



Introduction to **GENI**

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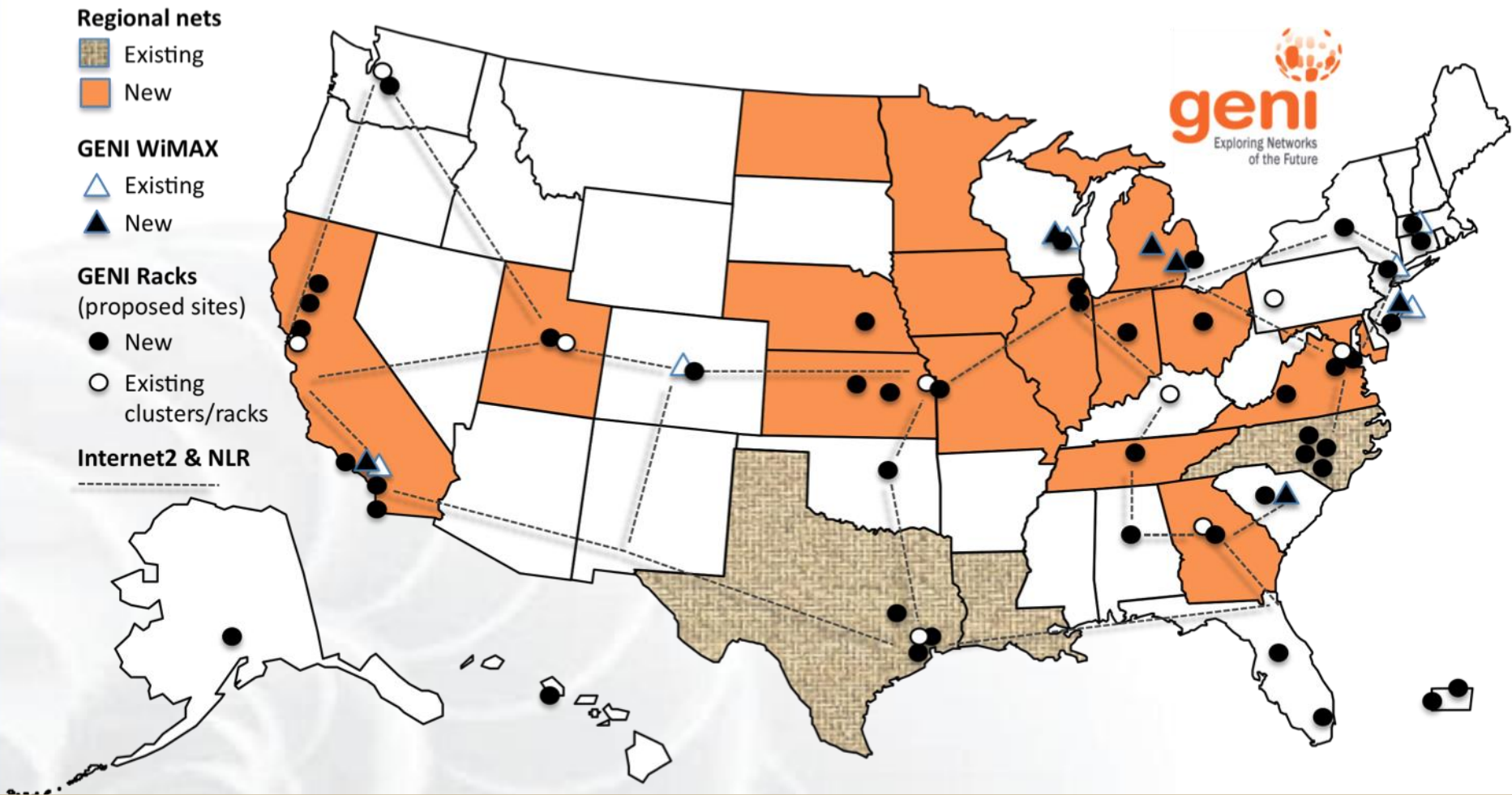
What is GENI?

How is GENI being used?

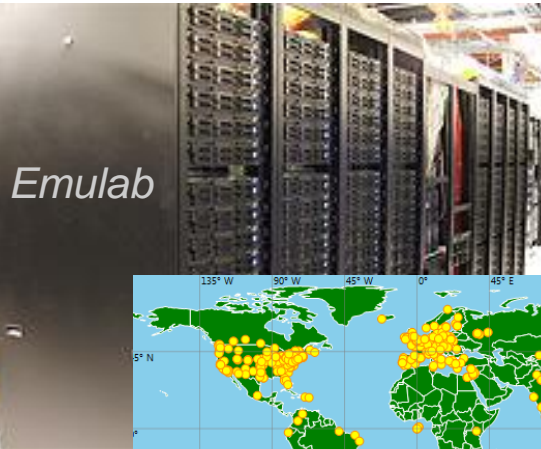
Key GENI Concepts

Demo: A simple experiment using GENI

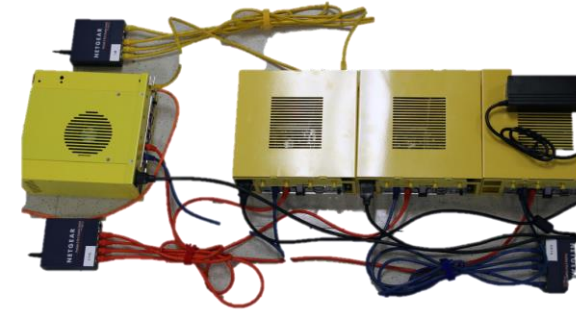
GENI: Infrastructure for Experimentation



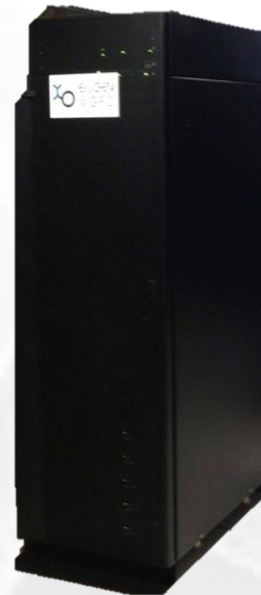
GENI provides compute resources that can be connected in experimenter specified Layer 2 topologies.



