

# GENI Infrastructure and Operations Update

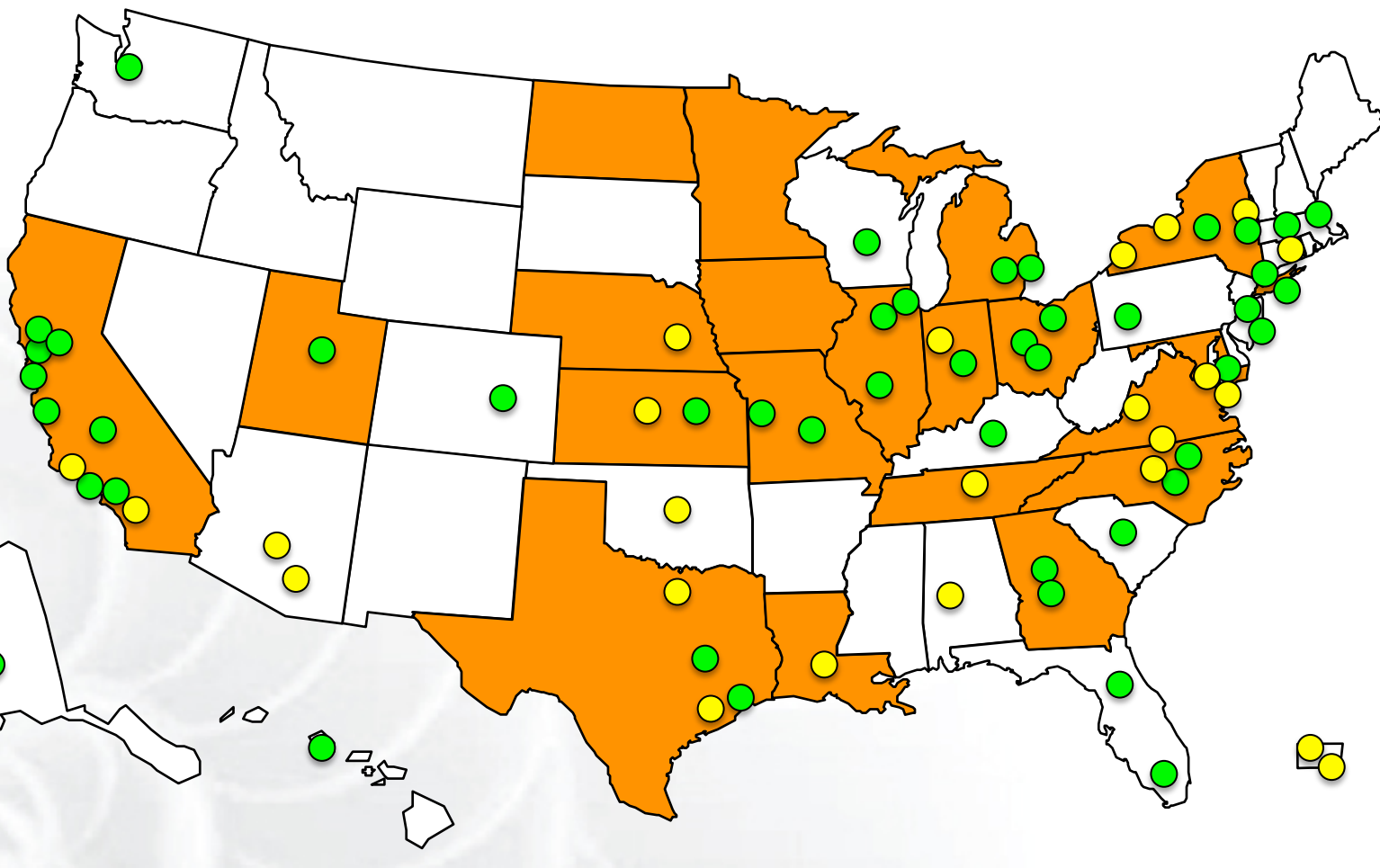
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GEC17  
July 22, 2013  
[www.geni.net](http://www.geni.net)

