

# GENI's Future Direction and Project Update

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March 2017



# Future Directions for GENI

More discussion in “Looking Ahead” session this afternoon.



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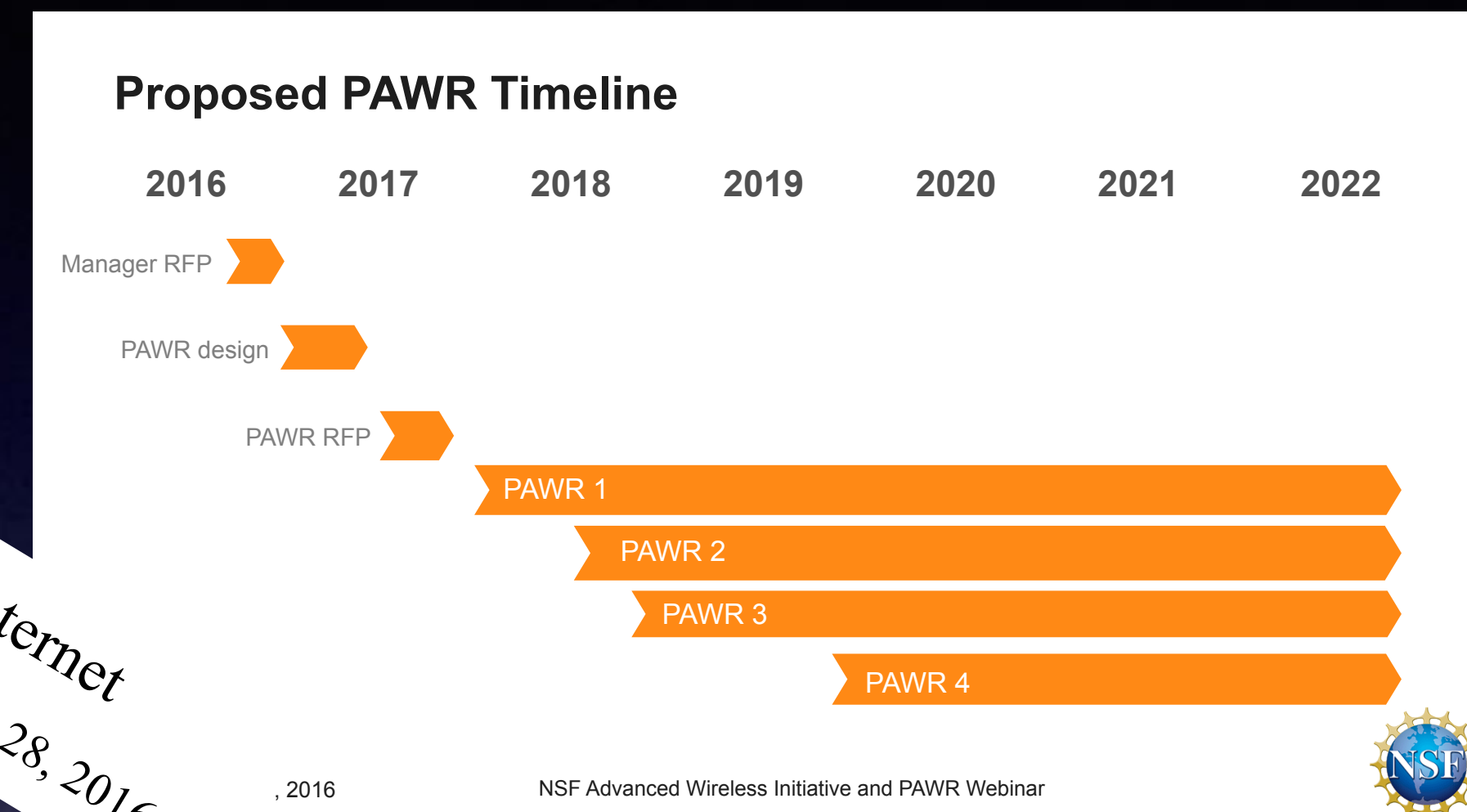


# Exciting Times in Mid-Scale Infrastructure

## GENI project & community goals

- Assure infrastructure support and sustainment.
- Create the technical and infrastructure underlayment for new research initiatives.
- Lead the conceptualization, design, and development of tomorrow's research infrastructure platform.

Looking Beyond the Internet  
Steering Group Final Report - March 28, 2016  
Source: "Looking Beyond the Internet" Steering Group



Source: National Science Foundation

**Tomorrow's Internet Project Office (TIPOFF)**  
Building on the Success of the Global Environment for Network Innovations

# Future Directions for GENI

## Making GENI better

- Expanded and improved support for researchers and educators

## Maximizing GENI's unique edge cloud capabilities

- Distributed cloud for advanced research and smart and connected community applications

## Leading future research cyberinfrastructure

- Underlying platform supporting interoperation and connectivity for future cyberinfrastructure research and deployments
- Open reference architecture for trusted cyberinfrastructure interoperability



# Community Asks For ...

## (Improving GENI)

- Refreshed/updated rack resources
- Enhanced computation at individual sites (more VMs, bare metal)
- More sites and simplified onboarding for new sites, including bring your own rack/resources (BYOR) opportunities
- More universal and reliable network stitching (more sites and better interactions with AL2S circuits)
- More high-speed (10+ Gbps) connectivity and guaranteed bandwidth
- More resources or resource management strategies to address oversubscription
- Improved reliability and SW update strategy (particularly ExoGENI)

There are obvious tensions among these desires.

