



GENI

Exploring Networks of the Future

www.geni.net

- GENI – Exploring future internets at scale
- The GENI Concept
- Building GENI
- Using GENI
- GENI and US Ignite
- What's next for GENI?

Global networks are creating extremely important new challenges

Science Issues

We cannot currently understand or predict the behavior of complex, large-scale networks



Innovation Issues

Substantial barriers to at-scale experimentation with new architectures, services, and technologies



Society Issues

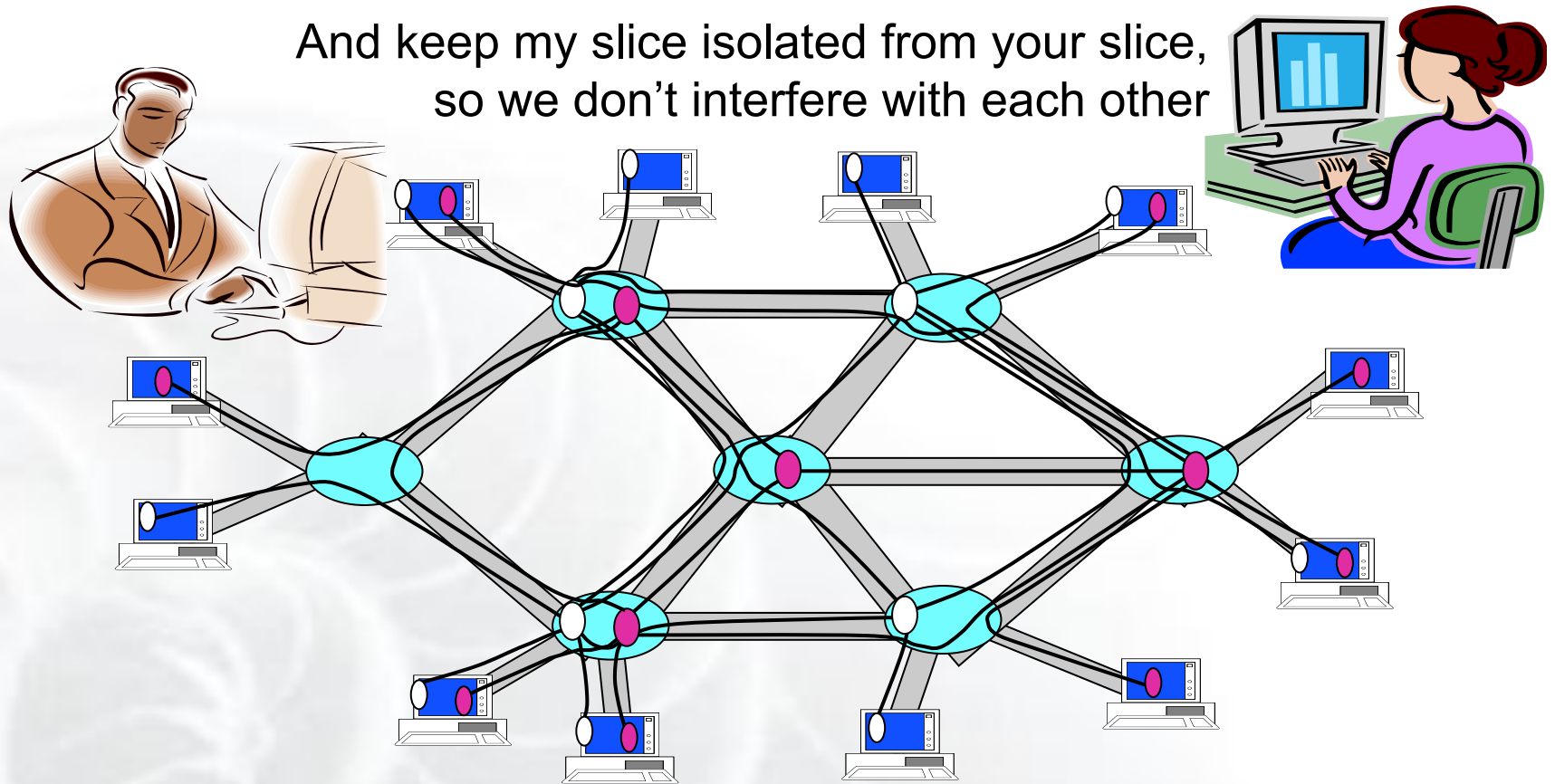
We increasingly rely on the Internet but are unsure we can trust its security, privacy or resilience



- GENI is a nationwide suite of infrastructure for “**at scale**” experiments in networking, distributed systems, security, and novel applications.
- GENI opens up huge new opportunities
 - **Leading-edge research** in next-generation internets
 - **Rapid innovation** in novel, large-scale applications
- Key GENI concept: slices & deep programmability
 - Internet: open innovation in application programs
 - GENI: open innovation deep into the network

Install the software I want *throughout* my network slice
(into firewalls, routers, clouds, ...)

And keep my slice isolated from your slice,
so we don't interfere with each other



We can run many different “future internets” in parallel

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I have a great idea! The original Internet architecture was designed to connect one computer to another – but a better architecture would be fundamentally based on PEOPLE and CONTENT!



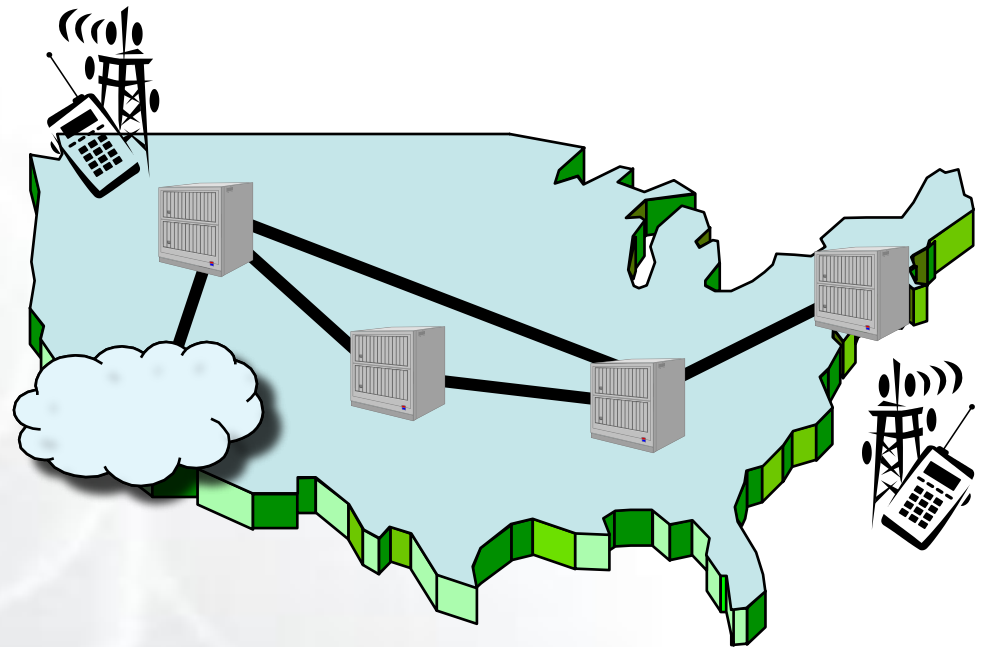
*That will never work! It won't scale!
What about security? It's impossible
to implement or operate! Show me!*



My new architecture worked great in the lab, so now I'm going to try a larger experiment for a few months.



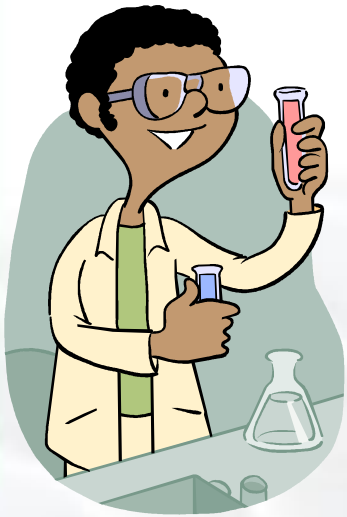
And so he poured his experimental software into clouds, distributed clusters, bulk data transfer devices ('routers'), and wireless access devices throughout the GENI suite, and started taking measurements . . .



He uses a modest slice of GENI, sharing its infrastructure with many other concurrent experiments.

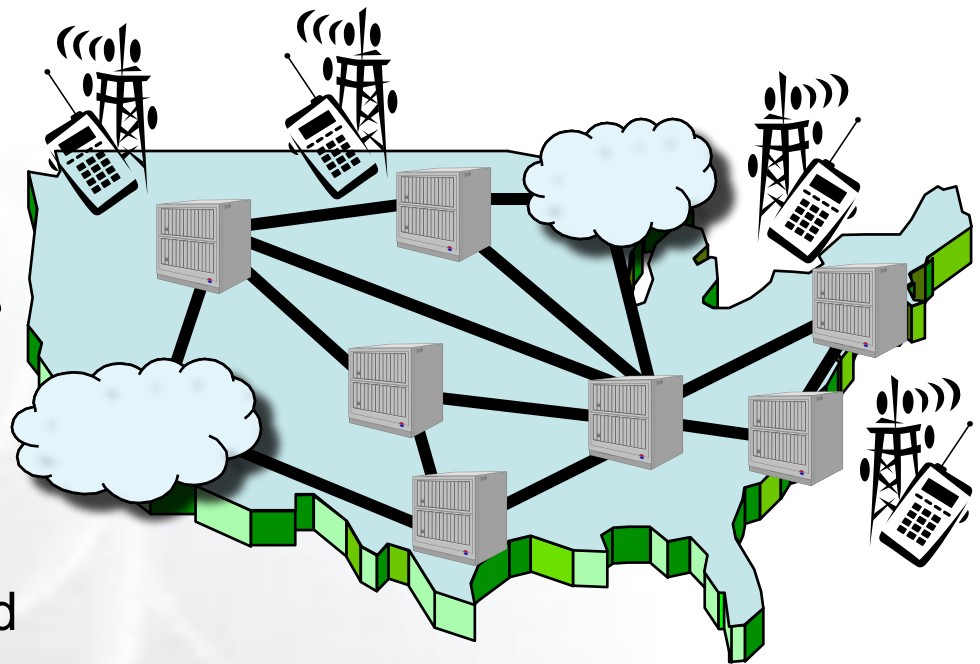
It turns into a really good idea

Boy did I learn a lot! I've published papers, the architecture has evolved in major ways, and I'm even attracting real users!



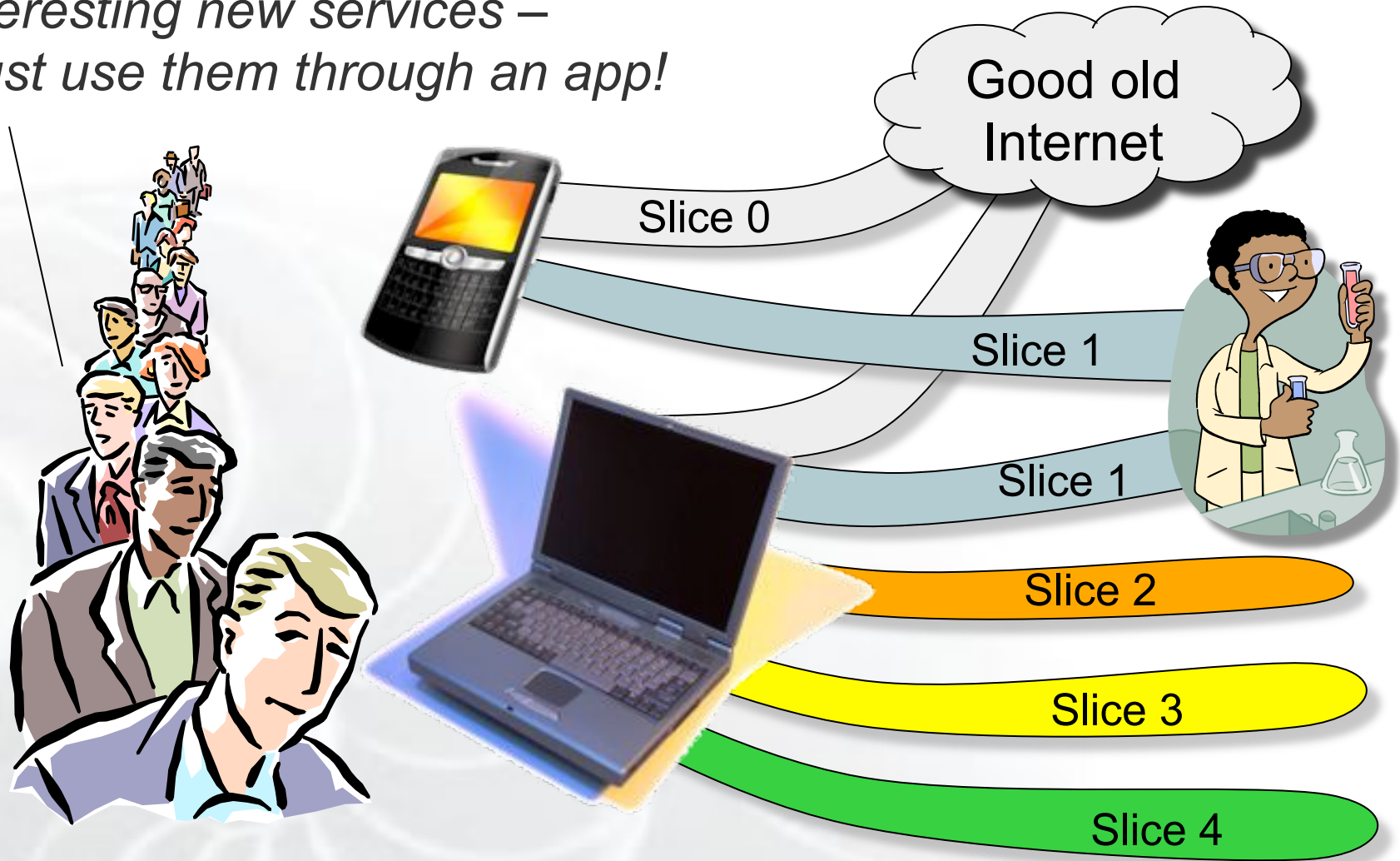
Location-based social networks are really cool!

