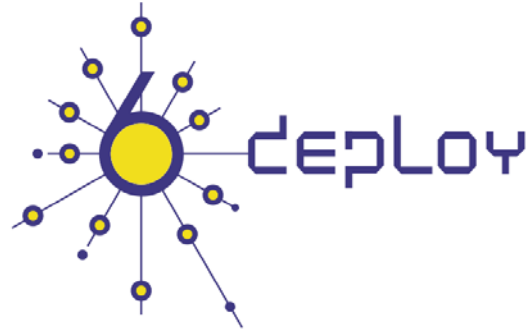




e-infrastructure



Title: Deliverable D1.1 IPv6 training material and related usage procedures	Document Version: 1.0
--	-------------------------------------

Project Number: 223794	Project Acronym: 6DEPLOY	Project Title: IPv6 Deployment Support
----------------------------------	------------------------------------	--

Contractual Delivery Date: 30/04/2008	Actual Delivery Date: 15/05/2008	Deliverable Type* - Security**: R – PU
---	--	--

* Type: P – Prototype, R – Report, D – Demonstrator, O – Other
** Security Class: PU- Public, PP – Restricted to other programme participants (including the Commission Services), RE – Restricted to a group defined by the consortium (including the Commission Services), CO – Confidential, only for members of the consortium (including the Commission Services)

Responsible and Editor/Author: Bernard Tuy	Organization: RENATER	Contributing WP: WP1
--	---------------------------------	--------------------------------

Authors (organisations):

Simon Muyal (RENATER), Martin Potts (Martel), Alvaro Vives (Consulintel), Jordi Palet (Consulintel), Tim Chown (University of Southampton), Spass Kostov (BREN)

Abstract:

This document lists all the training material available to organise IPv6 training sessions and the way to use it. Procedures for booking and using - safely – the testbed labs are explained too. Finally, additional useful information relevant to IPv6 workshops organisation is mentioned.

Keywords:

IPv6, Support, Training, Testbeds, Modules, 6DISS, 6DEPLOY, Hands-on exercises

The 6DEPLOY project nr. 223794 is co-funded by the European Commission under Framework Programme 7. This document contains material, which is the copyright of certain 6DEPLOY beneficiaries and the EC, and may not be reproduced or copied without permission. The information herein does not necessarily express the opinion of the EC. The EC is not responsible for any use that might be made of data appearing herein. The 6DEPLOY beneficiaries do not warrant that the information contained herein is capable of use, or that use of the information is free from risk, and accept no liability for loss or damage suffered by any person using this information.

Revision History

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

Revision	Date	Description	Author (Organization)
v0.1	10/04/2008	Document creation	Bernard Tuy (RENATER)
v0.1	11/04/2008	Review of Deliverable	Martin Potts (Martel)
v0.2	13/04/2008	Review of Deliverable. Added Paris testbed section	Simon Muyal (RENATER)
v0.3	15/04/2008	Integrated contributions.	Bernard Tuy (RENATER)
v0.3	16/04/2008	Contribution: testbed access, inband/terminal server	Simon Muyal (RENATER)
v0.4	17/04/2008	Integrated comments and contributions. Added conclusions and references sections.	Bernard Tuy (RENATER)
v0.5	22/04/2008	Reviewed Deliverable. Moved the content to actual template.	Alvaro Vives (Consulintel)
v0.6	28/04/2008	Integration of FCCN and Consulintel comments. Short description of each module	Simon Muyal (RENATER)
v0.7	29/04/2008	Revision and validation	Bernard Tuy (RENATER)
v0.8	29/04/2008	Integration of Consulintel contributions (slideset description, overall review, template)	Simon Muyal (RENATER)
v0.9	08/05/2008	Revision of styles to follow proposed template	Alvaro Vives (Consulintel)
v0.10	08/05/2008	Added text and pictures in the Sofia testbed section (chapter 3.2.2)	Spass Kostov (BREN)
v0.11	09/05/2008	General document review, checking also some references to former 6DISS material that is being carried forward to 6DEPLOY.	Tim Chown (Soton-ECS)
v0.12	14/05/2008	Final review	Bernard Tuy and Simon Muyal (RENATER)
v0.13	14/5/2008	Style review to meet proposed template	Alvaro Vives (Consulintel)
v1.0	15/5/2008	New EC logos inserted, final review	Martin Potts (Martel)

Executive Summary

This document gathers all the available training material that has been produced by the 6DEPLOY project at the date of publication, inherited from previous project activities (namely 6DISS) or that has been drawn from a partner's commercial learning material. It will be updated as any significant changes occur during the 6DEPLOY project lifetime.

The goal of this document is to explain how the training material is organised and how the material should be used both by the 6DEPLOY project partners and by other parties. A short explanation of every module's content is provided and a list of responsible partners for every part of the training material is mentioned. These are the contacts to be used in case of any modification or in case any feedback needs to be taken into account.

