Data Interoperability - An Introduction

Data Integration Tools for ArcGIS

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Agenda

• Desktop Product Overview
  – Format Support
  – Data Translation
  – Spatial ETL (Extract, Transform and Load)
    • Workbench

• Engine and Server Product Overview

• Questions
Product Overview

- **Extension to ArcGIS**
  - Co-developed with Safe Software
  - Extension based on Safe Software’s FME product

- **Standard Extension pricing**

- **Works on ArcView, ArcEditor, and ArcInfo**

- **Supported on Windows Vista, XP, 2000**
## Development timeline

<table>
<thead>
<tr>
<th>ArcGIS (ESRI)</th>
<th>FME (Safe Software)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0</td>
<td>FME2004</td>
</tr>
<tr>
<td>9.1</td>
<td>FME2004</td>
</tr>
<tr>
<td>9.1 SP1</td>
<td>FME2005</td>
</tr>
<tr>
<td>9.1 SP2</td>
<td>FME2005</td>
</tr>
<tr>
<td>9.2</td>
<td>FME2006GB</td>
</tr>
<tr>
<td>9.3</td>
<td>FME2008</td>
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</table>
Key Features

• **Format Support**
  – Adds 85+ data formats
  – Use data directly in all Desktop applications

• **Data Translation**
  – Data Interoperability Tools Toolbox
  – Convert between data formats

• **Spatial ETL (Extract, Transform, Load)**
  – Semantic Data Translation
  – Data Restructuring
Added Format Support

- Directly read additional data formats (vector-only)
  - ArcMap, ArcCatalog, ArcScene, etc
Format Support

**ArcCatalog and ArcMap**

- **ArcCatalog**: Manage your data
  - Browse tree
  - Interoperability Connections

- **ArcMap**: Supports all standard map functions

![Image of ArcCatalog and ArcMap features]

- Selections
- Symbolization
- Label
- Identify
Data Translation

Data Interoperability Tools

- Automated Translation Tools
  - Quick Import
    - New File or Personal Geodatabase
  - Quick Export (75+ formats)
    - Publish data to many formats

- Combine tools in geoprocessing models
  - Import data into ESRI format
  - Distribute data in desired format

This model runs a Buffer operation on a MapInfo file. The output of the operation is then converted back to a MapInfo file using the Data Interoperability Extension Quick Export tool. The output from the Buffer operation is set to Intermediate so that it will be deleted when the operation is completed.
Geoprocessing Integration

- Data as input to core tools
  - Buffer, Clip, Union, Frequency, etc
  - Outputs to ESRI format

- Build interoperability into models

Interoperability data sources used as input to core tools.

Quick Export results to GML.
New at 9.3

Formats

- Upgrade to FME 2008

- New formats
  - Industry Foundation Class STEP Files (IFC)
  - CityGML
  - LandXML
  - GeoRSS
  - Trible JobXML
  - Autodesk 2007 (DWG/DXF)
  - Aeronautical Information Exchange Model (AIXM)

Updated Formats

- KML 2.1
- Autodesk AutoCAD Reader/Writer now supports Release 2007 files.
New at 9.3
*Help / Documentation*

- Help Topics updated
  - Reorganized
  - New content

- **ArcGIS Data Interoperability extension**
  - About the Data Interoperability help system
  - An overview of Data Interoperability
  - Key concepts of the Data Interoperability extension
  - Using the Data Interoperability tools
  - Common tasks using Data Interoperability

- **Common tasks using Data Interoperability**
  - Enabling the Data Interoperability extension
  - Creating an Interoperability Connection
  - Using external data sources in ArcMap and ArcGIS Pro
  - Using Data Interoperability in Geoprocessing
  - Using the Quick Import tool
  - Using the Quick Export tool
  - Creating a custom format
  - Creating Spatial ETL tools using the Workbench
  - Using Data Interoperability with ArcGIS Server

- **Using the Data Interoperability tools**
  - Direct read
  - Quick conversion
  - Data transformation
Demonstration

- Format Support
- Data Translation
- Geoprocessing
Spatial ETL

• **ETL – Extract, Transform, Load**
  
  – Extract: extracting data from outside sources
  – Transform: transforming data to fit business needs
  – Load: loading the data into the data warehouse

