Data Interoperability
An Introduction

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What is the Data Interoperability Extension?

Moving data from app to app – “ETL” in industry jargon

- If you are not the custodian you don’t control the data
  - Format or System of Record
  - Attribute Schema
  - Transport Technology

- Data providers probably don’t care much about your functional requirements
- Data itself certainly doesn’t care about you at all

- Data Interoperability empowers the ArcGIS data professional
  - Connectivity & Authentication
  - Data Transformation & Business Rules
  - Workflow Automation
  - Sharing
Where is the Data Interoperability Extension?
ArcGIS Pro, ArcMap, ArcCatalog

• Licensed like any extension
  - Named User (Pro), Concurrent, Single User
  - Evaluation licenses available
• You must **install** the extension
• Immediate authoring from the Analysis ribbon in Pro
  - We’ll get to ‘authoring’ later
• ArcGIS 10.x - enable the extension
  - Tools visible in Pro 2.0
Why Should I use the Data Interoperability Extension?

- Traditionally three workflows – Direct Read, Quick Conversion, Spatial ETL
  - Web GIS needs more than direct format support e.g. feeds, authentication…
- Lets look at it this way

<table>
<thead>
<tr>
<th>Capability</th>
<th>ArcGIS 10.x</th>
<th>ArcGIS Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Read of Formats</td>
<td>✓</td>
<td>✗₁</td>
</tr>
<tr>
<td>Quick Format Conversion</td>
<td>✓</td>
<td>✗₂</td>
</tr>
<tr>
<td>Spatial ETL Tools</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FMW Integration</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

1: Use Workbench; Interoperability Connections Coming  2: Use Workbench
How Do Others use the Data Interoperability Extension?

Top Use Cases

• Migration
  - Adoption of ArcGIS

• Integration
  - Projects with External Parties’ Applications

• Publication
  - Formats Accessible to Target Audiences

• Validation
  - Feature Level Business Rule Enforcement

• Detection
  - Cross-Feature/Format/Schema Interaction

• Creation
  - Make Features from Anything (including Nothing)
The Classic Use Cases
Direct Read, Quick Conversion, Spatial ETL
Direct Format Read

- ArcGIS is Geo-Relational
  - Feature classes are database tables with an ObjectID and a geometry column
- Some file formats can be automatically interpreted this way
  - Recognized by file extension (.gml, .geojson, .kml, .gpx, .xlsx, .osm, .xyz….)
  - Default behavior assumed
- Some formats can get help from a friend
  - VRT gateway files
- Many data sources are out of scope for direct read
  - Interpretation is required
  - Custom formats are an option (advanced topic)
Direct Read Demo

ArcCatalog
Quick Import and Quick Export

• Easy Button

• When you need data to participate in:
  - Editing
  - Geodatabase behavior

• Quick Import
  - Writes to Geodatabase
  - Create or Overwrite
  - Default Schema
  - Postprocessing often required
    - In Modelbuilder the Select Data tool accesses feature classes
    - Project or Define Projection

• Quick Export
  - Writes Any Format (277 available)
  - Default Schema
The Format Challenge
Dale, I’m sticking with 277

• Pick from 100’s
  - On Disk
  - Database
  - Semantic (XML, JSON)

• Web as Filesystem
  - Box
  - DropBox
  - OneDrive
  - AWS S3
  - Google Drive
Multiple Formats
Combining is OK

- Read Many
- Join Many
- Spatial Interact Many
- Write Many

Translation Parameters

User Parameters

Source Geography Markup Language (GML) File(s):
D:\Work\UC2017\DataInteroperability\Introduction\MultipleFormats\city_parks.gml

Source MapInfo MIF/MID File(s):
D:\Work\UC2017\DataInteroperability\Introduction\MultipleFormats\BirdNestPoints.mif

Eggs CSV:
D:\Work\UC2017\DataInteroperability\Introduction\MultipleFormats\eggs.csv

Destination Google KML File:
D:\Work\UC2017\DataInteroperability\Introduction\MultipleFormats\BirdSociety.kml

Destination Microsoft Excel File:
D:\Work\UC2017\DataInteroperability\Introduction\MultipleFormats\BirdSociety.xlsx

[OK] [Cancel]
Multiple Formats Demo

ArcCatalog
ArcGIS Earth
Spatial ETL – Moving Data With Transformation

**Extract Transform Load**

- Doesn’t ArcGIS Already Read Most Useful Formats?
  - Arguably, but the details really matter
- Spreadsheets
- Character Separated Values
- Shapefile

- Did you notice the non-spatial formats above?
Workbench
Graphical Programming Application

- Separate Process
- Menus, Controls
- Canvas
  - Readers
  - Transformers
  - Writers
- Navigator
- Transformer Gallery
- Log
What’s a Transformer?

• Transformers Are Analogous to a Geoprocessing Tool
• Have Input and Output Port(s)
• Typically Operate Per Feature
• May Operate on Attributes and/or Geometry
• Optionally Operate Per Group of Attribute Value
• May Operate With Parallel Multiprocessing
• Show Me
Common Workflow #1

- **Transformation Automation**
  - Spatial ETL Tools *are* ArcGIS Geoprocessing Tools
    - Use in Modelbuilder
    - Use Spatial ETL Tools in standalone Python scripts
    - Use ArcPy inside Workbench
    - Publish to ArcGIS Enterprise (Windows, 10.x)

- **ArcGIS Pro 2.0 interoperates with FME**
  - Read and Write .fmw files
  - FME 2017 Engine

- Publish maps that use non-native formats copied to a Data Store folder
Common Workflow #2

• Integrate Multiple Formats

- CityMap.gml
- CityPlan.xlsx
- CityBuildings.dwg

...
Common Workflow #3

- Distribute/Migrate Data Between Systems

CityPlan.xlsx
CityMap.gml
CityBuildings.dwg

Data Interoperability
Common Workflow #4

- Validate Data
- Examples:
  - Consider the previous feature in some custom sort order
  - Build expressions using multiple attributes
  - Use statistical analysis to drive tests
  - Reach out to web services for real time checks
  - Cast geometry to another type temporarily
- Create reports of issues found
Spatial ETL Demos
ArcGIS Pro 2.0
Try it, Learn it

• 60-day Trial:
• Courses – search ‘ETL’ in the Training Catalog:
  - [Transforming Data Using Extract, Transform, and Load Processes](http://www.esri.com)
  - [Controlling Data Translations Using Extract, Transform, and Load Processes](http://www.esri.com)
Question Time

- Bruce Harold bharold@esri.com
- Dale Lutz https://www.safe.com/live-chat/
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