



# e-infrastructure

Title:	Report	Deliverable D1.3 from the 2 <sup>nd</sup> Workshop		Document Version: 0.5
Project Number: 223794	Project Acronym: 6DEPLOY	<b>Project Title:</b> IPv6 De	eployment Support	
Contractual Delive	r <b>y Date:</b> 7/2008	Actual Delivery Date: 31/07/2008	Deliverable Type* - R -	Security**: · PU
* Type:	P – Prototype, R – F	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)

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#### Abstract:

This deliverable presents a report from the workshop held in Nairobi (Kenya) from 17<sup>th</sup> to 19<sup>th</sup> June 2008, within the KENIC-AfriNIC IPv6 Workshop. The presentation material is listed, the attendees and their affiliations are given and the opportunities for further co-operation and follow-up actions are described.

#### Keywords:

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

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# **Revision History**

The following table describes the main changes to the document since created.

Revision	Date	Description	Author (Organization)
v0.1	25/06/2008	Document creation based on Martel's model	Alvaro Vives (Consulintel)
v0.2	30/6/2008	Minor format corrections, typos and graphs format adjustment based on Cesar Olvera's comments	Alvaro Vives (Consulintel)
v0.3	3/7/2008	Document review	Alvaro Vives (Consulintel)
v0.4	4/7/2008	Document review	Sarah Kenehan (Martel)
v0.5	23/7/2008	Document review. Added workshop group photo	Alvaro Vives (Consulintel)

## **Executive Summary**

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

This deliverable presents a report from the workshop held in Nairobi (Kenya) from 17<sup>th</sup> to 19<sup>th</sup> June 2008, at the KENIC-AfriNIC IPv6 Workshop. The following is described in this report: a) the workshop attendees and their affiliations, b) the programme outline, c) the material presented, d) an assessment of the opportunities for further co-operation and follow-up actions planned, and e) an analysis of the feedback questionnaires from the participants.

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## 1. **INTRODUCTION**

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## **1.1 6DEPLOY Objectives**

The following comprise the 6DEPLOY objectives:

- organize workshops for the e-Infrastructure community and give practical advice and hands-on support for deploying IPv6 in their environments.
- work on deployments in Europe and in developing countries; exchanging experiences and best practices.
- improve the competitiveness of European industry by sharing experiences from IPv6 deployments in other regions.
- gain expertise with which to support *more commercial* deployments in European industries (e.g. Emergency Services, Health, Broadcast, Transport, Schools, Environment, Gaming, etc.).
- help to build consensus between European researchers, by enabling and exploiting synergy among related projects (e.g. GÉANT-2, SEEREN-2, SEE-GRID, EUMEDCONNECT, CLARA, ALICE).
- encourage and enhance the effectiveness of the coordination between National and pan-European e-Infrastructure initiatives by being a focal point for IPv6 activities, giving IPv6 training, and supporting IPv6 deployments.
- open up the ICT programme to the participation of third country organisations in International Cooperation Partner Countries, including countries in Africa, Asia and Latin America, by involving organisations that influence e-Infrastructures on those continents.
- improve scientific cooperation between Europe and the declared target regions (Africa, Asia and Latin America,) by exchanging knowledge and experiences through direct practical support for deployment, training events, etc. The project therefore also helps support other Community policies, most notably the development policy. Telecommunications infrastructure and the capability to access information worldwide are key measures of a country's progress. IPv6 has been a cornerstone of European Internet policy for several years.
- support interoperability and standards by sharing information on the latest IPv6 standards, equipment hardware and software releases, and IPv6 policies (RIRs).

One of the main activities in the 6DEPLOY project is therefore to organise workshops to

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train the different Internet communities in the areas of IPv6 deployment, configuration, operation, and management. This activity is a follow up of previous project's activities within and outside the Framework Programmes of the European Commission.

### **1.2 6DEPLOY Workshop Methodology**

The 6DEPLOY methodology relating to the workshops is shown in the diagram below:



Figure 1-1: 6DEPLOY methodology (diagrammatically)

The approach is to use course material available from 6DISS and elsewhere relating to IPv6, the e-learning course, and the 6NET IPv6 Deployment Guide book as the basis of the training material. This training material is supplemented with knowledge from partners' participation in events such as IPv6 Forum meetings, IPv6 Task Force meetings, Internet2 meetings, and the IETF, and from the experience of similar activities brought to the project by the representatives of the Internet Registries in North and South America, the Asia-Pacific region, Africa, and Europe. The knowledge is disseminated through training sessions that, for practical reasons, are often held in conjunction with AfriNIC, LACNIC, APNIC, AfNOG, APRICOT and ISOC meetings.

