IPv6DISSemination and Exploitation

Information Society Technologies

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6DISS

IPv6 Dissemination and Exploitation

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Thematic Priority 2

D05: Report on the Workshop and Status of Internet connectivity in South & Central America

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Executive Summary

This document provides a report on 6DISS IPv6 training workshop for South and Central America that was held on 26-28 July 2006 in Quito, Ecuador. It also summarises the current status of networking connectivity in the region.

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)	

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1. Overview

The 6DISS IPv6 training workshop for South and Central America was held on 26-28 July 2006 at the Universidad Tecnológica Equinoccial (UTE) in Quito, Ecuador. It was organised by TERENA in conjunction with FCCN and RENATER, with support also being provided by CLARA (the association of Latin American NRENs) and the WALC 2006 organising committee.

The 6DISS project and CLARA had previously agreed that a 6DISS workshop would be organised in Latin America, with the 6DISS project developing the workshop material, providing the tutors, and offering travel support to the participants. In return, CLARA would arrange a venue at a suitable event in the region, and would help with the identification and invitation of suitable participants.

The original intention was to hold the workshop in November 2005, as there was also an ALICE-CLARA meeting being held at that time. However, it was felt that meeting was more management-oriented, and that it would be more appropriate to hold the workshop in conjunction with a CLARA TEC meeting sometime during 2006. As it transpired, this was arranged to coincide with the annual WALC event, which aims to provide training for networking personnel in Latin America and the Caribbean. It was therefore agreed that the 6DISS workshop should be co-located with this event in Ecuador, and that it should constitute an IPv6 track in the WALC 2006 programme (see http://www.walc2006.ula.ve/).

This arrangement proved to be very satisfactory for both the 6DISS project and WALC. The requisite room, equipment and logistical support were provided by the local organisers (UTE) free-of-charge, whilst WALC were provided with an IPv6 training track and tutors at no cost to themselves. In addition, the travel support offered by the 6DISS project, not only enabled a number of additional participants to attend the IPv6 workshop who would otherwise not have been unable to do so, but they were also able to take the opportunity to attend the co-located CLARA TEC meeting held immediately prior to the workshop.

The workshop itself combined theoretical presentations with hands-on exercises, and took place in a classroom-style laboratory. The local organisers provided a number of PC terminals and four Cisco 2600 series routers, whilst FCCN brought along two Cisco 1800 series routers loaned by Cisco Belgium. This meant there were a total of six routers available for working through the interactive exercises.

In line with the WALC event, the workshop was conducted in Spanish as this is the common language for Latin American networking events.

2. Participants

The 6DISS workshop involved three tutors who were Miguel Baptista and Pedro Lorga from FCCN, and Simon Muyal from RENATER who presented a module via videoconference. Pedro Allieti from LACNIC, the Latin American Internet Addresses Registry, was also invited to give a presentation about the IPv6 address allocation process.

A total of 22 persons from 8 countries were invited to participate in the 6DISS workshop. This was felt to be an appropriate number given the hands-on nature of the programme, the available tutors, and the amount of equipment that could be provided.

The participants were selected after consultation with CLARA, and included students as well as networking personnel working for NRENs, universities, and commercial ISPs. The aim was to ensure as broad a geographical representation as possible, so there was an initial limitation of two participants per country; with the exception of more places being made available to Ecuadorians as the local host. It was also agreed that travel support would be prioritised for those NRENs that were normally unable to send any representatives to CLARA meetings, followed by those who were only able to send one representative, but who could identify other suitable candidates for the 6DISS workshop.

The 6DISS project agreed with CLARA that it would provide travel support in the form of flight tickets and a subsistence allowance for six participants. CLARA also managed to negotiate free registrations for WALC 2006 for these individuals. All the other participants were funded by their own organisations.

Of the 22 persons invited to the workshop, 21 actually participated as one invitee was unable to travel to Ecuador because of illness. The full list of participants was as follows:

Name	**Organisation**	**Country**
Rene Alberto Aguilera Amaya	SVNet	El Salvador
Victor Hugo Alvarez Castillo	Telconet	Ecuador
Elvia Marina Aquino Sanchez	Controloria General de la Nacional	Ecuador
Elba María Bodero Poveda	Universidad Nacional de Chimboraz (UNC)	Ecuador
Yesenia Cevallos Villacres	Universidad Nacional de Chimboraz (UNC)	Ecuador
Daniel Díaz Ataucuri	Instituto Nacional de Investigación y Capacit	Peru
Máximo Escobar Flores *	Universidad de Panamá	Panama
Lucas Graciano	Latin American and Caribbean Internet Address Registry (LACNIC)	Uruguay
Jose Hernan Guerrero Gonzalez	Municipio de Zamora	Ecuador

Byron Gustavo Jaramillo Campovei	Universidad Técnica Particular de Loja (UTPL)	Ecuador
Lorena Jiménez Medina	Pontificia Universidad Javeriana	Columbia
Jaime Leonardo Martínez Rodriguez *	Universidad de Cauca	Columbia
Marco Antonio to de León	Red Avanzada Guatemalteca de Investigación y Educación (RAGIE) / Universidad Galileo	Guatemala
Marco Antonio Mejia Navas *	Universidad Rafael Landivar	Guatemala
Alex Moura	Rede National de Ensino e Pesquisa (RNP)	Brazil
Walter Eduardo Munguia Martínez *	Red Academica Peruana (RAAP)	Peru
Juan Carlos Muñoz Cadena	Universidad Técnica de Babahoyo (UTB)	Ecuador
Eric Ramirez López *	Universidad de El Salvador	El Salvador
Juan Carlos Proaño Cargua	Escuela Politécnica National (EPN)	Ecuador
Rommel Vicente Torres Tandazo	Universidad Técnica Particular (UTP)	Ecudaor
Yesenia Lisseth Ventura Penado	Red Avanzada de Investigación Ciencia (RAICES)	El Salvador

** Travel costs supported by the 6DISS project*

3. Programme Outline

The workshop programme aimed to combine theoretical presentations with hands-on exercises, and in particular aimed to convey practical operational experiences. It was based on the material previously developed by the 6DISS project, although FCCN put significant effort into development of the practical exercises. Feedback from previous workshops suggested there should be more focus on this aspect of the programme, and the work undertaken in this area would be beneficial for the remaining 6DISS workshops.

The first day focused on IPv6 addressing schemes, configuration and deployment, with the second day dealing with routing and network management. The final day concentrated on security aspects and DNS configuration. Each day commenced with presentations outlining the theoretical aspects of the subject matter, followed by practical exercises where the participants worked through a number of specific deployment scenarios using the equipment.

The full programme was as follows:

Wednesday, 26 July 2006

- 6DISS Overview and Workshop Objectives - *Miguel Baptista, FCCN*
- Introduction to IPv6 - *Miguel Baptista, FCCN*
- IPv6 addressing - *Pedro Lorga, FCCN*

- IPv6 associated protocols - *Miguel Baptista, FCCN*
- LACNIC Overview - *Pablo Allieti, LACNIC*
- IPv6 deployment - *Miguel Baptista, FCCN*
- IPv6 autoconfiguration - *Miguel Baptista, FCCN*
- Router configuration #1 (practical exercise)
- Host configuration for Windows & Linux (practical exercises)
- Router configuration #2 (practical exercise)
- Autoconfiguration (practical exercises)

Thursday, 27 July 2006

- IPv6 routing protocols - *Pedro Lorga, FCCN*
- IPv6 management - *Simon Muyal, RENATER (via videoconference)*
- Routing protocols: RIPng (practical exercise)
- Routing protocols: OSPFv3 (practical exercise)
- Routing protocols: MBGP (practical exercise)

Friday, 28 July 2006

- DNS - *Miguel Baptista, FCCN*
- Security - *Pedro Lorga, FCCN*
- DNS (practical exercise)
- Configuring services: Apache, FTP (practical exercise)
- Management Tools (practical exercise)
- IPv6 Security (practical exercise)

4. Workshop Material

The presentations and exercise material from the workshop were compiled onto CD-ROMs that were distributed to each participant. Other useful material such as the 6DISS e-learning module, the 6NET IPv6 cookbooks, and various IPv6 utilities were also included on the CD-ROM.

This material is available on the 6DISS website at http://www.6diss.org/workshops/sca/

5. Issues

It was intended that three tutors would participate in the workshop in Quito, as this was considered the minimum number needed to cover the material and provide sufficient support to the participants. Unfortunately, Simon Muyal was denied entry into Ecuador on the grounds on incorrect travel documentation, even though he had previously checked with the Ecuadorian embassy in Paris that Andorran nationals did not require an entry visa. It subsequently transpired that the immigration authorities at Quito International Airport had made a mistake, but this was only discovered after Simon was forced to return to Paris.

The local organisers proved very helpful in arranging for Simon to present some of his planned modules via videoconference (H.323) on the second day, but it was necessary to re-arrange some parts of the programme to accommodate his absence on the other days. In addition, whilst videoconferencing is adequate for presenting material, it obviously makes it difficult to establish interaction with the participants; something that is important in a hands-on workshop. However, the videoconference did allow Simon to present some of his material, with the remainder being adequately covered by the two other tutors.

There were also difficulties in trying to take network equipment to Ecuador. The original intention was to ship six Cisco 1800 series routers (loaned by Cisco Belgium), but FCCN was advised that the importation process was very convoluted and high customs duties would be payable. After consultation with local organisers, it was decided to transport two Cisco 1800s as personal effects, and utilise some older Cisco 2600s that were surplus to requirements at UTE.

As these routers lacked the memory to run the necessary IOS images (operating system) needed for the workshop, it was necessary to cannibalise several of them for spare memory. That way, it was possible to put together four additional routers that could be used for the practical exercises.

Although these problems were potentially quite serious, they did not significantly affect the running of the workshop. An additional tutor to support the hands-on exercises would have been desirable, but two tutors were still able to provide adequate support. This said, it did highlight the importance of being prepared for the unexpected, and the bureaucratic difficulties that can sometimes be encountered.

6. Feedback

At previous 6DISS workshops, a questionnaire has been circulated to the participants on the last day, in order to obtain feedback from them about the workshop. Unfortunately, this was not possible in Quito due to the workshop over-running because the tutors had been short-handed throughout (see ‘Issues). In addition, the standard questionnaire was in English, and there was simply insufficient time and effort to translate it.

However, WALC 2006 had an online evaluation form where respondents scored different aspects of each track. The marks for the 6DISS workshop were as follows; where 5 is the highest, and 1 the lowest:

Tutors

1. Knowledge of content 4.78
2. Effectiveness in conveying content 4.57
3. Quality of the presentations 4.74

4. Usefulness of content 4.43

Support Material
5. Usefulness of material 4.39
6. Overall content 4.57

Infrastructure
7. Laboratory equipment 3.00
8. Overall condition 3.17
9. Audiovisual quality 4.00

Logistics
10. Registration 3.00
11. Administration 3.52
12. Refreshments 4.57

Satisfaction
13. To what extent did track meet expections? 3.96

Overall 4.05

These marks largely concur with the comments received from some of the participants that were positive about the workshop content and the standard of the tuition. The practical exercises were generally found to be more useful though, and there was a suggestion to reduce the amount of theory on the first day.

The knowledge of the participants proved to be quite variable, with some already having a degree of familiarity with IPv6, whilst others had limited grounding in even basic IPv4 principles. This meant that some participants were able to complete the practical exercises quite quickly, whilst others needed more assistance. Having a missing tutor obviously limited how much time could be spent with those needing extra help, but also caused delays when trying to move on to the next module in the programme.

7. Synergy

The 6DISS workshop provided an ideal opportunity to further develop contacts between the European and Latin American research networking communities. These initially began through the CCIRN (Coordinating Committee for Intercontinental Research Networking) and other informal groups, but were hampered by the lack of a cohesive international networking community in Latin America until the formation of CLARA in 2003. Since then, the EC-supported ALICE project has established connections between the GEANT(2) and RedCLARA networks, but there is still relatively limited collaboration within Latin America itself.

The main reason for this is undoubtedly down to a lack of funding which restricts the number of common activities that can be organised. CLARA and ALICE have made the first steps towards

establishing a well-connected pan-American infrastructure, but also recognise that human networking and training is crucial when attempting to establish technical collaborations. The WALC network training events also take a step in this direction, but again have limited resources so are interested in having some external support.

The collaboration between 6DISS, CLARA and ALICE was very productive as it allowed travel funding to be pooled so that more participants could attend both the 6DISS workshop and the CLARA TEC meeting. The CLARA TEC is a bi-annual meeting that provides an opportunity for the representatives of the Latin American NRENs to discuss technical issues and update each other about developments. This not only fosters a sense of community within the region, but also provides a forum for local NRENs to hear about developments in Europe and elsewhere in the world. Indeed, TERENA took the opportunity to attend the meeting and gave a presentation about other relevant networking initiatives.

Making the 6DISS workshop a track of the WALC 2006 training event also benefited all parties. WALC were able to make an IPv6 training course part of their programme, whilst 6DISS had the local organisational issues taken care of. At the same time, CLARA was able to help 6DISS identify suitable participants who could benefit from IPv6 training, whilst receiving some help with travel funding. As one of the barriers to improving networking is a lack of contact between countries, anything that builds-up recognition of regional initiatives such as CLARA and WALC should be encouraged.

The 6DISS workshop and CLARA TEC also provided an opportunity to meet research networking personnel in Latin America. Although TERENA and FCCN already had contacts with the NRENs in the larger countries such as Brazil, Chile, Mexico and Venezuela, there had previously been little or no contact with the NRENs in Columbia, Ecuador, El Salvador, Guatemala, Panama and Peru. Establishing communication is clearly of use for potential collaborations in the context of future development programmes.

Following the conclusion of the workshop, the 6DISS project was approached by RAGIE (the Guatemalan NREN) as to whether it would be possible to hold another IPv6 training workshop in Central America. It was agreed that the 6DISS project would be happy to undertake this if there was sufficient money left in the budget, and it had the sanction of CLARA.

8. Status of Internet connectivity in South and Central America

The South and Central America region is comprised of twenty-two countries, of which eighteen collectively form CLARA, the Latin American research networking association. Belize, Guyana, Suriname and French Guiana are not currently members, although French Guiana has 4 x 2 Mbps

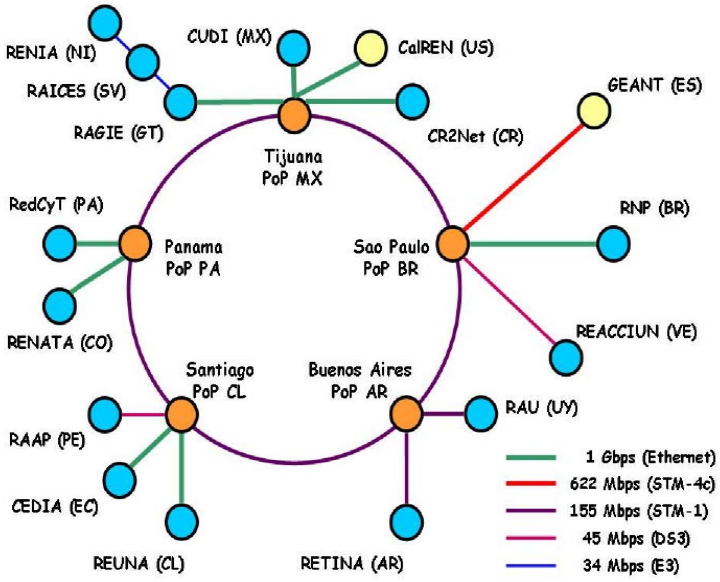
connections between Cayenne and RENATER (the French NREN), as well as an internal 2 Mbps link between Cayenne and the space centre at Kourou.

CLARA, with financial assistance from the EC-funded ALICE project, operates the RedCLARA network which currently provides connectivity to the NRENs in Argentina (RETINA), Brazil (RNP), Costa Rica (CR2Net), Chile (REUNA), Colombia (RENATA), Cuba (RedUniv), Ecuador (CEDIA), El Salvador (RAICES), Guatemala (RAGIE), Mexico (CUDI), Nicaragua (RENIA), Panama (RedCyT), Peru (RAAP), Uruguay (RAU) and Venezuela (REACCIUN). Bolivia (ADSIB), Honduras (UNITEC) and Paraguay (Arandu) are not yet connected, although there are plans to do so.

A 155 Mbps (STM-1) backbone connects Tijuana, Sao Paulo, Buenos Aires, Santiago and Panama City in a ring topology, with each NREN linked to one of these PoPs at speeds of 34 Mbps (E3), 45 Mbps (DS3) or 1 Gbps (GE). The exception is Cuba which is presently linked via satellite.

