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Abstract:

This document describes the overall trial scenario of the 1st Year Public Trial of the Euro6IX project that was scheduled at the Madrid 2003 Global IPv6 Summit during May 2003.

Because of the actual lack of big numbers of Euro6IX "native" customers the 1st Year Public Trial was realized as a big trial at the GIS2003 event that attracted lots of visitors of the conference as well as the representatives from the European Commission and from other European projects.

This deliverable D4.3p describes the trial activities of the 1st Year Public Trial in more detail and shows, how these activities are related to the special conditions of the Euro6IX networking scenario and which project results were shown within this public trial.

Keywords:

1st Year Public Trial, GIS2003, IPv6 Applications, IPv6 Demonstration, IPv6 Euro6IX Network, IPv6 Network Services.

Revision History

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

Revision	Date	Description	Author (Organization)
v0.1	16/06/2003	Document creation	O. Bonneß (T-Nova)
v0.2	01/07/2003	Chapter 1: Introduction	O. Bonneß (T-Nova)
v0.3	03/07/2003	Executive Summary	O. Bonneß (T-Nova)
v0.4	10/07/2003	Chapter 2: Overview of the 1st Year Public Trial	O. Bonneß (T-Nova) J. Palet (Consulintel)
v0.5	30/07/2003	Chapter 3: Trial Scenarios	E. Azanon (TID) O. Bonneß (T-Nova) A. Ferrandiz (TID), M. Gomez (UPM) P. Hovell (BT) R. De Luca (Telscom) V. Ksinant (6WIND) R. Martinez (TID) J. Munoz (nGn) J. Palet (Consulintel) C. Parada (PTIN), A. Skarmeta (UMU) C. Ralli (TID) A. Tapjador (UPM) R. Vazquez (TID)
v0.6	14/08/2003	Restructuring Chapter 3 and Insertion of Paragraph 3.1	O. Bonneß (T-Nova)
v0.7	21/08/2003	Chapter 4: Summary	O. Bonneß (T-Nova)
v0.8	28/08/2003	Review from Editor	O. Bonneß (T-Nova)
v0.9	29/08/2003	Delivered to PSC for Review	O. Bonneß (T-Nova)
v1.0	28/09/2003	PSC review completed	J. Palet (Consulintel)

Executive Summary

The four main objectives of the Euro6IX project are (as mentioned in the Technical Annex):

1) To research an appropriate architecture to design and deploy the first Pan-European non-commercial IPv6 Internet Exchange (IX) Network.
2) To use the deployed IPv6 IX infrastructure to research, test and validate IPv6-based applications and services.
3) To open the Euro6IX network to specific user groups.
4) To do dissemination, liaison and coordination with clusters, fora, and standards organizations.

In order to fulfill the second of these main project objectives, several trial activities (Internal Trials and Public Trials) are scheduled on a yearly basis. These trials are organized and carried out in Activity 4.3 of Work package 4.

This document describes the organization, realization and the results of the 1st Year Public Trial event, which was scheduled for Month 18 of the project lifetime (June 2003) and was realized as Milestone 4.3 in the form of a very successful trial at the Madrid 2003 Global IPv6 Summit (GIS2003) conference in Madrid (Spain) already in May 2003.

The structure of this deliverable D4.3p '1st "Trials and Evaluation" Report' is as follows:

- Chapter 1 gives a short introduction to the 1st Year Public Trial and clarifies the objectives of this trial.
- Chapter 2 contains an overview about the general approach of the 1st Year Public Trial.
- Chapter 3 enhances this deliverable with some remarks respectively the preparation of the GIS2003 trial and a detailed description of the scenarios shown (including the achieved results).
- Chapter 4 concludes this deliverable D4.3p with a summary of the 1st Year Public Trial and some lessons learned during preparation and realization of the GIS2003 demo.

In summary it can be said that the 1st Year Public Trial of the Euro6IX project contained besides a very sophisticated IPv6 network setup within the GIS2003 conference hotel, lots of very interesting and successful IPv6 applications, network and service trials.

The 1st Year Public trial highlighted the achievements of the Euro6IX project and attracted the attendees of the GIS2003 conference. Hence the objectives of the 1st Public Trial, as written down in the Technical Annex, were met.

Table of Contents

Table of Figures

1. INTRODUCTION – OBJECTIVES OF THE 1ST YEAR PUBLIC TRIAL

Activity A4.3 in Work package 4 of the Euro6IX project is structured around a peer of yearly trials (Internal Trial and Public Trial), which will evaluate and demonstrate key features of IPv6 with emphasis on the assessment of end user service scenarios in real large-scale deployments and with respect to the special constraints and requirements of an IPv6 based IX network.

This will be achieved in close collaboration with A4.2, which will provide the applications as well as with A4.1 (Advanced Network Services Design and Evaluation), WP2 (Network Architecture Design) and WP3 (Network Implementation).

The technical Annex of the Euro6IX project description says respectively the Public trials:

"Public Trials will act as highly visible demonstrations of the results of the project, but will be used also for the validation of the services, the Euro6IX test-bed and other developments performed in the project. Public Trials will involve external users, which will be selected in cooperation with WP5 in order to increase the dissemination of the results of the project. Three public trials are foreseen during the project, one each year of the project."

Hence the derived objectives for the Public Trials (and thus also for the 1st Year Public Trial) are:

- Define realistic trial scenarios, which can be used to demonstrate the enormous project achievements the Euro6IX project has reached during the first 16 month of project lifetime.
- Demonstrate and validate scenarios of (already deployed) IPv6 Network Services, which are under investigation within the Euro6IX project and which are of special interest for external users and customers of an IPv6-based Internet Exchange network.
- Generate feedback to A4.1 and A4.2, as well as to WP2 and WP3.
- Open the demonstration to a large amount of customers and allow them to gather their own experiences with the implemented Euro6IX IPv6 Services.
- Demonstrate and show applications, which could be used to generate IPv6 network traffic within the Euro6IX backbone and which can attract (and are needed by) future IPv6 users.
- Generate feedback to A4.1 and A4.2, as well as to WP2 and WP3
- Generate a rough impression about the new and enhanced possibilities for IPv6-based Network Services and Applications within future IPv6 IX environments.

Doubtless not all objectives could be reached completely within the 1st Year Public Trial (especially the number of public customers for this trial was limited to the audience of the GIS2003 event) but the trial scenarios and results, described in this Deliverable D4.3p, are a good synchronization point for the following research and implementation activities within the Euro6IX project and illustrate the big achievements of the project during it's first 16 month of project lifetime.

2. OVERVIEW OF THE 1ST YEAR PUBLIC TRIAL

This chapter gives an overall overview how the 1st Year Public trial was structured and which general approach was chosen to realize the objectives stated in chapter 1 above.

2.1 General Approach

The Technical Annex of the Euro6IX project states: "Public trials … act as highly visible demonstrations of the results of the project".

What does more fulfill this requirement than a public trial of the project achievements at a really well visited and well-known IPv6 conference?

For this reason it was decided during the Euro6IX project meeting in February 2003 to choose an extremely high visible event of the IPv6 community and the biggest IPv6 conference in Europe for the realization of the 1st Year Public Trial – the Madrid 2003 Global IPv6 Summit (GIS2003) in Spain.

This conference was scheduled for May 12th to 14th 2003 and took place within the conference hotel "Auditorium Madrid y Centro de Congresos Príncipe Felipe" near the Airport of Madrid.

The scheduling of this conference to May 2003 fitted also very well into the time planning of the project that fixed the 1st Year Public Trial to month 18 of the project lifetime (i.e. June 2003).

Another reason to choose such a big IPv6 conference for the 1st Year Public Trial was, that because of the actual status of the Euro6IX network and services the number of connected customers was not as high as possible and hence the demonstration of project achievements during a big conference would reach much more people than an abstract event via the Internet.

Besides that it would be much easier to communicate directly to the customers (visitors of the conference) and get back much more information and feedback about the customer's impression with respect to the shown trial scenarios.

The Euro6IX project is a very complex one, which deals with a whole bunch of interesting and new aspects of IPv6 in an Inter-Provider (Inter IX) network, connecting lots of end sites and potential IPv6 customers. That's why many things have to be implemented, tested and demonstrated for all levels of the IPv6 Internet architecture. In order to demonstrate the entire project achievements to the visitors of the GIS2003 event it was decided to subdivide the whole trial into the following 3 demonstration fields:

Network:
To demonstrate:

- Core Network connectivity to all Euro6IX Exchanges, according to Figure 2-1.
- Addressing and Routing (incl. BGP-Policies).
- Network Operation and Management.
- Statistics.
- IPv6 access via GPRS networks.
- etc.

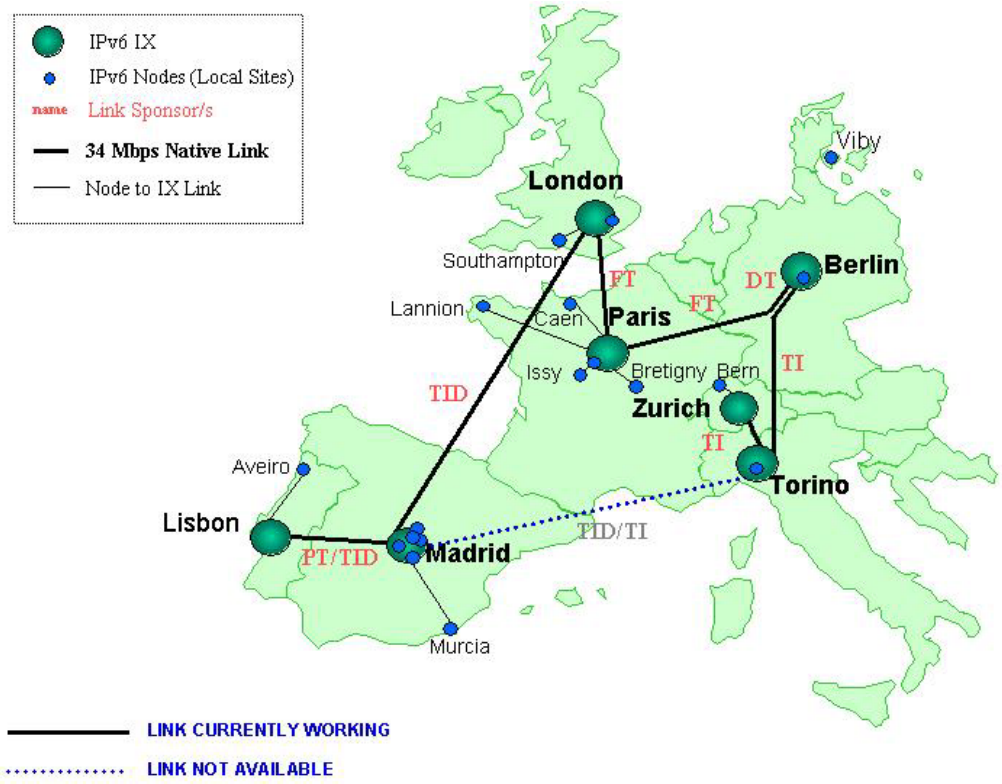

Figure 2-1: Status Quo of the Euro6IX Network at the time of the 1st Year Public Trial (M4.3)

Euro6IX Network (and End user) Services:

To demonstrate:

- DNS.
- Mobility.
- Multicast.
- Multihoming.
- QoS.
- Transition tools (NAT-PT, TB, etc.).
- Security/VPN etc.

Applications:

To demonstrate:

- VoIPv6.
- Audio/Video Streaming.
- Instant Messaging.
- Web Tools.
- Multimedia and Videoconferencing, etc.

An equivalent separation was chosen as well for the 1st Year Internal Trial in November 2002, which means that the Public Demonstration at GIS2003 was a stringent enhancement of these trial scenarios that were already investigated during the 1st Year Internal Trials.

2.2 Further Requirements

Besides the "simple" demonstration of the Euro6IX project achievements (as 1st Year Public Trial) several other requirements and tasks were formulated for the Euro6IX project and the IPv6 infrastructure of the GIS2003 event, which was heavily based on the Euro6IX backbone.

1. IPv6 (WLAN) Internet Access for the audience of the GIS2003 conference in the conference and the terminal room.
2. IPv6 Internet Access for several demonstration booth's of other European IPv6 projects (6POWER, 6QM, 6NET, …).
3. International IPv6 connectivity for the "1st ETSI Multi-site Remote IPv6 Interoperability event" (IPv6 Plugtests).
4. International IPv6 connectivity for the vendor exhibitions and showroom.
5. International IPv6 connectivity for the Euro6IX Demonstration (1st Year Public Trial).

Some of these requirements were directly derived from the Technical Annex of the Euro6IX project that states "Public Trials … will be performed in coordination with the European commission … and will involve external users. … Public trials are coordinated and scheduled with similar events and workshops of the 6NET project." and the other ones arose from official requests of the EC Euro6IX project officer.

It is pretty obvious that satisfying these demanding requirements will end in a very complex and sophisticated IPv6 networking environment, that is based in it's core network on the Euro6IX network infrastructure.

A further dimension of complexity was hidden in the challenge for finding a sponsoring ISP for attaching the IPv6 island of the GIS2003 to the Euro6IX backbone in TID's IX POP in Madrid with a sufficient bandwidth.

Kindly Jordi Palet (Consulintel) could convince the ISPs Espanix and RedIRIS to overtake this part, so that finally RedIRIS enabled the connectivity of the GIS2003 network cluster to the Internet and the 6Bone as well to the 6NET project and MAD6IX (via UPM). Espanix enabled the connection between the local loop of the hotel and RedIRIS.

At this point it should be stated once more that the decision for choosing a trial scenario on a big international IPv6 conference for the 1st Year Public Trial was as well driven by the small amount of native IPv6 customers that were connected to the Euro6IX network in May 2003. This status is owed the comparatively early deployment state of IPv6 network services within the Euro6IX network and hence an actual lack of outreach to the European public.

As an additional highlight of the GIS2003 conference Jordi Palet (Consulintel) managed it to establish native IPv6 connectivity into all hotel rooms of the Auditorium Madrid (which were equipped with an IPv4 internet access per default). The event inaugurated at this way the first hotel in the world offering free IPv6 connectivity into the rooms. Thanks again to Jordi at this place.

2.3 Design of the Overall Network Infrastructure

The Figure 2-2 describes the international part of the IPv6 network infrastructure as it was discussed and designed for satisfying the above requirements as well as the 1st Year Public Trial (GIS2003 Demonstration) of the Euro6IX project.

Figure 2-3 below illustrates in more detail the Hotel internal IPv6 infrastructure at the GIS2003 conference and Figure 2-4 gives a more exact overview of the Euro6IX trial network that was implemented for realizing the 1st Year Public Trial.

