



## Geospatial Visualization and the Region Viewer

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## ORA Geospatial Features

- Geospatial visualization
  - Basic features:
    - Zoom
    - Pan
    - Select
  - Network analysis
    - Color/Size by network properties
    - Export geospatial network
    - Smoothing measures over space
- Geospatial Trail Visualization
  - View trail
  - Change trail resolution
  - Loom-OraGIS compatibility
- Geospatial network resolution changes
  - Choose appropriate level of granularity/summarization
  - Balance with information loss
- Geospatial Information Loss
- Network Information Loss
- Shapefile import and export
- KML export
- Key Locations Report
- GeoSpatial Assessment Report
- Create spatial nodesets
- Create spatial relations
- Save/Load view configuration



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## Representing Geospatial Information

- Attributes
  - Latitude/Longitude
  - MGRS
  - UTM
- Relations
  - "is-located-at" relations
  - John->Chicago means John is located at Chicago
- Working on easing the transition between named places and geographic coordinates

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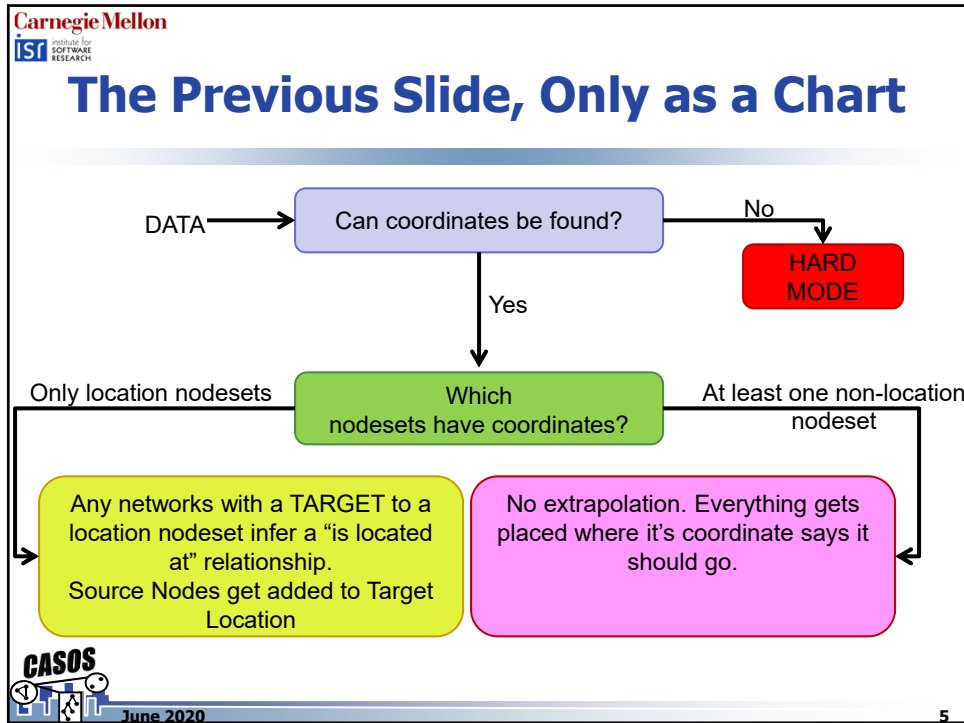
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## Representing Geospatial Information – Two Defaults

- "Only Locations" default
  - Only location nodes can have coordinate information
  - Nodes that are connected to that location via a "node -> location" link are said to be in that location
- "Everything has a Location" default
  - Any node can have coordinate information
  - Links are just links. They don't imply any special relationship beyond what they're already meant to imply
- If your data lacks the geospatial attributes, you can specially configure your data to work with GIS. This is called "Hard Mode"

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## Representing Geospatial Information: Default A

- Nodes of type "Location" are checked for attributes
  - "mgrs"
  - "latitude" and "longitude"
  - "utm"
- All networks to/from a node of type "Location" are "is-located-at" networks
- This method is handy when you're working with more general locations that multiple entities can inhabit. It allows for a type of aggregation before the map is even opened.

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## Representing Geospatial Information: Default B

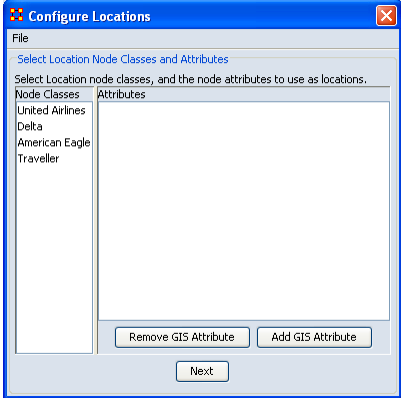
- Multiple nodesets are checked for attributes
  - “mgrs”
  - “latitude” and “longitude”
  - “utm”
- If only “Location” nodes are found, it defaults to the “old” default. If multiple nodesets are found, it uses the “new” default.
- This method tends to be preferred when you want each entity to have its own location. Data acquired directly from a GPS, for example.

