)**.

**Canadian Geospatial Data Infrastructure**

... is an open information technology infrastructure that is based upon publicly available standards and specifications. It provides Canadians with on-demand access to geospatial information through an interoperable, standards-based network built by a host of data, services and technology suppliers.

**Goal:** To improve Canadians' quality of life by enhancing decision making by making location-based information and technologies accessible and sustainable.
2. CGDI continuum, models

- Pre-CGDI Readiness/Leadership 1992-1999
  - GIS databases
  - Internet Connectivity

- CGDI 1.0 Product Based 1999-2005
  - GeoBase data coverage
  - Standards and technology Solutions
  - Policy instruments

- CGDI 2.0 Community Based 2005-2010
  - User driven geospatial projects investments
  - Evolution of Product Based model
  - e.g. KML/Google integration

- CGDI 3.0? Institutional/Collaborative Based
  - See views on SDI/CGDI (SIA Molde 2009)
  - Evolution of components of both Product & Community Based-models
2. CGDI continuum, standards (con’d)

- **Pre-CGDI**
  - Readiness/Leadership 1992-1999
  - *de facto* standards

- **CGDI 1.0**
  - Product Based 1999-2005
  - Reference Model
  - Content standard e.g. ISO 19107, 19108, 19115, 19136, etc.
  - Web services e.g. ISO 19128

- **CGDI 2.0**
  - Community Based 2005-2010
  - User driven geospatial projects investments
  - Mass market and Domain standards
  - KML, georss, CityGML, Land Cover, Land Admin

- **CGDI 3.0?**
  - Institutional/Collaborative Based
  - See views on SDI/CGDI (SIA Molde 2009)
  - Ubiquitous, Ontology, Virtual/Metaverse?
“Coping with natural disasters is one of the greatest challenges Canadians will face in the future, particularly in light of growing evidence that extreme events may occur more frequently as Earth’s climate warms.”

(Source: Canadians at Risk: Our Exposure to Natural Hazards, 2009)
3.1 Role of Geospatial Data & Tools

“In all aspects of emergency management, geospatial data and tools have the potential to contribute to the saving of lives, the limitation of damage, and the reduction in the costs to society of dealing with emergencies.”

(Source: The U.S. National Research Council)
3.2 Role of information sharing, priority stacks

... building of a Common Operating Picture (CoP) of content from multi-agencies.

- Management of Consequences

- Response Data
  - Viewing and dissemination of real-time and near real-time incident information, e.g., resource locations, near real-time satellite imagery

- Threat or Hazard data
  - Involves the fusion of threat and hazard information, e.g., critical infrastructure interdependencies, weather hazards

- Infrastructure
  - Location-based infrastructure information of key sectors, e.g., Energy/utilities, transportation, Government facilities

- Basic Geography
  - Common layer of Location-based information that provides reference and context, e.g., Geobase, Provincial Base mapping

**GeoConnections**
4. Multi-Agency Situational Awareness

**Strategic Direction**
Mitigating the threats and hazards that affect the safety and security of Canadians
“National Seamless Situational Awareness”

**Intended Outcome**
Improved National Situational Awareness among emergency management agencies and federal public safety and security organizations

**Output**
- FPT Situational Awareness System
- System Architecture
- Content
- National Emergency Management Symbology
4.1 Multi-Agency Situational Awareness System

MASAS is focused on connecting systems to enable information exchange between emergency management agencies based on architecture.

Based on an incremental approach of working towards National Situational Awareness.
MASAS is composed of a **system of systems based on standards** enabling each participant to:

1) **Publish** information for other participants to consume

2) **Enables/Views** information to cross agencies in a predictable and reproducible manner; Each agency:
   - Controls what they share
   - Decides what information from other agencies is relevant to them
   - Uses their existing systems to publish and consume

3) **Integrate** information from external sources into the local emergency operations system.
4.3 MASAS: Community Architecture

The Reference Model for Open Distributed Processing (RM-ODP) (ISO Standard) defines 5 viewpoints:

- Enterprise
- Information
- Computation
- Engineering
- Technology

MASAS Architecture Online:
http://www.geoconnections.org/developersCorner/situational_awareness/MASAS_Architecture_V1.pdf
4.3.1 MASAS Architecture: Enterprise Viewpoint

- 62 categorized requirements:
  - Informational (7): Alerts, events, situation reports, maps, metadata
  - Qualitative (28): Security, performance, reliability, standards, policy, legal

