Getting Started with ModelBuilder

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Agenda

• Geoprocessing overview
• Getting started with ModelBuilder
• Creating model tools
• Tips for designing and sharing models
• Additional resources
Geoprocessing Overview
What is Geoprocessing?

- The ArcGIS system for managing and manipulating data
  - Solve real-world spatial problems
  - Model processes and systems
  - Ask questions; get results
The Geoprocessing Language

Toolboxes

- 3D Analyst Tools
- Analysis Tools
- Extract Tools
- Clip Tools
- Select Tools
- Split Tools
- Table Select Tools
- Overlay Tools
- Proximity Tools
- Statistics Tools
- Cartography Tools
- Conversion Tools
- Data Interoperability Tools
- Data Management Tools
- Editing Tools
- Geocoding Tools
- Geostatistical Analyst Tools
- Linear Referencing Tools
- Multidimension Tools
- Network Analyst Tools
- Parcel Fabric Tools
- Schematics Tools
- Server Tools
- Spatial Analyst Tools
- Spatial Statistics Tools
- Tracking Analyst Tools

Tools

- Clip
  - Extracts input features that overlay the clip features.
- Raster Calculation
  - Performs arithmetic operations on rasters.
- Identify
  - Computes a geometric intersection of the input features and identity features.

Use these tools to perform various geoprocessing tasks.
The Geoprocessing Framework

Tools

ModelBuilder

Python Window

Scripts

```python
>>> arcpy.Clip_analysis("Sidewalks", "Study Area", "c:/data/output.gdb/SidewalkClip")
```
Finding Tools

Geoprocessing Menu

Search

Catalog
Geoprocessing Options

- Open **Geoprocessing menu > Geoprocessing Options**
- Settings to control defaults and behavior for geoprocessing
- **Tip:** Enable “**Overwrite the outputs of geoprocessing operations**” to allow interactive re-running of Models and tools
Demonstration: An Example
Workflow for Demonstration

- **Goal:** Prioritize schools for emergency shelter planning.
- **Problem:** Which schools are in more vulnerable areas?
  - Schools are used as Emergency Shelters. We need a list of schools that can potentially serve as shelters for citizens in times of need. Schools in vulnerable areas are not ideal locations for a shelter.

Step 1: Buffer HAZMAT Routes

Step 2: Buffer Hazardous Facilities

Step 3: Overlay with Flood Hazard areas

Step 4: Find schools NOT in those areas
Getting Started with ModelBuilder
What is ModelBuilder?

- **Visual programming language**
  - Without writing code
- **Tool for encapsulating workflows**
  - Reusable
  - Sharable
Why use ModelBuilder?

- Automate and manage geoprocessing workflows
- Run complex succession of processes as one tool
- Plug in additional tools and parameters as needed
- See a visual representation of analysis operations
Types of Toolboxes

• System toolboxes
  - Installed with ArcGIS
  - Read-only

• Custom toolboxes
  - User created
  - Stored in a folder (.tbx file type) or a geodatabase

System toolboxes are read-only. This is a good thing!
Creating a New Model

1. ModelBuilder button on ArcMap Standard toolbar launches ModelBuilder with a new, *unsaved* model.

2. Inside a **Custom toolbox** > right click > *New Model*

Models are created or saved in *custom* or “*My toolboxes*”
Model Properties

- **Name**
  - Cannot have spaces

- **Label**
  - How it appears in Toolbox
  - Can include spaces
  - Tip: Succinct, but meaningful! *(i.e. “Model_1”?)*

- **Description**
  - Good practice for sharing

- **Relative paths**
  - Great practice for sharing

Open in Model > Model menu > Model Properties
Environments: Settings

- Settings can be set at different “levels”
- Environments are passed down to tools and processes
- At each level, you can override the passed-down environment settings

1. Application Settings
   - System wide defaults saved to geoprocessing settings.

2. Tool Settings
   - Temporarily overrides application settings. Not saved anywhere.

3. Model Settings
   - Can override passed-down settings, saved with model.

4. Model Process Settings
   - Can override passed-down settings, saved with model.

If model runs within ModelBuilder

If model runs as a tool
Demonstration: Creating a Model
Model Elements

• There are three basic types of elements:
  - Tools
  - Variables
  - Connectors
Adding Tools and Data to a Model

**Tools**
- Drag and drop from Catalog
- Drag and drop from Search
- Drag and drop from Toolbox
- Use Add button in ModelBuilder
- Use Insert menu in ModelBuilder

**Data**
- Drag and drop from TOC
- Drag and drop from Catalog
- Drag and drop from Search
- Fill in dialog
- Use Add button in ModelBuilder
- Use Insert menu in ModelBuilder
Two Ways to Connect Elements

To connect processes, link the output of one process to the input of another using the Connect tool.
Derived Data is Created by Processes

- **Existing data**
  - Blue ovals
  - Schools
  - MyTable

- **Derived Data**
  - Data created in the model
  - Schools_buffer
  - MyTable (2)

