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RPKI and Origin Validation Deployment in Ecuador

IETF 88 – Vancouver

Some facts about me

- I practice kung fu



- I went to a military high-school -> I know how to shoot a gun



Motivation

- **Chicken and Egg Situation**

- I have no experience working with these technologies, so I don't deploy them.
- I don't deploy these technologies, so I don't gain experience.

- **Creation of “islands of trust” where these technologies are fully deployed**

- **Identify gaps. What is stopping the deployment?**

A Success Story

- To overcome the chicken and egg problem perception, we decided to create a success story.
- We expect that everyone can learn from it.

Where and When?



- Ecuador's IXP (NAP.EC)
Managed by AEPROVI
since 2001
- 4th and 5th September
(being planned since IETF 81 (Quebec))



2 Points of Presence



NAP.EC Community

- Operators connected directly to NAP.EC: ~97% of the total Internet users in Ecuador.
- NAP.EC also allows the indirect interconnection of smaller providers: almost 100% of the total number of users and local traffic.
- RESULT: the adoption of new technologies by NAP.EC and its community, in practice means a full adoption of the whole country.

NAP.EC Community (2)

- NAP.EC is an IXP with mandatory multilateral peering and route servers in each POP, which makes it easier to activate origina validation and to become an island of trust.
- AEPROVI manages NAP.EC in an impartial and not-for-profit fashion. It represents it's partners' (ISPs) interests and is in constant colaboration with other organizations from the Internet ecosystem.
- RESULT: These characteristics of the NAP.EC community give sustainability to the project.

Participants

- Large network operators
- Small bussiness networks
- Public and private organizations
- All of them interested in addressing routing problems within the country.

Action Plan

- Identify gaps
- Equipment renewal
- Community outreach
- Event planning
 - Training materials
 - Activity planning

Identified Gaps

- Human Capacity (RPKI and BGP)
- Equipment (Routers and Servers)
- Tools
 - Automatization scripts
 - Validators instrumentation
 - Monitoring tools
 - ROAs creation



Human Capacity

- July 2013
 - Informative meeting with technical staff from the operators connected to the NAP
 - What about the IXP member's customers? It was decided to invite all network operators members and not members
 - Topics
 - Impact of the project
 - Quick intro to RPKI, origin validation and ROA creation
 - Some people started creating their ROAs

Equipment

- August 2013
 - Two Cisco ASR-1001 routers were installed as route servers (one in Quito and one in Guayaquil)
 - For RPKI, redundant validators were implemented: 2 VMs, each one with 2 different processes (RIPE's software and rpki.net software)
 - Origin validation was implemented in the route servers (no action regarding RPKI validity status)

Monitoring Tools

lacniclabs  Origin Validation **looking glass** 

Search form:

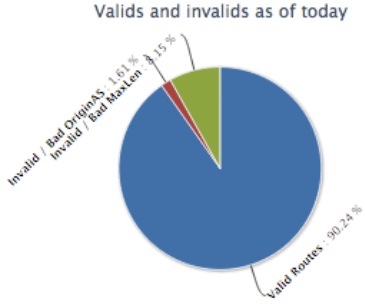
Query current RPKI Dataset:

Select your query type: Prefix CIDR query (v4 and v6) ▾

Refine your search scope: Search All Routes ▾

Time frame: Last 24 hours ▾

Valid and invalids as of today



Category	Percentage
Valid Routes	90.24%
Invalid / Bad Origin AS	1.61%
Invalid / Bad MaxLen	3.15%
Invalid / Bad Origin AS	4.99%

Highcharts.com

Origin Validation Looking Glass

This tool allows performing different queries on a dataset composed of BGP routes currently covered by ROAs (Route Origin Authorizations) hosted on any of the five RIRs (Regional Internet Registries)

BGP Route and path data are periodically fetched from [RIPE NCC's RIS Project](#).

Route counts for the last 24 hours

Current INVALID route count for all repositories: 2037

Bad MaxLen: 1701

Wrong BGP Origin AS: 336

Current VALID route count for all repositories: 18824

Dataset processed on: Oct. 24, 2013

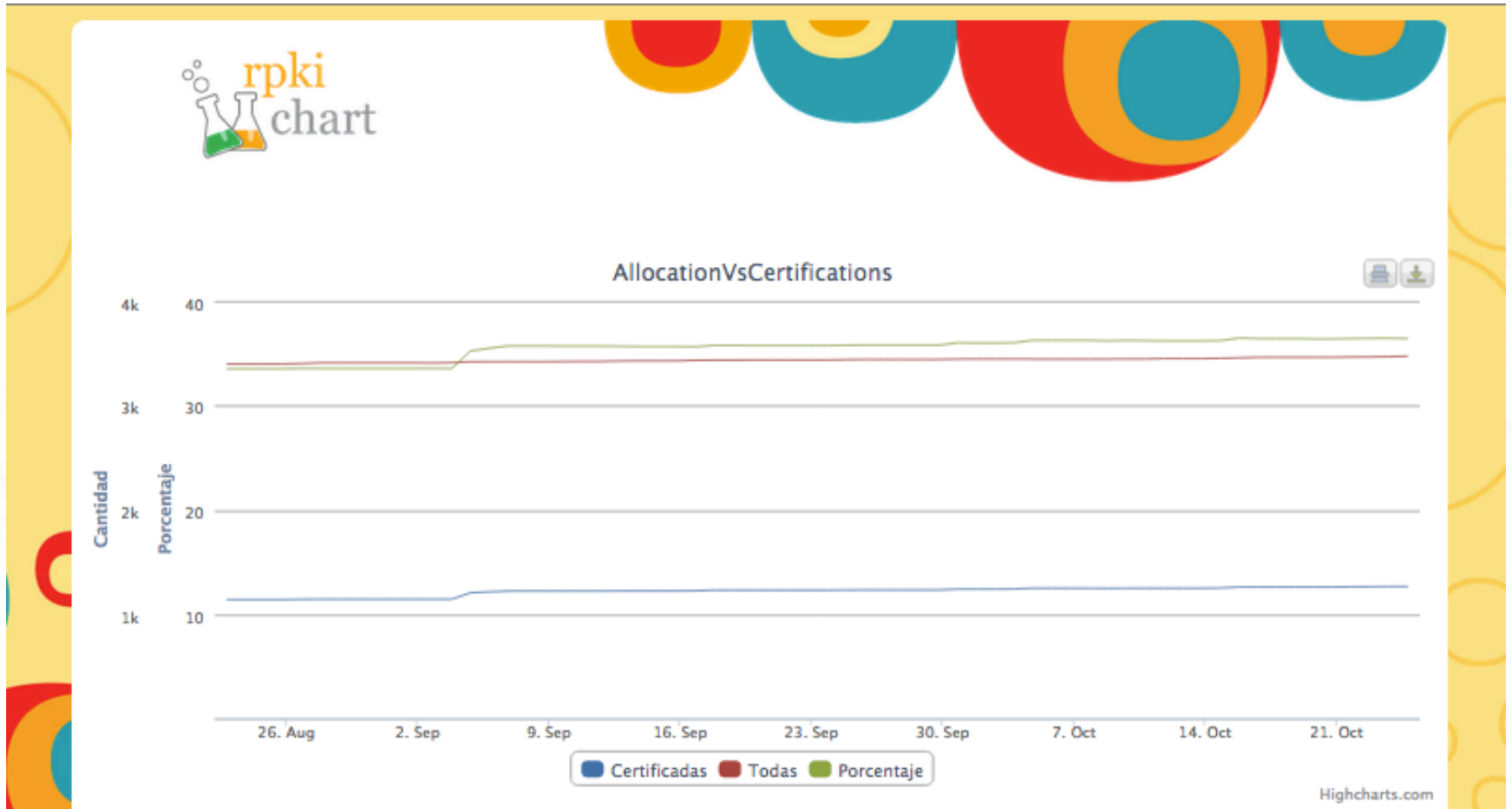
Application Version: 3.1.4 -- Last Updated 20120530



