



# GeoBase, Building on Common Ground

*Montreal,  
September 14, 2005*



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 



# Plan

- **Presentation of GeoBase**
- Standards with Geobase



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 



# 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.



Natural Resources  
Canada

Ressources naturelles  
Canada

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.



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 



## GeoBase Data Downloads

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

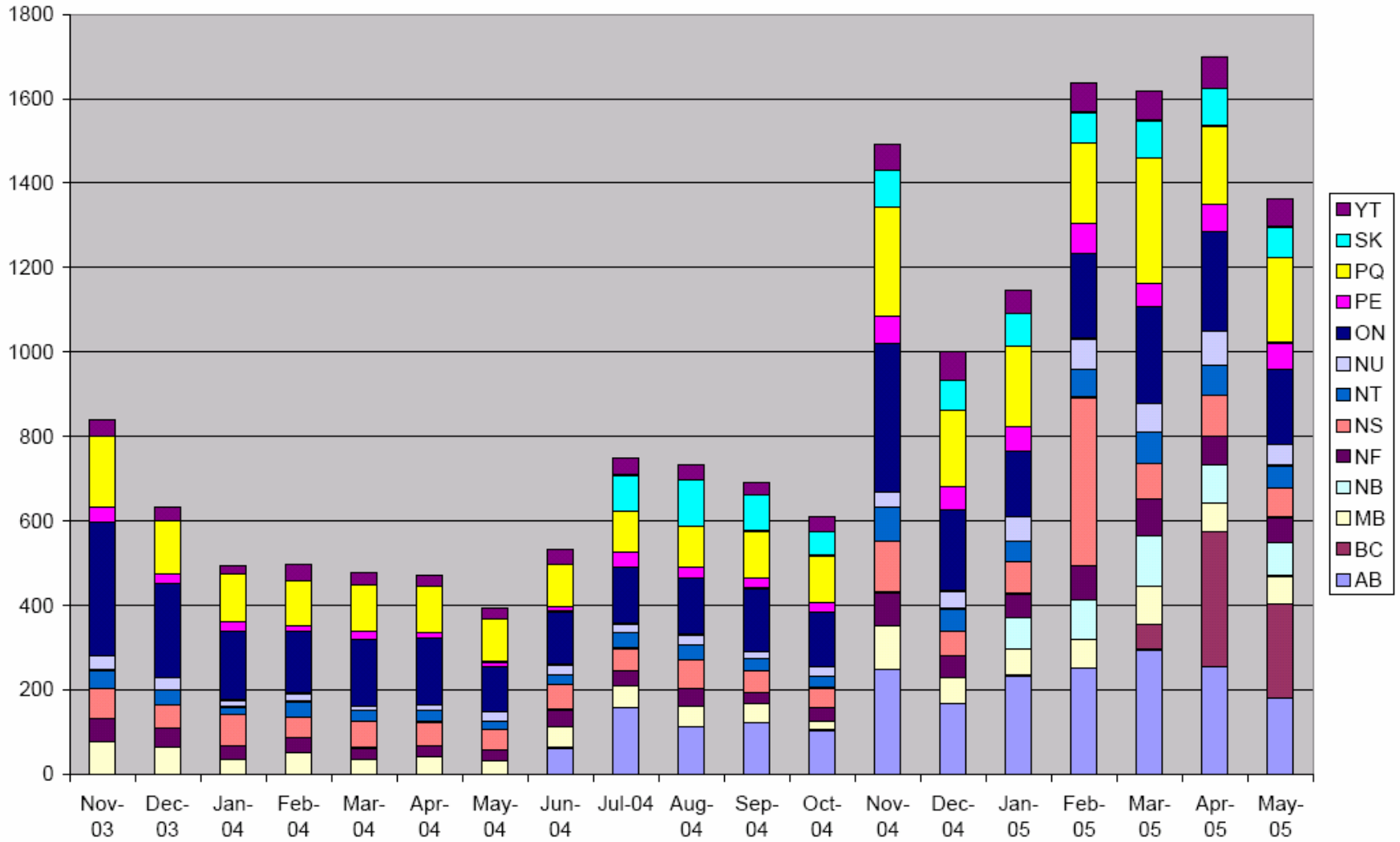


Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

### GeoBase Data Download: NRN





# Plan

- Presentation of GeoBase
- **Standards with Geobase**



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 



# 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 transfert format/physical model
  - Data delivery
  - Data capture and maintenance