His experiment grew larger and continued to evolve as more and more real users opted in . . .



His slice of GENI keeps growing, but GENI is still running many other concurrent experiments.

*Interesting new services –
I just use them through an app!*

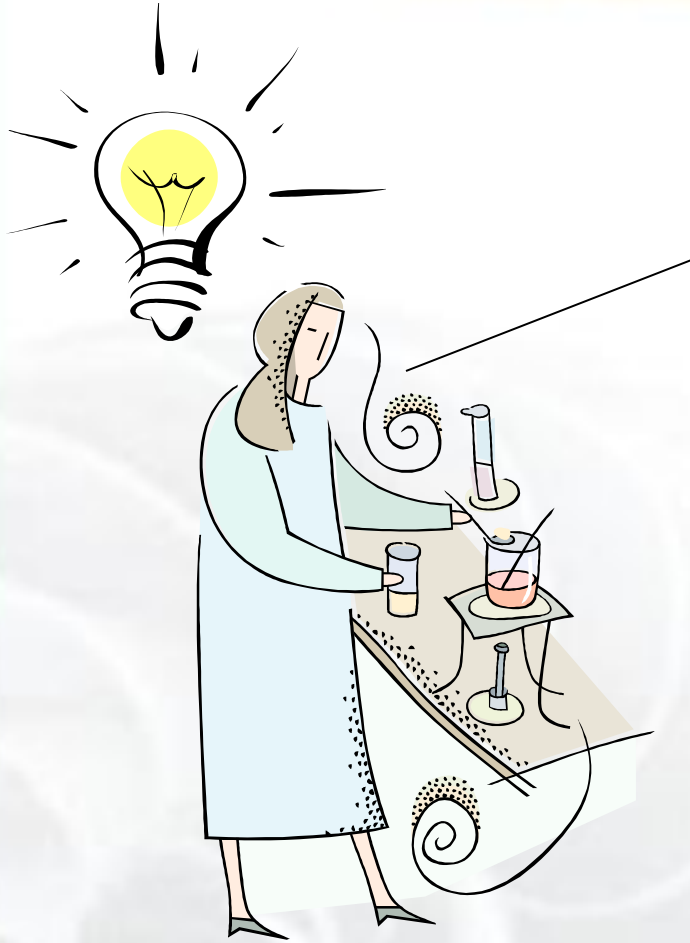


Experiment turns into reality

My experiment was a real success, and my architecture turned out to be mostly compatible with today's Internet after all – so I'm taking it off GENI and spinning it out as a real company.

I always said it was a good idea, but way too conservative.





I have a great idea! If the Internet were augmented with a scalable control plane and realtime measurement tools, it could be 100x as robust as it is today . . . !

And I have a great concept for incorporating live sensor feeds into our daily lives !

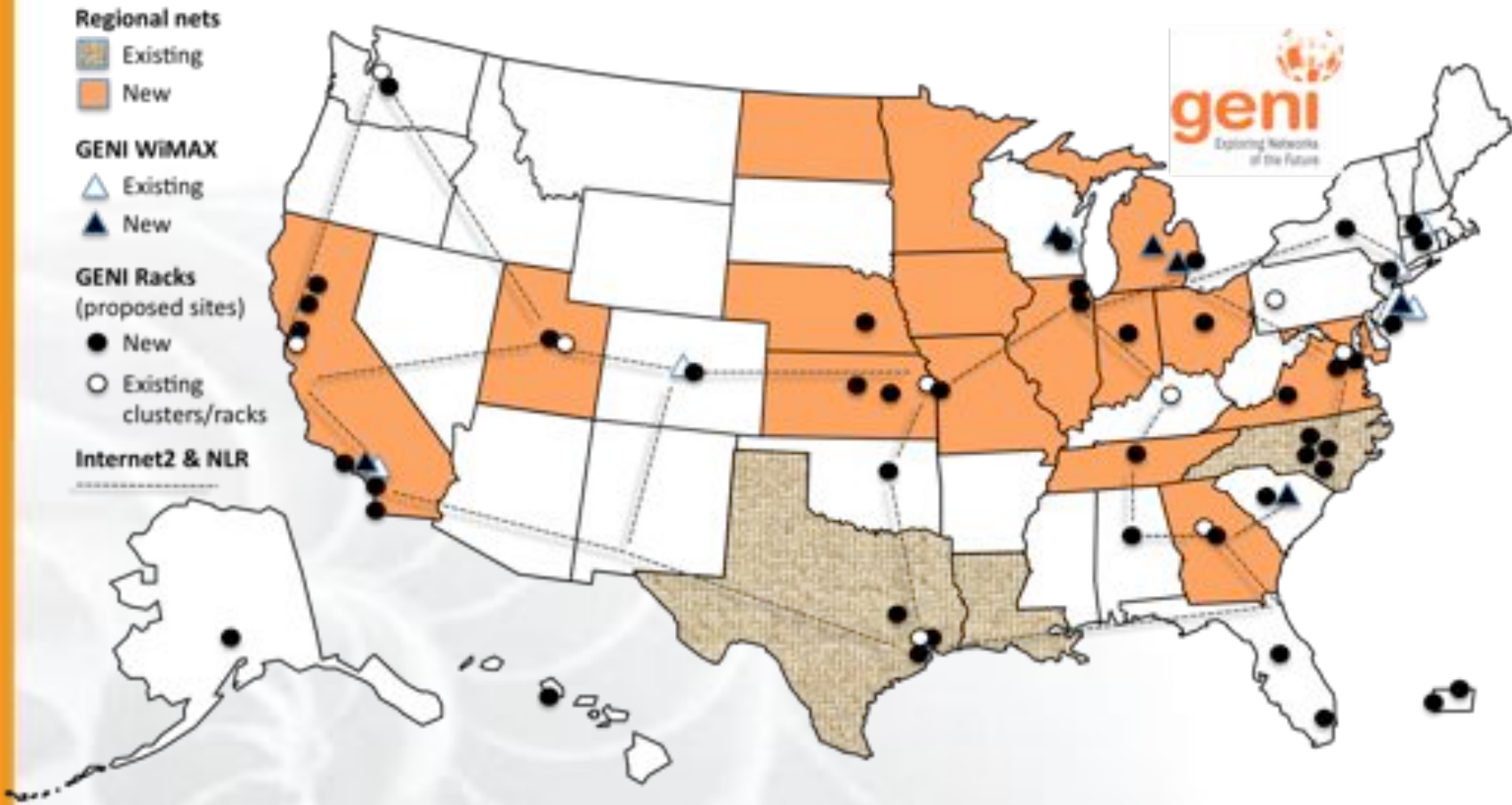


If you have a great idea, check out the **NSF CISE research programs for current opportunities.**

- GENI is meant to enable . . .
 - **At-scale experiments**, which may or may not be compatible with today's Internet
 - **Both repeatable and “in the wild” experiments**
 - **‘Opt in’ for real users** into long-running experiments
 - Excellent **instrumentation and measurement** tools
 - **Large-scale growth for successful experiments**, so good ideas can be shaken down at scale

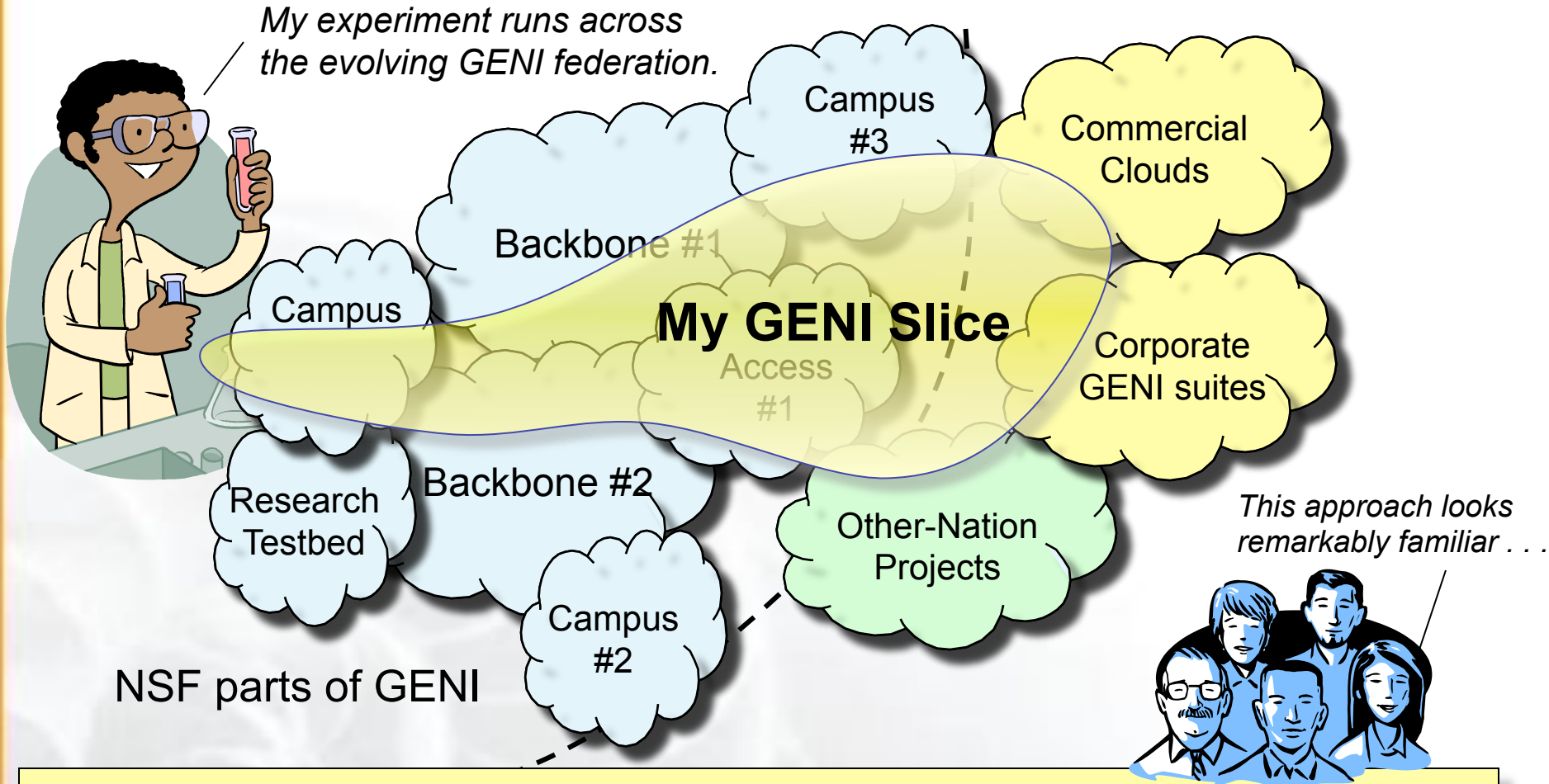
GENI creates a huge opportunity for ambitious research!

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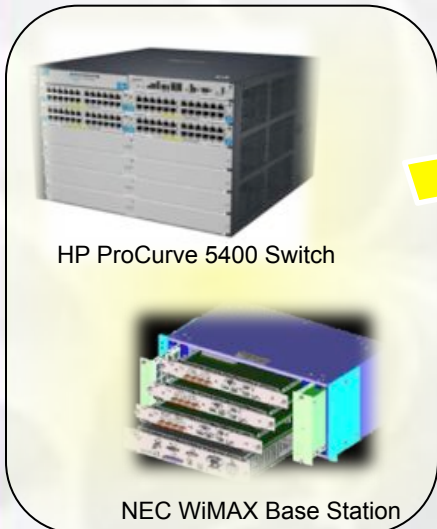
(as proposed; actual footprint to be engineered)

GENI grows by “GENI-enabling” heterogeneous infrastructure

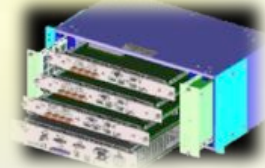


Goals: avoid technology “lock in,” add new technologies as they mature, and potentially grow quickly by incorporating existing infrastructure into the overall “GENI ecosystem”

- **How can we afford / build GENI at sufficient scale?**
 - Clearly infeasible to build research testbed “as big as the Internet”
 - Therefore we are “GENI-enabling” testbeds, commercial equipment, campuses, regional and backbone networks
 - **Students are early adopters / participants in at-scale experiments**
 - Key strategy for building an at-scale suite of infrastructure

