

GENI

Welcome to GEC20!

Mark Berman
June 23, 2014
www.geni.net

Thank you to our hosts

- UC Davis
- Prof. Ben Yoo
- Prof. Felix Wu
- Teresa Brown



A special welcome to those attending JUNO (Japan-US Network Opportunity) PI meeting after GEC

- Welcome
- Demo Night Awards
- GENI Update
- GENI Going Forward
- Experimentation Update
- Call for GEC22 demo proposals
- Apt (Adaptable Profile-Driven Testbed)
- Demonstrations: Systematic Experimentation and GENI Wireless



Harris Lewin

Vice Chancellor for Research

Professor of Evolution and Ecology

University of California, Davis



Bryan Lyles

Program Director

NSF CISE CNS

1st place

- FLARE – Aki Nakao, U. of Tokyo

2nd Place (tie)

- Vehicular Sensing and Control – Yuehua Wang, Wayne State U
- Jacks – Robert Ricci, U. of Utah

... to Chip Elliott, who was honored Saturday evening as a new Fellow of the ACM.

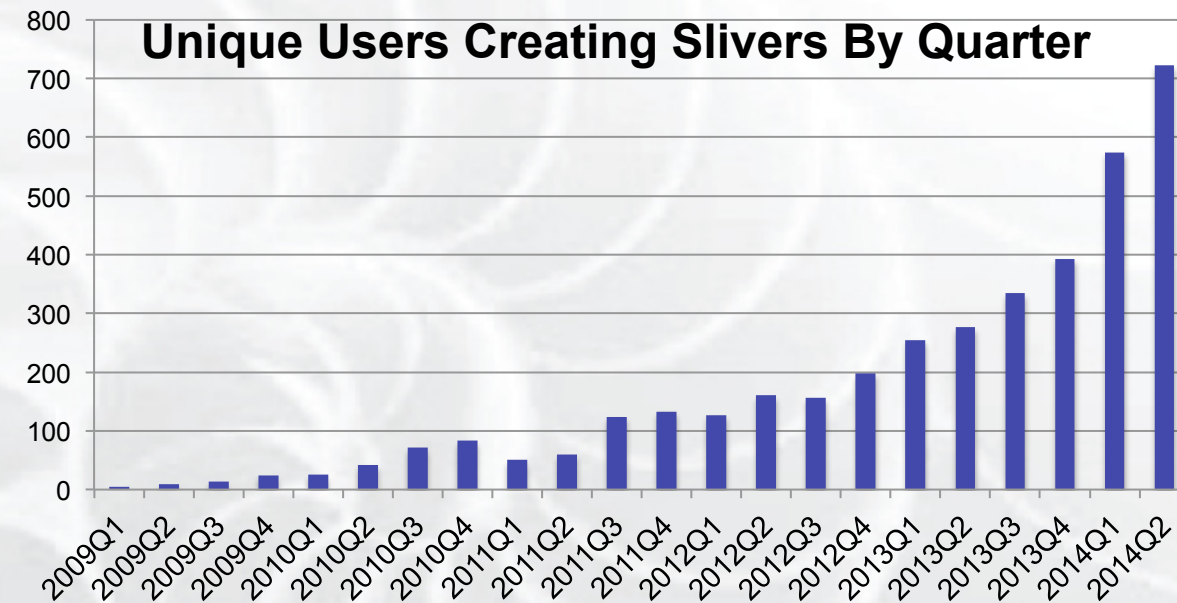
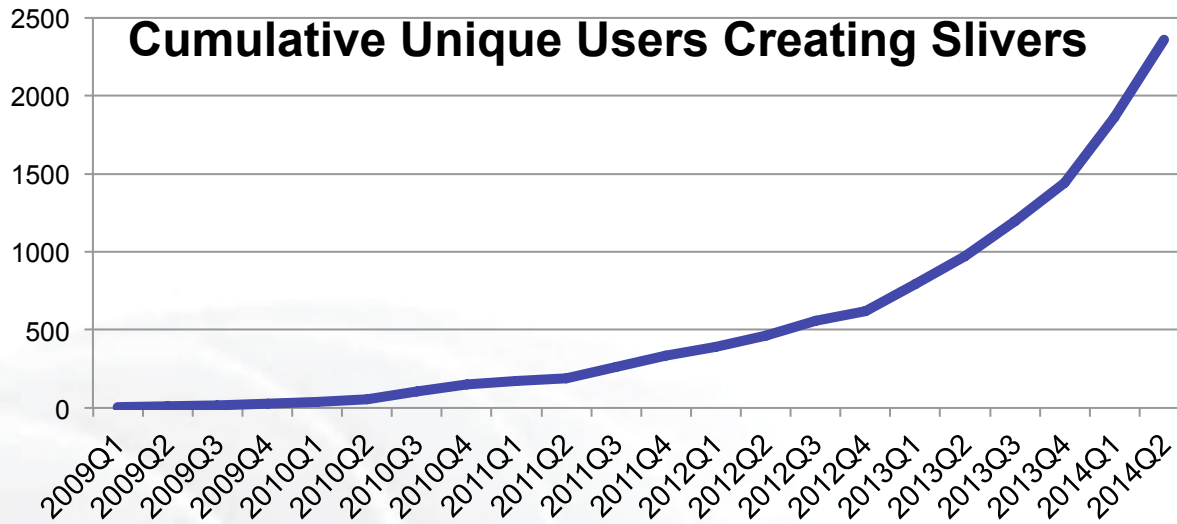