http://www.labs.lacnic.net/rpkitools/looking_glass/




Monitoring Tools (2)



<http://tools.labs.lacnic.net/rpki-chart/all?1>

Monitoring Tools (3)



ASN	Anuncio	Estado	Referencia	Recomendación
28001	200.3.12.0/22	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	
28000	200.7.84.0/23	VALID	Montevideo-v4v6-1-v.21/03/2013 14:10	
28001	200.7.86.0/24	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	
28000	200.7.87.0/24	VALID	Montevideo-v4v6-1-v.21/03/2013 14:10	
28001	200.10.60.0/23	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	
28000	200.10.62.0/23	VALID	LACNIC-Montevideo-Alt-v.21/03/2013 14:10	
28000	2001:13c7:7001::/48	VALID	Montevideo-v4v6-1-v.21/03/2013 14:10	
28001	2001:13c7:7002::/48	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	
28001	2001:13c7:7010::/47	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	
28001	2001:13c7:7012::/47	VALID	SaoPaulo-v4v6-1-v.21/03/2013 14:10	



Latin American and Caribbean Internet Addresses Registry
Registro de Direcciones de Internet para América Latina y Caribe
Registro de Endereços da Internet para América Latina e Caribe

<http://tools.labs.lacnic.net/announcement/result/UY-LACN-LACNIC?0>



ROAs Creation

rpki
roa
wizard
lacnic

español english Português

ID organización: **Procesar**

Ingrese prefijos IPv4 y/o IPv6 separados por comas. Ej.

200.0.88.0/24,
200.3.12.0/22,
200.7.84.0/23,
200.7.86.0/23,
200.10.60.0/23,
200.10.62.0/23,
2001:13c7:7001::/48,
2001:13c7:7002::/48

Procesar

lacnic Latin American and Caribbean Internet Addresses Registry
Registro de Direcciones de Internet para América Latina y Caribe
Registro de Endereços da Internet para América Latina e Caribe

<http://tools.labs.lacnic.net/roa-wizard>

ROAs Creation (2)

rpk roa wizard
lacnic

español english Portuguès

Crear Todos **Descargar Todos**

ROA - AS28000: (Criterio 1)

Recomendado si el ASN es propio

Prefijo	Largo máximo	Operaciones
200.10.62.0/23	23	Ripe Stat RDAP
200.7.84.0/23	23	Ripe Stat RDAP
200.7.86.0/23	24	Ripe Stat RDAP
2001:13c7:7001::/48	48	Ripe Stat RDAP

Descargar Crear ROA Cambiar criterio

<http://tools.labs.lacnic.net/roa-wizard/result/UY-LACN-LACNIC?4>

Measuring Success

- Goals:
 - Achieve a coverage of 70-80 % of the country's networks in the RPKI system.
 - Create a success story
 - Technology working at a production environment
 - Local capacity creation
 - Dissemination of results and acquired experience

