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<b>Abstract:</b> This deliverable presents a report from the workshop held in Prague (Czech Republic) from March 21 <sup>st</sup> – 23 <sup>rd</sup> , 2011. 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.
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<b>Keywords:</b> IPv6, Support, LAC, Training, Testbeds, Modules, 6DISS, 6DEPLOY, Hands-on exercises
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# Executive Summary

One of the main activities in the 6DEPLOY-2 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 report details the IPv6 workshop which took place from March 21st – 23<sup>rd</sup>, 2011 on the premises of the Faculty of Information Technology of the Czech Technical University (FIT – Kolejní 2a, Prague 6 – Dejvice).

The workshop was organized by FIT and CESNET. The workshop launched the operation of the recently-installed 6DEPLOY IPv6 Lab at FIT. The following workshop details are described in this report: a) the workshop attendees and their affiliations, b) the programme outline, c) the material presented, d) hands-on exercises, e) an assessment of the opportunities for further co-operation and follow-up actions planned, and f) an analysis of the feedback questionnaires from the participants.

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## 1. INTRODUCTION

### 1.1 6DEPLOY-2 Objectives

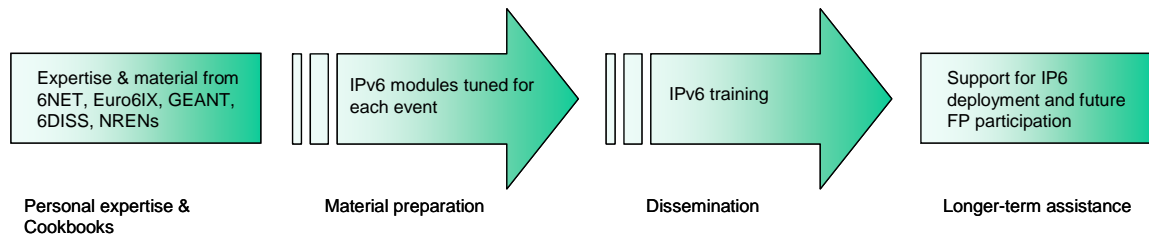
The following comprise the 6DEPLOY-2 objectives:

- to support the deployment of IPv6, in Europe and developing regions
- to sustain the wealth of 6DEPLOY training material (e-learning package with subtitles in national languages, presentation material, exercises, etc.)
- to create a catalyst of global IPv6 expertise through the installation of strategically-placed sustainable IPv6 training labs
- to synchronise with the training schedules of AfrinIC and LACNIC (and also APNIC) to exploit training opportunities cost effectively in Africa, Latin America and Asia
- to revive the IPv6 Cluster
- to describe deployment examples on the project Website
- to exploit the expertise and high quality training material from 6DEPLOY, including presentations, the e-learning course and the available IPv6 Labs, and - whilst continuing to offer professional training to organisations in Europe and developing countries - focus on supporting real deployments
- to maintain and update the 6DEPLOY material and include new training media, and multiply its training effectiveness through courses which educate other trainers about the basics of IPv6, so that they can teach others ("training trainers")
- to extend to global scale the IPv6 Labs. Sustainability is achieved initially through the careful selection of locations for the installations (e.g. within NRENs) where the connectivity, funding and qualified staff support are all secured
- to support the (human) networking between the Lab managers with regular workshops.

One of the main activities in the 6DEPLOY-2 project is therefore to organise 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-2 Workshop Methodology

The 6DEPLOY-2 methodology relating to the workshops is shown in the diagram below:



**Figure 1-1: 6DEPLOY-2 methodology (diagrammatically)**

The approach is to use course material available from 6DEPLOY and elsewhere that relates to IPv6, the e-learning course, and the 6NET IPv6 Deployment Guide book, together which will form 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 are collected from the participants, enabling 6DEPLOY-2 to assess the impact of the presentations and to identify any areas that need improvement.

The full set of dissemination materials (including the e-learning course and several managed testbeds) is available from 6DEPLOY 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 D1.1.1 "Report of the available training material and the assignment of partners responsible for maintaining each item".

This deliverable presents a report from the workshop held in Prague, Czech Republic from 21<sup>st</sup> to 23<sup>rd</sup> March 2011. The workshop comprised both slide presentations and hands-on exercises.

Chapter 2 of this document explains the general motivation for running IPv6 workshops, and Chapter 3 describe the specific details of this workshop, in terms of the

attendees, the modules that were presented, and the “hands-on” exercises that were performed. Chapter 4 identifies opportunities for further collaboration in the region and follow up actions, Chapter 5 summarises the analysis of the feedback questionnaires that were filled in by the participants, and Chapter 6 provides some general conclusions.



## 2. THE WORKSHOPS (GENERAL)

Workshops are one of the main mechanisms used by 6DEPLOY-2 to transfer information and to build collaboration.

