Bureau Telecommunicatie en Post

A Practical approach for
IPv6 Introduction and Migration

Bureau Telecommunicatie en Post

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Content

1   Introduction

Bureau Telecommunicatie en Post (BTP) has identified the urgency to address the introduction of IPv6. Currently the addressing used in most of the global and local Internet and IP infrastructures is based on IPv4. However the numbering capacity of IPv4 is limited to around 4 billion numbers, which although it seems a lot, is due to be exhausted in the coming years.

Timely introduction of IPv6 and migration of IPv4 to IPv6 is important to prevent shortage of IPv4 addresses becoming a critical issue for the local economy. Besides providing the necessary address space to allow further growth of Internet connected devices IPv6 also offer functionality benefits for Operators and users.

The IPv6 policy is addressing the necessary steps to be taken by:
- Government
- Operators
- Business users

2 Global developments

2.1 General considerations

The exhaustion of the IPv4 address space has been on the agenda for a long period of time. Until now solutions have been found to reduce the use of Public IP numbers. One of the main mechanisms used has been Network Address Translation (NAT). This allows an Operator to have many subscribers connected on Private IP addresses while using only a few Public IP addresses to communicate with the "outside world". A similar approach has also been taken in many Local Area Networks (LAN) of Government, Corporate and Business users.

Since June 6th 2012 many of the major global websites started offering permanent and standard dual stack IPv4/IPv6 service.

2.2 Global developments

Global and Regional Internet Registries

Globally the IP addresses are allocated by the Internet Assigned Numbers Association (IANA). IANA allocates blocks of IP addresses and ASNs to the Regional Internet Registries (RIR's). The RIR's are independent, not-for-profit, membership organisations that support the infrastructure of the Internet. The RIR's distribute the IP Addresses and AS Numbers to their members within their own specific service regions.
Each RIR performs a range of critical functions including:

Source: http://nro.net/news/nro-response-to-itu.html

- The reliable and stable allocation of Internet number resources (IPv4, IPv6 and AS Number resources)
- The responsible storage and maintenance of this registration data
- The provision of an open, publicly accessible database where this data can be accessed
- A range of technical and coordination services for the Internet community

All the Regional Internet Registries have issued warnings that the IPv4 address space is due to be exhausted. Several measures are being taken to stimulate the timely deployment of IPv6 and to delay the actual moment of real exhaustion by various actions to recover unused, or inefficiently used, IPv4 address space. Early 2011 the last IPv4 blocks have been allocated by IANA to RIR's. Shortly afterwards also APNIC exhausted the IPv4 number blocks. The next RIR expected to run out of IPv4 number blocks is RIPE.

The Regional Internet Registry for Latin America and the Caribbean (LACNIC) reports the following depletion of the remaining IPv4 numbers:

Available IPv4 Address Space

Currently LACNIC as RIR is responsible of the registry, allocation and assignment of 11.13 /8s (186,775,296). The utilization of this space up to 2012-08-26 is shown in Figure 1.
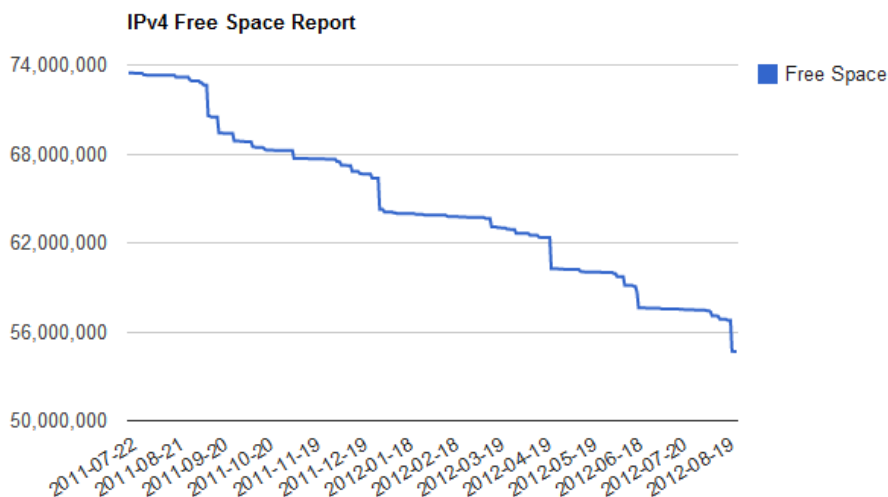
When the remaining space in the graph shows less than 4,194,304 we will consider the LACNIC stock exhausted. Also when the pool reaches 2,097,152 available addresses LACNIC will switch to Policies Relating to the Exhaustion of IPv4 Address Space.

