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Title : NSF 93-52 - NETWORK ACCESS POINT MANAGER, ROUTING ARBITER, REGIONAL NETWORK PROVIDERS, AND VERY HIGH SPEED BACKBONE NETWORK SERVICES PROVIDER FOR NSFNET AND THE NREN(SM) PROGRAM

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This File has been updated 10/31/96 to reflect the proper address of the:

National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230

For more information call: (703)306-1234

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NETWORK ACCESS POINT MANAGER,  
ROUTING ARBITER,  
REGIONAL NETWORK PROVIDERS, AND  
VERY HIGH SPEED  
BACKBONE NETWORK SERVICES PROVIDER  
FOR NSFNET AND THE NREN(SM) PROGRAM

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Amendment No. 1

In Section IV, QUESTIONS ABOUT THIS SOLICITATION, the solicitation states that the cutoff date for receipt of questions is "3:00P.M. Eastern Standard Time, Monday, May 31, 1993." Because the given date is the Memorial Day holiday, that cutoff is hereby extended for three (3) days to be "3:00P.M. Eastern Standard Time, Thursday, June 3, 1993."

We apologize for any inconvenience caused by this change.

Sincerely your,

Donald R. Mitchell  
Staff Associate, DNCRI

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NOTE

ANY ORGANIZATIONS RECEIVING THIS SOLICITATION ELECTRONICALLY ARE REQUESTED TO SEND EMAIL TO DMITCHEL@NSF.GOV OR A LETTER TO DONALD R. MITCHELL, STAFF ASSOCIATE, DNCRI, NATIONAL SCIENCE FOUNDATION, 1800 G ST., N.W., WASHINGTON, DC 20550 SO THAT ANY FOLLOW-UP MATERIAL MAY BE SENT OUT TO ALL INTERESTED ORGANIZATIONS.

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Program Solicitation

NATIONAL SCIENCE FOUNDATION

I. PURPOSE OF THIS SOLICITATION

NSFNET has supported the data networking needs of the research and education community since 1986. It has become an essential infrastructure for that community and is used daily to facilitate communication among researchers, educators, and students and to provide them with remote access to information and computing resources. The number of users, the number of connected networks, and the amount of network traffic continue to grow rapidly.

NSFNET also supports the goals of the High Performance Computing and Communications (HPCC) Program which was delineated in the President's Fiscal 1992 and 1993 budgets and which became law with

the passage of The High Performance Computing Act of 1991 (Public Law 102-194). The National Research and Education Network (NREN/1/) Program, one of the four components of the HPCC Program, calls for gigabit-per-second networking for research and education by the mid-1990s. As steps towards achieving the goals of the NREN Program, "the National Science Foundation shall upgrade the National Science Foundation funded network, assist regional networks to upgrade their capabilities, and provide other Federal departments and agencies the opportunity to connect to the National Science Foundation funded network."/2/ This program solicitation relates directly to these activities.

Since the creation of the NSFNET in 1986, the data networking industry has evolved considerably. New companies have been created and a number of existing companies have shown increasing interest in data networking. These and other evolutionary changes have prompted the need for a new architecture for NSFNET. The expiration of the current Cooperative Agreement for NSFNET Backbone Network Services has prompted the need for a new solicitation for NSFNET services.

To provide for the continued development and growth of NSFNET and to support the goals of the NREN Program, a new architecture has been formulated and is specified here. The implementation of the architecture includes four separate projects for which proposals are herein invited: one or more Network Access Point (NAP) Managers; a Routing Arbiter (RA) organization; a provider organization for very high-speed Backbone Network Services (vBNS); and a set of Regional Networks which connect client/member institutions and which provide for interregional connectivity by connecting to NAPs and/or to Network Service Providers (NSPs) which are connected to NAPs. No solicitation is presented here for NSPs as it is anticipated that costs of operation of the NSPs will be recovered from users of the services that they provide.

The solicitation invites proposals for one or more NAP Manager organizations to arrange for and oversee NAPs (as specified below) where the vBNS, NSPs, and other appropriate networks may interconnect. This component of the architecture will provide access for other networks to the U.S. research and education community and will provide for the interconnection of networks in

a NAP environment .

The solicitation also invites proposals for an RA organization to establish and maintain databases and routing services which may be used by attached networks to obtain routing information (such as network topology, policy, and interconnection information) with which to construct routing tables. This component of the architecture will provide for an unbiased routing scheme which will be available (but not mandatory) for all attached networks. The RA will also promote routing stability and manageability, and advance routing technology.

The solicitation also invites proposals for a vBNS Provider to establish and maintain a vBNS that will support applications that require high network bandwidth. In the tradition of NSFNET and as discussed below, the vBNS Provider will demonstrate leadership in the development and deployment of high performance data communications networks. This component of the architecture will: provide for the interconnection of NSF Supercomputing Centers (Cornell Theory Center, National Center for Atmospheric Research, National Center for Supercomputing Applications, Pittsburgh Supercomputing Center, and San Diego Supercomputing Center); connect to all NSF-designated NAPs; provide for the interconnection of other locations which may be subsequently specified by NSF; support the development of a national high performance computing environment (the metacenter/3/); support other high bandwidth applications such as distributed high performance computing and isochronous visualization; and promote the development and deployment of advanced routing technologies. Traffic on the vBNS must be in support of research and education.