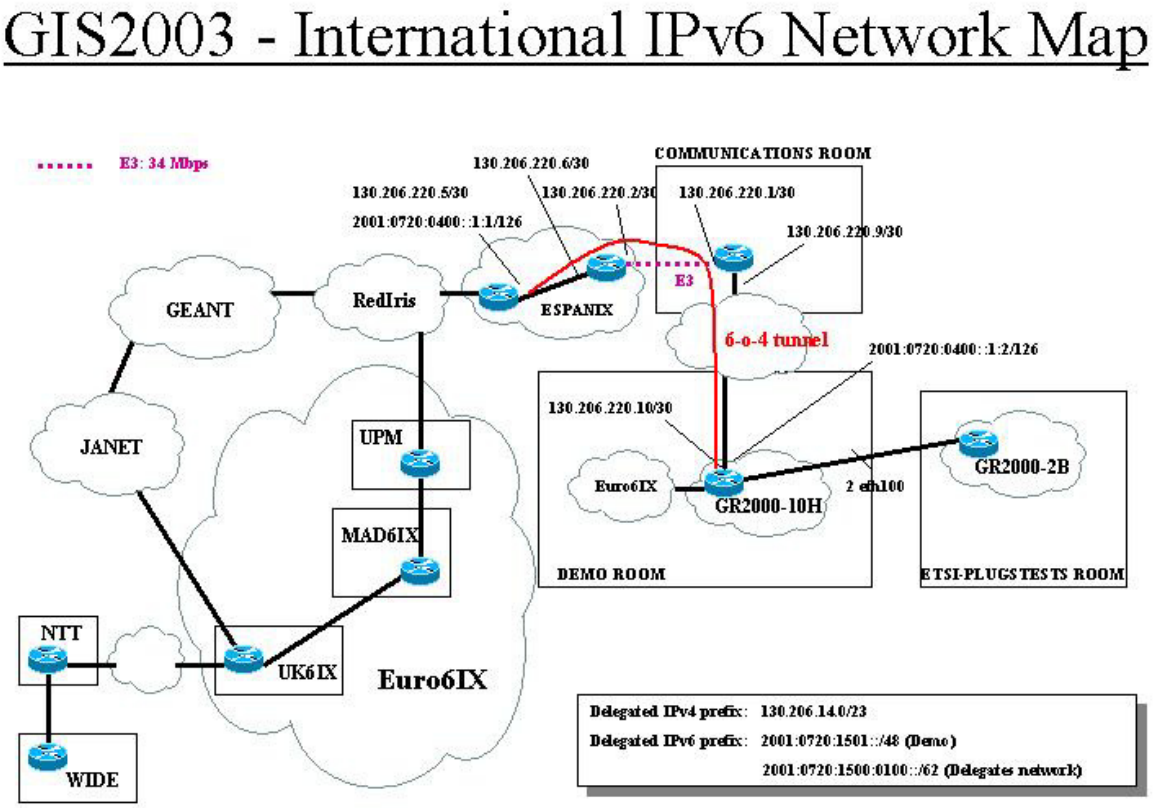

Figure 2-2: International IPv6 Network Infrastructure for the GIS2003 Event

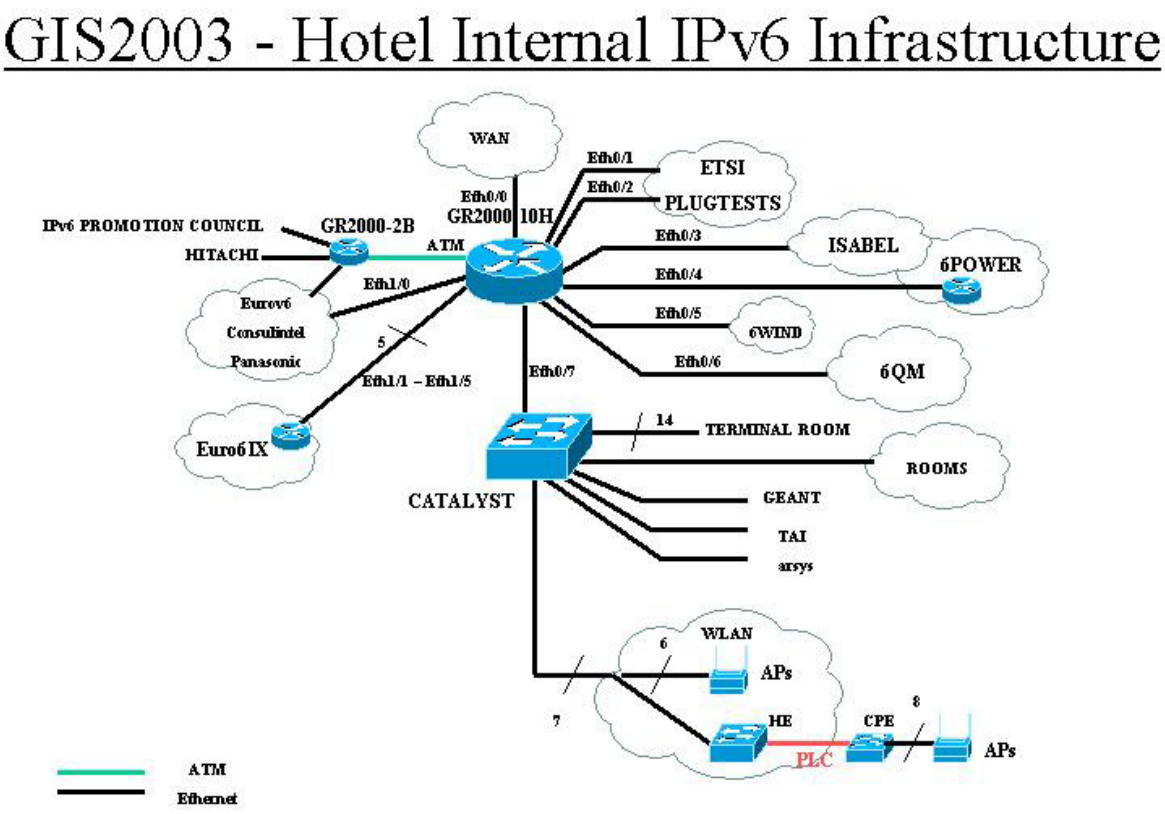

Figure 2-3: Hotel IPv6 Network Infrastructure for the GIS2003 Event

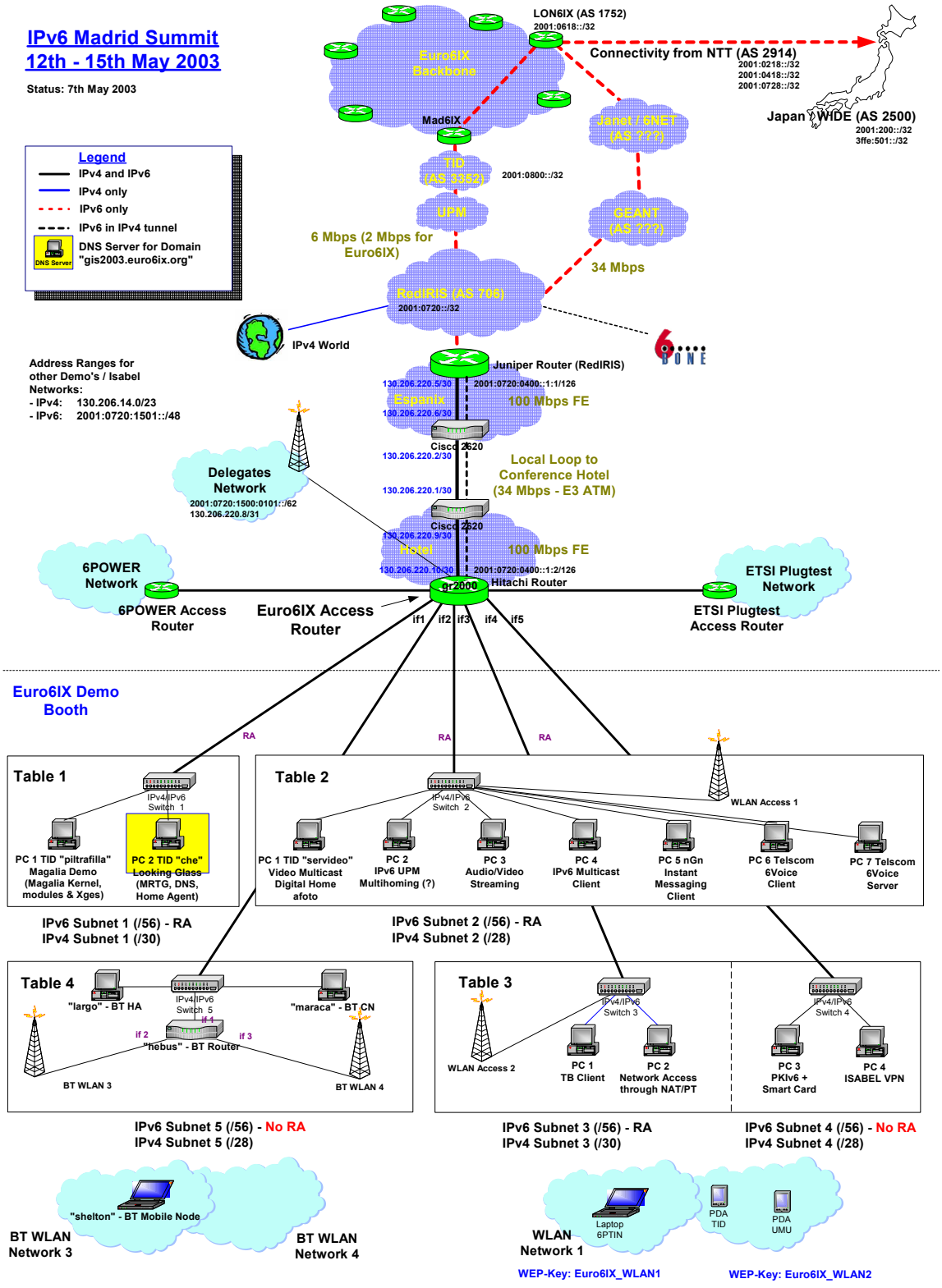

Figure 2-4: Snapshot of Euro6IX IPv6 Network Infrastructure for the 1st Year Public Trial

2.4 Chosen Trial Scenarios

In order to attract the attendees of the GIS2003 conference with the achievements of the Euro6IX project and to involve them into the 1st Year Public Trial the following trial scenarios were chosen.

Nr.	Scenario	Table/PC#	Organizing Partner	Responsible Person	Classification
1	A Range of IPv6 Applications	4 / Laptop	BT	Peter Hovell	**Applications**
2	Instant Messaging Client	2 / 5	nGn	Jesus Munoz	**Applications**
3	Video on Demand	2 / 1	TID	Ruth Vázquez	**Applications**
4	Digital TV Streaming	2 / 1	TID	Aurora Ferrándiz	**Applications**
5	AFoto	2 / 1	TID	Aurora Ferrándiz	**Applications**
6	Web Access to an IPv4 service via NAT-PT (Digital Home)	2 / 1	TID	Aurora Ferrándiz	Applications and **Services**
7	ISABELv6: SIP, H323 & Web Antenna	3 / 4	UPM	Miguel Gomez	Applications and **Services**
8	Access of a mobile node to advanced services	3 / Laptop	PTIN	Carlos Parada	Applications and **Services**
9	PKIv6 and Smartcard for accessing IPv6 Network Services/Apps	3 / 3	UMU	Antonio Skarmeta	**Services**
10	PDAs / Laptops for Mobile IPv6 with video streaming applications	3 / PDA	UMU	Antonio Skarmeta	**Services**
11	Network address translation-Protocol Translation (NAT-PT)	3 / 2	UMU	Antonio Skarmeta	Network and **Services**
12	Voice over IPv6	2 / 6 2 / 7	Telscom	Riccardo De Luca	Network and **Services**
13	IPv6 Access via GPRS	4 / Laptop	BT	Peter Hovell	Network and **Services**
14	IPv6 Multicast Client	2 / 4	6WIND	Vladimir Ksinant	Network and **Services**
15	Video Multicast	2 / 1	TID	Aurora Ferrándiz	Network and **Services**
16	Audio/Video Streaming over IPv6 with QoS Support	2 / 3	Consulintel	Jordi Palet	Network and **Services**
17	Network access via Tunnel Broker	3 / 1	UMU	Antonio Skarmeta	Network and **Services**
18	IPv6 Multi-homing based on Default Address Selection	2 / 2	UPM	Antonio Tapjador	Network and **Services**
19	Mobile IPv6	4 / Laptop	BT	Peter Hovell	Network, **Services** and Applications
20	MRTG Statistics of Madrid GIS2003	1 / 2	TID	Rafael Martinez	**Network**
21	TID Web statistics system & MRTG	1 / 2	TID	Carlos Ralli	**Network**
22	Web access to Looking Glass Server at TID premises	1 / 2	TID	Aurora Ferrándiz	**Network**
23	Magalia	1 / 1	TID	Eduardo Azañón	**Network**

Figure 2-5: Trial Scenarios for 1st Year Public Trial

Several of the above enumerated trial scenarios present as well achievements within the Network and Service Area of the Euro6IX project as also project results from the Application-oriented parts. Hence it is not very easy to map these scenarios only into one of the 3 categories.

For each trial scenario within the 1st Year Public Trial one project partner took the leadership, normally the one, who has implemented this application or service or that one, who acts already as leading party within the correspondent task of work activity 4.1.

Furthermore the "Table/PC#" column illustrates on which of the 4 tables in the Euro6IX GIS2003 booth this trial was located and to which cluster (applications, network or services) this belongs to.

These selected scenarios were chosen because of their very good possibilities to illustrate the huge amount of work which was spent during the first 16 month of project lifetime and to underline the enormous achievements with respect to network connectivity, network services and of course applications. It was the decision of the project that this small subset of the overall project achievements will provide a good trial scenario, that attracts the visitors of the Euro6IX booth and also the European Commission representatives and give these users the chance to make their own experiences with the IPv6 world of the Euro6IX project.

The broad mix of presentations from network, service and application areas allows the Euro6IX 1st Year Public Trial to exhibit project results as well from work packages 2 and 3 (Network and Service design and implementation) as from Activities A4.1 and A4.2 of WP4 (Application implementation and porting).

The trial scenarios itself are described in more detail within the following chapter 3 of this deliverable together with a statement why this scenario was chosen to represent the project at the GIS2003 event.

3. PREPARATION AND REALIZATION OF THE 1ST YEAR PUBLIC TRIAL

The Realization of the 1st Year Public Trial was another big and impressive exhibition of the Euro6IX project achievements that were reached during the first 16-month period of project lifetime.

Almost all Euro6IX partners participated in the preparation and realization of the network, service and application trial scenarios for the 1st Year Public Trial and many of these scenarios (like for instance Mobile IPv6, ISABEL Videoconferencing, Magalia Network Management, VPN, etc.) were based on the connectivity of the Euro6IX backbone.

The following enumeration illustrates the general time schedule for the preparation and realization of the 1st Year Public Trial (GIS2003 Trial) as well as for the preparation of this deliverable D4.3p, as it was decided during the Euro6IX project Isabel Videoconference in April 2003 and the project meeting in Aveiro (June 2003).

Activity.	Until	Responsibility
Identification of 1st Year Public Trial Event	01/03/2003	PSC, All
Proposal of Trial Scenarios	10/04/2003	A4.3 Leader, All
Rough Description of Scenarios	17/04/2003	Scenario Leader
Final Decision about Trial Scenarios	24/04/2003	PSC, All
First Test of Scenarios in Euro6IX	01/05/2003	Scenario Leader, All
Dress Rehearsal for Euro6IX 1st Year Public Trial	05/05/2003	Scenario Leader
(Partner site internal or over Euro6IX network)		
1st Year Public Trial (Milestone M4.3)	12/05/2003	Scenario Leader, A4.3 Leader
Template for Input to D4.3p	20/06/2003	A4.3 Leader
Final Description of Trial Scenarios and Results of the 1st Year Public Trial	07/07/2003	Scenario Leader
Compilation of first version of D4.3p	21/07/2003	A4.3 Leader
Internal Review of D4.3p	30/07/2003	A4.3 Leader, PSC
Delivery of D4.3p to EC Project Officer	31/07/2003	PSC

Figure 3-1: Timeline for Realization of 1st Year Public Trial (M4.3) and D4.3p

Section 3.1 below describes how the 1st Year Public Trial of the Euro6IX project was prepared and section 3.2 gives a pretty detailed overview about the specific trial scenarios that were shown by the Euro6IX project at the GIS2003 conference.

3.1 Preparation of 1st Year Public Trial (GIS2003 Trial)

The preparation of the 1st Year Public Trial can be separated into several activities that will be described within the following few sections.

3.1.1 Identification of a Suitable Event for the 1st Year Public Trial

The most important objectives for a Public Trials are to "… act as highly visible demonstration(s) of the results of the project, …" and to "… involve external users …".

The basic idea for involving external customers was to attach normal customers to the Euro6IX network and to involve them in a big trial scenario of very high visibility in order to reach a very big audience with the demonstration of the Euro6IX project achievements.

Because of the actual very limited number of native Euro6IX customers, the project thought about another solution for involving "external users" and generated the idea to use one of the big European IPv6 conferences as "framework event" for the 1st Year Public Trial. A very sophisticated and comprehensive demonstration should be used to attract all the conference participants and visitors with the achievements of the project and reach hence a very broad publicity.

Following the time scheduling for the 1st Year Public Trial (M4.3) to month 18 of the project lifetime it was decided during the Isabel Videoconference of the Euro6IX project in February 2003 to chose the biggest IPv6 conference in Europe as the "framework event" for the 1st Year Public Trial – the Madrid 2003 Global IPv6 Summit from May 12th to 14th (GIS2003).

This decision and the corresponding time plan was coordinated as well with the Euro6IX project officer and the EC as also with the other European IPv6 projects in order to reach a well-balanced and comprehensive IPv6 demonstration at the GIS2003 event.

3.1.2 Identification of Trial Scenarios

In order to demonstrate as much as possible of the Euro6IX project achievements it was proposed from the Euro6IX project during the Isabel project Meeting in April 2003 to spread the 1st Year Public Trial about 4 tables and to present project results from all work packages and activities.

After a useful discussion on the mailing list the final trial scenarios were fixed at the end of April 2003 and it was decided to include as well Network and Service trial scenarios, as Application presentations into the 1st Year Public Trial.

Each of the 4 tables should present one highlight of the project:

- Table 1: "Demonstration of the Usage of the Euro6IX Backbone" (Network)
- Table 2: "Standard IPv6 Applications – Live" (Applications)
- Table 3: "Using Network Services within Euro6IX" (Services)
- Table 4: "Using Network Services and IPv6 applications" (Services/Applications)

For every concrete trial scenario a leader was elected, who was responsible for the in-depth definition of the specific scenario as well as for testing, installation and trialing of this scenario during the GIS2003 event in Madrid.

Figure 2-5 above contains the trial scenarios inclusive their corresponding scenario leaders.

3.1.3 Identification of other Requirements

In order to incorporate feedback from EU and from the other European IPv6 Projects several synchronization means were used (emails, physical meetings, etc.). This led to the list of additional requirements for the 1st Year Public Trial which was already discussed in section 2.2 above - mainly targeting at a complex IPv6 infrastructure which is heavily based on the Euro6IX network infrastructure.

3.1.4 Preparation of Concrete Trial Scenarios

The corresponding scenario leader prepared each specific trial scenario in the following way:

- Proposal of a trial scenario for the 1st Year Public Trial.
- Rough description of this proposal scenario.
- Discussion about issues with this trial scenario on mailing list.
- Decision about realization of this scenario during the 1st Year Public Trial.
- Fine description of this trial scenario (incl. network requirements, etc.).
- Implementation and test of this trial scenario (on-site).
- Dress Rehearsal for this trial scenario.
- Implementation and Realization of trial scenario at the GIS2003 event.

In site-internal as well as Euro6IX-wide dress rehearsals before the Madrid GIS2003 event the scenario leaders verified all the trial scenarios, in order to make sure that the whole implemented IPv6 functionality and all the targeted project achievements of Euro6IX, can be demonstrated to the public and the representatives of the EU.

The overall timeline (look at Figure 3-1 above) for the Euro6IX 1st Year Public Trial illustrates the timely ordering of the different preparation steps.

3.1.5 Determination of Network Structure, Addressing, Naming and Routing

During the discussion about the different trial scenarios on the mailing list a first draft deliverable was compiled, describing the trial scenarios for the 1st Year Public Trial, including their requirements with respect to network infrastructure, routing, addressing and naming.

Several decisions with respect to the global routing (like usage of static routing entries for interconnecting the GIS2003 IPv6 network to the IPv6 world outside) and the address planning were made and led to the overall network maps, that where presented already in chapter 2.

Besides that it was decided, that for the Euro6IX GIS2003 network and the demonstration areas an own name space

gis2003.euro6ix.org

(with a local name server "che") will be implemented, used and delegated from the euro6ix.org name server.

All the routers and end systems that were involved within the Madrid 2003 Global IPv6 Summit Demonstration had to be represented by name entries in the domain "gis2003.euro6ix.org" with the following naming convention

"Name.gis2003.euro6ix.org"

The zone file for this namespace (as it was used) is attached in appendix A1.

The following ranges of IPv6 addresses could be observed within the GIS2003 IPv6 network:

- Janet 2001:630::/32, AS786
- UK6x 2001:618::/32, AS1752
- NTT 2001:218::/32 & 2001:418/32 & 2001:728/32, AS2914
- WIDE 2001:200::/32, AS2500

whereas the ranges

- RedIRIS 2001:720::/32, AS766
- TID 2001:800::/32, AS3352

were used to address the IPv6 systems of the 1st Year Public Trial of the Euro6IX project.

Most IPv6 sub-nets for the 1st Year Public Trial were chosen with a prefix length of 56 bits from the 2001:720:1501::/48 address range of the IPv6 Internet connectivity provider RedIRIS. The remaining ones (Isabel demonstration for instance) were numbered with addresses from the TID IPv6 address space 2001:800::/32.

The IPv4 addresses of the demonstration subnets were separated in /28 or /30 ranges and were taken from the 130.206.14.00/23 IPv4 address range provided by RedIRIS.

3.1.6 Network Set-Up of 1st Year Public Trial Network

The actual network set-up of the demonstrations for the 1st Year Public Trial of the Euro6IX project within the conference hotel started on May 10th and was based on the draft document for D4.3p describing the networking infrastructure as it was nailed down already during the discussions on the mailing list.

The overall network connectivity was provided by RedIRIS right in time on 11th of May and after fixing some problems with international IPv6 reachability (routing, etc.) the Euro6IX trial scenario was up and running on 12th of May and without interruption until 14th of May.

Besides the "simple" IPv6 connectivity to the Euro6IX booth an overall IPv6 reachability in all hotel rooms as well as in the whole conference area was realized together with attaching the other European IPv6 Projects to the outside IPv6 world.

Parts of the infrastructure (Connectivity for the ETSI IPv6 Plugtests, etc.) were already fixed and implemented in advance to the conference in order to give the participants a longer time frame for their tasks.

3.2 1st Year Public Trial Realization

This chapter of Deliverable D4.3p gives a more detailed overview about the trial scenarios which were implemented by the Euro6IX project in order to exhibit their project achievements in a 1st Year Public Trial at the GIS2003 conference in Madrid.

Most of the provided trial scenarios can be counted into more than one category (application/service/network) and will hence be mentioned in the category that fits best. Look also at Figure 2-5.

3.2.1 IPv6 Application Trial Scenarios

The following set of Trial Scenarios was chosen by the Euro6IX project consortium to demonstrate as well the project achievements of Activity A4.2 (“IPv6 Application development”) of Work Package 4 as also the underlying network features and services which were the results of the successful work within WP2 and WP3.

3.2.1.1 A Range of IPv6 Applications – BT

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This trial showed a complete range of IPv6 applications:

- Simple IPv6 web browsing.
- Interworking between IPv6 and IPv4.
- High-speed video streaming.
- Audio streaming.
- Multi player network based games.
- Instant messaging.

This trial used the Euro6IX network to gain access to the services based at the LON6IX (www.uk6x.com) which is BT's Internet Exchange based at Telehouse, London, UK. Interworking with the IPv4 Internet was demonstrated via BT's Ultima device that contains a number of interworking mechanisms but in this circumstance seamless NAT-PT based interworking was demonstrated. The high-speed video streaming trial is visually pleasing as well as providing an application that stresses the network. Combining the applications show that IPv6 application are available today in many forms.

