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Abstract:

This deliverable summarizes the status of IPv6 labs which have been deployed or are in the process of being deployed since the beginning of the 6DEPLOY-2 project. It also presents the reservation system and other tools available to manage the 6DEPLOY-2 labs. This deliverable also details the lab improvements, which are on-going and planned throughout the 6DEPLOY-2 project lifetime.

Keywords:

IPv6 labs, IPv6 standard lab, lab reservation system, lab management activity, virtual machines, ToIPv6.

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Executive Summary

This deliverable presents the status of IPv6 labs which have been deployed or are in the process of being deployed mid-way through the 6DEPLOY-2 project. The different lab statuses indicate if a lab is ready for use for training workshops and how the lab will be integrated into the 6DEPLOY-2 processes.

This deliverable also presents the existing reservation system and other available tools used to manage the 6DEPLOY-2 labs. There is further documentation available which assists new trainers discover how to use a lab and how to prepare hands-on training.

Due to the increasing amount of IPv6 labs, common rules are being adopted in order to facilitate their management. In addition, enhancements and new services have been and will continue to be developed.

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1. INTRODUCTION

This deliverable is an update of deliverable D2.1.1: "Initial status of the Lab Reservation Service". As in D2.1.1, it also includes the current status of the IPv6 labs and the way these labs are structured, configured and managed under WP2: "Globalisation of IPv6 Training Labs" and the specific Activities A2.1: "Extending the number of Labs" and A2.2: "Coordination of the Lab managers".
It also identifies the new labs being discussed, shipped or installed.

This deliverable describes the improvements and changes that are in place - and planned during the rest of the 6DEPLOY-2 project.

As a complement to this document, deliverable D2.2.2: "Update on the status of the available exercises to be used with the lab equipment" presents and explains the content of the hands-on material, which makes use of the labs described here.

2. CURRENT LAB STATUS

2.1 IPv6 Labs locations

Since the beginning of the 6DEPLOY-2 project, additional IPv6 Labs (also referred to as IPv6 test bed platforms) have been installed worldwide.

The current list of the labs and their status are shown below:

Region	Country	City	Organisation	Status
Europe	France	Paris	RENATER	Operational
Europe	Bulgaria	Sofia	BREN	Operational
Europe	Spain	Madrid	Consulintel	Operational *
Europe	Slovenia	Ljubljana	go6	Installed
Europe	Czech Republic	Prague	CESNET	Installed *
Europe	Slovakia	Kosice	University	Installed *
Europe	Hungary	Budapest	University	Operational *
Europe	Poland	Krakow	University	Ready to ship *
Africa	Mauritius	Ebene	AfriNIC	Operational
Africa	Kenya	Nairobi	KENIC	Installed *
Africa	Ghana	Accra	AITI	Installed *
Africa	Egypt	Cairo	University	Installed *
Africa	Cameroon	Yaounde	University	Installed *
Africa	Rwanda	Kigali	RWEDNET	Installed *
Asia	India	Bangalore	CEDT/IISc	Installed
Central Asia	Georgia	Tbilisi	GRENA	Installed
Central Asia	Kyrgyzstan	Bishkek	CGEIT	Installed
Central Asia	Kazakhstan	Almaty	KazRENA	Installed *
Latin America	Colombia	Bogota	CCIT	Installed *
Latin America	Uruguay	Montevideo	LACNIC	Installed *
Latin America	Argentina	Buenos Aires	ARIU	Under discussion *
Caribbean	Dominican Republic	TBD	TBD	Under discussion *
Europe	Moldova	TBD	TBD	Under discussion *
Middle East	UAE	Dubai	TBD	Under discussion *

Middle East	Lebanon	*TBD*	*TBD*	Under discussion *
Central Asia	Afghanistan	Kabul	*TBD*	Under discussion *

