Networking Technology and Systems (NeTS)

Program Solicitation
NSF 07-507

Replaces Document(s):
NSF 06-516

National Science Foundation

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

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

    January 22, 2007

       Updated Annually

REVISION NOTES

In furtherance of the President's Management Agenda, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via Grants.gov or via the NSF FastLane system. In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following items are major revisions to the previous program solicitation:

- Programmable Wireless Networks (ProWin) is no longer a separate programmatic area. Submit proposals addressing ProWin subjects to the new Wireless Networks (WN) programmatic area;
- Wireless Networks (WN)-- has been added as a programmatic area;
- Future INternet Design (FIND), Networking of Sensor Systems (NOSS), and Networking Broadly Defined (NBD) have been updated; and
- Budget restrictions for PI's, co-PIs, Senior Personnel, and subcontractors from for-profit organizations have been added. See complete text of this solicitation for further information.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Networking Technology and Systems (NeTS)

Synopsis of Program:

NSF's Networking Technology and Systems (NeTS) program solicits proposals from the networking research and education community, encouraging investigators to make bold assumptions about the future of networking. The scope of the program covers all properties of information networks including network architecture, protocols, algorithms, and proof of concept implementation of hardware and software. Research activities include creation of new network architectures, modeling of phenomena, network design, analysis, measurement, and performance evaluation. The research scope of the program spans many types of networks that include end-to-end complex wide-area networks and sub-networks including local area networks, ad hoc networks, sensor networks, vehicular networks, and optical networks. It also includes research on heterogeneous networks that are hybrids of two or more types of sub-networks.

NeTS proposals may be submitted in one of the four programmatic areas defined below:

    I. **Future INternet Design (FIND):** Projects will explore revolutionary architectures to develop the "Future Internet" and will address requirements such as core functionalities, security, robustness, openness, economic utility, and social needs as well as support for new technologies and services.

    II. **Networking of Sensor Systems (NOSS):** Projects will investigate promising architectures, tools, algorithms and systems that support critical and emerging applications and make it easy to assemble and configure networks of sensor systems.

    III. **Wireless Networks (WN):** Projects will address issues pertaining to the phenomena of radio communications, mobility, location, and the limited power supplies of portable information devices.

    IV. **Networking Broadly Defined (NBD):** Projects will span a wide range of topical areas in networking, including both theoretical and experimental research that expands our understanding of large, complex, heterogeneous networks, design of access and core networks based on emerging wireless and optical technologies, and other technologies that will continue the evolution of the Internet.

NeTS supports the development of innovative curricular materials that have the potential to significantly improve higher education in networking technology and systems areas, particularly in emerging areas or topics that benefit from NeTS research results. Education-focused activities may be submitted as stand-alone projects or as components of broader research and education projects. Stand-alone curriculum development projects are expected to include strong justification for the need for new materials and must include plans both for disseminating them to the community and for evaluating their effectiveness. Proposals that solely focus on education must be discussed with a NeTS Program Officer prior to submission.

Four types of awards will be made:

- Individual and Small Group grants;
- Large Group grants;
- Planning grants; and
- Workshop grants in new and emerging areas.

On occasion, the NeTS program will accept proposals for Small Grants for Exploratory Research (SGERs). These proposals may be submitted on or before the deadline for this solicitation under the conditions described herein, or they may be submitted at any other time in accordance with GPG guidelines. However, prior to submission of any SGER proposal, a PI must discuss their interests with a NeTS Program Officer before submitting the proposal. Additional information about SGER proposals can be found in Section II.D.1. of the NSF Grant Proposal Guide (GPG).

Cognizant Program Officer(s):

- David Du, telephone: (703) 292-8950, email: ddu@nsf.gov

- Darleen Fisher, telephone: (703) 292-8950, email: dlfisher@nsf.gov

- Allison Mankin, telephone: (703) 292-8572, email: amankin@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: 60 to 80 total.

The NeTS program expects to make the following types of awards:

- Individual Investigator and Small Group awards will be funded for durations up to three years, with anticipated award sizes up to $120,000 per investigator per year.

- Large Group awards will be funded for durations up to four years, with project award sizes up to $500,000 per year.

