iGENI Quarterly Report

GENI Project #1719

For the Period Oct 1, 2011 Through Dec 31, 2011

Joe Mambretti, International Center for Advanced Internet Research (iCAIR), Northwestern University, j-mambretti@northwestern.edu
Maxine Brown, Electronic Visualization Laboratory, University of Illinois at Chicago, maxine@uic.edu
Thomas A. DeFanti, California Institute for Telecommunications and Information Technology (Calit2), University of California, San Diego, tdefanti@ucsd.edu

I. Major Accomplishments

This project is defining, designing, and implementing the International GENI (iGENI), a distributed network research infrastructure, which is being integrated with current and emerging GENI resources and which is being operated for GENI researchers, who have already begun conducting experiments that utilize these resources based on multiple aggregates at multiple sites. The iGENI infrastructure is being defined in collaboration with the GPO and other GENI projects a) to expand the variety of resources, especially controllable transport services, available to GENI researchers, b) to add additional capabilities to that infrastructure, c) to make GENI available to more research communities, and d) to provide a platform for demonstrating its capabilities for supporting experiments. In Q1, the iGENI initiative undertook multiple efforts to expand GENI international infrastructure and to prepare for and stage a series of demonstrations at GEC 12 in Kansas City and at the SC11 supercomputing conference in Seattle, Washington in November (Ref Figure 5). During Q1, iGENI staged demonstrations at the GEC 12, which took place November 1-3 in Kansas City, Mo (Ref Figures 3-4). These demonstrations included those implemented on international testbeds (Ref Figure 1). Also, during Q1, iGENI continued to participate in the design and implementation of aggregate interconnections among Cluster-D participant sites (Ref Fig 2). iGENI also enhanced the capabilities of several iGENI international testbeds that have been established among StarLight/iCAIR and a number of international universities.

A. Milestones Achieved

The basic infrastructure architecture and design has been developed for the iGENI distributed, federated environment, and these concepts have been presented and discussed at various forums. The ORCA clearinghouse that has been implemented at iCAIR was updated in this quarter. This core facility, which has been implemented within one of the iCAIR network research labs, is connected by dedicated optical fiber to high performance switches at the StarLight International/National Communications Exchange Facility. Also, private dedicated fiber has been implemented between iCAIR/StarLight to the NLR core node at a large co-location space at 111 North Canal in Chicago. The iGENI community is engaged in various planning and implementation processes directed at providing additional connections from existing resources at the StarLight national and international communications exchange with current GENI backbone transport resources, having implemented initial paths based on NLR Layer 2/Ethernet VLANs) using 10 Gbps NLR FrameNet and national C-Wave lightpaths. Paths have been extended across the Global Lambda Integrated Facility (GLIF) and GLORIAD paths. These activities are being assisted through funding from a NSF award for the TransLight/StarLight proposal under the International

Research Network Connections (IRNC) program. This program is providing some support for iGENI international activities.

B. Deliverables Made

The initial design of the iGENI infrastructure has been developed and implemented, and this infrastructure is currently being extended nationally, and internationally (Ref Fig 2). The majority of current activities are focused on a) planning for additional extensions nationally and internationally, providing additional resources for those extensions, providing control frameworks for those extensions, planning for researcher use of those resources, and demonstrating the capabilities of the exiting platform. iGENI has been integrated as an aggregate with the ORCA control framework in Cluster D, with persistent and dynamic L1/L2 paths among multiple Cluster-D sites using GCDnet. This implementation has been demonstrated as useful to support multiple major demonstrations. All future extensions are based on the current model. In addition, options for various tunneling techniques are being investigated, including through experiments. The ORCA GENI Cluster D implementation includes one Broker, multiple Service Managers, and multiple Site/Domain Authorities. iGENI has been integrated with ORCA, through an initial lab implementation at iCAIR. During this period, the ORCA instantiation was upgraded several times. In addition, iGENI has been working with PlanetLab, ProtoGENI, and GpENI, to allow for additional connections and framework integration.

II. Description of Work Performed During 1nd Quarter

II..a. Activities and Findings

Q1 activities were focused on planning for, testing, and providing for additional resources, extending prototypes based on core infrastructure architectural concepts, testing and evaluating the current implementations, planning for demonstrations, staging demonstrations, and presenting the iGENI and GENI environments at various forums. The iGENI initiative has developed processes and procedures for integrating core resources with an ORCA based control plane framework, including L2/L1 paths. iGENI continues to plan additional resource extensions, including those related to cloud computing and to other control frameworks. The current implementations have allowed for resources to selectively advertise their external interfaces, including vLANs, enabling interconnects among dedicated GENI resources, initially among Cluster-D sites (to be followed later, among resources provided by regional networks, nationals R&E networks, internationals R&E networks, non-profit R&D organizations, corporate R&D organizations, and other sites, facilities and institutions). Investigations are also being conducted to determine options for supporting multiple types of L1/L2 paths, including vLANs, tunneling services, e2e lightpaths, standard optical L2 framing, and others.

