# The Instageni Initiative

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# The instageni rack

- ### Designed for GENI Meso-scale deployment

  - Eight 2012 deployments, 24 2013 deployments

- ### ProtoGENI and FOAM as native Aggregate Managers and Control Frameworks

  - Boots to ProtoGENI instance with OpenFlow switch

- ### Designed for wide-area PlanetLab federation

  - PlanetLab image provided with boot
  - InstaGENI PlanetLab Central stood up

- ### Designed for expandability

  - Approx 30U free in rack

# Understanding the instageni rack

- Two big things:
  - IT'S JUST ProtoGENI
  - It's this thing

# It's just protogeni

- Key Design criterion behind the InstaGENI rack

  - Reliable, proven control framework

  - Familiar UI to GENI experimenters and administrators

  - Well-understood support and administrative model

- We're not inventing new Control Frameworks, we're deploying Control Frameworks and Aggregate Managers you understand and know how to use

  - Network of baby ProtoGENI's, with SDN native to the racks

- Allocation of resources with familiar tools

  - Flack...

- Easy distribution and proven ability to run many images

- Support model well-understood

  - If something goes wrong, we know how to fix it...

- PlanetLab and OpenFlow integration out-of-the-box

# The GENI "Apple-II"

- Key insight: the Apple II wasn't the first mass market computer because it was innovative, but because it was packaged

- Pre Apple-II, computers were all hobbyist kit
  - "Much Assembly, Configuration, Software Writing, Installation required"

- But the Apple-II worked out of the box
  - Plug it in and turn it on
  - And that's what made a revolution

- Same Idea
  - Plug in the InstaGENI Rack
  - Put in the wide-area network connection
  - Rob will install the software and bring it up over the net
  - You're on the Mesoscale!

# The instageni rack

- **Designed for easy deployability**
  - Power: 220V L6-20 receptacle (or two 110V)
  - Network: 10/100/1000 Base-T

- **Pre-wired from the factory**

- **On the Mesoscale**
  - Network connections pre-allocated
  - VLANs and connectivity pre-wired before the rack arrives

- **Designed for Remote Management**
  - HP iLO on each node

- **Designed for flexible networking**
  - 4 1G NICs/node, 20 1G NICs, v2 linecards OpenFlow switch

# instageni rack hardware

- **Control Node for ProtoGENI Boss, ProtoGENI users, FOAM Controller, Image storage…**
  - HP ProLiant DL 360G7, quad-core, single-socket, dual NIC (1 Gb/sec), 12GB RAM, 4TB Disk (RAID), iLO

- **Five Experiment Nodes**
  - HP ProLiant DL 360G7, six-core, dual-socket, quad NIC (1 Gb/sec), 48GB RAM, 1TB Disk, iLO

