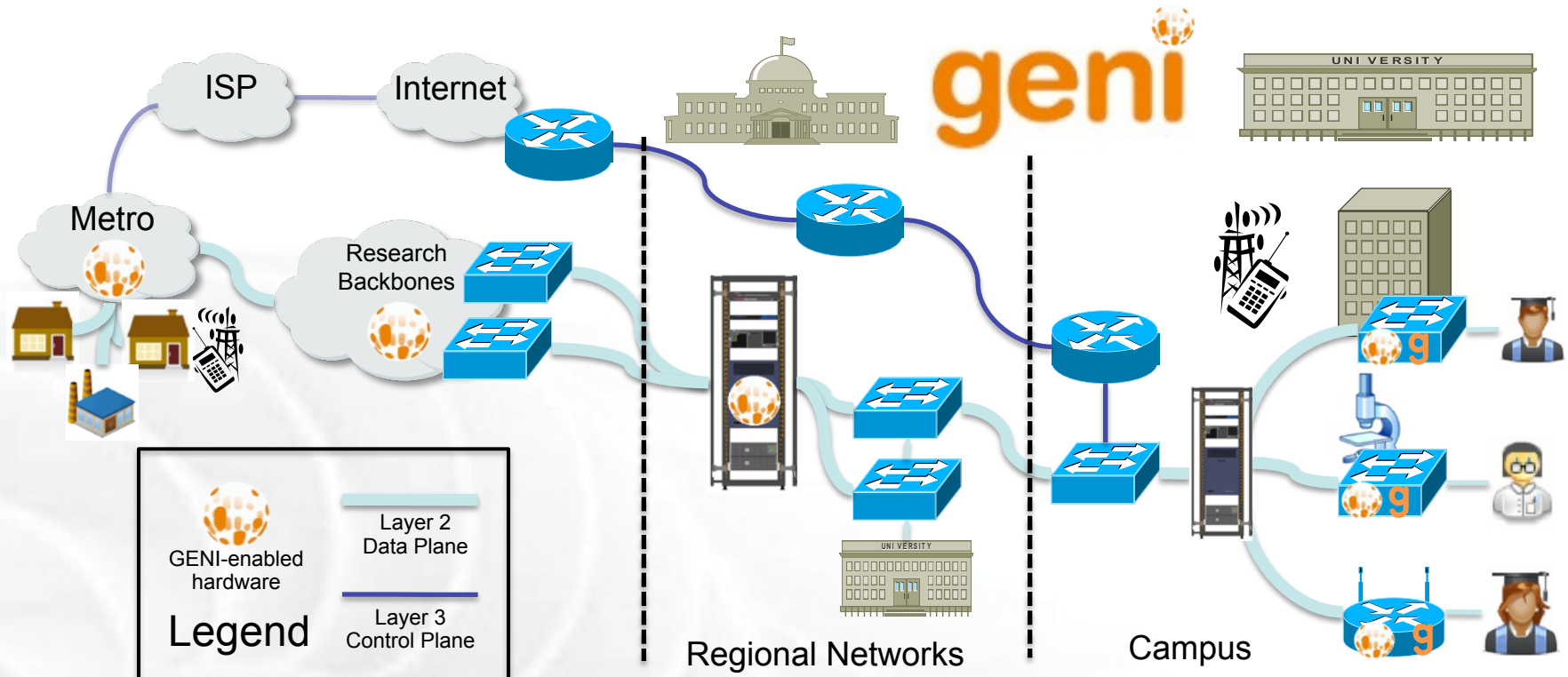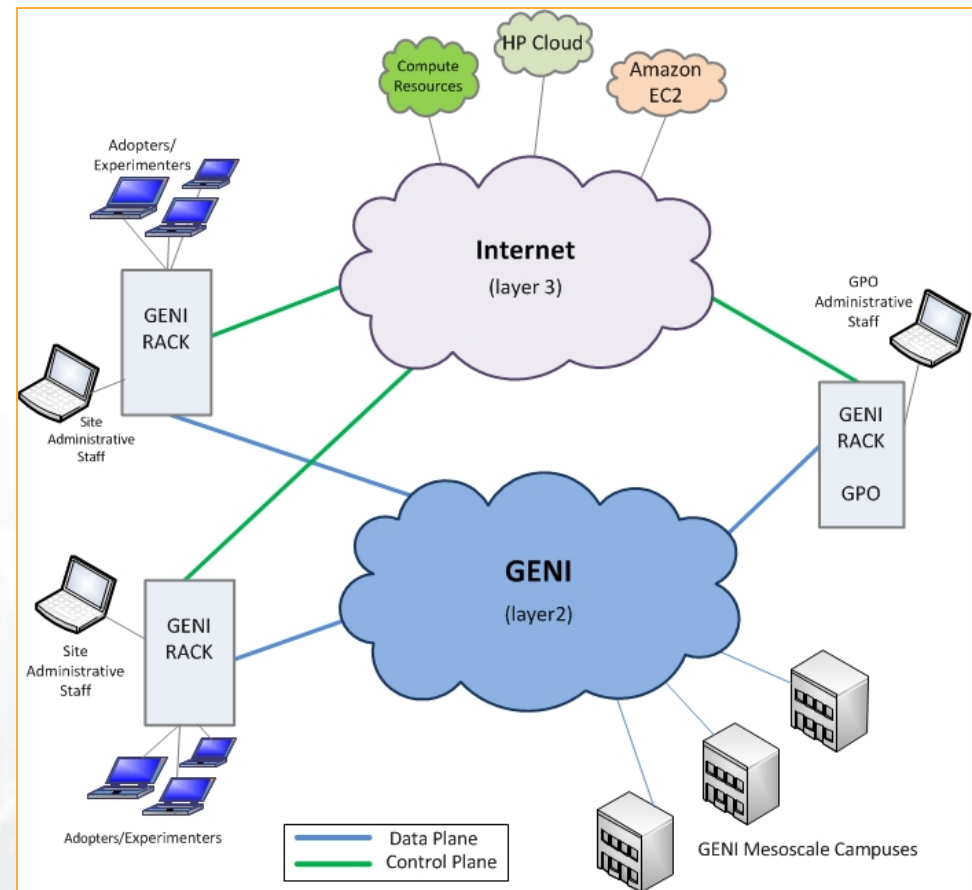# GENI Hardware