# Infrastructure: Racks and Campuses

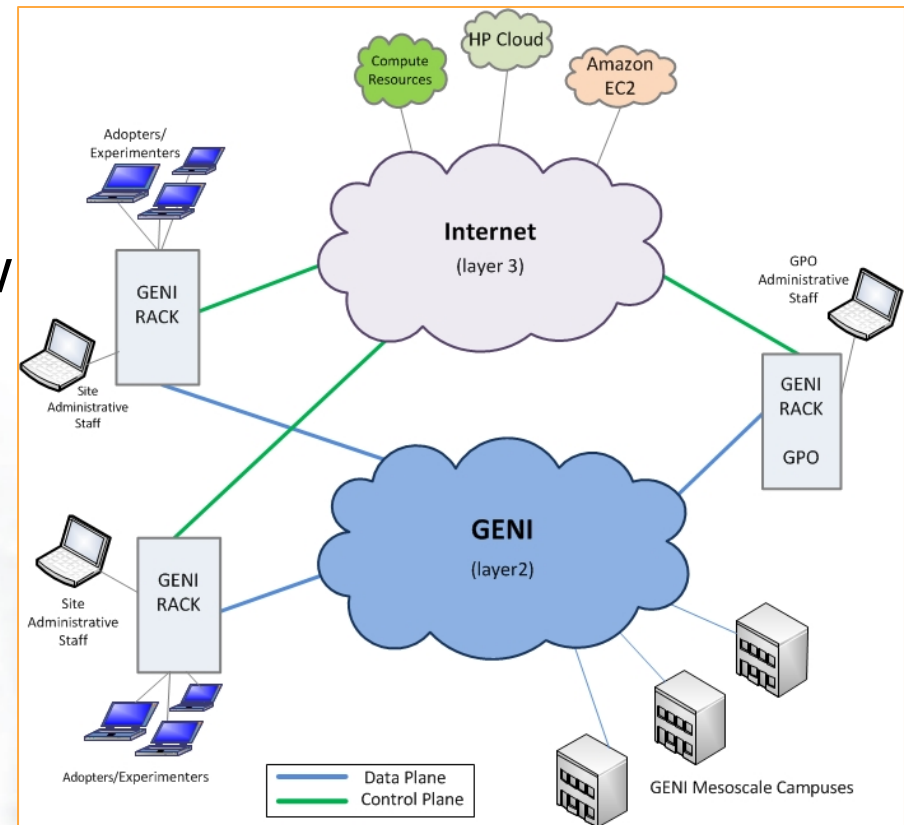
● Funds in hand

● Needs funding

Oct. 24, 2012



- 43 racks with integrated OpenFlow, compute nodes, and some stitching deploying through Feb 2013
- Campuses extend OpenFlow networks locally
- Software updates and GENI testing for both rack types ongoing
- Rack team status
- <http://groups.geni.net/geni/wiki/GENIRacksHome/ExogeniRacks>
- <http://groups.geni.net/geni/wiki/GENIRacksHome/InstageniRacks/ConfirmationTestStatus>



# GENI Rack Recipient Expectations

- Provide space, power, security (as with other campus IT resources)
- Provide at least 1Gbps OpenFlow/SDN path from rack to campus boundary (within 3-6 months of receipt)
- Provide connection from rack to on-campus resources (varies by campus, usually SDN)
- Operate with up-to-date GENI-specified software (e.g. AM API, OpenStack)
- Provide no-cost access to rack resources for GENI authorized users at other campuses
- Provide points of contact for GENI response team (see [http://groups.geni.net/geni/attachment/wiki/ComprehensiveSecurityPgm/Aggregate Provider Agreement v3.pdf](http://groups.geni.net/geni/attachment/wiki/ComprehensiveSecurityPgm/AggregateProviderAgreement_v3.pdf) )