- **In/Out Derived Data**
  - The input will be updated

- **Add Field**
  - Buffer
Tools and Parameters

• Inputs and outputs of a tool
• Required and Optional parameters
  - Required must be filled out before tool process can execute in the model

*Distance (required parameter) is not filled out; the tool is not ready to run yet and is “empty” colored*
Connect Tool Tip

- Enable **Geoprocessing menu > Geoprocessing Options > ModelBuilder** to display valid parameters
  - By default, a list of valid parameters appears when connections are made
Model Process States

- Zoning
- Frequency
- Zoning_Freq.dbf

A Single Process

- Tool
- Derived Data

Input Data → Tool → Derived Data
  - Not Ready-To-Run

Input Data → Tool → Derived Data
  - Ready-To-Run

Input Data → Tool → Derived Data
  - Has-Been-Run
Validating

- Verifies all data elements and parameter values are valid
- Success: Returns model from *Has-Been-Run* to *Ready-to-Run* state
- Unsuccessful: Model elements may turn to *Not-Ready-to-Run* state
Creating Model Tools
What Does This Mean?!

This tool has no parameters.
Running a Model as a Tool

- “Double-clicking” or Right-click > Open a model from its toolbox opens the model tool dialog
- These ARE models:

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.
Parameters

Output Folder → Create Table → MyTable → Output Table

Model Parameters will have a “P” next to them

The element name becomes the parameter label on the tool dialog

Input point features → Create Thiessen Polygons → Output
Creating Variables from Tool Parameters

• 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 on tool: Make Variable > From Parameter
  - Then set variable as a model parameter
Demonstration: Creating a Model Tool
Tips for Designing and Sharing Models
Intermediate Data

- Derived data in a model is set to Intermediate by default
  - Excludes “final” output
- Is not automatically deleted*
  - Manually delete from Model menu > Delete Intermediate data

Right click derived data and check/uncheck Intermediate

**There are exceptions, see Tips for running models slide**
Tips for Managing Intermediate Data

• Don’t:
  - Write to ArcSDE geodatabase
  - Remote data or networked drives
  - Clutter your “permanent” results databases

• Do:
  - Use *Scratch* workspace wisely
Models Added as Tools to Other Models

- Models can be added to another model
  - Break down complex models into smaller, perhaps more manageable sub-processes
  - Collaborate with a team where domain experts can work on their model
Tips for Running Models

- Running models from **ModelBuilder:**
  - Intermediate data is not automatically deleted
  - *Add to display* enabled outputs are added to Map
  - No Background Geoprocessing – always runs in foreground

- Running models from **Model tool:**
  - Intermediate data is deleted on completion
  - Only *parameters* are added to display
  - Option to run in foreground (**Model menu > Model properties dialog**) to disable/enable background geoprocessing
Design Models to be Sharable

• Flexible
  - Not data-dependent, good folder structure
  - Environments, Relative paths, etc..
  - Parameters & variables
  - Read: Tips for distributing tools

• Clear and easy to read
  - Layout is simple and logical
  - Labels added for clarity
  - Elements renamed and not cryptic

• Documented
  - Item descriptions (New at ArcGIS 10)
  - Help documentation
Modifying the Layout

- ModelBuilder provides the ability to:
  - Modify arrangement of elements manually by repositioning and resizing
  - Change the name of elements
  - Apply labels and other text
  - Change symbols of elements

- Does not affect how models run; only their appearance
Layout Mode: Automatic

- Automatic Layout mode: enables Auto Layout button
  - Arranges model elements using settings under the Layout tab

This is the default mode
Layout Mode: Manual

- Manual Layout mode: disables *Auto Layout* button
  - Auto-arranging will not occur
  - This message appears:
Layout Options

- Orientation of processes, Spacing between elements/connectors, Connector styles
- Clicking *Auto Layout* button applies these options

These are the default settings
Documenting: Labels

- Free Floating Labels
- Element Labels
- Regional Districts
- Connector Labels
Pictures for Elements

- You can use graphic files for tool and variable elements
  - *Right click model elements > Switch to picture symbol*
Demonstration:
Designing and Sharing Models
Learning more...
ArcGIS Online Help

Professional Library

Geoprocessing Book

Geoprocessing with ModelBuilder
Geoprocessing Resource Center

http://resources.arcgis.com/content/geoprocessing

Check-list for submitting models to gallery
Learning more…at the Conference

- **Getting Started with ModelBuilder**
  - Repeated - Wednesday from 1:30PM - 2:45PM, Room 5A/B

- **Building Tools with ModelBuilder**
  - Wednesday from 10:15AM – 11:30AM, Room 14B
  - Thursday from 3:15PM – 4:30PM, Room 4

Come visit us in the Spatial Analysis Showcase
Learning more...beyond the Conference

- **Instructor-led training**
  - Updated ArcGIS Desktop I, II, III courses for ArcGIS 10 on the schedule

- **Live seminars (and recordings):**

- **Books**
  - *Getting to Know ArcGIS ModelBuilder*
    - This book covers all ModelBuilder topics from beginner to advanced.
Session Evaluation:
www.esri.com/sessionevals