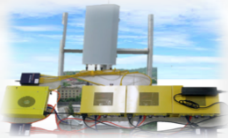
geni
Exploring Networks of the Future



GENI

Welcome to GEC19!

Mark Berman
March 18, 2014
www.geni.net

Sponsored by the National Science Foundation

Welcome to Atlanta!

- Thank you to our hosts
  - Georgia Institute of Technology
  - Russ Clark, Sandra Slaughter, and Don Schoner
- And to our event sponsors
  - Georgia Tech RNOC
  - Georgia Tech Institute for People and Technology
  - Georgia Tech Scheller College of Business
  - NSF
  - Ciena
  - Cisco
  - ColoAtl
  - Turner Broadcasting

Welcome to GEC19!

Ron Hutchins

Associate Vice Provost – Research & Technology

Chief Technology Officer

Georgia Institute of Technology

Bryan Lyles

Program Director

NSF CISE CNS

Administrative issue of importance and program of interest

Bryan Lyles, CISE/CNS

March 18, 2014 (GEC 19)

Administrative Issue
Listen UP!

- NSF lost more than a month of working time last fall and many schedules have slipped.
- At the end of FY14/start of FY15 NSF is moving to a new financial system
  - This will result in a financial system blackout period from the close of business on Friday, September 19 through Monday, October 13, 2014.
- All award recommendations (including continuing grant increments) must be completed by August 4, 2014.
  - This is a week earlier than usual and exceptions are not allowed this year.
- You ***REALLY*** don't want to have late/overdue reports this year.
  - GET THEM IN EARLY!!!!!!!!!!

International Research Experiences for Students (IRES), NSF 12-551

- Support for US graduate and undergraduate students conducting research at foreign sites with appropriate foreign expert mentorship
  - Do you have a close collaborator in another country and would you like to send students to work with them for up to a year?
  - Could you imagine running such an exchange for three years with multiple cohorts of students?
- IRES proposals must have a unifying research theme that enables a "cohort" experience for participating students. The IRES cohort concept requires that within each IRES project, each participating student must have an individual research project for which he/she is responsible, but these individual projects must also be coordinated to address a unifying research theme.
- IRES support must be given to students who are U.S. citizens or permanent residents; the intent of the program is to broaden the international experience of US students, not to provide an additional international experience to non-U.S. students.
- Full Proposal Deadline Date: August 19, 2014

Topics for Today

- Welcome
- Events at GEC19
- GENI Progress and Update
  - GPO: Experimenter Support, Rack Deployment and Stitching
  - Eric Boyd, Internet2: Progress & Upcoming Capabilities for Experimenters
- SDN, SDX, and SDI
  - A glimpse of the future – with proto-SDX demo

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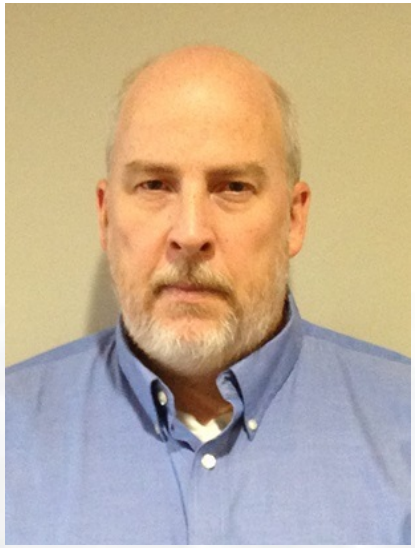
Our Guest Speakers Today



Eric Boyd

Internet2

Mike Zink

UMass – Amherst

Larry Landweber

Univ. of Wisconsin & GPO

Guest Events At GEC19

GECs have often been an opportunity for co-located events, where the GENI community can interact with our colleagues who are involved with related efforts.

This GEC has more co-located events than usual, so it's worth highlighting them.

Thanks to the event organizers for providing information in the following slides.

