Getting to Know Data Interoperability Extension for ArcGIS

“Do More with Less” - Improve and Automate Data Integration, the Quality Control Process, and Reporting

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UMass-Amherst
Goal of this presentation

Define the ‘problem’
- data interoperability
Show several examples
Generate interest and motive to explore
Data Interoperability Extension for ArcGIS
Introduction: system description & data interoperability

- 28,084 Students
- 6,254 Employees
- 10.8 Million square feet
- 200+ Major Buildings (main campus)
- 1,450 acre campus
Campus is a complex system (decomposition)

- Processes
  - Academic/Teaching
  - Research
  - Operations
  - Residential Life

- Buildings
- Open Space
- Transportation/Transit
- Utilities
- Infrastructure

“No buffer space”
“Changes all the time”
“Divide & Conquer”
Campus is a Complex System

- Specialization (to cope with complexity)
- Multiple databases
- “Silos” & “Silos Paradox”
- Living organization/changes!

Location/Space & Time as KEY to join and relate entities/features in the DBs.

How can we create & maintain ‘comprehensive’ spatial model/db of Campus efficiently.

Spatial Data: CAD, GIS, BIM, NavisWorks
Non-Spatial Data: MS SQL Server, SharePoint, Excel, Other DBs, Text files

Diff IT Systems
Data InterOp problem = \textbf{Data exist but you cannot use them}

- Within Spatial Context
- Effect ‘other’ sub-systems
- KPIs have spatial component
- Awareness of trends/projects
- Require integration of multiple data-sources
- Snapshot of performance matrix
- Snapshot of current ‘state’ of the system

\textbf{Data Interoperability issue is a native issue for large organizations}
The Costs of Inadequate Data Interoperability

by Stakeholder Group & Life Cycle Phase (In $Millions)

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Planning, Design &amp; Engineering Phase</th>
<th>Construction Phase</th>
<th>Operations &amp; Maintenance Phase</th>
<th>Total</th>
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<tbody>
<tr>
<td>Architects &amp; Engineers</td>
<td>1,007.2</td>
<td>147.0</td>
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<tr>
<td>General Contractors</td>
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<td>1801.6</td>
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<td>Owners &amp; Operators</td>
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<td>898.0</td>
<td>-</td>
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<td>Total</td>
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<td>4,072.4</td>
<td>9,093.3</td>
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</table>

The O&M phase has higher cost associated with it than any other life cycle, and Owners & Operators incur most the majority of these costs.

Who are the Owners & Operators?

Any corporation or institute that owns, maintains, and/or operates a capital facility (commercial facilities, institutional facilities, industrial facilities) is considered an owner & operator.
Innovate (It’s very costly not to innovate)
Universal constants: e, g, 80%-20% rule, 70-30 ‘gis’ rule
Why Data InterOp Extension for ArcGIS & FME Technology are right tools for the job

• Automation
• Re-use of workflows
• Easy to teach and learn
• Adaptive to user requests or problem nature
• Data-centric & format-agnostic
Modeling: Tools: FME

ETL = Extract – Transform - Load

~300 formats in
~250 formats out
Ability to embed Python sci libraries
Easy to express ideas
Innovate or Perish ...

http://www.faberinfinite.com/are-we-too-busy-to-improve-2/
Drainage Network: Structures & Lines
Question: to show FLOW in the network + structure diagrams.
Manhole ("Clock Diagram")

3 STEP PROCESS: DIAGRAMS, PDF BUILDER, & ASSEMBLER
Step 2: Assemble PDF Report
Step 4: It will take 1 additional transformer to Generate Flow Diagram based on Steps 1, 2 and 3
Integrating CAD Floorplans with GIS

QAQC
Build-up Attributes
Two views: orthogonal/architectural + real world/stacked
Automate GIS/CAFM data integration
3.1 Spatial DB of Space Inventory

Input:
- CAD Floor Plans (TRI)
- Space Info (TRI)
- GIS Layers with BLDG footprints
- Elevation profiles

3 step process: (3 feature classes)
STEP 1: CAD to GIS (Architectural Space)

From CAD Space to ARCH Space
Origin (0,0) is shifted to specific tile/cell

Every SPACE has PRIMARY KEY
BLGD_FLOOR_ROOM
2D (2.5D) Inner Space Modeling: “Architectural Space”
2D (2.5D) Inner Space Modeling: 2-Way process

2-way translation: ETL to add/update data in CAD via GIS (“Breadcrumbs”)
Each space/room has LOCATION_ID to join with DBs
Getting Floorplans From BIM to CAD and GIS

QAQC
Build-up Attributes
Two views: orthogonal/architectural + real world/stacked
Automate GIS/CAFM data integration
BIM models to GIS
(2.5D, 3D)

FME & BIM
BIM - New Integrative Learning Center
BIM Models to GIS

• Substantial efforts at Design & Construction Phases.
• Industry Foundation Classes (IFC) as data format
• **SlimBIM** – the subset of data/information
  » Building Shell
  » Spaces
  » Walls
  » Doors
  » Windows
• Goal to translate information in full.
FME 2015 supports reading from REVIT
- Model simple objects as multi-patch:
  - Slabs [+ BIM info]
  - Walls [+ BIM info]
  - Spaces [Primary Key to connect to SPACE DB]
- Complex elements (doors and windows)
  - Create a DB of unique objects [ETL]
  - Generate assets (for every door/window type) [ETL]
  - Approximate every door/windows with ORIENTED 3D BOUNDING BOX + reference to assets and all BIM info.
- Assemble 3D model with 3D GIS Data + Procedural Rules [CE]
ETL: FME: Door Objects and Info Table

- Wavefront OBJ
- Collada (preferable)
  - Some info can be embedded
- 27 unique door types
- GIS: keeps AssetName/Filename

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<th>ObjectType</th>
<th>Tag</th>
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<th>OverallWidth</th>
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CityEngine (Demo)
GUI interface to powerful open-source
http://mapnik.org
Defines “rules” for rendering
An approach to automate ‘cartography’ tasks
2D/data, 3D data, labels, diff geometries

https://owenpowell.wordpress.com/
Safe Software
Rendering report components
Data Driven Reports - Report Assembly
Data Driven Reports - Report Assembly

Whitmore Hall
Third Floor Plan
Facilities Planning
University of Massachusetts Amherst

DATA AS OF: 201505:

Building No. 388

388 03

No Scale
Enriching GIS Layers - advanced visualization

Add artificial objects to extend/improve visualization
Integrating GIS/CAD with Tableau

Tableau - the fastest growing BI tool
Provides some support for GIS data
Automate GIS/CAFM data integration
How we can approach reporting on building level with Tableau?

a) How to bring GIS Building footprints into Tableau shapes?

b) How to bring centroids of Buildings as X/Y (lat/lon) into Tableau?

Example of case use: Teaching/Instruction/Operations happen in Buildings ...
Building Footprints in Tableau. Now it's ready to be connected with data tables and to run analytics.
FME to convert Building Footprints to centroids (Polygons -> X/Y centroid -> Lat/Lon):
Student distribution at 10am on Thursday (Fall 2013)
Supporting Decision Making with Tableau: Bringing Floor Plans + Space Inventory
FME Workflow generate:
- HD Raster Floor Plans
- Floor Plans’ Bounds
- Centroids/Polygons representing rooms in Tableau format
Supporting Decision Making with Tableau: Bringing Floor Plans + Space Inventory
Thank you!

Q&A

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