IPv6 deployment in LAC: successful and not so successful stories

Main facts, current situation, drivers and tendencies

IPv6 in LAC

- LACNIC and Banco CAF partnered to analyze IPv6 deployment in Latin American and Caribbean region

- Results will help us understand:
  - Why IPv6 adoption is still low in Latin America and the Caribbean compared to other regions
  - What can be done to improve the situation

- The study was done during second semester of 2015

- Results published at http://portalipv6.lacnic.net

Main content

- ## The study includes several parts:
  - A survey among LACNIC members
    - Reasons they had for deploying / not deploying IPv6
  - Face to face interviews with largest ISPs, governments and academic institutions
  - Guides, recommendations, best practices
  - An economic model to help ISPs evaluate the cost of the different alternatives

- ## Different points of view:
  - ISPs / Content providers
  - Governments
  - Academic & Research Networks / Universities

- ## Detailed analysis of successful examples in the region

Main results

Key IPv6 Deployment Progress Indicator: LACNIC ICAv6.

ICAv6

- Based on different measurements of IPv6 uptake (Cisco, Akamai, Google, APNIC, thanks!), we developed an index for our region
  - **ICAv6**: Indicador Clave de Avance IPv6
    - (*Key IPv6 Deployment Progress Indicator)*
- Based on similar work by Cisco and others, but with higher weights applied to planning stages
- Better suited for our region to compare IPv6 adoption plans
- Results are available for our region and compared with other main economies

Basic partial indicators

1. PACTO: % of IPv6 allocated prefixes with observed traffic wrt total allocations

2. ASTRAN: transit AS with observed IPv6 traffic. Average of AS providing IPv6 transit and IPv4 transit AS that have an IPv6 assignment

3. CONT: weighted percentage of IPv6 enabled sites (including IPv6 embryos)

4. USUARIOS: percentage of IPv6-capable end-users

Indicador Clave de Avance (Key IPv6 Progress Indicator) LACNIC ICAv6

- Based on the basic partial indicators
- Adapts Cisco formula to take into account planning stages for countries starting to deploy IPv6
- ICAv6 formula:

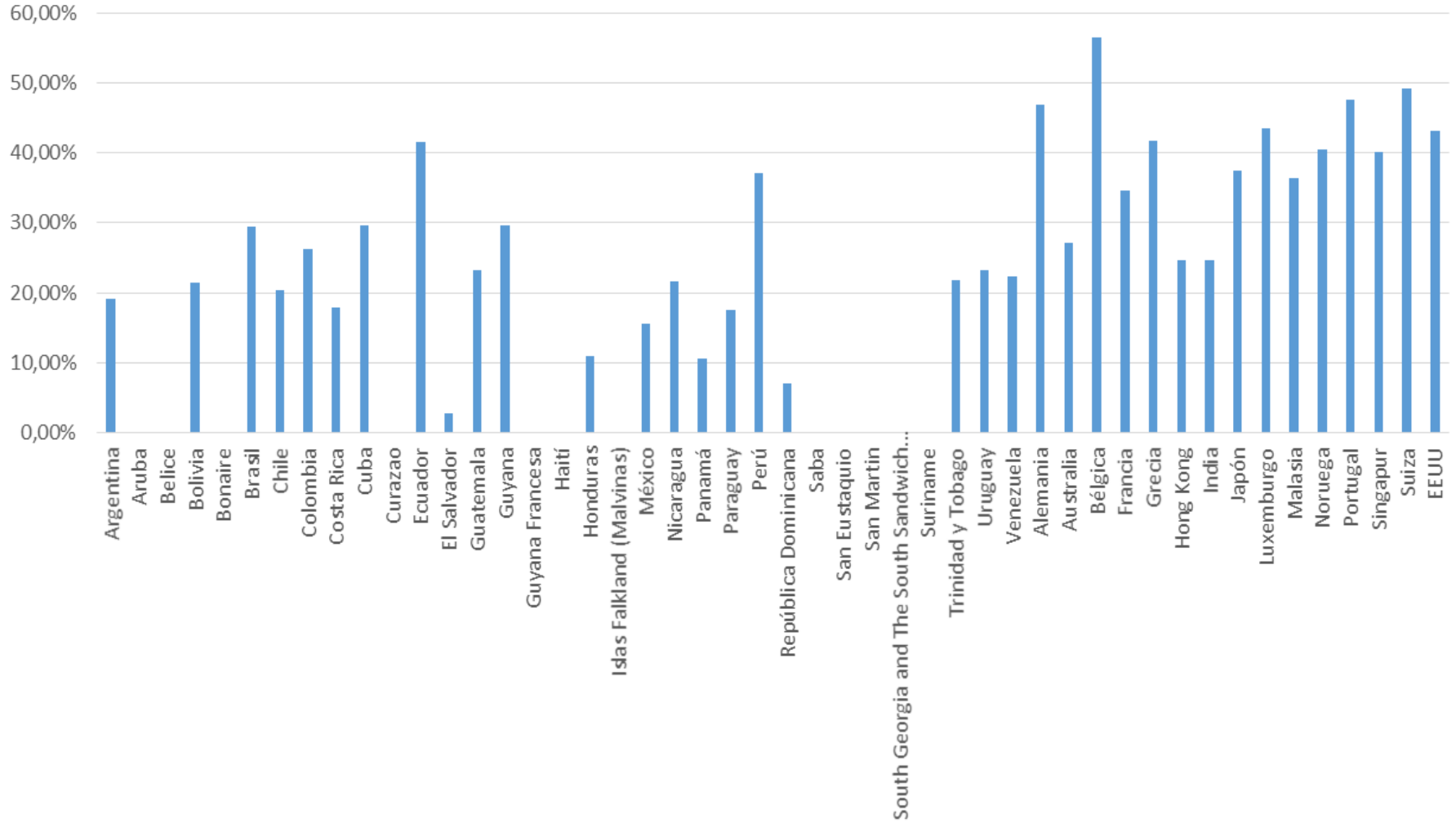$$LACNIC\ ICAv6\ \% = 0.3 * (0.1 * PACTO + 0.9 * ASTRAN) + 0.7 * \sqrt{CONT * USUARIOS}$$

- It defines a 30% weight for planning stages and 70% for the product of content by users
- Only if a country deploys IPv6 to the end-user can it have an ICAv6 value over 30%

Results for selected countries compared with other main economies

LACNIC ICAv6

Países LACNIC	LACNIC (18/11/2015)					Cisco (18/11/2015)	
	LACNIC ICAv6	Planificación (PACTO)	AS de tránsito (ASTRAN)	Contenido (CONT)	Usuarios (USUARIOS)	% conglobado de despliegue IPv6	Indicador Relativo (IR) de un país respecto del mundo. Valores de 1 a 10.
Argentina	19,09%	5,58%	66,75%	46,95%	0,04%	16,56%	1,9
Aruba	N/D	50,00%	50,00%	N/D	0,00%	5,00%	0,5
Belice	N/D	10,00%	34,74%	N/D	0,04%	7,86%	0,8
Bolivia	21,41%	10,00%	43,00%	49,74%	3,70%	12,92%	2,5
Bonaire	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Brasil	29,52%	11,91%	55,72%	60,39%	6,74%	26,98%	4,7
Chile	20,43%	15,74%	70,83%	47,38%	0,03%	17,91%	2
Colombia	26,24%	16,54%	93,04%	52,53%	0,02%	24,00%	2,6
Costa Rica	17,81%	11,59%	62,87%	49,12%	0,01%	15,31%	1,7
Cuba	29,67%	16,67%	100,00%	52,03%	0,19%	28,24%	3,4
Curazao	N/D	5,88%	0,00%	N/D	0,16%	0,00%	0
Ecuador	41,57%	72,55%	96,96%	47,79%	7,46%	37,79%	5,8
El Salvador	2,76%	5,56%	7,78%	49,52%	0,01%	1,30%	0,2
Guatemala	23,22%	9,09%	78,91%	52,67%	0,11%	20,92%	2,4
Guyana	29,61%	50,00%	100,00%	50,07%	0,05%	26,47%	3
Guyana Francesa	N/D	0,00%	N/D	N/D	0,02%	0,00%	0
Haití	N/D	0,00%	0,00%	N/D	0,01%	0,00%	0
Honduras	10,89%	7,89%	33,61%	53,68%	0,10%	5,37%	0,7
Islas Falkland	N/D	N/D	N/D	N/D	N/D	N/D	N/D
México	15,57%	25,25%	51,07%	53,39%	0,04%	12,57%	1,5
Nicaragua	21,70%	6,25%	79,66%	50,76%	0,00%	18,78%	2
Panamá	10,64%	3,77%	37,72%	49,64%	0,01%	8,55%	0,9
Paraguay	17,59%	3,45%	63,47%	49,17%	0,01%	13,71%	1,4
Perú	37,05%	28,21%	57,55%	52,67%	16,54%	26,55%	5,6
República Dominicana	7,09%	10,34%	22,17%	51,76%	0,03%	5,54%	0,6
Saba	N/D	N/D	N/D	N/D	N/D	N/D	N/D
San Eustaquio	N/D	N/D	N/D	N/D	N/D	N/D	N/D
San Martin	N/D	N/D	N/D	N/D	N/D	N/D	N/D
South Georgia and The	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Suriname	N/D	66,67%	0,00%	N/D	0,01%	0,00%	0
Trinidad y Tobago	21,81%	16,67%	71,57%	50,41%	0,16%	16,57%	2
Uruguay	23,22%	12,00%	81,82%	48,19%	0,03%	20,77%	2,3
Venezuela	22,33%	16,67%	78,65%	48,26%	0,02%	19,40%	2,1