Main Event

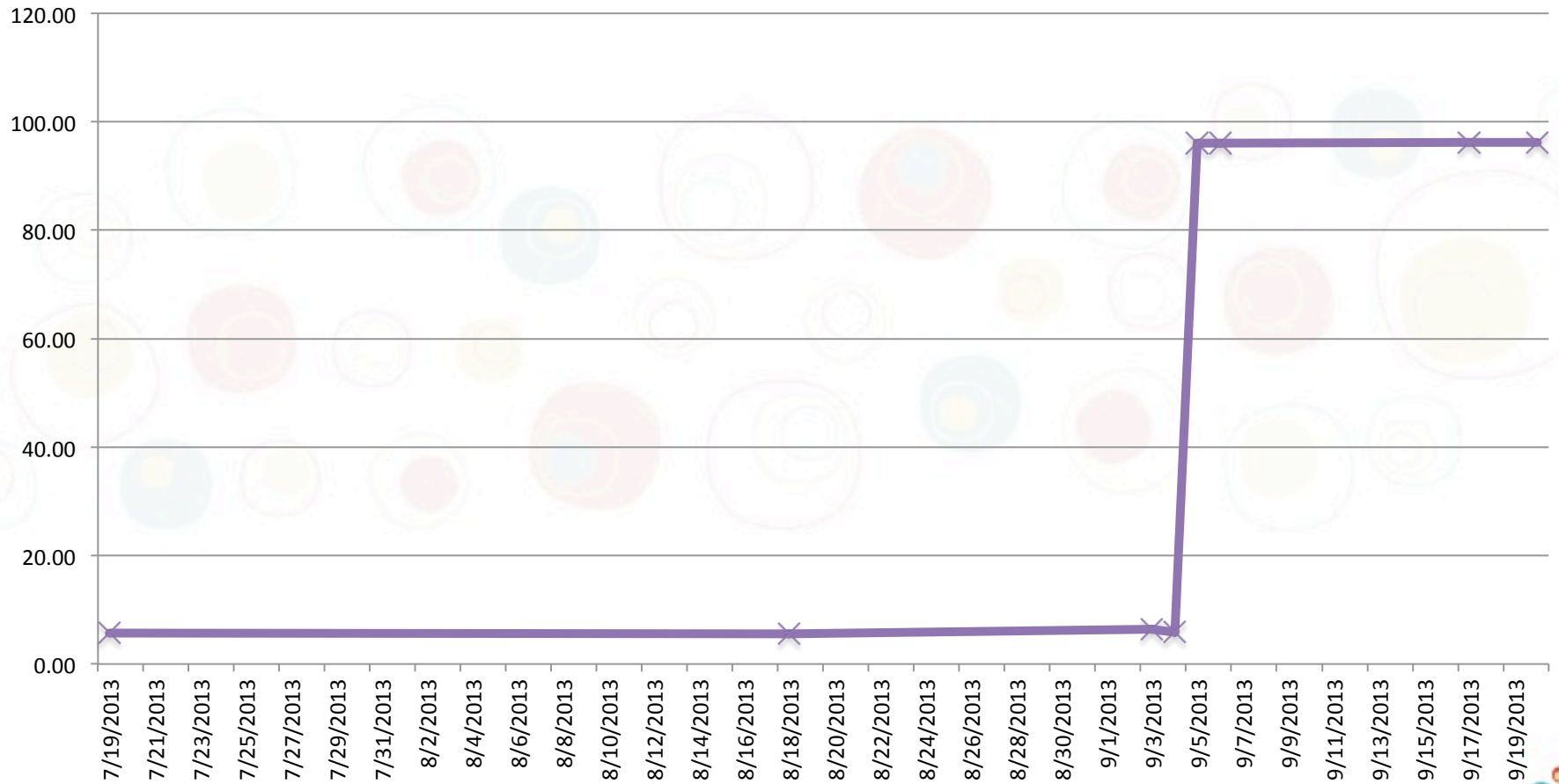
- 4th and 5th Sep 2013
- Resource holders from Ecuador (not only those connected to the NAP)
- ROA creation was performed at the end of the first day and was complemented during the second day



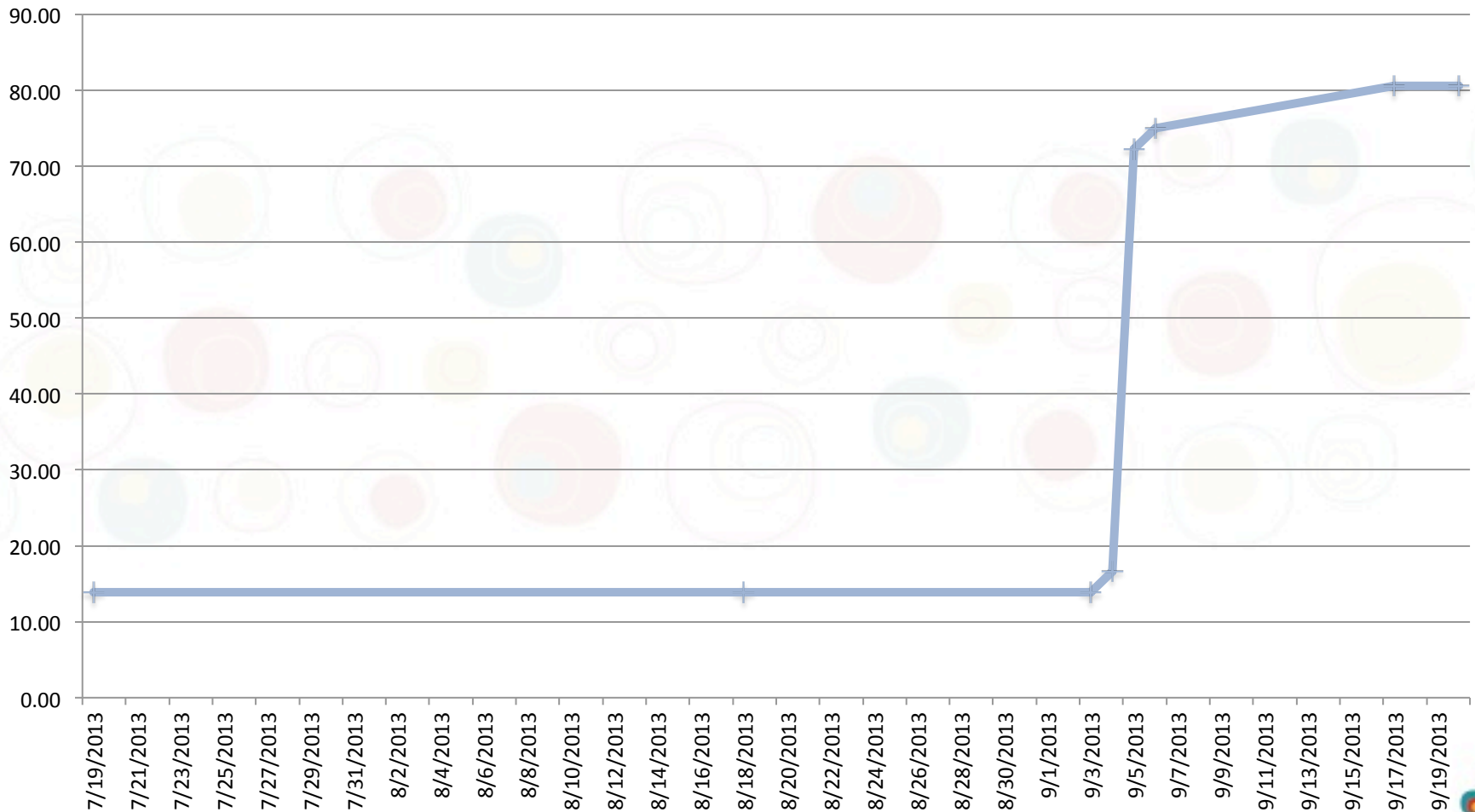
Results

- More than 90 % of coverage in IPv4 and IPv6
- Operators enthusiastic about using the technologies to manage their customer's connections.

