NGI/CE/06

Native IPv6

FY 2004 Proposal to the NOAA HPCC Program

August 11, 2004

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Native IPv6

Proposal for FY 2004 HPCC Funding

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Executive Summary:

The Internet2 currently offers native Internet Protocol version 6 (IPv6) over the nationwide Abilene backbone network. IPv6 service is now available to over 200 Internet2 member organizations and thousands of research and education institutions with access to Abilene across the United States. IPv6 technology offers several necessary improvements over IPv4. IPv6 provides128-bit Internet addresses instead of the 32-bit addresses of IPv4 which increases the number of addresses available by many orders of magnitude. This, along with other improvements, paves the way for a huge array of new network technology developments.

A previous HPCC proposal (NGI/CE/07) was approved to enabled NOAA facilities in Silver Spring, MD; Norman, OK; Miami, FL; Seattle, WA; and Fort Worth, TX to participate in initial testing and deployment of IPv6 using the Abilene infrastructure. This proposal will provide the resources necessary to enable native IPv6 at additional key NOAA facilities located in Kansas City, MO; Salt Lake City, UT; Bohemia, NY; and Suitland MD. IPv6 service will enable all NOAA sites connected to Abilene to run the native IPv6 protocol between locations. In addition to providing the new sites direct experience with IPv6, the work involved with this proposal will benefit NOAA in three key ways: First, all eight 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 private IP VPNs and reliable multicast service. Second, this project will provide the catalyst for network engineers from each of the eight NOAA sites to develop a coherent strategy for the implementation of IPv6. Finally, native IPv6 is a critical component to the implementation of the next generation reliable multicast applications. The collection 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 original concept for the Internet was one that relied upon the 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. A 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 Internet Engineering Task Force (IETF) has responded to these problems by designing IPv6, the next generation Internet Protocol. IPv6 is envisioned to eventually replace IPv4 and 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 embedded support for authentication and privacy.

The transition to IPv6 will take several years and might never be adopted place globally. For this reason IPv6 has been designed to coexist with its predecessor, IPv4. However, 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 all enterprise Internet users like NOAA must eventually 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/NWS Headquarters in Kansas City, Salt Lake City, and Bohemia as well as the NESDIS site in Suitland to participate with the five existing sites in the implementation of a large-scale IPv6 deployment. This implementation of an eight site IPv6 network will provide a model for a future NOAA wide transition to the new protocol.

As a first step in implementing the IPv6 network, NOAA engineering staff at each NOC have been trained in the IPv6 protocol via formal classes and through additional research. High performance routing equipment for the first five sites has been purchased. The next step, currently in process, is the development of an IP address plan. With an address plan in place, the new routers will 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 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:

The addition of these three sites to the IPv6 network 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