Field study

- Visits to 10 countries in LAC Region

Face to face interviews

- A sample of 10 countries was selected:
  - Argentina, Chile, Bolivia, Peru, Ecuador, Colombia, Venezuela, Panama, Dominican Republic and Trinidad & Tobago
  - Face to face interviews with main ISPs
 - Academic networks
  - Governments

Successful models

COMTECO - Bolivia

- 2010: IPv6 planning started
- 2012: IPv6 prefix requested from LACNIC
- 2013: IPv6 prefix advertised 2803:9400::/32
  - Problems with some core infrastructure detected (AAA)
  - Tender for new backbone equipment
- 2014: IPv6 deployment to end-users started
  - ~4000 IPv6 users by end of 2014
- 2015: 20,000 IPv6 users (40%)
 - 30,000 potentially (CPEs ready)

COMTECO - Bolivia

Bolivia
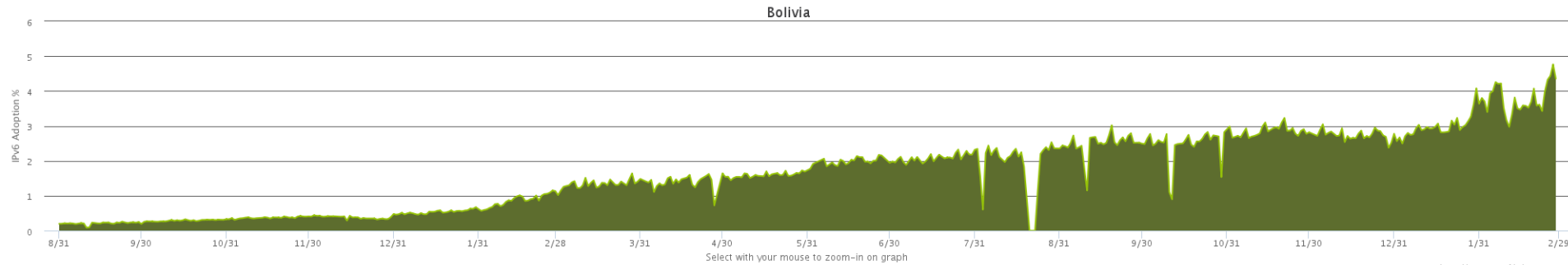
- Key facts:
  - IPv6 traffic is mostly video: 2 Gbps IPv6 traffic
  - Devices: Smartphones, Smart TVs, Win7 & Win8
  - Some problems with DHCPv6 & SLAAC: OS with different behavior
  - Some sites not supporting IPv6: Vimeo, Crackle, Skype…
  - Not using CGNAT: will still have IPv4 addresses until 2017

