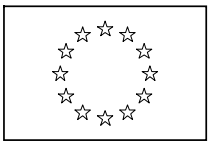

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# COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

## Next Generation Internet – priorities for action in migrating to the new Internet protocol IPv6

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**TO THE COUNCIL AND THE EUROPEAN PARLIAMENT**

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## Executive Summary

The Internet and its widespread use is central to the knowledge economy. However, the rapid and continued growth of the Internet now requires new measures to ensure that it can continue to meet new and evolving requirements.

It is widely acknowledged that the European Union needs to play a stronger role in developing and mastering the base technologies that support the next generation Internet evolution, by accelerating the development of a high capacity, reliable and secure, communications infrastructure, with always-on connectivity and high wireless mobility.

Indeed the European Union's ambition to be the most competitive and dynamic knowledge-based economy by 2010 can only be realised if it also plays a leading role in the upgrading of the Internet's capabilities. Maintaining and building on its technological leadership in wireless and mobile communications and providing for an efficient transition to the next generation Internet based on the new Internet Protocol (IPv6) are crucial factors in this regard.

With the anticipated convergence of the wireless and Internet sectors, a unique opportunity is now created for the European manufacturing and service industries to capitalise on their technology know-how, to strengthen their competitive edge, to release their entrepreneurial potential allowing the creation of novel applications and services on which new business opportunities can be built to the benefit to all actors in the new Internet economy.

However for new Internet enabled services to be deployed in a timely manner, it is of key importance to structure, consolidate and integrate European efforts on IPv6, and notably to develop the necessary base of skilled human resources, to fully harmonise, where needed, the policy approaches, to sustain the research effort, to promote the standards and specifications work and to ensure that all sectors of the new economy likely to be impacted by IPv6 are fully aware of potential benefits accruing from its adoption.

Further to the work carried out by the IPv6 Task Force, the Commission proposes a set of actions to ensure that the European Union maintains the initiative and leadership in these global developments. These actions require a concerted action aiming at the structuring, consolidation and integration of European efforts on IPv6, notably through:

1. An increased support towards IPv6 in public networks and services,
2. The establishment and launch educational programmes on IPv6,
3. The adoption of IPv6 through awareness raising campaigns,
4. The continued stimulation of the Internet take-up across the European Union,
5. An increased support to IPv6 activities in the 6$^{th}$ Framework Programme,
6. The strengthening of the support towards the IPv6 enabling of national and European Research Networks,
7. An active contribution towards the promotion of IPv6 standards work,
8. The integration of IPv6 in all strategic plans concerning the use of new Internet services.

## 1. INTRODUCTION

Information and communication technologies (ICT) are revolutionising the functioning of the economy and society, and are triggering new ways of working, trading and communicating. The further development of ICT into the 21st century, will have a wide-range and long lasting impact not only on the economy, but also on every aspect of people's lives, leading to radical transformations and far-reaching changes. Indeed, these changes are not just about technology, they are also about creating wealth and generating new business opportunities, sharing knowledge, bringing communities closer together and enriching everyone's lives.

As a response to these anticipated developments, the European Council at its meeting in Lisbon[1] on March 2000[2], set the objective for Europe to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion.

In June 2000, the European Council endorsed the "*e*Europe 2002"Action Plan[3] which defines the necessary measures to accomplish the objective of "An Information Society for All". It identified three main objectives (a cheaper, faster secure Internet; investing in people and skills and stimulating the use of the Internet) where action at European level would add value, and it detailed a number of policy actions in connection with these objectives. These actions included affordable access, by businesses and citizens to a world-class communications infrastructure and the rapid development of a wide range of competitive online services. It specifically addressed the next generation Internet, including mobile Internet, and emphasised the need for a vastly increased Internet IP address space, commensurate with the anticipated medium and long-term requirements. Indeed, the emergence of peer-to-peer communications, the rapid development of broadband access infrastructure such as ADSL, the necessity to cope with the demand for machine-to-machine communications, all point to the need for a rapid evolution towards the next generation Internet.

