GeoBase, Building on Common Ground

Montreal, September 14, 2005
Plan

• Presentation of GeoBase
• Standards with Geobase
GeoBase Initiative

• Overseen by the Canadian Council on Geomatics (CCOG)
• Coordinated by the GeoBase steering committee.
  • GeoBase Steering Committee: Chaired by NRCan
  • Members: North West Territories, Saskatchewan, Ontario, Nova Scotia, Department of National Defence, Statistics Canada and Natural Resources Canada.
GeoBase Principles

• Quality Geospatial Data:
  – One Geometry (Single source)
  – Accurate
  – Up-to-date
  – National coverage

• Data available at no cost.
GeoBase Data

Six Themes

1. Geodetic Networks (X,Y & Z)
2. National Road Network
3. Elevation Data
4. Geographical Names
5. Administrative Boundaries
6. Landsat 7 Imagery & Control Points

Others to come
Licence

• All GeoBase Data is subject to an Unrestricted Use Licence.
## GeoBase Data Downloads

<table>
<thead>
<tr>
<th>GeoBase Data Layers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Geodetic</td>
<td>34,152</td>
</tr>
<tr>
<td>Canadian Digital Elevation Data</td>
<td>1,034,757</td>
</tr>
<tr>
<td>Canadian Geopolitical Boundaries</td>
<td>1,942</td>
</tr>
<tr>
<td>Canadian Geographical Names</td>
<td>191,176</td>
</tr>
<tr>
<td>GeoBase Alignment Layer</td>
<td>80,552</td>
</tr>
<tr>
<td>Landsat 7 Orthorectified Imagery</td>
<td>65,766</td>
</tr>
<tr>
<td>National Road Network</td>
<td>17,088</td>
</tr>
<tr>
<td><strong>Total downloads</strong></td>
<td><strong>1,425,433</strong></td>
</tr>
</tbody>
</table>
Plan

- Presentation of GeoBase
- Standards with Geobase
Standards and Specifications

- Based on CGDI architecture and technology
- **Open GIS Consortium (OGC) Specifications**
  - Geography Mark-up Language (GML)
    - ftp files
  - Available through a Web Mapping Service
    - 3 sites
  - GeoBase is based on ISO TC 211 standards
    - Data Specifications, 19131
    - Metadata 19115 and FGDC
Data product specification

- Same table of contents based on ISO TC211 19131
  - Data identification
  - Geospatial characteristics
  - Data model
  - Data dictionary/feature catalog
  - Coordinate reference system
  - Data quality
  - Metadata
  - Data portrayal/data transfer format/physical model
  - Data delivery
  - Data capture and maintenance
• **Characteristics of the element**
  – Code element
  – Name (french & english)
  – Definition (french & english)
  – Class type, category etc.

• **Attributes of the element**
  – Name (french & english)
  – Definition (french & english)
  – Attribut value (domain).

• **Constraints of the element**
  – Minimum sizes
  – Spatial Constraints
  – Etc.
Standards and data validation
Topological operators are used in the GDB to guarantee the topological integrity of data. The theory defining the topological operators used to define relationships has been fully documented in the literature [Clementini 1994, 1996, Egenhofer 1991, 1994]. The nine-intersection model defined in ISO 19125.1 [ISO CD 19125.1] was selected for use in the GDB.
Topological-relationship predicates according to ISO

- **Equals:** Geometry that is "spatially equal" to another geometry.
- **Disjoint:** Geometry that is "spatially disjoint" from another geometry.
- **Intersects:** Geometry that "spatially intersects" another geometry of smaller dimension.
- **Touches:** Geometry that "spatially touches" another geometry.
- **Crosses:** Geometry that "spatially crosses" another geometry.
- **Within:** Geometry that is "spatially within" another geometry.
- **Contains:** Geometry that "spatially contains" another geometry.
- **Overlaps:** Geometry that "spatially overlaps" another geometry.
### Concepts of Interior, Boundary, and Exterior

<table>
<thead>
<tr>
<th></th>
<th>Point</th>
<th>Line</th>
<th>Polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interior (I):</strong></td>
<td><img src="image" alt="Point Interior" /></td>
<td><img src="image" alt="Line Interior" /></td>
<td><img src="image" alt="Polygon Interior" /></td>
</tr>
<tr>
<td>The interior of a geometric object is all the direct positions that are on the object but not on its boundary.</td>
<td><img src="image" alt="Point Interior" /></td>
<td><img src="image" alt="Line Interior" /></td>
<td><img src="image" alt="Polygon Interior" /></td>
</tr>
</tbody>
</table>

| **Boundary (B):** | ![Point Boundary](image) | ![Line Boundary](image) | ![Polygon Boundary](image) |
| A set of geometric primitives of smaller geometric dimension that limits the extent of a geometric object. | ![Point Boundary](image) | ![Line Boundary](image) | ![Polygon Boundary](image) |

| **Exterior (E):** | ![Point Exterior](image) | ![Line Exterior](image) | ![Polygon Exterior](image) |
| The exterior of a geometry comprises all the points not contained with the interior or boundary. | ![Point Exterior](image) | ![Line Exterior](image) | ![Polygon Exterior](image) |
## Intersection Matrix (DE-9IM)

