

COMMITTEE OF VISITORS REPORT

Advanced Networking Research Program October 2015

Date of COV: October 14, 2015

Program: Advanced Networking Program

Office: Advanced Scientific Computing Research (ASCR)

Agency: United States Department of Energy

Committee Members:

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0. Executive Summary

The Committee of Visitors (COV) met to review the management processes for the Next Generation Networking for Science (NGNS) elements of the Office of Advanced Scientific Computing Research (ASCR) program at the DOE Germantown location on Tuesday, October 14, 2015.

The COV thanks the program officers and other ASCR staff who gave their time and knowledge to help the COV in its deliberation. Their support was instrumental in enabling a smooth and effective review process.

Finding and Recommendation:

Based on the presentations and discussion with the NGNS office, the COV considers the NGNS under review to be good program, with quality execution, including in-depth reviews resulting in an effective and well-managed program. Overall, the COV was impressed with the quality and amount of work that gets done with a limited number of staff and funds.

1. Introduction

Patricia M Dehmer, Acting Director of Office of Science, charged the Advanced Scientific Computing Advisory Committee (ASCAC) for the Office of Science, United States Department of Energy (DOE), with assembling a Committee of Visitors (COV) to review the management processes for the Next Generation Networking for Science (NGNS) elements of the ASCR Networking Research Program. The program focuses on research and development activities in networking to support distributed high-end science including: end-to-end of high-performance, high-capacity and middleware network

technologies necessary to provide secure access to distributed science facilities, high-performance computing resources and large-scale scientific collaborations.

A COV of seven members was formed to review NGNS elements. Three members of the COV, Dr. Martin Berzin, University of Utah, Dr. Vint Cerf, Google and Wendy Huttoon, KINBER, are ASCAC members. The list of all participants in the COV is provided in Attachment 1, and the letter charge to the committee from the chair of the ASCAC is provided in Attachment 2.

This report presents the findings and recommendations of the COV. The review covers the operations of the Networking Research Program during the fiscal years 2011, 2012, 2013, and 2014, with a focus on (i) the processes used to solicit and review research proposals, recommend awards, and manage research projects and (ii) the breadth and depth of the research and development portfolio to support distributed, collaborative high-end science.

Prior to the meeting, the COV was provided with a link to the ASCR website and to a secure Google Docs folder with documents to review prior to the COV meeting. The ASCR website included general information on ASCR as well as a link to the 2010 ASCAC COV Next Generation Networking for Science Committee of Visitors report. The Google Docs folder included information on the ASCR merit review procedures, spreadsheets listing information about the proposals submitted during the fiscal years of 2011-2014, and documents related to the proposals submitted to the Federal Opportunity Announcements (FOAs) during this period including research project descriptions, proposal reviews, and recommendations. As part of its review process, the COV reviewed the 2011 COV NGNS report, evaluated whether or not the program had implemented the recommendations made by that COV, what impact the changes had made on the program, and identified any recommendations that were not yet fully implemented.

The COV meeting was held at the DOE Germantown location on Wednesday, October 14, 2015. The meeting opened with a welcome from both Dr. Christine Chalk and Dr. Barbara Helland. Following the welcome and introductions, the two Program Officers, Dr. Richard Carlson and Dr. Thomas Ndousse-Fetter, presented an overview of the NGNS program. The presentation provided an overview of the Office of Advanced Science Computing Research, including the organizational structure, the fundamental science research programs and the facilities, including ESnet. The majority of the presentation focused on the NGNS program goals, the approach used to evaluate proposals and the major accomplishments of the program during the fiscal years under review. Selected accomplishments from university, laboratory and collaborative proposals were reviewed.

The presentation session was interactive, with significant opportunity for questions from the COV members, answers from the program officers, and discussion between the COV members on process, content, and strategic vision of the program. Following the presentations, the COV continued to meet with the Program Officers to clarify any outstanding issues regarding the material provided, the solicitation process, including the

final decision making process, relationship to the ASCR mission, workshop process and composition.

The COV then met in executive session to identify any outstanding questions, review the COV charge, and develop an outline for the COV's findings and recommendations. During the executive session, the COV asked and received answers to questions including metrics to measure the international standing of the program and copies of the selection statements associated with each solicitation. The final report was prepared after the in person meeting, using e-mail exchanges between the COV members to review an initial draft of the report.

2. CoV Charge

The COV was asked to consider and provide evaluation of the following two major program elements:

1. For both the DOE laboratory projects and the university projects, assess the efficacy and quality of the processes used to:
 - (a) solicit, review, recommend, and document proposal actions, and
 - (b) monitor active projects and programs.
2. Within the boundaries defined by DOE missions and available funding, comment on how the award process has affected:
 - (a) the breadth and depth of portfolio elements, and
 - (b) the degree to which the program is anticipating and addressing emerging challenges from large-scale scientific facilities and collaborations in support of the DOE missions, and
 - (c) the national and international standing of the program with regard to other computer science research programs that are also focused on high performance networking tools and middleware for science.

