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Python Scripting for Map Automation

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What is map scripting (arcpy.mapping)?

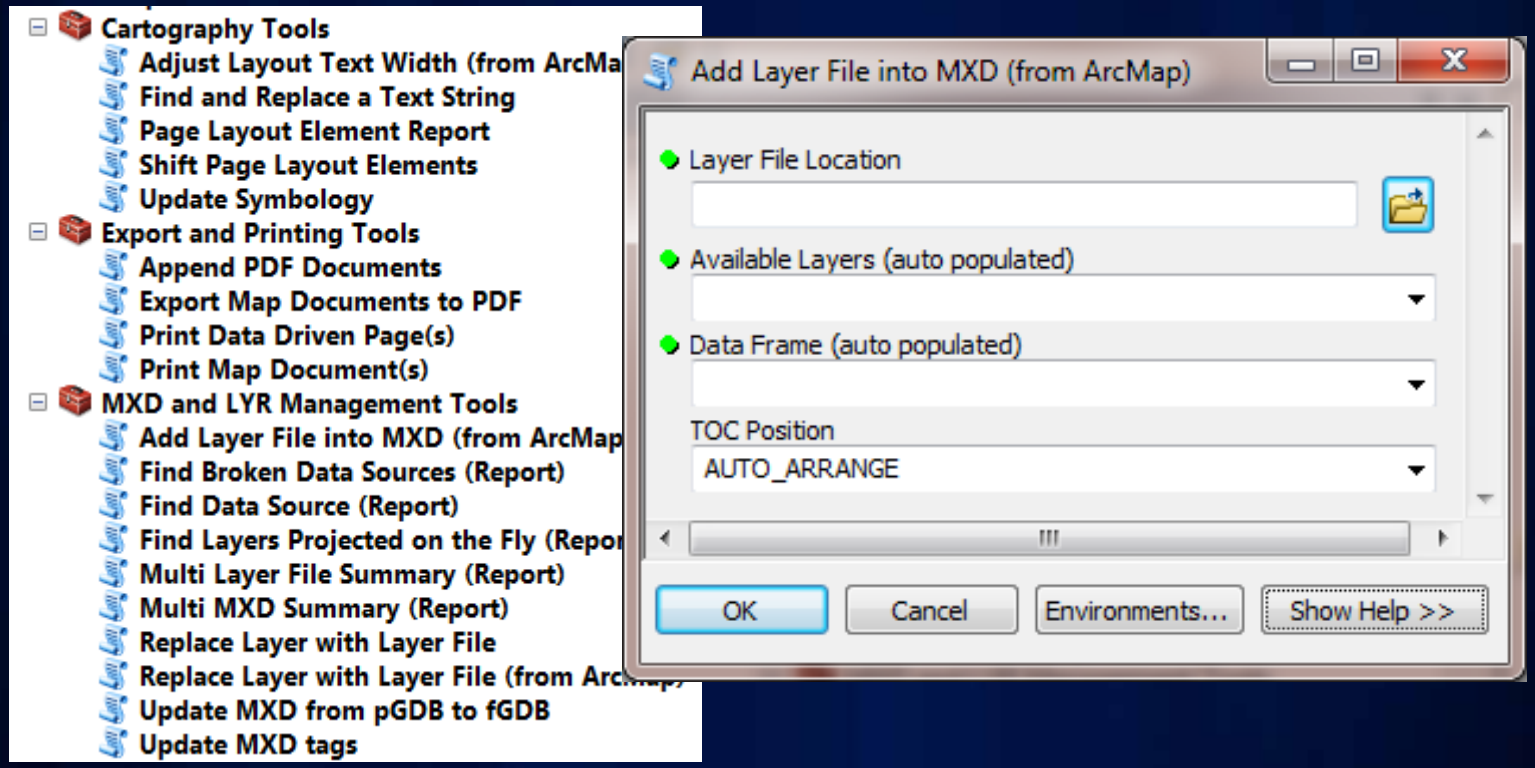
- A new mapping module that is part of the geoprocessing ArcPy site-package
- A python scripting API that allows you to:
  - Manage map documents, layer files, and the data within them
    - Find a layer with data source X and replace with Y
    - Update a layer's symbology in many MXDs
    - Generate reports that lists document information
      - Data sources, broken layers, spatial reference info, etc.
  - Automate the exporting and printing of map documents
  - Automate map production and create PDF map books
    - Extend Data Driven Pages

Who is arcpy.mapping for? Why was it built?

- An easy to use, productive scripting environment for the GIS Analyst
  - Courser grained object model
  - Not a complete replacement for ArcObjects
- An environment to use for basic map/layer management and map automation tasks
- A simple way to publish mapping tasks to the server environment
  - arcpy.mapping scripts can be easily published as geoprocessing tools

Demonstration:

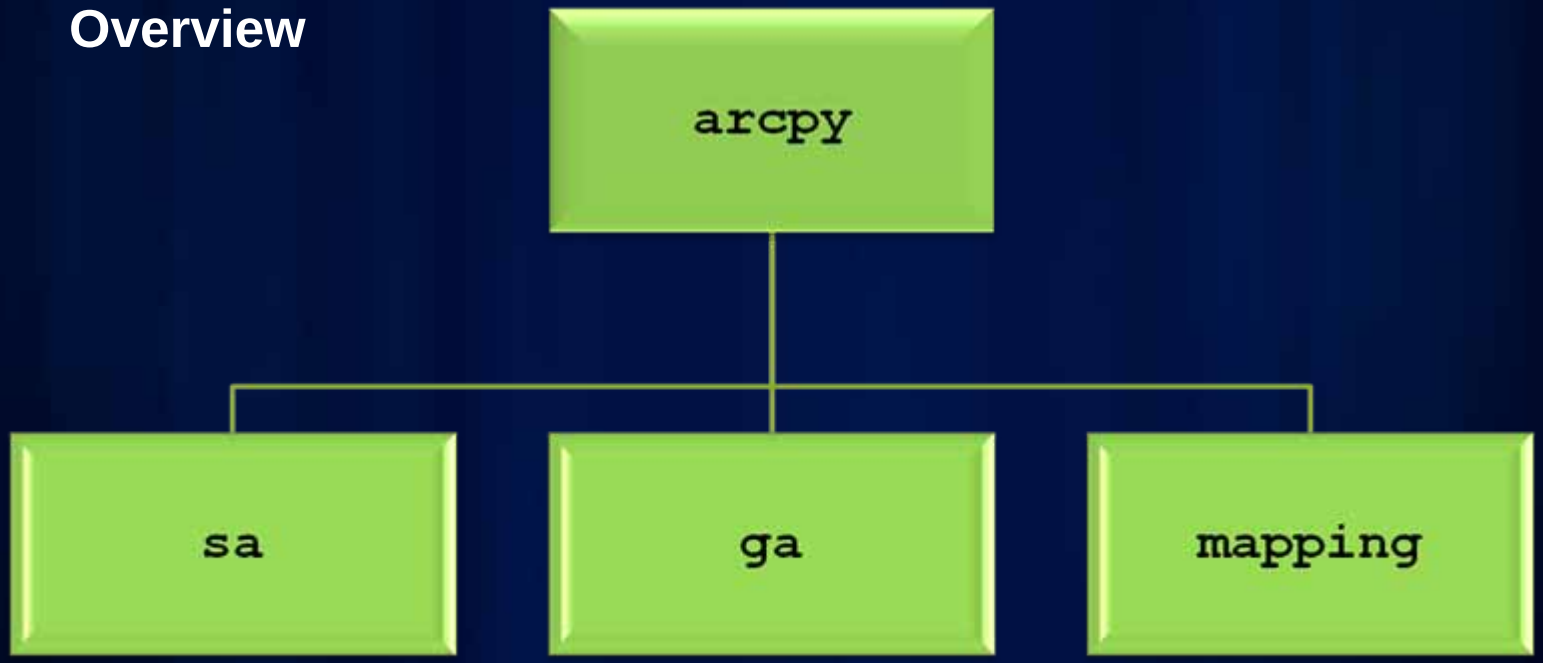
Brief introduction to arcpy.mapping sample script tools



Samples available on the Resource Center

Tour of arcpy.mapping

Overview



Tour of arcpy.mapping (cont.)

Managing Documents and Layers

CLASSES

```
MapDocument
Layer
TableView
LabelClass
DataFrame
DataFrameTime
GraphicElement
LegendElement
PictureElement
TextElement
MapSurroundElement
PictureElement
```

FUNCTIONS

```
MapDocument
Layer
ListBrokenDataSources
ListDataFrames
ListLayers
ListLayoutElements
ListPrinterNames
ListTableViews
AddLayer
AddLayerToGroup
InsertLayer
MoveLayer
RemoveLayer
UpdateLayer
```

Tour of arcpy.mapping (cont.)

Printing, Exporting, Server Publishing, Map Books

CLASSES

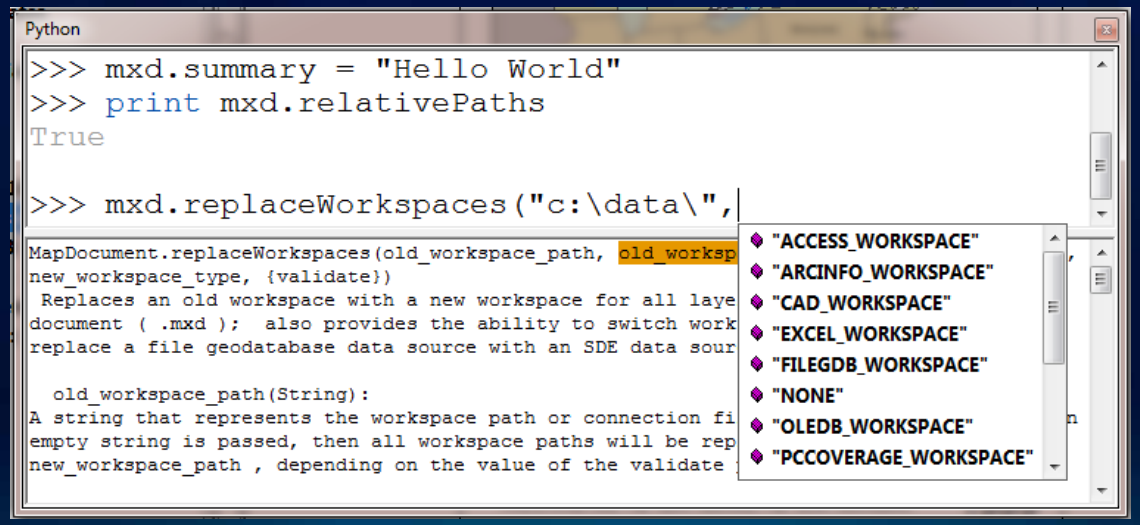
```
DataDrivenPages
PDFDocument
```

FUNCTIONS

```
ExportToAI
ExportToBMP
ExportToEMF
ExportToEPS
ExportToGIF
ExportToJPEG
ExportToPDF
ExportToPNG
ExportToSVG
ExportToTIFF
PDFDocumentCreate
PDFDocumentOpen
PrintMap
PublishMSDToServer
AnalyzeForMSD
ConvertToMSD
```