* New in DEPLOY-2

Table 2-1: List of IPv6 labs and deployment status

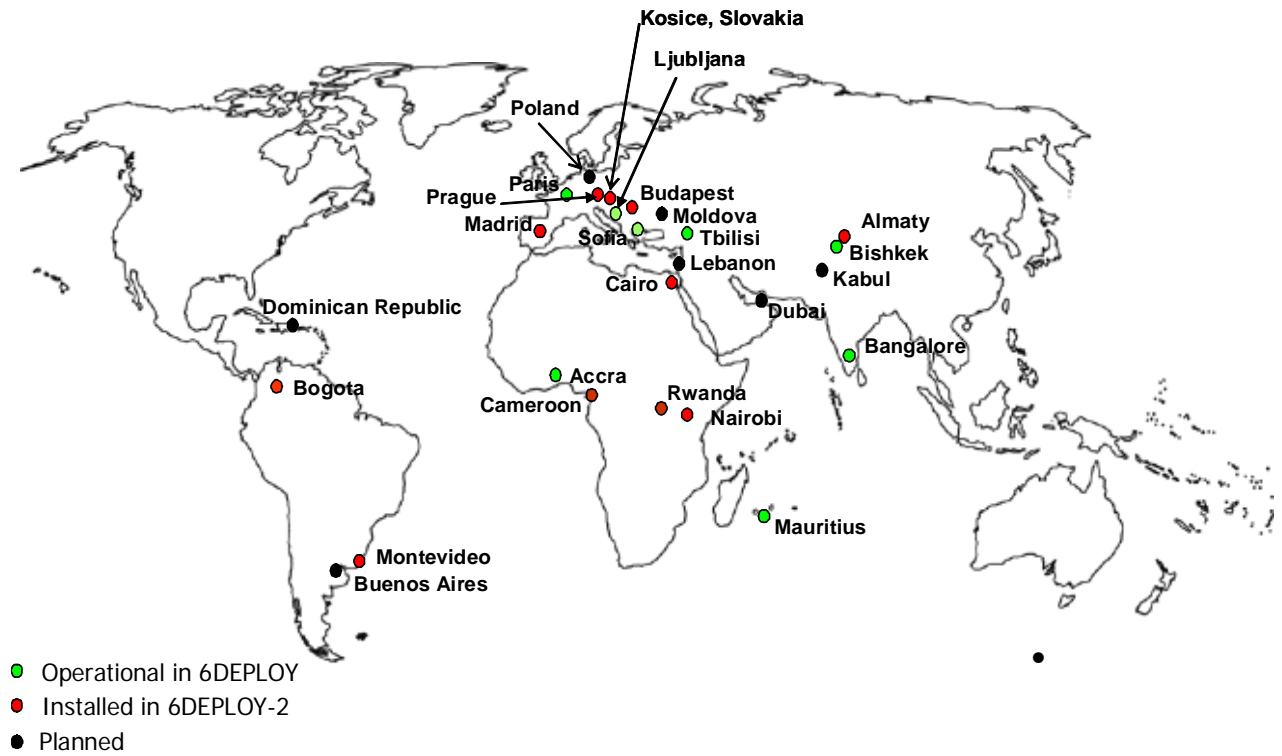**Figure 2-1: The location of the 6DEPLOY IPv6 Labs**

A tool has been deployed to be able to follow dynamically the deployment of new labs:

- http://www.6deploy.eu/labs.php

It is planned to liaise this tool with lab reservation portal. Then, it will be possible by clicking on one lab to have information like reservations statistics, availability, planned trainings, etc

The following steps are taken prior to a lab becoming operational:

- *Under Discussion:* Prior to installing a lab in a new location, discussions must take place between the 6DEPLOY-2 project responsibles and the organisation willing to host the new lab. The conditions of hosting and managing the equipment are checked for compliance with rules applied to the other platform locations.

  These rules were originally informal, but – as the number of labs is increasing – they are being documented and made contractual.

- *Ready to be shipped:* After initial discussions regarding the decision to deploy a 6DEPLOY-2 lab in a new location, Cisco prepares the equipment for shipment and completes the export paperwork.

- *Installation:* Once the equipment is received, installation begins by following the procedures defined in 6DEPLOY-2. During this phase, some assistance can be provided by Cisco.

- *Installed:* A lab is considered as "installed", when it is powered on and the routers can be accessed via Internet.

- *Operational:* A lab is considered in "*Operational*" status when it follows the rules defined in the 6DEPLOY-2 project (configuration, topology, etc). These common rules facilitate the usage of the labs and their integration into the reservation portal.

All of the official 6DEPLOY IPv6 labs can be configured remotely for "hands-on" exercises such as addressing and routing and can be reserved by priority for the 6DEPLOY-2 training workshops. The labs can also be used for other local activities/ projects according to their availability. The composition of each test bed is topologically similar. Thus, it is possible to use more than one lab during a workshop to accommodate more trainees during a single session.