## GENI Rack Deployment Phases

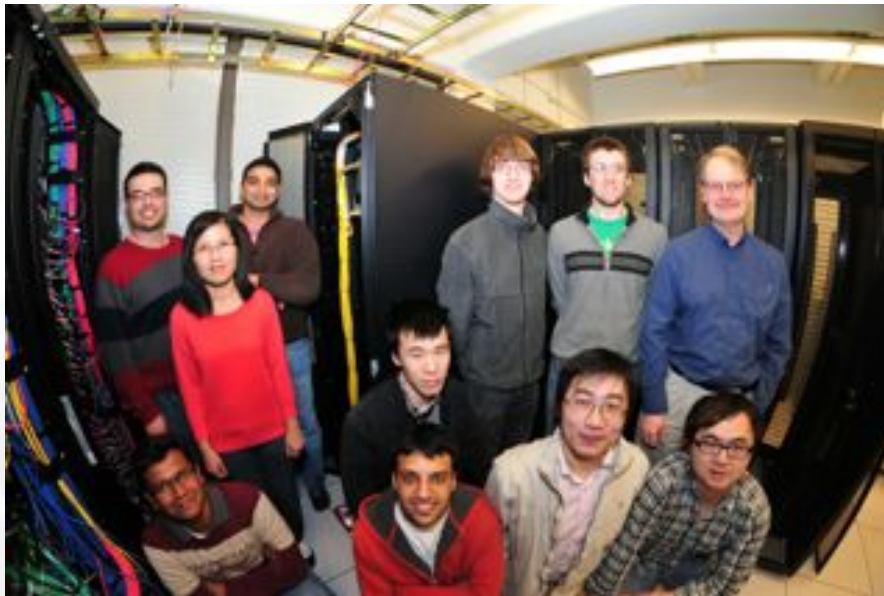


22 racks

GENI Rack Type	Rack Delivered to Site	Rack Connected to Network	Rack Integrated with GENI	New Site Confirmation Tests	Rack integrated with Site Resources	Ready for Experimenters
InstaGENI	-New York University -U of Utah Data Center -Rutgers University -SOX -MAX -Case Western -Stanford -Louisiana State	-Clemson -University of Kansas -University of Idaho			-Georgia Tech -Princeton University	-University of Utah -GPO -Kettering University -Northwestern University -University of Kentucky
ExoGENI				-University of Houston -Florida International University		-GPO -RENCI

- New racks from Cisco (WVNet) and Dell (Clemson) under development in joint efforts.

# Testing Deployed Racks



Site status:

[http://groups.geni.net/geni/wiki/  
GENIRacksHome/ExogeniRacks/  
ConfirmationTestStatus](http://groups.geni.net/geni/wiki/GENIRacksHome/ExogeniRacks/ConfirmationTestStatus)