Ecuador's IPv4 space covered by ROAs



Ecuador's IPv6 space covered by ROAs



Impact

RIR Stats – July 2013

RIR	Total	Valid	Invalid	Unknown	RPKI Adoption Rate
AFRINIC	10839 (100%)	12 (0.11%)	0 (0%)	10827 (99.89%)	0.11%
APNIC	116379 (100%)	84 (0.07%)	212 (0.18%)	116083 (99.75%)	0.25%
ARIN	182009 (100%)	199 (0.11%)	30 (0.02%)	181780 (99.87%)	0.13%
LACNIC	56294 (100%)	5561 (9.88%)	1184 (2.1%)	49549 (88.02%)	11.98%
RIPE	128726 (100%)	6400 (4.97%)	1147 (0.89%)	121179 (94.14%)	5.86%

Source: <http://www.ietf.org/proceedings/87/slides/slides-87-sidr-14.pdf>



RIR Stats – October 2013

RIR	Total	Valid	Invalid	Unknown	Accuracy	RPKI Adoption Rate
AFRINIC	11306 (100%)	41 (0.36%)	43 (0.38%)	11222 (99.26%)	48.81%	0.74%
APNIC	118215 (100%)	122 (0.1%)	235 (0.2%)	117858 (99.7%)	34.17%	0.3%
ARIN	186998 (100%)	640 (0.34%)	53 (0.03%)	186305 (99.63%)	92.35%	0.37%
LACNIC	60853 (100%)	10812 (17.77%)	1098 (1.8%)	48943 (80.43%)	90.78%	19.57%
RIPE NCC	131800 (100%)	7410 (5.62%)	1118 (0.85%)	123272 (93.53%)	86.89%	6.47%

Source: <http://rpki.surfnet.nl/perrir.html>



LACNIC Stats - July vs Oct

July

RIR	Total	Valid	Invalid	Unknown	RPKI Adoption Rate
LACNIC	56294 (100%)	5561 (9.88%)	1184 (2.1%)	49549 (88.02%)	11.98%

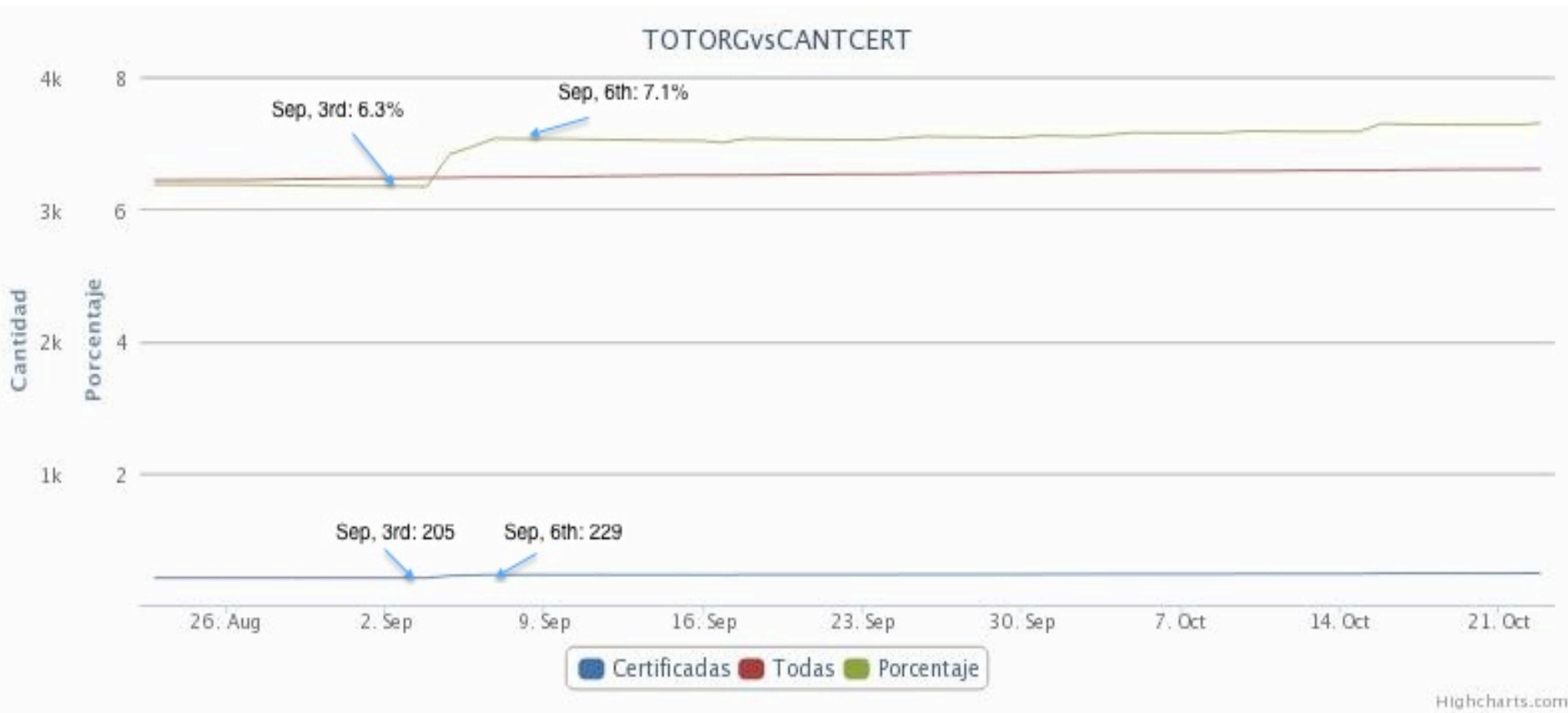
October

RIR	Total	Valid	Invalid	Unknown	RPKI Adoption Rate
LACNIC	60853 (100%)	10812 (17.77%)	1098 (1.8%)	48943 (80.43%)	19.57%

Comparison

- Announcements covered by ROAs
 - . From 56,294 to 60,853 (4,500+ increment)
- Valid announcements
 - . From 5,561 to 10,612 (5,000+ increment)
- Invalid announcements
 - . From 1,184 to 1,096 (almost 100 decrement)
- Unknown announcements
 - . From 49,549 to 48,943 (600+ decrement)
- RPKI adoption rate
 - . From 11.98 % to 19.57 %

