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Abstract:
This deliverable presents a report from the workshop held in Praia (Cape Verde) from the 12th May to 14th May 2010. The presentation material is listed, and the attendees and their affiliations are included.

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	29/06/2010	Document creation	Carlos Friaças (FCCN)
V0.2	30/06/2010	Revision	Jorge Brás (FCCN)
V1.0	17/08/2010	Modifications incorporated and sent to the EC	Alicia Higa, Martin Potts (Martel)

Executive Summary

One of the main activities in the 6DEPLOY project is to organize 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 document describes the 17th of these IPv6 training workshops, which took place in Praia (Cape Verde) from the 12th May 2010 to the 14th May 2010. The workshop was well attended (27 participants) and comprised both slide presentations and hands-on exercises using the participants' laptops. The workshop material was mostly FCCN translated content from previous 6DISS and 6DEPLOY workshops, adapted to participants' needs. 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, the "hands-on" exercises that were performed, etc. 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.

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1. INTRODUCTION

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 organizations in International Cooperation Partner Countries, including countries in Africa, Asia and Latin America, by involving organizations 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 organize workshops to 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

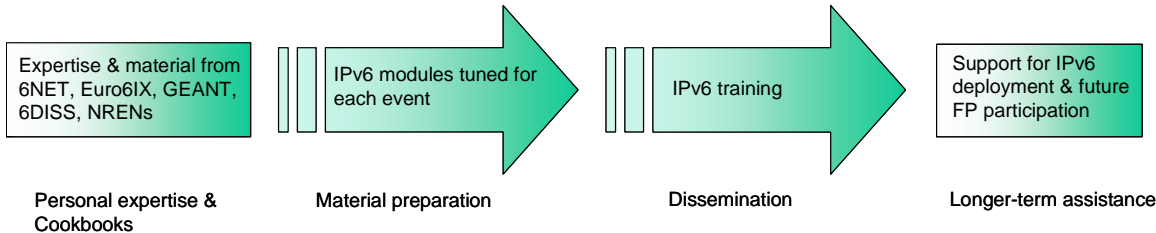The 6DEPLOY methodology relating to the workshops is shown in the diagram below:

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, Mobile IP, 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".

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 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 organizations 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, format and contents were tailored in conjunction with the local organizers so as to suit

the type of participants, the subjects to be addressed, the location, the host and sponsoring organization (ANAC – The National Communications Authority of Cape Verde).

3. THE 6DEPLOY WORKSHOP IN PRAIA (CAPE VERDE)

General aspects about the workshop are referenced in the Overview section where then the attendees and their affiliations are described. The programme and the material outlined are included in the Workshop Programme section. The material is divided into theoretical modules and hands-on sessions. In addition, some photos taken during the workshop has also been included. .

3.1 Overview

The workshop was held during three days and comprised eight different topics, with a "hands-on" session related to each topic. The balance between theoretical presentations and "hands-on" time was about 50% each. The day before the workshop started (11th May) was planned to be the «setup day», however, the trainers could only fly in at the end of this day, due to flight delays caused by the Icelandic volcanic ash problem.

Individuals from 6DEPLOY who presented at this workshop were Carlos Friaças (FCCN) and Jorge Brás (FCCN). The workshop was held with the assistance of Ms. Suzete Centeio of ANAC who organized the logistics and also attended the workshop. The audience had questions about each topic, especially in the workshop's "hands-on" sessions. Local Internet Service Providers and State Organizations even without any prior knowledge about IPv6 (or from other types of organizations) benefited from the event.