These investigations include consideration of and experimentation with other control frameworks and APIs to those frameworks. For example, iCAIR is actively supporting the GLIF NSI API experimental and demonstration activities. (The current NSI implementation was demonstrated at the SC11 supercomputing conference in November in Seattle, Washington.) . Plans have been developed to enable core L1/L2 resources to be identified using standard L1/l2 resource addressing. Techniques are being investigated for developing identification methods for experimental L1/L2 core resources allowing for a level of abstraction that can be integrated into an XML-RPC based resource description language. Within the iGENI infrastructure, calls are mapped onto an addressable L1/L2 path infrastructure, using static,

semi-dynamic and dynamic infrastructures. Edge resources use a private addressing scheme. This design anticipates that the core resource infrastructure framework and the experimental research infrastructure will be operated by distributed operational NOC processes. Core infrastructure will be addressed by a management plane based on common L3 secure channels in addition to the control plane framework.

As noted, the ORCA control framework has been integrated with the iGENI infrastructure. iGENI Consortium has implemented the Open Resource Control Architecture (ORCA) control framework at the StarLight Communications Exchange Facility. An instantiation of ORCA has been operational on a server in one of the iCAIR research labs for two years, and it has been integrated with facilities equipment. A second implementation integrates iCAIR and StarLight facilities with the ORCA clearinghouse at RENCI. This implementation is integrated with switches and servers at a core node in the StarLight facility. iGENI is now integrated as an aggregate with that implementation of the ORCA control framework in Cluster D, with L1/L2 paths among StarLight, RENCI/BEN, and other Cluster-D sites. This initial implementation is serving as a model for establishing connections to other sites. Through ORCA, available resources in iGENI can be discovered; services can be setup and managed; and, individual traffic streams will be controlled and managed. This project has implemented interfaces to ORCA that allow dynamic control of network services involving iGENI, associated transport resources and GENI aggregates. It is possible to setup services using prepackaged or customized configurations and topologies.

II.b. Project Participants

The iGENI initiative consists of multiple organizational partners, including International Center for Advanced Internet Research (iCAIR), Northwestern University, Electronic Visualization Laboratory, University of Illinois at Chicago, California Institute for Telecommunications and Information Technology (Calit2), University of California, San Diego, the computer science department, UCSD, the StarLight consortium, the Metropolitan Research and Education Network, RENCI, Duke University, North Carolina State University, MCNC, the University of Massachusetts at Amherst, Ohio State University, Wane State University, the University of Houston, Columbia University, the University of Oklahoma, University of Utah, Princeton University, University of Victoria, HP Research Labs, PlanetWorks, Kaiserslautern University, DFN, Cisco, the NLR, Merit, MAX, NOX, the GLORIAD consortium, the Global Lambda Integrated Facility (GLIF) Consortium, SURFnet, NetherLight, SARA, University of Amsterdam, CANARIE, CAnet, Communications Research Center, the Computer Network Information Center, Chinese Academy of Sciences, SingAREN, KREONET, KISTI, GIST, TWAREN, National Center for High Performance Computing, Taiwan, KAUS, NCKU, Ampath, CRP, RNP, and others..

2.c. Publications and Presentations

The iGENI project was also presented at meetings with many groups of visitors, including international visitors, at iCAIR. In Q1, the iGENI initiative planned and staged demonstrations at GEC 12 (Ref Figures 1-4 and in the at the SC11 international supercomputing conference in November 2011 in Seattle, Washington (Ref Fig 5).

II.d. Outreach Activities

The iGENI community has had GENI and iGENI planning discussions with networking research groups from Australia, Brazil, Canada, China, Egypt, Germany, India, Japan, Korea, Singapore, Taiwan, Spain, New Zealand, Sweden, Switzerland, Poland, Saudi Arabia, the UK, and others. iGENI has also been presented at multiple community forums, e.g., those related to state wide, metro, and regional R&E networking. There were various GENI/iGENI activities at the SC11 supercomputing conference in Seattle, Washington in November, including two forum presentations.

