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Abstract:

Deliverable D5.8 is an update to deliverable D5.3. It describes the current status of the deployment of the Points of Presence (PoP) and data centres from Activities 5.3 and 5.4 installed at the five selected sites, namely: Telin (NL), France (F), University College London and University of Southampton (UK) and GRnet (GR).

The software environment and the applications being deployed at each particular location are described.

Keywords:

IPv6, applications, portal, PoP, data centre

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Introduction

One of the activities within WP5 of the 6NET project is to deploy and maintain different Points of Presence (PoPs) and data centres around Europe. The purpose of these PoPs is to allow a user community to make use of services developed or ported within the 6NET project as well as allowing participants in the 6NET project to gain experience with deploying IPv6 services. The services also generate traffic on the 6NET infrastructure, which may be engineered or monitored by other Work Packages in the project. The initial user community in most cases will be the 6NET community themselves. After gaining experience with the services the user community can be expanded to include people from outside the 6NET project.

The first chapter is intended to describe the different applications to be deployed at the different locations. The information itself however, is not in this Deliverable but on a web page that the first chapter refers to. This way the information can be kept up to date, by the developers themselves, without the need to constantly produce updates of this Deliverable.

The second chapter lists and describes the platforms installed at the 5 selected sites: Telin (NL), France (F), University College London and University of Southampton (UK) and GRnet (GR).

1 Applications development

Deliverable D5.1 of the 6NET project (available at the 6NET website[1]) lists the applications initially identified as candidates to run on 6NET's IPv6 network. Since the porting of applications to support IPv6 is not a 'static' activity, it is very difficult, if not impossible, to capture the ever- evolving status of the different applications mentioned in a single document. Therefore WP5 has decided that the applications list and current status would be in the form of a web page. This approach enables application 'owners' to keep the status of their porting effort up to date and additionally allows other interested people to keep track of the status, knowing that it is more up to date than a Deliverable downloaded from a web site.

The up-to-date list of 6NET applications is available at: http://6NET.laares.info/apps.phtml, although it is planned to move it to the Dutch POP. This site also provides the results of the Trials performed on each application through Test Evaluation Forms (TEF) according to the methodology described in Deliverable D5.5.

The current status of the application trials will be covered, followed by future plans for Activity 5.1.

1.1 Trials

A number of trials have been planned and carried out in accordance with D5.5. The trials are broadly broken down into two classes; Class **A** which are larger scope applications with correspondingly larger trial planning, and Class **C** which are less widely used applications, with more limited trial demands. The class of each application is indicated in parenthesis after each application name heading in the following subsections.

[1] http://www.6net.org/publications/deliverables/D5.1.pdf

In a few cases a set of trials has been planned and performed but has "failed" in one way or another. However these "failed" trials provide useful input to the network and application developers so that appropriate alterations and reconfiguration could be performed. Once the suitable changes were made subsequent trials followed.

For a number of the trials multicast was required. Multicast has been available since early in the project as a tunnelled network known as the M6BONE. However for realistic deployment of multicast, a native IPv6 multicast network needed to be deployed. The new native multicast IPv6 service of 6NET is known as M6NET. This service has taken sometime to roll out. The delays were incurred for two reasons.

- Firstly IPv6 multicast capable software for the core routers (Cisco GSRs) on 6NET did not become available till after Easter 2003. The software took some time to be carefully tested and deployed in the core.
- Secondly there were a number of sites that were using line cards in their core routers that were incompatible with native multicast IPv6. The line cards were too expensive for the partners to replace from project funds so the additional small scale routers have been deployed to circumvent the problem cards. This procedure has been performed at UKERNA and is now undergoing final testing.

Understanding and dealing with such issues has been very valuable and adds to the project's experience in the roll-out of a large scale IPv6 network. Indeed, 6NET has taken a leading role in IPv6 Multicast development, in both standardisation (in the IETF mboned WG) and through implementations (e.g. Cisco's support for the embedded RP technology).

1.2 Interactive Applications

Within the 6NET project conferencing services have been utilised informally for testing and small sessions for some time now. Trials have been performed on the major applications.

1.2.1 VIC *(A)*, RAT *(A)*, NTE *(C)*

The conferencing tools that were tested were the UCL multimedia tools which include the Videoconference tool (VIC), the robust audio tool (RAT), the Network Text Editor (NTE), and the Secure Conference Store (SCS). Local trial feedback forms were created for individual feedback on each of the tools which were in addition to the main feedback forms on WP5 applications database site.

An initial round of tests was performed half way through 2003 which brought to light a number of issues. The tools run on wide variety of platforms and the software installed ok at the participant sites. Firstly the multicast connectivity on M6NET was not fully deployed at that stage thus there was not sufficient connectivity to get five partners connected properly, and secondly there were some problems with the tools.

The test consisted of getting a number of sites together and running the tools at each site on a common multicast address.

Since the audio and video tools generally require additional hardware to run, there are invariably problems when a number of sites are using a wide variety of hardware. The problems can also be compounded by poor or outdated drivers. Users were recommended to use tested hardware with the latest drivers. In addition some issues were discovered with the tools themselves. Specifically with RAT a bug was observed in the MBUS code which resulted in the appearance of a duplicate local user. This problem only appeared when running the tool on IPv6 on Windows. After some investigation it was discovered to be due to a small

delay in the return of an MBUS ACK packet, which resulted in an untrapped retransmission of local user registration information. This may have been due to the IPv6 code in Windows being slightly less efficient than the IPv4 code.

Later in the year a second round of tests was performed on the fully operational M6NET to 8 sites with 11 participants. Whilst the planned number of people per site was not quite achieved, the site count exceeded that required by D5.5, which was seen as more important.

The second round of trials was successful, though there were new issues raised. One such issue was regarding appropriate multicast address selection, given partners were coming from both M6NET and M6BONE. The addresses needed to chosen so that they attached to the M6BONE PIM Rendezvous Point so both parties could access the traffic.

1.3 VOIP systems

Work on VoIP systems has proceeded within a number of different groups on both SIP and H323 based systems.

1.3.1 VOCAL *(C)*

VOVIDA's VOCAL SIP system has been worked on by UoS. They have ported the bulk of the VOCAL networking code to IPv6. The *sipset* SIP client now provides fully ipv6 capable peer-to-peer operation. The client was demonstrated at IST2002 and tests have been performed by UoS and UCL. The IPv6 support was integrated into the version 1.5 release code of the software, which is available from the vovida.org web site.

Plans to integrate ENUM support for IPv6 have been delayed due to the removal of ENUm support from the main release code. We expect to reivestigate ENUM support during 2004, possibly through kphone (described below). A number of countries are just commencing ENUM trials, so it is timely to also push IPv6 support in such trials.

1.3.2 SER and kphone *(C)*

Work has proceeded on Fraunhofer's SIP Express Router (*SER*) in combination with the IPv6 enabled *kphone* (which replaces the bonephone listed in D5.5).