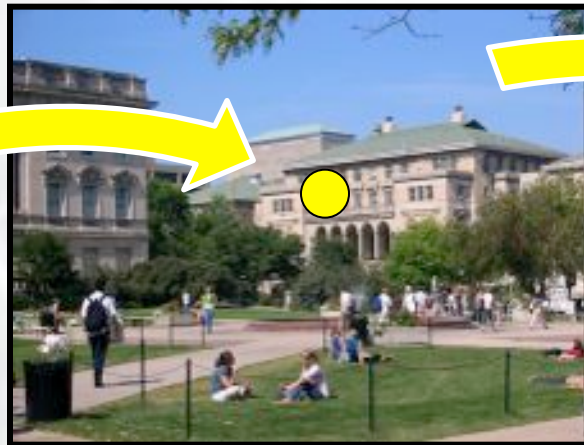


HP ProCurve 5400 Switch



NEC WiMAX Base Station

GENI-enabled equipment



GENI-enabled campuses, students as early adopters



“At scale” GENI prototype

Georgia Tech: a great example

One of the first 14 GENI-enabled campuses



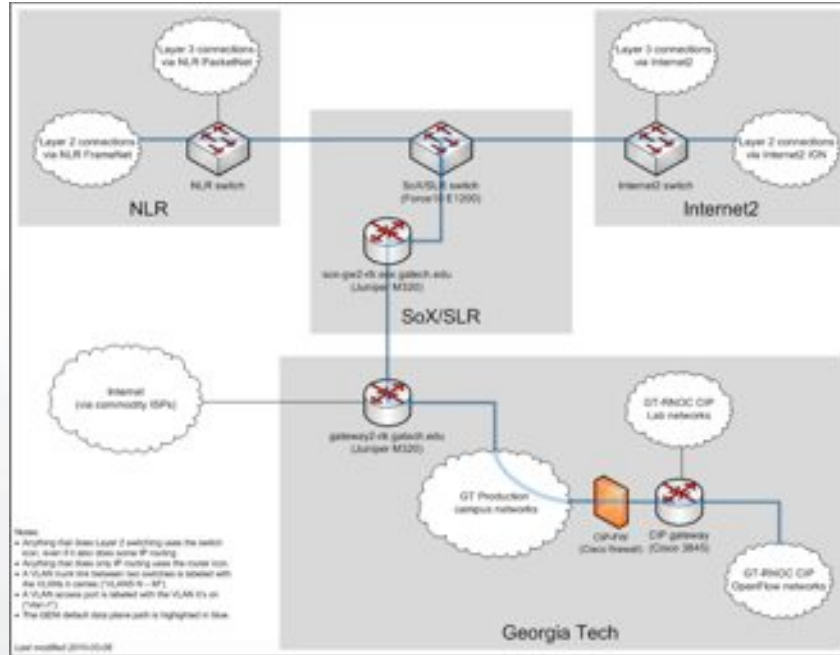
Nick Feamster
PI



Ellen Zegura
Ron Hutchins,
OIT



Russ Clark,
GT-RNOC



- OpenFlow in 4 GT lab buildings **now**
- OpenFlow/BGPMux coursework **now**
- Dormitory trial
- Students will “live in the future” – Internet in one slice, multiple future internets in additional slices

Trials of “GENI-enabled” commercial equipment



HP ProCurve 5400 Switch



Juniper MX240 Ethernet Services Router



NEC WiMAX Base Station



HTC Android smart phone



Toraki LightSwitch 4810



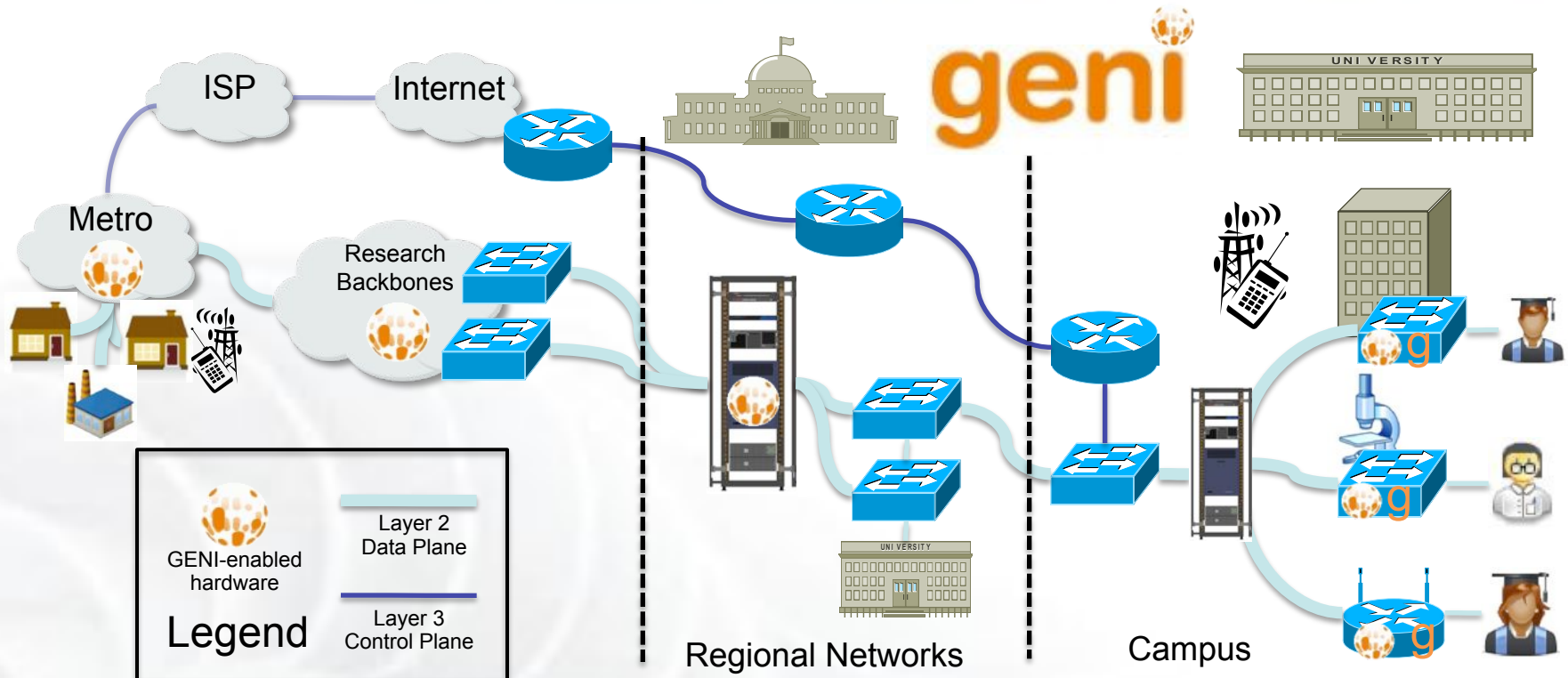
GENI racks



NEC IP8800 Ethernet Switch



Arista 7124S Switch



- Flexible network / cloud research infrastructure
- Also suitable for physics, genomics, other domain science
- Support “hybrid circuit” model plus much more (OpenFlow)
- 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 and NLR
- 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

Creating and deploying GENI racks



ExoGENI Rack

Installed at GPO – Feb 22, 2012



Ilia Baldine
RENCI

More resources / rack,
fewer racks



Rick McGeer
HP Labs

Fewer resources / rack,
more racks



ExoGENI

- 14 GPO-funded racks
 - Partnership between RENCI, Duke and IBM
 - IBM x3650 M3/M4 servers
 - 1x146GB 10K SAS hard drive +1x500GB secondary drive
 - 48G RAM
 - Dual-socket 8-core CPU w/ Sandy Bridge
 - 10G dual-port Chelso adapter
 - BNT 8264 10G/40G OpenFlow switch
 - DS3512 6TB sliverable storage
 - iSCSI interface for head node image storage as well as experimenter slivering
- Each rack is a small networked cloud
 - OpenStack-based
 - EC2 nomenclature for node sizes (m1.small, m1.large etc)
 - Interconnected by combination of dynamic and static L2 circuits through regionals and national backbones
- <http://wiki.exogeni.net>



- **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, v2 linecard 20 1 Gb/s
 - Hybrid mode

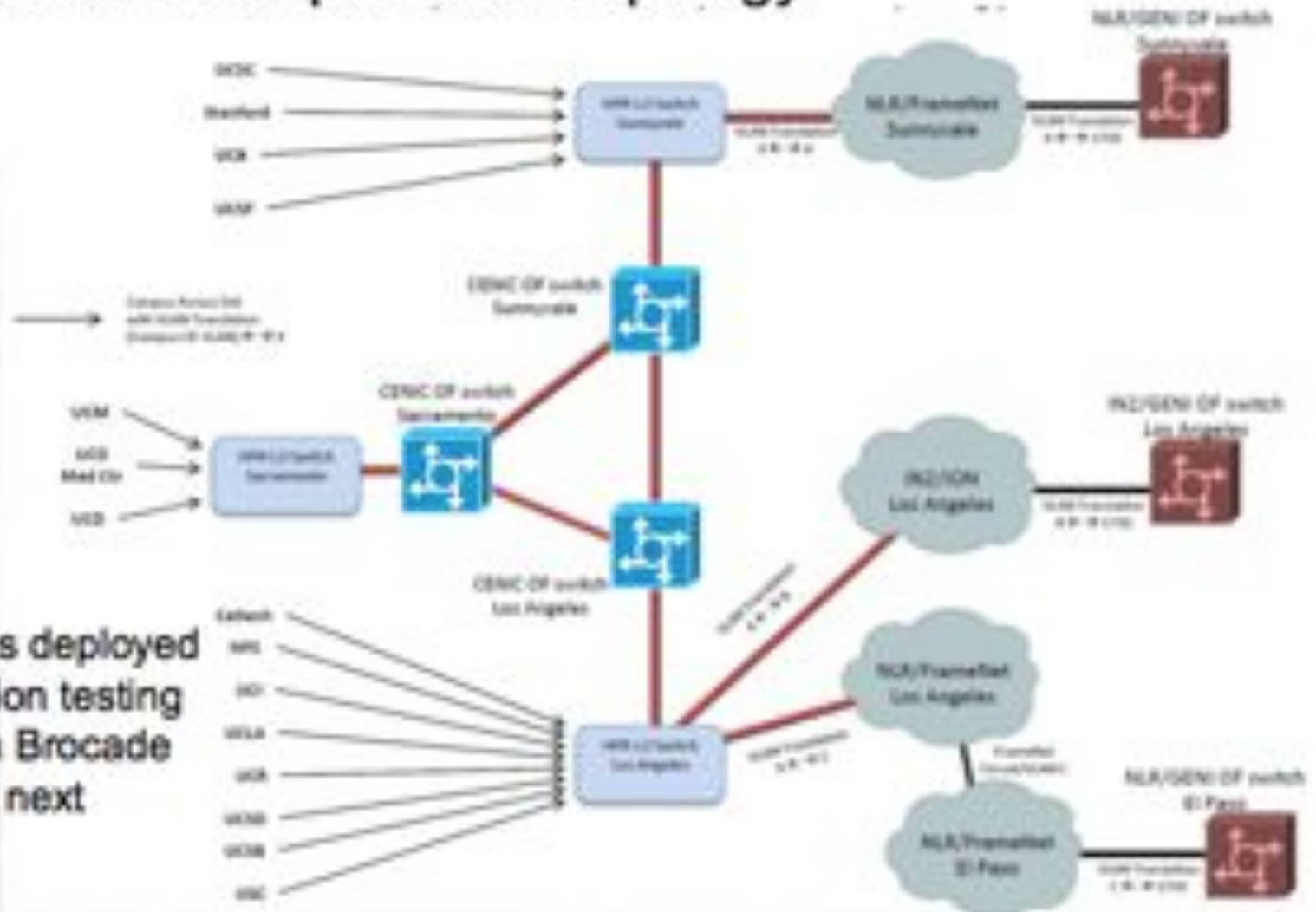


Campus	Buildout	Deployment Status	Experiments
Columbia University	WiMAX	Completed and in use by local teams	
NYU Poly	WiMAX	Completed and open for GENI experimenters	Used for WiMAX tutorial at GEC13
Rutgers WINLAB	WiMAX (enhanced) (and OpenFlow)	Completed and open for GENI experimenters	Used for WiMAX tutorial at GEC13 Used for demo of MobilityFirst FIA at GEC12
Clemson University	WiMAX (enhanced, multiple base stations)	Installation pending.	Intended for mobile, vehicular experiments
UCLA	WiMAX (enhanced, multiple base stations)	Completed and in use by local teams	To be part of mobile vehicular testbed
University Colorado at Boulder	WiMAX (initial)	Completed and in use by local teams	Focused on coverage measurements

GENI WiMAX deployments (2 of 2)

Campus	Buildout	Deployment Status	Experiments
University of Wisconsin at Madison	WiMAX (enhanced, multiple base stations) (and OpenFlow)	Completed and in use by local teams	Intended for mobile, vehicular experiments
University of Michigan	WiMAX (enhanced)	Installation pending.	Intended for mobile, vehicular experiments
Wayne State University	WiMAX (enhanced, multiple base stations)	Equipment arrival pending.	Intended for mobile, vehicular experiments
UMass Amherst	WiMAX	Completed, and in use by local teams	To be used for integration with GIMI I&M tools
Raytheon-BBN Technologies	WiMAX (enhanced)	Completed Accessible by GENI experimenters pending	Focused on site software development and basic range, throughput and coverage experiments Used for demo of MobilityFirst FIA at GEC12

CENIC GENI OpenFlow Topology



- Switches deployed
- Integration testing with beta Brocade software next

- Collaboration to **implement national-scale infrastructure**
 - sliced and deeply-programmable
 - incorporating OpenFlow/SDN switches, GENI Racks, university datacenters, etc.
 - high-speed (10-100 Gbps initially)
- With software that supports shared use by faculty, students, and campus IT organizations
- Gradual migration from today's "prototype GENI" backbone in Internet2 to a real, production system
- Scaling to an envisioned goal of 100-200 GENI campuses

Opens the door for "at-scale" GENI !