In the context of 3G mobile communications, the Commission issued a Communication[4] also stressing that the current Internet Protocol (IPv4) may hinder the full deployment of 3G services in the long run. The proposed new Internet Protocol version, IPv6, would overcome the addressing shortage of IPv4 and enable additional features. Implementing IPv6 in mobile networks will also allow for wireless machine-to-machine interconnection, thereby considerably boosting the 3G-application range. While it is widely acknowledged that the transition to all-IPv6 networks will require several years of effort, it is also considered that any delay

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1 Lisbon European Council, 23-24 March 2000: Presidency conclusions, http://europa.eu.int/council/off/conclu/index.htm

2 eEurope – An Information Society for All, Communication on a Commission Initiative for the Special European Council of Lisbon, 23-24 March 2000, http://europa.eu.int/information_society/eeurope/action_plan/index_en.htm

3 eEurope 2002 Action Plan, http://europa.eu.int/information_society/eeurope/action_plan/actionplantext/index_en.htm

4 The Introduction of Third Generation Mobile Communications in the European Union: State of Play and the Way Forward, COM(2001)141, http://europa.eu.int/ISPO/infosoc/telecompolicy/en/com2001-141en.pdf

towards such a transition, may hinder the deployment of these advanced 3G service features at a later stage, while depriving the European Union of a major opportunity to become a significant actor in the new Internet generation.

In the eGovernment declaration agreed by Ministers from 28 European countries on 29th November 2001, Ministers invited the European Commission to make the necessary investments in research and technological development, in particular in the 6th Framework Programme, to ensure interoperability and dependability in the next generations of infrastructures[5] and open systems.

Thanks to its ability to set ambitious and timely strategic goals and the dynamism of its network operators and equipment manufacturers, the European Union has acquired an uncontested position of leadership in the usage of mobile communications, illustrated by its very high penetration levels (close to 73% on average, in January 2002). As for the uptake of the Internet, the average Internet penetration in the EU Member States is growing, even if there are still important variations between different Member States, being currently used by over 35% of households and by over 50% of the workforce[6].

With the anticipated convergence of these two different sectors of the communication industries, a unique opportunity is now created for the European manufacturing and service industries to capitalise on their technology know-how, to strengthen their competitive edge, to release their entrepreneurial potential and to successfully make the leap to the wireless Internet world. Indeed accessing and using the Internet via a mobile communicator/phone or computer or a TV set-top box, is expected to become commonplace in the coming years, allowing the creation of novel applications and services on which new business opportunities can be built to the benefit to all actors in the new Internet economy.

An earlier and smooth deployment of IPv6 would also avoid future much higher transition costs and reduce the possibility of a need for rushed and therefore more risky and more expensive implementations later. This is an issue of paramount importance (a significant risk exists that world-wide, IPv4 addresses will be in increasingly short supply by 2005) to a wide range of industries, which will be producing goods with embedded Internet access, including cars and consumer electronics as well as for fixed, mobile and wireless communications.

For new Internet enabled services to be deployed in a timely manner, it is of key importance to structure, consolidate and integrate European efforts on new Internet Protocol IPv6, and notably to develop the necessary base of skilled human resources, to fully harmonise, where needed, the policy approaches, to sustain the research effort, to promote the standards and specifications work and to ensure that all sectors of the new economy likely to be impacted by IPv6 are fully aware of potential benefits accruing from its adoption.

A concerted effort is hence called for, that will enable the overall competitiveness of the European Union to be strengthened in this strategically important area of development.

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5 Including a fast but coherent transition to broadband access and the next Internet Protocol.

6 Eurobarometer, Nov 2001- Work in knowledge-based economy: Quality for change

## 2. THE INTERNET – ADDRESSES AND APPLICATIONS

As the world's population increases to some 9 billion people in 2050, it becomes essential to plan technically for all of these people to have the potential for Internet access. IPv6 is the only technology capable of serving the needs of the projected human population, while also providing for the networking and interconnection of a myriad of devices in cars, homes, airplanes, consumer electronic goods etc.

### 2.1. Internet communication and addressing

To a user of the Internet, computers are known by their domain name, e.g. in the Web context one would use "www.IPv6-TaskForce.org" as the web address of the IPv6 Task Force, or "editors@IPv6-TaskForce.org" as a user e-mail address. While such domain names are easier for people to remember, the networked devices – such as web servers, e-mail servers or home PCs – communicate using a numeric address format and a protocol called the Internet Protocol. As a loose analogy, domain names and IP addresses can be compared to people's names and their postal addresses. The Internet Protocol requires that communicating devices, anywhere on the Internet, have unique IP addresses, so that data packets can be carried (routed) between the devices across one or more Internet Service Provider (ISP) networks.

