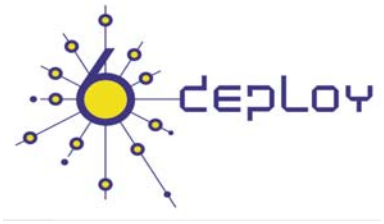

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Responsible and Editor/Author:	**Organization:**	**Contributing WP:**
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Abstract:

This deliverable presents a report from the workshop held in Lome, Togo from the 11th - 13th April 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.

Keywords:

IPv6, Support, Training, Testbeds, Modules, 6DISS, 6DEPLOY, 6DEPLOY-2, Hands-on exercises

Disclaimer

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 deliverable presents a report from the workshop held in Lome (Togo) from 11th - 13th April 2011. 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 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:

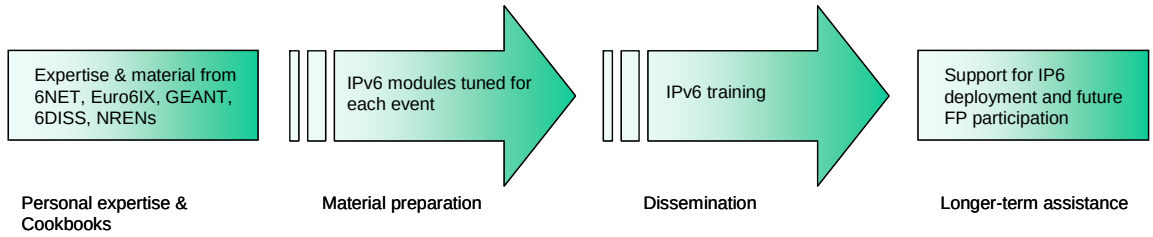


Figure 1-1: 6DEPLOY-2 methodology (diagrammatically)

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 2 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 Lome (Togo) from the 11th - 13th April 2011. The workshop comprised both slide presentations and hands-on exercises using remote testbeds for routing exercises.

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. 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 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-2, 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 LOME (TOGO)

This IPv6 Workshop was held in Lome (Togo) from April 11th - 13th, 2011. In the following paragraphs we provide information about the workshop, including the programme outline, and the material that was presented.

3.1 Overview

Alain Aina Patric led the workshop from AfriNIC with practical sessions led by Mukom Akong Tamon.

The course started with a brief overview of the problem i.e. IPv4 address exhaustion. After sharing the statistics and projections for RIR run out dates, the options for dealing with the problem are presented, namely, NAT and IPv6.

The next session dissects the problems inherent with NAT and shows clearly that NAT is not a sustainable solution to the problem of IPv4 address exhaustion. Thus, the only alternative is IPv6.

The fundamentals of IPv6 were then taught, starting with basic addressing, drawing parallels of equivalent IPv6 protocols to the basic functionality protocols that engineers use today with IPv4, IPv6 sub-netting and address planning, basic routing and transition techniques. The session ended with hands-on labs were the participants practiced taking a IPv6 prefix, breaking it up and allocating it to the testbed and then proceeding to configure a full dual-stacked network (addressing, routing) and then practice transition techniques.

3.2 Attendees

	Full Name	Organisation
1	Abdoul-Akim ADJIBOLA	Benin Telecoms
2	Ametepe Kodjo ANIFRANI	Togo Telecom
3	AMEVOR Kossi	IMET Sarl
4	Arnaud AMELINA	Agence universitaire de la Francophonie
5	Aurel Rodrigue GUIDI	BENIN TELECOMS S.A
6	DOGBE-SEMANOU Dope Afiwa Emefa	UNIVERSITE DE LOME
7	Gbedeh Komi ATTIOGBE	Socit des Postes du Togo
8	Lawson Tevi Rodrgue	Iservices Sarl

