GENI Quarterly Report for ViSE project
October 1st, 2008 - December 31st, 2008

I. Major accomplishments

In the first quarter of the ViSE project we accomplished our initial set of bootstrapping milestones and began work on the software and hardware infrastructure to complete future milestones. We first provide details relating to the work behind achieving the two 1st quarter milestones below.

I.A. Milestones achieved

[1a] Assembly of three x86 sensor nodes. (2mo) Note: No budget allocated for hardware development, which will be funded from other sources as needed. They are deployed on the CS Building, UMass MA2 Tower, and Mount Toby, and are network accessible. Also includes deployment of the RayMarine radars at the three locations. (December 1st). Completed.

Milestone 1a was more challenging than anticipated due to the departure of a key staff member (Brian Donovan) prior to the subcontract's start date. Brian's primary project focus had been construction, integration, and maintenance of three modified RayMarine radars, one of three ViSE sensors with a "rich" set of programmable actuators. As a result, other staff members learned both the software interface to the radar (e.g., through an Adlink Data Acquisition Card and USB-to-PIC) as well as the details of radar to the ViSE hardware platform (e.g., programmable PIC for radar control, data and control connections, power and battery connections). While the learning curve had not been planned for the 1st quarter, the results should ease the completion of future milestones since much of the radar control software will have to be modified to complete future milestones 1f and 1h in the fourth quarter of Spiral 1.

Milestone 1a also required reconstructing nodes from a previous project (the Off-the-Grid radar project) to accommodate the anticipated sharing and "deeply programmable" nature of GENI. The modifications to the hardware platform were primarily the addition of a more robust computing platform, two additional sensors called for by ViSE, and a cellular backplane for out-of-band Operations and Management connections. The computing platform includes a processor capable of running the Xen Virtual Machine Monitor, which we will use to sliver node resources by allocating resources to virtual machines created on-demand for user slices. The platform also includes a processor with a higher clock-speed than the previous one (1.86Ghz) and more memory (2GB) and storage (32GB Flash). ViSE adds both a weather station and a Pan-Tilt-Zoom video camera to the sensor nodes in addition to the RayMarine radar. Finally, our previous experiences managing partially inaccessible node deployments motivated our integration of a cellular backplane. We connected each main node to a Linux Gumstix Embedded node with a connection to a commerical cellular network using a serial GPRS modem. The Linux Gumstix includes both serial connections (for remote consoles) and wired

Ethernet connections to the main node and is capable of powering the main node using Wake-On-Lan. At present, we are prototyping this backplane functionality on just the CS Building ViSE node, but have found it useful thus far.

In addition to deploying these nodes, we have also set up a testing environment in our lab with an identical node and sensors attached, including a deconstructed (and non-radiating) radar for testing. The testing environment will prove useful for future software development (Milestons 1f and 1g). Finally, we documented each component of the hardware platform for the GENI Substrate Catalog and forwarded it to John Jacobs at his request.

[1b] Field deployment of three sensor nodes; native non-virtualized drivers; software testing. (January 1st). Completed.

We have field deployed the nodes constructed in milestone 1b, and installed a base image that includes the 3.2 version of Xen as well as the appropriate drivers for each sensing device and wireless/wired card. Since the driver for the PCI9812 Adlink Data Acquisition Card did not run under recent versions of XenLinux (2.6.18) we modified the source of the driver to support these; additionally, we obtained the most recent driver from Adlink under a new NDA and are currently testing its compatibility with Xen in the lab. Additionally, since the development of the base image is a tedious process we heavily documented it on the ViSE Trac Web Site (http://vise.cs.umass.edu).
The documentation should prove useful to both the project, by preventing unnecessary work in replicating configurations/images, and users, by providing a detailed description of the node's foundational software layer (similar, in principle, to the Substrate Catalog for documenting GENI hardware). Additionally, we also set up an initial Trac web site and SVN repository for ViSE related software. The initial import into the SVN repository includes the drivers and firmware for the radar and a framework for developing Xen-compatible device drivers for each sensing device. In addition to installing the base image we have codified and documented appropriate settings for the wireless network card to communicate over long distances via 802.11b.

I.B Milestones in Progress

The next major milestone for ViSE Spiral 1 is 1b: Initial Shirako/ORCA integration. Xen and Shirako software running on three sensor nodes, non-slivered, no radar control via Xen by February 1st. We are well-positioned to complete this milestone at the present time. We have a test deployment of Orca running in our lab, and the base software image completed for Milestone 1b is compatible with Orca's existing framework for creating and managing slices of Xen VMs. One minor modification to Orca is also necessary to complete the milestone since Orca's existing codebase assumes a fully connected topology (i.e., the management authority server assumes connectivity to any nodes in the physical substrate). Since our wireless mesh does not adhere to this assumption, we require a mechanism for the management authority to communicate with interior mesh nodes. Our initial plan is to augment Orca node managers to forward messages (at the

application-level) from the management authority into the mesh using pre-configured static routing tables.

Work for subsquent milestones is also underway. Milestone 1d is a demo at GEC4. We plan to demo both the Orca control framework on ViSE, as well as the capabilities of radar actuation. We have also begun development of Xen drivers (Milestone 1f and 1h) for the Camera, Weather Station, and radar sensors. We hope to use the same basic framework for each sensor, and, since both the Camera and Weather Station interfaces are well-documented, we are focusing on these two sensors in the initial stages of the development, while working on the radar in parallel.

II. Deliverables made

The first quarter of the project resulted in three primary deliverables: the ViSE chapter of the GENI Substrate Catalog, the ViSE presentation and poster at GEC4, and the ViSE Trac website and SVN repository for posting software and documentation. Details on the completion of these milestones is provided in the previous section.

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. In addition to attending GEC4, we held monthly Cluster D group meetings via teleconference. The first meeting centered on inding out about each project's goals and substrate characteristics. The second meeting focused on coordinating for GEC4, while the third meeting included a demo of the Orca control framework and a discussion of how each project fits into that framework. In addition, one of our research staff sat in on a teleconference for demonstrating the Orca control framework to BBN staff, and provided input on how Orca may integrate with ViSE as well as other Cluster D projects.

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.

III.B. Publications (individual and organizational)

No publications resulted from the 1st quarter of work; we are preparing work related to the actuator virtualization in ViSE for submission in the next quarter. Once completed, this document will be publicly posted on the ViSE Trac website as a UMASS technical report.

III.C. Outreach activities

In the first quarter we had no significant outreach activities.
However, during the summer we held a seminar for REU Undergraduate

Students on the construction of ViSE nodes and sensors.

III.D. Collaborations

We have been working closely with the DOME project in our cluster at UMass and with the Orca-BEN project at Duke. We are planning to integrate the Orca control framework before their official release data 6 months into Spiral 1, and, as noted above, envision only minor obstacles to completion. Additionally, we aided DOME in setting up a pre-release of the Orca control framework to experiment with before an official release. Finally, at GEC3 we discussed integration with the Kansei project at Ohio St.