- **Actors** (Administrator, Emergency Officer/Analyst, Subscriber and Publisher), and **Use Cases** (users’ account management, feeds management)
4.3.2 MASAS Architecture: Information Viewpoint

Content Feed / entries supplying:

- **GeoRSS / GeoAtom (GML)** with links to:
  - **KML** (geo-browser markup language)
  - **EDXL** (Emergency Data Exchange Language)
  - **CAP** (Common Alerting Protocol)
4.3.3 MASAS Architecture: Information Viewpoint

- Canadian Profile of the Common Alerting Protocol (CAP-CP) defines rules, recommendations and managed lists to be used in Canada with CAP
- CAP alerts includes level of urgency, severity and certainty, which we might associate with presentation style guidance
- CAP-CP alerts, supported by Event Location Layer (point, line, polygon or circle) are well suited to conversion, distribution, & presentation via GeoRSS and KML.

http://www.capan.ca
4.4.4 MASAS Architecture: Computational Viewpoint

... Web Services:

- User Management: add, modify, delete user accounts
- Catalogue: search, view feed metadata
- FeedAccess: atom publishing protocol
- Authorization: determine match of user to requested operation
- Authentication: log on, off
- Log: record requests, access, performance
- Subscribe: subscribe, aggregate feeds
- Publish Notify: when feed content changes, notify subscribers
4.4 National Infrastructure Data Model to support MASAS

- Develop the first version of NIDM to support strategic situational awareness in the context of emergency management; gather information on authoritative source for infrastructure data across Canada to its facilitate sharing across jurisdictions.

- 10 critical infrastructure sectors + recommendations (e.g. establish national schema)

- Aligned to Canadian base data: i.e. National Road Network

- Build on and do not replace existing standards (i.e. industry-standard data models, DHS Geospatial Data Model, where applicable)

- Implementations: National Defense/Canada Command, Geo-British Columbia Critical Infrastructure & Olympics Venues
4.5 Canadian Emergency Management Map Symbology

- Multi-Agency Emergency Mapping Symbology
- Identified Gaps
- ANSI INCITS 415–2006
- Specialized Domains
- CAP-CP
- NIDM
- CAP
- CBIP

- All-hazards
- Infrastructure/Key Assets
- Operations
- Incidents
- Damage
- Alerts

“rule sets for portrayal in line with ISO 19117”
4.6 MASAS Project - New Brunswick emergency system

New Brunswick experienced a major flood in 2008, and it became clear that improvements to situational awareness during large scale events was required to improve decision making within the Emergency Measures Organization and supporting agencies.

GeoRSS & CAP-CP
The GeoNews service utilizes the RDF encoding of geography within the CPNewsML XML format — then processed to generate a GeoRSS feed.
- Basic Geography: Spatial Schema, metadata, Feature Catalogue.
- Infrastructure: National Infrastructure Data Model, Symbology, Portrayal
- Hazards Data: WMS, Common Alerting Protocol – Canadian Profile, GeoRSS (Atom) / GML, KML
5. MASAS Progress & Momentum

- National stakeholder workshops and consultations to define MASAS Architecture
- Provincial Projects: New Brunswick, Alberta, British Columbia, ...
- Content Projects: Canadian Press Geonews, City of Vancouver
- Federal Project being led by Public Safety Canada
- MASAS stream within Defence Research Development Canada – Public Security Technical Program Call for Proposals (Fall 09)
- Canada-Wide Interoperability ‘Sandbox’ Exercise supported by GeoConnections
- International Hurricane Exercise with US partners being led by Province of New Brunswick
6. Closing Remarks

- Geospatial Information and Standards have a key role in mitigating the threats and hazards that affect the safety and security of Canadians by improving National Seamless Situational Awareness.

- Leveraging CGDI Foundational Standards and consulting with the user community to create the MASAS Community Architecture has been key to advancing this initiative.

- The Government of Canada and its partners are creating a valuable Canadian Geospatial Public Asset, i.e., the MASAS.

- Investments to date have created many of the partnerships that have developed MASAS components, and this collaboration will have a major payoff in the future.
Web sites

GeoConnections
http://www.geoconnections.org

ISO/TC 211, Geographic Information & Geomatics
http://www.isotc211.org

Open Geospatial Consortium Inc.
http://www.opengeoportal.org

Organization for the Advancement of Structured Information Standards
http://www.oasis-open.org/home/index.php
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