Regional Networks have been a part of NSFNET since NSFNET's inception and have been a major force in the drive towards ubiquitous network connectivity for the research and education community. The important role that regional networks have played and will continue to play is recognized in this solicitation. Existing and/or realigned regional networks may seek support to provide for interregional connectivity by connecting to NSPs that are connected to NAPs or by connecting directly to NAPs. Regional Network Providers are also anticipated to: connect regional network client/member organizations; support the general

networking needs of clients/members; and provide for the special networking needs of clients/members who have applications which justify high bandwidth. These later functions of regional networks are among the evaluation criteria for Regional Network Provider proposals, but only the interregional connectivity function will be supported under this solicitation.

It is anticipated that this solicitation will result in two or more separate five-year cooperative agreements between NSF and the organizations and/or consortia of organizations chosen as NAP Manager(s), RA, and vBNS Provider. It is also anticipated that this solicitation will result in a number of four-year cooperative agreements with organizations chosen as Regional Network Providers. Combinations of solicited services (such as NAP Manager and vBNS Provider) may be proposed with the exception that the same organization and/or consortium cannot propose to be both the vBNS Provider and the RA. If the same organization or consortium wishes to propose for both the Regional Network Provider Project and for one or more of the other projects, the Regional Network proposal must be submitted separately. Total NSF funding for all awards resulting from this solicitation is expected to be approximately \$18,000,000 per year.

This solicitation is issued pursuant to the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861 et seq) and the Federal Cooperative Agreement Act (31 U.S.C. 6305) and is not subject to the Federal Acquisition Regulations.

## II. BACKGROUND

The network of networks known as the Internet includes more than 10,000 IP (Internet Protocol) networks. These networks interconnect more than one million computers and millions of users throughout the world. The domestic portion of the Internet contains a number of NSF-supported networks. These include: campus network connections at educational institutions; regional networks; and the NSFNET Backbone Network Services. Broadly speaking, NSFNET consists of all of these networks together with a number of other networks at locations such as government laboratories and private corporations which are connected to

regional networks.

The Internet also includes other federally-sponsored networks such as the NASA Science Internet (NSI), the DOE ESnet, and the DARPA DARTnet and TWBnet. The multi-agency NREN Program includes these networks in addition to the NSFNET. These sponsoring agencies have provided for the interconnection and interoperability of their networks at Federal Information eXchange (FIX) access points.

It is anticipated that networks such as NSI and ESnet will continue to have acceptable use policies which restrict traffic to that which is in support of the missions of their funding agencies. On the other hand, any traffic which is in support of research and education will be permitted on the VBNS.

Because of the breadth of the charter of the NSFNET and because of its wide use by the research and education community, it is projected that the NSFNET user base will continue to grow and that its users will continue to require new levels of connectivity and network services. In addition to the anticipated growth in aggregated traffic, new applications such as distributed high performance computing and isochronous visualization make the provision of increasingly high network performance necessary for the continued success of NSFNET and to achieve the goals of the NREN and the HPCC Programs.

After consulting with many segments of the Internet community, issuing a draft solicitation, and receiving and considering comments on that draft, the National Science Foundation has developed this solicitation for one or more NAP Managers, an RA organization, a vBNS Provider, and Regional Network Providers. In the manner specified below, it is anticipated that NSFNET will: develop increasingly high performance network services; accommodate the anticipated growth in numbers of users and networks and in network traffic; and transition to a networking infrastructure that is increasingly provided by interconnected network service providers operating in a competitive environment.

### III. NETWORK ARCHITECTURE AND PROJECT REQUIREMENTS

NSF intends to establish a new network architecture for NSFNET in the following manner. A number of NAPs, as specified below, will be established where a vBNS and other appropriate networks will be interconnected. One or more NAP Manager organizations will arrange for and oversee the NAPs. An RA organization will provide routing services such as route servers and route databases for attached networks and will provide and make available certain routing services in support of the Internet community. Finally, regional networks will continue to provide various services for their client/member organizations and to provide for interregional connectivity through NAPs and/or NSPs that are connected to the NAPs. This section gives more details on this architecture and gives specific project requirements.

#### A. Network Access Points

Network Access Points (NAPs) are to be proposed, subject to the locations and characteristics described below, by organizations responding to the NAP Manager(s) Project. NAPs are described separately in this section because of their relevance to all projects described in this solicitation.

An Internet NAP is defined as a high speed network or switch to which a number of networks can be connected via routers for the purpose of traffic exchange and interoperation./4/ A NAP should have capacity adequate to keep up with the switching requirements of the attached networks. The attached networks are presumed to be part of the connected Internet, but the NAP itself may be of a lower protocol level; e.g., it may be a level two network or switch.

The NAP will be a conceptual evolution of the FIX and the Commercial Information eXchange (CIX). The FIX is currently built around a level two network, a 100 Mbps FDDI ring, with attached Internet networks operating at speeds of up to 45 Mbps. Neither the FIXes nor the CIX currently have dedicated route servers with route databases.

