

# OpenFlow Campus Trials at Indiana University Quarterly Report

**3/1/2010-6/30/2010**

**Christopher Small – Principal Investigator**

**Matthew Davy – Co-Principal Investigator**

**Dave Jent – Co-Principal Investigator**

## **Summary**

- *Deployment OpenFlow 1.0 code in Production and Testlab switches*
- *20 Engineering Staff using OpenFlow*
- *OpenFlow SSID deployed to 6 campus buildings*
- *Connectivity to NLR OpenFlow network*
- *Multiple campus deployment with switches at IU Bloomington and IUPUI*

## **Major Accomplishments**

### **Deliverables Made**

OpenFlow 1.0 Deployment: We have installed OpenFlow 1.0 switch firmware on all switches and deployed NOX and SNAC controllers that support the OpenFlow 1.0 code.

Production deployments: 20 members of the IU GlobalNOC Engineering staff are currently on OpenFlow switches for production use. Multiple switches (HP 5406 switches have been converted to use OpenFlow and deployed. Traffic is controlled on the production VLANs by SNAC with separated controllers than used by Testlab switches.

Wireless deployment: We have deployed an OpenFlow SSID to 6 campus buildings including the campus IT office complex (Wruble Computing Center and Telecommunications Building), the Computer Science building (Lindley), the Innovation Center, and Informatics buildings (Informatics East and West). This SSID routes all traffic through an OpenFlow capable switch in the Bloomington Data Center.

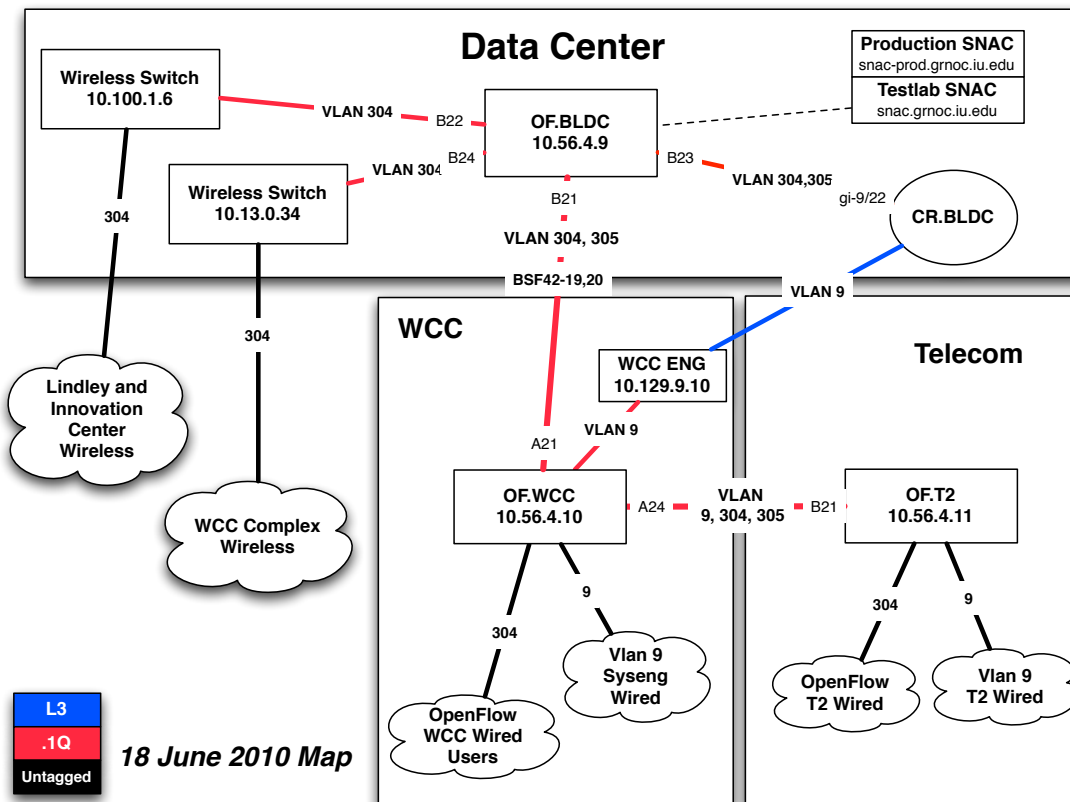
Initial wide area connectivity: We have deployed Layer 2 connectivity between CIC OpenFlow and the Indiana Gigapop. This will allow testing to any device reachable through the NLR dynamic provisioning service using the Sherpa dynamic provisioning tool.

Multiple campus deployments: 8 Switches have been deployed. 4 switches in the Bloomington testlab. 3 Production switches in Bloomington and a switch in Indianapolis (IUPUI machine room).