The current version of the Internet Protocol, IPv4, has been in use for over twenty years, however, when IPv4 was designed in the 1970's, the vast growth in the Internet was not foreseen, and at the time, the Web was still many years away from conception. As a result, and given the limitations of hardware at the time, the original Internet designers only chose to use 32 bits to represent IPv4 addresses. Those 32 bits allow $2^{32}$, or just over 4,000 million, IPv4 addresses.

There are not, at present, enough IP addresses for every person on the planet. When one considers that homes, offices, cars and other environments may all contain many IP-enabled devices in the near future, the pressure on address space is evident, given any one device on the network may wish to connect to any other (e.g. a computer system at a car dealership may remotely check the status of sensors in a car, to monitor performance and predict future problems). That pressure is heightened because the full range of IP addresses can never be fully utilised and because of large allocations per ISP or per site in the early days of the Internet.

IPv6, in development since the early to mid 1990's, has now matured to the state where vendors are delivering early commercial products and initial deployments are being made. IPv6's major advantage is that it uses 128-bit addresses, enough to offer globally unique IP addresses to any device wanting it for the foreseeable future[7]. Given that all Internet communications use IP, the importance of the availability of IP address space for all cannot be stressed enough.

### 2.2. IP address allocation

In Europe, the IPv6 address space is managed and allocated to Internet Service Providers by RIPE NCC[8]. The three regional registries – RIPE NCC, APNIC and

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[7] Those 128 bits allow $2^{128}$, or just over 4 billion*4billion*4billion*4billion IP addresses

[8] RIPE NCC: http://www.ripe.net/

ARIN, that are responsible for address allocations, share a common IP address allocation policy.

The availability of IPv6 address space should, through market forces, lead to IPv6 addresses being cheap (compared to IPv4) if not free to the end user. Many ADSL users currently have no chance to obtain a single, static IPv4 address for their home network. With IPv6, not only does a home network user get a whole set of IPv6 addresses (rather than just one IPv4 address), IP address scarcity is no longer a reason for an ISP to limit the access to static IP addresses.

The combination of the availability of multiple globally reachable IPv6 addresses for a home network, along with broadband access, enables a whole new range of remote home management applications (e.g. multiple web cameras, or wireless temperature sensors) that are not feasible with IPv4.

## 2.3. The scarcity of IPv4 address space

The risk of global IPv4 addresses becoming critically scarce by 2005, coupled with the uneven distribution of the address space between Northern America[9] and the rest of the world, is sufficiently serious for action to be taken now and swiftly, thereby promoting the achievement of the Lisbon Strategy objectives. While IPv4 addresses may never be completely exhausted, their availability is becoming increasingly scarce, particularly for large-scale requirements. Scarcity implies an undesirable cost to those wanting IP addresses.

Without sufficient global IP address space, applications are forced to work with mechanisms that provide local site addressing – loosely the equivalent of the early days of telephony where users had to interact with one (or more) operators to place a call. Such mechanisms (i.e. Network Address Translation, or NAT) restrict the end-to-end functionality of the Internet and decrease its overall performance. While a user (client) behind a NAT device can communicate out to servers on the Internet (the "client-server" communication model), that same user (client) cannot be guaranteed to be accessible when external devices wish to establish a connection (as typified by the "peer-to-peer" communication model).

The need for always-on environments (such as residential Internet through broadband, cable modem, or satellite) to be globally reachable, precludes NAT-style IP address conversion, pooling, and temporary allocation techniques, and the "plug and play" always-on consumer Internet appliance requirements further increases the address pressure. Rather than connecting temporarily via dialup, with a temporary IP address taken at random from a pool, users and applications of the future, need permanent connectivity with dedicated IP addresses.

IPv6 reintroduces end-to-end security and communication and its plug and play feature makes device deployment, for example in the home, much easier for vendors and end users who would not be required to configure their network appliances.

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[9] 74% of the IPv4 address space is already allocated to organisations in North America (15% to the USA government alone): the Universities of Stanford and MIT each have more allocated addresses than Peoples Republic of China.

## 2.4. Future Internet applications

In the context of a vastly increased Internet IP address space (as offered by IPv6, and IPv6 alone), a plethora of novel Internet services and applications will be made possible. The expected developments of peer-to-peer communications, the use of novel forms of interactive multimedia services over the broadband access infrastructure, the take-up of machine-to-machine communications, all point to the urgent need for a rapid evolution towards IPv6.