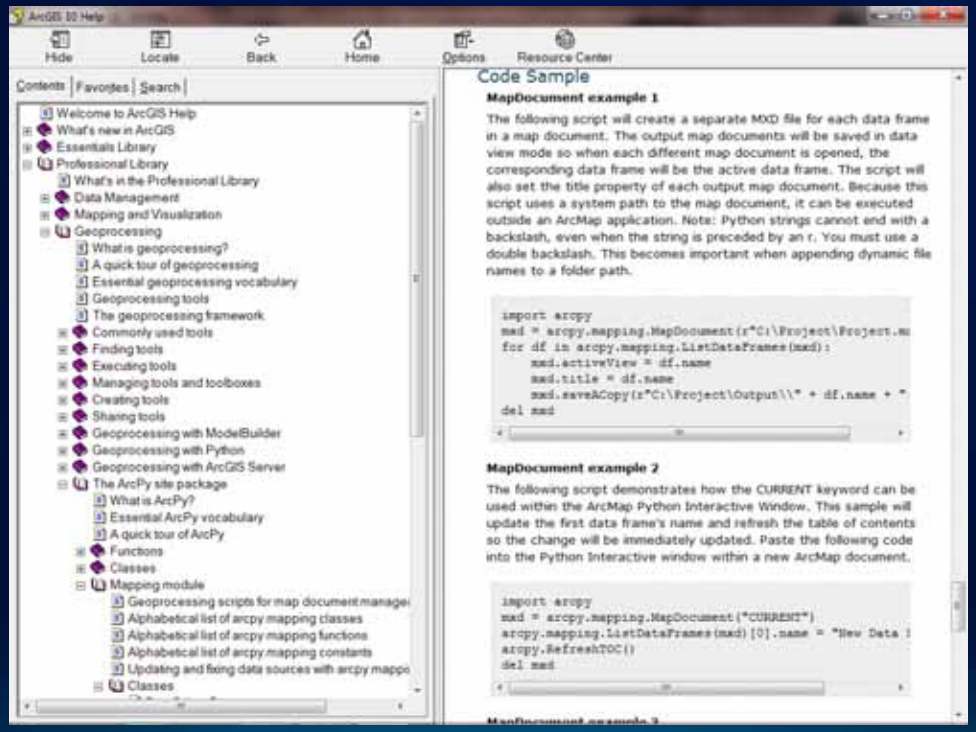
Python Window

- Command Line becomes the Python Window
- Quick and easy access to Python and arcpy
  - Gateway for new users to learn Python
  - Intellisense for all tools and methods/properties & help window
  - Quickly and efficiently execute tools



