Computer and Network Systems (CNS): Core Programs

PROGRAM SOLICITATION
NSF 09-556

REPLACES DOCUMENT(S):
NSF 08-576

National Science Foundation

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems

Submission Window Date(s) (due by 5 p.m. proposer's local time)**:**

Medium Projects: August 1, 2009 - August 30, 2009, August 1 - August 30, Annually Thereafter

Large Projects: November 1, 2009 - November 28, 2009, November 1 - November 28, Annually Thereafter

Small Projects: December 1, 2009 - December 17, 2009, December 1 - December 17, Annually Thereafter

REVISION NOTES

The core program descriptions have been updated.

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Computer and Network Systems (CNS): Core Programs

Synopsis of Program:

CISE's Division of Computer and Network Systems (CNS) supports research and education projects that develop new knowledge in two core programs:

- The Computer Systems Research (CSR) program; and
- The Networking Technology and Systems (NeTS) program.

Proposers are invited to submit proposals in three project classes, which are defined as follows:

- Small Projects - up to $500,000 total budget with durations up to three years;
- Medium Projects - $500,001 to $1,200,000 total budget with durations up to four years; and
- Large Projects - $1,200,001 to $3,000,000 total budget with durations up to five years.

A more complete description of the three project classes can be found in section *II. Program Description* of this document.

CISE investments in Small, Medium and Large projects complement the directorate's investments in the Expeditions in Computing program, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503169&org=CISE&from=home, where projects are funded at levels of up to $10,000,000 total for durations up to 5 years.

Cognizant Program Officer(s):

- Krishna Kant, Point of Contact, Computer Systems Research, 1175, telephone: (703) 292-4776, email: kkant@nsf.gov

- Alhussein Abouzeid, Point of Contact, Networking Technology and Systems, 1175, telephone: (703) 292-8950, email: aabouzei@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 80 to 120 - It is anticipated that up to 120 awards will be made each year.

Anticipated Funding Amount: $60,000,000 Approximately $60 million each year, dependent upon the availability of funds.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In any contiguous August through December period, an individual may participate as PI, Co-PI or Senior Personnel in no more than **two** proposals submitted in response to the *coordinated solicitation* (where *coordinated solicitation* is defined to include the *Computer and Network Systems (CNS): Core Programs*, the *Information and Intelligent Systems (IIS): Core Programs* and the *Computing and Communication Foundations (CCF): Core Programs* solicitations). For example, between August 2009 and December 2009, an individual may participate as PI, co-PI or Senior Personnel in one proposal submitted to a core program in CCF and in a second proposal submitted to a core program in CNS, or an individual may participate as PI, co-PI or Senior Personnel in two proposals submitted to an IIS core program, etc.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e. the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

The limit on the number of proposals per PI, co-PI or Senior Personnel applies only to the *coordinated solicitation.*

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. proposer's local time)**:**

  Medium Projects: August 1, 2009 - August 30, 2009, August 1 - August 30, Annually Thereafter

  Large Projects: November 1, 2009 - November 28, 2009, November 1 - November 28, Annually Thereafter

  Small Projects: December 1, 2009 - December 17, 2009, December 1 - December 17, Annually Thereafter

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

The Division of Computer and Network Systems (CNS) supports research and education activities that invent new computing and networking technologies and that explore new ways to make use of existing technologies. The Division seeks to develop a better understanding of the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems.

II. PROGRAM DESCRIPTION

CNS CORE PROGRAMS

CNS supports two core programs as described below. (The successor to the Cyber Trust program---the Trustworthy Computing program--- is described in the CISE Cross-Cutting Programs: FY 2010 solicitation

1. Computer Systems Research (CSR)

Advances in software and hardware technologies are expanding the frontiers of distributed computing along multiple dimensions. Progress in Internet technologies is revolutionizing the use and scale of distributed systems, ushering in a variety of applications, such as Web search, e-commerce, social networking, distributed virtual environments, and utility computing. Advances in handheld and embedded device technology, coupled with progress in wireless communications and mobile computing, have led to the emergence of pervasive and ubiquitous computing where technology is increasingly invisible and where access to information and services is provided unobtrusively anytime, anywhere. Recent advances in multi-core architectures is enabling new levels of parallelism, never seen before in mainstream computing, with potential for significant performance gains without exacerbating the problems of power dissipation and design complexity. The Computer Systems Research (CSR) program supports the exploration of the new frontiers of computer systems and software, focusing on **systems** research that explores novel ideas and expands the limits of existing paradigms, with potential for significant advances in scientific or technical understanding of future computing systems and applications, and the way they

are designed, operated, managed and used.