Rapid Growth in Infrastructure and Usage

- Key GENI capabilities continue to take shape and are being widely deployed
 - More GENI racks coming on line
 - With increasing use of stitched configurations, experimenters are building wide-area, sliced, deeply programmable layer two topologies
 - New core network capabilities will facilitate layer two and OpenFlow controlled configurations
- Rapid uptake among researchers and educators
- Infrastructure and tool support is emerging for longer duration and larger scale experiments

An excellent moment to focus our attention on systematic design and execution of experiments in GENI.

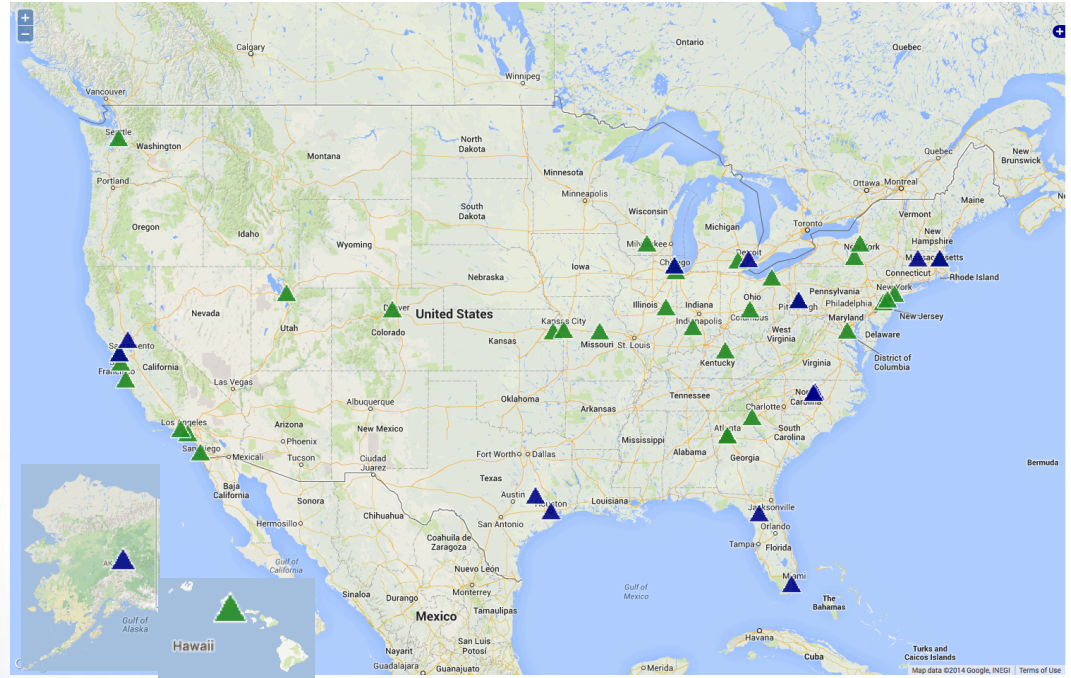
Update: Research and Educational User Growth Keeps Accelerating



Still some instances of scarce resources, but several improvements are helping

- More racks.
- Wiki page for information on avoiding heavily loaded racks.
- Stitching improvements improve resource efficiency (and setup convenience).

- 58 racks deployed/
in progress
 - InstaGENI,
ExoGENI,
OpenGENI, and
Cisco racks
 - Includes some racks
with prototype or
provisional capability
- Rack teams continue to innovate
 - ExoGENI rack upgrades for newest 5 sites: SSD drives, more RAM and cores, 40G interfaces on bare metal worker nodes
 - InstaGENI upgrades to all sites: 2 XEN VM servers per rack (replace OpenVZ); improved control plane protection against IP-based attacks
- More sites ordering their own “spontaneous” racks



Update: Stitching – A Giant Leap Forward

Remember life before stitching (way back in 2013)?



“... communicating over a **transcontinental layer two network**... don’t take it down, because we don’t want to go through that again.”

- GENI stitching early availability announced March
 - Twelve GENI sites
 - Stitching tool support (stitcher, stitching computation service) and tutorials
 - Proving very popular: over 2000 SCS requests from April to mid-June
- Initial federation with five EU testbeds
 - Via 50 VLANs between MANLAN (NY), iMinds (Ghent)
 - Two demos last night
 - Brecht Vermeulen will conduct a tutorial in July where all participants will create their own **transcontinental layer two networks**

Stitching is available for use in your experiments.

