GENI: Slivers and Slices in a Diverse, Outdoor, Mobile Network Environment (DOME) Testbed

Milestone 1a Status and Documentation

(Revision 1.0, December 4, 2008)

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Overview

This purpose of this document is to summarize the hardware that will be used in the DOME GENI testbed. It also provides the status of DOME Milestone 1a: deploying the required hardware on the buses. This document is intended to fulfill the DOME GENI Milestone 1a documentation requirement.

Status

To support DOME for GENI, two major hardware upgrades to the testbed were required. The first upgrade was to replace the 802.11b USB WiFi dongles, based on a Prisms2 chipset, with an 802.11abg Mini PCI card based on the Atheros AR5413 chipset. This has been completed using Compex WLM54AGP23 WiFi cards. We have also worked with the UMass IT department and the Town of Amherst to ensure continued use of the UMass WiFi network and the Amherst Town WiFi mesh via the new cards. The benefits of this hardware upgrade are: the device can be isolated and accessed in a Xen VM through PCI virtualization; higher throughput using 802.11g versus 802.11b; the addition of 802.11a support; the PCI cards are more reliable than the USB dongles; and the support of a current, widely-used chipset with a large development community and feature-rich (madwifi) driver.

The second upgrade was to migrate the RS232/serial port MultiTech GPRS modems to a 3G solution. We have worked with our cellular service provider to switch to a 3G data plan, and we have acquired Sierra 881U USB modems. The benefit of 3G over GPRS is greater throughput, which is important since the 3G link is the backbone of the experimental control plane. We are currently quantifying the bandwidth improvements of 3G versus GPRS.

All hardware has been installed and deployed on the UMass transit buses. This also required an upgrade of the Linux operating system, and we have re-imaged all hard drives on the buses. Our GENI development system, which will provide the next-generation image for our computers, also supports the new hardware.

Additionally, the new hardware introduced a slightly different antenna configuration on the Gillig buses (there are two bus vendors, requiring separate hardware placement configurations). We have repositioned antennas on all of the Gillig buses.

Hardware

This section summarizes the hardware installed on each of the buses. This also defines the hardware that would be required to reproduce a DOME node for sandbox testing of GENI experiments.

Computer

We use systems with a CI852A motherboard. We have deployed the Hacom OpenBrick-E Intel Celeron-M 1GHz CI852A-4RN10 systems on the buses. Hacom has started to end-of-life these systems, and instead offers the Lex Neo Intel Celeron-M system. These systems use the same motherboard, but have a different case permitting faster (hotter) CPUs. We have verified the Lex Neo with the DOME software. Each computer has:

- CI852A motherboard
    - 400 MHz FSB
    - Intel 82852GM chipset
    - 5 USB (2+2+1) on the OpenBrick, 4 USB (2+2) on the Neo
    - 4 100Mb LAN ports
    - Mini PCI slot
    - Serial port
    - IDE (1 x 40 and 1 x 44 pins)
    - Compact Flash slot
- 1 GHz Intel Celeron M processor
- 1 GB memory (DDR 400)
- 60 GB IDE hard drive

WiFi

Every computer has a Compex WLM54AGP23 Mini PCI WiFi card. This uses the Atheros AR5413 chipset. GENI experiments will have full access to the WiFi card, and by default it will be configured to use the madwifi driver. The driver is very flexible and supports both client and AP configurations. We attach external antennas to these devices. This requires a U.FL to reverse SMA antenna cable. The antenna is a standard WiFi reverse SMA antenna.

There is also a WiFi access point connected to each computer via a LAN port. The AP allows for WiFi connections into the computer. We use off-the-rack APs by various vendors. Examples include the Netgear WGR614, Linksys WRT54GC and Airlink 101 AR335W.

3G Modem

Each bus has a Sierra 881U 3G USB modem. The cellular link is used as the control plane, and it is shared between the VM executing GENI experiments and domain 0. Guest domains will have their eth0 traffic routed though the 3G modem.

Our cellular provider is AT&T. They have a soft cap of 5 GB/month on their 3G service.

Sierra has recently announced plans to end-of-life the 881U. The replacement modem, the Sierra Compass, uses the same driver as the 881U.

GPS Device

Each system has a Deluo USB GPS device attached to it. We use the open source gpsd GPS daemon to share the device with the Xen virtual machine. A benefit of gpsd is that it hides the particulars of the GPS hardware from users.