- **OpenFlow Switch**
  - HP E 5406, 20 1 Gb/s, v2 linecards
  - Hybrid mode

# Instageni planned deployment
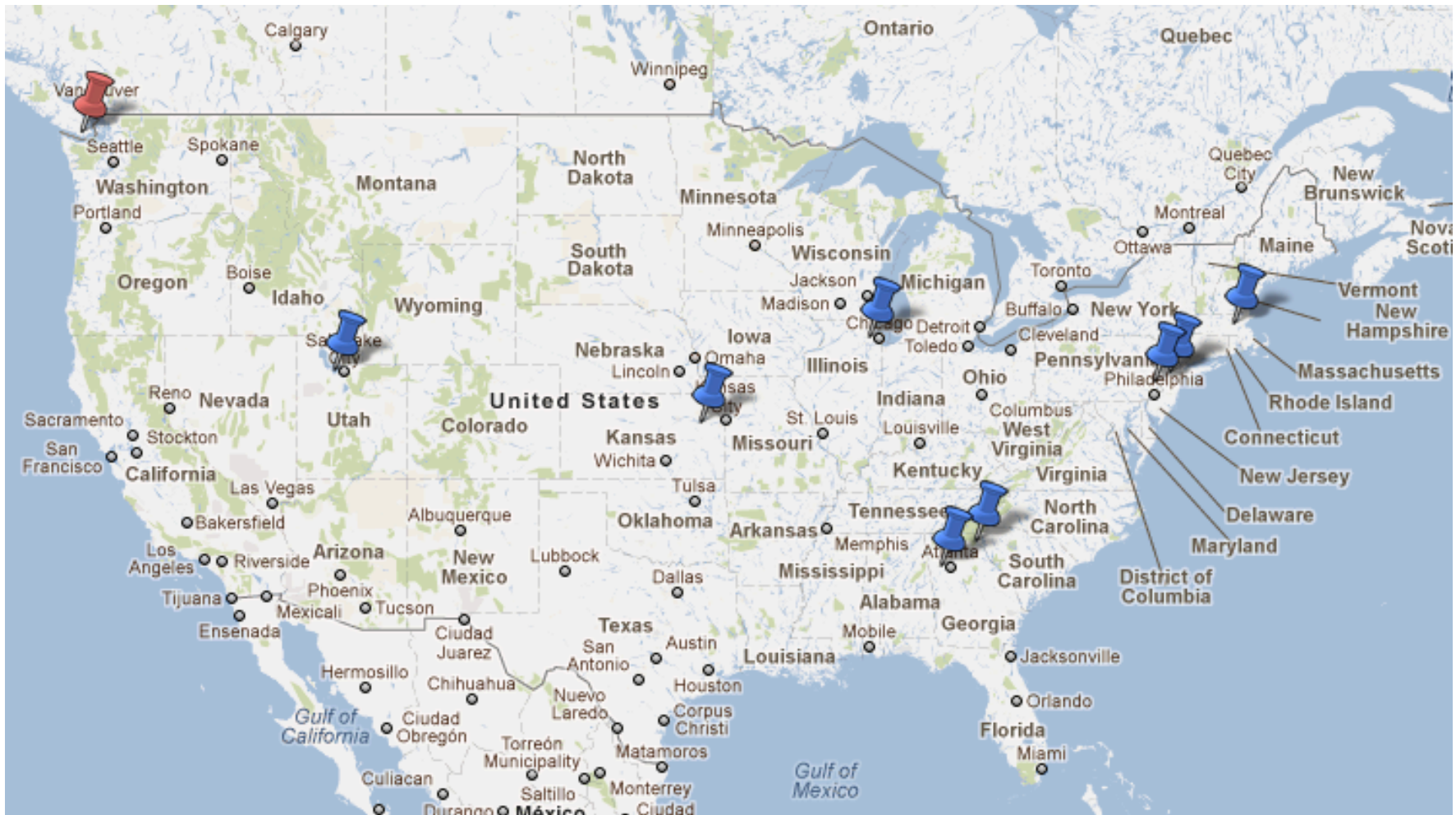
- **GENI funding**
  - 8 sites in Year 1
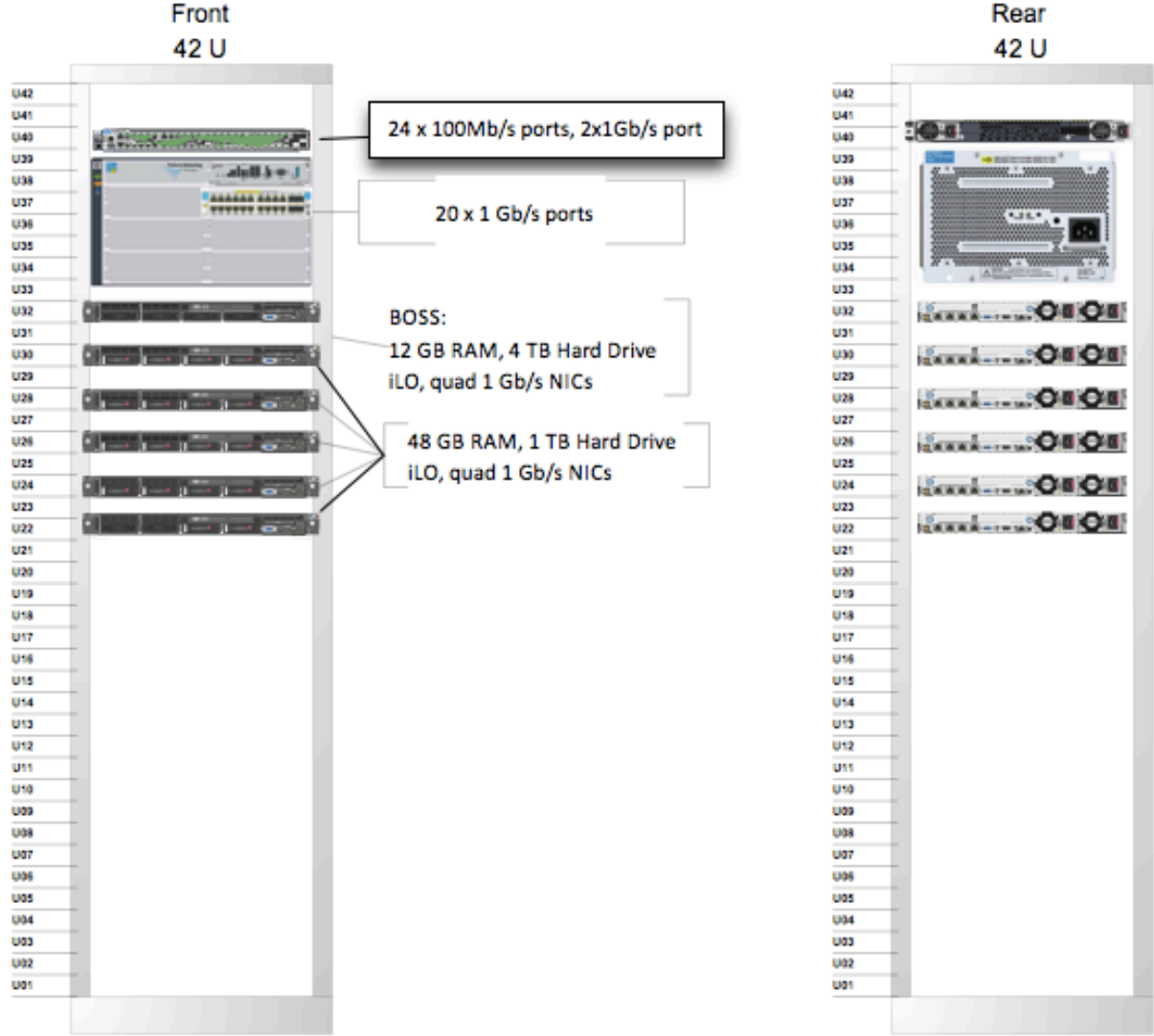  - 24 sites in Year 2