# Community Asks For ...

(Expanding GENI Capabilities)

- Outdoor Software Defined Radio (SDR) capability
- Enhanced network programmability (e.g., OpenFlow 1.3, P4, or DPDK)
- Managed interoperation
- More network-aware tools to support distributed cloud, campus-specific, and wireless edge interactions
- Tool improvements to manage images and licensed software



# Community Asks For ...

(Leading research infrastructure interoperability)

- Programmability and resource control bridging wireless edge and network core
- Capabilities geared towards cyberphysical systems support (low latency, diverse resource interoperation)
- Programmable and low friction network linkages to unique and high value resources at specific sites
  - Benefitting from SDX and campus cyberinfrastructure (CC-\*) efforts
- Tools and corresponding infrastructure support to improve experiment design and repeatability

# Planning and Transition Timeline

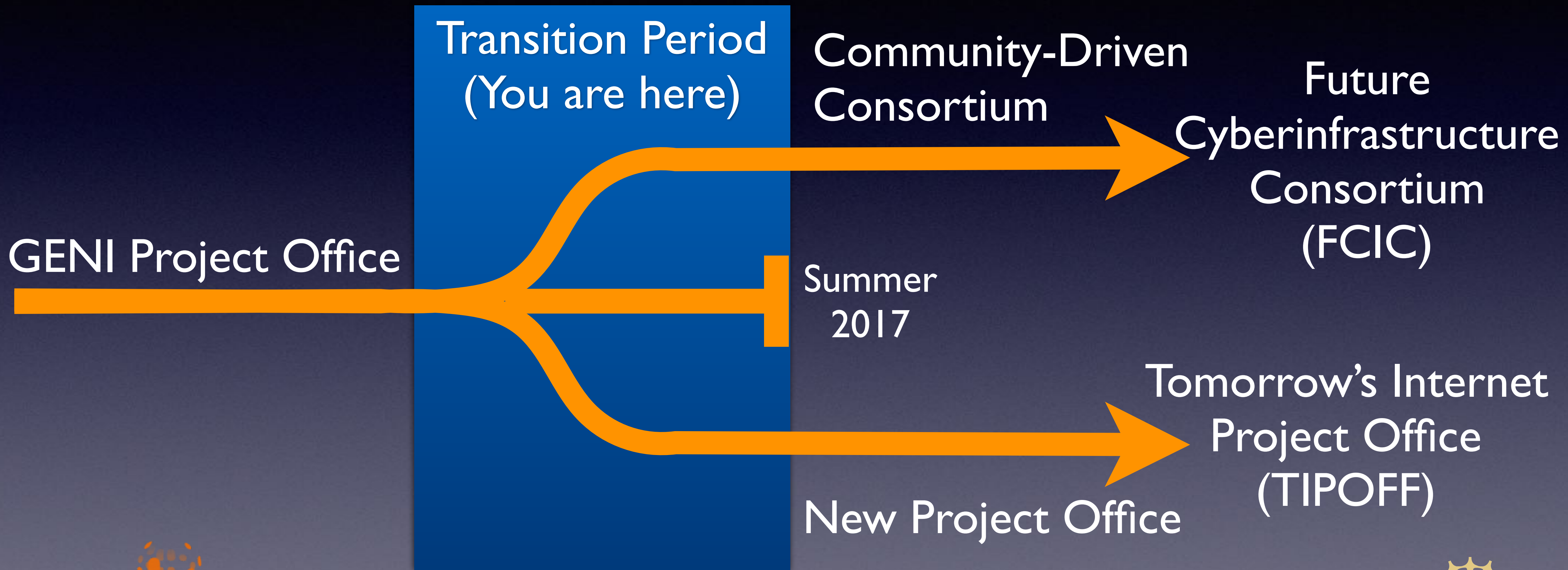


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# Planning and Transition Timeline



# GENI Transition Plan & Status



## Future Cyberinfrastructure Consortium (FCIC)

- Research community-driven vision of what is needed in research CI
- Voice of the community for research sponsors, connection to end users in computer and domain sciences
- Members develop, deploy, and operate distributed, agile, shared, and heterogeneous research cyberinfrastructure at national/global scale
- Provide guidance and prioritization for cyberinfrastructure projects
- Fifteen founding institutions at organizational meeting, Oct. 2016
  - See: [tinyurl.com/FCICWorkshop2016](http://tinyurl.com/FCICWorkshop2016)

More FCIC news in Consortium Update session



# GENI Transition Plan & Status



## Tomorrow's Internet Project Office (TIPOFF)

- “... leadership and administrative oversight in developing, deploying and operating innovative mid-scale computing research infrastructure to meet evolving research community needs ....”
- Operate and evolve GENI.
- Lead research community in development of an expanded and enriched experimental platform.

# GENI Transition Plan & Status



## Technical Readiness For Transition: Recent and Upcoming

- Major sustainment transitions in January 2017
  - Moved GENI portal and clearinghouse from GPO-hosted servers to Amazon Web Services
  - Primary operations responsibility transitioned from GPO to distributed ops team
- Network reconfiguration in concert with Internet2 AL2S updates
- New US Ignite rack configuration debuts in March 2017, three sites in progress
- Decommissioning GPO identity provider beginning in April 2017

More details in transition and roundtable sessions



# GENI Community Events



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# Reminder: GENI Community Events

Multiple events for different purposes.