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## Representing Geospatial Information: Configuration, pt.1

- Using the “Add GIS Attribute” button, you can specify what to use for that Node Class’s coordinates
- This must be done for each node class you want to use as “locations”



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## Representing Geospatial Information: Configuration, pt.2

- In the next window, you can specify the Networks to be used to establish “Who is at Where”.

For each node class, select any networks that should be interpreted as an IS-LOCATED-AT relationship.  
For example, if Bob and Jane in your Agents node class are connected to their respective homes, home1 and home2 in the Homes node class, select the Agent x Homes network for the node class Agents.

Nodesets	Networks
United Airlines	Traveller x American Eagle Terminals(to American Eagle)
Delta	Traveller x Delta Terminals(to Delta)
American Eagle	Traveller x United Airlines Terminals(to United Airlines)
Traveller	

Previous Finish

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## Three Different Visualizations

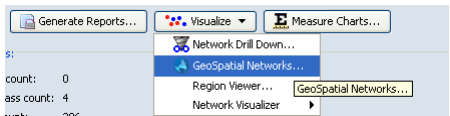
- 2-dimensional map (pretty)
  - Powered by Jmap
  - Pulls down map images from multiple sources
  - Requires an internet connection
  - Medium scalability
- 2-dimensional map (nice personality)
  - Powered by Openmap
  - Highly scalable
  - Low computational requirements
- 3-dimensional map
  - Powered by NASA’s WorldWind Java
  - Less scalable
  - Requires relatively modern graphics card and more memory

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## Loading Data

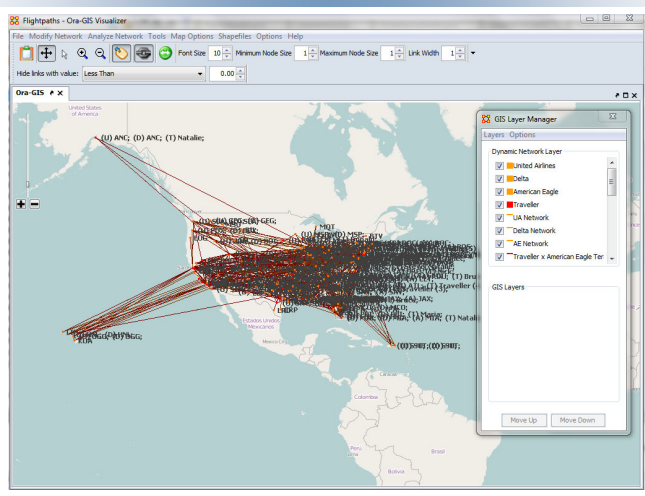
- **Load the network in the geospatial folder of your data disk (Flightpaths.Avenged.xml) into the GeoSpatial Networks visualizer**
  - Import the file into ORA
  - Select Flightpaths
  - Menu: Visualization → Geospatial Networks
  - If your data matches the default convention (which this one will), you can also use the small down arrow on the “Visualize” button to open GIS



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## What You'll See




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## Basic Navigation

- Select the pan tool from the toolbar
  - Left Click + Drag to pan around
  - Mouse wheel forward to zoom in
  - Mouse wheel backward to zoom out
  - Or use the zoom bar on the map to zoom in/out

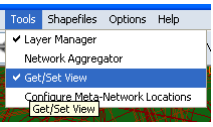
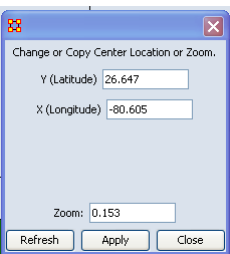


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## Get/Set View

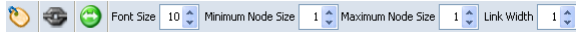
- Useful for creating screenshots of the same area using different datasets

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## Rest of the Toolbar



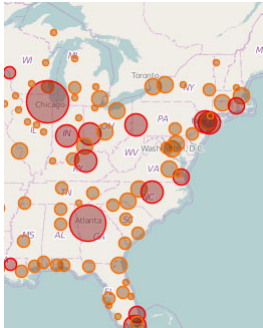
- Toggle Labels on/off
- Toggle Links on/off
- Toggle Link Arrows on/off
- Change the Font Size
- Change the Minimum Node Size
- Change the Maximum Node Size
- Change the Link Width

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## Node Size

- By increasing the Maximum node size, you can start to see more info about a location
- By default, Node Size corresponds to the number of nodes associated with that location



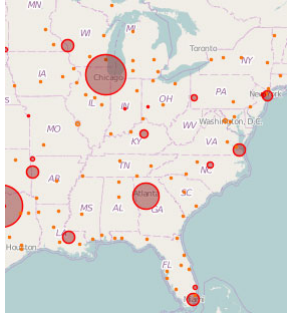
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## Size Nodes by Attribute/Measure

- Using "Analyze Network", you can size nodes by different Attributes or Measures
- In this screenshot, we resized by "Centrality Betweenness."



