# GENI Experimenter and Educator Community Engagement

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The GENI project engages with a different communities including: (1) end users such as experimenters and educators who use GENI for research and teaching, (2) campus IT departments that host and manage GENI resources, (3) operators of R&E networks that provide wide-area network connectivity, and (4) national and international cyber-infrastructures that federate with GENI.

This paper catalogs activities chiefly related to engagement with the GENI end user community. It is mostly about this community because in recent years, as GENI has transitioned from "building GENI" to "using GENI", this is where the bulk of engagement activities have been directed.

The paper is intended to spark debate on which activities are most useful, which should be revised or discarded, and what new activities should be started. Also worthy of discussion is whether the emphasis on engagement with end-users has gone too far, to the detriment of other communities.

The objectives of end-user community engagement activities are:

1. Growing the community of GENI users by informing researchers and educators about its capabilities and help them get started using it.

2. Supporting existing users so GENI is more useful and effective for their research and teaching,

3. Fostering a sense of community to encourage users to help one another by sharing their GENI knowledge and experiences.

## 1 Growing the GENI User Community

1. **Tutorials at GENI Engineering Conferences (GECs).** Until recently the GECs were the largest experimenter training venues with tutorials ranging from "Getting Started with GENI" to topics such as running "Hadoop in a Slice" and using tools such as `geni-lib`. *Tutorials are proposed and led by members of the community and GPO staff.*

2. **GENI Regional Workshops.** These are intended to replicate the success of the tutorials at the GECs but at a smaller scale, lower cost and reduced organizational overhead. They are: (1) smaller in scale because they are one to two day events that are exclusively presentations and hands-on tutorials, (2) lower in cost because most participants are drawn from the region where the workshop is held, and (3) have reduced organizational overhead because there is no need to find a venue big enough to host a large GEC like event, negotiate room blocks with hotels, meet complex audio/visual needs, etc.

Two such workshops have been held, each *hosted by a faculty member at a university who takes care of local arrangements such as tutorial rooms, catering and publicity. For both workshops,the GPO set the workshop agenda, arranged for instructors and speakers and led some of the tutorials. A few travel grants were given to attendees from outside the region and to instructors and speakers.* In 2016 and 2017, a community member funded by the GPO will lead the organization of the workshops.

3. **Summer and winter camps.** Participants of these week-long camps learn start with introductory GENI tutorials and move on to more advanced tutorials. Camps typically have a theme (e.g. software defined networking, systematic experimentation, etc.) that are covered in the advanced tutorials. Participants form teams early in the week, define and complete a GENI-based team project during the week and present results at the end of the camp. Teams are encouraged to continue to work together even after the camp and publish their results.

   Five such camps have been held to date, all organized by Kaiqi Xiong (RIT), Bing Wang (U. of Connecticut) and Yong Guan (Iowa State U.). *The local host arranges for tutorial rooms, lodging, networking and catering. GPO staff have been heavily involved in setting the agenda, inviting tutorial leads, coordinating tutorial logistics and leading some of the tutorials. Travel, lodging and meals are covered for all camp attendees and instructors.* The organization of the 2016 and 2017 camps will continue to be led by GPO funded community members.

4. **Tutorials at conferences and workshops.** Over the years community members and GPO staff have organized tutorials at conferences and workshops. Community member led tutorials include those at SIGMETRICS, SIGCSE, ENC, Cloud Security Curriculum Development Workshop and Workshop on Large Scale Experimental Research Environments. GPO led tutorials include those at ICDCS, NSDI, TridentCom, IC2E and IEEE NFV-SDN.

   In addition to tutorials, GENI posters and demos at conferences have been used to spread the word about GENI.

5. **Talks at conferences, workshops and university seminars.** Members of the GENI community and the GPO have been invited to speak at numerous conferences, workshops, seminars and classes. Depending on the venue, the talk may include a demo of an experiment on GENI and even a simple hands-on exercise.

## 2 User Support

1. **Online tutorials and documentation.** The GENI wiki includes a collection of tutorials developed by community members and GPO staff. They include tutorials on started with GENI, learning about GENI tools, using GENI resources such as OpenFlow switches and running interesting experiments on GENI such as Hadoop and Named Data Networking.

   Online documentation includes how-to pages and FAQs. Most of these have been written by GPO staff, based on commonly asked questions on the GENI help mailing lists.