The need to operate in heterogeneous, unpredictable and challenging environments requires ground-breaking approaches and methodologies to advance our understanding of how computation is performed and how resources are managed, at varying levels of granularity and scale. The proliferation of Internet-scale applications and services poses new challenges and require radical thinking of how distributed computation is carried out and how future file and storage systems are designed and managed. The difficulty of these challenges grows with the number of users and the intensity of the data. This is further compounded by the need for energy-efficient and self-managing systems and computing capabilities, support for pervasive access to both personal and very large-scale storage and data resources, including support for caching, replication and consistency at scale. Fundamental advances in methods and models to address power, thermal and sustainability issues in the design and operation of computing resources from chips to large scale data centers and study of tradeoffs between energy efficiency, performance and reliability are also essential to reduce the carbon footprint of fast expanding information technologies that are shaping our society. Frameworks, approaches and methodologies to address these challenges must show potential to improve system's characteristics, such as manageability, configurability, operational sustainability, usability and performance, while reducing vulnerabilities.

As mobile device technology continues to evolve, pervasiveness and ubiquity are increasingly becoming essential requirements of future distributed systems. The dynamic and heterogeneous nature of ubiquitous and pervasive computing environments, coupled with the interaction between human and devices, give rise to unique fundamental and socio-technical challenges. At the core of these challenges is the concept of context, its representation and the underlying principles that underpin how human behavior, activity and interaction with the environment are captured at the appropriate levels of detail. Advances in context-aware, pervasive and ubiquitous computing require new programming models, abstractions and languages. Methodologies and tools are also needed to monitor, evaluate and predict the performance of ubiquitous systems and assess users' experience. Collaborations with researchers in artificial intelligence and the social sciences that provide new perspectives on how human and context-aware ubiquitous computing are encouraged.

Fully leveraging the opportunities and unprecedented levels of parallelism offered by multi-core architectures poses new challenges which bring into question traditional frameworks, approaches and methodologies for system and software design in large-scale, high performance environments. Addressing these challenges requires sound parallel execution and memory models, innovative system-level approaches to automatic parallelization of sequential programs, novel compiler techniques and dynamic run-time execution to expose and exploit inherent parallelism and optimize code generation, and new design approaches for high performance I/O systems. Understanding parallel systems and applications also requires innovative methodologies and tools for quantitative and qualitative characterization, evaluation, monitoring and prediction of system behavior at different levels, including the implications of workloads in system design in large-scale, high performance environments.

CSR seeks advances that are specific to an application domain or a particular hardware platform as well as generic across domains and/or platforms. Also sought are proposals focused on advancing the state-of-the art in systems and software research for compute-intensive applications and hardware. Proposal focused on data-intensive applications and hardware should be submitted to the Data-intensive Computing cross-cutting program: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf09558. Investigators interested in the CSR program may also wish to consider the Software and Hardware Foundations program: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf09555, which supports foundational software and hardware research essential to enhance the capability of computing systems. CSR PIs should describe credible plans for demonstrating the utility and potential impact of their proposed work.

For more information on the types of projects supported by the CSR program, please visit our web site at http://www.nsf.gov/cise/cns/csr_pgm.jsp.

2. Networking Technology and Systems (NeTS)

Future computer and communication networks must be available anytime and anywhere, be accessible from any communication device, be resource-efficient, require little or no management overhead, be resilient and adaptive to failures and malicious attacks, and be trustworthy for all types of communications. They must be able to evolve over time to incorporate new technologies, support new classes of applications and services, and meet new requirements and challenges. They also need to accommodate growth and unforeseen changes across many dimensions, including types of applications, traffic load, network size and topology, physical link characteristics, different mobility patterns, and heterogeneity, while achieving high-energy efficiency and reduced performance degradation.

The Networking Technology and Systems (NeTS) program supports the exploration of innovative and possibly radical network architectures, algorithms, protocols, and technologies that are responsive to the evolving requirements of current and yet to be discovered network services and applications operating in various environments. The NeTS program will enable scientific and technological advances leading to the development of future generation, high performance networks. The scope of the program ranges from personal area and home networks, to wireless and sensor networks, to enterprise, core and optical networks, and peer-to-peer and application-level networks.

Of interest is research in innovative paradigms, architectures, algorithms and protocols to address various challenges, in wired, wireless and sensor networks. Examples include the interconnection of heterogeneous networks, topology management, resource and service discovery, naming and addressing, routing and congestion control, mobility management at different levels and granularities, virtualization at scale and programmability of hetergeneous physical substrates, strategies for the location of intelligence within the network and at endpoints, and the impact of widely distributed, data intensive computing resources as in cloud computing. In the area of network control and management, NeTS will entertain innovative projects focused on novel frameworks, methods, protocols and tools that enable effective network monitoring, security, management, performance measurement, modeling, quality of service and diagnosis. Proposed solutions are expected to bring the network closer to autonomy, where the need for human intervention is minimal.