Examples of NAP implementation include but are not limited to: a LAN (like the FIXes); a MAN (Metropolitan Area Network) using a

service such as Switched Multimegabit Data Service (SMDS); and a high speed switch such as an ATM switch.

Traffic on NAPs awarded under this solicitation will not be restricted to that which is in support of research and education. This will, for example, permit two attached networks to exchange traffic without violating the use policies of any other networks interconnected at the NAPs. NSF will utilize announcements in the Federal Register and public discussion with the U.S. research and education community and other interested parties to develop policies on traffic and usage at NSF supported NAPs.

Priority and desirable NAP locations are specified below. NAPs will be established at the priority locations if at all possible. NAPs will be established at one or more of the desirable locations if finances and other circumstances permit. Only general geographic locations are given. Specific locations should be proposed, and NAP attachment policies should promote fair and equitable pricing for and access to NAP attachment.

#### Priority NAP locations

- o California
- o Chicago
- o New York City

#### Desirable NAP locations

- o Atlanta
- o Boston
- o Denver
- o Texas
- o Washington, D.C.

#### B. NAP Manager(s) Project

One or more NAP Manager organizations will be selected to arrange for and manage NAPs which they have proposed. Prospective NAP Managers may utilize different subawardees for different NAPs where appropriate.



The specific anticipated duties of the NAP Manager organization(s) are as follows:

- o Establish, operate, and maintain, possibly with subawardees, all or a subset of the specified NAPs for the purpose of interconnecting the vBNS and other appropriate networks. Traffic on NAPs will not be restricted to that which is in support of research and education;

NAPs can be proposed to be implemented as LANs or MANs or other innovative approaches. NAPs must operate at speeds commensurate with the speeds of attached networks and must be upgradable as required by demand, usage, and Program goals. NAPs must support the switching of IP (Internet Protocol) and CLNP (ConnectionLess Networking Protocol) packets

- o Develop and establish attachment policies (including attachment fee schedules) which would apply to networks that are connected to NAPs
- o Propose NAP locations subject to the given general geographic locations. Propose fair and equitable pricing for NAP attachment as discussed above
- o Propose and establish procedures to work with personnel from other NAP Managers (if any), the RA, the vBNS Provider, and regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users
- o Specify reliability and security standards for the NAPs and procedures to ensure that these standards are met
- o Specify and provide appropriate NAP accounting and statistics gathering and reporting capabilities
- o Specify appropriate procedures for access to the NAP premises (if any) for authorized personnel of connecting networks and ensure that these procedures are carried out

### C. Routing Arbiter Project

Under the current cooperative agreement, the same consortium which provides the NSFNET Backbone Network Service also acts as routing arbiter. Under the new cooperative agreements described here, the routing arbiter function will be distinct from the vBNS. That is, the same organization and/or consortium cannot propose to be both the vBNS Provider and the RA. The RA will provide for equitable treatment of the various network service providers with regard to routing administration and will provide for a common database of route information to promote stability and manageability of the network.

The RA will provide database management for information such as network topology, policy (routing path preferences), and interconnection information which can be used by attached networks to build routing table configurations. The RA will make this data publicly accessible, but will not mandate its use by attached networks. In addition, this information will be used to configure attached route servers in support of NSPs and other attached networks. Route servers are to support stable routing of the Internet and to provide for simplified routing information to NSPs and other attached networks. It is expected that route servers will use standard routing protocols, such as BGP (Border Gateway Protocol, RFC 1267) and ISO IDR (Interdomain Routing Protocol, ISO 10747).

The RA organization will also provide certain other services which will facilitate the logical interconnection of the attached networks. For example, it will assist in the development of new routing technologies and the deployment of simplified routing strategies for attached networks. It will also assist in the development of tools which can be used to configure, manage, and operate network routing systems.

The specific anticipated duties of the RA organization are as follows:

- o Promote Internet routing stability and manageability

- o Establish and maintain network topology and policy databases, possibly at each NAP, by means such as exchanging routing information with and dynamically updating routing information from the attached Autonomous Systems using standard inter-domain routing protocols such as BGP and IDRP. RA activities must support the network service providers which switch IP (Internet Protocol) and CLNP (ConnectionLess Networking Protocol) packets
  
- o Propose and establish procedures to work with personnel from the NAP Manager(s), the vBNS Provider, and regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users
  
- o Develop advanced routing technologies (such as type of service and precedence routing, multicasting, bandwidth on demand, and bandwidth allocation services) in cooperation with the global Internet community
  
- o Provide for simplified routing strategies, such as default routing, for attached networks
  
- o Promote distributed operation and management of the Internet

#### D. Very High Speed Backbone Network Services Provider Project

Since its inception, the NSFNET has been a leader in providing for high speed networking services for the research and education community. The vBNS will continue this tradition and will provide for: high speed interconnection of NSF Supercomputing Centers (SCCs); the development of a national high performance computing environment (the metacenter); applications involving distributed high performance computing and isochronous visualization; and connection to the NSF-specified NAPs. The vBNS connections to the NAPs will, for example, facilitate connecting the SCCs to research institutions that have meritorious high bandwidth network

applications.