Note that this agreement does not exclude either party from additional collaborations.



OS³E

The Open Science, Scholarship & Services Exchange



INTERNET₂



INDIANA UNIVERSITY

STANFORD UNIVERSITY

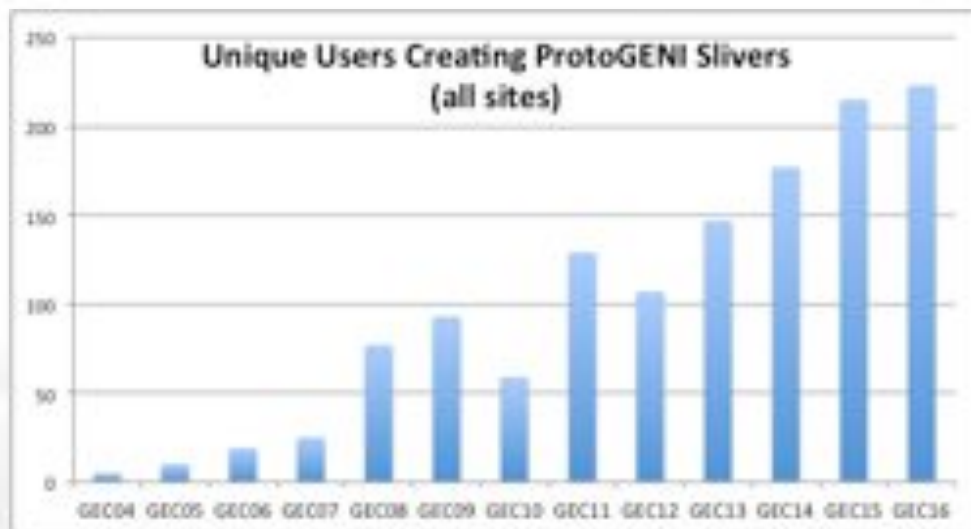
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- **GENI is gaining traction with experimenters.**
 - More experimenters are signing up for credentials.
 - More experimenters are actively using GENI.
- **Experienced experimenters are pushing up against some limits. They want access to more GENI resources.**
 - More deeply programmable sites
 - More compute resources
 - Long-lived slices



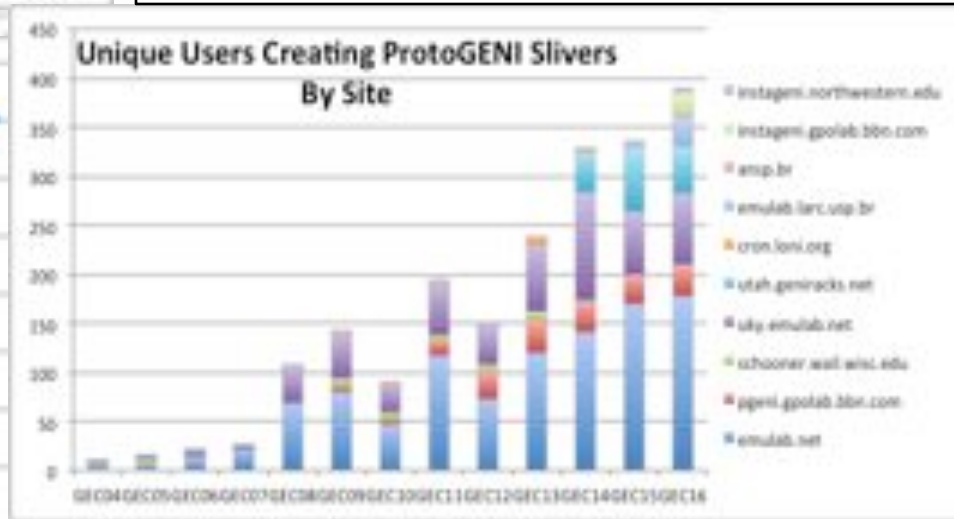
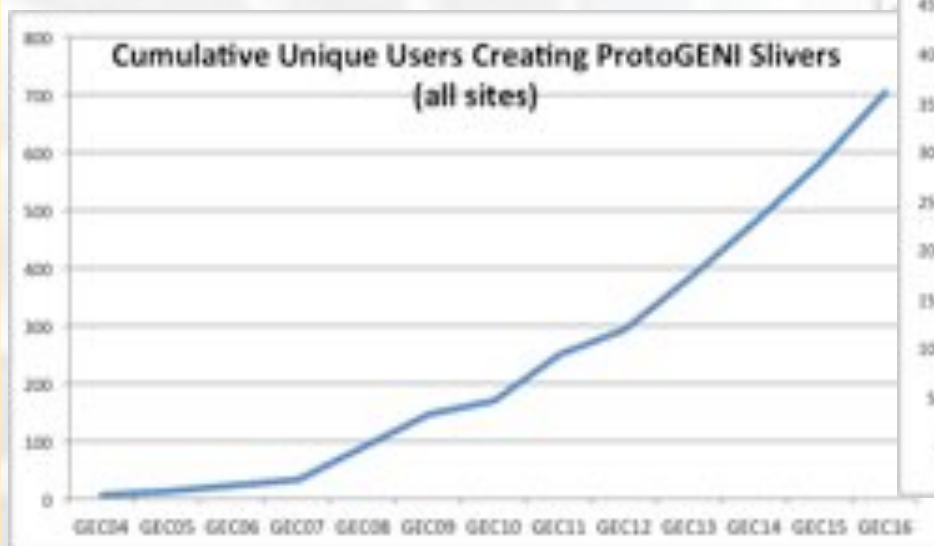
Planned GENI expansion significantly enhances experiment opportunities.

Growing number of experimenters

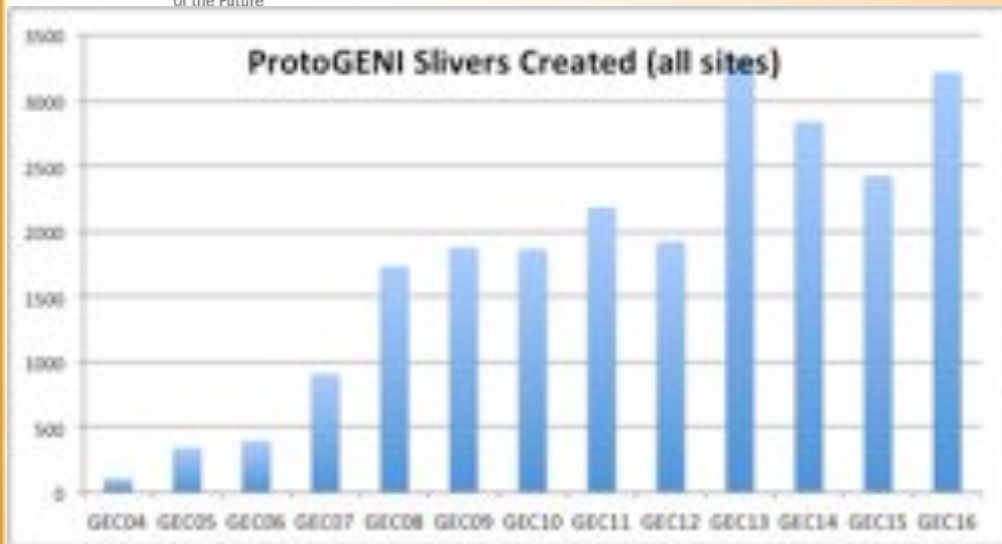


Notes

- ProtoGENI sites only
- Excludes test users and sites, includes tutorials
- Data as of 12 March 2013

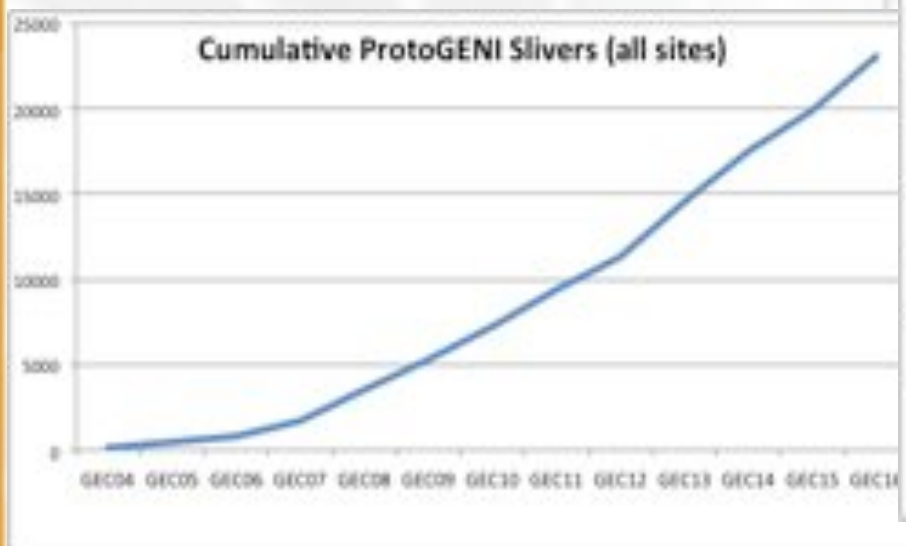


Growing number/size of experiments



Notes

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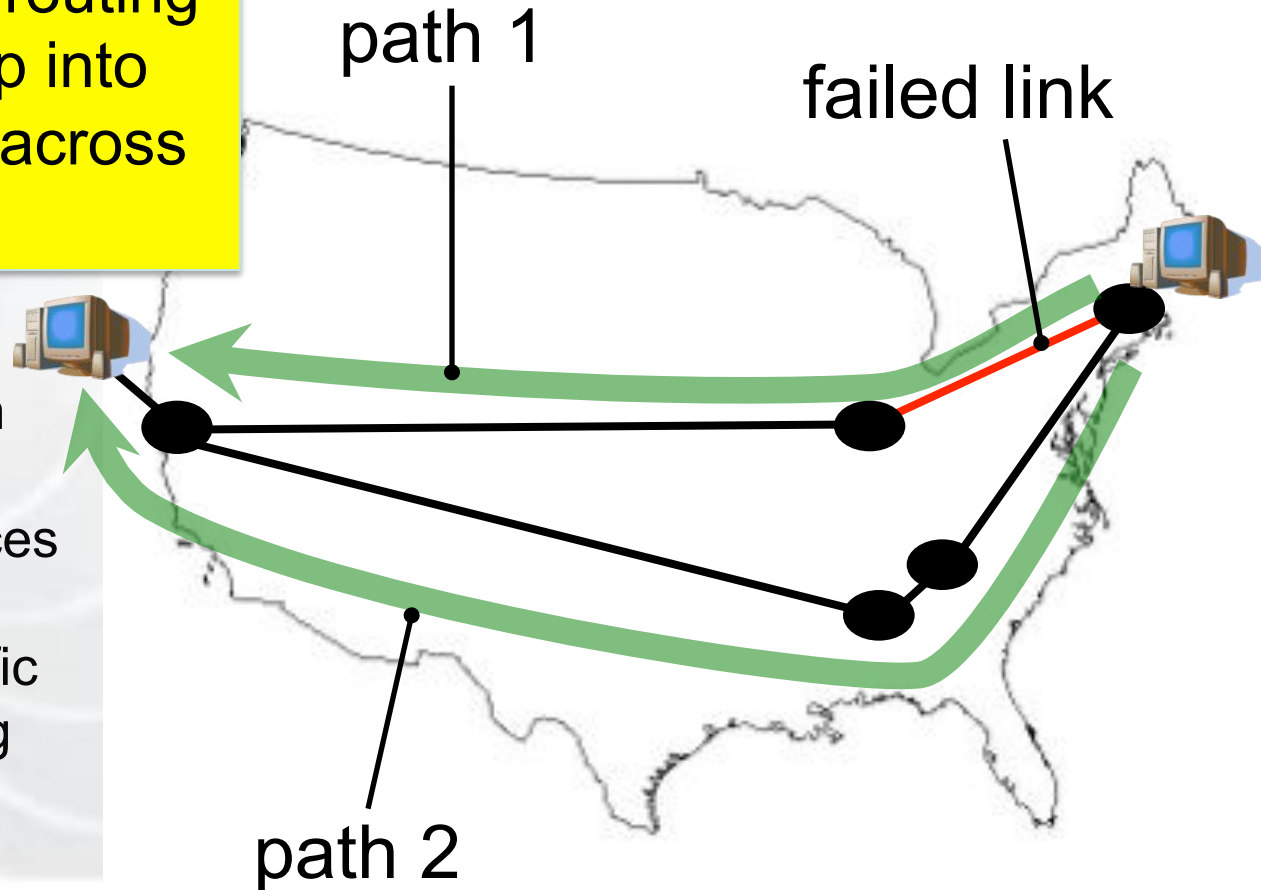


Resilient Routing in the Pathlet Architecture

Ashish Vulimiri and Brighten Godfrey
University of Illinois at Urbana-Champaign

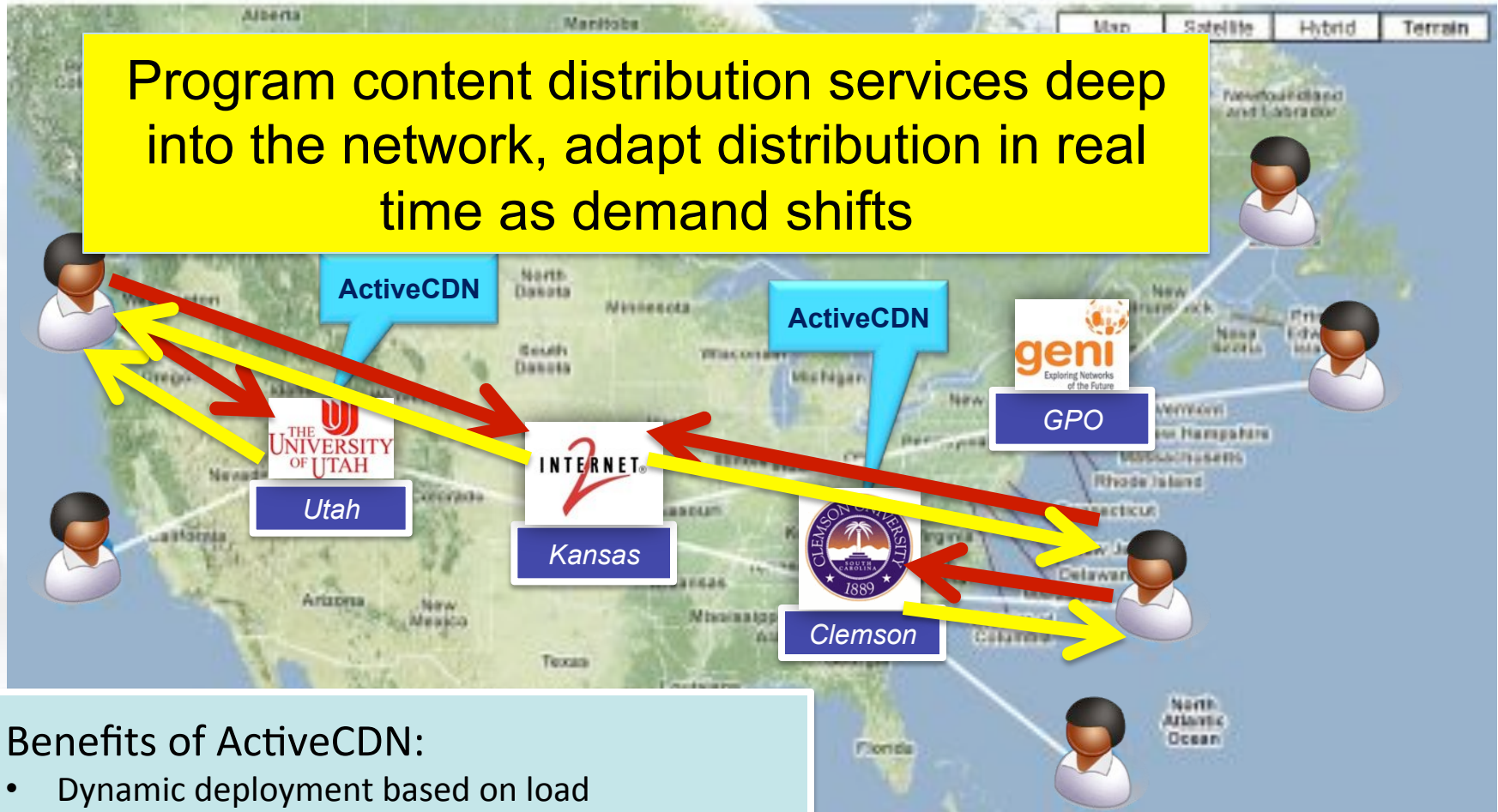
Deploy innovative routing architecture deep into network switches across the US

- Lets *users* monitor and select their own network paths to optimize their services
- Protects critical traffic even without waiting for adaptation time





Program content distribution services deep into the network, adapt distribution in real time as demand shifts



Benefits of ActiveCDN:

- Dynamic deployment based on load
- Localized services such as weather, ads and news

Jae Woo Lee, Jan Janak, Roberto Francescangeli, SumanSrinivasan, Eric Liu, Michael Kester, SalmanBaset, Wonsang Song, and Henning Schulzrinne

David Irwin et al



UMASS
AMHERST

casa Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere

Revolutionizing our ability to observe, understand, predict and respond to hazardous weather events



Generate "raw" live data
ViSE/CASA radar nodes

<http://stb.ece.uprm.edu/current.jsp>



"raw" live data

Create and run realtime
"weather service on demand"
as storms turn life-threatening



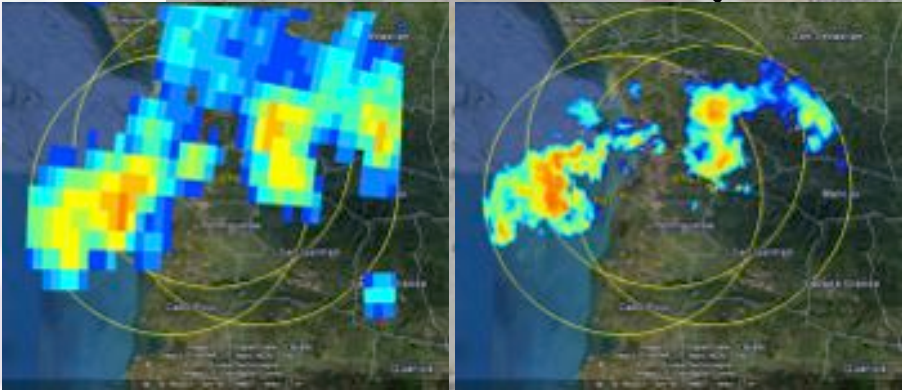
Nowcast images for display

1. Spin up system in Amazon commercial EC2 and S3 services on demand

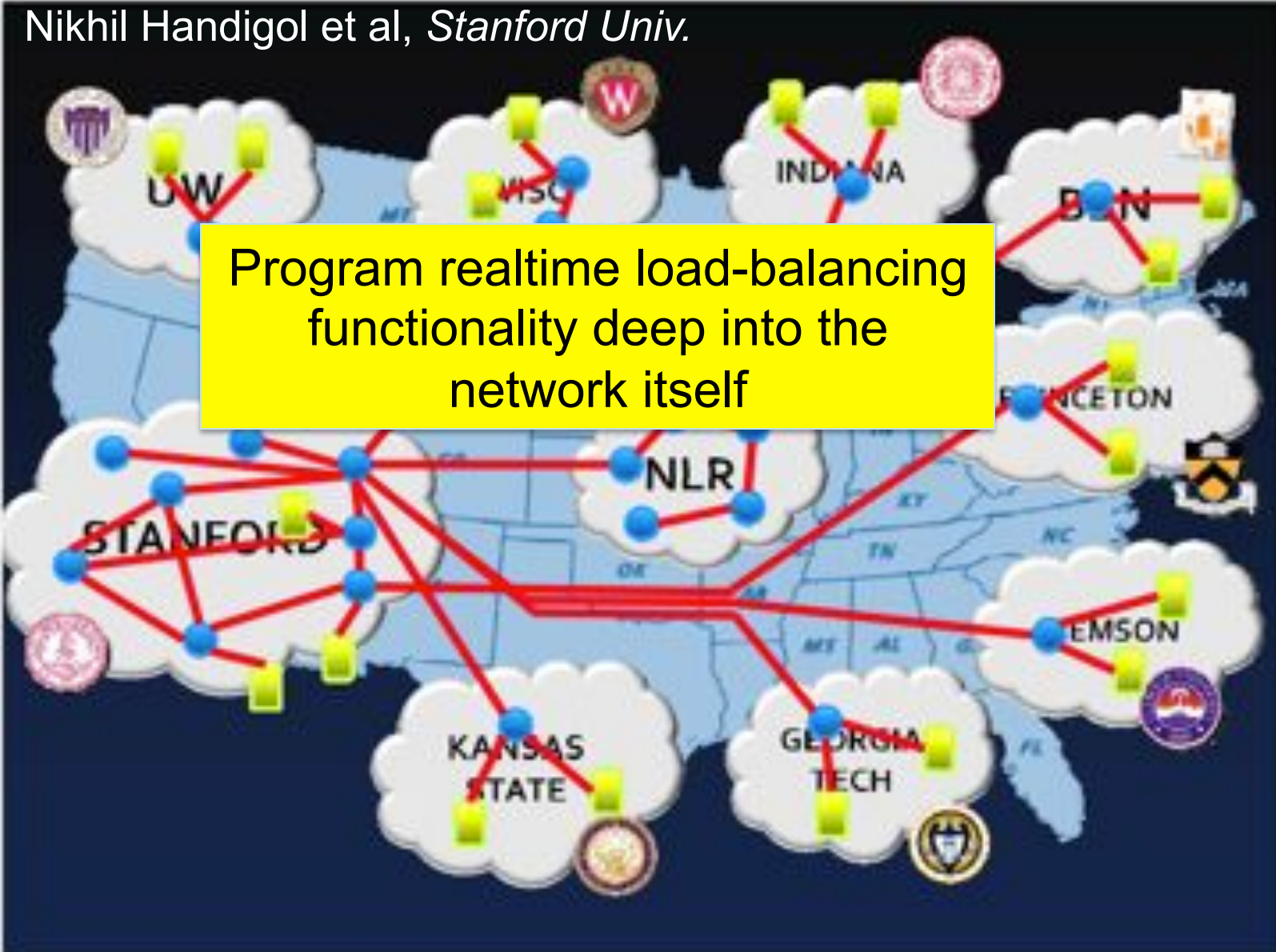
Multi-radar NetCDF Data



Nowcast Processing



Nikhil Handigol et al, *Stanford Univ.*



Program realtime load-balancing
functionality deep into the
network itself

Workshops and journals

Using GENI for research and education

- **Kaiqi Xiong, RIT**
 - GENI Research and Educational Experiment Workshop – March 2013
 - Second Summer Camp – May/June 2013
 - 4.5 days of tutorials, advice, one-on-one support
- **Jeannie Albrecht, Williams**
 - Curricula for Undergraduate Courses in Distributed Systems
- **Nick Feamster, GA Tech**
 - “Living lab” – being planned
- **ACM SIGCOMM 2012**
 - Workshop on Hot Topics in Software Defined Networking
- **ICC 2012**
 - Workshop on Software Defined Networks (SDN'12)
- **ICCCN 2012**
 - Track on Network Architectures and Clean-Slate Designs
- **TridentCom 2012**
 - Testbeds, Experimentation and Innovation for the Future Internet
- **SIGCSE 2013**
 - Tutorial on GENI
- **NSDI 2013**

Special issue on Future Internet Testbeds –
Computer Networks, James P. G. Sterbenz et al, eds.

- **Fall 2012:**
 - Zongming Fei (U. of KY), Rudra Dutta (NCSU)
- **Spring 2013:**
 - Jay Aikat (U. of NC)
 - 2 classes at NCSU (including a seminar class by Rudra)
- **Planned for Fall 2013**
 - Christos Papadopoulos (Colorado State), Zhi-Li Zhang (U. of MN), Zongming Fei (U. of KY)

Initial Page for Instructors on the GENI Wiki



GENIEducation - GENI: geni - Trac

groups.geni.net/gen/wiki/GENIEducation

My Drive - Google Drive - Google Calendar - Yahoo! - BSN Iweb - Google Maps - Merriam-Webster - Wikipedia - BSN - GENI - vacation rental - OpenVZ - Back

My Drive - TurboTax Adva... The iPad's Iweb... Cart - Apple St... How to Refund... BNY Transac... GENIEducation...

geni Exploring Networks at the Future

NETWORK SCIENCE AND ENGINEERING

SEARCH

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Wiki Newcomer Experimenters **Instructors** Aggregate Providers Operations Developer Special Four SPG Docs

Index by Title Index by Date Last Change View Tickets New Ticket Search

The Global Environment for Network Innovations – **GENI** – is a suite of **research infrastructure** rapidly taking shape in prototype form across the United States. It is sponsored by the National Science Foundation, with the goal of providing a **laboratory environment for networking and distributed systems research and education**. It is well suited for exploring **networks at scale** thereby promoting innovations in network science, security, services and applications.



Getting Started

GENI is a networked federation of multiple testbeds that form a large-scale distributed testbed that you can use in a classroom or in tutorials to teach students networking and distributed system concepts. If you want to either use GENI in your class, or you would like to do a GENI tutorial you will have to first **create a GENI project** and then **choose the material** you want to present.

Resources for using GENI in the classroom

GENI is a federated virtual laboratory that provides access to multiple different testbeds to GENI experimenters, enabling networking and distributed systems research. These are some useful pointers that will help you navigate through the GENI world. Feel free to email us with any questions you might have at help@geni.net.



