Understanding our world.
Geoprocessing Tools and Techniques for CAD in ArcGIS

Don Kuehne & Jeff Reinhart
Agenda

• Overview of ArcGIS CAD support
• Mapping specification for DWG
• CAD Data Loading to Geodatabase
• CAD Interoperability Patterns
  - Consumable Web services
  - CAD edits clients
  - Clip, Zip and Ship
  - Data Interoperability Extension
  - ArcGIS for AutoCAD
ArcGIS CAD Data Support

- ESRI has long provided CAD support and integration tools
- Out of the box
  - No extension required
- Direct read
  - Conversion not required
- Current version support:
  - AutoCAD DWG/DXF: Up to 2014 (read only)
  - MicroStation DGN: Up to V8
- Geoprocessing tools available at various license levels work with CAD data
Direct-read CAD datasets in ArcGIS

- Translated on the fly as virtual feature classes
Mapping Specification for CAD (MSC)

- Open source framework developed by ESRI for coding information in DWGs to define:
  - GIS feature classes + attributes
  - Coordinate systems
- Utilizes CAD data structures to define schema and store data
- Leveraged by ArcGIS Desktop CAD tools
  - CAD direct read/import tools
  - Export to CAD
- Provides improved interoperability between CAD and GIS
CAD data structure in ArcGIS

City.dwg

- Annotation: Text, tags, and attribute definitions
- Multipatch: Polygons and is useful for 3D representation
- Parcels: MSD feature class that represents parcels (subset of polygons)
- Point: Points, blocks, and cells
- Polygon: Closed areas such as polygons, ellipses, and circles
- Polyline: Lines, polylines, and arcs
- Roads: MSD feature class that represents roads (subset of polylines)

Parcels.prj: Projection files define a coordinate system for a CAD dataset. They are recommended but not required.
Demo:

Create Additional CAD Feature Classes with Export to CAD
CAD Data Integration Stages

Add  Geo-reference  Filter  Render  Load
Preparing CAD data for ArcGIS

- Organize layers/levels intelligently
- Create data in real-world coordinate locations
- Use blocks and Cells for attributing objects
- Avoid CAD entities that are unsupported in ArcGIS
- Follow a CAD standard and use Seed files
Seed & Template Files

- Blank template used to define a new file
- Seed file allows the default symbology of the seed drawing will be used
- Used to control Blocks definitions utilized by Export to CAD

- Microstation requires a seed file for design file creation
- Microstation seed file topics for Export to CAD
  - Design plane, appropriate dimensions, units and origin
Geoprocessing Scenarios

- CAD text inside polygons
- CAD text near lines
- Line segments to polygons

- CAD to Geodatabase
- Append to existing Geodatabase
- Merge with other layers
Demo:

- Bulk loading of CAD files to a Dataset
- Data clean up with Trim/Extend lines
- Create Z values for CAD files
Export to CAD

- Output features to native CAD format
  - DGN V8
  - DWG/DXF Release 14 to 2012
- Available at all license levels
- Support for 2013/2014 in 10.2.? release
Attribute Driven Export

• Use Fields and their attributes to control how elements and entities are generated

• Key areas:
  - Entity types, geometry
  - Elevation
  - Blocks and attributes
  - Document names and paths

• Help topic “reserved CAD fields for ....”
Interoperability
CAD Interoperability Patterns

• Central Data
  - CAD Edits… GIS Views
  - GIS Edits… CAD Views

• ETL (Extract, Transform, Load)

• Web Services
  - WMS/WFS
  - ArcGIS Services
ArcGIS Platform
Geographic Information for Everyone

Apps & Applications

Devices

Desktop

Web

Online

Server

Content & Services

Easy, Open and Cloud-Enabled . . .

. . . Providing Transformational Opportunities
Central Data Repository

• Author / Publish
  - Data Producers
  - Data Consumers

• Bi-directional Editing
  - Lowest Common Denominator
  - Or, Complexity
Central Data Repository

- **Oracle SDO**
  - Registered R/O Layers…
  - Geodatabase Layers for Editing
    - Others R/O ?