Network Service Interface (NSI)

- The Open Grid Forum (OGF) is standardizing the NSI protocol.
- NSI is a framework and a suite of protocols that enables multi-domain network connections to be requested via a web-service API.
- NSI includes the Connection Service, the Topology Description, the Topology Service and the Discovery service.
- The NSI Connection Services protocol v2.0 is now out for public comment, responses by 15 April please. http://redmine.ogf.org/projects/editor-pubcom/boards
- NSI CS has been adopted by the GLIF AutoGOLE community as well as international R&E networks such as ESnet, GÉANT, Internet2, JGNX, NORDUnet, and SURFnet.

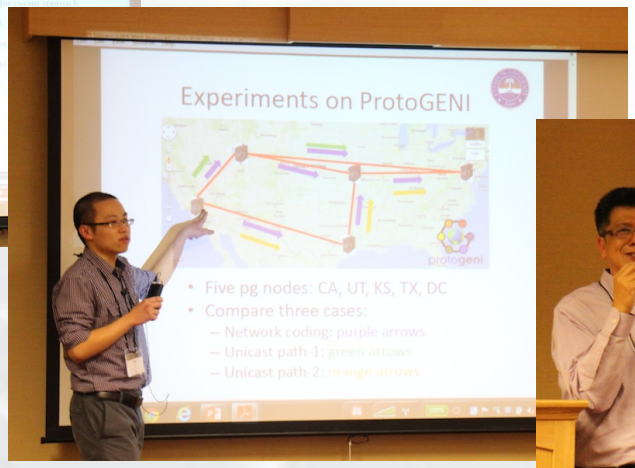
NSI meetings at GENI and GLIF

- The NSI working group held a standards meeting on Monday morning. Presentations at: https://redmine.ogf.org/dmsf/nsi-wg?folder_id=6582

- GLIF is using NSI for automated GLIF Open Lightpath Exchanges (GOLEs). The following NSI related sessions will be held at the GLIF meeting:
  - Wed 19th 13:45-14:30 NSI CS v2.0 update - Inder Monga & John McAuley, ESnet
  - Wed 19th 14:30-15:00 AutoGOLE Task Force - Gerben van Malenstein, SURFnet
  - Thurs 20th 13:30-15:00 NSI Implementation Task Force, John McAuley, ESnet

- Wednesday afternoon and Thursday morning
  - Eighteen papers (full, short, work-in-progress) covering a wide variety of research and classroom applications: SDN, cloud computing, non-IP network protocols, emergency communications, network measurement, …
  - OpenFlow tutorial
  - SDN Research Panel

Keynote speaker:
Ada Gavrilovska



March19th – 21st 2014 (After GEC)

- ***Purpose:*** Designed to equip university and laboratory network engineers with the knowledge and training needed to build next-gen networks optimized for data-intensive science and meet the challenges of the NSF CC-NIE/CC-IIE solicitations
- ***Presented by:*** the Department of Energy's ESnet, Indiana University's GlobalNOC, and Internet2
- ***Content:***
  - Science DMZ Network Architecture
  - Network Security Posture
  - Construction of Data Transfer Nodes
  - Use of Globus
  - The perfSONAR Network Monitoring Framework
  - Overview of Software Defined Networking through OpenFlow
  - Introduction to the Internet2 AL2S Service
  - Hands on exercises and lecture topics
- ***Logistics:***
  - Weds Afternoon through Friday Afternoon
  - Georgia Tech Hotel & Conference Center
  - $200 Registration Fee
  - http://oinworkshop.com
  - Watch for upcoming workshops – next opportunity expected July in Oregon

GLIF - Global Lambda Integrated Facility

GLIF Techs

GLIF Technical Working Group

19-20 March 2014

GLIF Techs

- GLIF, the Global Lambda Integrated Facility, is an international consortium of organisations who pool their lightpaths, optical exchanges and engineering effort to support a global facility for data intensive research.
- GLIF Techs is one of three GLIF working groups with responsibility for:
  - Identifying technical requirements;
  - Defining best practice;
  - Coordinating technical resources;
  - Developing automated control plane mechanisms.

