Network Analysis with ArcGIS for Server

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Introduction

• Who are we?
  - Network Analyst Product Engineers

• Who are you?
  - Current Network Analyst users?
  - Current ArcGIS Server users?
  - Worked with ArcGIS 10.1 for Server?
  - Familiarity with Geoprocessing framework?
Topics

- ArcGIS Network Analyst extension and concepts
- ArcGIS for Server workflow
- Geoprocessing services
- Network analysis services
- Choosing the correct option
- What is new at 10.1 and what is coming
- Support and resources
Network Analyst Extension

More Information:

What is Network Analyst in ArcGIS help
ArcGIS Network Analyst Extension
Solving transportation problems
Network Analyst Concepts

More Information:

Essential Network Analyst vocabulary in ArcGIS help
Network Dataset

Transportation Network

Network Dataset

Data Model

Geodatabase

Shapefile StreetMap
Where do you get street data?

- **StreetMap Premium for ArcGIS**
- **Vendor data**
  - NAVTEQ or TomTom
  - **Vendor street data processing tools**
- **Data and Maps media**
  - Included with ArcGIS
  - North America ready-to-route dataset
- **Your own data**
- **Government data**
  - TIGER
- **Community data**
  - OpenStreetMap
  - **OSM to NDS tools**
- **No street data at all**
  - Network analysis services on ArcGIS online
Network Analysis Layer

- Composite layer configured for a specific solver
- Stores analysis properties, inputs, and outputs from the solver
Network Analysis with ArcGIS for Server

More Information:

[Network analysis services](https://arcgishelp.com) in ArcGIS help
ArcGIS for Server Workflow

Author GIS Resources

Publish GIS Services

Use GIS Services
Network Analysis with ArcGIS for Server

ArcGIS for Server

- Geoprocessing Services
- Network Analysis Services

⚠️
Geoprocessing Services

More Information:

Sharing workflows with geoprocessing services in ArcGIS help
What is a Geoprocessing Service?

- A web service for performing analysis using geoprocessing tools
- Full use of the geoprocessing framework
- Synchronous and Asynchronous execution
- Provides SOAP and REST endpoints for working with all Network Analyst solvers
- Out-of-the-box clients
Authoring Geoprocessing Services

- Create geoprocessing tools that perform your network analysis in a toolbox
- The geoprocessing tools can be
  - Model tool created using ModelBuilder
  - Script tool created using Script tool wizard that runs a script file (usually a Python file)
  - Tools in Python Toolboxes
  - Custom tool created using ArcObjects and a compiled programming language like C#, VB.Net, Java, C++
Authoring Geoprocessing Services

1. Make or Edit Network Analysis Layer
2. Add locations to one or more Network Analysis Classes
3. Solve
4. Use the results

Network Analysis Workflow
Authoring Geoprocessing Services

• **Generate Service Areas tool**
  - Single tool for service area analysis
  - Use hierarchy for fast execution and large problems

• **Solve Vehicle Routing Problem tool**
  - Single tool for solving vehicle routing problems
  - Faster than executing multiple tools

• Chain multiple tools for other solvers
Authoring Geoprocessing Services

- Network analysis layer is a non-transportable dataset
  - Convert sublayers to feature classes

- Network dataset becomes project data for the service

- Document the tools
  - Acts as an API reference for the tasks
Authoring Geoprocessing Services

Performance Tips

• Use layers for project data
  - Network dataset layers and network analysis layers

• Preprocess network analysis layers used by the tasks
  - Prepopenulate network analysis classes

• Pre-calculate network locations for permanent facilities
  - [Calculate Locations tool](#)

• Write outputs to in_memory workspace
  - Use file geodatabase for very large analysis outputs

• Dissolve large network datasets
Demo: Author Store Site Selection Service

- Author a tool to generate drive time polygons around given points.
- Author a tool to choose store locations that would generate the most business for a retail chain.
Publishing Geoprocessing Services

- Execute the tool
  - Tool should execute without any errors
  - Create small output datasets
- From Results window, share the result as a service
  - Publisher or Administrator privilege is required
Publishing Geoprocessing Services

- Register project data with ArcGIS for Server before sharing your tools
  - Multiple services can use the same network dataset
  - Easy to apply data updates
  - Can use local path to the data when using clusters
  - ArcGIS will not copy the network datasets to the server machine
Publishing Geoprocessing Services

- Set service settings
  - Synchronous or Asynchronous execution
  - Message level as Warning
  - Execution timeouts
- Add results
  - Multiple tasks within a service
- Set task settings
  - Input mode for task parameters
Publishing Geoprocessing Services

• Analyze your service
  - Examine the messages in the Prepare window
  - Often provide a performance improvement tip
Using Geoprocessing Services

• Can be used without writing any code in:
  - ArcMap
  - ArcGIS Explorer Desktop
  - Silverlight Viewer
  - Flex Viewer

• Requires client side code to use from Web, Mobile and Runtime APIs
  - Samples available for JavaScript, Flex, Silverlight, and Windows Phone
Demo: Publish & Use Store Site Selection Service

- Share the Locate Stores and Calculate Drive-Time Polygons tools as a service
- Use the tasks in a web application created with ArcGIS Viewer for Silverlight
Network Analysis Services

More Information:

Network analysis services in ArcGIS help
What is a Network Analysis Service?