The RENATER lab is shown below as an example[1]:

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[1] Note that the test beds are only configured initially with IPv4 addresses, so it is up to the trainees with their tutor to perform all the necessary actions to have it running over IPv6 and connected to the IPv6 Internet.
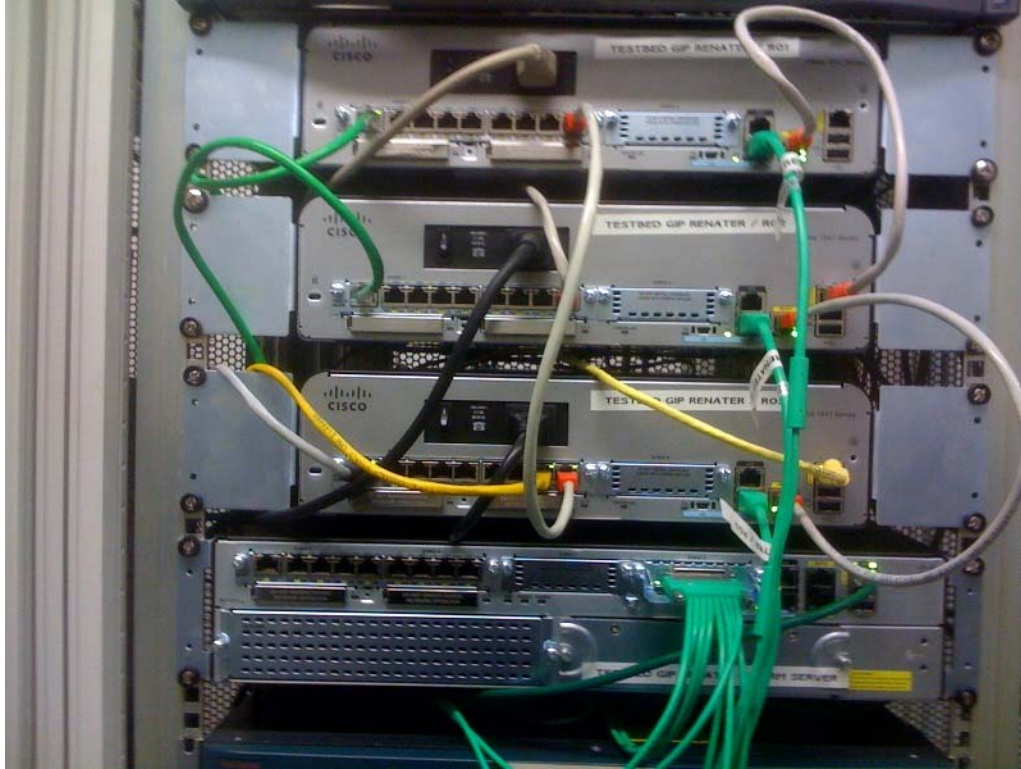
Figure 2-2: The initial configuration of the 6DEPLOY IPv6 Lab at RENATER in Paris