9	komlan SOSSOE	CAFE informatique
10	Kouassi Edem HOUMAVO	Tlvision Togolaise
11	KPAKPOVI AGBEGNIHO	UNIVERSITE DE LOME
12	Leon Komlan TOGBEDJI	ATLANTIQUE TELECOM TOGO
13	Mazama-esso GNALOU	Togo Telecom
14	Minzah KABISSI-YAO	Togo Telecom
15	Morou SALAMI	Direction Gnrale Informatique
16	Nabede Aklesso SOO	Togo Telecom
17	Nahmsath Yabouri	SIDIK
18	Vivien Gbtondji ASSANGBE WOTTO	BENIN TELECOMS SA
19	Yawo Dodzi Dzotsi	CIC-University of Lome
20	Yves Kodjo KINDE	SOGEQUIP
21	Mazah-Abalo Maani BOROZE	Cell

Table 3-1: Lome (Togo) Workshop participants

The participants represented a wide range of the ICT community. They were technical people whose knowledge about IPv6 ranged from almost no knowledge at all (about 50%) to having intermediate level skills in using IPv6. Only a small percentage of the participants (11%) were even testing global IPv6 transit at this point.

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	Modules and Topics Covered
11/04/2011 (Half day)	• Why NAT is not a sustainable solution to the problem of IPv4 address exhaustion
12/04/2011	[a] IPv6 Addressing • Address notation, shortening rules and examples • Address types and scopes [b] IPv6 Address Planning • Sub-netting in IPv6 (reasons, procedures with sipcalc and examples + exercise) • About nibble boundaries • Address planning worked example and class exercise [c] IPv6 from an IPv4 Perspective • IPv6 packet structure (schematic and live packet capture) • IPv6 and IPv4 packets compared and contrasted • IPv6 compared to IPv4 with respect to Network access layer, automatic IP host configuration options, Link-layer address resolution, FQDN to IP address resolution,

	host to router multicast membership protocols, automatic default gateway configuration, routing, minimum MTU size and sending packets to all nodes • Neighbour Discovery – features, mechanism plus live packet analysis • Host configuration (Windows and Linux) – class exercise • SLAAC – theory, advantages and disadvantages over DHCPv4, configuration example and packet analysis • DHCPv6 – how it works, difference from DHCPv4 • Exercise: IPv6 ping sweep, and neighbour cache and mac address discovery [d] IPv6 Routing (static, OSPFv3 theory and configuration examples)
13/04/2011	[e] Transition Techniques • Understanding the need and use cases for transition techniques • Dual stack - overview, 'how it works' and configuration examples • Manual tunnels - overview, 'how it works' and configuration examples • 6to4 - overview , 'how it works' and configuration examples • NAT64 - overview , 'how it works' and configuration examples [f] Hands-on Labs (using testbeds) • Sub-netting an IPv6 allocation and assigning sub-nets to links of lab network • Configuring, testing and troubleshooting IPv6 addresses • Configuring, testing and troubleshooting static routing • Configuring, testing and troubleshooting OSPFv3 routing • Configuring, testing and troubleshooting manual tunnels • Configuring, testing and troubleshooting 6to4 tunnels

Table 3-2: Lome (Togo) Workshop programme

3.4 Presentation material

The following material was presented:

Modules	Presented by	Affiliation
IPv6 Introduction, IPv6 Addressing, Transition and coexistence, and IPv6 Routing	Alain Aina.	AfriNIC
Addressing Practice: Sub-netting	Alain Aina	AfriNIC
Hands –on labs	Mukom Akong T.	AfriNIC

Table 3-3: Lome (Togo) Workshop list of modules used

The class was divided into 18 groups and each group was assigned to one of the routers in the AfriNIC, RENATER and Consulintel testbeds. Each group was given a printed copy of the lab manual that details the objectives of the exercises to be performed with step by step instructions as well as all required supporting information. The trainers supervised the exercises, making clarifications and explanations when required.