The vBNS must be able to switch both IP and CLNP packets and it must operate initially (at least between SCCs) at speeds of 155 Mbps or higher. Speeds should be achieved directly, not by the provision of multiples of slower speed services. Speeds higher than 155 Mbps are desirable and may be preferred if finances and other circumstances permit. Additionally, the vBNS Provider must participate in the development and deployment of advanced Internet routing technologies such as type of service and precedence routing, multicasting, bandwidth on demand, and bandwidth allocation services.

The vBNS may have connections and customers beyond those specified by NSF provided that the quality and quantity of required services for NSF-specified customers are not affected. In this regard, the vBNS Provider must be able to distinguish between NSF customer traffic and that of other customers and to gather and report traffic statistics (such as throughput and delay) based on these categories. It must also be able to assure proposed service levels for NSF-specified customers.

The specific anticipated duties of the vBNS Provider are as follows:

- o Establish and maintain a 155 Mbps or higher transit network service which switches IP and CLNP packets and which interconnects NSF SCCs (Cornell Theory Center, National Center for Atmospheric Research, National Center for Supercomputing Applications, Pittsburgh Supercomputing Center, and San Diego Supercomputing Center) and the NSF-specified NAPs (and possibly other specified locations in the future)
- o Propose and establish a set of quality of service (QoS) metrics which will be used to characterize the proposed network services and to ascertain and publicize network performance on an ongoing basis
- o Propose and establish a schedule to enhance the speed at which the network operates, quality of service measures,

and type of service offerings in line with NSF's broad program goals and consistent with anticipated NSF customer requirements and available funding

- o Propose and establish procedures to work with personnel from the NAP Manager(s), the RA, and regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users
- o Participate in the development of advanced routing technologies (such as type of service and precedence routing, multicasting, bandwidth on demand, and bandwidth allocation services) in cooperation with the RA and with the global Internet community
- o Subscribe to the policies of the NAP Manager(s) and the RA; implement procedures based on standard inter-domain routing protocols such as BGP-and IDRP-based to assist in establishing and maintaining the network topology and policy databases

#### E. Regional Networks Project

Regional Networks have been a part of NSFNET since its inception and have been a major force in the drive towards ubiquitous network connectivity for the research and education community. Regional Network Providers connect an increasingly broad base of client/member organizations, provide for interregional connectivity, and provide other networking services for their clients/members. One such networking service may be the provision of special connections for their client/member institutions that have meritorious high bandwidth network applications.

It is anticipated that regional networks will continue to play these important roles. Existing and/or realigned regional networks are invited to propose how they will meet the interregional connectivity needs of their client/member organizations. Under awards resulting from this solicitation, NSF will support regional networks for the provision of interregional connectivity. They may

connect to NSPs which connect to NAPs, or they may connect to NAPs directly. (If they connect to NAPs directly, they may require additional arrangements with one or more NSPs to provide them with inter-NAP connectivity.)

Under awards resulting from unsolicited proposals and/or from proposals submitted in response to existing and anticipated solicitations and program announcements, NSF may support regional networks for activities such as: providing special connections for client/member institutions that have meritorious high bandwidth network applications; providing innovative information services to client/member organizations; and providing connection assistance to new client/member institutions of higher learning.

Regional networks may attach to one (or more) NSPs that are connected to NAPs to obtain interregional connectivity. Regional networks may also attach directly to one (or more) NAPs. Under this second approach, some further arrangement (such as procuring inter-NAP connectivity services from an NSP) would be required to obtain full interregional connectivity.

Under this solicitation regional networks may propose to NSF for support of the fee for either attachment to and use of one NSP or attachment to and use of one NAP. The amount of available funds may limit the number and size of awards that can be made. The amount of each award will in general be related to the number of proposed clients/members which are institutions of higher learning and to the aggregate bandwidth requirements of those clients/members. In each year after the first, NSF support for the NSP fee and/or the NAP fee will decrease and will cease at the end of the regional network cooperative agreement (which shall be no more than four years).

The specific anticipated duties of the regional network providers are listed below. Only the first-listed duty will be supported under awards resulting from proposals submitted in response to this solicitation.

- o Provide for interregional connectivity by means such as connecting to NSPs which are connected to NAPs and/or by connecting to NAPs directly and making inter-NAP

connectivity arrangements with one or more NSPs

- o Provide for innovative network information services for client/member organizations (in cooperation with the InterNIC, the NSFNET Network Information Services Manager)
- o Propose and establish procedures to work with personnel from the NAP Manager(s), the RA, the vBNS Provider, and other regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users
- o Provide services which promote broadening the base of network users within the research and education community
- o Provide for, possibly in cooperation with an NSP, high bandwidth connections for client/member institutions who have meritorious high bandwidth network applications
- o Provide for network connections to client/member organizations

#### F. Other Architectural and Policy Considerations

It is possible that other NAPs beyond those specified by NSF may be established by members of the networking community. The various network service providers called for in this solicitation may at their own discretion and expense utilize the services provided by such NAPs provided that the quality and quantity of required services for NSF-specified customers are not affected. These providers will be neither required by nor supported by NSF to include such NAPs in their interconnectivity tasks unless specifically designated and/or approved by NSF in advance.