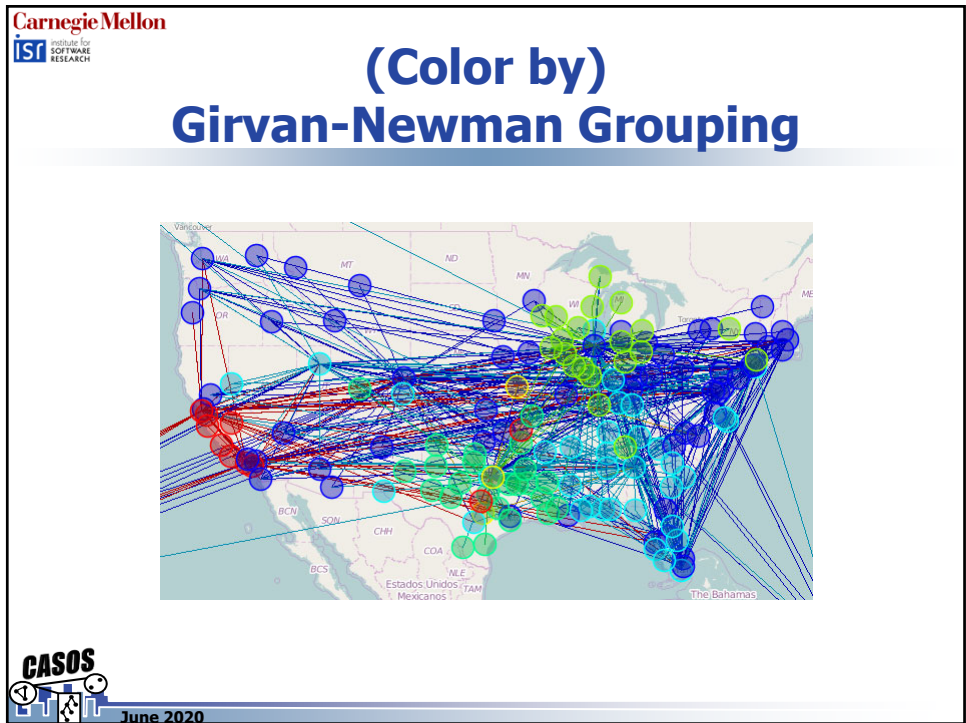
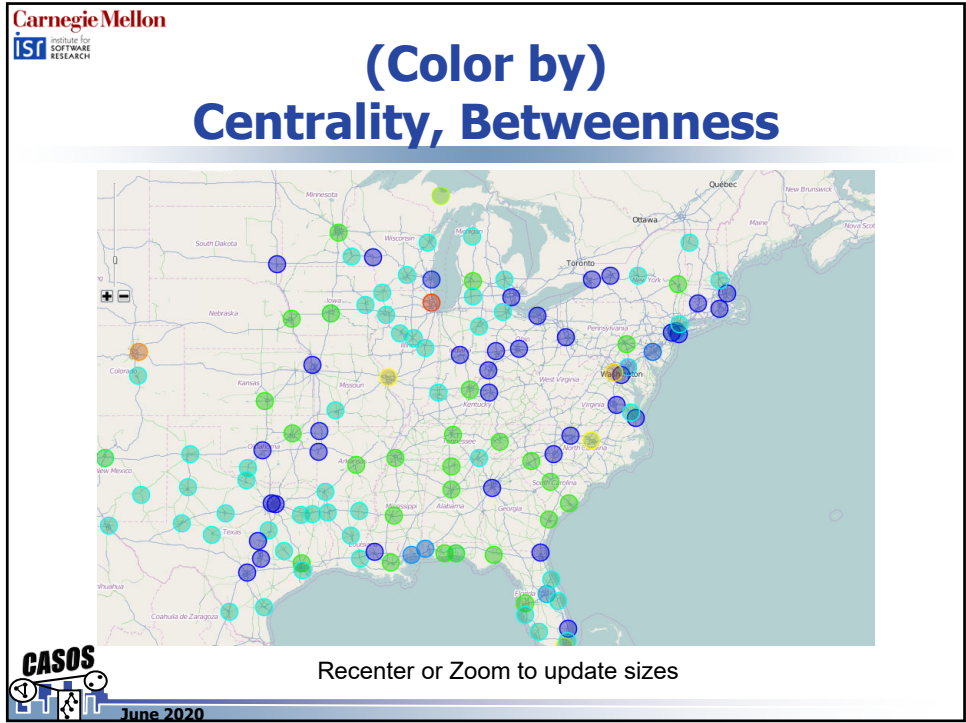
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## Size/Color by Network Measures

- Open the Size/Color dialog boxes
  - Analyze Network → Size Nodes by Attribute or Measure
  - Analyze Network → Color Nodes by Attribute or Measure
- Explore different network measures
  - Color by Closeness centrality
  - Color by Eigenvector centrality
- Explore groupings
  - Analyze Network → Color By Newman Grouping
  - Analyze Network → Color By CONCOR Grouping

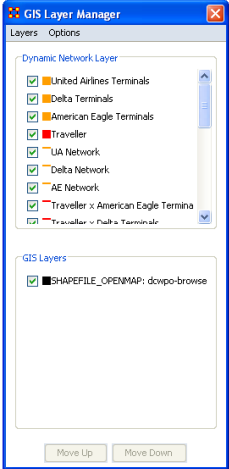
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## Using the Layer Manager