Table of Contents

- 1. Introduction..... 7**
- 2. Training material..... 8**
 - 2.1 Training Material related to IPv6 workshops..... 8**
 - 2.1.1 IPv6 Modules 8
 - 2.1.2 IPv6 Testbeds 11
 - 2.1.2.1 Paris Lab..... 11
 - 2.1.2.2 Sofia Lab..... 11
 - 2.1.3 Hands-on modules 11
 - 2.1.3.1 Consulintel Hands-on exercises 12
 - 2.1.3.2 6DISS Hands-on exercises 12
 - 2.1.4 Workshops repository 13
 - 2.2 Other available training material 13**
 - 2.2.1 E-learning course 13
 - 2.2.2 Training the trainers 13
 - 2.2.3 Miscellaneous..... 14
- 3. Using the 6DEPLOY IPv6 training material 15**
 - 3.1 Using the IPv6 Training Modules 15**
 - 3.2 Booking & using the testbeds 16**
 - 3.2.1 Paris testbed..... 16
 - 3.2.1.1 Equipment availability 16
 - 3.2.1.2 Testbed Topology 17
 - 3.2.1.3 Booking procedures 17
 - 3.2.1.4 How to access the lab 18
 - 3.2.1.4.1 Inband connection 18
 - 3.2.1.4.2 Connection on console port via terminal server 19
 - 3.2.1.5 Usage and rules..... 21
 - 3.2.2 Sofia testbed..... 21
 - 3.2.2.1 Equipment availability 22
 - 3.2.2.2 Testbed topology 23
 - 3.2.2.3 Booking procedures 23
 - 3.2.2.4 How to access the lab 24
 - 3.2.2.4.1 Inband connection 24
- 4. Conclusions 25**
- 5. References 26**

Figure Index

Figure 3-1: Paris Testbed schema 17

Figure 3-2: Out-of-band architecture20

Figure 3-3: Sofia testbed equipment22

Figure 3-4: Sofia Testbed topology23

Figure 3-5: Sofia Testbed details24

Table Index

Table 2-1: List of available IPv6 training modules.....9

Table 3-1: Available Chassis on Paris testbed 16

Table 3-2: Available Chassis on Paris testbed 16

Table 3-3: Paris testbed addressing plan..... 19

Table 3-4: IPv4 Addresses and ports for out-band access20

Table 3-5: Available Chassis on Sofia testbed.....23

1. INTRODUCTION

One of the main activities in the 6DEPLOY project is to organise workshops to train the different Internet communities in the subjects of IPv6 installation, configuration and usage. This activity is a follow up of previous project activities within and outside the Framework Programmes of the European Commission.

To be able to organise these IPv6 workshops, the training material from previous projects like 6DISS and 6NET, and from commercial courses provided by project partners, such as Consulintel, are being reused, updated and adapted to the trainers' needs. This work is split over all the 6DEPLOY stakeholders.

In the first part of this document, a list of all the material available at the beginning of the project is provided. In the following parts, details on responsibility, procedures to book the testbeds and how to use them are explained.

2. TRAINING MATERIAL

At the beginning of the 6DEPLOY project training material has been gathered from existing material of the partners (mainly 6DISS and projects Consulintel was stakeholder of). IPv6 training material can be divided into a set of categories, as listed below. These categories can be grouped into 2 main ones:

- Material related to IPv6 workshops activities.
- Other material.

2.1 Training Material related to IPv6 workshops

2.1.1 IPv6 Modules

All the material available from the previous projects and commercial courses provided by the 6DEPLOY project partners is being merged and updated.

To help the trainers and workshops organisers, the IPv6 theoretical knowledge has been split into 19 modules. Each module focuses on a single topic to ease understanding and update management.

The module list is shown in the Table 2-1 below with the 6DEPLOY partner organisation responsible for its updating.

Module Topic	Module Responsible	Module Topic	Module Responsible
IPv6 Introduction	RIPE-NCC	RPSLNg	FCCN
IPv6 Protocol	RENATER	IPv6 Security	UCL
IPv6 Addressing	Consulintel	IPv6 Mobility	Cisco
Addressing Case Studies	HUNGARNET	IPv6 Coexistence With IPv4	Soton-ECS
IPv6 Associated Protocols	GRNET	IPv6 Deployment Scenarios	HUNGARNET
IPv6 Network Management	RENATER	Equipment Configurations	Consulintel
IPv6 Multicast	UNINETT	Guide for Services & Applications	AfriNIC
IPv6 DNS	LACNIC	How-to Guide for Developers	UNINETT
IPv6 Autoconfiguration	UCL	IPv6 QoS	GRNET
IPv6 Routing	FCCN		

Table 2-1: List of available IPv6 training modules

Below is a brief description of each module's content:

- **IPv6 introduction:** This module explains why a new version for IP, IPv6, has been developed. A brief history of IPv6, its motivation and benefits are given.
- **IPv6 protocol:** This module describes the IPv6 protocol: IPv6 packet header, extensions headers and differences from IPv4 headers. Packet size issues and upper layer considerations are also treated.
- **IPv6 addressing:** This module explains the IPv6 addressing architecture, the different types of addresses (unique local IPv6 addresses, interface IDs, multicast addresses), their textual representation, how these are built and related to a layer 2 address.
- **Addressing case studies:** This module describes 2 addressing case studies:
 - RENATER backbone addressing plan, and
 - HUNGARNET backbone and site addressing plans.

