Global Research NOC at Indiana University - GENI Meta Operations Center

Scope of Work

As GENI moves close to a common facility, it will become increasingly important to facilitate the sharing of operational and experimental information among GENI experimental components. Even though each component or prototype may have its own internal structure and its own internal operational support model, it will become vital that GENI provide a unified method for these prototypes to share information about the important details of the state of the prototype and the data passing into and out of each prototype.

A GENI Meta Operations Center (GMOC) would provide this functionality. The goal of a GENI Meta Operations Center would be to take the disparate and dissimilar prototypes and components of the GENI experimental facility and provide a common collection point and protocol for the operational data sharing needed to operate the GENI facility.

This effort has both technical development and operational requirements. Technically, the GMOC would require a well-defined protocol to help generalize the operational details of GENI prototypes and for the providers of prototypes to send those details to an operational data repository. These requirements suggest a modular approach, with a generalized protocol rather than a restricted set of hardware and software that GENI prototype participants would be required to run. In other words, it would be largely up to the GENI Spiral 1 project investigators to decide what data to share and how to collect this data from their prototype infrastructure. The GMOC would provide the standardized format for this data and the systems required to share, monitor, display, and act on this data. In addition, the GMOC could be used to help provide a repository for data collections passing into and out of GENI prototypes for the purpose of discovering and isolating prototypes that have caused problems. This might require additional instrumentation at the connection points and substrate elements between prototypes.

This would be accomplished with the help of the other prototypes which will be a part of GENI Spiral 1. The GMOC will work with these other projects to develop the operational data formats, processes, and systems needed for a consistent and useful GENI infrastructure.

In addition to addressing these important technical issues, it will be important to develop the organizational structures needed to provide successful operations of the GENI facility. It will be vital to investigate how a Meta Operations Center might interact with the prototype participants. There are several possible models, and it will be

important to take the time early in the development of GENI to evaluate these.

The success of the GMOC would depend on 2 things. First, it would depend on the ability to produce the Dataset schema, protocols, and processes as set out in the deliverables section. Second, it would also depend on the ability to provide useful services to our initial partner projects and later to attract more projects to refine and expand GMOC services. Certainly, the most immediate such services would include emergency stop processes and systems to partition or shut off parts of the GENI infrastructure that are interfering with the rest of GENI. It would also include an early version of a GENI portal to share useful data gathered by the GMOC with researchers and operators.

In addition to the efforts of a dedicated GMOC Developer and the PI and Co-PI, We propose to incorporate 2 undergraduate students from the university to help develop the GMOC Framework. This would consist of full-time work during the summer and part-time work during the school year. This will provide the resources needed to make the project a success. More importantly, this will allow undergraduate students to get immediate experience applying their skills to a real large-scale project in the area of network research. This experience is invaluable for helping to attract talented students into this field and in giving them the applied development background they would need to succeed either in the research & education sector or in the private sector.

Deliverables

Coordination and Definition (Month 1 – Month 6) – In the initial 6 months, we will concentrate on coordinating with other prototypes willing to partner with us to define 4 things:

1.) *A Common Operational Dataset* – this is a minimum set of operational-related data that should be common among all components that would be monitored by the GMOC
2.) *A Specialized Operational Dataset* – this would consist of the operational data that is specific to certain components, but which may be useful for the GMOC to monitor
3.) *GMOC Native Operational Data Format* – this would be the format partner projects would use when providing operational data to the GMOC
4.) *Security services* – We will work with other projects providing security services to GENI. The security services will be integrated into the GMOC framework as they become available.

Initial GMOC Framework Implementation (Month 6 – Month 12) – Once the initial coordination and definition is complete, we will spend the next 6 months on prototype implementation and initial operations. For this effort we will deliver 4 things:

1.) *An Operational Dataset translator* – this will be software used to convert data in existing formats from existing projects that would be of operational interest into the GMOC Native Operational Data Format.
2.) *GMOC Data Exchanger* – this is the software implementation and protocol used to receive and transmit operational datasets among GMOC partner projects and with the GMOC.
3.) *A working GMOC, sharing operational data* – We will have the documented suite of systems and processes working to share operational data among all the partner projects.
4.) *Emergency Stop and Active Notifications* – We will be actively providing "emergency stop" functionality to participating projects to isolate or turn down disruptive experiments, and we will be actively notifying partner projects of operational issues, as they want.

Data Sharing Portal (Year 2)- A portal would be implemented to allow service provides and experimenters to view the Operational datasets and provide some operational control. This portal would integrate security services to protect operational control and sensitive datasets. This will be implemented in year 2 of the project.

Evaluation, Expansion, and Refinement (Years 2 & 3) – Once we have a working GMOC providing services to our partner projects, we will revisit the data formats, services, and architecture to improve them for our partner projects. We will also solicit input and participation from other projects. This process is parallel to some of the other work and is planned to start as soon as the version on the GMOC Framework is available. This work will include Spiral 2 and Spiral 3 projects. This process will result in the following 4 deliverables:

1.) *Updated Data formats* - A documented revised version of the Common and Specialized Operational Datasets, Native GMOC Operational Data Format, based on feedback on initial datasets, and input from new partner projects
2.) *Updated GMOC Framework software* – An improved version of the translator, exchanger, and alerting software used by the GMOC
3.) *Updated GMOC Processes & Services* – A documented and updated suite of processes used by the GMOC to better provide operational services and sharing of data among partner projects. Also, possible expansion of services to include other areas as needed by new and existing partners.
4.) *Integrating New Active Projects* – As new projects are implemented, data from these new sources will be integrated in the GMOC Framework

GENI Concept of Operations (**Years 1-3)** - Coordinate with GENI projects and the OMIS working group to develop a GENI Concept of Operations that extends beyond the prototype spirals. The Concept of Operations would be documented and used as GENI goes forward to develop operational procedures and functions.

Milestones

Year 1

1.) *Month 6: Spiral 1 design and datasets* - After 6 months of coordination and discussion with other GENI projects, we will set the content and format for the necessary operational data for GENI operations.

2.) *Month 12: Spiral 1 active sharing & implementation* - an initial implementation of a GMOC Framework will be complete and providing operations for a set of GENI projects participating. This would include active sharing of operational data and early functionality such as "Emergency Stop." Results of this would be demonstrated and discussed with OMIS and full GENI community at GEC

Year 2

1.) *Month 18: Spiral 2 design and datasets* – By Month 18, the GMOC will have revised the data content and formats used to share operational data based on initial experience, to incorporate the needs of Spiral 2. Formats for data sharing and additional needed datasets to collect would be defined, as well as additional functionality needed from the GMOC

2.) *Month 24: Spiral 2 implementation* – Based on the Spiral 2 design, the GMOS will implement a revised and evolved GMOC framework, including improved "Emergency Stop" functionality, and the GMOC portal, to share operational data with other operators and researchers.

Year 3

1.) *Month 30: Spiral 3 design and GENI Operational Concepts Defined* – The GMOC will again make any necessary revisions to O&M datasets and formats in coordination with GENI projects as of Spiral 3. In addition, a full design for GENI Operations will be defined in preparation for final prototyping and implementation.

2.) *Month 36: Final GENI Operations Concepts prototype, Final Report* – The GMOC will spend the final 6 months implementing what should be a prototype of a fully operational GENI Operations System, testing the final definition of GENI Operations Concepts. This would include all the vital functionality a GENI Operations system would require, as defined by the previous iterations and revisions. At the conclusion of this, we would produce a final report for both OMIS and GENI as a whole, describing what we learned and our recommendations for future GENI Operations.