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Abstract: The two projects 6NET and Euro6IX both focus on large-scale IPv6 deployment, but for different market segments, research/academic and commercial, respectively. They have in common the objective of disseminate the results related to IPv6 technology, standards, coexistence and transition, applications, internetworking and interoperability, users requirement, constraints, research activities related to deployment issues, etc.. In this context, the two projects had organized a joint workshop at Limerick, co-located with Terena conference on 5 th of June, in collaboration with IPv6 cluster facilitated by 6LINK project. This report summarizes the result of this workshop in Limerick on 5 th June 2002.

Keywords: 6NET, Euro6IX, IPv6, Joint Workshop

Revision History

The following table describes the main changes done in the document since its creation

Revision	Date	Description	Author (Organization)
v0.0	04/07/2002	Document creation	Sathya Rao (Telscom)
v0.1	20/08/2002	Formating of the document	Sathya Rao (Telscom)
v0.2	21/08/2002	Overall review and template agreement	Jordi Palet (Consulintel)
v0.3	22/08/2002	Final comments	Sathya Rao (Telscom)
v0.4	28/08/2002	PSC Review	Jordi Palet (Consulintel)

Executive Summary

The 6NET and Euro6IX projects both focus on large-scale IPv6 deployment, but for different market segments. 6NET is deploying an IPv6 infrastructure in an academic and research environment, with a high-capacity native IPv6 backbone spanning many countries. Euro6IX is deploying a number of pre-commercial IPv6 exchange points (IX's), with relatively lower connectivity speeds between the IX's.

The two projects 6NET and Euro6IX both have as a common objective the dissemination of results related to IPv6 technology, standards, coexistence and transition, applications, internetworking and interoperability, users requirement, constraints, research activities related to deployment issues, among others. In this context, both projects had organized a joint workshop at Limerick, co-located with Terena conference on 5th of June, in collaboration with IPv6 cluster facilitated by 6LINK project.

This report summarizes the result of this workshop in Limerick on 5th June 2002.

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1. INTRODUCTION

The Joint 6NET/Euro6IX Workshop was held on 5 June 2002 in conjunction with the TERENA Networking Conference in Limerick, Ireland. The objective was to publicize the 6NET and Euro6IX project activities, as well as discuss IPv6 developments elsewhere, including the activities of IST IPv6 projects in the framework of IPv6 cluster. It also provided an opportunity for feedback from the European research networking community.

2. AGENDA OF THE WORKSHOP

09.00-10.30	Chair: Valentino Cavalli
6NET: An IPv6 Testbed for the European Community	Bruno Ciscato, Cisco
Euro6IX: The Pan-European IPv6 IX Backbone	Jordi Palet Martínez, Consulintel
European Initiatives on IPv6	Bernhard Fabianek, European Commission
IP Standards Update	Steve Deering, Cisco
11.00-12.30	Chair: Jordi Palet Martínez
Security Services on IPv6 Networks: PKIv6 and IPv6-VPNs	Antonio F. Gómez Skarmeta, U. of Murcia
ISABELv6	Juan Quemada, Madrid Technical U.
Internet2 IPv6 Update	Guy Almes, Advanced Systems
14.00-15.30	Chair: Sathya Rao
User projects expectation from IPv6 backbone network	Sathya Rao, Telscom
IPv6 Multimedia Adaptive Apps in the Framework of MIND	Pedro Ruiz, Agora System
IPv6 Services in LONG Network	Carlos Ralli Ucendo, TID
Security Architectures for Mobile IPv6	Thomas Scheffler, T-Systems Nova
IPv6 in the IST @Hom project	Paolo Pastorino, Telecom Italia Lab
16.00-17.15	Chair: Jane Butler
6WiN: IPv6 in DFN	Christian Müller-Böhm, U. of Münster
IPv6 and the Internet Applications Suite	Harald Alvestrand, Cisco
17.15-18.00	Chair: Jane Butler
Panel Session	Harald Alvestrand, Steve Deering, Bernhard Fabianek & Jordi Palet Martínez

3. PROCEEDINGS

The workshop logistics was organized by TERENA, who are partners of 6NET project and also main conference organizers in Limerick.

Unfortunately, the workshop happened to coincide with a strike at Aer Lingus, which created a few difficulties for some of the speakers and participants travelling to Limerick. However, only a couple of the programmed speakers were unable to attend and it was possible to replace them. The organizers would like to express their thanks to both Guy Almes and Christian Müller-Böhm who agreed to stand-in at short notice.

The workshop ran from 09.00 to 18.00 and was divided into four sessions. Attendance figures were approximately as follows:

- 1st Session (09.00-10.30) – 85
- 2nd Session (11.00-12.30) – 45
- 3rd Session (14.00-15.30) – 40
- 4th Session (16.00-18.00) – 55

The proceedings of the workshop can be found on the web at: <http://www.euro6ix.org> under the Events section.