## Learning GENI

- Hands-on tutorials and intro

## Using GENI

- Research & education exchange
- Demos & posters

## Building & improving GENI

- Collaborative design



# GENI Community Events

## Regional Workshops (3-4 per year)



## GENI Engineering Conferences

### Learning GENI

- Hands-on tutorials and intro
- Tempe, Boston, & Clemson, 2016
- Miami, March 2017
- Next GRW: Summer, 2017, TAMU
- Want to host? [help@geni.net](mailto:help@geni.net)

### Using GENI

- Research & education exchange
- Demos & posters
- NICE 2016: December, Irvine, CA

### Building & improving GENI

- Collaborative design
- Demos & posters

Travel grants available for US academics!



# Recent GENI Community Events

## Third CNERT – Workshop on testbed based research

*April 11, 2016 with INFOCOM San Francisco, CA*

**PC Chairs:** Violet Syrotiuk (ASU), Lucas Nussbaum (Université de Lorraine)

**Stats:** ½ day workshop + 5 demos invited to INFOCOM demo session

Submissions based on research on 8 different testbeds

All presentations included a demo



## Regional Workshop

*Dec 2-3, 2016 at Clemson University*

**Host:** KC Wang

**Stats:** 40 participants – 4 faculty, 1 testbed administrator

**Keynotes:** Mike Reiter (UNC Chapel Hill), Jim Griffieon (U. of Kentucky)

**Tutorials:** Beginner and advanced tracks with 8 hands on tutorials



# FGRE – GENI-Fed4FIRE Summer School at iMinds, Belgium

*July 11-15, 2016 at iMinds, Belgium*

**Organizers:** Brech Vermuellen (iMinds) and Kaiqi Xiong (USF)

**Stats:** 10 US + 14 EU Participants

4 project teams (joint US-EU teams)

- Mitigating cyber-attacks using big data and SDN
- Software Defined Smart Cities
- Self-healing LTE back-haul
- Maintaining QoS in mobile wireless networks using SDN



## Regional Workshop

*March 13, 2017 at Florida International University, Miami*



# Upcoming Events



**CNERT** – Workshop for testbed-based research

*May 1, 2017 with INFOCOM 2017 in Atlanta, GA*



**GENI Regional Workshop**

*May 22, Texas A&M University*

*+ 3 more GRWs in 2017*



**Week-long GENI Camps**

*Next camp: May 22-26, Texas A&M*

**Network Innovators Community Event (GENI NICE),  
with ICNP 2017, October 10-13, Toronto.**



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# GENI Monthly Webinar Series



Hadoop in a GENI Slice  
*Paul Ruth*



Building Clouds with CloudLab  
*Rob Ricci*

**Organizers: Jay Aikat & Ben Newton (UNC)**

**Next scheduled webinar:**

- Programming the Data Plane with P4  
April 21, 2017  
*Changkoon Kim, Barefoot Networks*

- Getting Started with GENI-Lib, *Nick Bastin*
- NFV using SDN and control theory, *Ibrahim Matta*
- PhantomNet, *Kobus Van der Merwe*
- Virtual Computer Networks Lab, *Mike Zink*
- Network-Aware Apps, *Prasad Calyam*
- GENI LTE for Mobility and Edge Cloud Research, *Manu Gosain and Ivan Seskar*
- Denial of Service Detection & Mitigation, *Xenia Montrouidou*

More info, including recorded webinars available from GENI wiki or Ben Newton's YouTube channel.