Example Assignments



Resources for Instructors



Help using GENI for education

Download in other formats:
[Plain Text](#)

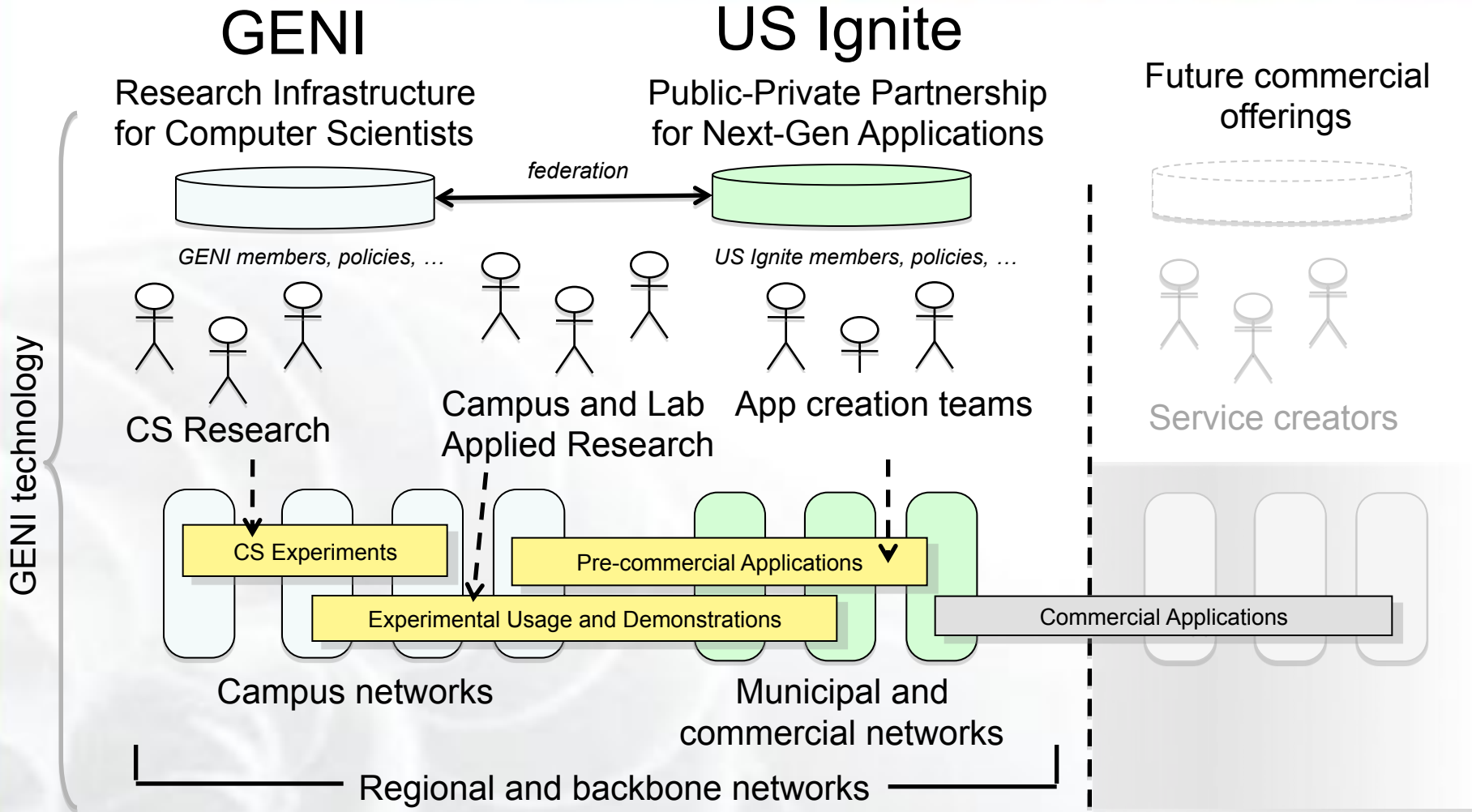
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- US Ignite is an initiative to spark the development of **gigabit applications and services**
- **in areas of national priority:** advanced manufacturing, health, education, energy, economic development, transportation, and public safety/emergency preparedness
- **on an ultra high speed, deeply programmable, and sliceable network testbed.**



US Ignite is now taking shape

Bridging CS Experiments to Next-Gen Applications in Cities



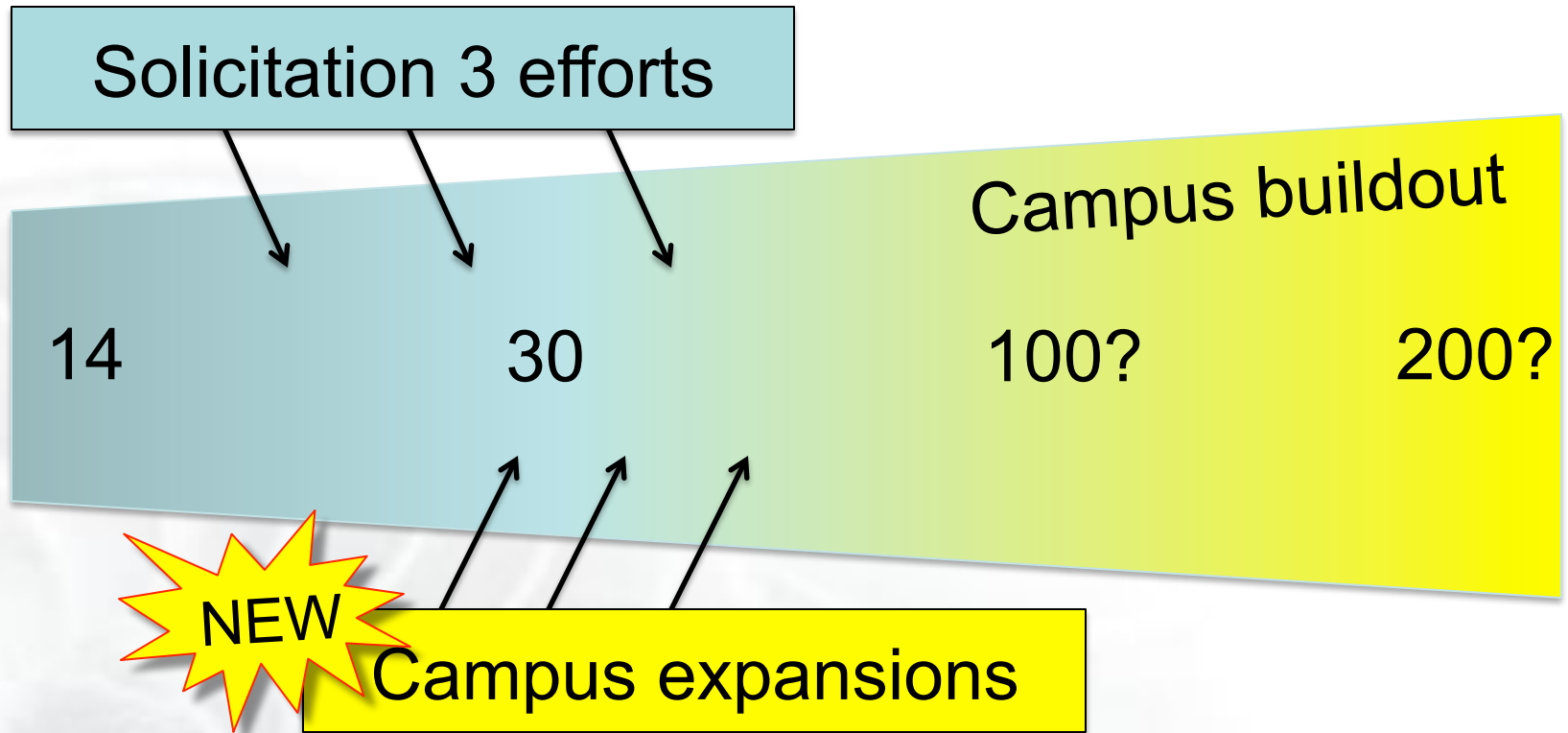
US Ignite is a new organization that will promote advanced applications and infrastructure leveraging GENI research and technologies.

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- **What's next for GENI?**

- Suggest 100-200 US campuses as target for “at scale”
 - Both academia and national labs
 - GENI-enable the campuses
 - Their students, faculty, staff can then “live in the future” using both today’s Internet and many experiments
 - Build out backbones, regionals, and shared clouds to support the campuses
- Grow via ongoing spiral development
 - Identify, understand, and drive down risks
 - Learn what is useful and what is not
 - Early GENI campuses can help later ones
- Transition to community governance

Growing GENI to 100-200 campuses

GENI racks, OpenFlow, WiMAX, training, ops



GENI racks, OpenFlow, WiMAX, training, ops



Spiral development . . .



Dr. Larry Landweber, U. Wisconsin

- **“GENI-enabled” means . . .**
OpenFlow + GENI racks, plus
WiMAX on some campuses

- **Current GENI campuses**
Clemson, Colorado, Columbia,
Georgia Tech, Indiana,
Princeton, Kansas State, NYU
Poly, Rutgers, Stanford,
UCLA, U MA Amherst, U
Washington, U Wisconsin
- **CIO Initiative - 19 campuses**
Case Western, Chicago,
Colorado, Cornell, Duke,
Florida International, U Kansas,
Michigan, NYU, Purdue,
Tennessee, U FLA, University
of Houston, UIUC, U MA
Lowell-Amherst, Utah,
Washington, Wisconsin
- **Rapidly growing waitlist**

Ramping up experimenter workshops and training sessions for IT staff

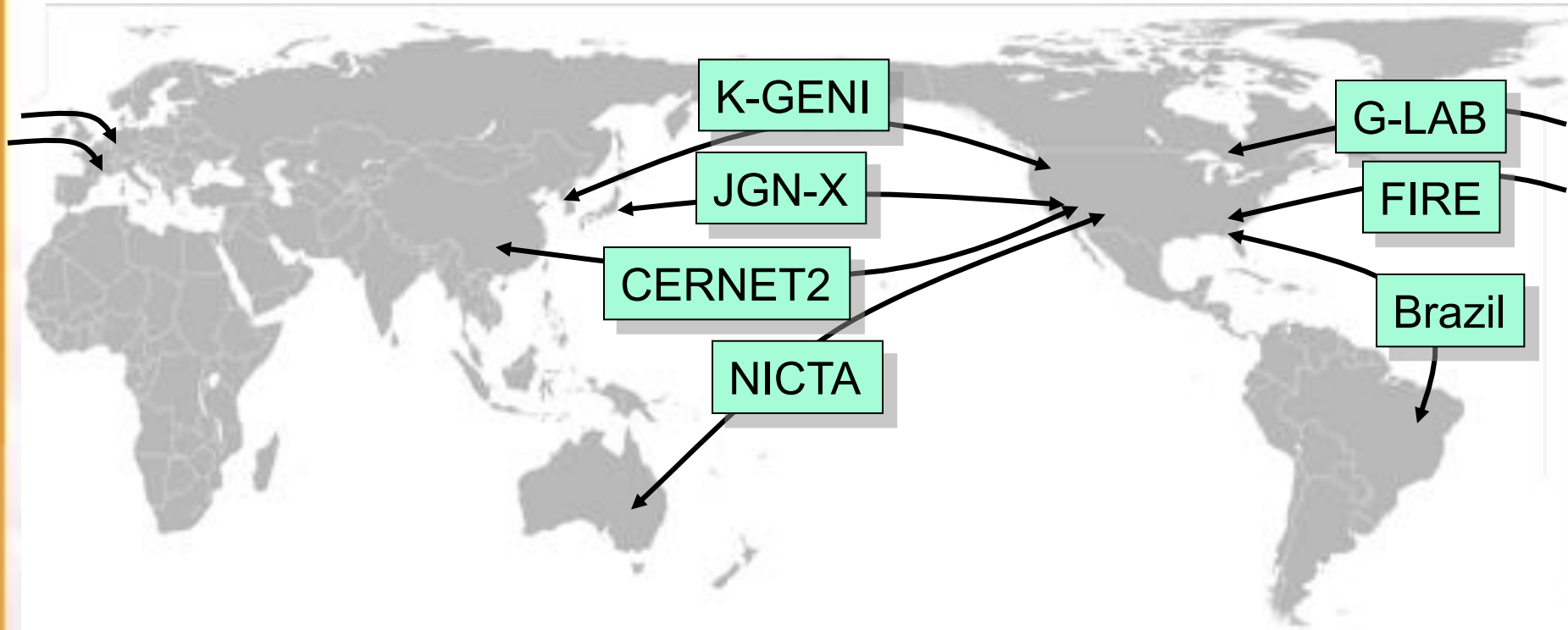


Network Engineers “boot camp” organized by Larry Landweber and given by Matt Davy and Steve Wallace, Indiana University

- GPO funding 3 workshops / year by Indiana University
- Goal: train IT staff on OpenFlow and (when available) GENI racks
- At GEC 12 in Kansas City:

Case Western Reserve	Cornell
Duke	Florida International
NYU	Purdue
Univ Chicago	Univ DC
Univ Florida	Univ Houston
UIUC	Univ Colorado
Univ Kansas (Lawrence)	Univ Massachusetts, Lowell
Univ Massachusetts, Amherst	Univ Michigan
Univ Tennessee, Chattanooga	Univ Utah
Univ Washington	Univ Wisconsin, Madison

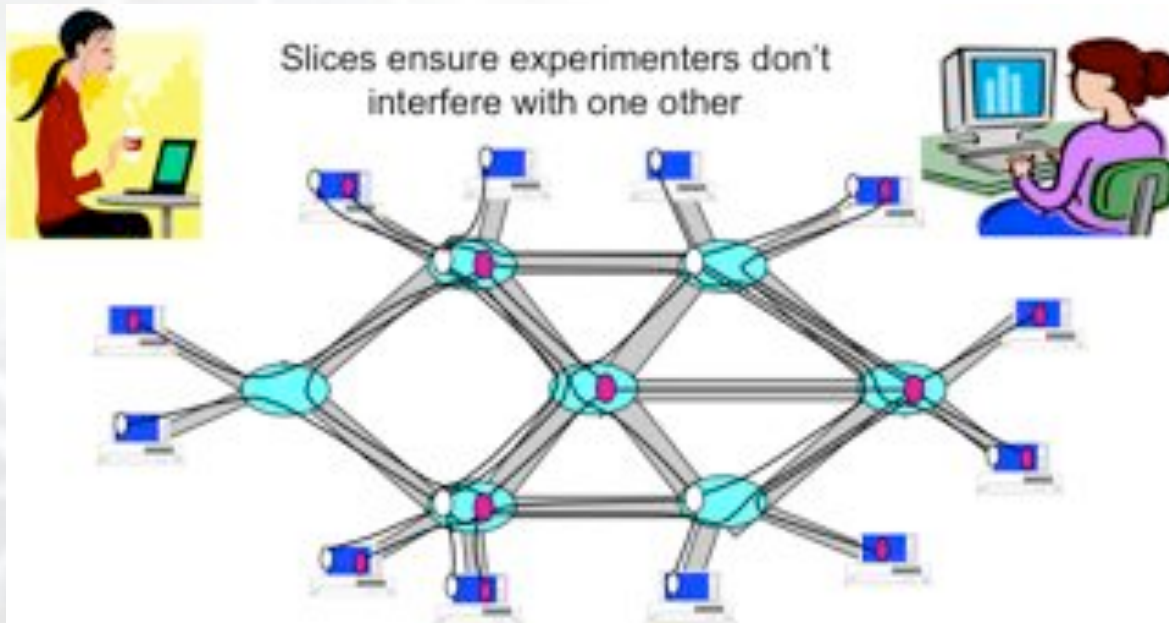
- 35 additional schools have expressed interest and are on waitlist



