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Abstract:

This document presents the Eurov6 Fixed Showcase scenario providing the first realized integrated network and applications demonstration center according to the scenarios developed in D2.3.

The three centers in Basel, Brussels and Madrid are operational with interconnection to the NGN-LAB test-bed and Euro6IX network for wide area connectivity.

Nomadic showcase has also been realized and was demonstrated during the Swiss IPv6 national workshop in April 2003, and the Madrid 2003 Global IPv6 Summit in May 2003.

Keywords:

Eurov6 Fixed Showcase, Eurov6 Nomadic Showcase, IPv6 Applications, IPv6 Configurations, IPv6 Devices, IPv6 Services.

Revision History

The following table describes the main changes done in the document since it was created.

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v0.1	14/06/2003	Document creation	Sathya Rao (Telscom)
v0.2	07/07/2003	First draft of the document with contributions from Telscom	Sathya Rao (Telscom)
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v1.3	13/06/2004	Final Review	Jordi Palet (Consulintel)

Executive Summary

The Eurov6 project has as main objective to show the usage of IPv6 products and services and their impact to anybody at anytime.

This deliverable presents the Eurov6 Fixed Showcase scenario providing the first realized integrated network and applications demonstration center according to the scenarios developed in D2.3.

The three centers in Basel, Brussels and Madrid are operational with interconnection to the NGN-LAB test-bed and Euro6IX network for wide area connectivity.

The Basel center can be viewed on line and home appliances can be controlled from an IPv6 browser remotely.

Nomadic showcase has been also realized and was demonstrated during the Swiss IPv6 national workshop in April 2003, and the Madrid 2003 Global IPv6 Summit in May 2003.

Among the applications, the showroom includes multimedia applications, video/audio streaming, games, peer-to-peer file sharing, remote interaction, home networking, etc.

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1. INTRODUCTION

The main objective of the Eurov6 project is to show the usage of IPv6 products and services and their impact to anybody at anytime. Realizing this objective will include:

- Bringing together vendors and sponsors to demonstrate and test their devices and systems.
- Showing various users applications based on IPv6 products and services, permanently at a few locations in Europe ("Fixed Showcase"), which can be visited physically or accessed remotely through telematic means.
- Organizing temporary demonstrations at different locations and/or significant telecommunication industry events (concept of "Nomadic Showcase").

Deliverable D2.3 provided the showcase scenarios foreseen and possible enhancements planned.

The aim in this deliverable is to provide the first realized integrated network and applications demonstration center according to the scenarios developed in D2.3.

The Eurov6 project has three Fixed Showcases located in Basel, Brussels and Madrid respectively. The Basel and Brussels showcases are co-located with NGN-LAB test-beds to facilitate easy access to wide area IPv6 networks such as Euro6IX, 6NET and GEANT. The Madrid showcase is located at CONSULINTEL premises and is connected to Euro6IX network.

The Nomadic Showcase is also realized based on few laptops and PDAs to demonstrate both network and applications features of IPv6 showcase anywhere with the ease of configuring in a relatively short time.

2. NETWORK AND APPLICATIONS INTEGRATION

The Eurov6 showcase has heterogeneous network elements such as routers, operating systems and applications obtained from multiple sources.

The showcase case has routers from CISCO, HITACHI and 6WIND, which are interconnected and tested for interoperability. The operating systems deployed in the showcase comprise LINUX, WINDOWS, .NET, and FreeBSD.

Different kinds of terminal devices: PCs, laptops, PDAs, mobile phones, etc.

Available applications vary among three different sectors:

Home environment

- Control of lights, fans, refrigerator, toys etc…
- Security devices (webcam,…).
- Power line communication.

Business environment

- All data services: mail, ftp, web, http,…
- Multimedia services: ISABELv6.
- Audio video services: RAT, VIC, 6VOICE (VoIP), streaming, etc…
- Location based services.
- VPN services.
- Mobile IPv6 networks and services.
- Peer to Peer services.

Infotainment

- Control of audio/video devices (VCR; TV…).

Currently Eurov6 deployed three Fixed showrooms, where the demonstrations are generally available round the year and special demos targeted to particular types of visitors that can be arranged at short notice. The venues of these showrooms are Basel, Brussels and Madrid and are maintained by Telscom, University of Brussels and Consulintel respectively.

Each section shows specific applications suitable for each environment. The D2.2 deliverable described a wide range of applications, including Home Automation, Security and Surveillance, Gaming, Audio, Video, P2P, GRID, VPN, AAA, Hot Spot Services, Wearable Devices, Sports, Health and Public Safety, etc.

3. SHOWCASES

This section gives description of each showcase as deployed today.

3.1 Basel Showcase

3.1.1 Devices

This section gives a brief description of devices integrated and used in the Basel Fixed showroom.

3.1.1.1 Hosts

Several PC hosts are used in the demonstrations, these PCs ranging from desktop and laptop to pocket kind, are configured with several IPv6 enabled operating systems with different distributions and versions of Linux, FreeBSD, and Windows.

3.1.1.2 Routers

Two IPv6 enabled routers: CISCO 7206 and 6WIND 6100 are used in the Showcase.

3.1.1.3 Mobile Devices

The following pocket/wireless device also augments the general network infrastructure of the Eurov6 showroom:

- Compaq iPAQ 3870 with Linux (Familiar distribution + BlueZ stack) and Bluetooth.

This equipment forms the basis for showing wireless access on pocket devices. Several usage scenarios have been prepared and tested. One of the typical scenarios is shown in Figure 3-1.

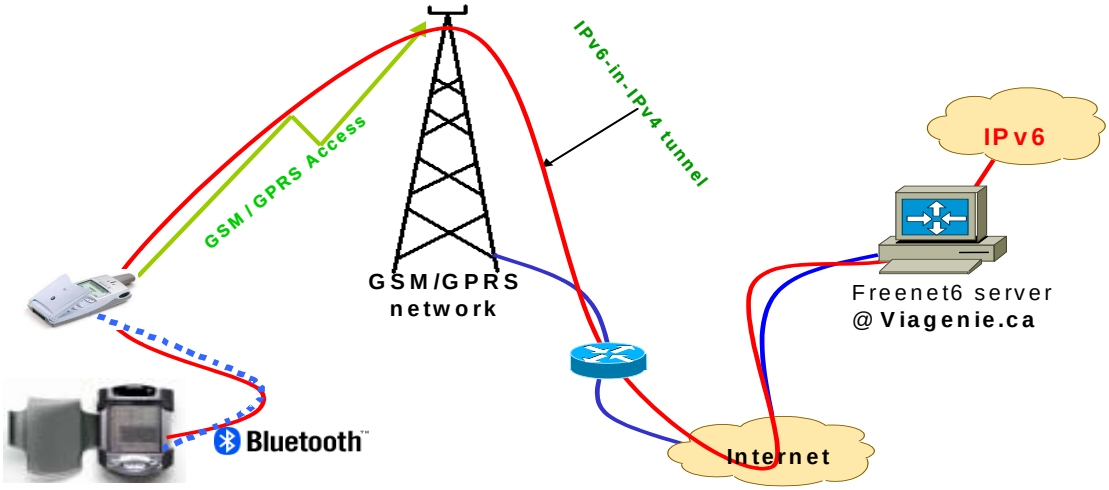

Figure 3-1: IPv6 Access Using a GPRS Connection

The iPAQ handheld uses Bluetooth to establish a wireless connection with the GPRS phone. The GPRS phone is used as a modem to cross the GSM network and connect to the router. After establishing the (PPP) connection, the iPAQ receives an IPv4 address and is ready to connect to the Internet. After establishing the IPv4 connection to the network, the client requests an IPv6 address using the Freenet6 service.

3.1.1.4 Home Network Devices

The Basel showroom has implemented Home Automation based on IPv6 networks. It uses commercially available X.10 devices for electric appliances control and Spitfire devices to control the infotainment services. The implementation is based on the OSGi platform and in close collaboration with the Future Home project (http://future-home.org).

The configuration implemented:

- Consists of remote controlling of devices sitting at home.
- Possible IPv6 killer application because it allows the delivery of unlimited services each of which adds value to the network and is a revenue source.
- IPv6 versus IPv4:
    - Direct connection possible due to wider range of addresses; this allows moving of server functionalities outside home (e.g. at the provider's site) making the service user-friendlier.
    - User-friendlier services provided thanks to auto configuration protocols.
    - Security at the connection level embedded (the same "firewall-style" level of security of IPv4 can be reached at the application level).
    - Easier and wider range of services deployable due to inbuilt QoS features.

The IPv6 protocol drives some basic issues in home networking: with its enlarged address scheme, it allows for direct connection with all the devices capable of holding an address; with its embedded security, it allows for an improved service in this delicate area; finally, with its enhanced auto-configuration protocols, it increases transparency and usability for the end user.

In order to see and operate the environment also remotely a home portal has been implemented. VTT in Finland recently converted from Linux to Microsoft its Home portal so that, using Windows Media Player 9 Series, which supports now IPv6, the showroom can be visited remotely.

