LambdaStation to SDN

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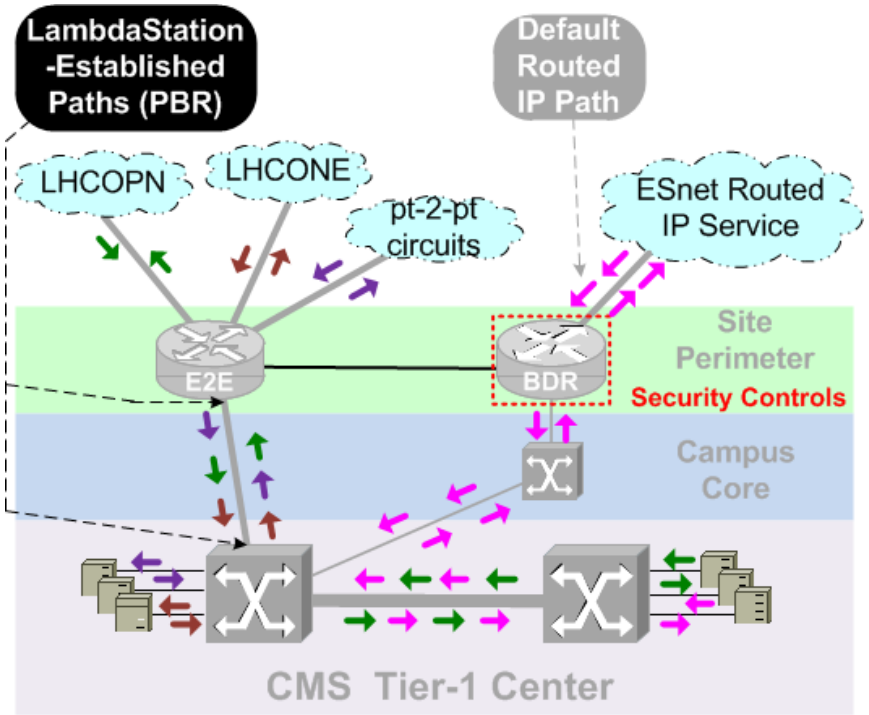
May 12, 2014

LambdaStation - early SDN (I)

- LambdaStation (LS) = Alternate Network Path Service
  - Complement to ESnet's early OSCARs/SDN service
  - Selective forwarding on a ***per-flow*** basis
  - Graceful setup & tear-down
  - On demand capability for applications

SDN-like

- Alternate path forwarding based around PBR:
  - PBR = src/dest route-map
  - OpenFlow is functionally src/dest-based forwarding
- Security advantage from src/dest routing



LambdaStation - early SDN (II)

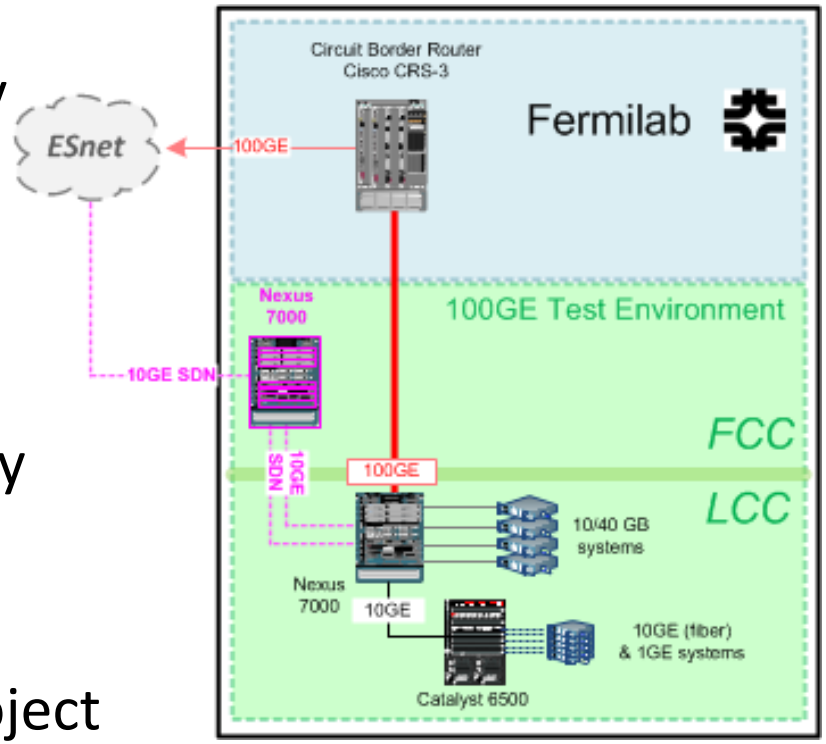
- LS strategically designed around dynamic network path (circuit) services:
  - But circuit services were/are largely long lived (static)
  - PBR evolved into our preferred tool for separating out high impact science data
- LS-awareness built into Storage Resource Manager (SRM) for data movement:
  - A very basic form of network-awareness in applications
  - It worked, but there was pushback
  - In response, developed flow data-based application-awareness tool in conjunction with LS
    - This is still an R&D area of interest…

FNAL High-Level SDN Interests

- Focus is on intra-domain OpenFlow-based SDN scope
  - Inter-domain issues important, but site SDN model needs to come first
- Our current potential SDN use cases:
  1) Science Data Express Path
     - SDN to separate science data from general network traffic
  2) Support archiving service for external organizations
  3) Logical experiment/collaboration data center networks
     - Separate physical infrastructure gets expensive/complex at 100GE
  4) Logical large-scale test facility
  5) Extreme high performance data movement (see Wenji…)
- Strong desire to rationalize these to a common use case

FNAL SDN Facilities & Efforts

- R&D test bed network environment:
  - 100GE infrastructure
  - Deploying OpenFlow capability
    - Nexus 7000 & Catalyst 6500
  - OpenDaylight Controller
- SDN task force:
  - Charge = draft site SDN strategy
  - Mix of network services staff & network researchers
  - Currently, opportunity cost project
    - Competes with other opportunity cost projects (ie., IPv6)
    - Migrating lead from network service staff to network research



One Suggestion for Site-Based SDN Development Path

- Develop a generic model for site SDN support that:
  - Incorporate “common” set of anticipated end site use cases
  - Capable of interfacing to transit network SDN-based services
  - Make use of local network abstraction model(s) developed for LambdaStation/TeraPaths/<others>
- Then build upon LambdaStation/TeraPaths platforms, adapted for OpenFlow, to support that generic model
- Create diverse service access paths:
  1) User/Operator-driven service (ie., manual…)
  2) SDN service awareness in applications
  3) SDN-based application-awareness in networks