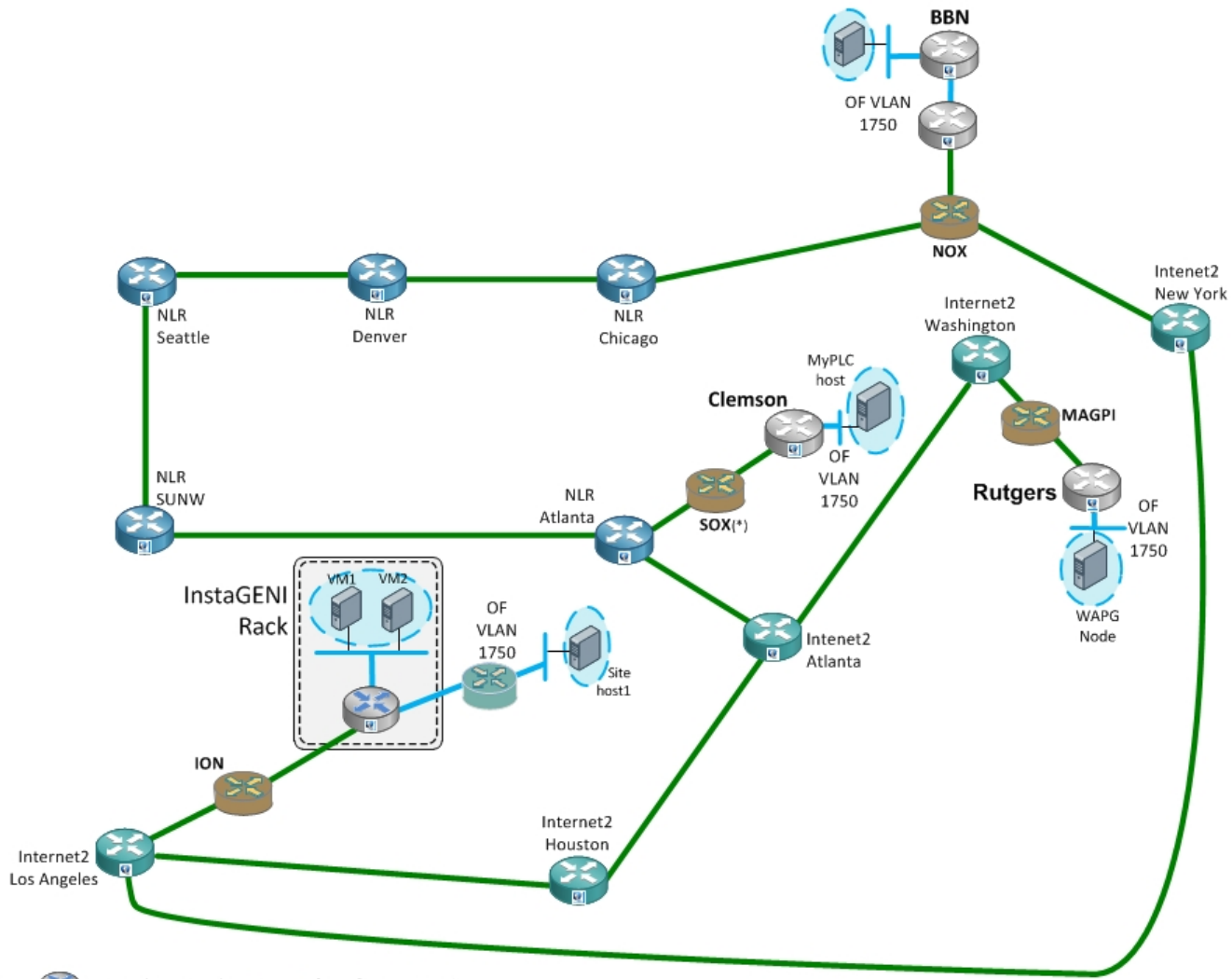
[http://groups.geni.net/geni/wiki/  
GENIRacksHome/InstageniRacks/  
ConfirmationTestStatus](http://groups.geni.net/geni/wiki/GENIRacksHome/InstageniRacks/ConfirmationTestStatus)

Site resource and access details:










[http://groups.geni.net/geni/wiki/  
GeniAggregate](http://groups.geni.net/geni/wiki/GeniAggregate)