# Catalogue DataBase

- 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



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 



# Topological Operators

- 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

	Point	Line	Polygon
<b>Interior (I) :</b> The interior of a geometric object is all the direct positions that are on the object but not on its boundary.			
<b>Boundary (B) :</b> A set of geometric primitives of smaller geometric dimension that limits the extent of a geometric object.	Does not exist by definition !		
<b>Exterior (E) :</b> The exterior of a geometry comprises all the points not contained with the interior or boundary.			





# Intersection Matrix (DE-9IM)

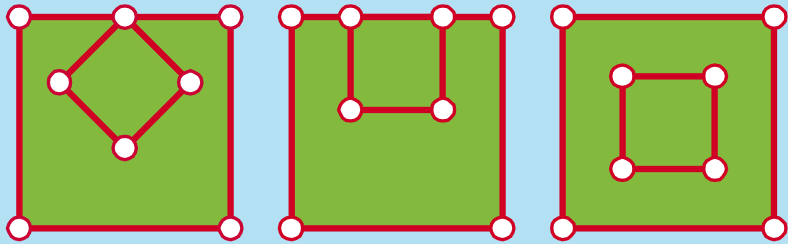
	Interior (b)	Boundary (b)	Exterior (b)
Interior (a)	$I(a) \cap I(b)$	$I(a) \cap B(b)$	$I(a) \cap E(b)$
Boundary (a)	$B(a) \cap I(b)$	$B(a) \cap B(b)$	$B(a) \cap E(b)$
Exterior (a)	$E(a) \cap I(b)$	$E(a) \cap B(b)$	$E(a) \cap E(b)$





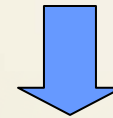
# Predicate extensions

**Within:**



*TANGENT*    *BORDER*    *STRICT*

→ 3 Concepts



Within

Tangent

Border

Strict





# Within «Strict»

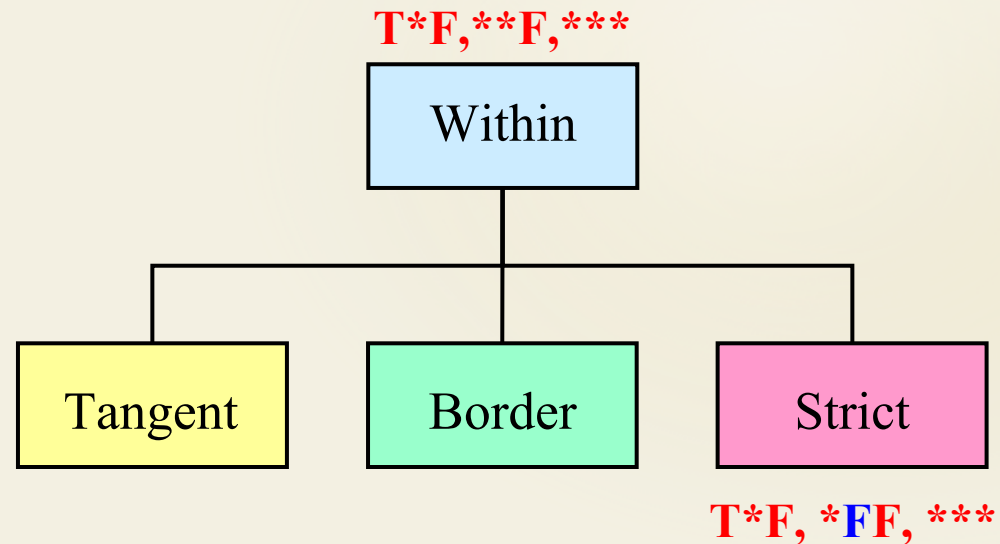
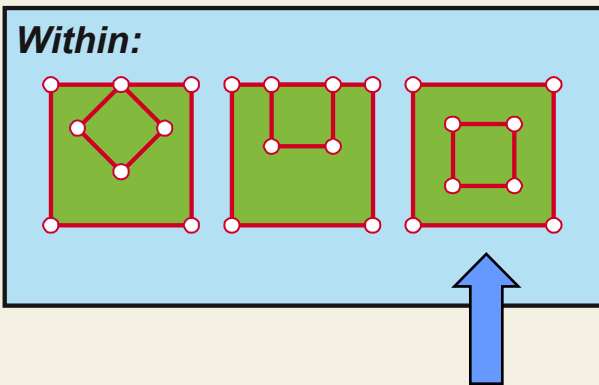
Definition :

