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
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

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”
The Previous Slide, Only as a Chart

DATA
Can coordinates be found?

Yes

No

HARD
MODE

Only location nodesets

Which nodesets have coordinates?

At least one non-location nodeset

Any networks with a TARGET to a location nodeset infer a "is located at" relationship.
Source Nodes get added to Target Location

No extrapolation. Everything gets placed where it's coordinate says it should go.

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.
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.

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"
Representing Geospatial Information: Configuration, pt.2

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

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Airlines</td>
<td>Transfer to Delta Terminal (605 Cell B)</td>
</tr>
<tr>
<td>Delta</td>
<td>Transfer to Delta Terminal (605 Cell B)</td>
</tr>
<tr>
<td>American Eagle</td>
<td>Transfer to United Airlines Terminal (605 United Airlines)</td>
</tr>
</tbody>
</table>

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
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

What You’ll See
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

Get/Set View

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

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
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.”

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
(Color by) Centrality, Betweenness

Recenter or Zoom to update sizes

(Color by) Girvan-Newman Grouping
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

Layer Manager (cont.)

- Choose Network Layers
- Change Network Colors

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

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)
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

Alternate Map Sources

- Under the Map Options menu, you can select the source for your maps.
  - Bing Aerial
  - Stamen Terrain
  - Stamen Watercolor
  - OpenStreetMap
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.

OpenMap (Just a screenshot)
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
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://www.census.gov/geo/www/tiger/shp.html)
  - [http://maplibrary.org/](http://maplibrary.org/)

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.
The Shapefile, Loaded in

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
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.

Color by Node Count
Stuff to Watch Out For

- Border locations. Portland is still in Oregan, which is good, but improper rounding or a faulty script could easily place it in Washington.
Stuff to Watch Out For

- Centroids. Oddly shaped areas can have centroids placed in another territory. Croatia here is a fine example.

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...
• The meta-network has a new Location node class called "tl_2009_us_state locations"
• Each location has whatever attributes it had in the Shapefile’s .dbf. What exactly this entails varies from shapefile to shapefile.
Example Report

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