Implementing IPv6 in mobile networks will also allow for wireless machine-to-machine interconnection, thereby considerably boosting the 3G-application range. While it is widely acknowledged that the transition to all-IPv6 networks will require several years of effort, it is also considered that any delay towards such a transition, may hinder the deployment of these advanced 3G service features at a later stage, while depriving the European Union of a major opportunity to become a significant actor in the new Internet economy.

In the initial phase of GPRS/UMTS with a few millions of terminals, IPv4 is however a perfectly reasonable solution, but to offer a scalable service that will cater for over a billion terminals, IPv6 is an imperative. By adopting IPv6, the European Mobile industry has a unique chance to investigate and pioneer the future, together with all other Internet related players, be they Internet service providers, operators of fixed networks, cable networks, etc. In so doing they will acquire a competitive edge which can be explored and exported.

Also the combination of VoIP (voice over IP also referred to as Internet telephony) and wireless LAN (local area networks) could have a significant business impact opening up the possibility, as it does, of offering a degree of mobility with Internet access and cheap integrated voice communications

IPv6 will facilitate access to IP based services and applications using a wide range of access technologies. Network operators will be able to deliver their services irrespective of the type of access (e.g. UMTS, Wireless LAN) as well as providing a seamless Internet experience to their customers. Users can connect to whatever web sites they choose, log in to their corporate intranet (and be reached from that network), do Internet telephony, get streaming audio/video, use whatever network applications (in a variety of contexts such as those of education, health, transportation, games, etc) they need. They will not be constrained by the limited set of value added network services the operators will offer through their own portals. This level of service interoperability will both strengthen competition and enhance social cohesion within the European Union.

# 3. IPV6 DEVELOPMENT AND DEPLOYMENT

At present, IPv6 is gradually being introduced. However this process needs to be accelerated to prevent the current IPv4 shortcomings from hindering the further development of the Internet, to ensure a more open and competitive arena for the provision of new generation services, and to avoid much higher transition costs if that process is delayed.

## 3.1. IPv6 standards development

The IPv6 standards, are developed by the Internet Engineering Task Force (IETF)[10] Which is a vendor-neutral organisation that spans the globe and that has working groups dealing with IPv6. In the wireless area, standards are developed by 3GPP[11] and 3GPP2, and the ITU[12]. The work of 3GPP and 3GPP2 is critical as 3G is seen as a prime area for early commercial IPv6 deployment.

While the IETF sets standards, it does not mandate policy, nor perform advocacy. Other organisations such as the Internet Society (ISOC)[13] or the IPv6 Forum[14] have respectively a key educational and marketing role.

## 3.2. IPv6 Research and Development

All aspects of IPv6 and notably its research and development dimensions are addressed by a multitude of organisations, telecommunications operators, equipment manufacturers and academic institutions.

The European Commission has been instrumental in providing necessary funding for the research and development of IPv6 related issues. In particular, and in response to the conclusions of the Stockholm Summit, the Commission stepped up its R&D efforts notably in the context of the 5th Framework Programme. A large number of IPv6 projects totalling some € 55 Million of community funding is currently operational, including two large scale IPv6 trials, namely 6NET[15] and Euro6IX[16]. These trials are fully complementary to the efforts deployed at national level in the context of National Research and Education Networks (NRENs) and at European level in the context of initiatives such as GEANT[17].

In its preparatory work for the 6th Framework Programme, the Commission has stressed the importance to continue the R&D effort on IPv6 with a view to provide further opportunities to the research community and ensure notably the development of innovative tools, services and applications.

## 3.3. From IPv4 to IPv6

While IPv6 offers a bright future for the Internet, IPv4 will not go away overnight. As IPv6 is being deployed today, it is done so alongside IPv4. The first IPv6 deployments began in 1996, from which emerged the 6bone IPv6 test bed network[18], now spanning over 50 countries and 1000 sites. Commercial IPv6 deployments are happening, led by Japan, and in countries where IPv4 address allocations have been historically lower (in particular in Asia).