3.2 Attendees

No.	Surname	First name	Affiliation
1	TIMAS	PAULO	COMPTA CABO VERDE
2	CRUZ	YURI	NOSI
3	RIBEIRO	ERNÂNDIA	NOSI
4	ROSÁRIO	ARMANDINA	NOSI
5	SILVA	CARLOS	CAMÂRA MUNICIPAL DA PRAIA
6	PINA	BRUNO	CABO VERDE TELECOM
7	FERREIRA	JORGE	CABO VERDE TELECOM
8	RODRIGUES	ARLINDO	
9	BRITO	EZEQUIEL	CABO VERDE TELECOM
10	GONÇALVES	JEIR	POLÍCIA JUDICIÁRIA
11	MONTEIRO	OCTÁVIO	POLÍCIA JUDICIÁRIA
12	FRAGOSO	ANTÓNIO	BANCO BAI
13	SANTOS	ADMILTON	BANCO BAI
14	DIAS	ALCINDO	CABO VERDE TELECOM
15	COSTA	PAULO	ANAC
16	SILVA	NUIAS	SISP
17	GOMES	DAVID	ANAC
18	FERNANDES	GAUDÊNCIO	SISP

19	SEMEDO	DILSON	UNIVERSIDADE DE CABO VERDE
20	SILVA	ELCELINA	UNIVERSIDADE DE CABO VERDE
21	RAMOS	JOÃO	ANAC
22	FERNANDES	CLAUDINO	
23	RODRIGUES	ANTÓNIO	T+
24	CENTEIO	SUZETE	ANAC
25	ALMEIDA	CELSO	BRITHOL MICHCOMA
26	RAMOS	LUÍS	ANAC
27	MODESTO	GILSON	CVNET

Table 3-1: List of participants

The attendees brought their own laptops. Every computer in the room was then plugged into the local network, connected to the world by a 2Mbps connection kindly provided by CVT. A connection to the IPv6 Internet was then established, using a tunnel setup from Praia to Lisbon, directly into FCCN's backbone.

The requirements for participation in the workshop were:

- Laptop running on Windows XP/Vista/7, MAC OS, or any Linux distribution.

- Knowledge about basic TCP/IP.

- Knowledge about Windows and Linux (added advantage but not a requirement).

In all cases the attendees were technical people, but whose knowledge about IPv6 was almost at a beginners' level.

The workshop attendees are part of a local group of people who will collectively determine the rate of deployment of the latest Internet technologies in their country. Therefore, the impact will be that they will promote the upgrading of the networks.

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

3.3 Workshop Programme

The agenda was agreed on after close collaboration with the local organizers from ANAC. The configuration exercises which were held in the Portuguese language were updated from the ones used in the Mozambique workshop, which was also in Portuguese. The workshop agenda and the related material were submitted in advance, so that the local organizers could decide which topics should be prioritised in order to manage the logistics accordingly. As was requested by most of the participating organizations, the "hands-on" sessions took around 50% of the overall training workshop time. The programme of the workshop is presented in the following table:

Date	Time	Session	Modules of session
12/05/2010	09:00	Session 1	Welcome Address About 6DEPLOY Introduction Addressing Autoconfiguration
12/05/2010	14:00	Session 2	Hands-On #1: IPv6 in Windows Hands-On #2: IPv6 in Linux Hands-On #3: Router Configuration
13/05/2010	09:00	Session 3	DNS Management Applications
13/05/2010	14:00	Session 4	Hands-On #4: Router Configuration Hands-On #5: DNS
14/05/2010	09:00	Session 5	Hands-On #6: Services - Apache and FTP Security Routing Protocols
14/05/2010	14:00	Session 7	Hands-On #7: Security Feedback Forms Closing Address

Table 3-2: Workshop programme

3.4 Presentation material

The agenda was composed by presentations (modules) and "hands-on" sessions.

3.4.1 Modules

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

- **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. Also, Header Formats & Packet Size, and IPv6 addressing issues were presented.

- **Addressing**: This module describes types of IPv6 addresses, statistics on IPv6 allocations and addressing plans.

- **Auto configuration, including DHCPv6 and Prefix Delegation**: This module describes new protocols associated with IPv6 Auto configuration: e.g.

Neighbour Discovery Protocol, DHCPv6, Prefix Delegation, etc.

- **DNS**: This module describes new Resource Records for IPv6 DNS, the availability of IPv6 in the root servers zone and CC-TLDs, the DNS usage in servers and clients, etc.

