

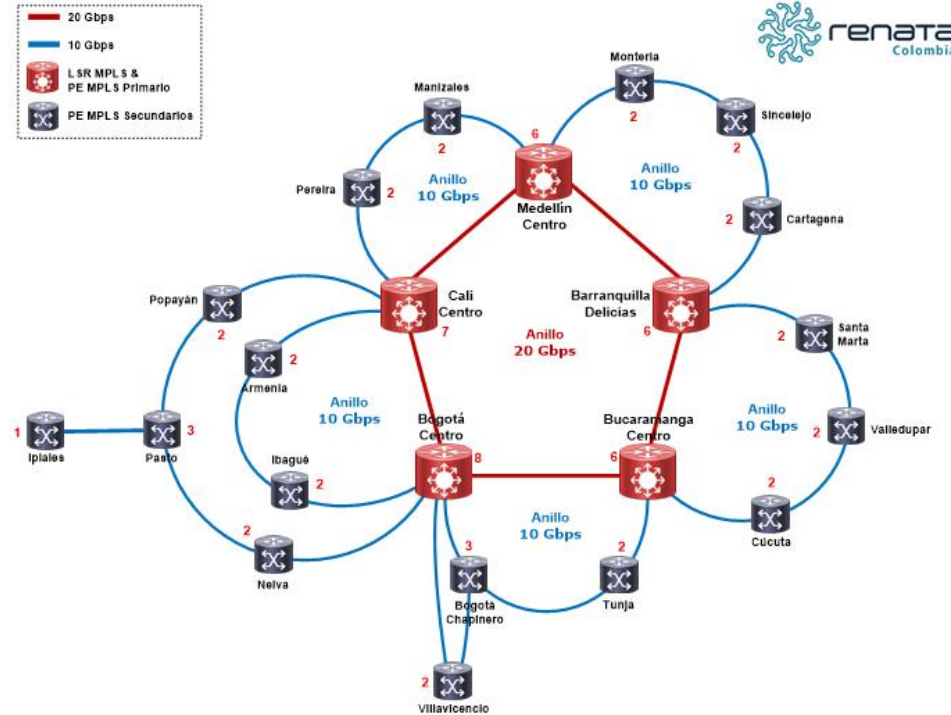
Origin Validation in the infrastructure of RENATA

Content

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Infraestructura de RENATA

- Transmission Network of 19,000 km of optical fiber through the national territory.
- Backbone of 22 nodes, interconnected by 100 Gbps lambdas.
- Alcatel Lucent IP / MPLS network based on the high technology that supports 100 Gbps, 200 Gbps, 400 Gbps and 1 Tbit / s



Interconnection points

Academic network– CLARA

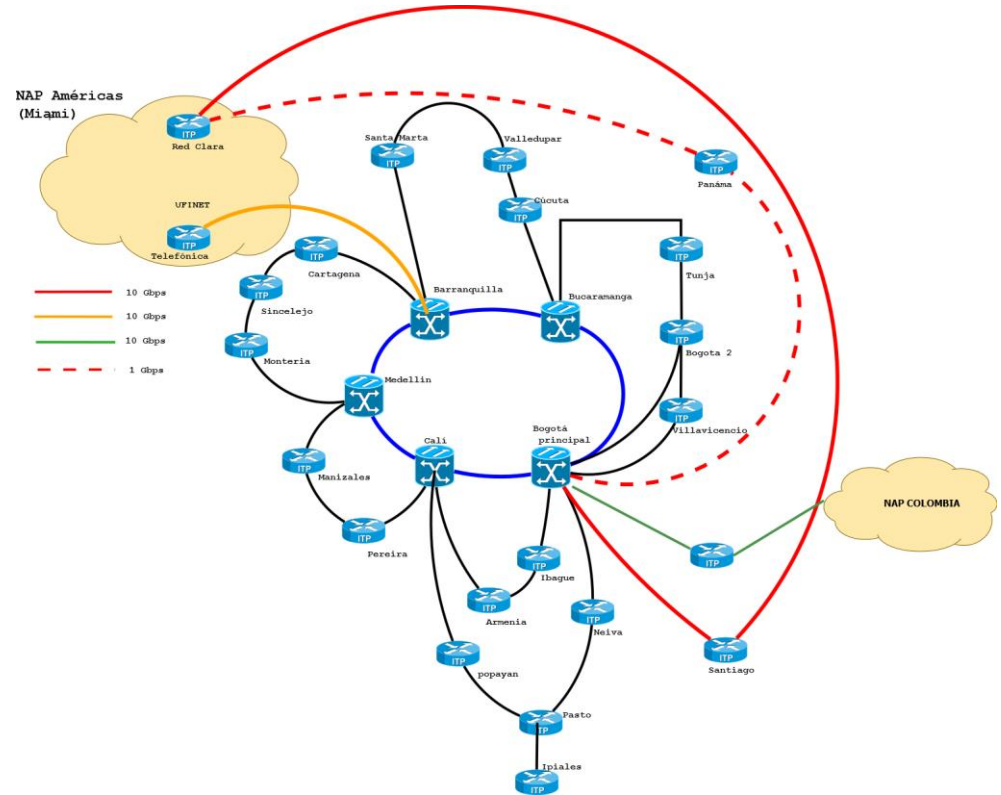
- A 1 Gb link Panama – Miami.
- A 10 Gb link Santiago –Miami.