<table>
<thead>
<tr>
<th></th>
<th>Interior $(b)$</th>
<th>Boundary $(b)$</th>
<th>Exterior $(b)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior $(a)$</td>
<td>$I(a) \cap I(b)$</td>
<td>$I(a) \cap B(b)$</td>
<td>$I(a) \cap E(b)$</td>
</tr>
<tr>
<td>Boundary $(a)$</td>
<td>$B(a) \cap I(b)$</td>
<td>$B(a) \cap B(b)$</td>
<td>$B(a) \cap E(b)$</td>
</tr>
<tr>
<td>Exterior $(a)$</td>
<td>$E(a) \cap I(b)$</td>
<td>$E(a) \cap B(b)$</td>
<td>$E(a) \cap E(b)$</td>
</tr>
</tbody>
</table>
Predicate extensions

Within:

TANGENT  BORDER  STRICT

3 Concepts

Within

Tangent  Border  Strict
Within «Strict»

Definition:

\[ \text{Within}(b) \iff (a \cap b = a) \land (I(a) \cap I(b) \neq \emptyset) \]

DE-9IM:

\[ \text{Within}(b) \iff (I(a) \cap I(b) \neq \emptyset) \land (I(a) \cap E(b) = \emptyset) \land (L(a) \cap E(b) = \emptyset) \]

\[ \iff \text{a.Relate}(b, \text{’T}\ast\text{F}, \text{**F}, \text{***’}) \]

\[ \text{Within} : \]

\[ \text{T}\ast\text{F}, \text{**F}, \text{***} \]

\[ \text{Tangent} \quad \text{Within} \quad \text{Border} \quad \text{Strict} \quad \text{T}\ast\text{F}, \text{**F}, \text{***} \]
Within «Tangent»

Definition:

\[ \text{a. Within}(b) \iff (a \cap b = a) \land (I(a) \cap I(b) \neq \emptyset) \]

DE-9IM:

\[ \text{a. Within}(b) \iff (I(a) \cap I(b) \neq \emptyset) \land (I(a) \cap E(b) = \emptyset) \land (L(a) \cap E(b) = \emptyset) \]

\[ \iff \text{a.Relate}(b, \text{‘T*F,**F,***’}) \]

Within:

- T*F, *FF, ***
- T*F, *0F, ***
- T*F, **F, ***

Tangent

Border

Strict
Within «Border»

Definition:

a. $\text{Within}(b) \iff (a \cap b = a) \land (I(a) \cap I(b) \neq \emptyset)$

DE-9IM:

a. $\text{Within}(b) \iff (I(a) \cap I(b) \neq \emptyset) \land (I(a) \cap E(b) = \emptyset) \land (L(a) \cap E(b) = \emptyset)$

$\iff a.\text{Relate}(b, \text{‘T*F,**F,***’})$
XML

« DataBase »
GDB Catalogue

GDB
« Production »
New Production Line
- Inspection,
- Validation, etc.

GDB
« Catalogue »
Catalogue
- ISO, Internal,
- Subset,
- Etc.
### Hydrology

- **Super Class**: Water Disturbance
  - **Abstract Class**: Water Disturbance
    - **Geometric Class - Point**
      - **Sub-Type - Point**
        - Fall
        - Unknown
        - Disappearing stream
        - Rapid
        - Rock in water
    - **Geometric Class - Line**
      - **Sub-Type - Line**
        - Fall
        - Unknown
        - Rapid
        - Coincident linear rapid
    - **Geometric Class - Polygon**
      - **Sub-Type - Polygon**
        - Rapid

World Wide Web Consortium (W3C): [http://www.w3.org/]
- XML Path Language (XPath) Version 2.0 — W3C Working Draft 4 Avril 2005 [XPath 2.0]
- XSL Transformations (XSLT) Version 2.0 — W3C Working Draft 4 Avril 2005 [XSLT 2.0]
- Extensible HyperText Markup Language (XHTML™) Version 2.0 — W3C Working Draft 27 Mai 2005 [XHTML 2.0]
- Cascading Style Sheets, level 2 revision 1 CSS 2.1 Specification Version 2.0 — W3C Working Draft 13 Juin 2005 [CSS 2.1]
Thank you