GLIF Techs @ GEC 19 Work

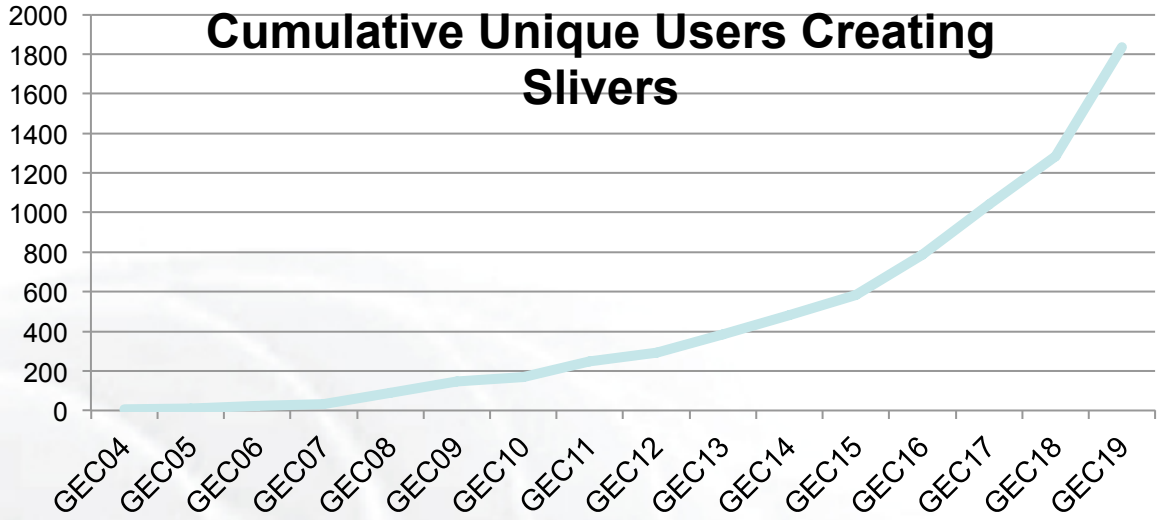
- GLIF Architecture – where are the fibres/lightpaths, and where should there be fibres/lightpaths around the world?
- AutoGOLE – developing global dynamic lightpath set-up and tear-down capability
- Update on NSIv2 – Joint OGF/GLIF activity to define standard interfaces.
- Performance Verification – how to measure end-to-end performance of lightpaths.
- Software Defined Networking – how it applies to GLIF.
- Network Virtualisation
- Demonstrations – defining demonstrators for GLIF 2014 and SC'14.