- Meta-Network Layers
  - Enable/Disable nodeset layers
  - Enable/Disable network layers
  - Clicking the Box/Line allows you to change colors
- Add ESRI Shapefile
- Spatial Layers
  - Enable/Disable spatial layers
  - Clicking the Box/Line allows you to change colors
  - Change the order of the Layers

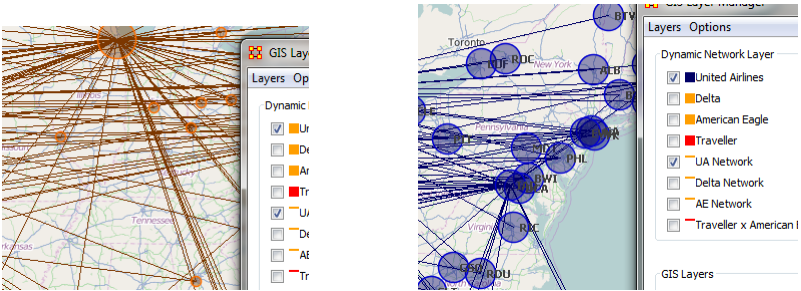


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## Layer Manager (cont.)

- Choose Network Layers
- Change Network Colors



After changing the color, recenter or zoom to refresh the map

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## Explore Network Aggregation

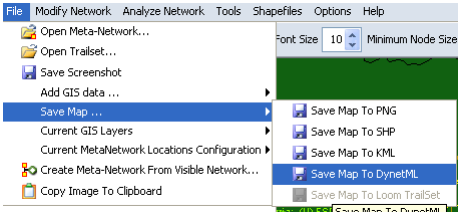
- Open the dialog: Tools → Network Aggregator
  - Move the slider back and forth to change the level of aggregation
  - When you're done experimenting, set it to .04
- Note: Even without any set aggregation level, if two locations have the same Coordinates, they'll still be aggregated together
- How does aggregation work? Density-Based Clustering!

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## Export the network from ORA

- As an image: File → Save Map → Save Map To PNG
- As a shapefile: File → Save Map → Save Map To SHP
- As a Google Earth file: File → Save Map → Save Map To KML (Only in Commercial Versions of ORA)



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## The Map Options Menu

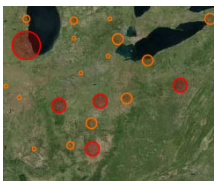
- The map options menu is Map source dependant.
  - In the pretty map version, it provides multiple map sources
  - In the not-so-pretty map, it doesn't do anything
  - In 3d maps, it allows for flat earths and other tools

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## Alternate Map Sources


- Under the Map Options menu, you can select the source for your maps.



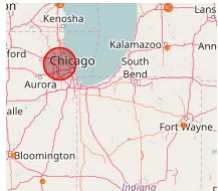
Bing Aerial



Stamen Terrain



Stamen Watercolor



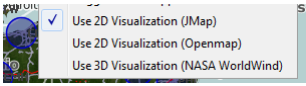
OpenStreetMap

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## Switching Between Maps

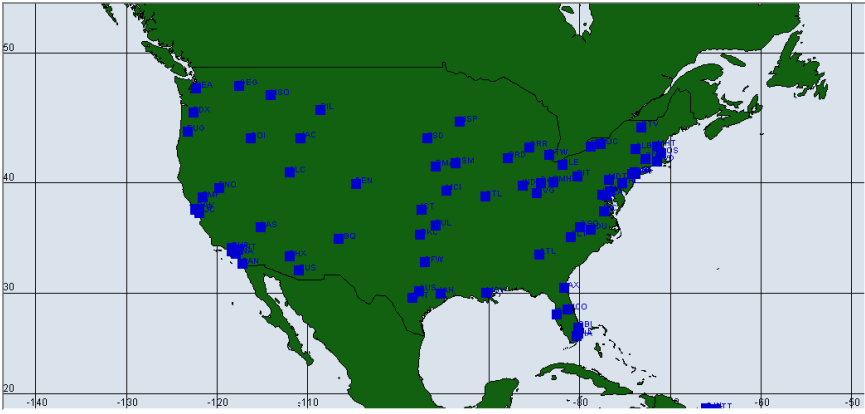
- Under "Options", you can switch between the three different mapping programs.
- "Jmap" is what has been featured in every previous slide.
- "Openmap" will be seen in one slide, right after this one.
- "NASA Worldwind" will also be seen in an upcoming slide



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## OpenMap (Just a screenshot)