4. OPPORTUNITIES FOR FURTHER CO-OPERATION

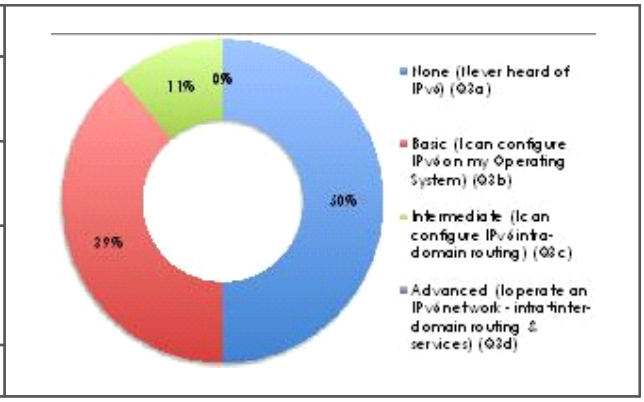
The links to the 6DEPLOY-2 material were given to the participants. They were also told and shown how to book any of the labs in the 6DEPLOY-2 project and to practise on their own, either using the provided lab manual or for their own scenarios.

5. ANALYSIS OF THE FEEDBACK QUESTIONNAIRES

1. Pre-workshop knowledge and skills

39% of the respondents reported that they had basic IPv6 skills prior to the workshop and 50% reported they had never heard about IPv6.

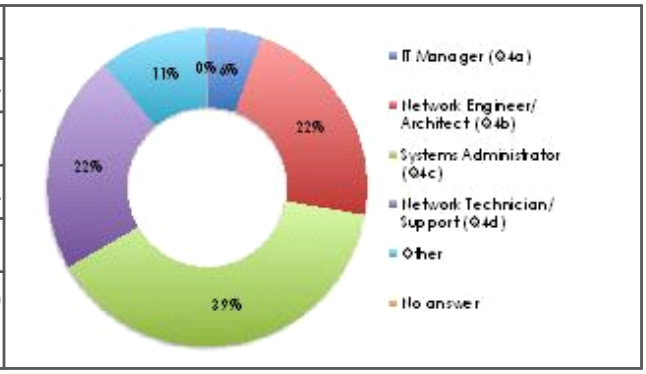
(Q3a) None (Never heard of IPv6)	9
(Q3b) Basic (I can configure IPv6 on my Operating System)	7
(Q3c) Intermediate (I can configure IPv6 intra-domain routing)	2
(Q3d) Advanced (I operate an IPv6 network - intra+inter-domain routing & services)	0
(Q2e) No answer	0



2. Primary role in the organisation

Network engineers and Systems engineers made up 61% of the class, IT managers made up 6% and network technicians 22%.

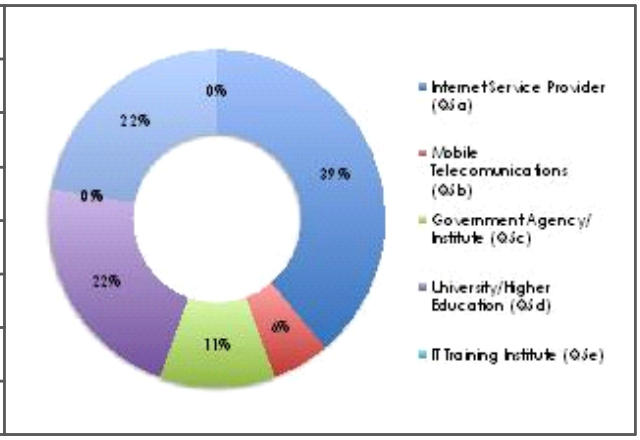
(Q4a) IT Manager	1
(Q4b) Network Engineer/Architect	4
(Q4c) Systems Administrator	7
(Q4d) Network Technician/Support	4
(Q4e) Other	2
No answer	0