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

DE-9IM :

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

$$\Leftrightarrow a.\text{Relate}(b, 'T^*F, **F, ***')$$





# Within «Tangent»

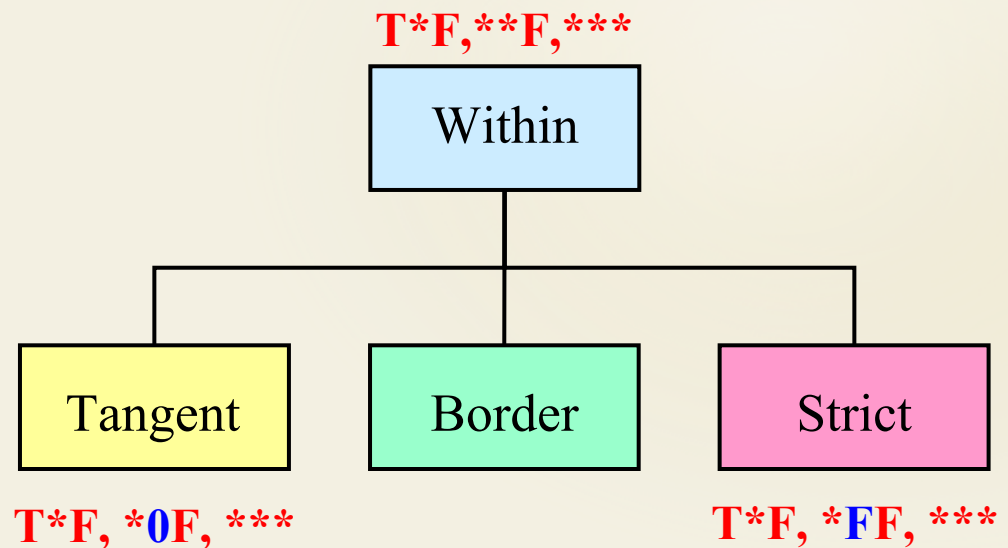
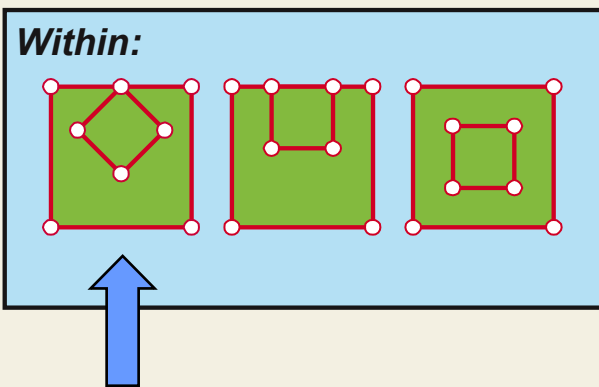
Definition :

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

DE-9IM :