- **IPv6 associated protocols:** This module describes new protocols associated to IPv6: e.g. Neighbour Discovery Protocol, SEND, ICMPv6, MLD, etc.
- **IPv6 network management:** This module explains how to manage an IPv6 network. The different ways to retrieve management information are described (MIBs, IPv6 flows) and IPv6 management tools and platforms are presented.
- **IPv6 multicast:** After giving some multicast concepts the following topics are covered: multicast addresses, Multicast Listener Discovery (MLD) protocol, multicast routing, PIM-ASM and PIM-SSM. Some practical issues are included.
- **IPv6 DNS:** This module describes new Resource Records for IPv6 DNS, the availability of IPv6 in the root servers zone and CC-TLDs, etc.
- **IPv6 autoconfiguration:** This module describes stateful (DHCPv6) and stateless (Router Solicitation/Router Advertisement) autoconfiguration mechanisms.
- **IPv6 routing:** This module mainly describes the differences between IPv4 and IPv6 routing protocols for OSPFv3, EIGRP, RIPng, BGP4+, ISIS and MPLS.
- **RPSLng:** This module describes the Routing Policy Specification Language for IPv6. Some examples are provided for a better understanding.
- **IPv6 security:** Several issues are covered like the IPsec model, privacy extensions, ND threats, IPv4 vs. IPv6 threat analysis, IPv6 security issues, practical IPv6 security issues and firewalling IPv6. The distributed security model is introduced. Security issues from the point of view of transition and coexistence are also provided.
- **IPv6 mobility:** This module describes IPv6 mobility and the new features compared to IPv4 mobility.
- **IPv6 coexistence with IPv4:** This module explains different approaches to deploy IPv6 in an IPv4 environment. Transition concepts are introduced and several transition mechanisms are covered: Dual Stack, tunnels, tunnel broker, 6to4, Teredo, Softwires and translation (at various layers).
- **IPv6 deployment scenarios:** This module details different scenarios to deploy IPv6 in a campus network (case studies).
- **Equipment configuration:** This module lists some examples of IPv6 configurations for operating systems (Windows, Linux, etc.) and routers (Cisco, Juniper).
- **IPv6 QoS:** This module describes how to implement IPv6 QoS with Classes of Services (configuration examples, performance tests) and discusses the usage of the IPv6 Flow Label.

- **Guide for services and applications:** This module is under construction and will describe the services and applications that are available for IPv6.
- **How-to guide for developers:** This module is under construction and will explain how to migrate an IPv4 application to IPv6 (porting issues, etc.)

2.1.2 IPv6 Testbeds

To help ensure the workshop attendees will be able to install IPv6 in their own environment after the course is over, a set of practical exercises has been designed, known as 'hands-on modules'. To avoid the burden of carrying network equipment or asking the workshop organisation's local staff to provide it, the project has access to two testbed labs, which were originally established in the 6DISS project, thanks to a Cisco donation. In the first instance these two labs were installed in Paris (RENATER premises) and Brussels (CISCO TAC premises). Recently with the help of GRNET it has been decided to move the Brussels lab to Sofia (BREN premises).

2.1.2.1 Paris Lab

At the start of the 6DEPLOY project, only the Paris lab is operational and used on a regular basis as shown through the following link:

<http://www.renater.fr/spip.php?article439&lang=en>

Every partner is allowed to use the test lab, and advised to book it upon availability to check how it works before any IPv6 training has been planned and, at the latest, a couple of weeks before the first training they will give.

2.1.2.2 Sofia Lab

The need for a second lab was already experienced during the 6DISS project lifetime. It allows the trainers to welcome more attendees in a single workshop session since it is advisable to have no more than 2 trainees working on a single router. At this stage the second lab is installed at BREN in Sofia (Bulgaria). Further work has to be performed in collaboration with RENATER before it is fully operational. The two testbeds in Paris and Sofia will then be interconnected using a multi-hop IPv6 BGP peering over GÉANT-2.

2.1.3 Hands-on modules

In addition to providing workshop participants with a theoretical basis of the IPv6 protocol, we also have ready-to-use hands-on exercises. These can be used by the trainers for a specific session and targeted community as a basis for their exercises, thereby avoiding the necessity for them to reinvent everything from scratch.

2.1.3.1 Consulintel Hands-on exercises

These hands-on exercises will also be available on 6DEPLOY website. The practical material covers the following topics:

- IPv6 setup in several platforms (Windows 2K/XP/2003/Vista, Linux, BSD)
- Basic Configuration, Stateless/Stateful Autoconfiguration, Privacy, Static Routes
- Transition Mechanisms Configuration¹
- Examples of Applications
- IPv6 DNS
- IPv6 and PPP
- Firewall IPv6
- Enable IPv6 on Cisco Routers and IPv6 ACLs
- SNMP over IPv6

2.1.3.2 6DISS Hands-on exercises

The hands-on exercise material from 6DISS is available from

<http://www.6diss.org/publications/deliverables/hands-on.pdf>

and will be updated on the 6DEPLOY web site as soon as new versions are ready.

The list of available hands-on modules is described below:

- **Host configuration:** Two hands-on exercises illustrate how IPv6 works on Linux and Windows XP operating systems. IPv6 protocol is analysed in depth: Neighbour Discovery, Autoconfiguration, etc.
- **Stateful autoconfiguration:** In this hands-on exercise, the trainees are requested to install a DHCPv6 client (Dibbler) and make a basic configuration.
- **Routing:** In this exercise, IPv6 routing protocols are configured by the trainees on the testbed routers. Internal Gateway Protocols (RIPng, OSPF or ISIS) and External Gateway Protocol (BGP) are tested.
- **DNS:** In this exercise, the trainees have to manipulate IPv6 resource records (AAAA, PTR) in a DNS server. It is performed on Linux OS.
- **Services/Applications:** In this hands-on exercise, the trainees install IPv6 services such as web servers (with virtual hosts) or FTP servers. This exercise is

¹ In this hands-on exercise configuration of different transition mechanisms examples are given over different platforms, such as Linux and Windows. The main focus is on tunnelling mechanisms.

performed on Linux OS. The other trainees check the configured services are available from their machine using IPv6 web/ftp clients (on Linux or Windows).