General Overview of the Trial Scenario:

Shows a range of IPv6 applications and interworking with the IPv4 Internet.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Very relevant, without applications and interworking IPv6 is of no technical or commercial use.

Innovation of this Trial Scenario:

Several aspects of the demo have required development and ingenuity to achieve the level of trial performed at the GIS2003 event. In particular the development of the Ultima interworking device and the video streaming (VideoLAN) software that was ported to IPv6 by BT.

Scenario Improvement with IPv6:

Many - just having addresses and removing NAT allows several people to play Quake from a single location that in IPv4 may have only had 1 IP address, which may have caused limitations.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

More services and applications will be added with time.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements
IPv6 PC with range of IPv6 applications, BT ported VideoLAN software.

Server Requirements
Lots of IPv6 servers.

Network Requirements
IPv6 network with Ultima interworking box and careful configuration of DNS.

Other Requirements
Considerable amount of skill configuring the equipment

Graphical Illustration of the Trial Scenario:

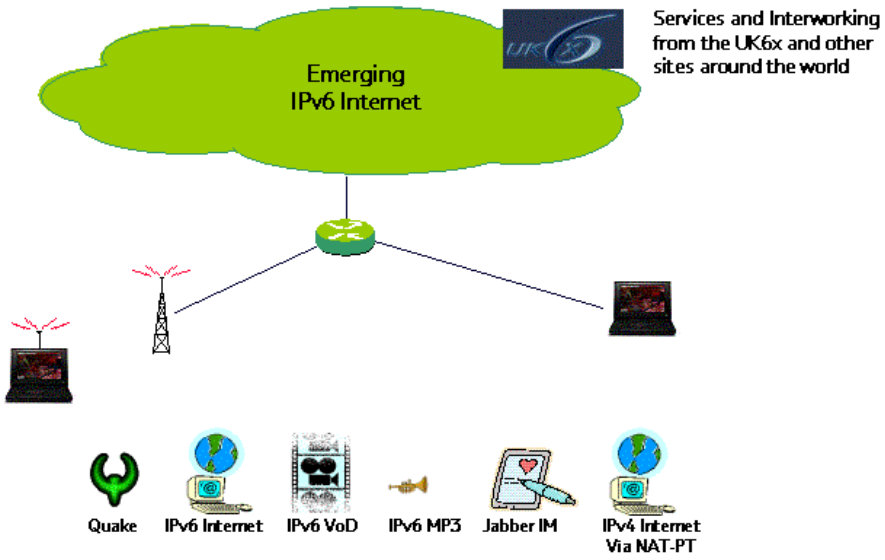

Figure 3-2: A Range of IPv6 Applications

Trial Configuration and Realization (Steps):

Servers and Ultima interworking at the UK6x, PC's with applications at the GIS2003 event.

Observed Results of the Trial/Additional Remarks:

Very good set of trials and seamless interworking with IPv4 based services showing that IPv6 is viable

3.2.1.2 Instant Messaging Client – nGn

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This demo shows the state of development of instant messaging tool over IPv6 transport and the main objectives of this trial are:

- To evaluate the applications working over a public IPv6 network as the Euro6IX test-bed.
- To verify the proper functionality of the implemented services..

General Overview of the Trial Scenario:

- A PC runs the client application and connects to the central server to start a session.
- The Server accepts the connection identifying the user or registering a new user.
- Client will select a remote contact sited in a different IPv6 network.
- A peer-to-peer communication will start between client and remote contact site.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

This demo allows using and investigating a peer-to-peer application over the Pv6 network being deployed within the Euro6IX project.

Innovation of this Trial Scenario:

The innovation of this trial is the usage of IPv6 transport for peer-to-peer applications. There are IPv6 centralized applications and IPv4 peer-to-peer applications but this trial scenario shows a hybrid system using IPv4 and/or IPv6 transport for central services and peer-to-peer communications.

Scenario Improvement with IPv6:

Peer to peer applications take advantages from IPv6 features like number of addresses, end-to-end security, mobility and connectivity without NAT protocol. The development state of the application does not include security or mobility issues so that the whole IPv6 impact could unfortunately not completely be shown within this trial scenario.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

An enhancement of this peer-to-peer application with the complete set of IPv6 functionalities/features could improve the impact of this trial.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC, Linux OS, Red Hat 7.2 or later, Suse 8.0

- Java jsdk 1.4.1 with IPv6 support
- Client application of Instant Messaging

Server Requirements

- 1 PC located at nGn site, Linux OS, Red Hat 7.2 or later, Suse 8.0
- Java jsdk 1.4.1 with IPv6 support
- MySql DB Server
- Server application of Instant Messaging

Network Requirements

- Connectivity to IPv6 network
- 10/100 Mbit/s Ethernet
- IPv6 address needed

Graphical Illustration of the Trial Scenario:

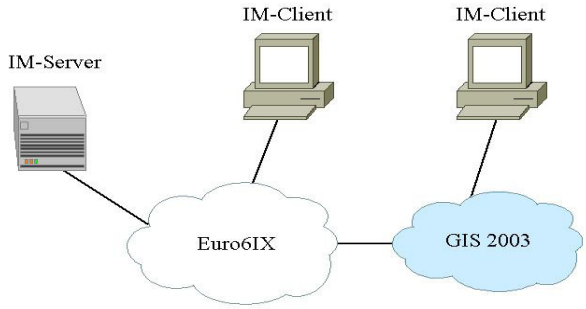

Figure 3-3: Instant Messaging

Trial Configuration and Realization (Steps):

Trial Steps:

- Start client application, which selects a server from a set of servers previously running.
- Register as new user or log in to the system using an existing identifier or nick-name.
- Check server's validation and download the contact's list of the user.
- Managing the contact list: Searching, Adding, Deleting of contacts, …
- Select a user to chat and start a peer-to-peer communication.

Observed Results of the Trial/Additional Remarks:

The system can identify a user managing IPv6 address to establish connections independently of IPv6 network prefix. The server was installed within Euro6IX test network, accepted connections and identified the users properly.

3.2.1.3 Video on Demand – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To demonstrate the usage of new terminals (PDAs, iPAQ H3970) with IPv6.
- To illustrate the proper functionality of the streaming server developed by TID.
- To illustrate the deployment of TID's IPv6 network within the Euro6IX test-bed.

General Overview of the Trial Scenario:

A new terminal (iPAQ H3970 equipped with a sleeve and a wireless PCMCIA card) accesses a streaming video service through an access point. It is the streaming client.

There is a streaming server located in TID IPv6 network and another one located in the same network as the access point (in the Conference Hotel).

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Video on demand is an end user application. Unlike other end user applications, video on demand has high bandwidth requirements that have to be taken into account to choose the best location of the server (for instance in the service area of an IPv6 IX).

Innovation of this Trial Scenario:

This trial shows how next generation terminals can make use of the Euro6IX IPv6 network. In this case, using an IPv6 video client installed in an iPAQ does this.

Scenario Improvement with IPv6:

The new terminal services are expected to be numerous in the future and this will lead into a massive need of IP addresses, which is the main lack of IPv4. Other features that ease the configuration of these new terminals are Stateless Auto-configuration and the developing of Mobility as a native IPv6 feature that will ease the Mobility environment in which the new terminals will be promoted.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

The most impressive about this trial was to have a new terminal (iPAQ) as client. There is a good range of equipment with the ability of being video client, but new terminals such as PDAs and mobile phones are the ones most appropriate in this kind of events, since they are closer to future terminals.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- IPAQ H3970.
- Sleeve for wireless CF card.
- Cisco Aironet 350 series wireless card.

Server Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.
- Video server developed at TID.

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone.
- 10/100 Mbit/s Ethernet.
- Required bandwidth: 10MB.
- IPv6 Address needed.

Other Requirements

- WLAN Access in bridging mode or IPv6 routing mode.

Graphical Illustration of the Trial Scenario:

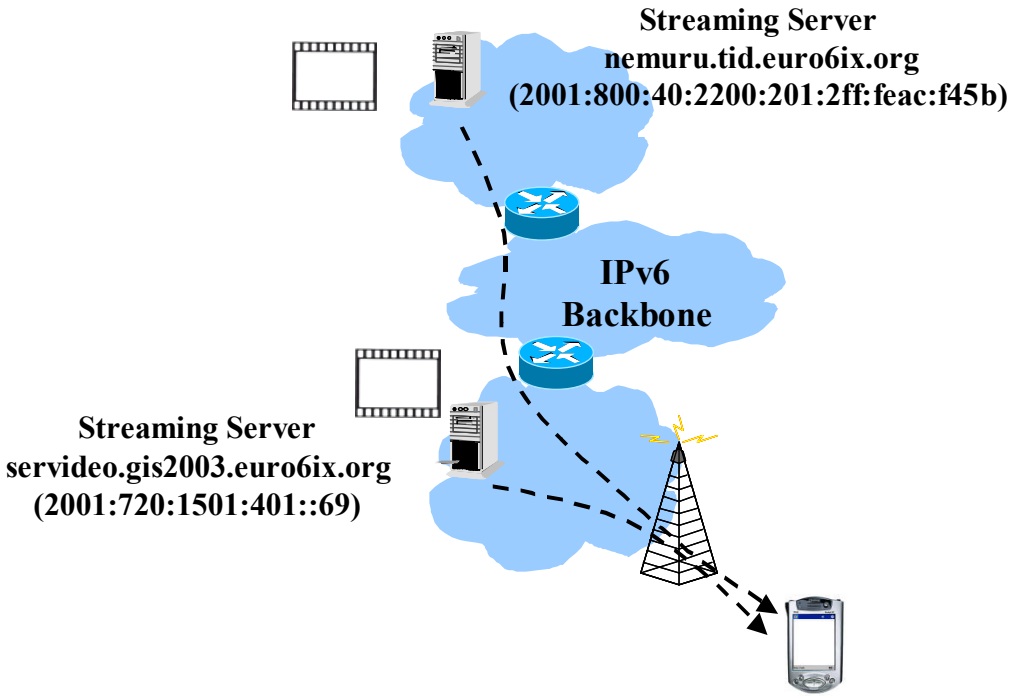

Figure 3-4: Video on Demand

Trial Configuration and Realization (Steps):

1. Start the streaming server:
   - Start the server: ./mortadela_tcp6 9999 8.mpg

2. Start the client:
   - First the access point has to be configured: ifconfig eth0 essid MY_PC
   - IPv6 address: ip -f inet6 addr add 2001:720:1501:500::84/64 dev eth0
   - Default IPv6 route: ip -f inet6 route add default via 2001:720:1501:500::1
   - Start the video client: vlc http://servideo.gis2003.euro6ix.org:9999/harry4.mpg

Observed Results of the Trial/Additional Remarks:

Video on demand can conflict with other network services using high bandwidth when the access point is configured in bridging mode because all the traffic is radiated to the wireless network.

3.2.1.4 Digital TV Streaming – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To verify the proper operation of the Euro6IX network.
- To show the Euro6IX network bandwidth availability.
- To evaluate and demonstrate the Multicast feature of IPv6.
- To illustrate the deployment of TID's IPv6 network within the Euro6IX test-bed.

General Overview of the Trial Scenario:

There is a digital TV server at TID premises (nemuru.tid.euro6ix.org). It consists of a software package developed by TID that transmits IPv6 Multicast in raw transport stream (UDP).

Two clients with two different operating systems are used to demonstrate that Multicast is being used. Firstly, a Red Hat Linux 9 running VLC 0.5.3. VLC version 0.5.3 introduces the capability of receiving IPv6 Multicast in Linux. Secondly, a Windows XP running VLC 0.5.3 and a Multicast-to-unicast relay are used for another client installation.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Digital TV is an end user application. Unlike other end user applications, Digital TV has high bandwidth requirements that have to be taken into account to choose the highest quality of the network for the path to the server.

Innovation of this Trial Scenario:

This trial highlights how TV broadcasting can be provided with IPv6 using the specific IPv6 features as well as how it makes use of the Euro6IX network.

Scenario Improvement with IPv6:

IPv6 broadcasting can be offered in an easier way than with IPv4 due to the embedded Multicast feature of IPv6.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

The scenario would show the advantages of Multicast if the traffic going through the Euro6IX network were shown graphically at the same time that clients are joining to the session.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.
- 1 PC Windows XP. Pentium IV with 256MB RAM.
- VLC Client for Windows (http://www.videolan.org/).
- VLC Client for Linux (http://www.videolan.org/).

Relay Server Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.
- Video relay server developed in TID.

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone.
- 10/100 Mbit/s Ethernet.
- Required bandwidth: 10MB.
- IPv6 Address needed.

Graphical Illustration of the Trial Scenario:

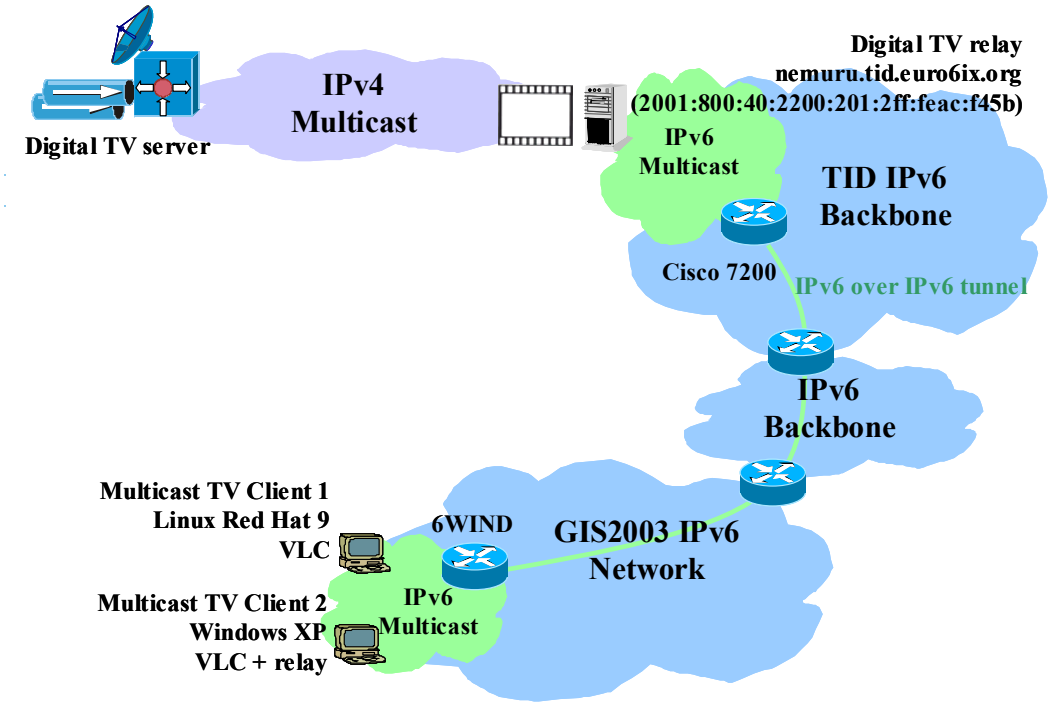

Figure 3-5: Digital TV Streaming

Trial Configuration and Realization (Steps):

1. Start the TV relay server: ./relay_m2t CFG_RELAY

2. Start the client:

Linux client:

1. Launch VLC.
2. Go to Network, UDP/RTP Multicast, and write the Multicast group address (ff18::55).
3. Accept.

Windows client:

1. Launch the relay (relay ff18::55 1234 4 ::1 5678).
2. Launch VLC.
3. Go to Network, UDP/RTP, and select the port (5678).

Observed Results of the Trial/Additional Remarks:

The last version of Windows VLC doesn't work yet with IPv6 Multicast, so a Multicast-to-unicast relay has been developed as a temporary solution to be able to use VLC for Windows XP.
Advantage: Network benefits of Multicast in terms of load. Disadvantage: CPU usage on final client equipment increases.

Note: The trial explained in this section worked fine when preparing the event but in the event it did not work as described due to external problems (configuration of IPv6 over IPv6 tunnel). It finally worked unicast mode (not Multicast) so the main objectives of this test where achieved anyway.

3.2.1.5 aFoto –TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate a mail service using IPv6.
- To show the translation between IPv4 and IPv6 in an IP-based service such as mail.

General Overview of the Trial Scenario:

aFoto is an application that uses the mail service. The application has a mail client that is allowed to send mails through a dual stack mail server at TID premises. aFoto sends the mail to the IPv6 mail server that forwards it to other MTAs (either IPv4 or IPv6) in the way to the mail server of the recipient.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

aFoto is an end user application that represents a good example of how mail servers have to be configured to work with IPv6 and IPv4, during the transition phase.

Innovation of this Trial Scenario:

This application shows how IPv6 mail service works inter-connected with the current existing IPv4 mail systems.

Scenario Improvement with IPv6:

Mail is a basic service that has to be also provided to IPv6 users. In this context, this application shows how mail servers can be rapidly migrated/adapted to IPv6 users.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Mail available from IPv6 or IPv4 is an essential service that should be allowed in both directions: either from IPv4 to IPv6 or from IPv6 to IPv4. aFoto is an example of how the service works.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.
- Avermedia card.
- aFoto developed in TID.
- Mail account for aFoto in TID's mail server.

Server Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.

Network Requirements

- IPv6 connectivity between the client and the server.

Graphical Illustration of the Trial Scenario:

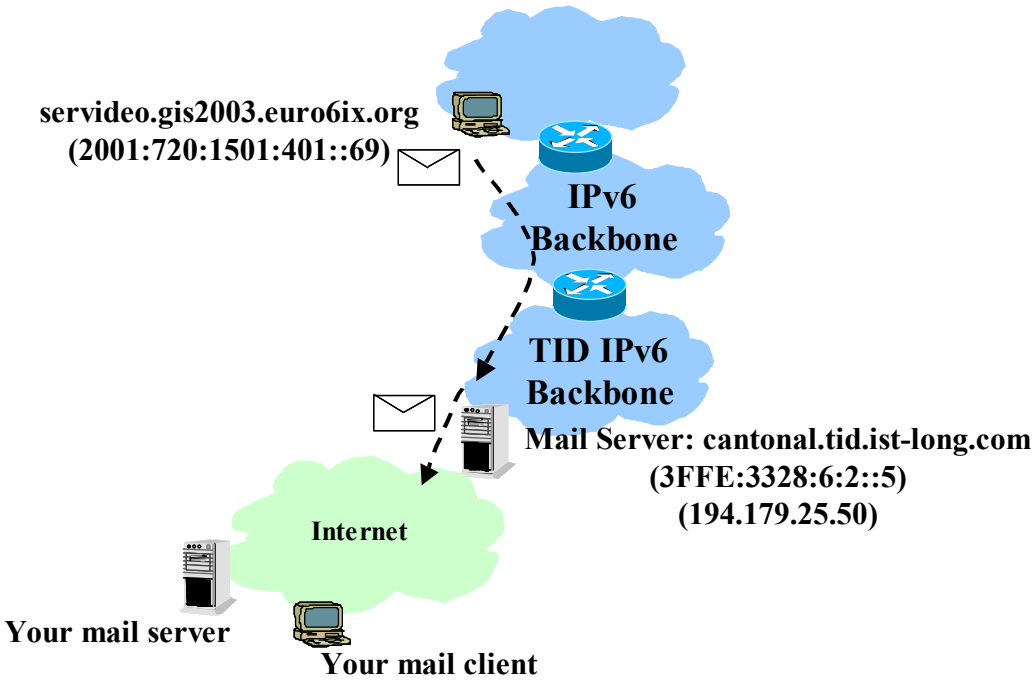

Figure 3-6: aFoto

Trial Configuration and Realization (Steps):

1. Start sendmail in the server: sendmail –bd
2. Start aFoto as user "prueba", from directory aFoto:
   ./afoto captura.bmp -32 -delay 100
3. The image captured by the Web-Cam it is shown in the application window.
4. The user writes the mail address where the photo will be sent.
5. After clicking "Send" button, the image is sent using IPv6 mail server in TID to the

mailbox specified by the user in the previous step.