The scenario implemented and the underlying concepts are shown in the following pictures.

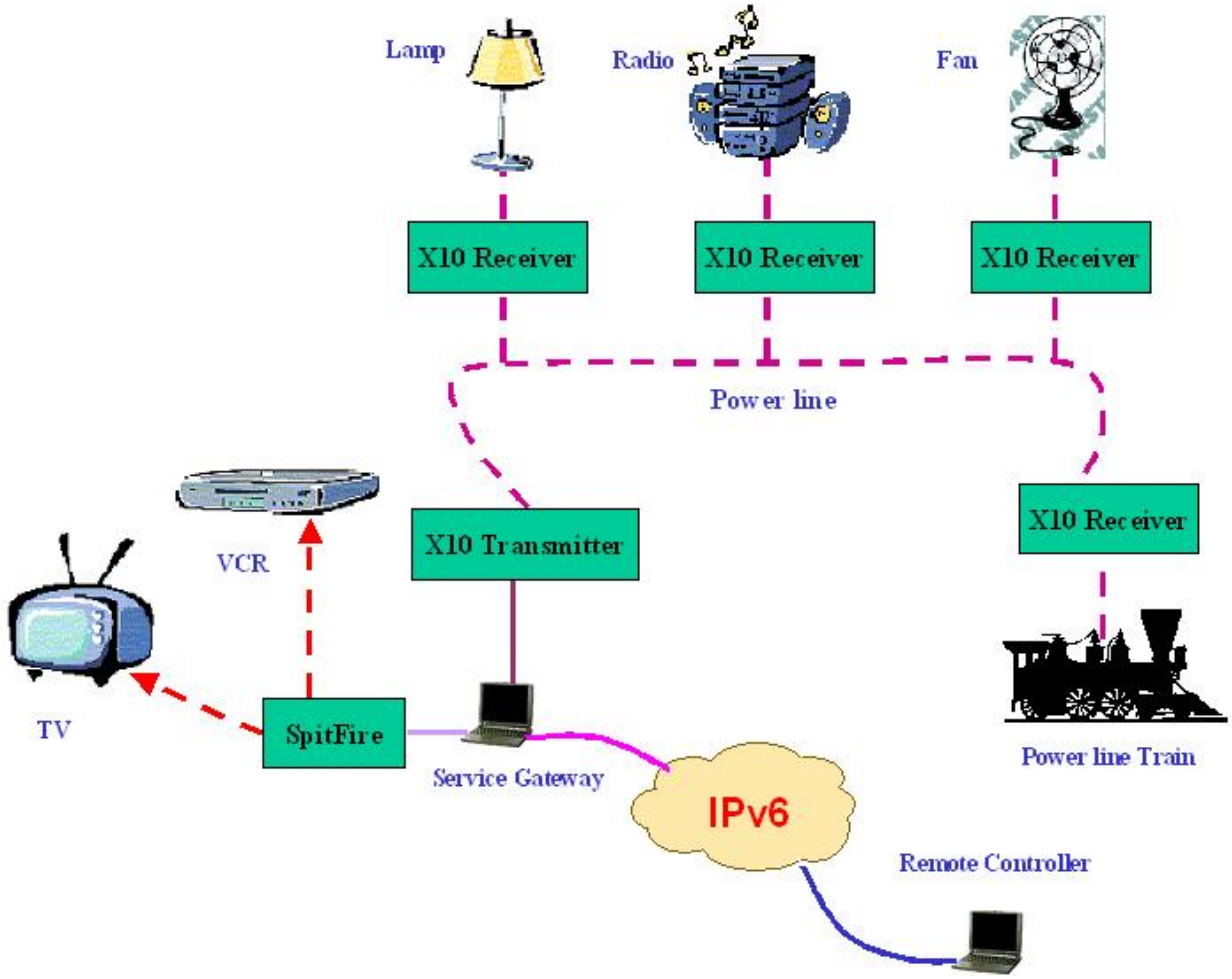

Figure 3-2: Home Networking Scenario

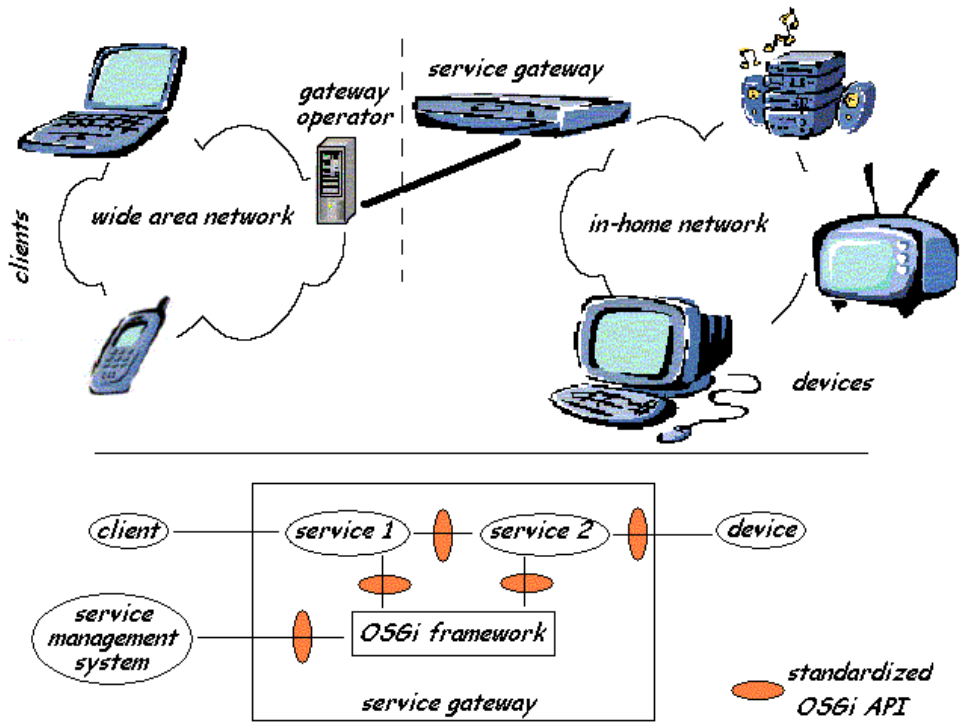

Figure 3-3: Home Networking Concept

3.1.2 Applications

There are several applications installed in the permanent IPv6 Showcase. The selection was made thinking of the way of catching the visitor attention. In the showroom, there are common IPv6 applications as base of several attractive IPv6 applications.

Furthermore, the goal with the installed applications is to support the idea that the user projects can benefit from the testing platform to validate their development work and make international IPv6 demonstrations.

The applications installed try to show the "state of the art" in the IPv6 field in the different areas that were identified in Eurov6 D2.2.

The following applications are available in the Showcase and they are the support for the more elaborate and interesting applications. Documentation and the configuration files of all applications implemented in different showcases are publicly available for download by the user groups, for their use in their labs at http://www.eurov6.org or at partners websites.

3.1.2.1 HTTP Client

There are several web browsers with IPv6 capability. Mozilla (v0.9) for Linux and Internet Explorer (v6 and SP3) for Windows are common examples.

To test if it is working with IPv6 protocol, call the URL: http://www.ipv6forum.com. This site was built with the feature that if a user uses the IPv4 backbone to open the site, the browser would not able to show the earth logo rotating. Some web sites indicate from which IPv4/IPv6 address are the user visiting the site: http://www.euro6ix.org, http://www.kame.net, http://www.telscom.ch, etc.

3.1.2.2 HTTP Server

A package that builds an IPv6 capable HTTP server is Apache. The Eurov6 showroom IPv6 site is at http://www.eurov6.org. The server supports both IPv4 and IPv6, which mean that depending upon the protocol used by the client, the URL is resolved as either an IPv4 or an IPv6 address, transparently to the client.

The following applications are available in the Fixed Showcase and they are intended to show in a more elaborate and "amazing" way the IPv6 applicability.

3.1.2.3 ISABEL Multimedia Videoconference

The ISABEL multimedia application has been installed supporting both IPv4 and IPv6 protocols.

This platform permits to attend a number of events distributed with ISABEL including the NGNI-ISABEL workshop and Madrid 2003 Global IPv6 Summit.

3.1.2.4 Multicast Videoconference Tools

The multimedia applications such as RAT (audio), VIC (video), NTE (shared text editing) and SDR (Session Directory Tool) are available at the Basel showcase.

Robust Audio Tool RAT

RAT can be used for VoIP. Voice over IP means that voice is transmitted over an IP network such as the Internet, rather than the familiar public switched telephone network (PSTN). The RAT application was chosen because of its simplicity. This application supports IPv6 and multicast also.

Video Conferencing Tool VIC

VIC is a simple application for sending video streams over IPv4 or IPv6. It works on many platforms, such as Linux, Solaris, Windows, FreeBSD and uses RTP (real-time transmission protocol) to send the stream. This application supports IPv6 and multicast also.

Session Directory Tool SDR

SDR is a session directory tool designed to allow the advertisement and joining of multicast conferences on the M6Bone (http://www.m6bone.net).