- A map service published with network analysis capability
- Server object extension that works with network analysis layers
- Synchronous execution only
- SOAP endpoints for all solvers and REST endpoints for Route, Closest Facility and Service Area solvers
- Limited out-of-the-box clients
Authoring Network Analysis Services

- Create a map document with one or more network analysis layers

- Set analysis properties on the network analysis layers

- Optionally include any data layers that will be used by the services
  - For example: census block group centroids to be used as demand points with location-allocation service
Publishing Network Analysis Services

Share the map document as a service
Publishing Network Analysis Services

- Register project data with ArcGIS for Server before sharing your map

  - Multiple services can use the same network dataset
  - Easy to apply data updates
  - Can use local path to the data when using clusters
  - ArcGIS will not copy the network datasets to the server machine
Publishing Network Analysis Services

• Enable the network analysis capability
  - Creates a map service and network analysis service

• Set the service properties
  - Generalization tolerance for output features
  - Auto-hierarchy distance
  - Maximum number of input features supported by the service
Publishing Network Analysis Services

• Analyze your service
  - Examine the messages in the Prepare window
  - Often provide a performance improvement tip
Using Network Analysis Services

• Routing service can be used without writing any code in:
  - ArcMap
  - ArcReader
  - ArcGIS Explorer Desktop

• Requires client side code to use from Web and Mobile APIs
  - Samples available for JavaScript, Flex, Silverlight, Windows Phone, iOS APIs
  - Support for Android API coming soon
Demo: Network Analysis Service for Routing

- Author and publish a network analysis service that can find shortest route based on traffic conditions
- Find best route that avoids traffic during rush hour using a web application
Selecting the Service Type
Geoprocessing or Network Analysis Service?

- Both geoprocessing and network analysis service support the full network analysis capabilities.

Select geoprocessing service if:
- Analysis runs for long duration (greater than 60 seconds)
- Out-of-the box client support is important
- Network analysis is just one part of a larger analysis
- Need to access the traversal result for further analysis
- Need to access OD Cost Matrix, Vehicle Routing Problem, or Location Allocation Solvers from REST based Web APIs

Select network analysis service if:
- Analysis runs for short duration (less than 60 seconds)
- Need very fast execution
# Geoprocessing or Network Analysis Service?

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Speed</th>
<th>Problem Size</th>
<th>Access to ArcObjects</th>
<th>Out-of-the-box client support</th>
<th>Development overhead</th>
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</thead>
<tbody>
<tr>
<td>Geoprocessing service</td>
<td>Constant overhead</td>
<td>Medium to large</td>
<td>No</td>
<td>Good</td>
<td>Low</td>
</tr>
<tr>
<td>Custom geoprocessing tool</td>
<td>Constant overhead</td>
<td>Medium to large</td>
<td>Yes</td>
<td>Good</td>
<td>Medium</td>
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<tr>
<td>Network analysis service</td>
<td>Fast</td>
<td>Small to medium</td>
<td>No</td>
<td>Limited</td>
<td>Low</td>
</tr>
<tr>
<td>Custom server object extension</td>
<td>Fast</td>
<td>Small to large</td>
<td>Yes</td>
<td>None</td>
<td>High</td>
</tr>
</tbody>
</table>
Pop Quiz

• A commercial equipment provider needs to generate up to one hour service areas around their facilities to determine premium support eligibility for their customers. The service area around each facility can take about 30 minutes to process.

• Choose geoprocessing service
  - Since the analysis runs for longer duration, the asynchronous execution provided with geoprocessing services is required to complete such long running jobs.
Pop Quiz

- A logistics company needs a fast point to point routing service. Often times the service needs to process multiple route requests per second.

- Choose network analysis service
  - The service requires fast execution. The overall time to complete analysis (find routes) is very small. The constant overhead associated with the execution of geoprocessing services will not provide the desired performance.
Pop Quiz

• A web developer needs to build a bike routing app that can find best routes for bikes and provide further quality assessment of a route such as percentage of route that uses bike lanes and highlight sections that use streets without bike lanes.

• Choose geoprocessing service
  - The service needs to analyze the routes and relate them to the street features to get further information about the edges that make up the routes. This requires using the traversal results which is easily available from a geoprocessing service.
Pop Quiz

• A GIS service provider needs to develop a custom routing product to support routing school buses for school districts. Along with routing, the product should also support other analyses such as determining the locations of bus stops and school redistricting. The product needs to have a simple web based user interface.