Since the local organization was done by the TERENA (participant of 6NET consortium) the presentations are posted also at 6NET site (<http://www.6net.org/events/joint-workshop>).

4. PRESENTATIONS AND SPEAKERS

6NET: An IPv6 Test-bed for the European Community	Bruno Ciscato Cisco
<p>6NET is a three-year IST project to demonstrate that continued growth of the Internet can be met using new IPv6 technology. It also aims to help European research and industry play a leading role in defining and developing the next generation of networking technologies.</p> <p>The project is building a native IPv6-based network with both static and mobile components in order to gain experience of IPv6 deployment and migration from existing IPv4-based networks. This will be used to extensively test a variety of new IPv6 services and applications, as well as interoperability with legacy applications.</p> <p>6NET exploits the synergy between European NRENs and major industrial partners, and cooperates with other IPv6 projects and activities, both in Europe and the rest of the world. The aim is for Europe to gain a technological advantage in the next-generation Internet and to create new business opportunities. There are currently 31 partners, although another 3 partners have recently been accepted into the project.</p> <p>The project budget is EUR 17 million of which EUR 9.5 million is being provided by the European Commission. The total effort within the project equates to 1100 man-months.</p> <p>The work is divided into seven work packages (plus coordination). An overview of the core network was provided, including information on routing protocols and address allocation.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/ciscato.pdf</p>	

Euro6IX: The Pan-European IPv6 IX Backbone	Jordi Palet Martínez Consulintel
<p>Euro6IX is a three-year IST project to build a scalable and native IPv6 backbone of traffic exchanges across Europe. It aims to allow not just research users to gain real experience of IPv6, and to establish an IPv6 production transit service. The project consortium consists of 17 partners from the telecommunications, industrial, academic and NGO sectors.</p> <p>The project is researching appropriate architectures and will deploy the first Pan-European network of Internet Exchanges. This infrastructure will then be used to research, test and validate IPv6-based applications and services in conjunction with specific user groups. Both Layer 2 and 3 interconnection and various routing protocols will be supported.</p> <p>Other aspects of the project include defining mobility scenarios and identifying the access technologies to be used in the test-beds. Static VPN implementations will also be evaluated and deployed in the test-beds. In addition, network management tools such as Magalia, intrusion detection and route servers will be trialed.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/paletmartinez.pdf</p>	

European Initiatives on IPv6: Future Perspectives	Bernhard Fabianek European Commission DG-InfoSoc
<p>The EU policy on research networks incorporates both the provision of networks for research, and research on the networks themselves. The GÉANT network already reached 32 countries and more than 3,000 universities, and there were plans to extend this further.</p> <p>The EU was taking a coordinated strategy towards IPv6. The individual components first needed to be developed, then trialed in large test-beds. To coordinate and advise on these activities, the European IPv6 Task Force had been created. This also worked closely with the global IPv6 Forum.</p> <p>Large-scale test-beds were seen as the most appropriate way of integrating and consolidating European efforts on IPv6. The aim was to make Europe the focus for experimentation in IPv6, and to lead global efforts.</p> <p>The forthcoming 6th Framework Programme would offer new ways of co-operation through the European Research Area (ERA). The budget had been doubled to EUR 300 million in order to reflect the importance of research networking. GÉANT would be maintained as the research backbone, but the aim was to upgrade it to 100 Gbps speeds and to extend its reach. At same time, advanced test-beds would be provided to help develop the next generation technologies.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/fabianek.pdf</p>	

IPv6 Standards Update	Steve Deering Cisco
<p>The IETF IPv6 Working Group had recently appointed Margaret Wasserman (WindRiver) as a 3rd Co-Chair alongside Bob Hinden (Nokia) and Steve Deering (Cisco). It was also starting an effort to raise many of the 32 proposed standards to Draft Standard status.</p> <p>In addition to developing an IPv6 Node Requirements specification in response to the appearance of several drafts for cellular hosts and low-cost network appliances, there had been some progress on older issues. The use of the flow label field, scoped address architecture, and default router preferences were all moving towards Proposed Standards. In addition, DHCPv6 had finally been submitted as a Proposed Standard, whilst the IPv6 3GPP recommendations had been submitted for publication as an Informational RFC.</p> <p>Unfortunately, there had been less progress on other issues. The IP version independent MIB work had</p>	