VIC and RAT are also installed on the iPAQ Linux machine. In one of scenarios shown in Figure 3-4, the laptop serves as the Access Point with proxy-arp enabled. All of the machines have VIC and RAT installed and communication between them has been tested over both IPv4 and IPv6 protocols.

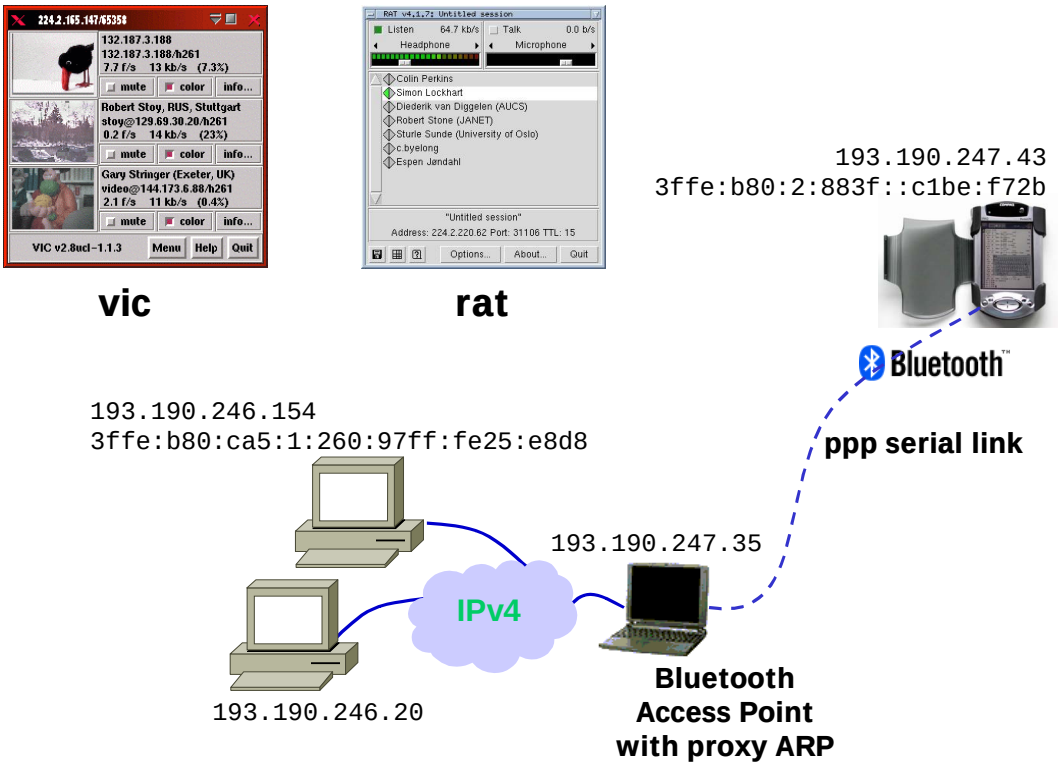

Figure 3-4: VIC/RAT on IPAQ over IPv6

3.1.2.5 VoIP with SIP

The 6VOICE application, supporting SIP, has been implemented and demonstrated during many events. This was also mixed with video application to demonstrate the advantage of SIP.

3.1.2.6 VideoLAN

VideoLAN Server and Client have been installed in a PC in Basel.

3.1.2.7 The Darwin Streaming Server (DSS)

DSS has been implemented and often used both for video-on-demand over IPv4/IPv6 Network, serving already available content from files on the hard disk, or streaming from a live source. DSS can be used as a repeater, and thus may distribute the same stream to many clients.

3.1.2.8 Windows Media Services and Media Encoder 9 Series

The showcases have Windows 2003 Streaming Server installed enabling the streaming service over IPv6 networks. The service is available both locally and remotely.

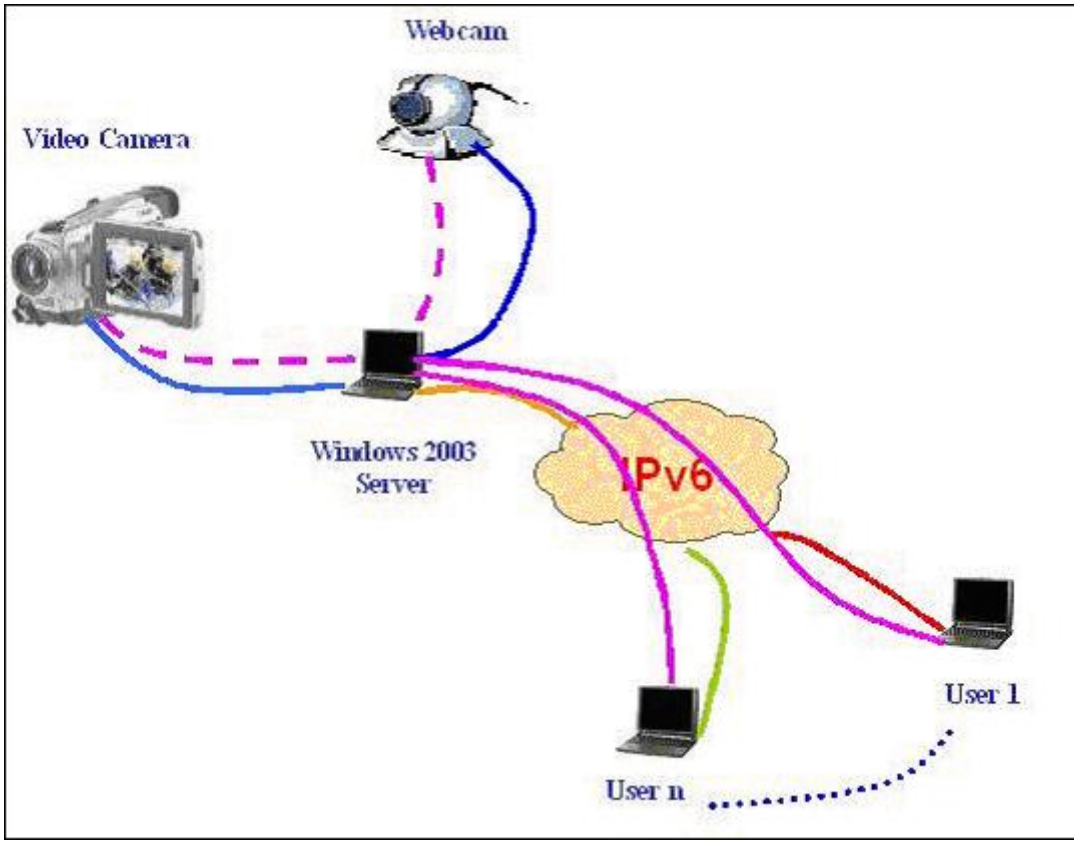

Figure 3-5: Windows 2003 Streaming Server

3.1.2.9 Windows Media Player 9 Series

Windows Media Player 9 is also available and used for receiving video streams from the events on IPv6.

3.1.2.10 Tetrinet (Server for Linux)

This is a network version of the popular Tetris game. There is not only an IPv4 version of this game but also IPv6. The goal in this game is to try to fit all falling pieces in a proper way so that no blank spaces remain among them. In this network version you must connect to a tetrinet server, which gives the permission to start to play. By means of the server, other players' games can be shown and the strategy of each player can affect to final result of the all other players.

In the Basel showroom an IPv6 tetrinet server is running and is accessible at the address: http://tetrinet.ipv6.telscom.ch.

3.1.2.11 Instant Messaging

A widespread instant messaging system is known as Jabber. An IPv6/IPv4 enabled Jabber server has been installed by Telscom AG in the Basel Showroom. Moreover many plug-ins, such as private conferencing, user database search, etc. and transports have been installed so that the server can be used to connect also to the other widespread messaging networks like MSN, Yahoo!, ICQ and AIM.

3.1.2.12 MP3 Streaming

An MP3 streaming server, working both for IPv6 and IPv4 is also running in the Basel showroom.

3.1.2.13 Home Portal

As mentioned in the "Home Network devices" section. A home portal is available in the Basel Showroom that allows to:

- Connect to an IPv6 video streaming of the showroom.
- Switch on and off home appliances (e.g. lamps, fan, toys, etc.) and operate a VCR.

3.1.3 Nomadic Showroom

The fixed showroom concept has been extended to the Nomadic showroom, by implementing the Mobile kit with applications running on LAPTOPs and PDAs so that the whole system can be moved at short notice to a remote place to set up an IPv6 showcase for the visitors. This mobile kit will be accompanied by a technical manual to set up the system, which facilitates the Eurov6 showcase go global, without any dependencies.

The first trial of such a Mobile Kit was set up before the IPv6 Summit Switzerland (24 April 03) in Zurich and the showcase was set up in 2 hours of time, to demonstrate the business applications, home automation and remote access applications.

The pictures show such a real scenario in Zurich

Figure 3-6: Nomadic Showcase at IPv6 Summit in Switzerland

3.1.4 Services

Some of the network services deployed in the Basel showcase are identified below.