• **Spatial ETL adds a geometric component to the ETL process**

  **Semantic Data Translation** focuses on changing the view of the data to that which matches the desires of the end user or end system. Changing the file format during data translation is only a small part of the translation process.
Spatial ETL and GIS

ArcGIS

QA

Legacy

Spatial ETL

ESRI
MapInfo
Autodesk
Intergraph
OGC/WFS

Data

Direct Read

Data Stream

Initial Load

Updates
Spatial ETL Use Cases

• **Data Migration**
  – Process of moving data between systems

• **Data Cleanup / Data Manipulation**
  – Clean up errors in the data and streamline data preparation

• **Data Distribution**
  – Distribute data to different systems

• **Change Detection**
  – Determine changes between two different files

• **Data Validation**
  – Verify and validate spatial data
Data Migration Example

*Migrate data to a common data model*

Regional / County

State

Federal

ETL

Nation GIS
Spatial ETL functions
Create, manipulate and convert geometry and attributes

- Select a subset of data to load

RoadType “Paved”
GeometryType = Polygon

- Translate coded values

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>12345</td>
<td>Residential</td>
</tr>
<tr>
<td>23456</td>
<td>Non-Residential</td>
</tr>
</tbody>
</table>

- Derive new attribute values or Construct geometry

sale_amount = qty * unit_price
Spatial ETL functions cont.
*Create, manipulate and convert geometry and attributes*

- **Join** together data from multiple sources

  - Jeff 1
  - Phil 2
  - 1 Sales
  - 2 Products

- **Summarize / Concatenate** multiple rows of data

  - 1 AB
  - 2 AC

- **Split** a single attribute into multiple attributes

  - ESRI, 380 New York St, Redlands, CA
  - ESR, 380 New York St, Redlands, CA
Workbench application

Graphically create dataflow from source to destination

**Extract** your source dataset on to the workspace.

**Transform** or adjust the way your data flows from its source to the destination.

**Load** your data into the destination dataset.
Transformers

Geometry

- **Alter / Build Geometry** (PointConnector, PolygonBuilder)

  ![Diagram of Alter / Build Geometry](image)

- **Filter by Geometry** (GeometryFilter, AggregateFilter)

  ![Diagram of Filter by Geometry](image)

- **Spatial Relationships** (NeighborFinder, PointOnAreaOverlayer)

  ![Diagram of Spatial Relationships](image)
Transformers

**Attributes**

- **Join** attributes to features (Joiner, FeatureMerger)

  - 12345 Residential
  - 23456 Non-Residential

- **Map new attribute values based on lookup** (ValueMapper)

  - Commercial
  - Institutional
  - Manufacturing
  - Office
  - Residential

- **Create new attribute values** (AttributeCreator, Concatenator)

  - AB CD

  → ABCD
Spatial ETL

ArcGIS Integration

- Custom Formats
  - No data conversion
  - Create your own view of the data
  - Define once and use many times

- Spatial ETL Tool
  - Data IS converted
  - Custom Geoprocessing Tool
  - Define your output schema once and use many times
Spatial ETL Tools

Geoprocessing Framework

- Use in ModelBuilder, scripting, and command line
ModelBuilder and Workbench

- **Graphical authoring environments**
- **Complementary Technologies**
  - Workbench is used to create processes that run in ModelBuilder
# ModelBuilder and Workbench

<table>
<thead>
<tr>
<th><strong>ModelBuilder</strong></th>
<th><strong>Workbench</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Graphical batch creation</td>
<td>• Data flow architecture</td>
</tr>
<tr>
<td>• Fundamental data unit is a dataset, or layer</td>
<td>• Schema-centric</td>
</tr>
<tr>
<td>• Partial runs of a model are possible</td>
<td>• Fundamental data unit is a feature</td>
</tr>
<tr>
<td>• Models exportable as Python scripts</td>
<td>• Partial runs not possible</td>
</tr>
<tr>
<td></td>
<td>• Writes Spatial ETL scripts (stored in Toolboxes)</td>
</tr>
</tbody>
</table>
New at 9.3

