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## Global IPv6 Service Launch Event report

On January 15-16, 2004, the European Commission hosted the Global IPv6 Service Launch event in Brussels. The event formally heralded the availability of world-wide native IPv6 connectivity spanning IPv6-enabled research networks around the globe, including networks such as GEANT in Europe, Abilene in the United States, CA\*net4 in Canada and WIDE in Japan.

The two-day event saw presentations from key players from the worldwide research networks, from industry and from the political arena. This document summarises the talks given by the speakers, and documents the launch ceremony and parallel IPv6 technology demonstrations.

The focal point of the event was the launch ceremony held on the evening of the 15<sup>th</sup> January. Eight representatives of the worldwide research networks were each invited to speak briefly on the importance of IPv6 from their perspective. European Commissioner Erkki Liikanen added his view:

“Today we are here to celebrate the arrival of IPv6 and its integration into Europe’s key research infrastructure. IPv6 is part of the next generation of Internet technology. It will improve the performance of the Internet and it will enable the Internet to be integrated into a wide range of devices and services in our homes, businesses and while on the move. Some of these are demonstrated at this event - from household appliances to the IPv6 enabled vehicles.

The introduction of IPv6, alongside unrestricted access to broadband, is of great importance. Together they will help to offer citizen’s wider access to an advanced Information Society. They will deliver improvements in economic growth, competitiveness, and productivity through the provision of a whole new generation of services and applications, including 3G.

Possible applications and services that this new technology promises to usher in are limited only by the imagination and many applications are currently under development now. If you consider that every device in the world is individually addressable, then this opens up limitless possibilities.”



*Commissioner Erkki Liikanen at the Global IPv6 Service Launch ceremony.*





Full details of the event can be found on the Global IPv6 Service Launch event web site ([www.global-ipv6.net](http://www.global-ipv6.net)), including the full agenda, the speaker presentations and various press releases including the full text of the speech of Commissioner Erkki Liikanen.

In parallel to the presentations, a demonstration area was set up which showcased the results of a number of IST and other research projects where IPv6 has been the base technology for deployment. The demonstrations included examples of collaborative work undertaken with international partners around the world, illustrating the potential for a global perspective on research networking.

In terms of its goals, the Launch Event was considered a success. It managed to demonstrate future potential for IPv6 services and applications, highlighting the results achieved in research to date and the capabilities of the international research networks to offer a production quality IPv6 service to universities and research institutions.

## Session 1: Global collaborations for IPv6 research

The first day began with a session on global collaborations for IPv6 research. Peter Zangl, Deputy Director General of the European Commission opened the event. He began by announcing the recent agreement to invest €10M in the new IPv6-enabled TransEurasia Information Network (TEIN) to link Europe to the Asia Pacific region. European IPv6 research and development, through projects such as 6NET and Euro6IX, has helped to allow the resolution of the Lisbon Council meeting to be realised, and the National Research and Education Networks (NRENs) in Europe to deploy IPv6 services, on their own networks and the interconnecting GÉANT backbone.

The various IPv6 Task Force activities have helped push IPv6 from research towards industry and deployment, and similar activities around the world have led to the availability of a worldwide native IPv6 research network. Policy initiatives have been well grounded with industrial and academic experimentation. In the US, the DoD has been an excellent example of IPv6 adoption in 2003. The new IST Sixth Framework programme will enable IPv6 to be a fundamental part of new research infrastructures, using GRID and optical technologies. The vision is of a GRID empowered e-infrastructure that is fully IPv6 compliant.



*Brian Carpenter speaks in the opening session of the event.*



Brian Carpenter of IBM spoke on global considerations for IPv6 deployment, principally on the issue of how current restrictive practises on the availability of globally unique IP addresses is a barrier to innovation and deployment of novel IP-based services on the Internet. The use of Network Address Translation (NAT) and private addressing with the current version of IP, IPv4, has led to barriers to innovation and services provided in 'walled gardens'. IPv6 can restore the original end-to-end model of the Internet. IPv6 has become a mature technology, through standardisation in the IETF and stable implementations from vendors. Most open source applications now support IPv6. The only notable weak spot is middleware and commercial applications; these are required by 3G, by the DoD and by the growing economy, so there is incentive to provide them.

Dany Vandromme spoke on behalf of GÉANT, and explained that IPv6 is now available in NRENs with millions of potential end users. He highlighted the importance of international collaborations, citing the example of GÉANT spreading to connect Russia. Universities can now get good IPv6 connectivity in most NRENs, and those universities have the staff and students who can develop new, innovative IPv6 applications. Such applications are important for IPv6 adoption, along with new technologies like advanced optical networking.



Tomohiro Fujisaki spoke on NTT's services in Japan, where some ISPs have paying IPv6 customers already, although such services are still in their infancy. He also stated that the challenge ahead lies with new applications; NTT sponsored an 'IPv6 Appli Contest' in Japan in 2003, and similar initiatives would be welcome elsewhere.

Jim Bound of HP talked about the North American Moonv6 test-bed, so named because deploying IPv6 was viewed as a grand challenge like going to the moon. He spoke of how NAT is like a disease that is crippling the growth potential of the Internet, and how end-to-end security is only fully possible with IPv6. It is important to note that IPv6 is a transition process at this time, not a migration; IPv4 and IPv6 will co-exist for many years. The goal of Moonv6 is to validate the technology and demonstrate its potential. Moonv6 seeks worldwide portals for collaboration with other networks, as it enters Phase II of its operation in March 2004.

Doug Van Houweling spoke of the academic IPv6 deployment in the US, where Abilene (Internet 2) has had high-speed native IPv6 since late 2002. In a 10Gbit/s network, tests showed combined IPv4 and native IPv6 traffic reached 9Gbit/s successfully, showing the performance of IPv6 is every bit as good as IPv4. The deployment is not just about technology; end user and engineer training are being provided, now that 50% of the US regional networks support IPv6. IPv6 is critical for Internet development, for new end-to-end services.

Latif Ladid concluded the first session by reporting how the IPv6 Forum has grown since its conception in the summer of 1998, now assisting the work of the national Task Forces around the world.

## **Session 2: Large Scale IPv6 Field Trials**

The second session illustrated the scope of the IPv6 test-beds that have been deployed to date.

Hiroshi Esaki of the WIDE project commented on the adoption of IPv6 around the world, including the US DoD, the Chinese government and Chinese Next Generation Internet project, and many vendors, especially consumer electronics vendors in the Asia Pacific region. In Japan, networks such as NTT/Verio already have an IPv6 service. Industries such as transport (cars, trains), health and gaming are adopting IPv6. Sony has made a commitment to build IPv6-enabled consumer devices by 2005, and other vendors are likely to follow suit. Full deployment is driven by many needs, including research, standardisation, interoperability & conformance testing (e.g. the IPv6 Ready program), vendor implementations and test-bed experience. The transition to IPv6 will touch everything, as IP-enabled devices are introduced into all walks of life, from building management systems, to home automation, entertainment systems, supply chain management, healthcare, etc. Complementary technologies like RFID tags will be important. For wireless networks, cooperation on available spectrums is highly desirable.

Jane Butler of Cisco spoke about the 6NET IST research project, which since early 2002 has deployed a pan-European academic IPv6-only backbone network. 6NET has 35 partner organisations, mainly from NRENs and universities, but also including Cisco (project coordinator), IBM and Sony. This network has allowed validation of hardware and protocols, hardening products for deployment in commercial networks. 6NET has been active in standardisation work, e.g. in developing new IPv6 Multicast protocols. Typical outputs are deliverables in the form of technology cookbooks. Some of the 6NET work has helped create demonstrators like the IPv6-enabled car that was on display at the Global IPv6 Service Launch event.



