

GENI Quarterly Report for ViSE project January 1st, 2010 - March 31st, 2010

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I. Major Accomplishments

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

- A successful intra-cluster demonstration at GEC7 that show-cased ViSE sensor data streaming over a dynamically stitched VLAN through NLR and BEN to servers at RENCi using the Orca control framework. The demonstration was presented at a plenary session of GEC7. To complete this demonstration, we worked with the GPO in Boston, Joe Mambretti at the Starlight facility, Ilia Baldine at RENCi, and Jeff Chase at Duke University.
- We had two papers on ViSE-related technology accepted to major research conferences. First, we will present our paper “Towards a Virtualized Sensing Environment” that describes ViSE’s integration with Orca and GENI at TridentCom 2010 in Berlin, Germany. Second, we will present our paper “Cloudy Computing: Leveraging Weather Forecasts in Energy Harvesting Sensor Systems” that describes how ViSE—or other GENI-like testbed facilities—could operate off harvested energy at SECON 2010.
- The successful completion of sixth quarter milestones and significant progress toward early milestones in the seventh quarter. The completed milestones include installation of x86 sensor node by 1/1/2010, installation of cameras by 3/16/2010, integration of virtualization by 3/16/2010, import of Orca version 2.1 by 3/16/2010, and demonstration of control of VLAN connections by 3/16/2010. We are well-positioned to complete our major seventh quarter milestones, including using our testbed to demo an experiment with another testbed.
- Continued our collaboration with the University of Puerto Rico, Mayagüez (UPRM), as part of our outreach plan. In mid-January Michael Zink and David Irwin organized and led a 3-day seminar at UPRM on GENI, virtualization, and sensor networks. We also collaborated with our colleagues at UPRM about their own radar testbed. Further, we are currently pursuing layer 2 connectivity from UMass, Duke, and other cluster D sites with UPRM in Mayaguez, Puerto Rico, through Florida International in Miami and the Puerto Rico High Performance Computing Center in San Juan.
- Significant collaborations with, and contributions to, our Cluster D peers through numerous email exchanges, video conferences, and in-person meetings.

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

I.A. Milestones Achieved

Our Statement of Work includes 5 major milestones in the sixth quarter of the project. We summarize these milestone completions below.

- Best-effort installation of Pelham tower x86 sensor node (note: funded from other sources), to include meteorological sensors, radar (if licensed), communications, computing. No camera. If Pelham node is problematic, optional rapidly-deployed node replaces Pelham node. (1/1/10).

We have deferred the deployment of our Pelham node until the Spring or Summer when the Pelham fire tower is accessible. As detailed in our milestone, we have a rapidly-deployable node in ViSE in place of the Pelham node. The rapidly deployable node is a replica of our other nodes, but is portable and not installed at a fixed location.

- Installation and virtualization of camera devices on CSB and MA1 tower nodes. (3/16/10, GEC7)

We have installed Sony SNC-RZ50N pan-tilt-zoom cameras at each ViSE node location, as well as for our rapidly deployable node.

- Integration of virtualization/slivering in testbed. (3/16/10, GEC7)

We have ported our original implementation of sensor virtualization from Xen to vservers to allow its use in our testbed. The modifications have been added to our SVN repository, and we now support both Xen and vservers.

- Update experiment control framework (ECF), based upon updated reference software, provided by RENCI/Duke group at 2/1/10, and integrate new features as needed. (3/16/10, GEC7)

As part of our demonstration for GEC7, we were the first group in Cluster D to port their experiment controller to Orca's new Bella 2.0 release, which includes a new substrate API. We demonstrated this integration at GEC7.

- Demonstrate control of VLAN connections from ViSE testbed to backbone network, contingent upon availability of transport by backbone network. (3/16/10, GEC7)

We demonstrated control of VLAN connections as part of our plenary demonstration at GEC7.

I.B. Milestones in Progress

We have three major milestones for the next quarter. We summarize our progress towards these milestones below.

- Import extended ORCA v2.2 (Due 07/20/10)

We are tracking the Orca releases and updating our portal software as necessary to incorporate their latest features, as evidenced by our import of Orca's Bella 2.0 release.

- Allocation policy for sensors (Due 07/20/10)

We begun writing an allocation policy for our sensors that supports Orca's new substrate API. This policy will support advanced reservations, queuing support, as well as the ability to request resources from multiple testbeds.

- Demo experiment with another testbed (Due 07/20/10)

Our GEC7 demonstrated initial support for coordinated allocation of resources at multiple testbeds. We are submitting a demo proposal as part of the GPO's call for demos on April 1st that describes a more in-depth extension of this initial demonstration.

II. Deliverables Made

The primary deliverable of this quarter was the demonstration code at GEC7. Our code for virtualizing sensors has been released. We also have the materials for the GENI Seminar we conducted in Puerto Rico in mid-January. We also sent documentation on how to port controllers to Orca's Bella release on the cluster-wide mailing list.

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 next quarter milestones. In addition to attending GEC7, we held bi-weekly 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.

III.B. Publications (individual and organizational)

Cloudy Computing: Leveraging Weather Forecasts in Energy Harvesting Sensor Networks. Navin Sharma, Jeremy Gummeson, David Irwin, and Prashant Shenoy. In SECON, Boston, MA, June, 2010.