Existing Testbeds

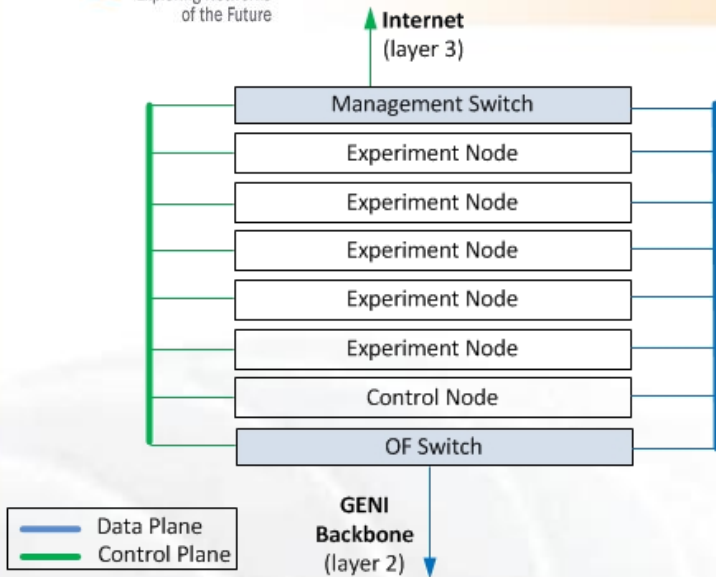


GENI Racks

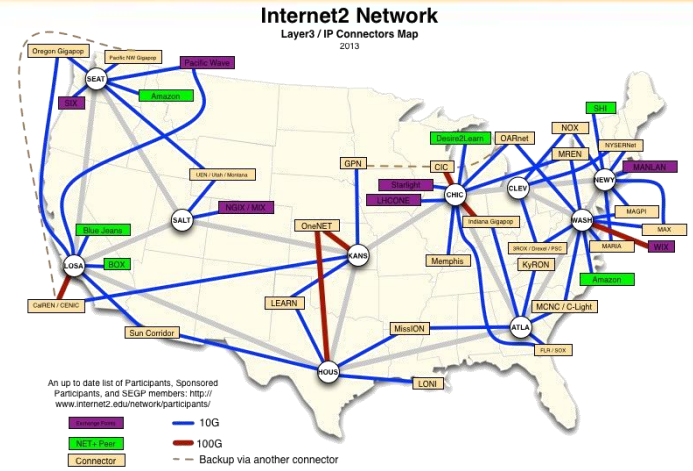


GENI Wireless
compute nodes

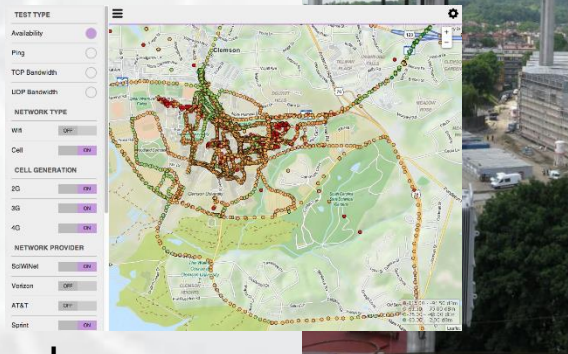




Networking within a Rack



National Research Backbones (e.g. Internet2)

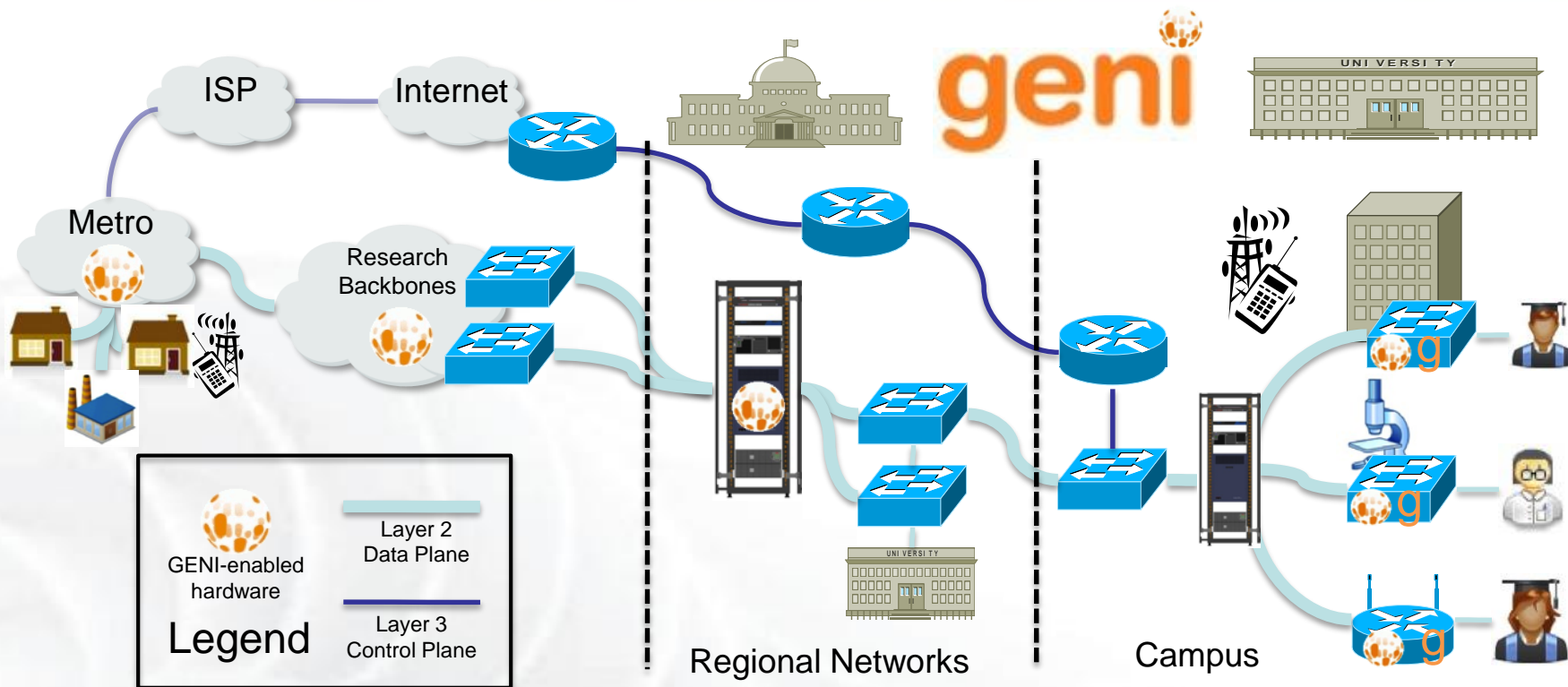


4G/3G
GENI network

WiMAX Base Stations



Regional Networks (e.g. CENIC)



