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Python for Map Automation

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What is arcpy.mapping?

- A map scripting environment introduced at 10.0
- Python mapping module that is part of the arcpy site-package

What can you do with arcpy.mapping?

- **Manage map documents, layer files, & their contents**
  - **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 map books**
  - **Extend Data Driven Pages capabilities**

What can't you do with arcpy.mapping?

- Create new symbology from scratch
- Create new layout elements
- Create new map documents (can 'Save As')

- Not designed to be a complete replacement for ArcObjects
- Product team is willing to consider additional improvements – let us know what you're missing!

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")
    ```

Layer Symbology

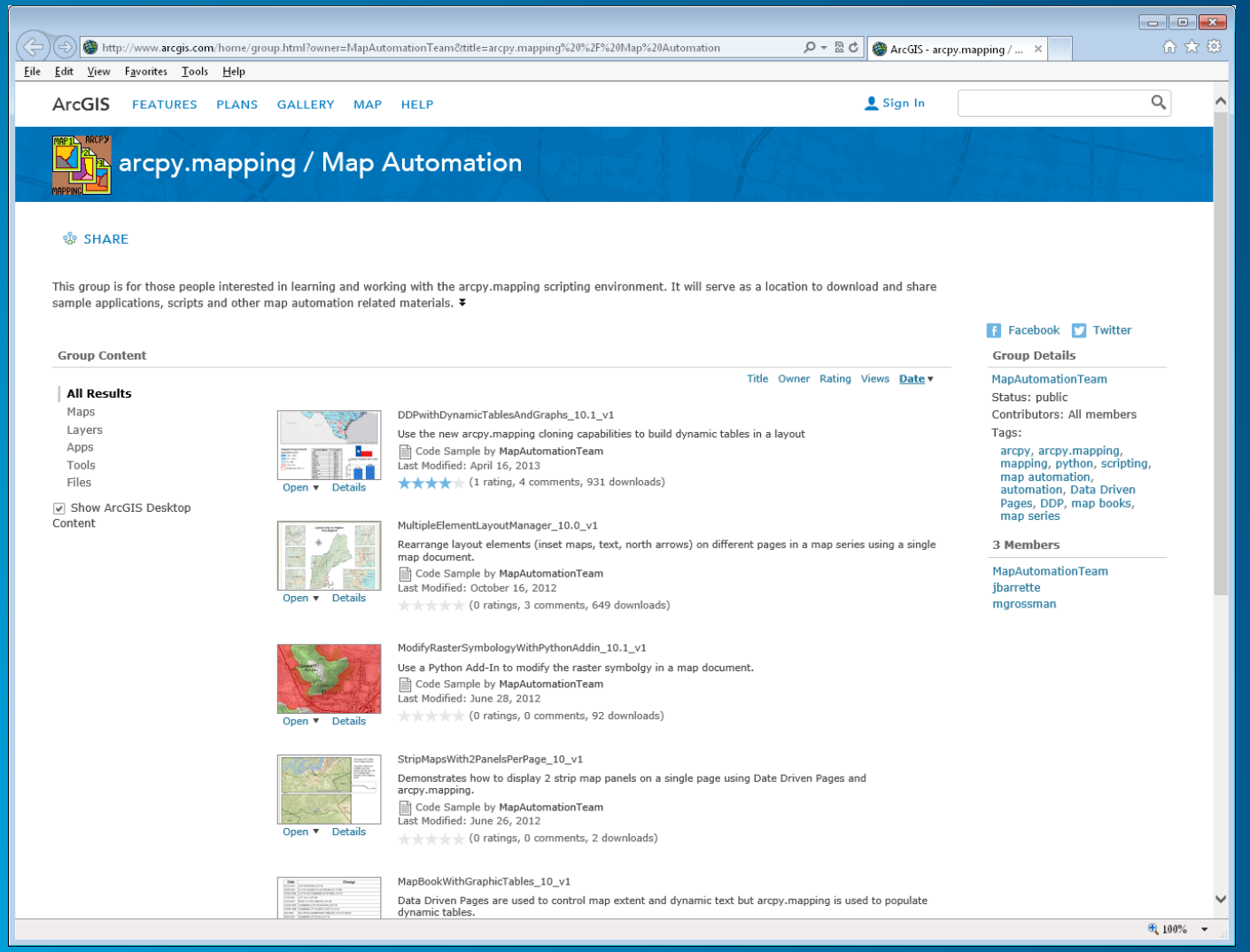
- Update layer symbology from templates
- Reclassify the symbology (updated data)
- Provide custom break values