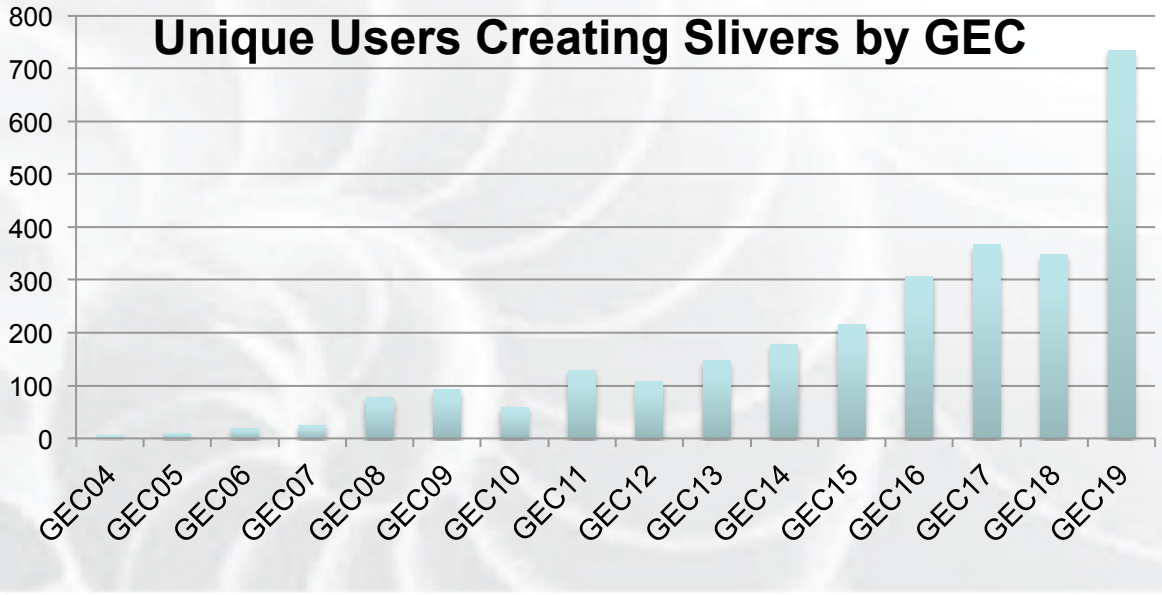
Update: An Exciting Time for GENI

- The GENI community today is seeing an impressive convergence of activity and potential
  - Continuing rapid growth in experimenter community
  - Very strong uptake in classroom environments
  - More GENI racks coming on line quickly
  - Realization of key connectivity and deep programmability options
  - International federation and interoperation activities
- Today's updates will touch quickly on many of these activities and preview some likely new developments in which GENI technology may play a part.

This is a good time to be involved in GENI,
and an excellent opportunity to shape the future.