- Flexible network / cloud research infrastructure
- Also suitable for physics, genomics, other domain science
- Distributed cloud (racks) for content caching, acceleration, etc.

- More **WiMAX base stations** with Android handsets
- GENI-enable 5-6 **regional networks**
- Inject more **OpenFlow switches** into Internet2
- Add **GENI Racks** to 50-80 locations within campuses, regionals, and backbone networks



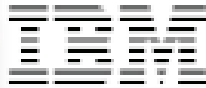
GENI Racks serve as programmable routers, distributed clouds, content distribution nodes, caching or transcoding nodes, etc



Ilia Baldine

RENCI

More resources / rack,
fewer racks



Rajesh Narayanan

DELL



KC Wang Clemson

Latest addition

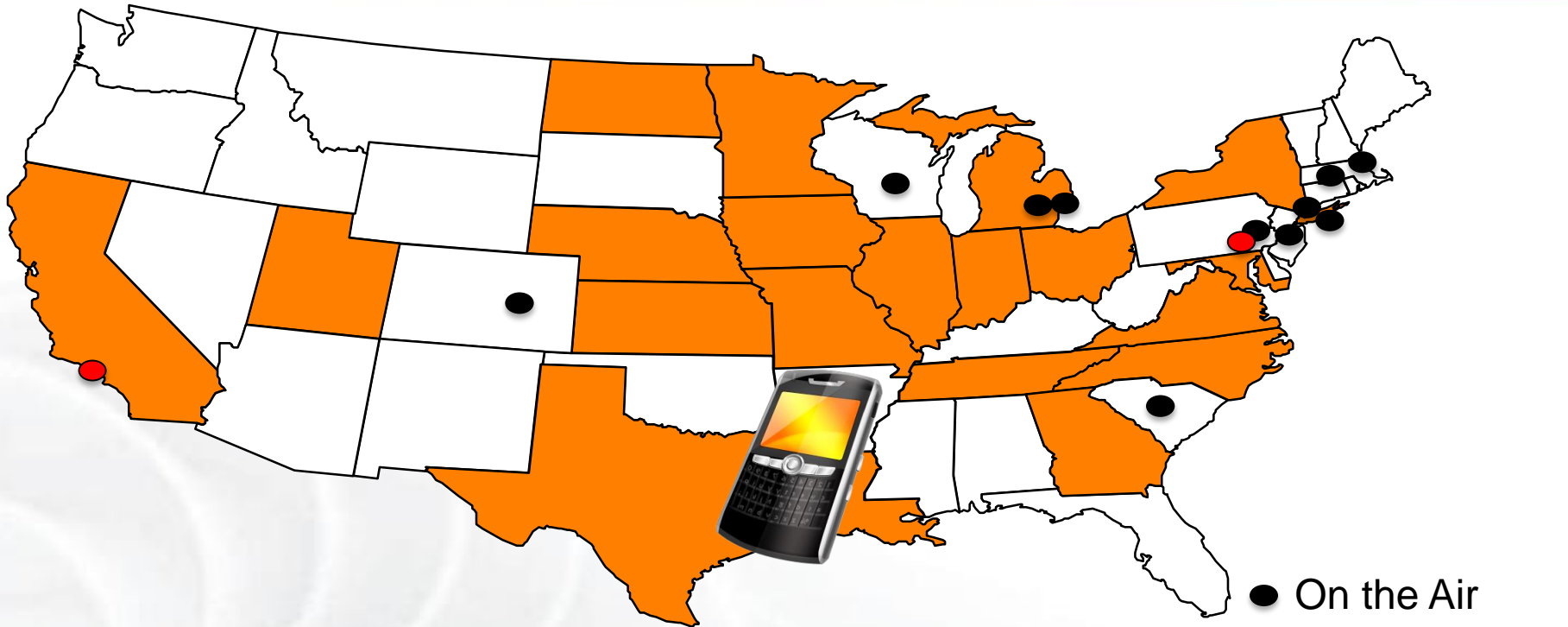


Rick McGeer

HP Labs

Fewer resources / rack,
more racks

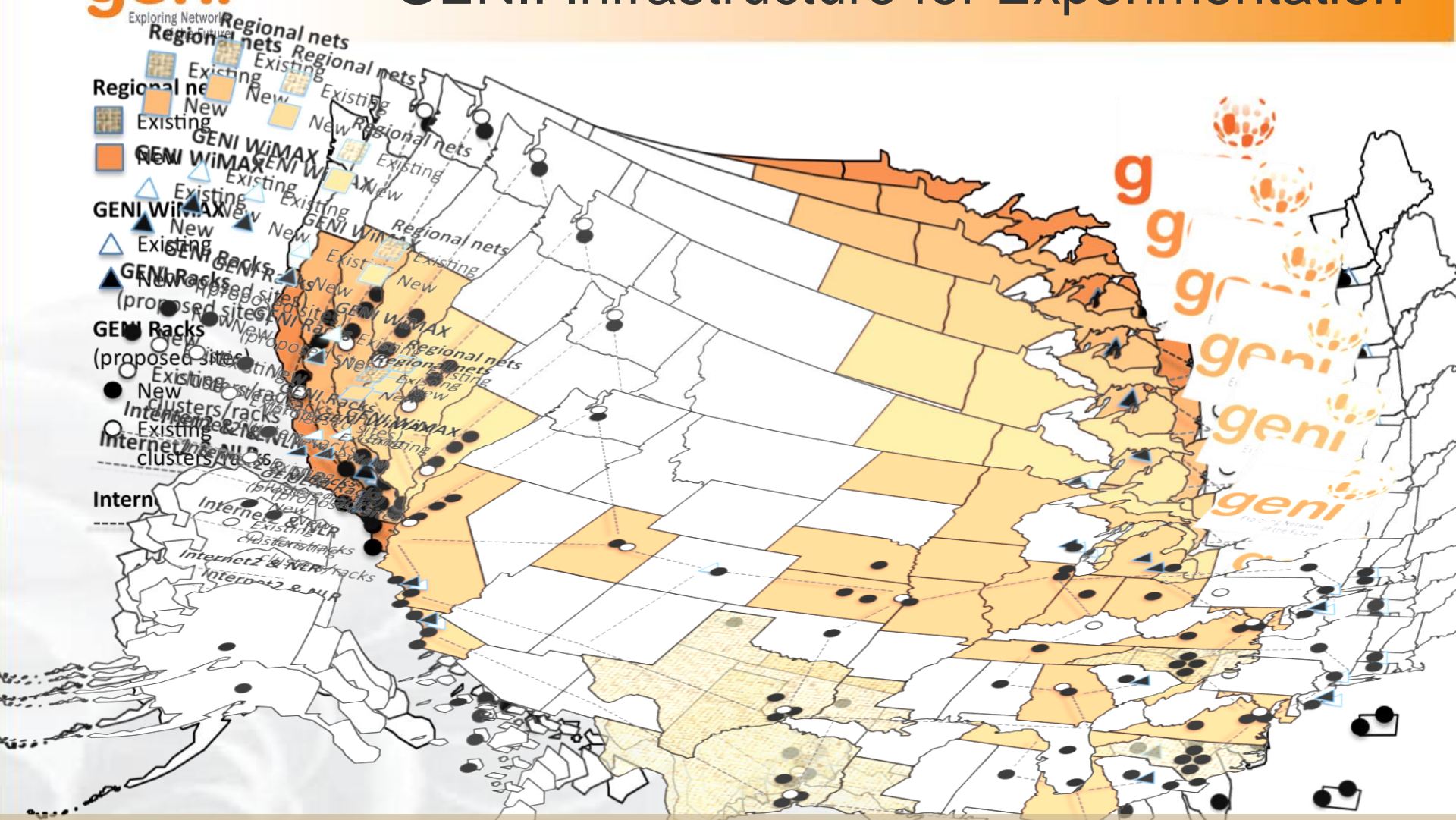




- 26 Wimax Base Stations in 13 Sites
- Sliced, virtualized and interconnected
- Researcher-owned,
- researcher-operated
- 4G cellular systems



GENI: Infrastructure for Experimentation

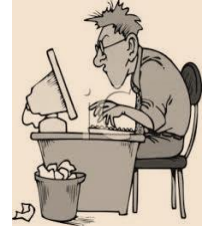


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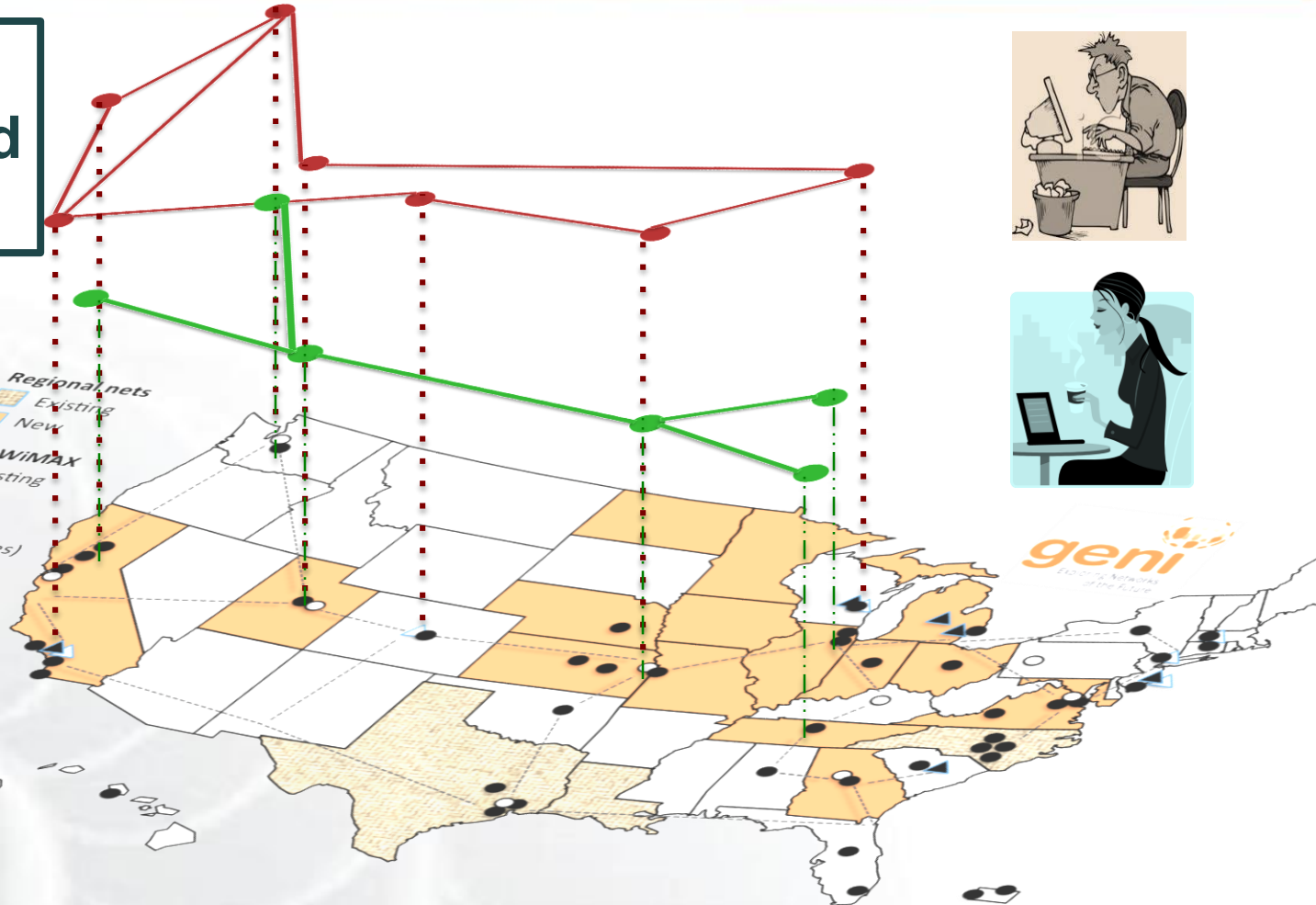