Internet access

- A 10 Gb link.

NAP Colombia

- A 10 Gb link.



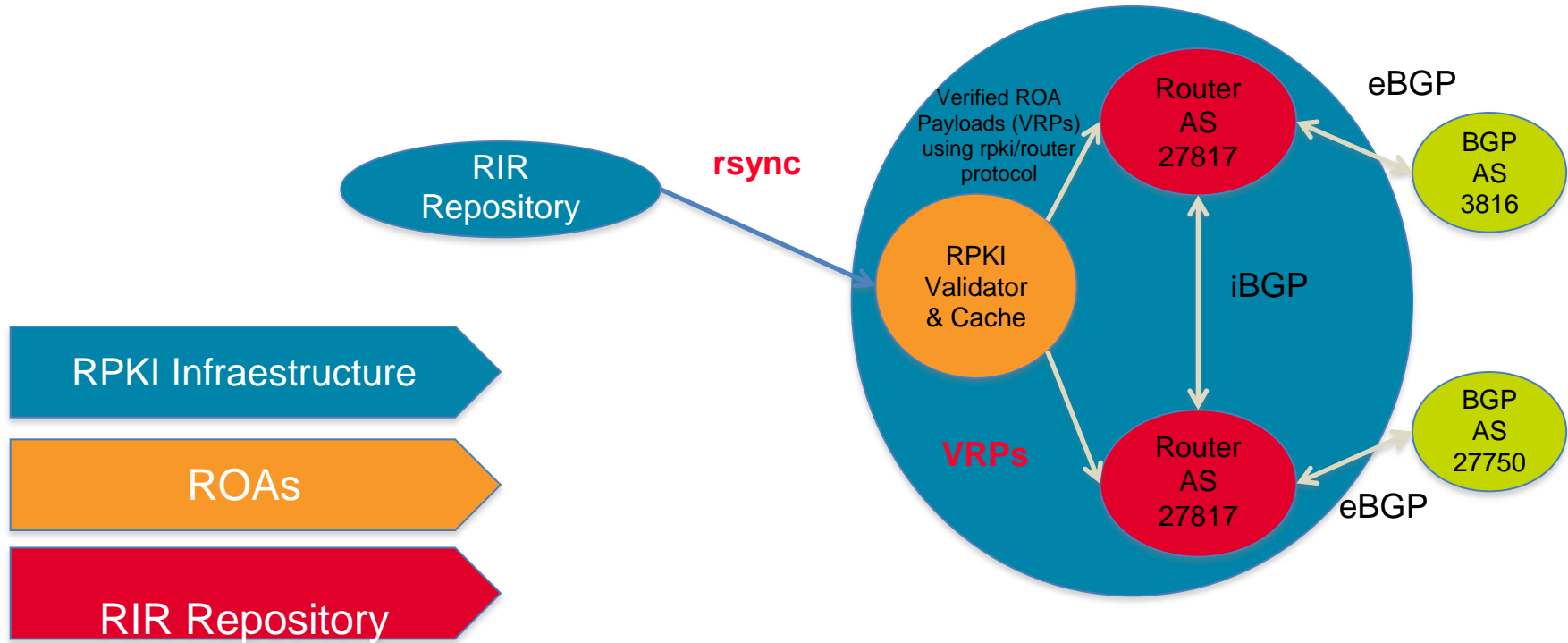
Objectives

1. To validate the content of advertisements at BGP routes that transit through RENATA network.
2. To achieve assurance of critical internet infrastructure and academic networks.
3. To provide new practices to the academic and research community of the country in order to get results and value experiences.
4. To provide information which can be verified independently of the BGP packets.

Technological process

The system has several parts such as: A Resource Public Key Infraestructure (RPKI), a global synchronization utility (rsync), and protocols for local validation in the network routing nodes.

Technological process



Development

- 1 Communication and dissemination of the project
- 2 Training and resources signature
- 3 Initial configuration and trials
- 4 Correcting Configurations and Validating Invalid Networks

Communication and Dissemination

Communications were constructed to be directed to the technical coordinators of all the institutions connected to RENATA. In those communications the following information was provided:

- What RPKI is
- Why it is important
- Why RENATA is working on its implementation
- The advantages of its implementation
- Steps to follow its implementation

Training and Resources Signature

How it was made

1. Theoretical and practical virtual seminars
2. Training to different institutions connected to RENATA and to service providers that are part of the NAP Colombia

