ModelBuilder – Getting Started
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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
  - Based on a framework of data transformation
  - Solve real-world spatial problems
  - Model processes and systems
  - Ask questions; get results
The Geoprocessing Language

**Toolboxes**

- 3D Analyst Tools
- Analysis Tools
- Extract
- Clip
- Select
- Split
- Table Select
- Overlay
- Proximity
- Statistics
- 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
- CAD to Geodatabase
- Identity

Use this tool to cut out a piece of one feature class using one or more of the features in another feature class as a cookie cutter. This is particularly useful for creating a new feature class—also referred to as a study area or area of interest (AOI)—that contains a geographic subset of the features in another, larger feature class.
The Geoprocessing Framework

- **Search**
- **Tools**
- **ModelBuilder**
- **Python Window**
- **Scripts**

```python
>>> arcpy.Clip_analysis
```

```python
# start try block
try:
    arcpy.analysis.Buffer(“c:\ws\roads.shp”, “c:\outws\roads10.shp”, 100)

# If an error occurs when running a tool, print the tool messages except arcpy.ExecuteError:
print arcpy.GetMessages(2)

# Any other error except Exception as e:
print e.message
```
Finding Tools

Catalog

ArcToolbox

Search

Geoprocessing Menu

ModelBuilder - Getting Started
Types of Toolboxes

- **System toolboxes**
  - Installed with ArcGIS
  - *Read-only*

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

- **Python toolboxes**
Geoprocessing Options

- Geoprocessing Menu > Geoprocessing Options
- Default behaviors for geoprocessing
  - Tips:
    - Overwrite outputs
    - Background Processing
    - Keep results
Workflow for Presentation

• **Goal:** Identify zones with inadequate fire hydrant coverage

• **Problem:** Some zones lack enough working fire hydrants
  - No zone should have more than 3 inoperable hydrants
  - Buildings should be within 250 feet of a fire hydrant
  - Identify unsafe zones
  - Identify buildings too far from a working hydrant
Getting Started with ModelBuilder
What is ModelBuilder?

• 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
Creating a New Model

- **ModelBuilder button ArcMap Standard toolbar**
  - Launches ModelBuilder with a new, *unsaved* model

- **ModelBuilder button ArcMap Geoprocessing Menu**
  - Launches ModelBuilder with a new, *unsaved* model

- **Inside a Custom toolbox**
  - Right-click > New Model
Model Properties

- **Name**
  - Cannot have spaces

- **Label**
  - How it appears in ArcToolbox
  - Can include spaces

- **Description**
  - Detailed information about the model
  - Good practice when sharing

- **Relative Path**
  - Good practice when sharing

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Open Model > Model Menu > Model Properties…
Environment 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
   - If model runs within ModelBuilder

2. **Tool Settings**
   - Temporarily overrides application settings
   - Not saved anywhere
   - If model runs as a tool

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

   **Model Process Settings**
   - Can override passed-down settings, saved with model
Creating a Model
Model Elements

- Three types of elements
  - Variables
  - Tools
  - 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
Connecting Elements

1. Connect Tool

Browse to the data on disk
OR
Use the dropdown to choose a variable or a layer

2. Tool Dialog

Connect the input to the tool
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
Derived Data is Created by Processes

- **In/Out Derived Data**
  - Input will be altered/updated when the model is executed
  - Data will have the same name as the input data with a unique number appended at the end
Tool 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.
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
Running a Model as a Tool

• **Double-click tool** or **Right-click > Open** a model from its toolbox opens the model tool dialog.

• These ARE models:

  - No parameters; click OK to run
  - Parameters; populate required, click OK
Parameters

Table Location → Create Table → Output Table

Table Name

Model Parameters will have a “P” next to them

Parameter name becomes the parameter label on the tool dialog
Creating Variables from Tool Parameters

- ModelBuilder will create a variable for input and output 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
Creating a Model Tool
Tips for Designing & Sharing Models
Intermediate Data

• Can think of Intermediate data as temporary scratch data
• All data variables except existing and final output are set to Intermediate by default
• Can determine where it is stored
  - Tip: Should not be set to an enterprise geodatabase
• Is not automatically deleted when run from ModelBuilder window
  - Manually delete from Model Menu > Delete Intermediate data
Model Tools in 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: A quick tour of sharing custom tools

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

• Documented
  - Item descriptions
  - Help documentation
Modifying the Layout

• ModelBuilder provides the ability to:
  - Arrange, reposition, and resize elements
  - Change the name of elements
  - Apply labels and other text
  - Change symbols of elements
Layout: Automatic vs. Manual

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

• Manual Layout mode:
  - Disables Auto Layout button
  - Auto-arranging will not occur
  - This message appears:
Layout Options

- **ModelBuilder window > Model Menu > Diagram Properties…**
- Orientation of processes, Spacing between elements/connectors, Connector styles
- Clicking Auto Layout button applies *these* options
Documenting with Labels

Element Labels

Free Floating Labels

Connector Labels
Pictures for Elements

- You can use graphic files for tool and variable elements
- **Right click model elements > Switch to picture symbol**
Designing & Sharing Models
Learning More
ArcGIS Resource Center

- **ArcGIS Online Help**

- **Communities – Analysis and Geoprocessing**

- **Blogs**

- **Videos**
  - [http://video.arcgis.com/channels](http://video.arcgis.com/channels)

- **Forums**
Learning More at the Conference

• **Geoprocessing with ArcGIS for Server**
  - Wednesday 8:30AM – 9:45AM, Room 04
  - Thursday 1:30PM – 2:45PM, Room 04

• **Geoprocessing: Real-World Examples of Spatial Analysis Models**
  - Wednesday 11:00AM – 12:00PM, Demo Theater – Analysis &
    Geoprocessing Exhibit Hall B

• **Geoprocessing: Sharing Workflows with Geoprocessing Packages**
  - Tuesday 10:15AM – 11:30AM, Room 15 B
  - Wednesday 3:15PM – 4:30PM, Room 15 B

*And many more….***
Learning More After the Conference

- **Training**
  - Instructor-led, Web-based, and FREE Seminars

- **Esri Press Books**
  - [http://esripress.esri.com](http://esripress.esri.com)
  - Getting to Know ArcGIS ModelBuilder
    - Covers topics from beginner to advanced
Thank you…

Please fill out the session evaluation

First Offering ID: 1170
Second Offering ID: 1291

Online – www.esri.com/ucsessionsurveys
Paper – pick up and put in drop box