- Limitations:
  - Cannot change symbology type directly – use arcpy.mapping.UpdateLayer
  - Cannot change colors directly – use arcpy.mapping.UpdateLayer
  - Once break values manually set, classification set to manual

Limitations

- Can’t create new content; must have pre-built content
  - Map Documents
  - Layers
  - Data Frames
  - Layouts (text elements*, graphic elements*, north arrow, scale bar)
- * Text and Graphic elements can be cloned from existing elements

arcpy.mapping group on ArcGIS Online http://esriurl.com/5915



Demo: Managing Layout Elements

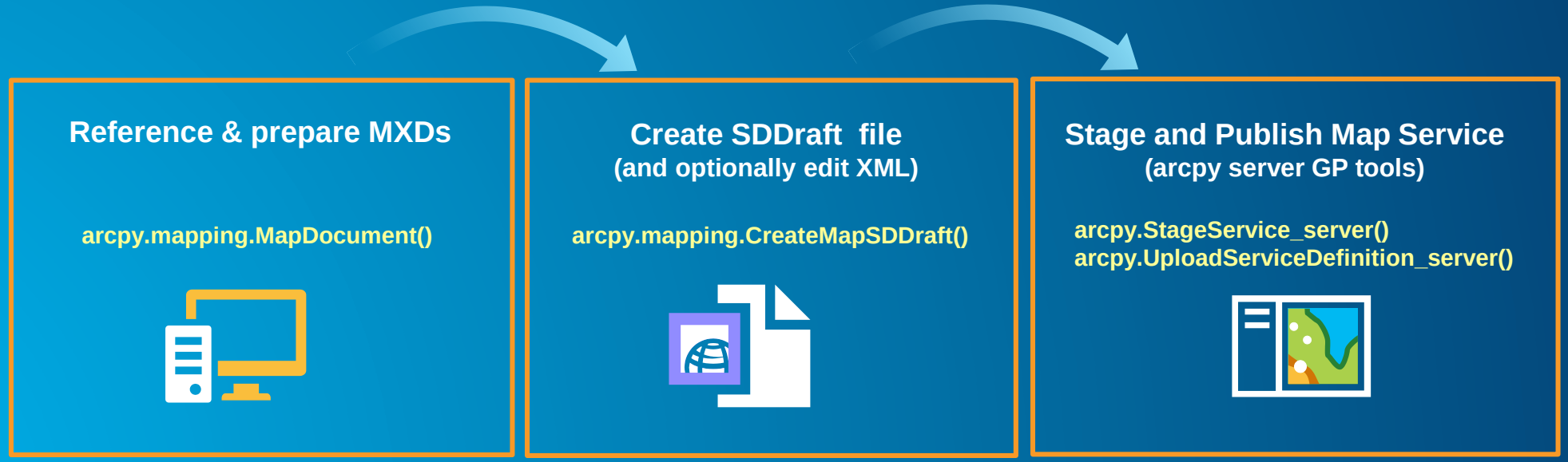
Arcpy.mapping & ArcGIS Server

- **CreateMapSDDraft() – Automate publishing map documents to services**

- **ConvertWebMaptoMapDocument() – Load Web Map for advanced printing workflows**

Publishing map services with arcpy.mapping

- arcpy.mapping.CreateMapSDDraft(map_document, out_sddraft, service_name, {server_type}, {connection_file_path}, {copy_data_to_server}, {folder_name}, {summary}, {tags})
- Workflow to convert map document to map service.
- Use python scripts for:
  - Scheduled service updates. E.g. nightly.
  - Publishing automated analysis results.
  - Batch publishing.



Sample Script: Publishing Service

Reference MXD

Server connection, service properties, etc.

Create and analyze sddraft for errors, warnings, etc.