Some initial trials with 3 sites, with one participant per site, have been carried out with IPv6 Kphone and SER. Kphone only runs on Linux and installed without trouble on the test systems. The users registered with the SER SIP registration proxy at Fokus and attempted to make calls. Whilst the SIP call set up was successful, bidirectional audio could not be established. Unidirectional audio connection was achieved between a number of parties. The bidirectional messaging feature of kphone was tested successfully. The initial trials highlighted issues with hardware compatibility with Kphone. Second stage trials are being planned.

1.3.3 ISABEL

Southampton has run an ISABEL conferencing node as part of its Euro6IX project effort, and has made the node available to 6NET partners. ISABEL has been used for international events such as the IPv6 Forum Summits.

ISABEL is developed within the Euro6IX project; 6NET has not made any development work on this application, but has trialled it.

In October 2003 Southampton hosted a Euro6IX meeting, with remote participation via ISABEL and also video transmission to 6NET using multicast and vic.

1.3.4 OpenH323 and GnomeMeeting *(C)*

CTI has worked on porting OpenH323 to IPv6. CTI has also worked on making applications that are based on OpenH323, like Ohphone, Openphone and OpenMCU compatible with IPv6. These applications have been tested in the internal CTI network and have also been used as real-time applications for performing QoS tests. CTI also plans in the last year of the project to test OpenH323 over the 6NET network.

GRNET has worked on porting GnomeMeeting to IPv6. This has resulted in an IPv6 capable GnomeMeeting which have been tested within GRNET and JOIN/WWU. The work required to port the application was minimal (less than lines of code) because IPv6 support was cleanly integrated in the supporting libraries (pwlib and OpenH323) which GnomeMeeting references in a well-engineered way.

GnomeMeeting IPv6 support is now in the release code, as of Summer 2003.

1.4 Streaming applications

A number of streaming applications underwent testing and trials, these systems streamed audio and/or video over unicast and/or multicast.

1.4.1 VideoLAN *(A)*

A VideoLAN video server is deployed at SurfNET with a custom web portal interface, which also links in sources from HUNGARNET. Two trials have been carried out using the VideoLAN server. Local trial feedback forms were created for individual feedback on the system, in addition to the main feedback forms on WP5 applications database site.

The VideoLAN system made available a number of video streams (in MPEG2) over unicast and multicast and was tested by 8 sites using the VideoLAN client on a number of platforms. Most testers suffered from distorted video, break-ups and the stream would sometimes freeze after the first few seconds. These problems are related to buffering of video. During the trial only small receive buffers were defined in the client. The combination small buffers and problems with the connectivity is probably the cause of the problem. The problems were related to the unicast streams (streaming up to 9 Mbit/s) whereas the multicast stream was received perfectly in all cases (800 Kbit/s). So with the unicast streams any loss or problem in the network, or lack of available bandwidth end to end, might result in problems with the MPEG2 decoder and therefore a distorted or broken video. Additional tests have been done with larger buffers and/or less bandwidth demanding video-assets. Results are promising, bandwidth demanding video-assets seem to work fine all the time, whereas assets requiring more bandwidth still show some glitches when streamed within the 6NET network.

Overall VideoLAN has proved to work well with IPv6 unicast and IPv6 multicast. The install on Windows Operating Systems works well, for some Linux distributions more efforts are needed. Problems with streaming high bandwidth unicast streams (6-9 Mbit/s) are reported, but may be the result of buffering or local network problems. Additional tests can be conducted changing buffer sizes on the receiver side. The web portal was evaluated very positive. It was created to facilitate the 6NET trial, in order to start and stop video streams.

1.4.2 Trondheim Underground Radio (TUR) *(A)*

TUR provides MP3 streaming over HTTP via a web based interface. It was tested by 9 sites, with a total of 10 participants, using a variety of clients on a windows and unix. The test

consisted of the participants attempting to connect to the server over unicast IPv6 and receiving mp3 streams.

The trial was largely successful. Most sites has little or not problems. The required software for the trial was already installed on the majority of participating systems. There was one site that reported packet loss problems. A further trial is under consideration using multicast, however there is currently a dearth of suitable client applications for such as trial.

1.4.3 Surge Radio

The University of Southampton student radio station now offers IPv6 streaming of its content. Surge had a licence to stream content for IPv4, and the IPv6 tools were added, using shoutcast which supports IPv6.

The service is available on unicast IPv6 from http://surge.ecs.soton.ac.uk:8080. Multicast support will be added soon, since Southampton is connected to the M6NET (described above).

1.4.4 MPEG4IP *(C)*

The Mpeg4ip streaming system was deployed at SurfNet and TELIN for streaming of video over multicast and unicast IPv6.

A trial was performed with a total of 3 participants at SurfNET and TELIN, using both unicast and multicast. The system installed without problem at TELIN, though there were some problems at SurfNET. The multicast tests operated well provided an appropriate multicast group was utilised. The choice of group was limited to those groups that had a correctly configured Rendezvous Point. Some loss of RTP packets was observed but caused little perceptible loss in picture quality. It was also noted that some fragmentation of packets was occurring. There were two clients tested; a GUI based client and command line client. The GUI client incurred slightly worse stream latency.

1.4.5 DVTS *(C)*

The DVTS system provides for high speed (30Mb/s) video and audio delivery over unicast and multicast IPv6. The DVTS system requires the use of Firewire hardware in a machine which is connected to a Firewire capable camera or codec running a mutually compatible video encoding scheme (i.e. PAL or NTSC). Some testing of the DVTS system has been performed at three sites including SurfNET, UoS and UCL. Further testing of the system is planned, particularly over SSM multicast.

1.4.6 MCast6 *(A)*

The MCast6 application is shortly before public demonstration. In this moment the application contains its basic components, which are tested with the internal performance and streaming performance tests.

The MCast6 is composed of two main parts: client (player) and server. The client is responsible for receiving multimedia streams using unicast or multicast techniques. The server keeps the information about accessible multimedia resources and sends multimedia streams according to either administrator request or end-user request (on-demand transmission).

The following components are necessary to achieve the basic functionality:

- A&A component (authentication and authorization)

- Content component (access to multimedia resources which is now implemented using plain xml files; this is version for demo release of the MCast6 server; database implementation will be introduced)
- Gateway component (translation actions: unicast <-> multicast, multicast <-> multicast, unicast <-> unicast, ipv6 <-> ipv4)
- Order & Communication components (allow to deploy distributed architecture of the MCast6 server; it means that some parts of the server may be placed on different computers)
- Adapter component (interface for streaming servers; the MCast6 server may have control over streaming servers through specially adopted plugins)
- JMF-based internal streaming server (sending selected resources)
- Playlist components (allow arranging multimedia resources in groups for sending operations)

The MCast6 developer team is going to add other optional components into presented architecture, e.g. Icecast wrapper (control over Icecast streaming server), sessions' timetable (SAP/SDP or administrative input), and session capture component. The MCast6 application uses standard RTP/RTCP protocol for multimedia streaming (media supported formats: http://java.sun.com/products/java-media/jmf/2.1.1/formats.html) but own internal protocol was invented and implemented for control purposes (communication between distributed components or transmission requests from the client). The RTSP protocol for communication between the client and server will be introduced as soon as possible. The application is being developed in Java and transmission elements are based on Sun JMF (Java Media Framework) API. Linux has been selected for application tests but the performance will be verified also on Windows platform (with Java ver. 1.5 Beta1 supporting IPv6 on Windows XP and 2003 server).

