ArcGIS for Land Records: Migrating your Data

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Session Goals

- Introduce Parcel Fabric data model
- Review data migration strategies
- Develop an Editing Map for daily workflows
What is a Parcel Fabric?

- Set of **related tables and feature classes** in a geodatabase
- Forms a **parcel boundary network**
- Explicit **topology**
  - defined by **common parcel corners**
    (no overlaps and gaps between neighboring parcels)
How parcel fabric data is stored?
Plans

- Store and manage plans, plats, legal records...
- Parcels can be created in and grouped by their associated legal record
How parcel fabric data is stored?

### Tables

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>SurveyDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crane's Roost</td>
<td>08/25/2007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Parcel Name</th>
<th>Plan ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>28</td>
<td>1</td>
</tr>
</tbody>
</table>
Parcels can be grouped with an associated Plan.

- **Parcels**
  - ID
  - Name
  - SurveyDate
  - Plan ID
  - Lines
  - Control

**Plans**

**Points**

**Line Points**
Parcels are defined by a set of boundary lines.
2-point Lines have a Start and End point

<table>
<thead>
<tr>
<th>ID</th>
<th>Distance</th>
<th>From Point</th>
<th>To Point</th>
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<tbody>
<tr>
<td>200</td>
<td>95.46</td>
<td>301</td>
<td>302</td>
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<td>417.10</td>
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<tr>
<td>205</td>
<td>200.00</td>
<td>306</td>
<td>301</td>
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</table>
Points can be associated with a Control Point

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>PointID</th>
</tr>
</thead>
<tbody>
<tr>
<td>401</td>
<td>CP1</td>
<td></td>
<td></td>
<td></td>
<td>302</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td></td>
<td></td>
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<tr>
<td>302</td>
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<td></td>
</tr>
<tr>
<td>306</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Control

Plans

Parcels

Lines
Parcel Fabric Data Model Relationships

- Plans
  - Parcels
    - Points
      - Control
        - Line Points
          - Lines

Relationships:
- 1-M
- 1
- 2-1
- 0-1
- 0-M
Data Integrity of Parcels in a Fabric

- Topological accuracy
  - Parcels are joined using shared points
Line points

- Added to existing parcel point when:
  - Point is on boundary of adjacent parcel
- Does not split the boundary line
Data Model

Fabric allows overlapping parcels

- Natural boundaries
- Donut/island and multipart parcels
- Historic parcels
Demonstration
Parcel Fabric Data Model
Data Migration Strategies

- CAD
- Coverages
- Geodatabase

Parcel Fabric
Loading Data into a Parcel Fabric – White Paper

• Important aspects:
  • Different paths depending on source data
  • Use a topology to check data integrity
  • Modeling different parcel types
    • (lots, subdivisions, etc.)
  • Delineating curves
  • Annotation

Get to know the Tax Parcel Editing Template for 10

- Download from ArcGIS.com and includes:
  - Maps and Geodatabase
  - Documentation
  - Application
  - Getting Started Document
- Watch the videos, read the blogs
- Work with sample data
- Review Local Government GDB

Search for “Tax Parcel Editing Template for ArcGIS 10” on ArcGIS.com
Local Government Information Model – Parcel Fabric

- Manage multiple parcel types in a parcel fabric
- Supports National Parcel Data Standard (FGDC)
- Use as starting point for your implementation
ParcelType Domain
1 PLSS Township
2 PLSS Section
3 PLSS Quarter Section
4 Special Survey
5 Simultaneous Conveyance
6 Conveyance Division
7 Tax
8 Ownership
9 Encumbrance
10 Separated Right
11 Other
("Type" = 7) AND (SystemEndDate IS NULL)

ParcelType Domain
1  PLSS Township
2  PLSS Section
3  PLSS Quarter Section
4  Special Survey
5  Simultaneous Conveyance
6  Conveyance Division
7  Tax
8  Ownership
9  Encumbrance
10 Separated Right
11 Other
"Type" = 5 AND (SystemEndDate IS NULL)

