**National Geospatial-Intelligence Agency Disparate Data Challenge**

This submittal (54.234.46.136:8080/Login.html) to the Disparate Data Challenge is a new form of aggregation and exploration of diverse data sets based on an emergent technology called xGraph being developed by Introspective Systems of Portland, ME. xGraph might be thought of as a kind of graph database with intelligent documents. The term xGraph comes from its full name of ‘Executable Graph Framework’, being developed for several market sectors whose organic mission and client base is rather similar to that of the NGA. Unfortunately, we only discovered the challenge a little over one week before the deadline, and so were only able to address a few of the many challenge data areas including OSM data, CSV data, and KML data with tracking tags.

This general product technology we refer to as xMap, which is a subset of the more general xGraph technology (complex IoT applications)[[1]](#footnote-0), aimed at developing market sectors involving aggregation of highly diverse collections of information with a spatial context over a broad geographical domain.

One xGraph application called GLASS for Global Associator, is currently being used by the USGS National Earthquake Information Center (NEIC) to provide the multiple data set association used to tame a complex system of highly dynamic links relating to millions of independent data points with 10’s of different analytics process. This system provides critical real-time location information on significant earthquakes world-wide. We are currently under contract with the USGS to expand this capability to include more diverse data (including but not limited to: phase picks, beam data, acoustic phase arrays, multicomponent particle motion, amplitudes, and social media data -Twitter).

We are also working on a current contract with the DOE “Department of Energy” to create a reference architecture based on xGraph for the next national electric grid. This architecture consists of independent collaborative analytics components using principals of Complex Adaptive Systems and Artificial Intelligence to disaggregate the control of the current centralized electrical grid into a confederation of collaborative components.

We have also been invited to propose a similar approach by AFTAC (Air Force Tactical Applications Center) for use in nuclear test ban verification.

Another project is being developed for an oil and gas services company in Denver Colorado to provides corporate level oversight for mid-range oil companies ranging from acquisition and evaluation of properties through optimization of exploration and exploitation of current holdings. Lastly, we are working with a local startup to develop a dismounted vector based mapping product (something like MAPS.ME ©) that can be used by individual such as hunters, hikers, visitors to national parks, marine navigation or other applications where direct access to the internet is not available. By using vector graphics, we are able to minimize the required download size allowing for implementation on mobile devices. We expanded this technology for this submission to the entire world rather than focused geographical locations. The latter would seem to be of particularly interest to the NGA with respect to client field operations.

The xMap product is focused to a similar market as MAPS.ME, but with a much more general reach back to diverse geographically referenceable sources of data (similar to the challenge datasets). It is specifically designed to provide user level input on selection layers. Datasets can be composed when Internet access is available and then accessed when access is denied. One basic difference between xMap and MAPS.ME is that xMap can be used to compose multiple areas of interest while retaining user specific content either locally, in a mobile device, or in a cloud based web repository, depending on specific customer needs. For example, the initial implementation of the technology was for a very popular mobile application specific to visitors of National Parks. The product provides an Internet denied guide to features of interest in the park. For the clients of the NGA, an application would be tailored to allow operatives to access detailed and cryptographically encoded information in areas of endeavor where Internet access would be inconvenient or even dangerous.

The xMap product suite leverages the xGraph framework. One way to imagine an xGraph or executable graph framework is to imagine a graph database (ie: MongoDB) where the documents also contain embedded behavior. The principles are drawn from complexity theory where systems are self-organizing. In the case of an associative data problem, as faced by the NGA, data is spread across analytics processes that make associations between data sets. This is, in-fact, the way that an earthquake hypothesis collects diverse data (multiple types-different pick types, beams, azimuth, amplitudes, twitter data) and data points (sensor feed from each) to locate an earthquake in 4D decision space (time and space).

Interacting with such systems is also radically different, as the data content is managed by the computational capabilities within the xGraph framework rather than being responsive to manipulation by external applications as is the case with legacy databases whether relational or graph based. An xGraph implementation is also both introspective (aware of it’s own performance) as well as reflective (able to self-modify). Adding a new analysis algorithm it is as simple as adding single analytics node to the framework rather than rebuilding the entire program. For legacy data sources, such as those referenced in the challenge, virtualizers are provided, which are nodes that essentially ‘wrap’ external data sources to make them appear to the rest of the framework as part of the xGraph framework.

We are Introspective Systems LLC – we build “Introspective Systems”.

**APPLICATION ACCESS INSTRUCTIONS**

For the purposes of the challenge, we have setup a demonstration site on Amazon Web Services which can be reached at:

URL: 54.234.46.136:8080/Login.html

Username: NGA

Password: DataChallenge

**Interface Layout:**

Upper right pane of the xMap web interface is a 3D sphere, a globe, for rapid global search and visualization. A left mouse click in this area allows the user to rotate the globe while a right mouse click selects the region in the projected red window for rendering in the 2D, larger, detail map. The 2D rendered region is then enclosed in a blue region projected on the 3D globe. Zooming is done through the mouse wheel in either pane. The 2D map can be panned by clicking the right mouse button and dragging the mouse prior to releasing the right button.

Disparate data layers (those which have been internally processed) can be added to the map by toggling the layer checkbox in either of the Map or World dropdown menus. This data is then rendered simultaneously on our xMap interface to be easily compared an analyzed.

The demonstration at this point is snapshot of our ongoing development effort to enter a very dramatic market of personalized mapping. The current state of development is focused on access to diverse sources of data that can be referenced geographically with a three-dimensional navigation tool.

1. Current active applications of xGraph include Oil and Gas investment portfolio data fusion, 4D seismic association of streamed sensor data for the USGS, and collaborative edge intelligence architecture for the Department of Energy. [↑](#footnote-ref-0)