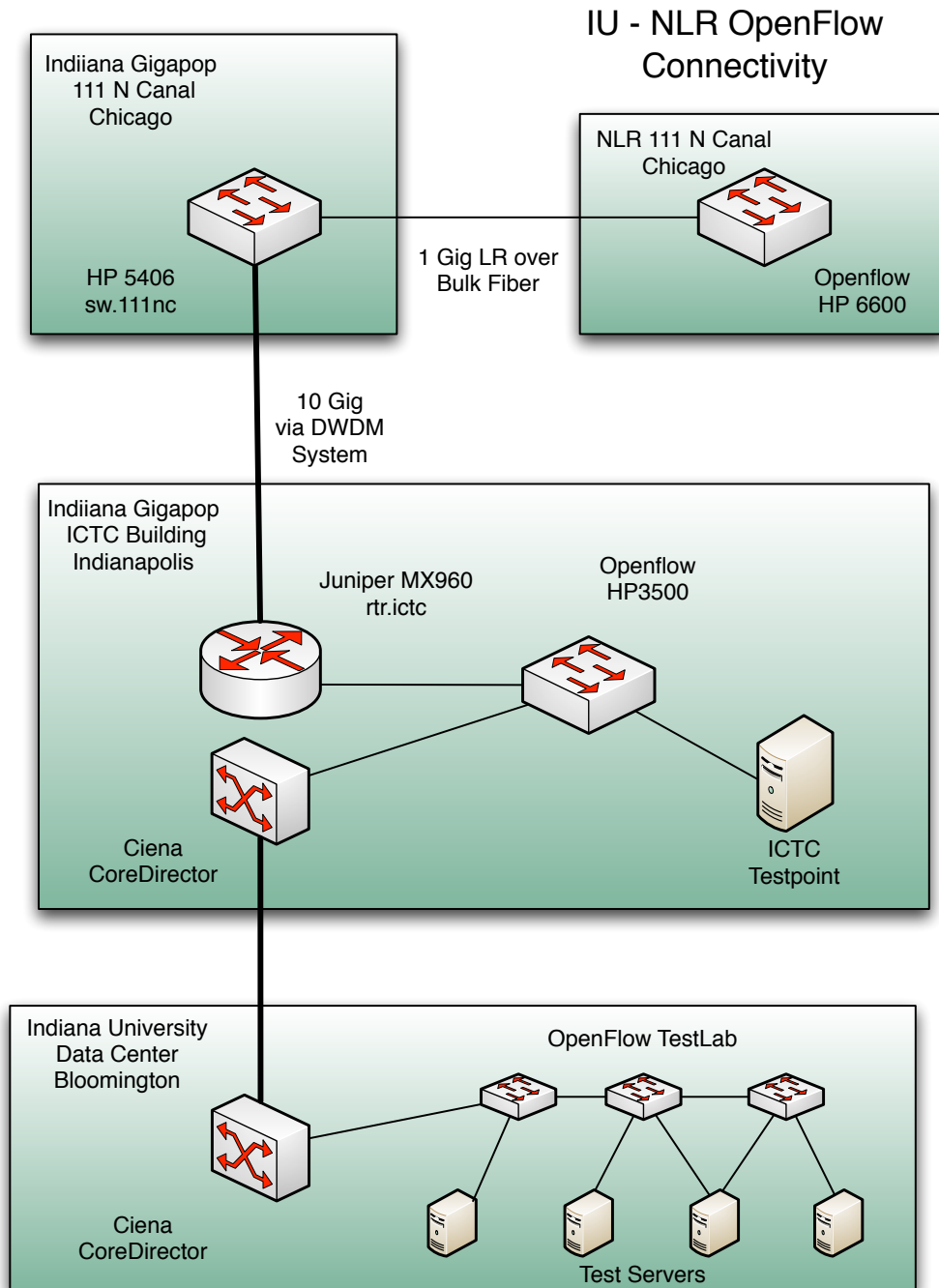
## Description of Work Performed During Last Quarter