Training and Resources Signature

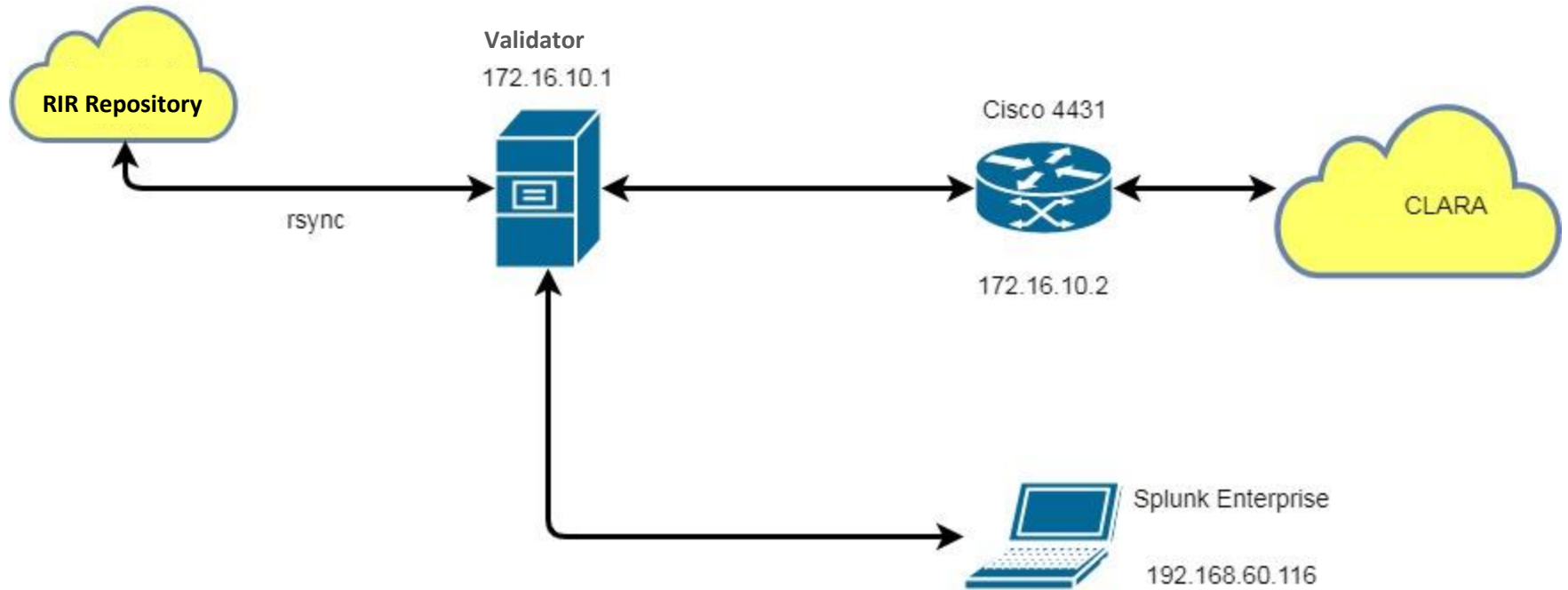
Results

- 328 professionals trained at virtual seminars
- 69 professionals trained at seminars
- Telefónica generated the signature for 1109 resources. (From **Not Found** to **Valid**)