- **Management:** After having tested the services, the trainees are requested to install a management application (Argus) to supervise the routers, PCs and configured IPv6 services (web, ftp, etc.).
- **Security:** In this exercise, the trainees are required to add filters on the routers (ACL) and on the PCs (ip6tables) to allow/deny some PCs/services.

This set of practical exercises will be enhanced with experiences from other previous projects and can be considered as an additional outcome from the 6DEPLOY project, resulting in an enhanced variety of hands-on exercises.

2.1.4 Workshops repository

Most of the workshops held under the 6DISS project umbrella led to the creation of a media (CD or DVD) to gather all the workshop material on top of additional useful information (IPv6 deployment guide, IPv6 applications, etc.).

The content of these media was uploaded to the 6DISS website where they are still available.

We intend to proceed in the same way, uploading each 6DEPLOY training session material onto the 6DEPLOY website. This will allow the attendees of that workshop to retrieve the information provided during the session, and other people to determine what benefits they could gain by participating in such an event.

2.2 Other available training material

2.2.1 E-learning course

The popular e-learning course from 6DISS will be reused and accessible from the 6DEPLOY website². At the kick-off meeting, discussion has started to decide how to update and enhance the 6DISS version. The addition of subtitles in more languages, and voice-overs in other languages than English are two possibilities.

2.2.2 Training the trainers

6DEPLOY can enhance its training effectiveness through courses targeted at potential IPv6 trainers. The intention is not to educate IPv6 experts but rather to share our

² At the time of writing, the e-learning package is available as a downloadable set from <http://www.6diss.org/publications/multimedia/e-learning.iso>

6DISS experience in organising hands-on IPv6 sessions and explain how to use the available training material.

These 'training the trainers' sessions are an opportunity for future IPv6 trainers to practice making IPv6 presentations and configuring simple IPv6 routing cases using the testbeds. As an example, the reader can go to <http://www.6diss.org/workshops/ttt/> to see the first trainers' session programme.

For more information on this topic, the reader is referred to the 6DISS Deliverables page at <http://www.6diss.org/publications/> (D11 & D12 are specifically relevant).

2.2.3 Miscellaneous

Additional sources of material include:

- A document drawn from partners' experience on how to organise an IPv6 workshop is available at <http://www.6diss.org/workshops/workshop-guidelines.pdf>.
- Programme time tables are available from the workshops repository (<http://www.6diss.org/workshops/>) as good examples on what can be performed in a limited period of time and for a dedicated Internet community.
- Feedback questionnaires (participants can answer anonymously) are a useful way to discover what should be improved. Experience has shown that it is more efficient to collect these responses and run an evaluation session before the end of the workshop; otherwise not all forms are returned. The feedback questionnaire created for the 6DISS workshops is available at <http://www.6diss.org/private/getdoc.php?docID=114>. It will be used more or less as it is for the 6DEPLOY trainings.
- The IPv6 ePrints repository at <http://www.6journal.org> was supported by the 6DISS project. This open archive currently hosts 240 papers and presentations on IPv6 that complement other learning material, or be cited by that learning material. The archive has been moved on to new hardware for the start of the 6DEPLOY project, and will be used and supported by the project.
- One of the 6DISS participants organised an IPv6 workshop for UK academic network administrators. The two half-day sessions included theory and hands-on material. The content, which is partly based on 6DISS material and which we may integrate into 6DEPLOY material, can be found at the following address: <http://www.ipv6.org.uk/workshop/>

3. USING THE 6DEPLOY IPV6 TRAINING MATERIAL

3.1 Using the IPv6 Training Modules

Note to the users:

As decided in the 6DEPLOY project kick-off meeting, the usage of the training material in general and of the slide set in particular must follow the rules mentioned below:

- All the training material is publicly available from the website - or any other repository - as **PDF files only** with digital signature and security features set so modification, annotation, copy and paste are not allowed. High quality printing is allowed.
- The source version of this material is available for people, which are not partners of the 6DEPLOY project, upon request via a form in the 6DEPLOY web site. The request will mention the requester identity, the organisation (s)he belongs to, the usage (s)he will have of the documents from 6DEPLOY and a firm commitment to not re-distribute the documents.
- A copy of each modified module or document by the requester will be provided to the 6DEPLOY project via email, so enhancements could benefit a larger community.
- Trainers are requested to update and configure beforehand each module they intend to use for IPv6 education purposes.
- **Adapt the content:** The trainer has to adapt the training content according to the needs of the trainees. Therefore, as there is a large list of modules, the trainer has to choose a subset of the available modules and adapt them (hiding slides, etc.) to his/her audience.
- **Use the comment zone:** In the comment zone of the Powerpoint documents, there are additional explanations to help the trainer to better understand the key points to talk about or extra details. Every slide set should contain comments in the comment area.