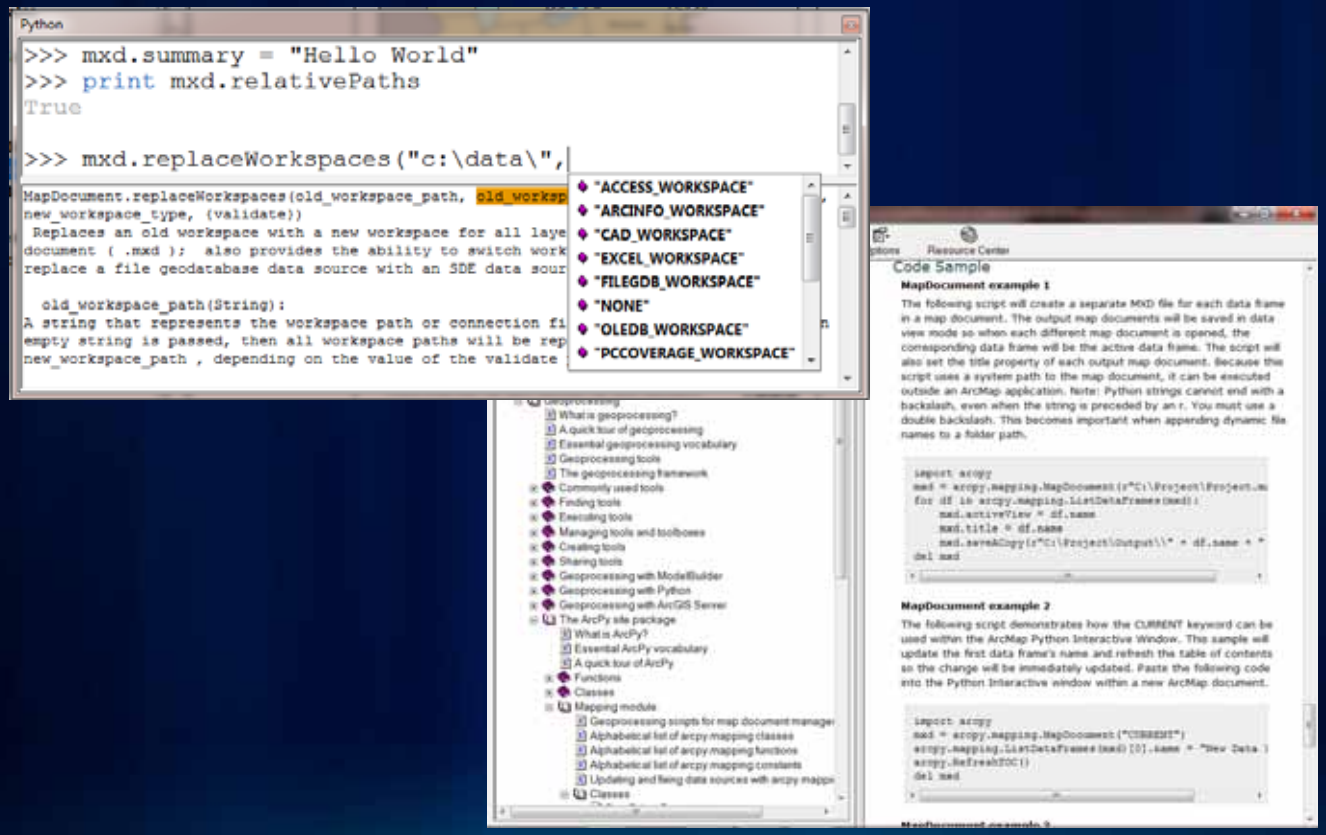
arcpy.mapping help

- Go to Professional Library → Geoprocessing → The ArcPy site package → Mapping module



Demonstration

The Python Window and using the Desktop Help System



arcpy.mapping for Map Documents

- MapDocument function

```
MapDocument
```

- **MapDocument Class**

```
Methods
 save
 saveAsCopy
 UpdateDataSources
 …

Properties:
 author
 credits
 ...
```

Referencing Map Documents (MXDs)

- Opening Map Documents (MXD) with arcpy.mapping
- Use the `arcpy.mapping.MapDocument` function
- Takes a path to MXD file on disk or special keyword "CURRENT“
- Reference map on disk
  ```
  mxd = arcpy.mapping.MapDocument(r"C:\some.mxd")
  ```
- Get map from current ArcMap session
  ```
  mxd = arcpy.mapping.MapDocument("CURRENT")
  ```

Referencing Map Documents (MXDs), cont.

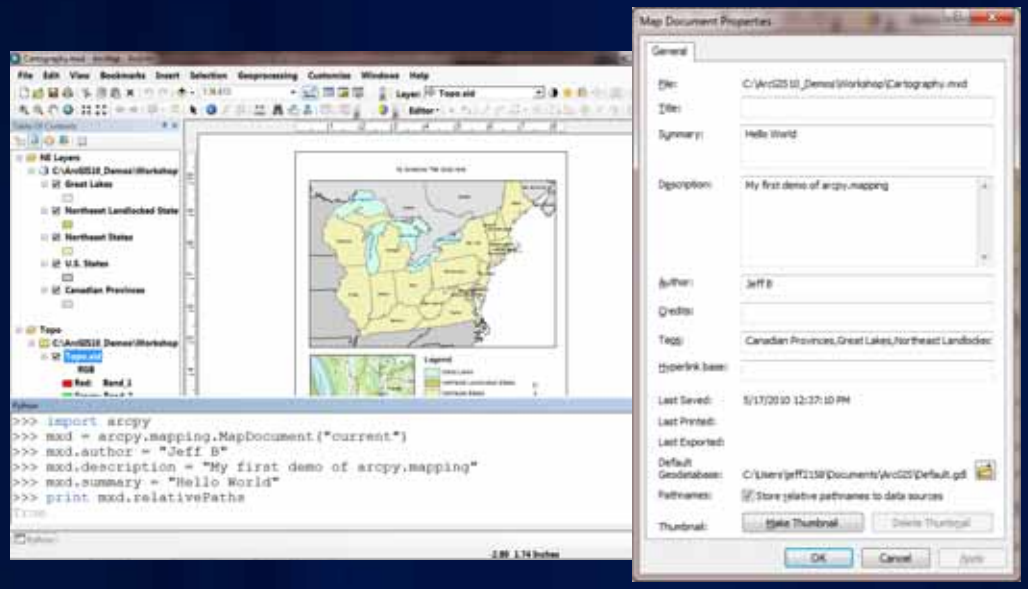
- When using CURRENT
  - Always run in foreground (checkbox in script tool properties)
  - Be wary of open conflicts, file contention
  - May need to refresh the application

```
arcpy.RefreshActiveView()
arcpy.RefreshContents()
```

- Limitations and pre-authoring
  - No "New Map" function, so keep an empty MXD available
  - Can’t create new objects (e.g., north arrow, text elements)

Demonstration:

Working with Map Documents (MXDs)



- Use Python Window to change map document property info
- Evaluate relative paths, last saved, etc.
- Change the active view
- Save changes out to a new file

arcpy.mapping for Map Layers and Data Frames

- The “List” functions
  - ListLayers
  - ListDataFrames
  - Watch the list indexes (you may often forget to use [0])

```
df = arcpy.mapping.ListDataFrames(MXD)[0]
```

- Layer properties
  - Common properties are available (e.g., def query, visible)
  - All properties can be updated via layer (.lyr) files
- DataFrame properties and methods
  - Map Navigation
  - DataFrameTime

arcpy.mapping for Map Layers and Data Frames

- Layer functions

```
Layer
ListLayers
ListTableViews

AddLayer
AddLayerToGroup
InsertLayer
MoveLayer
RemoveLayer
UpdateLayer
```