RedCLARA supports both IPv4 and IPv6, as well as running multicast for these protocols, and offering MPLS for QoS provisioning. Connectivity to other networks is provided via a 622 Mbps (STM-4c) connection from Sao Paulo to Madrid (GÉANT2), a 2.5 Gbps connection from Sao Paulo to Miami (AMPATH), and a 1 Gbps (GE) connection from Tijuana to San Diego (CalREN).

At the present time, the network would appear to be adequately provisioned with an average utilisation of just over 4 Mbps on the majority of the links, peaking at 38 Mbps. The busiest link is between Mexico and Brazil which averages around 11 Mbps. On the link with GÉANT2, average utilisation is 13.5 Mbps, peaking at just under 48 Mbps. On the link with CalREN, average utilisation is 12.5 Mbps, peaking at just under 33 Mbps. However, whilst there appears to be plenty of spare capacity on the backbone network, it should be noted that the internal connectivity in each country ultimately determines how much traffic can be generated.



Ecuador

CEDIA (Consorio Ecuatoriano para el Desarrollo de Internet Avanzado) is a consortium of twenty-four universities, research institutes and government departments. It operates a backbone network between Quito, Guayaquil, Chimborazo, Cuenca and Loja using microwave links at speeds of 11 Mbps, although Quito and Guayaquil at connected at 45 Mbps over an STM-1 circuit. There are further connections to local sites from each of these nodes at speeds of between 1 and 10 Mbps. The international links currently terminate at Guayaquil, although there are plans to add a

further international link between Quito and Cartagena (Columbia). Both IPv4 and IPv6 are supported on the backbone.

El Salvador

RAICES (Red Avanzada de Investigación, Ciencia y Educación Salvadoreña) connects seven universities in El Salvador. These sites are connected in a star topology to a Cisco 7200 in San Salvador, which also provides the onward link to RedCLARA. The links operate over PTO-provided DSL connections at 2 Mbps, with Cisco 2811 routers at each end-site providing local connectivity. The entire network uses native IPv6, although it also supports IPv4 as well.

Guatemala

RAGIE (Red Avanzada Guatemalteca de Investigación y Educación) is operated by Telgua (the incumbent PTO) and currently connects five universities and two other institutes. Each site is connected by MetroEthernet at 100 Mbps, and uses Linux-based routers to support both IPv4 and IPv6, as well as their multicast variants. There are plans to connect the three remaining universities, as well as other colleges and hospitals.

Nicaragua

RENIA (Red Nicaraguense de Internet Avanzada) connects six universities via an ISP-provided network, and onwards to RedCLARA and the commercial Internet. It operates a Cisco 3750 that provides both IPv4 and IPv6 connectivity.

Panama

REDCYT (Red Científica y Tecnológica de Centros de Investigación y Universidades) connects six universities and two government departments, with plans to also connect two research institutes. These sites are connected in a star topology over fibres provided by Telecarrier and Cable & Wireless at speeds of 2 Mbps. There is a 10 Mbps link between REDCYT router and the RedCLARA PoP which provides the international connectivity, although there is also a connection to the commercial Internet through SENACYT. The network supports dual stack IPv4/IPv6, as well as IPv4 multicast.

Peru

RAAP (Red Academica Peruana) connects five public and private universities, as well as two research institutes. Six sites are connected to PUCP (Pontificia Universidad Católica del Peru) at 10 Mbps which provides the onward connection to the RedCLARA PoP. The end-sites utilise Cisco 3725 routers, with the main router at PUCP being a Cisco 7204. IPv6 is currently being tested with a plan to roll it out on the production network shortly.

Uruguay

RAU (Red Académica Uruguaya) is operated by SeCIU (Servicio Central de Informática Universitario) and interconnects the faculties of the Universidad de la República and other

organizations of higher education. Each site is connected by 100 Mbps Ethernet, with a 34 Mbps (E3) onward connection to RedCLARA running over ATM. Tunnelled IPv6 connections are currently provided to three institutes.

Venezuela

REACCUIN (Red Académica de Centros de Investigación y Universidades Nacionales) currently connects ten universities and three research institutes. These are connected at 34 Mbps via ATM, with an 45 Mbps connection from CNTI (Centro Nacional de Tecnologías de Información) to Global Crossing who provide the international connectivity to RedCLARA and AMPATH.