3.2 Booking & using the testbeds

3.2.1 Paris testbed

3.2.1.1 Equipment availability

Chassis and Line cards available at the Paris testbed are

#	Chassis Name	Chassis Type
1	GSR-1	CISCO 12404
2	GSR-2	CISCO 12404
3	GSR-3	CISCO 12404
4	7200-1	CISCO 7204 NPE-G1
5	7200-2	CISCO 7204 VXR
6	7200-3	CISCO 7204
7	7200-4	CISCO 7204
8	ALCATEL	ALCATEL OMS7700
9	M5	JUNIPER M5

Table 3-1: Available Chassis on Paris testbed

#	Chassis	Line Card	Quantity
1	CISCO 12xxx	Engine 3 - 4 ports GE - 1 LC connector - multimode	1
2	CISCO 12xxx	Engine 3 - 16 ports OC3 - LC connectors - single-mode	4
3	CISCO 12xxx	Engine 0 - 1 port GE - SC connector - multimode	1
4	CISCO 720x	1 port FE - RJ45	2
5	CISCO 720x	2 ports FE - RJ45	2
6	CISCO 720x	1 port OC3 - SC connector - single-mode	3
7	ALCATEL OMS	24 ports FE - RJ45	1
8	ALCATEL OMS	2 ports GE - SC connectors	2
9	JUNIPER M serie	2 ports ATM - OC3 - SC connectors - multimode	1
10	JUNIPER M serie	1 ports GE - SC connectors - multimode	1
11	JUNIPER M serie	Tunnel PIC	1

Table 3-2: Available Chassis on Paris testbed

3.2.1.2 Testbed Topology

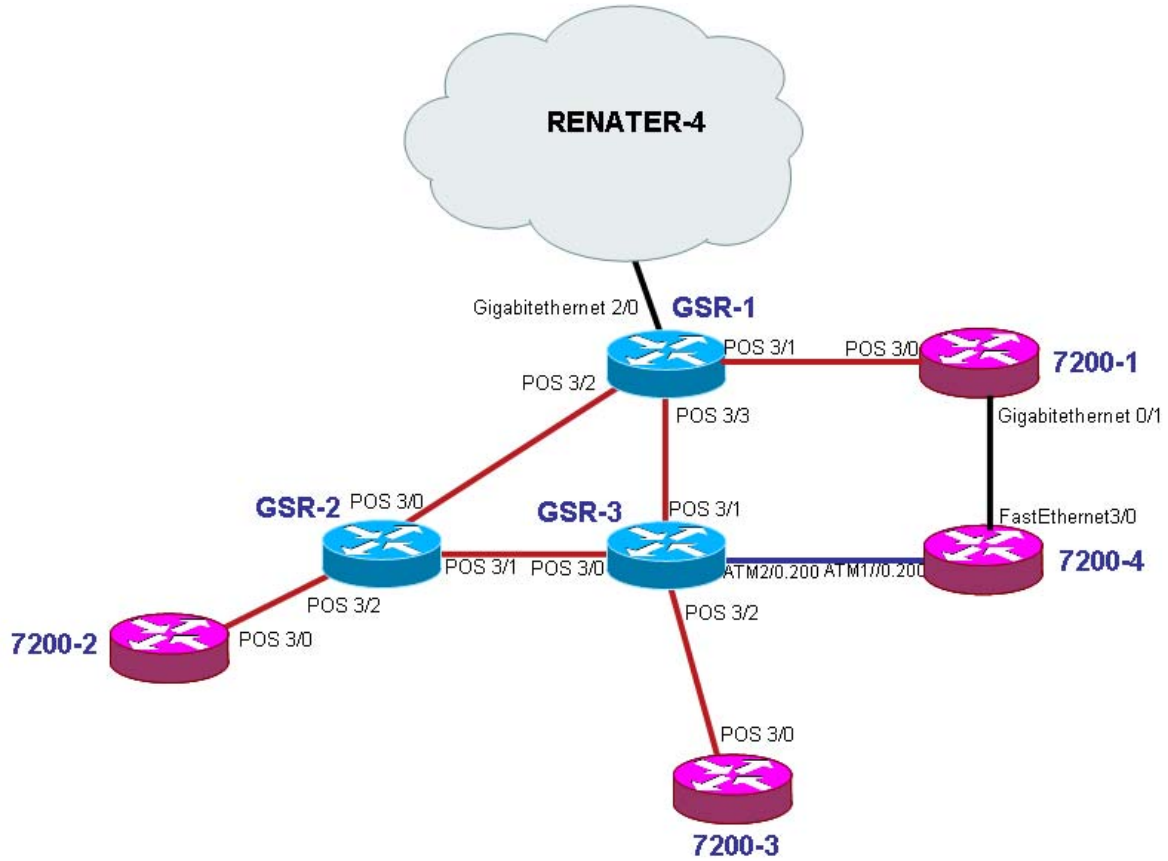


Figure 3-1: Paris Testbed schema

3.2.1.3 Booking procedures

There is no restriction per se on the people that are permitted to book the Paris testbed. Nevertheless, a higher priority is given to 6DEPLOY workshops, tests required for RENATER network operation, education purposes and advanced features testing.

The testbed booking schedule is available at the following URL:

<http://www.renater.fr/spip.php?article439>

To book the testbed, a reservation must be sent by email to testbed@renater.fr with the subject "Testbed reservation request". This email must clearly specify:

- The identity of the requester
- The organisation the requester belongs to
- The purpose of the reservation
- The desired dates

- The IPv4 prefixes from which the login will be done (to modify access-list on the routers)

The requester will then receive an email specifying that the request is accepted or declined with the following format:

Subject: Re[Testbed reservation request]

Hi,

Your organisation [Organisation name] sent a request to book the [Paris/Sofia] Testbed for the dates [200x/xx/xx-200x/xx/xx]

Your request is [accepted/declined].