  - All in USA
- **Other Racks**
  - US Public Sector except Federal Government: Special HP program
    - Contact Michaela Mezo, HP SLED
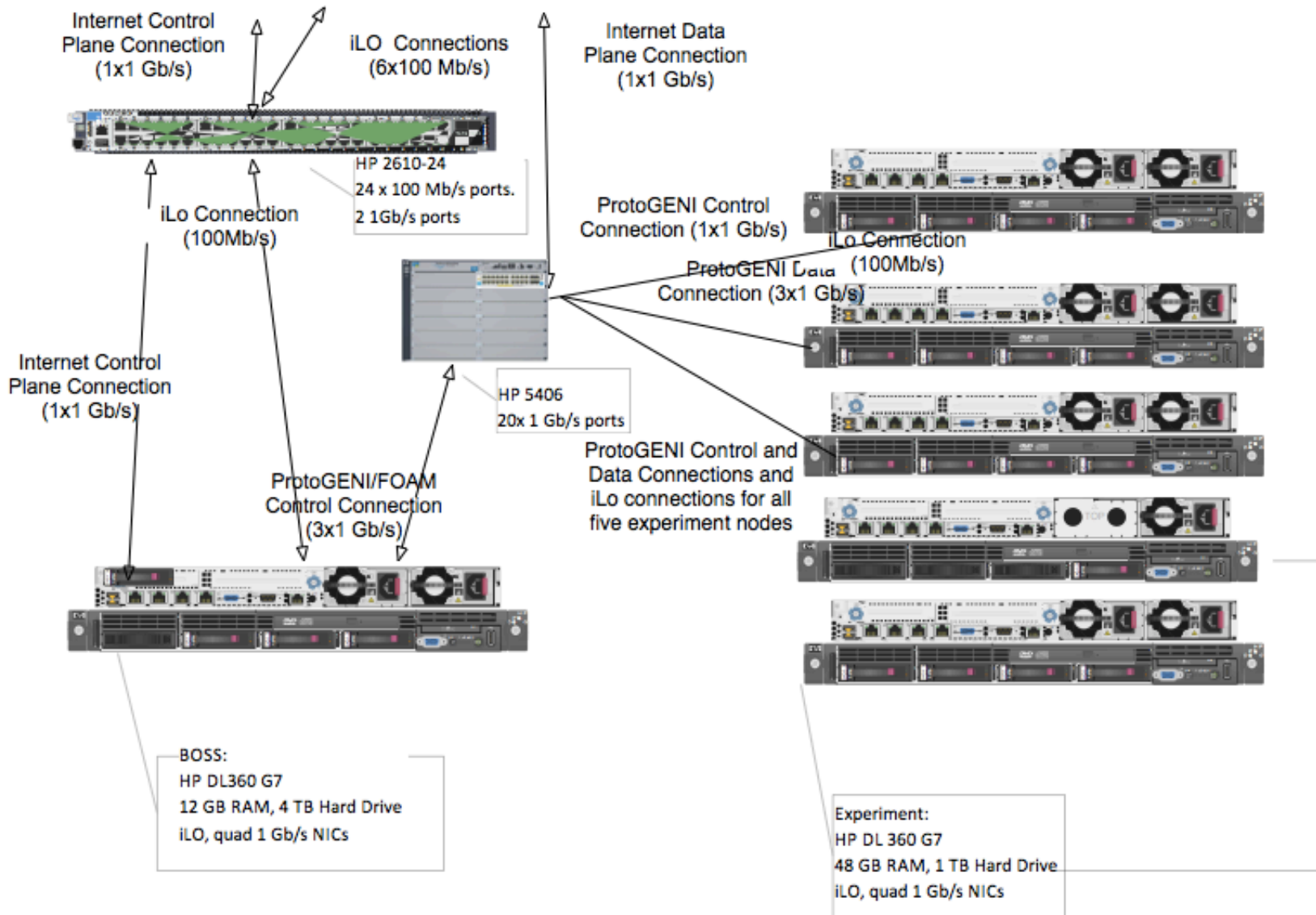  - Abroad: see me.

