Campus Testbed for Network Management and Operations

Nick Feamster
Georgia Tech

Joint with Ankur Nayak, Russ Clark, Ron Hutchins, Campus OIT
Also input from Wenke Lee

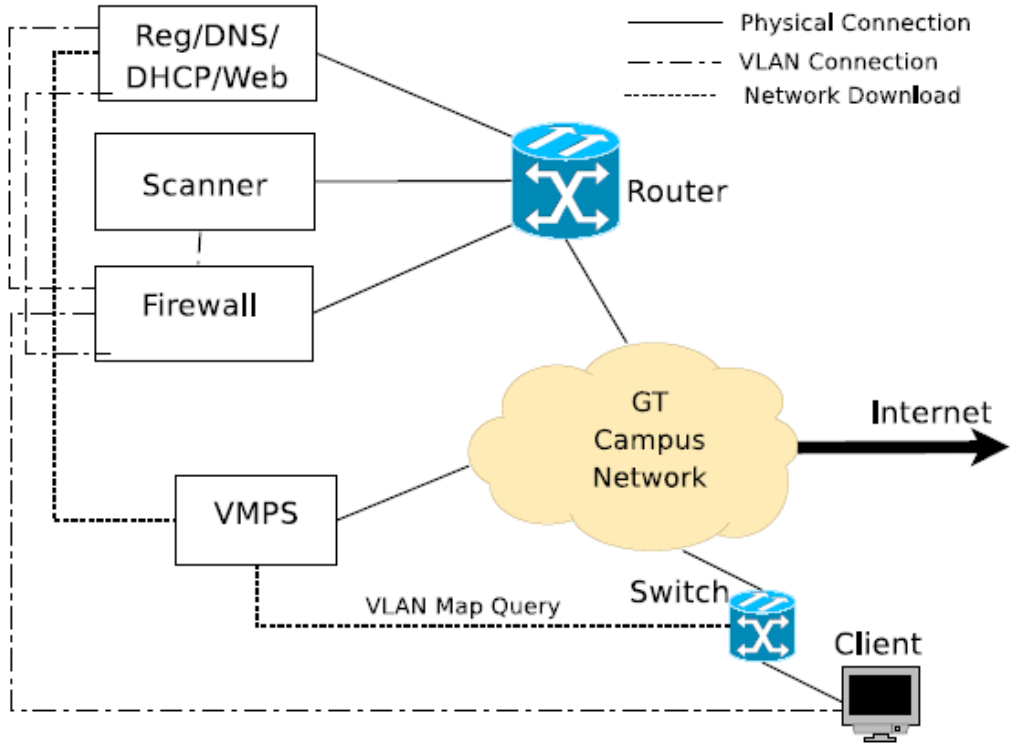
Summary

- We are building an experimental network at Georgia Tech
  - Programmable network switches (OpenFlow)
  - Multiple on-campus sites
  - Dedicated fiber between these sites
  - Upstream connectivity and IP address space (“own AS”)
- Initial testing platform for network solutions deployed on-campus
- We are building this to test our own ideas in network management and operations

Network Management Tasks

- Security-related network management tasks
  - Authentication and access control
  - Resource allocation
- Today: Many solutions require operator vigilance, hacks, magic, etc.
- We are exploring how to make these tasks easier with programmable networking