Update: GENI Continues to See Strong Uptake

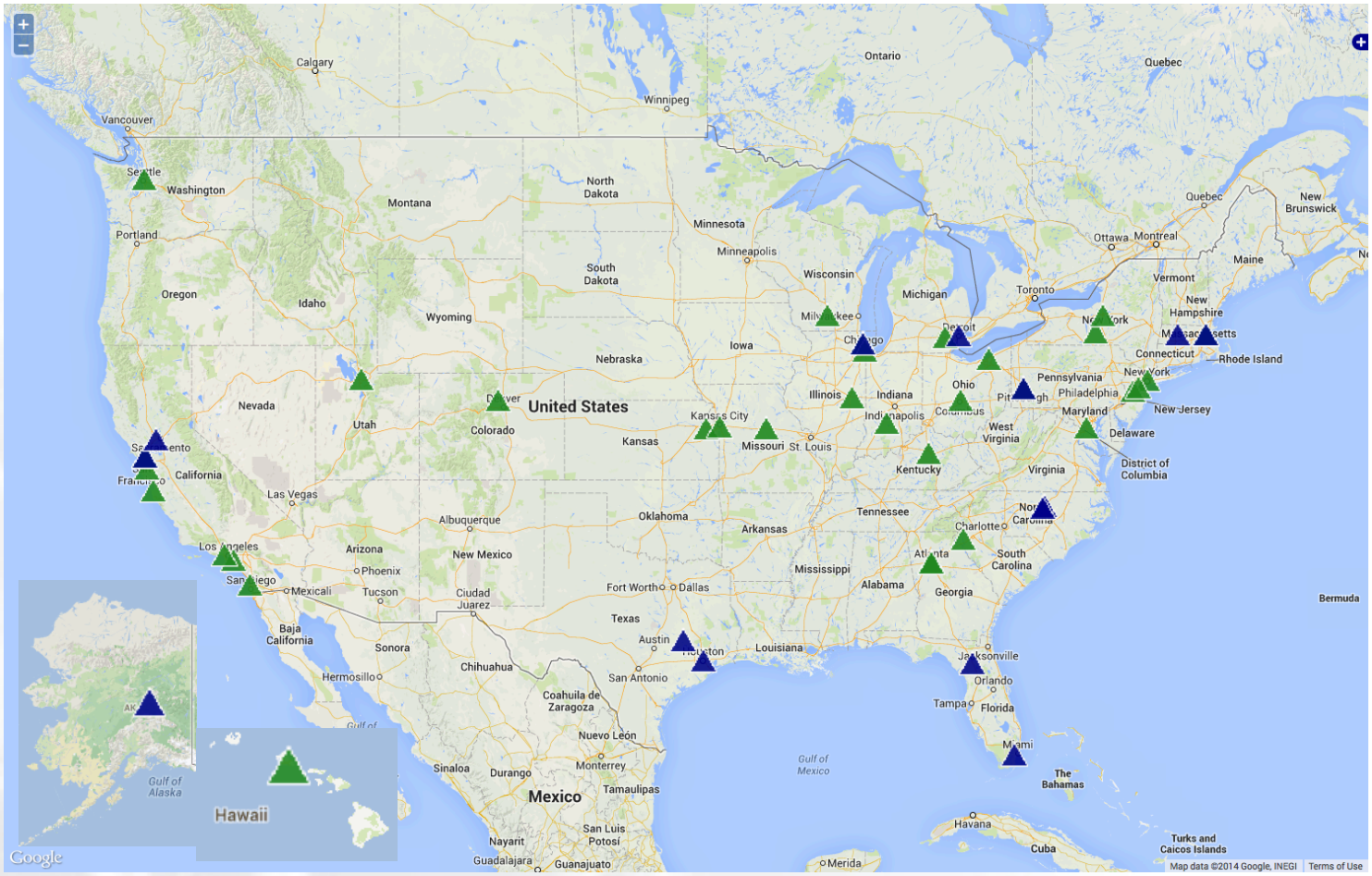




Continued increase in user demand is coming with some growing pains.

- We are seeing some instances of limited availability of scarce resources (VLANs for stitching, rack occupancy, bare metal compute nodes).
- Need better tools to guide experimenters toward more abundant resource types (e.g. VMs v. bare metal) and to help distribute resource loading – ongoing monitoring efforts will help some.

Update: GENI Rack Deployment

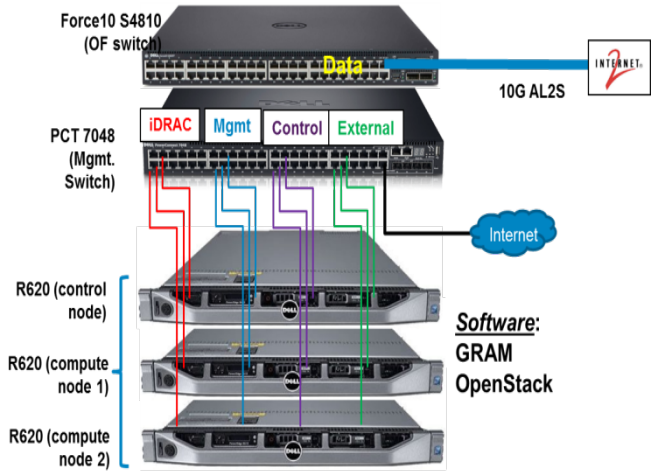


Deployments progressing rapidly – last two racks in initial set are in order process. 22 racks available on portal today.