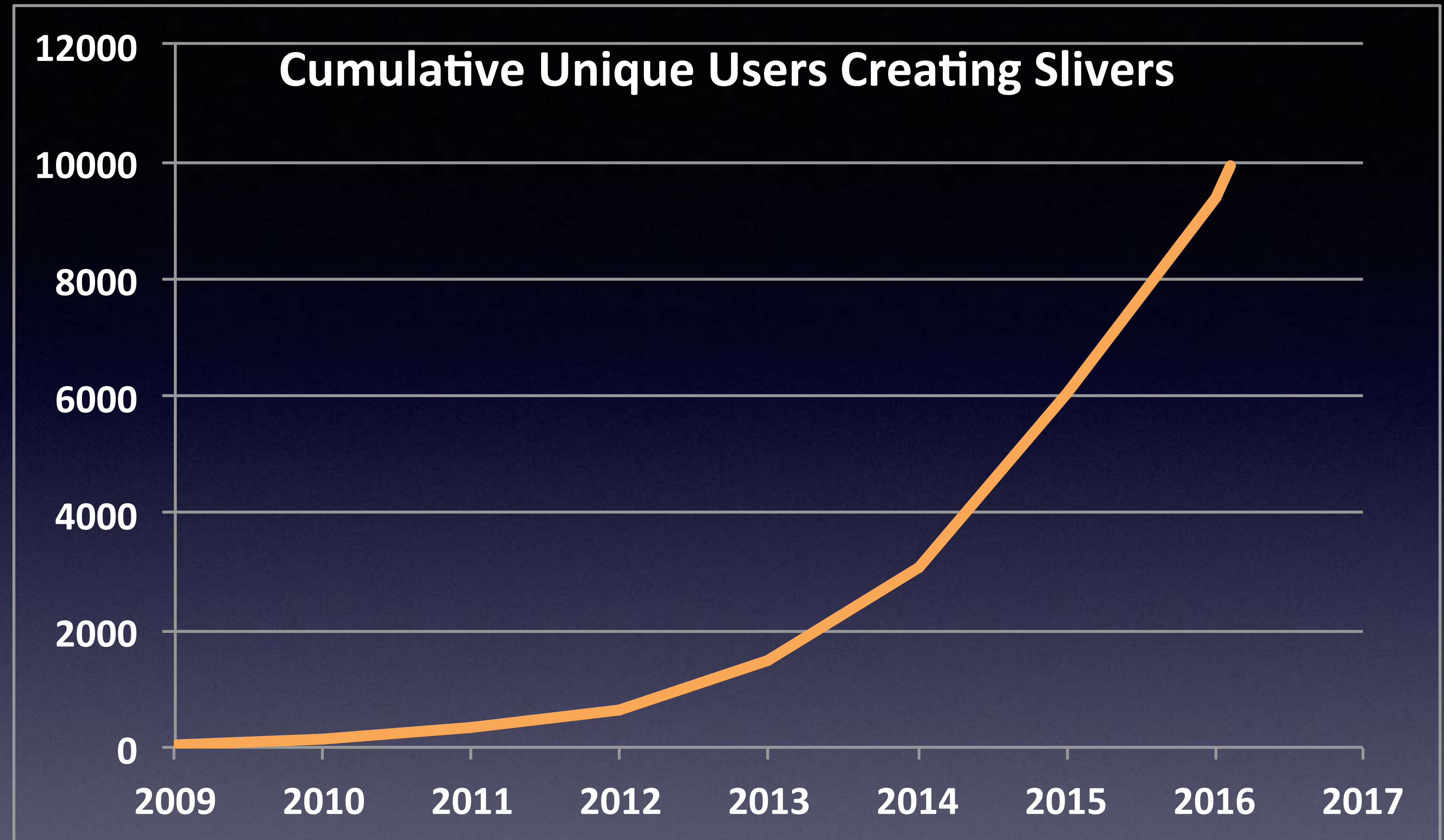
# Supporting a Growing Community



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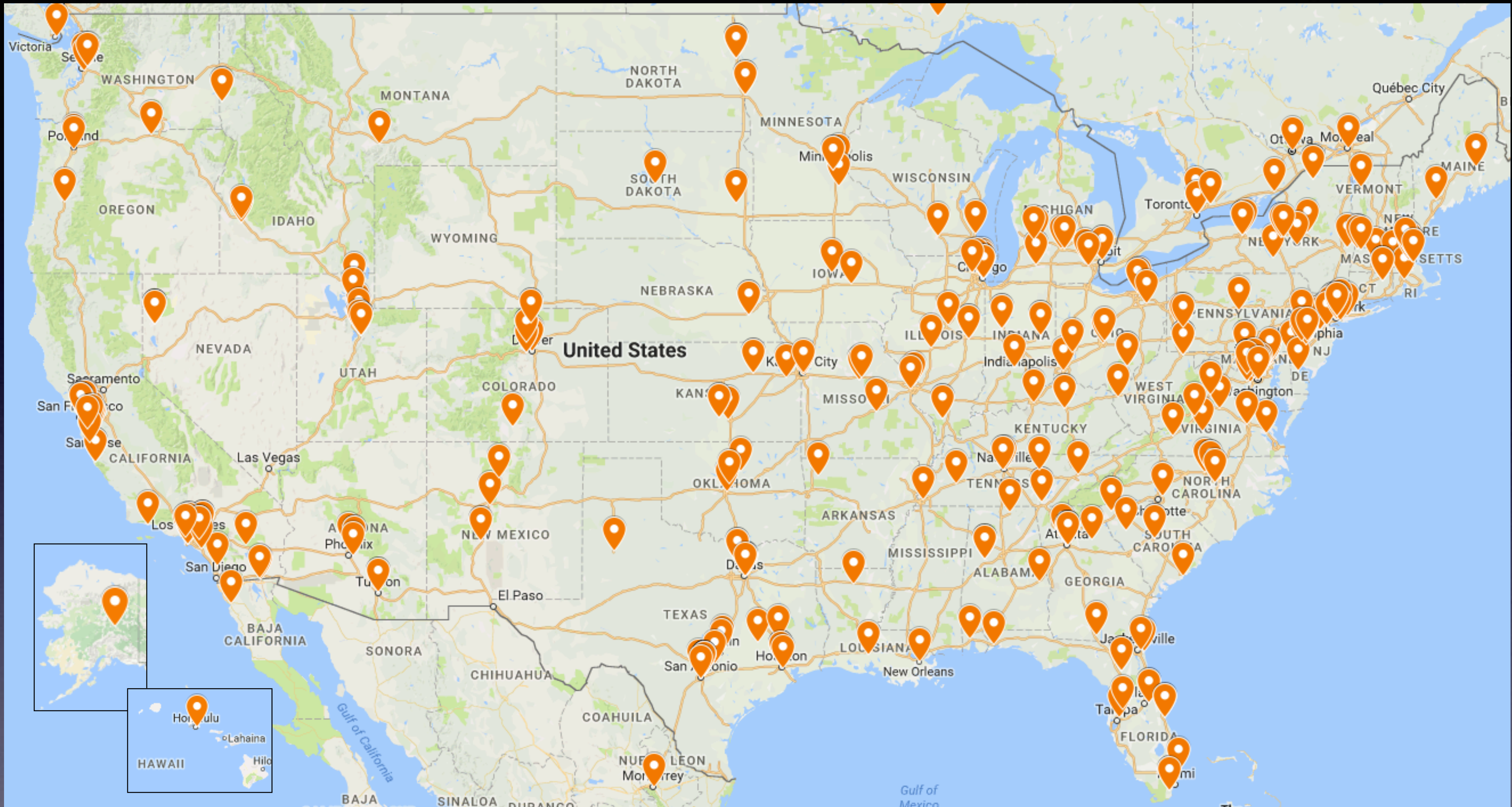






GENI is supporting over 10,000 researchers, educators, and students and their experiments.