Source: www.lacnic.net/en/registro/espacio-disponible-ipv4.html

Based on linear extrapolation of this graph it seems to take another 3 years before LACNIC has fully depleted the IPv4 numbers. This is quite a bit later than the previous projections (in 2007 depletion by 2010 was anticipated, as still mentioned on lacnic.net/ipv6/en/). However the main projections do expect depletion by 2015.

The website www.potaroo.net/tools/ipv4/index.html shows one of the more respected estimates of the IPv4 address exhaustion with a daily update based on actual developments. Two recent projections are shown, the 28 June 2012 estimate and the 27 august 2012 estimates.

This report generated at 28-Jun-2012 08:00 UTC.

IANA Unallocated Address Pool Exhaustion:
03-Feb-2011

Projected RIR Address Pool Exhaustion Dates:

RIR	Projected Exhaustion Date	Remaining Addresses in RIR Pool (/8s)
APNIC:	**19-Apr-2011**	0.9259
RIPENCC:	**27-Jul-2012**	1.8147
ARIN:	**04-Feb-2013**	3.5242
LACNIC:	**17-Jan-2014**	3.4243

For LACNIC there is a large difference (17 January 2014 ⇔ 24 May 2015) between the estimates. The May 2015 estimate seems to correspond with a more or less linear extrapolation of last year's allocation of IPv4 addresses.

This report generated at 27-Aug-2012 08:00 UTC.

IANA Unallocated Address Pool Exhaustion:
03-Feb-2011

Projected RIR Address Pool Exhaustion Dates:

RIR	Projected Exhaustion Date	Remaining Addresses in RIR Pool (/8s)
APNIC:	**19-Apr-2011**	0.9164
RIPENCC:	**01-Oct-2012**	1.2825
ARIN:	**11-Aug-2013**	3.3850
LACNIC:	**24-May-2015**	3.2501
AFRINIC:	**29-Oct-2019**	4.1518

A well-known graph illustrating the anticipated exhaustion of IPv4 is shown below. It shows the remaining address blocks at the RIR level.
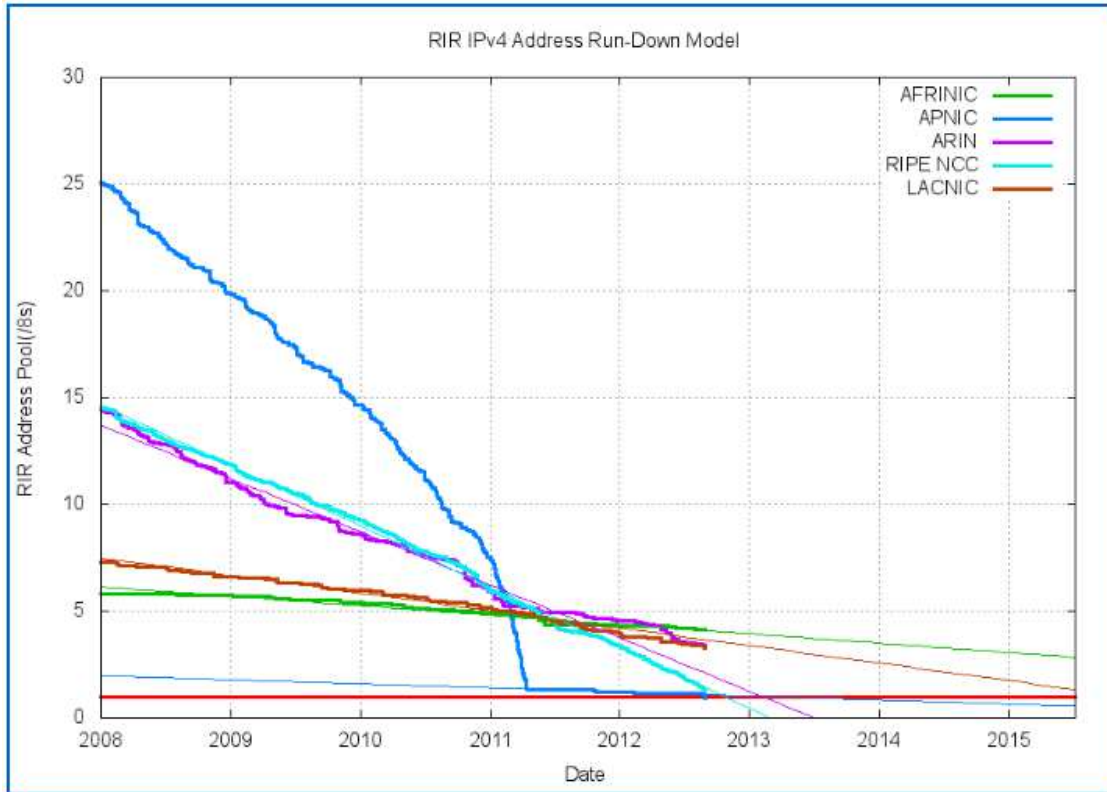
The available projections point towards 2015 for depletion of the LACNIC IPv4 addresses.