6DEPLOY-2 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-2 have deployed IPv6 on a production basis in their own NRENs, University networks and even on much larger scales. They 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 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; and
- 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 these workshops was collected, and the workshop schedules,

formats, 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-2 WORKSHOP IN PRAGUE, CZECH REPUBLIC

This workshop was held on March 21st – 23<sup>rd</sup>, 2011 on the premises of the Faculty of Information Technology of the Czech Technical University (FIT – Kolejní 2a, Prague 6 – Dejvice). The workshop was organized by FIT and CESNET. The workshop launched the trial operation of the IPv6 Lab – a shared laboratory of FIT. The Prague IPv6 Workshop included the formal opening of the IPv6 Laboratory donated by Cisco who has donated other similar 6DEPLOY laboratories.

Details of the workshop and the training material used could be found in 6DEPLOY's project web site:

[http://www.6deploy.eu/index.php?page=20110321\\_prague\\_czech\\_republic](http://www.6deploy.eu/index.php?page=20110321_prague_czech_republic)

#### 3.1 Overview

6DEPLOY-2 representatives at the workshop were M. Potts of Martel GmbH, A. Yourtchenko and Pierre Hooghen of Cisco, J. Mohacsi of NIIFI and A. Zafeiropoulos of GRNET.

The attendees came from previous networking experiences therefore, the workshop was mainly focused on IPv6, its theoretical summary and utilizing this knowledge in real (lab-simulated on real devices) situations from IPv6 network configuration across static/dynamic routing to IPv6 server (www) configuration. .

After the IP wireless sensors session, an introduction to IPv6 was given. Specific IPv6 materials were presented, including an introduction to basic IPv6 issues: header, addresses, associated protocols, and autoconfiguration. In addition, DNS and coexistence with IPv4 modules were presented.

The last part of the workshop was a hands-on practice using local LAN and linux machines.

#### 3.2 Attendees

Below is a list of people that attended:

No.	Name	Affiliation	Position
1	Jiri Brejcha	CISCO	College Intern
2	Lukas Fiala	Institute of Physics AS CR, v.v.i. (FZU)	Technician
3	Martin Cerny	CESNET, Association of legal	IT security, IT

		entities	Instructor
4	Michal Kostelec	University of West Bohemia	Network Engineer
5	Martin Zaloudek	Technical University of Liberec	Ph.D. student, teacher
6	Jiri Hnidek	Technical University in Liberec	Staff
7	Karel Sikola	Centre of Administration and Operations of the Academy of Sciences of the Czech Republic	IT Specialist
8	Jakub Serych	Secondary Technical School of communication technology	Head of IT
9	Jan Pinta	Czech University of Life Sciences Prague	Network Administrator
10	Viktor Bohuslav	Faculty of Electrical Engineering of Czech Technical University	Student

**Table 3-1: Prague Workshop list of participants**

### 3.3 Workshop programme

The agenda was agreed on after close collaboration with the local organisers. The meeting agenda and the related material were submitted in advance so that the local organisers could decide which topics should be prioritised and so manage the logistics accordingly. The programme of the workshop is presented in the following table:

Date	Time	Title of session
21/3/2011	9:00	Welcome and introductions
21/3/2011	9:30	Introduction to 6DEPLOY
21/3/2011	10:00	Introduction to IPv6
21/3/2011	10:30	Coffee Break
21/3/2011	10:50	IPv6 Basics: Protocol and Addressing
21/3/2011	12:00	Associated Protocols
21/3/2011	12:30	Lunch
21/3/2011	1:30	Auto-configuration
21/3/2011	2:30	IPv6 Support in the DNS
21/3/2011	3:30	Coffee Break
21/3/2011	3:50	Deployment and Transition mechanisms
21/3/2011	4:30	IPv6 Security

21/3/2011	5:30	Day Closing
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Date	Time	Title of session
22/3/2011	9:00	Routing and Addressing (theory).
22/3/2011	10:30	Coffee Break
22/3/2011	10:50	Routing (practical). Configuring routers (local 6DEPLOY testbed)
22/3/2011	12:30	Lunch
22/3/2011	13:30	IPv6 mobility (theory)
22/3/2011	15:30	Coffee Break
22/3/2011	15:50	IPv6 multicast (theory)
22/3/2011	17:30	Day Closing

Date	Time	Title of session
23/3/2011	9:00	IPv6 on clients (Windows and Linux)
23/3/2011	9:45	DNS
23/3/2011	10:30	Coffee Break
23/3/2011	10:50	Other Services (FTP, Web server)
23/3/2011	12:30	12:30 Lunch/Day Closing

Table 3-2: Prague Workshop programme

### 3.4 Presentation material

The following material was presented:

Modules	Presented by	Affiliation
Introduction to 6DEPLOY	M. Potts	Martel
Introduction to IPv6	A. Yourtchenko	Cisco
IPv6 Basics: Protocol and Addressing	A. Yourtchenko	Cisco
IPv6 Associated Protocols	A. Yourtchenko	Cisco
IPv6 Autoconfiguration	A. Yourtchenko	Cisco
IPv6 Support in the DNS	A. Zafeiropoulos	GRNET
IPv6 Deployment and Transition mechanisms	J. Mohacsi	NIIFI
IPv6 Security	J. Mohacsi	NIIFI
IPv6 Routing and Addressing (theory).	A. Yourtchenko	Cisco

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Routing (practical). Configuring routers (local 6DEPLOY testbed)	P. Hooghen	Cisco	
IPv6 mobility (theory)	P. Hooghen	Cisco	
IPv6 multicast (theory)	P. Hooghen	Cisco	
IPv6 on clients (Windows and Linux)	A. Yourtchenko	Cisco	
DNS	A. Zafeiropoulos	GRNET	
Other Services (FTP, Web server)	A. Yourtchenko	Cisco	

**Table 3-3: Prague Workshop list of modules used**

### 3.4.1 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 IPv6 protocol: IPv6 packet header, extensions headers and differences with 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.
- **IPv6 associated protocols:** This module describes new protocols associated to IPv6: e.g. Neighbour Discovery Protocol, ICMPv6, MLD, etc.
- **IPv6 Autoconfiguration:** This module describes stateful (DHCPv6) and stateless (Router Solicitation/Router Advertisement) autoconfiguration mechanisms.
- **IPv6 DNS:** This module describes new Resource Records for IPv6 DNS, availability of IPv6 in the root servers zone and CC-TLDs, etc.
- **Mobile IPv6:** This module describes IPv6 mobility and news features compared to IPv4 mobility.
- **Routing:** This module mainly describes the differences between IPv4 and IPv6 routing protocols for OSPFv3, EIGRP, RIPng, BGP4+, ISIS and MPLS.
- **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. Security issues from transition and coexistence point of view are also provided.

- **IPv6 Support in the DNS:** This module describes new Resource Records for IPv6 DNS, availability of IPv6 in the root servers zone and CC-TLDs, etc.
- **Deployment and Transition mechanisms:** 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). The deployment scenarios are described various address allocation and address management strategies.
- **Guide for Services and Applications:** This module describes the services and applications available for IPv6 (FTP, Web server, ...).

### 3.4.2 Hands-on exercises

To help understanding the IPv6 concepts and to let the participants have their first IPv6 experience, “hands-on” lab exercises were carried out using mainly local PCs with Ubuntu Linux or the participants’ own notebooks and a newly installed 6DEPLOY IPv6 Lab. There was at least one PC per participant at this workshop.

Lab exercises included:

- Check IPv6 is installed on linux platform (ifconfig and proc/ information)
- IPv6 network check/configuration
- IPv6 pings and packet capture (wireshark)
- Configure routing table, static/dynamic routing
- Enable DHCPv6 server and clients
- Connect to a web server over IPv6

## 4. OPPORTUNITIES FOR FURTHER CO-OPERATION

In all the workshops, the attendees were informed on how to stay in contact with the 6DEPLOY-2 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 way to submit questions. An e-mail to [helpdesk@6deploy.eu](mailto:helpdesk@6deploy.eu) 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, anyone can follow the e-learning course and/or check the availability of the 6DEPLOY-2 remote labs and use these.

A particular follow-up activity from Prague will be to incorporate the Lab Manager from FIT into the 6DEPLOY-2 Lab manager community and to use the Lab in subsequent 6DEPLOY-2 workshops.



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

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

<b>About the participants</b>		
10 participants were present, 8 questionnaires were returned		
<b>Employment sector</b>	Government	1
	University or other higher education	6
	Schools or further education	0
	Research	0
	Health	0
	Commercial	1
	Other (please specify)	
<b>Job function</b>	Government Advisor	0
	Senior Manager	1
	IT Manager	1
	Systems Administrator	1
	Network Administrator	1
	Researcher / Postgraduate	1
	Undergraduate	1
	Other (please specify)	2 (trainers)
<b>Usage of IPv6</b>		
Do you use IPv6 yourself?	Yes	2
	No	6
Does your organisation use IPv6?	Yes	2
	No, but planned in this year	1
	No, but planned in the next year	1
	No, but planned in the longer term	2
	No, and no plans as yet	2