# Instageni year 1 sites
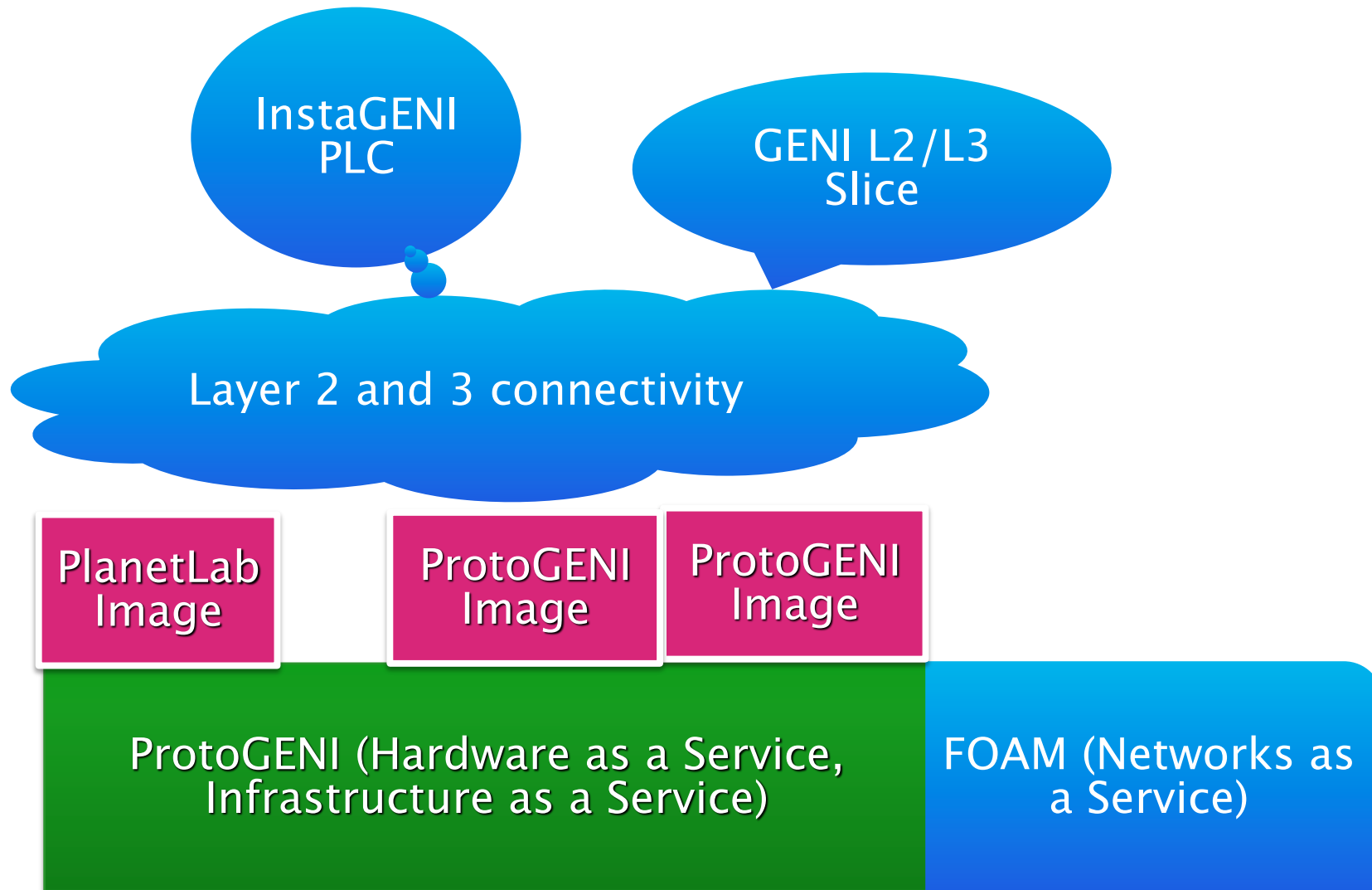
# Instageni rack diagram

Front
42 U

Rear
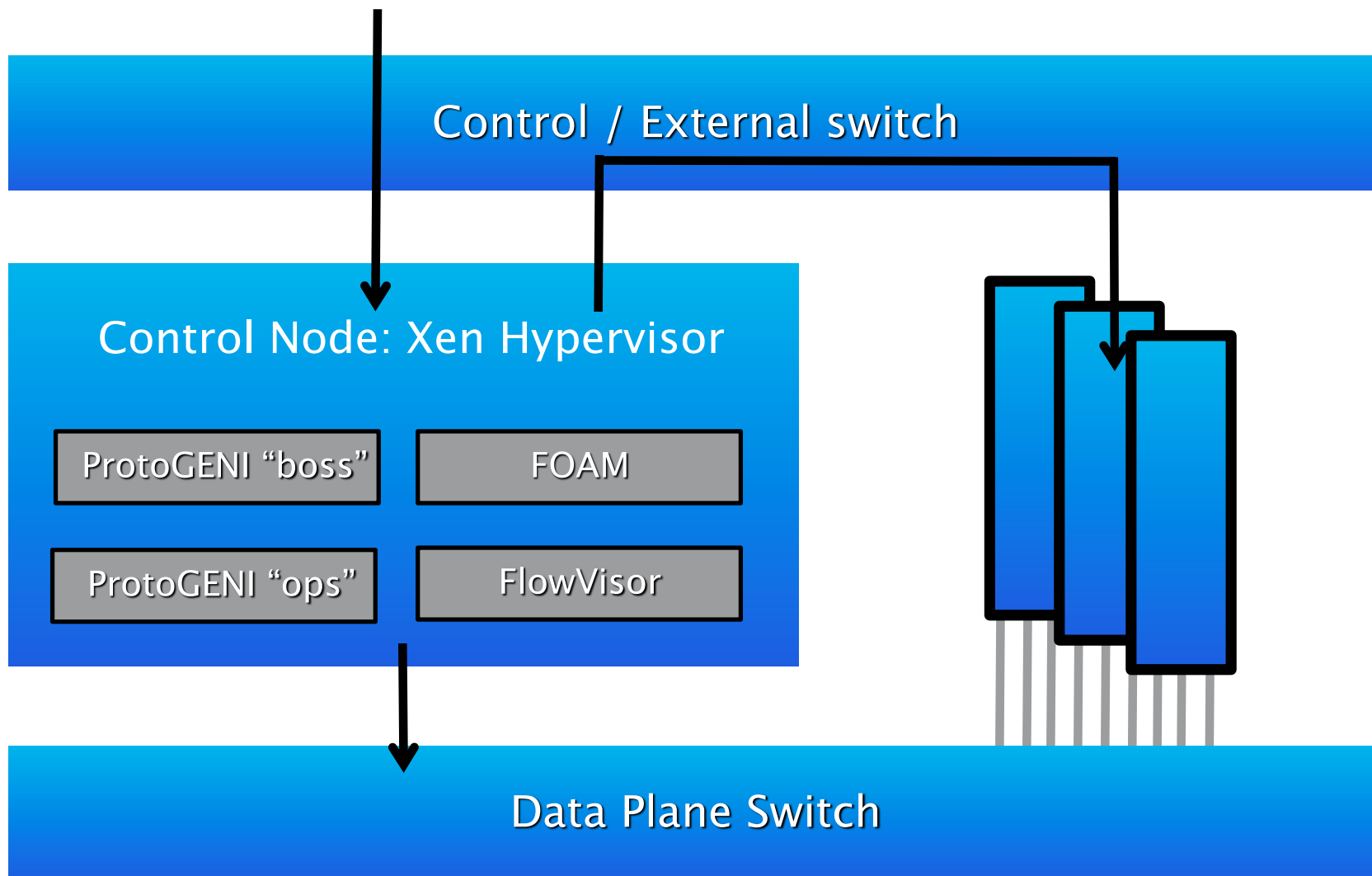42 U

24 x 100Mb/s ports, 2x1Gb/s port

20 x 1 Gb/s ports

BOSS:
12 GB RAM, 4 TB Hard Drive
iLO, quad 1 Gb/s NICs

48 GB RAM, 1 TB Hard Drive
iLO, quad 1 Gb/s NICs

# Instageni rack topology

Internet Control
Plane Connection
(1x1 Gb/s)

iLO  Connections
(6x100 Mb/s)

Internet Data
Plane Connection
(1x1 Gb/s)

HP 2610-24
24 x 100 Mb/s ports.
2 1Gb/s ports

iLo Connection
(100Mb/s)

ProtoGENI Control
Connection (1x1 Gb/s)

iLo Connection
(100Mb/s)

ProtoGENI Data
Connection (3x1 Gb/s)

Internet Control
Plane Connection
(1x1 Gb/s)

HP 5406
20x 1 Gb/s ports

ProtoGENI Control and
Data Connections and
iLo connections for all
five experiment nodes

ProtoGENI/FOAM
Control Connection
(3x1 Gb/s)

BOSS:
HP DL360 G7
12 GB RAM, 4 TB Hard Drive
iLO, quad 1 Gb/s NICs

Experiment:
HP DL 360 G7
48 GB RAM, 1 TB Hard Drive
iLO, quad 1 Gb/s NICs

# instageni photo

# Instageni software architecture



InstaGENI PLC

GENI L2/L3 Slice

Layer 2 and 3 connectivity

PlanetLab Image

ProtoGENI Image

ProtoGENI Image

ProtoGENI (Hardware as a Service, Infrastructure as a Service)