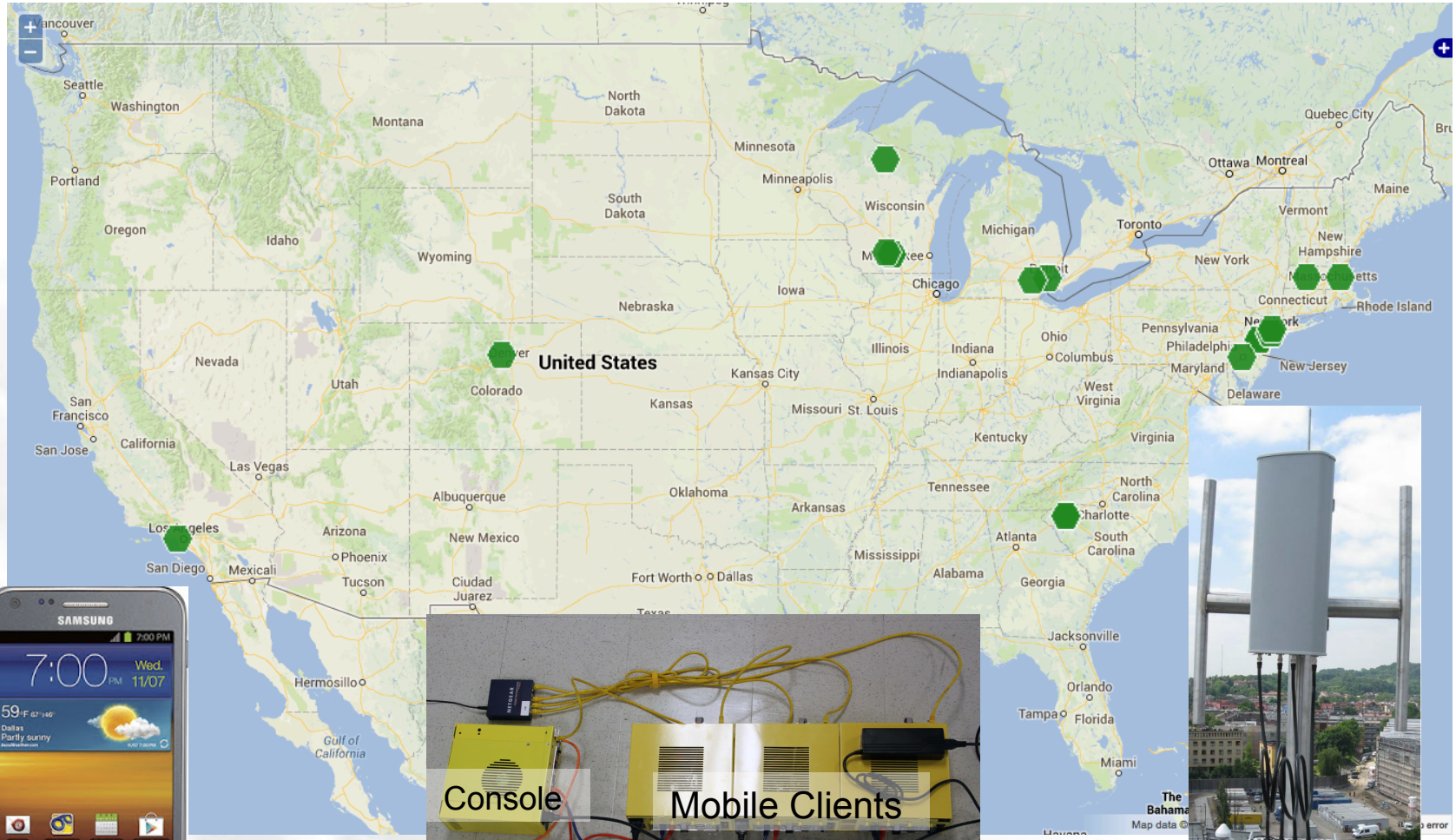
Update: A New Flavor of GENI Rack

- A combined team from Dell and Clemson have implemented the first instance of a new type of GENI rack, with support from the GPO
  - Dell hardware, running the GRAM aggregate manager
  - Initial rack deployed at Clemson, with a clone at GPO for testing
- Standalone testing complete
  - Dataplane and stitching testing underway
- Clemson OpenGENI rack available soon for experimenter use

- System Specifications
  - Data Switch - S4810
    - 48x10G OpenFlow switch
    - 4x40G QSFP
  - Management Switch
    - 48x1G PowerConnect 7048 Mgmt Switch
  - Control and Worker nodes
    - 1U, 128G,
  - Software –
    - Powered by GRAM from GPO
- Three different SKUs
  - Low/Mid/High will be server additions
  - Potentially Storage / Sonicwall security
- Simplified of Ordering
  - Single SKU
  - Site Survey – Preconfigure with VLAN/IP info.
  - Plug-and-Play when Rack arrives



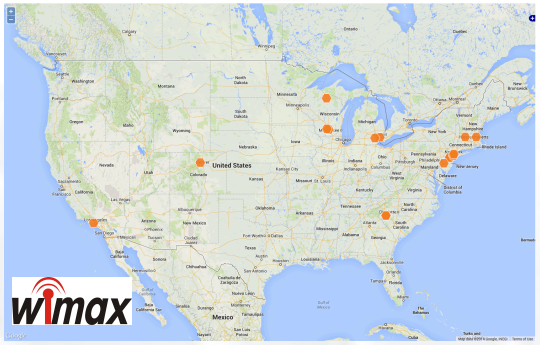
Update: GENI WiMAX Deployment Supporting Diverse Research