3. Primary industry of the organisations presented

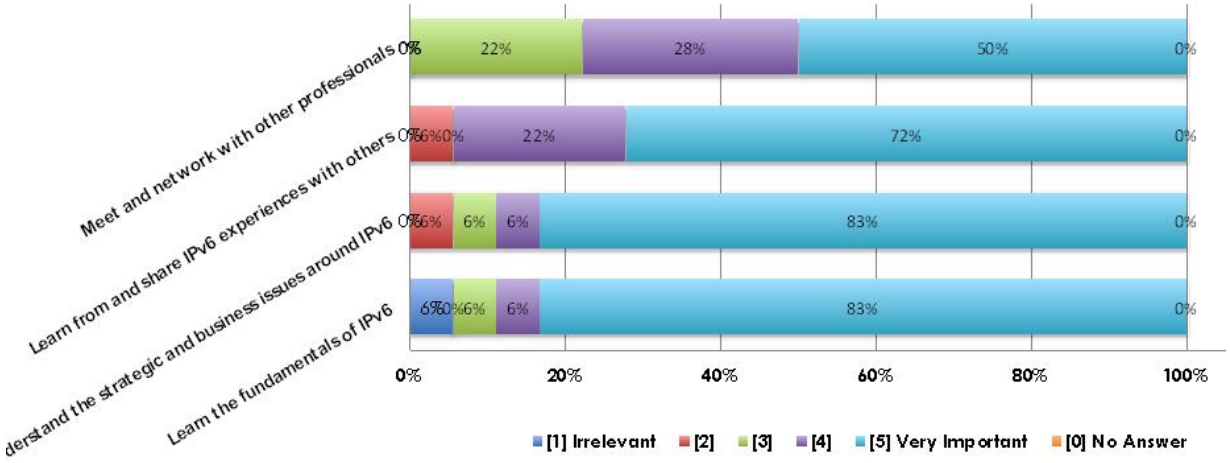
Service providers were the most represented segment (39%) followed by universities and IT training institutes (22%) each and then government agencies. Mobile telecoms were the least represented at 6%.

(Q5a) Internet Service Provider	7
(Q5b) Mobile Telecommunications	1
(Q5c) Government Agency/Institute	2
(Q5d) University/Higher Education	4
(Q5e) IT Training Institute	0
(Q5d) Finance/Banking	0
(Q5f) Other	4
No answer	0



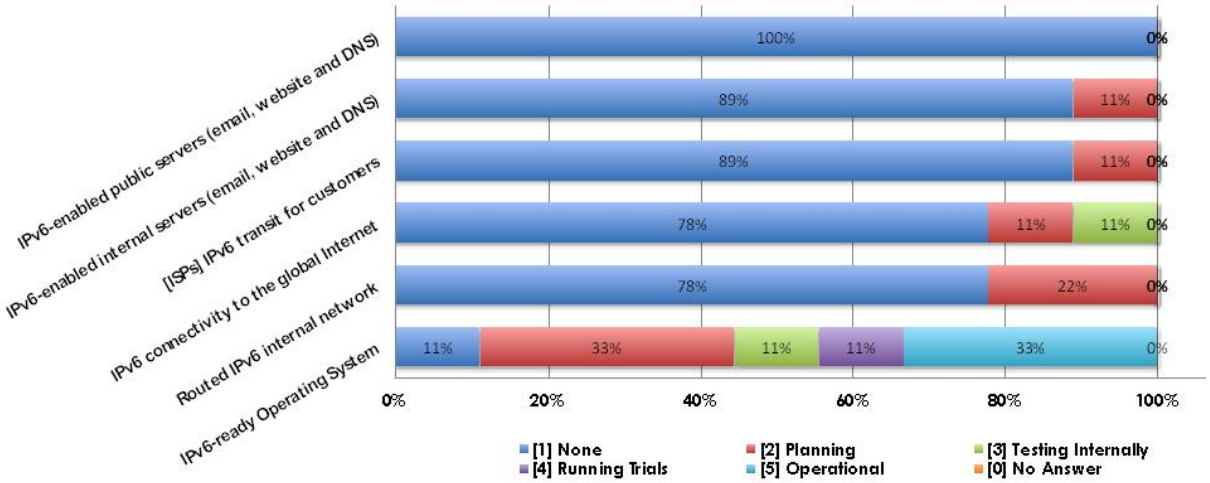
4. Reasons for attending the workshop

The most important reason participants gave for attending the workshop was to learn the fundamentals and understand the strategic and business issues around IPv6, with 83% stating these as very important. Learning and sharing IPv6 experiences was the second most important reason for attending, with 72% considering it very important.



