Annual Report of UMLPEN as of Oct 1, 2009

Yan Luo, UMass Lowell, yan_luo@uml.edu

Major accomplishments

Milestones achieved

Overall, we have completed all the milestones of Year 1 on time. We highlight some of the milestones as follows. We have federated our ProtoGENI site to ProtoGENI clearinghouse. Our resources (the PEN, PCs and a switch) are made available through ProtoGENI flash interface. We have developed software modules support OpenVZ based virtual containers. The virtual containers can access outside network through the virtual network interfaces instantiated with the network processor based NIC. The prototype provides basic measurement and diagnostic tools to aid experiments. We have compiled three design documents regarding the architecture and usage of our PEN prototype and made them available on GENI wiki. We demonstrated our PEN prototype at three GECs in the past year.

Deliverables made

(a) Architecture and design documents, including
- PEN design – describes the internals of the PEN prototype
- PEN integration with ProtoGENI – describes how we integrate our PEN prototype with ProtoGENI control framework
- PEN use cases -- describes how to use PEN with usage examples

(b) Source code of the integration of PEN to ProtoGENI control framework.
(c) Virtual router templates for OpenVZ virtual environments (aka containers)
(d) Measurement and diagnosis tools

Description of work performed during last year

Activities and findings

We have established a ProtoGENI site in the Computer Architecture and Network Systems (CANS) Lab at UMass Lowell. Our hardware setup, shown in Figure 1, contains two control nodes ("boss" and "ops"), three physical PCs and a PEN node. We have *.uml.emulab.net domain delegated from Utah so that a user can easily access our nodes from outside network. The control switch is one of the campus switches, which is located outside the lab and we do not have control of. The control switch connects machines via public IPs. The experiment switch (Cisco Catalyst 2960G 20-port Gbps switch), connecting the experiment nodes, is located in CANS lab, and we have full control of it. (Note: we replaced the previously used Dell switch due to its incompatibility with ProtoGENI software. The purchase of the Cisco switch was made through another funding source other than GENI.)

At the earlier stage of the project, we spent a significant amount of time on updating the Emulab software to ProtoGENI enabled revision on the hardware platform. The PI and the student read through the documents on Emulab website and in the software package to understand the principle of operation of the software. The configuration files were modified to fit our particular network connections. We configured the DHCP server such that it will not interfere with the rest of the campus network.
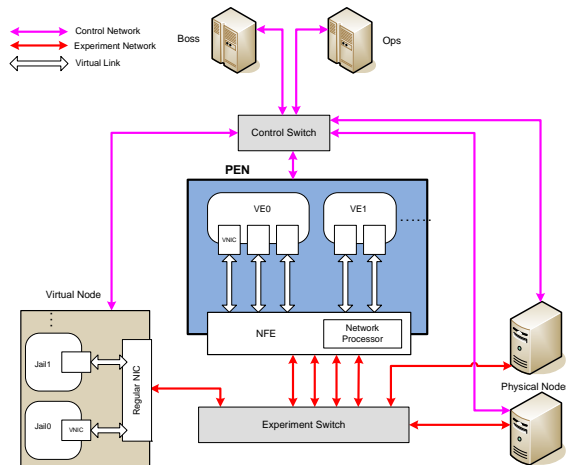
Figure 1. ProtoGENI federated site in CANS Lab at UMass Lowell.

In our recent development, we leverage the latest code of ProtoGENI to integrate our PEN prototype with ProtoGENI control framework. We make effort to understand the major scripts and programs that perform the node assignment and image loading in Emulab. We make modifications to the Emulab code base to intercept the node assignment and creation requests and assign router-type nodes to the Virtual Environments (VEs or containers) instantiated on the PEN. The modifications to the ProtoGENI code have been described in our design documents.

We have created OpenVZ templates to facilitate experiment setup. The templates contain Quagga router software for routing capability and GNU tool chain for further development.

Demos at Previous GECs

We gave demonstrations at GEC3, GEC4 and GEC5 on the operation of our PEN prototype. The demos were well received and we have started a number of collaborations since the demos.

Plan for Demonstration at GEC6:

The main goal of our demo is to demonstrate the integration of Programmable Edge Node with the ProtoGENI control framework. We will show how to request the resources from our ProtoGENI site using ProtoGENI flash interface. After being granted resources, we conduct a simple experiment and show the measurement results.

Project participants

Yan Luo, PI
Chunhui Zhang, student
Timothy Ficarra, student
Eric Murray, student
Sanping Li, student
Julie Bissell, student

Publications (individual and organizational)

Documents and source codes are published online at
http://cans.uml.edu/index.php?n=Research.PEN and GENI wiki page.

Outreach activities
Collaborations

We have been collaborating with both academic and industrial partners are GENI related projects. We are working with Profs. Jason Liu and Raju Rangaswami from Florida International University on the conduit of high-performance simulation and emulation. We are working with researchers from Orange Lab and Netronome Systems Inc on network service virtualization.

Other Contributions

The PI was invited to give a seminar talk at the Computer Science Department of UMass Boston on Nov 20, 2008. In the talk, Dr. Luo discussed about GENI and GENI's current status, and presented the programmable edge node we are currently building.

We have been attending the bi-weekly telecon of the ProtoGENI community since GEC3. We are actively collaborating with people from Utah and Georgia Tech to integrate our PEN into ProtoGENI.

The PI has engaged undergraduate students (Tim Ficarra and Eric Murray) and graduate students (Evan Zhang and Sanping Li) to GEC4 and GEC5, and gave demos of the initial integration of UMLPEN with ProtoGENI control framework. The PI has also recruited a female undergraduate student (Julie Bissell) to work on a GENI related research (virtual network embedding.)