Heidi Picher Dempsey, GPO
GEC20: June 24, 2014

- Spans campus/metro, regional, and nationwide networks
- GENI replies on participants to contribute compute and network resources
- Includes VMs, bare metal nodes, SDN switches (OpenFlow 1.0), WiMAX/LTE base stations and clients, L2 network access

- Plain old Internet control plane

- Layer 2 data plane slices in regional and national research networks (Ethernet VLANs)

- Hardware supports GENI specs for interoperating with other participants

- Switches supporting OpenFlow 1.0 in GENI: HP, NEC, IBM, Brocade, Pica8, Juniper, Cisco, Dell

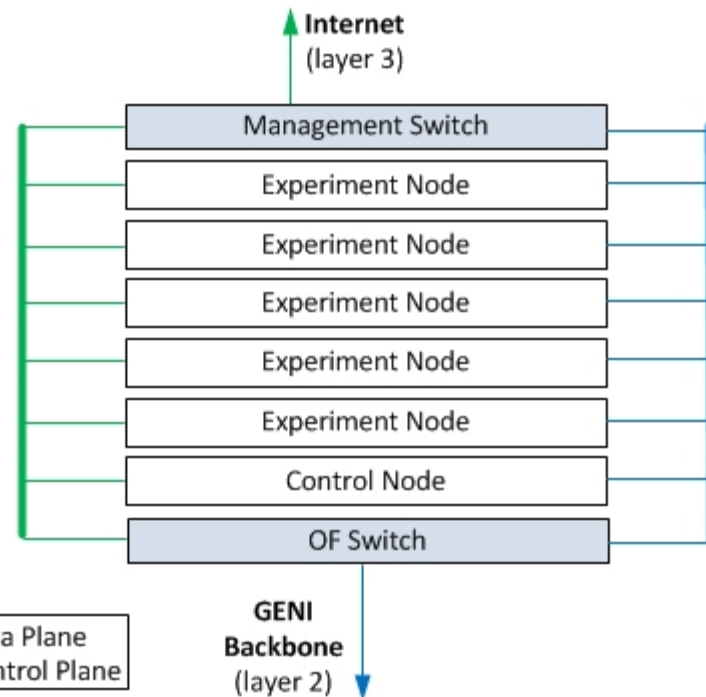- GENI racks simplify and help scale GENI connections