It is anticipated that networks other than the vBNS will connect to the NSF-specified NAPs. Examples of such networks include: NSPs; other federally-sponsored networks; other network service providers (beyond those connecting regional networks); and international networks.

To qualify for NSF support for NSP attachment and/or for the provision of interNAP connectivity, a regional network must attach to an NSP that connects all NSF-specified priority NAPs. Such NSPs must also be able to assist such attachment-supported regional networks to provide special connections to a NAP for client/member institutions which have meritorious high bandwidth network applications. Other qualifying networks can connect to one or more NAPs as requirements dictate.

Attachment to one or more NAPs will require the payment of both an initial and an annual fee (which will depend on parameters such as number of NAP connections and bandwidth of each connection). Fees will be proposed by the NAP Manager(s) and approved by NSF.

To attach to a NAP, a network must implement BGP- and IDRP-based procedures to assist in establishing and maintaining the network topology and policy databases maintained by the RA. Networks attaching to NAPs must operate at speeds of 1.5 Mbps or greater and must be able to switch both IP and CLNP packets. The requirements to switch CLNP packets and to implement IDRP-based procedures may, however, be waived by NSF based on the overall level of service to the R & E community, stimulus to the growth of the network and economies of scale, the Governments' desire to foster the use of ISO OSI protocols and other considerations of the public interest..

#### IV. QUESTIONS ABOUT THIS SOLICITATION

In order that all proposers receive the same information, all questions regarding this solicitation should be directed to the NSF in the manner indicated below. All questions must be submitted in writing. Questions must be received by 3:00 P.M. Eastern Standard Time, Monday, May 31, 1993, at:

National Science Foundation  
Division of Networking and Communications Research  
and Infrastructure  
1800 G Street, N.W., Room 416  
Washington, D.C. 20550



ATTN: D.Mitchell (NSFNET Inquiry)

Telephone, facsimile, and electronic mail questions will not be accepted.

Substantive questions received and the NSF's answers to them will be sent to all solicitation recipients approximately fourteen (14) calendar days thereafter.

#### V. PROPOSAL SUBMISSION INFORMATION

The following subsections describe: who may submit proposals in response to this solicitation; key personnel requirements; proposal submission address and due date; public access rights to proposals that result in an award; and evaluation criteria that will be applied to submitted proposals.

##### A. Who May Submit

Proposals for these projects may be submitted by U.S. entities including academic institutions, not-for-profit or for-profit organizations, or a consortium of several such organizations. Should an award be made to a consortium in response to this solicitation, that consortium must have a single lead organization, and the Principal Investigator/Project Director (PI/PD) must be an employee of that organization.

If the same organization wishes to propose for both the Routing Arbiter and the Very High-Speed Backbone Service provider, please be advised that while an organization may propose to perform both of these functions, these two activities will not be awarded to a single organization. Organizations submitting proposals for both should clearly indicate any preference.

If the same organization or consortium wishes to propose for both the Regional Network Provider Project and for one or more of the other projects, the Regional Network proposal must be submitted separately.

It is recommended that appropriate administrative officials of proposing organizations be familiar with the policies and procedures stated in the NSF Grant Policy Manual/5/ (GPM) which are applicable to NSF awards. If a proposal is recommended for an award, the NSF Division of Grants and Contracts will request certain organizational, management, and financial information from the submitting organizations. This information must be submitted before any award is made. These requirements are described in Chapter III of the GPM.

#### B. Key Personnel

For each award made, the individual designated as PI/PD and other personnel deemed critical to the effort will be named in a key personnel clause. NSF approval is required prior to diversion or replacement of key personnel. The PI/PD will be the primary point of contact with NSF.

#### C. Proposal Submission and Due Date

Ten (10) copies of the proposal, including one copy bearing original signatures, should be mailed to:

Proposal Processing Unit - Room 223  
Attn: NSFNET Project, NSF 93-52  
National Science Foundation  
1800 G Street, NW  
Washington, D.C. 20550

Only one (1) copy of NSF Form 1225, Information About PI/PD, should be sent, attached to the original signed proposal.

Proposals may also be submitted electronically. For information, contact the Electronic Proposal Submission Program Director, Division of Information Systems, via phone (202) 357-7439, or via electronic mail ([eps@nsf.gov](mailto:eps@nsf.gov)).

Proposals submitted in response to this solicitation must: (a) be

received by NSF no later than Tuesday, August 17, 1993; (b) be postmarked no later than five (5) days prior to the deadline date; or (c) be sent via commercial overnight mail no later than two (2) days prior to the deadline date to be considered for award. Proposals submitted electronically will be dated when they enter the NSF system.

#### D. Rights to Proposal Information

A proposal that results in an NSF award will become part of the record of the transaction and will be available to the public on specific request. Information or material that NSF, after consultation with the awardee, determines to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act (5 U.S.C. 552). Without assuming any liability for inadvertent disclosure, NSF will seek to limit dissemination of such information to its employees and, for purposes of evaluation of the proposal, to outside reviewers.

Accordingly, any privileged information contained in the proposal should be clearly marked or indicated (as with an asterisk or highlighter) and identified by a legend similar to the following: "Following is ((proprietary) or (specify)) information that (name of proposing organization) requests not be released to persons outside the Government, except for purposes of evaluation."