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

$$\Leftrightarrow a.\text{Relate}(b, 'T^*F, **F, ***')$$





# Within «Border»

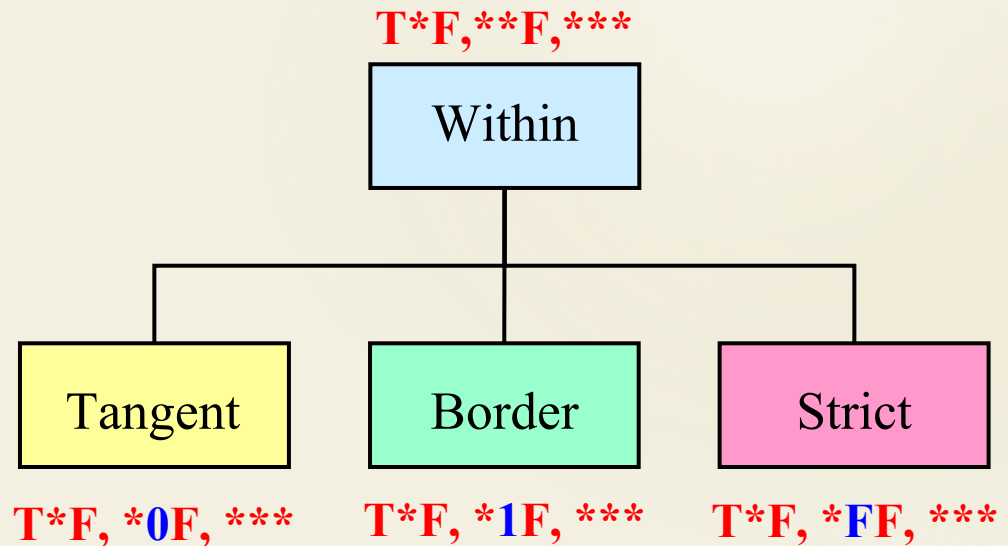
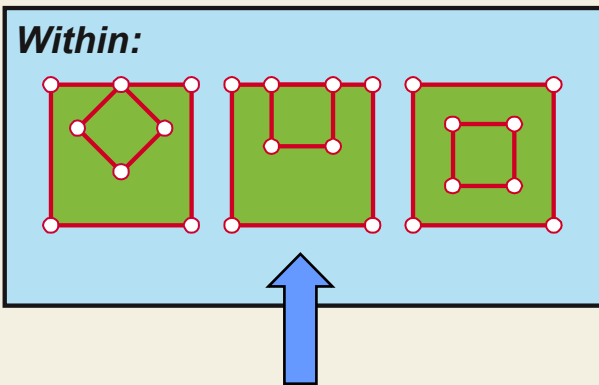
Definition :

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

DE-9IM :

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

$$\Leftrightarrow a.\text{Relate}(b, 'T^*F, **F, ***')$$



# Geospatial Database (GDB) Standard *ver. 2.0*

## Establishment of the spatial operators ISO-19125 at CIT-S

**Version 2.0**

- ISO-19125
- Extension CIT-S
- Special

### Crosses

$0^{**},F0^{*},102$      $T^{**},F0^{*},212$      $T^{**},F0^{*},102$   
 $0F1,F0^{*},102$      $101,0F0,212$      $102,0F1,102$

### Disjoint

$FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$      $FF^{*},FF^{*},***$   
 $FF0,FFF,0F2$      $FF0,FFF,102$      $FF0,FFF,212$      $FF1,FF0,0F2$      $FF1,FF0,102$      $FF1,FF0,212$      $FF2,FF1,0F2$      $FF2,FF1,102$      $FF2,FF1,212$