1.5 Grid systems

Grid systems have emerged to share resources through the distributed networks. They use distributed, potentially remote, resources to optimise computation and storage resources.

IBM and UCL jointly co-chair the newly formed IPv6 working group [1] in the Global Grid Forum. CTI, IBM, Southampton, and UCL have all contributed to the creation of two working group drafts with the IPv6-WG.

1.5.1 Globus Toolkit 3 *(C)*

The Globus Toolkit, developed mainly in the Argonne National Laboratory (ANL), provides the libraries and services for and Grid computing. The current edition of Globus Toolkit – Version 3 (GT3) is based on the latest Grid standards – the Open Grid Services Architecture (OGSA) and integrates the Grid services with the Web services. The 6Net project is also aware of the plan to develop GT4 based on the new Web Services Resource Framework(WS-RF) standards [5]. The implications of these changes are still in the hands of the Globus development team and the GGF.

UCL investigated the IP-dependency through all GT3 components, protocols and relevants applications [2]. To find out exactly which lower-layer protocols and APIs are being used, two approaches are taken – firstly the ‘top down’ approach where we execute some upper layer applications. Secondly the ‘bottom up’ approach where we monitor all the data traffic between nodes and on the Loopback interface.

Based on the results of IP-dependency investigation, modifications have been made to Globus. The modified version have been tested on the UCL Globus testbed along with the relevant IPv6-enabled applications. UCL has successful demonstrated full IPv6 functionalities on GT3-alpha for GT3 core and GRAM [4]. UCL has also demonstrated GT 3.0 (both 3.0.1 and 3.0.2) core working with IPv6 with the minimum modification [4]. More components are involved in GT 3.0; some of them are still being porting or under investigation. Some of GT 3.0 components, such as the Globus Resource Allocation Manager (GRAM), have been identified including more IP-dependent coding. UCL is currently investigating to deploy GT 3.0 on Tomcat 5 and testing the IPv6 functionalities.

UCL are in contact with the Globus implement group in Argonne so that modifications of the IPv6 non-compatible code are available in the official Globus Toolkit releases.

More details can be found in the separate report: GT3 IPv6-enabled Testing and Porting Report [2] and How-to IPv6 in Globus Toolkit 3 [4].

1.5.2 Globus on Websphere

The work on integrating Websphere with Globus within an IPv6 environment is being carried out on two of the three IBM servers. *ServerWAS* has the Websphere Application Server (WAS) running on it with a copy of the Globus Toolkit v3.0.2. ServerWAS is then connected to *ProxyIPv6* via a local IPv6 only network. ProxyIPv6 acts as a gateway into this network and has the IBM Edge Server installed which acts as a proxy to the servers running on ServerWAS.

To deploy an application in WAS requires either a Web Application Archive (WAR) or an Enterprise Application Archive (EAR). Globus provides a function to create a WAR file, that should contain all the necessary files to run the Globus servlet, see section 3 [3]. The WAR file is used to create an EAR file using the Webpshere Application Assembly Tool, see section 4 [3]. The process of installing the EAR file is fairly straight forward, given the right configuration options. Some additional fine tuning to the configuration of both the WAS itself and the deployed Globus application was necessary to get Websphere and Globus working together correctly.

Enabling of IPv6 functionality within Globus was then accomplished using the modified JAR files, writen by UCL, and the modification of certain config files as documented by the Globus IPv6 Porting Guide, written by UCL, see [2]. The UCL version of axis.jar caused some errors within the Websphere environment, so a modified version was created by UoS, that only incorporated the additional IPv6 functionality, and nothing else.

The last stage of integrating Websphere with Globus involved configuring the IBM Edge Server on ProxyIPv6 to map requests to the WAS running on ServerWAS. The end result is a Websphere server, running Globus services on a local IPv6 network, that can be accessed via a browser from anywhere with connectivity to ProxyIPv6. However due to the current setup of the Websphere machines at UoS, any services that require IPv4 connectivity will not be fully functional, for example the sample Google service that requires access to www.google.com via IPv4. The Globus services can also be accessed locally via the Globus GUI. This application is able to connect to the registry services and create instances of other services, using literal IPv6 addressing without a problem. In much the same way, a web browser is able to access the Globus servlet and view a list of the running services and their description in WSDL.

The Grid Resource Allocation & Management (GRAM) functionality is not yet available via Websphere over either protocol, at least for version 3.0.2 of the Globus Toolkit. This is due to problems within the Globus code that UoS and Globus are working on to rectify. Testing is on going with GRAM and the individual Globus services to ensure that they are operating correctly in the IPv6-Websphere environment.

1.6 Application deployment planning

The remainder of the trials laid out in D5.5 will be completed and feedback provided on all tools, which will be used to assist the planning of the latter phase of the project.

In the latter phase of the project the number of applications under consideration will be significantly reduced so that small number of applications can be widely deployed across 6NET and utilise the various technologies from the other work packages, such security, mobility, QoS, SSM, and transition mechanisms. The focus will be on applications that make the best use of IPv6 over 6NET.

These focused demonstrators are being discussed and detailed in Q1 2004, at an Applications Workshop at UCL in February 2004 and the 6NET project meeting in March 2004.

A small number of scenarios will be defined based on the existing applications. These scenarios will be developed to exercise the 6NET services.

In the previous version of this document, a conferencing architecture was defined. This architecture lays the framework for generic conferencing and has been partially deployed across 6NET. A specialised deployment of the architecture is under consideration as a candidate final phase scenario.

2 6NET PoP and data centres deployment

The two activities in the Annex 1- “Description of Work” that relate to PoPs and data centres are Activity 5.3 and Activity 5.4. The border between these two Activities is now less obvious, since the IBM Edge Server is an integrated part of the IBM WebSphere suite in version 5 (at the start of the 6NET project, the Edge Server was a separate product). The deployment activities of A5.3 and A5.4 are therefore described per location instead of per activity since they are so closely related.

The deployment locations mentioned here differ in the software deployed, the number of servers used, and the network connectivity. All servers will use RedHat 7.3 Linux distribution. The deployment and management of additional features that may be needed, such as firewalling, will be the responsibility of the 6NET partner responsible for the management of the PoP. The number of servers installed will depend, amongst others, on the load placed on the servers by the service itself and the number of users for that service.

It should be noted that RedHat 7.3 is no longer officially supported by RedHat (the replacements are RedHat Enterprise and Fedora), but the systems in 6NET will continue to use RedHat 7.3 for the foreseeable future.

The following sections describe the different platforms, the hardware used, the software that is being installed and the status of the deployment. Of the software and services to be

deployed only a summary is given. The current status of the different applications can be found at the web page mentioned in chapter 1.

2.1 PoP and data centre locations

Five locations are currently identified (Figure 2-1):

- SURFnet/Telin (NL)
- IBM (FR)
- UCL (UK)
- UoS (UK)
- GRnet (GR)

The schedules and configurations of these locations are described in more detail in the following sections. For some locations, the deployment schedule depends upon the availability of an IPv6 enabled version of WebSphere; i.e. a WebSphere release packaged with J2EE version 1.4 instead of version 1.3 that is normally packaged with WebSphere v5. Version 1.4 of Java is needed since that is the first Java version with full IPv6 support.