Observed Results of the Trial/Additional Remarks:

This application was developed in the context of LONG project to show the interoperation of IPv4 and IPv6 mail services. Its state is stable since then.

3.2.2 IPv6 Network/User Service Trial Scenarios

The trial scenarios of this section were chosen to highlight the project achievements of Euro6IX with respect to the definition and implementation of IPv6 network services. It is obvious that only a small range of the implemented set of services can be demonstrated and hence the decision has to be made already during the preparation phase of t he trial scenarios within the discussion on the mailing list.

The target was to demonstrate these network services to the public that are especially related to the Euro6IX project idea and that fit most to the new business possibilities of a future IPv6 Internet Exchange.

3.2.2.1 Web Access to an IPv4 service via NAT-PT (Digital Home) – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate the proper operation of an IPv4 service through a NAT-PT to make it accessible from IPv6 hosts.
- Find a way for current IPv4 ASPs to put their contents in a first quick phase available to IPv6-only users.

General Overview of the Trial Scenario:

An IPv4 service connected to a double-stack host with a NAT-PT. The client is also connected to the host via the NAT-PT.

IPv6 queries to the IPv4 service are made through this NAT-PT.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

The NAT-PT is a solution during the first phase of IPv6 introduction to allow offering the same contents in IPv6 networks.

Innovation of this Trial Scenario:

This service offers the possibility to control in a remote way all of the devices at home via IPv6.

Scenario Improvement with IPv6:

IPv6 is not to destroy everything deployed in the current IPv4 Internet. It pretends to be a solution to most of the problems that IPv4 protocol has.

In a first phase of IPv6 adoption, IPv4 services have to be adapted with solutions like these, but finally they have to be migrated.

Final User Services accessing the contents via IPv6 can incentive ASPs to migrate to IPv6.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

None.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- No Special Hardware Requirements.
- Software Requirements: O.S. with IPv6 installed, Web Browser with IPv6 Support.

Network Requirements

- IPv6 connectivity to the host where NAT-PT is installed (at TID premises).
- Special Bandwidth needs (> 1 Mbit).
- The client address must be mapped inside NAT-PT tables.
- The IPv6 address to access the service must be added.

Graphical Illustration of the Trial Scenario:

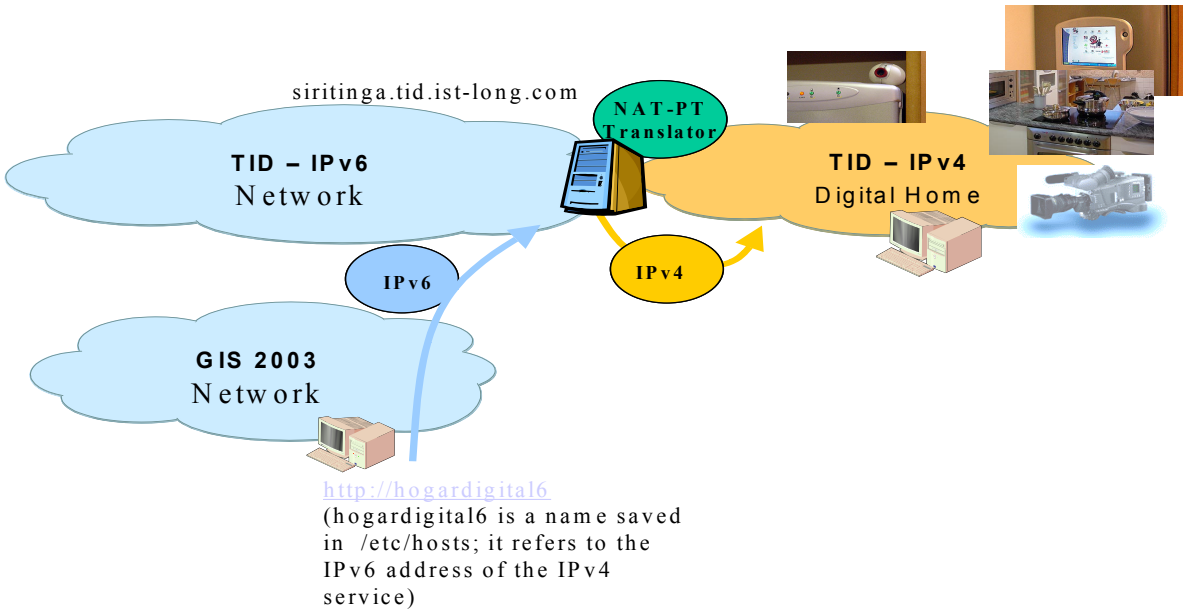

Figure 3-7: Web Access via NAT-PT

Trial Configuration and Realization (Steps):

1. The HTTP client initiates the connection.
2. The NAT-PT translates IPv6 packets into IPv4.
3. The client reaches the IPv4 server and the connection is established.

Observed Results of the Trial/Additional Remarks:

None.

3.2.2.2 ISABELv6: SIP, H323 & Web Antenna – UPM

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To demonstrate interworking between the ISABEL application being used to distribute the Madrid 2003 Global IPv6 Summit conference and standard web and videoconferencing applications, including:
  - Java applet-based web clients.
  - H.323 conferencing clients.
  - SIP conferencing clients.
- To illustrate the deployment of next generation communication services using SIP over IPv6.

General Overview of the Trial Scenario:

In this trial scenario, three different services where shown:

- ISABEL Web Antenna.
- ISABEL H.323 gateway.
- ISABEL SIP gateway.

The trial was made of two servers (one shared by the Web Antenna and the H.323 Gateway, and a different one for the SIP Gateway) and a client that could connect alternatively to any of the services.

The client was in this case a Tablet PC, used to prove that a wide range of heterogeneous clients can be used.

The trial consisted in showing how the ISABEL session could be followed, using a web application, a H.323 client or a SIP conferencing client.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

The Euro6IX framework based on IPv6 and novel IX architectures will provide an interesting field of experimentation to give access to ISABEL sessions from all kind of devices.

Innovation of this Trial Scenario:

This trial shows that ISABEL coverage is widely extended to all kind of devices, based on standard protocols and applications.

Scenario Improvement with IPv6:

Real-time communication services obtain a wide range of benefits from IPv6, including:

- Wider address space (necessary if we want every single 3G device to be IP-capable).
- Improved QoS support.
- IP-level mobility.

- Deployable Multicast environments.
- Network-level security.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Several improvements may be accomplished to enhance this trial scenario:

- Increase the number of supported codecs. This will improve the compatibility range with standard conferencing clients.
- Improve user management. This will allow a more flexible interaction between Isabel and standard clients.
- Enhance the integration between Isabel and the Gateway (e.g. implementing remote control mechanisms).
- Usage of a wider range of heterogeneous clients, such as PDAs, Pocket PCs, etc.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- Linux Operating System
- Audio and/or video capture and playback interfaces
- SUN's JRE 1.4 or higher (http://www.java.com)
- Java Media Framework 2.1.1 or higher (http://java.sun.com/products/java-media/jmf/)
- NIST's JAIN-SIP library (http://snad.ncsl.nist.gov/proj/iptel/index.html)

Server Requirements

- Linux Operating System
- Video capture interface
- SUN's JRE 1.4 or higher (http://www.java.com)
- Java Media Framework 2.1.1 or higher (http://java.sun.com/products/java-media/jmf/)
- NIST's JAIN-SIP library (http://snad.ncsl.nist.gov/proj/iptel/index.html)

Network Requirements

- No especial network requirements

Other Requirements

- No other requirements

Graphical Illustration of the Trial Scenario:

ISABEL Web Antenna provides standard Web access to an ISABEL session. It is a fully web based application made of several java applets. Publicly accessible from:

- http://antenna.upm.euro6ix.org (IPv6)
- http://antenna.dit.upm.es (IPv4)

It's architecture is depicted in the following figure:

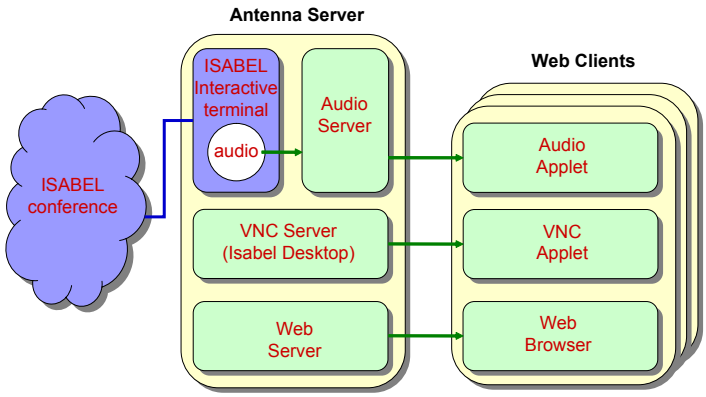

Figure 3-8: Isabel with Antenna Server

ISABEL Web Antenna is based on VNC streaming of the Isabel desktop and allows high quality streaming of the Isabel sessions. Although oriented for broadcasting Isabel sessions, it allows web clients to be interactive.

Since the ISABEL Web Antenna is based on Java technology, a Java-enabled Web browser is needed in order to use the service. For IPv4 connections any system configuration should be suitable. For IPv6 connections the Linux Operating System and Java (JRE) version 1.4 or higher is required, since there is no IPv6 support for Java in Windows environments.

ISABEL to SIP or H.323 Gateways provides interworking between standard videoconferencing applications based on SIP or H.323. Both include multipoint capabilities by the use of an MCU. The architecture used for both gateways is shown in the following pictures:

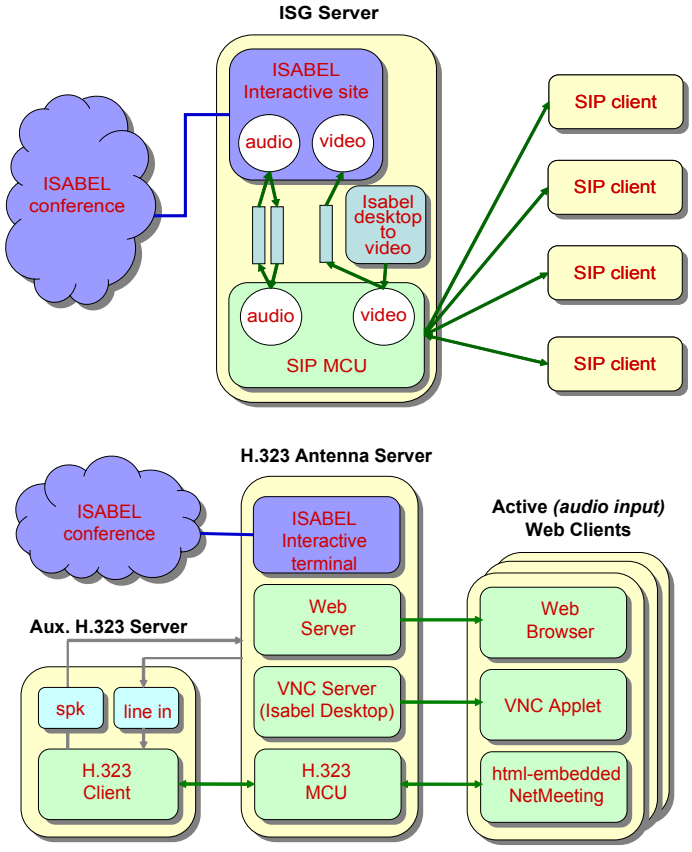

Figure 3-9: Isabel using H.323

H.323 gateway functionality (which by now is only IPv4) can be tested from http://antenna.dit.upm.es/h323/. The SIP gateway is being shown on a Tablet PC through WLAN on Euro6IX demo booth.

ISABEL web antenna and SIP and H.323 gateways are part of a research line aimed to extend the coverage of ISABEL application to new types of fixed or mobile devices. These demos show that:

- Interworking of ISABEL and standard videoconferencing is possible, by using a simple mapping of the desktop into the output video
- VNC (Virtual Network Computing) is a very appropriate choice as it provides good quality graphics with reasonable bandwidth

More tight integration is needed between ISABELv6 and SIP/SDP. Ongoing work to use SIP as ISABEL's signalling.

Trial Configuration and Realization (Steps):

No special configuration is needed. Servers and client have to install the appropriate software and to ensure IPv6 network connectivity between them.

Observed Results of the Trial/Additional Remarks:

The trial results were very positive. It was possible to follow the conference from the demo booth using any of the three offered services, and there were also several connections from attendants using the web application and standard conferencing systems.

The tablet PC with an IPv6 SIP client was used to show the demo to attendants during the coffee breaks, allowing user interactivity.

3.2.2.3 Access of a Mobile Node to Advanced Services –PTIN

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This demo shows how a Mobile IPv6 node (laptop) can access to different advanced services like Instant Messaging, IRC, Gaming (Quake I and II), audio and video streaming, as well as other most traditional ones like www or ftp.

General Overview of the Trial Scenario:

This demo was achieved using an Intel-based laptop with RedHat 7.1 Linux version. The MIPL version used is the 0.9.1 with 2.4.16 kernel (draft 15), without Security Associations (SAs).

In order to check the mobility functionalities, the laptop used the PT addressing space as the Home address (Ha), being the Home Agent (HA) on PTIN headquarters. In the demo room two Wireless Base Stations were deployed, allowing the Mobile Node (MN) to access either to one or other, changing the point of attachment through the use of a very simple script.

At the same time, the Mobile Node accesses to different services like www, ftp, Quake Gaming, IRC, Instant Messaging and audio/video streaming. Those services work transparently with mobility as if the node was not mobile. The main aspect to emphasize at this demo is the behavior of the applications during the handover periods, especially the most critical ones like audio/video streaming (the application with real-time requirements).

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

The mobile functionality is becoming more and more important as the time passes by and the 3rd generation wireless services enter the market. The mobility is starting to be a requirement, especially with the increase of wireless accesses and the rapid raising number of small devices using those wireless networks. The support of the different applications over mobility and the behavior of this application during handovers become, this way, a key issues.

Innovation of this Trial Scenario:

This trial scenario shows that IPv6 mobility can be used in order to provide new and innovative mobile services, what is very interesting from the IX's point of view. On the other side, that, what is very interesting for the final users, does not affect applications.

Scenario Improvement with IPv6:

This scenario is improved with IPv6 in several things. The two main ones are the IPv6 addressing availability, what is mandatory for mobility operations, and the increase of efficiency of the communication in comparison to IPv4 (triangle routing). The later case it is very noticeable in this scenario. For example in a communication between the MN with a given service in the demo room, the traffic from the service machines to the MN will go to the PTIN headquarters (HA location) and back.

In this particular scenario the IPv4 mobility will be quite more inefficient.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

An improvement for this scenario could be the possibility to use "Fast Handover" mechanisms in order to decrease significantly the handover times. This is an issue quite important because in this scenario, having the HA so far away, sometimes the applications with real-time requirements go down.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- Intel based laptop
- Linux OS
- Mobility software: MIPL 0.9.1 for kernels 2.4.16 (draft 15)
- Wireless LAN card
- MP3 client (FreeAmp)
- Video client (VIC)
- Mozilla 1.4
- Quake I and II clients
- Jabber client

Server Requirements

- Home Agent (HA)
- MP3 server (MP3server)*
- Video server (VIC)*
- Fnord*
- Quake I and II servers*
- Jabber server*

*Preferably the servers have mobility support for CN functionalities

Network Requirements

- Connectivity to Euro6IX network
- 2 WLAN on the demo room
- No IPv6 addressing on the demo room needed

Graphical Illustration of the Trial Scenario:

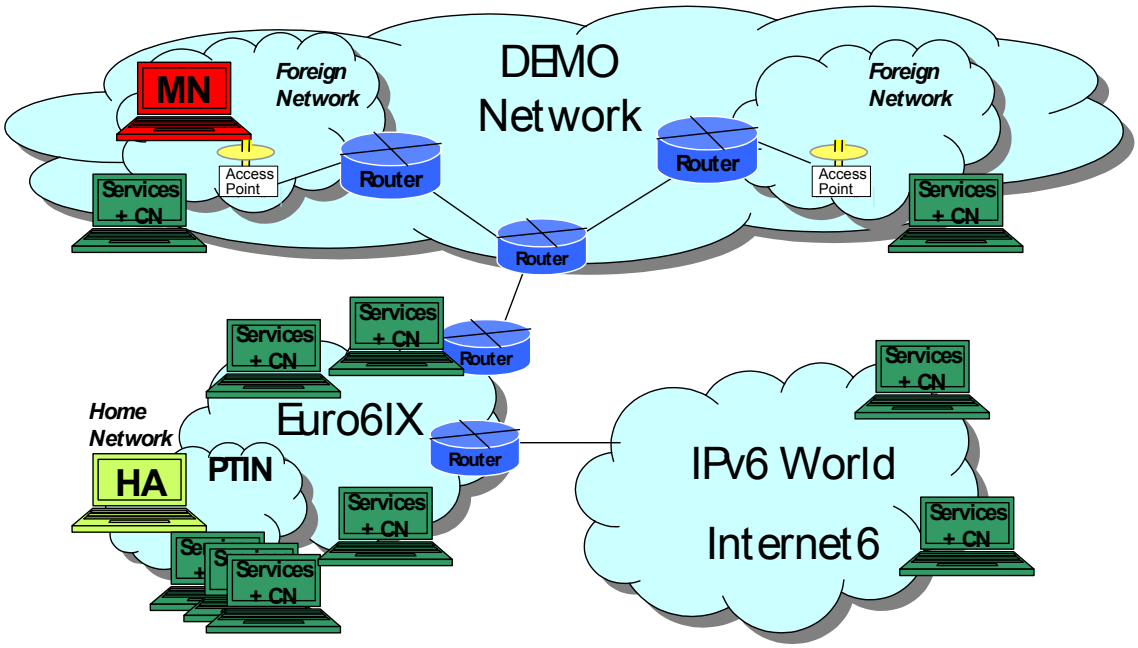

Figure 3-10: Access of a Mobile Node

Trial Configuration and Realization (Steps):

A possible sequence of steps for the demo could be the following:

1. Starting the MN.
2. Connect the MN to one WLAN access (note that in this case the MN will be always on a FN).
3. As soon the MN is registered on the HA, the Mobility is working yet.
4. Different applications/services could be started, and will work transparently.
5. At any time, and using the above-referred simple script, the MN will change their point of attachment to the other WLAN, performing the first handover
6. The same, other handovers can be performed as desired.
7. At any time, the application should be always working (is expected that periods of unavailability show up).

Observed Results of the Trial/Additional Remarks:

With this demo can be demonstrated that the MN can work transparently in both FN's and the communications remains alive after handovers. Regarding the audio streaming, it can be seen that usually the audio is interrupted for a seconds and starts again. So, seamless handovers are not achieved.