### Overlaps

$1^{**},F0^{*},T^{**}$      $T^{**},F0^{*},T^{**}$   
 $101,0F0,102$      $212,101,212$

### Touches

$FT^{*},***,***$      $FT^{*},***,***$   
 $F0F,FFF,102$      $F0F,FFF,212$

#### Touches - Tangent

Boundary / Boundary = 0

$F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$      $F^{**},F0^{*},***$   
 $FF1,F00,102$      $FF1,F00,212$      $FF2,F01,102$      $FF2,F01,212$      $F11,F00,212$      $FF2,101,102$      $F1F,F0F,212$      $FF2,101,FF2$

$FT^{*},*0T,***$      $FF^{*},*0T,***$      $F^{*E},*0E,***$      $F^{**},*0,FF^{*}$   
 $F11,F00,212$      $FF2,101,102$      $F1F,F0F,212$      $FF2,101,FF2$

#### Touches - Borders

Boundary / Boundary = 1

$F^{**},F1^{*},***$      $F^{**},F1^{*},***$      $F^{**},F1^{*},***$      $F^{**},F1^{*},***$      $F^{**},F1^{*},***$   
 $FF2,F11,212$      $FF2,F11,212$      $FF2,F11,212$      $FF2,F11,212$      $FF2,F1F,212$

$F^{**},F1F,***$   
 $FF2,F1F,212$

#### Touches - Strict

Boundary / Boundary = F

$F^{**},F^{*},***$      $FT^{*},*F^{*},***$      $FT^{*},*F^{*},***$      $FT^{*},*F^{*},***$   
 $FF1,0F0,102$      $F01,FF0,102$      $F11,FF0,212$      $F11,FF0,212$

### Contains

$T^{**},***,FF^{*}$      $T^{**},***,FF^{*}$   
 $0F1,FF0,FF2$      $0F2,FF1,FF2$

#### Contains - Tangent

Boundary / Boundary = 0

$T^{**},*0^{*},FF^{*}$      $T^{**},*0^{*},FF^{*}$      $T^{**},*0^{*},FF^{*}$      $T^{**},*0^{*},FF^{*}$   
 $101,F00,FF2$      $102,F01,FF2$      $212,F01,FF2$      $102,101,FF2$

#### Contains - Borders

Bound. / Bound. = 1

$T^{**},*1^{*},FF^{*}$   
 $212,F11,FF2$

#### Contains - Strict

Boundary / Boundary = F

$T^{**},*F^{*},FF^{*}$      $T^{**},*F^{*},FF^{*}$      $T^{**},*F^{*},FF^{*}$   
 $101,F00,FF2$      $102,FF1,FF2$      $212,FF1,FF2$

### Within

$T^{**},***,FF^{*}$      $T^{**},***,FF^{*}$   
 $0F1,FF0,FF2$      $0F2,FF1,FF2$

#### Within - Tangent

Boundary / Boundary = 0

$T^{**},*0E,***$      $T^{**},*0E,***$      $T^{**},*0E,***$      $T^{**},*0E,***$   
 $1FF,00F,102$      $1FF,00F,212$      $2FF,10F,212$      $11F,00F,212$