- **ArcSDE Geodatabase (ArcSDE)**
  - Many GIS Software Clients
    - (Autodesk FDO, Bentley ProjectWise Connector…)

- **Careful Workflows: SQL**
  - Layer Types
  - Geometry Types
  - Coordinate Systems
ETL Pattern
Data Migration / Direct Read

ArcGIS Desktop

Geodatabase

.DGN Files

.DWG Files

.DWG with ArcGIS Feature Classes
CAD and Geoprocessing

- **Geoprocessing Tools with CAD**
  - **Query, Analysis:** BUFFER, FREQUENCY, FEATURE TO POLYGON, INTERSECT, SPATIAL JOIN...etc...
  - **CAD to GIS tools:**
    COPY FEATURE, FEATURE CLASS TO FEATURE CLASS, APPEND, MERGE,
    CAD TO GEODATABASE, FEATURE to POLYGON, IMPORT CAD ANNOTATION...
  - **GIS to CAD tools:**
    EXPORT TO CAD
ETL Mode: Geometric and Attribute Manipulation
- Geometric Manipulation
- File and Data Aggregation
- Filtering
- Feature Building/Creaton/Reconstruction
- On-The-Fly Data Interpretation
- Geoprocessing Integration
Exchanging Files : Export to CAD

• Create CAD Entities from GIS Features

• Useful Default Functionality
  - CAD Layer by Feature Layer
  - Default Geometric Feature/Entity Mapping
  - Append\Overwrite Drawings

• ArcGIS Feature Classes in DWG
  - Feature Classes
  - Attributes
  - Coordinate System
  - Better than Shapefiles…
Web Services Pattern

ArcGIS System

- Discover
- Create
- Manage
- Visualize
- Analyze
- Collaborate
Demo

• ArcMap
  - Author Publish
  - WMS Map Service (Laptop ArcGIS Server) from GDB
  - WFS-T (Laptop ArcGIS Server) from GDB
  - KML
  - ArcGIS Feature Service
    - Map, Feature, Image, Location, Geoprocessing…

• Microstation
  - WMS Imagery (Cloud: Kentucky Image Server)
  - WFS (Read/Only)
Demo

Publish and Use

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Web Geoprocessing Services: Export to CAD

- Data Dissemination:
  - EXPORT TO CAD
  - CLIP-ZIP-SHIP…
Clip-Zip-Ship
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Asynchronous geoprocessing (Clip and ship)

This sample demonstrates how to call an asynchronous geoprocessing task and how to respond when the job result is ready.

1. Select area of interest
   - Polygon
   - Freehand Polygon
2. Select layers to extract data from
   - Incident Points
   - Incident Lines
   - Incident Areas
3. Specify download format
   - Bentley Microstation Design

Click to start drawing
Feature Service Editing

ArcGIS for AutoCAD

ArcGIS Desktop

Publish to ArcGIS Server

Geodatabase

ArcGIS Server

Web Services

.DWG Files

ArcGIS for AutoCAD
Multi Client Editing
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Providing Mapping and GIS
To the Entire Organization

Enabling Access by Everyone
What’s New for CAD Support at the 10.2 release

- Updated 3rd party libraries for DWG and DGN
- Support reading of AutoCAD DWG’s 2013/2014
- Major stability improvements for Microstation format
  - Shared Cells
  - Many other stability entities enhanced

- To be a patch for 10.1 SP2 (coming soon)
Resources

• CAD Integration Resource Center & Help System
  - Help, Videos, Samples, Downloads, Blogs

• Working with CAD Data - Instructor Led Course

• ArcGIS for AutoCAD – Live Training Seminar
  http://training.esri.com/Gateway/index.cfm?fa=seminars.viewDetails&course_id=182
CAD session at User Conference

- **Exhibit Hall – Geodatabase Management Island**

- **TUESDAY**
  - 01:30 AM - Introduction to using CAD Data in ArcGIS (Room 04)
  - 03:15 PM - The ArcGIS for AutoCAD CAD Plug-In (Room 32 A)

- **WEDNESDAY**
  - 09:00 AM – Lining Up CAD Data in ArcGIS (Hall F, Room 1)
  - 01:30 PM - The ArcGIS for AutoCAD CAD Plug-In (Room 32 A) (2nd offering)
  - 03:15 PM – Geoprocessing Tools & Techniques for CAD (Room 05A)
  - 04:00 PM - Georeferencing CAD datasets (Hall F, Room 1)

- **THURSDAY**
  - 08:30 AM – Introduction to using CAD Data in ArcGIS (Room 04) (2nd offering)
  - 10:30 AM – Lining Up CAD Data in ArcGIS (Hall F, Room 1) (2nd offering)
  - 11:00 AM - Using ArcGIS for AutoCAD Plug-In (Demo Theater– Geodatabase Management)
• Thank you for attending
• Have fun at UC2013
• Open for Questions

• Please fill out the evaluation:

   Paper in room

   or

   www.esri.com/ucsessionssurveys

   First Offering ID: 1296