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10 The Internet Engineering Task Force: http://www.ietf.org/
11 3rd Generation Partnership Project: http://www.3gpp.org/
12 The International Telecommunication Union: http://www.itu.org/
13 The Internet Society: http://www.isoc.org/
14 The IPv6 Forum: http://www.ipv6forum.org/
15 The 6NET Project: http://www.6net.org/
16 The Euro6IX Project: http://www.euro6ix.org/
17 The GÉANT Project: http://www.dante.org.uk/geant/
18 The 6bone project: http://www.6bone.net/

As the transition to IPv6 takes place progressively and at different speeds by different industrial sectors, the need will arise to develop IPv6 transition and integration guidelines that will recognise that the coexistence of IPv4 and IPv6 will last many years, that the phasing out of IPv4 will be soft and gradual and that there will not be a magic date imposed on any particular industry (as was the case with Y2K) to move to IPv6, but rather that there will be an incentive to act before it becomes too late and too expensive.

A smooth transition will enable providers and users to leverage their existing investment of today's IPv4 services, while preparing for a seamless migration to IPv6 as additional IPv6 devices come online. The IETF has devised a wide range of transition and integration techniques, enabling providers to pick those methods best suited to them. Ultimately many IPv6 deployments will be "native", i.e. pure IPv6, rather than islands of IPv6 connected by means of the existing IPv4 Internet.

### 3.4. IPv6 deployment around the world

Japan took recently (Sep 21, 2000) political leadership in the design of the IPv6 roadmap by setting a deadline of 2005 to upgrade to IPv6, existing networks in every business and public sector. Japan sees IPv6 as one of the ways of helping them leverage the Internet to rejuvenate the Japanese economy and has established an IPv6 Promotion Council[19] tasked with the realisation of the e-Japan programme.

The Japanese initiative was very crucial to the Asia-Pacific region. Korea followed suit on Feb 22, 2001 by announcing plans to roll out IPv6. Taiwan has also taken a decision concerning IPv6 and has notably established a IPv6 steering Committee. Bilateral consultations, at Ministerial level, between P.R. of China and Japan have taken place on the means to further promote IPv6.

Though most of the design of IPv6 and vendor implementations has been done in the US, the business case for IPv6 in the US has not, until very recently, been generally felt as acutely as in other world regions. Indeed since the US was first in the "land rush" for IPv4 address space, so is not yet in as critical a position as the Asia-Pacific region or Europe. However an industrial initiative towards the establishment of a North American IPv6 Task Force has been launched on December 2001, reflecting the growing pressure for an upgrade of the Internet.

In the European Union, in comparison with the Asia-Pacific region, the commercial roll-out of IPv6 is currently marginal and essentially limited to test beds. This has motivated the European Commission to launch in April 2001, an industrially driven IPv6 Task Force with a very broad representation of key actors in the mobile, telecommunications and Internet fields[20]. The Task Force has now completed its work[21] and has issued a series of recommendations calling for further urgent action to be taken at European level. Proposals for further action outlined in this document are broadly based on the work of the IPv6 Task Force.

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19 IPv6 Promotion Council: http://www.v6pv.jp and http://cwg.v6/keel.net/apwg/en/index.html

20 ETSI, Eurescom, EICTA, DANTE, EACEM, Euro ISP Association, UMTS Forum, GSM Europe, IPv6 Forum, RIPE, Eurocontrol, SITA, ISOC UK, ITU as well as representatives of major manufacturers, operators and academic institutions

21 EU IPv6 Task Force: http://www.IPv6-TaskForce.org

### 3.5. Privacy issues

Due to the fact that the Internet has, from the very beginning, been considered as an open network, there are many characteristics of its communication protocols which, more by accident than design, can lead to an invasion of the privacy of Internet users.

Concerns are expressed on a regular basis regarding the need to find a balance between the "open nature" of the Internet and the conflicting needs to effectively maintaining and debugging a network and the protection of the personal data of the Internet users. The fundamental right to privacy and data protection is enshrined in the EU Charter on fundamental rights and developed in detail in the EU data protection directives 95/46/EC and 97/66/EC which both apply to processing of personal data on the Internet. In its Communication on the Organisation and Management of the Internet Domain Name System of April 2000, the Commission stated already that an IP address can be a personal data in the sense of the legal framework (for example dynamic IP addresses). Also the Article 29 Data Protection Working Party, the independent EU advisory body on data protection and privacy established by Directive 95/46/EC, draw the attention at several occasions to privacy issues raised by the use of the Internet. The Article 29 Data Protection Working Party as well as the International Working Group on Data Protection in Telecommunications (the “Berlin Group”) consider to work specifically on IPv6.