#### Within - Borders

Bound. / Bound. = 1

$T^{**},*1E,***$   
 $2F1,11F,212$

#### Within - Strict

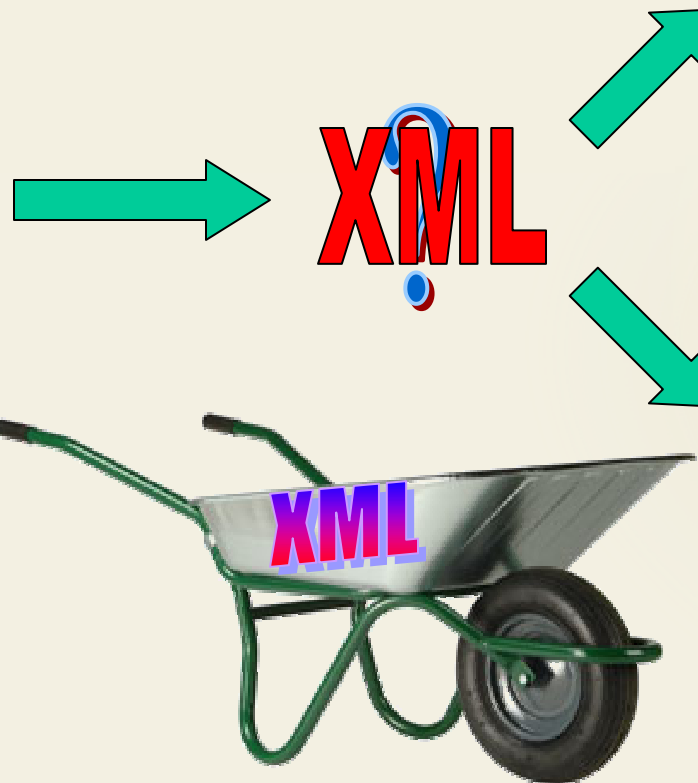
Boundary / Boundary = F

$T^{**},*F^{*},***$      $T^{**},*F^{*},***$      $T^{**},*F^{*},***$   
 $1FF,0F1,102$      $1FF,0F1,212$      $2F1,1F1,212$



# XML

« **DataBase** »  
GDB Catalogue



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

**GDB**  
« **Catalogue** »  
Catalogue  
- ISO, Internal,  
- Subset,  
- Etc.





Modifier	NameFr	NameEn	DefinitionFr	DefinitionEn	CodeBDG	Category	Type	Relate_To	Tiling	Group	Priority	CommentFr	CommentEn	CodeSD	FeatureCatalog	Geometry	Attrib	Constraint
1	10609	Perturbation des eaux	Water disturbance	Phénomène où le mouvement naturel des eaux de surface est perturbé ou entravé.	Phenomenon that disturbs or impedes the natural flow of surface water.	1170009	Category	20016	-99	Tiling	-99	-99		100605	10001	Geometry	Attrib	Constraint

Identifie	NameFr	NameEn	DefinitionFr	DefinitionEn	CodeBDG
1	10609	Perturbation des eaux	Water disturbance	Phénomène où le mouvement naturel des eaux de surface est perturbé ou entravé.	1170009

Hydrology (Super Class)...

Water Disturbance (Abstract Class)...

Water Disturbance (Geometric Class - Point)...

Fall (Sub-Type - Point)...

Unknown (Sub-Type - Point)...

Disappearing stream (Sub-Type - Point)...

Rapid (Sub-Type - Point)...

Rock in water (Sub-Type - Point)...

Water Disturbance (Geometric Class - Line)...

Fall (Sub-Type - Line)...

Unknown (Sub-Type - Line)...

Rapid (Sub-Type - Line)...

Coincident linear rapid (Sub-Type - Line)...

Water Disturbance (Geometric Class - Polygon)...

Rapid (Sub-Type - Polygon)...





# Standards (W3C, OGM)

## **Object Management Group (OGM) :** [\[http://www.omg.org/\]](http://www.omg.org/)

- Modeling and Metadata Specifications — **Unified Modeling Language™ (UML) Superstructure Specification — Version 2.0** [\[formal/ptc/04-10-02\]](#)

## **World Wide Web Consortium (W3C) :** [\[http://www.w3.org/\]](http://www.w3.org/)

- Extensible Markup Language (XML) Version 1.1 — W3C Recommendation 04 February 2004, edited in place 15 April 2004 [\[XML 1.1\]](#)
- 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 [\[XSLT 2.0\]](#)
- XML Schema Part 0: Primer Second Edition — W3C Recommendation 28 Octobre 2004 [\[XSD\]](#)
- XML Schema Part 1: Structures Second Edition — W3C Recommendation 28 Octobre 2004 [\[XSD\]](#)
- XML Schema Part 2: Datatypes Second Edition — W3C Recommendation 28 Octobre 2004 [\[XSD\]](#)
- 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



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada 