IPv6DISSemination and Exploitation

Information Society Technologies

Project no. 015926

6DISS

IPv6 Dissemination and Exploitation

Instrument: SPECIFIC SUPPORT ACTION

Thematic Priority 2

D16: Initial Plan for Using and Disseminating Knowledge

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Abstract

This first release of this Deliverable describes the overall strategy for the dissemination and exploitation of the 6DISS results, forthcoming plans for the dissemination of knowledge gained during the work, and the exploitation plans for the consortium as a whole, for individual participants, and groups of participants. It identifies the target groups for the 6DISS results and the strategic impact of the project in terms of improvement of competitiveness or creation of market opportunities for the participants. One of the purposes of this Deliverable is to disseminate information about the project, and its progress, in such a way that other workers in the area can make use of the results, or see how they can feed information into the project. In this way it acts as a vehicle for the cross-fertilisation of ideas and a means of establishing co-operation. This document will be maintained through the lifetime of the project, and represents an integral part of the Periodic Activity Report.

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

1 Executive Summary

This *Dissemination and Use Plan* is a living document, meaning that it will be updated during the life of the project. It has several purposes:

- to document the overall strategy for the dissemination and exploitation of the knowledge gained from the project
- to document partners' exploitation plans for the knowledge they have gained
- to be a repository of the history of presentations made at the workshops and in conferences, and publications, articles, etc. that have been written since the start of the project
- to generally disseminate information about the project, and its progress, in such a way that other workers in the area can make use of the results, see how they can feed information into the project, and/or collaborate.

In this way, the document serves as a vehicle for the cross-fertilisation of ideas and a means of establishing co-operation. Since the plans may be of interest for other projects, the document is classified as *public*, and is therefore available from the publicly-accessible area of the project Website.

The structure of the document is as follows:

Following an introduction to the overall strategy for the dissemination objectives of the project (Section 2), the document comprises three sections, which are standard for all FP6 projects: Exploitable knowledge and its use, Dissemination of knowledge, Publishable results.

Exploitable knowledge and its Use: This section (Section 3) presents those project results, which are classified as knowledge having a potential for industrial or commercial application in research activities or for developing, creating or marketing a product or process or for creating or providing a service. An overview table is accompanied by a short text per exploitable result.

Dissemination of knowledge: The dissemination activities in this section (Section 4) include the past and future activities in the form of a table. An overview table is accompanied by a short description for each major activity (workshop, conference, etc.) having taken place or planned since the last report.

Publishable results: This section (Section 5) provides a publishable summary of each exploitable result the project has generated.

The 3 main sections (3, 4 and 5) are followed by an Annex containing supporting sections entitled: Success Stories, Calendar of Past Related Events, Calendar of Related Forthcoming Events, Raising the Visibility of the Project, Involvement of Partners in other Past and Present IPv6 Activities, Partner Plans for the Support of Deployments, General Exploitation Plans and Deliverables.

As the name of the project suggests, we have a strong focus on dissemination activities. As an SSA, the project is not expected to produce exploitable results. However, there are outputs which other organisations may consider to be exploitable, and these are therefore included. It can also be seen that the project offers to collaborate with other organisations and give training, based on the material we have collected.

Contents List

List of Partners

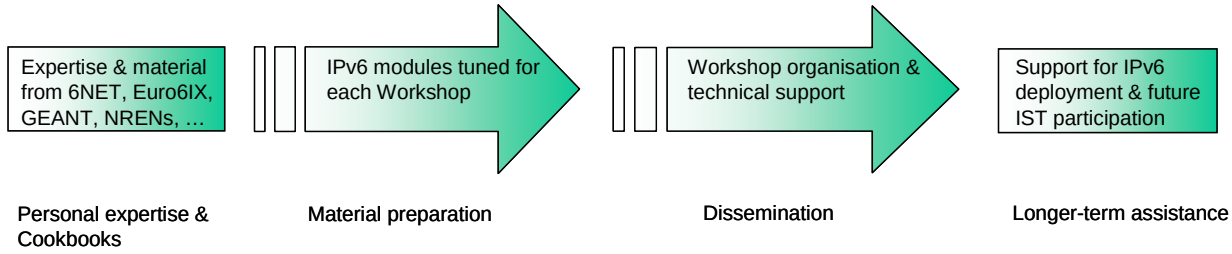
Partic. No.	Participant name	Participant short name	Country
1	Martel GmbH	Martel	CH
2	Cisco Systems (Belgium)	Cisco	B
3	Réseau National de Telecommunication pour la Technologie, l'Enseignement et la Recherche	RENATER	F
4	Greek Research and Technology Network	GRNET	GR
5	University College, London	UCL	UK
6	Trans European Research and Education Networking Association	TERENA	NL
7	University of Southampton	Soton-ECS	UK
8	Fundação para a Computação Científica Nacional	FCCN	P
9	ALCATEL CIT	ALCATEL	F
10	Hungarian Academic and Research Network Association *	HUNGARNET	HU

* Incorporated from 1st August 2005 in Contract Amendment 1

2 Overall Strategy for the Dissemination and Exploitation of the Knowledge gained from the Project

As the name suggests, the central purpose of the 6DISS project is to disseminate. The material being presented and distributed is based on the results of previous EC projects, knowledge gained within 6DISS itself, personal experience and other company material.

The strategy for the knowledge transfer is based on a life cycle represented by the following diagram:



The set of dissemination capabilities available from the project comprises:

- Workshops[1]
- E-learning package
- Conference presentations and journal publications
- IPv6 Technical Training
- Training the Trainers courses
- Tiger Team

The workshops are the key mechanism through which information will be transferred. The workshops enable to build constituencies and raise awareness; disseminate, benchmark and validate the research results from IST; promote European technologies; exchange best practices; and explain about activities related to standards and interoperability issues.

A typical sequence of events is as follows:

- Provide a “Train the Trainers” course in Europe (this might alternatively be done after the workshop, with a view to disseminating the information to others in the region who were unble to attend)
- Organise each of the 8 workshops in close collaboration with the local organisers, with the content tuned to the specific requirements of the region, in terms of future plans for deployments
- Make the workshop presentations and document the programme, the feedback, the future plans, etc. in the corresponding Deliverable (D03-D10)
- Follow up any concrete cases of transition to - or coexistence with - IPv6 through the support of a so-called “Tiger Team” of experts who already have some practical experience of similar deployments
- On site technical training in IPv6 can be given at laboratories in Brussels and Paris.

The available material for presenting in the workshops comprises slide sets on the following topics:

- Introduction to IPv6 (protocol, addressing and associated protocols)
- Multicast

[1] In accordance with the requirements of the associated Call for Proposals, the workshops are targeted at the following regions: Balkans, (southern) Mediterranean countries, Sub-Saharan Africa, Southern Africa, the Newly-Independent States, the Caribbean, the Asia-Pacific region, and South and Central America. Exchanges of information and best practices will also take place with people making similar deployment work in China and India.
The project has a contractual commitment to make 8 workshops (one in each of the regions above).

- M6bone and IPv6 multicast applications and services
- Auto-configuration
- Routing protocols
- DNS
- RPSLng
- Security
- QoS
- Mobility
- Multihoming
- Co-existence with IPv4
- Network Management
- Deployment experiences
- Regulation

6DISS partners are also capable of supervising “hands-on” sessions dedicated to the configuration of devices from different manufacturers, and information about applications. Where equipment is not available locally, access can be arranged to 2 laboratories (in Brussels and Paris).

In addition, a professional e-learning package has been produced, which can be used by persons not able to attend the workshops. Though not as comprehensive as the slide set, the following modules are available:

- Module 1: Introduction to IPv6
- Module 2: IPv6 Addressing
- Module 3: The IPv6 Header
- Module 4: IPv6 Basic Services
- Module 5: Security in IPv6
- Module 6: IPv6 Routing, Mobility and Management
- Module 7: Coexistence with IPv4

3 Exploitable knowledge and its Use

Being an SSA project, it is not anticipated that technical knowledge will be acquired from the project that will be subsequently exploited commercially in the traditional way, through patents (as is expected from STREPs and IPs). Nevertheless, the teaching material and the e-learning package is important information, which will be refined throughout the project in accordance with feedback from the workshops and new outputs from the standards bodies. In this sense, the results of workshops are exploited through the improvement of the training material. This training material will be used by the partners in University courses and within their organizations. Whilst the slide sets used in the workshops are considered to be public (they are based essentially on freely-available specifications from the IETF) it can be imagined that a commercial organization may take the material and include it in a product for IPv6 training. Each module is therefore listed below as a (potentially) exploitable result.

The e-learning package is based on a platform from the company Instrux!on. If there is an opportunity for selling the material to other companies, then this will be done by Instrux!on, since they have the tools and expertise to make the necessary adaptations. Indeed, whilst the basic input data for the e-learning modules is provided by - and the results are checked by - 6DISS partners, Instrux!on receives no funding from the project. Their motivation to participate is therefore related to their ability to exploit contacts made within the consortium, to re-use the knowledge gained and incorporate the results into a commercial product.

Furthermore, it is a goal of the project to encourage the participation of the targeted regions in future IST project proposals. This collaboration may lead to subsequent EC projects, which is also a form of exploitation of the results.

3.1 Overview Table

The following table gives an overview of the 16 results that have been identified as potentially exploitable:

Exploitable Knowledge	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner and other Partner(s) involved
Result 1: Module 1 - General IPv6 introduction	Slide set	The *material* can be used by companies/ institutes in the education and training business. The *knowledge* is useful for operators of large corporate/ campus networks, end users, ISPs, carriers	Immediately usable	None	RENATER, HUNGARnet, Cisco

Result 2: Module 2 - IPv4 -> IPv6 transition mechanisms and co-existence scenarios - esp. dual stack	As above	As above	As above	As above	SOTON-ECS, RENATER
Result 3: Module 3 - IPv6 and associated protocols	As above	As above	As above	As above	RENATER
Result 4: Module 4 - Addressing and Multihoming	As above	As above	As above	As above	RENATER
Result 5: Module 5 - Renumbering IPv6 networks	As above	As above	As above	As above	SOTON-ECS
Result 6: Module 6 - Security	As above	As above	As above	As above	UCL
Result 7: Module 7 - Multicast	As above	As above	As above	As above	RENATER
Result 8: Module 8 - Mobility	As above	As above	As above	As above	Cisco
Result 9: Module 9 - QoS	As above	As above	As above	As above	GRNET
Result 10: Module 10 - DNS	As above	As above	As above	As above	FCCN

Result 11: Module 11 - Auto-configuration and DHCP	As above	As above	As above	As above	FCCN
Result 12: Module 12 - Routing (and RPSLng)	As above	As above	As above	As above	FCCN
Result 13: Module 13 - Applications	As above	As above	As above	As above	UCL
Result 14: Course material 1 - IPv6 Technical Training	Material and laboratory equipment for IPv6 technical training	As above	As above	As above	Cisco
Result 15: Course material 2 - Training the Trainers	Material and laboratory equipment for training the trainers	As above	As above	As above	Cisco
Result 16: E-learning package	7 e-learning modules	As above	As above	As above	Instrux!on, Cisco

3.2 Supplementary information for each Result

Result 1: Module 1 - General IPv6 introduction

The overall market adoption of IPv6 will be determined by the ability of the architecture to best accommodate Internet growth, new applications and compelling IP services. IPv6 most notably offers expanded IP addresses, integrated auto-configuration, QoS, mobility and security.

In order to test all these facilities in a representative manner, the 6NET project built and operated a dedicated international pilot IPv6 network, and used this network to validate that the demands for the continuous growth of the global Internet can be met with the new IPv6 technology. It also validated the migration strategies for integrating IPv6 with the existing IPv4 infrastructure and evaluated the deployment and manageability of a large IPv6 network including physical infrastructure, address allocation, registries, routing and DNS operation.

The results of the experiences from 6NET are brought directly into 6DISS by the relevant partners, and documented in this set of slides. Since the material is based on practical experience gained on a realistic deployment it gives confidence to the workshop participants - and other organisations interested in exploiting the contents - that the information is accurate.

Result 2: Module 2 - IPv4 -> IPv6 transition mechanisms and co-existence scenarios - especially dual stack

In this module we explain the introduction of - and transition to - IPv6 networking in core networks and end-sites, which can for example be University campuses.

The conclusions are drawn from studies and trials of a number of transition techniques, including:

- Dual stack IPv4/IPv6 services, including Dual Stack Transition Mechanism (DSTM)
- Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)
- TCP-relay methods (eg. the “faithd” user-level translator from IPv6 to IPv4).
- Network Address Translation - Protocol Translation (NAT-PT) [RFC 2766] (which uses header rewriting between IPv4 and IPv6, like IPv4 NAT but also converting between IP protocols)
- Bump-in-the-Stack (BiS) [RFC 2767] (which snoops and converts data between protocols)
- Application Layer Gateways (ALGs) and proxies - such as web caches and e-mail gateways (including where to deploy them, and contrasting them to NAT-PT).

Result 3: Module 3 - IPv6 and associated protocols

In the context of IPv6, the KAME stack for several BSD variants is arguably one of the most advanced and complete IPv6 implementation. In fact, many router vendors use it in their products. A comparable implementation for Linux is available from the USAGI project. Such open-source operating systems and related software projects provide most of the functions required by IPv6 (or dual stack) edge routers: routing protocols, QoS and queue control, packet classification and filtering etc.

Result 4: Module 4 - Addressing and Multihoming

Addressing

Today, more than 1 billion people use the Internet. Companies are making huge savings in customer service costs by putting information on their Web sites, while others are actively using the Web for marketing and/or e-commerce. The Internet and the World Wide Web have made information available almost instantly to millions of people. This is focusing attention on the size of the addressing range, which now needs to be expanded to accommodate the increasing number of concurrent users (especially for countries that have been allocated few addresses) and attached terminals, devices and sensors.

Multihoming

In today's Internet, multihoming to several ISPs is a widely used strategy to increase the availability and resilience of Internet Services. The IETF multi6 WG is defining the requirements of multihoming and analysing the issues that are known from multihoming in IPv4. Many different concepts are under study here and this module will continue to reflect the current status of the work in the IETF.

Result 5: Module 5 - Renumbering IPv6 networks

One of the key design goals for IPv6 is to "facilitate the graceful renumbering of a site's machines" [RFC2462]. By "renumbering a network" we mean replacing the use of an existing (or "old") prefix throughout a network with a new prefix. IPv6 neighbour discovery [RFC2461] and stateless address auto-configuration [RFC2462] are examples of features in IPv6 designed to facilitate and automate the process of renumbering. The ideal situation would be to allow for renumbering of a network without any interruption of service to users.

As of now, there is a lack of operational experience in IPv6 network renumbering. One goal of this module is therefore to document the effects that a procedure as described in the IETF Internet Draft “Procedures for Renumbering an IPv6 Network without a Flag Day” (draft-ietf-v6ops-renumbering-procedure-00) has on a production network. The focus of this module is initially home/SOHO networks and core networks.

Result 6: Module 6 - Security

This module identifies the main aims of security as being:

- To ensure the robustness of the infrastructure
- To apply authentication and authorization, and ensure any accounting is accurate
- To maintain confidentiality of the information
- To maintain integrity and non-repudiation

The main threats are:

- Scanning gateways and hosts for weakness
- Scanning for multicast addresses
- Exposing weaknesses with NATs
- Unauthorised access
- Weaknesses in Firewalls
- Performance attacks with fragmented headers
- Protocol weaknesses
- Distributed Denial of Service

One conclusion is that IPv6 has the potential to be a foundation of a more secure Internet.

Result 7: Module 7 - Multicast

Modern networks need to transmit streams of video, audio, animated graphics, news, financial, or other timely data to groups of functionally related, but dispersed, end-stations. This is best achieved by network layer multicast. Typically, a server sends out a single stream of data, and a multicast-capable network routes the server's packets to each user in the multicast group, replicating the packets as seldom as possible.

Routers use multicast protocols such as PIM (Protocol Independent Multicast), SM (Sparse Mode), DM (Dense Mode) or MOSPF (Multicast Open Shortest Path First) to dynamically construct the packet distribution tree that connects all members of a group with the multicast server. Only members that have joined the multicast group perform the processing to receive the data. A new member becomes part of a multicast group by sending a "join" message to a nearby router. The distribution tree is then adjusted to include the new route. Servers can then multicast a single packet, and it will be replicated as needed and forwarded through the internetwork to the multicast group. This conserves both server and network resources and, hence, is superior to unicast and broadcast solutions.

Multicast applications have been developed for IPv4, but IPv6 extends IP multicasting capabilities by defining a much larger multicast address space. All IPv6 hosts and routers are required to support multicast. In fact, IPv6 has no broadcast address as such; it has various multicast addresses with different scopes. The improved scoping offered in IPv6 promises to simplify the use and administration of multicast in many applications.

Another important point is that anycast services, supported in the IPv6 specification, are not defined architecturally in IPv4. Conceptually, anycast is a cross between unicast and multicast: an arbitrary collection of nodes may be designated as an anycast group. A packet addressed to the group's anycast address is delivered to only one of the nodes in the group, typically the node with the "nearest" interface in

the group, according to current routing protocol metrics. This is in contrast with multicast services, which deliver packets to all members of the multicast group. Nodes in an anycast group are specially configured to recognise anycast addresses, which are drawn from the unicast address space.

Anycasting is a new service, and its applications have not been fully developed. Using anycast, an organisation could forward packets to exactly one of the routers on its ISP's backbone. If all of a provider's routers have the same anycast address, traffic from the enterprise will have several redundant access points to the Internet. Also, if one of the backbone routers goes down, the next nearest device automatically will receive the traffic.

Result 8: Module 8 - Mobility

One of the most interesting and challenging areas of development and research is that of mobile systems, and the convergence of mobile and fixed network technologies. It is clear that, if the full potential of mobile systems is to be realized, they must be interconnected using a wide range of technologies from conventional high speed wired (such as gigabit Ethernet) to wireless such as IEEE 802.11 networks. The importance of this has been recognised in the Internet community by the introduction of Mobile IPv6, which has been specified to support mobility as an integral part of the IPv6 protocol. The content of this module is supported by implementations and trials made in the 6NET project. It includes:

- the issues involved with providing MIPv6 support within a network
- handoff latencies
- the relationship between auto-configuration and user/terminal management. The auto-configuration features of IPv6 provide a very flexible approach to the configuration of IPv6 addresses, but within a mobile domain with a large number of devices and a large number of addresses, the relationship between the addresses, the users and the terminals must be defined and managed
- an analysis of the use of MIPv6 as an enabling technology for the provision of wireless overlays / multihoming.

The exploitable result is therefore a set of slides that enable the understanding of Mobile IPv6 technology. It will offer technological guidance and trouble shooting methodology.

Concerning technical and economic market considerations, commercial and technical thresholds etc. it is already possible to start using and delivering IPv6 Mobility services. Regarding further additional research and development work, including collaboration with organizations from the targeted regions, there are still useful contributions that can be made to the IETF MIP6 WG.

Result 9: Module 9 - QoS

There are some fundamental similarities and differences to bear in mind when considering QoS in an IPv4 or IPv6 environment. IPv4 carries a "differentiated services" byte and IPv6 carries an equivalent "traffic class" byte, intended for the support of simple differentiated services. Both IPv4 and IPv6 can support the RSVP protocol for more complex QoS implementations.

Additionally, the IPv6 packet format contains a new 20-bit traffic-flow identification field that will likely be of great value to vendors who implement QoS network functions. Such QoS implementations are emerging today, but IPv6 lays the foundation so that a wide range of QoS functions (including bandwidth reservation and delay bounds) may be made available in an open and interoperable manner.

An additional benefit for QoS in IPv6 is that a flow label has been allocated within the IPv6 header that can be used to distinguish traffic flows for optimised routing. Furthermore, the flow label can be used to identify flows even when the payload is encrypted (ie. the port numbers are hidden).

The information is supported by the results of tests carried out in 6NET on testing router capabilities to perform Service Differentiation for services based on EF (Expedited Forwarding) and AF (Assured Forwarding).

Result 10: Module 10 - DNS

It is essential that administrators deploy a Domain Name Service (DNS) before deploying IPv6 or dual-stack hosts. In response to this issue, IETF designers have defined "DNS Extensions to Support IP Version 6". This specification created a new AAAA DNS record type that will map domain names to an IPv6 address.

Domain name lookups (reverse lookups) based on 128-bit addresses are also defined. Once an IPv6-capable DNS is in place, dual-stack hosts can interact interchangeably with IPv6 nodes. If a dual-stack host queries DNS and receives back a 32-bit address, IPv4 is used; if a 128-bit address is received, then IPv6 is used. Where the DNS has not been upgraded to IPv6, hosts can resolve name-to-IPv6-address mappings through the use of manually configured local name tables.

IPv6 auto-configuration and IPv6 DNS can be linked by using dynamic DNS updates, coupled with secure DNS. By these means, DNS servers can be securely and automatically updated whenever an IPv6 node acquires a new address, enabling an additional measure of convenience compared with renumbering in IPv4 today.

The DNS module comprises knowledge which is fundamental for the correct functioning of the IPv6 Internet and a smooth and seamless integration in today's global naming hierarchy. The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

Result 11: Module 11 – Auto-configuration and DHCP

The Auto-configuration and DHCP module informs about these basic services, which are fundamental in simplifying the use of IPv6. The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

Auto-configuration

The auto-configuration features of IPv6 provide a very flexible approach to the configuration of v6 addresses, but within a mobile domain with a large number of devices and a large number of addresses, the relationship between the addresses, the users and the terminals must be defined and managed.

DHCP

IPv4 networks often employ the Dynamic Host Configuration Protocol (DHCP) to reduce the effort associated with manually assigning addresses to end nodes. DHCP is termed a "stateful" address configuration tool because it maintains static tables that determine which addresses are assigned to newly connected network nodes. A new version of DHCP has been developed for IPv6 to provide similar stateful address assignment as may be desired by many network administrators. DHCPv6 also assists with efficient reconfiguration in addition to initial address configuration, by using multicast from the DHCP server to any desired population of users.

Result 12: Module 12 - Routing (and RPSLng)

This module focuses on the latest developments related to routing protocols with IPv6 support. Recently, new protocols such as I-ISISv6 and OSPFv6 been standardised. As an EGP, BGP4 will continue to be the common standard but new features are available.

The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

IPv6 helps to solve a number of problems that currently exist within and between enterprises. On the global scale, IPv6 will allow Internet backbone designers to create a flexible and expandable global routing hierarchy.

The Internet backbone, where major organisations and Internet Service Provider (ISP) networks come together, depends upon the maintenance of a hierarchical address system. Without an address hierarchy, backbone routers would be forced to store route table information on the reachability of every network in the world. Given the current number of IP subnets in the world and the growth of the Internet, it is not feasible to manage route tables and updates for so many routes. With a hierarchy, backbone routers can use IP address prefixes to determine how traffic should be routed through the backbone.

Many of the same problems that exist today in the Internet backbone are also being felt at the level of the organisation and the individual user. When an organisation is unable to summarise its routes effectively, it puts a larger load on the backbone route tables. If an organisation cannot present globally unique addresses to the Internet, it may be forced to deploy private, isolated address space that is not visible to the Internet.

IPv6, with its immensely larger address space, defines a multi-level hierarchical global routing architecture. Using CIDR-style prefixes, the IPv6 address space can be allocated in a way that facilitates route summarization, and controls expansion of route tables in backbone routers. The vastly greater availability of IPv6 addresses eliminates the need for private address spaces. ISPs will have enough addresses to allocate to smaller organisations and dial-in users that need globally unique addresses to fully exploit the Internet.

Result 13: Module 13 - Applications

The successful deployment and adoption of IPv6 is dependent on solutions that address both new and existing user application environments and bridge all applications to the IPv6 enabled middleware, applications, client devices and services. 6NET specified, developed and enhanced middleware and

application solutions that are geared to take advantage of IPv6 functions and thereby accelerate the adoption of IPv6.

This module makes application developers aware of these results. It is shown that existing applications and middleware can be adapted for IPv6 with minor modification.

The IPv6 applications implemented and promoted to the user communities through 6DISS are:

- Real-time videoconferencing and media streaming,
- On-line games,
- E-business solutions,
- Edge Services for IPv6,
- Grid Solutions.

Result 14: Course material 1 - IPv6 Training

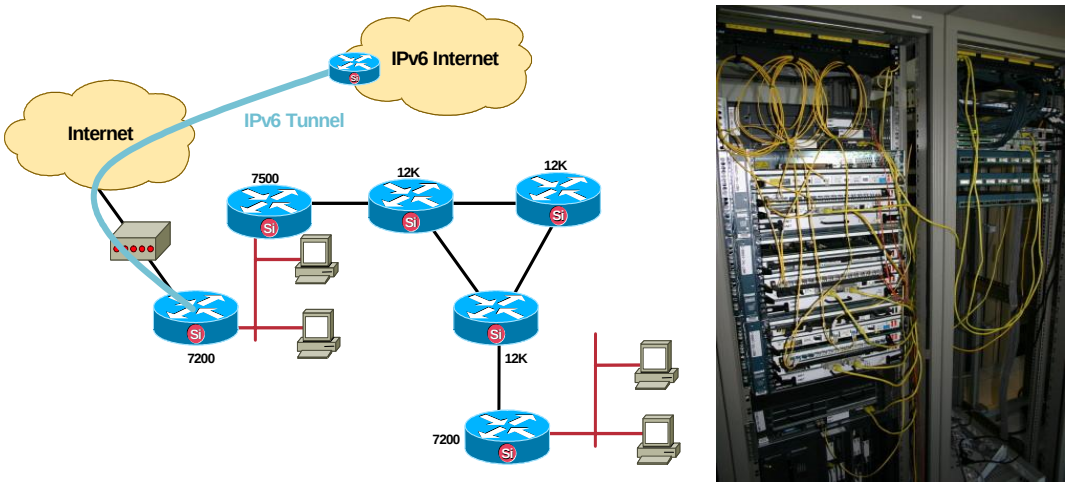
The IPv6 Training is a technical course, based in Brussels or Paris, which exploits the laboratories at these locations. The course comprises both slides and hands-on sessions. It is intended for engineers and network managers (especially from ISPs) who will work with equipment on a daily basis, and who want a deeper technical training on IPv6 configuration and management. The main objectives of this "complementary, non-workshop training" are:

- To develop an IPv6 training course for engineers (e.g. deployment engineers, maintenance engineers, NOC personnel)
- To give IPv6 training to engineers (e.g. deployment engineers, maintenance engineers, NOC personnel) in a testbed laboratory

The training course will last 1 week and will cover the same items as in the workshops, but with more focus on hands-on practical examples. Equipment from Cisco, Alcatel and Juniper is available. Typically, the course is suitable for up to 20 people.

More details can be found in Deliverable D12: "IPv6 Training Material".

The layout of the Brussels laboratory, and some of the equipment is shown below:



The Brussels Equipment

Result 15: Course material 2 - Training the Trainers

Due to time and budget constraints, 6DISS cannot deliver an unlimited amount of workshops. However, by offering a "Training the Trainers" facility, 6DISS is able to train other people, who can then disseminate the information further. These trainers will be given the full set of material, some guidelines for presenting the modules, additional notes to accompany the slides, and a list of key messages to get across to the participants.

The training can be given in Europe (Brussels or Paris), or at a local location; ideally immediately prior to - or after - a workshop.

The purpose of this course is to train trainers, who can then go back to the regions and disseminate the information on behalf of 6DISS. The intention is to satisfy needs such as:

- regions wishing to take advantage of the 6DISS material, independently from the workshops.
- people in the targeted regions wishing to make some training prior to the workshop
- due to high travel costs or other constraints, persons were not able to attend the workshop
- due to the success of the workshop, the local organisations wish to run several more in the region themselves
- as a result of a workshop on one particular topic, interest is generated in some of the other 6DISS topics (e.g. specialist programmes for Network Operation Centres, ISPs, or regulators)

The full set of material from WP1 is made available, plus specialist material from WP2. Equipment for the hands-on instruction is provided by Cisco and Alcatel.

The main objectives of this "complementary, non-workshop training" are:

- To train a set of experienced people so they can organise training session in their own region.
- To build a specific set of tutorial material suited to Internet / IPv6 trainers' needs.

Typically, the course is suitable for up to 20 people.

More details can be found in Deliverable D11: "Training the Trainers Material".

Result 16: E-learning package

The e-learning package is a set of attractive and effective content, using a well-balanced combination of audio (voice), graphical and animation components. The product guides the user to the required reference material (eg. from the 6NET Cookbooks).

More information can be found in Deliverable D13: "E-Learning Material".

4 Dissemination of Knowledge

This section includes past and future dissemination activities which are listed in tabular form below. The overview table below is accompanied by a short description for each major activity (workshop, conference, etc.) having taken place or planned. Relevant details, such as references of journal publications and conferences, website addresses, dates, quantitative data, etc. are explicitly mentioned.

In 6DISS, WP1 is responsible for the workshop preparation and dissemination of knowledge, which is the central part of the project. It is in this workpackage that the material for the workshops is collected and updated, and where the workshops are tailored in conjunction with the targeted regions, in terms of the type of participants, the focus of the material to be presented, location, host organisation, sponsoring, etc. The manpower for being present at each workshop to give the presentations also resides in WP1. The follow-up support after the workshops is also handled here, through the "Tiger Team" representatives (helpdesk@6diss.org) who will answer specific technical questions that arise relating to deployment.

Concerning knowledge transfer, TERENA manages the project Website and organises related conferences, workshops and seminars for the exchange of information between TERENA member organisations and in the wider research networking community, and to make them and the Internet community at large aware of relevant developments. TERENA also pursues the transfer of technical and managerial knowledge to less advanced networking organisations in the countries represented by the TERENA membership, both on a bilateral and on a multilateral basis.

The following table gives an overview of the dissemination activities that 6DISS has been - and will be - involved in.

4.1 Overview Table

Planned/ actual Dates	**Type**	**Type of audience**	**Countries addressed**	**Size of audience**	**Partner responsible /involved**
March 2005	TERENA Executive Newsletter No. 6	General public	World		TERENA
April 2005	"European IPv6 Deployments" publication	Technical	China		RENATER
May 2005	"From IPv6 testbeds to large scale deployments" publication	Technical	Europe		RENATER
May 2005	Press Release: "6DISS project to deliver IPv6 message worldwide"	General	Worldwide		Martel TERENA EC
June 2005	IPv6 renumbering technical meeting, San Jose, USA	Technical	USA	30 -40	SOTON-ECS Cisco
June 6th 2005	IPv6 Summit, Barcelona	Technical	Europe	80 – 100	SOTON-ECS
20th-24th June 2005	Présentation «Formation de Formateurs en Technologies de l'Information» (FFTI-2), Conakry, Guinée	Technical	Guinée		RENATER
26th-27th June 2005	ICCI2005, Beijing: "IPv6 interconnection Services using 6PE over Carrier Supporting Carrier - The SEEREN Case"	Technical	China		GRNET Cisco

Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audience	Partner responsible /involved
22nd-23rd August 2005	**1st 6DISS Workshop in Taipei**	Technical	Asia Pacific	45	SOTON-ECS Cisco HUNGARnet
19th-20th September 2005	**2nd 6DISS Workshop in South Africa**	Technical	Southern Africa	20 - 30	FCCN RENATER HUNGARnet
October 12th 2005	RIPE51 IPv6 WG meeting http://www.ripe.net/ripe/meetings/ripe-51/meeting-venue.html	Technical	Europe	100	RENATER
11th-14th December 2005	AfriNIC, Cairo: Presentations and "hands-on" session	Technical	Africa	20-40	Alcatel GRNET
13th-17th February 2006	ERNET CHEP Conference	Technical	India	Over 100	TERENA
March 2006	**3rd 6DISS Workshop**	Technical	Central and Southern America	20 - 30	TERENA FCCN GRNET
March 2006	**4th 6DISS Workshop, Malta**	Technical	Mediterranean countries	20 - 30	RENATER GRNET
April 2006	**5th 6DISS Workshop, Ochrid, FYRoM**	Technical	Balkan countries	20 - 30	GRNET ALCATEL UCL
October - December 2006	**6th 6DISS Workshop**	Technical	Sub-Saharan Africa	20 - 30	RENATER Cisco
April - June 2007	**7th 6DISS Workshop**	Technical	NIS countries and Central Asia	20 - 30	UCL SOTON-ECS
June - September 2007	**8th 6DISS Workshop**	Technical	The Caribbean	20 - 30	RENATER TERENA FCCN

4.2 Supplementary information about the dissemination activities

4.2.1 The 6DISS Workshops

The 8 workshops are the main mechanism of information transfer and collaboration-building. Two workshops have already been successfully held for the Asia Pacific and Southern Africa regions; six more are planned for the Central and Southern American region, Mediterranean region, Balkan countries, Sub-Saharan region, NIS and Central Asian countries and the Caribbean region. A Deliverable is produced describing each workshop, and these can be found on the 6DISS Website.

Best practices from the experiences of partners regarding deployment scenarios are exchanged during the workshops, thereby avoiding that the people in the targeted duplicate effort, or waste time on solutions that are known not to work, and generally making the most efficient usage of the available resources. Partners in 6DISS are active in deploying IPv6 on a production basis in their own NRENs and University networks, and

contribute to IETF informational/best common practice RFCs. The manufacturers in the consortium are also building IPv6 products.

The workshops are not only intended to lead to an improved quality of the Internet infrastructure in these countries, but will also raise the competence of the organisations and - exploiting the personal contacts made through 6DISS - facilitate and encourage their participation in future FP6 Calls and beyond.

Impacts from the workshops will include:

- a positive effect in preventing the "brain drain" from developing countries, by bringing interesting and state-of-the-art activities into these regions, making information and knowledge resources accessible to the scholars both locally and globally.
- the establishment of a communication channel between the scientific communities in the targeted regions and European industry, thus resulting in an increase in the demand for the specialised services provided by the highly skilled academics and researchers of the region.
- an expansion of the conditions for growth, by enabling the exchange of ideas, launching of joint experiments and projects, disseminating RTD results, and activating market forces; all 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 to an increase of the demand for specialized services provided by the highly skilled academics and researchers of the region.

While IPv6 standards and services remain constant, regional variations in practices and operations will require slightly different approaches for collaboration and dissemination. Therefore, the material for these workshops, and the workshop schedule, format and contents are tailored in conjunction with the local organisers, to suit the type of participants, the subjects to be addressed, the location, the host organisation, sponsors, etc.

In the **TERENA Executive Newsletter no. 6** the anticipated launch of 6DISS and its overall objectives were announced. The project duration and the targeted regions were also stated. The fact that 6DISS will provide training courses and practical workshops to those responsible for national research networks in these regions, and will also inform decision makers in these countries about the benefits of deploying IPv6 was mentioned. Finally, the project partners were listed.

The RENATER publication **European IPv6 Deployments** (April 2005) for the IPv6 Summit in Beijing can be found at: http://sem2.renater.fr/ipv6/biblio/presentation.html.

The RENATER publication **From IPv6 testbeds to large scale deployments**, which was presented at the RIPE50 Summit in Stockholm, Sweden (May 2005) can be found at: http://sem2.renater.fr/ipv6/biblio/presentation.html

The paper from Cisco and GRNET: **IPv6 interconnection Services using 6PE over Carrier Supporting Carrier - The SEEREN Case** was presented at the International Conference on Communication and Information (ICCI2005) in China (June 26th – 27th). The paper can be found at: http://www.confcenter.cn/huiyi/icci/icci2005/index.html. It states that the deployment of IPv6 technology on European research and commercial networks has been accelerated during recent years, and that today, GÉANT and most of the NRENs in Europe support native IPv6 services in their backbone networks. However, most commercial networks do not provide native IPv6 interconnection services, and therefore connectivity between isolated IPv6 islands is achieved via transition mechanisms that allow IPv6 to be deployed over the legacy IPv4 infrastructure. As an example of such a deployment, reference is made to SEEREN, the infrastructure that interconnects the South Eastern European NRENs, where the 6PE technique was chosen to support IPv6 connectivity. The paper provides implementation details of the technical solution.

4.2.2 The E-learning package

A professional e-learning package has been produced, which can be used by persons not able to attend the workshops. Though not as comprehensive as the slide set, the following modules are available:

Module 0: Introduction to the E-learning package

- The set of dissemination material that is available from 6DISS as a whole (the Website, E-learning package, Workshops, Laboratories, Tiger Team, deliverables)
- The positioning of the E-learning package within the whole framework

Module 1: Introduction to IPv6

- Limitations of IPv4
- Why IPv6 is needed

Module 2: IPv6 Addressing

- IPv6 address syntax
- Types of IPv6 addresses
- Automatic building of a host's interface identifier from its physical address

Module 3: The IPv6 Header

- Structure of an IPv6 packet header (and the differences between IPv4 and IPv6)
- IPv6 header functions
- IPv6 extension headers

Module 4: IPv6 Basic Services

- Internet Control Message Protocol (ICMP) for IPv6
- Neighbour Discovery Protocol (NDP)
- IPv6 stateless auto-configuration
- DHCPv6
- DNSv6
- IPv6 Multicasting (incl. Multicast Listener Discovery - MLD)
- QoS

Module 5: Security in IPv6

- IPv6 security elements
- IPSec functions in IPv6 (and differences from IPv4)

Module 6: IPv6 Routing, Mobility and Management

- Interior and Exterior Gateway Protocols
- Mobile IPv6
- Network management

Module 7: Coexistence with IPv4

- Transition and coexistence mechanisms overview
- Dual-Stack techniques
- Tunnelling techniques

An overview of each of these modules is given in Deliverable D13: "E-learning Material". The on-line e-learning package can be accessed via: www.6diss.org/e-learning

4.2.3 The IPv6 Technical Training Material

The IPv6 Training is a technical course, based in Brussels or Paris, which exploits the laboratory equipment at these locations. The course comprises both slides and hands-on sessions. It is intended for engineers and network managers (especially from ISPs) who will work with equipment on a daily basis, and who want a deeper technical training on IPv6 configuration and management. The main objectives of this "complementary, non-workshop training" are:

- To develop an IPv6 training course for engineers (e.g. deployment engineers, maintenance engineers, NOC personnel)
- To give IPv6 training to engineers (e.g. deployment engineers, maintenance engineers, NOC personnel) in a testbed laboratory

The training course will last 1 week and will cover the same items as in the workshops, but with more focus on hands-on practical examples. Equipment from Cisco, Alcatel and Juniper is available. Typically, the course is suitable for up to 20 people.

More details will be included in Deliverable D12: "IPv6 Training Material" (due M12).

4.2.4 The Training the Trainers Material

Due to time and budget constraints, 6DISS cannot deliver an unlimited amount of workshops. However, by offering a "Training the Trainers" facility, 6DISS is able to train other people, who can then disseminate the information further. These trainers will be given the full set of material from WP1, some guidelines for presenting the modules, additional notes to accompany the slides, and a list of key messages to get across to the participants.

The training can be given in Europe (Brussels or Paris), or at a local location; ideally immediately prior to - or after - a workshop.

The purpose of this course is to train trainers, who can then go back to the regions and disseminate the information on behalf of 6DISS. The intention is to satisfy needs such as:

- regions wishing to take advantage of the 6DISS material, independently from the workshops.
- people in the targeted regions wishing to make some training prior to the workshop
- due to high travel costs or other constraints, persons were not able to attend the workshop
- due to the success of the workshop, the local organisations wish to run several more in the region themselves
- as a result of a workshop on one particular topic, interest is generated in some of the other 6DISS topics (e.g. specialist programmes for Network Operation Centres, ISPs, or regulators)

Typically, the course is suitable for up to 20 people.

More details can be found in Deliverable D11: "Training the Trainers Material".

4.2.5 The Tiger Team

The 6DISS Tiger Team continues the work started in 6NET. The 6NET project produced over 100 deliverables in its lifetime from 2002 to 2005. Aims of the Tiger Team are to offer pointers to the relevant 6NET and 6DISS reference material and tutorials, and access to IPv6 expertise, via the virtual helpdesk.

The main material is made available to you as an IPv6 Wiki. The Wiki allows our team of IPv6 Tigers to modify and update the content on the fly.

A request tracker tool is installed to help us distribute all IPv6 queries to the appropriate people. To get IPv6 help, on any topic, just send an email to helpdesk@6diss.org and the request will be assigned to one of the Tiger Team members.

5 Publishable Results

This section provides a publishable summary of each result that is *potentially* exploitable result. Being an SSA project, it is not anticipated that technical knowledge will be acquired from the project that will be subsequently exploited commercially in the traditional way, through patents (as is expected from STREPs and IPs). Nevertheless, the teaching material and the e-learning package is important information, which will be refined throughout the project in accordance with feedback from the workshops and new outputs from the standards bodies. In this sense, the results of workshops are exploited through the improvement of the training material. This training material will be used by the partners in University courses and within their organizations.

We do not intend to apply for any patent to protect the contents of the material. The slide sets used in the workshops are considered to be public (they are based essentially on freely-available specifications from the IETF, or have been collected from presentations made previously by partners). However, it can be imagined that a commercial organization may want to take the material and include it in a product for IPv6 training. Each module is therefore listed below as a publishable result.

The e-learning package is based on a platform from the company Instrux!on. If there is an opportunity for selling the material to other companies, then this can probably only be done by Instrux!on, since they have the tools and expertise to make the necessary adaptations. Indeed, whilst the basic input data for the e-learning modules is provided by - and the results are checked by - 6DISS partners, Instrux!on receives no funding from the project. Their motivation to participate is therefore related to their ability to exploit contacts made within the consortium, to re-use the knowledge gained and incorporate the results into a commercial product. The e-learning package is therefore included in this section, in order that interested parties may contact Instrux!on for obtaining the information.

For each exploitable result, this section indicates:

- Possible market applications (sectors, type of use, ...) or how they might be used in further research (including expected timings)
- Stage of development (laboratory prototype, demonstrator, industrial product, ...)
- Collaboration sought or offered (manufacturing agreement, financial support or investment, information exchange, training, consultancy, other)
- Collaborator details (type of partner sought and task to be performed)
- Intellectual property rights granted or published
- Contact details

Result 1: Module 1: General IPv6 introduction

1	Module 1: General IPv6 Introduction

SUMMARY

The overall market adoption of IPv6 will be determined by the ability of the architecture to best accommodate Internet growth, new applications and compelling IP services. IPv6 most notably offers expanded IP addresses, integrated auto-configuration, QoS, mobility and security.

In order to test all these facilities in a representative manner, the 6NET project built and operated a dedicated international pilot IPv6 network, and used this network to validate that the demands for the continuous growth of the global Internet can be met with the new IPv6 technology. It also validated the migration strategies for integrating IPv6 with the existing IPv4 infrastructure and evaluated the deployment and manageability of a large IPv6 network including physical infrastructure, address allocation, registries, routing and DNS operation.

The results of the experiences from 6NET are brought directly into 6DISS by the relevant partners, and documented in this set of slides. Since the material is based on practical experience gained on a realistic deployment it gives confidence to the workshop participants - and other organisations interested in exploiting the contents - that the information is accurate.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 2: Module 2: IPv4 -> IPv6 transition mechanisms and co-existence scenarios – especially dual stack

2	Module 2: IPv4 -> IPv6 transition mechanisms and co-existence scenarios – especially dual stack.

SUMMARY

In this module we explain the introduction of - and transition to - IPv6 networking in core networks and end-sites, which can for example be University campuses.

The conclusions are drawn from studies and trials of a number of transition techniques, including:

- Dual stack IPv4/IPv6 services, including Dual Stack Transition Mechanism (DSTM)
- Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)
- TCP-relay methods (eg. the "faithd" user-level translator from IPv6 to IPv4).
- Network Address Translation - Protocol Translation (NAT-PT) [RFC 2766] (which uses header rewriting between IPv4 and IPv6, like IPv4 NAT but also converting between IP protocols)
- Bump-in-the-Stack (BiS) [RFC 2767] (which snoops and converts data between protocols)
- Application Layer Gateways (ALGs) and proxies - such as web caches and e-mail gateways (including where to deploy them, and contrasting them to NAT-PT).

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 3: Module 3: IPv6 and associated protocols

3	Module 3: IPv6 and associated protocols

SUMMARY

In the context of IPv6, the KAME stack for several BSD variants is arguably one of the most advanced and complete IPv6 implementation. In fact, many router vendors use it in their products. A comparable implementation for Linux is available from the USAGI project. Such open-source operating systems and related software projects provide most of the functions required by IPv6 (or dual stack) edge routers: routing protocols, QoS and queue control, packet classification and filtering etc.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 4: Module 4: Addressing and Multihoming

4	Module 4: Addressing and Multihoming

SUMMARY

Addressing

Today, more than 1 billion people use the Internet. Companies are making huge savings in customer service costs by putting information on their Web sites, while others are actively using the Web for marketing and/or e-commerce. The Internet and the World Wide Web have made information available almost instantly to millions of people. This is focusing attention on the size of the addressing range, which now needs to be expanded to accommodate the increasing number of concurrent users (especially for countries that have been allocated few addresses) and attached terminals, devices and sensors.

Multihoming

In today's Internet, multihoming to several ISPs is a widely used strategy to increase the availability and resilience of Internet Services. The IETF multi6 WG is defining the requirements of multihoming and analysing the issues that are known from multihoming in IPv4. Many different concepts are under study here and this module will continue to reflect the current status of the work in the IETF.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 5: Module 5: Renumbering IPv6 networks

5	Module 5: Renumbering IPv6 networks (SOTON-ECS)

SUMMARY

One of the key design goals for IPv6 is to "facilitate the graceful renumbering of a site's machines" [RFC2462]. By "renumbering a network" we mean replacing the use of an existing (or "old") prefix throughout a network with a new prefix. IPv6 neighbour discovery [RFC2461] and stateless address auto-configuration [RFC2462] are examples of features in IPv6 designed to facilitate and automate the process of renumbering. The ideal situation would be to allow for renumbering of a network without any interruption of service to users.

As of now, there is a lack of operational experience in IPv6 network renumbering. One goal of this module is therefore to document the effects that a procedure as described in the IETF Internet Draft “Procedures for Renumbering an IPv6 Network without a Flag Day” (draft-ietf-v6ops-renumbering-procedure-00) has on a production network. The focus of this module is initially home/SOHO networks and core networks.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 6: Module 6: Security

6	Module 6: Security

SUMMARY

This module identifies the main aims of security as being:

- To ensure the robustness of the infrastructure
- To apply authentication and authorization, and ensure any accounting is accurate
- To maintain confidentiality of the information
- To maintain integrity and non-repudiation

The main threats are:

- Scanning gateways and hosts for weakness
- Scanning for multicast addresses
- Exposing weaknesses with NATs
- Unauthorised access
- Weaknesses in Firewalls
- Performance attacks with fragmented headers
- Protocol weaknesses
- Distributed Denial of Service

One conclusion is that IPv6 has the potential to be a foundation of a more secure Internet

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		

Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 7: Module 7: Multicast

7	Module 7: Multicast

SUMMARY

Modern networks need to transmit streams of video, audio, animated graphics, news, financial, or other timely data to groups of functionally related, but dispersed, end-stations. This is best achieved by network layer multicast. Typically, a server sends out a single stream of data, and a multicast-capable network routes the server's packets to each user in the multicast group, replicating the packets as seldom as possible.

Routers use multicast protocols such as PIM (Protocol Independent Multicast), SM (Sparse Mode), DM (Dense Mode) or MOSPF (Multicast Open Shortest Path First) to dynamically construct the packet distribution tree that connects all members of a group with the multicast server. Only members that have joined the multicast group perform the processing to receive the data. A new member becomes part of a multicast group by sending a "join" message to a nearby router. The distribution tree is then adjusted to include the new route. Servers can then multicast a single packet, and it will be replicated as needed and forwarded through the internetwork to the multicast group. This conserves both server and network resources and, hence, is superior to unicast and broadcast solutions.

Multicast applications have been developed for IPv4, but IPv6 extends IP multicasting capabilities by defining a much larger multicast address space. All IPv6 hosts and routers are required to support multicast. In fact, IPv6 has no broadcast address as such; it has various multicast addresses with different scopes. The improved scoping offered in IPv6 promises to simplify the use and administration of multicast in many applications.

Another important point is that anycast services, supported in the IPv6 specification, are not defined architecturally in IPv4. Conceptually, anycast is a cross between unicast and multicast: an arbitrary collection of nodes may be designated as an anycast group. A packet addressed to the group's anycast address is delivered to only one of the nodes in the group, typically the node with the "nearest" interface in the group, according to current routing protocol metrics. This is in contrast with multicast services, which deliver packets to all members of the multicast group. Nodes in an anycast group are specially configured to recognise anycast addresses, which are drawn from the unicast address space.

Anycasting is a new service, and its applications have not been fully developed. Using anycast, an organisation could forward packets to exactly one of the routers on its ISP's backbone. If all of a provider's routers have the same anycast address, traffic from the enterprise will have several redundant access points to the Internet. Also, if one of the backbone routers goes down, the next nearest device automatically will receive the traffic.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	Sought	Offered
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.		Knowledge *(K)*/ Pre-existing know-how *(P)*
	Current	Foreseen	
Patent applied for	□ ……..	□	
Patent search carried out	□ ……..	□	
Patent granted	□ ……..	□	
Registered design	□ ……..	□	
Trademark applications	□ ……..	□	
Copyrights	□ ……..	□	
Secret know-how	□ ……..	□	
Other – please specify:	□ ……..	□	

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Result 8: Module 8: Mobility

8	Module 8: Mobility

SUMMARY

One of the most interesting and challenging areas of development and research is that of mobile systems, and the convergence of mobile and fixed network technologies. It is clear that, if the full potential of mobile systems is to be realized, they must be interconnected using a wide range of technologies from conventional high speed wired (such as gigabit Ethernet) to wireless such as IEEE 802.11 networks. The importance of this has been recognised in the Internet community by the introduction of Mobile IPv6, which has been specified to support mobility as an integral part of the IPv6 protocol. The content of this module is supported by implementations and trials made in the 6NET project. It includes:

- the issues involved with providing MIPv6 support within a network
- handoff latencies
- the relationship between auto-configuration and user/terminal management. The auto-configuration features of IPv6 provide a very flexible approach to the configuration of IPv6 addresses, but within a mobile domain with a large number of devices and a large number of addresses, the relationship between the addresses, the users and the terminals must be defined and managed
- an analysis of the use of MIPv6 as an enabling technology for the provision of wireless overlays / multihoming.

The exploitable result is therefore a set of slides that enable the understanding of Mobile IPv6 technology. It will offer technological guidance and trouble shooting methodology.

Concerning technical and economic market considerations, commercial and technical thresholds etc. it is already possible to start using and delivering IPv6 Mobility services. Regarding further additional research and development work, including collaboration with organizations from the targeted regions, there are still useful contributions that can be made to the IETF MIP6 WG.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement	✓	
Financial support or investment		
Information exchange		✓

Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

If companies involved in the mobile communications business are interested to explore making joint research and/or development into the benefits of combining IPv6 and mobility, this is welcomed.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 9: Module 9: QoS

9	Module 9: QoS

SUMMARY

There are some fundamental similarities and differences to bear in mind when considering QoS in an IPv4 or IPv6 environment. IPv4 carries a "differentiated services" byte and IPv6 carries an equivalent "traffic class" byte, intended for the support of simple differentiated services. Both IPv4 and IPv6 can support the RSVP protocol for more complex QoS implementations.

Additionally, the IPv6 packet format contains a new 20-bit traffic-flow identification field that will likely be of great value to vendors who implement QoS network functions. Such QoS implementations are emerging today, but IPv6 lays the foundation so that a wide range of QoS functions (including bandwidth reservation and delay bounds) may be made available in an open and interoperable manner.

An additional benefit for QoS in IPv6 is that a flow label has been allocated within the IPv6 header that can be used to distinguish traffic flows for optimised routing. Furthermore, the flow label can be used to identify flows even when the payload is encrypted (ie. the port numbers are hidden).

The information is supported by the results of tests carried out in 6NET on testing router capabilities to perform Service Differentiation for services based on EF (Expedited Forwarding) and AF (Assured Forwarding).

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 10: Module 10: DNS

10	Module 10: DNS

SUMMARY

It is essential that administrators deploy a Domain Name Service (DNS) before deploying IPv6 or dual-stack hosts. In response to this issue, IETF designers have defined "DNS Extensions to Support IP Version 6". This specification created a new AAAA DNS record type that will map domain names to an IPv6 address.

Domain name lookups (reverse lookups) based on 128-bit addresses are also defined. Once an IPv6-capable DNS is in place, dual-stack hosts can interact interchangeably with IPv6 nodes. If a dual-stack host queries DNS and receives back a 32-bit address, IPv4 is used; if a 128-bit address is received, then IPv6 is used. Where the DNS has not been upgraded to IPv6, hosts can resolve name-to-IPv6-address mappings through the use of manually configured local name tables.

IPv6 auto-configuration and IPv6 DNS can be linked by using dynamic DNS updates, coupled with secure DNS. By these means, DNS servers can be securely and automatically updated whenever an IPv6 node acquires a new address, enabling an additional measure of convenience compared with renumbering in IPv4 today.

The DNS module comprises knowledge which is fundamental for the correct functioning of the IPv6 Internet and a smooth and seamless integration in today's global naming hierarchy. The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	Sought	Offered
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.		Knowledge *(K)*/ Pre-existing know-how *(P)*
	Current	Foreseen	
Patent applied for	□ ……..	□	
Patent search carried out	□ ……..	□	
Patent granted	□ ……..	□	
Registered design	□ ……..	□	
Trademark applications	□ ……..	□	
Copyrights	□ ……..	□	
Secret know-how	□ ……..	□	
Other – please specify:	□ ……..	□	

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Result 11: Module 11: Auto-configuration and DHCP

11	Module 11: Auto-configuration and DHCP

SUMMARY

The Auto-configuration and DHCP module informs about these basic services, which are fundamental in simplifying the use of IPv6. The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

Auto-configuration

The auto-configuration features of IPv6 provide a very flexible approach to the configuration of v6 addresses, but within a mobile domain with a large number of devices and a large number of addresses, the relationship between the addresses, the users and the terminals must be defined and managed.

DHCP

IPv4 networks often employ the Dynamic Host Configuration Protocol (DHCP) to reduce the effort associated with manually assigning addresses to end nodes. DHCP is termed a "stateful" address configuration tool because it maintains static tables that determine which addresses are assigned to newly connected network nodes. A new version of DHCP has been developed for IPv6 to provide similar stateful address assignment as may be desired by many network administrators. DHCPv6 also assists with efficient reconfiguration in addition to initial address configuration, by using multicast from the DHCP server to any desired population of users.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	Sought	Offered
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.		Knowledge *(K)*/ Pre-existing know-how *(P)*
	Current	Foreseen	
Patent applied for	□ ……..	□	
Patent search carried out	□ ……..	□	
Patent granted	□ ……..	□	
Registered design	□ ……..	□	
Trademark applications	□ ……..	□	
Copyrights	□ ……..	□	
Secret know-how	□ ……..	□	
Other – please specify:	□ ……..	□	

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Result 12: Module 12: Routing (and RPSLng)

12	Module 12: Routing (and RPSLng)

SUMMARY

This module focuses on the latest developments related to routing protocols with IPv6 support. Recently, new protocols such as I-ISISv6 and OSPFv6 been standardised. As an EGP, BGP4 will continue to be the common standard but new features are available.

The exploitable results are twofold:

- the deployment of IPv6 DNS in the teaching and training sessions and workshops, is a support communication channel for conveying the intended knowledge
- the module slide set is reference material to which attendees can return to and recall any particular issue

The module:

- informs about the advanced development status of IPv6 technologies
- dismisses myths about the difficulties and shortcomings of IPv6
- explains the best common practices that avoid well-known pitfalls
- helps readers minimise the time to deploy

IPv6 helps to solve a number of problems that currently exist within and between enterprises. On the global scale, IPv6 will allow Internet backbone designers to create a flexible and expandable global routing hierarchy.

The Internet backbone, where major organisations and Internet Service Provider (ISP) networks come together, depends upon the maintenance of a hierarchical address system. Without an address hierarchy, backbone routers would be forced to store route table information on the reachability of every network in the world. Given the current number of IP subnets in the world and the growth of the Internet, it is not feasible to manage route tables and updates for so many routes. With a hierarchy, backbone routers can use IP address prefixes to determine how traffic should be routed through the backbone.

Many of the same problems that exist today in the Internet backbone are also being felt at the level of the organisation and the individual user. When an organisation is unable to summarise its routes effectively, it puts a larger load on the backbone route tables. If an organisation cannot present globally unique addresses to the Internet, it may be forced to deploy private, isolated address space that is not visible to the Internet.

IPv6, with its immensely larger address space, defines a multi-level hierarchical global routing architecture. Using CIDR-style prefixes, the IPv6 address space can be allocated in a way that facilitates route summarization, and controls expansion of route tables in backbone routers. The vastly greater availability of IPv6 addresses eliminates the need for private address spaces. ISPs will have enough addresses to allocate to smaller organisations and dial-in users that need globally unique addresses to fully exploit the Internet.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐

Other (please specify)	☐

Collaboration sought or offered

Collaboration type	Sought	Offered
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.		Knowledge *(K)*/ Pre-existing know-how *(P)*
	Current	Foreseen	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 13: Module 13: Applications

13	Module 13: Applications

SUMMARY

The successful deployment and adoption of IPv6 is dependent on solutions that address both new and existing user application environments and bridge all applications to the IPv6 enabled middleware, applications, client devices and services. 6NET specified, developed and enhanced middleware and application solutions that are geared to take advantage of IPv6 functions and thereby accelerate the adoption of IPv6.

This module makes application developers aware of these results. It is shown that existing applications and middleware can be adapted for IPv6 with minor modification.

The IPv6 applications implemented and promoted to the user communities through 6DISS are:

- Real-time videoconferencing and media streaming
- On-line games
- E-business solutions
- Edge Services for IPv6
- Grid Solutions.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 14: Course Material 1: IPv6 Training

14	Course Material 1: IPv6 Training

SUMMARY

The IPv6 Training is a technical course, based in Brussels or Paris, which exploits the laboratories at these locations. The course comprises both slides and hands-on sessions. It is intended for engineers and network managers (especially from ISPs) who will work with equipment on a daily basis, and who want a deeper technical training on IPv6 configuration and management. The main objectives of this "complementary, non-workshop training" are:

- To develop an IPv6 training course for engineers (e.g. deployment engineers, maintenance engineers, NOC personnel)
- To give IPv6 training to engineers (e.g. deployment engineers, maintenance engineers, NOC personnel) in a testbed laboratory

The training course will last 1 week and will cover the same items as in the workshops, but with more focus on hands-on practical examples. Equipment from Cisco, Alcatel and Juniper is available. Typically, the course is suitable for up to 20 people.

More details can be found in Deliverable D12: "IPv6 Training Material".

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	✓
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 15: Course Material 2: Training the Trainers

15	Course Material 2: Training the Trainers

SUMMARY

Due to time and budget constraints, 6DISS cannot deliver an unlimited amount of workshops. However, by offering a "Training the Trainers" facility, 6DISS is able to train other people, who can then disseminate the information further. These trainers will be given the full set of material from WP1, some guidelines for presenting the modules, additional notes to accompany the slides, and a list of key messages to get across to the participants.

The training can be given in Europe (Brussels or Paris), or at a local location; ideally immediately prior to - or after - a workshop.

The purpose of this course is to train trainers, who can then go back to the regions and disseminate the information on behalf of 6DISS. The intention is to satisfy needs such as:

- regions wishing to take advantage of the 6DISS material, independently from the workshops.
- people in the targeted regions wishing to make some training prior to the workshop
- due to high travel costs or other constraints, persons were not able to attend the workshop
- due to the success of the workshop, the local organisations wish to run several more in the region themselves
- as a result of a workshop on one particular topic, interest is generated in some of the other 6DISS topics (e.g. specialist programmes for Network Operation Centres, ISPs, or regulators)

Typically, the course is suitable for up to 20 people.

More details can be found in Deliverable D11: "Training the Trainers Material".

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	✓
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	☐
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓

Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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Result 16: E-learning Package

16	E-learning Package

SUMMARY

The e-learning package is a set of attractive and effective content, using a well-balanced combination of audio (voice), graphical and animation components. The product guides the user to the required reference material (eg. from the 6NET Cookbooks).

More information can be found in Deliverable D13: “E-Learning Material”.

CURRENT STAGE OF DEVELOPMENT

Scientific and/or Technical knowledge (Basic research)	☐
Guidelines, methodologies, technical drawings	☐
Software code	☐
Experimental development stage (laboratory prototype)	☐
Prototype/demonstrator available for testing	✓
Results of demonstration trials available	☐
Other (please specify)	☐

Collaboration sought or offered

Collaboration type	**Sought**	**Offered**
Manufacturing agreement		
Financial support or investment		
Information exchange		✓
Training		✓
Consultancy		
Other (please specify)		

COLLABORATION DETAILS

Partners interested in collaboration are expected to be professional trainers, Universities, research institutes and ISPs that would be interested to use the material for training purposes.

Commercial exploitation will be done through Instruxion (www.instruxion.com).

INTELLECTUAL PROPERTY RIGHTS

Type of IPR	**Tick a box and give the corresponding details (reference numbers, etc.) if appropriate.**		**Knowledge *(K)*/ Pre-existing know-how *(P)***
	Current	**Foreseen**	
Patent applied for	☐ ……..	☐	
Patent search carried out	☐ ……..	☐	
Patent granted	☐ ……..	☐	
Registered design	☐ ……..	☐	
Trademark applications	☐ ……..	☐	
Copyrights	☐ ……..	☐	
Secret know-how	☐ ……..	☐	
Other – please specify:	☐ ……..	☐	

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6 Conclusion

6DISS builds on the IPv6 deployment experiences of the 6NET, Euro6IX and GÉANT projects, as well as the liaisons established with the IPv6 Forum, European IPv6 Task Force and IETF.

The goal of the project is to enable organizations in certain targeted regions benefit from this experience. Since they usually have fewer legacy installations, they are often able to deploy the new IPv6 technology in an efficient manner, and catch up quickly with Europe, the US and Japan. The documentation produced by the aforementioned projects is being used as the basis of the 6DISS training material, and will be further expanded and improved during the lifetime of the project.

During the first 9 months of the project, the 6DISS project has collected and collated an enormous amount of material regarding IPv6, and packaged this into a consistent and accurate set of slides that represent a comprehensive reference on the complete range of topics relating to IPv6. Furthermore, the material has been divided into manageable modules that can be chosen selectively for dissemination to groups of people with interest in specific subjects. This material has already been successfully used to disseminate the current state-of-the-art knowledge on IPv6 to two of the target regions, Asia-Pacific and Southern Africa. The workshop in South Africa has already led to follow-up enquiries about further collaboration with the EU.

A further six IPv6 training workshops will be organised in the Caribbean, Central Asia, the Mediterranean, South & Central America, South-East Europe, and Sub-Saharan Africa, with follow-up support (from a so-called “Tiger Team”) being made available. This will also provide an opportunity to evaluate the current state of research networking in each region.

In addition, the project has used the material to produce an e-learning package, which enables anyone with an Internet connection to access the program and interactively learn about the main points of IPv6, and to test their knowledge. This package is available via the project Website.

6DISS has also built up the facilities for providing specialist training for instructors and engineers at two locations in Europe (Brussels and Paris).

Partners have begun to establish liaisons that will enable the exchange of deployment experiences with representatives of research networks in China and India.

7 Annex:

7.1 Success Stories

7.1.1 Asia-Pacific IPv6 Training Workshop

Date: **22nd - 23rd August 2005**

Location: **Howard Plaza Hotel, Taipei, Taiwan**

This workshop was aimed at network administrators in the Asia-Pacific region, particularly those working for NRENs or ISPs. It provided practical IPv6 training on addressing, migration from IPv4 to IPv6, multihoming, as well as mobility and security issues. The programme included practical hands-on sessions, along with access to a remote testbed for more complex configurations. In addition, specific deployment cases were considered.

The workshop was being held in conjunction with the Global IPv6 Summit Taipei on 23rd-29th August 2005, and the 20th APAN Meeting on 23rd-27th August 2005.

Monday, 22nd August (08:30-17:00)

IPv6 Addressing - *Patrick Grossetete & Kevin Chi, Cisco*

IPv6 Neighbour Discovery - *Patrick Grossetete & Kevin Chi, Cisco*

IPv6 Static Routing - *Patrick Grossetete & Kevin Chi, Cisco*

RIPng - *Patrick Grossetete & Kevin Chi, Cisco*

IPv6 Traffic Filtering - *Patrick Grossetete & Kevin Chi, Cisco*

OSPFv3 - *Patrick Grossetete & Kevin Chi, Cisco*

BGP4+ - *Patrick Grossetete & Kevin Chi, Cisco*

Tuesday, 23rd August (08:30-17:30)

Mobile IPv6 in Cisco IOS - *Patrick Grossetete, Cisco*

IPv6 Security - *Janos Mohacsi, NIIF/HUNGARNET*

IPv6 Multicast - *Stig Venaas, University of Southampton*

IPv6 Network Management - *Stig Venaas, University of Southampton*

Question and Answer Session

7.1.2 Southern Africa IPv6 Training Workshop

Date: **19th - 20th September 2005**

Location: **Port Elizabeth, South Africa**

This workshop was aimed at network administrators in Southern Africa and drew 23 participants from universities and ISPs. It provided practical IPv6 training on addressing, migration from IPv4 to IPv6, multihoming, as well as mobility and security issues. Specific deployment cases were also presented.

The workshop was held in conjunction with the DITCHE National Techie Event 2005.

Monday, 19th September 2005

6DISS Overview - *Janos Mohacsi, NIIF/HUNGARNET*

IPv6 Introduction - *Bernard Tuy, RENATER*

IPv6 Protocol (RFC 2460 DS) - *Bernard Tuy, RENATER*

IPv6 Addressing - *Bernard Tuy, RENATER*

IPv6 Addressing Case Study (RENATER) - *Bernard Tuy, RENATER*

Addressing Architecture at NIIF/HUNGARNET - *Janos Mohacsi, NIIF/HUNGARNET*

IPv6 Auto-configuration (Stateless and Stateful) - *João Nuno Ferreira, FCCN*

IPv6 Associated Protocols - *Bernard Tuy, RENATER*

IPv6 Support in the DNS - *João Nuno Ferreira, FCCN*

IPv6 Support on the ccTLD .pt - *João Nuno Ferreira, FCCN*

Host Configuration Overview - *Janos Mohacsi, NIIF/HUNGARNET*

Routing Protocols (Intra- and Inter-domain) - *João Nuno Ferreira, FCCN*

IPv6 Routing Configuration - *Janos Mohacsi, NIIF/HUNGARNET*

Tuesday, 20th September 2005

Question and Answer Session

Multihoming - *Janos Mohacsi, NIIF/HUNGARNET*

Campus IPv6 Deployment - *Janos Mohacsi, NIIF/HUNGARNET*

IPv6 Security - *Janos Mohacsi, NIIF/HUNGARNET*

IPv6 Mobility - *João Nuno Ferreira, FCCN*

IPv6 Multicast - *Bernard Tuy, RENATER*

M6Bone - *Bernard Tuy, RENATER*

IPv6 Network Management - *Bernard Tuy, RENATER*

7.2 Calendar of past related events

Date	Event	Venue
4-6 Apr '05	Global IPv6 Summit China	Beijing, China
14-15 Apr '05	17th TF-NGN Meeting	Zürich, Switzerland
18-19 Apr '05	6DISS Project Meeting #1	Diegem, Belgium
2-4 May '05	Internet2 Members Meeting	Arlington, USA
2-6 May '05	RIPE 50	Stockholm, Sweden
6-9 Jun '05	TERENA Networking Conference 2005	Poznan, Poland
6-10 Jun '05	Global IPv6 Summit Barcelona	Barcelona, Spain
13 Jun '05	6DISS Project Meeting #2	Paris, France
21 Jun '05	Global IPv6 Summit Korea	Seoul, South Korea
23-24 Jun '05	LACNIC VIII	Lima, Peru
26-29 Jun '05	Global Grid Forum 14	Chicago, USA
16-23 Jul '05	SANOG VI	Thimphu, Bhutan
28-29 Jul '05	18th TF-NGN Meeting	Paris, France
31 Jul - 5 Aug '05	IETF 63	Paris, France
16 Aug '05	Global IPv6 Summit Brazil	Sao Paulo, Brazil
21-23 Aug '05	**6DISS Workshop (Asia-Pacific)**	**Taipei, Taiwan**
23-29 Aug '05	Global IPv6 Summit Taipei	Taipei, Taiwan
23-27 Aug '05	20th APAN Meeting	Taipei, Taiwan
6-9 Sep '05	APNIC 20	Hanoi, Vietnam
7 Sep '05	Swiss IPv6 Summit	Geneva, Switzerland
12-14 Sep '05	6DISS Project Meeting #3	Paris, France
19-20 Sep '05	**6DISS Workshop (Southern Africa)**	**Port Elizabeth, South Africa**
19 Sep '05	North American IPv6 Summit	San Jose, USA
19-22 Sep '05	Internet2 Members Meeting	Philadelphia, USA

7.3 Calendar of related forthcoming events

Date	Event	Venue
9-12 Oct '05	Global Grid Forum 15	Boston, USA
10-14 Oct '05	RIPE 51	Amsterdam, The Netherlands
3-4 Nov '05	19th TF-NGN Meeting	Athens, Greece
6-11 Nov '05	IETF 64	Vancouver, Canada
11-14 Dec '06	AfriNIC-3	Cairo, Egypt
12-13 Jan '06	*20th TF-NGN Meeting (tbc)*	*Cambridge, United Kingdom*
12-20 Jan '06	SANOG VII	Mumbai, India
17-19 Jan '06	6DISS Project Meeting #4	London, United Kingdom
22-26 Jan '06	21st APAN Meeting	Tokyo, Japan
31 Jan '06	6DISS Project Review Preparation Meeting	Diegem, Belgium
1 Feb '06	6DISS Project Review	Diegem, Belgium
22 Feb - 3 Mar '06	APRICOT 2006	Perth, Australia
27 Feb - 3 Mar '06	APNIC 21	Perth, Australia
24-26 April '06	Internet2 Members Meeting	Arlington, USA
24-28 April '06	RIPE 52	Istanbul, Turkey
15-18 May '06	TERENA Networking Conference 2006	Catania, Italy
17-21 Jul '06	22nd APAN Meeting	Singapore
21 Feb - 2 Mar '07	APRICOT 2007	Bali, Indonesia
27 Feb - 3 Mar '07	APNIC 23	Bali, Indonesia

7.4 Raising the Visibility of the Project

A press release was issued on 20th May, announcing the start of the project. This can be viewed on the homepage of the Website.

Regarding general contact with the NREN community, TERENA has 33 European NRENs plus CERN and ESA in its membership. They also cooperate closely with other NRENs in SE Europe and the Mediterranean region through various EC-funded activities, and in other regions of the world with organisations such as Internet2/CANARIE (North America), APAN (Asia-Pacific) and CLARA (Latin America). They are constituent members of the CCIRN (Coordinating Committee for Intercontinental Research Networking) and the GLIF (Global Lambda Integrated Facility).

6DISS partners have also developed direct contacts with (amongst others) the following organizations, through which they are promoting the project and its dissemination capabilities:

7.4.1 South/Central America and the Caribbean

CLARA: FCCN is invited to attend and present at most of the CLARA Technical Meetings; recently in Rio Janeiro, Vera Cruz and Guatemala.

ALICE: The ALICE project is connecting the Latin American national research and education networks to GÉANT via a Latin American regional research network. FCCN is a member of ALICE.

LACNIC (via TERENA)

Note that there is currently no specific organisation that co-ordinates Internet deployment throughout all the Caribbean region. However, RENATER has the national responsibility for supporting the research connectivity to Guadeloupe and Martinique (being French Overseas Departments).

7.4.2 Central Asia /Caucuses

SPONGE (EC project) and **SILK** (NATO project), through UCL.

7.4.3 Africa

AFRINIC: FCCN is encouraging the Portuguese-speaking African countries to participate in this organization, namely Angola, Cape Verde and S. Tomé.

In the forthcoming AFRINIC conference (Cairo, 11th – 14th December) 6DISS has offered 2 presentations for the IPv6 session (13th December), and to lead the "hands-on" session on the 12th December.

6DISS has been invited to become the "knowledge advocacy" arm of the MEA&Ev6TF (the Middle East & Africa & Emerging Nations IPv6 Task Force) including Latin America, Asia-Pacific and Central Asia, in order to have "... a coordinated approach to IPv6 training in these regions".

7.4.3.1 Sub-saharan Africa

Senegal: 6DISS will follow up a first training workshop given in 2004 by RENATER at ESMT (Ecole Superieure Multinationale de Telecommunications) in Togo. ESMT co-ordinates the telecommunications training programme for a number of countries in the region.

7.4.3.2 Southern Africa

TENET: This collaboration began with a meeting between Soton-ECS and a representative of TENET (the South African NREN) at the IPv6 Summit in Barcelona 2005, where it was learnt that they intend to deploy IPv6 services in 2005/06. As a result, the 6DISS workshop for South Africa was brought forward ahead of its originally scheduled date, and held in September 2005 in conjunction with the DITCHE (Development of IT Capacity in Higher Education) conference.

7.4.4 Mediterranean Countries

EUMED-CONNECT: RENATER is a partner in the EUMED-CONNECT project, since it is both the provider of Internet connectivity to the region (via Tunisia) and is responsible for providing these countries with IPv6 knowledge and experience.

GRNET has also already helped organize other workshops in the EUMED-CONNECT region.

7.4.5 Balkans

GRNET is the co-ordinator of the SEEREN and SEE-GRID projects, which comprise, respectively, the SE European segments of GÉANT and EGEE.

SEEREN: The South-Eastern European Research and Education Network (SEEREN) interconnects the Research and Education Networks of Albania, Bosnia-Herzegovina, Bulgaria, FYR of Macedonia, Hungary, Romania, Serbia-Montenegro and Greece. The SEEREN network has operated since January 2004, and constitutes today the SE Europe segment of the multi-gigabit pan-European Research and Education network GÉANT. SEEREN has enacted a communication channel between the SE Europe research & scientific community and refocused the Research & Education community towards common endeavours. GRNET supports SEEREN towards the deployment of IPv6 technology in the local networks and assists with the development of IPv6 applications.

SEE-GRID: SEE-GRID aims to provide specific support actions to assist the participation of the SE European states in the pan-European and worldwide Grid initiatives by establishing a seamless and interoperable pilot-Grid infrastructure that expands and supports the European Research Area in the region. GRNET explains to the SEE-GRID community the benefits of deploying IPv6 technology in Grid infrastructure and provides technical advice when requested.

GRNET has already helped to organise workshops in the SE Europe region.

7.4.6 Asia-Pacific region

APAN: UCL attends the Asia-Pacific Advanced Network (APAN) meetings, and has collaborative IPv6 projects with organizations from the region for (among others) the AccessGrid video-conferencing application. TERENA also has contact with APAN.

7.4.7 India

ERNET: ERNET (the Indian NREN) has invited 6DISS, via TERENA, to make a presentation on IPv6 deployment experiences at their CHEP06 Conference in February 2006.

7.4.8 China

6DISS was represented at the ICCI2005 conference in Beijing, through GRNET.

7.5 Involvement of partners in other past and present IPv6 Activities

6Bone - *Experimental IPv6 testbed, now depreciated.*

IPv6 Transit Access Point (6TAP) - *Experimental IPv6 Internet Exchange.*

IPv6 Forum - *Worldwide consortium of Internet vendors and networks promoting IPv6.*

European IPv6 Task Force - *European consortium of national IPv6 task forces.*

APAN IPv6 Working Group - *Working on IPv6 deployment issues in Asia-Pacific region.*

Internet2 IPv6 Working Group - *Working on IPv6 deployment issues in USA.*

RIPE IPv6 Working Group - *Working on IPv6 deployment issues in Europe.*

TERENA TF-NGN - *Coordinates IPv6 activities amongst European NRENs.*

IPv6 Cluster - *Brings together IPv6-related projects.*

6NET - *Demonstrating use of IPv6 technology in a production environment.*

Euro6IX - *Establishment of IPv6-enabled Internet Exchanges (IXs).*

GÉANT - *Operating pan-European network to interconnect NRENs.*

6HOP - *Researching heterogeneous wireless IPv6 networks consisting of several wireless technologies.*

6INIT - *Investigated IPv6 networks for supporting multimedia services with QoS and security.*

6LINK - *Organised IPv6 clustering activities.*

6POWER - *Investigating deployment of IPv6 over power lines.*

6QM - *Research and development of measurement technologies for QoS in IPv6 networks.*

6WINIT - *Validating introduction of new mobile wireless Internet technologies.*

@HOM - *Promoting broadband home networks and development of seamless network architecture.*

ANDROID - *Proving use of application layers to provide dynamic customisation of services.*

DAIDALOS - *Integrating network technologies to give users access to personalised voice, data, and multimedia services.*

DRIVE - *Provision of in-vehicle multimedia services.*

Eurov6 - *Building an IPv6 showcase of applications and services.*

Future Home - *Developing open wireless specification for connecting home devices.*

GCAP - *Developing new end-to-end multicast and multimedia transport protocols.*

HARMONICS - *Developing dynamically reconfigurable fibre infrastructure.*

INTERMON - *Developing a scalable inter-domain QoS architecture with integrated monitoring.*

LONG - *Investigating problems related to the design, configuration and deployment of next generation networks.*

MESCAL - *Propose and validate scalable solutions enabling flexible deployment and delivery of inter-domain QoS.*

MIND - *Researching extension of IP-based radio access networks to include ad-hoc and wireless elements.*

Moby Dick - *Developing mechanisms for seamless handover, QoS, AAA and charging in wireless Internet infrastructures.*

NGN-LAB - *A testbed of interconnected laboratories for IPv6.*

NGNI - *A forum for next-generation networking initiatives.*

NOMAD - *Integration of technologies allowing users to freely roam across network infrastructures.*

OverDRiVE - *Coordination of UMTS and existing radio networks to provide mobile multimedia services.*

SATIP6 - *Developing efficient IPv6 protocols for satellite communication.*

SEEREN - *Provision of research and education network infrastructure in South-Eastern Europe.*

SEINIT - *Developing trusted and dependable security framework.*

TORRENT - *Building testbed for multi-service residential access networks.*

Tsunami - *Investigating deployment of new features of IPv6.*

Wireless Cabin - *Developing wireless network technologies for aircraft cabins.*

xMotion - *Developing networking technologies for emergency services.*

7.6 Partner Plans for the Support of Deployments

Martel has been involved in the follow-up discussions with TENET for initiating closer collaboration with the EC regarding Internet connectivity to the rest of the world and the exchange of information between those European organisations involved in complementary R&D activities and having already experience of deployments.

Cisco has had discussions with TENET (The Tertiary Education Network) concerning when the first full IPv6 roll outs are likely to occur. TENET is planning to start implementing IPv6 in the very near future. The plan so far is to drop a tunnel to GÉANT and announce the /32 and then drop IPv6 to the various institutions. They are planning on moving ahead with IPv6 at TENET in a very fast manner, since there is a heavy push from certain sectors in the educational environment to get this rolled out. Therefore, help from 6DISS was hugely appreciated. Cisco ran a separate workshop in combination with TENET (as an extension to the DITCHIE conference) with all the universities and educational institutions present. The majority of the people were network operators/administrators from the tertiary education units' IT departments. These people are the ones controlling the networks at the various institutions. With regard to subject matter, dual stacking of networks, transition mechanisms, advantages of the protocol, compatibility with current infrastructure, rollout methods etc. are probably the best route to take.

RENATER is supporting the deployment of:

- Internet services in Sub-saharan Africa
- IPv6 in France (French IPv6 TF, G6, ….)

GRNET will organize the workshop in the 2nd quarter of 2006 in SE Europe. The main objective of the workshop is to assemble the representatives from the National Research & Education Networks (NRENs) from the region, in order to inform them on the latest developments with regard to IPv6 applications, and the advantages deriving from the exploitation of IPv6; thus, it will provide an opportunity for those communities to keep pace with the developments in the field of IPv6.

The NRENs of the region are already familiar with the use of IPv6, a service which is provided by the SEEREN network (South Eastern European Research & Education Network), and the workshop will encourage co-operation and exchange of best practices among them, on IPv6 deployments. IPv6 experts from the 6DISS project will provide the SE Europe community with technical know-how and vision while informing them about the initiatives that can be taken at a policy level, to further disseminate the use of IPv6. The workshop will provide an opportunity to establish a communication channel and encourage cooperation between the Research & Education community of SE Europe and people that represent bodies that are actively involved in the region.

GRNET also leads the SEEREN2 project (the successor of SEEREN), which aims at creating the next generation of the SE European segment of GÉANT that will make leading edge technologies and services available to the entire Research & Education communities and all sectors. The SEEREN2 activities will remove the discrimination between users and sites in SE Europe in an attempt to further reduce the "digital divide" that still separates most of the SE European countries from the rest of the continent. The SEEREN infrastructure will be substantially enhanced in its performance but more significantly will add a new key item to its fundamental characteristic, the consolidation of the networking and Grid infrastructures, into an eInfrastructure for southeast Europe, fully integrated with the pan-European efforts (GÉANT2, EGEE, SEE-GRID etc). The latter will be achieved with the support of services and tools empowering the end-user (researchers, professors, students, etc.), responding to dynamic bandwidth requirements and guaranteed and seamless service quality. GRNET/6DISS in cooperation with the SEEREN2 consortium, will provide technical know-how to the Research & Education community of the region, will contribute to the dissemination of IPv6 in SE Europe and will assist in the deployment and support of IPv6 services in the SEEREN2 infrastructure.

In addition, GRNET actively participates in, or supports, several national research projects. GRNET currently supports IPv6-related activities in the Greek School Network (GSN), which is the educational intranet of the Ministry of Education and Religious Affairs (www.ypepth.gr). The GSN interconnects all primary and secondary schools and provides basic and advanced telematics services. Thus, it contributes to the creation of a new generation of educational communities, which takes advantage of the new Informatics' and Communication Technologies in the educational procedure.

The current design and implementation of the Greek Schools Network focuses in providing useful services to all members of the basic and middle education community, fulfilling among others the following goals:

- Access to telecommunication and informatics services
- Access to digitized educational material
- Distance learning, e-learning
- Encourage collaboration
- Information and opinion exchange
- Conduct of thematic discussions, seminars, lectures, etc.
- Access to digital library services
- Communication and Cooperation of all educational degrees
- Communication with European educational networks
- Facilitate complimentary educational programs
- Provide education to individuals with special needs or disabilities
- Inform, educate, and entertain

Personnel involved in GSN and GRNET closely cooperate in order to fulfil the above objectives. GRNET was involved in the deployment of IPv6 services in the core network of the GSN and the first pilot phase of providing IPv6 interconnection services in to a limited number of schools. GRNET/6DISS will further support the upgrade plans of the GSN infrastructure in order to extend the IPv6 interconnection services in all access networks and deploy new services using IPv6 technology.

Finally, GRNET promotes the adoption of IPv6 technology inside the University networks via technical workshops and training activities. GRNET/6DISS will further support such activities and dissemination material for the 6DISS technical workshops will be exploited in local workshops.

UCL is supporting the deployment of IPv6 in NIS countries through 6DISS and SPONGE (EU) and SILK (NATO) projects.

TERENA promotes the deployment and use of IPv6 within its member NRENs. This is undertaken through the TF-NGN group, through dedicated sessions at TERENA Networking Conferences, and the continuing support of the 6NET website (which makes available all documentation from that project).

TERENA is responsible for the 6DISS workshop to be held in South or Central America in conjunction with a CLARA/ALICE event during 2006. As there is demand for a wider continental research networking conference in the region, the current proposal is for CLARA, Internet2, and the ALICE and 6DISS projects to jointly organise such an event on the lines of an Internet2 Joint Techs Workshop or TERENA Networking Conference. This will take place during early 2006, and should include an IPv6 workshop organised by 6DISS.

TERENA is liaising with ERNET (Indian NREN) with respect to organising a Euro-India workshop in conjunction with a major networking conference in India (February 2006).

TERENA is building-up and maintaining lists of networking contacts in all the regions that 6DISS is targeting. They have also contacted national and territorial governments in the Caribbean region to further investigate research networking initiatives in that part of the world. The aim is to improve communications with NRENs and regional networking associations (where these exist) on other continents.

Soton-ECS was responsible for the Asia-Pacific workshop, held in Taipei from 22nd - 24th August 2005. The workshop was included as part of a broader IPv6 event in Taiwan (see http://www.ipv6.org.tw/summit2005/), held in conjunction with local Taiwanese organisations. Further collaborations around events such as APAN are expected.

Regarding specific deployments, Soton-ECS:

- has supported the deployment of IPv6 in the UK, through being an advisor to UKERNA for IPv6 deployment
- co-ordinated the IPv6 'Bermuda' project that made initial technology tests
- and UKERNA were both partners in the highly successful 6NET project, during which time IPv6 production services were deployed on the JANET backbone
- is now working with UKERNA to produce IPv6 technical guides and an IPv6 tunnel broker service
- organised an IPv6 training workshop in September 2005 (that may be repeated in the future) and will organize an IPv6 multicast training workshop in 2006
- has deployed an IPv6 network on the university campus. The Soton-ECS network spans over 1,000 nodes, is dual-stack enabled, as are the key IP services of DNS, email (MX transfer) and web (e.g. www.ecs.soton.ac.uk). The process has been documented (e.g. http://www.6net.org/publications/deliverables/D2.3.4v2.pdf and in IETF Internet Drafts and RFCs in the IPv6 and v6ops WGs, e.g. RFC4057). Reference case study material is being generated and maintained as part of the 6DISS work.
- leads the Tiger Team, which is a network of IPv6 experts that are available to assist with deployment and technology oriented questions about IPv6, through the 6DISS framework. The email contact address is helpdesk@6diss.org. Enquiries are tracked through a ticketing system, allowing an appropriate expert to field the enquiry and respond to the question or issue raised. The Tiger Team is also supported by documents held in the IPv6 EPrints archive at Soton-ECS, available at www.6journal.org.

FCCN supports TERENA for the dissemination and deployment support in South and Central America. The current plan is to hold this 6DISS workshop in conjunction with an ALICE event in April 2006. As ALICE has some money to pay for participants' travel, we can exploit their presence and therefore ensure that we get a good audience for the workshop.

In 2004, FCCN went to Vera Cruz, Mexico, to inform about IPv6.

FCCN also presented at the Southern Africa workshop (September 2005). This region has been going through very dynamic and deep changes in the last decade, at all levels. This environment creates very good opportunities for initiatives like the 6DISS workshops. In this region, South Africa clearly has an IT edge over the other countries, and plays an important leading role in the region. So it was chosen as the best target location to hold the first 6DISS workshop in the region. The initial 6DISS contacts with the representatives of TENET - Tertiary Education Network of South Africa, were quickly followed by an invitation to hold an IPv6 Workshop on the two days before the annual NTE - National Tech Event, that was to happen in Port Elizabeth, from the 21st to the 23rd of September. This enabled the direct contact with IT experts from all of the South African Higher Education institutions.

HUNGARNET has experience with the deployment of IPv6 in the Hungarian national research and education network.

7.7 General Exploitation Plans

University Partners

The training material generated in the 6DISS project will be used as input for educational purposes within the university's degree courses, and for other events organised by (for example) the national IPv6 Task Forces. Attendance of events such as IETF and TERENA TNC and TF-NGN will provide knowledge which will be used to improve the material, while the modules will also be iteratively improved through each workshop.

NREN Partners

The NRENs will use the material for their own IPv6 deployment purposes. The experience will be used to give feedback towards improving the module contents.

Manufacturing Partners

The manufacturers will use their participation in the project to advertise their devices, though their main reason for participation is to provide a service function in terms of supplying equipment for the laboratories and up to date information regarding emerging IPv6 features in new products.

7.8 Deliverables

All of the 6DISS Deliverables are public, and represent another route for information dissemination.

7.8.1 Deliverable List

Del. No.	Deliverable name	WP no.	Lead particip-ant	Estimated person-months	Del. type	Security	Delivery (project month)
D01	Project Presentation	0	Martel	0.5	Report	Public	M01
Outline: This Deliverable is a 2-page description of the project. It will be used to publicise the project on the EC Website and in EC publications, and as an introduction for other projects considering liaison with 6DISS.							
D02	Workshop Schedule	1	Martel	1	Report	Public	M03
Outline: This Deliverable gives the final schedule of the workshops, the locations, the parallel events with which synergy will be exploited, the local organiser, the lead partner from 6DISS and the partners that will also attend for support.							
D03	Report on the workshop and status of Internet connectivity in Southern Asia	1	Soton-ECS	3	Report	Public	M07
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in Southern Asia at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D04	Report on the workshop and status of Internet connectivity in Southern Africa	1	Cisco	3	Report	Public	M10
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in Southern Africa at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D05	Report on the workshop and status of Internet connectivity in South and	1	TERENA	3	Report	Public	M13

	Central America						
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in South and Central America[2] at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D06	Report on the workshop and status of Internet connectivity in the Mediterranean partner countries	1	RENATER	3	Report	Public	M18
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in the Mediterranean partner countries at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D07	Report on the workshop and status of Internet connectivity in the Balkan countries	1	GRNET	3	Report	Public	M21
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in the Balkan countries at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D08	Report on the workshop and status of Internet connectivity in the sub-Saharan Africa countries	1	RENATER	3	Report	Public	M24
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in the sub-Saharan Africa countries at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D09	Report on the workshop and status of Internet connectivity in the NIS countries	1	UCL	3	Report	Public	M27
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in the NIS countries at the time of the 6DISS workshop. A report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							

[2] This information will be extracted from information available from ALICE

D10	Report on the workshop and status of Internet connectivity in the Caribbean	1	TERENA	3	Report	Public	M29
Outline: This document presents the status of the major Internet connectivity links deployed by the NRENs in the Caribbean at the time of the 6DISS workshop. The report from the workshop is included in the form of: a) the presentation material, b) the attendees and their affiliations, c) an assessment of the opportunities for further co-operation and follow-up actions planned, d) an analysis of the feedback questionnaire.							
D11	"Training the Trainers" Material	2	Cisco	2	Report	Public	M06
Outline: This Deliverable represents the full set of course material, that will be made available to persons who will be responsible for training in the local regions.							
D12	"IPv6 Training" Material	2	Cisco	2	Report	Public	M12
Outline: This Deliverable comprises the set of training material that will be given to engineers who attend the hands-on training courses in the Brussels laboratory.							
D13	E-learning Material	2	Cisco	2	Report	Public	M06
Outline: This Deliverable is an on-line software package that will explain to users the main features of IPv6 and guide them to appropriate reference material (e.g. 6NET Cookbooks, IETF standards). It will also incorporate the capability to remotely configure routers and to "see" the results.							
D14	Final Report	0	Martel	1	Report	Public	M30
Outline: This report concludes the project by summarising the achievements obtained, the main outputs, and the resources spent.							
D15	Report on Raising Public Participation and Awareness	1, 3	Soton-ECS, TERENA	1	Report	Public	M30
Outline: This report summarises the way that an increase in public awareness has been achieved, eg. through the workshops, the Tiger Team services, and downloads of project documents from the Website.							
D16	Initial/Final Plan for Using and Disseminating Knowledge	0	Martel	1	Report	Public	M6 M30
Outline: The first version of this Deliverable identifies the target group of recipients of the 6DISS information, and documents the plans for reaching these people within the project timeframe. The final version summarises the dissemination that was made, and reports on the plans for continuing any co-operations (within a research environment or commercially) beyond the end of the project.							