\* See the graphics section for more information

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

## 5.2 Questions regarding the workshop

<b>About the Workshop</b>				
<b>Usefulness of the topic</b>	Very useful	Useful	Slightly useful	Not useful
Presentation 1 - IPv6 Introduction	3	3	2	0
Presentation 2 - IPv6 Addressing	5	2	1	0
Presentation 3 – Associated Protocols	3	4	1	0
Presentation 4 - Autoconfiguration	5	3	0	0
Presentation 5 – DNS	4	3	1	0
Presentation 6 - Transition	5	3	0	0
Presentation 7 - Security	5	2	1	0
Presentation 8 - IPv6 Routing	5	3	0	0
Presentation 9 – Mobility	3	5	0	0
Presentation 10 - Multicast	4	4	0	0
Practice 1 - Routing	7	1	0	0
Practice 2 – IPv6 on clients	5	3	0	0
Practice 3 – DNS	4	4	0	0
Practice 4 – Other services (FTP, Web server)	6	2	0	0
<b>Quality of the presentation</b>	Excellent	Good	Average	Poor
Presentation 1 - IPv6 Introduction	5	3	0	0
Presentation 2 - IPv6 Addressing	5	3	0	0
Presentation 3 – Associated Protocols	4	3	1	0
Presentation 4 - Autoconfiguration	5	3	0	0
Presentation 5 – DNS	5	3	0	0
Presentation 6 - Transition	6	2	0	0
Presentation 7 - Security	5	2	1	0
Presentation 8 - IPv6 Routing	5	3	0	0
Presentation 9 – Mobility	5	2	1	0
Presentation 10 - Multicast	4	4	0	0
Practice 1 - Routing	6	2	0	0
Practice 2 – IPv6 on clients	6	2	0	0
Practice 3 – DNS	5	3	0	0
Practice 4 – Other services (FTP, Web server)	5	3	0	0
<b>Familiarity with the topic?</b>	None	Some	Most	All
Presentation 1 - IPv6 Introduction	1	0	4	3
Presentation 2 - IPv6 Addressing	2	3	2	1
Presentation 3 – Associated Protocols	4	2	1	1
Presentation 4 - Autoconfiguration	3	2	2	1
Presentation 5 – DNS	3	3	1	1
Presentation 6 - Transition	3	2	2	1
Presentation 7 - Security	4	3	1	0
Presentation 8 - IPv6 Routing	3	2	2	1
Presentation 9 – Mobility	4	2	1	1
Presentation 10 - Multicast	4	2	1	1
Practice 1 - Routing	3	3	2	0
Practice 2 – IPv6 on clients	3	2	2	1
Practice 3 – DNS	4	2	1	1

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Practice 4 – Other services (FTP, Web server)	4	3	1	0
<b>Quality of the course documentation</b>	Excellent	Good	Average	Poor
	4	4	0	0
<b>General workshop organisation</b>	Excellent	Good	Average	Poor
	3	5	0	0
<b>Recommend to your colleagues?</b>	yes	no		
	8	0		

Table 5-2: Questions regarding the workshop

### 5.3 Results graphics

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

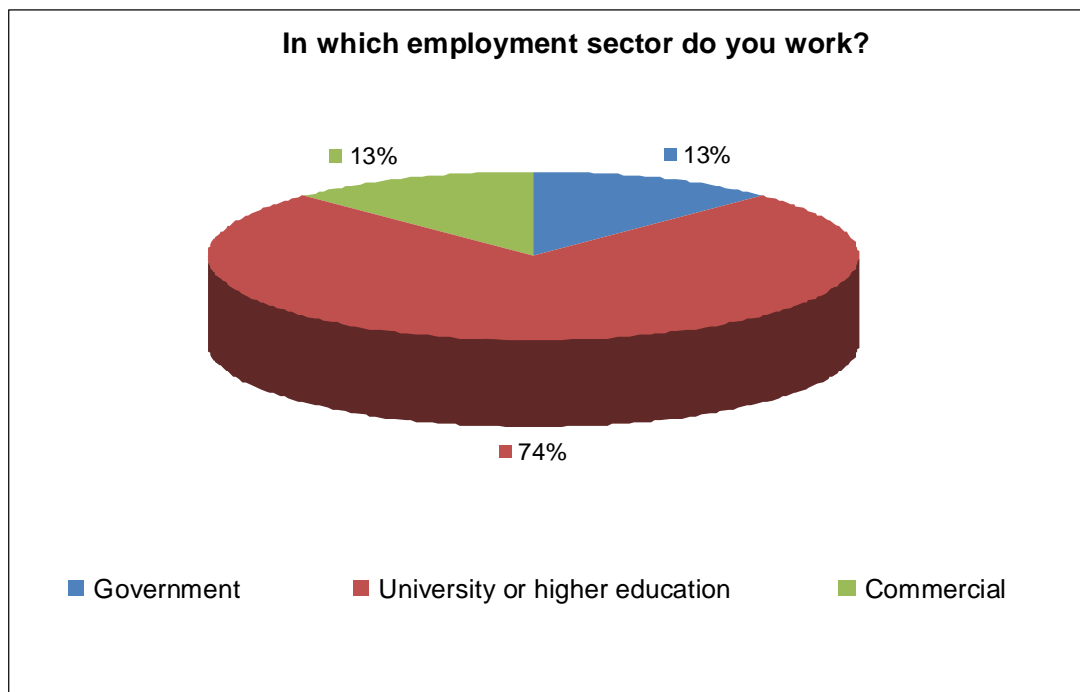


Figure 5-1: In which employment sector do you work?