After each workshop, feedback reports will be collected from the participants, enabling 6DEPLOY to assess the impact of the presentations and identify any areas that need improvement.

The full set of dissemination material (including the e-learning course and 2 managed testbeds) is available from 6DISS and partners' own sources. This includes presentation slides on all issues of Internet deployment and evolution; especially IPv4-IPv6 transition strategies, DNS, DHCP, routing, QoS, MobileIP, multicast, renumbering, auto-configuration, security, monitoring and management tools, and applications. This material was described in the deliverable D1.1: "IPv6 training material and related usage procedures".

This document describes the 2<sup>nd</sup> of these IPv6 training workshops, which took place in Nairobi (Kenya) from 17<sup>th</sup> to 19<sup>th</sup> June 2008 at the KENIC-AfriNIC IPv6 Workshop. The workshop was very well attended (approximately 100 participants) and comprised both

slide presentations and hands-on exercises (using local equipment and the remote 6DEPLOY testbeds in Paris, Sofia, and Brisbane). Due to the fact that only a short amount of time has passed since the start of the project, the material comprised modules from Consulintel (which are currently being updated and merged with 6DISS material and converted into the 6DEPLOY style) adapted to the needs of the participants.

Chapter 2 of this document explains the general motivation for running IPv6 workshops, and Chapter 3 describes the specific details of this workshop, in terms of the attendees, the modules that were presented and the "hands-on" exercises that were performed, using both local equipment and the remote testbeds in Paris, Sofia and Brisbane.

Chapter 4 identifies opportunities for further collaboration in the region and follow up actions, and Chapter 5 summarises the analysis of the feedback questionnaires that were filled in by the participants.

## 2. **THE WORKSHOPS (GENERAL)**

Workshops are one of the main mechanisms used by 6DEPLOY to transfer information and build collaboration.

6DEPLOY is structured to provide an ideal platform for the discussion of deployment scenarios and the exchange of best practices, thereby avoiding duplication of effort, by preventing the waste of time on techniques that are known not to have been deprecated, and generally making the most efficient use of the available resources in a region. Partners in 6DEPLOY have deployed IPv6 on a production basis in their own NRENs and University networks, and have documented their experiences in Cookbooks and in IETF informational / best common practice RFCs. The manufacturer in the consortium is building IPv6 products.

The workshops are not only intended to lead to an improved quality of the Internet infrastructure in developing countries, but will also raise the competence of the attendees and, in exploiting the personal contacts made through 6DEPLOY, facilitate and encourage the participation of their organisations in future FP7 Calls and beyond.

Impacts from the workshops will include:

- a positive effect towards preventing the "brain drain" from developing countries by bringing interesting and state-of-the-art activities into these regions, thus making information and knowledge resources accessible to the scholars both locally and globally.
- an expansion of the conditions for growth by enabling the exchange of ideas, launching joint experiments and projects, disseminating RTD results, and activating market forces; all of which are substantial elements in the process of regional development.
- making European research and industrial concerns aware of the highly skilled personnel who can contribute to the urgently needed improvement of ICT infrastructures; resulting in an increase of the demand for specialized services provided by the highly skilled academics and researchers of the region.
- the identification of IPv6 deployment activities in the region and an exchange of information about deployment experiences.

While IPv6 standards and services are quite stable, regional variations in practices and operations will require slightly different approaches for collaboration and dissemination. Therefore, the material for this workshop was collected, and the workshop schedule,

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format and contents were tailored in conjunction with the local organisers so as to suit the type of participants, the subjects to be addressed, the location, the host organisation, the sponsors, etc.

## 3. THE 6DEPLOY WORKSHOP IN NAIROBI (KENYA)

This workshop was held in Nairobi (Kenya) from 17<sup>th</sup> to 19<sup>th</sup> June 2008, at the KENIC-AfriNIC IPv6 Workshop. The workshop is described below, in the form of the attendees and their affiliations, the programme outline, and the material that was presented. There was an LIR workshop given by AfriNIC on 20<sup>th</sup> June, at the KENIC-AfriNIC IPv6 Workshop.

## 3.1 Overview

The KENIC-AfriNIC IPv6 Workshop was both an example of awareness work conducted by KENIC, as well as an example of the interest in new technologies - specifically IPv6 - shown by developing countries.

June 17<sup>th</sup> was the "Launch of IPv6 in Kenya", during which several organizations explained their interest in IPv6 and their future plans. Some interesting debate between the presenters and attendees also took place. Press media were present and raised the number of attendees to over 130.