II.e Collaborations

The primary activities among the initiative partners noted in II.B have been focused on continuing to a) design and implement GENI infrastructure, b) designing and conduct demonstrations for GEC 12 and planning for GEC 13 in Los Angeles, including GCDnet and TransCloud c) participating in R&D meetings with GENI Cluster D partners, national research networking organizations, and international research network organizations, as well as conference calls and meetings with the ORCA framework developers, d) planning for future infrastructure implementations and collaborative activities and e) planning for future demonstrations including at GEC 13, f) supporting a technology workshop in Kaiserslautern that took place in August, g) planning demonstrations of the GENI/iGENI initiative at the Global LambdaGrid workshop in Chicago in October, 2012 h) planning for the InstaGENI initiative and i) planning for SC12 in Salt Lake City in November 2012.

II.f Other Contributions

The iGENI initiative is currently exploring options for integrating GENI with additional major national and international testneds.

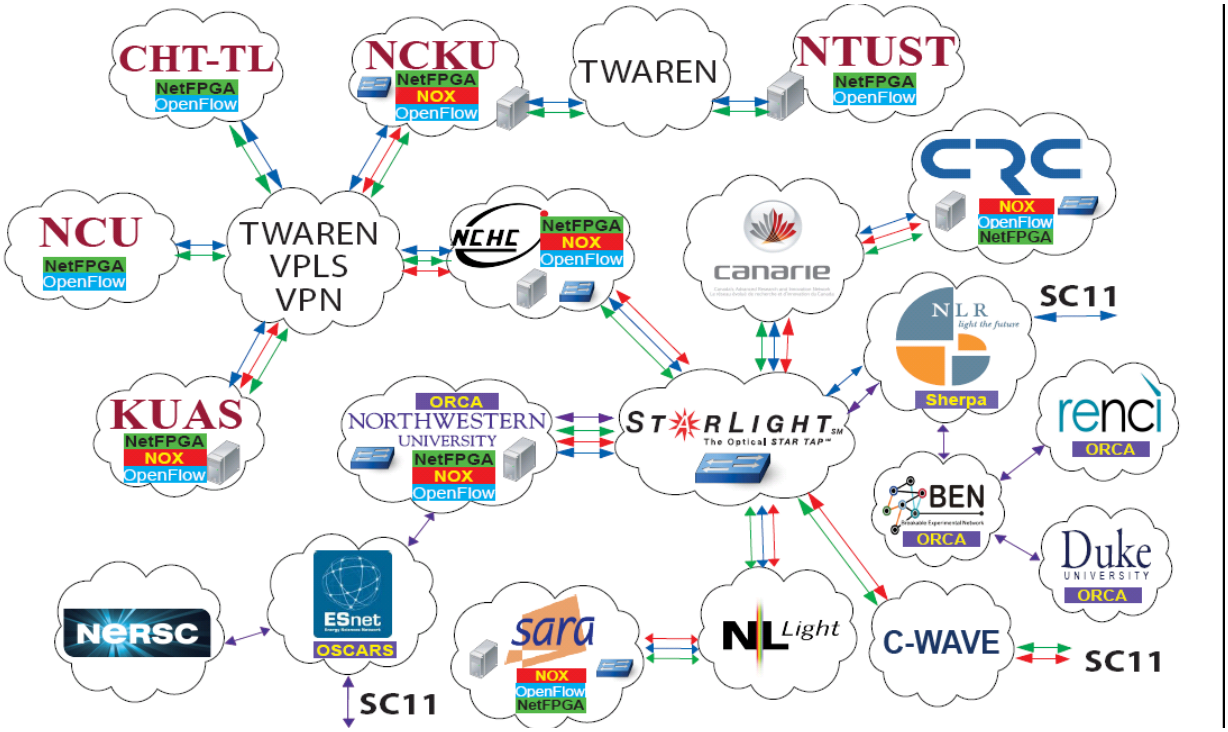


Figure 1

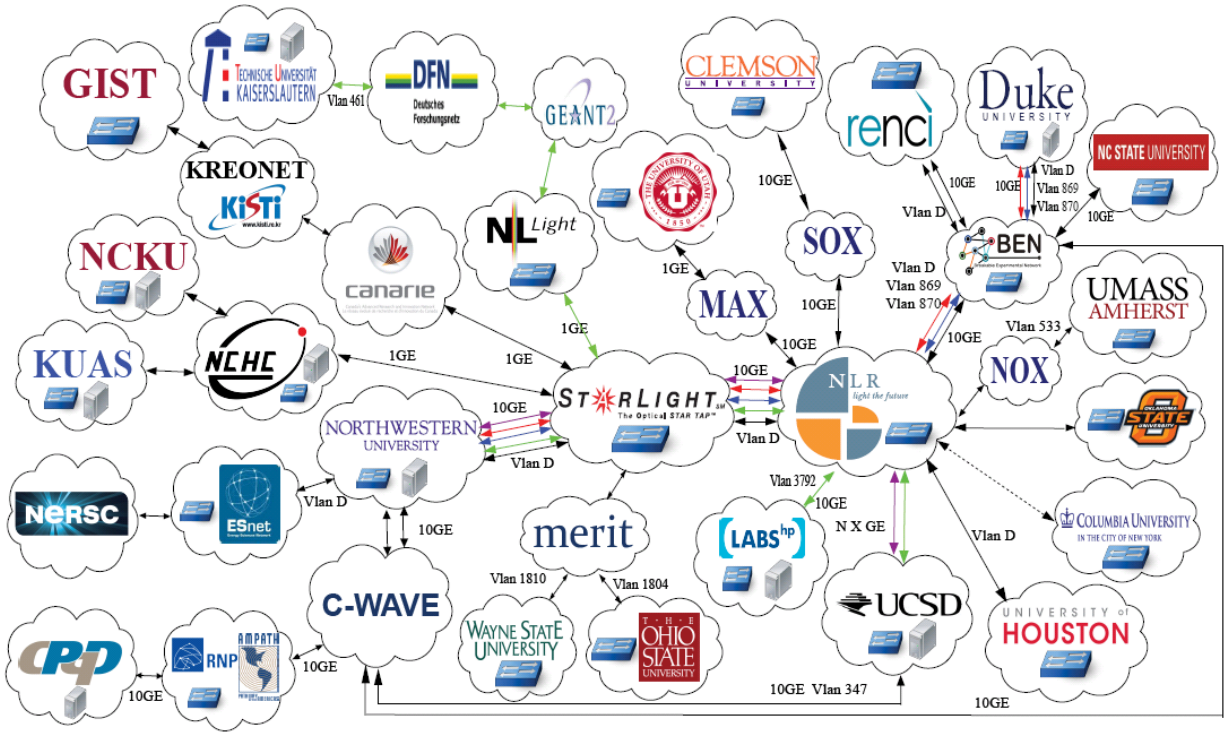
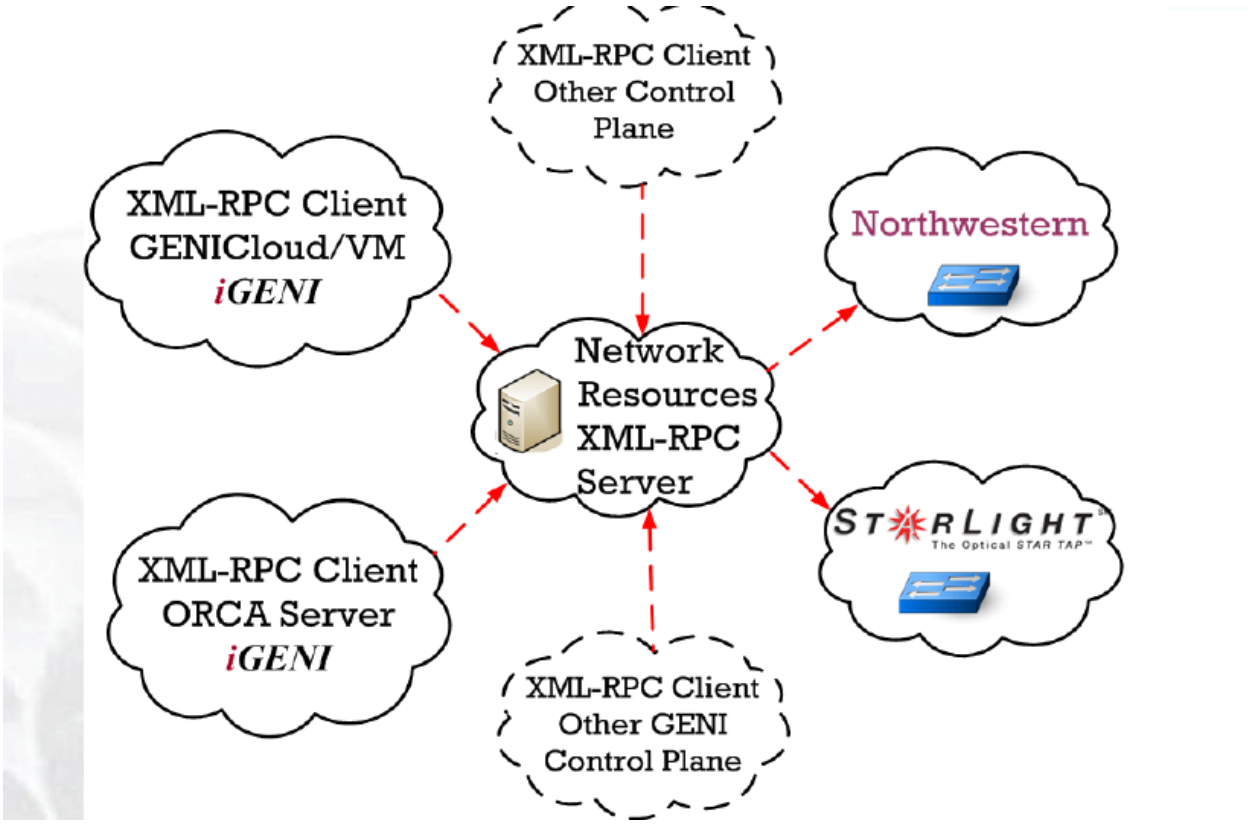