Access Control and Monitoring

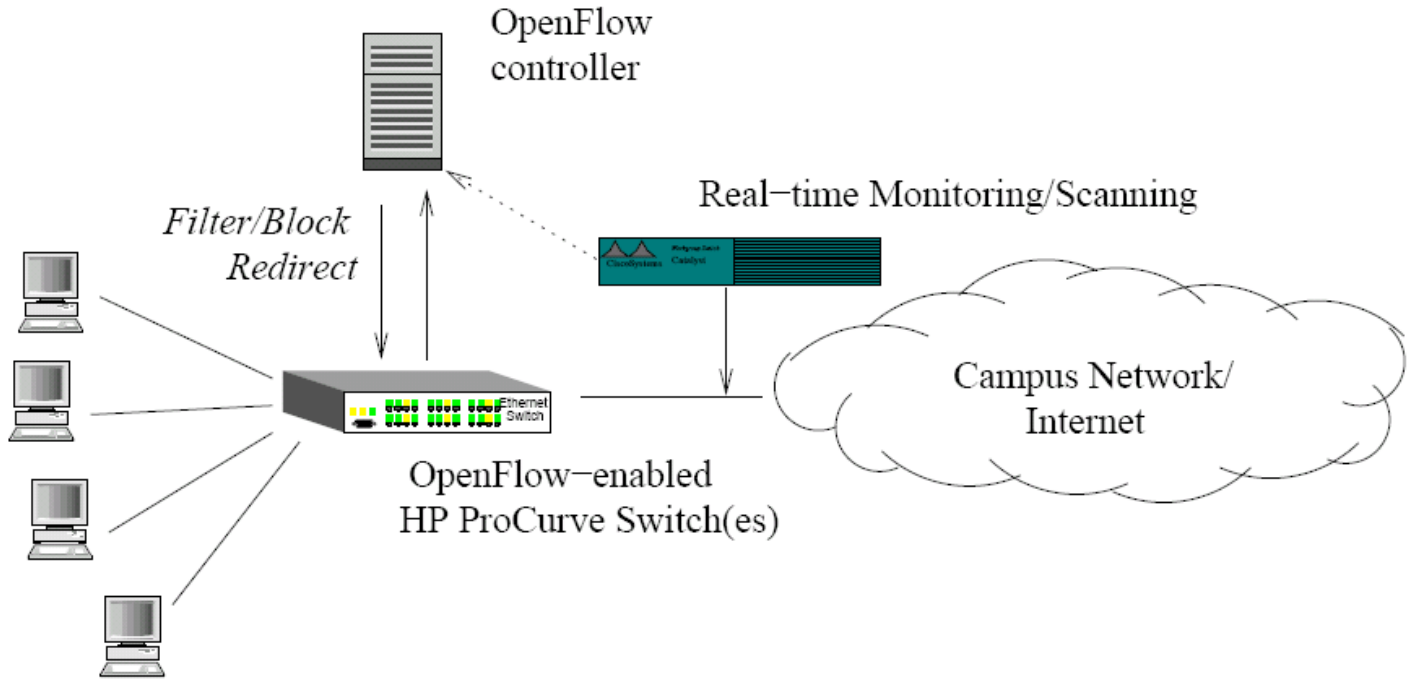


- New hosts
  - Assigned to private VLAN
  - Given private IP address space
  - Authenticated and scanned

Problems with Current Architecture

- Access control is too coarse-grained
  - All unauthenticated/unscanned hosts are on the same subnet
  - Hosts with access are all on the same VLAN
- Lack of dynamism
  - Hosts cannot be dynamically remapped
- Monitoring is not continuous
  - Reaction to alarms is manual

