



**Esri International User Conference | San Diego, CA**  
**Technical Workshops | Analysis and Geoprocessing**

# **Performing Network Analysis with ArcGIS Server**

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# Introductions

- **Who are we?**
  - **Network Analyst Product Engineers**
- **Who are you?**
  - **Current Network Analyst users?**
  - **Current ArcGIS Server users?**
  - **Familiarity with Geoprocessing framework?**
  - **Experience with ArcGIS Web APIs?**

# Topics

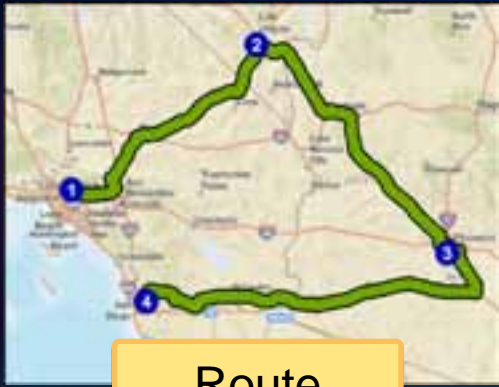
- **ArcGIS Network Analyst extension and concepts**
- **ArcGIS Server workflow**
- **Geoprocessing services**
- **Network analysis services**
- **Choosing the correct option**
- **Support and resources**
- **Network Analyst at the User's Conference**

# Network Analyst Extension

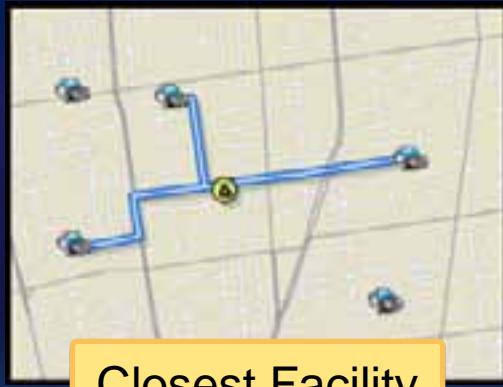
More Information:

[What is Network Analyst](#) in ArcGIS Desktop help

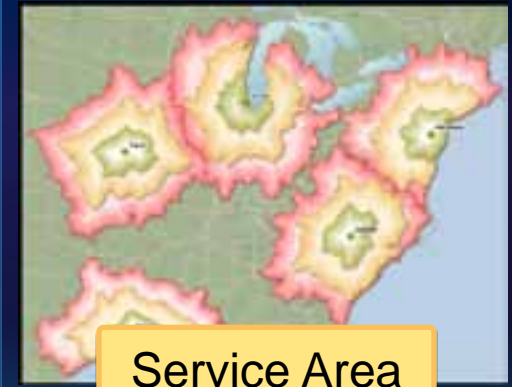




Route



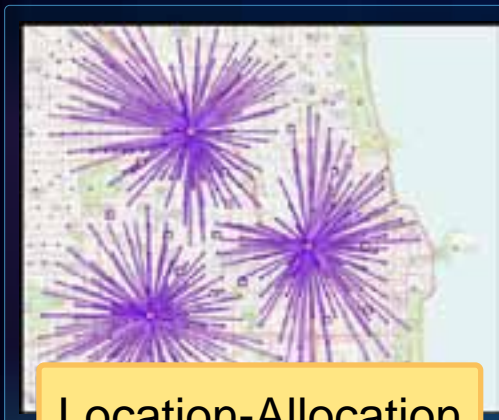
Closest Facility



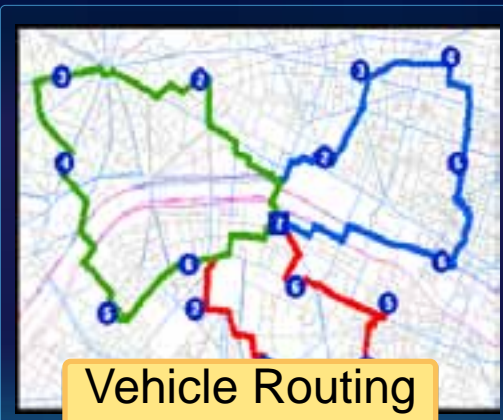
Service Area

# ArcGIS Network Analyst Extension

## Solving transportation problems



Location-Allocation



Vehicle Routing Problem



Origin-Destination Cost Matrix

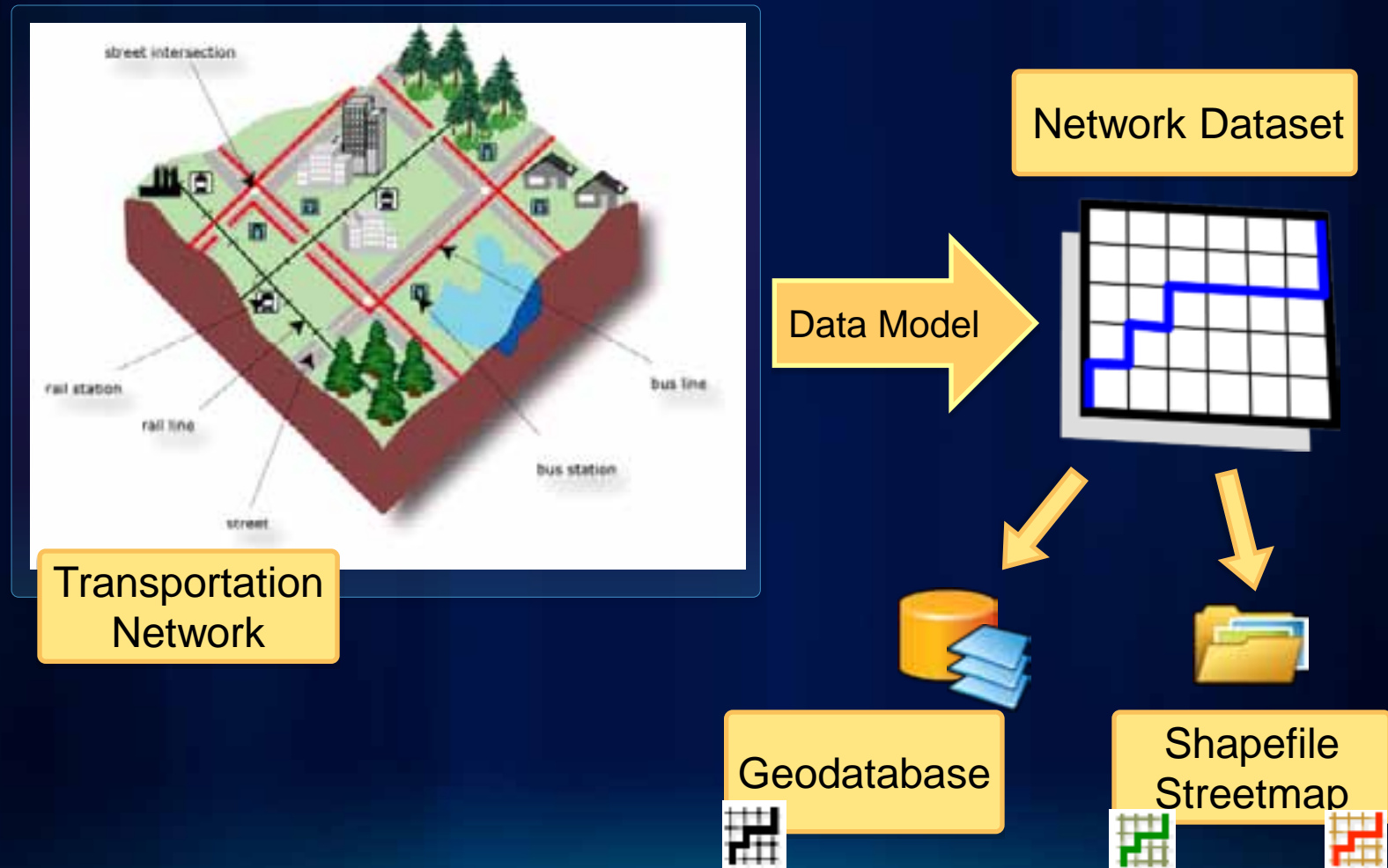
# Network Analyst Concepts

More Information:

[Essential Network Analyst vocabulary](#) in ArcGIS Desktop help



# Network Dataset





## Where do you get street data?

- **Free data**
  - Data and Maps DVD
  - TIGER



- **Community data**
  - OpenStreetMap



- **Your data**

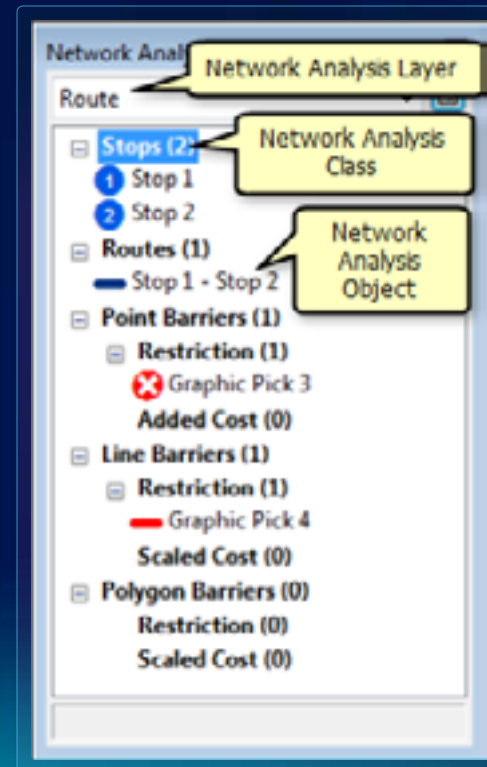
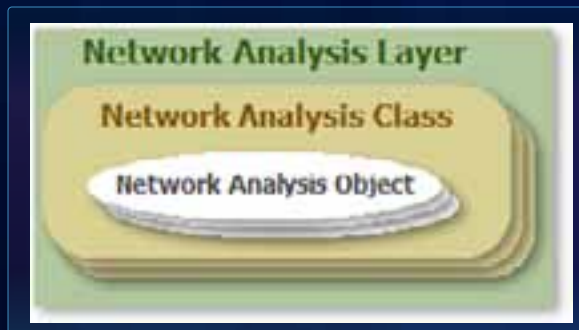
- **Vendor data**





## Network Analysis Layer

- Composite layer configured for a specific solver.
- Stores analysis properties, inputs, and outputs from the solver
- Contains **Network Analysis Classes** that store **Network Analysis Objects**