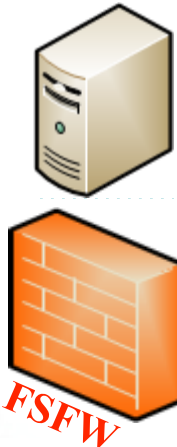
- GENI stitching aggregate manager deployed 5/28
 - Actively testing in collaboration with Internet2 to support stitching via AL2S (advanced layer two service)
 - Will help conserve scarce resources in many instances
- Flow space firewall and experimental controller processes deployed June 17
 - Enhancing GENI's deep programmability by extending OpenFlow control into Internet2 core
 - GPO reference learning switch controller and I2 support processes in test. Running successfully in NDDI.
 - More info at operations session this afternoon
- ★ Still need to watch for resource exhaustion risk
 - Track usage – likely to be a very popular capability
 - Consider approaches for resource management and enhancement

Connecting GENI Racks with OpenFlow

OF RSPEC: Site A

~~~~~  
 ~~~~~  
 ~~~~~  
 ~~~~~  
 ~~~~~

OF Controller



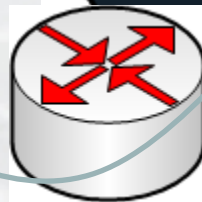
OF RSPEC: Site B

~~~~~  
 ~~~~~  
 ~~~~~  
 ~~~~~  
 ~~~~~

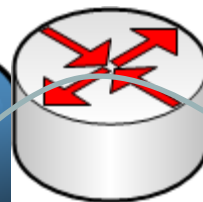


Site A

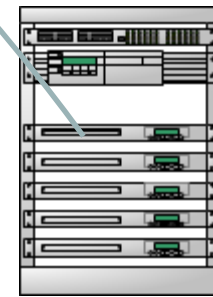
vlan x



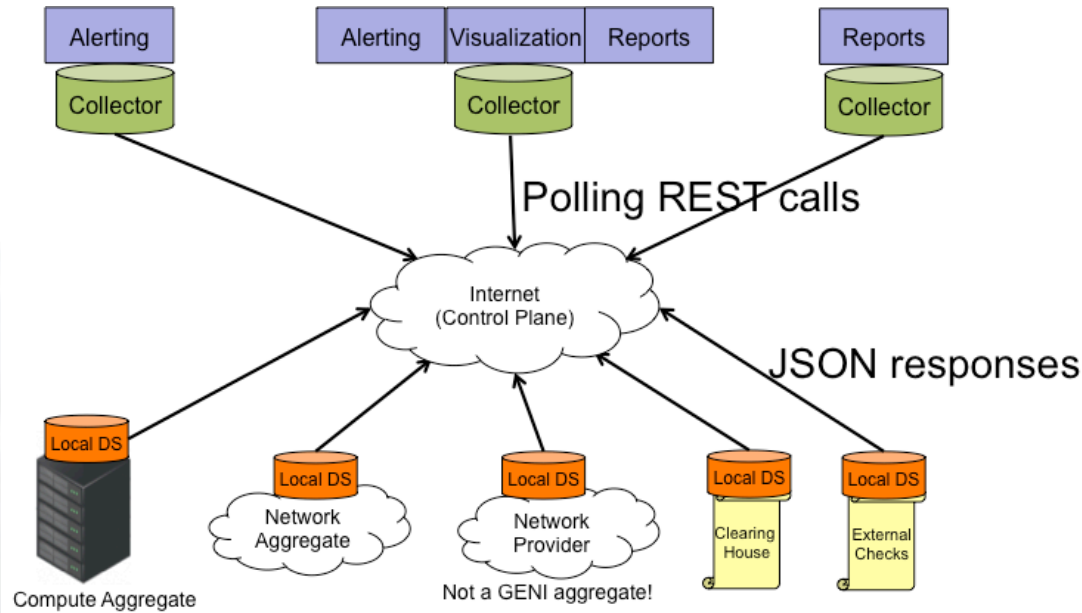
vlan y



vlan z



Site B



- ExoGENI, InstaGENI, Internet2, MAX, Kentucky, Indiana, GPO have completed implementations
- Currently collecting from 48 local data stores
- Several integration / data interpretation items to resolve
- Look forward to increased online data availability soon

Workshop Outbrief

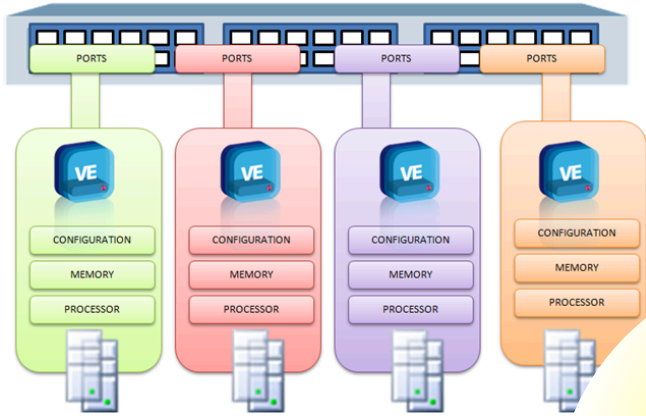
Workshop on Prototyping and Deploying Experimental Software Defined Exchanges (SDXs)