ParcelType Domain
1 PLSS Township
2 PLSS Section
3 PLSS Quarter Section
4 Special Survey
5 Simultaneous Conveyance
6 Conveyance Division
7 Tax
8 Ownership
9 Encumbrance
10 Separated Right
11 Other
Lots and Units

("Type" = 6) AND (SystemEndDate IS NULL)

ParcelType Domain
1  PLSS Township
2  PLSS Section
3  PLSS Quarter Section
4  Special Survey
5  Simultaneous Conveyance
6  Conveyance Division
7  Tax
8  Ownership
9  Encumbrance
10 Separated Right
11 Other
Lots and Units

SimConDivType Domain
Building
Unit
General Common Element
Limited Common Element
Ingress/Egress
Lot
Outlot
Park
Public Right Of Way
…
Unpack the Local Government Schema Package

- Browse for a target Geodatabase
- Specify the spatial reference
Preparing Your Source Data
General Migration Overview

Source Data → Staging Geodatabase → Target Parcel Fabric
Loading Your Data in a Parcel Fabric

- Establish target fabric schema before loading any data
- Modifying fabric schema once data is loaded is possible
  - Calculating fields will require edit session.
- Add fields to Staging datasets that match target fabric and pre-populate
- Start with a SMALL subset and go through entire process
Migration Workflow

Source Data
- Examine Template
- Generate Inventory
- Select Sample data
- Prepare & clean
- Identify COGO
- Map attributes

Staging Geodatabase
- Add/Calc staging fields
- Validate topology
- Fix topology errors
  - Dangles
  - Overlaps
  - Slivers/gaps
- Fix Curves

Target Parcel Fabric
- Author Editing Map
- Add/Alias fields
- Merge courses
- Merge curve center points
- Associate control
- Improve Accuracy
Migrating CAD Files
CAD Files

- Schema and structure varies
- Typically divided into multiple files (tiles, facets, etc.)
- Parcels maintained in files as:
  - Polylines
  - Annotation
Overview of CAD Migration

- Create a Staging File Geodatabase and Feature Dataset
- Use Select Geoprocessing Tool to import Polylines "Layer" in ( 'PARCEL_LINE', 'ROW_LINE' )
- Run Repair Geometry (GP) to remove NULL features
- Create a Geodatabase Topology to validate lines:
  - Must Not Overlap
  - Must Not Have Dangles
- Create parcel polygons with Feature To Polygon (GP) using CAD Text (parcel number) as Label Features
- Follow steps for migrating a Geodatabase Topology
Sample CAD To Geodatabase Conversion Model

1. Create File GDB
2. File Geodatabase
3. Feature Dataset for CAD File
4. Feature to Feature Class
5. CAD Polylines
6. Converted Lines
7. Repair Geometry
8. Updated Geometry
9. Delete Identical
10. Duplicates Removed

Branches:
- Add Feature Class To Topology
- Add Must Not Have Dangles Rule To Topology
- Add No Dangles Rule
- Add Must Not Overlap Rule To Topology
- Add No Overlaps Rule
- Validate Topology
- Validated Topology
Fix Topology Errors

• Common fixes for dangles
  - Extend (undershoot)
  - Trim (overshoot)
  - Planarize (Select lines with dangles and adjacent lines)
Some problems can be identified and fixed on the source data.
  • Keep working with software/tools you are most familiar
  • No impact on the legacy system downtime
• Must Not Overlap Errors
  • Planarize should be able to eliminate most if not all of these.
Create Parcel_polys (Staging)

- Feature To Polygon Geoprocessing Tool
  - Input Features Imported and validated Lines
  - Label Features CAD Annotation

Def Query: "Layer" = 'PIN_ANNO'
Preliminary (CAD) Staging Data ready

- Parcel_lines have no dangles or overlaps
- Parcel_polys have been created
- Continue “Migrating Geodatabase Topology” (discussed later)
Migrating ArcInfo Coverages