#### E. Evaluation of Proposals

Evaluation of proposals in response to this solicitation will be administered by the Division of Networking and Communications Research and Infrastructure of NSF. The proposals will be reviewed by one or more merit review panels chosen by NSF. At the discretion of NSF, site visits may also be conducted.

The proposals offering the greatest overall merit in meeting the requirements of these NSFNET Projects will be determined in accordance with the following special criteria. The first set of criteria applies to all of the projects contained in this solicitation, and the subsequent sets of criteria apply to each

specific project in turn. For each specific project, the general criteria and the specific criteria are of equal importance.

## 1. Criteria for all projects

Criteria are listed in descending order of criterion importance.

- o Quality and quantity of the proposed services. Also, the quality of performance measures which the proposer must develop and adopt to ascertain (at least quarterly) the quality and quantity of the proposed services
- o Plans to assure high quality services to the networking community during the transition to this new NSFNET architecture
- o Comprehension of the current Internet environment, vision as to how the NSFNET and NREN program should evolve, and relationship of proposed services to emerging international standards such as SONET, ATM, SMDS, and FDDI
- o Capability to design and provide and/or coordinate the proposed services. Factors include: use of innovative (but not untested) approaches; ability to adjust to rapidly changing service requirements; and ability to develop, adopt, and employ new technologies and relevant standards
- o Proposed procedures to work with personnel from the NAP Manager(s), the RA, the vBNS Provider, and regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users
- o Documentation of the qualifications of the proposing organization(s), including: experience applicable to the provision, operation and management of the proposed NSFNET Project(s); if a consortium and/or major subawards are proposed, experience in managing subawards with special emphasis on establishing performance standards

and monitoring quality control; and description of proposed facilities

- o Capabilities and experience of key personnel including those that are part of any subaward

## 2. Criteria for individual projects

Evaluation criteria that are specific to each project are specified in the subsections below. Criteria are listed in descending order of importance.

### a) Network Access Point Manager(s) Project

- o Proposed plan to establish, operate, and maintain all or a subset of the specified NAPs. Also proposed plan to insure that NAPs operate at speeds commensurate with the speeds of attached networks and will be upgradable as required by demand, usage, and Program goals
- o Proposed attachment policies (including type of equipment supported and attachment fee schedules) which would apply to networks that connect to NAPs; and the degree to which they promote fair and equitable pricing for NAP attachment
- o Proposed NAP priority and/or desirable locations
- o Proposed reliability and security standards for the NAPs and proposed methods to ensure that these standards are met
- o Proposed NAP accounting and statistics gathering and reporting capabilities
- o Proposed access procedures to the NAP premises (if any) for authorized personnel of connecting networks and proposed method to ensure that these procedures are carried out

### b) Routing Arbiter Project

- o Proposed plan to promote Internet routing stability, integrity, manageability, and quality
- o Proposed plan to establish and maintain route servers with network topology and policy databases
- o Proposed plan for developing advanced routing technologies in cooperation with the global Internet community
- o Proposed plan for developing simplified routing strategies for attached networks
- o Proposed plan to promote the distributed operation and management of the Internet in cooperation with similar functions from other domains; proposed tools to aid in the management of the Internet

c) Very High Speed Backbone Network Services Provider Project

- o Proposed plan to establish and maintain a (minimum) 155 Mbps vBNS which interconnects NSF SCCs and the NSF-specified NAPs
- o Proposed quality of service (QoS) metrics, including ability to verify and assure proposed service levels for NSF-specified customers
- o Proposed schedule for enhancing the speed at which the network operates, quality of service measures, and type of service options
- o Proposed participation in the development of advanced routing technologies (such as type of service and precedence routing, multicasting, bandwidth on demand, and bandwidth allocation services) in cooperation with the global Internet community
- o Proposed plan for subscribing to the policies of the NAP Manager(s) and the RA; proposed implementation of BGP-and

IDRP-based procedures to assist in establishing and maintaining the network topology and policy databases

d) Regional Network Providers Project

- o Proposed plan to provide for interregional connectivity including relationships with and descriptions of any involved NSPs
- o Number of client/member organizations that are institutions of higher learning and justification of proposed bandwidths of connections to those institutions; plan for broadening the base of network users in the research and education community
- o Cost effectiveness of proposed services for client/member organizations; plan and/or proposal to leverage funds sought from NSF
- o Proposed plan to provide for innovative network information services for client/member organizations (in cooperation with the InterNIC, the NSFNET Network Information Services Manager)
- o Proposed plan to provide for high bandwidth connections for client/member institutions who have meritorious high bandwidth network applications
- o Proposed plan to provide for network connections to client/member organizations

In addition to technical merit, the cost of all proposed services, both to the government and to the networking community as a whole, will be considered.

VI. AWARD INFORMATION

NSF reserves the right to make two or more awards as a result of proposals received in response to this solicitation. NSF also reserves the right to make no award.

Should two or more awards be made, it is contemplated that they will be Cooperative Agreements providing operational support for a period of five years (four years in the case of regional network awards). It is expected that any resulting awards will be announced in the winter of 1993.