Each WebSphere node is configured with the following standard software platform:

- Websphere Portal Server v4.1
- Websphere Application server v5.0 enterprise edition
- Websphere Studio Application Developer v5.0
- VNC server
- IBM HTTP Server v2.0 (IPv6) and v1.3 (IPv4)
- Linux Redhat 7.3
- Java 1.4

Figure 2-1: PoP and data centre deployment locations.

For most of these deployment sites, the initial target community is the 6NET participants themselves. The user community is gradually as experience is being gained experience with the software deployed on those PoPs.

Exceptions to this approach are the UoS and GRNet PoPs:

- The University of Southampton, Electronics and Computer Science department (ECS), is investigating the possibility of using a WebSphere portal to present their alumni services (http://www.zepler.org/). The alumni server currently hosts services for approximately 730 people, both students and staff, with a growth of about 200 persons per annum. An alternative is to use the system to host the student self-help web presence, currently offered through a Wiki system. It was hoped that such a trial could be enabled in 2003. Southampton is still hopeful to establish a demonstrator in 2004, using one of these approaches. The student system is more probable as it utilises real end users and does not require 6NET resources to be used for (non IPv6-specific) web engineering effort.

The GRNet PoP will be used to develop and host a portal for the student community of the National Technical University of Athens (NTUA).

2.2 Individual PoP and data center descriptions

2.2.1 SURFnet/Telin (Amsterdam, NL)

The hardware of this PoP was deployed at the premises of SARA Computing and Networking services of the National High Performance Computing Centre (http://www.sara.nl) during August 2003. This location was chosen since it is close to the SURFnet backbone and SURFnet already had a hosting agreement with SARA. The administration and maintenance of the software running at this PoP was the responsibility of TELIN.

Although the network connectivity was excellent it soon became apparent that for serious administration and maintenance activities easy physical access is a prerequisite. The distance between TELIN (Enschede) and SARA (Amsterdam) made easy physical access rather impractical. Therefore at the end of 2003 the decision was made to move the hardware to the premises of TELIN to ease administration.

By moving the hardware to TELIN quick physical access is made possible, thereby easing the administration task, while at the same time the network connectivity does not deteriorate appreciably, since TELIN has a dedicated 1Gb/s native IPv6 fibre link to the SURFnet backbone providing ample capacity.

2.2.1.1 Hardware

Three netFinity Servers (Netfinity – IBM xSeries 330 - Type K442XFR).

2.2.1.2 Network connectivity

The network connectivity changed since the hardware was moved to TELIN. TELIN has a native IPv6 1Gb/s fibre link to SURFnet. The IPv6 link is separate from the link used for (normal) IPv4 traffic allowing it to be used for all kinds of trials without interfering with normal traffic from Telin.

2.2.1.3 Operating System

RedHat Linux 7.x

2.2.1.4 Software

Deliverable D5.3 described the planned application to be deployed at this PoP to be an IPv6 application database/portal specific for the 6net project itself. At the start of 2003 the PoPs were not yet up and running, while there already was an immediate need for an application database for WP5 to store applications information and trial evaluations. As an intermediate solution a first version of the Applications database, using PHP and MySQL, was set up on a different site (http://6net.laares.info). A WebSphere specific (beta) version was developed after the PoPs were deployed. This version is undergoing tests at the moment and will co-exist for some time next to the original 6NET applications database to make sure it is ready for production use. Care will be taken to ensure a smooth transition to the new version. Hosting the new applications database at Telin also has the added bonus of IPv6 connectivity. The provider that hosts the original applications database does not provide IPv6 connectivity.

When the beta version has proven stable enough for production use, additional work can be done and extensions can be built to it.

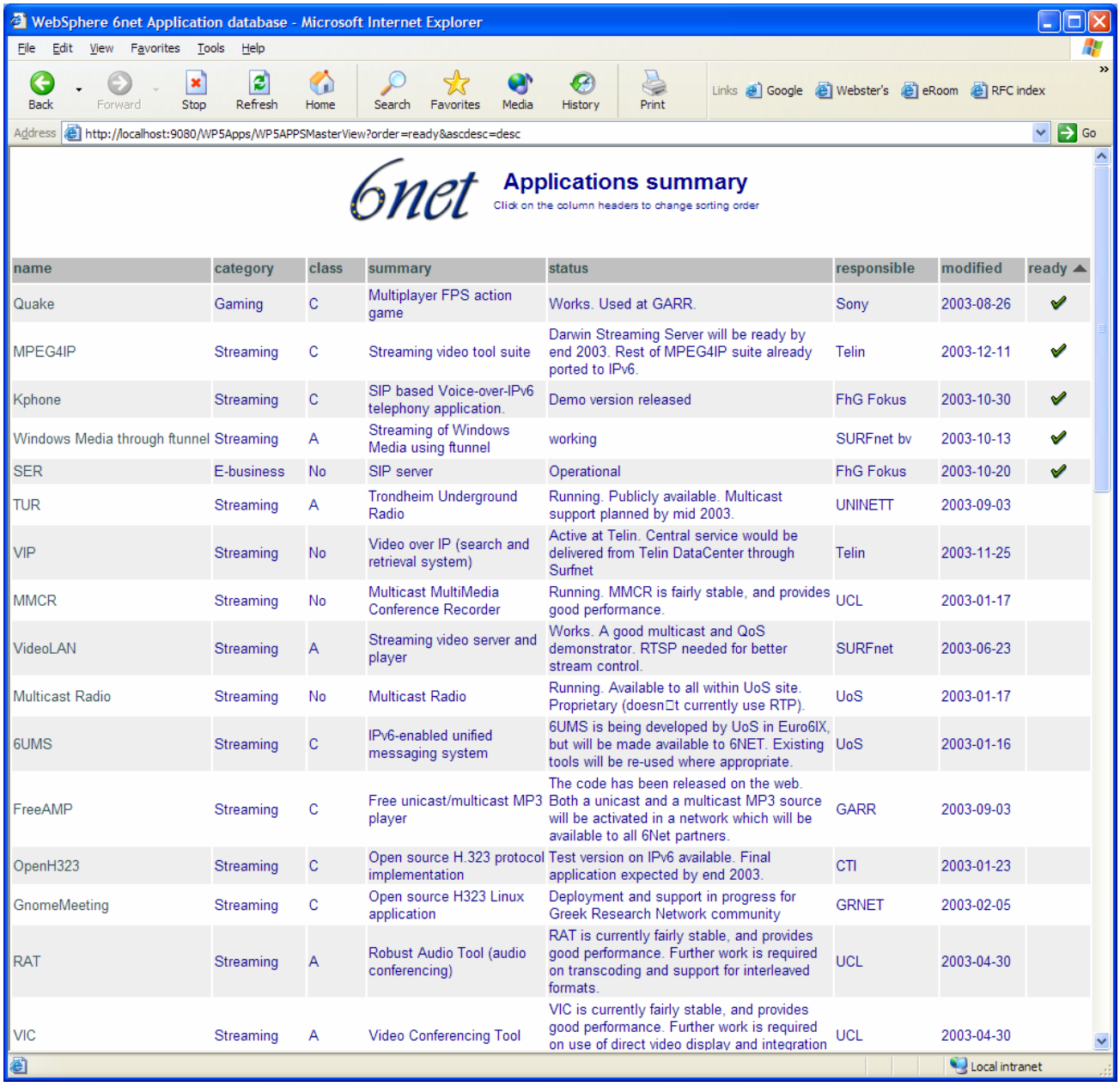


Figure 2.2: The beta version of the WebSphere 6NET application database.