# Example Meso-scale Integration: InstaGENI

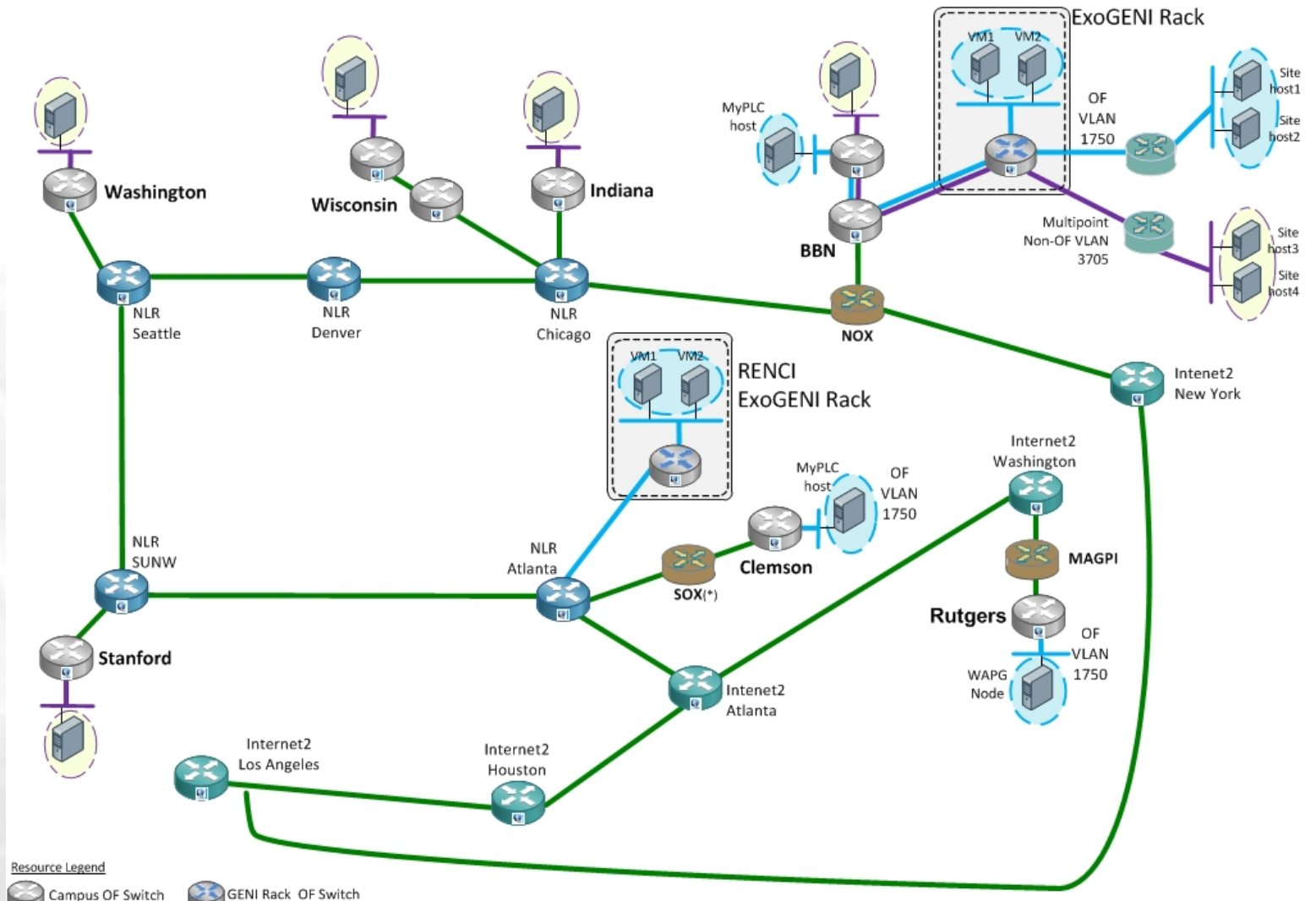


**Resource Legend**

-  Campus OF Switch
-  GENI Rack OF Switch
-  Core OF VLAN 3716
-  NLR OF Switch
-  Regional non-OFS Switch
-  Site Shared OF VLAN 1750
-  Internet2 OF Switch
-  Campus non-OFS Switch
-  Compute resource

(\*) an OpenFlow SOX connection will be implemented after GEC14 to connect Clemson GENIRack.

# Example Meso-scale Integration : ExoGENI



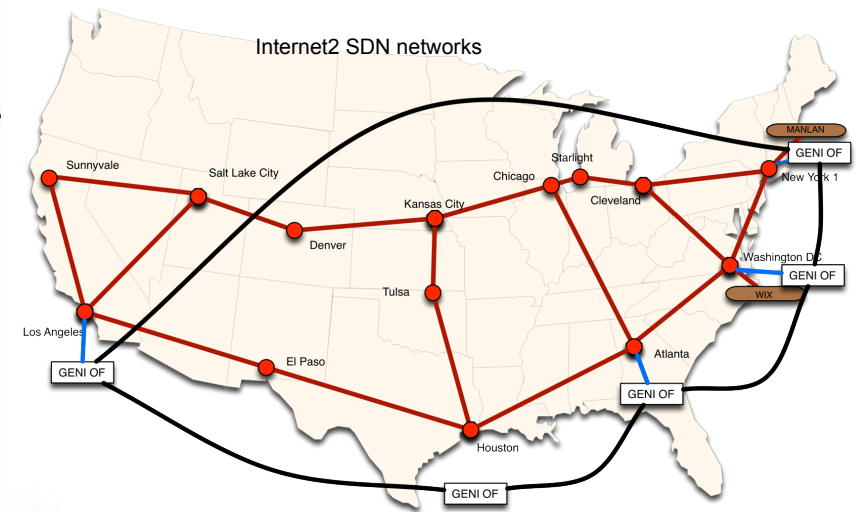
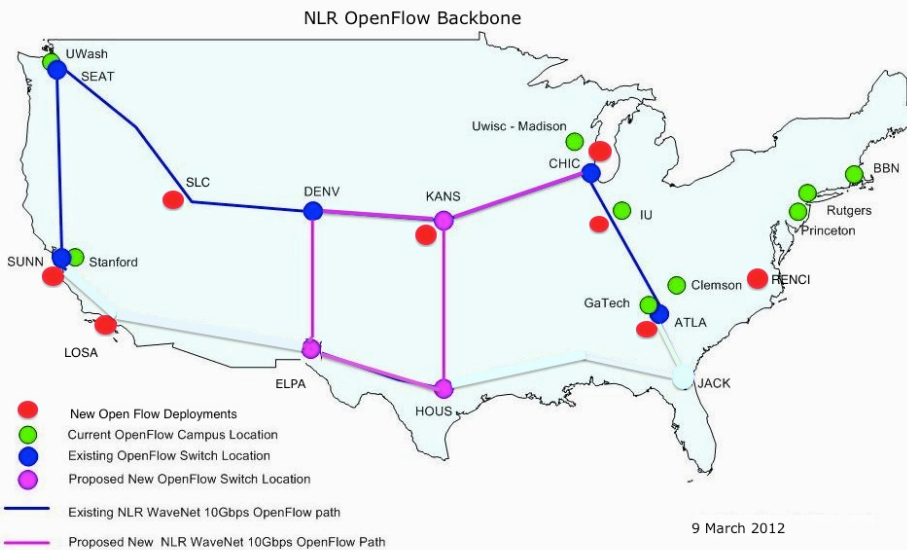
**Resource Legend**