3.1.4.1 Network Services

3.1.4.1.1 Mobility

MIPv6 implementation (version19) has been implemented in the Basel showcase. All required functionalities such as Home Agent, Mobile Node and Correspondent Node are implemented and tested with applications such as RAT and VIC on PDA devices which are easy to demonstrate and impressive to the visitors.

3.1.4.1.2 Multicast

Multicast is a default feature of IPv6, but its deployment is still in the early stage. To expedite this process, the M6Bone initiative has been set up by RENATER, http://www.m6bone.net. M6Bone is an IPv6 test-bed network specifically deployed to make tests in the IPv6 multicast field. The network architecture is in the form of a star, where all sites are connected to RENATER. An IPv6 tunnel achieves the connection over either IPv4 or IPv6, using a FreeBSD system and PIM-SM daemon. The main purpose of the multicast service is the transmission of multimedia streams.

Within the Eurov6 Basel showcase, a connection has been made with the M6Bone by means of an IPv6 tunnel and applications as RAT or VIC have been used to make tests.Security/VPN

3.1.4.1.3 Security/VPN

IPv6 is compatible with existing architectures and support the same security features as IPv4 described in the previous section. Therefore IPv6 provides the same solutions as IPv4 does for standard services such as mail, web browsing, file transfers, etc…

IPv6 provides security at layer 3 using IPSec. In this way common security services as connectionless integrity, datagram origin authentication, protection against replays and traffic flow confidentiality are provided for making secure connections. One of the big advantages of IPv6 regarding security is that IPv6 restores network simplicity. The complexity induced by the usage of NAT will disappear with IPv6 and simplicity will bring better security.

Security is a global issue and each component must have a coherent security level. Obviously, IPv6 alone does not provide solution when applications or implementations have bugs or security weaknesses. Nevertheless, the conjunction of features including IPv6 addressing accessibility combined with largely deployed end-to-end IPsec tunnels or more secure hosts internal architecture will allow to keep a security level that will be equivalent and higher than within IPv4 networks

Within the Eurov6 project, ROAD WARRIOR application has been implemented and tested across Brussels and Basel showcases.

IPsec VPN over IPv6 between Brussels and Basel has been setup and tested. The two sites will be in the same virtual LAN.

3.1.4.1.4 QoS

QoS is a desired feature within a network transporting audio and video traffic such as either real-time audio and videoconference or audio and video streaming. Even more, elastic traffic such as http, or ftp, could request QoS for demanding users.

The flowlabel feature identified in IPv6 standards supports the intserv concept by allowing end-to-end flow control, which adds value compared to IPv4. However, flow label field and the usage is not well defined in the standards and is part of ongoing discussions in IETF groups.

Both DiffServ and proprietory flowlabel based QoS mechanisms have been implemented and demonstrated with 6VOICE applications in the Basel test-bed.

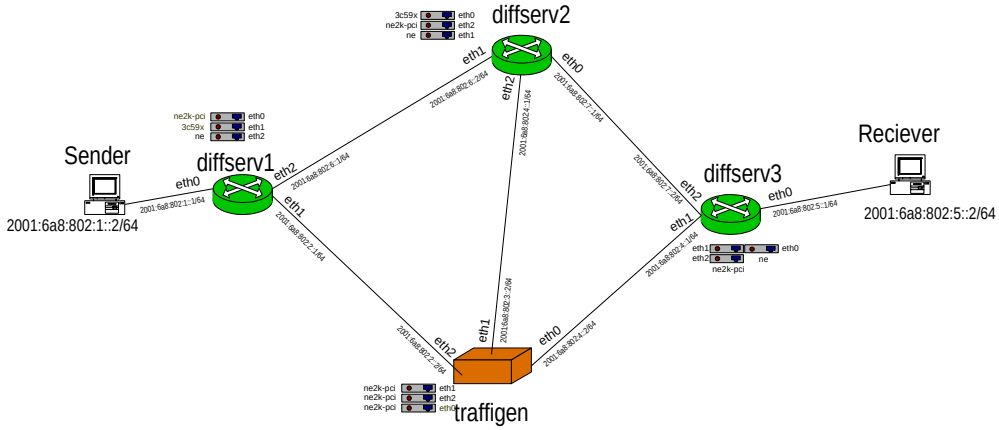

Figure 3-7: IPv6 QoS Test-bed

3.1.4.1.5 DNS

Bind (DNS daemon) version 9 has been implemented in the Basel showroom. Since the IPv6 network is not universally available, requests can be issued and answered both over IPv4 and IPv6, allowing passing between IPv6 islands.

3.1.5 Network Infrastructure

3.1.5.1 Wireless Access

Within the showrooms exist several wireless points of access exploiting the functionalities of the main wireless technologies. Bluetooth, WLAN and GPRS are used in the Basel showroom.

3.1.5.2 Transition Mechanisms

Transition mechanisms of Dual stack, NAT-PT and Tunnel broker are available in the Basel showroom.

3.2 Madrid Showcase

3.2.1 Devices

This section gives a brief description of devices integrated and used in the Madrid Fixed showroom.

3.2.1.1 Hosts

Several PC hosts are used in the demonstrations, these PCs including desktop and laptop kinds, are installed and configured with several IPv6 enabled operating systems with different distributions and versions of Linux, FreeBSD, and Windows.

3.2.1.2 Routers

A Hitachi GR2000-10H is used in the Showcase so as to provide connectivity to Euro6IX and 6Bone. A FreeBSD "router" provides multicast connectivity to M6Bone network.

3.2.1.3 Mobile Devices

A WLAN infrastructure is installed to support demonstrations with mobile devices.

3.2.1.4 PLC Devices

The PLC (Power Line Communication) devices used to show this technology in the Madrid showroom included one HE (Head-End) and one CPE (Customer Premises Equipment).

The CPE is intended to be at the user premises (for example, in the home), giving network connectivity. Several CPEs will depend on one HE, which will give network access to the CPEs by means of the power line.

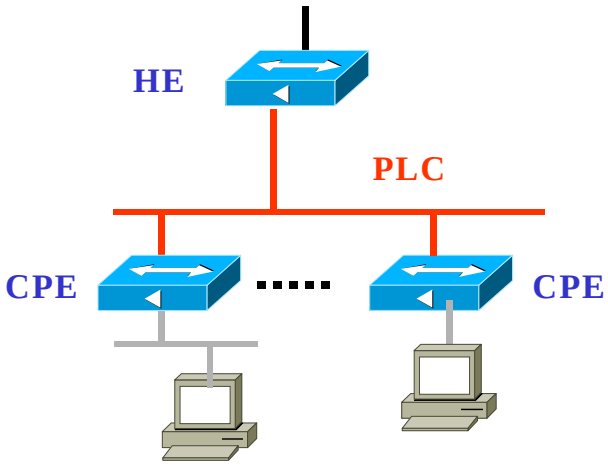

Figure 3-8: Basic PLC Topology

3.2.1.5 Other Devices

In addition to "traditional" network devices, the aim is to show new devices that are being integrated into the networked world. The following gives an idea of the kind of devices that may be available in the Madrid showroom.

- Internet freezer, washing machine, microwave oven, coffee maker, etc.
- Security, surveillance, gas/fire detection, alarm systems.
- Cameras, telephone, video and audio devices.
- Game consoles.

- Wearable devices.

The inclusion of specific devices will depend on the current availability for the Eurov6 showrooms, from manufacturers, sponsors, etc.

3.2.2 Applications

This section gives a brief description of IPv6 applications integrated and used in the Madrid Fixed showroom. As the same in all Eurov6 showcases, the applications installed in Madrid try to show the "state of the art" in the IPv6 field in the different areas that were identified in Eurov6 D2.2.

3.2.2.1 HTTP Client

There are several web browsers with IPv6 capability installed for web navigation. Mozilla (v0.9) for Linux and Internet Explorer (v6 and SP3) for Windows are used in the different demonstrations.

3.2.2.2 HTTP Server

The Apache HTTP server is extendedly used in the project. The Eurov6 showroom web site is at http://www.eurov6.org supporting both IPv4 and IPv6 access, and it's hosted by Madrid showcase.

3.2.2.3 FTP

The FTP server (Version 6.5/OpenBSD, linux port 0.3.3) of the project is at ftp://ftp.eurov6.org supporting both IPv4 and IPv6 access, and it's hosted by Madrid showcase also.

3.2.2.4 ISABEL Multimedia Videoconference

Eurov6 have installed in the Showrooms the latest version of ISABEL software in a multimedia Linux PC with audio and video interface.

The ISABEL platform permits to attend a number of events distributed with ISABEL including the NGNI-ISABEL workshop and Madrid 2003 Global IPv6 Summit.

3.2.2.5 Multicast Videoconference tools

In the Madrid showroom are installed the multicast applications such as RAT (audio), VIC (video), and SDR (Session Directory Tool).

As Eurov6 has a full IPv6 multicast infrastructure (see D2.3, Network infrastructure section), the visitor can receive the conference sessions through SDR and receive video and audio through VIC and RAT respectively.