The organizations represented at the "Launch of IPv6 in Kenya" were KENIC, AfriNIC, TESPOK, the Ministry of Information and Communications, and the Kenya ICT Board. Universities and enterprises were also represented during the debate.



Figure 3-1: Organizations represented in the "Launch of IPv6 in Kenya"

Shown in the picture above, from left to right, are: Mr. Jonathan Somen (Chairman, TESPOK), Dr. Bitange Ndemo (Permanent Secretary, Ministry of Information and Communications, Kenya), Mr. Anthony K. Mugambi (Chairman, KENIC), Mr. Adiel Akplogan (CEO, AfriNIC) and Eng. Victor Kyalo (Deputy CEO, Kenya ICT Board).

There was a small timing problem for the material that was scheduled in advance, due to the fact that the "Welcome Address & Launch of IPv6 in Kenya" session took up the entire morning, so the IPv6 course did not start until 14:00. Trainers had to compensate for this loss of time by quickly moving through the theoretical content and by taking some time from the "hands-on" sessions.

Individuals present at the workshop included Adiel Akplogan (AfriNIC), Ernest Byaruhanga (AfriNIC) and Alvaro Vives (Consulintel), all of whom are with 6DEPLOY. Adiel and Ernest participated in the first day "Welcome Address & Launch of IPv6 in Kenya". In addition, Ernest helped with the hands-on modules and gave an LIR workshop on the 20<sup>th</sup> of June. Alvaro was in charge of presenting both the IPv6 modules and the hands-on modules.

## **3.2 Attendees**

No.	Surname	First name	Affiliation
1	ORIARO	SHADRACK	ABC BANK
2	ONSANDO	NEMWEL	ABC BANK
3	KAGENI	CLARE	ACCESS KENYA
4	MAMBO	JACOB	ACCESS KENYA
5	KIGATHI	MICHAEL	AFRICA LEGAL NETWORK
6	ITURIU	MAURICE	AFRICA NAZARENE UNIVERSITY
7	OTIENO	ACHIENG	AFRICA NAZARENE UNIVERSITY
8	NDERITU	ALEX	AFRICA ONLINE
9	BAKO	FELIX	AFRICA ONLINE
10	ABOI	HUSSEIN	AFRICA ONLINE
11	KIMWELI	MATHEW	AIG KENYA
12	GATHONDU	SAMUEL	AQUADER ONLINE
13	MBUGUA	KINYANJUI	BYTRONICS
14	NZANO	JOSEPH	ССК
15	MUSOMBA	PAXTON	ССК
16	WAKO	GABABO	CCK-FOGNET
17	WANJIKU	REBECCA	COMPUTERWORLD
18	MWANI	ERIC	COMTECH SYSTEMS
19	KARINA	CAROLINE	CSK
20	MORAA	DOREEN	CUEA
21	MUSILA	KIM	CUEA
22	ODEMBA	LUCAS	CYBERTECH ENGINEERING
23	NJUGUNA	PATRICK	CYBERWORLD ISP
24	MBUGUA	JAMES	E-GOVERNMENT
25	NDUNDA	STEPHEN	E-GOVERNMENT
26	MUGAMBI	ALEX	EGERTON UNIVERSITY
27	GITHEKO	JASON	EGERTON UNIVERSITY
28	MUNGAI	J	EGERTON UNIVERSITY

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29	MITEI		HF	INRY	EGERTON UNIVERSITY
30	MUTHEE		1Δ	MES	
31		FDF			CET2NET
32	MTIMEA		FN		
32					
24	OMPEC	) `Ц			
25		.11			
20	SANG	DIA			
20		KIA			
3/		МТ			
30		VII.	11		
39	KIPTUI		JC	ISEPH	
40		) 'T			JAMII TELECOMMUNICATIONS
41	NDUAT	1		IARLES	
42	KUECH				
43	NZAU		SA		
44	GUTTER		AL	VARO	KASNET
45	KAIEII	=1	AP	NUS	KUUI
46	KAMAN		PA		KUUI
4/	WALUE	ENGO	JC		
48	ASEDA		KE		KENET
49	GATAM	AH	05	SCAR	
50	YIAPAN	۱ –	EL	JGAR	
51	GISORI		AP		
52	WAINA	INA -	AP	NIHONY	KENYAWEB.COM
53	KAGWE		JA	IMES	
54	UGADA	\	PE		
55	IMBO				
50	KAMAU		JU		KQ-GALILEU
5/	KAMAU	CT.		AURICE	KSPS
58					
59		A			
60	GIKERA	4		1ARLES	LUGISTIK CREATIONS
62		JA T	I*I/ ⊤∟		
62					
64					
0 <del>1</del> 65					
66		λŪ	JU		
67					
62			CI CI		
60	MIICAC	TE	10		
70	W/FDI1	16	50		
70					
/1	ODAINL	,0	INC		
72	MIDUC	т	Ц		
72		1	11	IRUS	MMIIST
73	CHITFE	, 21	M	ARTIN	
75		MRI	6	REGORY	MOLUNIVERSITY
75			10	)HN	MOLUNIVERSITY
70	CHUMU		KI	YENG	MOLUNIVERSITY
78			GI	IBFRT	NAIROBINET
70			FI	ΙΔς	NAIROBINET
80				FMFNT	
81	KIFMA		ST	FPHEN	NSIS
82	MUNUE	łF	Т	)NY	NWCH
83	KOFCH		C/		SAFARICOM
84	GATHA	RA	M		SAFARICOM
07	SATTA		1.17		