- Planning Grants will support community building and planning activities necessary to develop larger-scale research and education projects. An investigator considering submission of a Planning Grant must discuss the idea, and potential budget amount, with a NeTS program officer prior to submitting a proposal.

- Workshops in new or emerging areas in networking will bring researchers together, including those from multiple disciplines, to identify new research and education opportunities and challenges. Workshops will be funded at levels up to $50,000 for one year. An investigator considering submission of a workshop proposal must discuss the idea with a NeTS program officer prior to submitting a proposal

Anticipated Funding Amount: $40,000,000 in FY 2007 pending availability of funds.

Eligibility Information

Organization Limit:

> None Specified

PI Limit:

> Researchers from for-profit organizations may serve as PIs, co-PIs, Senior Personnel, or sub-contractors in NeTS projects. NeTS will provide support for graduate students to work on such collaborative university-industry projects. NeTS will not provide salary or related support for individuals from for-profit organizations.

Limit on Number of Proposals per Organization:

> None Specified

Limit on Number of Proposals per PI: 2

> An individual may appear as a PI, Co-PI, Senior Personnel, or Consultant on no more than two NeTS proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable

- **Full Proposals:**

- Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. 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.

- Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf/)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

     January 22, 2007

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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: Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Computer and communication networks are among society's most important infrastructures. Networks are vital to the operation of many sectors of our society - from financial and manufacturing to education and healthcare - and they are engines for economic growth. However, with the existing network architecture stressed and reaching the limits of its capabilities, significant innovations are necessary to enhance security, accommodate mobility, facilitate new applications, and make advanced information services easy to use and accessible to the entire population.

As NSF's NeTS program enters its fourth year, the networking research and education community is moving forward with the planning necessary to establish the feasibility of a major new experimental platform that will permit groundbreaking work on networking and distributed systems. Known as the Global Environment for Networking Innovations (GENI), this facility promises to serve as a major stepping stone in the path toward a future Internet designed to meet the needs of the twenty-first century.   In the longer term, it is anticipated that NeTS investigators will have the opportunity to experiment with their ideas and results on GENI.

II. PROGRAM DESCRIPTION

In FY 2007, NETS will fund research and education projects in four programmatic areas as defined below:

I. **Future INternet Design (FIND)**

The FIND focus area was developed on the premise that to meet the needs of the twenty-first century, the research community must ask not how to make the existing Internet better through incremental change, but rather what the desirable network should be and how it should be designed. To do so, investigators must begin with a clean slate unconstrained by the properties of today s Internet. FIND will support fundamental and possibly radical innovations in networking, leading to the architecture of the next-generation Internet that is referred to herein as the "Future Internet".

A multi-year, three-phase program, FIND is based on a new conceptualization of networking research that alters the *nature* of the research process - moving away from business as usual within the established research and education communities and towards a more collaborative, more integrated, more inclusive program of research.   In a continuation of phase one, in FY 2007 FIND will support research and education projects that address elements of the Future Internet. The goal of phase one is to identify the functional elements of the Future Internet and their interactions. Investigators are encouraged to propose and evaluate requirements for a new architecture, to reason carefully about architectural responses to these requirements and to propose, develop and demonstrate ideas that might be a part of a new architecture. To facilitate shared learning and the development of consensus, phase one investigators are required to attend FIND meetings three times each year. NSF will issue new program solicitations for phase two and phase three. In phase two, a small number of teams will implement elements of a new architecture building on the insights gained in phase one. Phase three will reduce select architectures to practice by fleshing out the details of protocols and producing code that could run on research infrastructure. Initial experiments in phases two and three are likely to lead to iteration in design, so there will be continuing opportunities to propose and integrate new concepts into the most promising future architectures.

To serve the purposes of the Future Internet, the protocols and structures that guide its operation require coordinated, coherent design. New approaches require rethinking of network functions and the development of strategies to address a range of challenges and opportunities. These include, but are not limited to:

- exploration of fundamental policy and engineering trade-offs in the design of secured, privacy protecting, and robust networked systems or fundamental new requirements and capabilities in

such areas;
- exploration of new paradigms of communication that go beyond packet and circuit switching;
- consideration of new models of information dissemination;
- co-design of data, control, and management planes;
- further advances in self-evolving networks with virtualized overlays; and,
- architectures that promote healthy economic models.

