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National Science Foundation
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Dear Colleague Letter: Cyber Infrastructure Framework for the 21st Century (CIF21) in Engineering

The National Science Foundation (NSF) has announced several activities that support research, infrastructure, and education related to "Cyber-Infrastructure Framework for the 21st Century" (CIF21). The CIF21 vision is to 'provide a comprehensive, integrated, sustainable, and secure cyberinfrastructure (CI) to accelerate research and education and new functional capabilities in computational and data-intensive science and engineering, thereby transforming our ability to effectively address and solve the many complex problems facing science and society' (read at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504730).

These activities support the NSF aims **to advance the creation of new knowledge and to educate experts and non-experts in the new frontiers of science and engineering, while enabling the resources necessary for these advancements to take place.**

The two CIF21 research opportunities are Computational and Data-enabled Science and Engineering in Engineering (CDS&E-ENG) and Core Techniques and Technologies for Advancing Big Data Science & Engineering (BIGDATA). NSF has launched two new opportunities for infrastructure development listed under Data Infrastructure Building Blocks (DIBBs) and the Data Charrette. NSF created a new IGERT track, called IGERT-CIF21, for educational challenges and opportunities related to cyberinfrastructure. These new opportunities are described below.

The Directorate for Engineering is participating in these new activities and encourages relevant communities to actively engage in these activities by developing productive partnerships with colleagues in the engineering and related research and education communities.

COMPUTATIONAL AND DATA-ENABLED SCIENCE AND ENGINEERING (CDS&E)

"CDS&E is now clearly recognizable as a distinct intellectual and technological discipline lying at the intersection of applied mathematics, statistics, computer science, and core science and engineering disciplines. It is dedicated to the development and use of computational methods and data mining and management systems to enable scientific discovery and engineering innovation…" (read at http://www.nsf.gov/mps/cds-e/).

"The Computational and Data-enabled Science and Engineering (CDS&E) program recognizes the importance of engineering in CDS&E and vice-versa. Many natural and built engineering processes, devices and/or systems require high fidelity simulations over disparate scales that can be interrogated, analysed, modeled, optimized or controlled, and even integrated with experiments or physical facilities. This program accepts proposals that confront and embrace the host of research challenges presented to the science and engineering communities by the ever-expanding role of computational modeling and simulation on the one hand, and experimental and/or observational data on the other. The goal of the program is to promote the creation, development, and utilization of the next generation of theories, algorithms, methods, tools, and cyberinfrastructure in science and engineering applications…" (read at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504813&org=ENG&from=home)

CORE TECHNIQUES AND TECHNOLOGIES FOR ADVANCING BIG DATA SCIENCE & ENGINEERING (BIGDATA)

"The Core Techniques and Technologies for Advancing Big Data Science & Engineering (BIGDATA) solicitation aims to advance the core scientific and technological means of managing, analyzing, visualizing, and extracting useful information from large, diverse, distributed and heterogeneous data sets so as to: accelerate the progress of scientific discovery and innovation; lead to new fields of inquiry that would not otherwise be possible; encourage the development of new data analytic tools and algorithms; facilitate scalable, accessible, and sustainable data infrastructure; increase understanding of human and social processes and interactions; and promote economic growth and improved health and quality of life. The new knowledge, tools, practices, and infrastructures produced will enable breakthrough discoveries and innovation in science, engineering, medicine, commerce, education, and national security -- laying the foundations for US competitiveness for many decades to come.

The phrase "big data" in this solicitation refers to large, diverse, complex, longitudinal, and/or distributed data sets generated from instruments, sensors, Internet transactions, email, video, click streams, and/or all other digital sources available today and in the future…" (read at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504767)

DATA INFRASTRUCTURE BUILDING BLOCKS (DIBBS)

"NSF's vision for a Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) considers an integrated, scalable, and sustainable cyberinfrastructure as crucial for innovation in science and engineering (see www.nsf.gov/cif21). Data Infrastructure Building Blocks is an integral part of the CIF21 portfolio and seeks to provide support for the following research activities: Conceptualization, Implementation and Interoperability." (read at http://www.nsf.gov/events/event_summ.jsp?cntn_id=124341).

The Engineering Directorate is interested in all aspects of data infrastructure; however it emphasizes the conceptualization awards. The engineering and related communities are encouraged to carefully develop plans for sustainable data infrastructure that will support and significantly advance engineering knowledge, and innovation in engineering education. PIs are encouraged to contact the appropriate cognizant program officer in the Engineering Directorate.

DCL: NEW SOLUTIONS TO CREATE INTEGRATIVE DATA MANAGEMENT INFRASTRUCTURE(S) FOR RESEARCH ACROSS THE SCIENCES (DATA CHARRETTE)

"NSF seeks transformative approaches to create integrative data management infrastructures across science and engineering disciplines that will advance US research and innovation through new capabilities empowering the majority of the nation's researchers whether they are working individually, in small groups, or as part of large projects…NSF will host a series of webinars followed by a charrette meeting to rapidly facilitate the early stages of novel approaches to achieve the goals described. NSF expects that actionable ideas emerging from the charrette will help define future developments of this system in FY2013 and beyond…" (read at http://www.nsf.gov/pubs/2012/nsf12090/nsf12090.jsp).

For information on closely related topic, the reader is referred to the NSF Data Management Plan requirements (http://www.nsf.gov/eng/general/dmp.jsp).

INTEGRATIVE GRADUATE EDUCATION AND RESEARCH TRAINEESHIP PROGRAM-CIF21 TRACK (IGERT-CIF21)

"The Integrative Graduate Education and Research Traineeship (IGERT) program has been developed to meet the challenges of educating U.S. Ph.D. scientists and engineers with interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills. The program is intended to establish new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to a world-class, broadly inclusive, and globally engaged science and engineering workforce. …Within the Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) and IGERT, NSF recognizes the need to educate and support a next generation of researchers able to address fundamental challenges in 1) core techniques and technologies for advancing big data science and engineering; 2) analyzing and dealing with challenging computational and data enabled science and engineering (CDS&E) problems, and 3) researching, providing, and using the cyberinfrastructure that makes cutting-edge CDS&E research possible in any and all disciplines…Through this amendment to the IGERT solicitation NSF 11-533, a new IGERT-CIF21 track has been created as a mechanism to address the training and education needs in CDS&E and cyberinfrastructure research…" (read at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504772).

For questions regarding these opportunities, please contact Eduardo Misawa at emisawa@nsf.gov or 703-292-5353.

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