Title:	**IPv6 Deployment Status in Europe and Required Actions**
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Contents

This report is derived from the various work and initiatives undertaken by the European and National IPv6 Task Forces in Europe during the first half of the 2nd phase of the European Union IPv6 Task Force initiative.

As a result, this report makes comprehensive recommendations for EU Member State governments, for the European Commission and for industry.

A fully-fledged document outlining the global IPv6 deployment roadmap will be produced in six months, as the final recommendation report at the end of the 2nd phase of the EU IPv6 Task Force.

Executive Summary

IPv6 has been validated as a technology within the projects of the EC FP5 IST Programme, as well as in other initiatives elsewhere, particularly in Japan. While there is research and standardization work to be done, the basic premise of IPv6 as a deployable enabler of an advanced Internet society is proven.

However, one of the major hurdles to IPv6 deployment continues to be the economic climate. There is little doubt that the dot.com collapse (starting at the end of 1999) and the high amount of investment pumped in to 3G spectrum licenses (starting in February 2000) stalled investment in new core technologies such as IPv6 across the board and focused business plans on cost containment and survival strategies. This has incurred unprecedented delays in deployment of IPv6 by at least 3 years in Europe. Europe is at the point of crossing the chasm and should swiftly get on the path of wider IPv6 deployment.

While perceived pressure on IPv4 address space is not great at this point in time, we must remember that this is at the cost of placing an ever-greater proportion of the Internet behind restrictive NAT environments. Furthermore, it is the introduction of a significant new application technology, such as 3G mobile, that would create a demand for a billion globally addressable IP numbers and in so doing place the IPv4 address space in danger of depletion.

The collective initial findings of the 2nd phase of the European Union IPv6 Task Force are detailed in this report and in the minutes of the Milan meeting (http://www.ec.ipv6tf.org), including the following key messages:

- The critical mass needed for IPv6 adoption in Europe and the member states has been garnered, though in a slow process, which needs further strengthening through increased active participation of key industry players and involvement of the new European countries to design a comprehensive European IPv6 roadmap.
- Global cooperation, including Research & Development, policy-making and real life deployment, should be strengthened to pave the way to a global scale deployment of IPv6 and equitable access to knowledge, avoiding the creation of isolated Internets and allowing a rhythmic adoption at a global scale.
- The National IPv6 Task Forces are still in the formation phase (with many with less than one year of activity) with a relative degree of success engaging their governments in the dialogue and recruiting volunteer experts to formulate objectives and action plans. The “volunteer model” delivers on a best effort basis. A dedicated or funded model would be more suitable for such an important, large-scale undertaking.
- The actual level of IPv6 deployment is still imperceptible, especially when compared with Asia Pacific and the expected growth in other areas (including North America).
- A number of barriers and hurdles towards IPv6 deployment have been detected, namely deployment business models, return on investment models, CEO/CTO unawareness and some political showstoppers. The creation of a new panel of experts, led by the IPv6 Task Forces, winning stakeholders from the public and private sector, including SMEs, will allow in depth investigation of these barriers and the generation of new recommendations and case studies.
- Similarly, a number of technical barriers had been identified, and it is necessary to address these, while driving forward technology in a networked world that will increasingly rely on IPv6 as an enabler. The creation of a research-led center of IPv6 expertise or excellence would address this requirement. Such a center should combine a technology-driven focus

with the needs determined by the IPv6 panel of experts, and both should liaise in this mission.

- The adoption of IPv6 by governments, universities, schools and the European Commission, where it make sense (e.g. deployment on web sites), will generate confidence in the minds of end-users (as is happening with the DoD announcement in the US), and a possible trigger for business cases.
- Public and private sector procurements should require IPv6 capabilities for future-proof investment.
- Top-level national NICs should accelerate their support of IPv6.
- IPv6 deployment progress should be benchmarked in order to monitor its success.
- The achievements and progress of the Task Forces must be widely disseminated by means of an extended IPv6 Task Force portal.
- It is of paramount importance to take all required actions aiming at the continuation of the work performed by the "European IPv6 Task Force" and renew its mandate for the third phase with an enlarged team including the national IPv6 Task Forces and selected key industry players (ISPs, ASPs, vendors) with a "funded model". The third phase should focus on tangible success in the short-term deployment in wired and wireless broadband access and strategic innovative revenue-generating applications (consumer electronics, end-two-end security, e-vehicle, etc.) and in the longer term strategic objectives (e-Infrastructure, GRID, 4G, Ambient technology,…).

While IPv6 deployment should be market-led, this Task Force encourages the consideration of the recommendations contained in this report because of their critical importance towards the achievements of the *e*Europe 2005 goals (including "broadband for all", security and Ambient Intelligence) and the future development of Internet in Europe.

The European Commission is called upon to submit the results of the work of the 2nd phase of the IPv6 Task Force, contained in this document, to the European Council.

1. The 2nd phase of the IPv6 Task Force

The 2nd phase of the EU IPv6 Task Force was initiated in September 2002, with an inaugural meeting in Brussels, as a result of the recommendations from the 1st phase.