FIND proposals must define requirements of a Future Internet, such as: enhanced security, privacy, resilience and availability; openness to incorporation of new technologies; ability to adapt to new computing paradigms; ability to support future complex applications; improved network management; economic viability; harmony with societal values; and, openness to future innovations.

Together, such requirements and others mandate a transformed global network that will be a subject of research and development, a benefit to society, and a driver of new investment and innovation. NeTS does not insist that investigators accept the requirements listed herein as a mandate. Investigators are free to state their own view of requirements for a Future Internet, but FIND projects must be justified in the context of high-level requirements these or others.

All FIND proposals must be relevant to *architecture*, meaning the basic design principles and structures that will define a Future Internet, rather than a specific technology. Research on the architecture and design of specific subnet technologies, such as wireless or optics, is not appropriate for FIND unless the primary motivation of the work is to influence architectures at an internetworking level - a level that spans heterogeneous networking technologies and defines the basis on which end-points communicate.

FIND will support research across a broad range of topics including, but not limited to:

- creating new core functionality;
- design for security;
- design for manageability;
- design for utility and social needs;
- design for real-time and uninterruptible services;
- architectural implications of new technology in the optical, wireless, sensor network and embedded computing spaces;
- creating higher-level service architectures;
- holistic network design; and,
- theory of network architecture.

Projects that address security or trustworthiness of the current Internet should be submitted to the CISE Cyber Trust program. Projects that examine fundamental theory and the science of network design should be submitted to the CISE Theoretical Foundations cluster. Investigators exploring architectures that facilitate natural and productive human-networking system collaboration are encouraged to consider submitting a proposal to the CISE Human Centered Computing cluster. Investigators with proposals that appear to be relevant to more than one program are encouraged to contact the Program Directors identified in this solicitation for guidance.

II. **Networking of Sensor Systems (NOSS)**

An individual sensor system can sense its immediate environment, process what it senses, communicate its results to others over a wireless link, and possibly take action in response. Sensor systems are enabled by developments in digital sensors, digital actuators, and low power RF radios and by integrating these in a single chip with a processor-memory system. While a single sensor system has very limited use, a network of sensors can be used to instrument and manage large environments and systems.

Significant scientific and technical progress is required to realize the potential of networks of sensor systems. Sensor systems contain new types of computing machines, run different kinds of network applications, execute in different physical environments, and have large numbers of nodes. Moreover, sensor systems often must operate with severe power and other resource constraints, and must communicate and cooperate with a large number of other sensor systems over wireless links that have severe bandwidth and range constraints.

NOSS emphasizes research and education focused on sensor network architectures, network programming systems, their reference implementations, and is already supporting the work of several groups exploring sensor network architectures, such as SNA at UC Berkeley, Tenet at UCLA/USC, COMPASS at Rice, and Wavescope at MIT. More information on these and other projects already funded can be found at http://www.nsf.gov/cise/cns/noss.jsp.

In the aggregate, NOSS projects will:

- create a strong foundation and system knowledge for the design and development of networks of sensor systems that are easy to manage, evolve, and are secure, and that can provide quality of service guarantees;
- explore a range of efficient and usable network sensor system platforms and tools;
- create a limited number of sensor network architectures and their reference implementations;
- create a limited number of network programming systems and their reference implementations;
- develop network testbeds for sensor systems with diverse applications and platforms in order to gain significant experimental knowledge and experience; and
- investigate unique research issues arising in sensor network systems supporting emerging applications in critical areas like healthcare, environmental monitoring, transportation, emergency response and pubic safety.

At annual PI meetings, NOSS investigators are expected to share and demonstrate project outcomes of increasing capability, and to discuss integration-related opportunities with other awardees in the program.