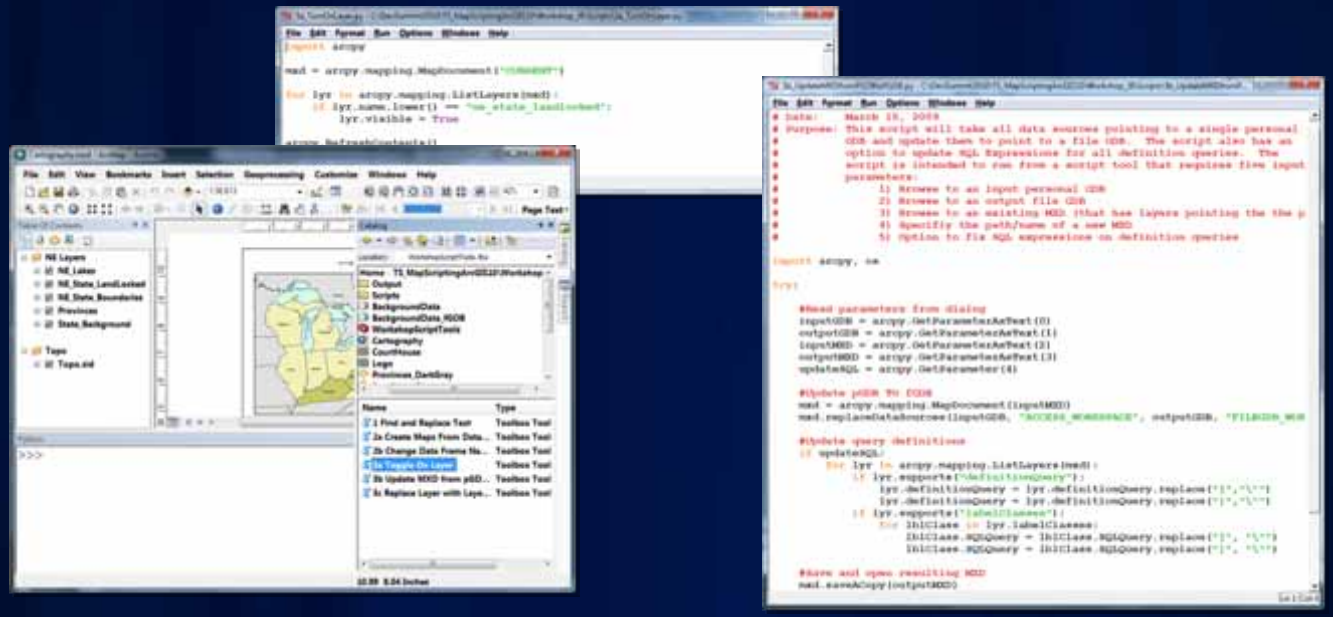
- **Data Frame Class**

```
Methods
 panToExtent(extent)
 zoomToSelectedFeatures()

Properties:
 credits
 description
 displayUnits
 elementHeight
 elementPosition
 ...
```

Demonstration:

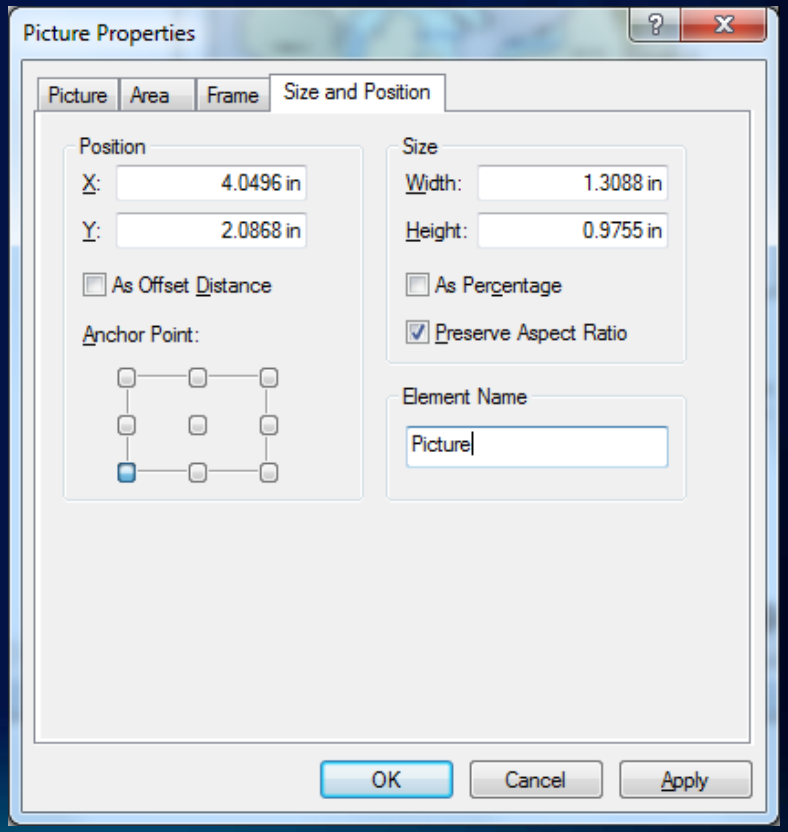
Working with Map Layers and Data Frames



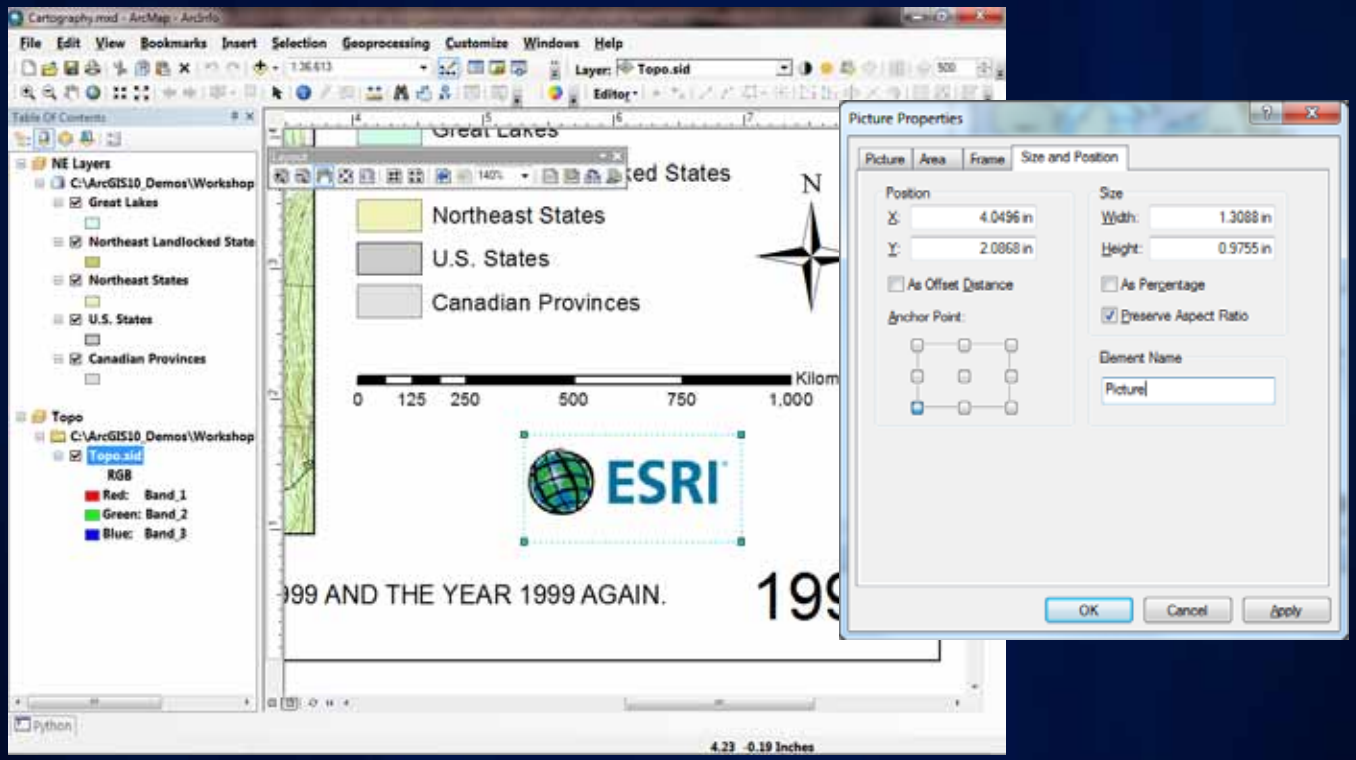
- Find a layer and turns it on or off
- Update a layer’s symbology using an existing layer file
- Modify the scale/rotation of a data frame
- Zoom to selected features

arcpy.mapping for the Page Layout

- When and what to pre-author for layout manipulation scenarios
  - Name your layout elements
  - Set the appropriate anchor
  - Cannot add new elements, so pre-author and hide



Demonstration:
Working with layout elements



- Find a picture element and change its data source
- Find and replace text in an ArcMap layout

arcpy.mapping for Printing and Exporting

- PDF & DDP classes
- Export and print functions
- Map Server Publishing
- Map Book generation

