Planning for the Future of the National Science Foundation's Global Environment for Network Innovations

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This document consists of comments on the process of transitioning the National Science Foundation's (NSF's) Global Environment for Network Innovations (GENI) project from a stage of development and deployment managed by the GENI Project Office (GPO) to a phase of continuing operations and support of research innovations under community governance. The GENI program has been a major success for its constituent communities. All possible efforts should be undertaken to ensure its continued sustainability as a valuable network science research and education resource.

Community Governance

Providing for actual sustaining community governance processes is critical for the future success of GENI. GENI should be developed and operated directly by and for its constituent community. The core community consists of faculty, students, and network researchers at computer science departments and at network research centers at institution of higher education. It is difficult for secondary, proxy representative of those communities to represent appropriately their interests. However, for effective governance, it is important to have and to communicate clearly established policies of rights and responsibilities for those participating in the governance processes.

Key Activities That Should Be Continued

Key Activities That Should Be Continued Are:

a) Primarily, all activities related to supporting network science research should be continued as a top priority. This includes support for NSF programs that support research using GENI
b) Another key activity consists of initiatives related to education, basic network science education, educational processes related to training the next generation of network researchers, general education on programmable distributed infrastructure, methods that encourage innovation among students, and related topics.

c) Other important areas of activity consist of major collaborations with other types of distributed testbed infrastructure, within the US, such as the NSFCloud projects, Chameleon and CloudLab as well as related NSF funded mid-scale infrastructure testbeds, but also research testbeds in other countries. These collaborations provide for a much richer research environment that would be possible otherwise.
d) During the term of this project, the GENI community has designed prototyped, built and supported an important infrastructure, including components that allowed OpenFlow software control testbed networks to support end user managed network environments to connect all the GENI resources. In addition, the community also was able to prototype, build, and support this fabric to interface with national and international networks, which allowed non-GENI resources to participate in collaborations with the GENI environment. This policy based user programmable network fabric environment should continue to exist and an open, collaborative effort should continue to support this environment. Supporting such collaborative efforts should be a high priority in the next two years for the GENI community (researchers, educators, and students) to ensure continued innovation, building, learning, and support for multiple experimental network environments - advancing the network/Internet of the future.
e) Although the current infrastructure should be maintained as long as possible, it requires a refresh, which will require capitalization for new equipment. Careful planning should be devoted to this process to ensure leveraging the array of innovations that have emerged since the start of the GENI project A detailed set of requirements, plan, roadmap, and timeline should developed and communicated to the GENI community. This should not necessarily depend on identify all potential the funding sources.

Key Activities That Should Be Initiated

a) One activity that does not require initiation so much as enhancement consists of educational programs for undergraduate and graduate students specifically designed around the GENI environment
b) It would be useful to initiate a process that could create a collaborative framework enabling research projects that would span multiple segments of NSF cyberinfrastructure.
c) It would be useful to implement infrastructure operation processes based on automation capabilities that take advantage of advanced implementations of distributed processes, which would be more cost effective

d) Another area that does not require initiation but more enhancement is the set of activities around engagement with commercial companies that would be willing to cooperate with advancing the goals of the GENI community.
e) During the term of GENI project, GENI Program Office (GPO) provided the lead role in the overall planning and implementation of four key GENI network resources, with support from community: (1) the network within the GENI racks and the network for non-GENI local resources, (2) the network connecting edge nodes to regional networks and the GENI national core, (3) the GENI network core, (4) the network connecting to non-GENI resources over GENI SDXs and other exchange facilities. Each instance of resource has its' own policies, administrative domain, selected technology and operational priorities, evolutional plans, with potential future technology impact, and local implementation issues. As the GENI project transitions to a community support model, the interfaces between different type of resources and acceptable minimum requirements, functions, features, and best practice policies should published to enable all members of the community to participate both as users and resources providers and community supporter, for example, answering questions and resolving problems.
f) A GENI "Cook Book" should be considered -- to establish an easy on-ramp for others to participate in using the GENI environment and to integrate local resources as part of experimental environment.

Key Activities That Should Be Wound Down To Meet Community Goals for GENI

a) In the early years of GENI, much effort was focused on design, development and implementation. In the normal course of events, these activities will diminish. However, as noted, there is a need for an infrastructure refresh.
b) Many in the community have commented that three major GENI events per year may be too many, perhaps two would be better, with one focused more extensively on research methods and results.

Approaches to Governance

As noted, GENI should be developed and operated directly by and for its constituent community. It is difficult, and perhaps impossible, for secondary, proxy representative of those external communities to represent appropriately their requirements and approaches. At the same time, for effective governance, the GENI community must develop and communicate clearly established policies of rights and responsibilities for those participating in the governance processes. The higher education community has had much experience in designing and

establishing successful governance organizations for research infrastructure. The best practice models from those approaches should be employed. All major processes should be undertaken by members of the research community who are experienced (or who would like to become experienced) in managing cooperative multi-organizational research infrastructure. Administration (and governance in general) should be as light-weight as possible - based on committees charged with key focal areas comprised of GENI community members.

The financial model should be extremely modest, so that it can be supported directly by the GENI community vs external parties. For example, if a type of subscription is implemented, it should be a fairly small one, which could be supported directly by computer science departments and university research centers and not third parties. In addition, support for local infrastructure should be undertaken by local institutions. The financial model should be carefully design to minimize on going, fixed costs

Contributions and Lessons The GENI Experience and Community Can Offer to Future Research Cyberinfrastructure Projects

The key lesson is that these types of projects must be driven by and for the research communities and not by external parties/organizations, which tend to restrict required research and education activities. Also, the GENI infrastructure is not only a support infrastructure for research projects, it also provide noteworthy guidance for many types of future advanced distributed infrastructure design.

GENI Workshop December 10-11, 2015

The International Center for Advanced Internet Research will participate in the December 10-11 GENI workshop.
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