Following the awards, the NAP Manager(s), the RA, and the vBNS Provider will be required to develop operations agreements with the current NSFNET Backbone Network Services Provider (Merit, Inc.) and with each other to insure that NSFNET continues to operate smoothly both during the transition and afterwards.

The progress, plans, and services of all the providers will be assessed annually. In particular, the quality and quantity of the services should be ascertainable annually during the period of the agreement by performance measures which the proposers must develop and adopt. Reasonable determination(s) may be made at any time about any additional, increased, decreased, or modified services within the general scope and context of the agreements and NSF may negotiate appropriate modification(s) to the award(s).

After eighteen (18) months of operation, the performance of the NAP Manager(s), RA, vBNS Provider, and the Regional Network Providers will be externally reviewed. The review will determine if the awardees are meeting established goals and objectives. The review will be used to determine whether and at what level NSF will continue to support the awardees beyond the second year.

Awards resulting from this solicitation are administered in accordance with the terms and conditions of GC-1, "Grant General Conditions", and CA-1, "Cooperative Agreement General Conditions". Copies of these documents are available at no cost from the NSF Forms and Publications Unit, via phone (202) 357-7861, or via electronic mail (pubs@nsf.gov). More comprehensive information is contained in the NSF GPM.

## VII. CONTENTS OF PROPOSAL

Proposals should be prepared as follows in accordance with the



guidelines contained in the brochure Grants for Research and Education in Science and Engineering, (GRESE) (NSF 92-89 rev 10/92) (available from the NSF Forms and Publications Unit as referred to above). Each proposal should reflect the unique combination of the proposing organization's interests and capabilities in providing network services to support research and education users of the NSFNET.

Since reviewers will be asked to review more than one proposal, lengthy proposals are not recommended. However, proposers are specifically advised that the page limits contained in the GRESE have been waived for proposals submitted in response to this solicitation. Appendices other than those from the GRESE brochure and Appendices A and B described below will not necessarily be considered in the merit review process. Proposals should be securely fastened together, but not placed in ring binders.

Proposals should contain the following Sections and Appendix A. Regional Network Proposals should also include Appendix B. (References below to appendices with roman numerals are references to appendices in the GRESE brochure):

A. NSF Cover Page(s) (Appendix IV)

All consortium members and/or all major subawardees should complete and submit a copy of this page.

B. Information about Principal Investigator/Project Director (Appendix III)

Attach one copy to the original signed proposal. Do not include the form within the body of the proposal.

C. "Certification Regarding Lobbying" form See page 26 of GRESE.

D. Results from prior NSF support

E. List of collaborators within past 48 months and names of graduate and postdoctoral advisors of each investigator

F. Current and pending support for key personnel (Appendix VII)

G. Table of Contents with page numbers keyed to the major sections of the proposal

H. Executive Summary of no more than two pages which provides a brief description of the proposed effort

I. Explicit procedures for monitoring the quality, availability and effectiveness of the services provided. Risk/benefit analysis of proposed new technologies

J. Plans to assure high quality services to the networking community during the transition to this new NSFNET architecture

K. Vision as to how the NSFNET and NREN program should evolve, and relationship of proposed services to emerging international standards such as SONET, ATM, SMDS, and FDDI

L. Proposed procedures to work with personnel from the NAP Manager(s), the RA, the vBNS Provider, and regional and other attached networks to resolve problems and to support end-to-end connectivity and quality of service for network users

M. Documentation of the qualifications of the proposing organization(s), including

- o experience applicable to the provision, operation and management of the proposed NSFNET Project
- o if a consortium and/or major subawards are proposed, experience in managing subawards with special emphasis on establishing performance standards and monitoring quality control
- o description of proposed facilities

N. Documentation of technical and managerial qualifications of key personnel including those that are part of any subaward.

(Curricula vitae of key personnel should be placed in Appendix A.)

Sections for the Network Access Point Manager(s) Proposers

O. Proposed plan to establish, operate, and maintain all or a subset of the specified NAPs. Also proposed plan to insure that NAPs operate at speeds commensurate with the speeds of attached networks and will be upgradable as required by demand, usage, and Program goals

P. Proposed attachment policies (including type of equipment supported and attachment fee schedules) which would apply to networks that connect to NAPs

Q. Proposed NAP locations

R. Proposed reliability and security standards for the NAPs and proposed methods to ensure that these standards are met

S. Proposed NAP accounting and statistics gathering and reporting capabilities

T. Proposed access procedures to the NAP premises (if any) for authorized personnel of connecting networks and proposed method to ensure that these procedures are carried out

#### Sections for the Routing Arbiter Proposers

U. Proposed plan to promote Internet routing stability, integrity, manageability, and quality

V. Proposed plan to establish and maintain network topology and policy databases

W. Proposed plan for developing advanced routing technologies in cooperation with the global Internet community

X. Proposed plan for developing simplified routing strategies for attached networks

Y. Proposed plan to promote the distributed operation and management of the Internet; proposed tools to aid in the management of the Internet

Sections for the Very High Speed Backbone Network Services Provider Proposers

Z. Proposed plan to establish and maintain a vBNS which interconnects NSF SCCs and the NSF-specified NAPs

AA. Proposed quality of service (QoS) metrics, including ability to verify and assure proposed service levels for NSF-specified customers