Coverages → Staging Geodatabase
Coverages

- Migrate arcs, polygons, and regions to Staging Geodatabase
- Topology in coverage easily translates to Geodatabase
- Remove internal coverage fields LPOLY#, RPOLY#, etc. during import.
Librarian and ArcStorm

- COPYOUT or EXTRACT into one or more coverages
- Start with a relatively small pilot area
Preliminary (Coverage) Staging Data ready

- Parcel_lines imported from arcs
- Parcel_polys imported from polygons
- Continue “Migrating Geodatabase Topology”
Source Data – What if I only have Polygons?

- Use **Polygon to Line** GP Tool to create the Lines
- **LEFT_FID = -1** may help identify ROW boundaries
Migrating Geodatabase Topology
Load a Topology to a Parcel Fabric

Target Parcel Fabric
Error free Geodatabase Topology
Containing Parcel Lines and Parcel Polygons
That is Validated against 6 Topology Rules

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Migrating Data into Tax Parcel Editing Template
**Tax Parcels**

- **Parcels**
  - **Parcel_lines**
  - **Parcel_polys**
  - **Parcel_Topo**

**Parcels Model**

- Name = [PARCELNUM]
- Type = 7
- LegalStartDate = Sub_poly.[DATE]
- StatedArea = CAMA.[ACRES]

**ParcelType Domain**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PLSS Township</td>
</tr>
<tr>
<td>2</td>
<td>PLSS Section</td>
</tr>
<tr>
<td>3</td>
<td>PLSS Quarter Section</td>
</tr>
<tr>
<td>4</td>
<td>Special Survey</td>
</tr>
<tr>
<td>5</td>
<td>Simultaneous Conveyance</td>
</tr>
<tr>
<td>6</td>
<td>Conveyance Division</td>
</tr>
<tr>
<td>7</td>
<td>Tax</td>
</tr>
<tr>
<td>8</td>
<td>Ownership</td>
</tr>
<tr>
<td>9</td>
<td>Encumbrance</td>
</tr>
<tr>
<td>10</td>
<td>Separated Right</td>
</tr>
<tr>
<td>11</td>
<td>Other</td>
</tr>
</tbody>
</table>

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Parcel_lines (Staging)

- Add fields to match Parcel fabric schema
  - Category (Long Integer)
  - CartoLineType (Text 50)
Parcel_lines (Staging)

- Populate staging fields for Parcel Lines
  - Category = 0
  - CartoLineType = “Parcel Boundary”
(ROW) Parcel_lines (Staging)

- Populate staging fields for ROW Lines
  - Category = 5
  - CartoLineType = “ROW Boundary”
Parcel_polys (Staging)

- Add matching fields in fabric schema
  - Name (Text 50)
  - Type (Long Integer)
  - LegalStartDate (Date)
  - StatedArea (Text 50)
Parcel_polys (Staging)

- Populate staging fields for Parcels
  - Name = PARCEL_NO
  - Type = 7 (Tax Parcel)
  - LegalStartDate = Sub_poly.[LegalStartDate]
  - StatedArea = CAMA.[DEEDED_ACREAGE]
Create and Validate (Staging) Topology

- Include Staging Line and Polygon Feature Classes
- Accept Default Cluster Tolerance
- 2 Ranks
  - Lines Rank 1
  - Polygons Rank 2
- Add Topology Rules listed below

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Staging Data ready for loading

