

Digital Object Registry
Corporation for National Research Initiatives
GENI Quarterly Report – Jul 1, 2009 through Sep 30, 2009
And
GENI Final Report – Oct 14, 2008 through Sep 30, 2009

1. Major Accomplishments

The scope of work on this project is to adapt the Handle System and/or the CNRI Digital Object Registry to create a clearinghouse registry for principals, slices, and/or components in at least one GENI Spiral 1 control framework, capable of supporting limited operations in Year 1. We will also analyze ways in which the Handle System and/or a Digital Object Registry could be used to identify and register GENI software, including experimenter's tools, test images and configurations, and test results. Finally, we will define the operational, scaling, security, and management requirements, plus recommended design approaches, for implementing GENI clearinghouse and software registry services.

During this quarter, we continued our collaboration with the ProtoGENI group to federate the ProtoGENI clearinghouse records into the proposed GENI Federated Clearinghouse (GFC), which is based on our digital object registry technology. We:

- designed and implemented an adapter that translates the ProtoGENI clearinghouse records into a GFC compatible structure, as part of the federation effort;
- implemented the security model that we designed in the previous quarter and integrated into the GFC;
- hosted the GFC on the public Internet after aggregating records from the ProtoGENI clearinghouse and made the GFC accessible to the public;
- demonstrated the GFC capability to the GPO and GENI members and participants during the fifth GENI Engineering Conference held in Seattle, WA;
- proposed a plan to use the digital object architecture for experimenter tools and services.;
- completed the final two milestones for this year;
- continued to participate in the ProtoGENI biweekly calls.

The achievements and work performed during this past year are summarized in section 2.b. of this document.

1.a. Milestones achieved: We submitted a plan to the GPO on 3 August 2009, describing how the digital object architecture may be used to design and create experimenter tools and services. The proposed plan describes a system that can be built by customizing the digital object architecture in order to allow experimenters to register and store experiment-related information, both during the period the experiments are performed and also at the end of those experiments.

We also demonstrated the GFC capability to the GPO and the GENI members and participants during the fifth GENI Engineering Conference (GEC5) held in Seattle, WA, 20 - 22 July 2009. The capabilities that were demonstrated include the discovery of GENI control framework information over the web, a service model to register and disseminate such information, and a new security approach that circumvents the need to create and manage digital certificates.

1.b. Deliverables: During this quarter, we submitted our experimenter tools and services proposal to the GPO and presented a poster during GEC5, both of which are made available on the GENI wiki page for our project.

2. Description of Work Performed

2.a. Activities and Findings During This Quarter

As described in the last quarterly report, we continue to adapt the digital object architecture to various GENI requirements, including a GENI clearinghouse, and experimenter tools and services.

We have successfully collaborated with the ProtoGENI cluster for building a GENI Federated Clearinghouse (GFC) using the Digital Object Architecture (DOA). The GFC is designed to meet the GPO and various cluster members' requirements. They include, among other things, the need to minimize the number of trust relationships between the experimenters and the resource providers, and provide standard services to register, search, and disseminate 'user', 'sliver', 'slice', 'resource', 'component', 'aggregate', and various authorities' records. The GFC is also designed to be a distributed system with various components of the clearinghouse hosted on various machines, in a redundant fashion. The GFC data model and service interface, along with the scalability approach taken, is documented and is made available on the wiki page at:

<http://groups.geni.net/geni/attachment/wiki/DigitalObjectRegistry/FederatedClearinghouse.pdf>

We hosted the implemented clearinghouse for public usage on a server machine at CNRI, which can be accessed at:

<http://geni.doregistry.org/GFC/>

The GFC is integrated with an adapter to parse the ProtoGENI clearinghouse information and crosswalk to its own data model. As a result, the hosted GFC holds the ProtoGENI clearinghouse records. Note that the information in the GFC may be obsolete because the adapter is not pulling the records from the ProtoGENI on a real-time basis. In order to make the GFC synchronize with the ProtoGENI clearinghouse, the ProtoGENI clearinghouse records must include timestamp information to specify when such records were created, which at the moment is missing from the ProtoGENI records. We will continue to collaborate during the next funding year to complete the integration effort.