AB. Proposed schedule for enhancing the speed at which the network operates, quality of service measures, and type of service options

AC. Proposed participation in the development of advanced routing technologies (such as type of service and precedence routing, multicasting, bandwidth on demand, and bandwidth allocation services) in cooperation with the global Internet community

AD. Proposed plan for subscribing to the policies of the NAP Manager(s) and the RA; proposed implementation of inter-domain routing procedures to assist in establishing and maintaining the network topology and policy databases

Sections for the Regional Network Proposers

AE. Proposed plan to provide for interregional connectivity including relationships with and descriptions of any involved NSPs

AF. List of client/member organizations that are institutions of higher learning and proposed bandwidths of connections to those institutions. Plan for broadening the base of provided services to the research and education community

AG. Cost effectiveness of proposed services for client/member organizations. Plan and/or proposal to leverage funds sought from NSF

AH. Proposed plan to provide for innovative network information services for client/member organizations (in cooperation with the NSFNET Network Information Services Managers)

AI. Proposed plan to provide for high bandwidth connections for client/member institutions who have meritorious high bandwidth network applications

AJ. Proposed plan to provide for network connections to client/member organizations

Sections for all proposers

AK. A proposed five-year (four-year in the case of Regional Network proposers) budget narrative/business plan (referred to as "the narrative" in this paragraph) for funds requested from NSF

The narrative should be organized by the (proposed) sub-areas described in Section III, Project Requirements of this solicitation on a per year basis. The narrative should contain information about the services proposed and explain the significant costs associated with the individual sub-areas proposed. The annual costs of each sub-area should be explained in sufficient detail to allow identification of such items as the proposed level of effort for professional and support personnel (and associated direct and indirect costs), travel, equipment, subawards, and profit (if any). If for estimating purposes, the proposer normally uses fully loaded labor rates, such rates may be used if their derivation is explained.

AL. Summary Proposal Budget (NSF Form 1030) for the cumulative five-year period plus individual annual budgets (on NSF Form 1030) for each year (Appendix V)

As instructed on the reverse side of NSF Form 1030, identify each year's request (e.g., ~Cumulative Budget~, ~First Year~, etc.) in the margin at the top right of the form.

Upon completion of the project, a Final Project Report (NSF Form 98A), including the Part IV Summary, will be required. Proposers should review this form prior to proposal submission so that appropriate tracking mechanisms are included in the proposal plan to ensure that complete information will be available at the completion of the project.

## Appendix A. Curricula Vitae

Biographical information (limited to two pages) on the principal investigator and other key individuals from all organizations who will be directly involved in the management and operation of the project. Lists of publications for each individual should be limited to the five most relevant.

## Appendix B. (For Regional Network proposers only) Letters of intent from Institutions of higher learning

Regional Network Provider proposers should include a letter of intent from each client/member which is an institution of higher learning. These letters should be signed by a suitable officer of the institution.

## FOOTNOTES

/1/NREN is a service mark of the United States Government, administered by the National Science Foundation. Organizations receiving awards as a result of this solicitation may be asked to enter into trademark licenses in connection with the use of the NREN service mark.

/2/Public Law 102-194--Dec. 9, 1991. 15 USC 5521 (Section 201)

/3/MetaCenter Networking: A White Paper, Lambert et al, 1992

/4/The interconnection of networks produced by a NAP should be viewed more as a FIX interconnection than as a CNSS (Core Nodal Switching Subsystem) or ENSS (External Nodal Switching Subsystem) interconnection both of which are components of the current NSFNET Backbone Network Service.

/5/The NSF Grant Policy Manual (NSF 88-47, July 1989) is for sale through the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Telephone (202) 783-3288.

In accordance with Federal statutes and regulations and National Science Foundation (NSF) policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the NSF.

Privacy Act and Public Burden. Information requested on NSF application materials is solicited under the authority of the national Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be used and disclosed to qualified reviewers and staff assistants as part of the review process and to other government agencies. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records" and NSF-51, "Reviewer/Proposal File and Associated Records" 56 Federal Register 54907 (October 23, 1991). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

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 or any other aspect of this collection of information, including suggestions for reducing this burden, to: Herman G. Fleming, Reports Clearance Officer, Division of Human Resource Management, NSF, Washington, DC, 20550; and to Office of Management and Budget, Paperwork Reduction Project (3145-0058), Washington, DC 20503.

The Foundation has TDD (Telephonic Device for the Deaf) capability which enables individuals with hearing impairment to communicate with the Division of Personnel and Management for information relating to NSF programs, employment, or general information. This number is (202) 357-7492.

Facilitation Awards for Scientists and Engineers with Disabilities

(FAD) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on an NSF project. See the FAD program announcement (NSF Publication 91-54), or contact the FAD Coordinator in the Directorate for Education and Human Resources. The telephone number is (202) 357-7456.

The Foundation provides awards for research and education in most fields of science and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for such findings or their interpretation.

The Foundation welcomes proposal on behalf of all qualified scientists and engineers, and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research and research-related Programs described in this document.

This program is described in the Catalog of Federal Domestic Assistance, Number 47.070, Computer and Information Science and Engineering

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