[Please send IPv4 prefixes³ from which logon will be performed (this is needed to update ACLs on testbed routers to permit remote access)]

Best regards,

-The testbed team

3.2.1.4 How to access the lab

For all testbed routers, login and password are:

- **Login:** *****
- **Password:** *****

There are two ways to access the lab:

- Inband connection
- Connection on console port via a terminal server

3.2.1.4.1 Inband connection

Routers are configured beforehand to accept telnet connections from the training location. The following table shows the Paris testbed addressing plan (administration IP addresses). 193.51.190.240/28 prefix is used for that:

³ It could be a CIDR prefix (with the subnet length) or a single IP address

#	IPv4 Address	Router
1	193.51.190.242/28	GSR-1
2	193.51.190.243/28	
3	193.51.190.244/28	
4	193.51.190.245/28	7200-1
5	193.51.190.246/28	GSR-2
6	193.51.190.247/28	GSR-3
7	193.51.190.248/28	
8	193.51.190.249/28	7200-2
9	193.51.190.250/28	7200-3
10	193.51.190.251/28	M5
11	193.51.190.252/28	ALCATEL
12	193.51.190.253/28	7200-4

Table 3-3: Paris testbed addressing plan

3.2.1.4.2 Connection on console port via terminal server

This connection is used by the trainers if a problem occurs on a router.

A terminal server is configured with console access to routers GSR-1, GSR-2, GSR-3, 7200-1, 7200-2, 7200-3 and 7200-4. This terminal server is accessible from the training location. The following schema depicts the architecture:

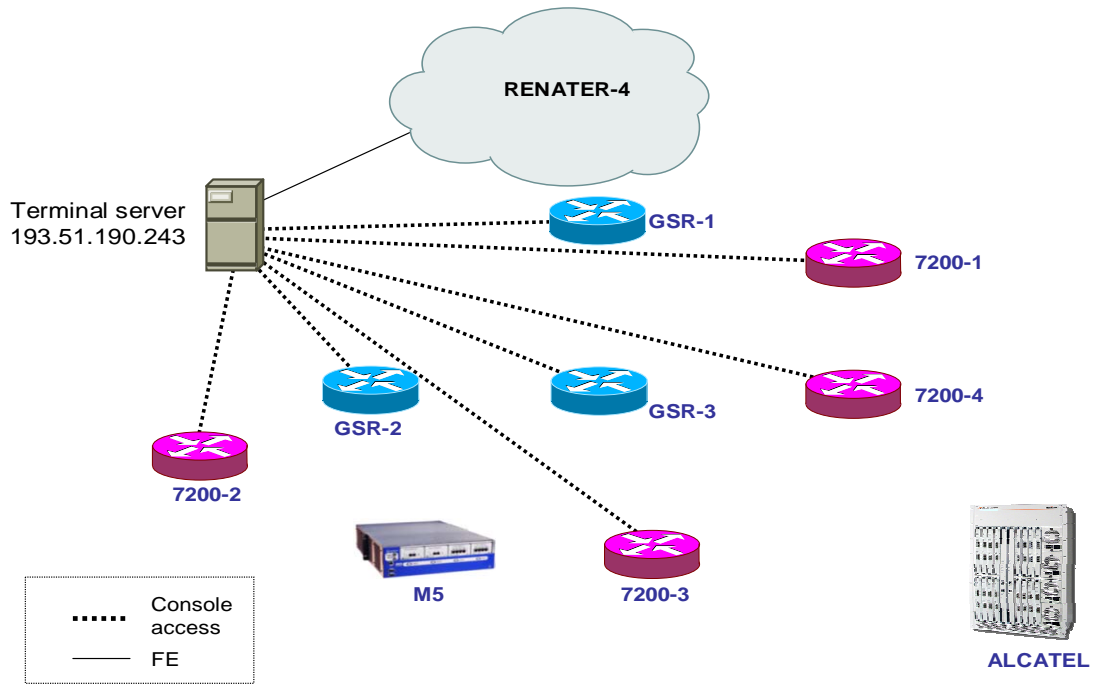


Figure 3-2: Out-of-band architecture

Connecting to the routers via telnet to the following addresses and ports:

#	Router	IPv4 Address	Port
1	GSR-1	193.51.190.243	2039
2	GSR-2	193.51.190.243	2042
3	GSR-3	193.51.190.243	2034
4	7200-1	193.51.190.243	2043
5	7200-2	193.51.190.243	2035
6	7200-3	193.51.190.243	2036
7	7200-4	193.51.190.243	2033

Table 3-4: IPv4 Addresses and ports for out-band access

Alternately, a connection can be established via telnet to the terminal server (193.51.190.243 port 23) and then by typing "connect XXX" where XXX is one of the routers name (for example: "connect 7200-4"). To disconnect from the router and get back to the terminal server enter "ESCAPE x" and then enter "disconnect XXX" where XXX is the router you want to disconnect from (for example: "disconnect 7200-4").

It is possible that the connection between the terminal server and the routers is not freed after a disconnection. If that happens:

- Connect to the terminal server
- Enter "*sh users*"
- Find the tty connection with problems
- Enter "*clear line tty X*"

If the problem is not solved with this operation, please contact sso@renater.fr that might decide to reboot the terminal server.

3.2.1.5 Usage and rules

The prefixes which can be used to configure the testbed are:

- IPv6 prefix: 2001:660:3008::/48
- IPv4 prefix: 194.254.101.128/25⁴

These 2 prefixes are announced to the Internet by GSR-1.