- *InstaGENI*: University of Utah , HP hardware
- *ExoGENI*: RENCI and Duke, IBM hardware
- *OpenGENI:* Clemson University partnered with Dell (Provisional Racks)
- *Cisco SDN:* Cisco hardware, Cisco and ExoGENI software

http://groups.geni.net/geni/wiki/GENIAggregateProviderWelcome

- ***Compute Resources*** 5 HP ProLiant DL360 G7 or G8 Server series hosts to provide the VM Server, Monitoring, Storage, and Application functions:
- **Control Node** - 1 HP ProLiant DL360 G7 or G8 Server, quad-core, single-socket, 12 GB Ram, 4 TB Disk (RAID), and dual NIC
- **Experiment Nodes** - 5 HP ProLiant DL360 G7 or G8 Server, six-core, dual-socket,48GB Ram, 1TB Disk, and dual NIC
- Bare Metal Node
- ***Network Components*** 2 network components to provide access to GENI core networks and commodity Internet:
- HP ProCurve 2620 Switch (J9623A), 24 10/100/100 Mb/s ports, 2 1 Gb/s ports
- HP ProCurve 5406zl Switch (J8697A) 48 1 Gb/s ports, 4 10 Gb/s ports
- ***Misc. Components*** General purpose hardware also included:
- 1 or more HP Intelligent Mod PDU
- HP Dedicated iLO Management Port Option
- HP TFT7600 KVM Console US Kit
- Optional 10GE dataplane interface
- http://groups.geni.net/geni/wiki/GENIRacksHome/ InstageniRacks

Internet (layer 3)

Management Switch

Experiment Node

Experiment Node

Experiment Node

Experiment Node

Experiment Node

Control Node

OF Switch
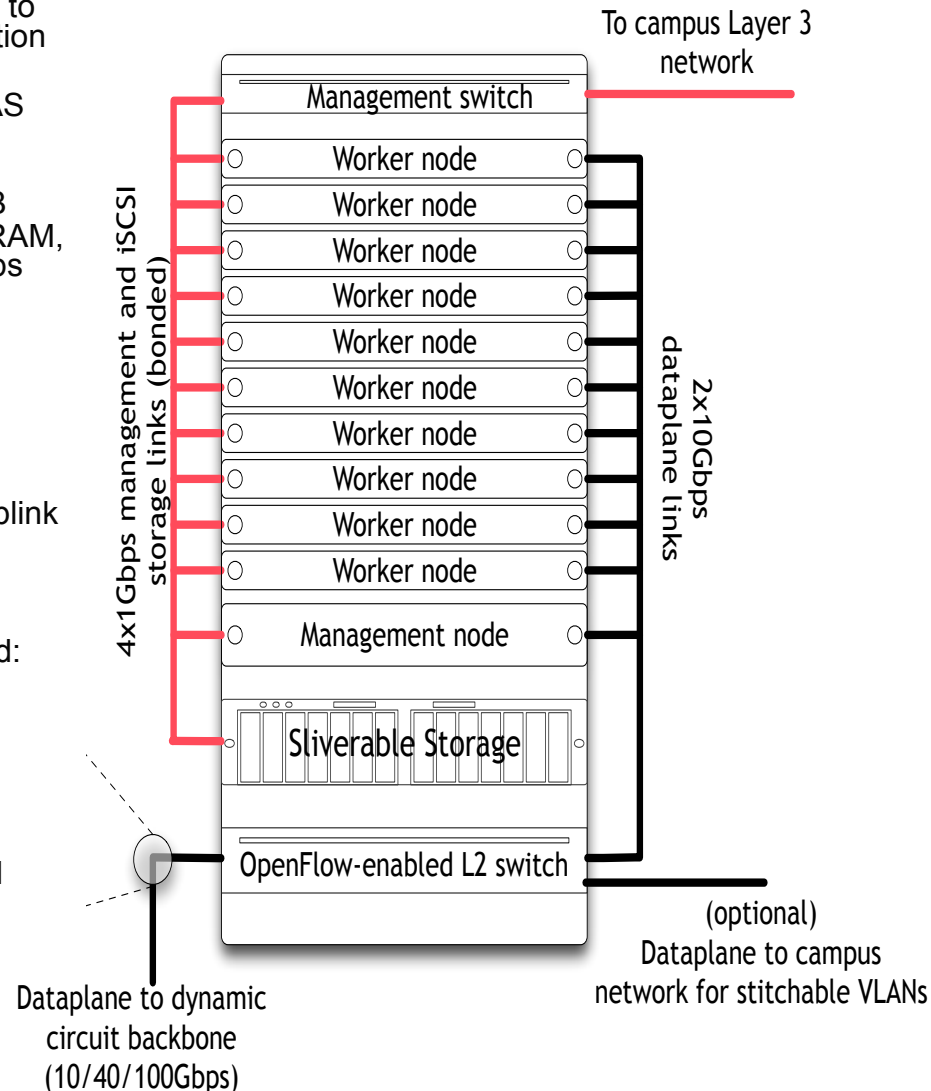
GENI Backbone (layer 2)

