

Network Centric MIDDLEWARE Services (MWIR)

Infrastructure & Research for Networks

Program Announcement

NSF 01-63

ADVANCED NETWORKING INFRASTRUCTURE AND RESEARCH
DIRECTORATE FOR COMPUTER AND INFORMATION SCIENCE AND ENGINEERING

FULL PROPOSAL DEADLINE(S): May 10, 2001



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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: Network Centric MIDDLEWARE Services (MWIR)

Synopsis of Program: The purpose of this announcement is to enable the members of the advanced network community (research universities, government agencies and industrial units) to collaborate in assembling the known and needed pieces of Network Centric MIDDLEWARE Services. Middleware refers to the software which is common to multiple applications and builds on the network transport services to enable ready development of new applications and network services. Although this broad topic has been discussed widely, a single concrete gathering point is needed to sort out the solution components in solving the problem of improving the network experiences for most applications. The dilemma is that tradeoffs between two goals are needed. The desired goals are:

- optimizing the entire network for a single application
- sharing limited resources for the common good of all applications

Parts of how to do this are known, but other parts need research. By producing a working software distribution, this project will assemble the known pieces and highlight places where new knowledge is needed.

The limited NSF resources available for this undertaking will require balancing a holistic goal with the making of specific integration choices to accomplish real results and to produce a software distribution. The program will need efforts in three areas:

- Applied infrastructure research area: specifically directed at middleware services, especially with working prototypes as outcomes
- Infrastructure area: to provide a software distribution based on research prototypes and to operate middleware services
- Application research area: to exploit the new middleware infrastructure to experiment with new distributed applications

Cognizant Program Officer(s):

- Thomas J. Greene, Senior Program Director, CISE, ANIR, 1175, telephone: (703) 292-8948, e-mail: anir-mwir@nsf.gov.

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

- 47.070 --- Computer and Information Science and Engineering

ELIGIBILITY INFORMATION

- **Organization Limit:** None
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** None

AWARD INFORMATION

- **Anticipated Type of Award:** Standard and continuing awards and cooperative agreements
- **Estimated Number of Awards:** 15-20
- **Anticipated Funding Amount:** \$10 million in FY2001, subject to availability of funds.

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

- **Full Proposals:** Standard Preparation Guidelines
 - Standard GPG Guidelines apply.

B. Budgetary Information

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

C. Deadline/Target Dates

- **Letters of Intent (*optional*):** None
- **Preliminary Proposals (*optional*):** None
- **Full Proposal Deadline Date(s):** May 10, 2001

D. FastLane Requirements

- **FastLane Submission:** Full Proposal Required
- **FastLane Contact(s):**
 - FastLane user Support, IRM/DIS, telephone: (800) 673-6188, e-mail: fastlane@nsf.gov.

- Laura Barnes, CISE, ANIR, telephone: (703) 292-8950, e-mail: lbarnes@nsf.gov.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** National Science Board approved criteria apply.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

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I. INTRODUCTION

By this announcement, NSF/ANIR, the NSF Division of Advanced Networking Infrastructure and Research, is commencing a new major theme and emphasis.

ANIR has evolved in advancing and supporting inter-institutional computer networking for research and education by means of several themes expressed as programs:

- 1986-95 - the basic backbone (NSFnet) program and regional networks
- 1995 - high performance backbone network service (vBNS and later, the Internet2 Abilene) program
- 1996 - Connections program for emerging backbone services
- 1997 - peering to other Federal networks in Next Generation Internet (NGI) initiative
- 1998 - international connections through STARTAP
- 1998-9 - series of workshops conclude NSF support of a cross section effort on Middleware is needed
- 2000- Committee of Visitors to CISE/ANIR endorses need for middleware program in ANIR

ANIR's evolution of themes through new programs now continues. This new program will focus the network community on this widely discussed need - middleware services. The program will provide a place to gather knowledge in order to pursue a complete picture of middleware services. The desired goal is to assemble and integrate existing pieces in order to showcase known solutions and to highlight research problems by identifying gaps in knowledge concerning the middleware suite. The desired outcome is a growing software release of production middleware using (mostly) open-source and open-standards. The problem is to balance between the two objectives of network infrastructure through middleware. The competing objectives are:

- optimizing the entire network for a single application
- sharing limited resources for the common good of all applications

II. PROGRAM DESCRIPTION

The initiative is focused on: experimental software (part of a research program), advanced production software (developed, deployed, maintained by an NSF awardee), and commercial and/or open source software. Experimental software will migrate through a middleware test bed(s) into a production software release.

The program elements are:

1. Production middleware: a software distribution maintained and developed by one (or more) system integrator(s). Some of this software will be deployed and operated on network servers with the support of others, and other software may be provided as a distribution for installation on servers or clients in research organizations.
2. The middleware testbed: an additional software distribution that is layered on and depends upon the production middleware. This is an environment within which experimental software prototypes can be tried out.
3. Experimental applications: those applications specifically deployed for the purpose of experimenting with new middleware prototypes and/or new application capabilities depending on those prototypes.
4. Advanced science and education production applications: those applications built and deployed by NSF grantees or others, and which benefit from and depend on the production middleware.

The evolution of middleware solutions is generally from the test bed to production middleware environment, once its usefulness is proven in the context of applications. There would desirably be more than one experimental solution to choose from, so the evolution is based on merit and is not guaranteed. Within the general picture, we envision three types of awards:

1. System integrators (one or more). Responsibilities of system integrators are:
 - to define and document an overall middleware (production and testbed) architecture
 - to define and document (primarily commercially available) languages and tools to be used in the initiative
 - to identify and license needed commercial solutions suitable for the production environment
 - to aid in the integration of experimental prototypes into the testbed environment, and to aid in the integration of experimental prototypes into the production environment
 - to provide challenge problems and participate in the definition of yearly areas of opportunity (see below)

Following the earlier model used for NSFNET, system integrators will operate under a cooperative agreement with NSF. This will allow the relationship to appropriately evolve over time. Teams of commercial, university and non-profit organizations with proposals will be of special interest.