In collaboration with UvA/SNB (University of Amsterdam, Dutch Masters education in System and Network Engineering, see http://www.os3.nl), a number of students will do an 'Analytical Server Project', which is part of their education. This project is a four week full-time assignment planned for January 2004. The content of this assignment will focus on (the analysis of) a specific web service.

If the load and configuration of the PoP allows for it, part of the hardware will additionally be used to perform testing on a ported, IPv6 capable, version of the Darwin Streaming Server.

2.2.2 IBM (La Gaude, FR)

2.2.2.1 Hardware

A number of Netfinity Servers (8664-81Y Xseries 240 server with 1GHz Processor, 2GB RAM and a 36.4GB HDD).

2.2.2.2 Network connectivity

This location has a tunnelled connection over the IBM backbone to the "SWITCH" backbone (the Swiss educational and research network) and is implementing a direct IPv6 connectivity to the "RENATER" backbone (the French educational network) through the RENATER PoP at the INRIA, in Sophia Antipolis (near Nice, France).

2.2.2.3 Operating System

Linux Red Hat 7.3 (migration to Enterprise Edition in process).

2.2.2.4 Software

The three servers have the following software installed:

- ServerWAS: WAS v5.0, IBMHTTP v2.0
- ServerWPS: WAS v4.2, WPS v4.2, IBMHTTP v1.3
- ProxyIPv6: WSAD v5.0, Edge Components

These products have been chosen because they will be the first IPv6 enabled IBM product.

These systems are used for grid deployment and testing.

2.2.2.4.1 WebSphere (WAS) and WebSphere Portal (WPS)

How can companies plan for Web services? The best way to build these systems is to use a component-based architecture, such as WebSphere/WebSphere Portal and EJB, because it maps immediately to this business need. If you have a system that is procedural, or in some other way not component-based, it will be difficult to open it in a Web services way, although not impossible.

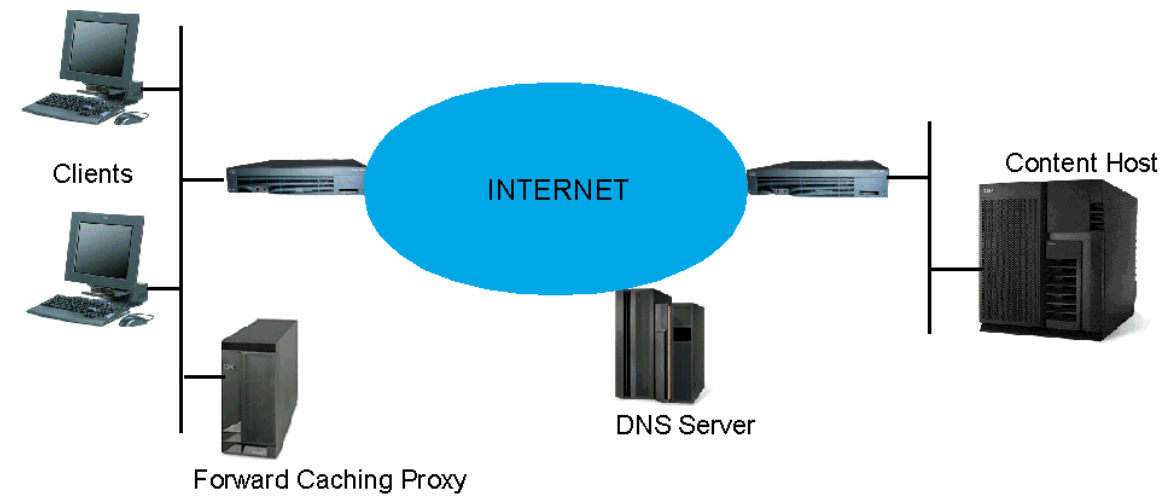
Because the components talk to each other in a standard way, you can give them an XML interface that maps to the service: Web services gives to the end client what component-based development gives to the developer.

2.2.2.4.2 Edge Components

IBM Edge Server is a powerful tool providing a better service both to users who access information on the enterprise server and to internal users accessing to the Internet. Four systems are included in IBM Edge Server: Network Dispatcher, Application Service at the Edge, Content Distribution and Caching Proxy.

The Caching Proxy intercepts a request from a client, retrieves the data from content host and sends it back to the client. Although HTTP(S) requests are often done, it can also deal with FTP and Gopher traffic. The Caching is done by storing cacheable content before sending it to the client, so next requests to the same content can be delivered more quickly and with saving network bandwidth.

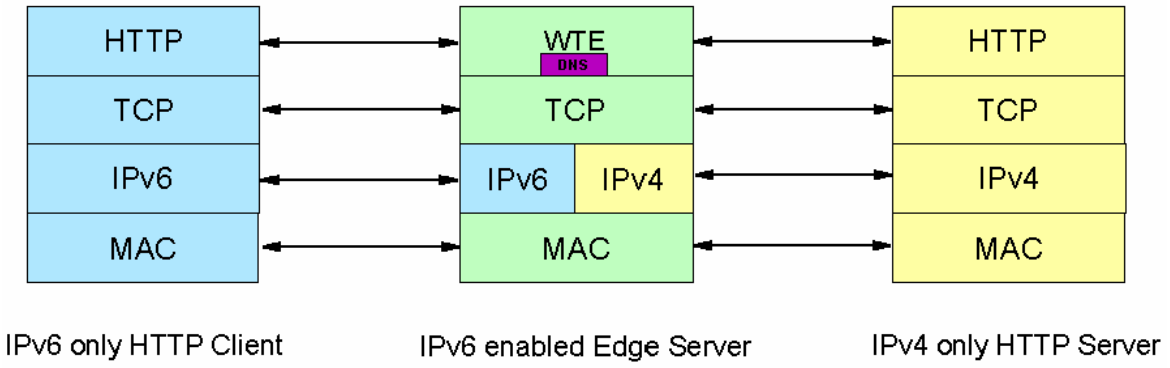
Proxys can be used in two different ways: “Forward Proxy” when located on the client’s network, and “Reverse Proxy” when located on the server’s network.



IPv6-enabled version

The current IPv6-enable prototype is based on Edge Server Proxy v1.1 but will be shortly upgraded to version 5.0.

- Web Traffic Express (Proxy's name within the Websphere suite) works upon a dual stack for processing both IPv4 and IPv6 requests. The following picture shows protocol stack used in the case where an IPv6 only client asks for data on an IPv4 only server.