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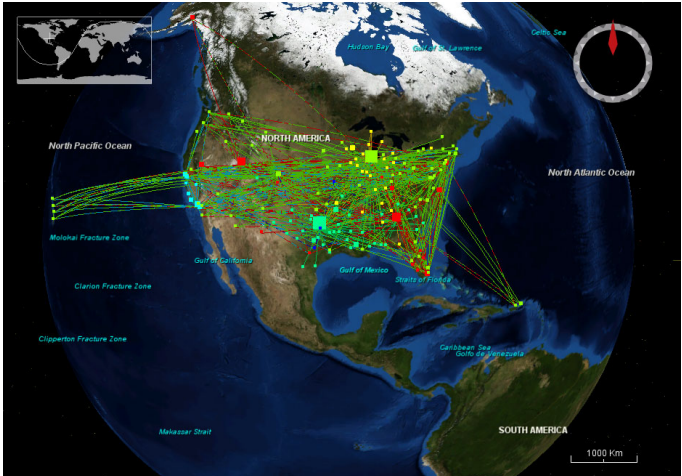
## Use the 3D Visualization

- Options → Use 3D Visualization
- Zooming
  - Scroll the mouse scroll wheel to zoom
  - Or press CTRL-<up arrow> and CTRL-<down arrow>
- **Warning: this requires a somewhat powerful computer, and is still very slow on large datasets**

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## Use the 3D Visualization



North Pacific Ocean  
North Atlantic Ocean  
Gulf of Mexico  
Robeson Fracture Zone  
Clarion Fracture Zone  
Clipperton Fracture Zone  
Melozar Strait  
1000 Km

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## An Introduction to Shapefiles

- Database for Geographical Data
- Contains a set of Polygons, Points, Lines, or Lists of Polygons
- Described using a set of coordinates
- Consist of more than one file
  - .shp : geometry of the shapes
  - .dbf : attributes of the shapes
  - .shx : shape index
- Recommended resources
  - <http://www.census.gov/geo/www/tiger/shp.html>
  - <http://maplibrary.org/>

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## Loading Shapefiles

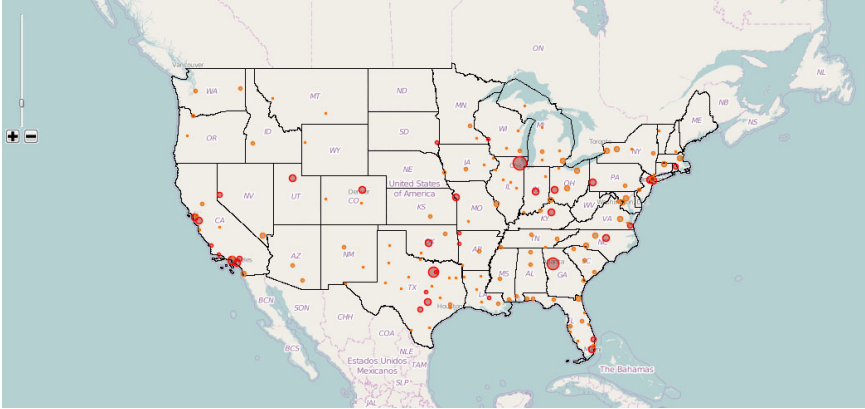
- Load in the Shapefile using "Shapefiles -> Add... -> Add ESRI Shapefile"
- For this example, we'll be using tl\_2009\_us\_state.shp. It contains shapes for all United States territories.
- ORA has three shapefiles included with it
  - Countries of the world
  - US States
  - International Timezones
- Yes, I'm having you load in something that's already available in ORA.

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## The Shapefile, Loaded in



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## Shapefile Based Operations

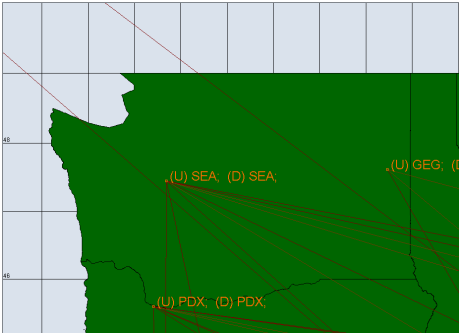
- Shapefiles -> Color by Node Count
- Shapefiles -> Color by Attribute Measure
- Shapefiles -> Color Shapes by Links...
  - ->...by Internal Link Count
  - ->...by External (Outgoing) Link Count
  - ->...by External (Incoming and Outgoing) Link Count
  - ->...by Internal/External Link Ratio
  - ->...with No External Links

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## Shapefile Base Operation

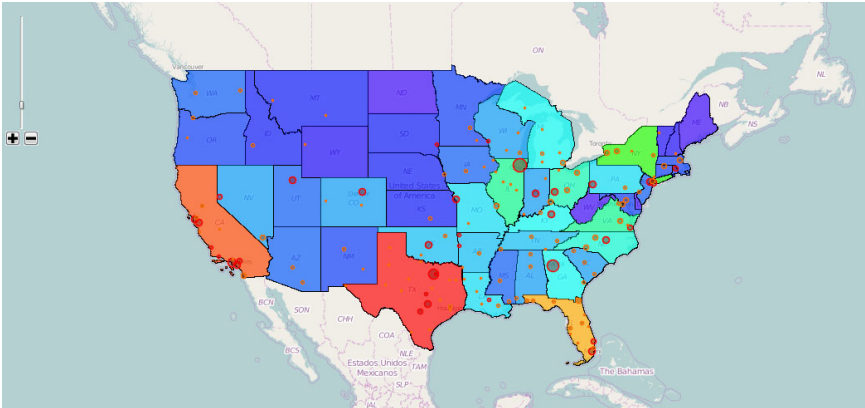
- Most Operations operate the same way. Select the option, select the Coloring parameters, and the operation executes.
- A Location is considered inside the shape if a shape contains that location's coordinates