*The IPv6 car demonstrator involving Cisco and Renault collaboration*

Isidoro Padilla of Telefónica spoke of their involvement with Euro6IX, the IST project that has deployed native IPv6 Internet exchange (IX) points across Europe since early 2002. Key challenges in the Euro6IX project, which has a commercial focus, include studies of network management systems, of new services for Layer 3 IX's, and security and PKI solutions.

Phil Holmes of BT Exact emphasised the fact that services are converging on an all-IP future, and IPv6 is a key part of that future. IPv6 offers solutions where NAT and private addressing in IPv4 have barriers, e.g. merging multiple (VPN) networks, or deploying 'private' networks with more than 16 million hosts. A key advantage for IPv6 users should be simpler, easy-to-deploy services, particularly for home users with multiple IP-enabled devices in the home, opening up new peer-to-peer applications including voice over IP (VoIP). For the ISPs there should be savings in NAT removal and simplified management and greater revenue from new services and greater connectivity to new devices.

Mario Campolargo of the Commission reinforced how the IST research projects have validated and integrated different technology in user-driven experiments. The national IPv6 Task Forces are emerging, with the important role to complement the technical work, bridging the gap between researchers, industry and politicians. Policy decisions on compliance are important, given the benefit for society in the future.

### **Discussion Session on IPv6-enabled Research Networks**

In this session the representatives of the worldwide research networks were able to speak in more detail about their activities before the official launch ceremony, with some discussion on the important issues for further use and adoption of IPv6 by end users and application developers.

While many national research networks have had IPv6 services for a year or more, the key achievement now has been international native (dual-stack) IPv6 linkage between them, a process that is ongoing in some areas.

Roberto Sabatino of DANTE described how IPv6 experiments had been performed within the GÉANT community (and QUANTUM and TEN-155 in the years before GÉANT), including the work of the TERENA TF-NGN working group. This work led to deployment of a production service in 2003. Early work had been done in ATM environments, with the experience gained being applied to the subsequent production networks. University take-up is still small; that issue is the next key challenge now that a global IPv6 research service is present between the national research networks.

Bill St.Arnaud of CA\*net4, Canada, spoke of their deployment of IPv6, including a production service since 2002. There have been a number of innovations for IPv6 in Canada, including the work of Viagenie and Hexago, in particular some early application porting work (including the Quake game engine) and the world's best-known IPv6 tunnel broker, freenet6. Bill highlighted IPv6 multihoming as one area where further research is required.

Kilnam Chon of APAN described how fierce competition for the broadband market made it difficult for new IPv6 services to be added in the Asia Pacific region, as margins are small. However, the largest broadband supplier has a commitment to IPv6 for 2005. There will be some IPv6-only networks deployed. IPv6 is seen as a means to bridge the digital divide in Korea, China and Japan. Large-scale early experience is gained in academia, and then transferred to industry. Research areas such as high-energy physics need worldwide collaboration and connectivity.

Vasilis Maglaris spoke on how the SEEREN project has connected the Balkans, SE Europe and parts of Greece to GÉANT. Some IPv6 services are tunnelled, but will become native in due course. The EUMEDCONNECT initiative is also connecting North Africa and the Middle East to Europe, working with NRENs including France (Renater), Spain (Rediris) and Greece (GRnet). In some places, IPv6 can be deployed directly without legacy upgrades as there is no legacy network.

Duncan Martin of TENET, South Africa, described how the new SA NREN will run IPv6 from its launch. Some South African ISPs have IPv6 on their backbones and are experimenting.

Sandra Jaque spoke on CLARA, the Latin America backbone, which is establishing GÉANT connectivity through the Alice project. IPv6 is an important issue for this project.

For China, Jianping Wu spoke on how IPv6 test-beds have been running in China since 1998. The China NGI project is the major focus for IPv6 deployment, with government backing. As of late 2003, CERNET 2 is being launched with native IPv6 nationwide on a Gigabit backbone, with 20 Gigabit PoPs each with 10 or 2.5Gbit/s DWDM links. Universities will connect with 1-10Gbit/s lambdas. CERNET and CERNET2 exist in parallel, with the new network being IPv6-only. The old network is running near capacity, so users have an incentive to use the less-congested IPv6-only network. The key task at present is encouraging university users to develop new IPv6 applications.

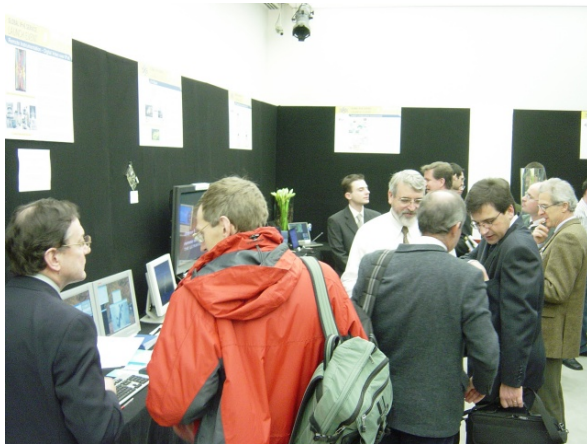
In the discussion, it was pointed out that IPv6-only is unlikely to be seen in Europe for a long time. Dual-stack services can be used to interact with IPv6-only networks in Asia Pacific.

The IPv6 exhibit area featured some ten demonstrations of IPv6 technology in action from European research projects, including:

- IPv6 over satellite (with the European Space Agency)
- The Mobile IPv6 Car (Cisco and Renault, for GPRS-WiFi roaming)
- IPv6 over power lines (6POWER, at speeds of up to 45Mbit/s)
- Internet on the Move (Euro6IX)
- IPv6 broadband demonstrator, showing the potential for IPv6 and broadband services (from I2cat, Eurov6 sponsor)
- Remote Instrumentation – digital video over IPv6 (in collaboration with Internet 2)
- Remote home automation and interaction (IPv6@Home, from Eurov6, including with pets)
- IPv6 HDTV streaming with guaranteed QoS (6NET, in collaboration with ETRI Korea)

- IPv6 Multicast (6NET and the M6Bone)
- IPv6 conferencing applications (Euro6IX, including ISABEL)

The Digital Home demonstrator showed how future homes could be remotely controlled or monitored using direct IPv6 connectivity.



*The demonstration area included a "Digital Home" exhibition*

### Session 3: IPv6 Services and Applications

This session focused on commercial exploitation of IPv6, and was chaired by Patrick Cocquet of 6WIND, the company that won an IST2003 prize (one of 20 awarded across the whole IST spectrum) for its innovative IPv6 product.

Patrick spoke about the new opportunities for IPv6 technology, as services converge on all-IP. There is potential to reduce capital expenditure (capex) and operational expenditure (opex) with IPv6, through simpler network management in the absence of NAT (it is possible that capex will be higher during a transition period, but experience of those ISPs deploying IPv6 is that as part of a planned upgrade process the cost of adding IPv6 services is not as high as some think).

Pertti Korhonen of Nokia described the services that Nokia plan to introduce. There are many important issues including security, privacy, device capability and usability. Nokia sees IPv6 as important because it solves IPv4 address limitation issues, enables peer-to-peer communication (no NAT), enables end-to-end security, multiple IP addresses per device and it allows a simpler network design. Transition has begun, and Nokia will support IPv6 in products beginning in 2004.

Joao da Silva of the EC renewed the call for new applications IPv6. He also called for position papers and work on areas such as the projected depletion data for IPv4 addresses, on return on investment for IPv6, and hard business evidence of the IPv6 benefits. The deployment of IPv6 services needs to be benchmarked, business cases must be published to accelerate adoption, 3GPP should be nudged along, RIPE (the European address allocation agency) should be engaged, technologies such as RFID should be explored for synergy, and consumer electronics vendors should be encouraged to adopt IPv6. Finally, he suggested that government policies should be formulated to ensure IPv6 adoption.





Axel Pawlik of RIPE emphasised that, on current consumption rates, IPv4 addresses would not run out in the near future, and certainly not in 2005 (citing some recent press articles that suggested otherwise). He invited those interested in address assignment policy to RIPE meetings.

Roland Thienpont of Alcatel said he felt it was hard for ISPs to move to IPv6 in the absence of a killer application. While some standardisation work is still ongoing, transition is now the key topic to be addressed, along with ensuring that IPv6 training is happening at the right level and volume.

Michael Morisseau of Renault showed how the car industry is a great application area for IPv6. There is potentially a huge range of applications and services to/from the car for the driver and passengers, delivered over a variety of media (GPRS, 3G, WiFi, etc). To support millions of cars, with many devices on board, IPv6 is a necessity. The IPv6 car demo at the event shows the tip of the applications iceberg. One interesting limitation for cars is that the IP devices must last for 10-15 years at least, much longer than a typical PC.

Bosco Fernandes of Siemens spoke for the UMTS Forum, and reported that progress to get IPv6 out was slower than had been hoped. There are many issues to be resolved, including performance issues, but IPv6 is mandated in 3GPP IMS and it will happen in due course. IPv6 is the only long-term solution, so the sooner it is deployed, the better.

Finally, Jose Maria Casas Cortezón of the European Space Agency spoke on how important satellite will be for offering broadband access to new customers, including both home users and services to vehicles. The ESA had an IPv6 over satellite demonstrator at the event.

In the subsequent discussion, an interesting topic that arose was the issue of device-to-device communications, which are rare today but expected to be a big growth area for IPv6.

#### **Session 4: IPv6 as a Key Element of the e-Infrastructures**

In this session, European ministers from a number of countries explained why IPv6 fitted their vision of future Internet services.

European Commissioner Erkki Liikanen chaired the session, opening by making observations on the potential for the future worldwide e-infrastructure to empower researchers, on future broadband services and on high-speed IPv6 compliant optical and GRID networks.

John Brown (Ireland) stated how the Lisbon Council strategy to make the EU the most competitive and dynamic knowledge-based society was being driven forward. The 2002 action plan led to the eEurope 2005 initiative to exploit broadband in the public and private sector. There are many opportunities in Europe for IPv6 and convergence technologies. In the mobile Internet alone, there are 420 million new terminals being produced per year; the GSM success needs to be built on. He noted that the NRENs have led by example with IPv6.

Aidan Ryan (Ireland) mused over reasons for the delay in 3G service rollout, noting the economic downturn. In Ireland, 200M Euros has been invested for broadband from 2002-2006. Much work has been done deploying metro networks, and fibre networks with public ownership. Trials in new mobile technologies, and technologies like ENUM, are aimed towards future growth of Internet services.



B.D. Antoniuk (Russia) described the Electronic Russia Programme, which began some time ago. New technology needs to be pushed in Russia where it is not market driven, or where applications do not yet exist, with the aim of generating a snowball effect. IPv6 is seen as an opportunity in Russia, and capex is not seen as being much bigger than IPv4.

Sidse Aegidius (Denmark) described a holistic view of new technology, for pervasive computing, privacy and Internet governance. With fast-moving technology, policy implications need to be thought through very carefully, and flexible regulation processes are required. In Denmark, IPv6 is integrated into public sector policy, support being dictated in some areas and encouraged in others.

Victor Izquierdo (Spain) described his country's IPv6 activities. The government supports the national IPv6 TF, believing it important to listen to stakeholders – people, industry and users. The Spanish TF began in 2002 and has grown quickly since then. There have been three Global IPv6 Summits in Spain since 2001, organized by Consulintel. The Rediris NREN has deployed IPv6, and new initiatives and commercial IPv6 services are on the way.