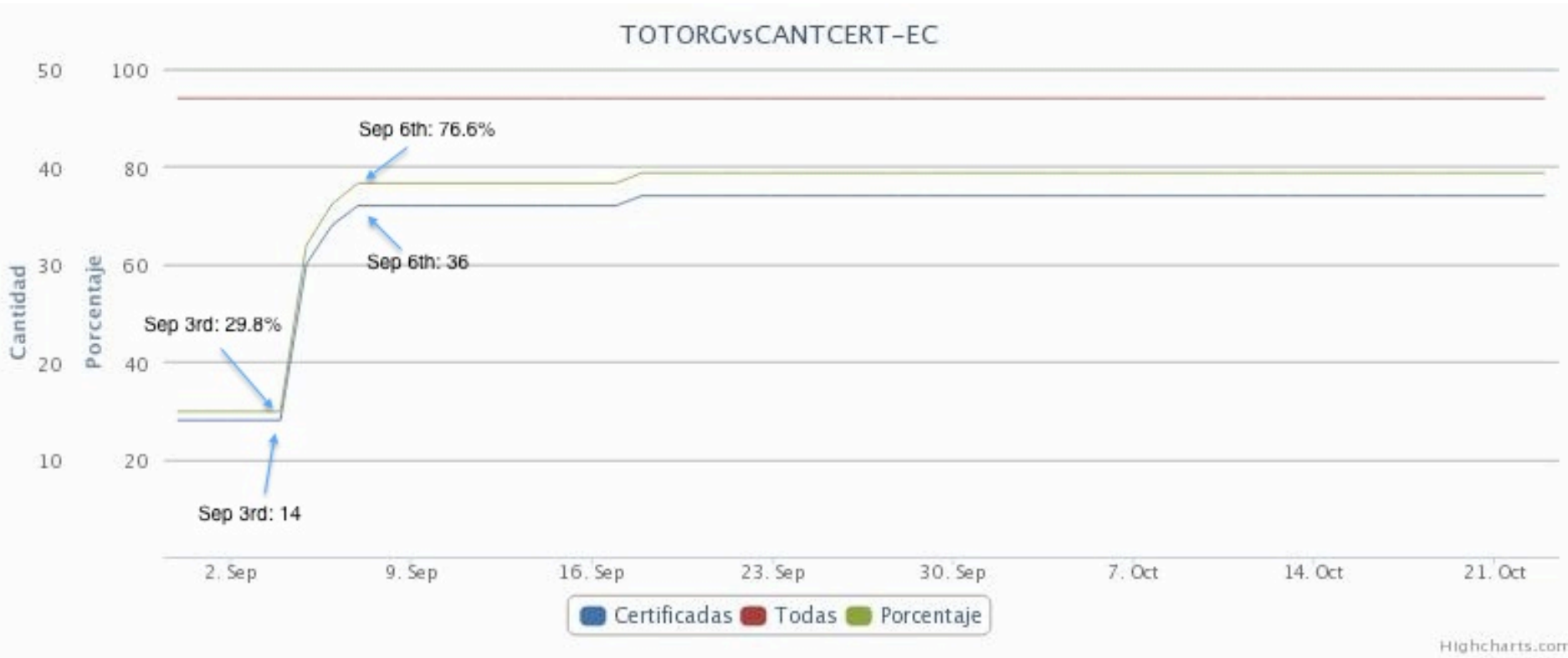
Organizations and Certificates LAC region