ITU

ITU is encouraging the deployment of IPv6. The ITU website, www.itu.int/net/ITU-T/ipv6/, provides information and an estimate of IPv4 exhaustion. Also here a large change between the June 28th 2012 and the August 27th 2012 estimates: January 2014 ⇔ May 2015.

OECD (Organisation for Economic Co-operation and Development)

Also the OECD has addressed the IPv6 issue in their report "*Internet Address Space: Economic considerations in the Management of IPv4 and Deployment of IPv6, Ministerial Background Report, DSTI/ICCP(2007)20/final*". The main conclusions are:

To create a policy environment conducive to the timely deployment of IPv6, governments should consider:
1) Working with the private sector and other stakeholders to increase education and awareness and reduce bottlenecks
2) Demonstrating government commitment to adoption of IPv6
3) Pursuing international co-operation and monitoring IPv6 deployment

US

The US has started to preparation for IPv6 years ago. In August 2005 the Government issued Memorandum M-05-22 requiring all United States Government (USG) agencies to prove IPv6 capability over IP backbone networks through basic testing, certification, and reporting by June 30, 2008. The main steps for each Government Department and Agency in this Memorandum were:

November 15, 2005
- *Assign an official to lead and coordinate agency planning,*
- *Complete an inventory of existing routers, switches, and hardware firewalls*
- *Begin an inventory of all other existing IP compliant devices and technologies not captured in the first inventory; and*
- *Begin impact analysis to determine fiscal and operational impacts and risks of migrating to IPv6.*

February 2006
- *Using the guidance issued by Chief Information Officers Council Architecture and Infrastructure Committee, address each of the elements in Attachment C in your agency's IPv6 transition plan and provide the completed IPv6 transition plan as part of the agency's Enterprise Architecture (EA) submission to OMB. Additional guidance on your agency's EA submission will be forthcoming.*
- *Provide a progress report on the inventory and impact analysis, as part of the agency's Enterprise Architecture (EA) submission to OMB. Additional guidance on your agency's EA submission will be forthcoming.*

June 30, 2006
- *Complete inventory of existing IP compliant devices and technologies not captured in first inventory, and*
- *Complete impact analysis of fiscal and operational impacts and risks.*

June 30, 2008
- *All agency infrastructures (network backbones) must be using IPv6 and agency networks must interface with this infrastructure. Agencies will include progress reports on meeting this target date as part of their EA transition strategy.*

All Government Departments and Agencies met the deadline to report successful demonstration of IPv6 capability by June 30, 2008. Also one of the largest cable companies, Comcast, deployed a complete IPv6 broadband access network mainly because their size exceeded the private numbering capacity of IPv4. Among others due to the Government requirements and tenders the Operators accelerated their IPv6 readiness.

Overall the IPv6 deployment globally has been slower than anticipated and the "lifetime" of IPv4 has been extended a bit by solutions such carrier grade NAT, re-use of some unused IPv4 blocks, etc. However the depletion of IPv4 is nevertheless approaching.