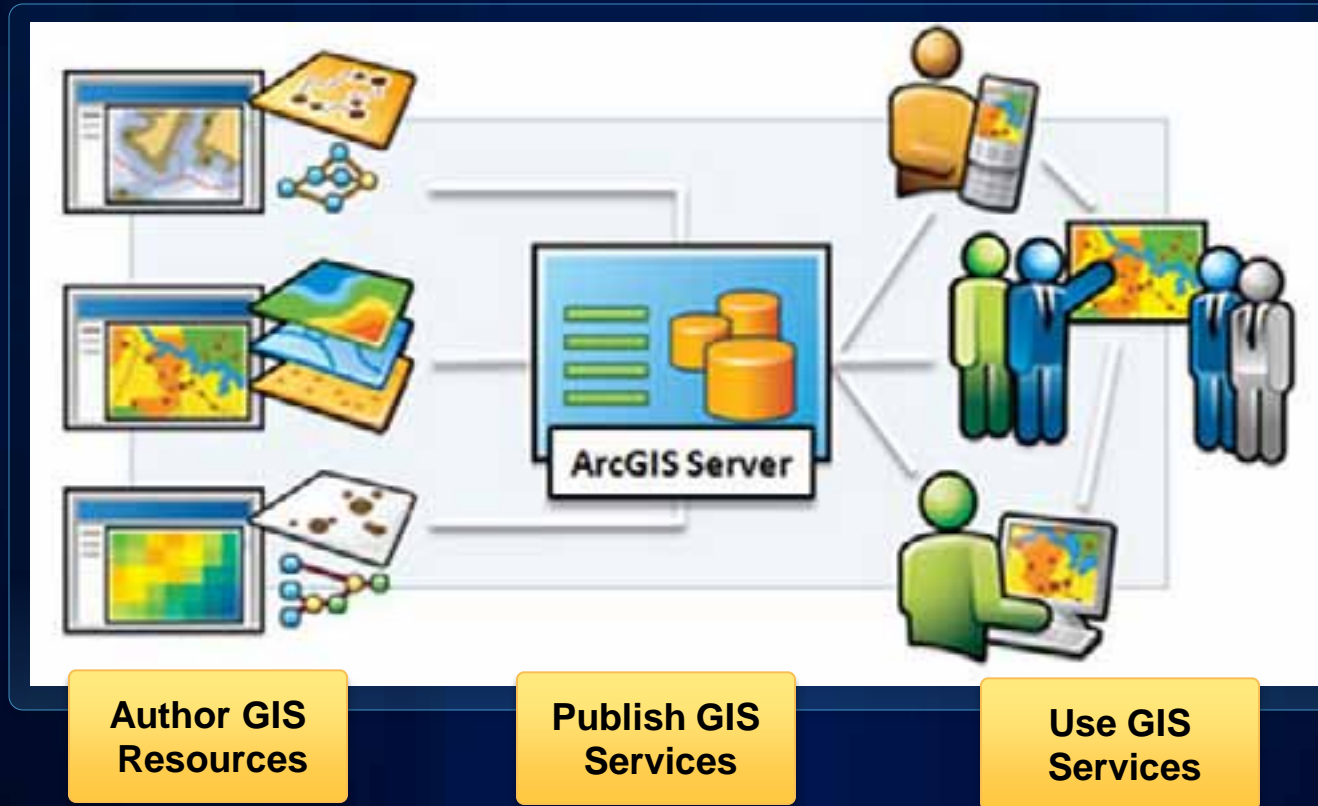
# Network Analysis with ArcGIS Server

More Information:

[Network analysis services](#) in ArcGIS Server help



# ArcGIS Server Workflow



# Network Analysis with ArcGIS Server

## ArcGIS Server

**Geoprocessing  
Services**

**Network Analysis  
Services**



# Geoprocessing Services

More Information:

[Geoprocessing services](#) in ArcGIS Server help

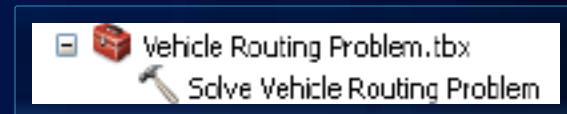
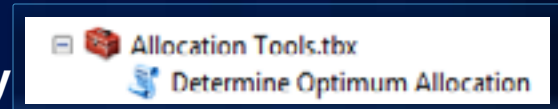
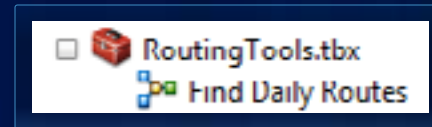
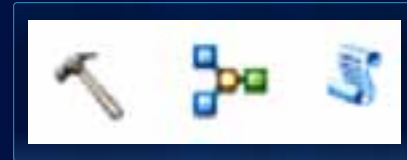


## What is a Geoprocessing Service?

- **A web service for performing analysis using geoprocessing tools**
- **Full use of the geoprocessing framework**
- **Synchronous and Asynchronous execution**
- **SOAP and REST endpoints for 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)
  - Custom tool created using ArcObjects and a compiled programming language like C#, VB.Net, Java, C++