Data Plane
Control Plane

courtesy Rob Ricci, Rick McGeer

- *Compute Resources:* A total of 12 hosts are in the rack to provide the Resources, Monitoring, Storage and Application functions:
- **Management node:** 1 IBM x3650 M3, 2x146GB 10K SAS hard drives, 12G RAM, dual-socket 4-core Intel X5650 2.66Ghz CPU, Quad-port 1Gbps adapter
- **Worker/Bare-Metal nodes**: 10 IBM x3650 M3, 1x146GB 10K SAS hard drive +1x500+GB secondary drive, 48G RAM, dual-socket 6-core Intel X5650 2.66Ghz CPU, dual 1Gbps adapter, 10G dual-port Chelseo adapter
- **Sliverable Storage:** 1 IBM DS3512 storage NAS 6x1TB 7200RPM drives
- *Network Components*:
- **Management Switch:** IBM BNT G8052R 1G client/10G uplink ports - Access to commodity internet.
- **OpenFlow Switch**: IBM BNT G8264R 10G client/40G uplink ports - Access to GENI backbone.
- **VPN Appliance:** Juniper SSG5 - Backup management access.
- *Misc. Components*: General purpose hardware included:
- IBM PDU based on site power requirements, (GPO=IBM 5897 PDU; RENCI=DPI 5900 PDU)
- No UPS included
- IBM Local 2x16 Console Manager (LCM16)
- IBM 1U 17-inch Flat Panel Console Kit (PN 172317X)
- upgrades for newest 5 sites: SSD drives, more RAM and cores, 40G interfaces on bare metal worker nodes
- Optional 40G dataplane interface
- http://groups.geni.net/geni/wiki/GENIRacksHome/ExogeniRacks

To campus Layer 3 network

Management switch

Worker node

Worker node

Worker node

Worker node

Worker node

Worker node

Worker node

Worker node

Worker node

Worker node

Management node

4x1Gbps management and iSCSI storage links (bonded)

2x10Gbps dataplane links

Sliverable Storage

OpenFlow-enabled L2 switch

option 2: fiber uplink

Dataplane to dynamic circuit backbone (10/40/100Gbps)

(optional) Dataplane to campus network for stitchable VLANs

courtesy Ilia Baldine

Compute Resources - 3 PowerEdge Dell R620XL rack server hosts that provide the VM Server, Monitoring, Storage, and Application functions:

Control Node - 1 Dell PowerEdge R620XL server Server with 252 GB of RAM and 300 GB hard drive.

Experiment Nodes - 2 Dell PowerEdge R620XL server Server with 252 GB of RAM, and 300 GB hard drive. More compute nodes are possible.

Bare Metal Node - Not supported at this time.