In 2010 the CIO of the US Government has issued the following timeline:

In order to facilitate timely and effective IPv6 adoption, agencies shall:

- *Upgrade public/external facing servers and services (e.g. web, email, DNS, ISP services, etc.) to operationally use native IPv6 by the end of FY 2012;*
- *Upgrade internal client applications that communicate with public Internet servers and supporting enterprise networks to operationally use native IPv6 by the end of FY 2014;*
- *Designate an IPv6 Transition Manager and submit their name, title, and contact information to IPv6@omb.eop.gov by October 30, 2010. The IPv6 Transition Manager is to serve as the person responsible for leading the agency's IPv6 transition activities, and liaison with the wider Federal IPv6 effort as necessary; and,*
- *Ensure agency procurements of networked IT comply with FAR requirements for use of the USGv6 Profile and Test Program for the completeness and quality of their IPv6 capabilities.*

The initial 2009 IPv6 planning is presented in the next figure and shows the main step for the US Government is to start offering IPv6 based services to the outside world. From January 2012 (currently delayed until December 2012) the complete service portfolio should be available in IPv6 to accommodate IPv6-only users via a native IPv6 network.
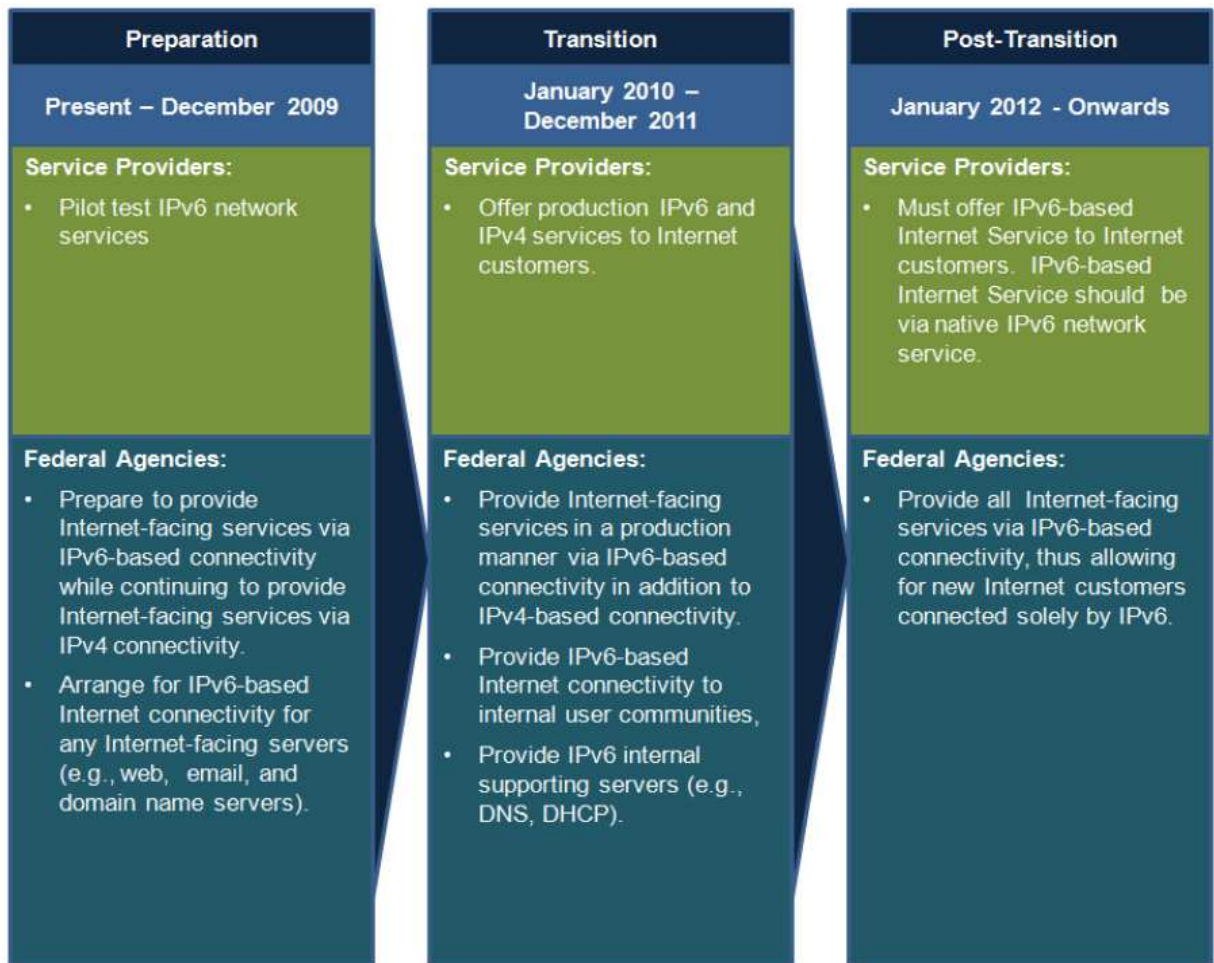
Preparation	Transition	Post-Transition
Present – December 2009	January 2010 – December 2011	January 2012 - Onwards
Service Providers:	**Service Providers:**	**Service Providers:**
• Pilot test IPv6 network services	• Offer production IPv6 and IPv4 services to Internet customers.	• Must offer IPv6-based Internet Service to Internet customers. IPv6-based Internet Service should be via native IPv6 network service.
Federal Agencies:	**Federal Agencies:**	**Federal Agencies:**
• Prepare to provide Internet-facing services via IPv6-based connectivity while continuing to provide Internet-facing services via IPv4 connectivity. • Arrange for IPv6-based Internet connectivity for any Internet-facing servers (e.g., web, email, and domain name servers).	• Provide Internet-facing services in a production manner via IPv6-based connectivity in addition to IPv4-based connectivity. • Provide IPv6-based Internet connectivity to internal user communities, • Provide IPv6 internal supporting servers (e.g., DNS, DHCP).	• Provide all Internet-facing services via IPv6-based connectivity, thus allowing for new Internet customers connected solely by IPv6.