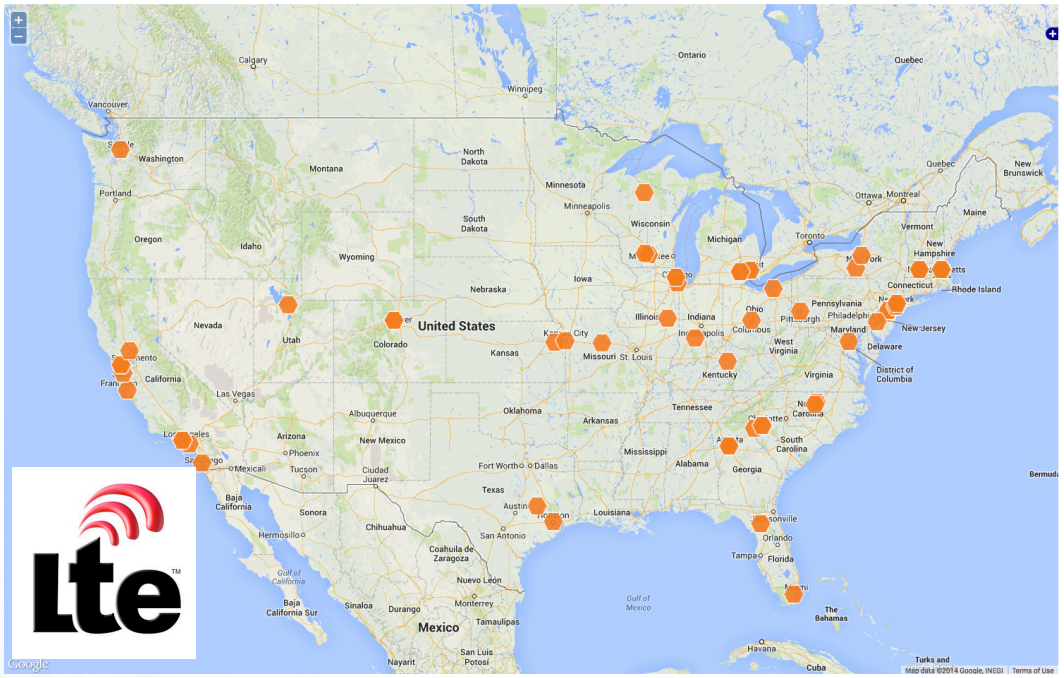
What's Next?

Candidate GENI LTE Research Infrastructure

From this:



To this:



- Co-locate GENI LTE base stations at fifty GENI rack sites, operating under revised master agreement
- Connect to GENI racks and backbone for wide-area experiments
- Standard smartphones, USB modules, embedded devices
- Employ existing and emerging low-level wireless testbeds for "under the hood" access, integrated with GENI tools
- Use SciWiNet model for researcher-friendly wireless data transport

Update: Stitching Available for Early Adopters

- Twelve GENI racks added to available stitching mesh
  - New stitching sites are rapidly becoming available
  - Intent is to have experimenter-specified, stitched configurations available to every GENI rack
- Initial tool support in place
  - Stitching tutorial yesterday
- Still some limitations
  - The VLANs used for stitching are a limited resource and need to be expanded and better managed
  - Tool support needs reliability and usability improvements
- These limitations are being addressed through a combination of improved tools and expanded capabilities at rack sites, regional networks, and Internet2

Update: Connectivity and Programmability Report Card

	Connectivity Options		Deep Programmability Options		
	Layer 2	Layer 3	Software Routing	OVS OpenFlow	Hardware OpenFlow
Single-site	✔+	✔+	✔+	✔+	✔+
Multi-site (stitching)	✔	✔	✔	✔	★

