Network Analyst:
Automating Workflows with Geoprocessing

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Links, samples, and slides

http://esriurl.com/AutoWorkflows
• Who are we?
  - Network Analyst Product Engineers
• Who are you?
• Who are you?

- Are you current Network Analyst users?
• Who are you?
  - Are you current Network Analyst users?
  - Are you current geoprocessing users?
• Who are you?

- Are you current Network Analyst users?
- Are you current geoprocessing users?
- Have you made geoprocessing models?
• Who are you?
  - Are you current Network Analyst users?
  - Are you current geoprocessing users?
  - Have you made geoprocessing models?
  - Have you made geoprocessing Python scripts?
• Why should you use geoprocessing?
  - Automate repetitive tasks
  - Reduce mistakes
  - Share analysis capabilities
  - Increase efficiency
ArcGIS Network Analyst extension concepts

Geoprocessing and network analysis

ModelBuilder: Models and model tools

Python: Scripts and script tools

Support and resources

Topics to be covered
ArcGIS Network Analyst Extension

analysis types

Route

Service Area

Location-Allocation

Origin-Destination

Cost Matrix

Vehicle Routing

Problem

Closest Facility
Network Analyst layer

- One layer type for each solver
- Holds the analysis
Network Analyst workflow
Performing an analysis manually
Steps for network analysis:
- Make an analysis layer
- Add locations
- Solve
- Work with results
Topics to be covered

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Support and resources
What is Geoprocessing?

ArcGIS Help: The geoprocessing framework
System tools

Network Analyst Tools
  Analysis
    Make Service Area Analysis Layer
    Solve

Script tools

DemoTools.tbx
  BestRouteScript
  BestRouteScriptwithExtras

Geoprocessing tool types

Model tools

DemoTools.tbx
  BestRouteModel
  BestRouteModelwithExtras
Using Geoprocessing tools

Single tool

Tool dialog

Python window

Chain tools

Model

Script

Network Analyst Tools:
- Make Closest Facility Analysis Layer
- Make Cost Matrix Analysis Layer
- Make OD Cost Matrix Analysis Layer
- Make Route Analysis Layer
- Make Service Area Analysis Layer
- Share As Route Layers
- Solve
- Solve Vehicle Routing Problem

Network Dataset:
- Build Network
- Create Network Dataset From Template
- Create Template From Network Dataset
- Dissolve Network
- Make Network Dataset Layer

Turn Feature Class:
- Create Turn Feature Class
- Increase Maximum Edges
- Populate Alternate ID Fields
- Turn Table To Turn Feature Class
- Update by Alternate ID Fields
- Update by Geometry

Python:
```python
network = r"C:\Data\SanFrancisco.gdb\Transportation\Streets_NG"
arcpy.na.MakeClosestFacilityAnalysisLayer(network, "ClosestHospitals", "Driving Time", "TO_FACILITIES", 5, 3, "1/1/1900 00:00 AM", "QFT", "Start Time", "ALLOW_NETWORK", ["Meters", "TravelTime"])
```

Script:
```python
cflayerObj = arcpy.na.MakeClosestFacilityAnalysisLayer(networkDataset, layerName, "Driving Time", "PRESERVE_BOTH").getOutput(0)
```
Network Analyst: Automating Workflows with Geoprocessing

Network Analyst system tools
Network Analyst: Automating Workflows with Geoprocessing

Network Analyst system tools

- Performing Network Analysis
Network Analyst: Automating Workflows with Geoprocessing

• Performing Network Analysis

• Building networks
Network Analyst: Automating Workflows with Geoprocessing

- Performing Network Analysis
- Building networks
- Managing turns
Using Geoprocessing

- Performing Network Analysis
- Building networks
- Managing turns
Using Geoprocessing

- Performing Network Analysis
- Building networks
- Managing turns
- Publishing services
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Support and resources

Topics to be covered
Building Geoprocessing Models

ArcGIS Help:
What is ModelBuilder?
Geoprocessing Models
- Created in Model Builder
Geoprocessing Models

- Chain tools to perform a workflow
Geoprocessing Models

- Use models like system tools
Geoprocessing Models

- Use models within other models
Geoprocessing Models

- Apply all Model Builder techniques to network analysis models
Automating workflows with geoprocessing models

Performing a network analysis in Model Builder

Sharing a model as a tool
Demo: Automating Workflows with Geoprocessing Models

- **Automate workflows** with Model Builder
- Make inputs and outputs **model parameters**
- **Run** your model as a tool
- **Share** models and projects

Takeaways
When running models as tools...
- The output network analysis layer should be a **model parameter**
- This will add the layer to the map

Visualizing analysis results in ArcMap
Demo

Automating workflows with geoprocessing models

Working with inputs and outputs
Include the network analysis workflow as part of a larger workflow

Use the Select Data tool to access sublayers

Work with external data like CSV files
Post-processing your analysis

- Use your analysis result as an input to another tool
  - The Select Data tool accesses individual sublayers
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Topics to be covered
Writing Python Scripts

ArcGIS Help: Python in ArcGIS Pro
• Conditional logic
• Loops
• Conditional logic
• Loops
• Cursors, creating geometry
• Conditional logic
• Loops
• Cursors, creating geometry
• Built-in and third party modules
Network Analyst: Automating Workflows with Geoprocessing

ArcPy
- Introduction
- ArcPy functions
- ArcPy classes
- Data Access module
- Mapping module
- Network Analyst module

What is the Network Analyst module?