900 MHz Radios

The buses are equipped with Digi (previously known as MaxSteam) XTend USB RF modems that operate at the proprietary 900MHz frequency. Support for these modems are a Year 2 deliverable.

Bus-Specific Hardware

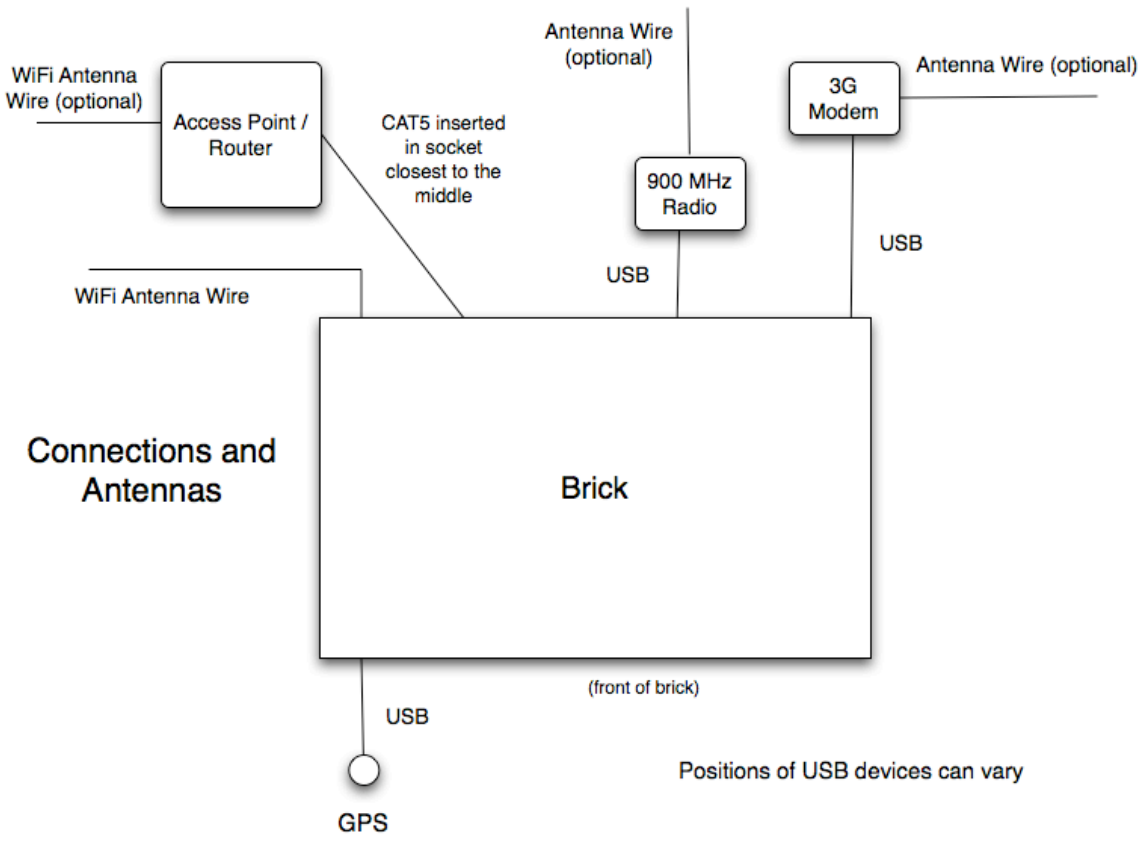
We have a couple components that are specific to our environment; they are not required to build a DOME system for sandbox development. They are:

- Power transformer for converting the bus's 24V DC battery output to 120V AC to power the computer and peripherals.
- Proprietary UMass microcontroller that we have developed to simulate pressing the power-on button when the buses provide power. We have found the computer's BIOS power-on state to be unreliable.

We also make use of external antennas on the Gillig buses. The mini PCI WiFi cards, APs and XTend radios all use reverse polarity SMP connections. The Sierra 881U USB modems use an SSMB connector.

Hardware Installation

The following diagram illustrates the hardware as installed on the UMass buses.


Antenna Wire
(optional)
WiFi Antenna
Wire (optional)
Access Point /
Router
CAT5 inserted
in socket
closest to the
middle
3G
Modem
Antenna Wire (optional)
900 MHz
Radio
USB
USB
WiFi Antenna Wire
Connections and
Antennas
Brick
(front of brick)
USB
GPS
Positions of USB devices can vary