- **Management**: This module explains aspects related to SNMP, remote access, monitoring tools, etc.

- **Applications**: This module focuses on IPv6 aspects of basic services (Web, E-Mail, FTP), and also on Multicast, Video Conference and Streaming, and Peer-to-Peer Protocols.

- **Security**: This module revisits some security threats, describes IPv6 firewalls usage scenarios, and includes an introduction to IPsec.

- **IPv6 routing**: This module mainly describes the differences between IPv4 and IPv6 routing protocols (BGP4+, RIPng, OSPFv3 and IS-IS).

3.4.2 Hands-on exercises

A set of practical exercises (known as 'hands-on modules') has been designed to help ensure the workshop attendees will be able to install IPv6 in their own environment once the course is over. These exercises were performed on the attendees' laptops.

Below is a brief description of objectives related to each of the "hands-on" exercises that were performed in this workshop:

- **Hands-On #1 – IPv6 in Windows:**

  Activate IPv6 in WinXP based PCs
  Understand IPv6's basic concepts
  Manually add/remove IPv6 addresses in WinXP based systems

- **Hands-On #2 – IPv6 in Linux:**

  Verify IPv6 kernel support
  Add/Remove manually IPv6 address in a Linux based system
  Use and tryout some Linux IPv6 tools

- **Hands-On #3 & #4 – Router Configuration:**

  Activate and configure IPv6 on a Quagga router interface
  Visualize some information about IPv6 on a Quagga router
  Configuring Router Advertisement (RA) options on a Quagga router interface
  Adding static routes on a Quagga router

- **Hands-On #5 – DNS:**

  Create a forward and reverse DNS zone

Add IPv6 related DNS records
Perform some DNS queries, in order to retrieve type A and AAAA records

- **Hands-On #6 – Services: Apache & FTP:**

  Configure and run an IPv6 virtual web server in Linux
  Configure and run an IPv6 FTP server in Windows
  Test services using IPv6 web and ftp clients

- **Hands-On #10 – Security:**

  Analyze IPv6 services running on a given server
  Configure access control lists (filters) for IPv6 traffic

3.5 Photographs taken at the event

Figure 3-1: Opening Session. ANAC's President and one of the Trainers

Figure 3-2: Attendees to the workshop

Figure 3-3: Attendees to the workshop

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 plans, etc. In this respect, the role of the *helpdesk* was explained as being the best method to submit questions. An e-mail to helpdesk@6deploy.org will be distributed to a mailing list composed of 6DEPLOY consortium volunteers who are available to answer (or forward) any kind of questions, requests, etc. A web form can also be used to send requests to the project.

Additionally, the attendees can follow the e-learning course and/or check the availability of the 6DEPLOY remote labs.

Due to the trainers' affiliation with a national research and education network (NREN), which also manages the country's DNS ccTLD, contacts were established with ANAC which is also the responsible entity for ccTLD management in Cape Verde (.CV). The presence of several ANAC members in this training enabled the establishment of contacts in order to pursue future cooperation with them, and the creation of a local IXP in Praia was briefly discussed.

5. ANALYSIS OF THE FEEDBACK QUESTIONNAIRES

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

Personal information was not mandatory, so as to allow for anonymous responses.

Each participant was first asked to indicate:

- His/her organization and job responsibilities
- His/her plans for IPv6 deployment in his/her organization

Then, for each topic, each participant was requested to assess usefulness, quality of presentation, familiarity with the topic, quality of the course documentation, and general organization, etc.