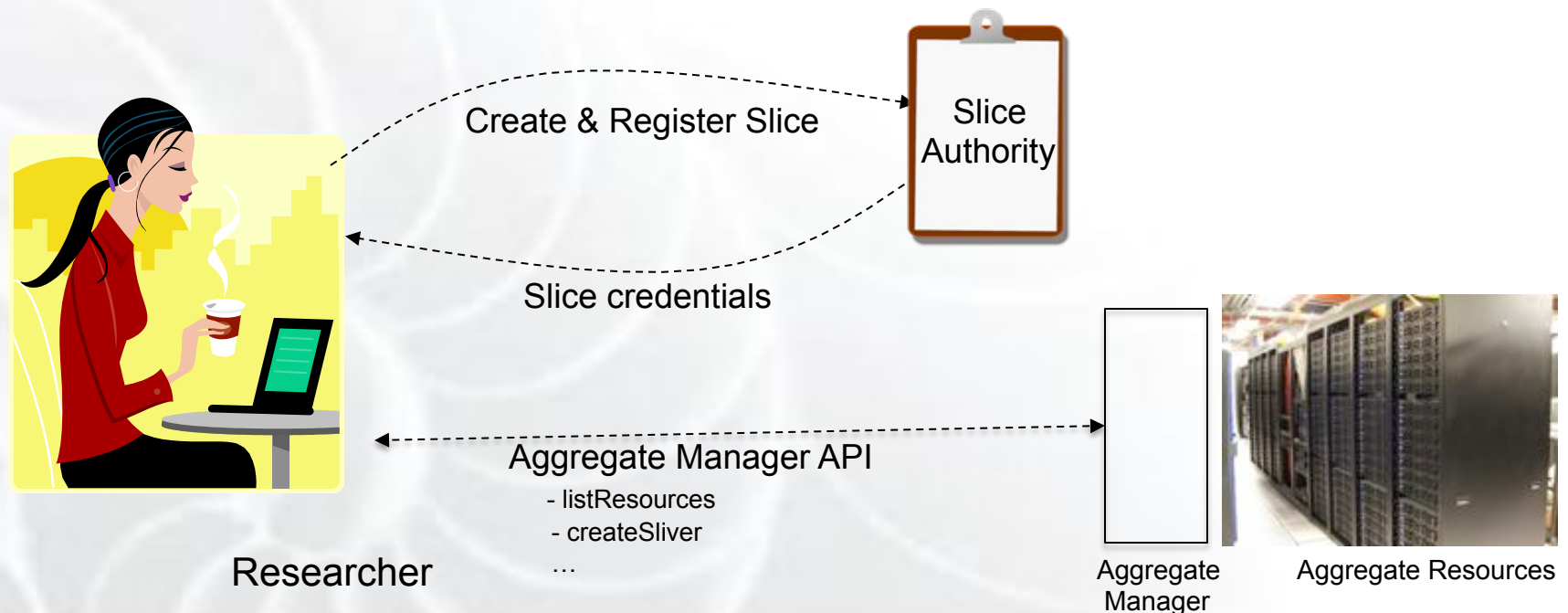
The GENI project is actively collaborating with peer efforts outside the US, based on equality and arising from direct, “researcher to researcher” collaborations.

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- **What's next for GENI?**
- GENI: An experimenter's view

- Slice: Abstraction for a collection of resources capable of running experiments
 - An experiment uses resources in a slice
 - Slices isolate experiments
 - Experimenters are responsible for their slices

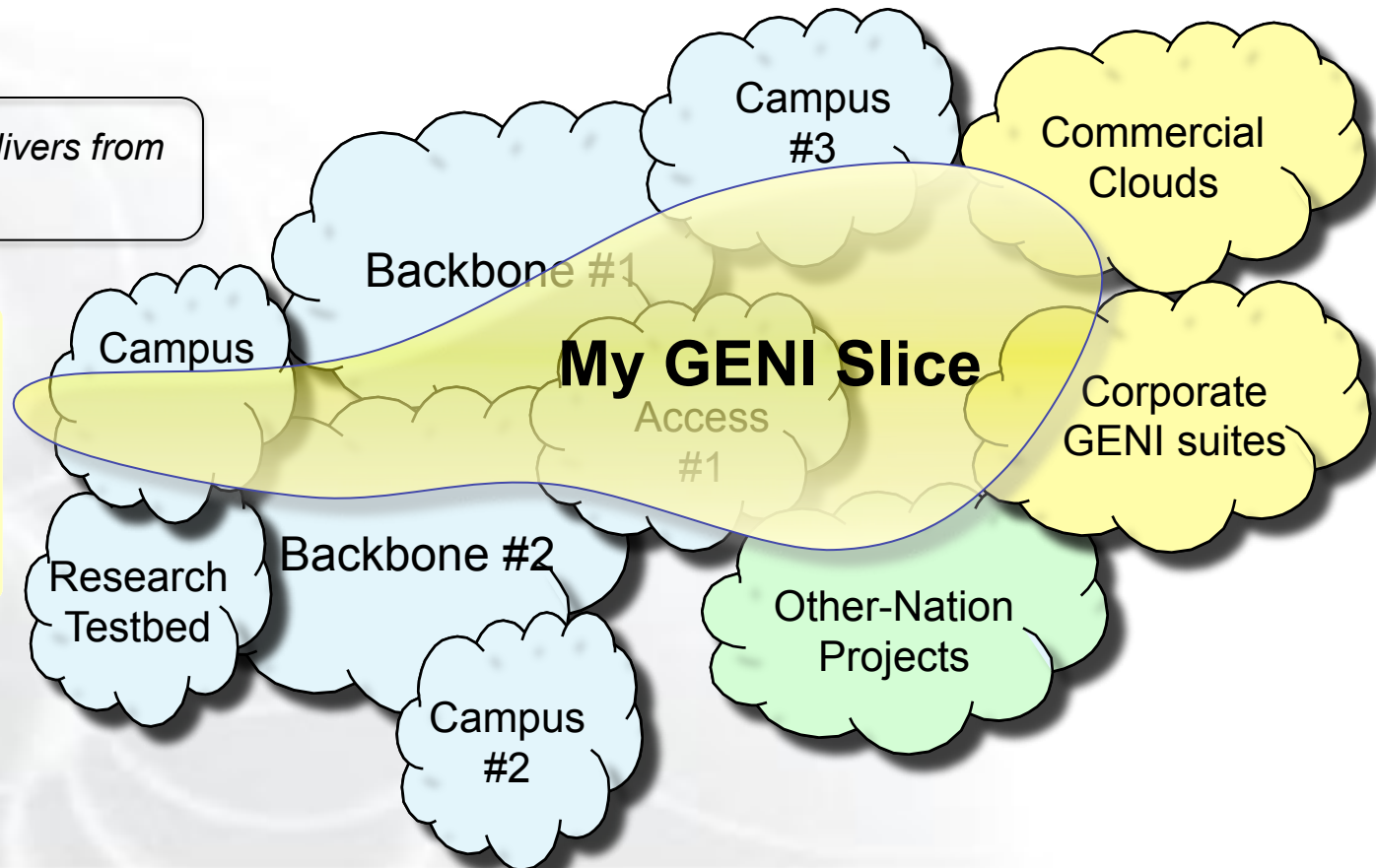
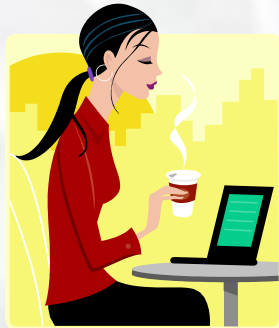


- Slice authority: Creates and registers slices
 - GENI slice authorities: PlanetLab, ProtoGENI, GPO Lab
- Aggregate: Provides resources to GENI experimenters
 - Typically owned and managed by an organization
 - Examples: PlanetLab, Emulab, GENI Rack on various campuses
 - Aggregates implement the GENI AM API



- Sliver: One or more resources provided by an aggregate
 - E.g. Bare machines, virtual machines, VLANs

My slice contains slivers from many aggregates.



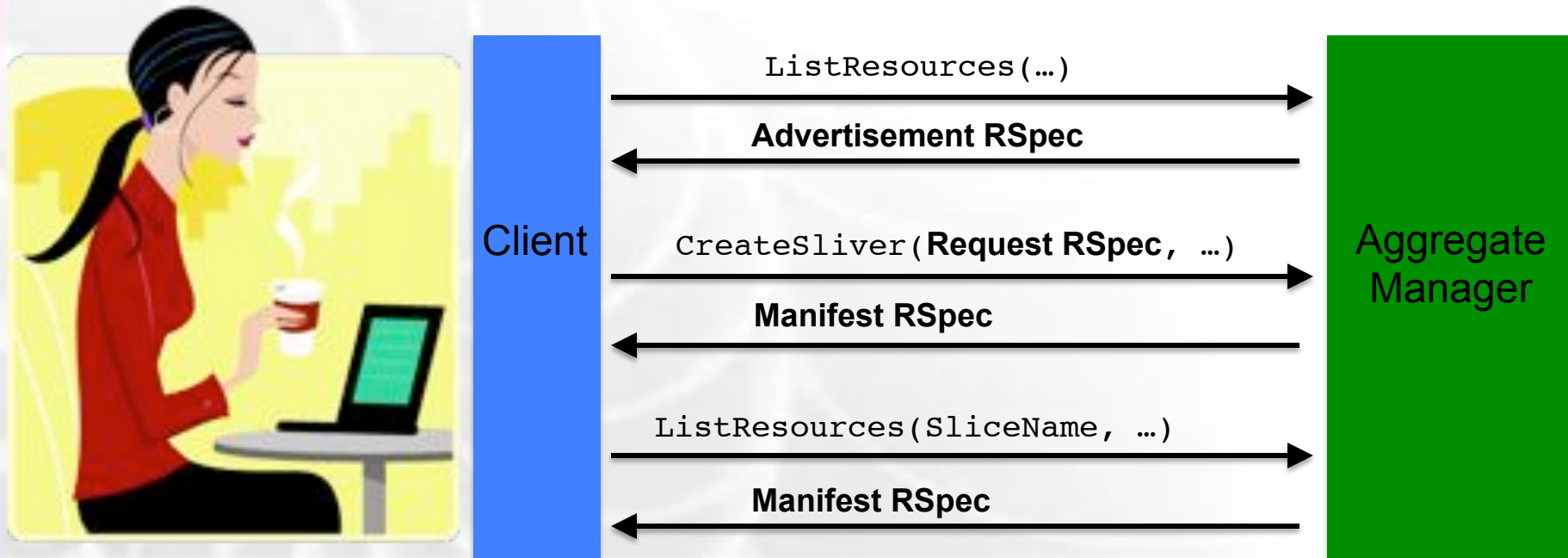
- RSpecs: Lingua franca for describing and requesting resources
 - “Machine language” for negotiating resources between experiment and aggregate
 - Experimenter tools eliminate the need for most experimenters to write or read RSpec

```
<?xml version="1.0" encoding="UTF-8"?>
<rspec xmlns="http://www.protogeni.net/resources/rspec/2"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.protogeni.net/resources/rspec/2
    http://www.protogeni.net/resources/rspec/2/request.xsd"
  type="request" >
  <node client_id="my-node"
    exclusive="true">
    <sliver_type name="raw-pc" />
  </node>
</rspec>
```

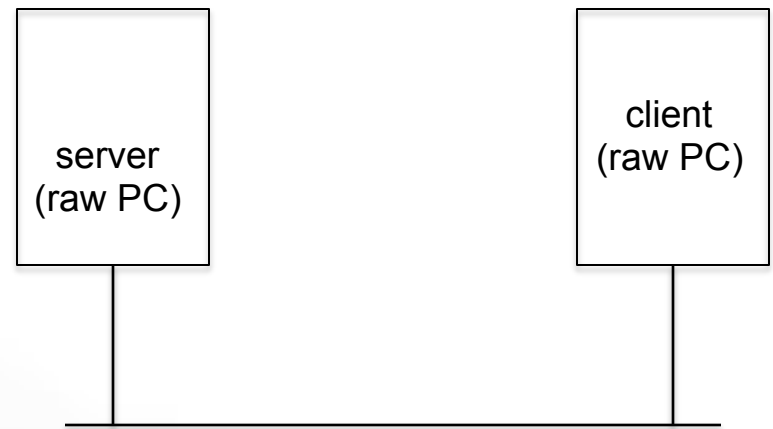
RSpec for requesting a single node

Sliver Creation using RSpecs and the AM API

- Advertisement RSpec: What does an aggregate have?
- Request RSpec: What does the experimenter want?
- Manifest RSpec: What does the experimenter have?