3.2.2.6 VideoLAN

VideoLAN purpose is to set up and exploit a very high throughput network, in order to broadcast digital video and Video on Demand within the campus (http://www.videolan.org). Possible inputs include DVDs, DVB-S satellite streams, MPEG-1 or MPEG-2.

VideoLAN Server and Client have been successfully installed in Madrid for showing the possibilities that this application offers.

3.2.2.7 Windows Media Services and Media Encoder 9 Series

Windows Media Services 9 Series is installable in the Windows Server 2003 family of the Windows Media 9 Series platform, which supports IPv6, and it can work alone or in conjunction with Windows Media Encoder to deliver audio and video content to clients over the Internet or an intranet.

The Madrid showcase has a Windows Media Service and a Windows Media Encoder for broadcasting over IPv6 both some videos and a live stream. Such server can be found at http://6stream.madrid.eurov6.org.

3.2.2.8 Windows Media Player 9 Series

Windows Media Player 9 Series can receive and play the audio and video streams that either Windows Media Service or Windows Media Encoder 9 Series can stream. This component also supports IPv6 and can be downloaded from Microsoft site for several Windows platforms (2003, XP, 2000, 98 SE and ME).

See http://www.microsoft.com/windows/windowsmedia/9series/player.aspx.

3.2.2.9 Mplayer for Linux

Mplayer is the Linux equivalent application to Windows Media Player. It can be downloaded from http://www.mplayerhq.hu/homepage/design6/dload.html and applying the proper patch it can support IPv6. It allow play audio and video streams on Linux platforms and it is compatible with the Windows Media Server Series 9.

3.2.2.10 Gnomemeeting for Linux

Gnomemeeting is a VoIP application based on H.323 protocol allowing video conferencing also. His code is available form http://gnomemeeting.org and it has been developed on Linux. The latest release supports IPv6 and although the application has not reached yet the final version, it is stable enough for having it in a test-bed scenario. Because of this Madrid showroom has successfully installed this application on several hosts.

Figure 3-9: Receiving Video Streams with Window Media Player 9

3.2.2.11 Tetrisnet

This is a network version of the popular Tetris game where the goal is to play against other players. The movement of the pieces of each player can be visualized on the screen of all players. The application follows the client-server model. Server controls the access of the players and which match belong each player. The Client part is an X-Window application where the pieces of all players are shown.

The Madrid showroom has installed a Tetrinet Server, called tetrix, at its lab and it can be reached at http://tetrix.madrid.euro6ix.org. Also, the Madrid showroom has installed on several hosts the network tetris client part, which is gtetrinet.

3.2.2.12 Instant Messaging

Within the Euro6IX project, nGn has developed an on-line Instant Messaging tool to send and receive, in real time, messages among devices such as PCs, PDAs, cell telephones, and even devices belonging to home automation. A beta version has been tested and installed for Eurov6 demonstrations at Madrid showroom.

3.2.2.13 Three Degrees (Peer to Peer Application)

Three Degrees application works exclusively with IPv6 (http://www.threedegrees.com). By installing it, it automatically enables IPv6, or updates automatically Windows to IPv6. This is the

new kind of peer-to-peer application that runs only with IPv6 and would fail in networks built with NAT and Firewalls. Three Degrees connects people in small groups and they can share several kinds of files. The Eurov6 Madrid showroom had this application included in its demonstrations.

3.2.2.14 Home Portals

A home portal is locally available in the Basel Showroom, and trough HTTP this portal can be reached and showed remotely from the Madrid showroom.

3.2.3 Services

This section gives a brief description of network services that support the demonstrations of the Madrid showroom.

3.2.3.1 Network Services

3.2.3.1.1 Mobility

With mobility service, a node can be reached by means of its IPv6 address even when it is not attached to its home network. It is an advanced service allowing new kind of applications as: firmware updates of home automation devices, sending data to cars, localization of luggage, etc. In general, application related to mobile devices that need to receive/transmit some information.

However, the standardization of this service is not finished yet, so that not many implementations are available. In fact, only a Linux Mobile IPv6 implementation has been developed, which can be download from http://www.mipl.mediapoli.com , so that not many possibilities for tests are available yet. In spite of this, the Madrid showroom has installed a basic scenario for testing and showing Mobility IPv6, with a Home Agent that is ready for receiving binding requests from a Mobile Node attached to a foreign network. Mobile Node can be a desktop PC, laptop or even a PDA device.

Possibilities for showing this service depend on the state of the art of the future implementations for both operating systems and devices.

3.2.3.1.2 Multicast

The multicast concept was thought to let applications save bandwidth in data networks, multicast is a default feature of IPv6, but its deployment is still in the early stage. M6Bone is an IPv6 test-bed specifically deployed to make tests in the IPv6 multicast field. The network architecture is in the form of a star, where all sites are connected to RENATER. An IPv6 tunnel achieves the connection over either IPv4 or IPv6, using a FreeBSD system and PIM-SM daemon. Within the Eurov6 Madrid showroom, a connection has been made with the M6Bone by means of an IPv6 tunnel and applications as RAT or VIC have been used to show multicast applications.

3.2.3.1.3 PKI

The goal of a PKI (Public Key Infrastructure) is to provide a PKC (Public Key Certificate) management to the group of security protocols designed to protect Internet. These protocols, as IPSec, SSL, TLS or S/MIME use public key cryptography to provide services such as confidentiality, data integrity, data origin authentication and non-repudiation.

PKIv6 developed in the Euro6IX project is based on a basic PKI developed in the University of Murcia; this original PKI has been extended with several services and, of course, with IPv6 support. The PKIv6 test-bed set-up in UMU is a complete system, which can offer certification services to final users and VPN devices, such as an IPSec router. The Eurov6 Madrid showroom users, can reach PKIv6 through a web browser, https://pki.umu.euro6ix.org, and VPN devices should use the SCEP protocol or 6WIND SCP method to get PKCs. Moreover, users can use smart cards to store their public and private keys. This PKI is also accessible through the IPv6 6Bone network.

3.2.3.1.4 QoS

QoS is a desired feature in a network transporting audio and video traffic such as both real-time audio and videoconference or audio and video streams. The following QoS test-bed, deployed as part of the Eurov6 Nomadic Showcase held during the Madrid 2003 Global IPv6 Summit aims to show a preliminary use of IPv6 QoS functionalities for audio/video streaming services. A similar scenario is deployed in the Madrid Fixed showroom.

Using a multihomed-streaming server, the use of both IPv6 streams and IPv6 QoS functionalities are showed. A router is used for marking the packets and for the ingress traffic limitation. Also the goals are to show the use of commercial IPv6 video streaming software and commercial router's QoS functionalities, and a visual demonstration of QoS functionalities.

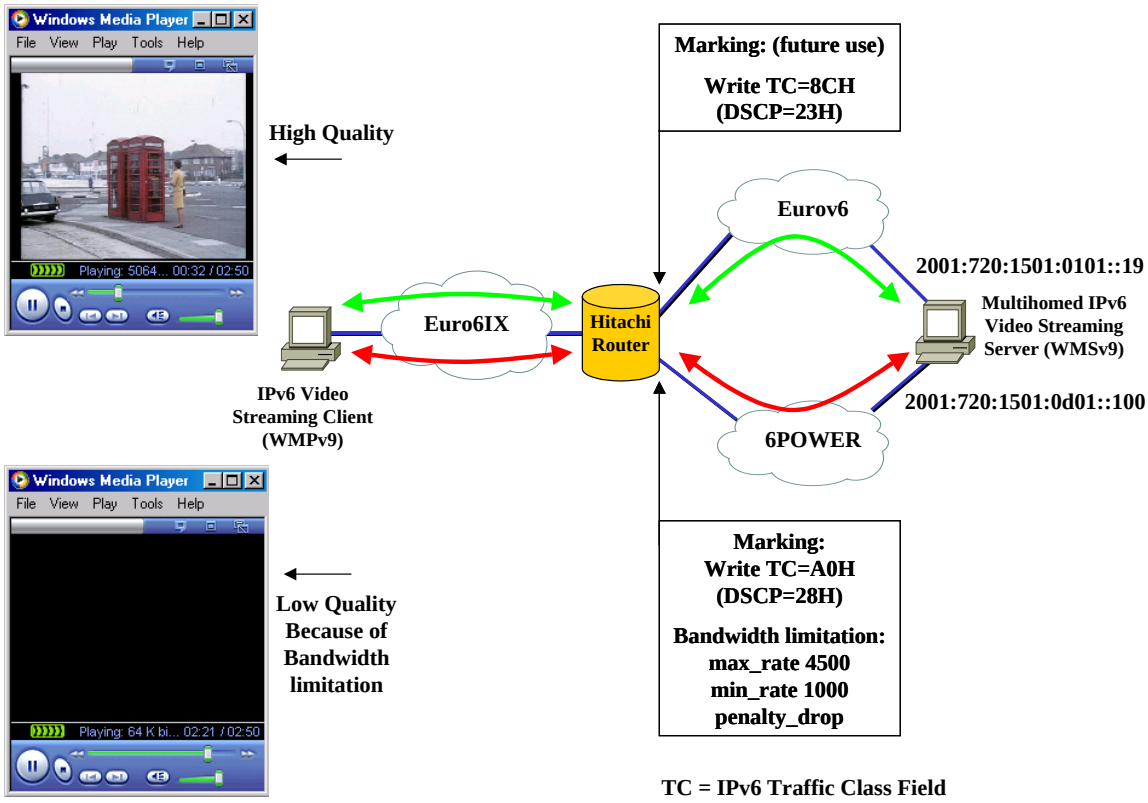

Figure 3-10: IPv6 QoS Test-bed

3.2.3.1.5 DNS

DNS is one of the most important services in the Internet, and to support IPv6 addresses new AAA records are used (Bind supports them from version 9). Since the IPv6 network is not universally available, requests can be issued and answered both over IPv4 and IPv6, allowing passing between IPv6 islands.