5.1 General questions related to participants and IPv6

About the participants		
27 participants present, 25 questionnaires were returned		
	Government	11
	University or other higher education	3
Employment sector	Banca	4
	Telecommunications	5
	Private	2
	Network Administrator	7
	Systems Administrator	4
	IT Manager	4
	Researcher	3
	Electronics Engineer	1
Job function	Network & System Administrator	1
	Senior IT Manager	1
	IT Manager & Network Administrator	1
	Technician	1
	Consultant	1
	Regulator	1
Usage of IPv6		
	Yes	0
	No, but planned in this year	0
Does your organization use IPv6?	No, but planned in the next year	0
	No, but planned in the longer term	8
	No, and no plans as yet	17

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
Session 1 – About 6DEPLOY	17	7		
Session 2 – Introduction	19	5		
Session 3 – Addressing	16	8		
Session 4 – Autoconfiguration	12	12		
Session 5 – DNS	18	6		
Session 6 – Management	18	6		
Session 7 – Applications	16	8		
Session 8 – Security	19	5		
Session 9 – Routing Protocols	14	10		
Quality of the presentation	Excellent	Good	Average	Poor
Session 1 – About 6DEPLOY	13	11		
Session 2 – Introduction	14	10		
Session 3 – Addressing	10	14		
Session 4 – Autoconfiguration	12	12		
Session 5 – DNS	12	12		
Session 6 – Management	15	9		
Session 7 – Applications	14	10		
Session 8 – Security	12	12		
Session 9 – Routing Protocols	12	12		
Familiarity with the topic?	None	Some	Most	All
Session 1 – About 6DEPLOY	12	9	3	
Session 2 – Introduction	1	15	5	3
Session 3 – Addressing	2	14	7	1
Session 4 – Autoconfiguration	5	16	3	
Session 5 – DNS	6	11	5	2
Session 6 – Management	6	14	4	
Session 7 – Applications	4	13	7	
Session 8 – Security	5	10	7	2
Session 9 – Routing Protocols	5	13	6	
Quality of the course documentation	Excellent	Good	Average	Poor
	9	15	1	
General workshop organization	Excellent	Good	Average	Poor
	11	14	0	
Recommend to your colleagues?	Yes	no		
	25			

Table 5-2: Questions regarding the workshop

5.3 Feedback Questionnaires - Graphics

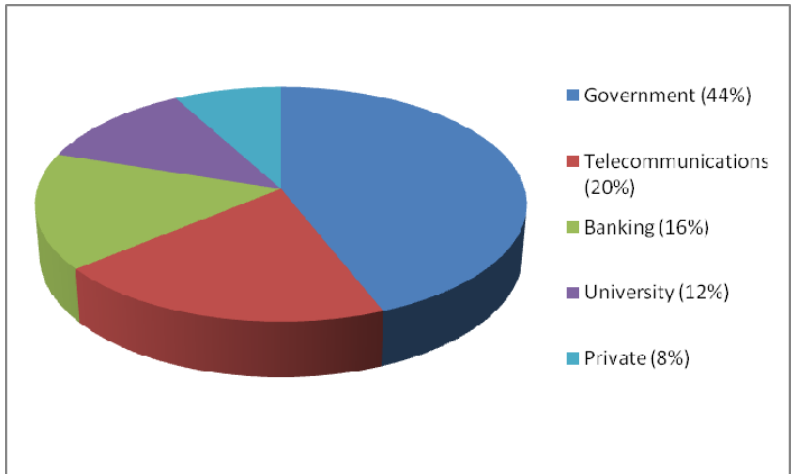Following are some graphics that represent the above results.

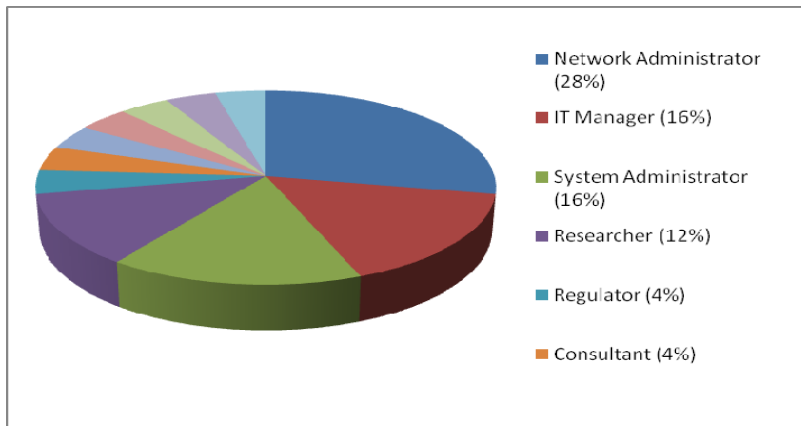**Figure 5-1: In which employment sector do you work?**