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Г	85	OCHIENG		DC	DUGLAS	SAFARICOM
	86	ONIM		ER	RIC	SOFTWARE APPLICATION ARCHITECTS
	87	OLWEN	10	JU	LIUS	STRATHMORE
	88	OUMA		MI	CHAEL	SUNDAY STANDARD
	89	SARATI	Η	KR	RISHNA	TANGERINE LTD
	90	MORI		W	ILSON	TELKOM KENYA
	91	KABAJI		EL	LY	TELKOM KENYA
	92	SANDE		CH	IARLES	TELKOM KENYA
	93	KATHA	0	MA	ARY	TELKOM KENYA
	94	WAMBL	JGU	NI	CHOLAS	TESPOK/KIXP
	95	MUTIN	DA	ΤI	М	TTCG
	96	IDOWU		AB	BRAHAM	UEAB
	97	WALEL	A	PR	ESTON	UEAB
	98	GICHA	ГНА	٨N	ITHONY	UEAB
	99	AYIEM	BA	JA	MES	UEAB
	100	KINUTH	HIA	JO	RAM	UNIVERSITY OF NAIROBI
	101	TENAI		EL	IJAH	UNIVERSITY OF NAIROBI
	102	OMWE	NGA	EL	IJAH	UON
	103	NZIOKA	Ą	JO	SEPH	UUNET
	104	KOROS		٨N	IDREW	UUNET
	105	KIOKO		GE	ORGE	VEGPRO KENYA
	106	KOINAI	NGE	PE	TER	WANANCHI ONLINE
	107	MUIRURI		PA	TRICK	WANANCHI ONLINE
	108	MBURU		JA	HN	WANANCHI ONLINE
	109	OKECH		٨N	ITONY	WANANCHI ONLINE
	110	GAKUR	U	AL	EX	WAY FORWARD TECHNOLOGIES
	111	OLUOCH		CH	IARLES	WEC KENYA

 Table 3-1: List of participants

The pre-requisites or requirements for participation in the workshop were:

- Laptop running on Windows XP or higher or Ubuntu 7.0 or higher.
- Knowledge in basic TCP/IP.
- Knowledge in Linux (will be an added advantage but not a requirement).

In all cases the attendees were technical people whose knowledge about IPv6 ranged from almost no knowledge at all, to having some experience of IPv6 deployment. Some had already performed IPv6 experiments or were planning some level of deployment at their institutions.

The participants represented a wide range of the ICT community. These people are precisely the ones who will collectively determine the rate of deployment of the latest Internet technologies in Kenya, and therefore the impact will be that they will promote the upgrading of the networks to a state of the art that is comparable with EU countries.

In section 5 more details about the attendees can be found based on their answers to the questionnaire.

## **3.3 Workshop programme**

The agenda was agreed on after close collaboration with the local organisers from KENIC, and tailored set up and configuration exercises were created for this workshop. The meeting agenda and the related material were submitted in advance, so that the local organisers could decide which topics should be prioritised and manage the logistics accordingly. As was requested by most of the participating organisations, the "hands-on" sessions took around 50% of the overall time of the training workshop. The programme of the workshop is presented in the following table:

Date	Time	Title of session
17/06/08	09:00	Welcome Address & Launch of IPv6 in Kenya
17/06/08	14:00	Presentations (IPv6: Protocols and Standards)
17/06/08	16:00	Lab1 - Basics [IPv6 Using hosts]
18/06/08	9:00	Presentations (IPv6: Protocols and Standards) (cont.)
18/06/08	11:00	Presentations (IPv6 Applications & DNS IPv6)
18/06/08	12:00	Presentations (Transition mechanisms)
18/06/08	14:00	Presentations (IPv6 Security)
18/06/08	16:00	Lab2 – Basics 2 [IPv6 Using hosts]
19/06/08	9:00	Presentation (IPv6 Routing, OSPFv3, MP-BGP)
19/06/08	11:00	Lab5 - IPv6 OSPF and BGP [Using remote labs]

