Background

• ArcGIS for Local Government is based on a harmonized information model of GIS datasets, web services, and maps

• In the U.S. this harmonized model is referred to as the Local Government Information Model (LGIM) and connects silos of information in an organization and integrates processes across typical government departments

• The Canadian Municipal Data Model (CMDM) initiative is leveraging the LGIM to create a Canadian version of this data model for use by municipalities

• The CMDM is only one component of what will be the ArcGIS for Local Government Canadian Version
ArcGIS for Local Government

• A series of useful maps and apps focused on municipal government work
  – Organized into modules
  – Extensible, configurable

• An online community
  – Best Practices / Implementation Support

• A network of Esri Services and Partner offerings
  – Help users implement, sustain and enhance
CMDM Project Objectives

- Convert U.S. oriented feature classes, feature types and domains to Canadian requirements
- Beta test data model in 2 or 3 municipalities
- Modify Local Government Election application templates to use the new data model
- Create a Canadian municipal demonstration environment
Data Model (schema) Review

- Detailed review by Township of Langley and County of Simcoe
- Reviewed by municipal operations specialists in Esri Canada
- Compared to existing (published) municipal data models from across Canada
Data Model Revisions

- Only necessary changes made – no changes for change sake
- Revise obvious differences with addressing and quantity measurements
- Replace parcel related Feature Class with Esri’s Canadian Parcel Feature Data Model (parcel publishing tables)
## Revision Examples

### Election Administration Feature Dataset

<table>
<thead>
<tr>
<th>LGIM (US)</th>
<th>CMDM (CDN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>County District</td>
<td>Polling Division</td>
</tr>
<tr>
<td>Local District</td>
<td>Polling Place</td>
</tr>
<tr>
<td>Polling Place</td>
<td></td>
</tr>
<tr>
<td>State House District</td>
<td></td>
</tr>
<tr>
<td>State Senate District</td>
<td></td>
</tr>
<tr>
<td>US House District</td>
<td></td>
</tr>
<tr>
<td>US Senate District</td>
<td></td>
</tr>
<tr>
<td>Voting Precinct</td>
<td></td>
</tr>
</tbody>
</table>
## Revision Examples

<table>
<thead>
<tr>
<th>Demographics Feature Dataset</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LGIM (US)</strong></td>
<td><strong>CMDM (CDN)</strong></td>
</tr>
<tr>
<td>Census Block</td>
<td>Census Division</td>
</tr>
<tr>
<td>Census Block Group</td>
<td>Census Subdivision</td>
</tr>
<tr>
<td>Census Landmark Point</td>
<td>Dissemination Area</td>
</tr>
<tr>
<td>Census Tract</td>
<td>Dissemination Block</td>
</tr>
</tbody>
</table>
### Pipe Diameter Size Domain

<table>
<thead>
<tr>
<th>LGIM (US)</th>
<th>CMDM (CDN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>19 mm</td>
</tr>
<tr>
<td>1&quot;</td>
<td>25 mm</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>31 mm</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>38 mm</td>
</tr>
<tr>
<td>2&quot;</td>
<td>50 mm</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>63 mm</td>
</tr>
<tr>
<td>3&quot;</td>
<td>75 mm</td>
</tr>
<tr>
<td>4&quot;</td>
<td>100 mm</td>
</tr>
</tbody>
</table>
Features Added

- Postal Code Boundary
- Environmentally Sensitive Area
- Land Use Category (Domain)
- Street Calming
- Street Calming Type (Domain)
- Vegetation Type (Domain)
Benefits

• Consolidated data for use in numerous GIS applications
• Common framework for data sharing within organizations and with external partners
• Configurable application templates can be shared
• Easily participate in programs such as GFX and Community Maps of Canada
Demonstration

- ArcGIS for Local Government
  - Election application – Polling Places
  - Public Information Centre
Canadian Parcel Data Model

• Standard Parcel Data Model for Canada
  • Standard parcel editing model
  • Standard parcel publishing model
• Leverages LGIM parcel model
  • “Canadian-izes” survey legal descriptions
  • Optional parcel dimension annotation
• First implementation in Oxford County
  • Survey, ownership, assessment and easement parcels
  • Condominium units as spatial entities
  • Survey plan image mosaic
What is Parcel Mapping?

