

IPv6 Around the World

Number Resource Organization's Contribution to ITU-T IPv6 Study Group

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Introduction

This submission informs stakeholders of the current state of global IPv6 deployment. A vast amount of IPv6 address space is already distributed to networks around the world. IPv6 adoption is gaining significant momentum, with key service and content suppliers deploying IPv6 capabilities on their infrastructure and numerous governments, through partnerships with the private and civil sectors, are actively engaged in activities designed to ensure their citizens have Internet access via the new protocol.

Meanwhile, the Internet technical community is pro-actively involved in a range of joint initiatives to raise awareness of, and prepare the technical infrastructure for large-scale IPv6 adoption, while end-users are almost universally equipped with IPv6-ready computer operating systems, and so are therefore prepared for IPv6 deployment.

The information contained in this submission should inform discussion on all six 'Terms of Reference' of the ITU IPv6 Group meeting on 15-16 March 2010 in Geneva, Switzerland.

The Strategic Approach

Strategic IPv6 deployments are creating the necessary momentum for accelerating adoption through all stakeholder groups.

For the past decade, a quiet evolution of the Internet has been taking place. As Internet Protocol version 4 (IPv4) addresses have been distributed to the Internet's rapidly expanding user base, many people from the technical, business, and government sectors have been preparing for the adoption of a new Internet Protocol, IPv6.

The global deployment of IPv6 is vital to the continuing growth and stability of the Internet. Key organisations are taking market leadership positions, implementing IPv6-ready networks, and actively working to ensure that all regions and sectors have access to the equipment and education necessary to join the IPv6 Internet.

Distributing IPv6 Around the World

IP address space is distributed by five Regional Internet Registries (RIRs) that receive those IP addresses from a central global source, the IANA (Internet Assigned Numbers Authority). The RIRs then make allocations directly to Internet Service Providers (ISPs) and network operators within their respective regions. To date, combined IPv6 allocations to network operators by the RIRs comprises enough address space to accommodate more than two trillion End Users - and is more than

500 times the size of the entire IPv4 address pool. While this is a significant distribution of IPv6 addresses, nevertheless it amounts to only 0.003% of the entire IPv6 address pool.

Looking at distribution from the perspective of a developing region, to date the IPv6 allocations made in the AfriNIC region are equivalent to 5,000 times the address space that has been assigned to IPv4 enabled end users in the region.

Doing Business Over IPv6

Throughout the world, the commercial sector is embracing IPv6. While Internet traffic via IPv6 is still significantly less than IPv4, we observe an increase in the speed of deployment as market leaders, such as, Google and Microsoft deploy IPv6 in their products and on their networks.

Internet Service Providers

Many Internet Service Providers, including **Comcast** (US), **Free** (France), **XS4ALL** (Netherlands), **GTD Group** (Chile), **NTT** (Japan), **D-NET** (Indonesia) and **Sify** (India), to name a few, are already providing or planning to provide IPv6 services to both business and residential customers.

Content Providers

The major Internet content providers such as **Google** (including **YouTube**) and **Netflix** are already providing the infrastructure for their users to access content directly over IPv6.

Governments Working Toward IPv6

Governments are major stakeholders in the Internet community and their influence on an issue like IPv6 deployment can be profound. In recent years, governments around the world have found different ways to support and promote the adoption of IPv6. Through partnerships with the private and civil sectors, governments are helping to ensure their citizens have access to all the benefits that the Internet can provide, and on today's Internet, that means access via IPv6. Examples include:

- **Algeria, Egypt, Kenya and Senegal:** All have setup a local IPv6 taskforce lead by significant involvement from government to support local awareness and encourage network operators to implement IPv6. Senegal is investigating a national policy to enforce that all imported network equipment is either IPv6 compatible or that the vendor can prove that there is a clear upgrade roadmap to support IPv6.
- **Australia:** The Australian Government's Australian Government Information Management Office (AGIMO) strategy to deploy IPv6 across various departmental networks, to be completed in 2012, has been hailed as a model by other governments around the world.