3.2.2.4 PKIv6 and Smartcard for accessing IPv6 Network Services/Apps –UMU

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This demo shows the integrated use of the PKIv6 developed within Euro6IX project to offer a wide range of services: Windows access control; web authentication based on smart cards and PKIv6, VPNs based on IPsecv6 based on certificates for multimedia applications. A Windows cryptographic module has been created to be enabled using smart cards in the certificate-based web authentication. Moreover the Windows access control has been modified to be enabled using smart cards.

General Overview of the Trial Scenario:

- UMU will provide a PC with the Windows access control modified to be enabled using smart cards and certificates from our PKIv6.
- When somebody inserts his smart card he gets access to a web-based authentication page using the certificate in the smart card and there he has access to several services inside the Euro6IX network that check the identity. Some management pages (UMUs at least) and the access to the AGWS server from UPM+Agora.
- As result of the co-operation with the 6power project another trial scenario allows to start the ISABEL application via this authenticated network access.
- From the same page it is possible to access in a secure way to the Videocamera installed in the 6POWER remote simulated home.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

This demo shows the use of the PKIv6 developed within Euro6IX project and Smartcards to secure access of services.

Innovation of this Trial Scenario:

- PKIv6 as a security services on IPv6 networks.
- Integration of security features within different applications.
- Graphical Identification and Authentication (GINA). The GINA (a DLL component loaded by Winlogon) implements the Smartcard-based authentication policy of the interactive logon model.
- Cryptographic Service Provider (CSP). The CSP is plugged into Windows to provide cryptographic services based on smart cards and PKIv6.
- Smart Card supported by PKIv6. New modules and developments permit that PKIv6 supports smart cards to store private keys and certificates.

Scenario Improvement with IPv6:

IPv6 enables the security services to be considered as relevant services within the communications world like end-to-end security and always secure services. Finally PKIv6 services and its integration with Smartcards are used to enable certificate-based authentication and access control in innovative IPv6 based services and applications.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Smartcard technology and PKIv6 are the main solution for the services/applications with security requirements.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC, standard configuration provided by UMU
- PC with Smart Card Reader provided and installed by UMU
- Operating System – Windows 2000
- Dual-Stack System with
- IPv6 Web Browser
- ISABEL client using Antenna version via Web Page
- CSP for smart card provided by UMU
- IPSecv6

Server Requirements

- Using PKI Infrastructure of UMU
- Attaching Management pages at UPM/UMU
- AGWS Server
- Videoserver in 6POWER remote home

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone
- Connectivity to IPv4 network because of DNS resolution
- 10/100 Mbit/s Ethernet to both access points
- Required bandwidth al least 2Mbps

Graphical Illustration of the Trial Scenario:

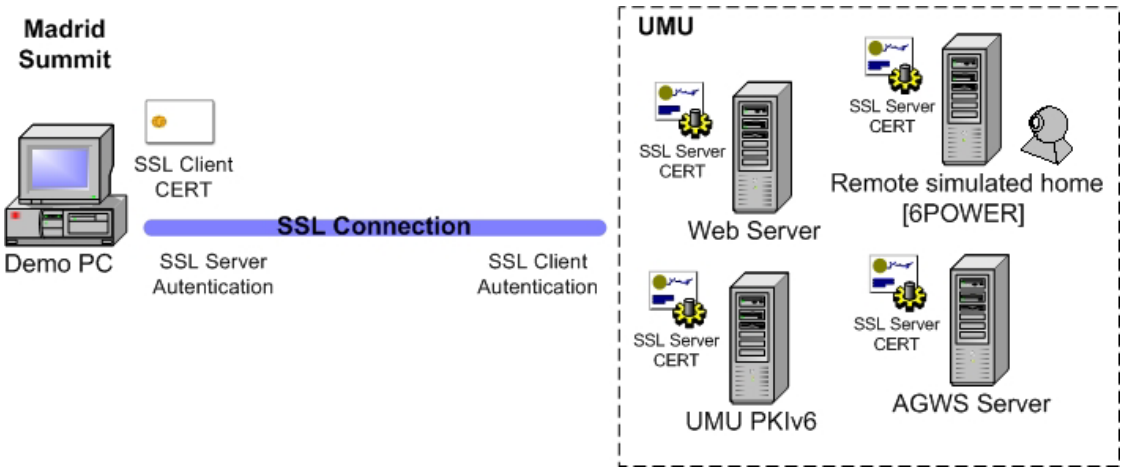

Figure 3-11: PKI & Smartcard

Trial Configuration and Realization (Steps):

PC configuration:

- Windows 2000 and dual stack system.
- Smartcard Reader, CSP for Smartcards and GINA for Smartcards.

Steps of trial:

1. Winlogon requests a smart card. When the user inserts the smart card, Winlogon performs user identification and authentication interactions.
2. The user gains access to a web authentification page using the certificate in the smart card.
3. From the same page the user has access to several services inside the Euro6IX network that check the identity.
4. The user can access in a secure way to the Videocamera installed in the 6power remote simulated home or can visit traffic statistics and management pages.
5. Also integration of VPNs with Isabel application in order to make secure the IPv6 traffic is shown

Observed Results of the Trial/Additional Remarks:

The use of Smartcard technology provides a secure mechanism to store and transport the user cryptographic information. PKIv6 is indispensable for Smartcard management.

3.2.2.5 PDAs/Laptops for Mobile IPv6 with Video Streaming Applications – UMU

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This demo shows how Mobile IPv6 can be used to offer streaming applications and services to end-users that are allowed to move between different networks defined inside Euro6IX project.

General Overview of the Trial Scenario:

In order to test a Mobile IPv6 implementation for PDAs, a Compaq iPAQ 3870 PDA was used. To evaluate a MIPv6 implementation, a Linux version for Intel ARM processors (Familiar v0.6.1) was installed. To get support for IPv6 and Mobile IPv6 it is needed to install two packages, which contain IPv6 and Mobile IPv6 modules respectively.

Three different access points compose this trial scenario and each one of them works with different frequencies. There is an installed audio/video-streaming server, which works as correspondent node. This server sends audio/video stream to PDA's home address and thanks to Mobile IPv6 protocol, this stream reaches the PDA to whatever network it is connected.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Nowadays, small devices as PDAs or mobile telephones are being widely used by end-user. One of the most important features of these devices is their mobility due to small size and weight. An IX as macro-ISP should support and give services to this kind of devices in order to connect them to Euro6IX network.

Innovation of this Trial Scenario:

Real IPv6 IXs, like the Euro6IX ones, could begin to offer mobility services to their clients through small devices as PDAs provided with Mobile IPv6 support.

Scenario Improvement with IPv6:

The mobility protocol of IPv6 (Mobile IPv6) adds the possibility of establishing communications with mobile users without being aware of the actual position of the mobile user within the network. Although IPv4 offers a mobility protocol (Mobile IPv4), Mobile IPv6 uses IPv6 advantages in order to optimise mobile communications and reduce packet lost caused by management of mobility.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

- Based on this test-bed for iPAQ and Mobile IPv6 to develop some IPv6 applications adapted for this kind of devices.
- Test other PDAs with IPv6 support on this scenario.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PDA iPAQ h3870
- WLAN Network Interface
- Operating System – Linux
- mipv6-0.9.4-v2.4.19 version(draft 15) (without security associations)
- Additional Video streaming client software: Video Client: VLC

Server Requirements

- Home Agent for Mobile IPv6 (draft 15)
- Streaming Server from the Euro6IX IX’s (VLC)

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone
- 2 WLAN access point in different IPv6 subnets (routing mode)
- 10/100 Mbit/s Ethernet to both access points
- IPv6 Address needed

Graphical Illustration of the Trial Scenario:

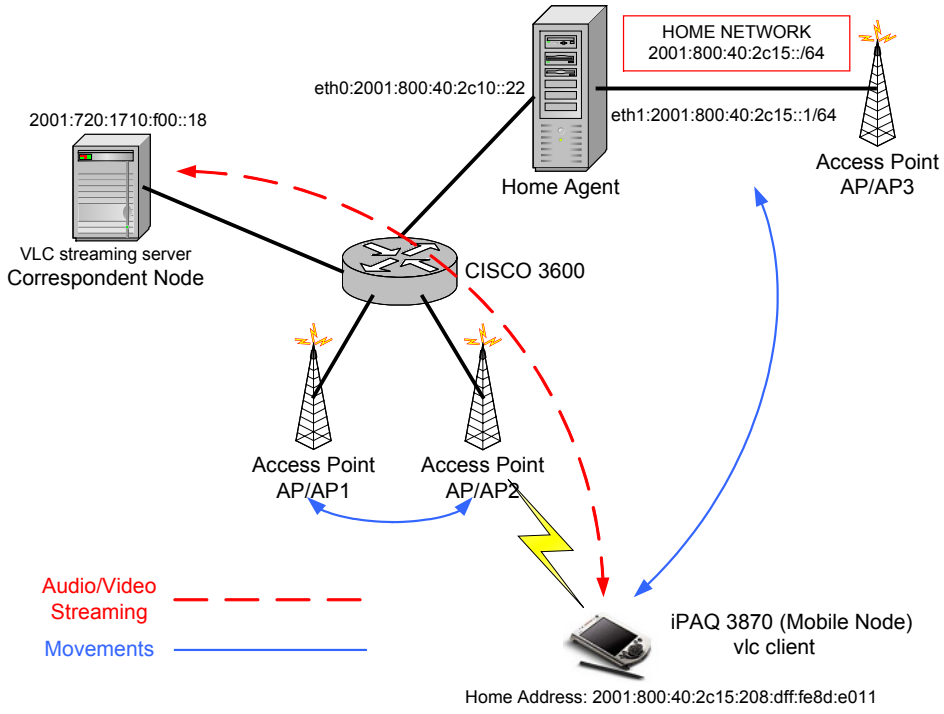

Figure 3-12: PDAs with Mobile IPv6

Trial Configuration and Realization (Steps):

Mobile clients (PDAs, Laptops) are attaching streaming servers.

Steps of trial:

1. A streaming server (VideoLan Server) in Euro6IX network broadcasts an audio/video streaming.
2. Laptops and/or PDAs connect to this server to receive the stream.
3. Laptops and/or PDAs move between different access points (APs), which belong to different networks.

Observed Results of the Trial/Additional Remarks:

Communications remain established after a little period of time and audio/video streaming goes on normally. Mobile IPv6 gives needed support to reach this objective.

3.2.2.6 Network Address Translation – Protocol Translation (NAT-PT) – UMU

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

This scenario allows attaching the IPv4 world from an IPv6 end system using the NAT-PT transition mechanism that could be placed within the service area of an IPv6 IX.

General Overview of the Trial Scenario:

This scenario shows a PC with IPv6 support in an IPv6 network which want to access to the IPv4 Internet network. This scenario is possible thanks to a NAT-PT box connecting the IPv4 and IPv6 world.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

There are different mechanisms that allow communication between the emerging IPv6 networks as tunneling or mechanisms for a gradual migration like Dual Stack. NAT-PT belongs also to these transition mechanisms. Although NAT-PT follows different objectives than tunneling or Dual-Stack it has important features that make it a useful and powerful mechanisms.

NAT-PT should be configured in every IPv6 IX because it allows IPv4 clients to access IPv6 world and vice versa in a transparent way.

Innovation of this Trial Scenario:

Real IPv6 IX's, like the Euro6IX ones, could begin to offer IPv6 connectivity to their IPv4 clients using NAT-PT in a transparent way. Users do not need to know nothing about it.

Scenario Improvement with IPv6:

This scenario does not have sense without IPv6.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

This scenario is a perfect test-bed to use NAT-PT and it allows IPv6 users to access IPv4 networks and vice versa.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC
- Operating System – Linux
- Dual-Stack System with
    - Web Browser
    - Telnet, FTP, …

Server Requirements

- Using NAT-PT Box (6WINDgate) at UMU's premises to attach IPv4 servers

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone
- 10/100 Mbit/s Ethernet to dedicated IPv4 router interface
- Required bandwidth 2Mbit/s
- IPv4 Address needed (Not necessarily needed)
- IPv6 Address needed

Graphical Illustration of the Trial Scenario:

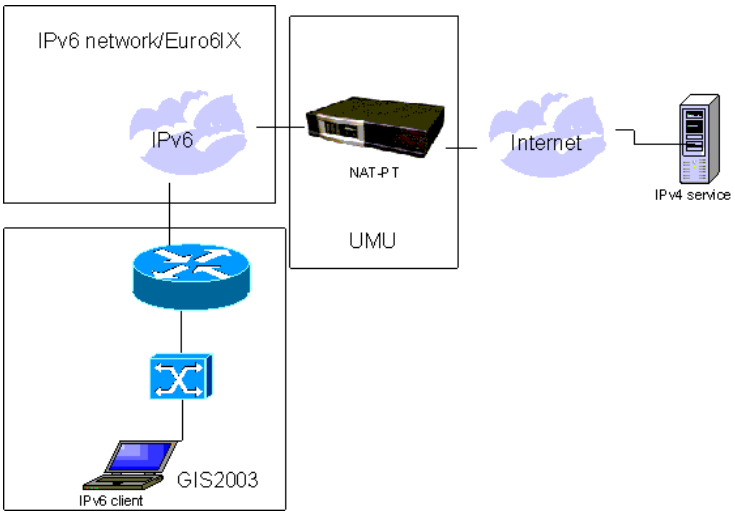

Figure 3-13: NAT-PT

Trial Configuration and Realization (Steps):

This scenario demonstrates how IPv6-only clients are capable of accessing services on IPv4-only networks. The NAT-PT was set up on the top router (6WIND 6200).

Steps of trial:

1. To see NAT-PT working, it is enough to access an IPv4-only host via its host name (Not via IP address, since NAT-PT works by means of the DNS resolution).
2. The 6200 router doing NAT-PT will assign an IPv4 address for PC (for using in the IPv4 network) as well as an IPv6 address for the remote host (for using inside our IPv6 network).
3. Several basic tools can be used to test the access to the IPv4 world, like web browser, telnet, FTP, ping, etc….

Observed Results of the Trial/Additional Remarks:

NAT-PT provides a powerful service to connect IPv4 and IPv6 networks between them, in an easy and transparent way.

3.2.2.7 Voice over IPv6 – Telscom

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

Voice over IPv6 using the SIP protocol.

General Overview of the Trial Scenario:

This demo shows the use of a "Voice over IP" software that allows end-users to talk through the Internet infrastructure using the IPv6 protocol.

This software implements the SIP (Session Initiation Protocol) that lets users initiate a session.

Audio data are then transmitted using the RTP protocol, a protocol designed for Real Time applications. RTP comprises RTCP (real-time control protocol) that provides feedback on the quality of the data distribution. Applications may then use this feedback to adapt the streaming to different network conditions.

In this demo the application runs on two laptops based on the Linux RedHat Operating System. The trial shows the two main aspects of this software, namely SIP and RTP:

- A user invites another user through an IPv6 address;
- The latter accepts the incoming invitation;
- The RTP session starts transmitting and receiving the audio data in "Full Duplex" mode;
- One of the two users ends the session.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

This application shows the use of IPv6 protocol to transmit voice over the Internet infrastructure.

Innovation of this Trial Scenario:

Real-time application, such as voice, on IPv6 as a peer-to-peer communication.

Scenario Improvement with IPv6:

The IPv6 protocol allows the use of a wide range of available addresses.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

One possible enhancement of this scenario is to have 6Voice running in "PC to Phone" mode.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC (High Performance)
- Audio Input/Output (Microphone/Speakers)
- PC provided by Telscom
- Operating System – Linux RedHat

Server Requirements

- 1 PC (High Performance)
- Audio Input/Output (Microphone/Speakers)
- PC provided by Telscom
- Operating System – Linux RedHat

Network Requirements

- WLAN Ethernet connectivity
- No IPv4 Address needed
- IPv6 Address needed

Graphical Illustration of the Trial Scenario:

Figure 3-14: Voice over IPv6

Trial Configuration and Realization (Steps):

1. Installation, in the two PCs, of Java Runtime Environment and Java Media Framework packages.
2. Installation of the 6Voice application.
3. Run the demo from the two PCs.

Observed Results of the Trial/Additional Remarks:

After the invitation, a pop-up window was visible on the other machine waiting for an answer in order to accept or reject the invitation. Both possibilities were successfully demonstrated.

3.2.2.8 IPv6 Network Access via GPRS – BT

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

Currently the GPRS networks being rolled out around the world does not support IPv6. This trial shows how IPv6 can be tunneled over the current IPv4 based GPRS networks to provide connectivity. The trial uses a Laptop PC connected to a GPRS mobile phone. It is easy to imagine GPRS capable palm devices with similar capabilities – these could have similar functionality to future 3G terminals, but with limited bandwidth capabilities compared with 3G.

General Overview of the Trial Scenario:

Shows a slightly different access mechanism to the normal.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

An interesting alternative access mechanism that with 3G rollout will become more prevalent.

Innovation of this Trial Scenario:

Configuration of bearer circuit is difficult because of the different organization involved. Novelty of showing the demo in Madrid is that protocol 41 is not blocked by any of the Mobile operators!

Scenario Improvement with IPv6:

Little except to show it is possible and a view of the future of 3G.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Could use a hand held device with GPRS card to make a pseudo 3G-terminal.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- IPv6 PC and GPRS mobile phone.

Server Requirements

- IPv6 web site to show an application.

Network Requirements

- Bearer access to a GPRS network.

Other Requirements

- User account on GPRS network has to be configured with the appropriate access rights to the APN.

Graphical Illustration of the Trial Scenario:

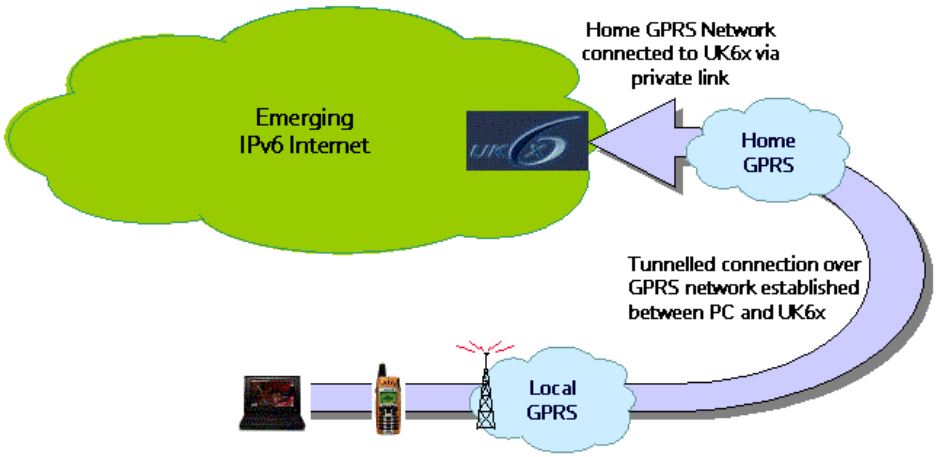

Figure 3-15: IPv6 Network Access via GPRS

Trial Configuration and Realization (Steps):

Access to the GPRS network via the UK6x i.e. bearer circuit plus address allocation etc, PC and mobile phone at the GIS2003 event.

Observed Results of the Trial/Additional Remarks:

Interesting alternative access mechanism to IPv6 that showed web browsing, etc.

3.2.2.9 IPv6 Multicast – 6WIND

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To illustrate the deployment of IPv6 Multicast within the Euro6IX test-bed.

General Overview of the Trial Scenario:

IPv6 Multicast Clients receive Multicast data streams (Vic, Rat) from Multicast Servers within the partner networks of the Euro6IX project. Clients join and leave different IPv6 Multicast sessions in SDR.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

The trial illustrates a deployment on Euro6IX network supporting IPv6 Multicast routing.