- Mapping depicting interests (ownership, leases, rights of way, etc.) in land – sometimes called “Cadastral Mapping”

- Commonly created by Land Titles, Assessment, Local Government and other organizations.

- Increasing and broad demand for parcel mapping across many sectors.

- A foundational component of Canada’s spatial data infrastructure – essential for spatial analytics and geo-enabling a key business systems and processes.

Courtesy: Oxford County Ontario
Parcel Life Cycle

Demand for Parcel Mapping Through the Parcel Life Cycle

Plan of Survey Recorded At This Point

Demand for Mapping

Engineering Design
Review & Comment
External Design
Planning

Benefit Gap

Proposed → Registered → Assessed → Retired
(Package Mapping Life Cycle Stage)

"Build" Phase → "Operate" Phase

Permitting & Licensing
Public Works
Assessment

Source: Geomatica Volume 61 Number 4, 2007
The Esri Parcel Fabric

- Core geodatabase structure
- Designed for parcel mapping
- Explicit topology
- Integrated dataset of parcels, boundaries and corners
- Infrastructure of parcels, dimensions and control
Parcel Fabric Model

• More than just title parcels
  • Ownership, assessment, survey, easement, subsurface, zoning, lease

<table>
<thead>
<tr>
<th>Parcels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape (Polygon)</td>
</tr>
<tr>
<td>Joined</td>
</tr>
<tr>
<td>PlanID</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>StatedArea</td>
</tr>
<tr>
<td>Compiled</td>
</tr>
<tr>
<td>Historical</td>
</tr>
<tr>
<td>SystemStartDate</td>
</tr>
<tr>
<td>SystemEndDate</td>
</tr>
<tr>
<td>LegalStartDate</td>
</tr>
<tr>
<td>LegalEndDate</td>
</tr>
<tr>
<td>GroupID</td>
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<tr>
<td>Accuracy</td>
</tr>
<tr>
<td>Rotation</td>
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<tr>
<td>Scale</td>
</tr>
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</tr>
<tr>
<td>MiscloseRatio</td>
</tr>
<tr>
<td>MiscloseDistance</td>
</tr>
<tr>
<td>MiscloseBearing</td>
</tr>
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<td>Construction</td>
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<td>ShapeStdErrorE</td>
</tr>
<tr>
<td>ShapeStdErrorN</td>
</tr>
<tr>
<td>BacksightBearing</td>
</tr>
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</table>
Parcel Fabric Benefits

- Core parcel editing tools and data model
- Explicit topology for managing parcel integrity
  - Continuous and seamless maintenance
- Simple fabric update using surveys
- Holistic adjustment using recorded dimensions
  - Fabric positional accuracy can improve over time
  - Nothing captured is ever lost / self validating
- Can leverage digital survey submissions

... parcels are a core part of a municipality’s data infrastructure
LGIM Parcel Model

• LGIM has parcel editing and publishing components

• Parcel editing extension to core parcel fabric
  • Standard parcel classes
    > Attribute model based on ArcGIS Land Parcel Data Model
  • Standard automated workflows
  • U.S. biased
    > PLSS based survey fabric
    > County assessor focused workflows

• Standard parcel viewer leverages parcel publishing model
LGIM Parcel Model

• ParcelEditing
  - ParcelDimensions
  - ParcelFabric
    - ParcelFabric_Parcel
    - ParcelFabric_Lines
    - ParcelFabric_Points
    - ParcelFabric_LinePoints
    - ParcelFabric_Control
    - ParcelFabric_Plans
  - TaxParcelCondo

• ParcelPublishing
  - Block
  - ConveyanceDivision
  - ConveyanceDivisionPoint
  - Encumbrance
  - OwnerParcel
  - SimultaneousConveyance
  - TaxMapIndex
  - TaxParcel
  - TaxParcelPoint
LGIM Parcel Classes