Efforts have been made to enhance the existing labs capabilities. In the RENATER and BREN Labs, 2 desktop servers have been installed in each test bed. Several virtual machines were installed on these servers. In the RENATER lab, 12 virtual machines can be launched simultaneously. Windows or Linux operating systems can run on these virtual machines. It is possible to run all types of "hands-on" exercises (DNS, applications, ...) remotely with this configuration. The advantage is the time savings during workshop preparations, since configurations do not have to be done locally. With machines connected directly to the routers, we can imagine "hands-ons" mixing application and routing exercises. The only requirement is to have an IPv4 Internet connection to the labs.
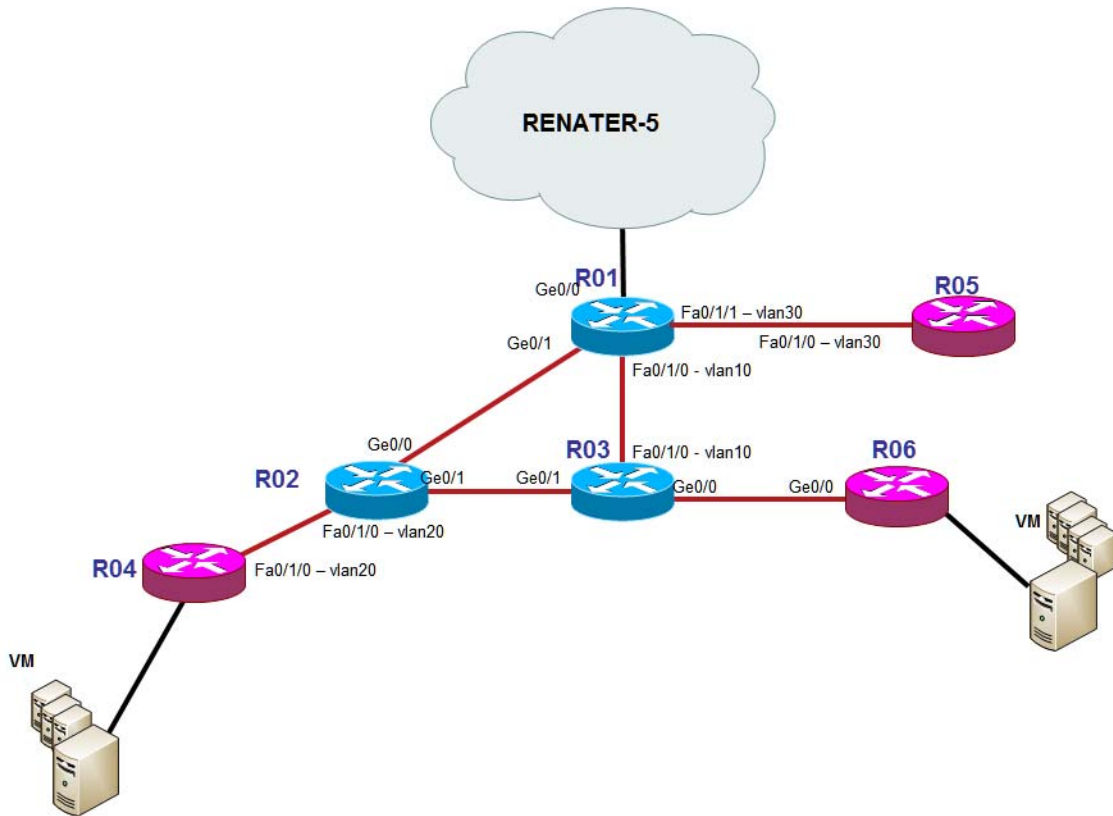
Figure 2-3: The placement of the Virtual Machines in RENATER lab

2.2 IPv6 Labs reservation system and procedure

2.2.1 Central reservation portal

The process of reserving the test beds has not changed significantly. The same one-stop-shop web interface that was established in 6DEPLOY is still used. It allows a workshop organizer to book the set of test beds needed for a dedicated event, by going to http://www.6deploy.org/index.php?page=testbed_reservation2 to perform his/her reservation. A mailing list has been created to inform test bed managers when a reservation has been requested. The test bed managers can access an interface where it is possible to accept or reject a reservation. Generally, some discussions will have taken place previously on the test bed manager mailing list, in order to determine which lab(s) - and how many - will be used for a given training session. The decision to use one lab or another depends also on the location (time zone) where the workshop is to take place and the availability of this (these) lab(s) regarding previous bookings.

Following is a list of pending requests. You can Accept or reject them and an e-mail will be sent to the user.

Filter the requests by: **pending:** ☑ **accepted:** ☐ **rejected:** ☐   stats | logout

ID | Status | Dates | User | e-mail

90 | pending | 15 and 16 October 2009 | Alvaro Vives | alvaro.vives@consulintel.es   accept | reject

Desired dates: 15 and 16 October 2009
Trainees: 24
Prefixes: Unknown yet
Purpose: Hi Testbed managers, We have fixed the date for an IPv6 Workshop in Mauritius in October. We will need two testbeds, Maurituis and other for the desired dates. As we will have a maximum of 24 attendees, two people for each router would be great, what means that two testbeds with 6 routers each if perfect. Best regards, Alvaro Vives Consulintel
Status: pending
Created: 14 SEP 2009 18:31

Please add your comments to the e-mail that will be sent to the user.

Accept

Figure 2-4: A reservation request to the Lab managers

In order to enhance this portal, lab manager's team decided to install and test phpScheduleIt, an open source tool permitting to manage reservations and resources. This tool is currently tested internally and probably the current portal will be replaced in the next months by a new one based on phpScheduleIt.