Towards the achievement of a wider participation, it was decided to initiate the creation of the National IPv6 Task Forces, with their own charters, with the common goal of defining the IPv6 roadmap, in order to foster the deployment of IPv6 nationally and Europe-wide.

Following National IPv6 Task Forces have been created:

- Spain (May 2002).
- France (September 2002).
- Luxembourg (November 2002).
- Finland (August 2002).
- UK (January 2003).
- Portugal (February 2003).
- Switzerland (April 2003).
- Germany (April 2003).
- Denmark (May 2003).
- Sweden (May 2003).
- Italy (October 2003)

It is expected that Austria, Ireland, Netherlands and Norway, at least, will follow in the next couple of months.

International cooperation has sparked the creation of the North American IPv6 Task Force (November 2002), The China IPv6 Council (May 2003) and the Asia Pacific Task Force (October 2003). The EU IPv6 model has been adopted by these initiatives due to its focused objectives, its mission, value-add and the desire to take the Internet where it should go.

Global cooperation in IPv6 has gone beyond R&D activities. The major push has been achieved in the policy environment and the real life deployment with great success.

2. Key Findings from the National IPv6 Task Forces

After this initial "kick-off" period and after achieving a sizable critical mass and representation, the EU IPv6 Task Force is now starting to reap the benefits of its initiatives by collecting the key findings from the field, combining country-specific results to identify common successes and common areas that need concerted action to resolve.

2.1. Achievements

Most of the National IPv6 Task Forces have achieved a certain level of:

- Awareness and working meetings.
- Different focused working groups.
- Local web site, ftp, mail exploders and archives.
- Press releases and articles.
- Participation from key industry, education, research and government groups.
- National Research and Education Networks connected to GÉANT with IPv6 and offering IPv6 services to their community.
- Trials in different business sectors.

In some cases, Internet Exchanges (IX) have incorporated IPv6, or started to consider doing so. So far, only a couple of countries have deployed IPv6 services at the national NIC, though many plan to do so.

Only a few ISPs, in a couple of countries, have started to offer IPv6 services, but several have concrete plans to start deploying.

2.2. Barriers

There is a consensus about the following barriers challenging the success of this mission:

- Lack of official commitment from governments.
- Lack of strategic recognition of the importance of IPv6.
- Lack of new IPv6-ready applications.
- Lack of concrete business models.
- Lack of customer demand (customers/consumers want services not protocols).
- Lack of European Industrial leaders.
- Lack of simpler and clearer technical answers.
- Lack of funding for the National Task Forces activities.
- Lack of funding for the take-off of the ISPs and industry in general.
- Lack of benchmarking of the real deployment and the bigger picture.

It is also interesting to note that in several countries most of the achievements have not been well disseminated and recognized by the media. For example, at least in one country several public and

private entities have confirmed that they are mandating IPv6 in their new procurements policies, but this has gone unnoticed and not been advertised publicly.

Though government support has been provided in most of the countries to kick-off the National IPv6 Task Forces, there is in general a lack of real commitment (or funding) from the government to set the pace. Simple technical solutions are available to enable IPv6 in web servers, but none of the EC or European governmental web sites have been enabled up to now.

2.3. Next Steps

In general, there is a unanimous agreement to push forward with the following activities:

- Continue and strengthen the work and cooperation of the National and EU IPv6 Task Forces, defining National and European recommendations.
- Focus on deployment and applications.
- Continue the awareness and dissemination activities, communicating on best practices.
- Update the national Task Force web sites and create a EU IPv6 web portal.
- Promote the creation of a centre of excellence, which can be an independent reference point for those wishing to design, build, develop or deploy IPv6 products.
- Convince the public and private organizations to demonstrate their commitment, demanding IPv6 in any procurement.
- Arrange for the key public sites to be accessible with IPv6.
- Gather more potential industrial actors (SMEs, integrators, ISPs, WISPs, etc.).
- Work on “business case” examples.
- Study a detailed deployment roadmap

3. The Vision of the Way Forward

The first coordination meeting among the National IPv6 Task Forces provided several additional inputs, depicted in the following sections.

3.1. "Broadband for all", IPv6 and the "Digital Divide"

The eEurope 2005 states the importance of broadband for all without specifying the underlying enabling key technologies. IPv6 is the key enabler of the broadband e-Infrastructure for knowledge sharing across all sections of information technologies.

New services, new applications, including areas such e-Health, e-Safety, e-Government, etc., are only possible if there is a secure end-to-end broadband infrastructure.

As already described in the final report of the 1st phase of the IPv6 Task Force, IPv6 can help bridge the digital divide that currently exists between the developed world and emerging Internet nations. This digital divide exists also in Europe and the deployment of new broadband access networks with technologies as WiFi, VDSL and PLC, provide the tools that only IPv6 could enable to take full benefit of their possibilities.

3.2. "Ambient Intelligence" and IPv6

Ambient Intelligence is key for the long-term view of the Information Society and IPv6 takes center-stage in enabling scalable Ambient Intelligence infrastructures.

