

## Distributed Seismic Event Detection Analytics at the Edge

Over two decades ago, the Earthworm regional seismic processing system was introduced as a state-of-the-art analytical system for regional seismic event detection and analysis. Today it is still in wide spread use worldwide, despite amazing advances in distributed processing, cloud-based computing, data storage and edge-based analytics. The xQuake system, designed and built by the original architect of Earthworm, incorporates these advances into a plexus of microanalytics with interconnecting streaming hubs (e.g. Apache Kafka brokers), a modern version of Earthworm's "rings and things", with a GPU accelerated browser interface. A centerpiece of xQuake is xGlass, an extension of the GLASS 3.0 global associator developed for the USGS/NEIC providing fusion of multiple sensor types within a 3D GIS context, locally adaptable global travel-time models, and seamless application across teleseismic, regional, and local domains. The foundation for xQuake is the open source xGraph (eXecutable Graph) framework with analytics and database functions designed for the integration of extremely large and complex systems using algorithms drawn from the biomimetic concept of a computational ecosystem, artificial intelligence and complexity theory. The ultimate goal is to migrate analytics to the sensors themselves (the edge) in a truly distributed and adaptive System of Sensor Systems (SoSS) framework.

**Primary author:** JOHNSON, Caryl Erin (Introspective Systems LLC)

**Presenter:** JOHNSON, Caryl Erin (Introspective Systems LLC)

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