2.2.2 Lab configuration management

In order to ease the management of the labs remotely, scripts have been produced by RENATER. These scripts are available via a web page and allow the restoration of various configurations - i.e. resetting of the initial configurations - made during a training session. In this way, the lab can be prepared for a new training session within a few minutes. This system was initially trialled on the RENATER lab, but is now available for other labs. Another new feature which has been widely deployed is the possibility of saving the running router's configuration through a web interface. This operation can be useful at the end of a training session, for example, if the trainer or the trainees wish to have a copy of the achieved exercises.

2.3 Associated Documents

In order to assist the IPv6 trainers in not creating their own exercises from scratch when using the 6DEPLOY-2 labs, a - still small - set of documents has been written and is available on-line on the project website and are as follows:

- Paris (France) lab hands-on leaflet

- Sofia (Bulgaria) lab hands-on leaflet

- A summary of useful Cisco commands to help configure the routers for the set of proposed exercises

- An AfriNIC lab manual with configuration scenarios based on AfriNIC, RENATER, BREN and Consulintel labs,

- Procedures for using the lab material (deliverable D.1.1 from 6DEPLOY).

3. IMPROVEMENTS AND CHANGES IN 6DEPLOY-2

3.1 IPv6 labs types and characteristics

In order to create a larger set of routers available for a single training and allowing a larger number of attendees to participate in a given workshop, the idea of installing "Virtual Labs" has been realised. This facility implies that a subset of the labs – spread out worldwide today would be strictly coordinated, and have their hardware and software configured in the same manner (topology, interfaces numbering, etc.)

In the former 6DEPLOY project, it was already possible to book a set of 3 labs for a single workshop, however, discrepancies about configuration, addressing and even topology or hardware still existed, thus resulting in an overload of work and preparation time for the trainers.

From the onset of 6DEPLOY-2, Cisco has agreed to install the same hardware and software in all the 6DEPLOY-2 project IPv6 labs, even renewing the "old" or already operational labs (RENATER, BREN, ...). This operation began in January 2011 by replacing the old RENATER lab equipment.

It is recognised that some labs are more active than others and have the support to assist other labs in their region. Therefore, 3 categories[2] have been created:

- **Standard Labs**, which constitute the 6DEPLOY lab cloud (these follow the 6DEPLOY rules)

- **Potential Standard Labs** (these aim to follow the 6DEPLOY rules, but have not yet implemented them completely)

- **Regional Labs** (these offer a service for trainings in their region, but cannot implement the 6DEPLOY rules for various reasons).

Currently, the most experienced lab managers form the first category of sites –standard labs. The rules for achieving the status of a "Standard Lab" have been clearly defined so that other lab managers (from the "Potential Standard Labs" category) know what they have to comply with, in order to join the "Standard Labs" group. A document describing these rules is available:

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[2] The terminology for these categories is still under discussion and may change

- http://wiki.6deploy.eu/uploads/TBManagers/6DEPLOY-2_Labs_documentation_20111020.pdf

As the information regarding the labs can evolve quickly, a wiki page has been deployed to share new information instead of updating the initial document:

- http://wiki.6deploy.eu

This way the strongly coordinated management and usage of these lab categories will allow the trainers to organize workshops for larger audiences. As an example, since every lab site is configured with six Cisco C1941 series routers, having five **Standard Lab** sites in the **6DEPLOY lab cloud** would allow 30 routers to be used simultaneously, ie. 60 trainees to work together in a given workshop.

The following table shows the updated classification of the IPv6 labs that are currently operational:

Category	Country	City	Organisation	Region
Standard lab	France	Paris	RENATER	Europe
Standard lab	Bulgaria	Sofia	BREN	Europe
Standard lab	Spain	Madrid	Consulintel	Europe
Standard lab	Mauritius	Ebene	AfriNIC	Africa
Standard lab	Uruguay	Montevideo	LACNIC	Latin America
Potential Standard lab	Slovakia	Kosice	University	Europe
Potential Standard lab	Slovenia	Ljubljana	go6	Europe
Potential Standard lab	Hungary	Budapest	University	Europe
Potential Standard lab	Kyrgyzstan	Bishkek	CGEIT	Central Asia
Potential Standard lab	Georgia	Tbilisi	GRENA	Central Asia
Regional lab	Czech Republic	Prague	CESNET	Europe
Regional lab	Kenya	Nairobi	KENIC	Africa
Regional lab	Ghana	Accra	AITI	Africa
Regional lab	Rwanda	Kigali	RWEDNET	Africa