CLASSES

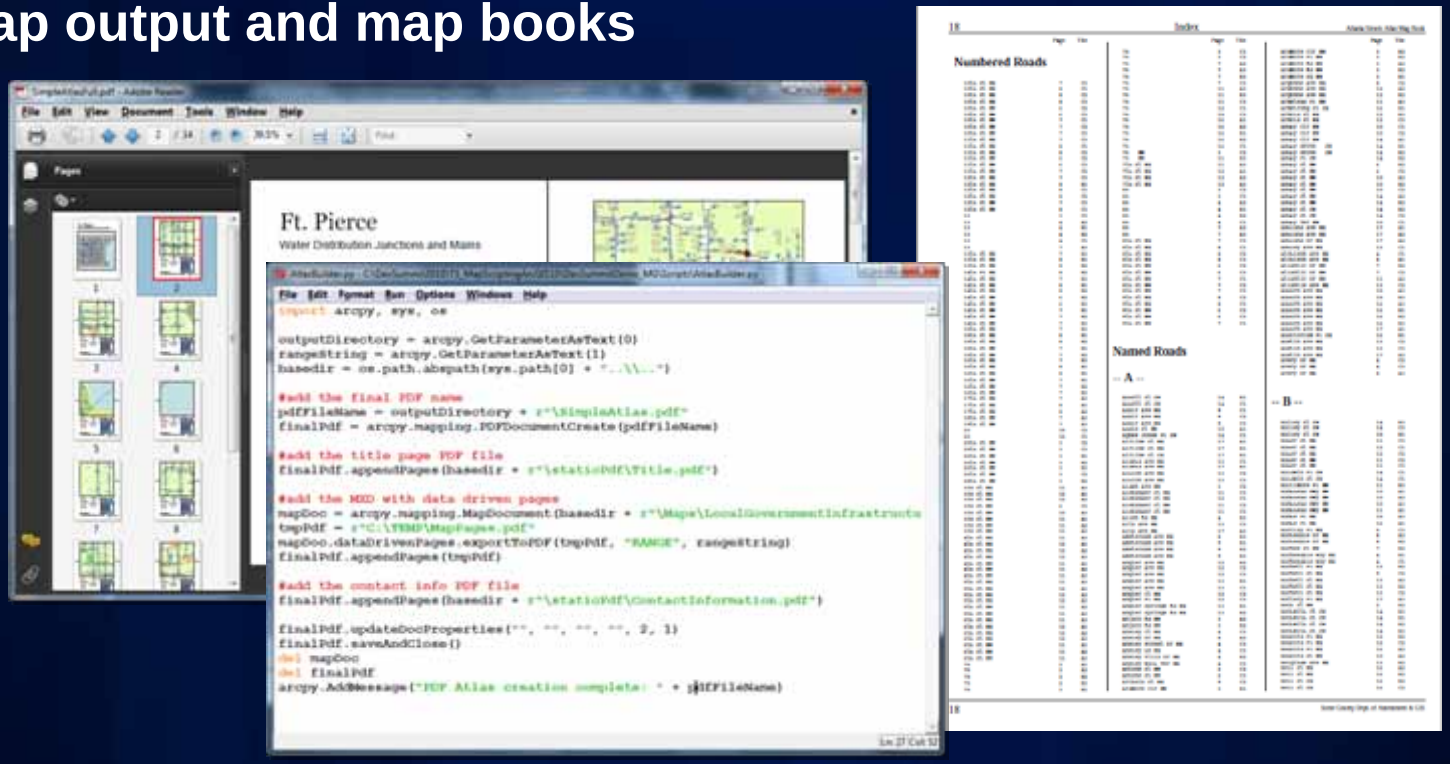
```
DataDrivenPages
PDFDocument
```

FUNCTIONS

```
ExportToAI
ExportToBMP
ExportToEMF
ExportToEPS
ExportToGIF
ExportToJPEG
ExportToPDF
ExportToPNG
ExportToSVG
ExportToTIFF
PDFDocumentCreate
PDFDocumentOpen
PrintMap
PublishMSDToServer
AnalyzeForMSD
ConvertToMSD
```

Demonstration:

Map output and map books



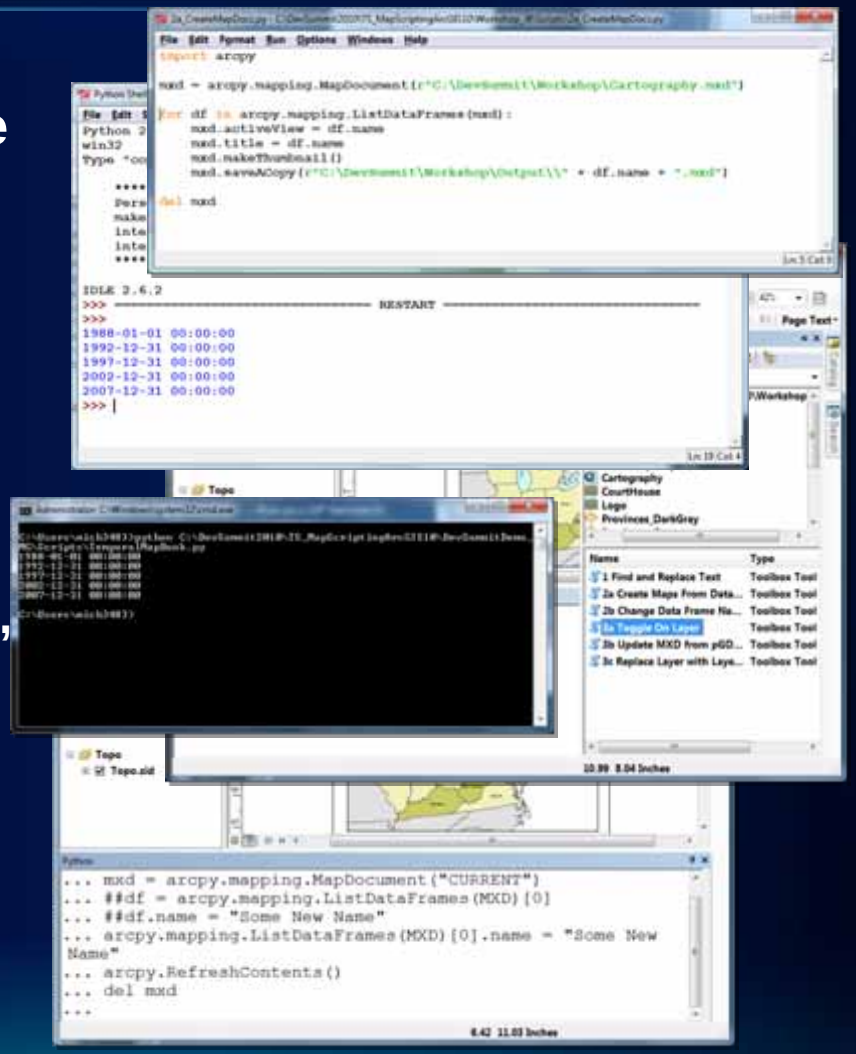
- Export data driven pages to multipage PDF
- Map book that includes index pages using Python ReportLab
- Custom thematic map application ported from AML