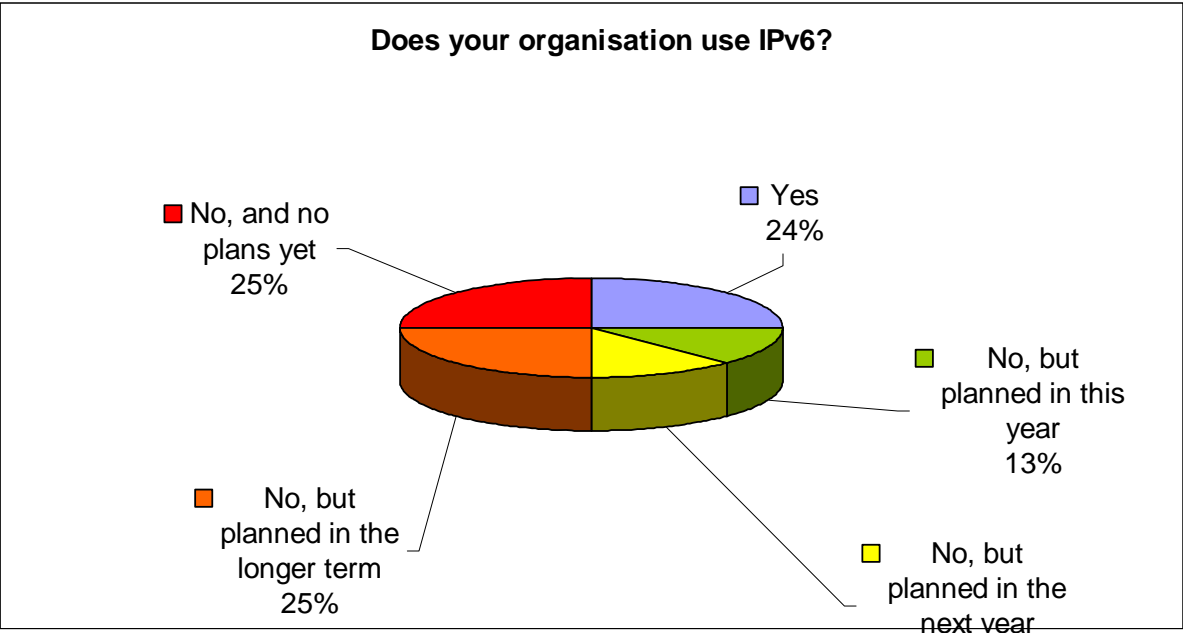


Figure 5-2: Does your organisation use IPv6?

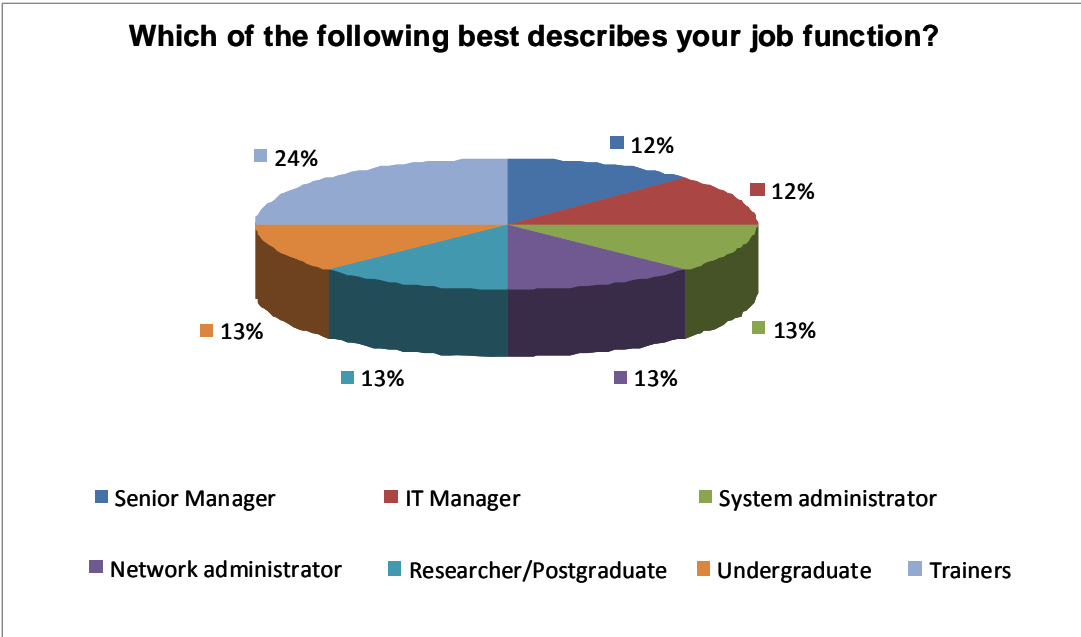


Figure 5-3: Which of the following best describes your job function?

