

# GENI Quarterly Report for ViSE project April 1st, 2009 - June 30th, 2009

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## I. Major Accomplishments

The third quarter of the ViSE project includes the following major accomplishments:

- A successful demonstration at GEC4 to begin the quarter. The demonstration showed initial progress on sensor virtualization and an initial integration with the Orca (Cluster D) control framework.
- A submission of ViSE-related technology to a major conference. The submission is currently under double-blind review.
- Significant progress toward achieving our four remaining Spiral 1 milestones. These milestones include importing the latest version of Orca, using a remote Clearinghouse from RENCi (if provided), and enabling non-sliverd control of radar sensor data due August 1st, 2009, and providing a VLAN connection to Internet2 and supporting an Orca-enabled testbed due October 1st, 2009.
- Significant collaborations with, and contributions to, our Cluster D peers through numerous email exchanges, video conferences, and in-person meetings.
- Started our collaboration with the University of Puerto Rico, Mayagüez (UPRM), as part of our outreach plan.

The rest of this document describes in detail the major accomplishments above.

### I.A. Milestones Achieved

Our Statement of Work includes no major milestones in the third quarter of the project. Thus, most of the work this quarter centered on milestones to be completed in the fourth quarter. However, as a result of the Orca-fest conference call on May 28th, the GENI Project Office and Cluster D set mini-milestones that were not in the original Statement of Work. We completed one of these milestones below.

- **June 15th, 2009.** Upgrade ORCA actors to support secure SOAP messages.

We upgraded ViSE the latest version of Orca, which includes support for secure SOAP messages. As part of this mini-milestone, Brian Lynn of the DOME project and the ViSE project also setup a control plane server that will host the aggregate manager and portal servers for both the DOME and ViSE projects. This server has the DNS name `geni.cs.umass.edu`. The server includes 4 network interface cards: one connects to a gateway ViSE node on the CS department roof, one will connect to an Internet2 backbone site (via a VLAN), one connects to the public Internet, and one connects to an internal development ViSE node. The installation of `geni.cs.umass.edu` with the latest version of Orca means that we are well-prepared to transition to using a remote Clearinghouse provided by RENCi.

## I.B. Milestones in Progress

We have four remaining major milestones for Spiral 1 as listed in our Statement of Work. We detail our progress toward each below.

- **August 1st, 2009.** Contingent upon availability of reference implementation of Shirako/ORCA at 6 months, import and then integrate it into our project over the following 4 months, with a minimum of support from the RENCI/Duke group.

Since we have already setup and tested the latest implementation of Orca on `geni.cs.umass.edu`, we are well-positioned to transition to a remote Clearinghouse if provided by RENCI.

- **August 1st, 2009.** Complete sensor virtualization. Non-slivered control of radar sensor data.

We have made significant progress on Xen sensor virtualization. Our recently submitted work demonstrates the virtualization and slivering of a pan-tilt-zoom video camera within the Xen device driver framework. In this case, slivering involves interleaving camera actuations at a fine-grain between multiple VMs. This quarter we began to look at virtualizing ViSE radars in the same way. One difficulty that arose is that unlike the pan-tilt-zoom camera, the device driver for the Analog-to-Digital card that connects to the radar does not work by default in `domain-0` of Xen (i.e., the host VM). The reason is that the Analog-to-Digital card makes heavy use of DMA (since it transfers substantial amounts of data), which `domain-0` does not directly support. We are currently porting the driver to work with Xen, but this requires significant changes to the driver and, potentially, to Xen itself. Others in the Xen community are also looking similar problems related to DMA and PCI devices.

As a result, to meet this Spiral 1 milestone we are transitioning to using VServers, while we work through these problems. VServers are a less powerful, but more robust, virtualization technology in wide use. For instance, PlanetLab uses them exclusively. ViSE users, which primarily use the sensor's on each node, should not be affected by the change. We have chosen to use VServers while we work through the ADC issues with Xen because VServers allow direct access to device files from VMs, while also allowing dynamic allocation and revocation of (sensing) devices. These are pre-requisites for integrating a device with GENI. Since VServers virtualize at the OS-level, the standard device drivers for the radar's analog-to-digital card work out-of-the-box. One side-benefit of using VServers while we work through the issues with Xen is that we will develop VServer resource handlers for Orca that other groups will be able to use (if they desire). With the use of VServers we are on-track to complete this milestone by August 1st, 2009, as scheduled. Once Xen support becomes available we should be able to switch back to using Xen easily.