Security Services on IPv6 Networks: PKIv6 and IPv6-VPNs	Antonio F. Gómez Skarmeta University of Murcia
<p>Security is an important issue in modern networks, particularly with respect to mobility. UPM is developing a PKI infrastructure for distributed IPv6 networks which provides support for LDAPv6 directories, smart cards, PKI certification, the OSCP protocol and web administration.</p> <p>The project is also evaluating a number of open-source and commercial IPv6 VPN solutions for deployment in the Euro6IX and/or 6NET test-beds. It will consider the various security scenarios and run trials on each using a defined test suite. Finally, the project will consider how VPNs can be integrated with authentication servers and the PKI infrastructure.</p> <p>The project has a tunneled connection to University College London and is conducting interoperability tests over this. There are also plans for a native IPv6 connection with Euro6IX, and onward connections to the 6NET network.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/gomezskarmeta.pdf</p>	

ISABELv6	Juan Quemada Technical University of Madrid
<p>ISABEL is an advanced multiconferencing system that had been developed at UPM since 1993. Agora Systems had subsequently commercialized it.</p> <p>The system allows groups of people to be interconnected via video, audio and shared workspaces and has been used for many events over the past ten years as well as for remote learning between Spanish universities. It had recently been ported to use IPv6 and the Global IPv6 Summit in Madrid had been the first event to be transmitted over IPv6 using the software.</p> <p>When porting ISABEL to IPv6, a number of modules had to be redesigned as they were conditioned to the IPv4 architecture. It was therefore felt that a complete redesign of these modules would be more efficient. The amount of work this involved was not huge, although some additional work still needed to be undertaken in the areas of QoS, security and mobile IP.</p> <p>When porting the application to IPv6, care needed to be taken to ensure enough memory was allocated for the new structures. In addition, fully qualified domain names should be used, application dependencies on IP addresses should be removed, and the loop-back address needed to be changed. The IP address parser also needed to be modified to take the different address structure into account.</p> <p>The Global IPv6 Summit was a realistic validation of an IPv6 transition scenario and had provided valuable feedback for improving the software. It also provided experience of how to port existing software to IPv6, and proving that it could be done in a reasonable time frame.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/quemada.pdf</p>	

Internet2 IPv6 Update	Guy Almes Advanced Systems
<p>Internet2 currently operates four IPv6 nodes based around Cisco 7200 routers. IPv6 is currently tunnel led over IPv4 between these routers and to the GigaPoPs and campuses. Unfortunately, the performance of these is limited.</p> <p>The plan is to move to Juniper T640 routers with dual IPv4/IPv6 stacks when Abilene is upgraded to 10 Gbps. This will provide high-performance native IPv6 connectivity and will allow GigaPops and campuses to move away from tunneled connections, hopefully by the end of the 2003 academic year.</p> <p>The core network infrastructure is relatively easy to upgrade, but the challenge is get campuses to do the same as they have more routers, servers and people to train. A number of two-day workshops are therefore being hosted by the GigaPoPs, which provide hands-on experience of IPv6 addressing, routing, DNS and applications.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/almes.pdf</p>	

User Projects Expectation from IPv6 Backbone Network	Sathya Rao Telscom Consulting
<p>The IPv6 Cluster represents a number of IST projects addressing IPv6 technologies, including 6NET and Euro6IX. It aims to identify the users who require access to IPv6 networks, and assist projects to better target their deployment. End-users will ultimately drive the demand for IPv6 services, so it would make sense to try and include them in the initial pilots.</p> <p>Users expect the IPv6 backbone to have full functionality to guarantee end-to-end features since the Internet has no core network and routing is unpredictable. There should be full interoperability with legacy networks, IPv6 networks should be plug-and-play, and QoS and security features must be present. All these features should also be available whilst roaming.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/rao.pdf</p>	

IPv6 Multimedia Adaptive Applications in the Framework of the MIND Project	Pedro Ruiz Agora System
<p>Juan Quemada made the presentation on behalf of Mr. Ruiz's (who could not reach Limerick due Aer Lingus strike). The MIND project involves Europe's leading telecom operators and manufacturers and is investigating the integration of wireless and fixed networks. It follows-up the BRAIN project, which developed a framework for the deployment of high-bandwidth access technologies. IPv6 is a key element in the trials as it offers many features required in future wireless networks.</p> <p>Unfortunately, macro-mobility solutions (MIPv6) do not offer enough performance for some kinds of applications. Micro-mobility solutions such as HMIPv6, Cellular IPv6 and BCMPv6 are therefore necessary. BCMPv6 was developed in BRAIN, but MIND is dealing with the handovers between the physical, middleware and application layers. In particular, network conditions are not always controllable, so a network must be adaptive when providing QoS.</p> <p>MIND is testing adaptive mechanisms using ISABEL-lite, a mobile- optimized version of ISABEL, on various test-beds. The interim results are promising, but more extensive tests still need to be conducted.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/ruiz.pdf</p>	

IPv6 Services in LONG Network**Carlos Ralli Ucendo****Telefónica Investigación y Desarrollo**

The LONG project is building a distributed IPv6 laboratory for adapting current services to IPv6, and deploy new services in IPv6 networks. This will provide developers and standardization bodies with feedback.