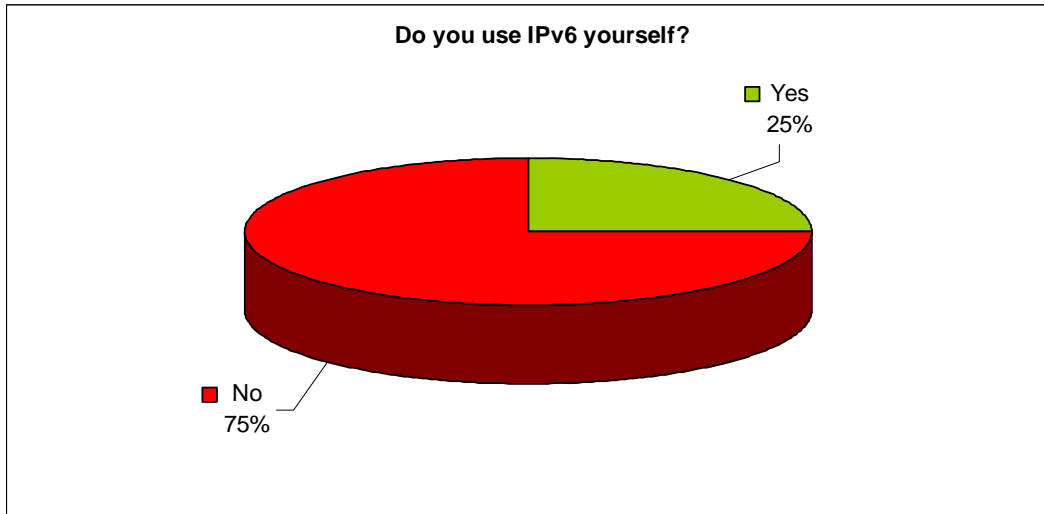


Figure 5-4: Do you use IPv6 yourself?

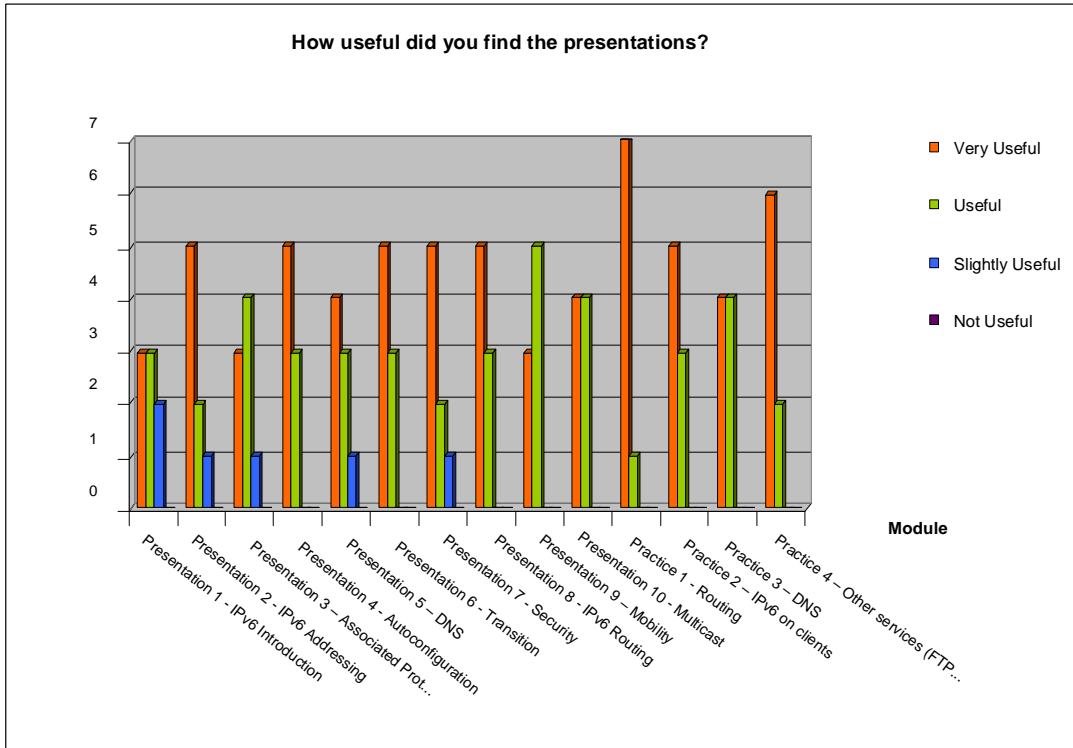


Figure 5-5: How useful did you find the presentations?