• Choose geoprocessing service
  - The product needs to perform Vehicle Routing Problem and Location-Allocation network analyses. The JavaScript API does not provide support for these solvers with network analysis services. The product also needs some integration between Network Analyst solvers and other third party optimization solvers for school redistricting. Geoprocessing services provides easy access to other GIS analyses and are supported with JavaScript API.
Performance
Performance Optimization Checklist

- Use file geodatabase based network datasets
  - Faster than streetmap premium datasets

- Use local paths to data
  - Copy network datasets to all machines in the cluster

- Dissolve large network datasets
  - Dissolve Network tool

- Load network datasets into memory
  - Data warm up tool
  - Minimizes disk I/O and maximizes service throughput
Summary
**Summary**

**ArcGIS for Server**

- **Geoprocessing Service**
  - A toolbox with geoprocessing tools
  - Full use of the geoprocessing framework
  - Synchronous and Asynchronous execution
  - SOAP and REST endpoints for all solvers
  - Out-of-the-box clients

- **Network Analysis Service**
  - Map document with network analysis layers
  - Synchronous execution
  - SOAP endpoints for all solvers
  - REST endpoint for Route, Closest Facility, and Service Area solvers
  - Few out-of-the-box clients
Network Analysis with ArcGIS Server

ArcGIS for Server

Geoprocessing Services

Network Analysis Services
What’s new at 10.1
Network Analyst: New Features

- Enhanced restrictions
- Real-time traffic support
- All solvers are time aware
- Fast service area polygons
- Capacitated location-allocation
- Server tools
- Additional geoprocessing tools
- Network analysis services on ArcGIS Online with organizational subscriptions (coming soon)
Network Analyst: New Features for Geoprocessing

- Network Analyst Python module (arcpy.na)
  - Easy access to Network Analyst functionality from Python, along with helper functions and classes
  - Ability to edit a Network Analysis layer without having to create a new one

- New tools
  - Working with traversal results
  - Easy publishing of GP Services
ArcGIS for Server: New Features

• ArcGIS for Server is a native 64-bit application
  - Can solve much larger network analysis problem

• Support for Z and M values from REST endpoints

• Easy deployment in the elastic cloud environments

• Support long running asynchronous geoprocessing services using multi-machine ArcGIS for Server site.
Network Analysis Services on ArcGIS Online
Available with ArcGIS Online for Organizations

- **Global Traffic Services**
  - Visualize live traffic speeds and traffic incidents
  - Configure local network datasets with live traffic

- **Global Network Analysis Services**
  - Route
  - Closest Facility
  - Service Areas
  - Vehicle Routing Problem
Resources
Support and Resources

• Tutorials
  - Network Analyst tutorial
  - Network Analyst geoprocessing service examples
  - Network analysis service tutorial

• ArcGIS Resource Center

• ArcGIS Network Analyst Extension Discussion Forum
Network Analyst at UC2012
Tech Workshops

- Network Analyst – An Introduction
- Network Analyst – Performing Network Analysis
- Network Analyst – Automating Workflows with Geoprocessing
- Network Analyst – Creating Network Datasets
- Network Analysis with ArcGIS for Server
Demo Theaters

- What’s new in Network Analyst at 10.1?
- Routing with Open Source Data (OSM)
- Modeling Real-World Problems with the VRP Solver
- Routing Inside Buildings with 3D Networks
- Using Streetmap Premium
<table>
<thead>
<tr>
<th>Time</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Network Analyst: An Introduction Room 3</td>
<td>Network Analyst: Automating workflows with Geoprocessing Room 10</td>
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<tr>
<td>9 am</td>
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<tr>
<td>10 am</td>
<td>Network Analyst: Performing Network Analysis Room 3</td>
<td>Network Analyst: Creating Network Datasets Room 9</td>
<td>Network Analyst: Performing Network Analysis Room 4</td>
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<tr>
<td>11 am</td>
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<td></td>
<td>Routing in buildings with 3D Networks **</td>
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<td>12 pm</td>
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<tr>
<td>1 pm</td>
<td>Network Analysis with ArcGIS for Server Room 3</td>
<td>Routing with Open Source Data (OSM) ***</td>
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<td>2 pm</td>
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<td>3 pm</td>
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<td>4 pm</td>
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<tr>
<td>5 pm</td>
<td>What’s New in Network Analyst 10.1 **</td>
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</tbody>
</table>

* Demo Theater – Online GIS – Exhibit Hall C

** Demo Theater – Analysis and Geoprocessing – Exhibit Hall B2

*** Demo Theater – Esri Labs – Exhibit Hall B1
Related Tech Workshops

- **Geoprocessing with ArcGIS for Server**
  - Wednesday 8:30 – Room 04
  - Thursday 8:30 – Room 09

- **Using ArcGIS for Server in the Amazon Cloud**
  - Wednesday 3:15 – Ballroom 06C
Steps to evaluate UC sessions

- My UC Homepage > “Evaluate Sessions”

- Choose session from planner
  OR

- Search for session by offering ID:

  1167

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

• Please fill out the evaluation:

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  Offering ID:  1167