ModelBuilder: An Introduction

Kevin Armstrong
What is ModelBuilder?

- A user-friendly way to automate a series of tools
- Part of the ArcGIS geoprocessing framework
  - ModelBuilder can run any tool in the ArcToolbox, including scripts, custom tools, and other models
  - Supports GDBs, shapefiles, tables, coverages, rasters, CAD
“Computing with data” — geoprocessing

What is ModelBuilder?

Data compilation, editing, and maintenance

Data visualization and exploration
Tools and Framework

- **Tools**
  - Perform essential operations on data
  - Learning tools enables you to solve real-world problems

- **Framework**
  - Mechanics of using, managing, and publishing tools
  - Automating workflows by creating new tools - models and scripts
Framework

Four ways to use tools

Command Line

Select Runways C:\Student\GIS\Database\Florida.mdb\NewRunways where_clause1
Select Runways C:\Student\GIS\Database\Florida.mdb\NewRunways where_clause1
Executing (Select 1): Select Runways C:\Student\GIS\Database\Florida.mdb\NewRunways where_clause1
[County] = 'Orange'
10:14:10 2004
Successfully.
End Time: Tue Sep 17 10:14:12 2004 (Elapsed Time: 2.00 secs)

Models

Runways ➔ Select ➔ New Runways

Tool dialog

Select

Scripts

# Import system modules
import win32com.client

# Create the Geoprocessor object
gp = win32com.client.Dispatch("esriGP"
gp.Select("Runways", "NewRunways")
Demo 1

- Create a new toolbox, add new tools/model
- Build a model
- Run the model w/in ModelBuilder
- Add more processes and run them
ArcToolbox Basics

• Dockable window in any ArcGIS application

• System tools organized into toolboxes and toolsets

• Each toolbox contains tools with similar functionality. Toolsets refine further.

• Window has four tabs
  • Favorites – tree-view of all tools
  • Index and Search - assist in finding tools
  • Results – logs what you’ve done and helps manage tool results

Show/Hide ArcToolbox Window
Demo Review

Model elements

Data Variables
- Project Data
- Derived Data

Value Variables
- Input Value
- Derived Value

Tools
- Drag and drop into window
- Use Add button

Data
- Drag and drop into window
- Drag and drop onto tools
- Fill in dialog
- In ArcMap, from the TOC
- Use Add button
Elements can be:

- **Copied/pasted within the same model, and other models**
- **Deleted** - remaining elements become “not ready to run”
- **Renamed** - only changes the label not the name
- **Disconnected from a tool** (exception: derived data variables)
Demo Review

*Model process and process states*
Demo Review

*Derived data*

**Project Data** – data you provide to the model

**Derived Data** – data created by tools in the model

**In/Out Derived Data** – input data updated by tool
Demo Review

Connecting data and processes

- There are two ways you can connect data elements to tool elements, either by using the Connect tool or the tool's dialog.

- To connect processes, connect the output of one process to the input of another.
Status messages can be viewed in:

- Progress dialog and Command Line window (if opened)
- Right-click on process and View Messages
- Reports

For each model, it shows:

- The parameter values specified
- The time the tool was run
- The status of the execution
- The time the tool finished executing
- Execution errors messages
Demo 2

- Run the model from ArcToolbox
- Create and use parameters
- Changing model properties
Running a model
From a dialog box

• Double-click on the model from ArcToolbox
• If there are no model parameters, just click OK in the dialog
• If there are model parameters, populate what is required, then click OK to run the model
Dem Demo Review

*Model parameters*

Element name becomes parameter label in dialog box

Model parameters will have a “P” next to them.
Demo Review
Adding Results

Tools > Options > Geoprocessing tab > Add results...

• All OUTPUT parameters will be added to map
Making variables

- ModelBuilder will create a variable for all input datasets
  - You decide which tool arguments to expose as variables
  - Any variable can be made a model parameter
- Right-click tool: Make Variable > From Parameter
  - Then set variable as a model parameter
Intermediate data

• You decide to how to handle intermediate data

• Data marked as intermediate:
  – Is deleted after model run as a dialog from ArcToolbox
  – Is flagged but NOT deleted automatically if model is run from ModelBuilder window
Model properties dialog

- Choose Model Properties on the tools context menu, or
- In the MB window: Model menu > Model Properties
Model properties

General

- Modify the name, label, description, and style sheet
- Specify relative vs. absolute paths
• Add, remove, or change the order of exposed parameters
Demo 3

- Add Feature Set input
- Symbology
- Sharing Tools
Feature sets and record sets

- **Interactive input of features**
  - Example: Allow the user to click a point on the map to buffer rather than using a point feature class as an input
- **Stored “in memory”**
- **Schema taken from existing data or layer**
  - Feature type
  - Fields
  - Must have a schema
Symbology

- Derived from layer file (.lyr)
- Used for result
Sharing tools

How data is used in the tool

• All variables have values. Can be run w/in ModelBuilder (all processes ready-to-run). All data accessible.
  - Data conversion tool that expects a certain file format and always writes to same location.

• Some data variables have values. The data is accessible. Cannot be run within ModelBuilder (some processes not-ready-to-run)
  - User enters an address, a five-mile buffer around address created and used to clip known data.

• Completely generic – no data variables have values. Cannot be run within ModelBuilder
  - Like a system tool that takes any dataset.
Performance Tips

Helping your models

- Use “in-memory” workspace
  - in_memory\feature

- Avoid coordinate transformations

- Add attribute/spatial indexes

- Reduce data size

- Use ESRI GRID raster format
New at 9.3

- Start ModelBuilder button on Standard Toolbar in Desktop
- Improved Error Messages
- Results Management
- Progress Bar

- Error/warning number is a hyperlink to the documentation about the error.
- New option to control the lifetime of results.
- Progress dialog will show you percent complete for many tools.
ModelBuilder Support

- **Online**
  - http://resources.esri.com/geoprocessing
  - http://arcscripts.esri.com
  - ArcGIS Desktop online help
- **Virtual Campus**
  - Geoprocessing using ModelBuilder*
  - Geoprocessing CAD data with ArcGIS*
  - Author & Publishing Geoprocessing Services*
  - Geoprocessing with ArcGIS Desktop
  - Getting Started with Scripting in ArcGIS 9*
- **Instructor-Led**
  - Introduction to ArcGIS II
  - Advanced Analysis with ArcGIS
  - Introduction to GP Scripts with Python
  - Writing Advanced GP Scripts with Python

* free course