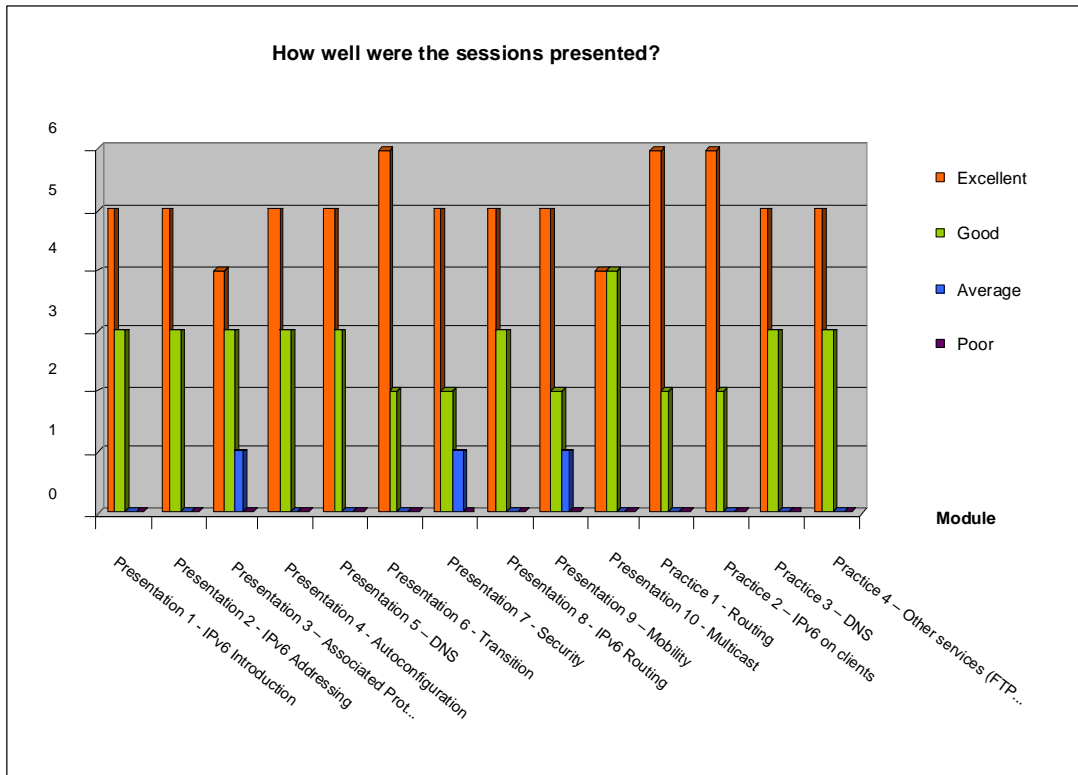


Figure 5-6: How well were the sessions presented?



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

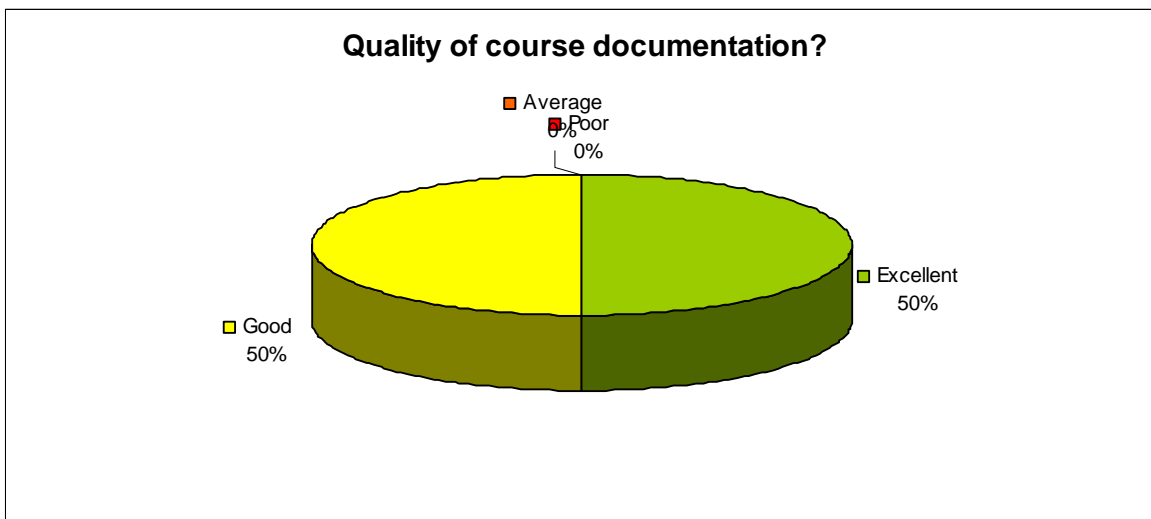


Figure 5-8: Quality of the course documentation?