Innovation of this Trial Scenario:

An overlay IPv6 Multicast network is built over Euro6IX network that connects IPv6 Multicast routers of different partners. IPv6 Multicast routing protocol is running on top of the overlay network and provides a virtual native Multicast IPv6 network.

Scenario Improvement with IPv6:

The trial shows the advantage of IPv6 with auto-configuration, unlimited IPv6 Multicast address and better management of network scope.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Possible enhancement is to increase the number of IPv6 Multicast routers in Euro6IX network and the use of some evaluation tools to monitor how much bandwidth is saved.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC with an audio output, a good graphics card, and a Ethernet card.
- Windows XP or FreeBSD with M6bone tools (VIC, RAT, SDR)

Server Requirements

- 1 PC with a Web Cam, an audio output, a good graphics card and a Ethernet card.
- Windows XP or FreeBSD with M6bone tools (VIC, RAT, SDR)

Network Requirements

- Router 6WIND 6100 for DR.
- 6OS allowing tunnel and Multicast configuration (pim6sd)
- Connectivity to IPv6 network/Euro6IX backbone
- Required bandwidth (2 Mbit/s)

Graphical Illustration of the Trial Scenario:

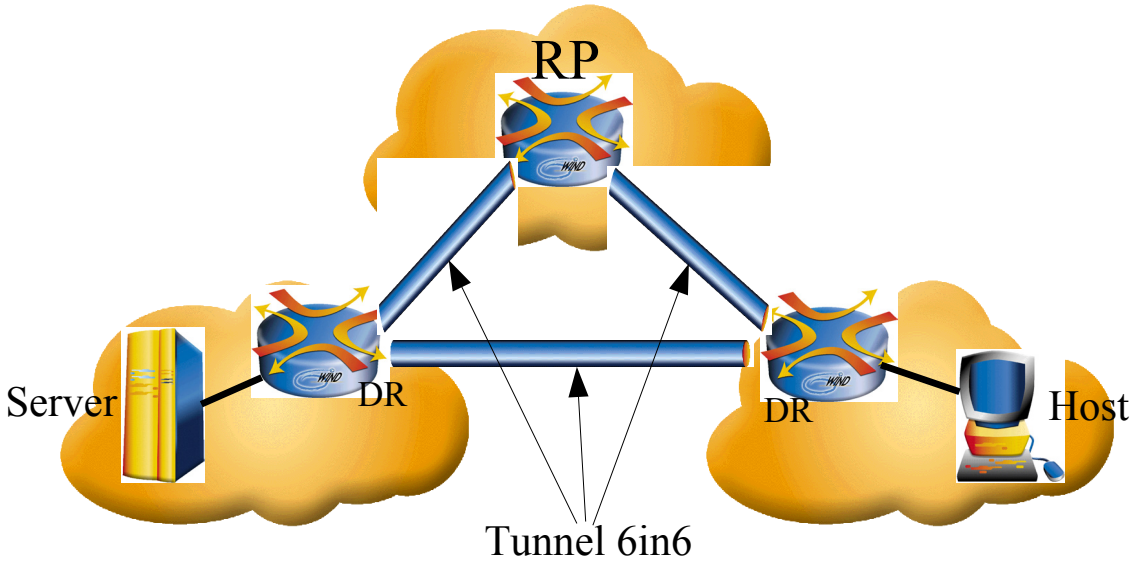

Figure 3-16: IPv6 Multicast

Trial Configuration and Realization (Steps):

- Launch pim6sd on the RP and DRs with the SM mode.
- RP configuration:
  - cand_rp;
  - group_prefix ff0e::/96;
- Build 6in6 tunnels between DRs and the RP
- Launch tools VIC, RAT and SDR on the host and the server
- Create a session in SDR on the Server for video and audio.
- Join the session with the host.
- Monitor the network traffic (sniffer : tcpdump6)

Observed Results of the Trial/Additional Remarks:

- A state is created on DRs for the Multicast group
- First the traffic flows trough the RP
- Then it flows between the two DR in the tunnel.

3.2.2.10 Video Multicast – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate the Multicast feature in IPv6.
- To verify the proper operation of the Euro6IX network.
- To show the Euro6IX network bandwidth availability.

General Overview of the Trial Scenario:

The streaming server is located at TID premises (nemuru.tid.euro6ix.org). It consists of a software package developed by TID that transmits IPv6 Multicast in raw transport stream (UDP).

Two clients with two different operating systems are used to demonstrate that Multicast is being used. Firstly, a Red Hat Linux 9 running VLC 0.5.3. VLC version 0.5.3 introduces the capability of receiving IPv6 Multicast in Linux. Secondly, a Windows XP running VLC 0.5.3 and a Multicast-to-unicast relay.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Multicast allows the sustainability of traffic in the core networks while it grows in the end networks. A Multicast policy adopted in the Exchange scenario would use the available bandwidth in the best way.

Innovation of this Trial Scenario:

The Multicast support in the video server and in the client side.

Scenario Improvement with IPv6:

IPv6 TV broadcasting can be offered in an easier way than with IPv4.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

The scenario could be improved in demonstrating the advantages of IPv6 Multicast if the traffic is going through the Euro6IX network and a graphical application goes on receiving a broadband video stream, at the same time when additional clients are joining to the session.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM and VLC client
- 1 PC Windows XP. Pentium IV with 256MB RAM and VLC client

(http://www.videolan.org/)

Server Requirements

- 1 PC Linux (2.4.20) Pentium IV with 256MB RAM.
- Video server developed in TID.

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone with 10/100 Mbit/s Ethernet.
- Required bandwidth: 10MB.
- IPv6 Address needed.

Graphical Illustration of the Trial Scenario:

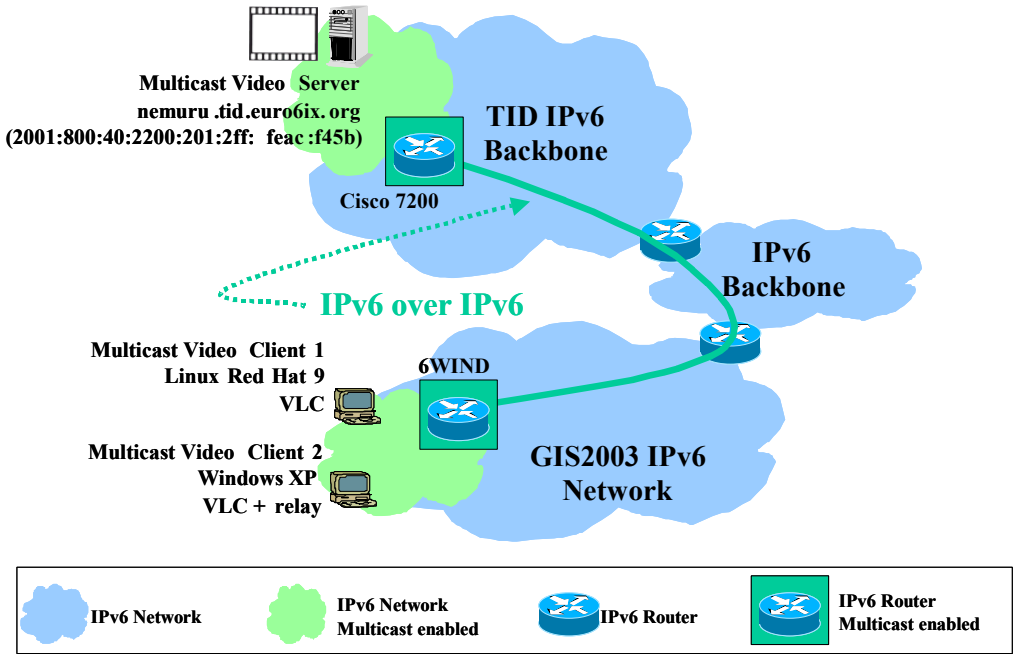

Figure 3-17: Video Multicast

Trial Configuration and Realization (Steps):

Linux client

1. Launch VLC.
2. Go to Network, UDP/RTP Multicast, and write the Multicast group address (ff18::5) and port (1234).
3. Accept.

Windows client

1. Launch the relay (relay ff18::55 1234 4 ::1 5678) and VLC
2. Go to Network, UDP/RTP, and select the port (5678)

Observed Results of the Trial/Additional Remarks:

The last version of VLC doesn't work yet with IPv6 Multicast, so a Multicast-to-unicast relay has been developed at TID Labs as a temporary solution to be able to use VLC for Windows XP. Advantage: Network benefits of Multicast in terms of load. Disadvantage: CPU usage of final client equipment increases.

3.2.2.11 Audio/Video Streaming over IPv6 with QoS support – Consulintel

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

In addition of a normal High Quality Video/Audio streaming, another goal is to show a preliminary use of IPv6 QoS functionalities for this kind of streaming services.

General Overview of the Trial Scenario:

Using a multihomed streaming server, the use of both IPv6 streaming and IPv6 QoS functionalities are showed. A router is used for marking the packets and for the ingress traffic limitation.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

- Shows the use of IPv6 streaming traffic and an early QoS use within Euro6IX network.
- Also shows the some QoS tools that would be needed by the IXs in order to provide End-to-End QoS to its customers.

Innovation of this Trial Scenario:

- The use of commercial IPv6 video streaming software and commercial router's QoS functionalities.
- The visual trial of QoS functionalities.

Scenario Improvement with IPv6:

QoS is a key issue in IPv6. Traffic Class and Flow Label will be used by the ISPs and IXs in order to provide QoS in a more extensive way than IPv4 permits nowadays.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Multimedia traffic over IPv6 and the use of QoS facilities are available in commercial products.

One possible enhancement of this scenario is to give an interactive interface to the user, in order to be able to change the QoS configuration. This is already available at Consulintel's Euro6IX web site (http://www.consulintel.euro6ix.com/services/6stream_qos_webpage.php), under the public services section.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- Audio Output (Speakers) and good Graphic Card
- Operating System: Windows 2000, Windows XP or Windows 2003 (.NET)
- VideoLan Client (http://www.videolan.org), or
- Windows Media Player Series 9 installed (http://www.microsoft.com/windows/windowsmedia/default.aspx)

Server Requirements

- Windows 2003 (.NET)
- IPv6 video streaming server (Windows Media Server 9)

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone
- 100 Mbit/s Ethernet interfaces for the server (2) and the client (1)
- Required bandwidth 100 Mbit/s(To allow several clients and several local demos simultaneously)
- 1 IPv6 Router for doing traffic mark and traffic limitation in order to provide QoS
- Access to DNS resolution to ease the server addresses resolution

Other Requirements

- In order to have a multi-homed streaming server, the 6POWER and Eurov6 IST projects networks were used.

Graphical Illustration of the Trial Scenario:

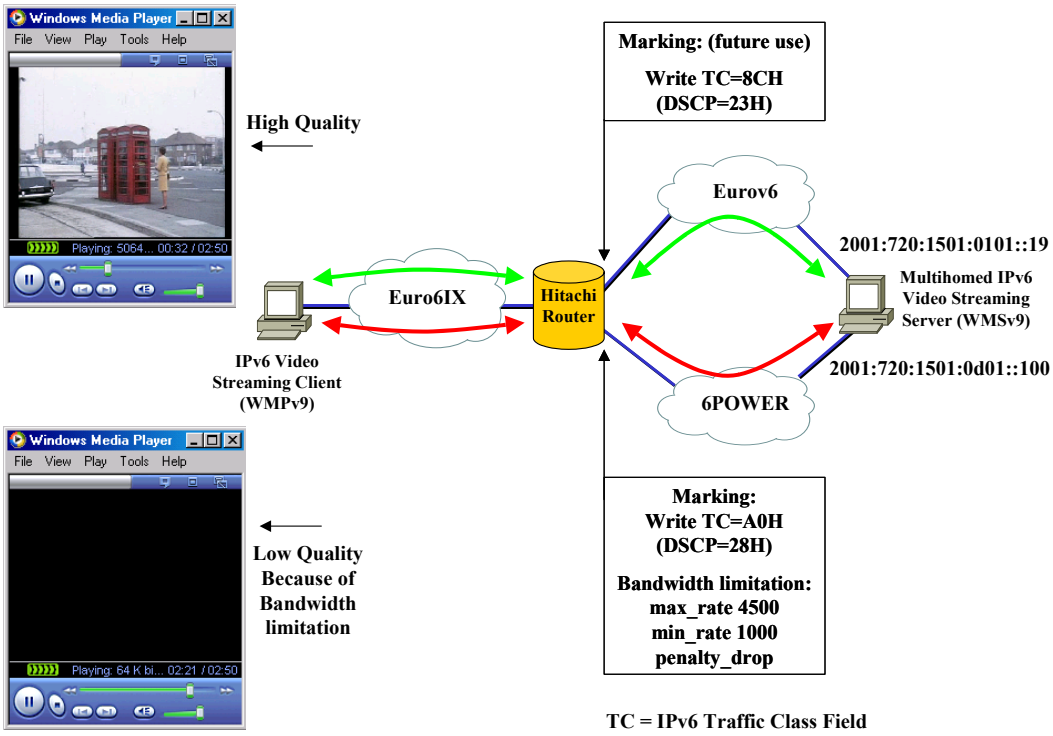

Figure 3-18: Audio/Video Streaming with IPv6 QoS

Trial Configuration and Realization (Steps):

1. Configure the clients: Install windows media player 9
2. Configure server: Install and configure windows media server 9
3. Configure router: Add the marking and traffic limit rules
4. Run the demo from the client

Observed Results of the Trial/Additional Remarks:

The different treatment of the two video streams was visible, although the windows media player tried to smooth the low quality effect. Investigating the media player statistics, the result became even clearer.

3.2.2.12 Network Access via Tunnel Broker – UMU

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- Test TILab's Tunnel Broker attaching the IPv6 world with it.
- Use standard IPv6 applications like web browsing and standard software to test Tunnel Broker

General Overview of the Trial Scenario:

In this scenario appears a PC client with IPv4 connectivity and it is connected to the TILAB's Tunnel Broker through the web pages offered by TILAB. Once the tunnel is configured the client can access to the IPv6 world through the Euro6IX network.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Tunnel Broker is an important transition mechanism that should be supported by every IXv6 and ISPv6 to offers IPv6 connectivity to the IPv4 clients. TILAB's Tunnel Broker is a standard tool that must be improved with new features. It's necessary to analyze the behavior inside a real scenario like Euro6IX network to design a new Tunnel Broker tool.

Innovation of this Trial Scenario:

Real IPv6 IX's, like the Euro6IX ones, could begin to offer IPv6 connectivity to their IPv4 clients using this transition mechanism.

Scenario Improvement with IPv6:

This scenario does not have sense without IPv6.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

This scenario is a perfect test-bed to analyze Tunnel Brokers requirements. Now, it allows to identify how standard solutions can be improved in order to add new features like IPSec tunnels, 6UDP4 tunnels or the support of options about routing, Multicast, etc.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- PC client
- Operating System – Windows
- Dual-Stack System with
    - IPv4 Web Browser
    - Telnet, FTP, …

Server Requirements

1. Tunnel Broker:
    - 1 PC able to run the following software and with IPv4 and IPv6 connectivity:
        - FreeBSD 4.5
        - Apache 2.0
        - TILab IPv6 Tunnel Broker

2. Tunnel Server
    - 1 PC able to run the following software and with IPv4 and IPv6 connectivity:
        - FreeBSD 4.5
        - ipfw6

3. DNS Server
    - 1 PCs able to run the following software and with IPv4 and IPv6 connectivity:
        - FreeBSD 4.5
        - Bind 9.x (we used release 9.2.1)

Network Requirements

- Connectivity to IPv6 network/Euro6IX backbone
- Connectivity to IPv4 network because of DNS resolution
- 10/100 Mbit/s Ethernet
- Required bandwidth 2Mbit/s
- IPv4 Address needed

Graphical Illustration of the Trial Scenario:

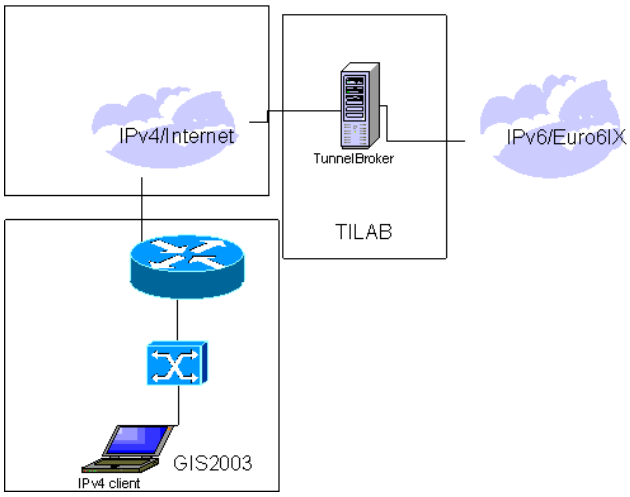

Figure 3-19: Network Access via Tunnel Broker

Trial Configuration and Realization (Steps):

In this trial the users are connected to the Internet via their traditional IPv4 connection. The Tunnel Broker is installed in the TILAB site with all the necessary servers (tunnel broker, tunnel server and DNS server)

Steps of trial:

1. The user must register itself.
2. Once done, he can enter to request a new tunnel. The user inserts the login and password obtained in the registration process.
3. Then he only should select the client operating system and click on "Create Tunnel".
4. If everything is correct the user gets have assigned an IPv6 address and a connection will be established through the Euro6IX.
5. Now, several basic tools can be used to access the IPv6 world, like web browser, telnet, FTP, ping, etc….

Observed Results of the Trial/Additional Remarks:

The obtained results are the expected ones, IPv4-only connected clients managed it to attach the IPv6 world, but the most important result it to know how a Tunnel Broker should be used inside an IX and how it must be improved with new tunnel types, options and security.

3.2.2.13 IPv6 Multi-homing based on Default Address Selection – UPM

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To show the functionality of the UPM's modification to source address selection mechanism in USAGI's IPv6 implementation, in order to evaluate its use in the multi-homing solution proposed in the RFC 3484.
- To verify the solution over a real multi-homed scenario and with a real application, in this case the v6 version of Quake 2 game.

General Overview of the Trial Scenario:

The trial scenario is made of a multi-homed host that inherits two different addresses from two service providers. The demo shows how the host tries to connect to external hosts accessible through the providers and has success or not depending of the selected source address.

When the standard USAGI kernel is used, the connection fails when source addresses are not chosen properly for each destination. On the contrary, when the modified USAGI kernel with source address selection modifications is used and the kernel address label table for each destination has been configured properly, the connection establishment succeeds.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

The scenario solved by the modifications shown in this demo is very usual inside Euro6IX network, where partners normally have several IPv6 address ranges assigned: One inherited from Euro6IX network or from the IX they are connected, and others from the 6BONE or other networks or research projects they are connected to.

Innovation of this Trial Scenario:

This scenario allows the correct use of multiple IPv6 source addresses in a multi-homed scenario, based on the proper configuration by a network administrator. This feature is not available in standard IPv6 stacks.

Scenario Improvement with IPv6:

The IPv6 addressing architecture allows multiple unicast addresses to be assigned to interfaces. Multiple addresses will typically come from multi-homing situations, where sites will have multiple ISP attachments, each one using a different prefix. Host inheriting multiple addresses will have to manage them properly in order to use the correct source address in each case.