Washington DC - June 5-6, 2014

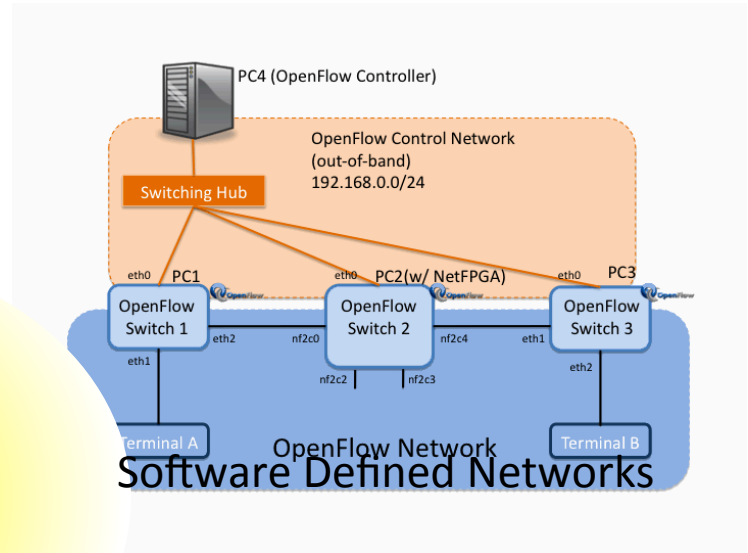
DRAFT

Excerpt from full draft workshop outbrief available at
<http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

The Internet is Rapidly Evolving



Multi-tenant Datacenters



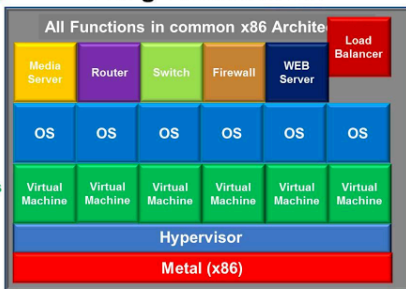
Software Defined Networks

Major trends are converging

Network Functions Virtualization (NFV)

- Standard Hardware
- Less Complex
- Very Flexible
- Reduced Power
- Lower CapEx
- Lower OpEx
- Test new apps
- Low risk
- Reduced TTM
- Open Market to Software suppliers

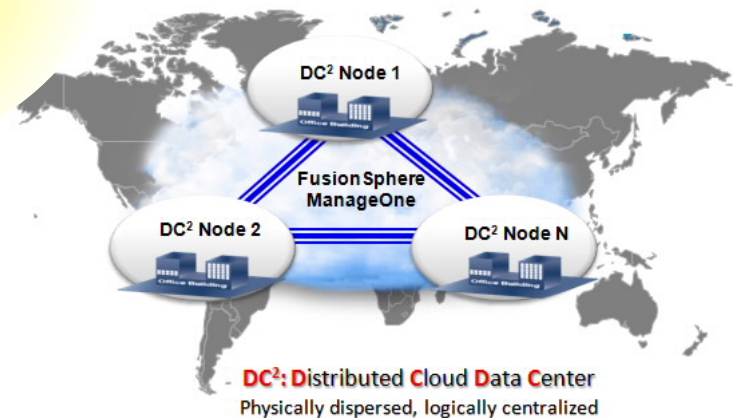
Using Virtualization



SPIRENT PROPRIETARY

SPIRENT

Network Functions Virtualization (NFV)



- DC²: Distributed Cloud Data Center
Physically dispersed, logically centralized

Distributed Datacenters

Excerpt from full draft workshop outbrief available at <http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

Software Defined Exchanges (SDXs)

