Abstract. In this paper author gave basic definitions of spatial ETL, overview of ModelBuilder functionalities and representation of practical example through model created using ModelBuilder application for CAD to GIS conversion (loading into GIS environment).

Keywords: ModelBuilder, CAD dataset, GIS environment
1 Introduction

Before we start with describing ModelBuilder and its use for CAD to GIS conversion within ArcGIS software package, author will provide readers with basic spatial ETL definitions and areas of usage in accordance with official definitions from ESRI web site.

Spatial data may be located in a variety of different data formats, schemas, and disparate systems. Spatial extract, transform, and load (ETL) capabilities enable organizations to overcome interoperability challenges by providing accurate and well-defined spatial data to their users when they need it [3].

ETL allows you to:
• Extract the spatial data from a source system,
• Transform the data into the format and data model required by the target system,
• Load the data into the target system.

A data transformation enables you to control the data flow by mapping geometry and attributes in the source data to geometry and attributes in the destination. This process may include a change in coordinate system, spatial feature types, or the attribute schema. This preserves the data integrity while making it accessible to end users [3].

2 ModelBuilder – basics

ModelBuilder represents application within ArcGIS software package for creating, editing, and managing models. Model is set of tools and data incorporated together in workflow so that output result from one step represents input data to another step of workflow. Also, ModelBuilder can be seen as visual programming language.

User runs ModelBuilder application from Geoprocessing menu and application interface is given in the Figure 1.

![ModelBuilder interface](image)

Figure 1: ModelBuilder interface [1]

ModelBuilder is intuitive and user friendly application which allows creating workflows and user-defined tools for wide spectrum of user needs in processing, analyzing and managing spatial data into ArcGIS software.

There are three basic elements of every model (Figure 2): tools, variables, and connectors.

- **Tools** for geoprocessing represents fundamental elements for creating workflows into models, and performing various operations on geographic (spatial) and tabular data.
Variables are model elements that contain values or data references that are stored on disc. There are two types of variables: data and values. Data variables contain descriptive information about data stored on disc (field information, spatial reference and path). Values are numbers, Booleans, spatial references, etc.

Connectors are used for connecting variables with tools. Direction of connecting arrow represents direction of workflow. There are four types of connectors: data connectors, environment connectors, precondition connectors and feedback connectors.

3 Practical example for creating a model

In this paper author will provide readers with practical example of creating model within ModelBuilder application for conversion and integrating CAD drawing into GIS environment following spatial ETL logic.

In this example we will assume that we have georeferenced CAD dataset with assigned spatial reference in projected coordinate system. The easiest way to load CAD dataset into ArcGIS is to click on CAD dataset in Catalog window and just drag and drop it into map, but this way your CAD dataset won’t be loaded into geodatabase, polygons and polylines from CAD drawing will be just the simple line segments without any spatial connection between each other. This is because lines in CAD drawing “don’t know” that they actually represent objects in real world. Problem is resolved loading CAD dataset into GIS environment using various tools connected in model which enables creation of spatial connections within drawing elements, adding CAD dataset to geodatabase and performing complex spatial queries in data analysis and GIS.

CAD dataset used in this example represents building blueprint and we will load this drawing into ArcGIS software using model in order to create base for future information system of the building.

ArcGIS tools used for creating such a model are:
- Feature Class To Feature Class,
- Split Line At Vertices,
- Make Feature Layer,
- Copy Feature,
- Extend Line,
- Feature To Polygon,
- Append.

Using above-mentioned tools, we created model given in the Picture 3, which automates loading CAD dataset and creating interior spaces within building. As you can know, CAD drawings are composed of various layers and for loading and creating interior spaces, we need just the ones that represent walls. For
such selection during loading, we can use SQL statements to define which layers will be loaded and which will not in Query Builder that can be accessed through Feature Class to Feature Class dialog box.

In this model SQL statement is:

```
/Layer" = '1.ZIDOVI' OR "Layer" = '1a.ZIDOVI-slojevi' OR "Layer" = '0' OR "Layer" = 'STOLARIJA ' OR "Layer" = 'STOLARIJA-prozori'
```

![Diagram](image)

Figure 3: Create interior spaces model [2]

Thanks to created model, process of loading and creating closed polygons (interior spaces within building) is reduced to less than 4 minutes. This is of great significance because loading and creating interior spaces means:

- Loading layers that contain polylines and represent walls,
- Splitting polylines on line segments,
- Extending line segments to each other section in order to achieve polygon closure,
- Forming closed polygons which represent interior spaces within building based on line segments,
- Copying entities and layers in different phases of loading CAD dataset,
- Loading annotations from CAD dataset [2].

On one hand, creation of this model solved the unnecessary layers and feature classes accumulation problem that occurs as intermediate results during CAD dataset loading. On the other hand, time spent to complete the task is significantly reduced.

Furthermore, for creating information system of the building it is necessary to append loaded CAD dataset into existing geodatabase (or create a new one), assign attributes to every room and building as whole, and link appropriate documents. Loaded CAD dataset can be used for performing various spatial analysis or for simple visualizing data on the map in GIS environment.

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system") written and successfully defended in September 2013 at Department of geodesy and geoinformatics, Faculty of Civil Engineering, University of Belgrade, by student Jelena Cvetinovic. Master thesis, as well as this paper, is based on presentation and demos of ESRI experts and developers on ESRI Federal GIS Conference in Washington D.C. in 2012 [4].

References