For the sake of the testbed operation, the only rules that must be strictly respected are the following:

- Don't change the management Ethernet interface configuration
- Don't remove IPv4 static routes
- Don't change login/password information
- Don't change filtering policy on the routers
- Don't change the console line configuration
- Don't change the BGP peering configuration with RENATER (GSR-1)
- Don't change interfaces description

3.2.2 Sofia testbed

The Sofia IPv6 installation more or less mirrors the procedures and functionality of the Paris testbed. The equipment is functional and accessible through the Internet over IPv4 and IPv6. The BREN team is still working on the re-addressing of the interfaces, connecting to the Paris lab using BGP neighboring scheme and configuring additional services installed on virtual servers along with the routers in the testbed. Training premises are available for the locally organized courses and hands-on sessions. New dedicated premises for the trainings are being prepared in the building of the Bulgarian

⁴ This prefix should be reserved for IPv4 trainings, since no configuration change is supposed to happen on the IPv4 part for the IPv6 trainings.

State Agency for IT and Communications.



Figure 3-3: Sofia testbed equipment

3.2.2.1 Equipment availability

Chassis and Line cards available at Sofia testbed are:

#	Chassis Name	Chassis Type	Line Card	Qt.
1	12000-1	CISCO 12404/GRP (R5000) IOS (GSR-P-M), 12.0(30)S5, (fc1)	16 port ISE OC3 POS single mode, intermediate reach, LC connector	1
			4 port Edge Engine3 Gigabit Ethernet	1
2	12000-2	CISCO 12404/GRP (R5000) IOS (GSR-P-M), 12.0(30)S5, (fc1)	16 port ISE OC3 POS single mode, intermediate reach, LC connector	2
			3 port Gigabit Ethernet	1
			10/100 Ethernet	1
3	12000-3	CISCO 12404/GRP (R5000)	16 port ISE OC3 POS single mode, intermediate reach, LC connector	1

		IOS (GSR-P-M), 12.0(30)S5,fc1)	4 port Edge Engine3 Gigabit Ethernet	1
4	7200-1	CISCO 7204 7204VXR (NPE400) IOS (C7200-P-M), 12.3(17a), (fc2)	I/O Dual FastEthernet Controller	1
			FastEthernet	1
			ATM WAN OC3 MM Port Adaptor	1
			POS Port Adapter (SM)	1
5	7200-2	CISCO 7204 VXR NPE400 C7200-P-M, 12.3(17a), (fc2)	I/O Ether/GigEther Controller	1
6	7500-1	CISCO 7505Z RSP4+ (R5000) IOS (RSP-JK803SV-M 12.3(7)T, (fc1)	Dual Port FastEthernet (RJ45)	1
			POS Port Adapter (SM)	1
			Dual-wide GigabitEthernet	1
			ATM WAN OC3 MM Port Adaptor	1

Table 3-5: Available Chassis on Sofia testbed

3.2.2.2 Testbed topology

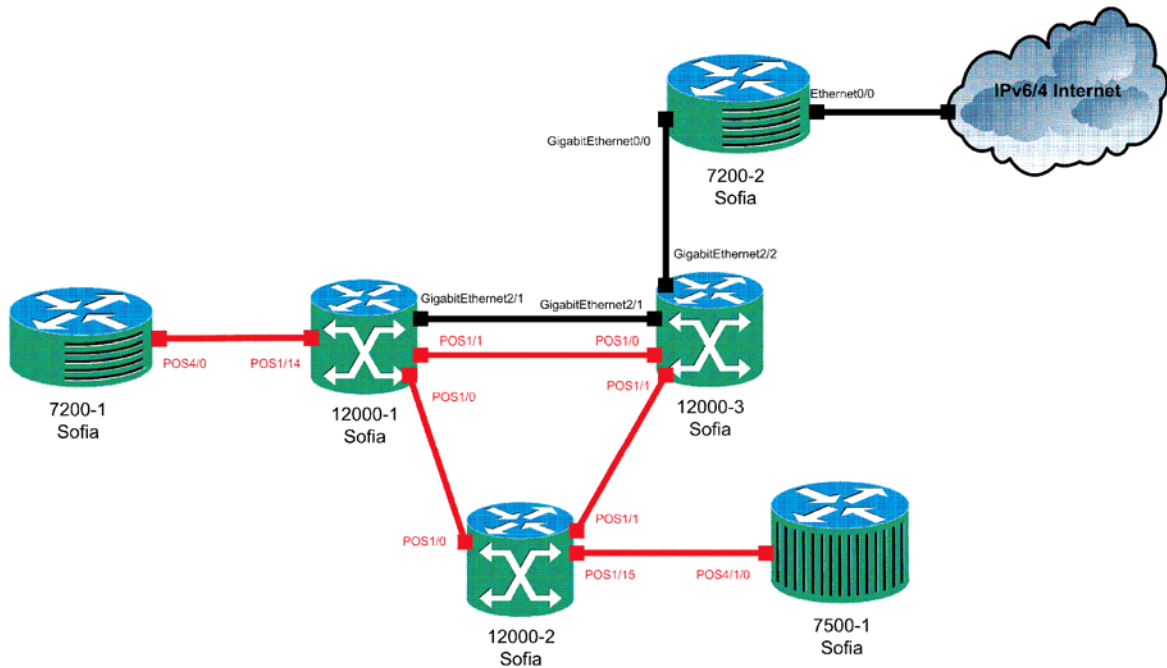


Figure 3-4: Sofia Testbed topology

3.2.2.3 Booking procedures

The booking procedures and web portal are under development by the BREN team. Best practices are being exchanged with RENATER and the Sofia installation will be

functional and ready for use by the end of May 2008.