Multiple GENI Experiments run Concurrently

Experiments
live in **isolated**
“slices”



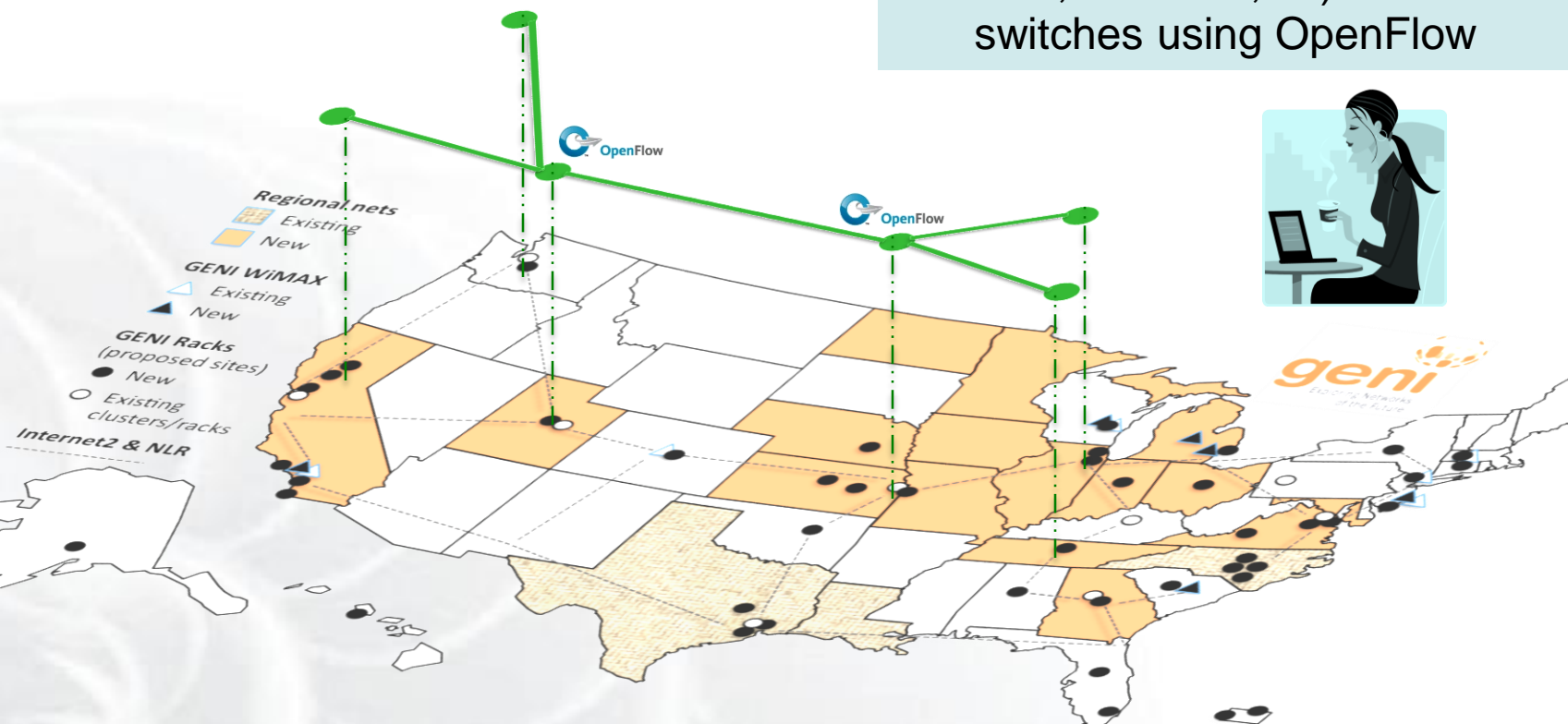
- Regional nets**
 - Existing
 - New
- GENI WiMAX**
 - Existing
 - New
- GENI Racks (proposed sites)**
 - New
 - Existing clusters/racks
- Internet2 & NLR**



Resources can be **shared** between slices

GENI is “Deeply Programmable”

I install software I want throughout my network slice (into routers, switches, ...) or control switches using OpenFlow



OpenFlow is part of the experiment not just the infrastructure

GENI Supports:

- Any combination of:
 - compute/cloud,
 - networking/SDN and
 - wireless
- Explore impact of geographic diversity

OK to DO

- man-in-the middle attacks
- Tor networks
- DDoS on your own resources (as long as it does not affect other experimenters)
- Securing OpenFlow/SDN
- Many more...

DO NOT use GENI to hack or affect other systems or other experiments

e.g. Do not hack another tenant on the same server

DO NOT run viruses, worms, or malware which could escape GENI

➤ Use DETER Lab instead

When in doubt, **ask**

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How is GENI being used?

