

6NET

Large-scale International IPv6 Pilot Network

Abstract:

6NET is a three-year European project to demonstrate that continued growth of the Internet can be met using new IPv6 (Internet Protocol Version 6) technology. It also aims to help European research and industry play a leading role in defining and developing the next generation of networking technologies.

Objectives:

The main objective of the project was to install and operate a pan-European pilot IPv6 network with both static and mobile components in order to gain a better understanding of IPv6 deployment issues.

It also allows migration strategies for integrating IPv6 networks with existing IPv4 infrastructure to be tested, as the two technologies will need to coexist for several years.

A network also requires services and applications in order to be useful, so the project is porting existing software to work with IPv6. In conjunction with this, it is investigating how legacy software can operate on IPv6 infrastructure.

Last but not least, the project aims to collaborate with other IPv6 activities such as Euro6IX and 6LINK, and contribute to standardisation bodies such as the IETF (Internet Engineering Task Force). It also sees itself playing an important role in promoting IPv6 technology at both the national and international level.

Technical Approach:

6NET is comprised of several work areas that focus on various aspects of IPv6 technology:

–6NET built and operates the native IPv6 network infrastructure (including addressing and naming schemes, routing architecture and peering policy). 6NET runs the NOC (Network Operations Centre), and facilitating interconnection with other IPv6 networks (e.g. Euro6IX, Abilene in the US and KOREN in Korea). The partners in 6NET carefully assessed interworking and migration issues that allow for the smooth change from IPv4 to IPv6 at all levels of networking (backbone, regional and campus)

–The provision of basic network services on top of IPv6 is key for the success of the new Internet protocol. Partners in 6NET design, implement and tests IPv6-enabled network services such as routing (both inter-domain and intra-domain), DNS, DHCP, registry procedures, quality-of-service (QoS) and multicasting. Additionally network management issues like configuration, fault reporting and security issues related to IPv6, as well as the development of appropriate management tools have been addressed. The new features introduced in IPv6, such as mobility, autoconfiguration, multihoming and renumbering are fully exploited as well.

Testbed:

During 2002, a backbone IPv6 network connecting fifteen countries and running at 155 Mbps was installed and tested. Local access is being provided through national IPv6 testbeds operated by partner NRENs (National Research and Education Networks) such as JANET (UK), RENATER (France) and SWITCH (Switzerland). Connectivity to the non-European 6NET partners in Japan and South Korea is provided via the UK6X Internet Exchange and RENATER respectively.

The 6NET backbone also has connections to Abilene in the US (via SURFnet), Euro6IX (via the UK6X) and to the 6Bone (which is a virtual network). GÉANT is connected as well, and provides the remaining European NRENs with links to 6NET.

Innovation:

6NET aims to encourage the adoption of IPv6 by resolving the two major hurdles that are considered to be hindering its widespread acceptance. These are to demonstrate that IPv6 is fully functional and stable, and to demonstrate that IPv6 offers distinct advantages over IPv4.

The project is working on the new features of IPv6 such as mobility, self-configuration, IPsec (security) and classes of service, with respect to how they might be used, and to identify which elements are missing. The aim is to make these extra features available as quickly as possible, in order to provide an added incentive for people to move to IPv6.

Results:

A pan-European IPv6 backbone network has been established and basic routing (using IS-IS and BGP4+), tunneling (IPv6 over IPv4) and DNS support has set-up and tested. A multicast overlay network (M6Bone) has been established, and is being used for conferencing and radio broadcasting (e.g. Norwegian State Radio). IPv6 has also been successfully tested over MPLS, ATM and WLAN-based networks, whilst IPv4/IPv6 dual-stack operation has been implemented as a production service on the GÉANT network.

A great deal of experience has been gained with transitional issues. Components important to widespread IPv6 deployment such as DHCPv6, autoconfiguration, multihoming, renumbering and mobile IPv6 have been evaluated, and feedback provided to the developers.

A core set of applications to develop or port to IPv6 have been identified in the categories of videoconferencing and streaming (e.g. GnomeMeeting, ISABEL and FreeAMP), online gaming (e.g. Quake and XPilot), e-business solutions (e.g. Globus and OpenLDAP) and edge services (e.g. proxy caching). Some of these are already available, and others will become available towards the end of 2003. In addition, several IPv6 traffic measurement and visualisation tools have been released (e.g. NetSNMP and Smokeping).

The project has organised two informational workshops and several training events on IPv6.

Contribution to Standards:

6NET actively contributes to the IETF, particularly to the ipv6, v6ops (formerly ngtrans) and multi6 working groups. Indeed, one of the 6NET participants is a co-chair of v6ops.

A number of Internet Drafts have been submitted in the areas of site- local addressing, multicasting, 6to4 security, SNMP over IPv6, application porting, 3GPP and DNSSEC. These are areas which were previously poorly defined, and 6NET has been able to provide input based on its operational experiences.

6NET has also contributed to the IEEE (Institute of Electrical and Electronics Engineers) in the areas of IPv6 transition and mobile source-specific multicasting. In addition, it regularly provides updates to RIPE (Réseaux IP Européens), a collaborative forum of European ISPs.

Success Stories:

The 6NET network has demonstrated that IPv6 is deployable in a production environment with the same functionality as IPv4. Not only does it solve the shortage of addresses, but it also promises a number of enhanced features which are not an integral part of IPv4. The GÉANT network has already moved to dual-stack operation, and other NRENs are planning to do so shortly. The 6NET network itself has been used to provide IPv6 connectivity to a number of worldwide events.

The experience gained during the project is also being turned into 'cookbooks' aimed at network administrators. Cookbooks on migrating backbone and campus networks from IPv4 to IPv6, and network management have already been published, and others are currently being produced.

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6NET

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