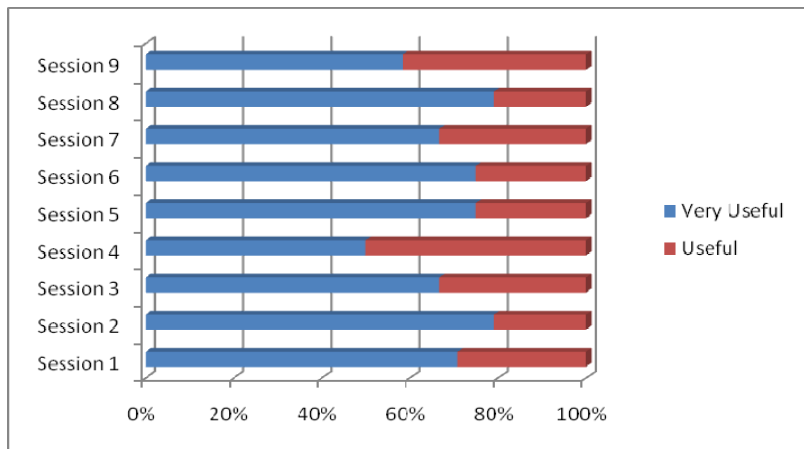**Figure 5-2: Which of the following best describes your job function?**

Figure 5-3: How useful did you find the presentations?
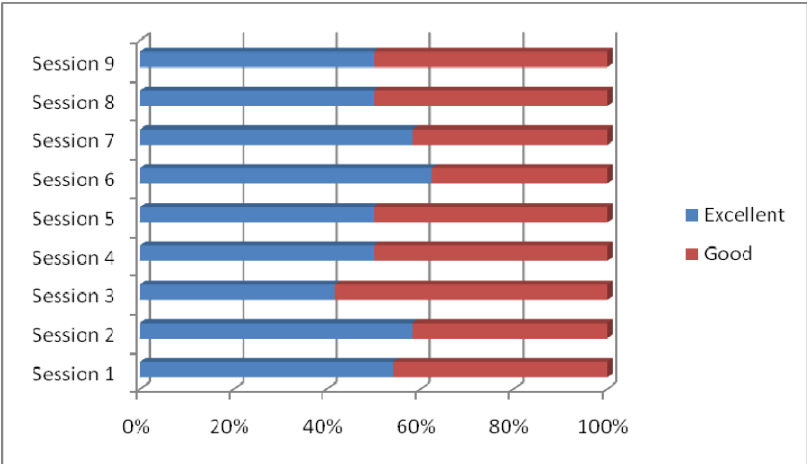
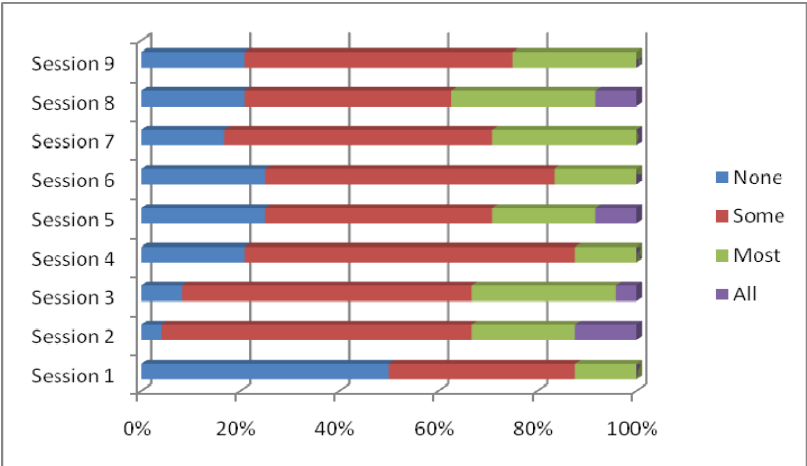**Figure 5-4: How well were the sessions presented?**