<table>
<thead>
<tr>
<th>Shape</th>
<th>Category</th>
<th>CartoLineType</th>
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</thead>
<tbody>
<tr>
<td>Polyline</td>
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<td>Parcel Boundary</td>
</tr>
<tr>
<td>Polyline</td>
<td>0</td>
<td>Parcel Boundary</td>
</tr>
<tr>
<td>Polyline</td>
<td>0</td>
<td>Parcel Boundary</td>
</tr>
<tr>
<td>Polyline</td>
<td>5</td>
<td>ROW Boundary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shape</th>
<th>SUB ID</th>
<th>Name</th>
<th>Type</th>
<th>LegalStartDate</th>
<th>StatedArea</th>
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<tbody>
<tr>
<td>Polygon</td>
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<td>7</td>
<td>7/9/2000</td>
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<td>7</td>
<td>7/9/2000</td>
<td>0.165 Ac</td>
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<td>7/9/2000</td>
<td>0.221 Ac</td>
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<td>519343050900000</td>
<td>7</td>
<td>7/9/2000</td>
<td>0.202 Ac</td>
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</tbody>
</table>
Load Topology in a Fabric

### Load a Topology to a Parcel Fabric

<table>
<thead>
<tr>
<th>Target Parcel Fabric</th>
<th>ParcelFabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (Topology) Feature Class</td>
<td>Parcel_Lines</td>
</tr>
<tr>
<td>Input Point Features (optional)</td>
<td></td>
</tr>
<tr>
<td>Minimum Line String Segment Count (optional)</td>
<td></td>
</tr>
<tr>
<td>Control Match Tolerance (optional)</td>
<td>0.1 Meters</td>
</tr>
</tbody>
</table>

- Import Parcels as Unjoined Group
- Direction Units (optional)
  - DEGREES_MINUTES_SECONDS
  - QUADRANT_BEARING
- Compute Area for New Parcels
- Area Units (optional)
  - ACRES
- Radial Point Tolerance (optional)
  - 0.5 Meters
- Accuracy Category for Inversed Lines (optional)
  - 7_LOWEST

### Accuracy Category for Inversed Lines (optional)

The accuracy category of the lines and polygons being migrated. Accuracy categories are defined by date of survey in the parcel fabric. Accuracy category 1 is the highest data accuracy (recently surveyed) and accuracy category 6 is the lowest data accuracy (year 1800 or lower). Accuracy categories are used in the fabric adjustment.

- **1_HIGHEST**—Most recently surveyed and recorded data. Data accuracy is the highest.
- **2_AFTER_1980**—Data is surveyed and recorded after 1980.
- **3_1908_TO_1980**—Data is surveyed and recorded between 1908 and 1980.
- **4_1881_TO_1907**—Data is surveyed and recorded between 1881 and 1907.
- **5_BEFORE_1881**—Data is surveyed and recorded before 1881. Data accuracy is low. This is the default.
- **6_1800**—Data is surveyed and recorded before 1800. Data accuracy is low. This is the default.
- **7_LOWEST**—Data is unreliable and data accuracy is unknown. Data is excluded from influencing the
Iteratively Load to the Parcel Fabric

- Loads a topology to a Fabric iteratively based upon a polygon feature class (grid)
- Create Fishnet GP Tool to generate polygon grid
COGO Attributes

- Lines with COGO attributes are transferred as is
- Lines without COGO attributes
  - Will be inversed when data is loaded into the fabric
  - Calculated field will be set to True
How are curves represented in your data?

- Densified curves will be loaded as Linestrings
  - May be able to be converted with Curves and Lines Add-In
Simultaneous Conveyances (Subdivisions)

- Staging Fields
  - Name = [Sub_name]
  - Type = 5
  - LegalStartDate = [DATE]
  - SimConType = “Subdivision”
  - PlanName = [Sub_name]

Parcel Model

- Subdivisions
  - Sub_lines
  - Sub_polys
  - Sub_Topo

- ParcelType域
  - 1 PLSS Township
  - 2 PLSS Section
  - 3 PLSS Quarter Section
  - 4 Special Survey
  - 5 Simultaneous Conveyance Division
  - 6 Tax
  - 7 Ownership
  - 8 Encumbrance
  - 9 Separated Right
  - 10 Other

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Sub_lines (Staging)

- Add and Calculate Staging Fields
  - CartoLineType = “Conveyance Boundary”
  - Category = 0
Sub_polys – Add Staging Fields