Wired and wireless networks must provide seamless support to the end-user enabled with IPv6 over heterogeneous access networks in view of achieving the ISTAG goals and vision.

3.3. Benchmarking

In order to be able to monitor the actual achievements towards the goal of the European deployment of IPv6, it is absolutely necessary to provide means for the correct measurement of the progress.

This benchmarking process will allow credible and substantiated dissemination of the achievements and follow up of the roadmap progress, detecting failures and providing measures to accelerate the success rate.

3.4. Security and IPv6

It is crucial to continue educating the stakeholders about the challenging issues of security and privacy. In general, there is this false perception of "NAT=security", but it is a totally wrong security model for the e-Europe 2005 concept.

A major effort must be deployed to investigate and research how IPv6 provides better means for end-to-end security compared to the use of NAT, while simultaneously providing new space and green fields for the design and creation of new and innovative applications and services.

3.5. Education

It is necessary to increase take-up of knowledge about IPv6 among they industry players and institutional stakeholders.

The inclusion of IPv6 in the education curriculum and programs is most probably the best path to achieve this goal, though only with medium/long-term impact.

3.6. Policy

IPv6 is growing in importance worldwide. It is necessary to be considered at all levels and towards this end, appropriate policies must be developed.

3.7. Consumer Electronics

It is necessary to engage the European consumer electronics industry at large in order to warrant its continued position and competitiveness in the consumer electronics markets.

All kind of home and professional appliances will be able to benefit from the new IPv6 features designed for this purpose.

3.8. Smart Tags

New application areas for RF-ID are becoming visible in several fields.

It is highly recommended to consider the relevance of IPv6 in the RF-ID space and encourage cross-fertilization in the early stage of their developments.

4. IPv6 Deployment Status

IPv6 is gradually being introduced but compared with Asia Pacific, the European take-off is still too slow. There is significant IPv6 native deployment in the research networks and backbones (including GÉANT and 18 connected NRENs), but little evidence of deployment in commercial ISP networks. While the transatlantic link from GÉANT to Abilene carries multi-Gigabit IPv6 native traffic, there is no real activity from big commercial transit providers to deliver IPv6, to enable a robust, reliable IPv6 infrastructure for commercial, day-to-day use.

It is now quite clear that North America will play a leading role with the major announcement of the US DoD of deployment of IPv6 starting October 2003. This will no doubt have an impact on the many vendors and suppliers competing for the billions of dollars of IP-related budget that the DoD has on offer. This will drive both IPv6-enabled products and also advanced services such as IPv6 IPsec and Mobile IPv6. Europe should seize the opportunity to take advantage of the strong investments done so far in R&D to reap the fruits of these efforts, to be able to secure and maintain a leading role in IPv6 technology

The urgent work of the EU IPv6 Task Force is to push forcefully the deployment of IPv6 in key industries and areas with immediate impact such as broadband, wireless, but also in industry training centers, schools and universities to build a knowledgeable deployment work force.

The national, European IPv6 Task Force activities should continue to foster the IPv6 deployment substantiated with clear roadmaps and implementation tools.

5. Call for Action at EU level

A.1 Take all required actions aiming at the continuation of the work already performed within the "IPv6 Task Force" with an enlarged participation and renewed mandate. The focus should consider the short-term deployment (wired and wireless broadband access), strategic applications (customer market, e-vehicle, etc.) and the long-term strategic objectives. Concerning the enlarged participation, the Task Force is requested to strengthen the participation of representatives of ISPs/WISPs and application vendors committed to the deployment, and include representatives of national IPv6 Task Forces.

A.2 Create a new panel of experts, led by the IPv6 Task Forces, with the aim of gaining input from stakeholders from the public and private sector, including SMEs, that will then allow in-depth investigation of non-technical deployment barriers and the generation of new recommendations and case studies for potential IPv6 adopters.

A.3 Promote the creation of a research-led center of excellence, to drive forward IPv6 research and deployment in Europe. The centre would be an independent point of reference in Europe for IPv6. It should include the technical analysis of deployment issues for IPv6 in its remit, as well as the impact of IPv6 on existing IP environments.

A.4 Promote the adoption of IPv6 by governments, schools, universities and the European Commission, including deployment in web sites and other infrastructure.

A.5 Benchmark IPv6 deployment progress in Europe.

A.6 Reinforce the strategic need of IPv6 to accomplish the eEurope 2005 objectives together with broadband for all, security and Ambient Intelligence.

A.7 Public and private organizations should require IPv6-capable devices and software in their procurements, including hosting of web sites.

A.8 Promote the adoption of IPv6 by the Top-level national NICs.

A.9 Promote the creation of an extended IPv6 Task Force portal.

A.10 Ensure that the IPv6 Task Forces achievements and the deployment progress are widely disseminated.

A.11 Ensure the collaboration among different research projects and between them and the industry, including the awareness and dissemination especially towards SMEs.

A.12 Create a European competition on best IPv6 deployment practices, including a European IPv6 Task Force prize for IPv6 innovation.