2. **Custom setup for experiments.** Some experimenters require special setups for their experiment that cannot be obtained using existing tools and services. Examples of such special setups include permanent multi-point VLANs to many racks, connecting to networks such as Google Fiber, stitching to an end-point outside GENI and getting public IP addresses

on R&E networks. *Many of these special setups require manual configuration by R&E and campus network administrators; GPO staff work with the appropriate administrators to fulfill reasonable requests from experimenters.*

3. **Review of potentially disruptive experiments.** Potentially disruptive experiments include security experiments, those with unusually large bandwidth needs or experiments that may run afoul of policies on some campuses. Experimenters are asked to review these experiments with the GPO before running them. *The GPO reviews these experiments to ensure proper controls are in place to minimize the risk of disruptions. If necessary affected aggregate owners are brought into the review.* In addition, the experimenter may be asked to inform the GMOC, aggregate owners and the GPO before running the experiment.

4. **Course modules for educators.** The GENI wiki has ready-to-use course modules developed by different faculty members and a few developed by the GPO. *These modules are hosted and maintained by their developers. The GPO maintains the wiki page that links to these modules.*

5. **Support mailing lists.** There are three mailing lists for user support:

   (a) `geni-users@googlegroups.com.` This for questions related to using GENI (e.g. how do I do X? why is Y not working for me?).

   (b) `geni-educators@googlegroups.com.` This list is for discussions and questions related to the use of GENI in the classroom (e.g. any tips for using GENI in a large class?).

   (c) `help@geni.net.` The help list is for questions to the GPO that may not be appropriate for community mailing lists (e.g. may I have a letter of support for my proposal to connect resources in my lab to GENI?). Messages to this list only go to the GPO but list archives are public.

   Even though the geni-users and geni-educators are community mailing lists, *the GPO makes sure all questions are either answered or assigned to somebody to answer. The GPO also responds to messages on the help list.*

   Other user support platforms such as StackExchange have been considered but are not currently used. Transition activities should explore such alternatives to mailing lists.

# 3 Community Building

1. **GECs.** The GECs have been the largest community building events drawing from the experimenter, educator, network and campus operations and software developer communities. *The GEC host, typically a faculty member at a university, handles all local arrangements, with active support from the GPO. The conference agenda is set by the GPO based on community responses to a "Call for Sessions and Tutorials" . Most sessions are led by community members with one or more GPO members assisting with the organization of each session.*

   The GECs served three purposes: (1) Tutorials for experimenters to learn to do more with GENI, (2) Opportunities for GENI developers to work out details of the architecture, new

features and APIs and debug integration related problems, and (3) Foster a sense of community by bringing together people to share experiences, come up with ways to collaborate and show off their work on GENI.

Over the years the GECs have grown increasingly experimenter focused with 80% of the sessions being tutorials. To correct this imbalance, we are exploring new approaches that will tease out the functions of the GEC into separate events: (1) **Regional Workshops** that are exclusively tutorials for experimenters, (2) **GECs** focused on engineering aspects including federation, APIs, monitoring and technical coordination with related NSF-funded infrastructure projects, and (3) **GENI Network Innovators Community Events (NICE)** for the community to get together to show off their work and celebrate GENI successes.

2. **CNERT.** CNERT is a community run workshop with a largely volunteer organizing committee. *Kaiqi Xiong (RIT) and his team were contracted to find a host conference for CNERT each year, put together an organizing committee and work with the host conference on logistics. NSF funding is used to cover travel costs for a few speakers including the keynote speaker and winner of the best paper award.* A similar contract will be used to get CNERT 2016 and 2017 organized and to ensure its continued success.

3. **Competitions for experimenters.** In March 2015, George Washington University (GWU) and Cisco Systems organized a competition to develop SDN applications on GENI. GWU students had about two months to learn about GENI's SDN capabilities and build an application that took advantage of SDN technology. The prizes were significant and ranged from $6,500 to $1,000. The applications developed by the six teams that participated were impressive and the judges had a difficult time picking three clear winners. *The volunteer judges were largely from the GENI community and the GPO.* The three winning teams presented their work at a GEC. The competitors were excited about defining and creating their own experiments and spent a great deal of time and effort on their projects.

4. **Education workshops.** Jeannie Albrecht of Williams College organized GENI in Education workshops in July 2012 and October 2013 to build up a community of educators that use GENI in their classes and develop and share course material.

# 4 Budget

A rough sketch of the GPO's planned expenditures for community engagement activities for the coming year is provided below. In addition, a great deal of outreach success is realized through goodwill and word-of-mouth activity by a large, active, and growing GENI community. While this "free" outreach may not require a specific budget line, we don't want to understate its importance.

An increasing proportion of community engagement work is carried out under subcontracts. The GPO anticipates issuing approximately four subcontracts, with an annual combined value of approximately $430K.

The GPO supports these outreach activities with approximately 1.7 FTEs of professional staff. In addition, there are surges of activity surrounding major events, such as GEC or NICE. The incremental effort for a GEC is 3–4 person-months and about 2 person-months for NICE.

NSF makes travel grant funding of approximately $240K per year available through the GPO to facilitate participation by US academics.