FOAM (Networks as a Service)
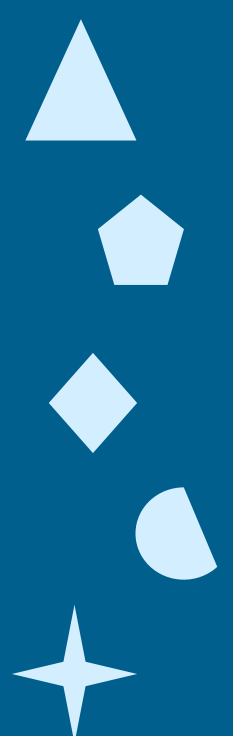
# Control Infrastructure
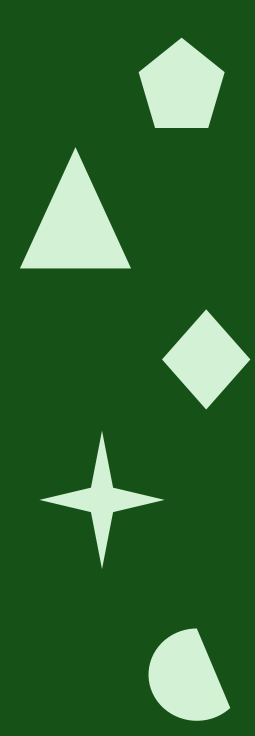


Control / External switch

Control Node: Xen Hypervisor

ProtoGENI "boss"

FOAM

ProtoGENI "ops"

FlowVisor

Data Plane Switch

# (rE)Provisioning Nodes

# GENI Integration

- Will ship with full support for GENI AM (likely v3)
  - Updates as GENI APIs evolve

- Support for Tom Lehman's RSpec stitching extension

- Will have local FOAM and FlowVisor instances for OpenFlow integration

- Will start by affiliating with the ProtoGENI clearinghouse

- Switch affiliation to the GENI Clearinghouse once up
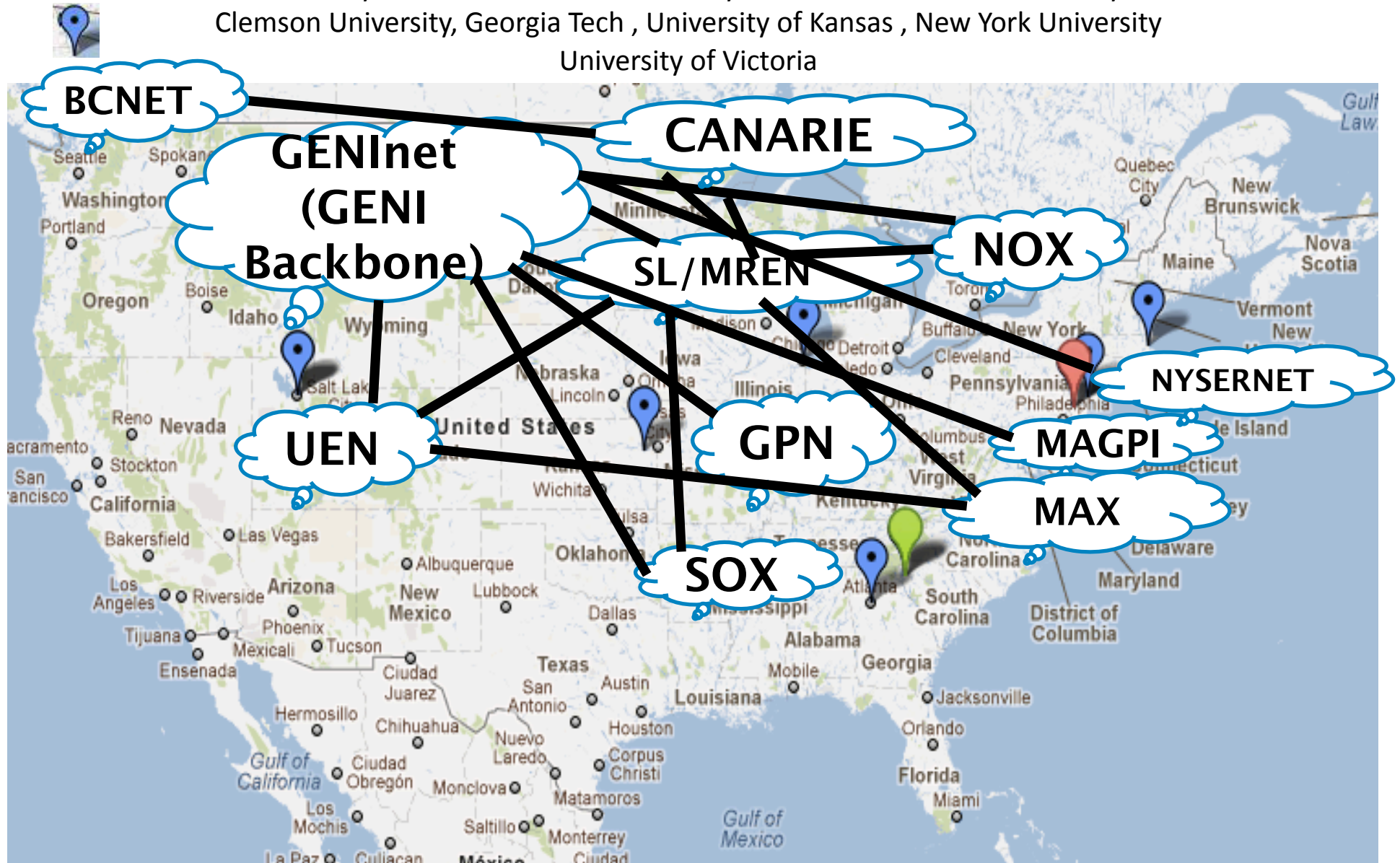
# Software Management