3. Efficacies and Quality of the Processes

The COV found the NGNS program to be a solid, well executed, and well-managed program created through a rigorous solicitation and review process that included high-quality, in-depth reviews that results in a balanced portfolio consistent with the mission of the Office of Science. In addition, COV found that the majority of the 2010 COV NGNS Report recommendations implemented or were in the process of being implemented, adding to the overall effectiveness of the program.

The program highlights provided during the review process underscored the program's ability to have significant impact on the development of networking technologies and capabilities in support of science applications, DOE Laboratories, ESnet infrastructure and local area networks and end-host systems. Specific project examples included: detection, localization and diagnosis of performance problems using perfSONAR¹;

¹ "Detection, localization and diagnosis of performance problems using perfSONAR", Constance Dovrolis, Georgia Tech.

network resource planning, scheduling and workflow support for DOE science applications,² and expanding the scope of existing projects such as PANDA³.

Charge 1(a): Assess the efficacy and quality of the processes used to solicit, review, and document applications and proposal actions.

The COV found that the solicitation and review process is effective and well administered.

Solicitation Development and Review Process

The COV looked at the solicitation development and review process together, understanding if the process encouraged a strategic set of programs and research resulting in a diverse portfolio.

The program continues to identify and develop areas for research through a series of community workshops, which then drive the FOAs consistent with the strategic direction and mission of the ASCR program. Once the FOA is developed, two solicitations are released, one for the DOE Laboratories and one for the university community. Collaborative proposals are encouraged.

The COV found that the program is conducted consistent with the normal DOE review process. The standard mechanism for proposal review were panel review where at least three, and preferably four, reviewers were assigned to each proposals. The program office actively works to add to and renew the pool of reviewers, including adding international reviewers where possible. While the solicitations are separate, the review process treats both Laboratory and University proposals equally, ensuring that quality projects are funded.

During the review process, the review committees do not rank the proposals against each other, but instead, assess the intellectual merit and contributions associated with each proposal. The program officer then integrates all the information from the review process and then applies that information along with the program goals to create a portfolio brief on how the recommended projects and funding fit into the overall program. Based the program officer brief, proposal funding decisions are made.

The program officers indicated, and the COV concurred, that the program was receiving a satisfying number of proposals with the breadth, scope and representation necessary for a strong program. When asked to identify a strategic area of funding currently not included in the program, the program officers identified the need for more stochastic math proposals on how networks are performing to build better future networks.

Since the 2010 NGNS report, the program has started to use the Portfolio Analysis and Management System (PAMS) to log and track proposal submissions, reviews and

² ARCHSTONE, T. Lehman, Chin Guok, N. Ghani.

³ WP2, Extending the Scope of PANDA @ ORNL.

awards. The PAMS system not only addresses recommendations made in the 2010 NGNS COV but has also improved the review process itself, making it easier to link and review collaborative proposals. PAMS has the ability to include additional documents, such as the portfolio brief, which is not currently connected into the PAMS system. PAMS has the ability to put in additional documents, but at this point, the portfolio brief is not necessarily connected to the program within the PAM. There are also some useful statistics that PAMS will be able to gather and represent for further COVs as well as program management.

Recommendations

- The program should continue to broaden the breadth and diversity of workshop participants without diluting the focus of the workshop topics on the Office of Science mission. While hosting workshop meetings in the Washington, DC area can be cost effective from a program standpoint, it may discourage broader participation by community members. To the extent possible, one or more community workshops per year should be held outside the DC area.
- The program office should host at least one workshop to understand better the issues associated with stimulating research in the area of network modeling in order to understand the performance existing networks in order to influence how future networks should be built as well as to encourage cross-disciplinary research in this area.
- The NGNS program office should complete the implementation of PAMS to manage and track elements of the proposal and funding process, including linking the portfolio brief for each FOA into the program. In addition, the program should provide access to PAMS for future COV reviews, which will make the program review process easier and clearer by linking together all the relevant information for a specific FOA as well as providing a general overview of the funding portfolio.
- The NGNS should consider implementing a database of current and potential reviewers to make the review panel selection process more efficient and provide broader and more diverse panels.

Charge1(b) monitor active projects and programs.

The NGNS office is responsible for monitoring the progress of the research projects funded by the Program. The COV found that the program officers use a number of mechanisms to both interact with and track the progress of funded projects. As recommended by the 2010 NGNS COV, the program officers now utilize PAMS to help track and manage the portfolio of funded project. As of the 2015 COV date, the program officers were tracking approximately 22 projects with 84 PI's and co-PI's, many of which were multi-institutional collaborative projects. For the multi-institutional projects, the program officer looks at each project component to insure it is consistent with the project as a whole. The PAMS is used to track annual reports, with PI's getting automatic notifications when reports are due. The program officer must approve the report in order for the next round of funding to be disbursed. PAMS provides the program officer with additional functionality such as checking on the overall project budget, including unspent

funds, an important management aspect for multi-institutional awards. The COV found that the program officers are limited in their ability for onsite visits to monitor projects and interact with the project PI's and associated staff. The program officers have mitigating the limited travel with effective regular PI conference calls and video conferences to stay abreast of proposal activities and engage PIs in cross project communication. In addition, the COV found that while the program officers typically attend the larger workshops and conferences, such as Supercomputing, they were limited in terms of their overall participation in community events due to travel budget limitations.