Although this is not a completely new problem (it happens also under some situations with IPv4), the strict hierarchical IPv6 routing model and the importance of multi-homing scenarios in today's Internet, stresses the need to find a solution to this problem. Proper source address selection algorithms have to be designed and implemented to cope with host based multi-homed scenarios.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

The demo shows the basic multi-homing capabilities added to USAGI IPv6 implementation based on source address selection mechanisms. The mechanism used requires the manual configuration of address label table.

Work is underway in order to improve the solution by adding automatic configuration capabilities from routers based on router announcements. Besides, the solution will be extended to solve two-gateways-in-a-LAN scenarios, which is a common problem in IPv6 environments. In these cases, in addition to kernel label table configuration, it is necessary to define next hop depending on the destination addresses.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- Personal Computer running Linux
- USAGI Linux kernel implementation (http://www.linux-ipv6.org/)
- User-label-table USAGI patch and addrlabel user level configuration tool (http://www.upm.euro6ix.org/source/multihoming/multihoming-1.0.tar.gz)

Server Requirements

- No server required (client side application)

Network Requirements

- Connectivity to two different network providers.

Other Requirements

- None

Graphical Illustration of the Trial Scenario:

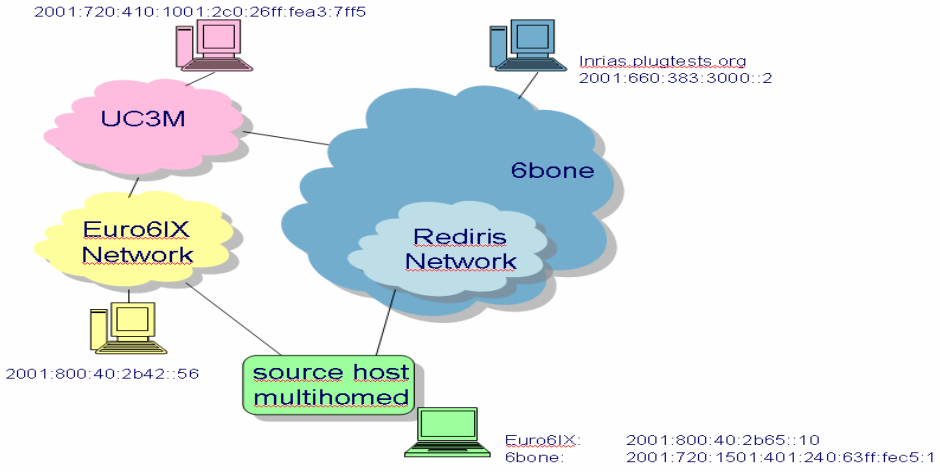

Figure 3-20: IPv6 Multihoming

Trial Configuration and Realization (Steps):

The following steps are needed to set-up the demo:

- Compilation and installation of patched USAGI kernel and *addrlabel* user level tool, as explained in the INSTALL file distributed with http://www.upm.euro6ix.org/source/multihoming/multihoming-1.0.tar.gz.
- Ping and traceroute target hosts, verifying the default source address selected by USAGI kernel, the path followed by packets and delay observed to each host, which will suggest the return path.
- Modification of the address label table using *addrlabel* tool.
- Repetition of pings and traceroutes to target host, noting the changes in the path and delay to each host.
- Since ping and traceroute applications are not very suitable in a trial scenario, the v6 version of Quake II game was used to show the functionality of multi-homing service. When the label table was not configured properly, the Quake II client in the multi-homed host was unable to get connected to the Quake II server in UC3M (see the figure above). However, once the label table was properly configured, the Quake client was able to get connected.

Observed Results of the Trial/Additional Remarks:

Some small instabilities of network connectivity during the event allowed the trial of multi-homing benefits.

During some periods of time, the only IPv6 connection available was the UPM-Euro6IX one, due to breaks in RedIRIS network. In this case the standard USAGI kernel was selecting the RedIRIS source address for most destinations, getting a failure in those connections because the source address was not reachable from outside.

In the case of the modified USAGI kernel, the problem was easily fixed, just setting (through *addrlabel* user tool) the UPM-Euro6IX source address as the default source address.

Once the network was stabilized, the scenario was the one shown in the figure. A good example of the multi-homing problem was the connection to UC3M hosts. The best path to reach them was UPM-Euro6IX link. However, USAGI kernel (following RFC 3484) was selecting the 6Bone source address for this destination.

Outgoing packets used UPM-Euro6IX link, but incoming packets were routed to 6bone and then to the Euro6IX network through London gateway. However, both multi-homed and target hosts were physically located in Madrid.

This problem was fixed using *addrlabel* in order to set the right source address for the destination prefix.

3.2.2.14 Mobile IPv6 – BT

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

In this trial the Mobile IPv6 protocol is used to show how a Laptop PC with WLAN access can remain connected to the network and continuously received a streamed MP3 audio whilst roaming between different WLAN networks.

Situations where Mobile IPv6 could potentially be very beneficial are large WLAN networks i.e. would allow you to remain connected to the network whilst walking though a complete airport or town. Other situation are to allow continuous network connectivity between different network technologies e.g. fixed and WLAN or fixed and 3G.

General Overview of the Trial Scenario:

Trial of Mobile IPv6 i.e. seamless roaming between two WLAN nodes those are on different IPv6 address segments.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Very relevant as the Mobile IP HA may be an IPv6 Exchange service also the more advance fast handoff aspects may affect the Exchange design.

Innovation of this Trial Scenario:

Mobile IPv6 is seen as an interesting technical and commercial aspect of IPv6 especially with the rapid deployment of WLAN and the inherent problems this could bring if permanent connectivity is required whilst roaming a large geographical area that is covered by several sub-nets.

Scenario Improvement with IPv6:

Yes – Mobile IPv6 superior to Mobile IPv4 because its an inherent part of the protocol stack, it can reduce network tromboning and auto-configuration easies the acquisition of addresses whilst mobile.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Convert to using a later version of the Mobile IPv6 specification that has secure binding updates. Fast handovers and various other facilities are being investigated that could be demonstrated.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- IPv6 PC with Mobile IPv6 capabilities, WLAN, MP3 player plus special software to force switch-over's between WLAN's

Server Requirements

- IPv6 MP3 server that is Mobile IPv6 aware.

Network Requirements

- IPv6 network that has a Mobile IP HA connected to it

Other Requirements

- Considerable amount of skill configuring the equipment

Graphical Illustration of the Trial Scenario:

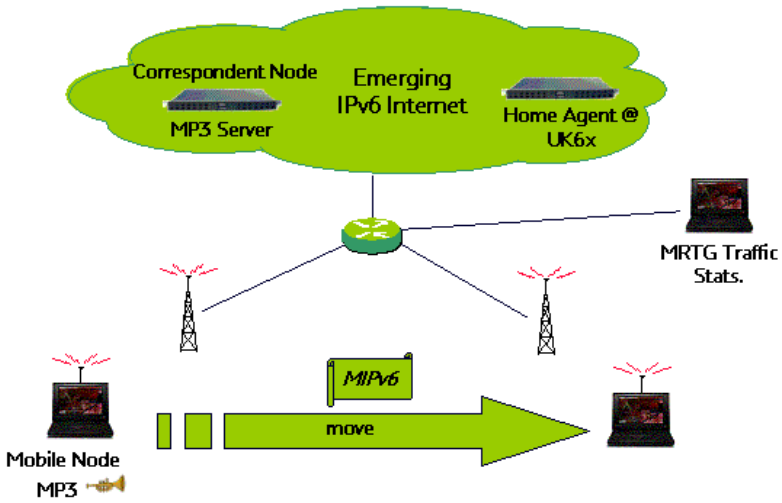

Figure 3-21: Mobile IPv6

Trial Configuration and Realization (Steps):

Mobile IPv6 HA deployed at the UK6, correspondent node (MP3 player) also at the UK6x, Mobile node and two WLAN base stations deployed at the GIS2003 event.

Observed Results of the Trial/Additional Remarks:

MP3 streaming whilst roaming between two WLAN base stations, data visualized on a separate MRTG view of the network.

3.2.3 Euro6IX Network Trial Scenarios

The target of the trial scenarios within this "Network Scenarios" section is to illustrate the complexity of the actual existing network infrastructure of the Euro6IX backbone and to attract the "external customers" with an insight into the real network usage on the basis of network statistics and looking glass facilities as well as in the tools of network management.

These trial scenarios highlight the project achievements that were reached mainly within the work packages 2 ("Network Architecture Design") and 3 ("Network Implementation") of the project.

3.2.3.1 MRTG Statistics of Madrid GIS2003 - TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate the results of the code porting on MRTG, done by nGn, a traffic-monitoring tool.
- To show the network reachability of the Euro6IX POPs

General Overview of the Trial Scenario:

A PC running MRTG-IPv6 runs as a IPv6 Manager, retrieving information from a SNMP Agent and putting them in a human readable format (HTML plus .jpg image files)

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

High. It allows monitoring and tracking the overall network traffic on an IPv6 subnet, given detailed characteristics on input/output traffic, average etc.

Innovation of this Trial Scenario:

Before this demo, MRTG could not run queries on IPv6 protocol, but only on IPv4. Now it can run on both.

Scenario Improvement with IPv6:

Nothing but IPv6 availability itself.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

For the time the scenario was run, only specifying SNMP Agents by DNS resolution was allowed. Future releases will allow dotted addresses to specify the target.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- A PC-software running Linux O.S.
  (Any distribution running kernel 2.4 should be enough, i.e. Red Hat 7.0)
- Perl 5.8 (http://www.cpan.org)
- Socket6 and INET6 Perl modules
  (http://www.cpan.org, versions 0.11 and 1.26 respectively)
- mrtg version 2.9.29 (http://people.ee.ethz.ch/~oetiker/webtools/mrtg/pub/)
- mrtg-2.9.29-v6-20030531.diff (patch making mrtg-2.9.29 IPv6 available)

(http://www.euro6ix.org/ => ShareWare => Private => Applications)

Server Requirements

- An agent running SNMP (1| 2c) over IPv6.
- A Web server running on the previous PC-Software in order to make the HTML pages available via a browser.

Network Requirements

- IPv6 connectivity required.
- IPv6 address assigned.

Graphical Illustration of the Trial Scenario:

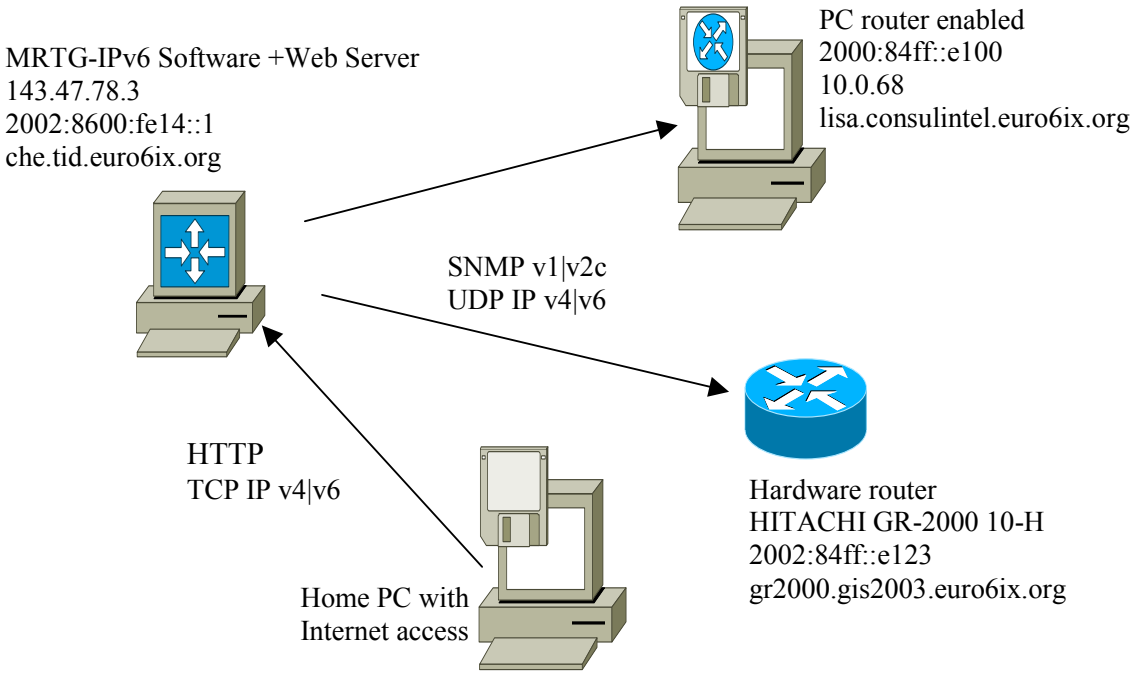

Figure 3-22: MRTG Statistics of GIS2003

Demonstration Configuration and Realization (Steps) of trial:

Installing prerequisites:

- Perl 5.8
  - bash-2.04$ tar xzvf /path/to/stable.tar.gz
  - bash-2.04$cd perl-5.8.0
  - bash-2.04$sh Confgure
  - bash-2.04$make
  - bash-2.04$make install
- Installing the Socket6-0.11.tar.gz
  - bash-2.04$tar xzvf /path/to/Socket6-0.11.tar.gz
  - bash-2.04$cd Socket6-0.11.tar.gz
  - bash-2.04$perl Makefile.PL
  - bash-2.04$make
  - bash-2.04$make install
- Installing the INET6-1.26.tar.gz module (important !! 1.27 will not run)

- bash-2.04$tar xzvf /path/to/INET6-1.26.tar.gz
- bash-2.04$cd INET6-1.26
- bash-2.04$perl Makefile.PL
- bash-2.04$make
- bash-2.04$make install

Installing mrtg-2.9.29 v6 patched

- bash-2.04$$ tar xzvf mrtg-2.9.29.tar.gz
- bash-2.04$ patch –p0 < mrtg-2.9.29-v6-20030525.diff
- bash-2.04$cd mrtg-2.9.29
- bash-2.04$autoconf
- bash-2.04$./configure –enable-ipv6 [--prefix=<path-to-install>
- bash-2.04$make
- bash-2.04$make install
- bash-2.04$export PATH=<path-to-install>/bin:$PATH

o Using MRTG

- bash-2.04$ ping myrouter.ipv6.euro6ix.org
- bash-2.04$ cfgmaker public@myrouter.ipv6.euro6ix.org -global 'WorkDir: /home/html' –output mrtg.cfg
- bash-2.04$ mrtg mtg.cfg

o Adding it to the crontab (voluntary).
Make a file containg these line (i.e crontab.mrtg).
0,15,30,45 * * * * /path/to/install/bin/mrtg /path/to/mrtg.cfg
And add it into the cron daemon

- bash-2.04$ crontab –l > buffer.txt
- bash-2.04$ cat crontab.ngn >> buffer.txt
- bash-2.04$ crontab buffer.txt

Observed Results of the Trial/Additional Remarks:

None.

3.2.3.2 TID Web statistics system & MRTG – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate the network statistics system developed at TID.
- To show the stability of Euro6IX networks.

General Overview of the Trial Scenario:

From the GIS2003 conference hotel an http session was initiated with the statistics server (http://stat6.tid.euro6ix.org) and the MRTG server (http://mrtg.tid.euro6ix.org), both at TID premises.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Useful tool to control Euro6IX nodes.

Innovation of this Trial Scenario:

TID pingstat system provides a new way to control IPv6 hosts.

MRTG is a useful system to monitor traffic.

Scenario Improvement with IPv6:

None.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

The network was stable enough during the public trial.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- No Special Hardware Requirements.
- Software Requirements: O.S with IPv6 installed, Web Browser with IPv6 Support.

Server Requirements

- No Special Hardware Requirements
- Statistics System package downloaded from official Euro6IX repository: /wp3_network_implementation/a3_3_operation_management/statistics_system/tid_ping_stat_system
- MRTG Server downloaded from http://people.ee.ethz.ch/~oetiker/webtools/mrtg/

Network Requirements

- Connection with TID premises,
- No special Bandwidth requirements needed
- Pingstat System: http://stat6.tid.euro6ix.org
- MRTG Web: http://mrtg.tid.euro6ix.org/mrtg/

Graphical Illustration of the Trial Scenario:

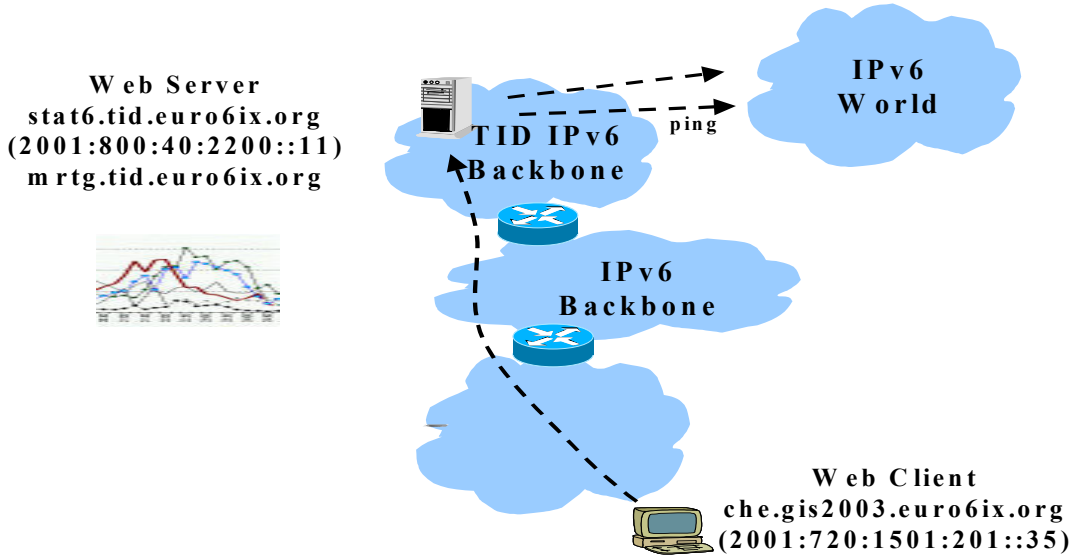

Figure 3-23: Web Statistics and MRTG

Demonstration Configuration and Realization (Steps) of trial:

1. TID Statistics System and MRTG Server are running at TID premises. An IPv6 web Browser (Mozilla for Linux and IE for Windows 2000 & XP with IPv6 protocol support) instance will be opened.

2. The URL of the Statistics System is http://stat6.tid.euro6ix.org, and the URL for MRTG is: http://mrtg.tid.euro6ix.org/mrtg/

3. Periodically (every hour in the case of ping_stat system and five minutes in the case of MRTG), the system refreshes the network statistics page of the Euro6IX net with new data about connectivity, so that the web page must be reloaded to display them.

Observed Results of the Trial/Additional Remarks:

3.2.3.3 Web access to Looking Glass Server at TID premises – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To evaluate and demonstrate the proper operation of Looking Glass (LG) server installed at TID premises. (This LG has been developed within Euro6IX by UPM and tested by TID and other partners).

General Overview of the Trial Scenario:

From the hotel an http connection is initiated to the TID statistics server (http://lg.tid.euro6ix.com/cgi-bin/ntools.pl).

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Useful tool to control IPv6 routers operation in Euro6IX backbone.

Innovation of this Trial Scenario:

Looking Glass is a tool adapted to IPv6 to obtain information from IPv6 routers in an efficient way.

Scenario Improvement with IPv6:

The connection to the routers is made using IPv6.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- No Special Hardware Requirements.
- Software Requirements: O.S with IPv6 installed, Web Browser with IPv6 Support.