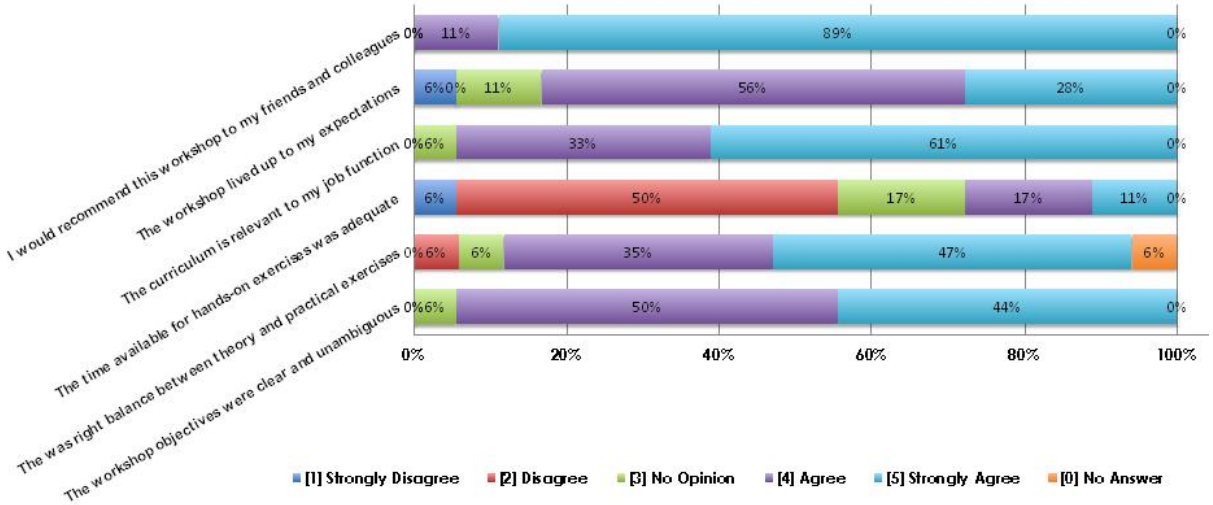
5. Implementation status of related technologies

There was very little IPv6-activity on the ground and horizon amongst the respondents.



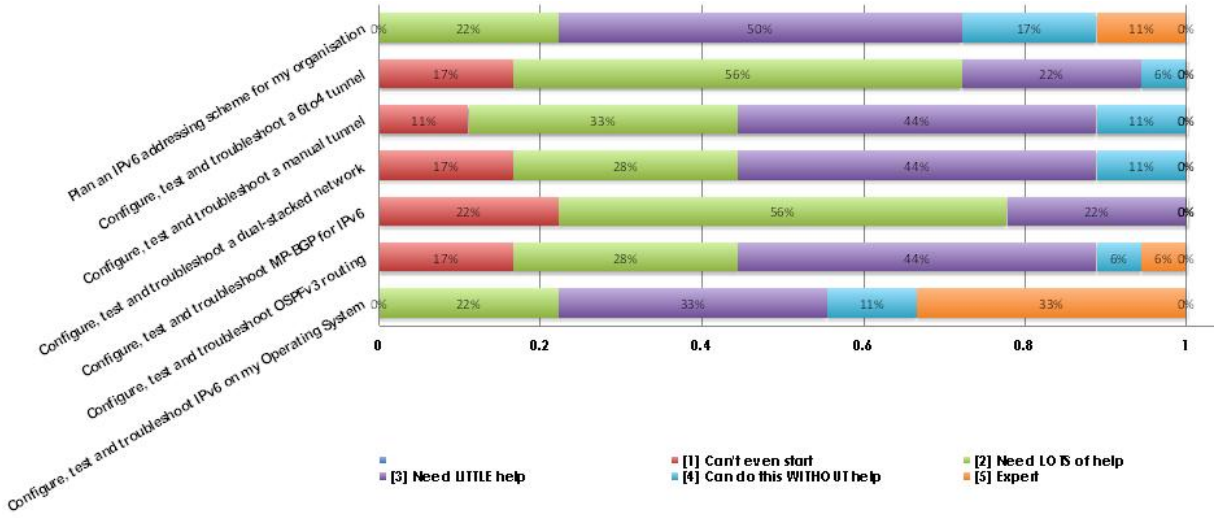
6. The effectiveness of the workshop design