Key GENI Concepts

Demo: A simple experiment using GENI



Research

- Future Internet architectures
- Software defined networking
- Large scale evaluation of smart grid protocols

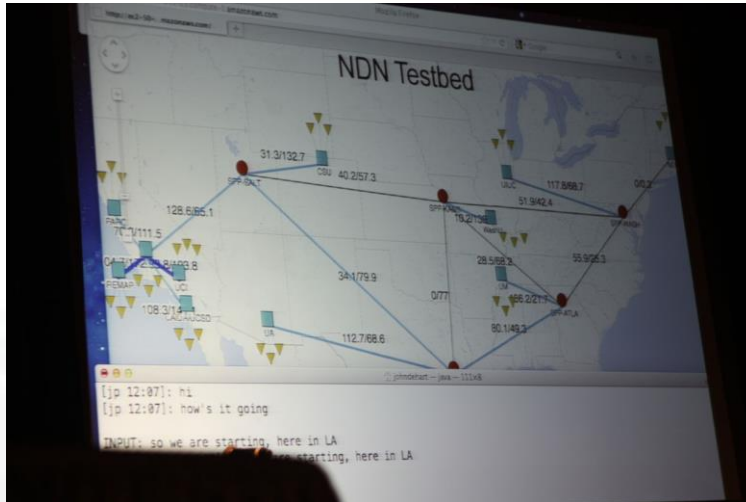


Education

- Networking and Distributed systems classes
- Cloud computing classes
- WiMAX classes

GENI has over 3400 users!

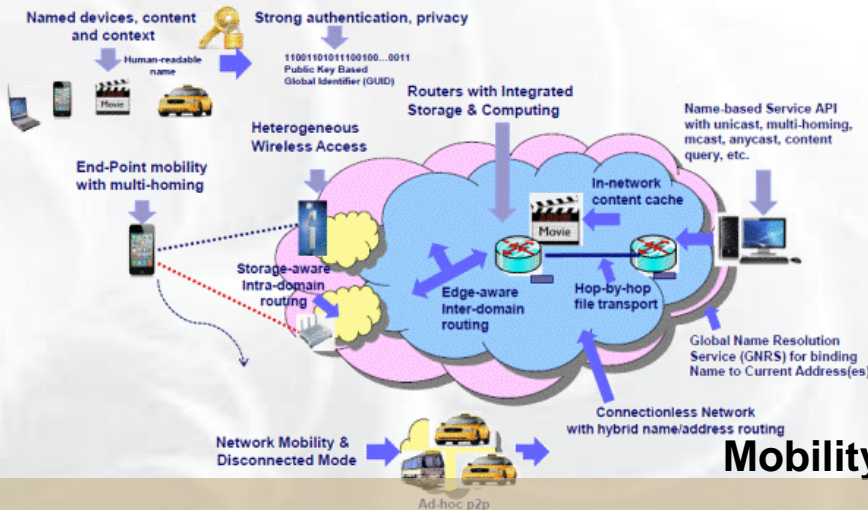
Three FIA Teams have Slices on GENI



NDN (demo at GEC 13)



XIA (demo at GEC15)



MobilityFirst (demo at GEC 12, GEC18, GEC20)

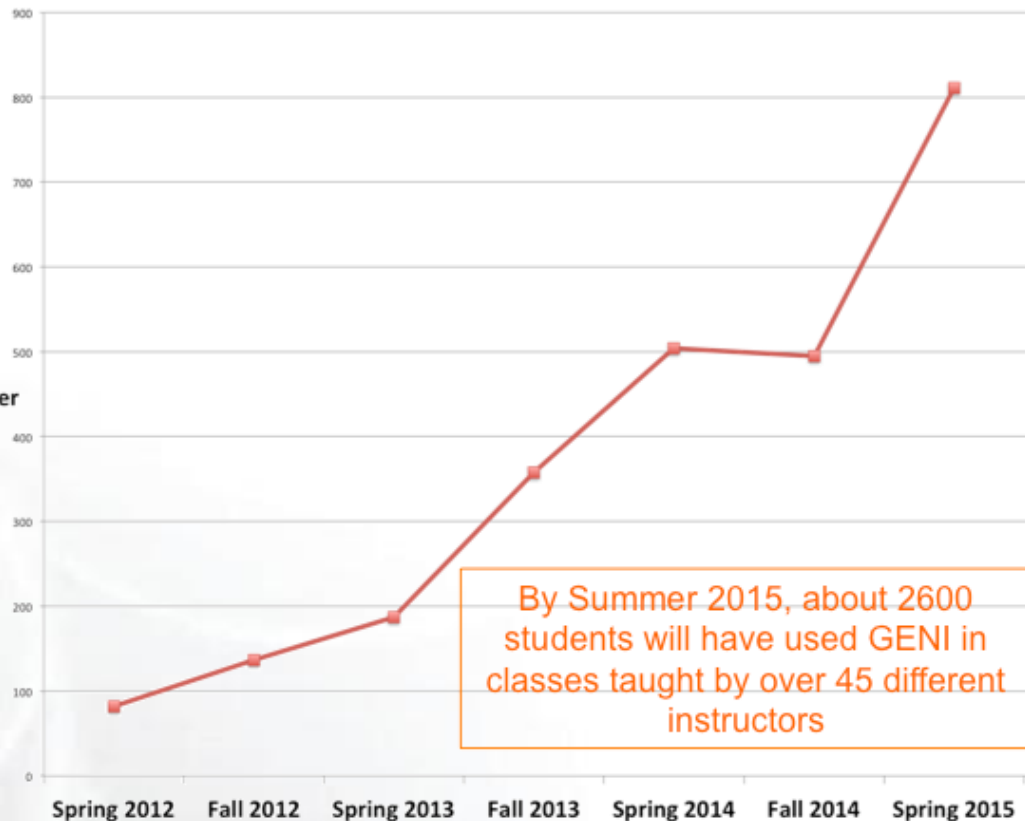
GENI is a unique testbed that can support all of these teams