- Splits parcel fabric into logical classes
- Supports the automated workflows at ArcGIS 10.1 SP1
- Provides a more natural interface to the fabric
LGIM Parcel Workflows

- New Subdivision
<table>
<thead>
<tr>
<th>Task</th>
<th>Merge</th>
<th>Split by Boundary</th>
<th>Split by Area</th>
<th>Split by Parent</th>
<th>Subdivision by COGO</th>
<th>Subdivision by CAD</th>
<th>Boundary Adjustment</th>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
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<tr>
<td>Subdivision plat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Request for update</td>
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<tr>
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<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
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</tr>
<tr>
<td>Copy / paste subdivision lines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
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<tr>
<td>Edit pasted lines</td>
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<td>Create remainder parcel</td>
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</tr>
<tr>
<td>Create lot parcels</td>
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<tr>
<td>Copy / paste lot lines</td>
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<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
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<td>Edit pasted lines</td>
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<td>Attribute lot parcels</td>
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<td>Create tax parcels</td>
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<td>Update selected parcels</td>
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<td>Attribute parcels</td>
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<tr>
<td>Annotate parcels</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
LGIM Parcel Model Issues

• Survey model is U.S. PLSS specific
• Workflows are County tax assessor focused
  • Subdivision and parcel creation in single workflow
  • Dimension annotation is required
• Current only information model supported by Esri
Canadian Parcel Data Model

• Leverages LGIM and legacy Esri parcel models
  • First implementation in Oxford County
• Expanded to include other jurisdictions
  • Other Ontario municipalities
  • Other provinces
  • Canada Lands
• Condominiums modeled as spatial entities
• No parcel annotation by default
  • Text generated exclusively via labeling
• Optional survey plan image mosaic
CPDM – Survey Model

- Original Survey models original survey fabric
  - Ontario – Township, Concession, Lot
  - Quebec – Parish, Lot
  - Western – Township, Section, Quarter (DLS)
  - BC – District, Lot

- Current Survey models subdivisions and condos
  - Subdivisions – Plan, Block, Lot
  - Condominiums – Plan, Level, Unit

- Descriptive Survey models descriptive plans only
  - Does not automatically create land divisions
CPDM – Parcel Model

• Property parcel models ownership
• Valuation parcel models assessment
• Regulated Use models zoning
  • Regulated use parcels allow modeling of property, assessment and zoning in a single combined parcel
• Encumbrance models easement
• Separated Right models primarily resource rights
• Condominium units are modeled as property, valuation or regulated use parcels
Multilevel Condominium
Fabric QA
CPDM Benefits

• Leverage COTS as much as possible
  • Reduces development cost
  • Facilitates migration to new releases

• Standard model for all interrelated parcel classes
  • Implement some or all of the parcel class as required
  • Fabric takes care of shared geometry
  • Facilitates sharing amongst land administration agencies

• Provides a Canadian perspective of the LGIM
  • Intelligent parcel model
  • Parcel history
  • Verify positional accuracy and improve over time
  • Ready to leverage digital plan submission
Digital Plan Submission

- In name only => PDF
  - Satisfies plan registration
  - Useless for digital cadastre
- Better => CAD
  - Geometry can be copied to fabric directly
  - No metadata, parcels
  - Requires standard spec (e.g., Alberta, NRCan)
- Best => XML
  - Full parcel geometry
  - Full metadata
  - LandXML, Cadastral XML
  - Requires standard template

… best practice
"...we must also rely on more advanced technologies to gain higher levels of efficiency. Electronic submissions are one way we can gain these efficiencies." – Township of Langley
CPDM Implementation

- Implementing fabric requires planning / best practices
- Successful implementation directly related to effort spent in modeling and migration
- Best practice and knowledge transfer leading to self sufficiency

... parcel fabric requires structured implementation
Next Steps

• Validate other jurisdictions against model

• Work with Redlands to add CPDM as a supported fabric information model
  • Standard layers and symbology
  • Standard automated workflows

• Provide guidance for CPDM implementation
Q & A