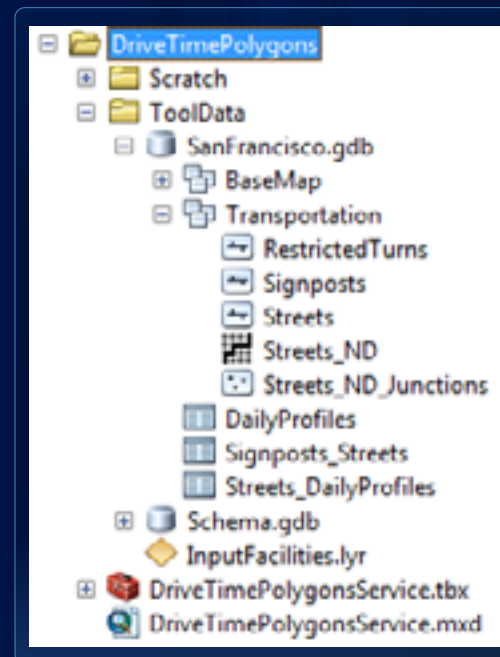


## Authoring Geoprocessing Services

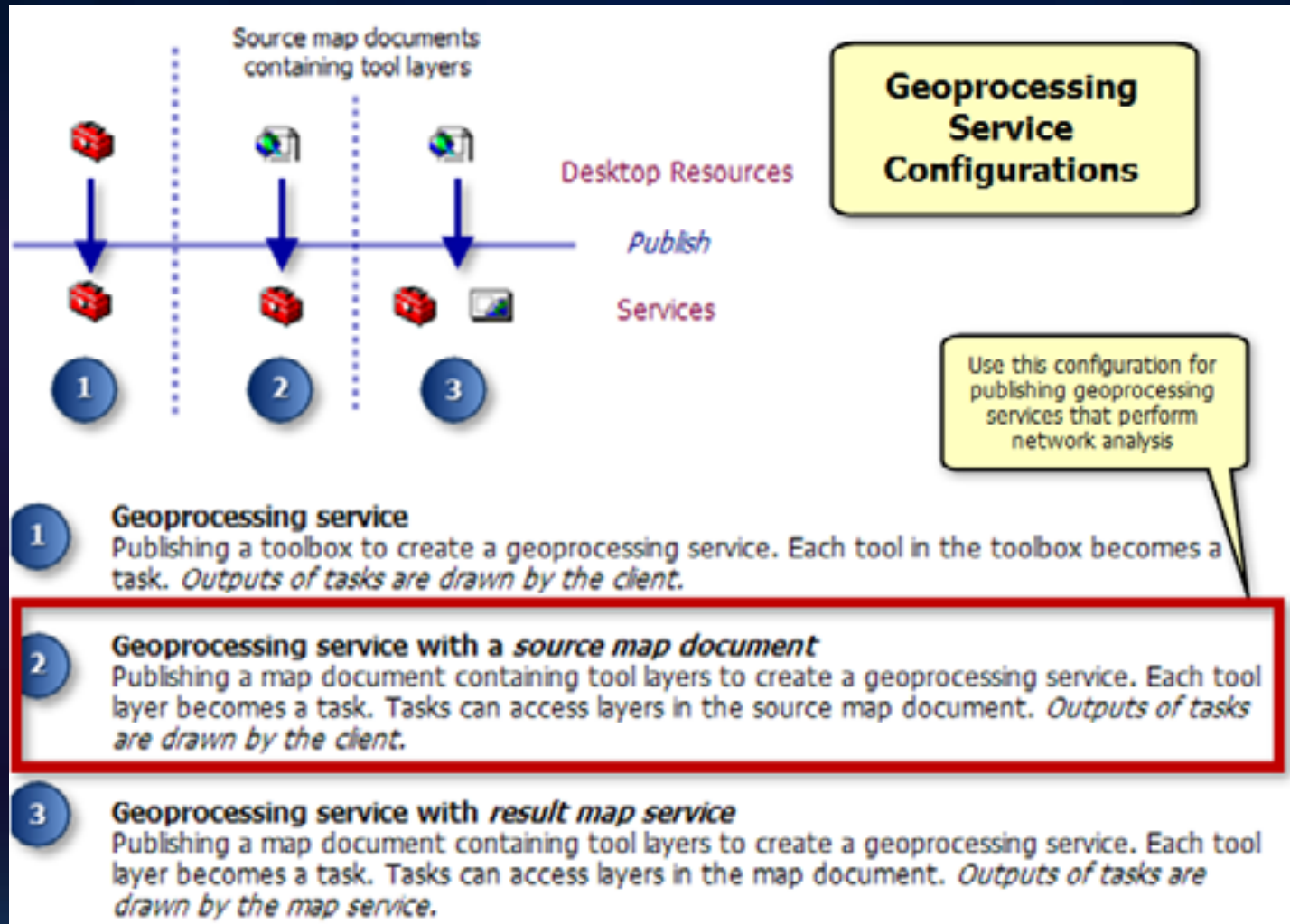
- **Few data types can be used as input and output parameters**
  - Use feature sets and record sets as input instead of feature classes and tables
  - Use feature class and table as outputs
- **Network analysis layer is not supported as an output parameter**
  - Convert sublayers to feature classes
- **Complete list of [supported data types](#) is available in the ArcGIS Server help**

# Authoring Geoprocessing Services

- Use relative paths when authoring model and script tools
- Document the tools
  - Acts as an API reference for the services
- Follow the Tool Share folder structure to organize service resources
  - Useful when copying resources from ArcGIS Desktop to ArcGIS Server machine

