NGI/CE/07

Native IPv6

FY 2003 Proposal to the NOAA HPCC Program

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| Title Page | Proposed Project | Budget Page |

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Proposal Theme: **NGI**

Funding Summary: FY 2003 $ 146,500 -- in-kind funds in place $103,000

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Native IPv6

Proposal for FY 2003 HPCC Funding

Prepared by: Jerry Janssen

Executive Summary:

On August 5, 2002 Internet2 announced that the nationwide Abilene backbone network will offer native next generation Internet Protocol (IPv6) service. This deployment makes high-performance IPv6 service available to over 200 Internet2 member institutions and thousands of other research and education institutions across the United States that have access to Abilene. IPv6 is a critical new technology which offers several improvements over IPv4. Most importantly, with 128-bit long Internet addresses instead of the 32-bit addresses of IPv4, IPv6 vastly increases the number of addresses available which, along with other improvements, paves the way for a large range of new applications. A previous HPCC proposal (NGI/CE/03) successfully enabled the Seattle and Boulder Network Operation Centers (NOCs) to participate in some of the initial testing and deployment of IPv6 using the Abilene infrastructure. The current IPv6 upgrade to the Abilene network will enable all Abilene connected NOAA sites to run the native IPv6 protocol.

This proposal will provide the resources necessary to enable native IPv6 at five key NOAA NOCs: Silver Spring, Norman, Miami, Seattle, and Boulder. In addition to providing direct experience with a new -and potentially critical- Internet protocol, the work involved with this proposal will benefit NOAA in three key ways: First, all involved sites will be required to install and maintain state-of-the-art routing hardware compatible with IPv6. This is a major step towards building a consistent routing infrastructure for the geographically dispersed NOAA sites and will facilitate the implementation of cooperative NOAA wide advanced network applications such as VPNs and reliable multicast. Second, this project will encourage network engineers from each site to work together to develop a common NOAA strategy for implementing the next generation Internet protocol. This type of cooperation was painfully absent during the implementation of IPv4 across our organization. And finally, native IPv6 is a critical component to the implementation of next the generation reliable multicast applications. The collection of and redistribution of real-time radar data and the dissemination of large-scale weather models are two examples where NOAA has the opportunity to be among the first to utilize a reliable multicast network application.

Problem Statement:

The basic concept of the Internet, established around 1973, is one of transparent transmission of datagrams across an arbitrary network of networks. Logical addresses were unique, and datagrams were not changed in transit. End systems handled error detection, retransmissions, security, naming, and binding. This concept determined the basic design of most of the original Internet applications. The transparency of the Internet has been eroded in recent years due to several factors including: Intranets, dynamic addressing, private addressing, firewalls, NATs, proxies and caches. The consequence of the loss of transparency in the Internet is that many applications either fail completely, or need modification, or must be specially handled by a

firewall or Network Address Translators (NAT) in order to work properly. It has become almost impossible to deploy new applications protocols globally. Instead new applications are being layered over old ones ("everything over HTTP").

The two primary factors contributing to this trend are the need for better network security and the shortage of IPv4 addresses. The IETF has responded to these problems by designing IPv6, the next generation Internet Protocol. IPv6 should eventually replace IPv4 and help bring back some transparency to the Internet. Although IPv6 will not abolish the Intranet concept (firewalls, caches, and proxies are here to stay) it will resolve the address shortage issue and it has built in support for authentication and privacy.

The transition to IPv6 will take several years and may never take place globally. For this reason IPv6 has been designed to coexist with its predecessor. But, IPv6 has capabilities such as expanded addressing and routing, authentication and privacy, quality of service, and native multicast that will never be supported by IPV4; so eventually all enterprise Internet users like NOAA must make the transition. It is important for NOAA to continue to gain experience with this protocol and to plan a coordinated approach for its own transition.

Proposed Solution:

This project will enable the NOAA Headquarters NOC, the Norman NOC, the Miami NOC, the Seattle NOC, and the Boulder NOC to cooperate in the implementation of a large-scale IPv6 deployment. This deployment will hopefully provide a model for a future NOAA wide transition to IPv6 when -and if- it becomes necessary.

The first step will be for the engineering staff at each NOC to research the IPv6 protocol. Since the specification is fairly new and does not closely resemble its predecessor IPv4, it will take time for some engineers to become familiar with its details. The next step will be to specify and purchase router upgrades for the sites that require them. Then an address plan must be agreed upon. The new routers will then be installed in a non-operational mode and IPv6 routes and traffic will be exchanged. After the successful implementation of IPv6, the new routing hardware may then be placed into operational IPv4 use. Finally the original IPv6 test configuration can be reactivated providing both native IPv4 and IPv6 support for the each site. Progress of the project will be logged on to a web site located at the Boulder NOC. In subsequent years the information gained may be used to bring along other NOAA sites.

Analysis:

This project is an investment in engineering expertise, cooperation and planning. It also provides an upgraded and consistent routing infrastructure for the participating NOAA sites. It helps position our organization for the use of advanced protocols such as reliable multicast. And finally it provides a template for a possible future NOAA-wide transition to the IPv6 protocol.

Performance Measures:

Milestones/Deliverables

Month 1	First coordination and planning meeting

Month 4	Research and training complete
Month 5	Router upgrades purchased & IPv6 address plan developed
Month 6	Router upgrades installed/tested in non-operational mode
Month 7	Routers passing IPv6 routes between NOCs
Month 9	Router upgrades installed to pass operational IPv4 traffic
Month 11	All routers in operational mode for IPv4 and IPv6
Month 12	Finalize website/report