NOSS proposals submitted in response to this solicitation should address one or more of the following topics:

- **Architecture**: Proposed activities may build on sensor network architectures already supported by NOSS, or explore new comprehensive architectures. Proposals must describe a coherent architectural vision encompassing all components in the proposed sensor network system.
- **Architecture Components**: Proposed activities may focus on development of components for NOSS projects already supported or a concurrently proposed architecture where the proposal has both an architectural and a component emphasis. Proposers must describe how the project will contribute to realization of a comprehensive architecture. A variety of issues might be investigated, such as routing, in-network processing, localization, calibration, energy and resource management, higher-level naming services, storage services, debugging, network management, integration of sensing modalities, and statistical techniques.
- **Programming Systems**: Proposed activities may focus on development of sensor network-centric macro-programming paradigms (e.g. declarative, data-centric, data-flow, and others), and complete associated tool chains. Proposals should describe how the proposed paradigm will be used to implement qualitatively different applications, and must address how the proposed research will complement currently funded or concurrently proposed sensor network architecture(s). Examples of research topics include, but are not limited to, macro-programming abstractions, programmer control for resource management, compile and run-time optimization techniques, code annotation and profiling, optimized code distribution mechanisms, and program analysis techniques. Research outcomes should be software artifacts that can be integrated with one or more programming paradigms.
- **Reference Implementation**s: Funded projects will produce reference implementations of already funded, newly funded architectures or a unified network architecture that encompasses elements of other architectures. Proposals should carefully justify the design of unified network architectures, and describe a work plan that leverages existing funded work to maximize return on investment. Proposals should describe realizable milestones for producing increasingly complete and robust versions of the reference implementations proposed.
- **Hardware and Software Platforms**: NOSS will support the development of sensor system platforms that can be networked and used to prototype other system components and testbeds. Platforms must provide capabilities required to support fundamental research on networking of sensor systems that are not available in commercial platforms. Proposers may also request support for distributing sensor system platforms. Proposers who wish to make a platform available to others must have clear support from the research community, and should talk to a cognizant Program Director before submitting a proposal.
- **Testbeds and Applications**: NOSS will support testbeds and the deployment of real applications in collaboration with applications researchers. Proposals must describe how the proposed testbeds will be used to demonstrate key networking capabilities and gain experimental experience and insights.

Projects focused on physical sensing devices, distributed real-time embedded sensor systems or sensor applications that do not include a significant networking component are not appropriate for NOSS funding, and will be returned without review.

III. **Wireless Networks (WN)**

Just as over the past twenty years, mobile wireless information network technology has completely transformed telephony, the next twenty years will see a corresponding transformation of the Internet. An increasing fraction of telephone conversations will be carried over the Internet and the majority of devices

with Internet connections will be mobile and portable and rely on radio signals to send and receive information.

Networks containing mobile portable devices have to cope with three phenomena beyond those encountered in wireline networks: radio propagation, mobility, and the limited lifetime of their self-contained power supplies. The need to understand these phenomena and create networking technologies that meet the challenges and opportunities they pose motivate a vast body of wireless networking research. Information on approximately 80 active NeTS wireless networking projects (excluding sensor networks) appears at http://nets.cs.ucla.edu/.

The following are examples of WN research topics, not an exhaustive list of funding opportunities. WN welcomes creative proposals that break new ground in the science, technology, and deployment of wireless information networks.

- **Network Types**: WN supports research and education projects focused on the following networks-- cellular, wireless local area, ad hoc, mesh, delay tolerant, and vehicular networks. WN also supports research on heterogeneous networks such as hybrids of ad hoc and infrastructure networks and hybrids of cellular and wireless local area networks.
- **Network Architecture:** WN encourages research that will unify today s diverse collection of network technologies.
- **Technology-oriented Projects**: Examples include projects focused on interactions of protocol layers, cooperative communications, routing, media access, spectrum sharing, and applications of location determination.
- **Phenomena of Wireless Communications:** Projects of this type address mobility modeling, spectrum occupancy, and interference modeling.
- **Application-based Problems:** In addition to projects oriented to networks that serve a wide range of applications, WN invites proposals that address networking issues pertaining to specific applications areas such as location-based services, health care, emergency services, education, banking, and transportation.

The research activities in WN projects include: network architecture; design of algorithms that promote network quality, efficiency, and resilience; design of protocols that perform network functions; simulation of networks; experimentation to validate analysis and design activities; and, modeling of phenomena including tele-traffic, mobility, interference, and radio propagation.