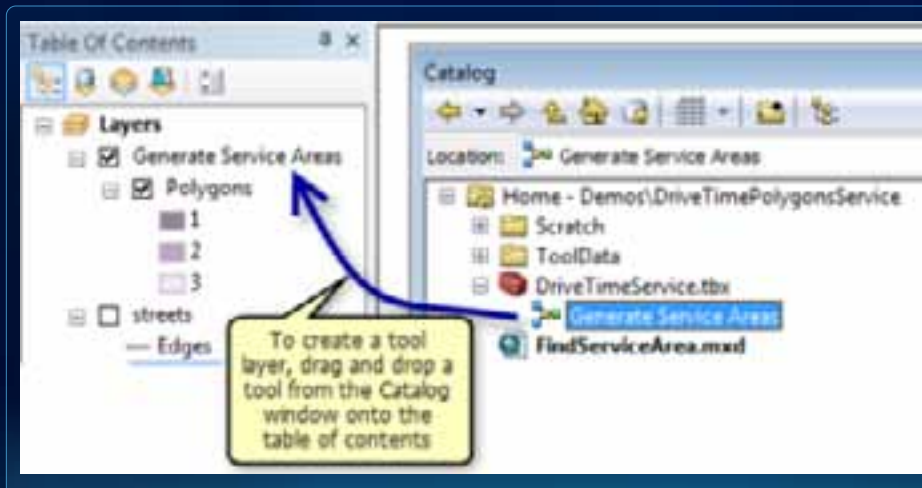


# Publishing Geoprocessing Services

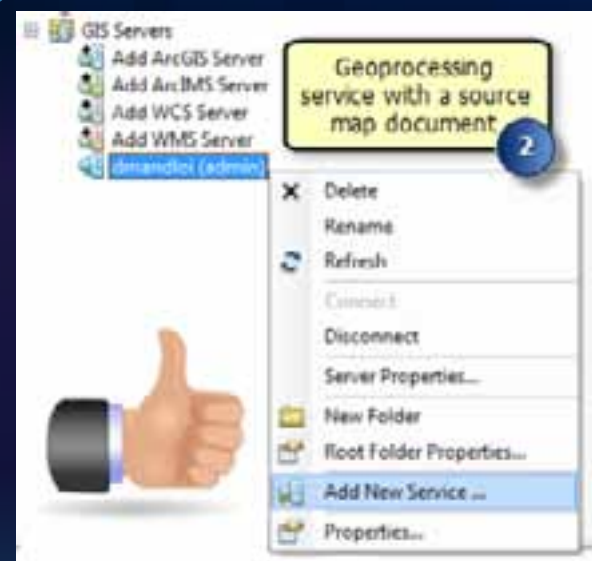


# Publishing Geoprocessing Services

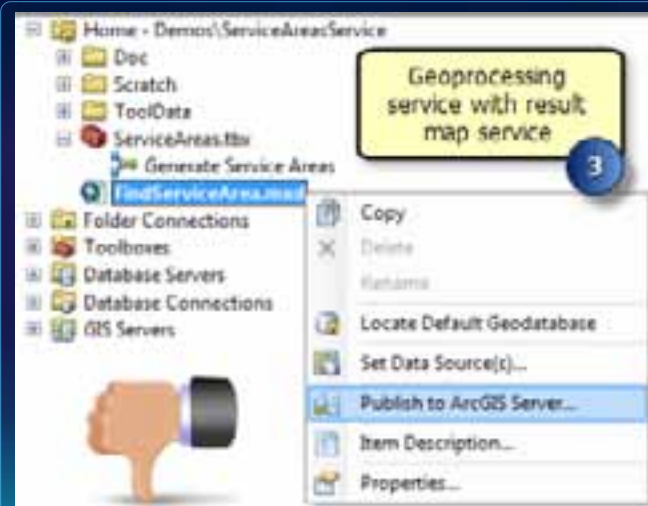
- **Publish services using tool layers in map document and not as toolbox**
  - Can use other layers including network analysis layers from the map document as model variables
  - Services run faster since the network dataset can be already open
  - Can publish only some models as opposed to all models within a toolbox



# Publishing Geoprocessing Services

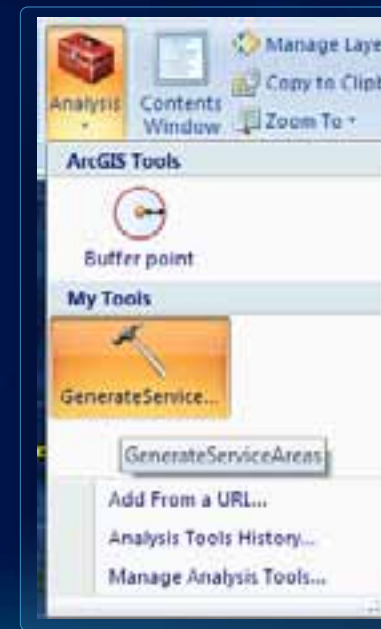
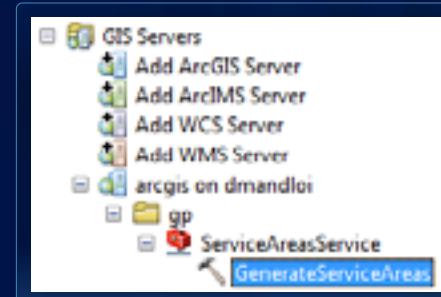


Use  
Add New Service  
option



# Using Geoprocessing Services

- Can be used without writing any code in:
  - ArcMap
  - ArcGIS Explorer Desktop
- Requires client side code to use from Web and Mobile APIs
  - Samples available for JavaScript, Flex, Silverlight, and Windows Phone





# Demo: Service Areas Service

**Author, publish, and use a  
geoprocessing service that finds  
service areas based on drive times  
around given points**





# Network Analysis Services

More Information:

[Publishing Network Analysis services](#) in ArcGIS Server help



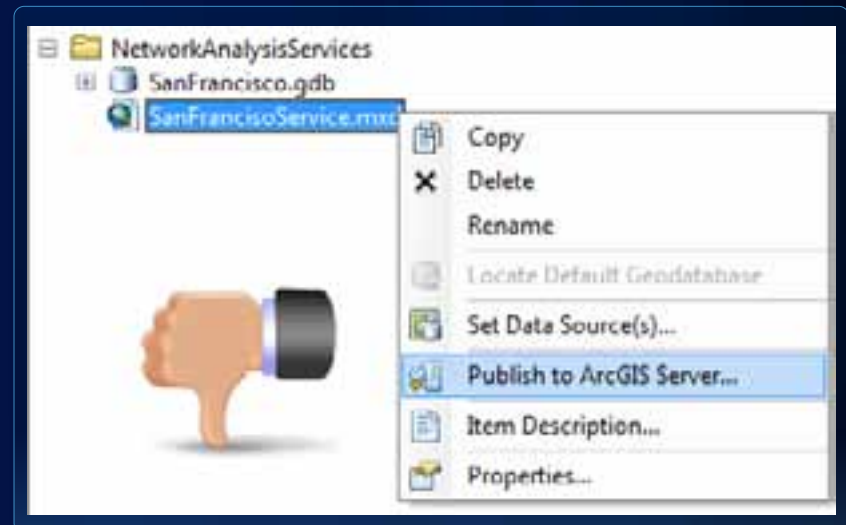
## What is a Network Analysis Service?

- **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**
- **Make the network dataset layer visible only if required**
  - **For example: To draw historical traffic at specified time**
- **Include any data layers that will be used by the services**
  - **For example: Fire stations to be used as facilities with closest facility service**
- **Use relative paths to save the map document**