Source: <http://tools.labs.lacnic.net/rpki-chart/all?0>



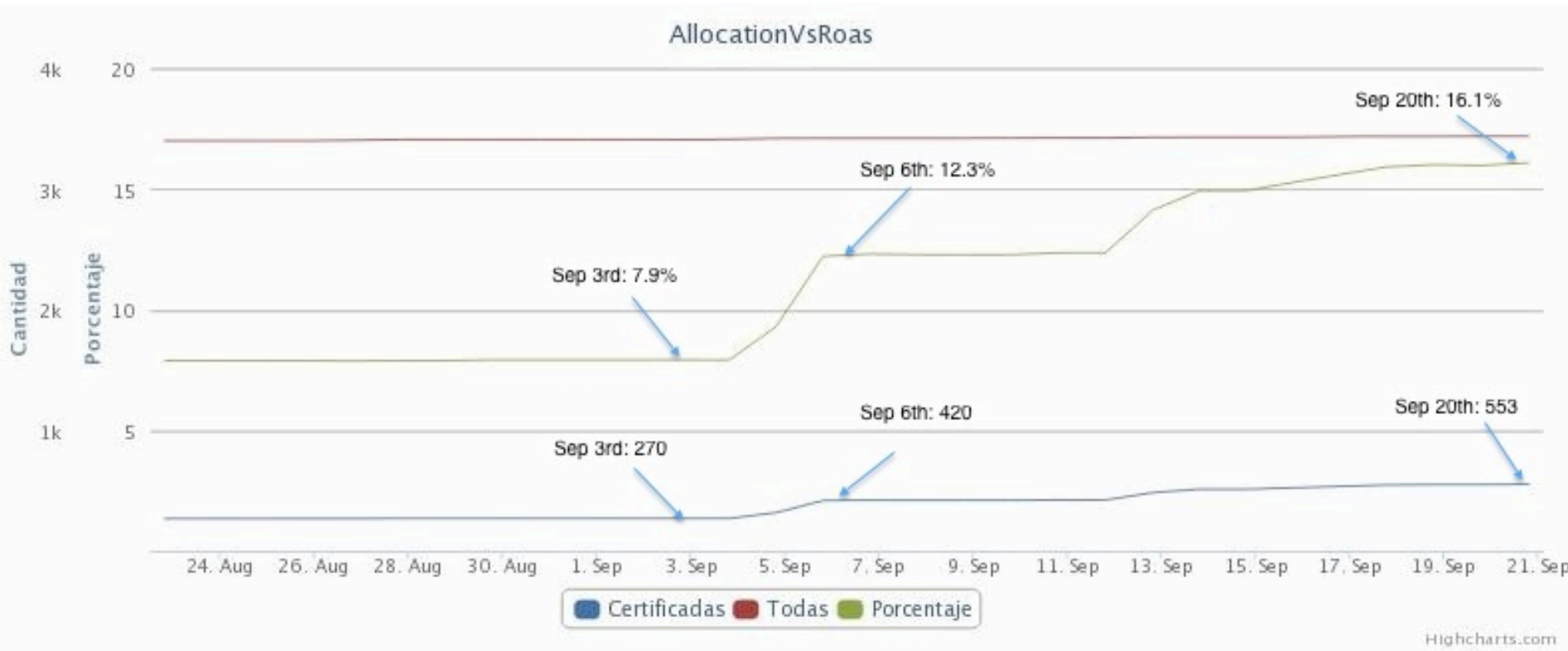
Organizations and Certificates - EC



Source: <http://tools.labs.lacnic.net/rpki-chart/all/EC?3>



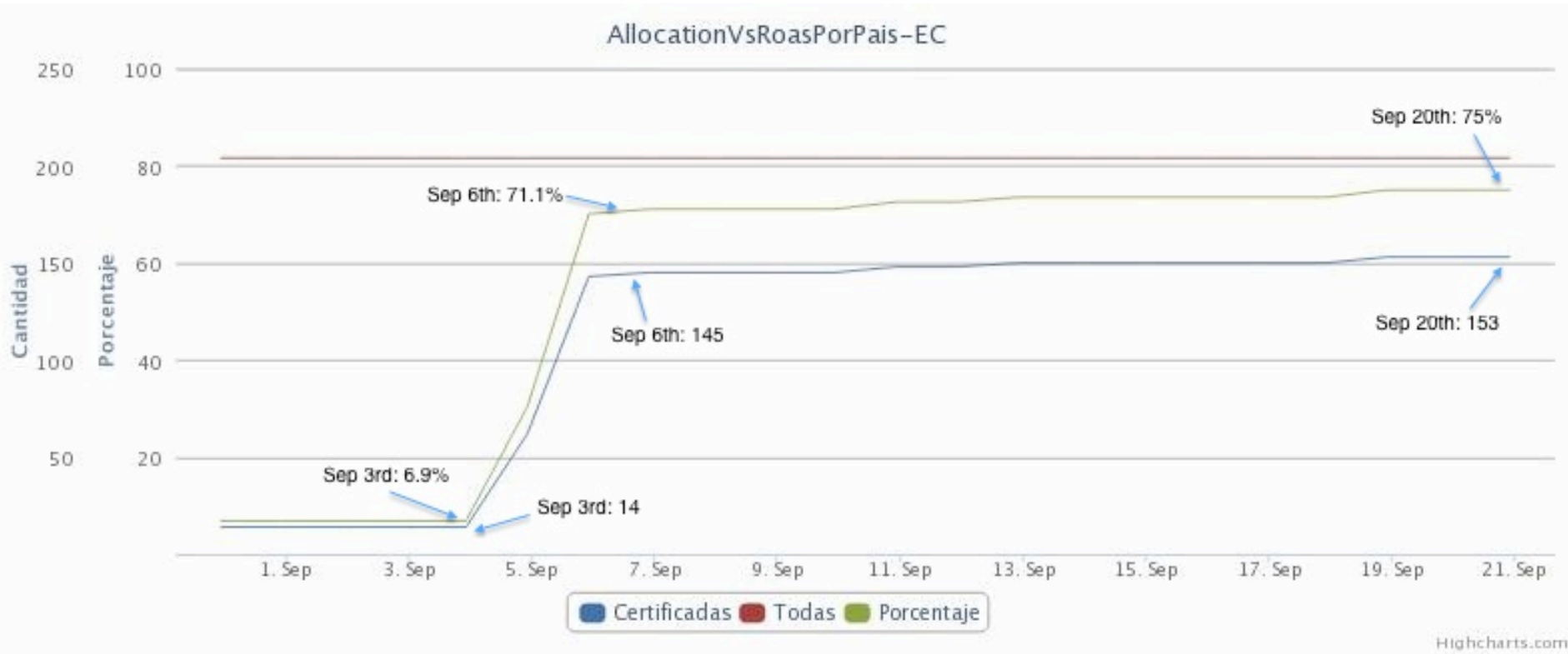
Allocations and ROAs LAC region



Source: <http://tools.labs.lacnic.net/rpki-chart/all?0>



Allocations and ROAs - EC

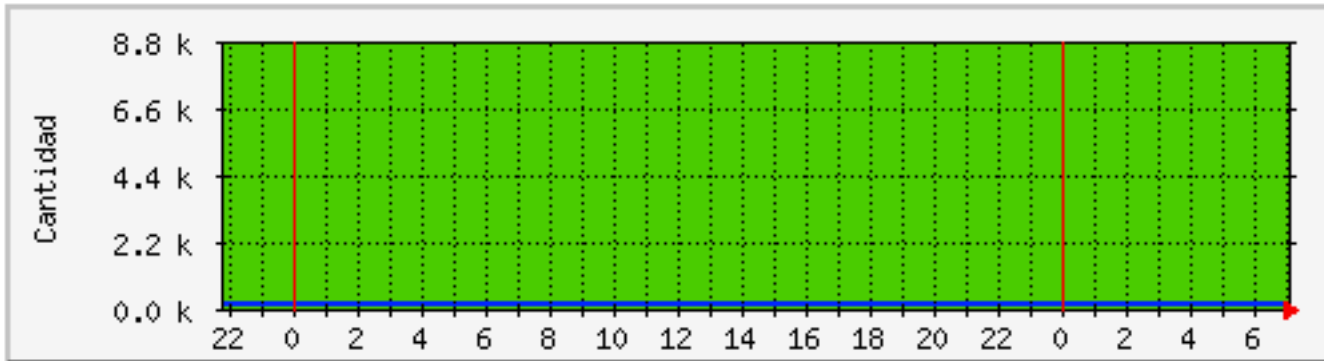


Source: <http://tools.labs.lacnic.net/rpki-chart/all/EC?3>

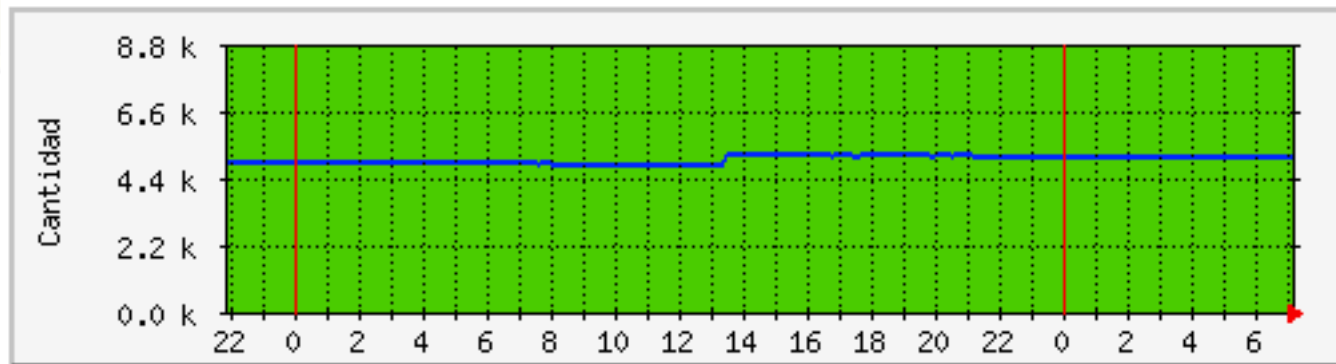