Simplify/Enhance: Programmable Networks

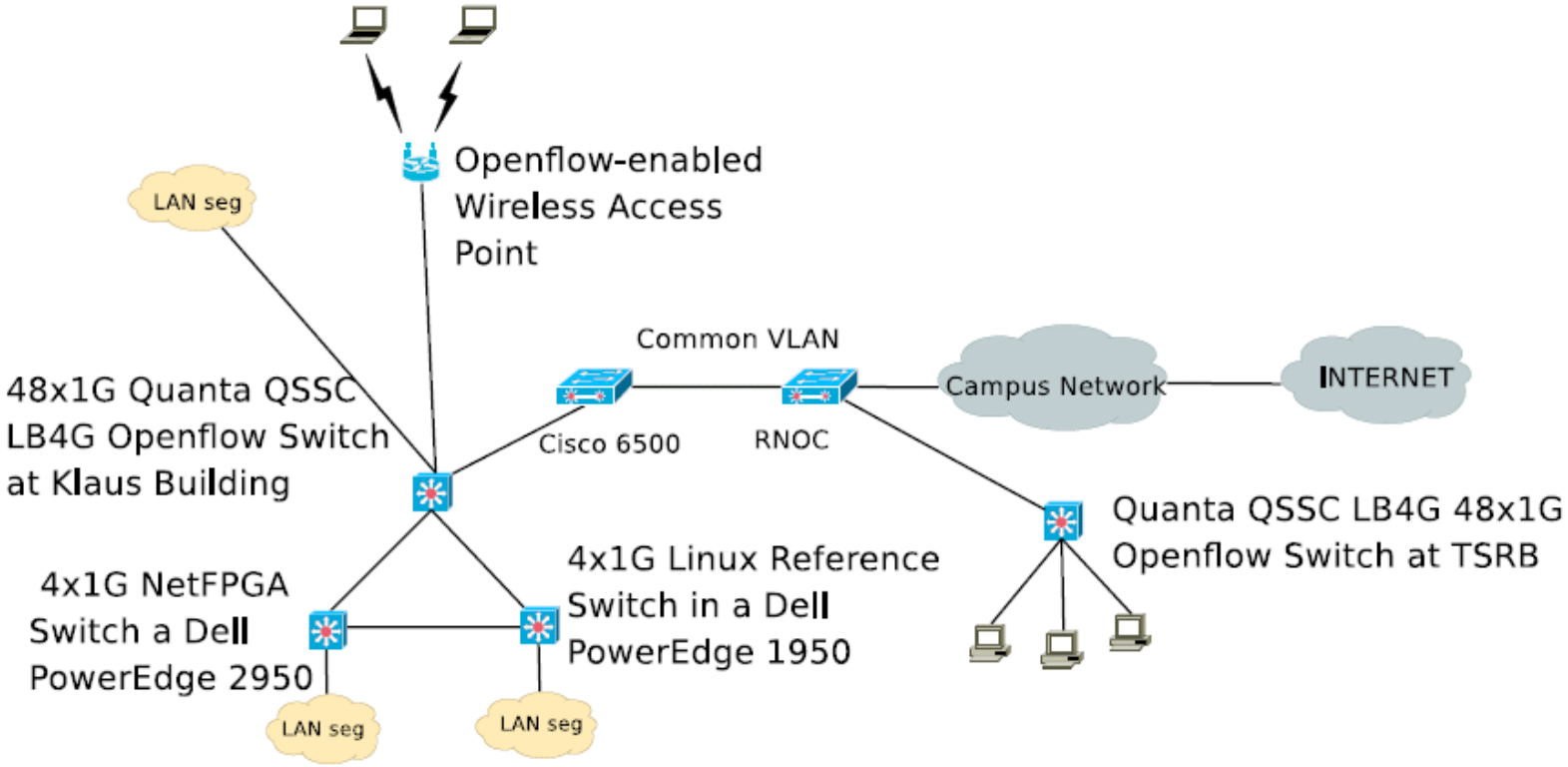


- Flow-table entries in switches redirect hosts to gardenwall
- Traffic is remapped with flow table entries per-host
- Continuous, real-time monitoring integrated with controller

“Outsourcing” Network Management

- Lots of independently operated networks
  - Each with view of network traffic
  - Including home networks (a known large source of unwanted traffic)
- Lots of distributed inference algorithms
  - SpamTracker
  - BotMiner
- **What if these networks had programmable switches?**
  - Use output from distributed inference to control network elements across many networks

Current Campus Testbed



- Space for running real-world projects and applications
- Need: Ability to “re-enact” network events

Looking Forward

- Campus-wide deployment
  - Network has 275 switches for access control that *can* run OpenFlow today
  - Firmware upgrade scheduled for Spring 2010
- Big questions
  - Sharing between production network and research
  - Connectivity to other campuses
  - Integration with measurement?