A DNS server is installed for both demonstration purposes and being used inside the showrooms. The domains available for the project and manage by Madrid showrooms are: eurov6.org, eurov6.com, eurov6.net, eurov6showcase.org, eurov6showcase.com, eurov6showcase.net, ist-eurov6.com, ist-eurov6.net and ist-eurov6.org.

3.2.3.1.6 AAA on IPv6

Authentication, Authorization and Accounting (AAA) is a very used service when a user needs to be identified before accessing a network service. It provides not only identification facilities but also accounting tools for later billing. Radius is a good example of AAA system, which has several implementations on Linux and other commercial products. Although AAA is being used for a long time, this is not true for IPv6 networks because of their recent deployment. However, this is changing currently thanks to efforts made within other IST projects, like Euro6IX. Within this project, an AAA implementation for Linux with IPv6 support has been developed by Telefónica I+D, which is based on the well-known freeradius implementation.

Such IPv6 support allows not only communication through IPv6 packets but also new Attribute Value Pairs that are defined on RFC 3162, "RADIUS and IPv6", and they are related to IPv6 parameters.

The Madrid showroom has installed such an IPv6 Radius server, which can be found at 2001:618:10:2a03:204:acff:fe77:b83d.

3.2.3.1.7 Autoconfiguration

The commonest autoconfiguration mechanism used by IPv6 is stateless autoconfiguration, which consist of Router Advertisement messages sent by routers. However, this is not enough in some environments where hosts must have a global IPv6 address fixed for accessing to services located at such hosts. Even if DNS information cannot be manually configured on the hosts, the stateless mechanism must be completed. An alternative is the use of stateful autoconfiguration mechanism based on DHCPv6. It allows both dynamic and static address assignments, DNS information deliveries and prefix delegation mechanism for router autoconfiguration.

Although DHCPv6 is still on the draft stage (no RFC is issued yet at the time of this writing) the work of the IETF work-group is very advanced and not many changes are foreseen for the final RFC version. There is an implementation of DHCPv6 for both client and server, which can be downloaded from http://sourceforge.net/projects/dhcpv6. It is developed for Linux and the Madrid showroom has successfully installed such application on its demo room for stateful autoconfiguration and prefix delegation mechanism.

3.2.3.2 Network infrastructure

3.2.3.2.1 Network Connectivity

The Madrid Showroom connects to European and Worldwide IPv6 networks through a native IPv6 link over ATM to Euro6IX. The main router here is a Hitachi GR2000-10H with hardware support for IPv6.

IPv6 multicast connectivity is implemented through a FreeBSD multicast router tunneling to RENATER.

3.2.3.2.2 Wireless Access

Within the showroom exist several wireless points of access exploiting the functionalities of the main wireless technologies as:

- Bluetooth.
- IrDA.
- WLAN.

3.2.3.2.3 Transition Mechanisms

Within the Madrid showroom the main transition mechanisms deployed for use in the demonstrations are:

- Dual stack
- NAT-PT
- Tunnel broker

In addition, the following specific applications are installed:

46Bouncer

This application aims to do the translation of IPv4 packets to IPv6 packets and vice versa, so it can be viewed as a proxy between IPv4 and IPv6 networks. It can be downloaded from http://netgroup-serv.polito.it/46Bouncer and it is developed for Windows 2000, Linux (2.4 kernel) and FreeBSD 4.3+.

Madrid has successfully installed this application for doing connections (http, telnet, ssh…) between IPv4-only hosts and IPv6-only hosts.

PortForwarder with IPv6 support

This application can be considered also a proxy between IPv4 and IPv6 networks. Here the difference is in the way that the connection is made. This application takes advantage of the port forwarding function of the ssh protocol. In this way, an IPv6 host willing to connect to a service located at an IPv4-only host sends connection requests to the proxy IPv6 host which forwards such requests to the IPv4 host through a secure ssh connection. The application is developed for Windows 2000 (SP1 or later) and Windows XP.

The Madrid showroom has successfully installed this application for using the Windows Remote Desktop application that comes with Windows XP, which only has IPv4 support.

3.2.3.2.4 IPv6 RAS

For offering native IPv6 connectivity to domestic users (without transition mechanisms like tunnels) most efforts are focused on links with more bandwidth like xDSL lines, due to the exploitation of the IPv6 features that improve the network performance. These kinds of links use the point-to-point protocol over Ethernet (PPPoE) as link protocol in order to set up the IPv6 link. However, all the users cannot afford this kind of links and they choose the legacy telephone links for getting IPv6 connectivity. In order to allow this, a telephone Remote Access Server using the PPPv6 protocol is needed.

Madrid has deployed a native IPv6 RAS on Linux allowing remote users to get IPv6 connectivity using phone links.

3.2.3.2.5 PLC Network

As said above, a basic PLC network is present in the Madrid showroom. This infrastructure is used with IPv6 for demonstration with audio/video applications because of the bandwidth that can drive the installed PLC devices.

3.2.3.2.6 Network Management

Regarding Network Management tools deployed for demonstration support, the Madrid showroom has installed several tools. As example:

SmokePing

Smokeping is a monitoring tool that uses ping6 packets to verify multiple network point's connectivity. (http://people.ee.ethz.ch/~oetiker/webtools/smokeping/index.en.html).

With SmokePing one can measure latency, latency distribution and packet loss in IPv6 networks. SmokePing maintains a long-term data store and draws pretty graphs, giving up to the minute information on the state of each network connection.

SmokePing comes with a smart alarm system, apart from simple threshold alarms, there are options of defining latency or loss patterns and uses them to trigger alarms.

3.2.4 Nomadic showroom

The Madrid showroom, on behalf of the whole Eurov6 project, presented the Nomadic Showcase during the Madrid 2003 Global IPv6 Summit. There were demonstrated a number of IPv6 applications and services available and easily deployed that are not showed in other project trials in the same event.

The applications and services showed in this event ran on both Linux and Windows operating system, and included:

Server/Client services	Applications
Web	Apache-2.0.40 (Linux) Mozilla-1.0 (Linux) Internet Explorer 6.0 (Windows)
DNS	Bind-9.2.1 (Linux)
FTP	ftp6 (Windows 2000) wu-ftpd-2.6.2 (Linux) ftp-0.17.15 (Linux)
Telnet	PuTTY (Windows 2000) Telnet6 (Windows 2000)
SSH	PuTTY (Windows 2000) OpenSSH-3.4p1 (Linux)
Streaming	Windows Media Server (Windows 2003) Windows Media Player (Windows 2000/XP) Mplayer on Linux (Linux)
Streaming with QoS	Streaming servers and Hitachi Router
Games and Entertainment	gtetrinet-0.4.1 (Tetrinet client) (Linux) tetrinetx-1.13.16 (Tetrinet server) (Linux) 3Degrees (Windows XP)
Transition Mechanisms	Dual Stack (Windows 2000/XP/2003 and Linux) NAP-PT

Figure 3-11: List of Applications and Services at the Madrid 2003 GIS

Furthermore, in the Nomadic showcase different demonstrations were shown provided by external companies. They were:

- Demonstration supplied by Xiran.
- Demonstration supplied by Panasonic.

In the showcase some other services provided by external IST projects were also used, like network access through PLC network, in order to test both Eurov6 and external IST projects services.

Figure 3-12: Demonstrating the Eurov6 Nomadic Showcase at the Madrid 2003 GIS

3.3 Brussels Showcase

3.3.1 Devices

This section gives a brief description of devices integrated and used in the Brussels Fixed showroom.

3.3.1.1 Hosts

Several PC hosts are used in the demonstrations, these PCs including desktop and laptop kinds, are installed and configured with several IPv6 enabled operating systems with different distributions and versions of Linux, FreeBSD, and Windows.

3.3.1.2 Routers

Three IPv6 enabled routers: CISCO 7204, CISCO 7206 and 6WINDGate 6121 are used in the Showcase.