RPKI Stats – Quito

IPv4 valid prefixes (green) vs IPv4 invalid prefixes (blue)



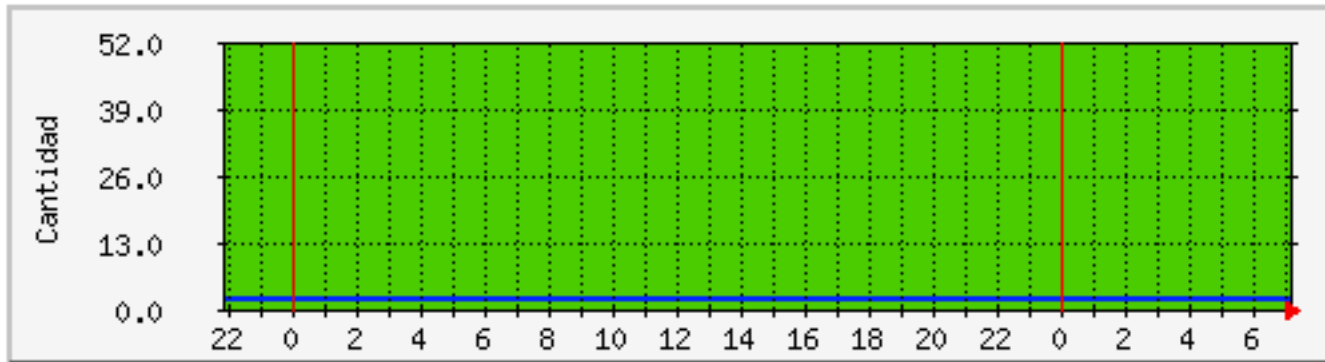
IPv4 valid prefixes (green) vs IPv4 unknown prefixes (blue)



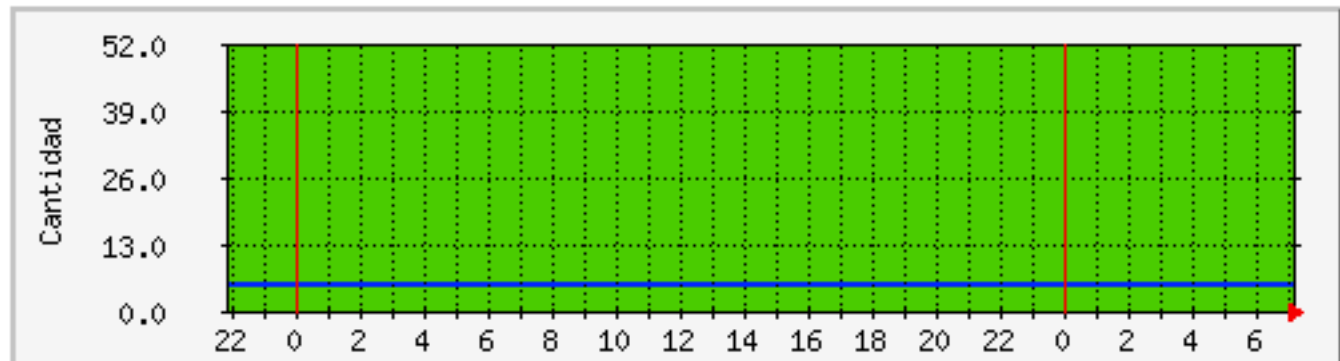
Source: <http://mon4.nap.ec/monitoreo/resumen-rpki-prefijos.html>

RPKI Stats – Quito (2)

IPv6 valid prefixes (green) vs IPv6 invalid prefixes (blue)



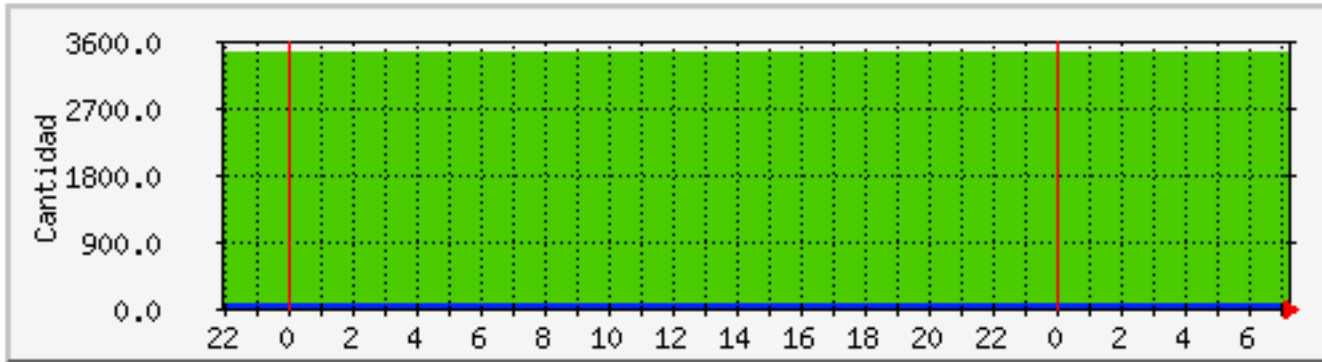
IPv6 valid prefixes (green) vs IPv6 unknown prefixes (blue)