Telefónica – Perú

- 2008: address shortage identified due to high growth rate of DSL customers
  - Internal planning involving all areas of the company
- 2010: equipment and software testing
- 2012: started ADSL IPv6 service
- IPv6 in HFC network is expected by 2016 and mobile in 2017

Telefónica – Perú
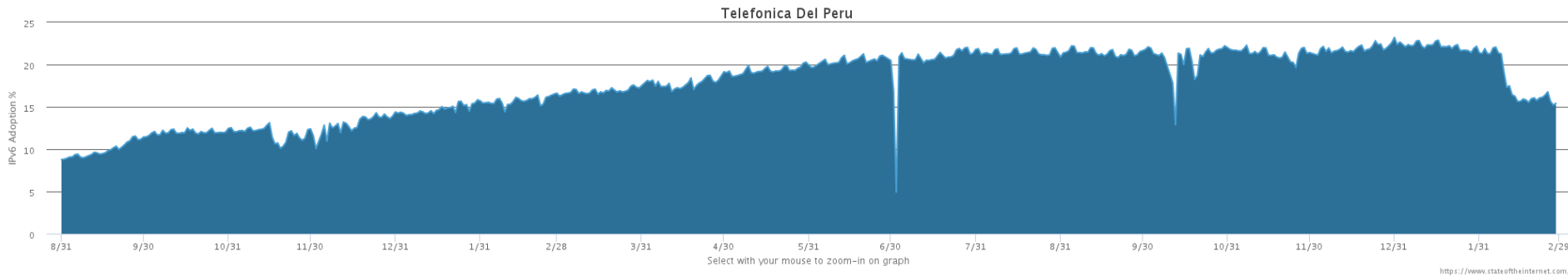
- CGN deployed due to IPv4 shortage (2012)
  - Corporate users and some DSL users get public IPs
  - Mobile uses CGN
  - IPv6: dual stack, CGN for IPv4 address sharing
- No problems identified in BSS
- Provisioning systems were part of the initial plan
- Help Desk: IP technology is irrelevant

CNT - Corporación Nacional de Telecomunicaciones - Ecuador

- Decision driven by an agreement with ICT Ministry to increase fixed and mobile Internet coverage
- Very fast growth rate for CNT:
  - 6 million fixed users and approx. 800,000 mobiles
- 2011/2012: IPv6 deployment in the fixed network
- Dual stack + CGN for IPv4 address sharing

CNT - Ecuador
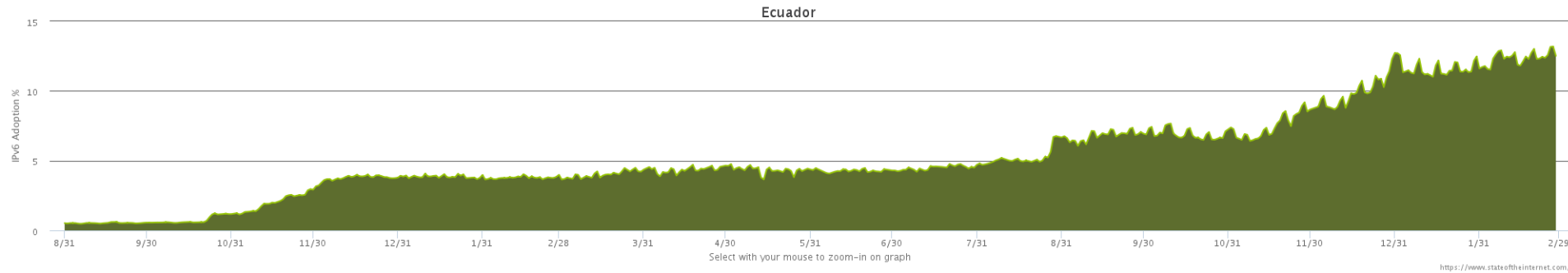
- High CPE replacement rate: more IPv6 enabled CPEs than IPv6 ready customers
  - The number of IPv6 users is expected to increase when some equipment is replaced (BRAS, others)
- Customers didn't notice any problem
- Software systems don't exhibit any problems at present