Kwanbok Jo (Korea) reinforced the view of an all-IP future, where IPv6 will be used for home networking in a ubiquitous networked environment, and with IPv6-based industry. Korea aims to get an early advantage in the IPv6 equipment market, backed by government policy. By taking a lead on IPv6 technology, Korea expects to be able to provide infrastructure for home and industrial use and gain early intellectual property rights on new devices.

Takuya Miyoshi (Japan) spoke of the strategy commenced in 2001 to make Japan the most advanced IT nation within 5 years; the eJapan strategy followed this in 2003. IPv6 is a key technology for this strategy, with ample address space, acting as a building block not only for PCs but also new IP-enabled appliances, in the home, in cars, in all walks of life – the workplace, the environment, logistics, traffic, education, finance, food, medicine, assisting the elderly, etc. The Japanese government is promoting the transition to IPv6, and engaging in collaboration with Korea and China with this goal.

David Williams of CERN also spoke in this session. He spoke of the dream of any-to-any, all-to-all communication, and the e-infrastructure required to meet this dream. There are two thrusts, one for citizens, one for business and commerce. This vision needs open standards, and it needs work on middleware, e.g. as being undertaken by the EGEE project. As more and more procurements require IPv6, the functionality will appear. Complementary technologies like RFID should be investigated, e.g. for use in supply chain management. IPv6 and pervasive computing can lead us to a bright future; the platform is now there, IPv6 is a major step forward and a fundamental component for eEurope with broadband. Open standards and global cooperation are both vital.

## **Session 5: IPv6 in Everyday Life**

Malcolm Read, chairman of the European Networking Policy Group chaired the session. In his opening comments he emphasised the need for IPv6 to now be pushed from the NRENs into the universities.



Dr. Ki-Shik Park of ETRI spoke of the success to date in IPv6 research, standardisation, development and deployment. There are many open issues to be followed, e.g. network mobility, ad-hoc networking, and development of value-add applications. Business models need to be published, showing advantages for peer-to-peer, mobility and 3G, factory and home automation, sensor networks, context-aware services, the automobile industry, etc. There needs to be a push from research into the commercial networks, with IPv6 being mixed with gaming, RFID, GRID, WLAN, Hpi and xDSL technologies, for example. The challenges now are for that technology integration to occur, for deployment of commercial production networks, all towards ubiquitous availability of IPv6.

Renaud DiFrancesco of Sony Europe described Sony's vision of connecting all digital devices in a ubiquitous IPv6 environment. Sony expects to see hard drives in consumer goods such as hifi, video recorders and stereos, e.g. the Cocoon home appliance. Broadband video will become possible with the PlayStation. The Sony Ericsson P800 and P900 handsets have IPv6 capability through their Symbian operating system. Sony sees IPv6 as a ubiquitous solution from 2005 onwards.

Marco Bonac of ARNES (Slovenia) stated that as of this year, 80% of the European NRENs have IPv6 deployed. He further made the case to push the technology out to the universities.

Yanick Pouffary of HP stated that IPv6 is a fundamental piece of technology for 21<sup>st</sup> century networks. The web happened because a bright idea at CERN was able to take off because of the environment in place at CERN, including its (IPv4) network connectivity to other research sites. Vint Cerf, father of IPv4, did not think of the web. There is a need to get the IPv6 superhighways in place, and remove the stifling of innovation that currently exists thanks to impediments such as IPv4 NAT.

David Kennedy of Eurescom noted the importance of the DoD announcement of a requirement for IPv6 capability in its procurements, which as a multi-billion dollar customer is in itself a good business case for IPv6. The telcos understand the pervasive service environment, but they need QoS in their IP networks before migrating from their circuit-switched services. There is a need for IPv6 network management tools, to ensure that agreed service levels are being delivered. Example business cases would be very helpful.

Closing comments were added by Pascal Drabik of the EC, who reminded the audience that this Launch Event was a signal to industry on the readiness of IPv6. Future applications and services are only limited by our imagination. Investments should be made now, and there will be revenue to be gained in the future.