Network Components 2 network components to provide access to GENI core networks and commodity Internet:
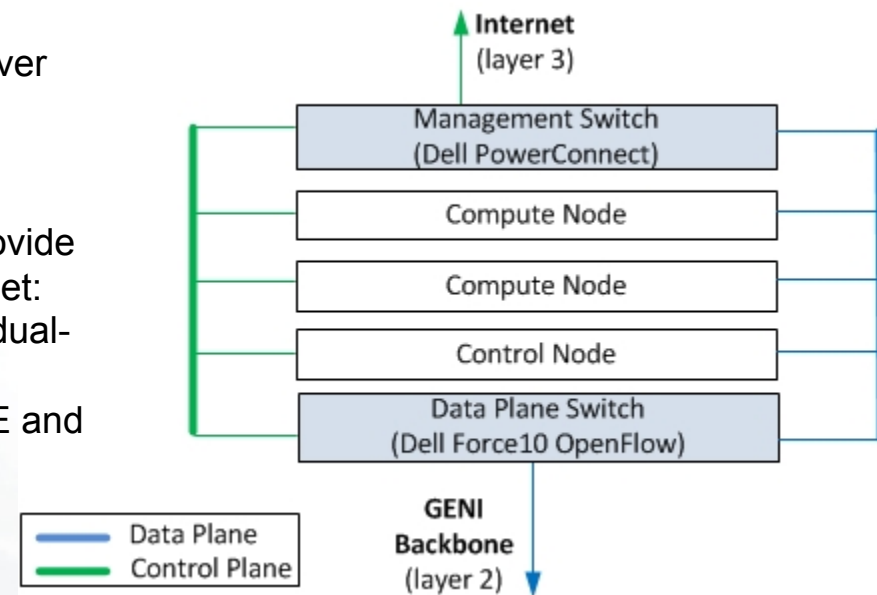
Dell Force10 S4810P Openflow Switch supports 48 dual-speed 1/10 Gb ports and four 40 Gb ports
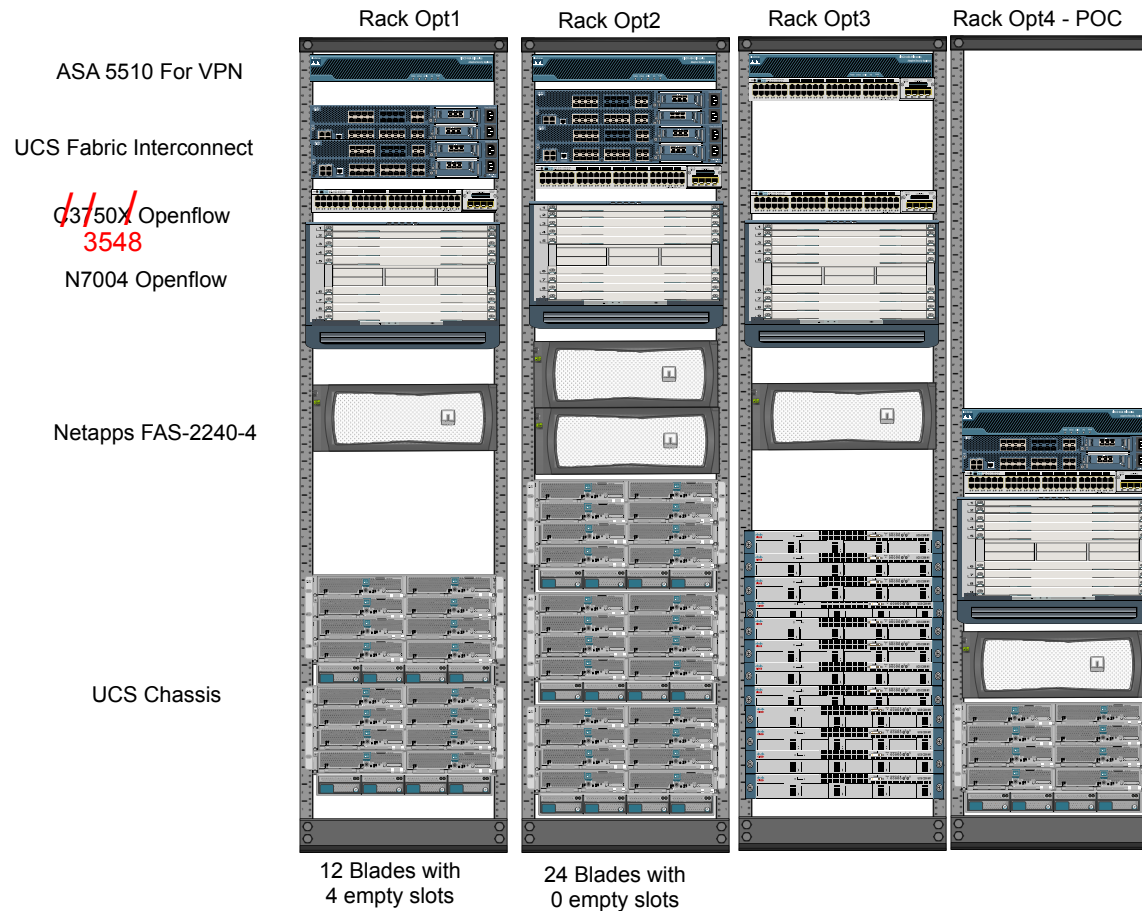
Dell PowerConnect Switch with up to 48 ports of GbE and optional 4x 10Gb