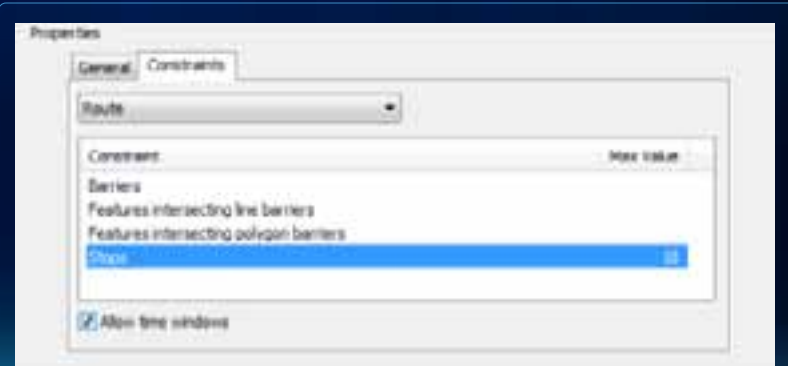
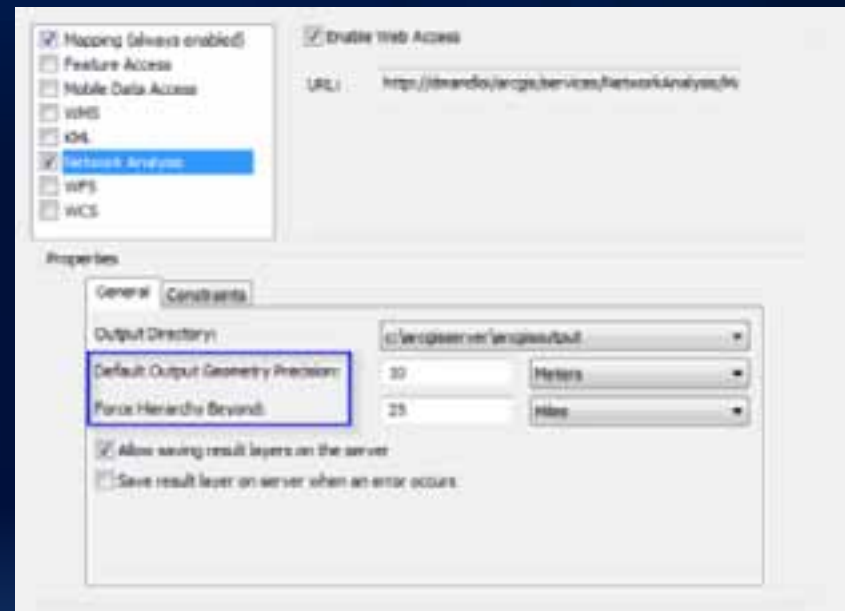
# Publishing Network Analysis Services



Use  
Add New Service  
option

# 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



# 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 and iOS APIs



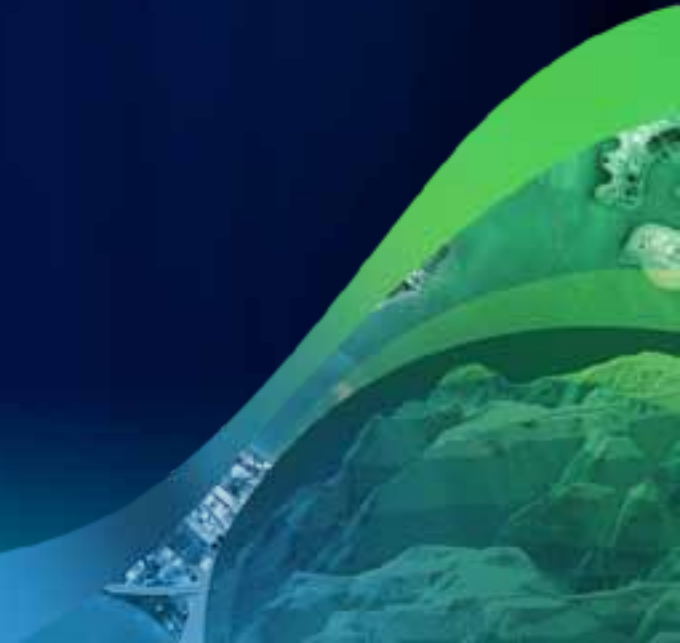
# Demos: Network Analysis Services

- Author and publish a network analysis service that can perform routing and closest facility analysis
- Find best route that avoids traffic during rush hour using Find Route dialog
- Find closest fire stations around a point 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 geprocessing 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 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?

	Speed	Problem Size	Access to ArcObjects	Out-of-the-box client support	Development overhead
Geoprocessing service	Constant overhead	Medium to large	No	Good	Low
Custom geoprocessing tool	Constant overhead	Medium to large	Yes	Good	Medium
Network analysis service	Fast	Small to medium	No	Limited	Low
Custom server object extension	Fast	Small to large	Yes	None <sup>1</sup>	High

<sup>1</sup> If custom server object extension adheres to the REST serialization rules and supports data types of geoprocessing service, client support will be similar to that of the geoprocessing service

## 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.**

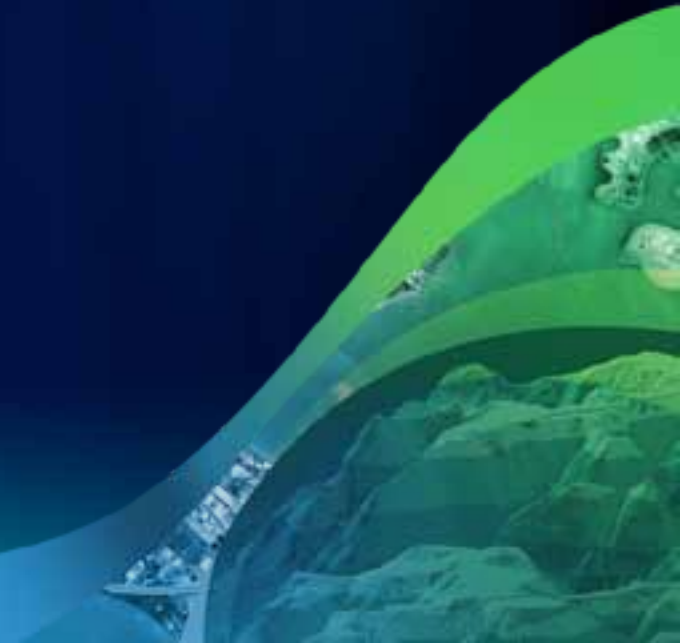
## Pop Quiz

- **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 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.**

# Summary





# Summary

## ArcGIS Server

```
graph TD; A[ArcGIS Server] --> B[Geoprocessing Service]; A --> C[Network Analysis Service];
```

### Geoprocessing Service

- Map document with geoprocessing tool layers
- 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