Towards a Virtualized Sensing Environment. David Irwin, Navin Sharma, Prashant Shenoy, and Michael Zink. In TridentCom, Berlin, Germany, May, 2010.

III.C. Outreach Activities

As part of our involvement in the GENI project, we scheduled a seminar at the University of Puerto Rico, Mayaguez in early January. The primary purpose of the seminar was to teach students at UPRM about emerging technologies in virtualization, wireless communication, networking, and sensing that make it possible to multiplex experimental testbeds, such as those being incorporated into the GENI prototype. Over the workshop's two days Michael Zink and David Irwin gave lectures and tutorials on virtualization, the GENI project, wireless communication, research efforts at UMass-Amherst, and cloud computing. A full agenda for the workshop is in the subsequent section.

The secondary purpose of the seminar was to have discussions with the UPRM faculty and students about the ViSE testbed they are deploying around Mayaguez. While the Massachusetts ViSE testbed is still primarily based on the modified RayMarine RD424 radar, the UPRM faculty and students have developed a Faruna radar that initial work shows is better suited to weather sensing than the RayMarine in use in Massachusetts. We are exploring whether to upgrade the radar used by the ViSE nodes to the Faruna model in use at UPRM. We also inspected the UPRM radar sites, as well as the wireless communication links using directional antenna to assess their suitability for use in a deployment. The seminar was mutually beneficial to both the UMass-Amherst team and the UPRM team.

Additionally, both the UPRM and UMass-Amherst teams met with Israel Matos, the lead meteorologist at the National Weather Service in San Juan. The goal of the meeting was to show the NWS staff the progress of the Test Bed and see how we can bring them on board and get their support.

Workshop Participants

UPRM Faculty: Professor Colom and Professor Cruz

UPRM Students: Gianni Pablos, Jose Ortiz, Wilson Castellanos

CSU Students: Dilum Bandara

UMass-Amherst Faculty and Staff: Michael Zink and David Irwin

UMass-Amherst Students: Jorge Trabal

Seminar Agenda

Tuesday January 12, 2010

- Meeting at 2pm at NWS headquarters in San Juan, Puerto Rico



Figure 1: A photo of the participants of the GENI workshop we gave at UPRM.

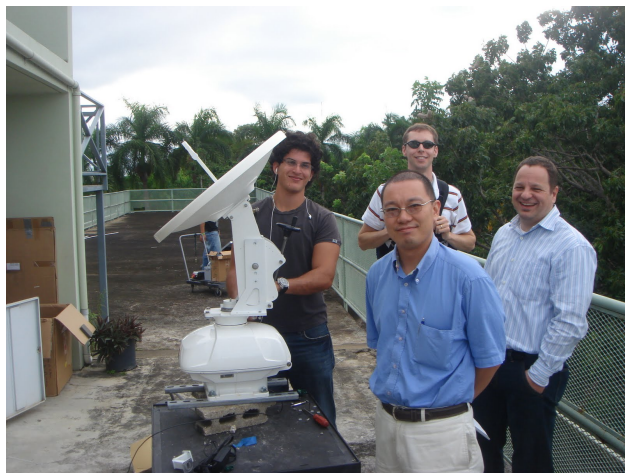


Figure 2: On the roof of UPRM's engineering building where one of their radar nodes is deployed.

Wednesday January 13, 2010

- Welcome and remarks (Jorge Trabal and Prof. Colom)
- Progress with the OTG radar (Gianni Pablos)
- Wireless point-to-point link setup (Jose Ortiz and Wilson Castellanos)
- MA test bed wireless network link architecture and network considerations (Prof. Zink and Dr. Irwin)
- Wireless sensor networks QoS, routing and energy-balanced algorithms, distributed processing (Dilum Bandara CSU)
- Lunch break (1 Hour)
- Discussion and plans regarding the implementation of the radars ad-hoc wireless communication for the student OTG test bed radar network (All)
- OTG radar demo and demonstration (Gianni Pablos and Jose Ortiz)

- Concluding remarks
- Thursday January 14, 2010 (meeting tentative start time 10 am)
- A general overview of the GENI initiative (1 hour)
- Overview on SRCP, MultiSense, and energy harvesting, and how it relates to our testbed. (1-2 hours)
- Lunch break (1 Hour)
- Lecture on Operating System Virtualization, including tutorials on Xen, VMware, and VServers. (1 hour)
- Cloud Computing, tutorial on Amazon's EC2, EBS, and S3 and discussion on storage virtualization technologies. (1 hour)
- Friday January 15, 2010 (meeting tentative start time 10 am)
- Network Virtualization techniques, including VLANs and VPNs. How we are integrating with NLR and Internet2. (1 hour)
- Wireless Communications. (1 hour)

III.D. Collaborations

We collaborated with other Cluster D projects significantly during the quarter. First, we provided documentation on the Cluster D mailing list about how to port controllers to the new Bella release. Second, we worked with the GPO, RENCI, Duke, and Northwestern to arrange for the VLAN control in the GEC7 demonstration. Further, we are in discussions with colleagues at Florida International, the Puerto Rico High Performance Computing Center, and UPRM to check the feasibility of getting a layer two network link to UPRM.