- Campus OF Switch
- GENI Rack OF Switch
- NLR OF Switch
- Regional non-OF Switch
- Internet2 OF Switch
- Campus non-OF Switch
- Core OF VLAN 3716
- Site Shared OF VLAN 1750
- Site Multi-point non-OF VLAN 3705
- Compute resource

(\*) an OpenFlow SOX connection will be implemented after GEC14 to connect Clemson GENIRack.



Regional	Sites	Regional OpenFlow	Location	Connection Method(s)	GENI Core Connection(s)
<b>CENIC</b>	Stanford OpenFlow	No	Sunnyvale, Sacramento, Los Angeles CA	ION FrameNet	Internet2,NLR
<b>FLR</b>	FIU ExoGENI	No	Miami, FL	FrameNet	NLR
<b>KanREN/GPN</b>	KSU OpenFlow, integration test sites	Yes	Lawrence, KS	ION	ION
<b>LEARN</b>	Houston ExoGENI	No	Houston, TX	FrameNet	NLR
<b>MAX</b>	Integration test sites	<b>Yes</b>	College Park, Maryland	ION	Internet2
<b>MOXI</b>	Indiana University	<b>Yes</b>	Indianapolis, IN	ION	Internet2
<b>NCREN</b>	RENCI ExoGENI	No	Chapel Hill, NC	FrameNet	NLR
<b>NoX</b>	GPO InstaGENI GPO ExoGENI GPO OpenFlow	No	Cambridge, MA	ION FrameNet	Internet2, NLR
<b>NYSERNet</b>	Integration test sites	Yes	Syracuse, NY	ION	Internet2
<b>SoX/SLR</b>	Georgia Tech multiple Clemson multiple	<b>Yes</b>	Atlanta, GA	Fiber	Internet2
<b>SoX</b>	U of Kentucky InstaGENI	No	Lexington, KY	ION	Internet2
<b>StarLight</b>	Northwestern U InstaGENI	No	Chicago, IL	Fiber	Internet2, NLR, ESNet
<b>UEN</b>	U of Utah ProtoGENI and InstaGENI	<b>Yes</b>	Salt Lake, UT	ION Fiber	Internet2



- NLR 2013 meso-scale OpenFlow expansion in progress
- Internet2 10GbE paths to Advanced Layer 2 Services (AL2S) available at four of the five OpenFlow meso-scale/ProtoGENI PoPs
- GENI rack integration with Science DMZ now in progress at some campuses
- Internet2 GENI Aggregate Manager in AL2S expected Q3
- Internet2 ION GENI stitching now, NLR later