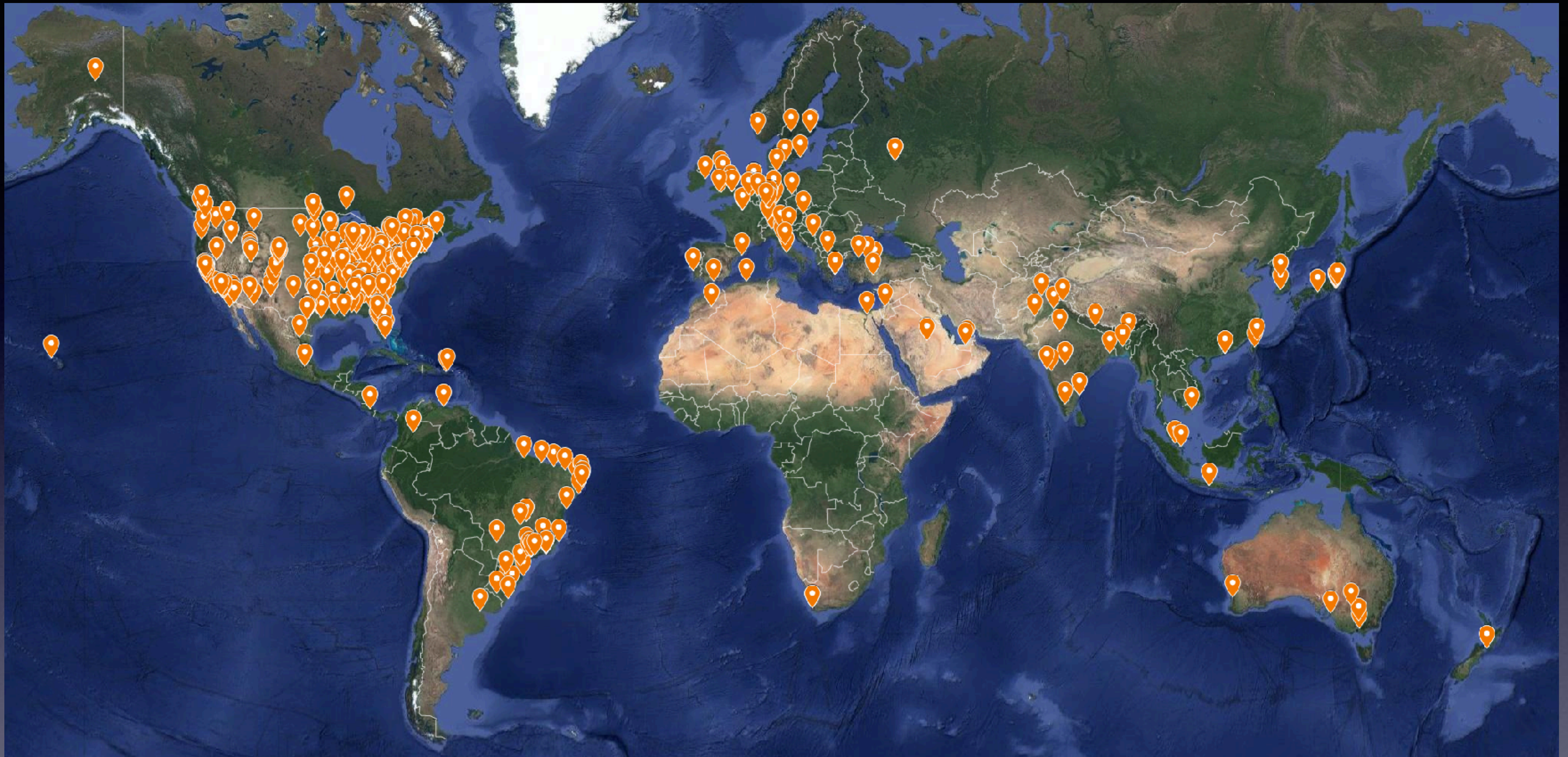




# GENI Users Span the US

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# Supporting International Collaborations

