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
  - Extracts input features that overlay the clip features.
  - 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.

- CAD to Geodatabase
  - Reads a CAD dataset and creates feature classes of the drawing. The feature classes are written to a geodatabase feature dataset.

- Identity
  - Computes a geometric intersection of the input features and identity features. The input feature or polygon thereof that overlaps identity features will get the attributes of those identity features.
The Geoprocessing Framework

- Search
- Tools
- ModelBuilder
- Python Window
- Scripts

```python
>>> arcpy.Clip_analysis

# start try block
try:
  arcpy.analysis.Buffer("c:/ws/roads.shp", "c:/outws/roads10.shp", 100)
except arcpy.ExecuteError:
  print arcpy.GetMessages(2)

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

- Catalog
- ArcToolbox
- Search
- Geoprocessing Menu
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** (10.1)
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
Model Example
Workflow for Presentation

- **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
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

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

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

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

If model runs within ModelBuilder

If model runs as a tool

Model Process Settings
- Can override passed-down settings, saved with model
Demonstration
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
   - Connect the input to the tool

2. Tool Dialog
   - Browse to the data on disk
   - OR
   - Use the dropdown to choose a variable or a layer
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

- **Existing Data**
  - Blue Ovals
  - Schools
  - Input Table

- **Derived Data**
  - Green Ovals
  - Buffer
  - Add Field
  - Schools_Buffer
  - Final Table

- **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**
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
Demonstration
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:
  - 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: 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:

![Error message](image)
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*
Demonstration
Designing and Sharing Models
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**
  - Thursday 8:30AM – 9:45AM, Room 09

- **Building Tools with ModelBuilder**
  - Thursday 3:15PM – 4:30PM, Ball06 D

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

• Training
  - Instructor-led, Web Course and FREE Seminars

• Esri Press Books
  - [http://esripress.esri.com](http://esripress.esri.com)
  - Getting to Know ArcGIS ModelBuilder
    - Written for ArcGIS 10.0 but still valid for 10.1
    - Covers topics from beginner to advanced
Steps to Evaluate UC Sessions

- My UC Homepage > “Evaluate Sessions”
- Choose session from planner
- Search for session

www.esri.com/ucsessionssurveys
• Thank you for attending
• Have fun at UC2012
• Open for Questions

• Please fill out the evaluation:

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