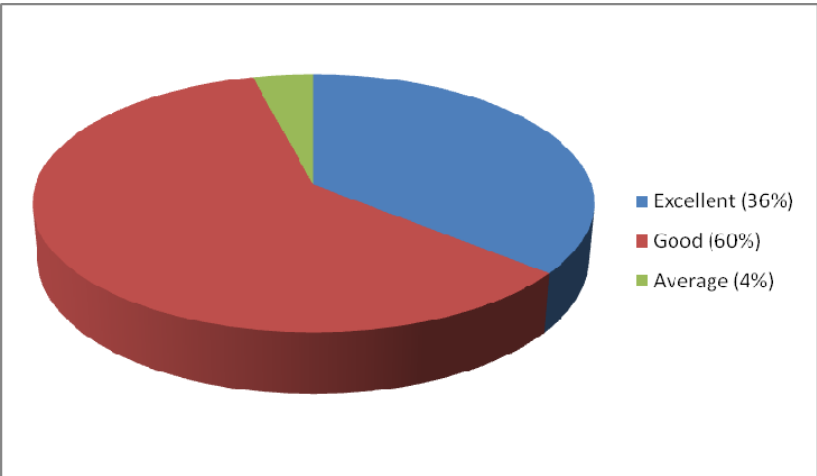**Figure 5-5: How much of the workshop material was already familiar?**
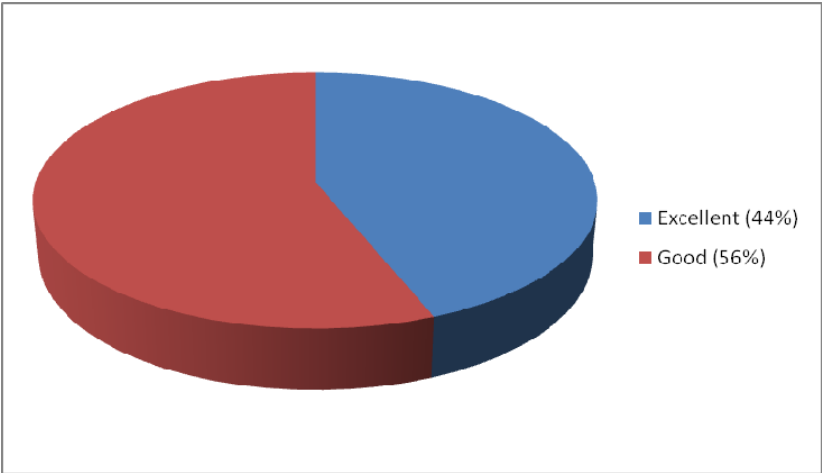
Figure 5-6: Quality of documentation?

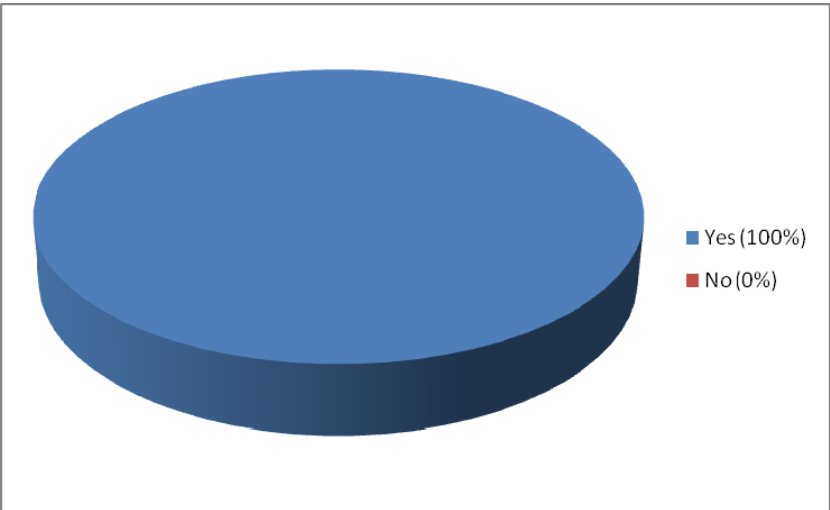**Figure 5-7: General organization of the workshop?**

Figure 5-8: 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.