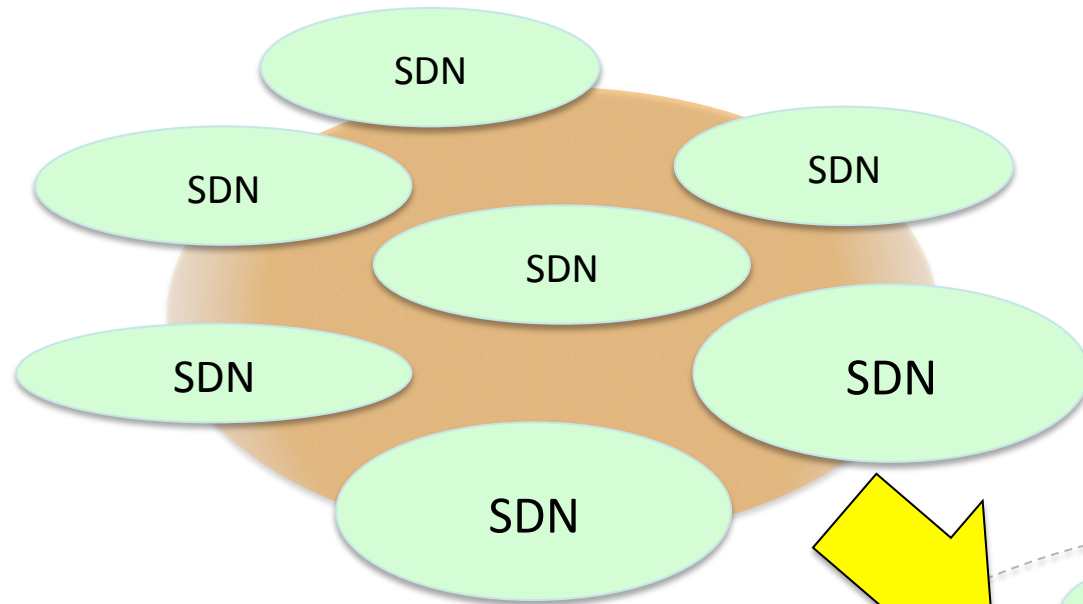
A range of SDX ideas and use cases



- “Near-term” SDX – pure connectivity/ROUTING
 - Layer 3 (IP) – e.g., connect AS’s
 - Layer 2 (Ethernet) – e.g., multi-domain circuits
 - SDN – connect SDN islands
- “Advanced” SDX – with compute/storage
 - Connect SDI islands
 - Compute / storage / network / instruments
 - GENI as an early instance

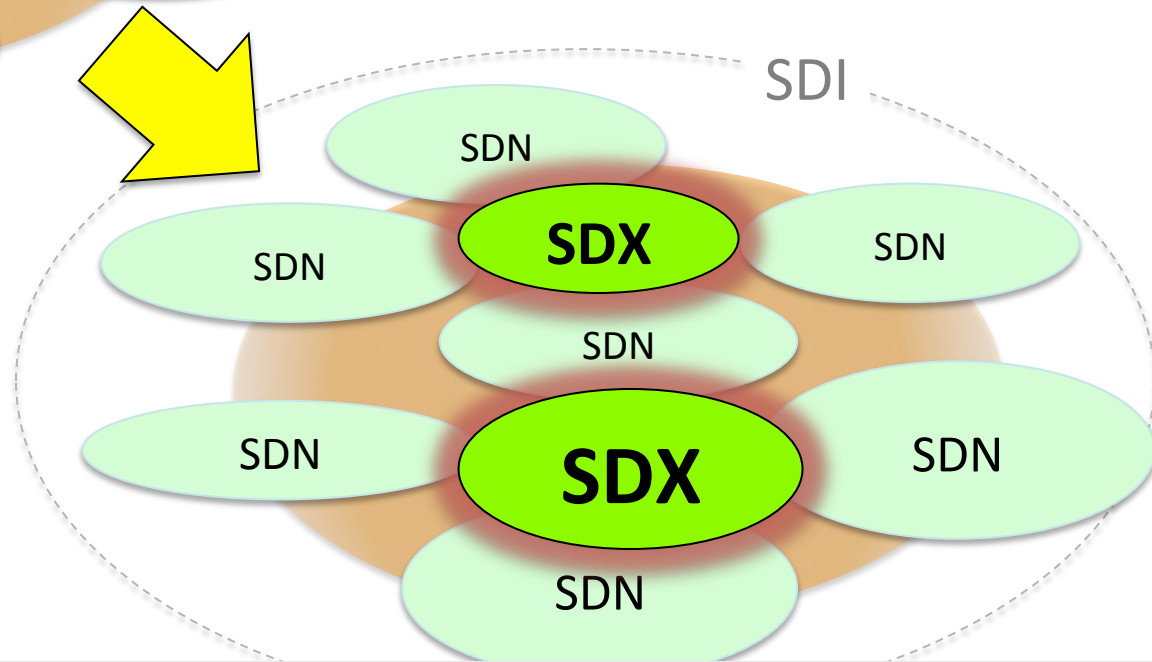
Excerpt from full draft workshop outbrief available at <http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