Regional lab	Cameroon	Yaounde	University	Africa
Regional lab	Egypt	Cairo	University	Africa
Regional lab	Colombia	Bogota	CCIT	Latin America
Regional lab	India	Bangalore	CEDT/IISc	Asia
Regional lab	Kazakhstan	Almaty	KazREN	Central Asia

Table 3-1: List of IPv6 labs deployed and category

The lab managers of the so-called "Standard Labs" are all 6DEPLOY-2 partners and are therefore closely coordinated. They have become effectively the central hub in their regions for supporting the other lab managers. This can be seen as a new service that the 6DEPLOY-2 project offers.

3.2 Lab managers' activity coordination

Creating a strong community among the lab managers is important in order for the lab equipment to be efficiently used. During the former 6DEPLOY project, a coordination activity led by RENATER was proposed and implemented. The coordination activity allowed the lab managers to provide and maintain the same level of services to the IPv6 trainers who were willing to use the RENATER material for an IPv6 workshop. Moreover, it allowed the opportunity to exchange experiences, ideas and make progress jointly.

From the onset of the 6DEPLOY-2 project, an important objective was to strengthen this activity. This is being accomplished by (for example) defining the objectives that every IPv6 lab needs to achieve and by stating the rules for working in a coordinated way, and then harmonising the training resources as much as possible. To this extent a monthly videoconference meeting is performed using the WebEx Cisco service.

3.3 IPv6 labs and associated services

3.3.1 Desktops and virtual machines

At the end of the former 6DEPLOY project, RENATER and BREN installed desktops connected to the Cisco routers. The goal was to create virtual machines connected to the set of routers in a given IPv6 lab. These machines help to set up new activities for the trainees (for instance, IPv6 multicasting or IPv6 flow monitoring hands-on). Alternately, these virtual machines can serve as a terminal for an audience when there are no available computers. It would take a trainer a minimum of preparation and configuration since every equipment could be configured beforehand.

3.3.2 Telecommunication means

Cisco has provided the IPv6 labs with IP Phones and a videoconferencing tool has also been investigated. EVO software (Enabling Virtual Organizations) from Caltech and WebEx from Cisco have been trialled. These allow the lab managers to better coordinate their activities.

With the Cisco WebEx solution, the audio is provided by a phone call generated by the WebEx system. This feature is appreciated by some 6DEPLOY partners because we don't need to make an international call. Moreover, next WebEx version will integrate IPv6. Some partners asked to be able to follow audio also using a SIP account.

3.3.3 New hands-on topics

Since IPv6 deployment in different market sectors is expected to increase because of the scarcity of the IPv4 address resources, the 6DEPLOY-2 partners felt the need to propose new hands-on activities for the IPv6 workshop attendees. In this category, we consider producing exercises for a set of transition scenarios. In the Plenary meeting held in Madrid, a subset of transition mechanisms and scenarios were selected. The first configurations have been trialled within Cisco. The MPLS-based ones have still to be implemented, since the basic requirements are a bit more complex to achieve, given we would like to provide the MPLS configuration for IPv4 from a web interface the trainer can activate himself. Then the trainees will have to only configure the 6PE or 6VPE features. Furthermore, as soon as the telephony over IPv6 and the videoconferencing systems become fully IPv6 compliant, both could become new hands-on topics too.

4. SUMMARY AND CONCLUSIONS

The deployment of new labs is a key activity in the 6DEPLOY-2 project. The lab manager's activity is specifically intended for the coordination of this deployment activity taking into consideration each location´s specificities. Even if the number of Standard Labs will increase before the end of the project, it is important to mention that some labs want to remain in a "Regional Lab" status. They do not have the resources to maintain their lab as a Standard one.

The reservation interface tool will be enhanced as necessary for additional visibility in the usage of the labs, to ease the booking process and add new tools. Moreover, new services are being deployed on the labs (virtual machines, video and voice services) and new hands-on activities are being written to extend the exercises that can be used during the training.

5. REFERENCES

Project web site : http://www.6deploy.eu

Testbed reservation portal :
http://www.6deploy.eu/index.php?page=testbed_reservation2

Lab managers wiki:
http://wiki.6deploy.eu

Possible scenarios for transition mechanisms hands-on:
http://wiki.6deploy.eu/uploads/TBManagers/TransMechs_Labs.pdf