Recommendations

- The program office should continue to integrate PAMS into the tracking and management of the funded project portfolio during the post-award period.
- The COV recommends that support, including the appropriate level of travel funding, be provided to the program officers so that they can perform project site visits. Such visits will not only allow program officers to more effectively manage their projects but to also interact with a broader set of project participants, including those that typically do not attend PI meetings or other community events.
- The COV recommends that the program officers be encouraged to continue to participate in community events, including but not limited to large events such as Supercomputing. Program officers should be encouraged to participate in a broad set of community events where funded projects are presented or discussed as well as strategic meetings where future network requirements and technologies in the support of scientific applications are discussed.
- Funding to allow program managers to participate in community events where funded projects are being presented or discussed.

4. Effect of the Award Process on Portfolio

Charge 2(a) the breadth and depth of portfolio elements.

The research portfolio, developed through a coherent set of FOA's, is of high quality and addresses challenges that are distinctly relevant to the mission of the Office of Science and DOE. The portfolio had both breadth and depth, funding projects that will have an immediate impact on critical infrastructure as well as projects that anticipate the integration of new technologies into the environment.

The COV requested information on the relationship between the NGNS program and portfolio and other funded research in high performance networking. The program officers indicated that the NGNS program is focused on DOE mission priorities, balanced with the known funding from other federal agencies, such as the NSF, and cross agency discussions and collaborations already exist, mostly in an informal manner.

As indicated in the recommendations, the COV observed that due to funding limitations a number of quality proposals were not funded, particularly for the larger FOA's. In

addition, the awards are typically for three-years with some eligible for an additional three-year renewal. Overall increases in the program funds as well as additional flexibility in project durations could increase the program impact. These changes to the program would help remove any existing gaps in producing network research that can be migrated into operational support for scientific applications and research.

Recommendations

- Cross agency collaboration should be encouraged, particularly in identifying overlapping high performance networking issues and technologies each agency is working to address. The COV recommends the initial tactical step where NGNS and the NSF go over their existing award portfolio in high performance networking infrastructure and research to understand the existing overlap in both projects and funded PI's and provide opportunities for leveraging the federal investment in these projects.
- The COV recommends a tighter relationship between the NGNS and ESnet, where use of ESnet resources are specifically written into the FOA's as a target platform.
- Identify gaps in where NGNS should be getting proposals from but they are not and broaden workshop participation as well as the target groups for the FOA announcements accordingly.

Charge2(b) the degree to which the program is anticipating and addressing emerging challenges from large-scale scientific facilities and collaborations in support of the DOE missions.

The NGNS has the ability to influence the arc high performance network technologies and infrastructure development take in support of and as part of the overall DOE and Office of Science programs. The COV discussed current and potential example strategic initiatives where the NGNS could have influence. These initiatives included: creating and supporting sustainable software in support of scientific applications; the National Strategic Computing Initiative (NSCI); and, scientific workflows in cloud environments.

The COV asked the program officers to comment on the sustainability of the software developed as part of the NGNS program in general. Software sustainability was recognized as an ongoing issue, specifically how to develop a program that was able to sustain strategic or mission critical scientific software. While ASCR encourages the use of open source software licenses, with a slight preference for BSD license, whenever software is developed it is a policy but not a contractual obligation as part of a funded project. Source code development through NGNS funding is not stored in a single repository but often available on standard open source software repositories such as GitHub.

The program office has planned a joint workshop on scientific workflows, one area that will influence the linking of the cloud environments in support of scientific applications.

The expectation is that the workshop outcomes will help drive what will most likely be a multi-agency activity.

The NSCI is expected to drive the national high performance-computing environment, including the networking infrastructure and technologies needed to support the associated science applications. It is expected that the DOE Exascale project, part of the NSCI program, will significantly influence the focus of the NGNS program for the next five years, including the nature of research collaborations including the need for cross-discipline project, particularly in applied math and other fields.

Recommendations

- Encourage strategic planning between NOAA, NSF, DOE, and other agencies working in this realm to leverage total dollars spent on these efforts the most efficiently and effectively

Charge 2(c) the national and international standing of the program with regard to other computer science research programs that are also focused on high performance networking tools and middleware for science.

The NGNS program contributes to DOE's leadership role in the development and deployment of high performance networking tools, technology and middleware in support of science producing prominent research both nationally and internationally. Many of the PI's funded by NGNS projects are recognized internationally, giving plenary talks and presentations at leading conferences as well as participating in standards organizations, both nationally and internationally.

Recommendations

- The COV recognized that many of the PI's participated in standards organizations or international projects as part of their own professional development. The NGNS should continue to encourage this participation, including through international collaborations when appropriate. In addition, the program office is encourage to track activities that underscore the program's national and international standing, possibly through the PAMS system or through the annual reporting process.