

### Background and Motivation

GENI WiMAX is to leverage a commercial IEEE 802.16e WiMAX base station product to prototype an open, programmable and virtualizable base station node that could work over a metropolitan area and connect with off-the-shelf WiMAX handsets and data cards. Clemson is funded to build testbed of GENI WiMAX and research for handover solutions of GENI WiMAX.

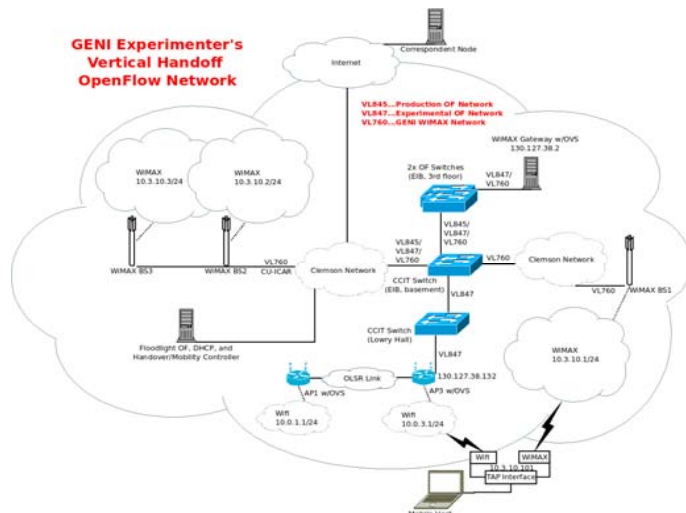


Figure 1

We have deployed GENI WiMAX Base Stations(BS) at Clemson main campus and the CU-ICAR campus in Greenville. The network topology is shown in Figure 1.

Two types of handover are considered:

- 1) Seamless handover from BS-to-BS in overlapped coverage area. (Using the two BS in the CU-ICAR campus).
- 2) BS-to-BS handover if they are far apart. (Clemson campus <-> CU-ICAR campus).

### Implementation Details

Client side can be any Linux based mobile device with SDN support.

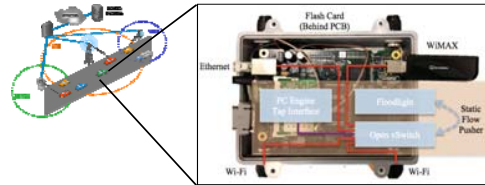


Figure 2

SDN techniques are adopted to enable transparent and efficient handover. The basic principle is to dynamically insert flows on switches to build paths for client packets so that they can be forwarded through the desired network interface.

Figure [3] demonstrates the overall structure of the handover scheme. Whenever the client triggers the handover, flows are written or removed on related switches to ensure seamless transition.

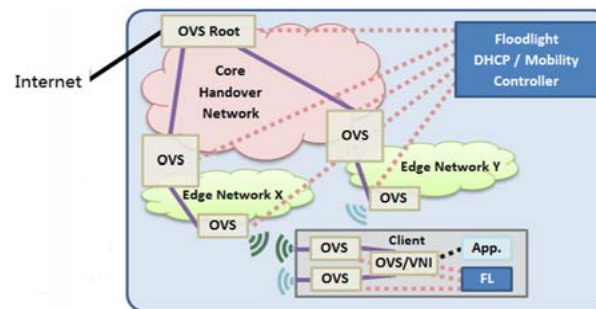


Figure 3

ORBIT Management Framework (OMF) is an open framework for resource management, experiment control, and measurement framework to support experiments across heterogeneous testbed resources. We are using this technique to enable outside experimenters to use our handover testbed.

### Demo Configuration & Results

The demo consists of a WiFi-WiFi handover between two AP's. A root Linux machine runs an instance of the floodlight controller and oversees the entire handover process. The network topology is shown in Figure[4].

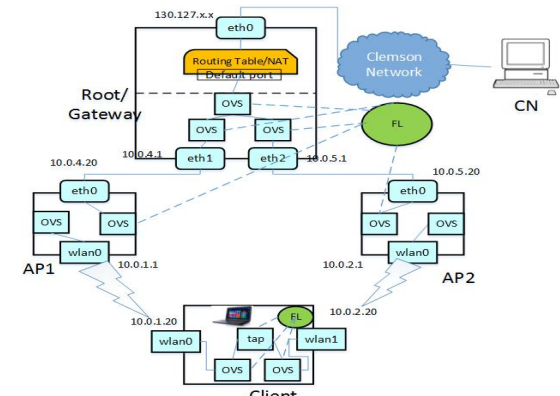


Figure 4

Figure [5] visualizes the inter-packet arrival times observed at the iperf transmission side. Huge spikes represent a handover.

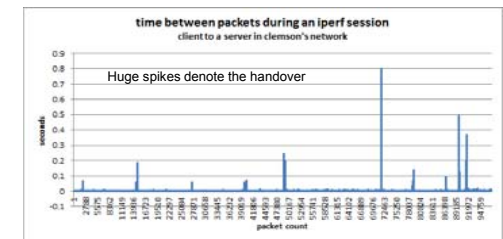


Figure 5

### Future Work

We have deployed GENI WiMAX at Clemson, and developed a SDN based handover solution for it. Our past demos have demonstrated its functionalities. The future work involves packaging the solution, and test it on school bus once we got our WiMAX BSs problems fixed.