It is therefore of indispensable that the European Commission and the European Union as a whole consider privacy issues in the further development of Internet. While privacy issues are currently[22] being taken into account in the development of IPv6, it is essential that the trust and confidence of Internet users in the whole system, including in the respect of their fundamental rights, is ensured.

## 4. ACTIONS TO BE TAKEN AT EU LEVEL

It is widely acknowledged that the European Union needs to play a stronger role in developing and mastering the base technologies that support the next generation Internet evolution, notably by accelerating the take-up of services made possible through the development of a high capacity, reliable and secure, communications infrastructure, with always-on connectivity and high wireless mobility.

However for new Internet enabled services to be deployed in a timely manner, it is of key importance to structure, consolidate and integrate European efforts on the new Internet protocol (IPv6), to ensure that the necessary base of skilled human resources is available, that the research effort is sustained, that standards and specifications work is promoted and that all sectors of the new economy likely to be impacted by IPv6 are fully aware of potential benefits accruing from its adoption.

A strategic concerted effort is hence required that will enable the competitiveness of the European industry to be strengthened. Standards activity needs to be sustained, while application developers, and organisations tendering for new IP-based services, should consider the IPv6-ready status and future proofing of the services they intend to deploy.

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22 http///www.ietf.org/internet-drafts/darft-ietf-ipngwg-temp-addresses-v2-00.txt

Rapidly adopting IPv6, the European industry at large, including all Internet related players, be they fixed (e.g. cable, ADSL) or wireless (e.g.3G, WLAN), has a unique chance to investigate and pioneer the future. In so doing they will acquire a competitive edge which can be explored and exported. Mastery of IPv6, both in technology supply and in its wider range of applications, will be of strategic benefit to the European Union in world trade and development.

In light of the above, a series of recommendations pertaining to the implementation of IPv6 by all relevant ICT sectors is proposed by the Commission as follows:

***EU Member States are called upon to:***

1. Provide support towards the IPv6 enabling, of the networks and services associated with the public sector (e.g. e-government, e-learning and e-health services), including educational institutions. Moreover, IPv6 should be considered in application procurements.
2. Establish and launch educational programmes on IPv6 tools, techniques and applications, so as to create the required base of IPv6 skills and knowledge.
3. Promote the adoption of IPv6 through awareness raising campaigns and co-operative take-up activities, targeted at consumer organisations, small and medium size enterprises, Internet service providers (fixed or wireless) and operators.
4. Continue to stimulate the wide spread use of Internet across the European Union and encourage the transition towards IPv6 by avoiding fragmented approaches or mandatory deployment time-lines.
5. Strengthen the financial support towards national and regional research networks (NRENs), with a view to enhance their integration in European wide networks such as GEANT, and increase the operational experience on novel Internet services and applications based on the use of IPv6.
6. Provide the required incentives towards the development and testing of IPv6 products, tools, services and applications in the new economy sectors. In particular, IPv6 enabled broadband access to the home, to small and medium size enterprise and in public areas, is of key importance.
7. Take appropriate measures (such as the establishment of a National or Regional IPv6 Council) to carry out:
    a. *The assessment, at national or regional level, of current developments and degree of take-up of IPv6, as well as the formulation of guidelines and dissemination of best practises relating to the efficient transition towards IPv6.*
    b. *The development of measures aiming at the alignment of IPv6 transition schedules favouring a cohesive IPv6 take-up.*
    c. *Encouraging the active participation of technology experts from industry in the work of European and International standards and specification bodies tasked with IPv6 matters.*

***The Industry is called upon to:***

1. Fully participate in the R&D activities to be supported in the context of the 6th Framework programme.
2. Actively contribute towards the acceleration and alignment of on-going IPv6 work within standards and specifications bodies.
3. Develop key guidelines permitting the efficient integration of IPv6 infrastructures and interoperability of IPv6 services and applications, notably in the context of 3G mobile communications.
4. Support and fully participate in interoperability events organised, including those by ETSI.
5. Address the multi-vendor interoperability issues impeding the wide-scale deployment of IP security and conduct extensive IP security trials.
6. Devote efforts towards the establishment of a European wide, vendor independent, training and education programme on IPv6 and ensure through timely and user friendly information, the collectively increase of IPv6 awareness.
7. Integrate IPv6 in their strategic plans and take early steps to obtain appropriate IPv6 address allocations.