Brazil

- Brazil wasn't initially part of our study
- However, in 2nd semester of 2015, IPv6 uptake was increasing steadily
- CLARO-NET (AS28573) and VIVO-GVT (18881) are the main IPv6 enabled operators
  - Others still implementing partial deployments
- Content providers like Globo & UOL have deployed IPv6
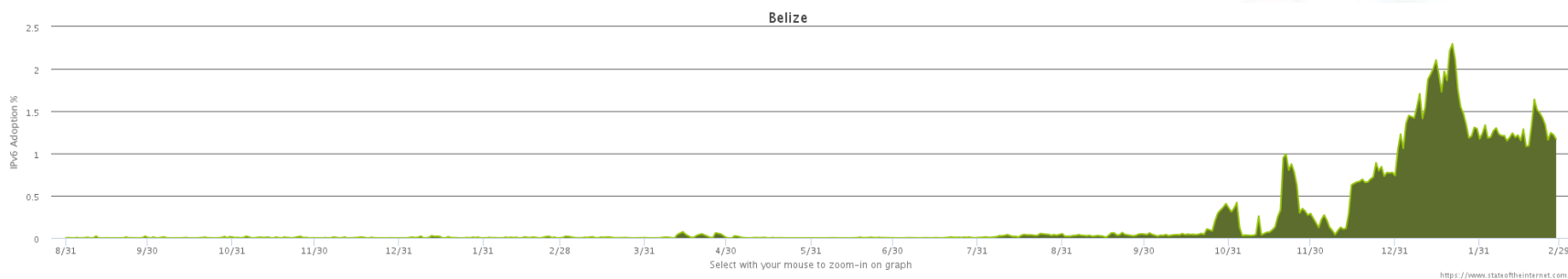
Brazil

Brazil
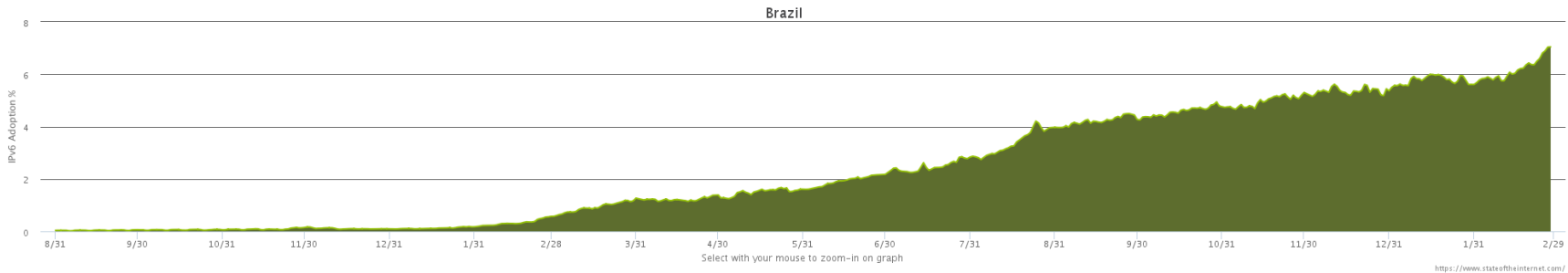
- Mostly dual stack with CGNAT
  - Some ISPs are freeing IPv4 addresses from mobile and using them for the fixed access (no NAT)
- Some problems found with IPv6 deployment:
  - Prefix delegation not working with some CPEs
  - CMTS not supporting IPv6
  - long testing time of CPEs (different vendors and firmware)
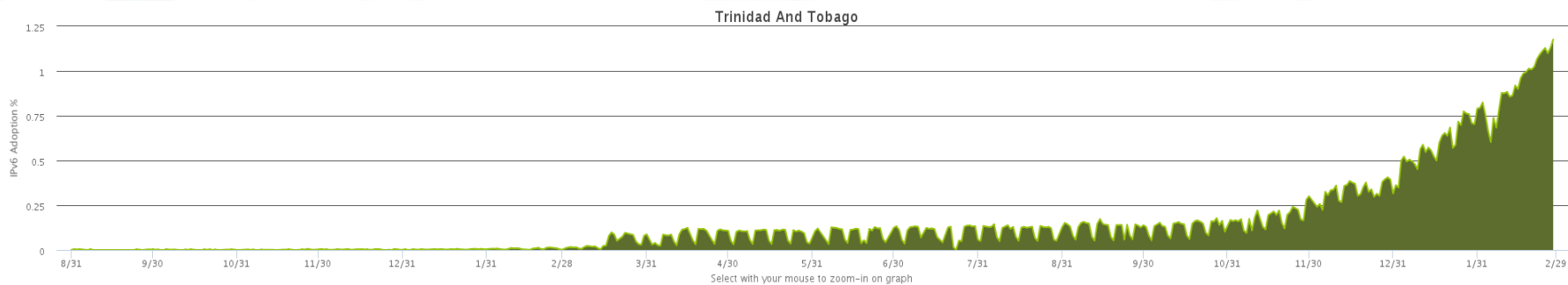
Other countries