Updating Data Sources

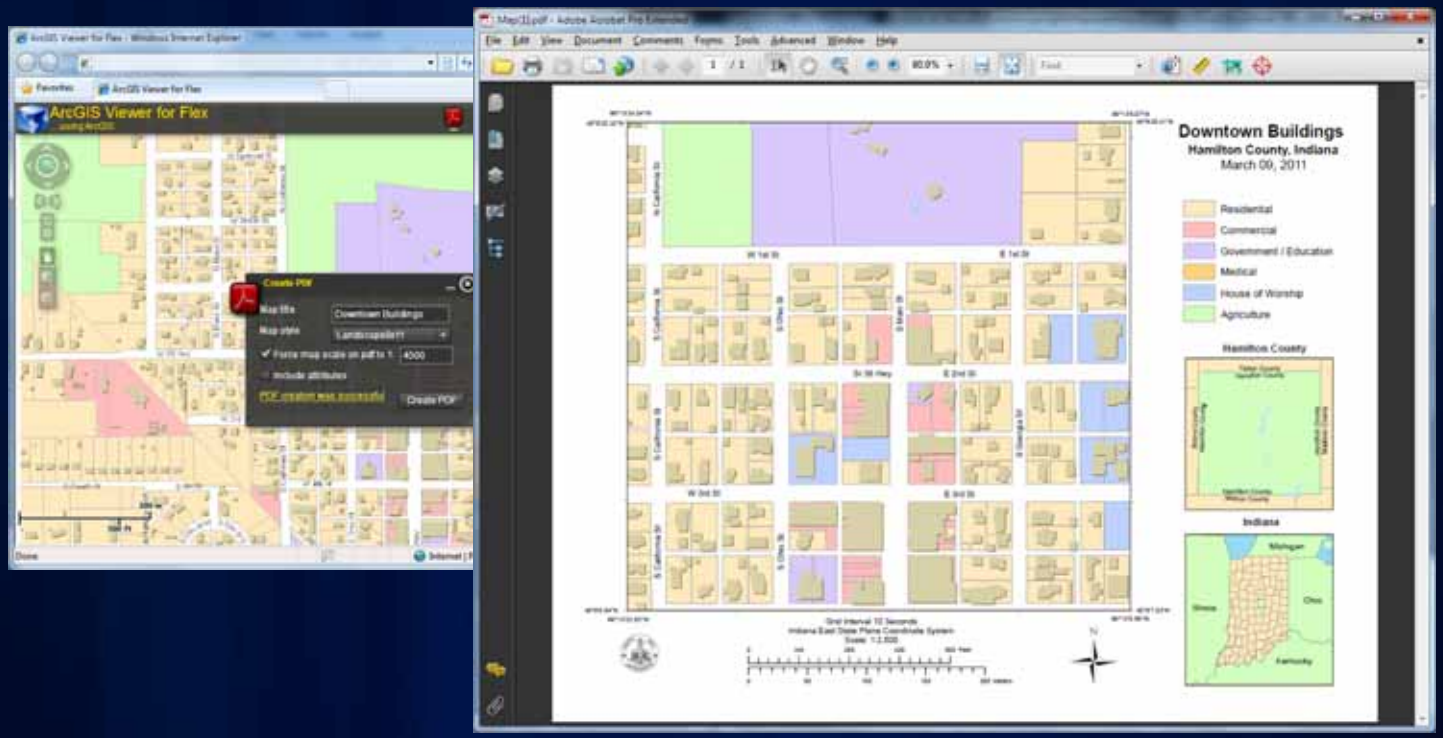
- Use arcpy.mapping for migrating Map Documents and Layer files to new data sources
- Fancier scripts can help mitigate migration pain: SQL syntax changes, field name changes, etc
- A complete concept document is dedicated to this topic
  - "Updating and fixing data sources with arcpy.mapping"
- Many capabilities:
  - Update all layers in an MXD or specific tables and layers
  - Works with all file and GDB types
  - Update joins and relates
  - Migrate from different workspace types
  - Etc

Running arcpy.mapping scripts

- arcpy.mapping is part of the geoprocessing (GP) framework
- Run in wide variety of places
  - Script tool in ArcMap or ArcCatalog
  - Standalone script - from IDE, from the command line, or as a scheduled task
  - Python Window
  - Run as a GP Service in ArcGIS Server



Demonstration:
arcpy.mapping on ArcGIS Server



- GP Services
- Exporting a Map Layout to PDF from the server

Resources available

- Desktop\Web help
  - Geoprocessing → The ArcPy site package → Mapping module
  - http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.htm
    - Alphabetical lists of classes and functions
    - Detailed discussions
    - Multiple sample scripts for each class and function topic

- ArcGIS Resource Center
  - http://resources.esri.com/content/geoprocessing
    - Download sample script tools from the Model and Script Tool Gallery
    - Watch video demonstrations
    - Monitor user forums and blog discussions

arcpy.mapping 10.1 Road Ahead

- Symbology
  - automate layer symbology (renderer) properties
    - Feature Layers: graduated colors, graduated symbols, unique values
    - Raster Layers: raster classified
- Export Report
  - automate the generation of reports without having to open ArcMap.
- Layer time
  - access a layer's time properties
  - enable time on layers
- Miscellaneous improvements to the API
  - reading bookmarks, setting text size, setting relative paths, reading page size, etc.

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