NRO
Number Resource Organization
10 Years

IPv6 Around the World

Momentum for IPv6 deployment is increasing globally, and IPv4 addresses are becoming scarce. Around the world, there are efforts to increase broadband penetration: more smart phones and network-ready devices are entering the market, and the number of Internet users is steadily increasing. A supply of global IP addresses larger than the currently available pool of IPv4 addresses is necessary to maintain the sustainable, long-term development of a ubiquitous and open Internet.

Global IPv6 deployment is vital to the continued growth and stability of the Internet. Technical, business, and government areas have been collaborating and preparing to deploy Internet Protocol version 6 (IPv6) since it first became available in the late 1990s.

Today, key organizations are implementing IPv6-ready networks and are working to ensure all regions and sectors have access to the equipment and education necessary to join the IPv6 Internet. Numerous governments, through partnerships with the private and civil sectors, are actively engaged in activities designed to ensure their citizens have Internet access via IPv6. Meanwhile, the Internet technical community is proactively involved in a range of cooperative initiatives to raise awareness and prepare the technical infrastructure for large-scale IPv6 adoption

Distributing
IPv6 Around
the World

Drawing from a central global source of IP address space – the Internet Assigned Numbers Authority (IANA) – the five Regional Internet Registries (RIRs) manage the distribution of IP addresses directly to Internet Service Providers (ISPs) and network operators within their regions.

The RIRs allocate IPv6 address space based on established need, according to policies created by the Internet community, using open and transparent policy development processes. These policies determine how address space is distributed among regional networks and help network operators get the most out of their allocations.

Because IPv4 and IPv6 will need to coexist on networks for the foreseeable future, extra effort must be made during the transition phase to ensure all parts of the Internet remain reachable whether they are accessible via IPv4 and IPv6.

To date, the RIRs have allocated the equivalent of more than 33 billion /48 IPv6 address blocks to network operators, which is already significantly larger than the size of the entire IPv4 address space. While this is a significant distribution of IPv6 addresses, it amounts to less than 0.004% of the unallocated IPv6 address pool.

IPv6 allocations are being made all over the world. In the AFRINIC region, which serves Africa, IPv6 allocations are equivalent to 5,000 times the amount of IPv4 address space that has been assigned to end users in the region. More than half of the RIPE NCC's members located throughout Europe, the Middle East, and parts of Central Asia, have an IPv6 allocation.

Doing Business Over IPv6

Throughout the world, the commercial sector is embracing IPv6. Results of the 2013 Global IPv6 Deployment Survey, supported by the Number Resource Organization (NRO), show the level of IPv6 presence among the respondents continued to grow for the fourth straight year. The survey findings point to a shift in emphasis from "IPv6 preparedness" to IPv6 usage. Survey results are available at:
www.nro.net/documents/2013-ipv6-survey-results

While Internet traffic via IPv6 is still significantly less than IPv4, there has been 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

Internet service providers (ISPs) around the world have deployed IPv6.

Many ISPs, including Free (France), Hurricane Electric (USA), XS4ALL (Netherlands), GTD Group (Chile), NTT (Japan), D-NET (Indonesia), Sify (India), and Columbus Networks (Caribbean) to name just a few, provide or plan to provide IPv6 services to both business and residential customers.

- Comcast and Verizon (US) have introduced commercial offerings that include access to IPv6 based services. Comcast started deploying native IPv4/IPv6 dual-stack broadband services.
- AT&T (US) offers new services and products to keep up with the US Government's federal mandate to deploy IPv6.
- KDDI and Chubu Telecommunications in Japan have enabled IPv6 services in their residential networks. IPv6 readiness among their end users is one of the highest globally, with a readiness ratio of close to 30%.
- Telefonica in Peru started to replace CPE (Customer Premises Equipment) to provide native IPv6 to residential users and presently, IPv6 traffic in Peru is near 3%.
- Apple iOS 6 now supports IPv6, and iPhone users can access the Internet via IPv6 using WiFi and LTE.
- ISPs all over Africa now have native IPv6 services that they offer to their customers including LinkdotNet, TEdata (Egypt), Safaricom (Kenya), Simbanet (Tanzania), Internet Solutions (South Africa), Sonatel (Senegal), and Liquid Telecom Group in Southern and Eastern Africa.
- The recent introduction of an IPv6-enabled service by Swisscom now means that close to 10% of Swiss citizens can access IPv6-based Internet content.

Content Providers

Major Internet content providers such as Google (including YouTube), Yahoo, and Netflix also provide their services using the IPv6 protocol, offering unhindered access to all Internet users.

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Governments Working
Toward IPv6

Governments around the world 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 of the Internet's benefits. Today, that means access via IPv6, and its progress, is occurring all around the world.