Figure 7 – IPv6 Transition Phases and Timeline

Source: Planning Guide Roadmap toward IPv6 adoption in USG_May_2009_final.pdf

Europe

In Europe both the National Governments and the European Commission have been stimulating and facilitating the deployment of IPv6. In the "*Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe COM(2008) 313 final, May 27th, 2008*" the following target is defined:

- **By 2010 at least 25% of users should be able to connect to the IPv6 Internet and to access their most important content and service providers without noticing a major difference compared to IPv4.**

However in reality it seems this target has not been achieved as yet and delays have been prone.

More specific elements of the actions are:

Actions to stimulate IPv6 accessibility to content, services, and applications

- The Commission will work with Member States to enable IPv6 on public sector websites and eGovernment services. To this end common deployment objectives should be agreed. The use of available instruments such as the i2010 eGovernment Action Plan and the IDABC Programme will be envisaged. For its part the Commission will make the "Europa" and "CORDIS" websites IPv6 accessible by 2010.
- The Commission calls upon content and service providers to make their offer IPv6 accessible by 2010, amongst them the top 100 European web sites. It intends to facilitate this co-operation through "Thematic Networks" involving vendors, ISPs, and content and service providers, as part of the Competitiveness and Innovation Programme (CIP).
- The Commission calls upon industrial stakeholders that are now embracing IP technology in their core business to consider IPv6 as their primary platform for developing applications or appliances (such as sensors, cameras etc). In this context the Commission envisages supporting the testing and validation of IPv6 related applications in trials, funded as part of the CIP beginning in 2009.
- The Commission has provided financial aid through standardisation support actions to improve interoperability of networks. In this context, the Commission is willing to support standardisation actions on protocols running over IPv6 networks (e.g. SIP – Session Initiation Protocol). Furthermore, the Commission calls on the European Standardisation Organisations to develop best practices manuals on the deployment of internet IPv6-enabled services.
- The Commission will encourage research projects funded by Framework Programme 7 and facing a choice of computer network protocol, to utilise IPv6 whenever possible.

Source: *Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe COM(2008) 313 final, May 27th, 2008*

Actions to generate demand for IPv6 connectivity and products through public procurement

In a public consultation the use of public procurement was identified as an efficient way to speed up the transition to IPv6. For example in 2005, the US Government directed all federal government agencies to migrate their core backbone networks to IPv6 by mid 2008.