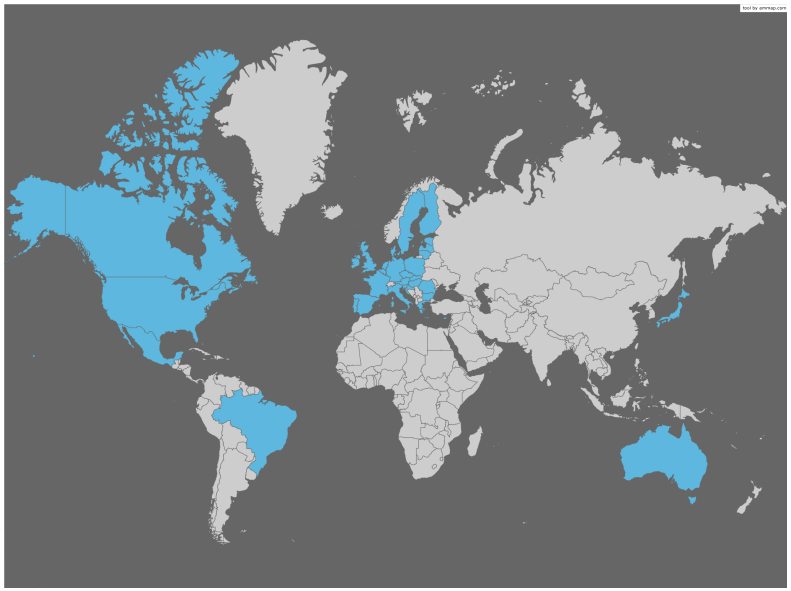
✔+ Capability available with good tool support.

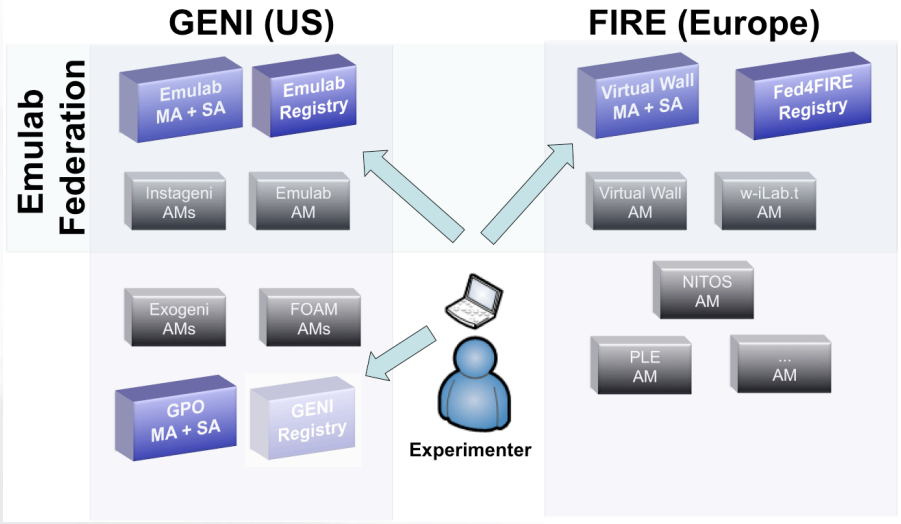
✔ Available, needs usability / reliability improvement – ask for help.

★ Available via GENI meso-scale backbone – stitched version coming.

Update: International Federation Activities

- International federation API for clearinghouse functions
  - Supported at multiple clearinghouses
  - Joint GENI / FIRE (US / EU) capability featured in last night's demo session
- Work underway on FAA (Federation Aggregate Manager API)
- Come to coding sprint on Wednesday to join the discussion





Update: Funding Opportunity for US/EU Collaboration

- 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
  - Six teams have been funded to date

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

usignite

usignite APPLICATIONSUMMIT

June 24-27 in Silicon Valley
In conjunction with GEC-20 at Davis
Direct bus from Davis to Sunnyvale
Academic travel grants anticipated

Demos welcomed!

Talk to Glenn

GENI Engineering Conferences

We welcome your participation in creating GENI

- **20th meeting, open to all:**
  June 21-24, 2014, University of California – Davis
  - Planning & discussion for experimenters, educators, software, infrastructure
  - Planning & discussion for experimenters, software, infrastructure
  - **New GEC format** emphasizing newcomer activities on first day
  - **Travel grants** to US academics for participant diversity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