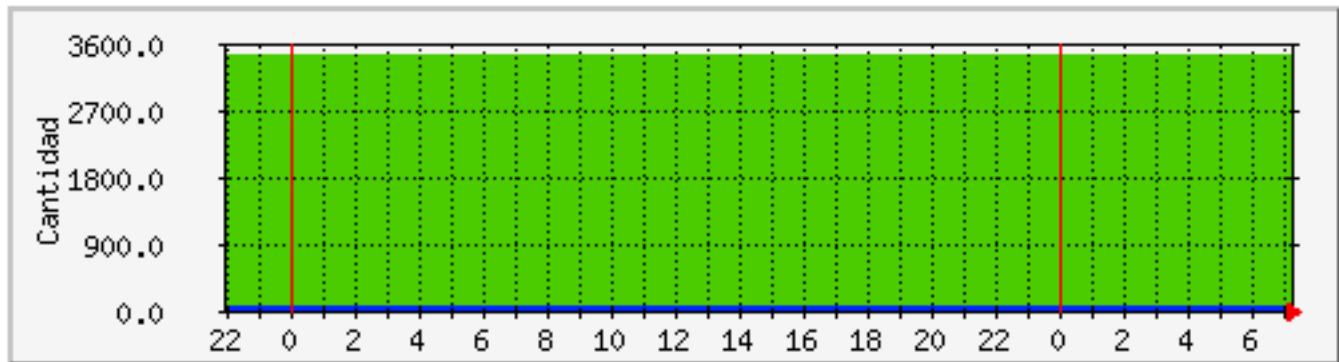
Source: <http://mon4.nap.ec/monitoreo/resumen-rpki-prefijos.html>

RPKI Stats – Guayaquil

IPv4 valid prefixes (green) vs IPv4 invalid prefixes (blue)



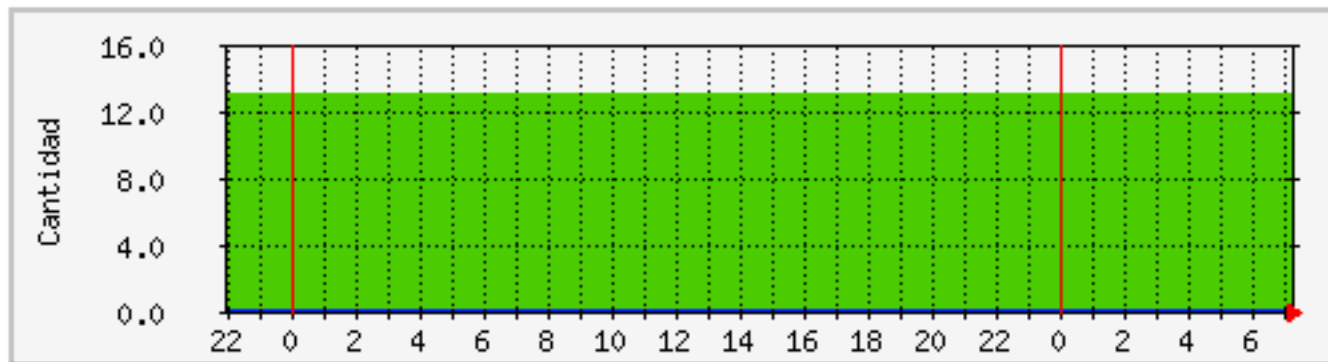
IPv4 valid prefixes (green) vs IPv4 unknown prefixes (blue)



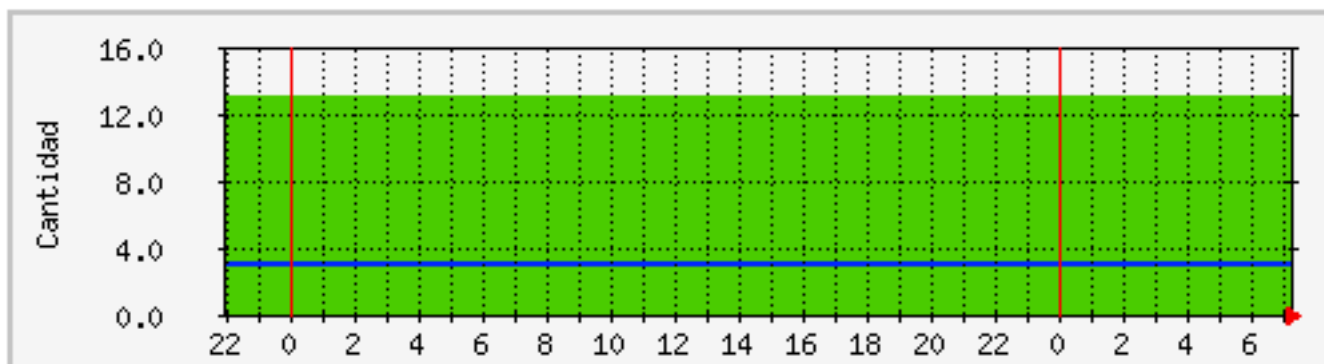
Source: <http://mon4.nap.ec/monitoreo/resumen-rpki-prefijos.html>

RPKI Stats – Guayaquil (2)

IPv6 valid prefixes (green) vs IPv6 invalid prefixes (blue)



IPv6 valid prefixes (green) vs IPv6 unknown prefixes (blue)



What are we working on?

- We are working with the operators to help them fix their announcements or their ROAs when needed.
- We are working on documenting the lessons learned so the process can be replicated by other communities
- A technical committee will evaluate what to do with invalid routes
- We will replicate the experience in other countries.

Results' Dissemination

- Roque Gagliano wrote a post for a Cisco blog
 - <http://cisco-latinoamerica.com/2013/10/10/pioneros-operadores-de-ecuador-cubren-todos-sus-recursos-dentro-del-sistema-rpki/>
- A document for CITEEL was written
- The document was also sent to be published in SUPERTEL's magazine

Lessons Learned

- Gaps (human capacity, equipment and tools)
- Fears (fear to break something)
- But, operators are not as conservative as we thought.
- Tools we need to work on

Credits

- AEPROVI (Fabián Mejía)
- NAP.EC, operators and resource holders
- Cisco (Roque Gagliano, Álvaro Retana)
- LACNIC (Arturo Servín, Carlos Martínez, Gerardo Rada)
- Food sponsorship: ISOC



Thanks!

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