3.2.2.4 How to access the lab

- **Login :** *****
- **Password :** *****

3.2.2.4.1 Inband connection

BREN is working on the new addressing scheme and policies for the inband connectivity of the lab. Currently, the testbed is accessible only through one of the routers with a configured real and routable IPv4/v6 interface. The console connectivity to every router through a dedicated terminal server is still being developed and deployed.

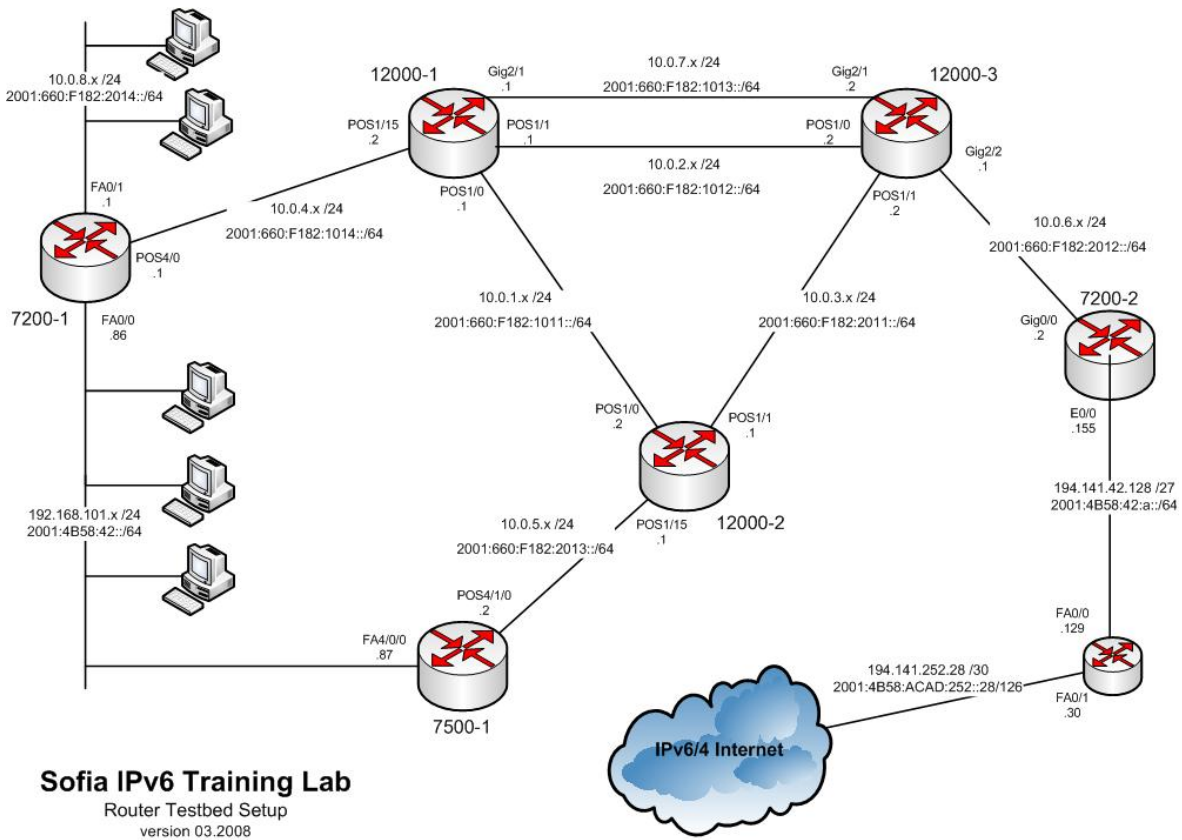


Figure 3-5: Sofia Testbed details

4. CONCLUSIONS

Thanks to previous projects and training activities about IPv6 education, more or less all the material needed to start the 6DEPLOY support programme activities is available from the very beginning. As examples, the first IPv6 workshops will be organised in the coming months (27th March: IPv6 Argentina event; May 2008: LACNIC meeting in Brazil; June 2008: AfriNIC meeting in Kenya ...). This would not have been possible had the prior teaching material not been available.

Some new ideas have already been discussed to improve the existing material, such as adding more "applications-oriented" elements to the labs, which are some of the key elements to be upgraded for a production IPv6 deployment.

During the 6DEPLOY lifetime, stakeholders will continue to enhance today's "knowledge database". The reader and interested parties are referred to the 6DEPLOY website to check for any new material.

5. REFERENCES

6DEPLOY website: <http://www.6deploy.org>

6DISS website: <http://www.6diss.org>

Paris Testbed: <http://www.renater.fr/spip.php?article439&lang=en>

Hands-on modules: <http://www.6diss.org/publications/deliverables/hands-on.pdf>

How-to organise an IPv6 workshop:

<http://www.6diss.org/workshops/workshop-guidelines.pdf>

Training to trainers workshop: <http://www.6diss.org/workshops/ttt/>

e-learning package: <http://www.6diss.org/publications/multimedia/e-learning.iso>

e-learning on-line: <http://www.6diss.org/e-learning/>

Feedback questionnaire:

<http://www.6diss.org/private/getdoc.php?docID=114>