Initial configuration and trials

How it was made

Topología



Initial configuration and trials

Results

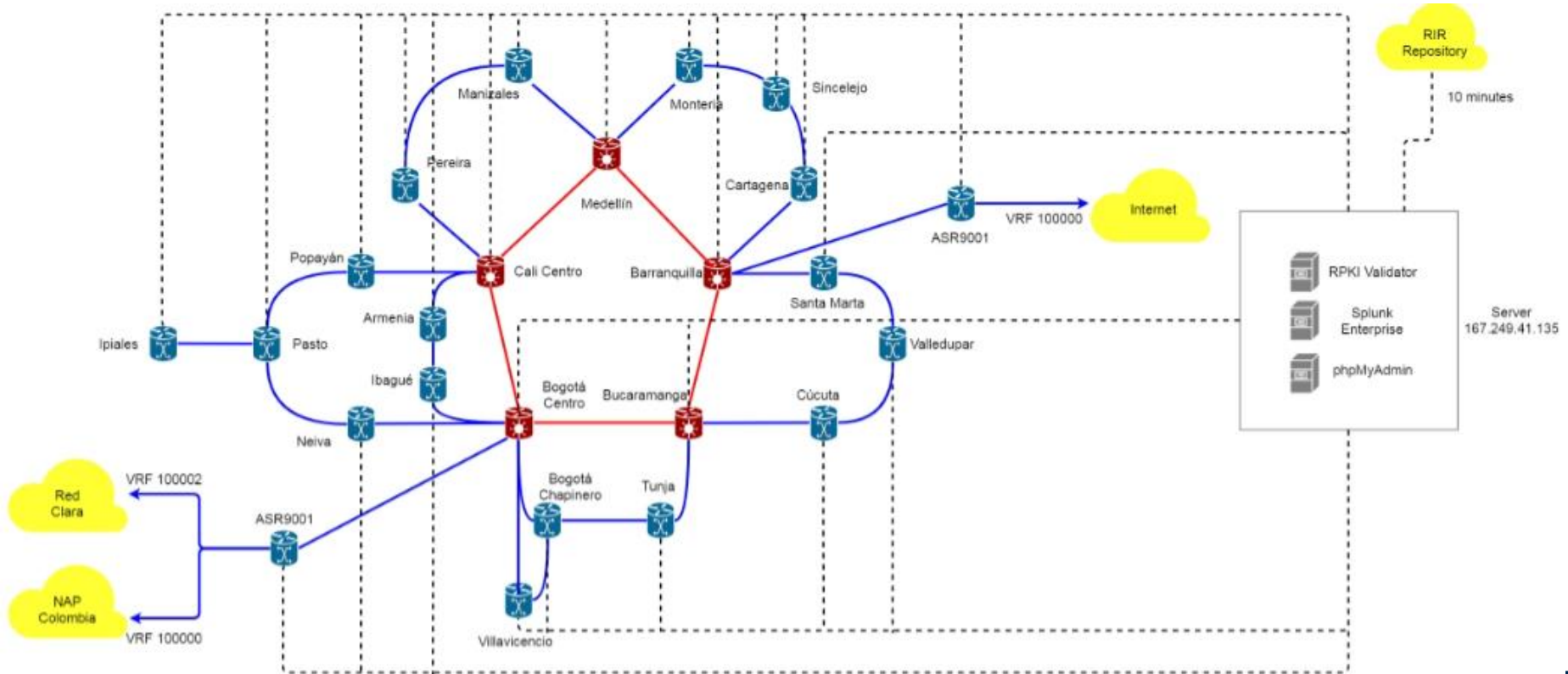
28713 prefixes going to Red CLARA were validated. Percentages are as follow:

Valid	Invalid	Not Found
28,95%	3,55%	67,50%

Initial configuration and trials

How it was made

Topología



Correcting Configurations and Validating Invalid Networks

How it was made

The analysed routes are part of the VRFs used in RENATA. Those VRFs contain the following amount of prefixes:

	VRF100000	VRF100002
Number of prefixes	14922	17912

Correcting Configurations and Validating Invalid Networks

VRF100000 contains the prefixes directed to NAP Colombia and Internet. Meanwhile, VRF100002 contains prefixes for Red CLARA.

Red Clara			NAP Colombia e Internet		
Valid	Invalid	NotFound	Valid	Invalid	NotFound
5.828%	1.066%	93.104%	46.134%	2.453%	51.411%
5.828%	1.066%	93.104%	46.141%	2.467%	51.391%
5.828%	1.066%	93.104%	46.148%	2.460%	51.391%
5.828%	1.066%	93.104%	46.154%	2.453%	51.391%

Correcting Configurations and Validating Invalid Networks

You Knew what?

Validation activation can not be done with in the address family



Correcting Configurations and Validating Invalid Networks Configuration

```
router bgp 27817
rpkf server 10.201.1.2
transport tcp port 8282
refresh-time 600
!
vrf 100000
address-family ipv4 unicast
bgp origin-as validation enable
bgp bestpath origin-as use validity
bgp bestpath origin-as allow invalid
```

VALIDACIÓN

```
sh bgp vrf 100000 origin-as validity
```

Correcting Configurations and Validating Invalid Networks

```
RP/0/RSP0/CPU0:RI-BOG-CEN-1#sh bgp vrf 100000 origin-as validity
```

```
Fri Nov 10 14:46:44.256 COL
```

```
BGP VRF 100000, state: Active
```

```
BGP Route Distinguisher: 27817:100000
```

```
VRF ID: 0x60000007
```

```
BGP router identifier 10.4.10.25, local AS number 27817
```

```
Non-stop routing is enabled
```

```
BGP table state: Active
```

```
Table ID: 0xe0000016 RD version: 45251533
```

```
BGP main routing table version 45251559
```

```
BGP NSR Initial initsync version 56445 (Reached)
```

```
BGP NSR/ISSU Sync-Group versions 0/0
```

```
Status codes: s suppressed, d damped, h history, * valid, > best
```

```
          i - internal, r RIB-failure, S stale, N Nexthop-discard
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Origin-AS validation codes: V valid, I invalid, N not-found, D disabled
```

```
          Network                  Next Hop                  Metric LocPrf Weight Path
```

```
Route Distinguisher: 27817:100000 (default for vrf 100000)
```