NeTS also seeks transformative research focused on the development of scalable, non-intrusive mechanisms, tools, and methodologies for network measurement and characterization, network simulation and network performance analysis, including the development and distribution of benchmarks targeted at specific classes of networking research, both for wired and wireless networks and protocols.

Research outcomes in the form of software and hardware technologies should be scalable, energy-efficient, ensure robust network operation, even in the most demanding and high performance environments, and be able to support automatic instantiation of protocols and facilitate their evolution. Projects focused on innovative holistic

approaches to address the end-to-end requirements of current and emerging applications in large-scale, heterogeneous networks are encouraged.

Networking research and education projects of an inter-disciplinary nature should be directed to the Network Science and Engineering (NetSE) cross-cutting program (click here for solicitation). For example, projects that take a broad social, technical and economic perspective focusing on how networks are optimally designed to meet social, economic or legal challenges should be directed to the NetSE program.

For more information on the types of projects supported by the NeTS program, please visit the following web site http://www.nsf.gov/cise/cns/nets_pgm.jsp.

PROJECT CLASSES

Proposals submitted to this solicitation must be consistent with one of three project classes. Proposals will be considered for funding within their project classes.

- **Small Projects, with total budgets up to $500,000 for durations of up to three years,** are well suited to one or two investigators (PI and one co-PI or other Senior Personnel) and at least one student and/or postdoc.
- **Medium Projects, with total budgets ranging from $500,001 to $1,200,000 for durations up to four years,** are well suited to one or more investigators (PI, co-PI and/or other Senior Personnel) and several students and/or postdocs. Medium project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, a Collaboration Plan is **required** for all Medium proposals with more than one investigator. The length of and level of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.
- **Large Projects, with total budgets ranging from $1,200,001 to$3,000,000 for durations of up to five years**, are well suited to two or more investigators (PI, co-PI(s), or other Senior Personnel), and a team of students and/or postdocs. Large project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, a Collaboration Plan is **required** for all Large proposals. The length of and level of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

CISE investments in Small, Medium and Large projects complement the directorate's investments in the Expeditions in Computing program, where projects are funded at levels of up to $10,000,000 total for durations of up to 5 years. The Expeditions solicitation can be accessed at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503169&org=CISE&from=home .

IMPORTANT PROJECT CHARACTERISTICS

The submission of far-reaching, creative research and education projects is encouraged. Funds will be used to support potentially transformative research with high-impact potential. In this way, CISE will catalyze exciting new research activities with the potential to make significant advances in the state-of-the-art.

Interdisciplinary, international and/or academic-industry collaborations that promise to result in major science or engineering advances are welcome. The directorate hopes to attract proposals from faculty at a broad range of academic institutions, including faculty at minority-serving and predominantly undergraduate institutions.

Proposals submitted should demonstrate that enriching learning experiences will be provided for a diverse population of students, and may describe the development of innovative curricula or educational materials that advance literacy about and expertise in areas supported by CISE.

Proposals that extend beyond the scope of one CISE core program are welcome. In such cases, PIs should identify the most relevant program(s) in the proposal submission process (see *Proposal Preparation Instructions* later in this document). CISE Program Officers will work with their NSF colleagues to ensure that these proposals are appropriately co-reviewed and considered for funding.

III. AWARD INFORMATION

Approximately $60 million will be available each year to support up to 120 awards, pending the availability of funds.

IV. ELIGIBILITY INFORMATION

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

In any contiguous August through December period, an individual may participate as PI, Co-PI or Senior Personnel in no more than **two** proposals submitted in response to the *coordinated solicitation* (where *coordinated solicitation* is defined to include the *Computer and Network Systems (CNS): Core Programs*, the *Information and Intelligent Systems (IIS): Core Programs* and the *Computing and Communication Foundations (CCF): Core Programs* solicitations). For example, between August 2009 and December 2009, an individual may participate as PI, co-PI or Senior Personnel in one proposal submitted to a core program in CCF and in a second proposal submitted to a core program in CNS, or an individual may participate as PI, co-PI or Senior Personnel in two proposals submitted to an IIS core program, etc.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission (i.e. the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

The limit on the number of proposals per PI, co-PI or Senior Personnel applies only to the *coordinated solicitation.*

Additional Eligibility Info:

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-PUBS (7827) or by e-mail from pubs@nsf.gov.