- **Brazil:** The Brazil National Internet Registry, nic.br, began making IPv6 allocations in December 2007. The number of Autonomous System Numbers (ASN) in Brazil with IPv6 allocations has increased seven-fold since implementing the IPv6 project.
- **China:** China launched the CNGI project to promote IPv6 in 2003, focusing first on academic networks before expanding to industry networks in 2009. They showcased their progress at the summer Olympic Games in Beijing in 2008. The project has funded development of the largest IPv6 network in the world, used by about one million students.
- **Egypt:** The Ministry of ICT and NTRA have setup a lab to conduct research on IPv6 for commonly used applications in the country such as VoIP and telemedicine. Reports from these studies have been presented at AfriNIC meetings.
- **European Union:** The European Commission released its Action Plan for the deployment of IPv6 in Europe in 2008, and followed this in 2009 with surveys of attitudes to IPv6 and measurement of IPv6 in use on the Internet.
- **Germany:** The German Government's plans for a federal IPv6 network connecting all German municipalities are already serving as a model for other government network strategies.
- **Japan:** The Japanese government has played a proactive role in the industry collaboration, through the Task Force on IPv4 Address Exhaustion, Japan. Through this task force each key sector of the industry has been presented with a clear path for implementation. Constant feedback on these actions is published for community consultation.
- **Lebanon:** Working with the Middle East Network Operators Group (MENOG) in 2009, Lebanese networks are now among the first in the Middle East that are able to connect and peer at the Beirut Internet Exchange (Beirut IX) over IPv6.
- **Nigeria:** A special committee was created by the government of Nigeria (EFCC and NCC) to increase IPv6 awareness and study policy that can bootstrap the process.
- **United States of America:** The Government of the United States of America set a June 2008 deadline for all agencies' infrastructure (network backbones) to be using IPv6 and for agency networks to interface with this infrastructure. Then, in December 2009, the government amended the Federal Acquisition Regulation (FAR) to require IPv6-compliant products be included in all new information technology acquisitions using Internet Protocol.

IPv6 and the Technical Community

Much of the work necessary to make IPv6 access ubiquitous needs to be done by the technical community. Organisations such as the Internet Society (ISOC), the Internet Corporation for Assigned Names and Numbers (ICANN), and the Regional Internet Registries as well as many Academic Networks are involved in a wide range of joint initiatives to raise awareness about IPv6 and educate people on what still needs to be done.

Root Name Servers

As of 2009, eight of the thirteen root name servers, that are another fundamental part of the Internet's Domain Name System (DNS) infrastructure, are offering service over IPv6 at multiple locations around the world.

Top-Level Domains

Top-Level Domains (TLDs) are another vital part of the Domain Name System (DNS), and are operated by a wide range of companies, governments, and organisations.

Of the 20 Generic TLDs (including .com, .net and .org), 15 have already deployed IPv6 on their infrastructure.

Of the 248 Country Code TLDs (ccTLDs), 152 have deployed IPv6, including countries such as Kenya (.ke), Tanzania (.tz), Haiti (.ht) and Tunisia (.tn).

Regional Internet Registries

The core function of the Regional Internet Registries (RIRs) is the allocation and registration of IP addresses. In 2009, AfriNIC deployed IPv6 on its own infrastructure that means that all RIRs globally have deployed IPv6 in their networks.

In addition, the RIRs have a vital role in raising awareness about IPv6 and educating people on what still needs to be done. The Policy Development Process of each RIR is open to anyone who wishes to propose or discuss the policies that govern these activities.

Each RIR also works closely with their community to educate, promote, and share information relating to IPv6. These efforts include dedicated websites, training courses, multi-stakeholder outreach activities (such as participation in the Internet Governance Forum) and IPv6 network measurement and analysis.

For more information on RIR IPv6 activities, see:

AfriNIC: **AfriNIC IPv6 Virtual Lab**, <http://www.afrinic.net/IPv6/>

APNIC: **IPv6 ICONS Wiki**, <http://icons.apnic.net/IPv6>

ARIN: **IPv6 Wiki**, <http://www.getipv6.info/index.php>

LACNIC: **PortalIPv6**, <http://portalipv6.lacnic.net>

RIPE NCC: **IPv6 Act Now**, <http://www.ipv6actnow.org>

IPv6 for Everyone

The deployment of IPv6 throughout the Internet is vital to ensuring continuing growth and innovation, but it will not fundamentally change the nature of the Internet itself. Approximately 90% of Internet users already have computer operating systems that work seamlessly over IPv6. This means that many home and small business users are simply waiting for their service providers to offer IPv6 connections. In some cases, they may already be using IPv6.

Looking forward

As IPv6 adoption accelerates over the coming months and years, it is vital that stakeholders in the Internet are aware of the issues surrounding IPv6. Through information sharing and cooperation, we will ensure that no one is disadvantaged or left behind by this evolution of the network.