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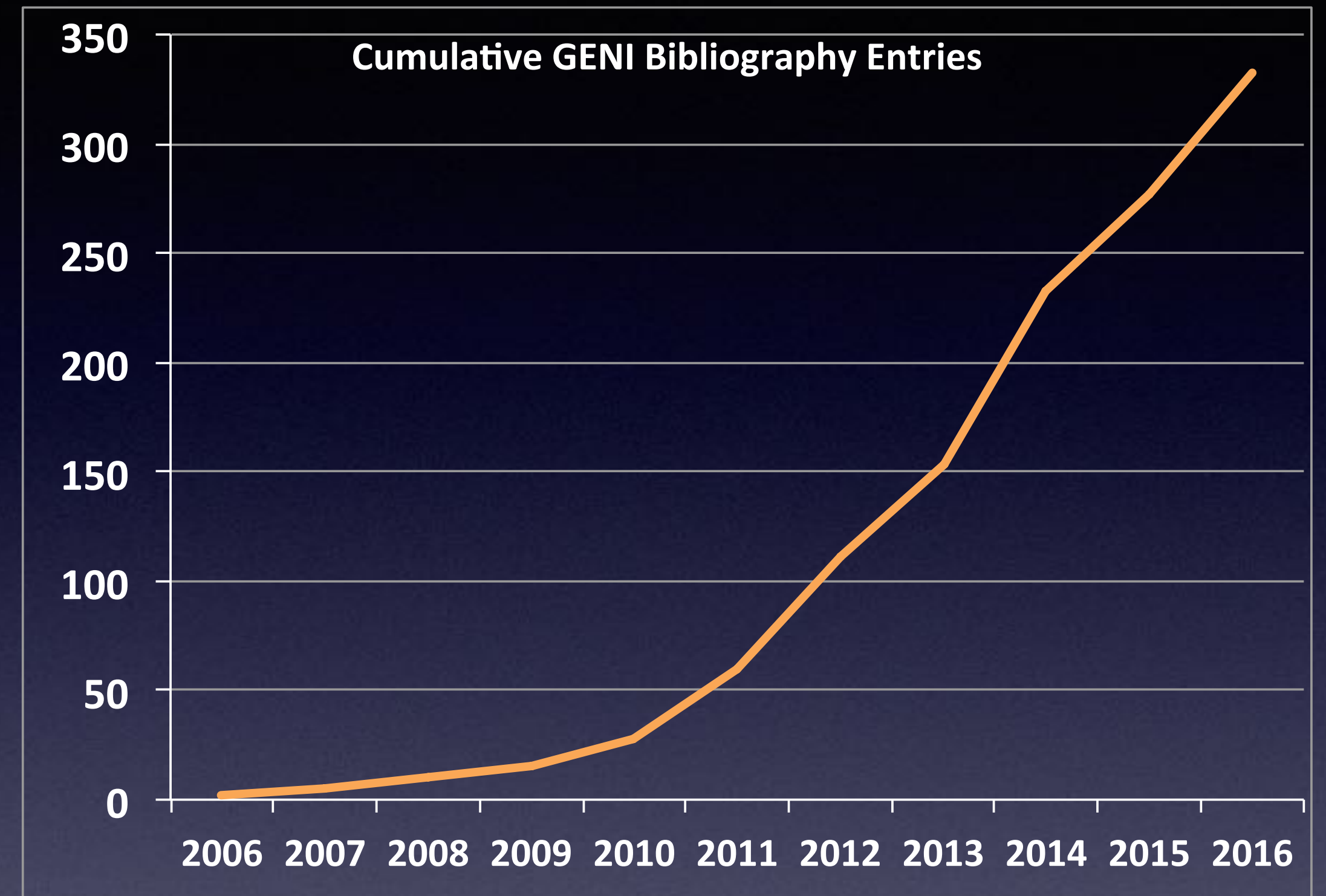
# Supporting Research

Hundreds of publications using GENI

- <http://groups.geni.net/geni/wiki/GENIBibliography>
- Is your work missing? Happy to add it, just send us a citation.

What are they all doing?

- Networking and distributed computing research
- On-demand science
- Locavore data, real-time integration
- Dynamic infrastructure