- The Commission encourages Member States to prepare for IPv6 within their own networks and when renewing their external network services contracts ensure that these also include provisions for IPv6 connectivity, and that all equipment procured is IPv6 capable. The Commission will bring together IT managers from Member States to exchange experience and to monitor progress.
- The Commission will equally specify IPv6 capabilities as a core requirement for the continuous renewal cycle of its own network equipment and services. It will carry out timely and appropriate internal trials and projects to prepare for IPv6.

Source: *Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe COM(2008) 313 final, May 27th, 2008*

Actions to ensure timely preparation for IPv6 deployment

The transition to IPv6 will take some time and will require operating a dual IPv4/IPv6 network, bringing up specific issues to be resolved. All actors will need to prepare themselves for developing and deploying IPv6 compliant solutions; the sooner the better. Organisations should not wait for their ISPs to provide native IPv6 connectivity but should begin to enable the protocol on their own network.

- The Commission will undertake targeted awareness campaigns to various user groups. Such actions are best conducted in public-private partnerships and in cooperation with Member States.
- The Commission intends to support "specific support actions" (within Framework Programme 7) to disseminate practical deployment knowledge.
- The Commission will continue to support standardization actions in relation to IPv6 interoperability, transitioning and availability, in line with the framework for testing IPv6 protocols already developed.
- The Commission encourages ISPs to provide full IPv6 connectivity to their customers by 2010 and where applicable to upgrade the equipment they supply to consumers.
- The Commission invites Member States to support the inclusion of IPv6 technology knowledge in relevant retraining curricula and in computer and network engineering courses of universities etc. The Commission will launch an accompanying study and intends to organize a conference in 2009.

Source: *Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe COM(2008) 313 final, May 27th, 2008*

Actions to tackle security and privacy issues

Security issues in IPv6 are not better or worse than in IPv4, they are just different. In a dual IPv4/v6 environment security issues could become complex to deal with in terms of implementation and configuration. The Court of Justice has recognised that an IP address may be considered as personal data falling within the scope of the Data Protection directives. Some concerns have been expressed about IPv6 and privacy, in particular by the Article 29 Data Protection Working Party.26 One particular concern has been taken up in a standard. However the situation needs to be monitored when it comes to configuration and actual implementation.

- The Commission will disseminate best practices and will work with vendors to provide full IPv6 functionality. Where necessary the Commission will call upon the expertise of the European Network and Information Security Agency, ENISA, to support these efforts.
- The Commission will monitor the privacy and security implications of widespread IPv6 deployment, in particular through consultation with stakeholders such as data protection authorities or law enforcement.

Source: *Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe COM(2008) 313 final, May 27th, 2008*

3   Practical approach

3.1 Existing situation

Currently IPv6 deployment on Curacao and the BES islands is still in its infancy. According to bgp.he.net some operators on Curacao do have IPv6 blocks and some initial IPv6 peering but others have no known IPv6 blocks or known IPv6 peering.

The capability of the Top Level Domain DNS servers to handle IPv6 for .an/.cw could not be fully confirmed . Globally 85.1% of the TLD's are IPv6 capable.

Source: www.ipv4depletion.com/?page_id=147 , 27 august 2012

The global IPv6 report at bgp.he.net/ipv6-progress-report.cgi does indicate that the .an and .cw domains do have IPv6 nameservers. In June 2012 no AAA records were reported but the August 27th report shows some initial AAAA's for the .an TLD.

```
TLD  domains      A     AAAA  A-glue AAAA-glue           downloaded                    processed
an      800      467      5      45        0  (Mon Aug 27 02:38:30 2012)  (Mon Aug 27 06:15:06 2012)
```

Actual IPv6 functionality of the .an and .cw DNS has not yet been verified.

Another source available on reported IPv6 users by country shows none for the (previous) Netherlands Antilles. This still seems to be common practice in the Caribbean. In the region the following countries show some IPv6 usage (from 0.09% down to 0.01% IPv6 usage): Costa Rica, Barbados, Brazil, El Salvador, Panama, Ecuador, Argentina, Colombia, Venezuela, Mexico, Uruguay and Chile.