Tutorials of all three at previous GECs



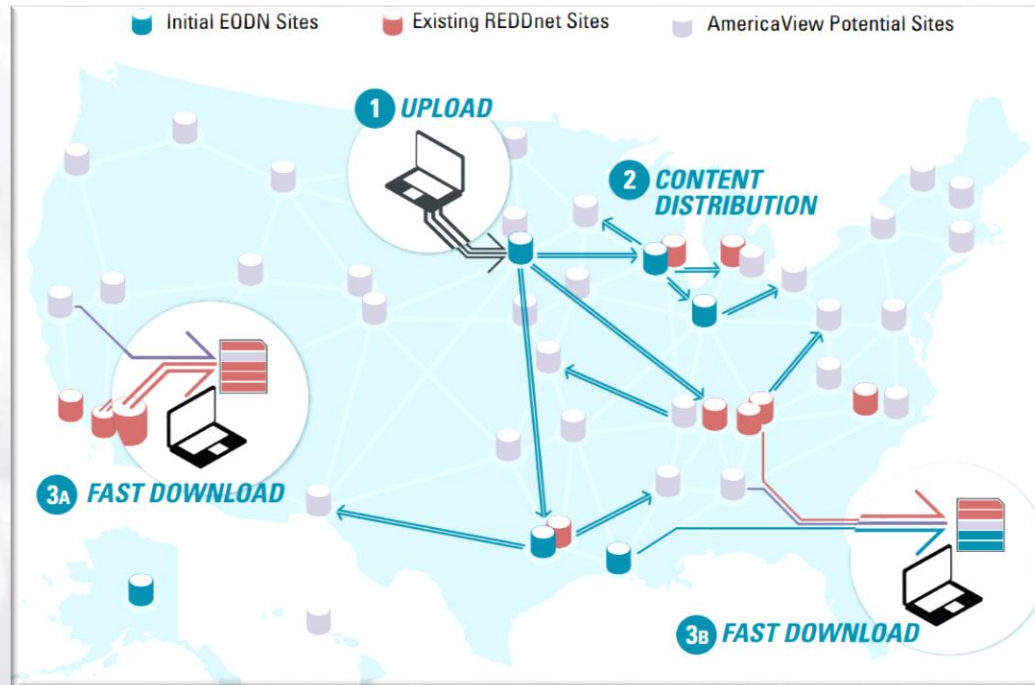
GENI as a remote, virtual lab for networking, distributed systems and cloud computing classes

Students per semester



Earth Observation Depot Network (EODN)

- Addresses the deployment concerns in enabling open access to remotely sensed data from a wide range of public, private, and commercial sources
- Built in part with the NSF-funded Data Logistics Toolkit (DLT)
- Deployed on a volunteer basis by AmericaView members in conjunction with existing REDDnet resources



Slide from:

IU: Ezra Kissel, Akshay Dorwat, Jeremy Musser, Prakash Rajagopal, Rohit Khapare, Joseph Cottam, Martin Swamy

UW-Madison: Sam Batzli

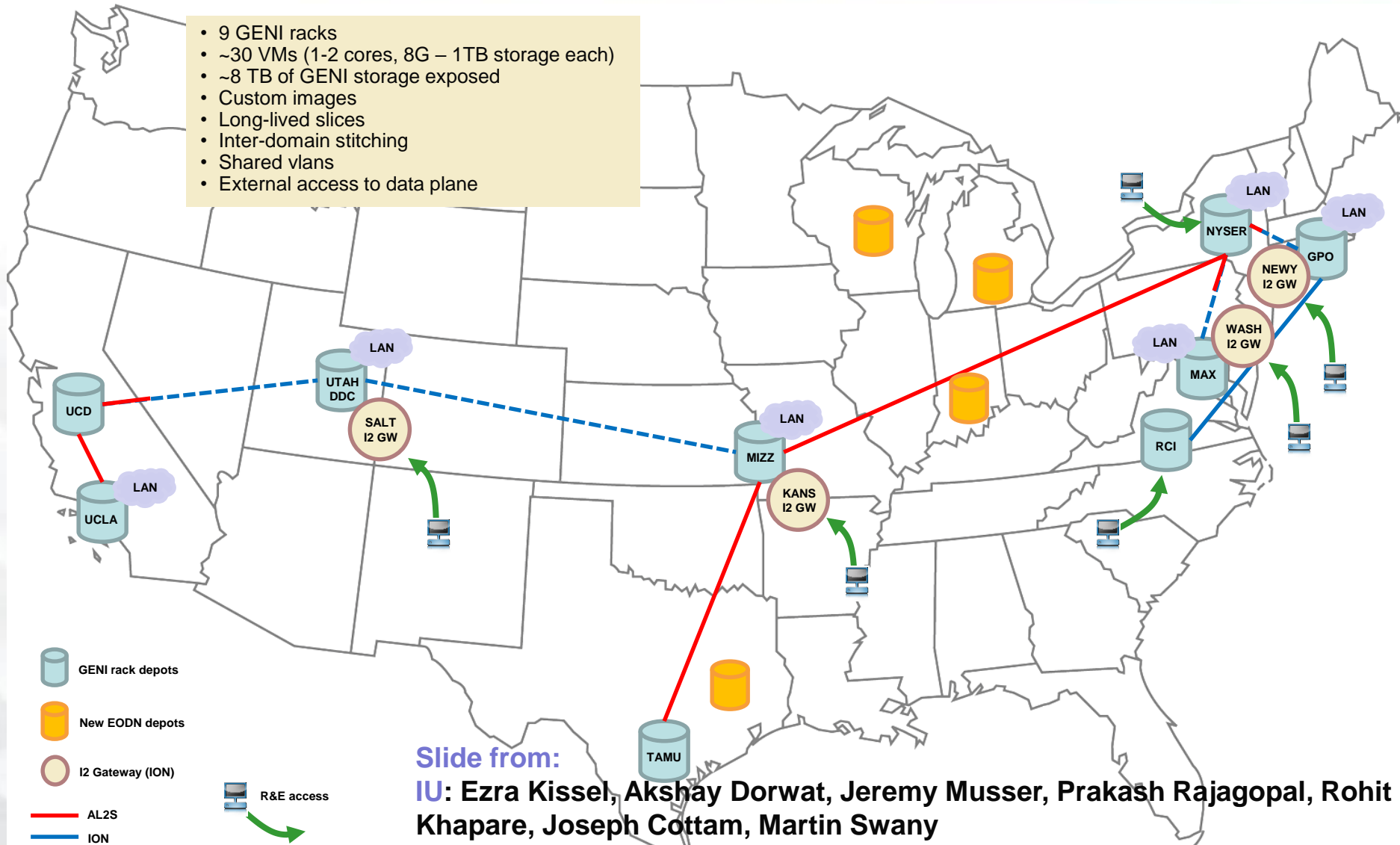
– Director, WisconsinView

SFASU: Paul Blackwell

– Exec. Comm., AmericaView

Intelligent Data Movement Service

- 9 GENI racks
- ~30 VMs (1-2 cores, 8G – 1TB storage each)
- ~8 TB of GENI storage exposed
- Custom images
- Long-lived slices
- Inter-domain stitching
- Shared vlans
- Shared vlans
- External access to data plane