***Complementary actions by the European Commission:***

The 6th Framework Programme has not yet been adopted and its allocation of resources shall respect the procedures and specific aims of the legal basis for this programme. To the extent it be permitted and in full complement to the above actions to be undertaken by Member States and Industry, the European Commission proposes to:

1. Increase and refocus EU support to RTD in the context of the 6th Framework programme in the following areas:
    a. *IPv6 broadband fixed and wireless network infrastructures, and their interoperability aspects,*
    b. *Development of IPv6 tools, devices and network elements,*
    c. *Large scale testing of IPv6 based services and applications, across heterogeneous, fixed and wireless, access platforms,*
    d. *IPv6 enabled advanced infrastructures for Research (GEANT and Grids)*
    e. *IPv6 awareness, training and education,*
    f. *Production of a European Code Base for IPv6, including the development of IPv6 open source code,*

*g. Launching a socio-economic and market study addressing the key potential impacts of the transition to IPv6, including on security, freedom of information privacy, user friendliness and easier management.*

2. Study the impact of the further evolution of the Internet including the new generation IPv6 protocol, on the fundamental right to privacy and data protection, so as to ensure that the required standards and specifications take these aspects into full consideration.

3. Renew the mandate of the "IPv6 Task Force" with an enlarged participation of all economic and industrial sectors likely to be impacted by IPv6, including, consumer organisations, research institutions, and independent data protection authorities as well as representatives of national or regional IPv6 Councils and appropriate representatives from candidate countries. In its renewed mandate the Task Force is requested to:

   *a. Ensure a working liaison with standards and Internet governance bodies such as ISOC, IETF, ICANN, RIPE NCC, 3GPP, ETSI, IPv6 Forum, Eurescom, ETNO, UMTS Forum and GSM Europe,*

   *b. Provide a regularly updated review and plan action ("the European IPv6 Roadmap") on the development and future perspectives of IPv6 in order to co-ordinate European efforts on IPv6,*

   *c. Establish collaboration arrangements and working relationships with similar initiatives being launched in other world regions.*

## 5. GLOSSARY

| | |
|---|---|
| 3G | Third generation mobile communications system. |
| ADSL | Asynchronous Digital Subscriber Line. Offers high-speed connectivity to the Internet over existing copper telephony wiring. |
| Always-on | Devices remain connected to the Internet when powered up (e.g. ADSL), rather than establishing temporary connections (e.g. dialup). Because devices need a unique IP address continuously, the rise in always-on devices demands more IP address space. |
| APNIC | The Asia-Pacific regional registry (equivalent of RIPE NCC). |
| ARIN | The Americas regional registry (equivalent to RIPE NCC). |
| Cable modem | High-speed Internet access via cable television service line. |
| Client-server | A communication model where communications is initiated one-way, from users (clients) to servers. |
| End-to-end model | Devices communicating on the Internet do so directly without any intervening translation devices. |
| GPRS | General Packet Radio Service. Allows Internet access from a mobile device running IP(v4) over the wireless telephony network. |
| IETF | Internet Engineering Task Force. Define global Internet standards, |
| Interoperability | The ability of two devices, usually from different vendors, to work together. |
| IP | Internet Protocol. The underlying technology by which all Internet data communication is carried out. |
| ISP | Internet Service Provider. Provides network/access services. |
| ITU | International Telecommunications Union. |
| LAN | Local Area Network. |
| NAT | Network Address Translation. Allow multiple computers to connect to the Internet via a limited number of global IPv4 addresses. Restricts end-to-end principle of the Internet. |
| Peer-to-peer | Communication model in which client devices may communicate directly, initiating the data exchange in either direction, without a server system. |
| RIPE NCC | The organisation (regional registry) that assigns IPv6 top-level prefixes in Europe. |
| Static IP address | An IP address allocated to a device that does not change, thus allowing the device to be consistently found at that address. Important when running Internet services to that device. |
| UMTS | The third generation mobile communications system. |
| VoIP | Voice over IP. Using an IP network to carry voice. |
| Wireless LAN | A local wireless network communication typically covering a hot-spot area. The current 802.11b standard allows 11MBit/s maximum throughput over a wireless LAN. |
| xDSL | The set of Digital Subscriber Line technologies, including ADSL. |