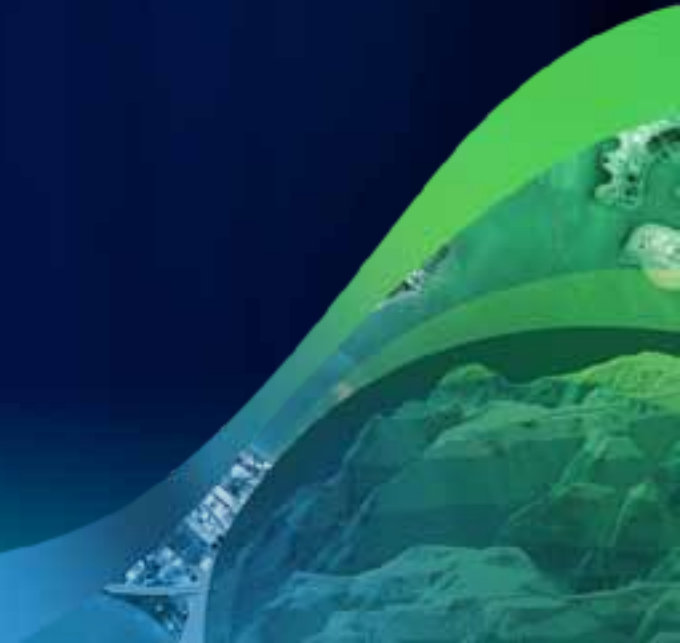
## ArcGIS Server

**Geoprocessing  
Services**

**Network Analysis  
Services**

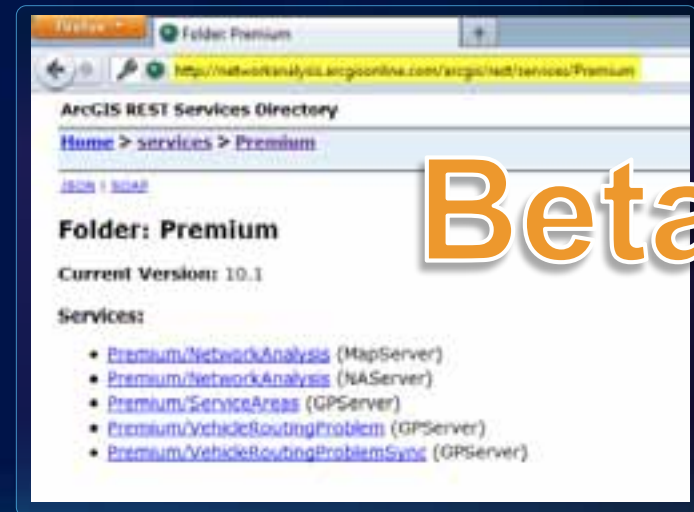
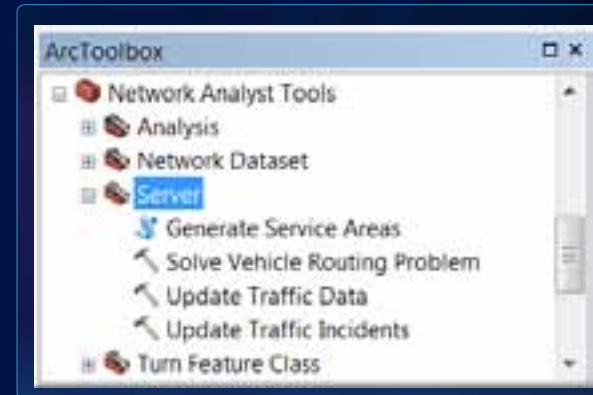


# ArcGIS 10.1



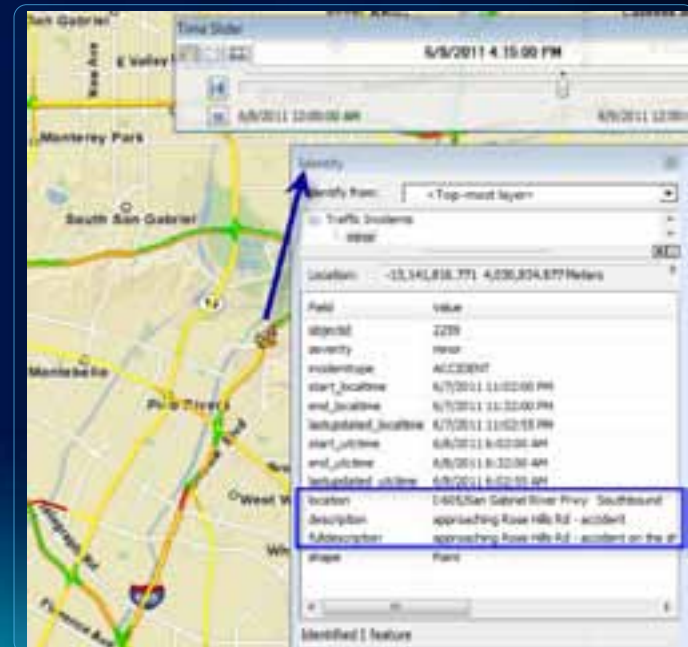
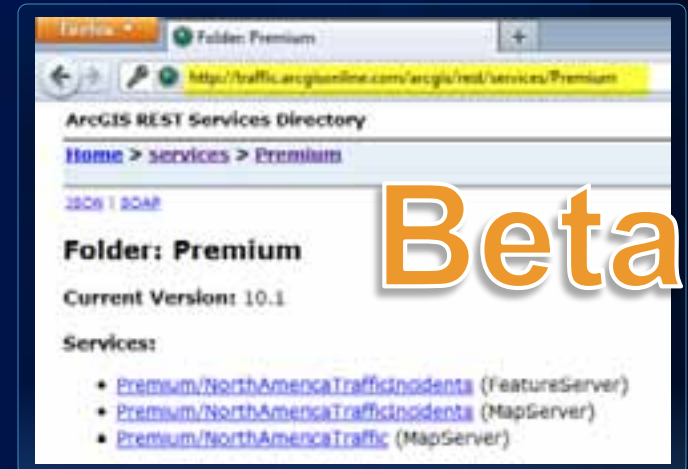
## What's coming in ArcGIS 10.1

- Easily publish geoprocessing services using tools in Server toolset
- Optimize GP services by using `arcpy.na` module
  - Edit analysis properties of existing layers
- Use network analysis services from ArcGIS Online
  - <http://networkanalysis.arcgisonline.com> (beta services)
  - Real-time traffic enabled
  - Global coverage: North America, Europe, South America, Australia
  - Can be accessed from 10.0 clients