94% of the respondents agreed or strongly agreed (50% and 44% respectively) that the workshop objectives were clear and unambiguous. 82% agreed or strongly agreed that there was the right balance between theory and practice. 94% considered that the curriculum was relevant to the various job functions represented and 89% would highly recommend the workshop to friends and colleagues. 56% however would like to see more time allocated to hands-on exercises.



7. Post-workshop knowledge and skills

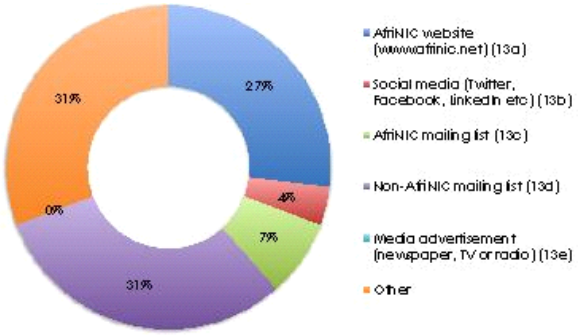
11% of respondents reported confidence at configuring, testing and troubleshooting a dual-stacked network as well as manual tunnels. 17% were confident with IPv6 address planning for their organisations. However more than half of the respondents did not feel confident in their ability to accomplish the non-basic skills aimed at.



8. How participants learnt about the workshop

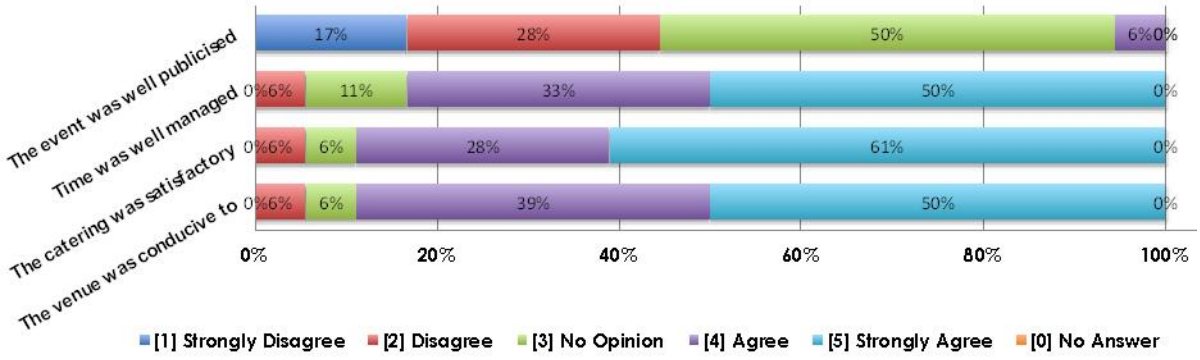
34% of the attendees found out about this workshop either through our website or mailing list (27% and 7%) respectively while 31% found out through non-AfriNIC mailing lists. 4% found out through social networks.

(Q13a) www.afrinic.net	7
(Q13b) Social networks	1
(Q13c) AfriNIC mailing lists	2
(Q13d) Non AfriNIC mailing lists	8
(Q13e) Media advertisement	0
Other	8



9. General event organisation

The data shows that the event was generally well organised (At least 50% of all respondents rated “Agree” on three of the four characteristics). More effort needs to be put into publicity and time management.



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 Lome - Togo from April 11th - 13th 2011. This Workshop was held in collaboration with Iservices Togo (a local IT training institute) who organized the logistics for the event. AfriNIC led this workshop and used new testbeds deployed in Mauritius, Paris (RENATER) and Madrid (Consulintel).

In summary, this workshop should be considered a success with regard to the dissemination of IPv6.

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