Figure 2


geni
Advanced Programmable Networks: A Demonstration of Software Defined Networks, OpenFlow, and Current GENI Capabilities
For the Advanced Programmable Networks Team: Northwestern University, National Center for High Performance Computing, Communications Research Center, SARA, University of Amsterdam, GENI, NLR, StarLight Consortium, Metropolitan Research and Education Network, GLIF
GLIF
NCHC
iCAIR
sara
NLR
STARLIGHT
The Optical STAR TAP
November 2-4, 2011
Sponsored by the National Science Foundation

Figure 3


XML-RPC Client
Other Control
Plane
XML-RPC Client
GENICloud/VM
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Northwestern
Network
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The Optical STAR TAP
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ORCA Server
iGENI
XML-RPC Client
Other GENI
Control Plane

Figure 4

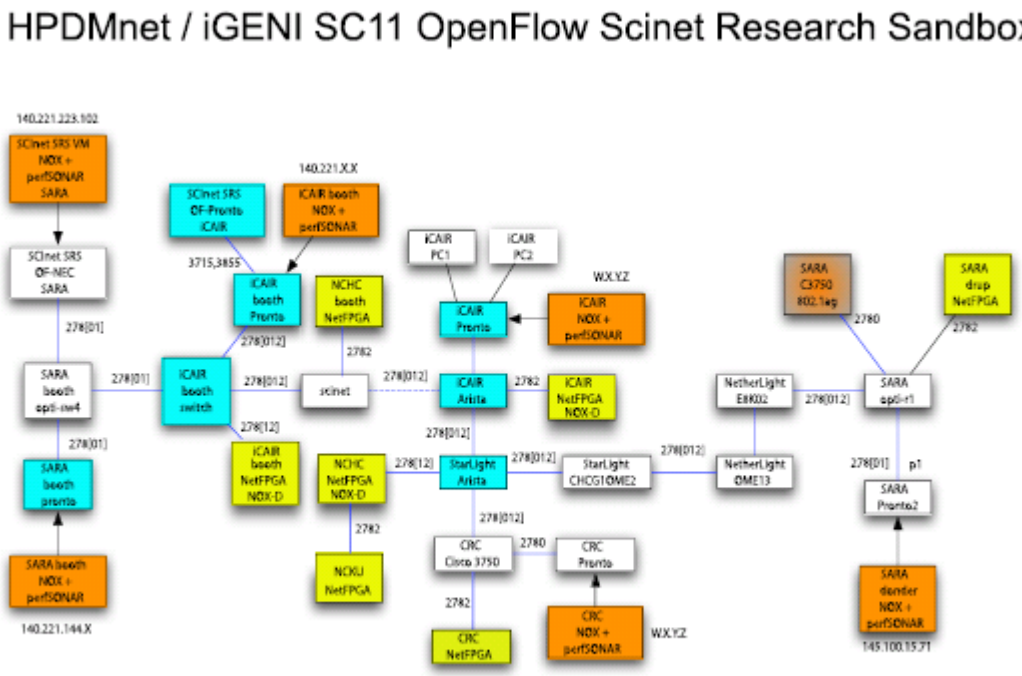
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Figure 5