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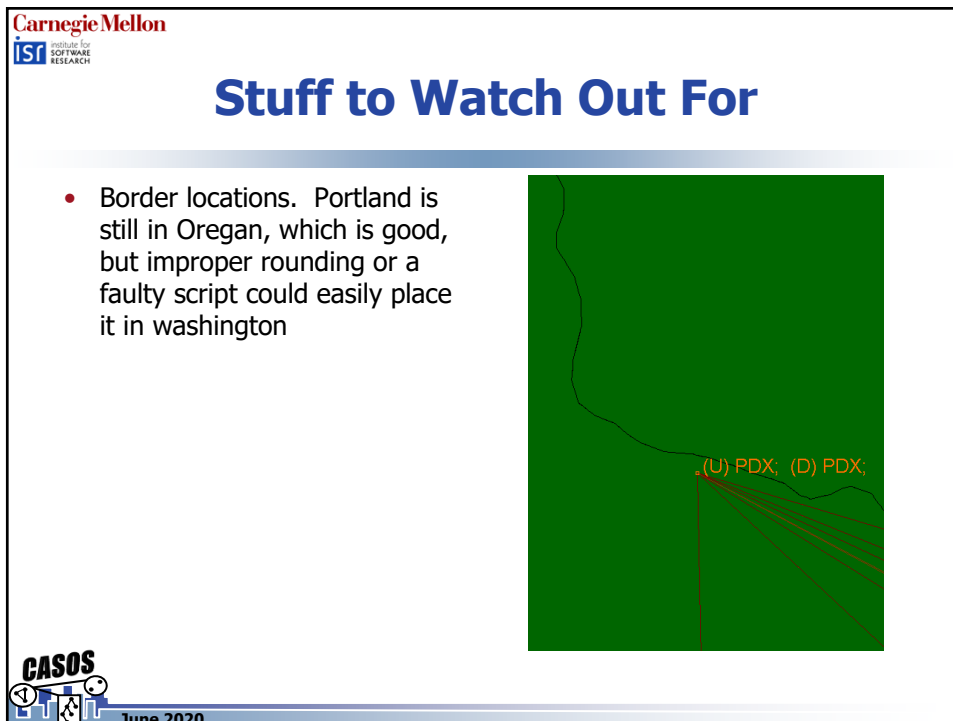
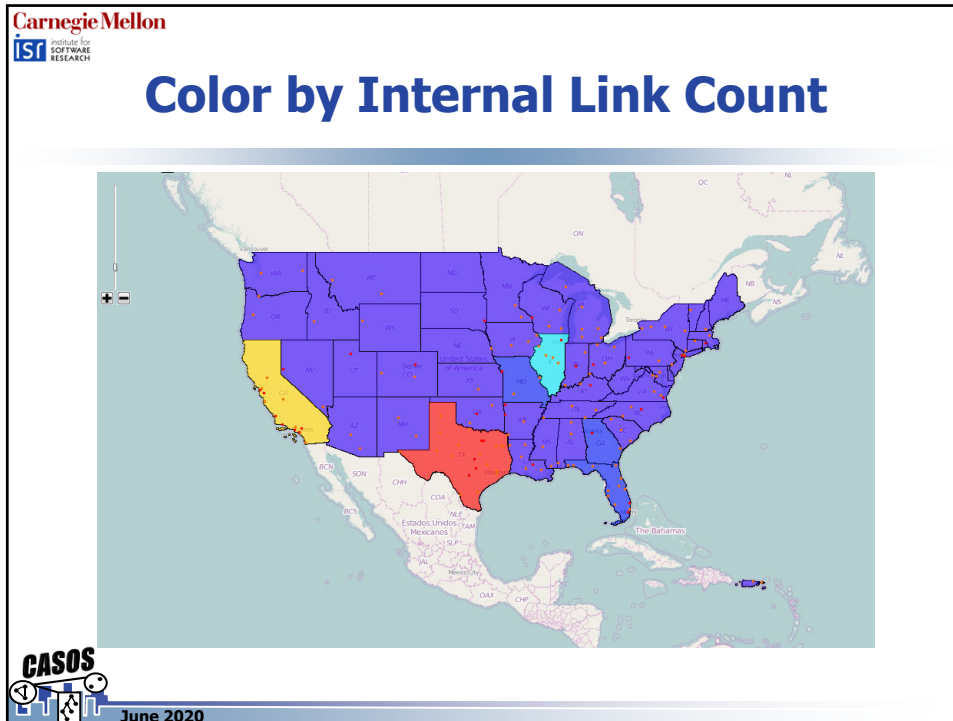
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## Color by Node Count



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## Stuff to Watch Out For

- Centroids. Oddly shaped areas can have centroids placed in another territory. Croatia here is a fine example.
- Croatia really doesn't want Bosnia to have access to the beach. Don't be like Croatia.