Classes
- ClosestFacilitySolverProperties
- LocationAllocationSolverProperties
- NAClassFieldMappings
- NAClassFieldMap
- ODCostMatrixSolverProperties
- RouteSolverProperties
- ServiceAreaSolverProperties
- StreetDirectionsProperties
- VehicleRoutingProblemSolverProperties

Functions
- CheckIntersectingFeatures
- GenerateDirectionsFeatures
- GetNAClassNames
- GetSolverProperties
- ListDirectionsLanguages
- ListDirectionsStyleNames
Network Analyst: Automating Workflows with Geoprocessing

- ArcPy site package
  - Network Analyst module
  - Other geoprocessing tools
  - Other useful functions and classes
    - Describe

ArcPy

Introduction
ArcPy Functions
ArcPy Classes
Data Access module
Mapping module
Network Analyst module

What is the Network Analyst module?

Classes
- BaseFlowDirectionalProperties
- LocationAllocationSolverProperties
- NClassFieldMappings
- NClassFieldNames
- ODClassMatrixSolverProperties
- RouteSolverProperties
- ServiceAreaSolverProperties
- StreetDirectionsProperties
- VehicleRoutingProblemSolverProperties

Functions
- CheckIntersectingFeatures
- GenerateDirectionsFeatures
- GetNAClassNames
- GetSolverProperties
- ListDirectionsLanguages
- ListDirectionsStyleNames
Import the arcpy site package
```python
arcpy.CheckOutExtension("Network")
```
Create/edit a Network Analysis layer

```python
routeLayerObj = arcpy.na.MakeRouteAnalysisLayer(networkDataset, layerName, "Driving Time", "PRESERVE_BOTH").getOutput(0)
```
Add locations to analysis classes

```python
arcpy.na.AddLocations(layerName, "Stops", claimLocations, fieldMappings_claims, """)
```
Run the analysis
# Name: Solve_WorkFlow.py
# Description: Solve a closest facility analysis to find the closest warehouse from the store locations and save the results to a layer file on disk.
# Requirements: Network Analyst Extension

import arcpy
from arcpy import env

try:
    # Check out the Network Analyst extension license
    arcpy.CheckOutExtension("Network")

    # Set environment settings
    env.workspace = "C:/data/Perls.gdb"
    env.overwriteOutput = True

    routeLayerObj.saveACopy(outputLayerFile)
Accessing sublayer with ListLayers


```python
result_object = arcpy.na.MakeRouteAnalysisLayer(network, layer_name,
                                              travel_mode, time_of_day=start_time,
                                              accumulate_attributes=["Meters"])```

```python
layer_object = result_object.getOutput(0)
```

```python
routes_sublayer = layer_object.listLayers(routes_layer_name)[0]
```
Python in ArcGIS Pro vs. ArcMap

- ArcGIS Pro: python 3.4
- ArcMap: python 2.7
- General migration help
- Network analysis migration help
Automating workflows with python scripts

Performing a network analysis with a python script
Takeaways

Demo: Automating Workflows with Python Scripts

- Run any geoprocessing workflow in **stand-alone python**
- Find **Code samples** in the tool help
- Run simple python commands in the **python window**
Building Script Tools

ArcGIS Help: What is a script tool?
• Work with your scripts through a user interface

• Use Script tools like any other tool within ArcToolbox
  - Use script tools in models and vice versa
Add outputs from script tool to a map

- If a network analysis layer is the output use `arcpy.SetParameterAsText`(...)

```python
layerName = "DailyRoute"
routeLayerObj = arcpy.na.MakeRouteAnalysisLayer(networkDataset, layerName,
                                                   "Driving Time", "PREERVE_BOTH").getOutput(0)

# Add the output layer to the map
arcpy.SetParameterAsText(2, layerName)
```
Create a script tool

Create a script tool to provide a UI for a Python script

Use tool validation to customize the UI
• Provide a user interface for python scripts by making a **script tool**

• Use derived output and `arcpy.SetParameterAsText()` to add results to the map

• Use **tool validation** to customize your script tool’s user interface
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Topics to be covered
• Use the geoprocessing framework for network analyses
  - Network Analyst Tools
  - Models and Model tools
  - Script and Script tools
Summary

- Automate workflows
Summary

• Incorporate network analysis in larger process
Resources

- Network Analyst tutorials
  - ArcMap
  - ArcGIS Pro
Resources

• Network Analyst code samples
  - ArcMap
  - ArcGIS Pro
Resources

- ArcGIS Network Analyst Extension Discussion Forum
Resources

- Python for ArcGIS resource center
Esri presents the

Employee of the Year Award

to

Melinda Morang

Signature of Manager
Links, samples, and slides

http://esriurl.com/AutoWorkflows