SDN Multi-domain SDXs



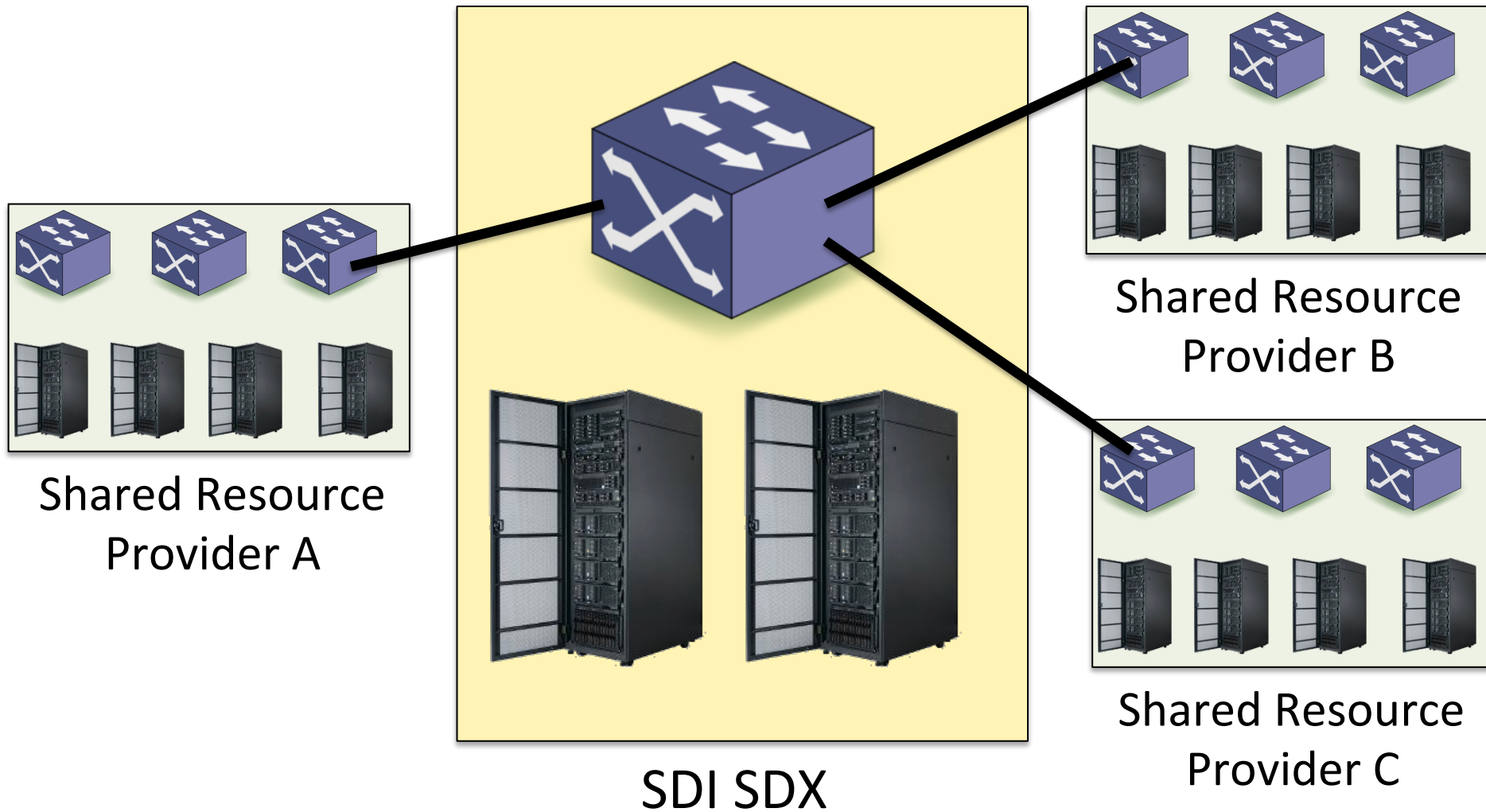
Today: “SDN islands”
GENI slices & VLAN stitching
help point the way

Next Step: Add SDX's
Build a “Rev 0” control plane,
run native next-gen apps
and scientific instruments
spanning multi-domain SDNs



Excerpt from full draft workshop outbrief available at
<http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

Software Defined Infrastructure (SDI) SDXs



Excerpt from full draft workshop outbrief available at <http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

What Needs to Get Done

- Analysis
 - Identify several reference applications
 - Define the SDX value proposition for each
- Implementation
 - Identify and implement a reference software stack that supports
 - Make network secondary to compute and storage
 - Integrate Network Virtualization
 - Deploy reference software stack at several IXPs (to become SDXs)
 - Define and implement a reference policy framework
 - Need virtual machines to support applications
 - Need testing harness
- Evaluation
 - Demonstrate the applications on the SDX
 - Evaluate the successes and failures of 1st Generation SDXs

Excerpt from full draft workshop outbrief available at <http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

How to Proceed?

- NSF to fund 3-4 likely IXP candidates
- Candidates to collaborate, not compete
- Identify a target date (Tech X 2014)
 - Initial implementations
 - Progress Update
- Final target date (Tech X 2015)
 - Final Implementation
 - Report out to community

Excerpt from full draft workshop outbrief available at <http://groups.geni.net/geni/wiki/SDXandSDIWorkshop>