Misc. Components General purpose hardware also included:

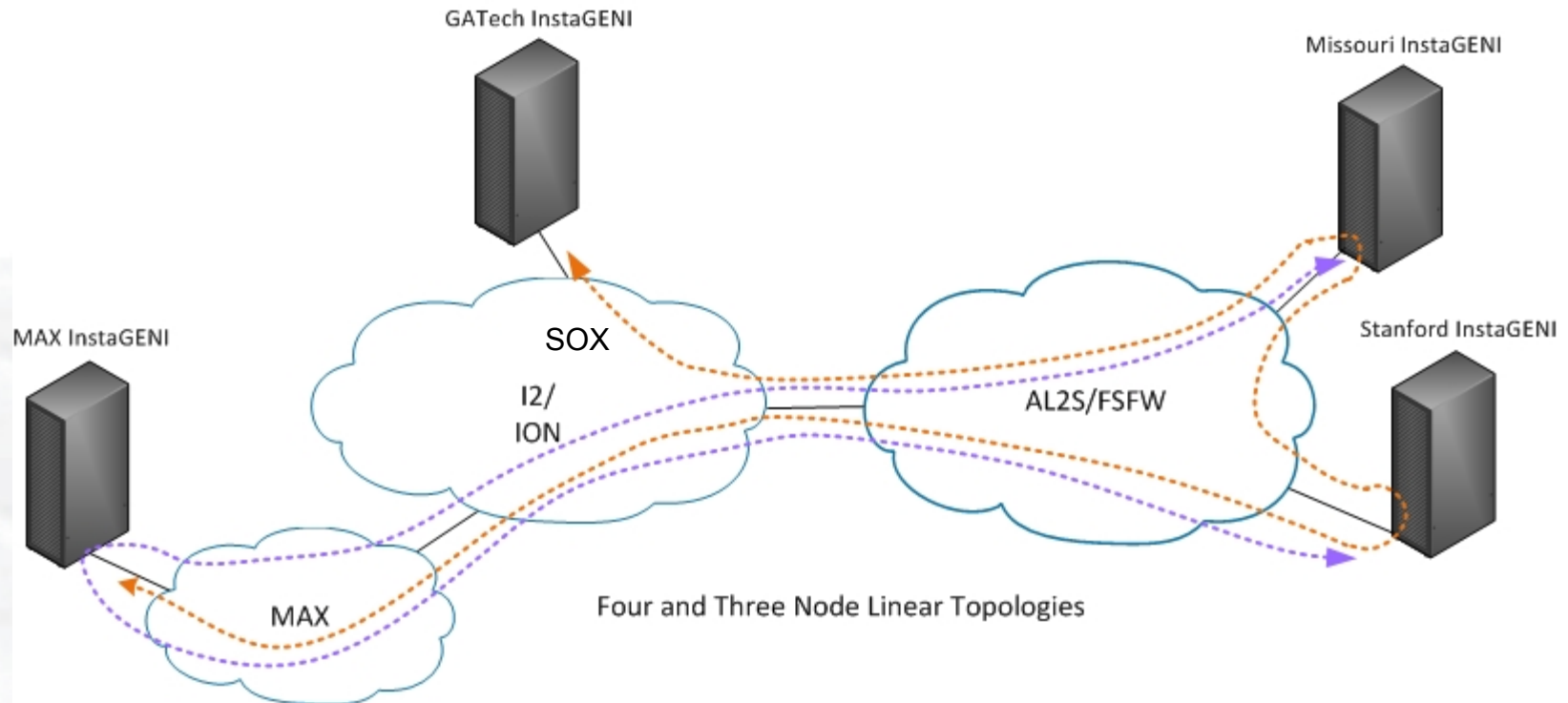Dell Remote Access Controller - iDRAC

http://groups.geni.net/geni/wiki/GENIRacksHome/OpenGENIRacks

courtesy Rob Ricci, Rick McGeer

Rack Opt1　Rack Opt2　Rack Opt3　Rack Opt4 - POC

ASA 5510 For VPN

UCS Fabric Interconnect

~~C3750X~~ Openflow
3548

N7004 Openflow

Netapps FAS-2240-4

UCS Chassis

12 Blades with
4 empty slots

24 Blades with
0 empty slots

Prototype Integration at NCSU and WVNET in progress

Four and Three Node Linear Topologies

- Configure racks with VLANS for GENI stitching and other data plane uses (VLANs compatible with site networks)
- Allocate VLANs to GENI in MAX, SOX, ION, and AL2S
- Configure OpenFlow switches in racks and AL2S to use configured VLANS
- Update SCS with VLANs, topology
- Configure FOAM if you are using OpenFlow (optional) and set up OpenFlow controller
- Test for connectivity and to ensure no MAC learning or STP

GENI Rack Installation and Support Flow

Rack Teams → GPO & Rack Teams → Campus Engineering GPO & Rack Teams → Campus Engineering & GENI Operations