Hands-on labs in dozens of classes

- Networking
- Distributed systems
- Software-defined networks

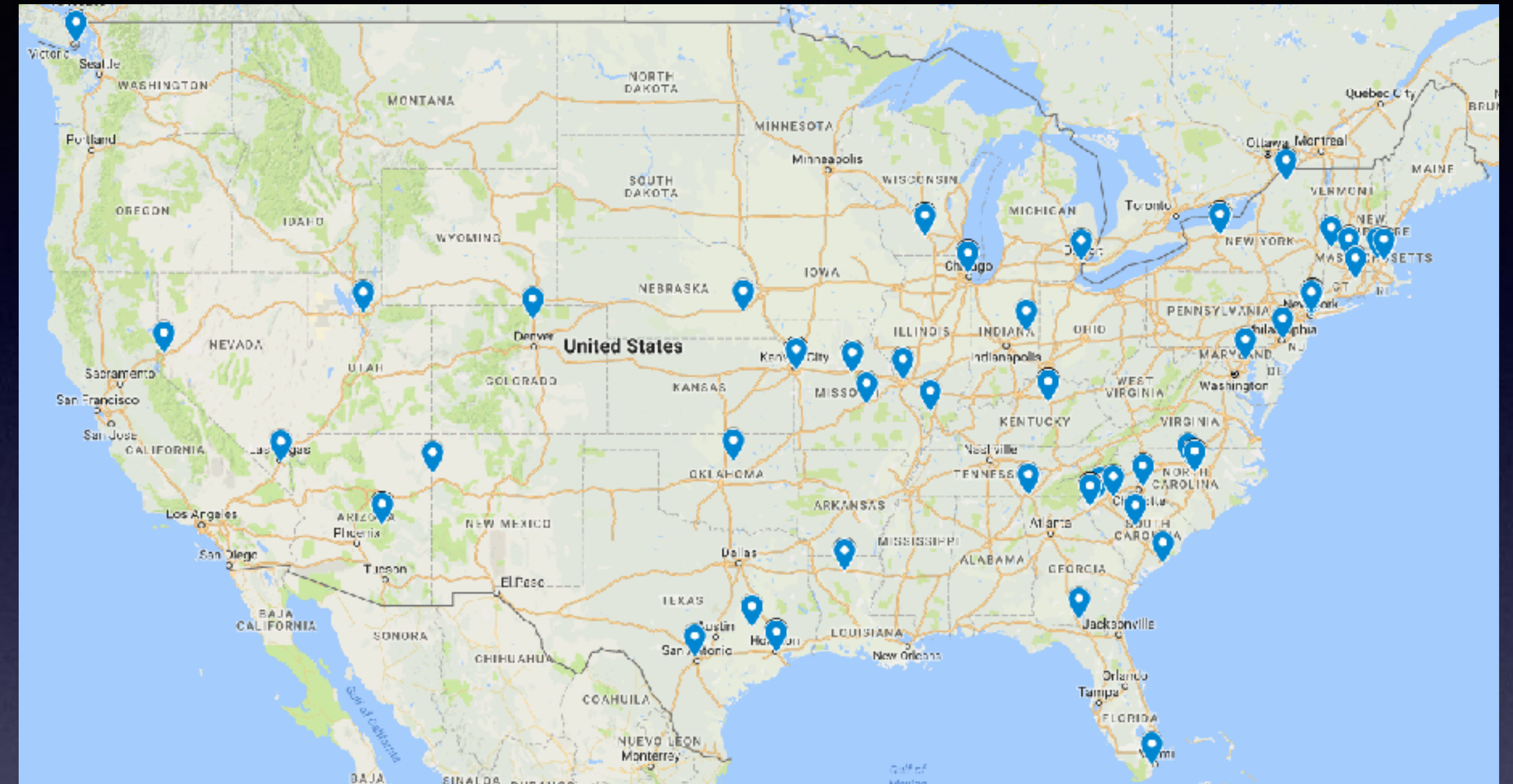
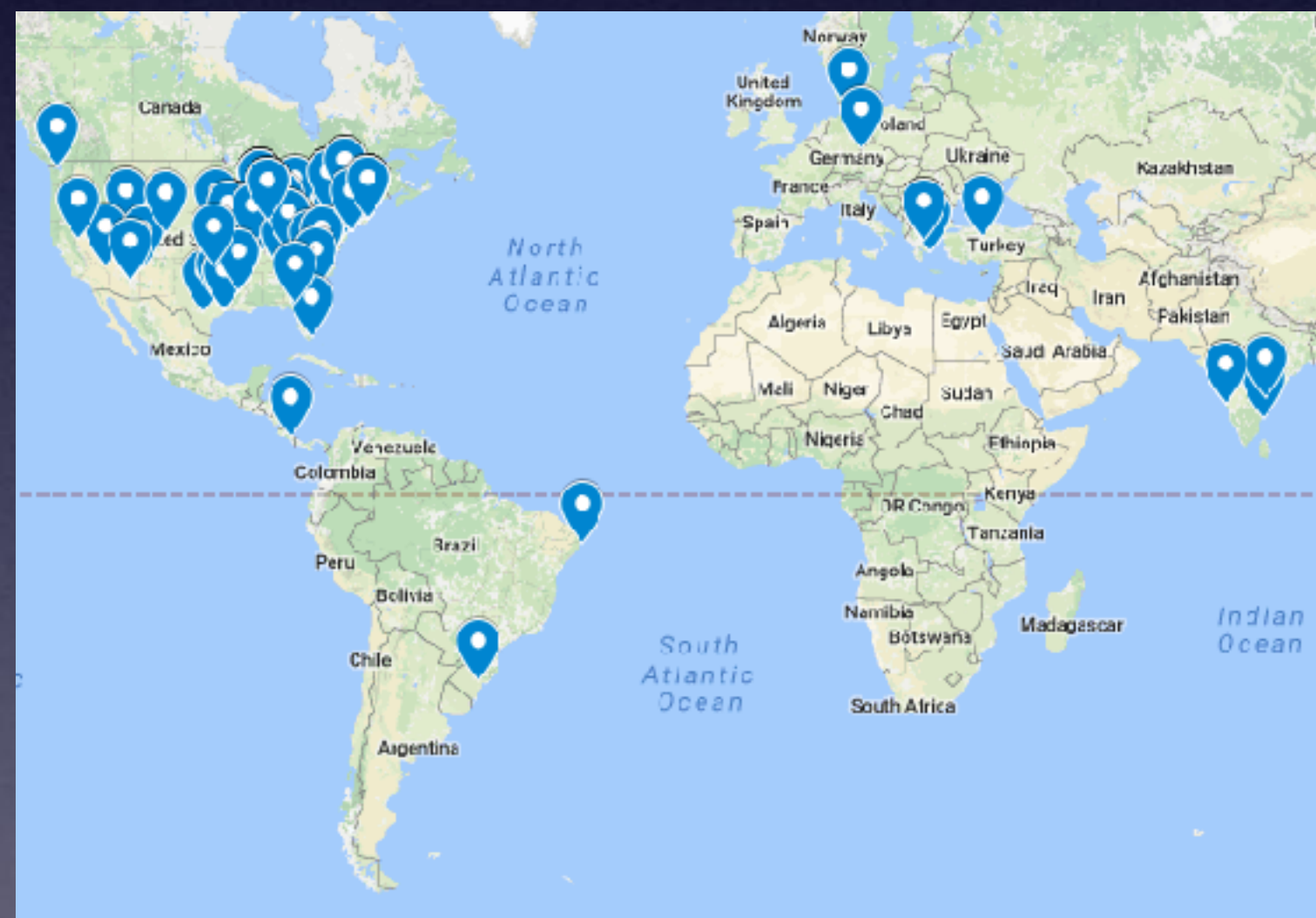