North America

The first phase of IPv6 adoption for the Government of Canada focuses on IPv6 connectivity for public websites through a shared service by September 2013. The next phase will focus on enabling IPv6 across principal Government of Canada public websites by early 2015.

The US Federal Government issued its first IPv6 transition plan in 2005 and is currently monitoring IPv6 deployment and conducting equipment testing. A 2010 mandate requiring US Government executive departments and agencies to implement IPv6 by 2014 is in a phased approach.

Latin America

In May 2013, the Costa Rican Government issued a Presidential Directive that established the date of 30 June of 2015 as the final date for implementing IPv6 in public sector services. In 2011, the Colombian Telecommunications and ICT Ministry published a declaration recommending coordination efforts for implementing IPv6 in Colombia. Ecuador's Telecommunications Ministry issued three different "Ministerial Agreements" demanding public sector IPv6 compatibility by establishing requirements for upgrades and other technical procurements. The first government that officially supported the adoption of IPv6 was Cuba in 2008, when the Ministry of Technology resolved that all new technology acquisitions must be IPv6 compatible.

Caribbean

As early as 2008, the Inter-American Telecommunication Commission (CITEL) recommended that its member states, in conjunction with the private and academic sectors, promote IPv6 in their respective countries. CITEL members include 13 Caribbean economies as part of the 35 independent state members. Organizations such as the Caribbean Telecommunications Union, with many Caribbean nation members, conduct widespread outreach and work closely with governments in the region on IPv6 deployment.

Today, transition awareness building continues through a variety of active forums. Government Ministers heard the call for IPv6 recently at the CANTO 2013 meeting and will have the opportunity for further discussions in upcoming IPv6 forums in Trinidad and Barbados.

More specifically, the Government of Costa Rica requested ISPs in the country do all they can to make the island IPv6 ready. In 2012, the Bureau of Telecommunications and Post in Curacao sponsored an IPv6 day to promote awareness.

European Union

GEN6 (Governments Enabled with IPv6), which launched in January 2012, is a coordinated European Commission project to facilitate IPv6 deployment in public sector networks. The European Commission is continuing its strong support of IPv6 adoption in the EU through its Digital Agenda, which includes partnering with industry on monitoring initiatives such as the IPv6 Observatory.

Middle East

Lebanese networks are among the first in the Middle East able to connect and peer at the Beirut Internet Exchange (Beirut IX) over IPv6. The Saudi Arabia IPv6 Task Force was established in 2008, bringing together stakeholders from the public and private sectors, and has held more than 10 meetings.

Asia Pacific

Many governments in the Asia Pacific region have committed to IPv6 deployment within prescribed timelines. The Asia-Pacific Economic Cooperation Telecommunications and Information working group (APEC TEL) developed "IPv6 Guidelines", to which APNIC contributed as a representative of the Internet technical community. The biannual APEC TEL ministerial meeting, TELMIN, has produced two statements endorsing those guidelines and the importance of IPv6 deployment in member economies.

Africa

Governments in Algeria, Cameroon, Egypt, Kenya, Mauritius, Nigeria, Senegal, South Africa, Uganda, Tanzania, and Tunisia are among those that have created an IPv6 task force with significant government involvement to increase local awareness and encourage network operators to implement IPv6.

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Regional Internet Registries

The core function of the RIRs is the distribution and registration of Internet number resources - IPv4, and IPv6 address space and Autonomous System (AS) numbers. The policies that determine these processes are developed by open consensus. In addition, the RIRs play a vital role in raising awareness about IPv6. This includes human capacity building through training for technical staff, as well as more general outreach and education, ensuring all Internet stakeholders understand the importance of timely IPv6 deployment.

In 2012, **ARIN** spoke or exhibited at the Consumer Electronics and Cable Shows, Interop, North American IPv6 Summit, Federal IPv6 task force meetings, Caribbean Telecommunication Union ICT Roadshows, and at Jamaica Internet Day. ARIN continues to be an active participant in regional operator forums such as CaribNOG and NANOG, and has hosted multiple "ARIN on the Road" educational events. ARIN also engages with the media, to dispel misinformation and to help educate the non-technical community about upcoming changes as the IPv6 Internet grows.

www.arin.net/knowledge/ipv6_info_center.html

Specific RIR activities

LACNIC has hosted several virtual IPv6 seminars and technical workshops around the region accounting for almost 7,000 trained professionals. LACNIC has also collaborated with other Internet organizations such as ISOC, ICANN, NIC Brazil, and LACNOG to organize seminars, workshops, and other related events such as the World IPv6 Launch and the IPv6 Week, among others. Since 2012, LACNIC has directed its efforts to promote IPv6 to the non-technical community by creating discussion on IPv6 business models. For 2013, a LACNIC goal is to reach 1% of IPv6 traffic in the region. To achieve this goal, it has started to focus its training activities to include IPv6 in access and mobile networks.

www.portalipv6.lacnic.net

All five RIRs have deployed IPv6 in their own networks and have all of their services available over IPv6. RIRs also work closely with their communities to educate, promote, and share information relating to IPv6. These efforts include dedicated websites, training courses, multistakeholder outreach activities, and IPv6 network measurement and analysis. The RIRs also engage with governments in their respective regions to ensure the needs and concerns of the public sector are understood.