 GENI rack depots

 New EODN depots

 I2 Gateway (ION)

 AL2S

 ION

 R&E access


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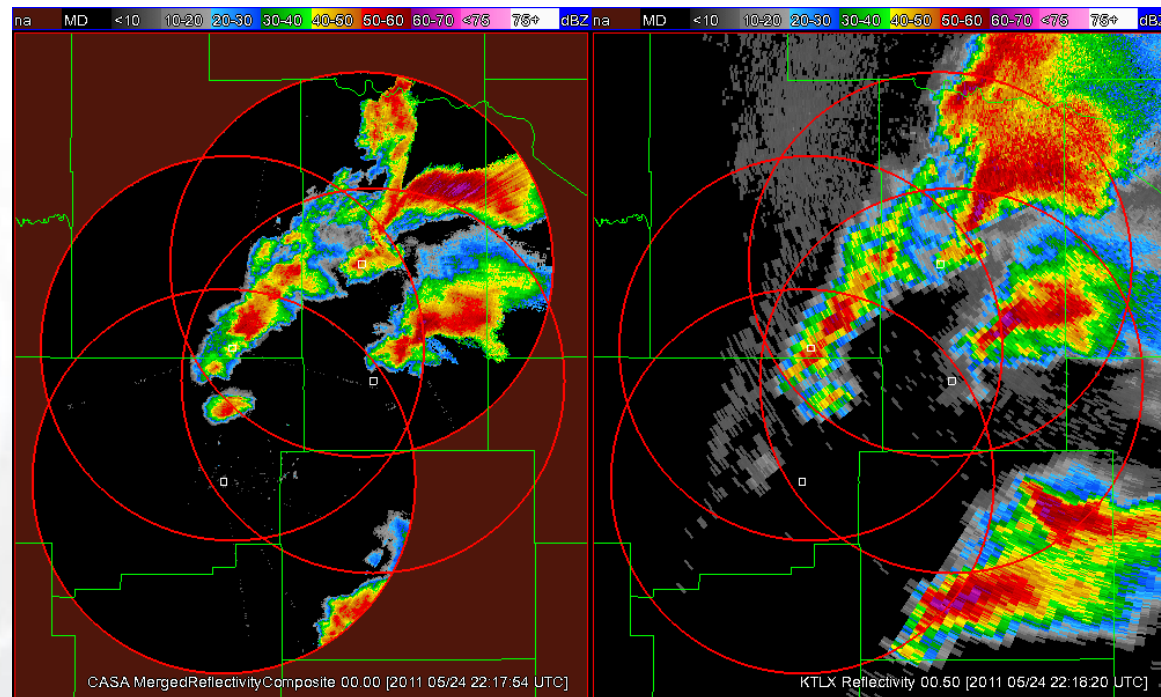
SFASU: Paul Blackwell – Exec. Comm, AmericaView

Slide by Mike Zink, UMass Amherst

Short-term weather prediction (1-15 mins)

Forecasts as we know them:

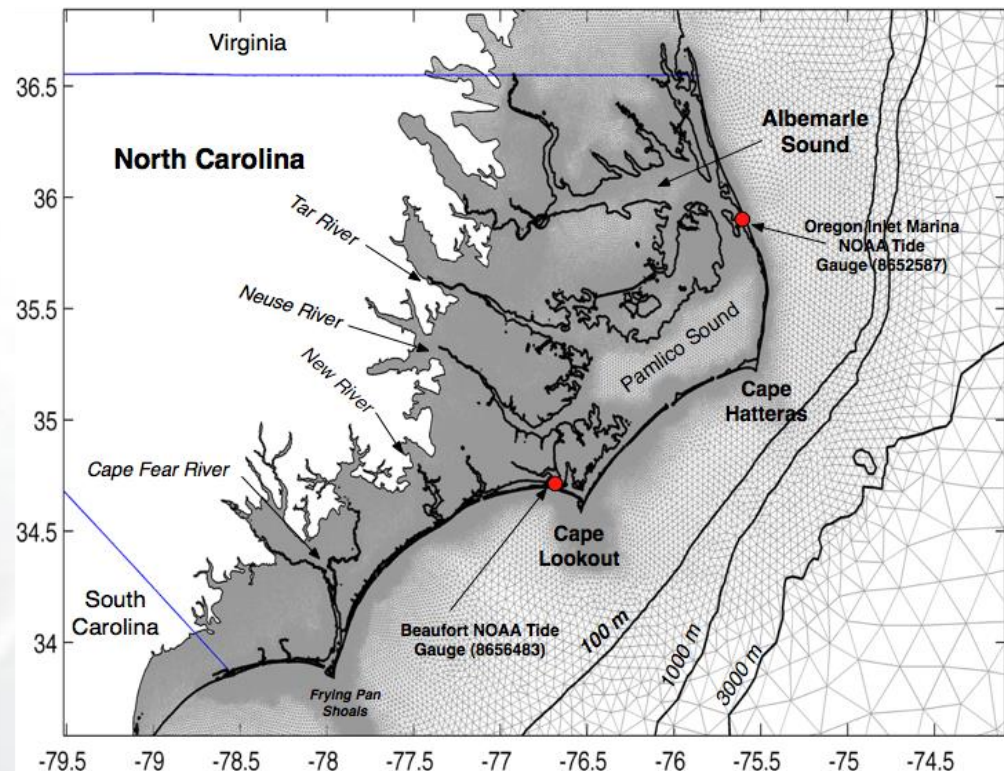
- Data from many sensors: Radar, satellite, balloons,
- Usually for large regions
- Takes super computers to calculate



ADCIRC

Brian Blanton (RENCI)

- Storm surge and tide model
- Finite element model
- MPI tightly coupled
- Approved by FEMA for computing storm surge flood hazard simulations
- Used for Digital Flood Insurance Rate Maps (DFIRMs)
- Scales to 10000+ MPI processes



Slide by Paul Ruth

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