Transformers

• 35+ additional transformers

- ArcMeasureExtractor
- ArcMeasureSetter
- ArcPropertyExtractor
- ArcPropertySetter
- ArcSDEGridSnapper
- AttributeExploder
- CoordinateSystem
- DescriptionConverter
- Creator
- EllipsePropertyExtractor
- EllipsePropertySetter
- FeatureHolder
- FMEFunctionCaller
- GeometryRefiner
- GeometryReplacer
- GeometryValidator
- GeoRSSFeatureExtractor
- GeoRSSFeatureReplacer
- LineMeasureExtractor
- LineMeasureSetter
- MinimumSpanningCircleReplacer
- NeighborColorSetter
- OrientationExtractor
- ParameterFetcher
- PartCounter
- PathSplitter
- PointMeasureExtractor
- PointMeasureSetter
- PythonCreator
- SummaryReporter
- TextAdder
- TextLocationExtractor
- TextPropertyExtractor
- TextPropertySetter
- URLFetcher
- VariableSetter
- VariableRetriever
New at 9.3

Workbench Updates

- Overview Window
- Floating Windows
- Customizable Transformer Gallery
  - (i.e. My Favorites GP toolbox)
New at 9.3
Feature Types and Geometry

• Select Feature Types Dialog
  – choose layers to process

• Rich Geometry Model – complex geometry
  – Advanced Geometries
    • paths (measures)
    • bulged polylines
New at 9.3
Transformer and Stream Interaction

• Incomplete Transformers

• Disconnecting Streams / Isolating Transformers
New at 9.3
Update Feature Types

• Feature Type Manipulation
  • Updating Feature Types for Source and Destination datasets when schema has changed.
New at 9.3
Schema Mapping Transformers

- Replace manual field maps with AttributeCopier
  - Persist throughout workspace
Demonstration

- Workbench
- Spatial ETL
Extensions

• **Data Interoperability Engine extension**
  – Data
  – Geoprocessing tools

• **Data Interoperability Server extension**
  – Map Services
  – Geoprocessing Services

Enables extension’s data handling and support capabilities to be embedded in custom desktop or server-based applications.
ArcGIS Engine extension

Provides custom desktop applications...

- Access to Data Interoperability data sources
- Ability to run Data Interoperability’s geoprocessing tools in custom applications
  - Quick Import, Quick Export
  - Spatial ETL
ArcGIS Server Workflow Basics

Share geographic content:

1. **Author** the GIS resource using ArcGIS Desktop

2. **Publish** the resource as a service using ArcGIS Server

3. **Use** the service from a client application
   - (Desktop, ArcGIS Explorer, Custom Web App)
Data Interoperability Server

The power of Desktop Data Interoperability on the Server

• Map Services
  – Author maps that include non-ESRI formats in Desktop
  – Publish those maps to ArcGIS Server

• Geoprocessing Services
  – Author geoprocessing models that include ETL tools in Desktop
  – Publish those models to ArcGIS Server
Federated GIS

*Shared data from many sources*
Clip, Zip and Ship

- Clip data based on area of interest
- Zip data in user-specified format and projection
- Ship results to end-user

Data Interoperability tools extend Clip, Zip and Ship functionality by providing additional export formats.
Demonstration

- Publishing Data Interoperability resources to ArcGIS Server
  - Map Service
  - Geoprocessing Service
    - Clip, Zip and Ship
OGC GML Simple Feature Format Support

Free support for GML-SF in ArcGIS Desktop

- Direct Read
- Translation
  - Quick Import / Quick Export
- WFS - access to Simple Feature based services

NOTE: Installation of the Data Interoperability extension is req’d
Future Development Plans

• Provide mechanism for ESRI customers to download latest release of FME platform
  – Benefit from improvements made by Safe Software

• Upgrade released software to latest FME platform
Resources

- GIS Standards and Interoperability
  http://www.esri.com/interoperability

- ArcGIS Data Interoperability
  http://www.esri.com/datainteroperability

- Introductory Training
  www.safe.com/esri
Summary

• Incorporate multiple data formats from open or proprietary sources directly into your GIS

• Maintain data quality (spatial and attribute information) as you convert between different data models.

• Migrate data from other systems/data models or maintain multiple systems.

• Works with ArcMap, ArcCatalog, ArcScene, ArcGlobe

• Fully integrated into the geoprocessing framework of ArcGIS

• Diagram and model your own spatial data formats and conversion tools
Session Evaluations Reminder

- Session Attendees:
- Please turn in your session evaluations.

Questions??

... Thank you