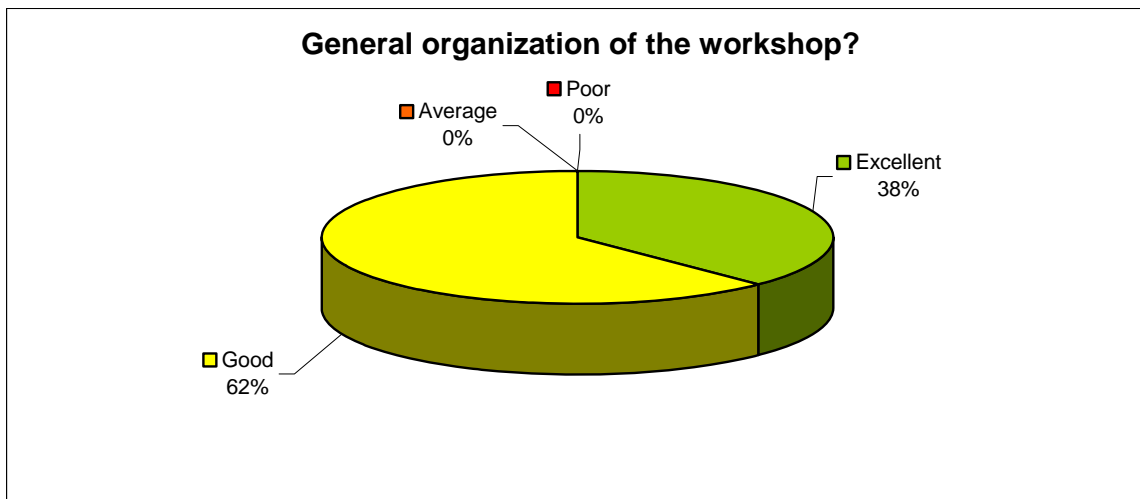


Figure 5-8: General organization of the workshop?

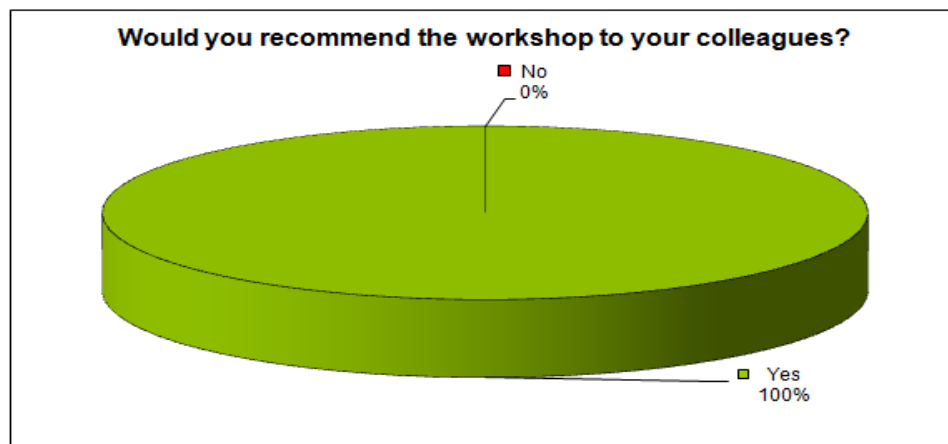


Figure 5-9: Would you recommend the workshop to your colleagues?

## 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 network administrators (and therefore more interested in applications and monitoring tools). Others were students, with little previous knowledge, whereas one was already an IPv6 instructor.

Depending upon their background, some participants would have preferred to spend more time on Management, Applications or "hands-on" sessions.

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**?:*

- (3) *Applications and services.*

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

- (2) *IPv6 Introduction.*

*Any **other comments**:*

- (1) *All major topics were included. Well done!*
- (1) *Consider incorporating applications with the lab.*

End of the excerpts ==



## 6. CONCLUSIONS

Workshops are a key mechanism through which information, knowledge, and know-how 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.

The 6DEPLOY-2 workshop took place in Prague March 21<sup>st</sup> - 23<sup>rd</sup>, 2011. Thanks to previous projects and training activities, most of the IPv6 education material needed to start 6DEPLOY-2 workshop training was available from the very beginning. The material included most of the issues of Internet deployment and evolution, especially IPv6 introduction, and transition to IPv6.

8 network and system administrators, students, an IT specialist and a trainer participated in the workshop. The topics presented were selected according to the participants' requirements, trying to accomplish their need of a more practical workshop. A large proportion of the modules were used.

According to the evaluation forms and the comments from the participants at the workshop, it is clear that the workshop was a success, and 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.

During the 6DEPLOY-2 lifetime, stakeholders will continue to enhance today's "knowledge database". The reader and interested parties are referred to the 6DEPLOY-2 website to check for new material.

In summary, this workshop should be considered a success with regard to the dissemination of IPv6 in this part of the AP region, though this is only one of many steps towards the deployment of real IPv6 networks and services in the region.

## 7. REFERENCES

6DEPLOY-2 website: <http://www.6deploy.eu>

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

Hands-on modules: <http://www.6deploy.eu/index.php?page=hands-on>

How-to organise 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://www.6deploy.eu/index.php?page=e-learning>

6DEPLOY-2 Workshops Agenda and detailed information:

<http://www.6deploy.eu/index.php?page=workshops2>