3.3.1.3 Mobile Devices

The following Pocket PCs and Wireless devices are used in the Brussels showcase:

- Compaq iPAQ 3870 with IrDA and Bluetooth, installed with Linux.
- Ericsson T39m with GPRS, IrDA and Bluetooth, registered to Proximus.
- Sony Ericsson T610 with GPRS, IrDA and Bluetooth, registered to Mobistar.
- 3Com Bluetooth PCMCIA Card.
- 3Com Bluetooth USB adapter.
- Compaq WLAN Access Point.

- Compaq Wireless PCMCIA Card.

3.3.1.4 Home Network Devices

The Brussels showroom has established a home network as in the Basel showroom.

This home network comprises X10 devices: Three appliance modules, one lamp module and an interface for the computer, the controller. The appliances connected to the home network are: a radio, a desk lamp, a fan and a lamp. The home automation system has also a Spitfire device, which controls all IR remote control - compatible entertainment devices directly from a PC. It converts digital signals received from the computer into infrared remote control signals transmitted to the controlled device e.g. the TV.

3.3.2 Applications

3.3.2.1 HTTP Client

There are several web browsers with IPv6 capability that are installed in PCs at the Brussels showroom: Mozilla (v0.9.9) and lynx (v2.8.4) for Linux, lynx (v2.8.4) for FreeBSD, and Internet Explorer (v6 and SP1) for Windows.

To test if it is working with the IPv6 protocol, call the URL: http://www.kame.net. If the turtle is dancing, the browser supports IPv6.

3.3.2.2 HTTP Server

There are four IPv6 enabled web servers and all of them are built from the Apache2 package. The web server of www.ipv6.iihe.ac.be is IPv6-only and the web server of www.ipv6tf.be can be accessed from both IPv4 and IPv6 clients. Another IPv6-only web server, www.ultima.ipv6.iihe.ac.be is located behind an IPv6 island to carry out NAT-PT tests. The last web server is Tomcat 4.0.24, which supports Java Servlet.

3.3.2.3 ISABEL Multimedia Videoconference

Eurov6 has installed the latest version (4.6) of the ISABEL software on a multimedia Linux (Redhat7.3) PC with audio and video interfaces in the Brussels showroom. The Brussels site ISABEL platform successfully participated in a number of events distributed with ISABEL including the NGNI-ISABEL workshop and the Madrid 2003 Global IPv6 Summit.

3.3.2.4 Multicast Videoconference tools

In the Brussels showroom are installed the multicast applications such as RAT (audio), VIC (video), NTE and SDR (Session Directory Tool). The visitor can receive the conference sessions through SDR and receive video and audio through VIC and RAT respectively. NTE is a Shared Text Editing tool, allowing participants to write on a whiteboard to discuss issues. The Brussels site has participated in several videoconferences through these tools.

3.3.2.5 VideoLAN

VideoLAN Server and Client have been installed in a number of PCs in the Brussels showroom. This streaming application has been used to do DiffServ tests and joint tests with Alcatel in Antwerp using their core router A7770 OBX.

3.3.2.6 The Darwin Streaming Server (DSS)

The Darwin Streaming Server (DSS) is a product of the Apple Corporation. It is a full-featured version of the QuickTime Streaming Server with source code. This product has been patched by Telematica Instituut to support IPv6, but future versions should support it directly. It is designed to work with the QuickTime player, but as it supports the Real-Time Streaming Protocol (RTSP), it can interoperate with any compatible software, including **mp4player**.

DSS may be used both for video-on-demand, serving already available content from files on the hard disk, or streaming from a live source. DSS can be used as a repeater, and thus may distribute the same stream to many clients.

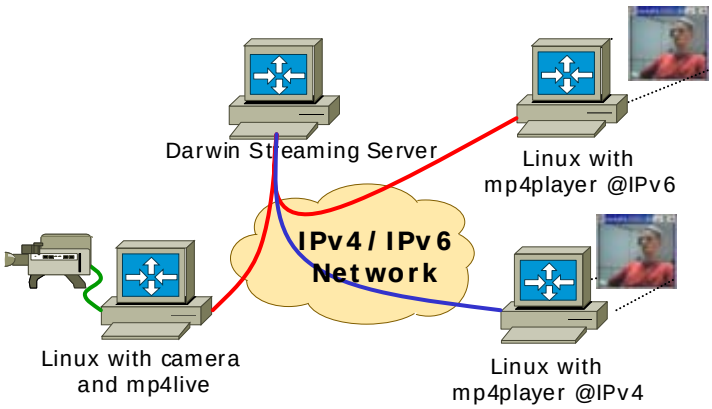

Figure 3-13: Mp4live and DSS Serving Live Video over an IPv4/IPv6 Network

This product has very advanced features, an administration and management interface and is a very good solution for both educational (eg. distant learning) or entertainment purposes.

3.3.2.7 Windows Media Services and Media Encoder 9 Series

The Brussels showcase has Windows 2003 Streaming Server installed, enabling the streaming service over IPv6 networks. Windows Media Encoder is used to encode captured films from a camera.

3.3.2.8 Windows Media Player 9 Series

Windows Media Player 9 Series can receive and play the audio and video streams that either Windows Media Service or Windows Media Encoder 9 Series can stream.

3.3.2.9 MPEG4IP

The Brussels showroom has installed the latest version of the mpeg4ip package from the site of http://sourceforge.net/projects/mpeg4ip/ on two Linux machines. The whole mpeg4ip package includes mp4player and mp4live streaming server.

3.3.3 Services

3.3.3.1 Network Services

3.3.3.1.1 Mobility

IPv6 Mobility will be set up soon.

3.3.3.1.2 Multicast

The multicast concept was thought to let applications save bandwidth in data networks, multicast is a default feature of IPv6, but its deployment is still in the early stage. M6Bone is an IPv6 testbed specifically deployed to make tests in the IPv6 multicast field. The network architecture is in the form of a star, where all sites are connected to RENATER. The connection is achieved by an IPv6 tunnel over either IPv4 or IPv6, using a FreeBSD system and PIM-SM daemon. Within the Eurov6 Brussels showroom, a connection has been made with the M6Bone by means of an IPv6 tunnel and tools such as RAT or VIC have been used to show multicast applications.

3.3.3.1.3 Security /VPN

IPv6 VPN can be demonstrated in two scenarios in the Brussels showroom. One scenario is to use FreeS/Wan IPsec on Linux as one VPN gateway and 6WINDGate 6121 as another gateway. Pre-share key (PSK) is used for ISAKMP authentication. A secured tunnel can be built between the two gateways.

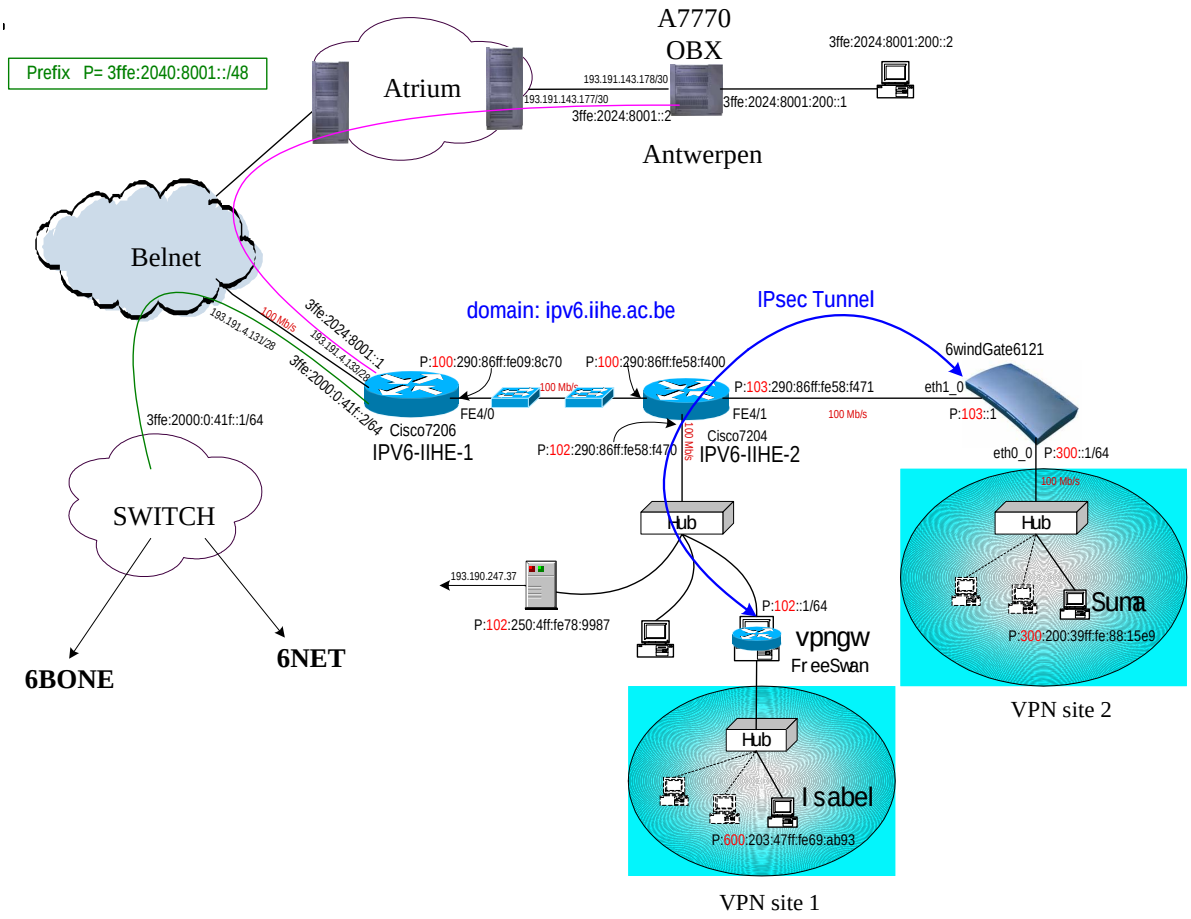

Figure 3-14: IPsec/IPv6 VPN between Linux with FreeS/WAN and 6WINDGate 6121

The other scenario is implemented by two 6WINDGate 6121 routers located in the Brussels and Basel showrooms.