# Supporting Education

Hands-on labs in dozens of classes

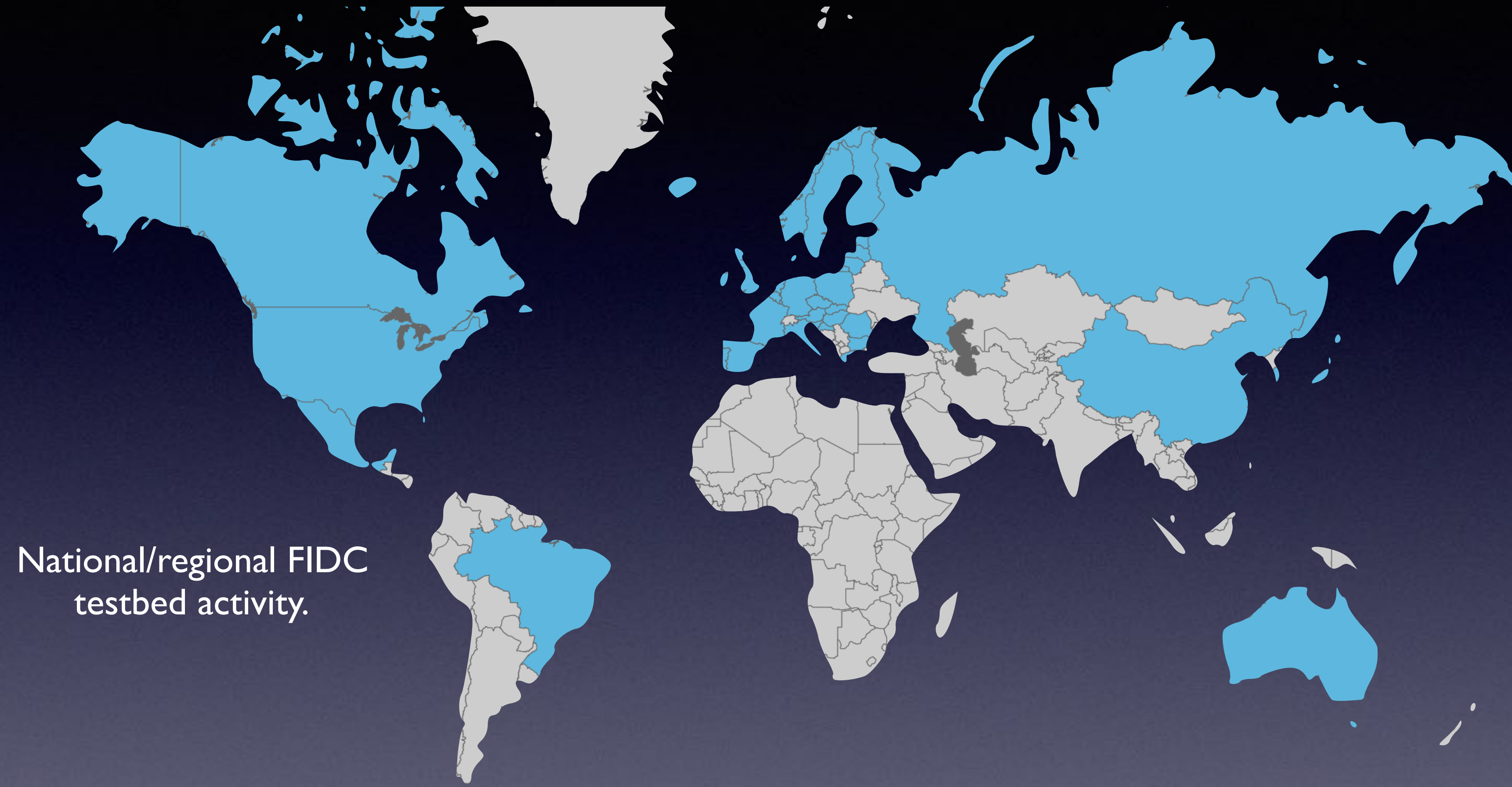
- Networking, Distributed systems, Software-defined networks, Cyber security, ...



This academic year, over 1400 students are using GENI in 47 different classes!



# Worldwide Growth in FIDC Testbeds



National/regional FIDC testbed activity.

Building a multi-national group of FIDC testbeds, seeking new partners, working from a basis of equality to expand opportunities for researchers worldwide.



# GENI Experimenter Contest

Thanks to Matrix Integration  
for sponsoring prizes!

And to our judging team:

Fraida Fund, NYU (lead)

Shannon Champion, Matrix Integration

Ibrahim Matta, Boston University

Mike Zink, UMass Amherst



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# GENI Experimenter Contest

And, the winners are ...



Christian Barrineau, Jon Oakley, Qing Wang, Lu Yu,  
Junaid Zulfiqar, Kuang-Ching Wang and Richard Brooks  
Clemson University

Towards a Traffic Analysis Resistant Internet Architecture



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Faculty members have  
waived cash prizes.





# GENI Experimenter Contest

And, the winners are ...



Dmitrii Chemodanov and Prasad Calyam  
University of Missouri  
Incident-Supporting Visual Cloud Computing  
Utilizing Software-Defined Networking



Faculty members have  
waived cash prizes.



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# geni

Exploring Networks  
of the Future



March 2017







March 2017