The GFC is also integrated with CNRI's implementation of a PKI-based security architecture that provides freedom for certificate revocation lists (CRLs). Consequently, once integrated into GENI, new users may be added and removed from the GENI infrastructure without requiring the various security databases to update their certificate stores. The details of the security implementation are made available on the wiki page at:

<http://groups.geni.net/geni/attachment/wiki/DigitalObjectRegistry/ClearinghouseSecurityReqmnts.pdf>

The GFC is designed to be accessible from a browser or by programmatic means. Accessing the GFC using a browser is straightforward and involves visiting the GFC URL, selecting the appropriate registry from the selection list, and listing the clearinghouse records (or searching using keywords), and following the links from the resulting page to either get more information about the resulted records or to access the entire record in XML. The GFC may also be accessed using programmatic means. The GFC is designed to be REST compatible with the mode of access being HTTP and the transaction message being encoded in XML. The complete details of the GFC in terms of programmatic access will be documented when the integration effort with ProtoGENI is completed during the next funding year.

In this past quarter, we proposed a plan to adapt the digital object architecture (DOA) to provide experimenter tools and services. The proposed adaptation of the DOA allows experimenters to register and store experiment-related information both during the period the experiments are performed and also at the end of those experiments. Experimenters may register, update, and delete information in a dynamic fashion at the time such experiments are performed, thereby keeping the state of the experiment up to date. The crux of the adaptation is based on the proposed Experimental Specification Model that would allow specifying experiments run in GENI, based on the Experiment LifeCycle Document, and the approaches taken by the cluster members. The model may be seen as a common mapping model between and among custom specifications, and may act as a starting point for gaining interoperability across the various clusters in GENI.

In addition to the proposed adaptation, we also proposed to host the three components of the digital object architecture, namely the Handle System, the DO Repository, and the DO Registry, for managing experiment related data, if required.

2.b. Summary of Work Performed During This Funding Year

During this past year, we studied and analyzed the various control frameworks within GENI, with a focus on adapting the DOA to meet the requirements of those control frameworks. We collaborated with various groups, including the GPO, through teleconferences and GENI Engineering Conferences. We also studied and analyzed documents produced by the GPO and other members to keep current with the technologies and the concepts GENI is embracing. Based on our analysis and GPO's recommendation, we chose to design and deploy a clearinghouse that would federate from various clusters in order to provide a logically centralized system for the experimenters to query, thereby discovering resources that are managed across the clusters. With ProtoGENI willing to participate as the first federate, we were able to successfully design and deploy a GENI Federated Clearinghouse. The design document and crosswalk between ProtoGENI and GFC are published on the GENI wiki page for our project. We also proposed a new security mechanism that would circumvent the problem of managing digital certificates both at the time of user registration and revocation. The proposed model is also implemented in the GFC, and the overall GFC functionality was demonstrated to the GENI participants at the fifth GENI Engineering Conference.

By studying the experiment workflow principles and requirements, we proposed a plan to the GPO for bringing interoperability across various experimental tools and services with the help of the digital object architecture.

We also made contact with the Million Node GENI (MNG) project team during the year, and we will be collaborating with that team during the next funding year to provide the digital object registry services for managing the MNG's operational records.

We have met all the deadlines and milestones that were agreed upon. With the goal of building a network infrastructure coupled with our expertise on information management principles, we believe we brought diversity into the GENI portfolio. We are pleased to be continuing to collaborate with the GENI members, including the GPO to meet the requirements and goals set for the GENI program.

2.c. Project Participants

CNRI has discussed its project with a number of other GENI participants, but all work done this quarter was done by CNRI alone or with the cooperation of ProtoGENI personnel. Names and email addresses of CNRI participants are available on the GENI wiki page for the project. Robert Ricci and Leigh Stoller from ProtoGENI collaborated with us during this quarter.

2.d. Publications

No publications were produced this quarter. CNRI produced the experimental tools and services proposal document and the poster for the fifth GENI Engineering Conference. Those documents are available on the GENI wiki page for the project.

2.e. Outreach Activities

CNRI, specifically project PI Laurence Lannom, Giridhar Manepalli and Christophe Blanchi, attended the technical discussions in the ProtoGENI bi-weekly tele-conference and also participated in various GENI mailing lists.