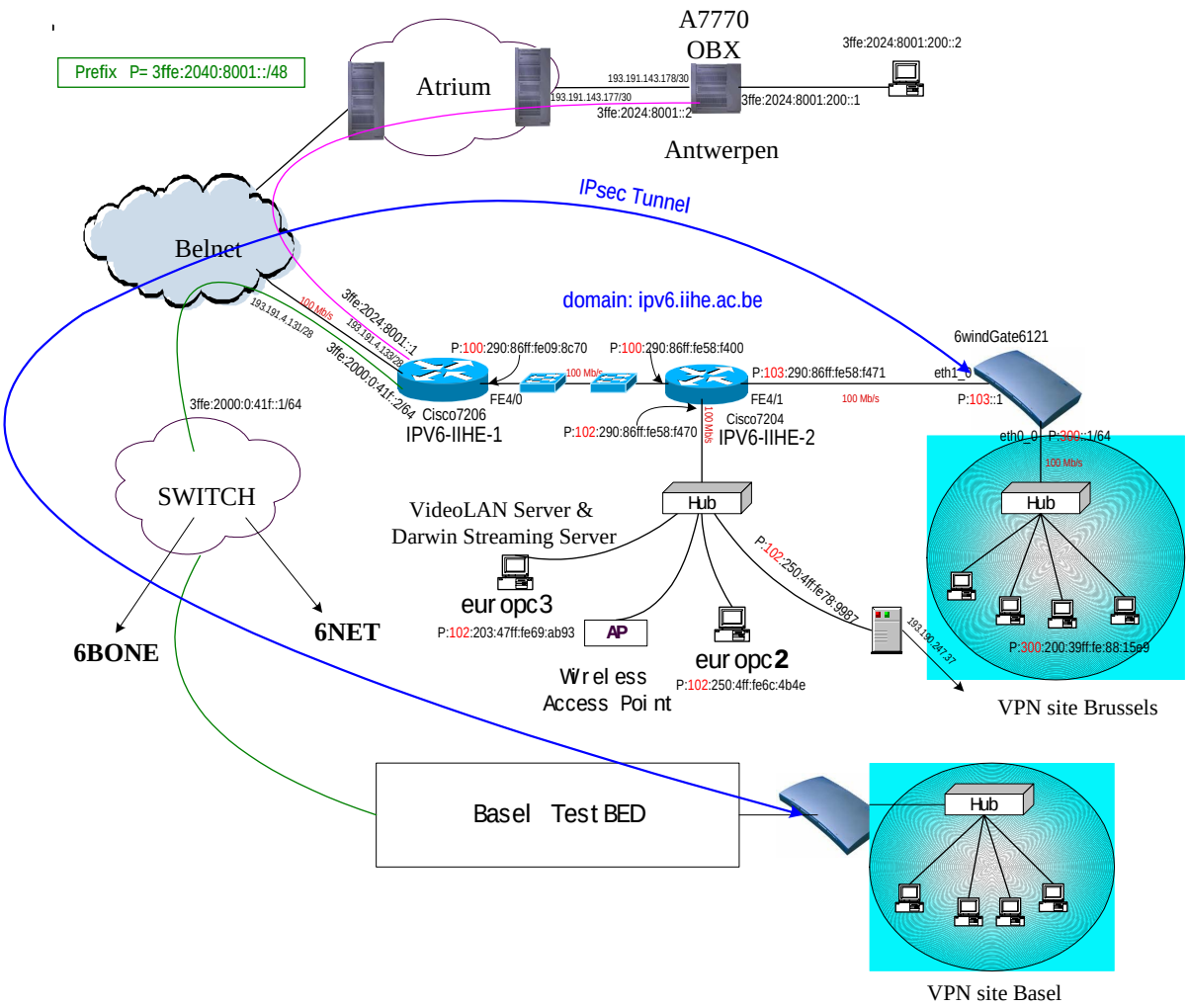

Figure 3-15: IPsec/IPv6 VPN between Brussels and Basel using 6WINDGate 6121

3.3.3.1.4 DNS

There are two DNS servers installed in the Brussels showroom. One DNS server, using bind9.2.1 on FreeBSD 4.7, masters the domain of ipv6.iihe.ac.be, and it is connected to both IPv4 and IPv6 networks through two network cards. The other one, using the same version of the bind package, is located in an IPv6-only island, and it is part of NAT-PT infrastructure.

3.3.3.2 Network Infrastructure

3.3.3.2.1 Wireless Access

Within the Brussels showroom exist several wireless points of access exploiting the functionalities of the main wireless technologies as:

- Bluetooth.
- IrDA.
- WLAN.

3.3.3.2.2 Transition Mechanisms

Transition mechanisms are available in the Brussels showroom:

- Dual stack.
- NAT-PT (6WIND router and Ultima BTexact on FreeBSD).
- Tunnel broker (Freenet6).
- Configured tunnel (Cisco 7204/7206).

3.3.4 Nomadic Showcase

This part will be available from September 22nd to 26th 2003 and will include the following companies and institutions: 6WIND, ACUNIA (with support from the Eurov6 and 6NET projects), ALCATEL, ERICSSON, INGINEO, JUNIPER, MBDS, MOBISTAR, PANASONIC, PSA/Citroën, TELSCOM, ULB/VUB, XYBERNAUT. The IPv6 connectivity will be provided by BELNET.

Here are details of some IPv6 demonstrations that will be available from ULB/VUB:

- Multicast Videoconference tools (VIC, RAT, SDR).
- VideoLAN.
- Windows Media Server (Windows 2003).
- Windows Media Player 9 Series (Windows 2000 and XP).
- Three Degrees (Windows XP).
- Web server (Apache2 on Linux).
- DNS (Bind-9.2.1 on Linux).
- SSH (PuTTY on Windows 2000 and OpenSSH on Linux).
- Home automation system: on and off switching of devices (radio, fan, TV and lamp) located at the ULB/VUB Fixed Showcase.

Participating companies will provide the following demonstrations:

- 6WIND. Provides a router with IPv4 and IPv6 services capabilities. IPv6 features to be demonstrated include Transition mechanisms (NAT_PT and 6to4), IP Security, Virtual Private Network and Quality of Service.
- ACUNIA. Demonstration of telematics services communicating over IPv6. Acunia is developing an IPv6 version of their CarCube product to be embedded in a vehicle. Identified telematics services to be demonstrated are off-board navigation, e-mail and traffic information.
- ALCATEL. Provides demonstrations of IPv6 features over the Alcatel A7770 OBX core router. A video streaming application (VideoLAN) has run over an Alcatel A7770 OBX in Antwerp and the ULB IPv6 network. The same scenario will be set up to run over the A7770 in Antwerp and the Showcase at the Hotel le Plaza.
- BELNET. The Belgian NREN provides IPv4 and IPv6 connectivity (through a dual stack service) between the Hotel Le Plaza and the external world (through a Belgacom leased line at 2 Mbps, while the BELNET infrastructure is at 2.5 Gbps).
- ERICSSON. Will demonstrate IPv6 applications over GPRS.
- INGINEO. Head-mounted displays connecting to mobile devices.
- JUNIPER. Will provide a dual stack router installed at the Hotel Le Plaza.

- MBDS and PSA/Citroën. Telematics applications over GPRS and WLAN, running on palmtop device, linked to hands-free GSM equipment in the car. Voice reading of e-mails and news; …
- MOBISTAR. Demonstrations of IPv6 services. Mobistar is configuring its APN to support IPv6. Demonstrations planned will show a laptop/PDA running basic IPv6 services like ping6 and ifconfig6 through a GPRS phone using the infrastructure provided by Mobistar.
- PANASONIC. Demonstration of IPv6 cameras.
- XYBERNAUT. Wearable computers.

4. SUMMARY AND CONCLUSIONS

This deliverable provides the overview of integrated network and applications realized in the three Fixed showrooms. The project has implemented most of the publicly available applications and network features to demonstrate the maturity of IPv6 protocols and technology. The Nomadic showcase is another example of how easily the IPv6 applications can be set up and demonstrated to achieve higher awareness among the target audience.