The following information SUPPLEMENTS (not replaces) the guidelines provided in the NSF Grant Proposal Guide (GPG).

Proposal Titles: Proposal titles must begin with an acronym that indicates the most relevant core program. Select an acronym from the following list:

- Computer Systems Research: CSR
- Networking Technology and Systems: NeTS

The acronym should be followed with a colon, then the project class followed by a colon, then the title of your project. For example, if you are submitting a Small proposal to the Networking Technology and Systems core program, then your title would be **NeTS:Small:Title**. If you submit a proposal as part of a set of collaborative proposals, the title of the proposal should begin with the acronym that indicates the most relevant core program followed by a colon, then the project class followed by a colon, then "Collaborative Research" followed by a colon, and the title. For example, if you are submitting a collaborative set of proposals for a Medium project to the Computer Systems Research core program, the title of each would be **CSR: Medium:Collaborative Research: Title.** Proposals from PIs in institutions that have RUI (Research in Undergraduate Institutions) eligibility should have a proposal title that begins with the acronym that indicates the most relevant core program, followed by a colon and the project class, followed by a colon and “RUI”, followed by a colon and then the title, for example, **CSR:Medium:RUI:Title**

Proposals that extend beyond the scope of one CISE core program are welcome. In such cases, PIs should identify the acronym for the **most relevant** core program, followed by any other relevant program acronym(s) separated by colons (for example, **CSR:HCC:Large:Title**). CISE Program Officers will work with their NSF colleagues to ensure that these proposals are appropriately co-reviewed and considered for funding.

Project Summary: All proposals must provide up to 6 sets of key words at the end of the Project Summary. These key words should describe the main scientific/engineering areas explored in the proposal. Key words should be prefaced with "Key Words" followed by a colon and each key word separated by semi-colons. Key words should be of the type used to describe research in a journal submission. They should be put at the end of the project summary and might appear, for example, as **Key Words: formal logic; computer graphics; multi-modal interfaces; sensor networks; information visualization; privacy.**

Project Description: Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, all Medium proposals with more than one investigator and all Large proposals must include a Collaboration Plan. ***Relevant Medium and all Large proposals that fail to include a Collaboration Plan will be returned without review.*** While the length of the Project Description for Small proposals is limited to 15 pages, for Medium and Large proposals up to 3 additional pages are allowed for Collaboration Plans. The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Where appropriate, the Collaboration Plan might include: 1) the specific roles of the project participants in all organizations involved; 2) information on how the project will be managed across all the investigators, institutions, and/or disciplines; 3) identification of the specific coordination mechanisms that will enable multi-investigator, cross-institution, and/or cross-discipline scientific integration (e.g., yearly workshops, graduate student exchange, project meetings at conferences, use of the grid for videoconferences, software repositories, etc.), and 4) specific references to the budget line items that support collaboration and coordination mechanisms.

Proposals that incorporate curriculum development activities should describe the curriculum development activities in a separate section of the Project Description entitled "Curriculum Development Activities."

Supplementary Documents: In the Supplementary Documents Section, include a list of all PIs, Co-PIs, Senior Personnel, paid Consultants, Collaborators and Postdocs to be involved in the project. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. John Jones; University of PQR; Senior Personnel
3. Jane Brown; XYZ University; Postdoc
4. Bob Adams; ABC Inc.; Paid Consultant

PIs from predominantly undergraduate institutions should also include a Research in Undergraduate Institutions (RUI) Impact Statement and Certification of RUI Eligibility in this Section.

Proposers are reminded to identify the program solicitation number (NSF 09-556) in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. proposer's local time)**:**

  Medium Projects: August 1, 2009 - August 30, 2009, August 1 - August 30, Annually Thereafter

  Large Projects: November 1, 2009 - November 28, 2009, November 1 - November 28, Annually Thereafter

  Small Projects: December 1, 2009 - December 17, 2009, December 1 - December 17, Annually Thereafter

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria:

For Medium and Large proposals only, reviewers will be asked to:

- Comment on the extent to which the project scope justifies the level of investment requested, and the degree to which the participating investigators will work synergistically to accomplish the project objectives.
- Comment on the Collaboration Plan.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is

contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report.