WN emphasizes the potential influence of the research on practical networks. Proposals should state explicitly how the research results can be validated and indicate how successful outcomes would improve networks of the future.

WN research and education projects are related to other NeTS programmatic areas as well as to the CISE Cyber Trust and Theoretical Foundations programs. Proposals that concentrate on security of wireless networks should be submitted to the Cyber Trust program. Proposals that break new ground in the theory of wireless networking should be submitted to the Theoretical Foundations program, while proposals that emphasize design, experimentation, and network deployment should be submitted to WN. Investigators with proposals that appear to be relevant to more than one program are encouraged to contact the Program Directors identified in this solicitation for guidance.

IV. **Networking Broadly Defined (NBD)**

Networking Broadly Defined (NBD) supports all areas of networking research and education not covered by FIND, NOSS, WN, Theoretical Foundations, Human Centered Computing or Cyber Trust, and invites investigators to identify new and strategically important areas of networking research and education. NBD will support compelling, far-reaching research projects aimed at addressing the strategic evolution of today's Internet and its capabilities, in terms of scalability, robustness, security, and its ability to support new as well as existing applications. Proposals are expected to address major limitations to the evolution of the Internet and to describe how the proposed solutions could be integrated into the Internet - i.e., into the existing TCP/IP protocol stack and into existing network components such as routers, switches, and firewalls.

The following are representative, not exclusive, topics currently supported by NBD.

- Network control and management
- Network topology studies
- Optimization and game theory applied to networking
- Internet measurement and understanding
- Distributed congestion control
- Optical networks and access networks

- Peer-to-peer networks
- Understanding BGP
- Networking for the home
- Traffic characteristics, measurement, and engineering

Additional Information

NeTS supports the development of innovative curricular materials that have potential to improve NeTS-related higher education, particularly that relate to emerging areas or topics that benefit from NeTS research results. Education-focused activities may be submitted as stand-alone projects, or may be included as components of broader research and education projects. Stand-alone curriculum development projects are expected to include strong justification of the need for the new materials and must include plans both for disseminating the materials developed to the community, and for evaluating their effectiveness. Proposals that focus solely on education must be discussed with a NeTS Program Director prior to submission.

On occasion, the NeTS program will accept proposals for Small Grants for Exploratory Research (SGERs). These proposals may be submitted on or before the deadline for this solicitation under the conditions described herein, or they may be submitted at any other time in accordance with GPG guidelines. However, prior to submission of an SGER proposal, a PI must discuss their interests with a NetS Program Officer before submitting the proposal. Additional information about SGER proposals can be found in Section II.D.1. of the NSF Grant Proposal Guide (GPG).

In unusual circumstances, NSF will entertain proposals that are beyond the scope and funding levels noted elsewhere in this solicitation. Such proposals would be expected to explore groundbreaking or paradigm-changing ideas or to pursue a grand challenge requiring the work of a substantial number of investigators. Projects of this type might well include investigators from multiple disciplines and cross CNS or CISE programs. PIs who have in mind such a project must first brief NeTS Program Directors and the CNS Division Director. PIs may submit a proposal only after being given permission to do so. The briefing must take place before the program solicitation deadline to allow CISE to plan for the receipt and review of this kind of proposal.

III. AWARD INFORMATION

The estimated program budget ($40M) and estimated number of awards (60-80) are subject to the availability of funds. Awards will be made as standard or continuing grants.

Four types of NeTS awards will be made:

- Individual Investigator and Small Group awards will be funded for durations up to three years, with anticipated award sizes up to $120,000 per investigator per year.

- Large Group awards will be funded for durations up to four years, with award sizes up to $500,000 per year.

- Planning Grants will support community building and planning activities necessary to develop larger-scale research and education projects. An investigator considering submission of a planning grant must discuss the idea, and potential budget amount, with a NeTS program officer prior to submitting a proposal.

- Workshops in new or emerging areas in networking will bring researchers together, including those from multiple disciplines, to identify new research and education opportunities and challenges. Workshops will be funded at levels up to $50,000 for one year. An investigator considering submission of workshop proposal must discuss the idea with a NeTS program officer prior to submitting a proposal.