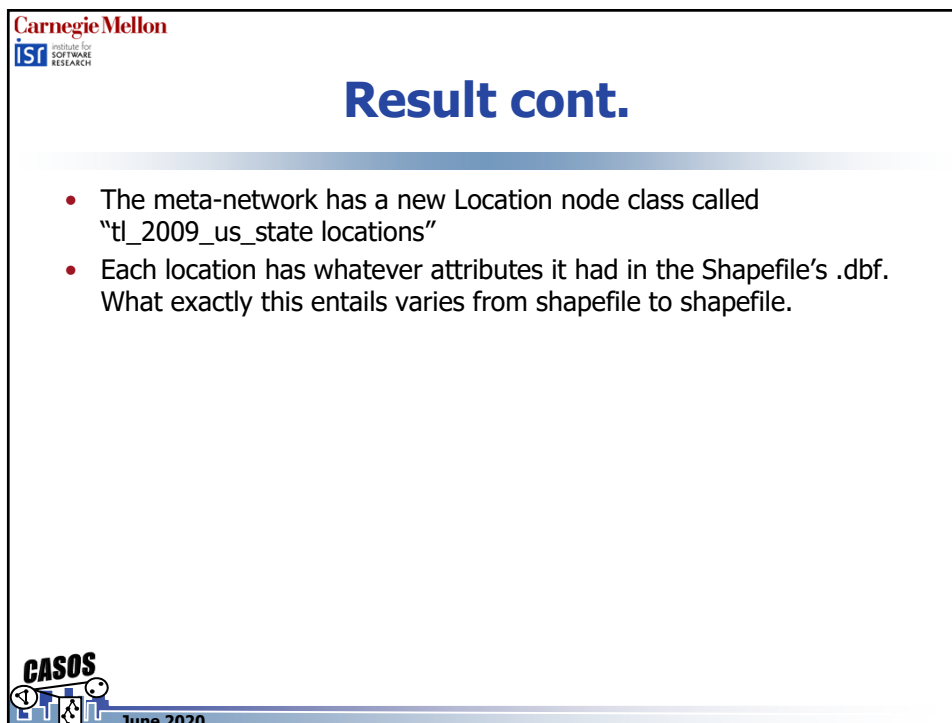
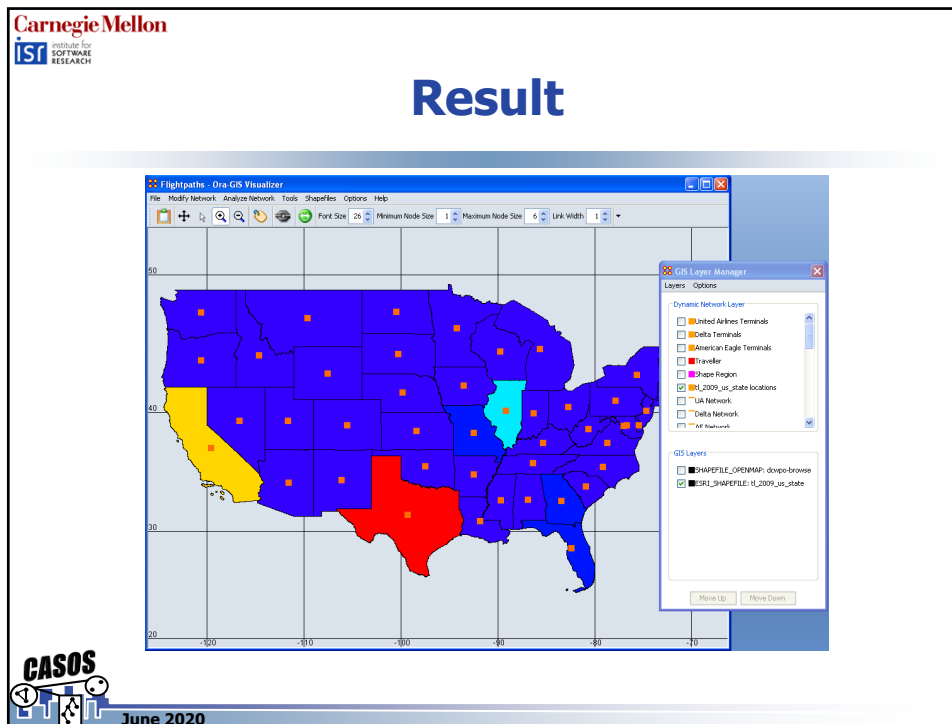
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## Using Shapefiles as a Source of Locations

- File -> Add GIS Data -> Import Locations from Shapefile
- This will use the shapefiles .dbf file to bring in a number of locations, usually one per shape, for use in ora.
- Using the same state shapefile we used before...

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## Example Report

**GEOSPATIAL ASSESSMENT REPORT**

Input data: seizureArrests\_viz.ncml  
 Start time: Wed May 27 10:49:33 2009

Locations which are within 10 mile(s) of each other are considered to be the same location.  
 The latitude and longitude of the Location codes was used to compute distances between them.