Belize and Trinidad & Tobago

- BELIZE

- TRINIDAD & TOBAGO

Main Study Findings: Transition

- Most ISPs are still not offering IPv6 to end users (residential, mobile) but most have IPv6 deployed in network core

- Most commonly, the transition strategy adopted is: Dual Stack with native IPv6 & and private IPv4 + CGN44

- Almost no-one is expecting to deploy other transition strategies like NAT64, 464XLAT, MAP
  - Not even in data centers!

- Countries with large Internet penetration are the most delayed in IPv6 uptake (lower growth rate, IPv4 stock still enough for their needs).

Main Study Findings: Roadblocks

- ISPs:
  - CPEs "IPv6-ready" not so IPv6-ready
  - **Provisioning systems & internal BSS software**
  - Operations / help-desk training (but not a big issue)
- NRENs / Universities: IPv6 deployed in the CPE, but some campus problems: Wi-Fi & firewalls generally not supporting IPv6 (or not configured)
- Governments: e-Gov systems, Government portals, community Wi-Fi networks not supporting IPv6

Economic model

- Evaluating the cost of different alternatives

Panel de Control

I.1 VPN de los costos de las alternativas

	Valor Presente Neto
Alternativa 1, de transición con Dual Stack y CGNAT inc. CPE	$4.910.952,82
Alternativa 1, de transición con Dual Stack y CGNAT no inc. CPE	$2.312.338,22
Alternativa 2, de uso de CGNAT sin desplegar IPv6	$6.192.207,28
Alternativa 3, de compra de direcciones IPv4 sin NAT ni IPv6	$4.077.689,49

I.2 Parámetros principales

Tasa de Oportunidad del Capital	12%
Vida útil de los activos de red	10
Vida útil de los CPE Dual Stack o plazo para sutitución de CPE IPv4 por Dual Stack	5,0
Vida útil de los CPE solo IPv4. Alternativa 2.	5,0
Cantidad total de clientes residenciales actuales	100.000
Idem pero ya atendidos en IPv4 (CGNAT o direcciones IPv4 individuales)	50.000
Tasa anual de crecimiento de clientes	15%
Capacidad operativa del CGNAT - sesiones simultáneas - módulo de cálculo	10.000.000
Cantidad máxima promedio de sesiones por usuario sin Dual Stack	1.000
Mínima cantidad de sesiones de diseño del CGNAT por usuario sin Dual Stack, por calidad	1.000
% de sesiones en IPv4 para usuarios con Dual Stack (Indicador CONT)	49,2%
Mínima cantidad de sesiones de diseño del CGNAT por usuario con Dual Stack, por calidad	492
% de usuarios conectados simultáneamente	30%
Cantidad promedio de usuarios por cliente	3
Caída anual de precios del CPE solo IPv4	10%
Caída anual en la diferencia de precios de CPE Dual Stack vs. solo IPv4. =0 en 5 años	20%
ARPU anual por cliente supuesto constante	$240,00

For more information

- Complete study is available at:

  - http://portalipv6.lacnic.net

- Also links to the partial indicators, CAF/LACNIC ICAv6 and other references

- Link to the economic model with a programmable interface

- New information will be published in the near future

Thanks

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