- Frequent control software updates
  - Rarely affects running slivers
  - VM snapshots to roll back failed updates
  - Major software changes, rather than on a set schedule

- All updates done by InstaGENI personnel
  - (Sites can make local modifications, but this "voids the warranty")
  - Testing period on Utah rack first
  - **Perfect score from GPO!  (8/5/12)**

- Updating disk images
  - New version of standard images distributed nightly
  - Voluntary updates for exclusive-use nodes and VM images
  - Scheduled updates for VM host images
  - Security updates will be handled differently on case-by-case basis
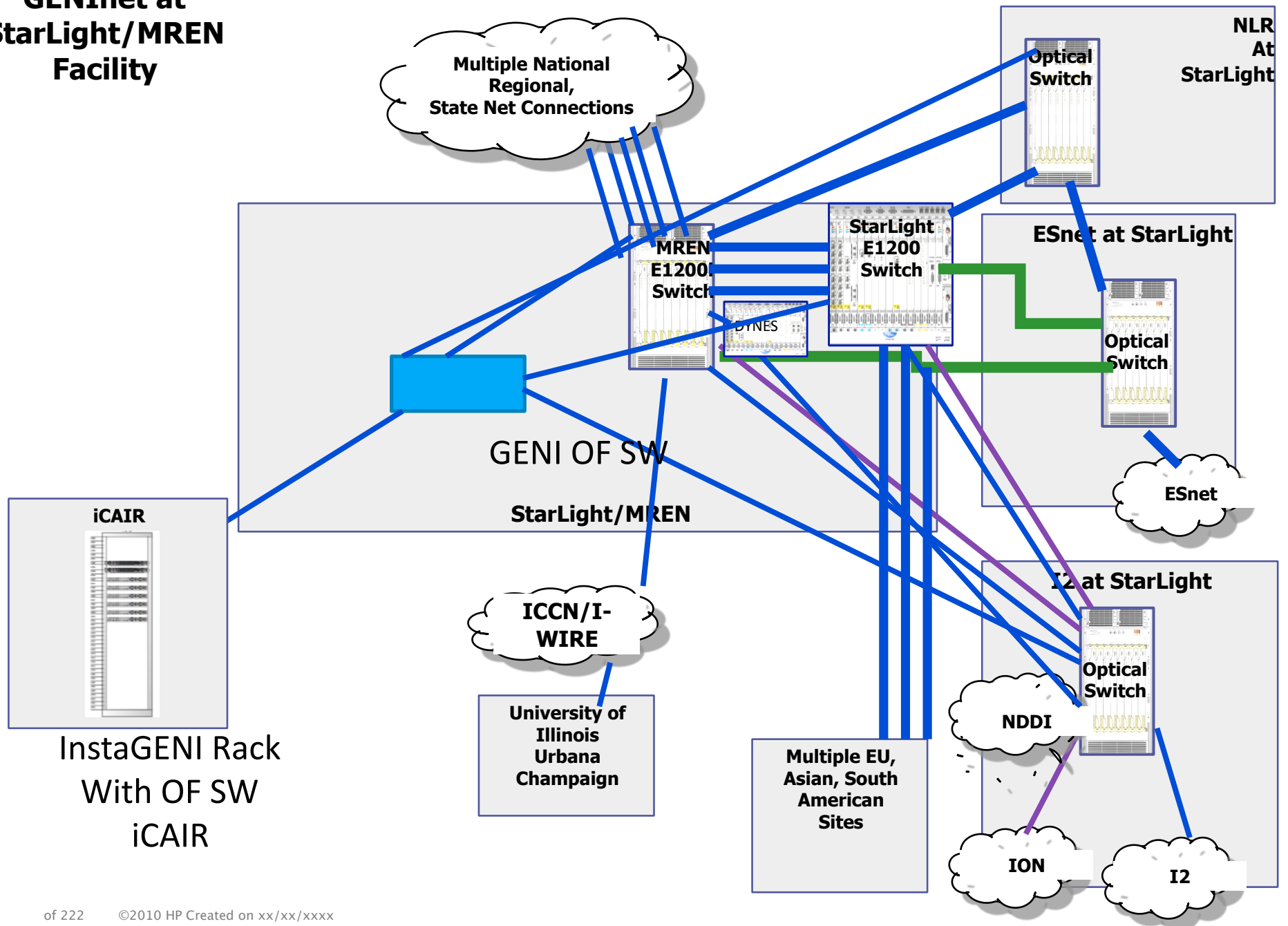
# Operations and Management