Server Requirements

- No Special Hardware Requirements.
- Server downloaded from UPM web (http://www.upm.euro6ix.org)

Network Requirements

- The connection to every requested router is via IPv6.
- URL: http://lg.tid.euro6ix.org/cgi-bin/ntools.pl

Graphical Illustration of the Trial Scenario:

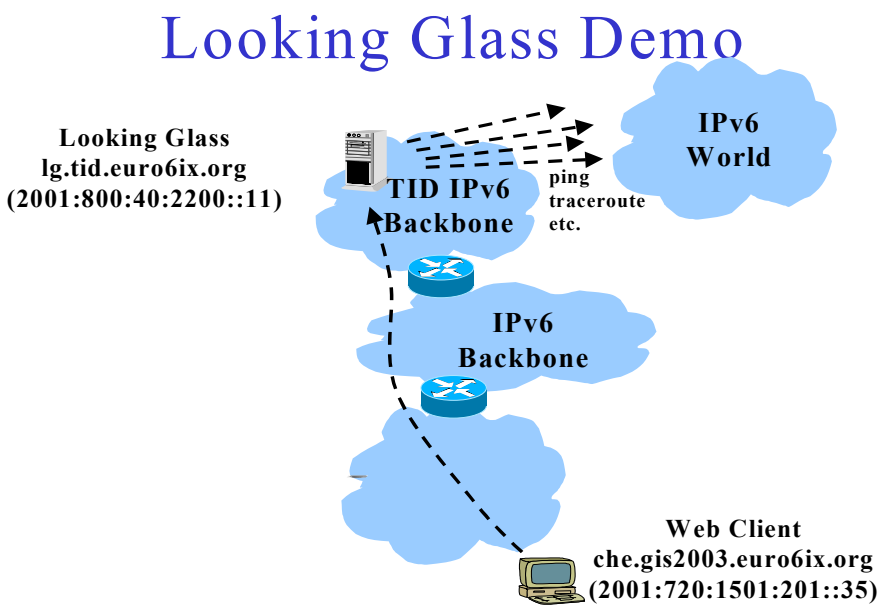

Figure 3-24: Looking Glass

Demonstration Configuration and Realization (Steps) of trial:

1. TID Looking Glass System is running at TID premises. An IPv6 web Browser (Mozilla) instance will be opened.

2. The URL of the Statistics System is http://lg.tid.euro6ix.com/cgi-bin/ntools.pl.

3. In this URL you can ask about any information of the routers that belong to TID network.

Observed Results of the Trial/Additional Remarks:

3.2.3.4 Magalia Network Management Tool – TID

1) General Description of the 1st Year Public Trial Scenario

Objectives of the Trial Scenario:

The main objectives of this trial are:

- To demonstrate the real time monitoring of an IPv6 network with Magalia distributed software.

General Overview of the Trial Scenario:

There is a host running a Magalia kernel and modules, and other hosts running the graphical clients (XGES).

This demo shows the graphical monitoring of the GIS2003 hotel network and Euro6IX network, showing the demo room scenario and European Euro6IX backbone maps.

Relevance of this Trial to the "IPv6 Internet Exchange" Scenario/Euro6IX project:

Management tools are of very big importance for an IX, Magalia is a specific management environment for 6IXs and IPv6 NOC's, so this issue has extremely high relevance within Euro6IX.

Innovation of this Trial Scenario:

This demo shows an intuitive real-time graphical management tool for an IPv6 network, with distributed modules along the network.

Scenario Improvement with IPv6:

Because Magalia is a specific IPv6 tools, there are no real improvements with IPv6 but an improvement to IPv6 networks.

Conclusion/Outlook/Possible Enhancements of this Trial Scenario:

Now it is possible to have a specific management tool for IPv6 networks and for first time, this management can be shared between various organizations.

An enhancement in trials could be to highlight how inter-organization sharing mechanism works.

2) Technical Description of the Realization of the Trial Scenario

Requirements:

Client Requirements

- Hardware (minimal requirements): A Pentium-III PC (or faster) with 64 MB of RAM, 50 MB of disk space and a graphic card with 16 bits of deep.

- Software requirements: Linux with kernel 2.4.8 (or later), X11, lesstif, OpenSSL 0.9.6b (or later), mhash-8.0.18 (or later)
- Download Magalia at http://www.tid.euro6ix.org/ipv6/NetworkManagement.htm

Server Requirements

- Hardware (minimal requirements): A Pentium-III PC with 64 MB of RAM, 50 MB of disk space.
- Software requirements: Linux with kernel 2.4.8, OpenSSL 0.9.6b, mhash-8.0.18 (or later), NET-SNMP version: 5.0.1 (Modified TID version), Radius, (the use of freradius-0.7.1 modified by TID with IPv6 support is recommended).
- Download Magalia at http://www.tid.euro6ix.org/ipv6/NetworkManagement.htm

Network Requirements

- A dual stack network, Magalia don't need IPv4 really, but the majority of commercial routers don't support IPv6 SNMP queries, Magalia uses SNMP for monitoring.
- The routes and switches to be queried must have SNMP configured.

Graphical Illustration of the Trial Scenario:

The Magalia demo was distributed in three locations, The GIS-2003 demo room, TID labs and MAD6IX, the illustration shows the relations in the Magalia management demo.

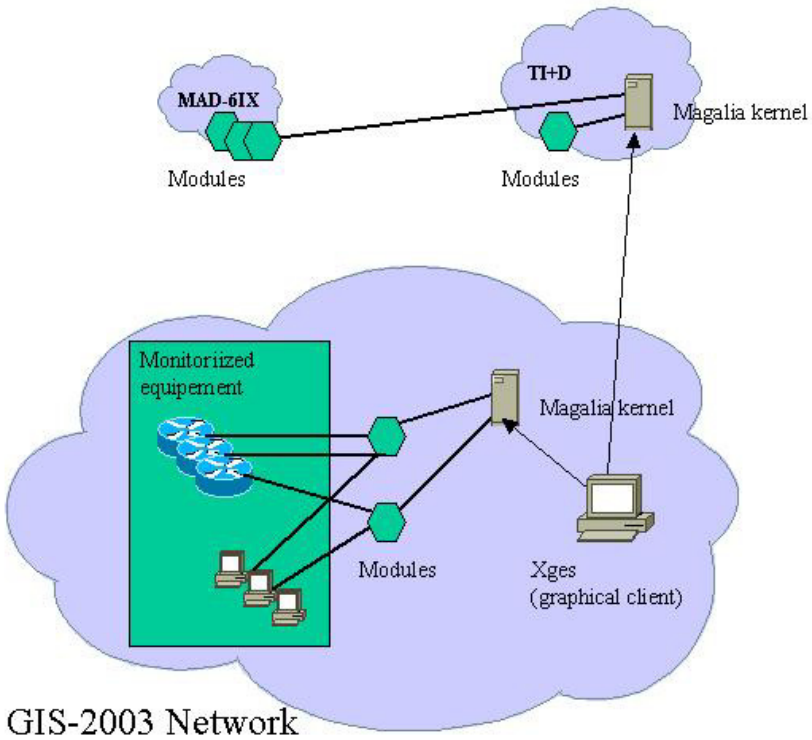

Figure 3-25: Magalia Network Management

Demonstration Configuration and Realization (Steps) of trial:

The Magalia configuration to GIS2003 demo needed the following steps.

- Installation of Magalia, freeradius-0.7.1 and NET-SNMP 5.0.1 packages.
- Creation and configuration of users FORUM and FORUMADMIN in freeradius.
- Configuration of addresses an port of Magalia kernel and modules.
- Creation and installation of the GIS2003 network map with XGES.

General Overview of the Trial Scenario:

The demo consists in one machine, with the server, modules and client installed.

This machine was doing local monitoring for GIS2003 network.

Magalia was linked to the server in TID labs and MAD6IX showing the real state of the Euro6IX and the conference network.

4. SUMMARY AND CONCLUSIONS

This chapter should give a short summary of the results of the different trial scenarios in the context of the 1st Year Public Trial and give some conclusions, which could be drawn from them.

4.1 Results

As an overall statement it can be stated that the 1st Year Public Trial of the Euro6IX project can be considered as great success. The Euro6IX project managed it to design, establish and run a very complex IPv6 network infrastructure, that was not only used for the own 1st Year Public Trial demonstrations but also for the IPv6 connectivity of the demonstration booths of the European IPv6 projects as well as for connecting the ETSI Plug tests to the IPv6 world as also the whole conference auditorium and all the conference rooms.

Besides that it could be derived from the feedback questionnaire (which was circled during the conference) that the demonstration scenarios of the Euro6IX 1st Year Public Trial attracted the attendees of the conference very much so that the main objective of the Public Trial was reached very well.

It proved in lots of discussions between the visitors of the demonstration room and the exhibitors of the Euro6IX demonstrations that the Euro6IX demonstration scenarios were very good chosen, prepared and demonstrated. Much feedback could be gathered as well in direction of enhancing and improving the demonstrations as with respect to the (future) customer requirements and needs respectively IPv6 services and applications.

The 1st Year Public Trial were also shown to the representatives of the European Commission who got a comprehensive and very positive impression about the project achievements during its first project phase.

Nearly all partners from and all Euro6IX network sites were involved in this 1st Year Public Trial and proved with a very engaged time planning and an excellent demonstration that the project is well-managed and able to reach its objectives.

Hence a single-sentence summary of the 1st Year Public Trial of the Euro6IX project could read as follows:

- The Euro6IX project showed a very sophisticated and impressive trial on the GIS2003 conference that attracted as well the attendees of the conference as the representatives of the EC. Lots of valuable feedback information's were gathered and the project could highlight very successfully its activities and the project achievements that were reached within the first 16 months of the project.

The following sections summarize the results of the different trial scenarios/categories.

4.1.1 Application Trial Scenarios

- The Application trial scenarios gave a pretty good overview about the span of IPv6 capable applications that are available already today.
- Besides some very well known basic IPv6 applications (like Quake, FTP and Web Server/Client) also some very impressive and new IPv6 applications were demonstrated: Digital TV Streaming, Peer-2-Peer Application/Instant Messaging, Voice over IPv6 (from an application point of view). Those applications gave the visitors of the demonstration an early feeling about tomorrows IPv6 Internet.

- Another advantage of the Application demonstration scenarios was that not-only the project work of Activity A4.2 could be highlighted; also the results, which were, achieved in A4.1 as well as the implemented network services and the underlying Euro6IX network infrastructure (WP2 and WP3) could be demonstrated.
- Nevertheless the Application demonstration scenarios realized it to show the enormous amount of work that was spent within the application porting activities of the project and the very good results that were reached.
- Using these Application scenarios the Euro6IX project managed it to involve the public into their 1st Year Public Trial and to fulfill this requirement from the Technical Annex of the project.

4.1.2 Service Trial Scenarios

- The demonstration of the IPv6 Network Services, which are implemented within the Euro6IX network, attracted the visitor of the Euro6IX demonstration booth very much and formed the largest cluster of the demonstration scenarios.
- Many IPv6 network services could be shown in the Euro6IX 1st Year Public Trial that are innovative and very complex. For an example only Multicasting, IPv6 GPRS network access, Multi-homing, Mobile IPv6, NAT-PT, IPv6 PKI and IPv6 QoS support for Multimedia Streaming should be mentioned.
- Unfortunately the network service demonstration could highlight only a part of the overall installed IPv6 service base of the Euro6IX network, but nevertheless it realized to present some of the most interesting services from the perspective of an IPv6 Internet Exchange and IPv6 ISP.
- It is the ultimate target of the Euro6IX project to use these demonstrated IPv6 services in its daily project work and to offer them also to the connected customer. For this reason (nearly) all of the above mentioned services have to be implemented in all IX POPs of the project which will be one of the main activities of the remaining project lifetime.
- These demonstrated services would be further investigated developed and tested within Activity 4.1 of the project and most likely presented within the next Public Trial in a much more sophisticated and enhanced manner.

4.1.3 Network Trial Scenarios

- The handful of pure network trial scenarios allowed it the visitors of the Euro6IX demonstration booth to get a very good overview about the structure and the behavior of the Euro6IX network.
- Normally its very hard to demonstrate a successful network infrastructure implementation to a broad publicity in an other way than through pure functionality, that's why the chosen statistics, Looking Glass and Network Management applications were the right way to open the "hidden" network features to an interested and broad audience.
- Besides that the proper working of the other application and service demonstrations can also be counted as an impressive demonstration of the underlying IPv6 infrastructure and the Euro6IX backbone. Especially if one keeps in mind the very complex IPv6 network layout of the GIS2003 that is illustrated in Figure 2-2 to 2-4 above.
- It's worth to mention that the biggest challenge of the 1st Year Public Trial was the IPv6 Network set-up and the organization of the overall Internet connectivity.

4.2 Conclusions

From the today's point of view several general conclusions can be drawn from preparation and realization phase of the 1st Year Public Trial. Some of them will be mentioned in the chapter "Lessons Learned/Open issues" later on.

- It proved to be a good idea to choose a big IPv6 Conference as 1st Year Public Trial because this event with about 400 (mostly skilled) attendees was the right environment to appreciate the work that was done within Euro6IX and the results that were reached.
- It is very hard to top the 1st Year Public Trial of the Euro6IX Project because this demonstration united already many of the good and sophisticated project achievements within a demanding demonstration.
- The best trial scenario seems to be flashing applications, which uses an innovative IPv6 network service over a European-wide broadband network infrastructure. But normally it's not so easy to find such a trial scenario that highlights all the achievements reached in the project. That's why the separation into the application, network and service clusters was the right decision for preparing the 1st Year Public Trial.
- The approach, the Euro6IX project has chosen to meet the objectives of the project (with respect to public trials), seems to be a well working approach, although not all objectives could be met by this first hit.
- During the definition and realization phase of this 1st Year Public Trial it was ensured (in a much more stringent way than for the 1st Year Internal Trial) that the main focus of the trials is directed to the Euro6IX networking and service scenarios and the corresponding questions and problems. Example: Multicasting, Multi-homing, Mobility and other network services.
- Within this 1st Year Public Trial it turned out that further implementation efforts have to be spent to finalize (some of) the applications in order to use them in the Euro6IX network for future demonstration scenarios and for attracting the potential IPv6 users of the Euro6IX backbone. But in comparison to the 1st Year Internal Trials (November 2002) it proved that already large progress steps were made.
- Nevertheless of the success of the 1st Year Public trial the next one should be based on the real IPv6 customers of the Euro6IX network. This induces that the efforts for attaching new customers to the Euro6IX network have to be intensified.
- Different from the preparation and realization of the 1st Internal Trials this Public Trial was well aligned with the correspondent activities of other IST IPv6 projects as well as with the European Commission. Example: Overall IPv6 network connectivity and common demonstration scenarios e.g. with the 6POWER project. This was one of the lessons drawn from the evaluation of the 1st Year Internal Trial.

Finishing these more or less philosophic conclusions, it can nevertheless be summarized, that the 1st Year Public Trials produced very good results and also good feedback for the other work packages of the project.

4.3 Lessons Learned/Open issues

Also during the preparation and the realization of the 1st Year Public Trial some open issues were identified, whereby this chapter should focus only to general open issues.

- It has proved once more that the preparation of the trials has to start very early in order to guarantee that these trials are brought to the point of interest and are realized in a short and effective way. Especially with respect to the overall IPv6 network implementation and Internet connectivity it has shown that all open question with respect of hardware equipment, routing and addressing have to be answered at the earliest possible point in order to make sure that the real network setup can be prepared and fixed in advance.
- For the next Public Trial the sponsoring situation with respect to the overall Internet connectivity has to fixed much earlier (as well as the required bandwidth etc.), so that in worst case scenario an extra local loop connection for IPv6 can be ordered (and paid from the project budget). But this will definitely up value the single demonstration scenarios and ensures that they will get the network parameters they need.
- Although there were already a lot of joined and aligned demonstrations between the Euro6IX project and some other IST IPv6 projects these common activities have to be intensified and more synchronized in direction of a common demonstration scenario.
- The preparation of a draft deliverable with rough descriptions of all the demonstration scenarios and technical requirements in front of the Public Trial proved to be a very effective approach to compile a valid network plan for the demonstration and to speed-up the real network setup for this event. Besides that responsibilities can be fixed and the provisioning of additional equipment can easily organized.
- A network installation (as shown within the GIS2003 network) can be realized within 2 days hard work, but if something goes wrong the targeted timeline will be missed. Hence it is recommendable to calculate an additional time buffer and/or to fix the network implementation as far as possible "offline".
- The future Public Trials have to be based on the Euro6IX customers. At the moment it's not very clear how to reach the targeted number of customers until the project end and how to involve them in a Public Trial scenario. This has to be discussed and clarified within the future project meetings.
- The flow of feedback from A4.3 to the other work packages and activities has to be intensified in order to get the maximal synergy effects out of the Internal and the Public Trials.

These open issues will be taken into consideration during preparation, realization and d-briefing of the next Internal and Public Trials in order to guarantee that all the objectives of the trial activity A4.3 of work package WP4 and as well as the overall project objectives will be met.

ANNEX A1: DNS ZONE FILE FOR DOMAIN GIS2003.EURO6IX.ORG

This zone file contains the name entries for the GIS2003 sub-domain of the 1st Year Public Trial of the Euro6IX Project.

```
$ORIGIN .
$TTL 604800     ; 1 week
gis2003.euro6ix.com     IN SOA che.tid.euro6ix.org. cpa.tid.es. (
                                2003051302 ; serial
                                7200       ; refresh (2 hours)
                                7200       ; retry (2 hours)
                                2419200    ; expire (4 weeks)
                                86400      ; minimum (1 day)
                                )
                        NS      che.tid.euro6ix.org.
                        NS      ns1.euro6ix.org.
                        NS      dns1.ist-long.com.
                        NS      dns-gis2003.eurov6.org.

$ORIGIN gis2003.euro6ix.com.
6wind                   AAAA    2001:720:1501:401::78
6wind_upm               A       130.206.14.67
ant6                    A       130.206.14.77
dns                     CNAME           che
eth10                   A       130.206.220.1
                        AAAA    2001:720:400::1:2
eth11                   A       130.206.14.33
                        AAAA    2001:720:1501:201::1
eth12                   A       130.206.14.49
                        AAAA    2001:720:1501:301::1
eth13                   A       130.206.14.65
                        AAAA    2001:720:1501:401::1
eth14                   A       130.206.14.81
                        AAAA    2001:720:1501:501::1
eth15                   A       130.206.14.97
                        AAAA    2001:720:1501:601::1
gr2000                  CNAME           eth11
hebus_if1               A       130.206.14.50
hebus_if2               A       130.206.14.51
hebus_if3               A       130.206.14.52
laptop_ptin             A       130.206.14.73
largo                   A       130.206.14.99
                        AAAA    2001:720:1501:301::99
maraca                  A       130.206.14.100
                        AAAA    2001:720:1501:301::100
miniyo                  A       130.206.14.68
neko                    A       130.206.14.84
                        AAAA    2001:720:1501:401::84
obelix_upm              A       130.206.14.72
pc5                     A       130.206.14.70
pc5bis                  A       130.206.14.71
pda1_umu                A       130.206.14.66
piltrafilla             A       130.206.14.34
                        AAAA    2001:720:1501:201::34
servideo                A       130.206.14.69
                        AAAA    2001:720:1501:401::69
shelton                 AAAA    2001:720:1501:301::101
```

```
T3_PC1          A       130.206.14.82
T3_PC2          A       130.206.14.83
T3_PC3          A       130.206.14.98
T3_PC4          A       130.206.14.99
telscom1        A       130.206.14.74
telscom2        A       130.206.14.75
telscom3        A       130.206.14.76
www.tid         CNAME       che
```