- Type (Long)
- LegalStartDate (Date)
- SimConType (Text 50)
- PlanName (Text 255)
Sub_polys – Calc fields for “Subdivision”

- Select Expression NOT([NAME] LIKE ‘%CONDO%’)
  Type = 5
  LegalStartDate = [DATE]
  SimConType = “Subdivision”
  PlanName = [NAME]
Sub_polys – Calc fields for “Condominium”

- Select Expression [NAME] LIKE ‘%CONDO%’
  Type = 5
  LegalStartDate = [DATE]
  SimConType = “Condominium”
  PlanName = [NAME]
Create and Validate (Staging) Topology

- Include Staging Line and Polygon Feature Classes
- 2 Ranks
  - Lines Rank 1
  - Polygons Rank 2
- Add Topology Rules listed below

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Pre-Populating Plan Directory

- Add PlanName to Staging Polygons (Subs/parcels/lots)
- Calculate values
- Plan Directory will get automatically populated and linked to fabric parcels as data is loaded into fabric
- Name = [Lot_number]
- Type = 6
- LegalStartDate = [DATE]
- SimConDivType = “Lot”
- PlanName = [Sub_name]

ParcelType Domain
1   PLSS Township
2   PLSS Section
3   PLSS Quarter Section
4   Special Survey
5   Simultaneous Conveyance
6   Conveyance Division
7   Tax
8   Ownership
9   Encumbrance
10  Separated Right
11  Other

Lots and Units

- Lots
  - Lot_lines
  - Lot_polys
  - Lot_Topo

- Parcel Model
- Assessor
- ParcelFabric

- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)
Derive Lot Staging layers from Parcel lines/polys

- Select/Export Parcel_polys with SUB_ID value
- Select/Export Parcel_Lines by Location that Share a line segment with Parcel_polys
Derive Lot Number from Annotation

- **Feature to Point**
  - Lot Centroid
- **Add/Calculate Name Staging Field**
- **Spatial Join to transfer Lot number from Lot Centroids to final Lot_polys**
Add/Calculate Remaining Staging Fields
Authoring an Editing Map
Configuring Tax Parcels in Editing Map

- Add Parcel Fabric Layer to map
- Rename Parcels Sub Layer “Tax Parcels”
- Open Layer Properties for Tax Parcels
  - Select Symbol
  - Definition Query
    \[(\text{SystemEnd} \text{Date IS NULL}) \text{ AND} (\text{"Type"} = 7)\]
  - Set Labeling Properties if desired

- Save Tax Parcels (Fabric sub layer) as Layer File
  \textit{Fabric Authoring Layer.lyr}
Configuring Subs and Condos in Editing Map

- Load *Fabric Authoring Layer.lyr* into Map
- Rename Layer “Subs and Condos”
- Open Layer Properties for Tax Parcels
  - Select Symbol
  - Definition Query
    \[(\text{SystemEndDate IS NULL}) \text{ AND } (\text{"Type" =5})\]
  - Set Labeling Properties if desired
Configuring Lots and Units in Editing Map

- Load *Fabric Authoring Layer.lyr* into Map
- Rename Layer “Lots and Units”
- Open Layer Properties for Tax Parcels
  - Symbol Properties
    - Unique Values
    - Value Field “Lot or Unit Type”
  - Definition Query
    \((\text{SystemEnd} \text{Date IS}\\text{NULL})\ \text{AND}\ (\text{"Type" = 6})\)
- Set Labeling Properties if desired
Establish Feature Templates for Parcel Types
Create Templates for each Parcel Type

- Create Templates for each Parcel Type
Edit Properties for Tax Parcel Feature Template

- Set Type = Tax
Edit Properties for Subs and Condos Feature Template

- Set Type = Simultaneous Conveyance
- Set Sub or Condo Type = Subdivision
Edit Properties for Lot/Unit Feature Templates

- Set Type = Conveyance Division
- Repeat for each Feature Template
Questions?