#### Table 3-2: Programme

## **3.4 Presentation material**

The agenda was agreed on after close collaboration with the local organisers from KENIC, and tailored set up and configuration exercises were created for this workshop.. The following material was presented:

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Modules	Han	ds-on exercises	Presented by	Affiliation
Basic Introduction	to IPv6		Alvaro Vives	Consulintel
Header Formats & Size Issues	Packet		Alvaro Vives	Consulintel
IPv6 Addressing	Basi	cs 1	Alvaro Vives	Consulintel
ICMPv6, Neighbor Discovery & DHCPv	6 Basi	cs 2	Alvaro Vives	Consulintel
IPv6 Applications	Basi	cs 2	Alvaro Vives	Consulintel
IPv6 DNS	Basi	cs 2	Alvaro Vives	Consulintel
Security/firewalling			Alvaro Vives	Consulintel
Transition and Coe	xistence Trar	sition mechanisms	Alvaro Vives	Consulintel
IPv6 Mobility			Alvaro Vives	Consulintel
IPv6 Routing	IPv6	Routing	Alvaro Vives	Consulintel

 Table 3-3: List of modules and hands-on exercises used

### 3.4.1 Modules

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

- **Basic Introduction to IPv6**: This module explains why a new version for IP, IPv6, has been developed. A brief history of IPv6, and its motivation and benefits are given.
- **Header Formats & Packet Size Issues**: This module describes the IPv6 protocol, including IPv6 packet header, extensions headers, and the differences from IPv4 headers. Packet size issues and upper layer considerations are also addressed.
- **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, and how these are built and related to a layer 2 address.
- ICMPv6, Neighbor Discovery & DHCPv6: This module describes new protocols associated with IPv6: e.g. Neighbour Discovery Protocol, SEND, ICMPv6, MLD, DHCPv6, etc.
- **IPv6 Applications**: This module explains how the client-server model is affected by the introduction of IPv6 and how the election between IPv4 and IPv6

is made.

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- **IPv6 DNS**: This module describes new Resource Records for IPv6 DNS, the availability of IPv6 in the root servers zone and CC-TLDs, etc.
- **Security/firewalling**: Issues such as the IPsec model, privacy extensions, ND threats, IPv4 vs. IPv6 threat analysis, IPv6 security issues, practical IPv6 security issues and firewalling IPv6 are discussed here. The distributed security model is introduced. Security issues from the point of view of transition and coexistence are also provided.
- **Transition and Coexistence**: This module explains different approaches to deploying 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 mobility**: This module describes IPv6 mobility and the new features compared to IPv4 mobility.
- **IPv6 routing**: This module mainly describes the differences between IPv4 and IPv6 routing protocols for OSPFv3 and BGP4+.

### **3.4.2 Hands-on exercises**

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'. These exercises are performed both on local equipment and on remote testbeds, some of which were originally established in the 6DISS project, thanks to a Cisco donation. These labs are installed in Paris (RENATER premises), Sofia (BREN premises) and Brisbane (APNIC premises).

Below is a brief description of the hands-on exercises that were performed:

- **Basics 1:** Exercises illustrate how to install IPv6 on several platforms, mainly Linux, Vista, and Windows XP operating systems. Use of link-local addresses, ping and traceroute. Configuration of static addresses.
- **Basics 2:** In this hands-on exercise, IPv6 protocol is analysed in depth: Neighbour Discovery, Autoconfiguration, etc. Management of static routes and routing table are shown.
- **Transition mechanisms**: In this exercise, the trainees have to configure different transition mechanisms, mainly tunnelled ones. Because of the use of public IPv4 addresses hosts were able to use 6to4 to access IPv6 content in the IPv6 Internet.

• **Routing**: In this exercise, IPv6 routing protocols are configured by the trainees on the testbed routers. Internal Gateway Protocol (OSPF) and External Gateway Protocol (BGP) are tested.

### 3.4.2.1 Hands-on exercises using local equipment

For the hands-on exercises that used attendee's hosts, a WLAN network was used that connected them all together in the same LAN segment.



Figure 3-2: Local experiment testbed

The Internet connectivity link was provided by Swiftglobal with a bandwidth of 512 kbps.

The local router at the venue did not support IPv6, so a tunnel from a laptop to Consulintel's premises was created to try to provide IPv6 connectivity to attendees' laptops. Because of the low bandwidth link available (512 kbps) and the number of laptops that were using that link, the tunnel was not useful at all.

