



# Extending ORA for Spatial and Temporal Data



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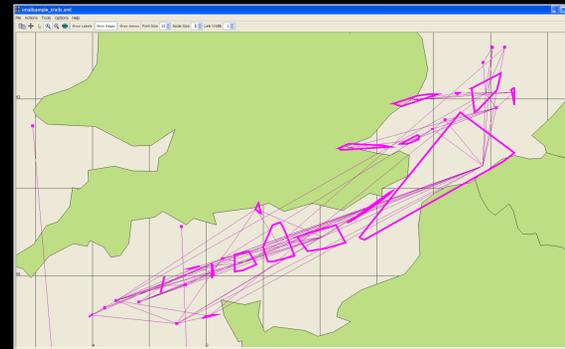
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## Spatial and Temporal Data Surveillance and Sensor Systems

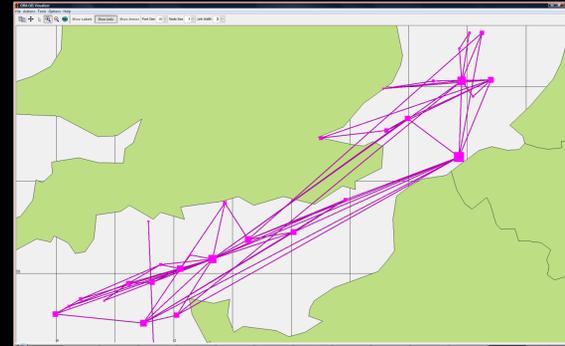
- Dynamic network analysis (DNA) consists of a set of theories, methodologies and tools for analyzing the relationships and attributes assigned to discrete entities.
- Recent proliferation of sensor systems has produced many datasets which feature geospatial and temporal information about agent activities in addition to the attributes and relationships typically measured. Examples include data from GPS sensors embedded in vehicles or devices, logs of online activities, and collected data from intelligence networks.
- Two new tools, Loom and OraGIS, have been added to the ORA analysis platform targeted at spatially and temporally continuous data.

## Continuous Spatial Data Clustering and Aggregating

- Real world spatial data is defined on continuous dimensions.
- DNA consists of the analysis of discrete entities and relationships. Continuous data must be binned into discrete entities in order to apply DNA techniques.
- OraGIS allows the user to dynamically adjust the resolution and aggregation of continuous spatial data. OraGIS provides a new Information Loss metric to measure the quality of an aggregation.

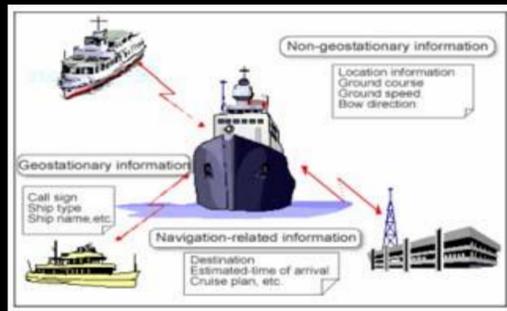


- OraGIS also allows standard Network Analysis metrics to be computed on the aggregated dataset.



## GPS Data on Merchant Marines Automated Information System (AIS)

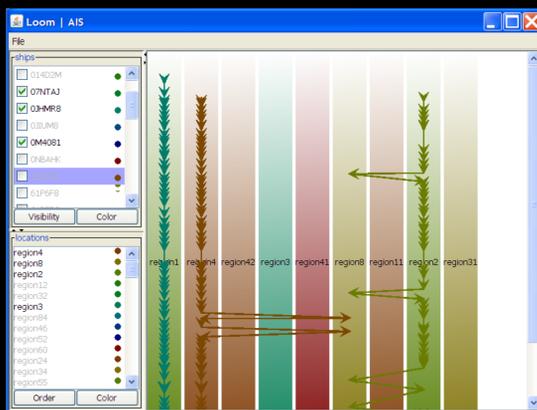
- For traffic control and security, large vessels are required internationally to carry an AIS transponder



- Sensors queried AIS transponders on vessels traveling through the English Channel over a period of 5 days.

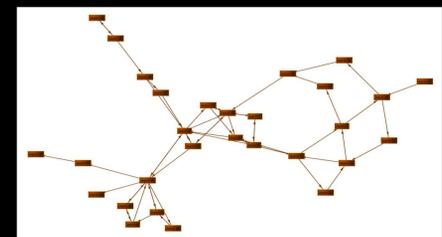
## Continuous Temporal Data Visualizing Trails

- Loom utilizes a waterfall diagram to show discrete transitions through space. OraGIS can be used to preprocess continuous locations.



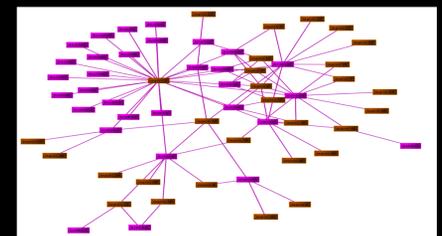
## Dynamic Network Analysis Integration with ORA

- Both Loom and OraGIS can export their modified datasets to ORA.



- Port to port network exported by Loom.

- Ship to port network exported by Loom.



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