IPv6 Users by Country

Date: 27 Aug 2012

Index	ISO-3166 Code	Internet Users	V6 Use ratio	V6 Users (Est)	Population	Country
137	AN	0	0.00%	0	0	Netherlands Antilles

Source: labs.apnic.net/dists/v6dcc.html

3.2 Government role: Create awareness, set the example and accelerate IPv6 deployment

The Government has three main roles:
* Create awareness
* Set the example
* Accelerate IPv6 deployment

Create Awareness

The Government, and in particular Bureau Telecommunication and Post, can play a major role in creating awareness for the IPv4 exhaustion and the need to deploy IPv6. Recommended steps are:
* Organise a seminar for the telecommunication industry about IPv6 and the need to deploy IPv6. Consider involvement of the academic world (UNA) as well.
* Assessment of IPv6 readiness of the Operators:
  o Request for Information to all major Operators with respect to when they expect to run out of IPv4 addresses
  o Request for Information to all major Operators with respect to their IPv6 readiness
  o Request for Information with respect to their IPv6 deployment plans
  Based on the results of this information gathering process BTP can assess the readiness of the local telecommunication industry and decide upon the required next steps to prevent the exhaustion of IPv4 causing bottlenecks for the local ICT developments.

* Provide IPv6 information to users with substantial ICT networks:
  o Business users like banks, refinery and ICT companies
  o Government users, all departments, agencies and the education sector (including the University)
  o Organise a seminar, if possible jointly with the telecom Operators, for ICT managers from Government and Private sector to explain the IPv6 migration.
  o CICA, the association for ICT companies could play an important role in dissemination

Set the example

The Government should set the example by becoming IPv6 ready and by providing all Government on-line services not only in IPv4 but also in IPv6.

Recommended steps:

November 2012
* *Assign an official to lead and coordinate agency planning,*
* *Complete an inventory of existing routers, switches, and hardware firewalls*
* *Begin an inventory of all other existing IP compliant devices and technologies*
* *Begin impact analysis to determine the deployment cost and the operational impacts and risks of migrating to IPv6.*

March 2013
* *Complete inventory of existing IP compliant devices and technologies not captured in first inventory, and*
* *Complete impact analysis of deployment costs and operational impacts and risks.*
* *Provide the completed IPv6 deployment and migration plan*

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June 2013
- *All Departments and Agency infrastructures (network backbones) must be using and supporting IPv6. Agencies will include progress reports on meeting this target date as part of their IPv6 transition strategy*

October 2013
- *At least 50% of all Internet facing services and websites must be using and supporting IPv6*

January 2014
- *100% of all Internet facing services and websites must be using and supporting IPv6*
- *The Government services should be fully available in IPv6, allowing for new Internet users connected solely by IPv6.*

<u>**Accelerate IPv6 deployment**</u>

Besides the role the Government can play by "*Creating Awareness*" and by "*Setting the Example*" the IPv6 deployment by Operators and local businesses should be stimulated as well. The approach towards the Operators will be discussed in chapter 3.3 and towards the business users in chapter 3.4.

3.3 Operator role: Introduction of IPv6 and migration IPv4 to IPv6

The Operators play a key role in the introduction of IPv6 in their networks and to offer IPv6 connectivity and services to their customers.

Recommended steps:

November 2012
- *Assign an official to lead and coordinate IPv6 deployment by the Operator*
- *Complete an inventory of existing routers, switches, and hardware firewalls*
- *Begin an inventory of all other existing IP compliant devices and technologies*
- *Begin impact analysis to determine the deployment cost and the operational impacts and risks of migrating to IPv6 and offering IPv6 services parallel to the existing IPv4 services.*

March 2013
- *Complete inventory of existing IP compliant devices and technologies not captured in first inventory, and*
- *Provide the completed plan for IPv6 deployment and IPv6 service introduction in 2010.*

June 2013, at the latest
- *The Operator should be offering initial IPv6 connectivity and services for their broadband access portfolio. This includes both dual-stack (IPv4 and IPv6) users and IPv6 only users*

October 2013
- *All Internet facing services and websites must be using and supporting IPv6*

Current status for as far as known at the date of publication of this report:
- Previously at least one Operator indicated that they are piloting IPv6 and are planning to provide IPv6 services in line with LACNIC timetables for exhaustion of IPv4 numbers.
- The CAR-IX has been prepared for IPv6 peering. Operators are encouraged to establish peering not only for IPv4 but also for IPv6 at the latest by 2010.