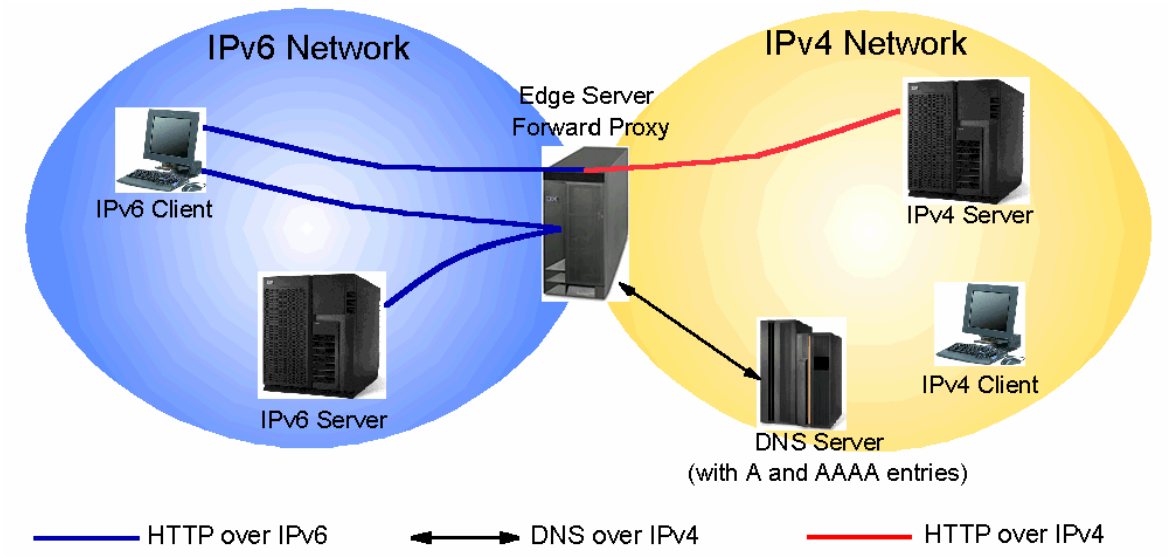


The scheme is quite the same with IPv4 client and IPv6 server. With two same IP version hosts, flows are common.

- The Edge Server Proxy can be listening, for example on usual TCP port 8080 for requests from IPv4 clients and on port 8090 for IPv6 ones. Obviously, that implies clients's browsers have to be set to the right port too, depending on their IP version.

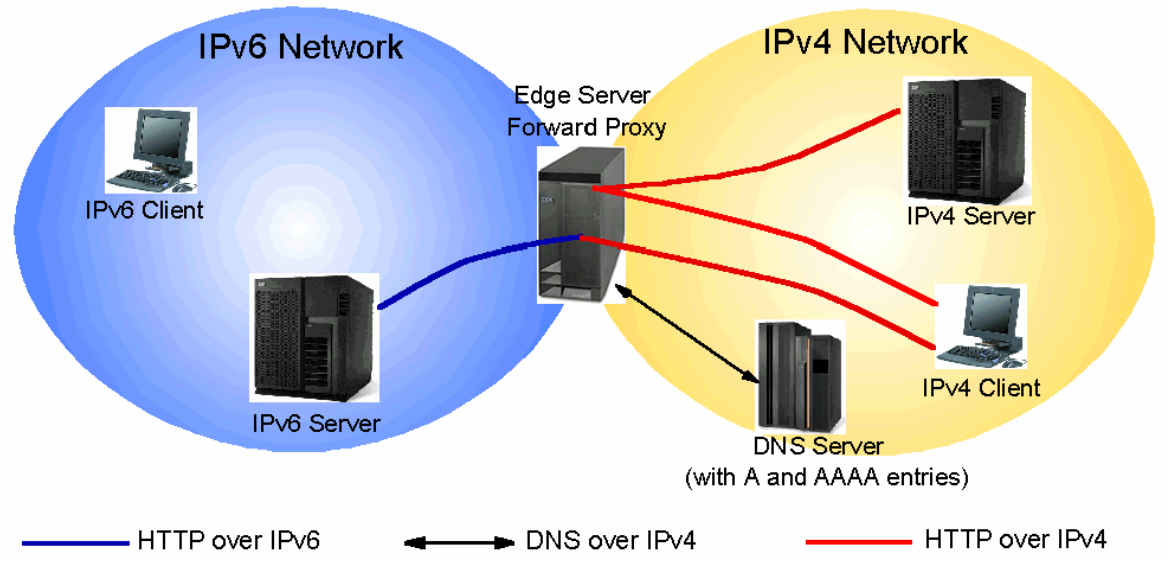
- Until today, IPv6-v4 Edge Server Proxy has been only tested as a forward proxy. Here are two schemes describing what has been done:

IPv6-only client accessing IPv4 and IPv6 servers transparently:



The DNS server is IPv4-only but allows IPv6 address entries (AAAA type). So, when The Proxy receives a request from the client it asks the DNS server to send IP address fitting the requested URL, either IPv4 or IPv6 address, then it performs its own request, and so on. From the client, the IP version of the servers is transparent while it asks the proxy to perform the request from the server's URL.

IPv4-only client accessing IPv4 and IPv6 servers transparently:



2.2.2.5 Deployment schedule

The deployment depends upon the availability of a WebSphere version with IPv6 support.

The platform is composed by three servers: the edge server, the Websphere Application Server (WAS) and the Websphere Portal Server (WPS).

The applications that are compatible with IPv6 are: Websphere Application Server, IBM http and Websphere Studio Application Developer. For this platform, DB2 is installed in the same server than WAS and WPS but if you need DB2 on remote server, you have to use IPv4 connectivity. The Websphere Portal Server is not compatible with IPv6 because it is based on the old Websphere application server (version 4).