Stage and publish Map Service

Don’t publish if errors exist

```
import arcpy

# define local variables
wrkspc = 'C:/Project/'
mapDoc = arcpy.mapping.MapDocument(wrkspc + 'counties.mxd')
con = 'GIS Servers/arcgis on MyServer_6080 (publisher).ags'
service = 'Counties'
sddraft = wrkspc + service + '.sddraft'
sd = wrkspc + service + '.sd'
summary = 'Population Density by County'
tags = 'county, counties, population, density, census'
# create service definition draft
arcpy.mapping.CreateMapSDDraft(mapDoc, sddraft, service, 'ARCGIS_SERVER',
                               con, True, None, summary, tags)
# analyze the service definition draft
analysis = arcpy.mapping.AnalyzeForSD(sddraft)
# stage and upload the service if the sddraft analysis did not contain errors
if analysis['errors'] == {}:
    # Execute StageService
    arcpy.StageService_server(sddraft, sd)
    # Execute UploadServiceDefinition
    arcpy.UploadServiceDefinition_server(sd, con)
else:
    # if the sddraft analysis contained errors, display them
    print analysis['errors']
```

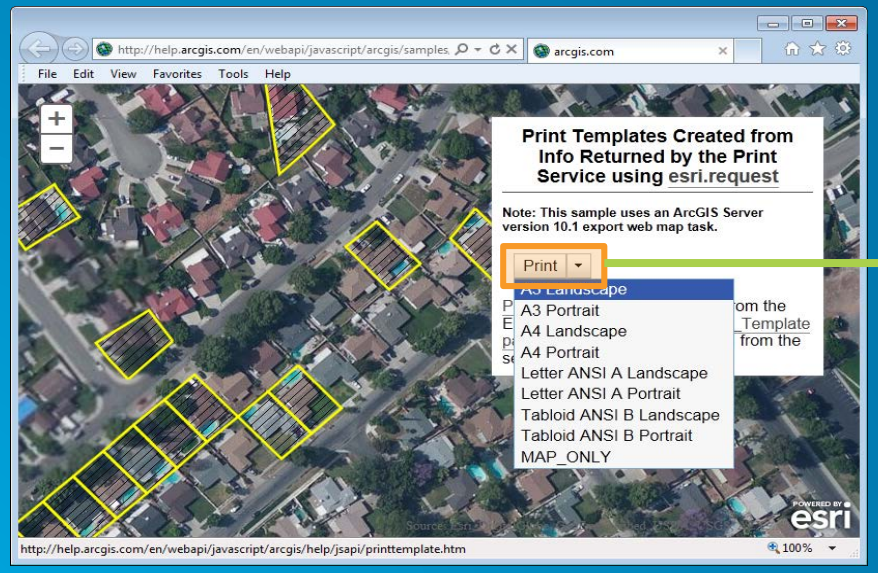
Online help and samples: http://esriurl.com/4598

Publishing other service types with python

- Create geoprocessing services
  - `arcpy.CreateGPSDDraft()`
- Create image services
  - `arcpy.CreateImageSDDraft()`
- Create geocoding services
  - `arcpy.CreateGeocodeSDDraft()`

Server printing out-of-the-box

- ArcGIS Server and the ArcGIS web APIs support web map printing via print services.
  - Out-of-the-box print service and template maps ship with Server
  - Print services sample: http://esriurl.com/6465




```
app.printer = new esri.dijit.Print({
  "map": app.map,
  "templates": templates,
  url: app.printUrl,
}, dojo.byId("print_button"));
app.printer.startup();
```

```
app.printUrl = "http://gilbert:6080/arcgis/rest/services/Utilities/PrintingTools/GPServer/Export%20Web%20Map%20Task";
```

Advanced server printing with arcpy.mapping

- Build web apps with customized versions of the out-of-the-box print service

- `ConvertWebMapToMapDocument (webmap_json, {template_mxd}, {notes_gdb}, {extra_conversion_options})`
- `<Layer>.UpdateLayerFromJSON(json_layer_definition)`

Advanced server printing with arcpy.mapping

- **Full capabilities of arcpy.mapping on the document**
  - **Swap out service layers for local vector data for *vector PDF output***
  - **Export using advanced options**
  - **Export data driven pages**
  - **Export to PDF and insert additional pages (title page, reports, etc.)**
  - **Controlling the appearance of the legend**
  - **Etc.**
- **Return a printer-friendly output file (PDF, PNG, etc.)**
- **Online help and examples** http://esriurl.com/4600