**Network Visit**

What nodes are at the same locations?  
 Refers to the output network: numbers point locations.  
 It contains links for nodes that are in the same location. The link weight is the number of locations they are at together.

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## Geospatial Network Centrality

- ORA Key Entities->Where Report
  - Key Locations by Centrality
  - Key Locations by Agents
  - Key Locations by Events
  - Key Locations by Resources
  - Key Locations by Exclusivity

**Highest concentration of actors**

Input network(s): agent-region

Rank	Value	Unscaled	Location
1	0.3125	5	region 7
2	0.25	4	region 8
3	0.125	2	region 1
4	0.125	2	region 2
5	0.125	2	region 4
6	0.125	2	region 5
7	0.125	2	region 13
8	0.125	2	region 14
9	0.125	2	region 15
10	0.0625	1	region 3

**Central locations (the most connections to other locations)**

Rank	Value	Unscaled	Location	Context*
1	0.9375	30	region 7	1.46207
2	0.9375	30	region 8	1.46207
3	0.90625	29	region 1	1.14341
4	0.90625	29	region 15	1.14341
5	0.875	28	region 2	0.824758
6	0.875	28	region 3	0.824758
7	0.875	28	region 4	0.824758
8	0.875	28	region 5	0.824758
9	0.875	28	region 6	0.824758
10	0.875	28	region 9	0.824758

\* number of standard deviations from the mean if links were distributed randomly

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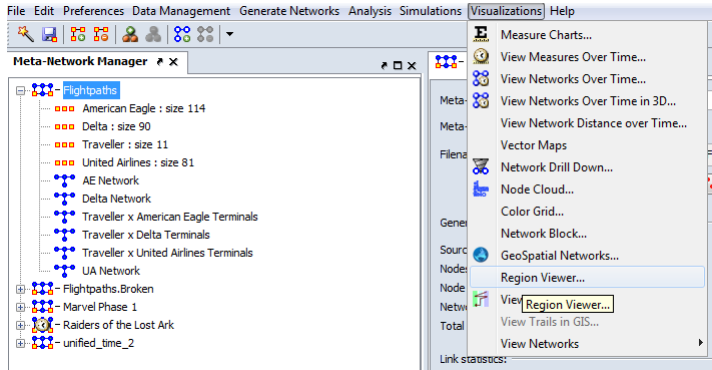
## The Region Viewer

- The Region Viewer is very, very similar in form and function to GIS, but it puts far more emphasis on shapefiles.
- It uses many of the same shape/location algorithms as GIS, but is a bit more streamlined

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## The Region Viewer



File Edit Preferences Data Management Generate Networks Analysis Simulations Visualizations Help

Meta-Network Manager

- Flightpaths
  - American Eagle : size 114
  - Delta : size 90
  - Traveller : size 11
  - United Airlines : size 81
- AE Network
  - Traveller x American Eagle Terminals
  - Traveller x Delta Terminals
  - Traveller x United Airlines Terminals
- UA Network
- Flightpaths.Broken
- Marvel Phase 1
- Raiders of the Lost Ark
- unified\_time\_2

Visualizations

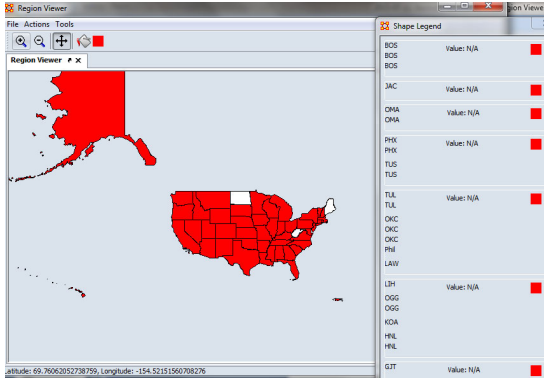
- Measure Charts...
- View Measures Over Time...
- View Networks Over Time...
- View Networks Over Time in 3D...
- View Network Distance over Time...
- Vector Maps
- Network Drill Down...
- Node Cloud...
- Color Grid...
- Network Block...
- GeoSpatial Networks...
- Region Viewer...
- View Region Viewer...
- View Trails in GIS...
- View Networks

Link statistics:

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- On startup it'll ask for a shapefile. Give it one, and it'll determine all the locations inside any given shape



The screenshot shows the 'Region Viewer' application interface. The main window displays a map of the United States with state boundaries highlighted in red. A 'Shape Legend' panel on the right lists state abbreviations and their values. The legend entries are:

State Abbreviation	Value
BOS	Value: N/A
BOS	Value: N/A
JAC	Value: N/A
OPM	Value: N/A
OPM	Value: N/A
PRK	Value: N/A
TUS	Value: N/A
TUS	Value: N/A
TLL	Value: N/A
TLL	Value: N/A
OKC	Value: N/A
OKC	Value: N/A
PHI	Value: N/A
LAW	Value: N/A
LPH	Value: N/A
OGG	Value: N/A
OGG	Value: N/A
KOA	Value: N/A
HPL	Value: N/A
HPL	Value: N/A
GTT	Value: N/A

altitude: 69.76962052738759, Longitude: -154.52151560708276

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