From the laptop where the tunnel was created RAs were sent to the workshop network in order to check how autoconfiguration works.

The tunnel information used was:

Workshop laptop public IPv4: 196.216.76.84

Workshop laptop tunnel end point IPv6: 2A01:0048:0100:0001:0001::10B2

Consulintel's router public IPv4: 213.172.34.125

Consulintel's router tunnel en point IPv6: 2A01:0048:0100:0001:0001::10B1

IPv6 prefix to be used: 2A01:0048:0249::/48

### 3.4.2.2 Hands-on exercises using the IPv6 Testbed in Paris

Routers were configured beforehand to accept telnet connections from the training location. The IPv6 prefix which was then used to configure the testbed was 2001:660:3008::/48.



Figure 3-3: Paris testbed

### **3.4.2.3** Hands-on exercises using the IPv6 testbed in Sofia

The Sofia IPv6 installation more or less mirrors the procedures and functionality of the Paris testbed. Routers were configured beforehand to accept telnet connections from the training location. The IPv6 prefix which was then used to configure the testbed was 2001:4B58:42:400::/54.



Figure 3-4: Sofia testbed

### 3.4.2.4 Hands-on exercises using Brisbane testbed

Routers were configured beforehand to accept SSH connections from the training location. The IPv6 prefix which was used to configure the testbed was 2001:DB8:3008::/48.

Access to the routers was accomplished by means of a terminal server, accessible over SSH.

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Figure 3-5: Brisbane testbed

### 3.4.2.5 Common tasks

Groups of four people were created and one router assigned to each group.

Three main tasks were proposed within the routing labs:

- Task 1: Configure Loopback and interfaces IPv6 addresses.
- Task 2: Configure OSPF routing.
- Task 3: Configure BGP routing.

## 3.5 Photographs taken at the event



Figure 3-6: Adiel Akplogan (CEO, AfriNIC) during the workshop launch



Figure 3-7: Attendees to the workshop

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Figure 3-8: Attendees to the workshop



Figure 3-9: Dr. Bitange Ndemo (PS Ministry Information & Communications Kenya)



Figure 3-10: Alvaro Vives (Consulintel) presenting



Figure 3-11: Alvaro Vives (Consulintel) helping with the hands-on exercises



Figure 3-12: Ernest Byaruhanga (AfriNIC) helping with the hands-on exercises



Figure 3-13: Trainees working hard during the routing hands-on



Figure 3-14: Workshop Group Photo

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#### 4. **OPPORTUNITIES FOR FURTHER CO-OPERATION**

In all the workshops, the attendees were informed on how to stay in contact with the 6DEPLOY partners in case they have questions regarding IPv6 deployment, addressing plan, etc. In this respect, the role of the *helpdesk* was explained as being the way to submit questions. An e-mail to <u>helpdesk@6deploy.org</u> will be distributed to a mailing list composed of volunteers who are available to answer (or forward) any kind of questions, requests, etc. Also a web form can be used to send requests to the project.

Additionally, the attendees (and trainers from the region) can follow the e-learning course and/or check the availability of the 6DEPLOY remote labs and use these.

Attendees showed interest in further workshops and in the possibility of using the remote labs employed during the workshop. There was a request for simplified IPv6 content to be used in introducing IPv6 in some courses given in Kenya.

All requests were attended to and forwarded to the project that would provide support for all needs related to IPv6.

## 5. ANALYSIS OF THE FEEDBACK QUESTIONNAIRES

A questionnaire has been specially designed for the purpose of getting feedback from the participants regarding the suitability of the course material, and the presenters' ability to convey information, and the relevance of the information to the expectations of the attendees.

Personal information was not mandatory, so as to allow for anonymous responses. Each participant was first asked to indicate:

- his/her organisation and job responsibilities, and
- his/her plans for IPv6 deployment in his/her organisation.

Then, for each theoretical presentation and "hands-on" session, each participant was requested to assess "usefulness", "quality of presentation", "familiarity with the topic", "quality of the course documentation", "general organisation", etc.