2. Service providers (one or more). Responsibilities of service providers are:

- to publicize and disseminate the software distribution
- to provision an equipment infrastructure
- to operate that portion of the production middleware environment that is provided as a network-centric service

It is anticipated that awards in this category may be made as cooperative agreements or as standard or continuing grants.

3. Middleware researchers. Responsibilities of middleware researchers include research on middleware of two types:

- Applied research will have as a goal the prototyping and experimentation with new middleware solutions in the testbed environment
- Fundamental research to address longer-term and more fundamental issues

Middleware researchers are encouraged to work closely with other discipline specific researchers in application domains, and to participate in or stimulate coordinated application research and prototype development. In some cases this application research may be co-funded by other programs in NSF or other agencies.

Awards will be made as standard or continuing grants.

The guidance of the network community outside NSF was sought in formulating this program. Specific recommendations for guidance in implementing this program were received. This guidance, which is neither mandatory nor all inclusive, is summarized by the following points and principles for consideration in preparing proposals:

- Target application requirements anticipated for 5-10 years in the future
- Use theory, simulation, emulation, prototypes, etc. where appropriate as intermediate steps for getting to the eventual outcomes of the program - working prototypes in real-life settings
- Preferentially use open standards and open source software where available and suitable
- Preferentially use commercially available solutions when available and suitable
- Promulgate de facto and explicit new standards as part of the initiative
- Emphasize public sector application needs (such as privacy, anonymity, and high confidence), but allow commercial needs where there are clear significant research issues
- Encourage commercial firms to use the production and testbed environments for their own research, at their expense

- Emphasize the end-to-end application perspective
- Recognize the future needs of system administrators, service providers, and end-users as well as application developers
- Cooperate with other researchers and with the system integrator(s)
- Include some high-risk high-payoff projects

This program will be reviewed on an annual basis by an external panel. During the review, "areas of opportunity" topics will be identified by the review panel and posted on a web site to be designated and linked to from the ANIR website <http://www.cise.nsf.gov/anir/>. These topics are neither mandatory nor all inclusive in establishing projects to be selected. Initial topics for consideration are:

- Security and robustness (such as identification, authentication, confidentiality, authorization and access control)
- Privacy
- Performance enhancement (such as caching)
- Directory, naming and location services
- New services, such as multicast
- Reliability and availability
- End-to-end quality-of-service objectives and guarantees
- Mobile code and agents
- Mobility
- Standard structured data types (XML, audio, video)

These suggested topics may be addressed as groups or separately.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program announcement/solicitation.

IV. AWARD INFORMATION

Award size will vary from \$50,000 to \$150,000 per year for single investigator research projects, up to \$1,400,000 per year for consortia integration/implementation projects. Award duration is expected to be 3 years.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal:

Proposals submitted in response to this program announcement/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 Web Site at: <http://www.nsf.gov/cgi-bin/getpub?nsf012>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program solicitation number (NSF-01-63) in the program announcement/solicitation block on the NSF Form 1207, *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 is not required in proposals submitted under this Program Announcement.

C. Deadline/Target Dates

Proposals must be submitted by the following date(s):

Full Proposals by 5:00 PM local time: May 10, 2001

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this Program Announcement through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: <http://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call 1-800-673-6188.

Submission of Signed Cover Sheets. The signed copy of the proposal Cover Sheet (NSF Form 1207) must be postmarked (or contain a legible proof of mailing date assigned by the carrier) within five working days following proposal submission and be forwarded to the following address:

National Science Foundation
DIS – FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he/she 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 and original 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?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration 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.

A summary rating and accompanying narrative will be completed and signed 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 Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Mail 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.

NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals. The time interval begins on the proposal deadline or target date or from the date of receipt, if deadlines or target dates are not used by the program. The interval ends when the Division Director accepts the Program Officer's recommendation.

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 its 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 Division 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.A. 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 (NSF-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 agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Web site at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Web site at <http://www.nsf.gov/cgi-bin/getpub?gpm>. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Web site at <http://www.gpo.gov>.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, 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.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding Network Centric MIDDLEWARE Services should be made to:

- Thomas J. Greene, Senior Program Director, CISE, ANIR, 1175, telephone: (703) 292-8948, e-mail: anir-mwir@nsf.gov.

For questions related to the use of FastLane, contact:

- FastLane user Support, IRM/DIS, telephone: (800) 673-6188, e-mail: fastlane@nsf.gov.
- Laura Barnes, CISE, ANIR, telephone: (703) 292-8950, e-mail: lbarnes@nsf.gov.

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF web site at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's Custom News Service (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

Proposers are encouraged to coordinate with any other program with an application that has special networking middleware needs.

The focus of this program is middleware. Other programs relating to networkng research are:

ITR (NSF -Wide)

Networking Research (CISE/ANIR)

Special Projects in Networking (CISE/ANIR)

Advanced Computational Research

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF (unless otherwise specified in the eligibility requirements for a particular program).

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement/solicitation for further information.

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, FIRS at 1-800-877-8339.

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

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; 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 applicant 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 needing information as part of the review process or in order to coordinate programs; 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," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

Pursuant to 5 CFR 1320.5(b), an agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid 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 this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Information Dissemination Branch, Division of Administrative Services, National Science Foundation, Arlington, VA 22230, or to Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for National Science Foundation (3145-0058), 725 17th Street, N.W. Room 10235, Washington, D.C. 20503.

OMB control number: 3145-0058.