Priority issues for Operators are:
- Specify IPv6 capability in all purchases of ICT equipment and services
- Begin as soon as possible with dual stack CPE's
- Upgrade Operational Support Systems, Business Support Systems and other back office systems to handle both IPv4 and IPv6.
- Apply for IPv6 address space
- Start a pilot

3.4 Business users: Introduction of IPv6 and migration IPv4 to IPv6

Business users should be included in the Government awareness program as outlined in chapter 3.2. The Government should encourage business users to adopt IPv6 for their networks, ICT services and Internet facing websites.

Practical steps for business users with existing IPv4 numbers:
- Specify IPv6 capability in all purchases of ICT equipment and services
- Acquire IPv6 numbers from LACNIC
- Start a trial to gain experience with IPv6
- Use dual stack capable (IPv4/IPv6) servers
- Upgrade the applications to dual stack, starting with firewalls and network management. Also make sure the company websites are dual stack.
- Upgrade company IP network between locations
- Connect to IPv6 IP Transit/Internet connectivity:
    o Use a dual stack ISP
    o Tunnel (IPv6 over IPv4 tunnel) into a public IPv6 provider if the current ISP does not (yet) offer IPv6 capability.
- Migrate end-users to IPv6. The proxy firewall will have to implement NAT functionality to reach external IPv4 applications/websites.

4 Conclusions and Recommendations

The ICT infrastructure of Curacao and the BES islands has to anticipate the exhaustion of the IPv4 address space in the coming years. Timely introduction and deployment of IPv6 is required to prevent bottlenecks in the ICT developments.

Globally Governments and International organisations play a key role in encouraging the migration to IPv6 since individual users are relatively slow to migrate as long as there are still IPv4 addresses available. Migration to IPv6 becomes more attractive for end-users once the IPv6 network of users and content becomes larger. However managing a migration from IPv4 to IPv6 is not done overnight and requires substantial planning and preparation and therefore has to be started well before the actual address space has been exhausted.

The Government has three main roles:
- Create awareness
- Set the example
- Accelerate IPv6 deployment

Recommendations:

1) **Start the "Create Awareness" program (chapter 3.2) shortly**

2) **Trigger the IPv6 migration process at the Operators:**

   November 2012
   - *Assign an official to lead and coordinate IPv6 deployment by the Operator*
   - *Complete an inventory of existing routers, switches, and hardware firewalls*
   - *Begin an inventory of all other existing IP compliant devices and technologies*
   - *Begin impact analysis to determine the deployment cost and the operational impacts and risks of migrating to IPv6 and offering IPv6 services parallel to the existing IPv4 services.*

   March 2013
   - *Complete inventory of existing IP compliant devices and technologies not captured in first inventory, and*
   - *Provide the completed plan for IPv6 deployment and IPv6 service introduction in 2010.*

   June 2013, at the latest
   - *The Operator should be offering initial IPv6 connectivity and services for their broadband access portfolio. This includes both dual-stack (IPv4 and IPv6) users and IPv6 only users*

   October 2013
   - *All Internet facing services and websites must be using and supporting IPv6*

3) Trigger the Government to "Set the Example" program:

November 2012
- *Assign an official to lead and coordinate agency planning,*
- *Complete an inventory of existing routers, switches, and hardware firewalls*
- *Begin an inventory of all other existing IP compliant devices and technologies*
- *Begin impact analysis to determine the deployment cost and the operational impacts and risks of migrating to IPv6.*

March 2013
- *Complete inventory of existing IP compliant devices and technologies not captured in first inventory, and*
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- *Provide the completed IPv6 deployment and migration plan*

June 2013
- *All Departments and Agency infrastructures (network backbones) must be using and supporting IPv6. Agencies will include progress reports on meeting this target date as part of their IPv6 transition strategy*

October 2013
- *At least 50% of all Internet facing services and websites must be using and supporting IPv6*

January 2014
- *100% of all Internet facing services and websites must be using and supporting IPv6*
- *The Government services should be fully available in IPv6, allowing for new Internet users connected solely by IPv6.*

4) Encourage business users to migrate to IPv6 (part of awareness campaign, chapter 3.2)