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Krishna Kant, Point of Contact, Computer Systems Research, 1175, telephone: (703) 292-4776, email: kkant@nsf.gov
- Alhussein Abouzeid, Point of Contact, Networking Technology and Systems, 1175, telephone: (703) 292-8950, email: aabouzei@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

In addition to the Program Officers identified as program points of contact above, the following CNS Program Officers also support CNS core programs as indicated below:

Computer Systems Research (CSR)

- Michael Branicky, (703) 292-8950, mbranick@nsf.gov, Room 1175
- Helen Gill, (703) 292-8950, hgill@nsf.gov, Room 1175
- Anita La Salle, (703) 292-8950, alasalle@nsf.gov, Room 1175

Networking Technology and Systems (NeTS)

- Sajal Das, (703) 292-8950, sdas@nsf.gov, Room 1175
- Darleen Fisher, (703) 292-8950, dlfisher@nsf.gov, Room 1175
- Victor S. Frost, (703) 292-8950, vsfrost@nsf.gov, Room 1175

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

In addition to the *coordinated solicitation* discussed in this document, NSF provides funding opportunities for the computing community via the following programs and their solicitations:

Discovery Research Programs

Advanced Learning Technologies (ALT), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12834&org=NSF&sel_org=NSF&from=fund

CAREER: Faculty Early Career Development, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5262

CISE Cross-cutting Programs: FY 2010, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13451

Collaborative Research in Computational Neuroscience (CRCNS), http://nsf.gov/funding/pgm_summ.jsp?pims_id=5147

Community-Based Data Interoperability Networks (Interop) *http://www.nsf.gov/funding/pgm_summ.jsp?*

pims_id=502112&org=CISE

CreativeIT, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=501096

Cyber-enabled Discovery and Innovation (CDI), http://www.nsf.gov/crssprgm/cdi/

Cyber-Physical Systems (CPS), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286&org=NSF&sel_org=NSF&from=fund

Engineering Research Centers (ERCs) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5502&org=NSF&sel_org=NSF&from=fund*

Expeditions in Computing, http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf07592

Foundations of Data and Visual Analytics, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=501081&org=NSF&sel_org=NSF&from=fund

Grant Opportunities for Academic Liaison with Industry (GOALI) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13706&org=CISE*

High-End Computing University Research Activity (HECURA), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13645&org=NSF&sel_org=NSF&from=fund

Industry/University Cooperative Research Centers Program (I/UCRC) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5501&org=CISE&sel_org=CISE&from=fund*

Partnerships for International Research and Education (PIRE) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819&org=CISE&sel_org=CISE&from=fund*

Research in Undergraduate Institutions (RUI) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5518&org=CISE&sel_org=CISE&from=fund*

Science of Learning Centers (SLCs) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5567&org=CISE&sel_org=CISE&from=fund*

Science and Technology Centers (STCs) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5541&org=CISE&sel_org=CISE&from=fund*

Sustainable Digital Data Preservation and Access Network Partners (DataNet) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503141&org=CISE&sel_org=CISE&from=fund*

Education and Workforce Development Programs

ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383&from=fund

Advanced Technological Education (ATE), *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5464*

Broadening Participation in Computing (BPC), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13510&org=NSF&sel_org=NSF&from=fund

CISE Pathways to Revitalized Education in Computing (CPATH), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=500025&org=NSF&sel_org=NSF&from=fund

Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS), *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13655&org=EHR&sel_org=EHR&from=fund*

Course, Curriculum, and Laboratory Improvement (CCLI) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5741&org=EHR&sel_org=EHR&from=fund*

Developing Global Scientists and Engineers [International Research Experiences for Students (IRES) and Doctoral Dissertation Enhancement Projects (DDEP)], *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12831&org=CISE&sel_org=CISE&from=fund*

Discovery Research K-12 (DR-K12), *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=500047&org=EHR&sel_org=EHR&from=fund*

Federal Cyber Service: Scholarship for Service (SFS) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5228*

Graduate Research Fellowships (GRF), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201&org=DGE&from=home

Integrative Graduate Education and Research Training (IGERT), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12759

International Research Fellowship Program (IRFP) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5179&org=CISE&sel_org=CISE&from=fund*

Information Technology Experiences for Students and Teachers (ITEST) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5467&org=EHR&sel_org=EHR&from=fund*

NSF Graduate Teaching Fellows in K-12 Education (GK-12), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5472&from=fund

NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5257&org=EHR&sel_org=EHR&from=fund*

Research Experiences for Undergraduates (REU) Sites and Supplements, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund

Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5488&org=EHR&sel_org=EHR&from=fund

Research Infrastructure Programs

Computing Research Infrastructure (CRI), http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12810&org=NSF&sel_org=NSF&from=fund

EPSCoR Research Infrastructure Improvement Grant Program http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5672&org=CISE&sel_org=CISE&from=fund

Major Research Infrastructure (MRI), http://www.nsf.gov/od/oia/programs/mri/

For more information on these programs, please consult the NSF web site.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: pubs@nsf.gov

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and

NSF-51, "Reviewer/Proposal File and Associated Records, " 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

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