## **5.1 General questions related to participants and IPv6**

About the participants		
99 participants were present, 64 q	uestionnaires were returned	
	Government	11
	University or other higher education	20
	Schools or further education	1
Employment sector	Research	1
	Health	1
	Commercial	13
	Other (please specify)	Several (17)*
	Government Advisor	2
	Senior Manager	2
	IT Manager	8
Job function	Systems Administrator	24
Job function	Network Administrator	18
	Researcher / Postgraduate	0
	Undergraduate	0
	Other (please specify)	Several (16)*
Usage of IPv6		
Do you use IDv6 yourself?	Yes	3
Do you use IPvo yoursell!	No	59
	Yes	0
Does your organisation use	No, but planned in this year	21
	No, but planned in the next year	8
TL AO:	No, but planned in the longer term	16
	No, and no plans as yet	18

\* See the graphics section for more information

Table 5-1: General questions related to participants and IPv6

## 5.2 Questions regarding the workshop

About the Workshop				
Usefulness of the topic	Very useful	Useful	Slightly useful	Not useful
IPv6: Protocols and Standards	38	23	1	1
IPv6 Deployment: DNS and IPv6	34	28	1	0
IPv6 Transition	35	26	2	0
IPv6 Security	34	20	2	0
IPv6 Routing OSPEv3 MP-BGP	31	27	5	0
	51	27		<u> </u>
Quality of the presentation	Excellent	Good	Average	Poor
IPv6: Protocols and Standards	17	42	4	0
IPv6 Deployment: DNS and IPv6 Applications	11	46	6	0
IPv6 Transition	14	42	7	0
IPv6 Security	15	41	7	0
IPv6 Routing, OSPFv3, MP-BGP	14	39	10	0
Familiarity with the topic?	None	Some	Most	All
IPv6: Protocols and Standards	9	33	16	4
IPv6 Deployment: DNS and IPv6 Applications	20	29	11	2
IPv6 Transition	20	32	8	2
IPv6 Security	22	30	8	3
IPv6 Routing, OSPFv3, MP-BGP	21	30	8	2
Quality of the course documentation	Excellent	Good	Average	Poor
	16	39	9	0
General workshop organisation	Excellent	Good	Average	Poor
	21	40	3	0
Recommend to your colleagues?	yes	no		
	64	0		

<b>Table 5-2:</b>	Questions	regarding	the	workshop
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## **5.3 Results graphics**

Following are some graphics that represent the above results in a more friendly way, so as to ease their interpretation.





Figure 5-1: In which employment sector do you work?





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#### Figure 5-3: Which of the following best describes your job function?



#### Figure 5-4: Do you use IPv6 yourself?



Figure 5-5: How useful did you find the presentations?



Figure 5-6: How well were the sessions presented?



Figure 5-7: How much of the workshop material was already familiar?



Figure 5-8: Quality of course documentation?









Figure 5-10: Would you recommend the workshop to your colleagues?

## **5.4 Participants comments**

It should be noted that the participants had different technical backgrounds. For example, some were network engineers (and therefore more interested in routing protocols and troubleshooting practices) while others were system administrators (and therefore more interested in applications and monitoring tools). Depending upon their background, some participants would have preferred to spend more time on Management, Applications, "hands-on", or to have a "hands-on" session related to security issues. It is also worth mentioning that a few attendees remarked that the sessions where too short, and that they would have been happy to work much later in the evening for more "hands-on" exercises.

Within the questionnaire there were three open questions where the trainees could give their feedback on the workshop. Below are almost all of the responses. Note that some are repeated (number put between parentheses).

Here are some comments provided by the trainees:

== Begin of the excerpts

What topics would you have liked to hear more about?:

- (25) IPv6 Security.
- (17) IPv6 routing, OSPFv3, MP-BGP.
- (14) IPv6 Transition.
- (9) IPv6 Subnetting and addressing scheme.
- (7) IPv6 Application.
- (6) IPv6 DNS, deployment.

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•	(3)	IPv6 deployment	
•	(2)	IPv6 router config	guration.
•	(2)	IPv6 Mobility.	
•	(2)	protocols and sta	ndards.
•	(2)	Switching and VL	AN in IPv6 environments.
•	(2)	DHCPv6.	
•	(2)	Labs.	
•	(1)	IPv6 Multihoming	g in BGP.
•	(1)	local and oversea	as routing.
•	(1)	Proxies.	
•	(1)	ULA prefix assigr	nment.
•	(1)	IPv6 on Cisco rol	uters / OSPF.
•	(1)	IPv6 on linux.	
•	(1)	BGP and OSPF us	sing the opensource zebra/quagga.
•	(1)	Software (OS) in	plementation.
•	(1)	Regulatory interv	entions in transition to IPv6.
•	(1)	More about who	is using IPv6.
•	(1) our ne	The support that etwork to IPv6.	we can get as an organization when we want to change
•	(1)	Recommendation	ns on migration to IPv6.
•	(1)	6to4 process con	figuration.
•	(1)	Mobile Applicatio	ns.
What	topics	would you have lii	ked to <b>hear less about</b> ?
•	(3)	Protocols and sta	ndards.
•	(2)	Security.	