### Activities and Findings

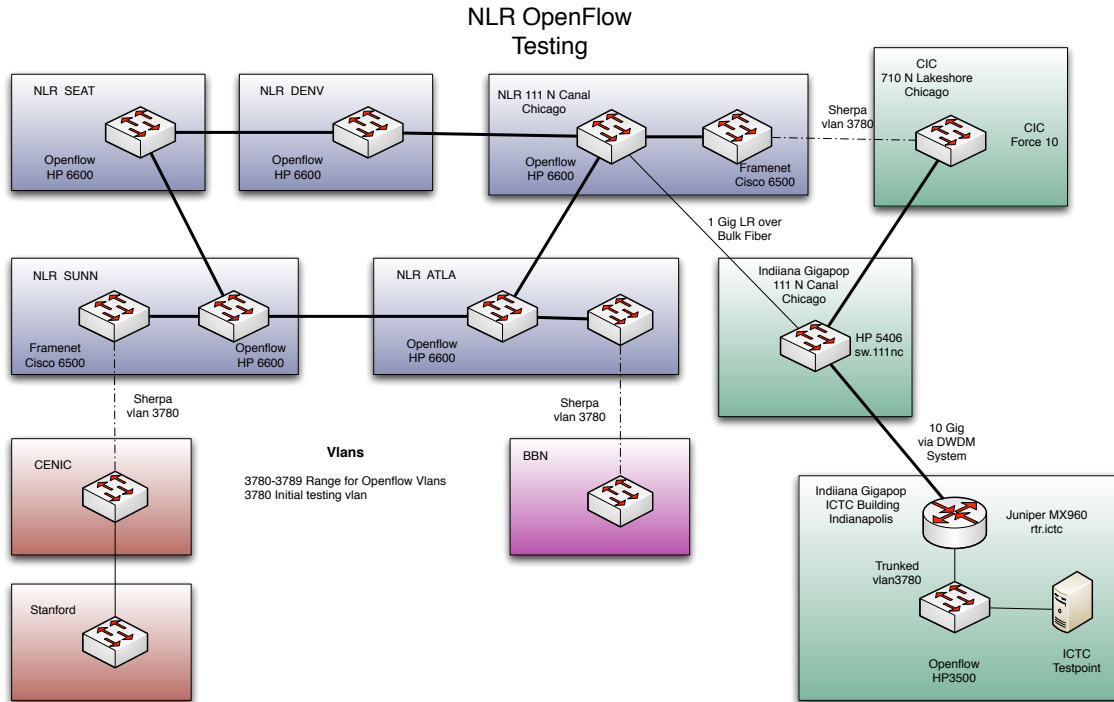
Bloomington Production Deployment: Diagram of current production deployment



Wide Area Connectivity: Equipment has been deployed to enable Layer 2 connectivity to the OpenFlow capable equipment deployed in the national backbones. Connectivity to other campus deployment can also be accomplished with Sherpa connections across OpenFlow.



A possible testing configuration using the NLR OpenFlow deployment equipment. Some of this deployment may be used in an IU OpenFlow GEC8 demo.



## Project Participants

During this time, key participants in the OpenFlow campus trial included:

Chris Small, PI  
 Matt Davy, Co-PI  
 Ed Furia  
 Camilo Viecco  
 Ian Bobbitt

## Publications & Documents

Davy, M, Small, C, . *Scaling Network Infrastructure: using OpenFlow in the Wide Area Network* GENI Experimenters Workshop White Paper Jun 29-30

[http://groups.geni.net/geni/attachment/wiki/OFIU/GRNOC\\_security\\_informatics.pdf](http://groups.geni.net/geni/attachment/wiki/OFIU/GRNOC_security_informatics.pdf)

## GENI Documents:

None

## **Outreach Activities**

Discussed outreach activities at Indiana University to introduce OpenFlow instruction into the “Internet Services and Protocols” course.

## ***Collaborations***

Worked with James P.G. Sterbenz (Univ of Kansas) to incorporate GpENI clusters with OpenFlow enabled switches. Integrated IU GpENI cluster and OpenFlow switches.

Worked with Sanjay Rao (Purdue U.) on how to allow access to OpenFlow resources to researchers at Purdue. Also discussed plans to interconnect resources if OpenFlow enabled networks are deployed at the Purdue West Lafayette campus.

Worked with Martin Swany (U of Delaware) and the LAMP project on tools that can be used in conjunction with OpenFlow networks.

Discussion with Nick Feamster (Georgia Tech) about a BGPmux deployment at IU that can be integrated into router experiments that utilize the OpenFlow GENI Meso-Scale deployments.

Integration of OpenFlow statistics and topology into the GENI Meta-Operational Center database schema and visualization tools

## ***Planned Activities for Q3***

Demo at GEC 8: Conduct a demo highlighting interconnectivity and integration of various GENI components and the IU OpenFlow deployment.

Deployment of Openvswitch layer 3 testing: Continue testing of Openvswitch to facilitate OpenFlow connectivity for locations that cannot get Layer 2 connections

Measurement and Visualization: Additional tools to measure and visualize statistics obtained from the OpenFlow switches.

Operational tool integration: We will survey existing operational tools and write a document describing an initial design for integration of OpenFlow software into monitoring and administrative interfaces used by IU Campus Operations.

.