- **October 1st, 2009.** Contingent upon available budget, provide a VLAN connection from your testbed to the Internet2 backbone network.

We had multiple phone meetings between the GENI project office and Rick Tuthill of UMass-Amherst OIT. As a result of these conversations, we believe it is possible to get a VLAN connection from `geni.cs.umass.edu` to an Internet2 backbone site in Boston by October 1st, 2009. This VLAN connection would be used by both DOME and ViSE. We are currently working through this process. Ilija Baldine of the Orca project also introduced us to John Volbrecht of Internet2. John is interested in having a demo of ORCA using I2 as a transit provider (using I2's DCN capability). We will be coordinating with John as we bring our Internet2 connection online.

- **October 1st, 2009.** Testbed available for use within our cluster, including: hardware assembly completion, field deployment of three x86 sensor nodes, Xen node integration, integration of Shirako existing management software.

We are well-positioned given the preceding milestones to "stand up" a functioning testbed by October 1st, 2009. This testbed will allow users to request VMs across the ViSE infrastructure and control their sensors using the Orca/GENI control framework.

## **II. Deliverables Made**

The third quarter of the project includes work toward a number of deliverables. These deliverables include the ViSE demonstration and poster scheduled for GEC5 on July 20th, 2009 in Seattle. Along with Brian Lynn and Ilia Baldine, we aided in drafting documentation and code for other Cluster D projects, such as KanseiGenie, that they can use as templates for integrating their own testbed.

## **III. Description of Work Performed During Last Quarter**

The primary work during the quarter, including our Activities and Findings, centered on achieving the milestones described above and making progress toward our final quarter milestones. In addition to attending GEC4, we held monthly Cluster D group meetings via teleconference.

### **III.A. Project Participants**

The primary PI is Prashant Shenoy. Co-PIs are Michael Zink, Jim Kurose, and Deepak Ganesan. Research Staff is David Irwin. Navin Sharma, a graduate student, is also contributing to the project and is the primary author of the ViSE-related submission currently under double-blind review.

### **III.B. Publications (individual and organizational)**

We submitted our research on sensor virtualization with Xen to a major conference. The work is currently under double-blind review. We are also submitting this work as a technical report in the UMass-Amherst CS Department.

### **III.C. Outreach Activities**

We began our discussions with UPRM about integrating with their student radar testbed project. Jorge Trabal, the primary student working on the UPRM project, is located at UMass-Amherst for the summer. The testbed project at UPRM has the same origins as the ViSE testbed, and thus many of the components are the same. However, while ViSE is focused on the virtualization aspect of the testbed, the UPRM team is focused on improving the data provided by its radar. Thus, the two projects are complementary. We are discussing with Jorge the best way to leverage their improved radar data, as well as the potential for integration with ViSE in the future. We are planning a trip to UPRM in September to look at the site of their testbed and help setup point-to-point wireless links, in addition to our planned 3-day class in December or January.

### **III.D. Collaborations**

We collaborated with other Cluster D projects significantly during the quarter. First, we aided the DOME project in developing an Orca controller for DOME. We then aided in developing the documentation and template code necessary for other projects to use the DOME controller as a template for integrating their own testbeds. Additionally, we had numerous email exchanges on the Orca user mailing list about the intricacies of integration. We also setup [geni.cs.umass.edu](http://geni.cs.umass.edu) to host both the DOME and ViSE projects, and coordinated with UMass-Amherst OIT to get an Internet2 VLAN connection for both DOME and ViSE to [geni.cs.umass.edu](http://geni.cs.umass.edu). ViSE also participated in the review of GPO documents on Experiment Services and Workflow, and contributed significantly to a lengthy discussion on the control framework mailing list about the fundamental architecture of GENI.