ExoGENI

InstaGENI
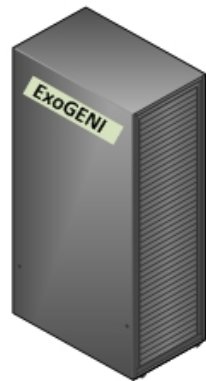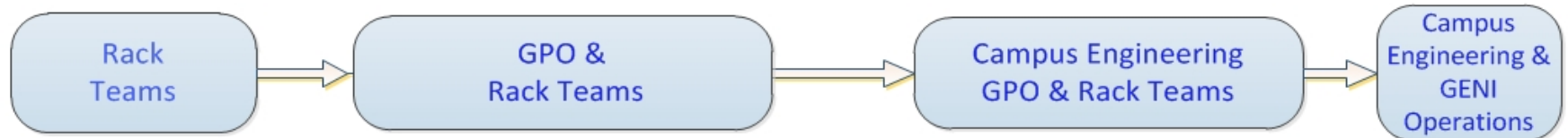
GENI Racks Acceptance Testing

Experimenter Tests:
- Access to compute resources, bare metal & VM.
- Access to network resources.
- Multi-site experiments.
- Multi-site OpenFlow Experiments.
- VLAN support for rack and campus connections.
- Experimenter custom image support.
- Meso-scale OpenFlow interoperability.

Administrator Tests:
- Administrative access to all rack components.
- Management of all infrastructure rack components.

Monitoring Tests:
- Rack components monitoring.
- Resource and FOAM aggregate resources monitoring.

Ready for GENI Network environment?

Site Deployments

Site Install Checklist:
- Set up control plane
- Set up FOAM/FV
- Verify connectivity
- Set monitoring
- Connect to campus

Site Confirmation Tests:
- Experiment support
- Admin and monitoring

Site support:
- Meso-scale eng.
- GMOC support.

Site Preparation and Validation.

Ready for Experimenters

http://groups.geni.net/geni/wiki/GENIRacksHome/RacksChecklistStatus