Demo: Web app to export vector PDF using arcpy.mapping

Python code used in custom GP service

Get web map JSON

Get template MXD

Create new MXD based on web map

Remove service layers

Export PDF

Output file of job

```
import arcpy, os, uuid

# Input WebMap json
Web_Map_as_JSON = arcpy.GetParameterAsText(0)

# Input Layout template
Layout_Template = arcpy.GetParameterAsText(1)

# The template location in the server registered folder
templatePath = '//gilbert/Austin/Templates'
templateMxd = os.path.join(templatePath, Layout_Template + '.mxd')

# Convert the WebMap to a map document
result = arcpy.mapping.ConvertWebMapToMapDocument(Web_Map_as_JSON, templateMxd)
mxd = result.mapDocument
df = arcpy.mapping.ListDataFrames(mxd, 'Webmap')[0]

# Remove the service layer
# This will just leave the vector layers from the template
for lyr in arcpy.mapping.ListLayers(mxd, data_frame=df):
    if lyr.isServiceLayer:
        arcpy.mapping.RemoveLayer(df, lyr)

# Export the web map to PDF
output = 'WebMap_{}.pdf'.format(str(uuid.uuid1()))
Output_File = os.path.join(arcpy.env.scratchFolder, output)
arcpy.mapping.ExportToPDF(mxd, Output_File, georef_info=True)

# Set the output parameter to be the output file of the server job
arcpy.SetParameterAsText(3, Output_File)
```

```
var printUrl = "http://gilbert:6080/arcgis/rest/services/Austin
printTask = new esri.tasks.PrintTask(printUrl, {async: true});
params = new esri.tasks.PrintParameters();
params.map = app.map;
ptemplate.format = "PDF"
params.template = ptemplate;
printTask.execute(params, printComplete);
```

Advanced Server Printing: new function at 10.3

- **Layer.UpdateLayerFromJSON(json_layer_definition)**
  - **Used in web map printing applications that support changing the renderer (or other properties) of dynamic web service layers.**
  - **Will apply the renderer (or other layer properties) as specified in the webmap_json to the corresponding vector layers staged in the template map document.**

```
# Convert the web map to a map document
result = arcpy.mapping.ConvertWebMapToMapDocument(Web_Map_as_JSON, templateMxd)
mxd = result.mapDocument

# Reference the data frame that contains the web map
df = arcpy.mapping.ListDataFrames(mxd, 'Webmap')[0]

# Reference the staged vector data that corresponds to the dynamic layer in the JSON
# This is the layer that will get updated based on the layer definition in the JSON
lyr = arcpy.mapping.ListLayers(mxd, "U.S. States (Generalized)", df)[0]
```

Get JSON Layer Defn. from web map

```
# Read the JSON and extract the layer definition
# In this case we have hardcoded it to second operational layer
data = json.loads(Web_Map_as_JSON)
layerDefinition = data["operationalLayers"][1]["layerDefinition"]
```

Update vector layer from JSON

```
# Update the staged vector layer with the layer definition (e.g. renderer info) from the JSON
lyr.updateLayerFromJSON(layerDefinition)
```

Migrating to ArcGIS Pro

- Help Topic: Migrating arcpy.mapping from ArcMap to ArcGIS Pro
  - Python 3.4
  - ArcGIS project file (.aprx)
  - Stand-alone functions have moved to appropriate classes
    - mapFrame.exportToPDF()
    - map.addLayer(), map.insertLayer(), etc
  - Layer files have changed
  - DataFrame replaced by Map, MapFrame, and Camera
  - New Layout object
  - Application always refreshes when using CURRENT

Resources

- **Examples:**
  - **Top N highlighting: https://github.com/tedrick/dcdev2015/tree/master/topN**
  - **Publishing Services: https://github.com/tedrick/dcdev2015/tree/master/atlasPublish**
- **Print Service Tutorials: http://server.arcgis.com/en/server/latest/create-web-apps/windows/printing-in-web-applications.htm**
- **ArcGIS Online arpy.mapping group: http://esriurl.com/5915**

Understanding our world.