The **RIPE NCC** conducts on-site IPv6 training events and publishes a wide range of educational documents for technical and governmental audiences. The RIPE NCC also works closely with MENOG to stage the highly successful IPv6 Roadshow events throughout the Middle East. IPv6 Roadshows will be expanded to Russia and the CIS countries in 2014. A "Train the Trainer" program is also planned for in Russia and the Middle East.

www.IPv6ActNow.org

APNIC has increased the frequency of IPv6 training courses and devotes a full day during the twice-yearly APNIC Conferences to practical discussions about IPv6 deployment. APNIC engages with intergovernmental forums in the region, and is regularly invited to APEC TEL meetings and TELMIN ministerial meetings as an expert guest on IPv6. APNIC administers the Asia Pacific IPv6 Task Force, where participants give updates on national progress.

www.apnic.net/ipv6

AFRINIC allocations of IPv6 address space increased significantly in 2012, with a number of huge assignments to many telecoms and operators, indicating major national plans and awareness in the region. Likewise, the percentage of African AS numbers that advertise IPv6 has jumped from 5.5% in early 2010 to 14.73% by mid 2013, signifying increased deployment on African infrastructure. AFRINIC's outreach programs also focus on IPv6 deployment training, with almost 2,000 engineers trained over the past years. Dedicated training is conducted at AFRINIC events on transition mechanisms, peering, and interconnection.

www.afrinic.net/en/services/ipv6-programme

IPv6 and the Technical Community

The technical community is responsible for much of the work necessary to make IPv6 access ubiquitous. Organizations such as the Internet Society (ISOC), the Internet Corporation for Assigned Names and Numbers (ICANN), and the RIRs, as well as many academic networks, are involved in several joint initiatives to raise awareness about IPv6 deployment and how everyone can contribute.

Root Name Servers and Reverse Root Name Servers

Nine of the 13 root name servers offer services over IPv6 at multiple locations around the world. All five reverse root name servers operated by the RIRs support native IPv6.

Top-Level Domains

Fifteen out of 20 generic Top-Level Domains (gTLDs) have deployed IPv6 on their infrastructure, including .com, .net, and .org. Out of the 248 country code TLDs (ccTLDs), 152 have also deployed IPv6.

World IPv6 Launch

On 6 June 2012, major ISPs, home networking equipment manufacturers, and web companies around the world permanently enabled IPv6 on their networks. The event built on the success of World IPv6 Day held a year earlier, when websites and Internet service providers around the world, including Google, Facebook, Yahoo!, Akamai, and Limelight Networks joined together with more than 1000 other participating websites for a successful global-scale trial of IPv6.

Since June 2012 global use of IPv6 has more than doubled. Measurement information is available at: **http://www.worldipv6launch.org/measurements**

Global IPv6 Deployment Survey

In July 2013 the RIR communities participated in the fifth annual Global IPv6 Deployment Survey. The findings show that organizations are seeing client uptake of IPv6, and that they are increasingly promoting IPv6 to their customers. Of the 1,550 total respondents, 80% plan to deploy IPv6 within the next two years.

IPv6 for Everyone

Global IPv6 deployment is vital to ensuring the continued growth and innovation of the Internet, but it will not fundamentally change the nature of the Internet itself. Approximately 90% of end users 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 deployment accelerates over the coming months, all Internet stakeholders need to be aware of the issues surrounding IPv6. The RIRs provide data, statistics, and analysis on IPv6 for the benefit of the Internet community and to inform decision-making in all sectors regarding IPv6 deployment and network readiness. These projects include:

- **IPv6 RIPEness:** A rating system developed by the RIPE NCC to measure the "IPv6 readiness" of RIPE NCC members. IPv6 RIPEness provides a unique indicator of IPv6 readiness and shows data at various levels including by country, sector, and Local Internet Registry (LIR) size: **http://ripeness.ripe.net**

- **IPv6 Tracker:** A tool developed by APNIC that allows you to monitor your visitor traffic to assess the effect IPv6 deployment would have on your website. **www.labs.apnic.net/tracker.shtml**

AFRINIC
The Internet Numbers Registry for Africa
www.afrinic.net

APNIC
www.apnic.net

ARIN
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www.arin.net

lacnic
www.lacnic.net

RIPE NCC
www.ripe.net

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