- OpenFlow switch firmware:
  - NEC:
    - Version 1.0.2.0 on newer models (e.g. PF5820s in SoX)
    - "Product" version 11.1.C.Af on older OpenFlow campus switches (IP8800) and Internet2 meso-scale switches
  - HP:
    - K.15.06.5008 in InstaGENI racks
    - K.14.83o at OpenFlow campus sites and including NLR meso-scale switches
  - IBM:
    - 7.6.1.0 at RENC1 and Houston, 7.4.0.41 at BBN and FIU
    - 7.6.1.0 supports port-based hybrid mode
  - Brocade:
    - 5.4.00b is the current GA release on MLXe and CES switches in regionals
    - A major limitation: Can't match both layer 2 and layer 3 fields at the same time
    - Fix expected in a future version

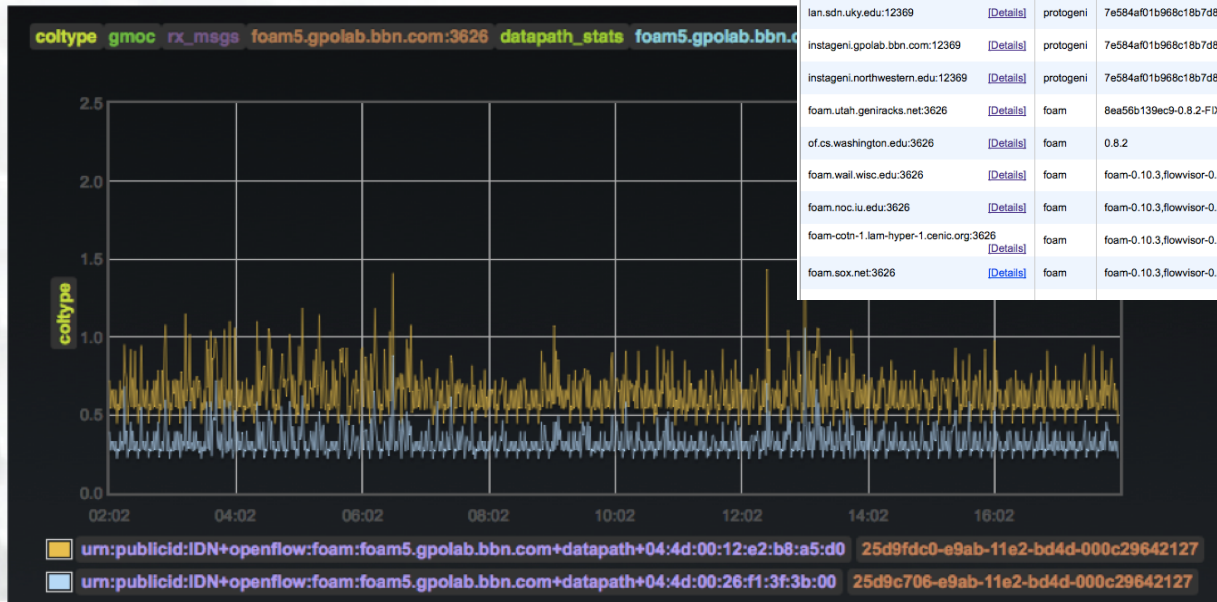
# OpenFlow integration and test (cont.)

- FlowVisor
  - Recommended version: 0.8.1.7
  - GPO testing 1.0.10
    - Packaging and admin improvements, per-slice rate limits
    - <https://github.com/OPENNETWORKINGLAB/flowvisor/issues?milestone=2&page=1&state=closed>
    - More info: <https://github.com/OPENNETWORKINGLAB/flowvisor/wiki>
- FOAM (FlowVisor OpenFlow Aggregate Manager)
  - Recommended version: 0.12.0
  - Includes VLAN-savvy auto-approval (e.g. on ExoGENI) and GENI AM API v2 support
  - More info: <http://groups.geni.net/geni/wiki/OpenFlow/FOAM>
  - Roadmap: <https://barnstorm.atlassian.net/wiki/display/FOAM/Roadmap>
- OpenFlow monitoring (tango-monitor-foam)
  - Reports data about FOAM and FlowVisor to GMOC
  - Recommended version: 0.5.3
  - Instructions: <http://groups.geni.net/geni/wiki/TangoGeniMonitoring/FoamConfiguration>
- Available GENI OpenFlow controller that forwards using L1 information to address MAC learning issues on some switches