- (1) IPv6 policies, protocol and standards.
- (1) A step by step guide on how to plan and roll out an IPv6 network.
- (1) Mobility.
- (1) BGP/OSPF.
- (1) History of IPv6.
- *(1) Theory.*
- (1) Concentration of Cisco OS, we would like it to be more wholesome include other router hardware, unix, linux and other.

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#### Any other comments:

- (7) Thank you for very good, informative workshop.
- (5) Organize more workshop in order to reach all every interested party.
- (4) Improve the material used in the OSPF and BGP lab: more detailed steps.
- (4) More instructors in place.
- (3) More lab work should have been added to the workshop.
- (2) Maybe you can get a network simulator and each member to follow principal.
- (2) Very informative. You should organise follow-up workshops or form groups for correspondence on the topic.
- (2) I think the lecturer would have been better had the sessions been segregated as eg. ISP's, higher educations, small enterprises, since some material was unnecessarily too technical.
- (1) Additional training material such as routers (local) should be added to the training material available.
- (1) Make sure the labs are more organized and working.
- (1) Great work on IPv6 awareness. Keep it up!!
- (1) Kindly make the presentation shorter.
- (1) Please consider router simulator in future.
- (1) The workshop was helpful but I would prefer more practical session in the future than theory.
- (1) In the practical, no assumptions should have been made about the participants knowledge of Cisco. Most of us were unfamiliar with it.
- (1) Perhaps the teacher should have taken longer to enhance understanding of topic.
- (1) Most end users are not concerned with OSPF/BGP/RIP configurations, but a single default route (static). This lab almost confused us.
- (1) Needed to know how to apply IPv6 on my LAN and gateway only.
- (1) Still need more time to play with IPv6 to a comfortable level before deploying.
- (1) Time was too short.
- (1) Too many people at one time, workshops should be smaller.5 people + laptops to 1 table is crazy.
- (1) If it would be possible to allow the students to practise for like one month on the routers.
- (1) Available material to be taught in university about IPv6 (basic materials about IPv6).

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•	(1)	Show the process of setting up an IPv6 network as a set of steps.		
•	(1)	Good interactive session.		

- (1) Wish this would be re-done when most of our ISPs have embraced IPv6.
- (1) Should be arranged more often to appreciate the transition of IPv4 to IPv6.
- (1) More training is required since IPv6 approach is totally different from IPv4.
- (1) Thank you for the appointment of Africa, especially Kenya for the launch of IPv6.
- (1) Arrangement to have adequate Internet Connectivity.
- (1) Not a bad start, it will give us a good start on IPv6.
- (1) Consider running the course in phases eg. Phase 1, phase 2, ..., phase n. Each phase being more advanced than the previous one.

End of the excerpts ==

## 6. **CONCLUSIONS**

Workshops are a key mechanism through which information, knowledge, and knowhow are transferred to less experienced countries and participants. The workshops enable us to build constituencies and raise awareness; disseminate, benchmark, and validate the research results from the EU's Framework Programmes; promote European technologies; exchange best practices; and offer information related to standards and interoperability issues.

This 6DEPLOY workshop took place in Nairobi (Kenya) from 17th to 19th June 2008, at the KENIC-AfriNIC IPv6 Workshop. Consulintel led this workshop, which was targeted at the African region; and were supported by AfriNIC. Thanks to previous projects and training activities, most of the IPv6 education material needed to start the 6DEPLOY workshop training was available from the very beginning. The material included most of the issues of Internet deployment and evolution, especially IPv4-IPv6 transition/co-existence strategies, DNS, Autoconfiguration, Routing and Applications.

Approximately 110 network engineers, system administrators, and regulators participated in the event. The topics presented were selected according to the participants' requirements.

According to the evaluation forms and the comments from the participants at the workshop, it is clear that there is significant interest in the region for the IPv6 technology. The participants expressed positive comments on the workshop's usefulness and organisation. They also requested that 6DEPLOY organise more workshops in the region with more specific technical subjects. Furthermore, some of the attendees expressed interest in participating in any subsequent "Training the Trainers" courses.

Some new ideas have already been discussed to improve the existing material, such as adding more "applications-oriented" elements to the labs, which might be of interest for IPv6 deployments.

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 new material.

In summary, this workshop should be considered a success regarding the dissemination of IPv6 in Kenya (and by extension in Africa), and is only the first of many steps towards the deployment of real IPv6 networks and services in the region.

## 7. **References**

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

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

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

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

How-to organise an IPv6 workshop:

http://6diss.6deploy.org/workshops/workshop-guidelines.pdf

Training the trainers workshop: <u>http://6diss.6deploy.org/workshops/ttt/</u>

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

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