National Science Foundation
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NSF 10-015

Dear Colleague,

Today, every discipline of science and engineering is being revolutionized by the widespread use of comprehensive cyberinfrastructure (CI). Computing power, data volumes, and network capacities are all on exponential growth paths, collaborations are growing dramatically, and all forms of CI---and multiple communities spanning multiple agencies and international domains---often must be brought to bear to address a single complex grand challenge problem, such as climate change. All of these developments are part of a revolutionary new approach to scientific discovery in which advanced computational facilities (e.g., data systems, computing hardware, high speed networks) and instruments (e.g., telescopes, sensor networks, sequencers) are coupled to the development of quantifiable models, algorithms, software and other tools and services to provide unique insights into complex problems in science and engineering.

NSF has, for over two decades, been providing the scientific community with open access to high performance computing facilities and the associated user support so that those facilities could be used to enable state-of-the-art, often transformative, scientific investigations. The support began in the 1980's with the initial funding of the NSF supercomputer centers, followed by the Partnerships for Advanced Computational Infrastructure (PACI) program and finally the TeraGrid program. Along with these programs, there have been other important developments in cyberinfrastructure such as the Open Science Grid, the National Virtual Observatory, data activities, major collaborative projects such as Network for Earthquake Engineering Simulation (NEES), The National Ecological Observatory Network (NEON), Ocean Observatories Initiative (OOI), Large Hadron Collider (LHC) and many others too numerous to list here.

As a logical next step, it is imperative that NSF develop a strategic long term vision of what is being called a *Cyberinfrastructure Framework for 21st Century Science and Engineering (CF21).* This vision will need to address concepts and capabilities such as,

1. High end computational, data, visualization and sensor-based systems and the associated user support needed for transformative science; HPC systems and services of all types and flavors, networking, interoperable data systems and mining, including a focus on sustainability and extensibility.
2. Activities that link cyberinfrastructure framework into campuses (including government and business) and programs that provide the widely dispersed, most broadly based activities and resources; grids, cloud computing, loosely coupled campus services, federated ID management and hybrid networks involving wireless and social networks.
3. Major national and international research facilities and collaborations including large-scale NSF collaborative facilities and projects, cyberinfrastructure developed across NSF and other government agencies, including international partners.
4. A comprehensive plan for education and outreach in computational science to support learning and workforce development for 21st century science and engineering.

CF21 will consist of geographically distributed locally-available cyberinfrastructure, advanced computing resources found at larger centers, software environments, advanced networks and data storage capabilities in the US and other nations. This framework needs to address a wide

range of needs and requirements beyond physical resources including expertise and know-how, access, policy, virtual communities and collaboration. These resources will be integrated, interoperable and comprehensive, so that individual researchers, teams, and multiple communities can more easily work together, bringing collaborative data- and compute-intensive methods to bear on the complex problems under investigation. Such an integrated cyberinfrastructure will also generate important economies of scale by leveraging closely related activities.

OCI has begun a process to partner with Directorates across NSF to help develop and establish the vision for *Cyberinfrastructure Framework for 21st Science and Engineering.* The NSF-wide Advisory Committee for Cyberinfrastructure (ACCI) has established 6 Task Forces and has asked them to address long-term cyberinfrastructure issues. The Task Forces are as follows:

Campus	Bridging
Data	Grand Challenges
High Performance Computing	Software and Tools
Work Force Development	

These Task Forces are composed of NSF program officers from each of the NSF research directorates and offices as well as a set of distinguished members from the external science and engineering community. The Task Forces are beginning to explore, discuss and generate a set of recommendations and ideas, and input is encouraged and solicited from the larger community to be combined and coordinated with the deliberations.

OCI has also established a Cyberinfrastructure Coordinating Committee (CICC) within NSF to help address CI efforts and plans across NSF. Additional efforts and collaborations will be developed and it is critical that these activities continue to expand in a coordinated way so that they also contribute to building out the vision for CF21.

The Task Forces and CICC have already started their work and are beginning to create working documents and meeting notes. Draft versions of these documents will be posted on an external wiki for public access and comment: https://nsf.sharepointspace.com/acci_public/default.aspx. Members of the community who are interested in tracking or contributing to CF21 activities are encouraged to send an email to acci-task-forces@nsf.gov.
Please join us in creating this ambitious framework for 21st Century Science and Engineering.

Sincerely,

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