# Monitoring Improvements

- Updated Python monitoring client
- Updated monitoring software running on aggregates in both types of GENI racks, backbones, regionals and campuses
- Clearinghouse integration – monitoring data now sent to GMOC
- GMOC shared database improvements and operations access changes
- Relational data download from GMOC in regular use
- Prototype for measurement data

Aggregate Name	Type	Version	Operator	AM API Status	Last Updated
rci-hn.exogeni.net:11443	<a href="#">[Details]</a> orca	4.0	<a href="urn:publicid:IDN+gmoc.geni.net+organization+RENCI">urn:publicid:IDN+gmoc.geni.net+organization+RENCI</a>	Unknown	2013-03-19 01:51:02
bbn-hn.exogeni.net:11443	<a href="#">[Details]</a> orca	4.0	<a href="urn:publicid:IDN+gmoc.geni.net+organization+ExoGENI">urn:publicid:IDN+gmoc.geni.net+organization+ExoGENI</a>	Unknown	2013-03-19 01:51:02
utah.geniracks.net:12369	<a href="#">[Details]</a> protogeni	7e584af01b968c18b7d87fe7e78a5dde3549c47f	<a href="urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI">urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI</a>	Unknown	2013-03-19 01:50:45
lan.sdn.uky.edu:12369	<a href="#">[Details]</a> protogeni	7e584af01b968c18b7d87fe7e78a5dde3549c47f	<a href="urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI">urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI</a>	Unknown	2013-03-19 01:50:44
instageni.gpolab.bbn.com:12369	<a href="#">[Details]</a> protogeni	7e584af01b968c18b7d87fe7e78a5dde3549c47f	<a href="urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI">urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI</a>	Unknown	2013-03-19 01:50:43
instageni.northwestern.edu:12369	<a href="#">[Details]</a> protogeni	7e584af01b968c18b7d87fe7e78a5dde3549c47f	<a href="urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI">urn:publicid:IDN+gmoc.geni.net+organization+InstaGENI</a>	Unknown	2013-03-19 01:50:42
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of.cs.washington.edu:3626	<a href="#">[Details]</a> foam	0.8.2	<a href="urn:publicid:IDN+gmoc.geni.net+organization+UW">urn:publicid:IDN+gmoc.geni.net+organization+UW</a>	Unknown	2013-03-19 01:50:29
foam.wail.wisc.edu:3626	<a href="#">[Details]</a> foam	foam-0.10.3,flowvisor-0.8.17	<a href="urn:publicid:IDN+gmoc.geni.net+organization+Wisconsin">urn:publicid:IDN+gmoc.geni.net+organization+Wisconsin</a>	Unknown	2013-03-19 01:50:28
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foam-cotn-1.lam-hyper-1.cenic.org:3626	<a href="#">[Details]</a> foam	foam-0.10.3,flowvisor-0.8.17	<a href="urn:publicid:IDN+gmoc.geni.net+organization+CENIC">urn:publicid:IDN+gmoc.geni.net+organization+CENIC</a>	Unknown	2013-03-19 01:50:26
foam.sox.net:3626	<a href="#">[Details]</a> foam	foam-0.10.3,flowvisor-0.8.17	<a href="urn:publicid:IDN+gmoc.geni.net+organization+SOX">urn:publicid:IDN+gmoc.geni.net+organization+SOX</a>	Unknown	2013-03-19 01:50:26



- Help for campuses and experimenters
  - [help@geni.net](mailto:help@geni.net) mailing list
  - GMOC helpdesk <http://gmoc.grnoc.iu.edu/gmoc/index/support.html>
  - Operations help at GEC  
<http://groups.geni.net/geni/wiki/GEC17Agenda/CodingSprintTutoring>
  - IRC/chat (informal)  
<http://groups.geni.net/geni/wiki/HowTo/ConnectToGENIChatRoom>
  - GMOC support for racks and OpenFlow campus infrastructure
  - Monitoring and status for Meso-scale sites and racks  
<http://gmoc-db.grnoc.iu.edu>  
<https://gmoc-db.grnoc.iu.edu/protected/> requires operator password
  - Scheduled/unscheduled outage notification and calendars
  - Emergency Stop
  - Escalation, tracking, some troubleshooting for reported problems
  - GENI rack and OpenFlow campus GMOC workflows in place