

# SC23 Network Research Exhibition

## **AutoGOLE/SENSE: End-to-End Network Services and Workflow Integration**

SC23-NRE-014 Abstract  
GNA-G AutoGOLE/SENSE WG

### **Abstract**

The GNA-G AutoGOLE/SENSE WG demonstrations will present the latest features and status for AutoGOLE and SENSE infrastructure and services.

This showcase will include demonstrations of technologies, methods, and systems for dynamic Layer 2 and Layer 3 network multi-domain service provisioning. These services are focused on meeting the challenges for data intensive science programs and workflows, such as the Large Hadron Collider (LHC), the Vera Rubin Observatory, and challenges in many other disciplines. The services are designed to support multiple petabyte transactions across a global footprint, represented by a persistent testbed spanning the US, Europe, Asia Pacific and Latin American regions.

The SC23 demonstrations will focus on new features in the area of programmatic driven domain science workflow integration and realtime monitoring/troubleshooting.

The Global Network Advancement Group (GNA-G) AutoGOLE is a worldwide collaboration of Open eXchange Points and Research & Education networks which delivers end-to-end network services in a fully automated way, wherein connection requests are handled through the Network Service Interface Connection Service (NSI-CS). Multiple networks across the globe use NSI to provision international network services, saving a considerable amount of time for NOC engineers to facilitate international network service requests. Provisioning of international circuits is done within minutes, instead of multiple

days or even weeks, since manual human interaction is very limited or even zero.

The Software-defined network for End-to-end Networked Science at Exascale (SENSE) system provides the mechanisms to integrate resources beyond-the-network, such as compute, storage, and Data Transfer Nodes (DTNs) into this automated provisioning environment. Key elements of the SENSE architecture, situated between the SDN layer and science program application agents, include an ontological model of the sites and networks, Site and Network Resource Managers and an Orchestrator.

The AutoGOLE/SENSE and Data Intensive Sciences working groups of the Global Network Advancement Group are a collaborative focus on a worldwide scale of R&E network operators and system developers, site software, network and data management system developers and university and laboratory-based scientists in several disciplines.

The combination of these infrastructures, services, and systems enables true "end-to-end" network service provisioning and management. This includes the multidomain network elements AND the network stacks inside the end-systems. The key focus for this work now is to deploy a global scale persistent infrastructure which combines the AutoGOLE and SENSE functionalities to enable complete end-to-end dynamic network services for domain science workflows, and for general use within the Research and Education community.

The AutoGOLE/SENSE infrastructure includes multiple provisioning options including:

- OpenNSA - client tool based on the Network Service Interface (NSI) standard
- SURF ultimate Provider Agent (SuPA) - NSI ultimate Provider Agent implementation
- MEICAN - graphical user interface enabling collaboration by NOCs across multi-domain infrastructures
- SENSE - model based orchestration system which integrates network and end-system resources into a common provisioning environment. SENSE leverages other provisioning systems as part of multi-resource orchestration.

The AutoGOLE/SENSE demonstration shows how domain science applications can integrate these services into their workflows via API driven information discovery and services provisioning and management. Multiple intercontinental data flows will be shown running across high-performance R&E networks with DTN based endpoints. The AutoGOLE/SENSE infrastructure is shown in the diagram above.

At the campus level, beyond 100G connectivity will be shown at Caltech and UCSD as well as Berkeley Lab (LBL) thanks to the support of CENIC and the use of Ciena Waveserver Ais at Caltech and Los Angeles.

The context of the GNA-G also provides a collaborative focus inter-relating this and several other SC23 Network Research Exhibition demonstrations, bringing together dynamic circuit services, end-to-end monitoring, intelligent data and control planes, and leading edge programmable network operations using P4 to direct and/or shape multiple large flows across intercontinental distances.

### **Goals**

The SC23 goal of these demonstrations and experiments is to showcase the global persistent multi-resource infrastructure based on the integration of the AutoGOLE and SENSE functions. Example programmatic driven domain science workflow integration, automated monitoring, and troubleshooting will be shown.

### **Resources**

This NRE demonstration will be conducted using resources of the collaborating domains, see Involved Parties. This will include: Global high-bandwidth links/networks, Data Transfer Nodes, MEICAN, Network Service Interface, and SENSE (Orchestrator, DTN Manager, Resource Manager).

This NRE demonstration will use the AutoGOLE/SENSE infrastructure external to SC23 in addition to links into the SC23 Exhibit Floor from StarLight in Chicago and CENIC in the Los Angeles area connecting Caltech and UCSD.

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