The network links several sites in Spain and Portugal over both native and tunneled connections, using a variety of physical media. There are also onward connections to both the 6Bone and GÉANT.

A number of basic services (e.g. DNS, web, mail, IRC and LDAP) are used for testing IPv4-IPv6 integration, whilst more advanced services (e.g. IPv6 mobile, multicast and QoS) are used for testing IPv6 only. In fact, videoconferencing (using ISABEL) and IRC are used for most project meetings, and there are plans to start using IPv6-based mail as well.

This presentation can be found on the web at: http://www.euro6ix.org/present_6/ralliucendo.pdf

Security Architectures for Mobile IPv6**Thomas Scheffler****T-Systems Nova**

The 6WINIT project aims to validate the introduction of the wireless Internet based on IPv6, GPRS and later UMTS/3GPP. It will investigate the problems of providing transnational wireless delivery services, will undertake early IPv6 applications testing, and will implement handsets and edge devices.

6WiN: IPv6 in DFN	Christian Müller-Böhm University of Münster
<p>JOIN is a project funded by DFN (the German NREN) based at the University of Münster. It has worked on IPng/IPv6 issues since 1994 and is a center of expertise within Germany. It is a 6NET partner, a major 6Bone site, and is currently working with T-Nova on an IPv6 Showcase.</p> <p>Since the beginning of 2001, DFN has been assigning production IPv6 prefixes to its members. At the present time, 32 prefixes have been assigned, whilst 12 sites actually have connectivity using these prefixes. The intention is to connect all sites with production prefixes to the 6WiN, the native IPv6 backbone that is currently being rolled-out. The 6Win will also be connected to 6NET, and there are plans to peer with Euro6IX via links in Berlin and Münster.</p> <p>A number of services are available including an IPv6 tunnel broker, an IPv6-IPv4 gateway, an FTPv6 server and an IRCv6 server. However, these are not currently being heavily used and the project is looking for more users to generate some traffic.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/mueller-boehm.pdf</p>	

IPv6 and the Internet Applications Suite	Harald Alvestrand Cisco
<p>The Internet applications suite encompasses interpersonal services such as mail and news; client/server services such as HTTP, FTP, SSH and NFS; and middleware services such as DNS, NTP, routing and DHCP. DNS uses the same namespace for both IPv4 and IPv6 hosts, with clients simply requesting records of the appropriate type. Other services require transition mechanisms.</p> <p>There are different methods by which this can be achieved: dual-stack hosts running both IPv4 and IPv6, half-NAT hosts running IPv4 locally and IPv6 globally, hosts behind a translation gateway, and hosts that don't need IPv4. There are additional complications with IPv6 in that interfaces can have multiple addresses, local addresses are preferred, and addresses have limited lifetimes.</p> <p>Applications based on a client/server relationship are relatively easy to fix, as they are able to connect using the appropriate protocol and/or translators. Experience of existing Network Address Translation techniques demonstrates what works.</p> <p>Application meshes are much more difficult to deal with. For example, there are problems sending e-mails via SMTP where destination addresses are a mixture of IPv6 and IPv4. The DNS has similar problems as most records are IPv4-compliant only and resolvers will need to support both types. There are ways around these issues, but they require careful planning and configuration.</p> <p>RFCs 2893 and 2766 should be of interest to those working on transition mechanisms. A number of relevant Internet Drafts and mailing list archives are also available.</p> <p>This presentation can be found on the web at: http://www.euro6ix.org/present_6/alvestrand.pdf</p>	

<p style="text-align: center;">Panel Session Moderator: Jane Butler, CISCO</p>	<p style="text-align: center;">Harald Alvestrand Steve Deering Bernhard Fabianek Jordi Palet Martínez</p>
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The workshop concluded with a 45-minute session where the audience was invited to put questions to a panel of speakers. This proved extremely productive with many topics of interest being covered.

5. SUMMARY AND CONCLUSIONS

The IPv6 workshop organized jointly by 6NET and Euro6IX projects was a successful event from many perspectives. It brought together researchers across the IST projects with complementary contributions, and the experts around the world active in the area of IPv6 networks, applications and standards. This facilitated a good exchange of information on the status of different technological issues, pilot national networks initiatives, standards status, barriers with respect to applications, business case for promoting IPv6 and political as well as marketing issues. The final discussions lead to some clear understanding of huge challenges ahead for successful deployment of IPv6 technology in the field.