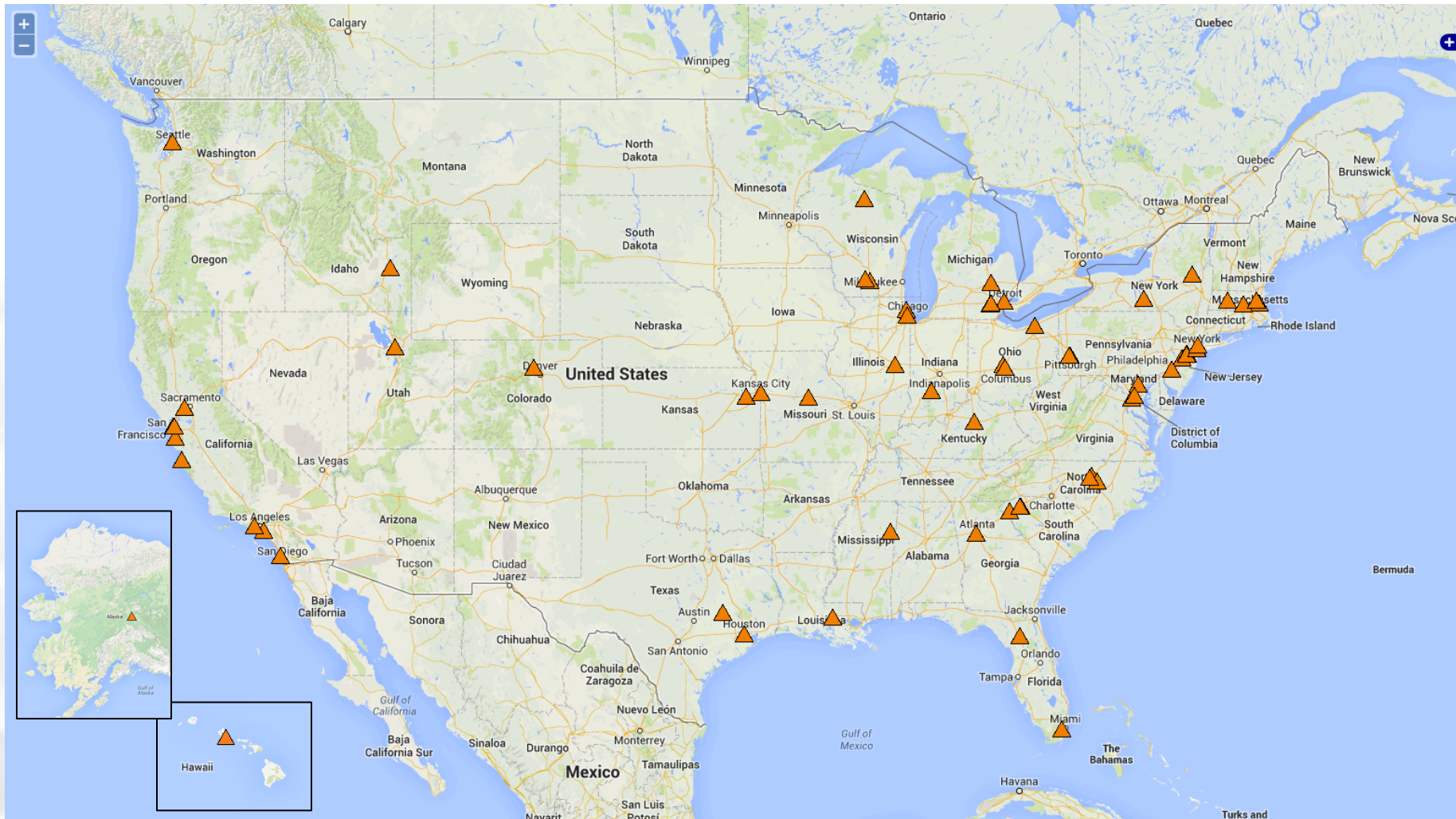


We have about 1.5 years remaining to finish GENI's intensive development phase.

- Complete infrastructure deployment and capabilities implementation.
- Transition GENI operations to ongoing support.
- Chart the future growth path of GENI infrastructure and concepts.

Not speaking for NSF here – just my opinion.