Correcting Configurations and Validating Invalid Networks

```
RP/0/RSP0/CPU0:RI-BOG-CEN-1#
RP/0/RSP0/CPU0:RI-BOG-CEN-1#sh bgp vrf 100000 origin-as validity | in V
Fri Nov 10 14:46:03.233 COL
BGP VRF 100000, state: Active
VRF ID: 0x60000007
Origin-AS validation codes: V valid, I invalid, N not-found, D disabled
V*> 57.74.192.0/19      206.223.124.140      0          0 6505 51964 i
V*> 104.132.160.0/24   206.223.124.143      0          0 7087 18747 41264 i
V* 131.0.136.0/22     206.223.124.147      2713       0 6140 3549 10753 61467 i
V*                    206.223.124.151      2703       0 6140 3549 10753 61467 i
V*>                    206.223.124.154      0          0 18678 61467 i
V*> 131.108.168.0/22   206.223.124.133      0          0 10299 i
V*                    206.223.124.134      0          0 10299 i
V*                    206.223.124.147      2593       0 6140 3549 10299 10299 10299 10299 10299 10299 10299 10299
10299 i
V*                    206.223.124.151      2583       0 6140 3549 10299 10299 10299 10299 10299 10299 10299 10299
10299 i
V*> 131.161.232.0/24   206.223.124.154      0          0 18678 262195 11664 11664 52327 52327 52327 52327 52327 i
V*> 131.161.233.0/24   206.223.124.154      0          0 18678 262195 11664 11664 52327 52327 52327 52327 52327 i
V*> 131.161.234.0/24   206.223.124.154      0          0 18678 262195 11664 11664 52327 52327 52327 52327 52327 ?
V*> 131.161.235.0/24   206.223.124.154      0          0 18678 262195 11664 11664 52327 52327 52327 52327 52327 i
V*> 131.221.32.0/24    206.223.124.154      0          0 18678 52368 263702 i
V*> 131.221.164.0/23   206.223.124.154      0          0 18678 27901 i
V*> 131.221.166.0/23   206.223.124.154      0          0 18678 27901 i
V*> 132.255.20.0/24    206.223.124.142      0          0 27951 i
```

Correcting Configurations and Validating Invalid Networks

Results

- 1150 signed prefixes since the first training.
- 328 professionals trained.
- Increasing of valid routes in prefixes published in Internet and NAP Colombia.
- The patch was applied only in the two interconnection points since the patch for the TiMOS is still under development.

Reporte VRF 100000

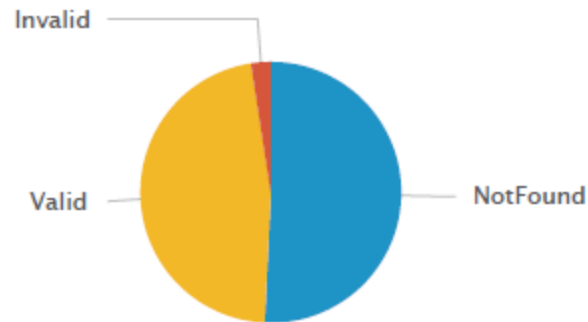
Statistics of BGP prefixes of ALU-BOG (VRF 100000) - NAP Colombia and commercial Internet

Consulted on October 31

Validity Status ↕	Number of Prefixes ↕	Percent ↕
NotFound	7572	50.767684
Valid	6982	46.811934
Invalid	361	2.420382

Graph of BGP prefixes of ALU-BOG (VRF 100000) - NAP Colombia and commercial Internet

Consulted on October 31



Reporte VRF 100002

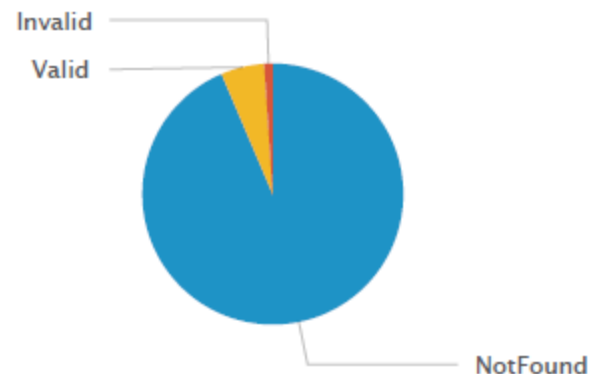
Statistics of BGP ads of the ASR9001-BOG
(VRF 100002) - Red Clara

Consulted on October 31

Validity Status ↕	Number of Prefixes ↕	Percent ↕
NotFound	16764	93.596114
Valid	961	5.365418
Invalid	186	1.038468

Graphic of BGP ads of the ASR9001-BOG
(VRF 100002) - Red Clara

Consulted on October 31



Impact and innovation

- Worldwide this project is the first one in considering the implementation of the origin validation in a national network.
- Innovative achievement towards security in critical infrastructure of Internet and academic networks.