- Demo
 - Create a slice
 - Create a sliver at one aggregate
 - Two computers (raw PCs), connected by a LAN
 - Install and run software on the machines
 - View output of software
 - Delete sliver
- Experimenter tool: Flack



- Launch Flack
- Log in
- Create slice
- Use Flack canvas to draw topology
- Create sliver
- Verify sliver creation was successful



Flack

Submit introlice1: Submitted v14.42

introlice1 View [Map] [Import] [Output] [GENI]

Add Resources Get Status

Get Silver Status: Ready

Remove

Extend 2 Hours

Submit

Previous Resource: RSPQC for introlice1



Download in other formats: Plain Text

```
<rspec type="request" xsi:schemaLocation="http://www.geni.net/resources/rspec/3 http://www.geni.net/resources/rspec/3/request.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.geni.net/resources/rspec/3">
  <node client_id="server" component_manager_id="urn:publicid:IDN+emulab.net+authority+cm" exclusive="true">
    <sliver_type name="raw-pc">
      <disk_image name="urn:publicid:IDN+emulab.net+image+emulab-ops//FEDORA10-STD"/>
    </sliver_type>
    <services>
      <execute command="sudo /local/install-script.sh" shell="sh"/>
      <install install_path="/local" url="http://www.gpolab.bbn.com/experiment-support/HelloGENI//hellogeni-install.tar.gz"/>
    </services>
    <interface client_id="server:if0" />
  </node>
  <node client_id="client" component_manager_id="urn:publicid:IDN+emulab.net+authority+cm" exclusive="false">
    <sliver_type name="emulab-openvz"/>
    <services>
      <execute command="sudo /local/install-script.sh" shell="sh"/>
      <install install_path="/local" url="http://www.gpolab.bbn.com/experiment-support/HelloGENI//hellogeni-install.tar.gz"/>
    </services>
    <interface client_id="client:if0" />
  </node>
  <link client_id="Lan">
    <component_manager name="urn:publicid:IDN+emulab.net+authority+cm"/>
    <interface_ref client_id="server:if0"/>
    <interface_ref client_id="client:if0"/>
    <property source_id="server:if0" dest_id="client:if0"/>
    <property source_id="client:if0" dest_id="server:if0"/>
  </link>
</rspec>
```

```

<rspec type="manifest" ...>
  <node client_id="server" component_manager_id="urn:publicid:IDN+emulab.net+authority+cm" exclusive="true"
    component_id="urn:publicid:IDN+emulab.net+node+pc554" sliver_id="urn:publicid:IDN+emulab.net+sliver+95506">
    <sliver_type name="raw-pc">
      <disk_image name="urn:publicid:IDN+emulab.net+image+emulab-ops//FEDORA10-STD"/>
    </sliver_type>
    <services>
      <execute command="sudo /local/install-script.sh" shell="sh"/>
      <install install_path="/local" url="http://www.gpolab.bbn.com/experiment-support/HelloGENI//hellogeni-install.tar.gz"/>
      <login authentication="ssh-keys" hostname="pc554.emulab.net" port="22" username="vthomas"/>
    </services>
    <interface client_id="server:if0" component_id="urn:publicid:IDN+emulab.net+interface+pc554:eth2" sliver_id="urn:publicid:IDN
+emulab.net+sliver+95509" mac_address="0024e87a46fb">
      <ip address="10.10.1.1" type="ipv4"/>
    </interface>
  </node>
  <node client_id="client" component_manager_id="urn:publicid:IDN+emulab.net+authority+cm" exclusive="false"
    component_id="urn:publicid:IDN+emulab.net+node+pc533" sliver_id="urn:publicid:IDN+emulab.net+sliver+95505">
    <sliver_type name="emulab-openvz"/>
    <services>
      <execute command="sudo /local/install-script.sh" shell="sh"/>
      <install install_path="/local" url="http://www.gpolab.bbn.com/experiment-support/HelloGENI//hellogeni-install.tar.gz"/>
      <login authentication="ssh-keys" hostname="pc533.emulab.net" port="37178" username="vthomas"/>
    </services>
    <interface client_id="client:if0" component_id="urn:publicid:IDN+emulab.net+interface+pc533:eth2" sliver_id="urn:publicid:IDN
+emulab.net+sliver+95510" mac_address="0262331adfd4">
      <ip address="10.10.1.2" type="ipv4"/>
    </interface>
  </node>
  <link client_id="Lan" sliver_id="urn:publicid:IDN+emulab.net+sliver+95508" vlantag="310">
    <interface_ref client_id="server:if0" component_id="urn:publicid:IDN+emulab.net+interface+pc554:eth2" sliver_id="urn:publicid:IDN
+emulab.net+sliver+95509"/>
    <interface_ref client_id="client:if0" component_id="urn:publicid:IDN+emulab.net+interface+pc533:eth2" sliver_id="urn:publicid:IDN
+emulab.net+sliver+95510"/>
    <property source_id="server:if0" dest_id="client:if0"/> <property source_id="client:if0" dest_id="server:if0"/>
  </link>
</rspec>

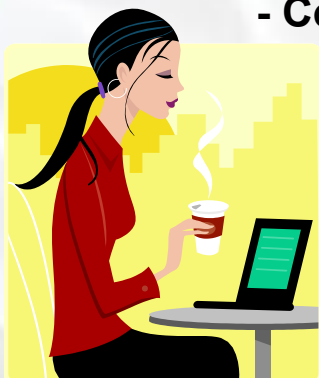
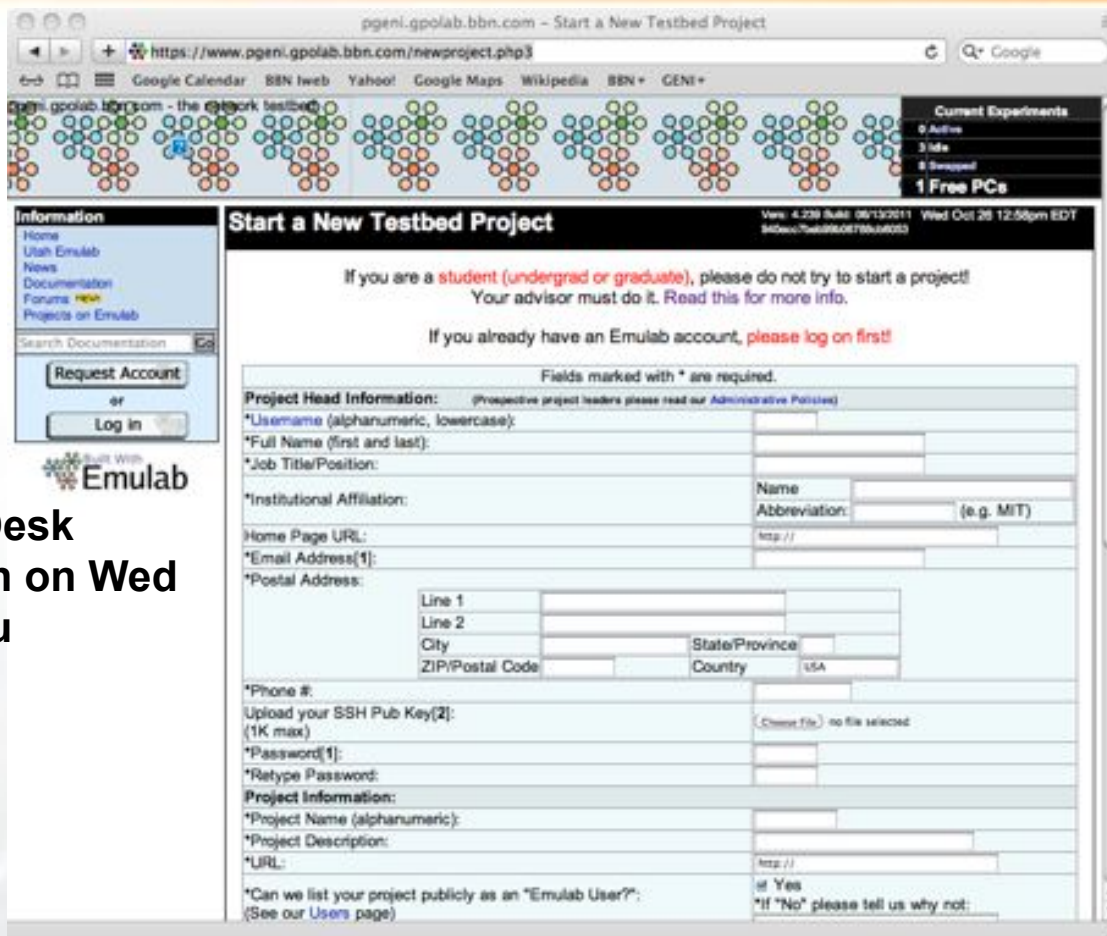
```

- Tutorials on the GENI wiki
 - Look for the  icon on the GENI wiki and then click on  for tutorials
- Participate in the hands-on tutorials at the GEC
- Get a GENI account today!



At the GEC:

- Experimenter Help Desk
- Experimenter drop-in on Wed
- Coding sprint on Thu

pgeni.gpolab.bbn.com - Start a New Testbed Project

https://www.pgeni.gpolab.bbn.com/newproject.php3

Google Calendar BBN Inweb Yahoo! Google Maps Wikipedia BBN+ GENI+

Current Experiments
0 Active
3 Info
4 Suspended
1 Free PCs

Start a New Testbed Project View: 4,239 (last: 09/13/2011 9:05am) Wed Oct 26 12:58pm EDT

If you are a **student (undergrad or graduate)**, please do not try to start a project!
Your advisor must do it. Read this for more info.

If you already have an Emulab account, **please log on first!**

Fields marked with * are required.

Project Head Information: (Prospective project leaders please read our [Administrative Policies](#))

*Username (alphanumeric, lowercase):

*Full Name (first and last):

*Job Title/Position:

*Institutional Affiliation:

Name:
Abbreviation: (e.g. MIT)

Home Page URL: http://

*Email Address(1):

*Postal Address:

Line 1:
Line 2:
City: State/Province:
ZIP/Postal Code: Country: USA

*Phone #:

Upload your SSH Pub Key(2): (1K max) no file selected

*Password(1):

*Retype Password:

Project Information:

*Project Name (alphanumeric):

*Project Description:

*URL: http://

*Can we list your project publicly as an "Emulab User?":
(See our [Users](#) page) if Yes if "No" please tell us why not:

Information
Home
Utah Emulab
News
Documentation
Forums **new**
Projects on Emulab

Search Documentation Go

or
















Join With Emulab

Online: <https://www.pgeni.gpolab.bbn.com/newproject.php3>

Email: help@geni.net

Student accounts need to be approved by a professor.

Participate in the Hands-On Tutorials!

Start Time / Room Name	Alpine Room	City Creek Room	Tues, Mar 19 Douglas Ballroom (East)	Douglas Ballroom (West)	City Creek Room	Wed, Mar 20 Officers Club (South)	Officers Club (North/West)	City Creek Room	Thurs, Mar 21 Douglas Ballroom (East)	Douglas Ballroom (West)	Fri, Mar 22 City Creek Room
7:00			Breakfast / Newcomers Breakfast* (provided)			Breakfast (provided)			Breakfast / Newcomers Breakfast* (provided)		
7:30											
8:00											
8:30				 An Introduction to GENI and Experimentation using GENI					  Using InstaGENI and GEMINI for Experimentation and Instrumentation	 OpenFlow Tutorial	
9:00		Service Developers Roundtable				Plenary (Part 1) Douglas Ballroom			OpenFlow Switches in GENI		GREE2013 Workshop
9:30											
10:00			Break			Break					BREAK (10:00-10:30)
10:30				  Getting Started with GENI using the GENI Portal					Break		
11:00		ISM Design Topics				Plenary (Part 2) Douglas Ballroom					GREE2013 Workshop
11:30									Plenary (wrap-up) Douglas Ballroom 11:30am - 12:15pm		
12:00			Lunch (provided)			Lunch (provided)			Boxed Lunch (provided) - 12:15pm		
12:30											
1:00											
1:30	GPO Office Hours (By appointment)		 Experimentation and Instrumentation with ExoGENI Racks and GIMI	Experimenter Roundtable	GENI Racks at Campuses and Regionals	 Advanced Networking Experiments	  Using ExoGENI and GIMI for Experimentation and Instrumentation		GREE2013 Workshop	Towards a Common GENI Execution Environment Coding Sprint Experimenter and Operations Tutoring	
2:00		Architects Meeting (by invitation only)									
2:30											
3:00				Break (3:00-3:30)							
3:30			 Experimentation and Instrumentation with InstaGENI Racks and GEMINI	Aggregate Developers' Topics		Break (3:30-4:00)					
4:00		WMAX Developers Meeting			Operations and Monitoring	  Experimentation with WMAX and GIMI	 Experimenter Drop-in		GREE2013 Workshop	 Coding Sprint, Experimenter and Operations Tutoring	
4:30											
5:00		Buses depart for demo and poster session									
5:30		Evening Demo session & Networking Event									
6:00											
6:30											
7:00											
7:30		Buses depart for hotels				BoF Dinners. You are invited to join one of the birds-of-a-feather dinners listed in the agenda below.					

Some tutorials require some pre-work.

GENI Engineering Conferences

We welcome your participation in GENI

- **17th meeting, open to all:
July 21-23, 2013, University of Wisconsin**
 - Planning & discussion for experimenters, software, infrastructure
 - Tutorials and workshops (plus Mozilla hackfest)
 - **Travel grants** to US academics for participant diversity



- Experimenter Tools
- Advanced Experiments, Services, Applications
- Documentation and Training
- Operations Transition
- Transitioning to a Self-Sustaining Community

Hear all about it a the Plenary tomorrow!

QUESTIONS?