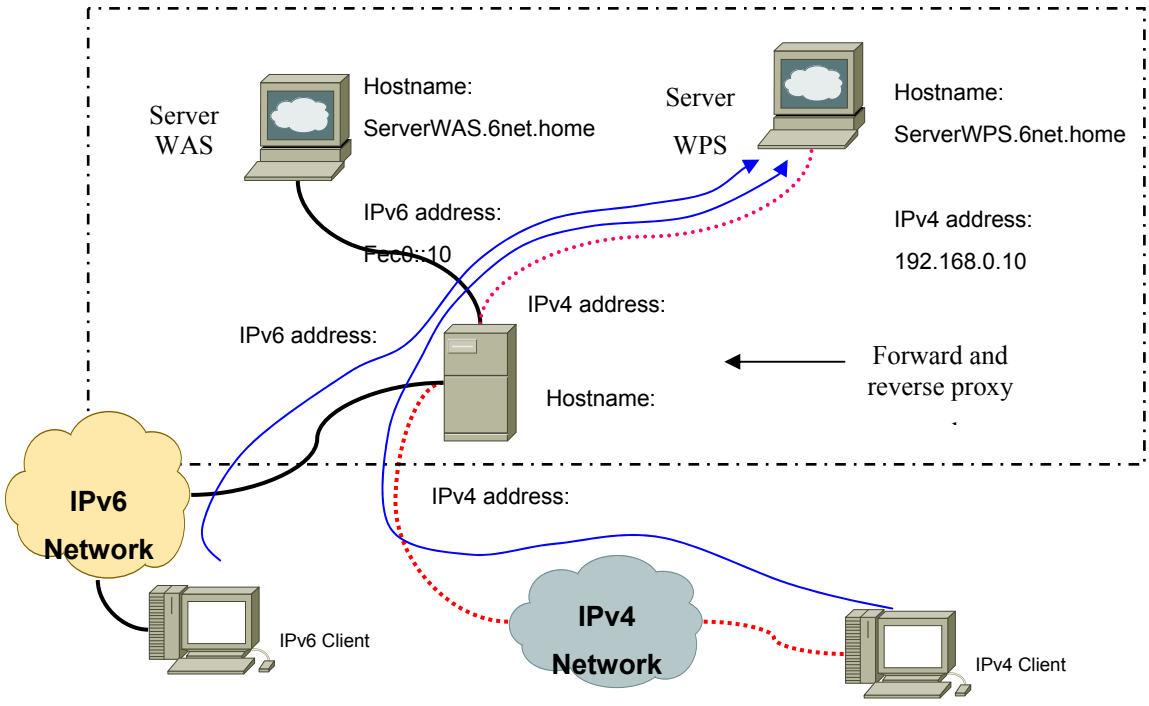


Figure 2.3: Dual Mode Use

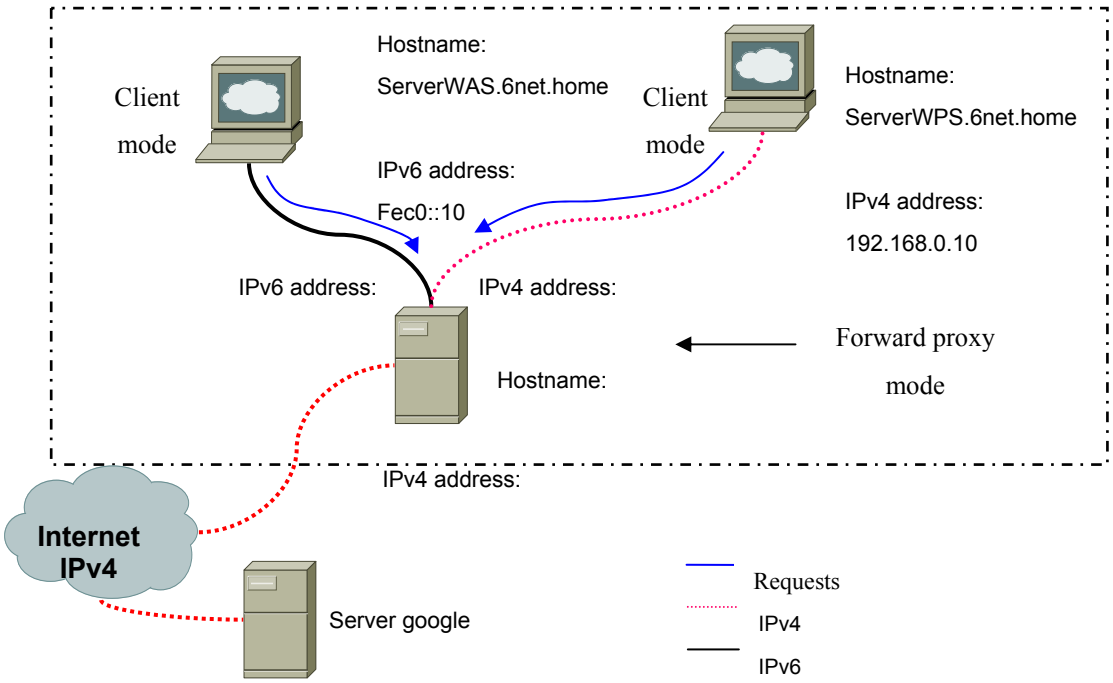


Figure 2.4: Outgoing to Internet

2.2.3 UCL (London, UK)

The Department of Computer Science at University College London has deployed a number of servers for use within the 6NET project.

The machines provided by IBM are running Websphere systems and are being used for Globus deployment with assistance from UoS. A six machine test-bed has been set up for deployment and testing of various VPN technologies, including XBone, DVC and others. An eight machine test-bed has been set up for deployment, testing and development of Globus on IPv6. As a Euro6IX collaboration activity UCL has run the University of Murcia's ipv6 enabled PKI. A number of machines have been set up for testing of VoIP systems on IPv6.

2.2.3.1 Hardware

There are three IBM Netfinity Servers (8664-81Y Xseries 240 server with 1GHz Processor, 2GB RAM and a 36.4GB HDD).

The test-bed machines are i586 based rack mounted systems accessed via 100Mb/s Ethernet switch and chained console switch for administrative access.

2.2.3.2 Network connectivity

UCL has a native IPv6 connection to 6NET, via the University of London Computing Centre, which also provides native unicast and multicast connectivity to M6NET. UCL also has tunnelled connections for connection to M6Bone and certain other sites.

UCL now has a full IPv6 prefix assignment from the UK Education and Research Networking Association (UKERNA).

2.2.3.3 Operating System(s)

UCL runs (IPv6 capable) systems on Solaris, Linux, FreeBSD, and Windows based machines.

2.2.3.4 Software

IBM Websphere servers

The three servers have the following software installed:
- ServerWAS: WAS v5.0, IBMHTTP v2.0
- ServerWPS: WAS v4.2, WPS v4.2, IBMHTTP v1.3
- ProxyIPv6: WSAD v5.0, Edge Components

These systems are used for grid deployment and testing.

Globus testbed

UCL has set up a IPv6 Grid testbed with around 10 nodes, running a mixture of IPv4 only, IPv6 only and dual stack. This provides for all the necessary combinations of inter-working between Globus implementations with different network support. The testbed is available to any group concerned with the porting activity.

UCL Multimedia tools

UCL has developed and maintained the multimedia conferencing tools, which include the Videoconference tool (VIC), the robust audio tool (RAT), the Network Text Editor (NTE), and the Secure Conference Store. Local trial feedback forms were created for individual feedback on each

Public Key Infrastructure (PKI)

The purpose of a Public Key Infrastructure (PKI) is to provide the mechanisms and elements needed to manage and enable the effective use of public key encryption technology on a medium or large scale.

The PKIv6 deployment at UCL is done in collaboration with the Euro6IX project (the University of Murcia) (http://www.euro6ix.org, https://pki.dif.um.es/)

TZI Gateway

The TZI Gateway provides call signalling and media transcoding gateway functionality for connectivity between different kinds of endpoints interconnected through different types of networks. The TZI Gateway provides IPv4/IPv6 interworking. It consists of 3 parts: An IPv4/6 H.323 gatekeeper, a Media stream processor and an IPv4/6 SIP back-to-back user agent.

VoIP systems

A number of systems have been set up for testing of SIP based VoIP systems including VOCAL, and kphone. UCL has also deployed a number of IPv4 Cisco 7960 hardware SIP IPv4 phones that are may be connected into IPv6 systems through an

IPv4 and IPv6 SIP gateway. In addition UCL has deployed Polycom H323 IPv4 conferencing system which may also be connected into IPv6 systems through an IPv4 and IPv6 H323 gateway.