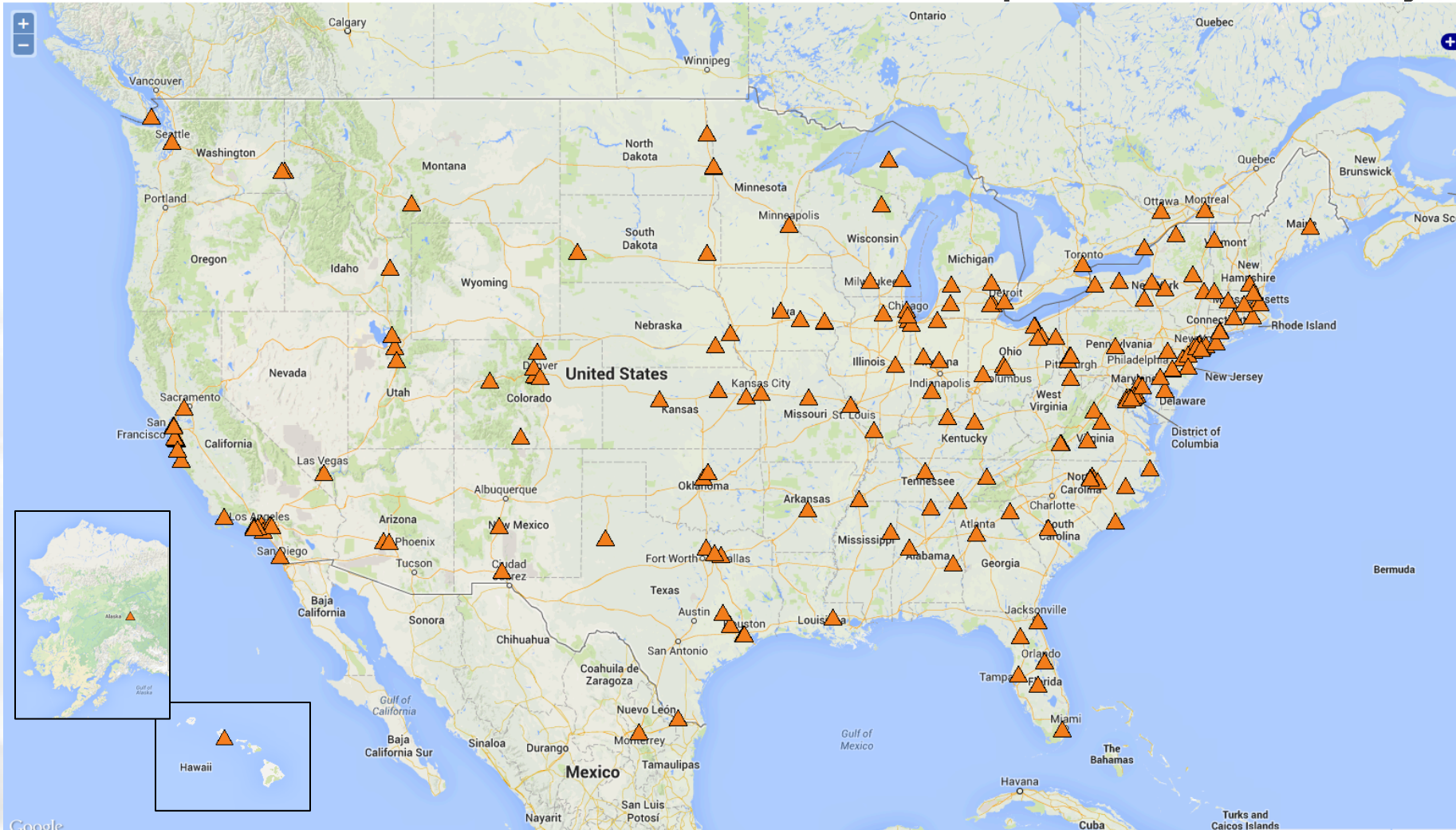
Completing GENI's Initial Deployment of Racks and Wireless Base Stations



Sliced, deeply programmable research infrastructure nationwide.

GENI's Broad National Impact

Research, Education, Municipalities, Industry



GENI has forged partnerships with universities, researchers, advanced app developers, cities, and industry.



GENI is working actively with peer efforts on five continents to define and adopt common concepts and APIs.

GENI's federated architecture is a preview of the future of research cyberinfrastructure

- Distributed physical infrastructure and ownership
 - Shared access, mediated by policy-driven software (aggregate managers)
- Federated
 - Resources are independently owned and managed, with common management processes and researcher access policies
- Common physical infrastructure
 - Virtualized, sliced, and deeply programmable

Federation is The Future of Mid-Scale Research Infrastructure (Net, Cloud, Grid)

- NSF CISE is encouraging convergences among mid-scale infrastructure projects
 - Federated capabilities and resources across GENI, CC*IIE, NSFCloud, ACI-REF (CondoOfCondos), FutureGrid, US Ignite will create a uniquely powerful research environment
 - Aligning efforts and resources of these programs will provide for scientific leadership in this area in the next decade
- GENI technology and partnerships are key to success
 - Direct integration with GENI hardware and software
 - Distributed and federated authentication (building on InCommon and similar), authorization and declarative policy (building on ABAC) are essential
 - Campus deployments, international federations, US Ignite community participation are all driving requirements

What NSF and the GENI Project Are Doing

- NSF is working to align mid-scale CI projects
 - New efforts, such as NSFCloud and CC*IIE, emphasize capturing innovations from GENI, as well as FIA, FutureGrid, and related mid-scale CI efforts
- Current GENI projects are creating repeatable processes for operations transition
- NSF and GPO are working together and with the community to identify ongoing funding and processes for
 - GENI operations
 - Continuing GENI infrastructure growth and technology development

Recent & Upcoming Community Activities

- US Multi-Agency Activities
 - SDX workshop, December 2013
 - SDX/SDI workshop, June 2014
- Federated, mid-scale cyberinfrastructure control plane workshop – October 2014 (tentative)
- International Activities
 - Common clearinghouse and aggregate APIs
 - Testbed federation
 - Research collaborations, e.g. JUNO, GENI/FIRE SAVI

- The GENI Project Office has modest funding available for travel and living expenses for GENI researchers to visit their FIRE collaborators in the EU
 - Emphasis on funding students, post-docs, and pre-tenure faculty
 - Research collaborations must be in the Future Internet area
 - Recipients must be currently affiliated with colleges and universities in the United States
- We will continue to accept proposals as long as funding is available
 - Eight teams have been funded to date

Send proposals or questions to
geni-savi-proposals@bbn.com