There were three open questions where the trainees could provide their feedback on the workshop in the questionnaire. Below are almost all or some of the responses are repeated (number indicated).

The following are some comments provided by the trainees:

== Begin of the excerpts

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

- Addressing and DNS

- Addressing, Management and Security

- DNS, Addressing and Applications

- DNS, Applications and Security (2)

- Wireless Networks Configurations

- Router Configuration using Linux

- DNS, Management, Applications, Security, Routing, Cisco equipments with IPv6 and ISA server with IPv6

- DNS, Webserver Configuration

- Security (2)

- Security, Management and DNS

- Security, Addressing and Routing

- Security and Addressing

- Security and DNS

- Security, Management and Applications

- Security Mechanisms and Configuration Mechanisms

- DNS, Management, Security and Routing

- Tunneling to allow IPv4 and IPv6 communication, and more detail about IPSec

- More DNS practical exercises, and a management tool exercise

*What topics would you have liked to **hear less about**?*

- IPv6, Addressing and DNS;

- The possible IPv4 usage decline;

- On the other hand, subjects should be approached with more detail;

- Despite IPv6 is projected and running for quite some time, it's never too much regarding knowledge transmission.

*Any **other comments**:*

- I would have a better participation if I worked directly with computer networks, however, I was motivated to deepen my knowledge in this field.

- This workshop was very good, providing insights about IPv6 by comparison with IPv4. It was very balanced between theoretical and practical content. The practical component was very strong with the labs, where we enjoyed this training provided by trainers with large competence.

- Activities like this one should be programmed for the future, and it should also be promoted by ANAC other local workshops to discuss more themes in this field;

- This training was very useful in the scope of IPv6 initiation. With the information we just received we can now go further and face naturally the challenges of IPv6 implementation;

- Generally, it was 3 days of good presentations which will be very useful to me. The majority of contents I already received in a previous training at my company. But the labs part of the training had a real positive impact. It was a very good training;

- Maybe we would need more time for practical exercises, in order for them to be more supported by the trainers;

- A big contribution to the process of IPv6 implementation in Cape Verde;

- I would like to have seen more practical exercises (labs) on this training;

- The training was, on a general sense, excellent for a first approach to IPv6. In future opportunities it would be good to go deeper in topics like DNS, Security and Management.

End of the excerpts ==

6. CONCLUSIONS

Workshops are a key mechanism through which information, knowledge, and know-how are transferred to less experienced groups of professionals across several countries. The workshops enable project 6DEPLOY to build constituencies and raise awareness about IPv6; disseminate, benchmark, and validate the research results from 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 Praia (Cape Verde) from the 12th May 2010 to the 14th May 2010.

FCCN led this workshop with strong cooperation and support from ANAC, the local Telecommunications Regulatory Office.

The set of training material included most of the issues of Internet deployment and evolution, especially DNS, Auto configuration, Routing and Applications.

25 IT professionals 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 IPv6 technology. The participants expressed positive comments on the workshop's usefulness and organization.

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 and updated content.

In summary, this workshop should be considered a success based on the extended dissemination about IPv6 in Cape Verde, and was a positive effort towards the deployment of real IPv6 networks in this country.

7. REFERENCES

6DEPLOY website: http://www.6deploy.eu

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

Hands-on modules: http://6diss.6deploy.eu/publications/deliverables/hands-on.pdf

How-to organize an IPv6 workshop:

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

Training the trainers workshop: http://6diss.6deploy.eu/workshops/ttt/

e-learning package: http://6diss.6deploy.eu/publications/multimedia/e-learning.iso

e-learning on-line: http://www.6deploy.eu/e-learning/english