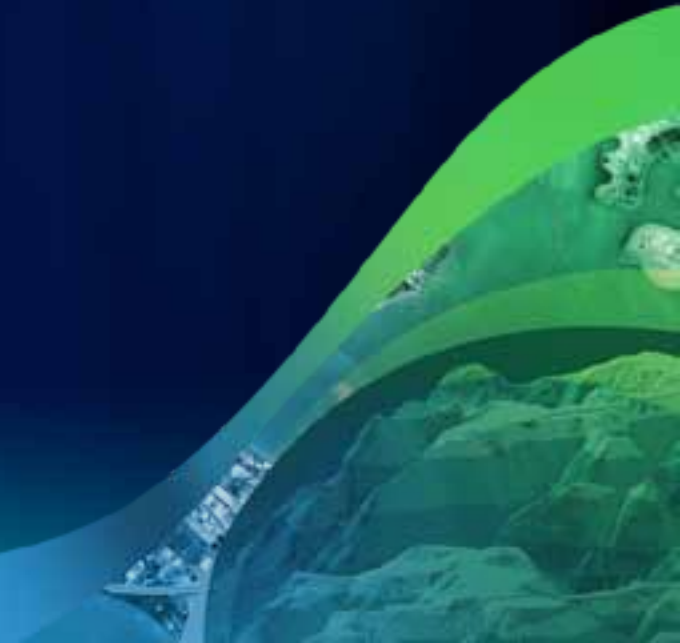


# Real-Time Traffic Services

- <http://traffic.arcgisonline.com> (beta services)
- Traffic map service
  - Displays road speeds relative to expected speeds
  - Color coded for easy interpretation
- Traffic Incidents feature service
  - Accidents, construction, events
- Traffic provider is NAVTEQ
- Data updated every 5 minutes
- Global coverage (US/CAN now, Europe in the future)
- Used by ArcGIS Online network analysis services



# Resources

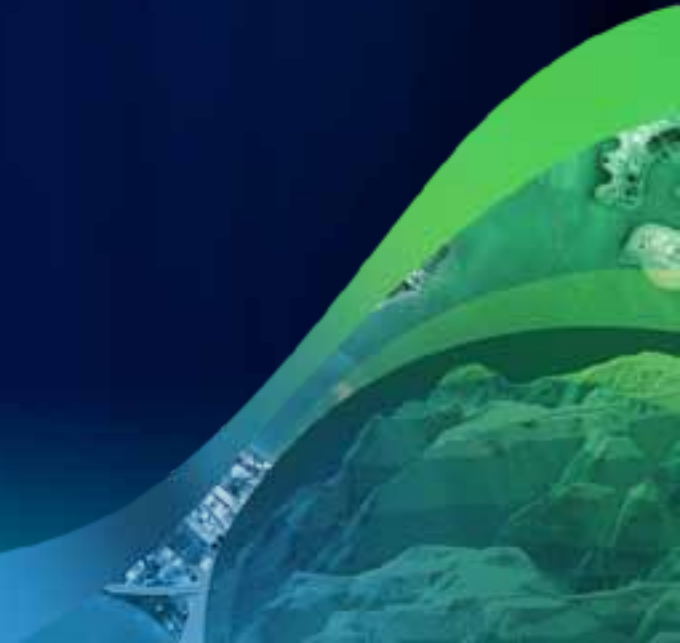


# Support and Resources

- [ArcGIS Server Resource Center](#)
- [Geoprocessing Services](#)
- [Network Analyst Help](#)
- [ArcGIS Network Analyst Extension Discussion Forum](#)



# Network Analyst at UC2011



# Tech Workshops

- **ArcGIS Network Analyst – An Introduction**
- **ArcGIS Network Analyst – Performing Network Analysis**
- **ArcGIS Network Analyst – Creating Network Datasets**
- **ArcGIS Network Analyst – Automating Workflows with Geoprocessing**



# Demo Theaters

- Patterns for Measuring and Mapping Access Using Network Analysis
- ArcGIS Network Analyst – Modeling Real-World Problems with the **VRP Solver**
- What is ArcGIS Network Analyst and Why Should I Use It?
- ArcGIS Network Analyst – Routing Inside Buildings with **3D Networks**
- ArcGIS Network Analyst – **Location-Allocation** and Accounting for Competition in Site Selection



	Tuesday	Wednesday	Thursday
8 am			
9 am	ArcGIS Network Analyst - An Introduction	ArcGIS Network Analyst - Automating workflows with Geoprocessing	ArcGIS Network Analyst - Performing Network Analysis
10 am	ArcGIS Network Analyst - Performing Network Analysis	ArcGIS Network Analyst - Creating Network Datasets	
11 am			
12 pm	Patterns for Mapping Access		
1 pm	Modeling Real-World Problems with the VRP Solver		
2 pm		ArcGIS Network Analyst - An Introduction	ArcGIS Network Analyst - Creating Network Datasets
3 pm	Performing Network Analysis with ArcGIS Server	ArcGIS Network Analyst – Routing Inside Buildings With 3D Networks	Room 3 Room 9 Room 6B
4 pm	What is Network Analyst?	ArcGIS Network Analyst – Location-Allocation in site selection	Spatial Analyst Island Demo Theater Mapping and Visualization Island Demo Theater

## **Related Tech Workshops and Demo Theaters**

- **ArcGIS Server**
  - **ArcGIS Server – An Introduction**
    - Wednesday 3:15 – Room 6C
  - **ArcGIS Viewer for Flex - An Introduction**
    - Thursday 8:30 – Room 5 A/B
- **Geoprocessing Services**
  - **Creating Geoprocessing Services**
    - Wednesday 8:30 - Room 14B
    - Thursday 1:30 – Room 14B
  - **Performance tips for a geoprocessing service**
    - Wednesday 2 PM – Exhibit Hall C (demo theater)

## **In Conclusion...**

- **Please fill out session surveys!**
  - <http://www.esri.com/sessionevals>
- **Questions**
- **Still have questions?**
  - **Spatial Analysis Island (Exhibit Hall C)**