2.2.3.5 Deployment schedule

IPv6 capability is now present is most deployed systems for 6NET. PKIv6 and Globus are operational over IPv6. The deployment of VPNs is covered in WP4. Two of the Websphere machines support IPv6 and UoS is currently investigating the deployment of IPv6 Globus on them. Although applications provide basic IPv6 functionality, work is on going in extending access to full IPv6 operation across all systems.

2.2.4 UoS (Southampton, UK)

The Electronics and Computer Science (ECS) School of the University of Southampton (UoS) is investigating the possibility of using WebSphere to present their alumni services (an improved version of what is currently available at http://www.zepler.org/). The alumni server currently hosts services for approximately 730 people, both students and staff, with an annual growth of about 200 (all new students now get Alumni service access on arrival). While this deployment would not see the Schools' information services using WebSphere, interfacing to the School's information sources (e.g. SQL databases) through WebSphere, with IPv4 and IPv6 access, would be an interesting test-bed environment.

An alternative test is to use Websphere systems to provide the student self-help system, currently facilitated in IPv4 on the School's web servers via a Wiki engine. This has the advantage of utilising student effort, and engaging real end-users, leaving 6NET manpower to be focused on engineering IPv6-enabled tools and systems (towards focused demonstrators for the project).

A decision will be taken during the February 2004 Applications Workshop on which path to take for the Websphere content.

UoS has also worked on three sets of porting activities during 2002 and 2003 related to 6NET:

- IPv6-enabling the VOCAL SIP-based VoIP package
- IPv6-enabling the GLOBUS Toolkit (activity led by UCL)
- Integrating Websphere with Globus in an IPv6 environment

These two porting activities are being done in conjunction with Euro6IX, with the view to promote joint use in both projects (e.g. VoIP calls between project members in 6NET and Euro6IX). UoS has also used the TZI SIP gateway in the 6WINIT project, and plans to support such a gateway for the 6NET project users (subject to TZI approval).

UoS is making audio and video streaming servers available, via unicast and multicast IPv6; this includes the local Surge university student radio station (described above), plus the availability of *icecast* and *VideoLAN*. UoS has a video archive of ECS seminars that could be broadcast, as could live seminars. Such activity is planned in 2004.

UoS has an ISABEL node running, which can be used for collaborative conferencing with other 6NET and Euro6IX partners. Currently vic, rat and nte are being used for conferencing in M6Bone and M6NET tests.

Other applications and services are being added as the project progresses. Supporting IPv6 transition, UoS runs services including a tunnel broker (which uses IPv6 OpenLDAP), and a

6to4 router and relay. UoS is able to support gaming services, including MUD server(s), if required.

Messaging applications being developed in Euro6IX will be released to 6NET as and when they become available, and can be supported from the UoS PoP.

2.2.4.1 Hardware

A number of Netfinity Servers (8664-81Y Xseries 240 server with 1GHz Processor, 2GB RAM and a 36.4GB HDD).

The number of servers installed here depends upon the size and impact of the user community on server performance. Since the whole alumni services for the ECS department will be redesigned to run on IBM WebSphere and IPv6; it is unclear at the time of writing of this document how many servers will be needed. The specification will be refined when the IPv6-enabled Websphere product nears completion.

UoS has three GLOBUS IPv6 test-bed nodes on site (currently Linux, but other operating systems are possible), and is using Linux laptops for VOCAL. Linux is used for UoS applications unless otherwise stated.

The ISABEL node runs SuSE Linux 8.1.

UoS' test-bed includes a number of rack-mount 1U-format servers, mainly running Linux. These also run local infrastructure services including IPv6 DNS. They also offer remote (ssh) login services.

2.2.4.2 Network connectivity

The School connects to the UK JANET network via its campus network and its regional MAN (called LeNSE). UKERNA has implemented a native (dual-stack) JANET IPv6 service on its core during 2003, which UoS plans to connect to natively as soon as LeNSE offers the service – this is expect in Q1 2004 (the current service is tunnelled to the JANET IPv6 Pilot router). A native (dual-stack) service will also be required on the main university campus, which will be deployed when LeNSE delivers its IPv6 service.

UoS also had tunnelled connectivity to the M6Bone for multicast experiments; it now uses the 6NET core network for IPv6 PIM-SM natively (the "M6NET"). For a while, UoS acted as a bridge between the m6bone and m6net.

2.2.4.3 Operating System

The WebSphere platform is Linux.

Most applications are aimed at Linux, but we also run Solaris, Tru64, BSD and Windows platforms for application testing, with HP/UX and Irix having been tested briefly and possibly being made more generally available in our test-bed.

2.2.4.4 Software

The WebSphere configuration as described in section 2.1.

VOCAL is available now, as is the TZI SIP gateway.

GLOBUS porting continues.

Various media streaming servers are available now.

ISABEL is available now.

The tunnel broker is available now.

2.2.4.5 Deployment schedule

Many services are already available. The 6NET Applications web site records the live status of the deployment, and future plans.

2.2.5 GRnet (Athens, GR)

The PoP in Athens will be used as a portal for network managers to gain access to measurements and data collected from a set of Network Management Agents. These Agents will be deployed in various locations and will have a Web Services Interface for the communication with the Portal Server. The services that these agents offer will be:

- Network Discovery
- SNMP Proxy and Monitoring
- SNMP Traps

Through the portal a user will be able to start new services on the agents, collect their results and later remove them. This will be done in a personalized manner since each user can select which portlets (and thus functionality) he wishes to deploy on the portal.

2.2.5.1 Hardware

Three "XSeries 330" IBM Servers.

2.2.5.2 Network connectivity

Native Gigabit Ethernet IPv6 connectivity.

2.2.5.3 Operating System

Redhat Linux 7.3

2.2.5.4 Software

The three servers have the following software installed:

- ServerWAS: WAS v5.0, IBMHTTP v2.0
- ServerWPS: WAS v4.2, WPS v4.2, IBMHTTP v1.3
- ProxyIPv6: WSAD v5.0, Edge Components

The WebSphere Portal Server will be used to develop a set of portlets that communicate through Web Services (SOAP/WSDL) with a set of Agents. These agents will be based on a JMX architecture and have MBeans that perform the measurements. The portlets will act as an interface to these MBeans giving the user functionality to add/remove MBeans, collect results e.t.c. There will be two classes of users, the administrator that will be able to manage the MBeans and the simple user that will only be able to view the results.

2.2.5.5 Deployment schedule

The three IBM Servers are deployed and running. They can be accessed in the IPv4 address "147.102.13.56" or the IPv6 address "2001:648:2:13:209:6bff:fe58:66c9".

In addition the JMX Agents are developed with their services being under testing. Currently the services are functionable only over IPv4, whereas the SOAP communication between the Portal Server and the Agents can be over IPv6.

The remaining thing is to develop the portlets that will be part of the Portal Server. A few test portlets are deployed but they cannot be assumed as part of a prototype yet.

3 References

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