

Clemson OpenFlow Trials

Glenn Evans, Jr., Sajindra Pradhananga, Aaron Rosen, Bob Strecansky, Bradley Collins Patrick Baxter, Ryan Izard, Kuang-Ching Wang, Jim Pepin, Dan Schmiedt



Project Scope

- OpenFlow Ethernet switches for campus buildings
- OpenFlow wireless access points along campus roads - Support for mesh networking and vehicle handoff
- Integration with campus Network Operations Center
- Participation in inter-campus OpenFlow trials

Current OpenFlow Network in ECE Wireless Lab Allocated DHCP 10 - 30DHCP Serve AP 1 AP 2 60.98 / 62.2 62.3 62.4 7 28 26 27 Toroki – 60.99 46 (6633) Non-OF 60,107 **VLAN 855 VLAN 498** FlowVisc 148 60.101 2 24 OpenRoads NOX Cisco 2970 PlanetI ab 1 60,100 60 106 / 110 **VLAN 498** Production OpenFlow Subnet: 130.127.60.96 / 27 Gateway: 130.127.60.97 VLAN Trunk mental OpenFlow Subnet 130,127,62,0 / 27 Gateway Clemson 130,127,62,1 Network

- Same setup will be replicated in other buildings/closets
- Except Cisco 2970 switch (used only in lab to expedite trial VLAN/subnet configurations)
- Currently used for OpenFlow team's daily Internet access
- More opt-in users will be added once network is stable

Motivation

- Establish Clemson-GENI connectivity
- Enable programmable wired/wireless network research
 - Vehicular networks, mesh networks, network security
- Provide network operation tools and policies for research and education use of campus network

Future Network across ECE/CS Buildings and Projects

iTiger Man Satellite Hybrid Stadium Wi-Fi (93) (93 **ECE Security/Architecture** CS Wireless Labs -WiMAX/sensor network/ mobile applications **ECE Wireless Labs** -**CU** Police mobile and mesh networks, Surveillance Mesh cognitive/software defined radio Map data ©2010 Google - Terms of Use 🗗 🕞

- Next step deployment will span three ECE/CS buildings and potentially a few major networking project sites
- ECE wireless, security, architecture, and p2p labs
- CS wireless and sensor labs
- Police video mesh and iTiger stadium Wi-Fi projects







Clemson OpenFlow Trials

Glenn Evans, Jr., Sajindra Pradhananga, Aaron Rosen, Bob Strecansky, Bradley Collins Patrick Baxter, Ryan Izard, Kuang-Ching Wang, Jim Pepin, Dan Schmiedt



Demo Components	
Hardware	Software
 Toroki LightSwitch 4810[®] 2 PC Engine access points 5 dell servers 2 Laptop clients 	 Flowvisor – v 0.4 SNAC – v 0.4 OpenRoads – v 0.4 ENVI/LAVI – latest from git

Demo Overview

- Two clients connect to different APs and begin Skype Internetbased video conferencing session.
- Clients move along the red path, each starting from one end and ending at the other end.
- Shell script at each client initiates handoff when current AP signal strength becomes lower than the other AP.

Connectivity Graph During Demo

OpenFlow-Enabled Functionality

- Flowvisor Two slices ٠
 - **OpenFlow Production**
 - 130.127.60.96/27 subnet
 - SNAC controller ٠
 - **OpenFlow Experimental**

Access Point 2

- 130.127.62.0/27 subnet
- **OpenRoads** controller
- Flowvisor slices AP traffic from other network traffic
- OpenFlow's potential use for wireless research in our group:
 - Measurement and control of mesh network traffic
 - Handoff control for vehicle clients across mesh APs

Demo Track

Infrastructure wireless network optimization

Expected area of handoff

Video streaming QoS control







This GENI project is sponsored by National Science Foundation via grant CNS-0944089