- Providing GMOC with:
  - Visibility into current users and slices
  - Health and historical data
  - "Kill switch" credentials for emergency shutdown
- Local administrators get the same access
- Automatic verification of slices upon setup
  - Local admins get mail about hardware failures
- PlanetFlow-based mapping of address/packets to slices
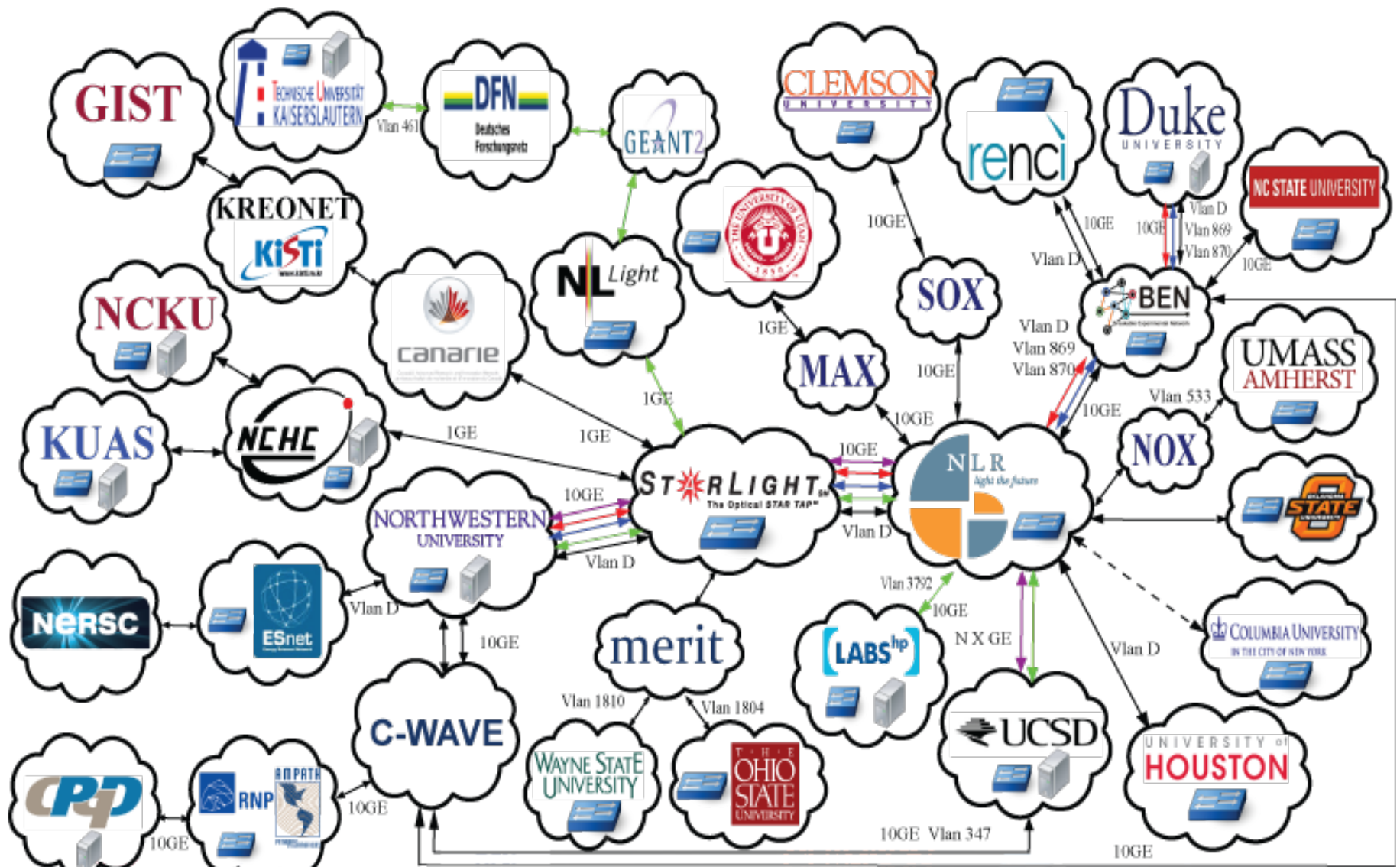
# InstaGENI Sites and Network: Y1

University of Utah, Princeton University, GPO, Northwestern University,
Clemson University, Georgia Tech , University of Kansas , New York University
University of Victoria

**GENInet at StarLight/MREN Facility**

Multiple National Regional, State Net Connections

NLR At StarLight

Optical Switch

ESnet at StarLight

StarLight E1200 Switch

MREN E1200 Switch

DYNES

Optical Switch

ESnet

GENI OF SW

StarLight/MREN

iCAIR

InstaGENI Rack With OF SW iCAIR

ICCN/I-WIRE

University of Illinois Urbana Champaign

Multiple EU, Asian, South American Sites

I2 at StarLight

Optical Switch

NDDI

ION

I2

# Selected Other Interconnections



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# Thanks!