IV. ELIGIBILITY INFORMATION

Organization Limit:

None Specified

PI Limit:

Researchers from for-profit organizations may serve as PIs, co-PIs, Senior Personnel, or sub-contractors in NeTS projects. NeTS will provide support for graduate students to work on such collaborative university-industry projects. NeTS will not provide salary or related support for individuals from for-profit organizations.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

An individual may appear as a PI, Co-PI, Senior Personnel, or Consultant on no more than two NeTS proposals.

Additional Eligibility Info:

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained 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) 292-7827 or by e-mail from pubs@nsf.gov. Proposers are reminded to identify this program solicitation number 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.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

The following instructions supplement the general guidelines in the GPG or NSF Grants.gov Application Guide:

- To assist NSF staff in sorting proposals for review, proposal titles should begin with an acronym that identifies the programmatic area to which the proposal is being submitted, i.e. Future INternet Design = FIND; Networking of Sensor Systems = NOSS; Wireless Information Networks = WN; and, Networking Broadly Defined = NBD. For example, a NeTS proposal might have a title such as "FIND: A Framework for Future Internet Manageability". Proposals not specifically intended for FIND, NOSS or WN should be submitted to NBD.

- Every NeTS proposal must include a discussion of broader impacts and should include substantive education component. Broader impacts include the integration of education and research, promoting diversity in the

networking workforce, developing substantial experimental research educational experiences, and developing curriculum in emerging network areas. The following URL contains examples illustrating activities that are likely to demonstrate the broader impacts: http://www.nsf.gov/pubs/2002/nsf022/bicexamples.pdf.

- Proposers to FIND should address the following points in their proposals:
  - Clearly indicate what Future Internet requirement(s) - such as those discussed earlier in this solicitation - the proposed work will address;
  - Discuss how this work would fit into a larger overall architectural framework. Discuss what other problems this work might mitigate or exacerbate.
  - Upload into FastLane's Additional Single Copy Documents section, text that describes the infrastructure to be used to validate the proposed work, such as simulation, emulation or demonstration on a networking infrastructure. If the appropriate infrastructure exists, describe whether and how it is sufficient to validate the proposed work. If infrastructure that does not exist is needed, describe the characteristics or features you would require to validate your work. This text will not be seen by reviewers and will not be used to evaluate your proposal. This document will provide input into the GENI planning process.
  - Budget for travel to three FIND PI meetings per year for at least one PI and for one student to attend one PI meeting per year for the duration of the award.

B. Budgetary Information

Cost Sharing: Cost sharing is not required by NSF.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

  January 22, 2007

  Updated Annually

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: https://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.

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants. gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants. gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed

application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. 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 with the proposer.

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 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:

Additional considerations in evaluating NeTS-FIND proposals include:

- How well does the proposed work address one or more architectural requirement(s)?
- How well does the proposed work relate to and enhance a larger overall architectural framework?
- How important is this work to the framing of a new architecture?

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 date of receipt. 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 Federal Demonstration Partnership (FDP) 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/general_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.

Large group projects may be site visited one or more times at NSF's discretion.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- David Du, telephone: (703) 292-8950, email: ddu@nsf.gov

- Darleen Fisher, telephone: (703) 292-8950, email: dlfisher@nsf.gov

- Allison Mankin, telephone: (703) 292-8572, email: amankin@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

The primary contacts for the four programmatic areas are:

- Future INternet Design (FIND): Darleen Fisher, Allison Mankin
- Networking of Sensor Systems (NOSS): David Du
- Wireless Networks (WN): David Goodman
- Networking Broadly Defined (NBD): Darleen Fisher

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, MyNSF (formerly the Custom News Service)is an information-delivery system 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 or the user's Web browser each time new publications are issued that match their identified interests. MyNSF also is available on NSF's Website at http://www.nsf.gov/mynsf/.

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.

Related CISE Programs with the CISE division affiliation:

- Computer Systems Research/CNS
- CISE Computing Research Infrastructure/CNS
- Cyber Trust/CNS
- Human Centered Computing/IIS
- Theoretical Foundations/CCF

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**   (703) 292-5111
  (NSF Information Center)**:**

- **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:

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

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