

EXECUTIVE REPORT

Survey on IXPS in Latin America and the Caribbean, 2021



Contents

1. Context of the survey	<u>3</u>
2. Goal of the survey.....	<u>4</u>
3. Methodology applied to achieve the goal of the survey	<u>4</u>
4. Summary of results obtained through the survey	<u>5</u>
5. Timeline for the growth of IXPs in Latin America and the Caribbean.....	<u>6</u>
6. General conclusions	<u>18</u>

Sponsored by:



LAC-IX reserves all rights for the information produced through this study, as well as for its results, reproduction, and authorship.



1 Context of the survey

From their inception, Internet Exchange Points (IXPs) have become a cornerstone for the development of the Internet. There are over 100 sites in Latin America and the Caribbean where traffic has been exchanged for over 20 years.

To this date, multiple (mostly qualitative) surveys on IXPs in the region exist. Additionally, relevant data is provided on the websites of several organizations. Nevertheless, the aforementioned surveys and sites provide limited information, making it necessary to expand the scope and detail of data, thus allowing for a clearer understanding of the current status of IXPs in the region.

Given how IXPs constantly evolve in every aspect (participants, technological equipment, services, tools, etc.), we recommend this survey be annually updated.



To have a quantitative understanding of the status of IXPs in Latin America and the Caribbean and highlight the most measurable aspects of each IXP, a survey on the IXPs in the region was conducted. Data collected will serve as a reliable, updated source of information useful for decision-making processes, allowing for the creation of road maps to strengthen IXPs as elements of the critical infrastructure of the Internet.

The survey attempts to cover all IXPs declared as such from Latin America and the Caribbean. Upon completing the survey, 98 sites represented by 36 active IXPs were identified. Data obtained referred to a broad, wide variety of aspects.

For the survey, a questionnaire was shared with all IXPs included in the analysis although, when necessary and given the size, complex architecture, or other aspects of the IXP, other customized survey methods were used.

2 Goal of the survey

Obtain precise information on IXPs in Latin America and the Caribbean and provide both a general and detailed analysis of their status.

3 Methodology applied to achieve the goal of the survey

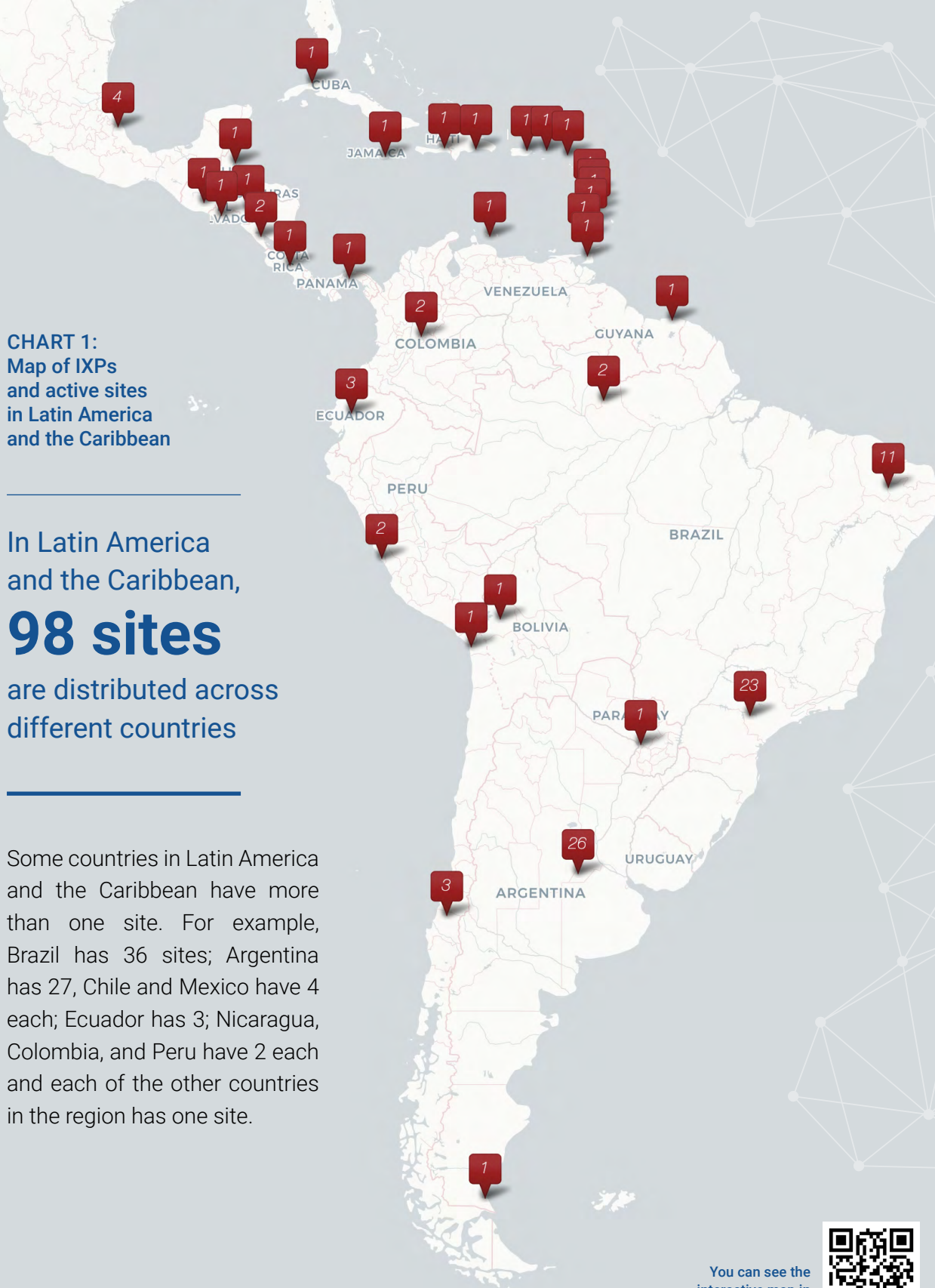
The methodology applied for the collection and analysis of data from this survey comprised the following activities:

- a.** Contact information for each IXP was identified and listed.
 - b.** A survey form for data collection was drafted and contacts from IXPs in Latin America and the Caribbean were asked to complete it.
 - c.** IXPs who had failed to complete the survey were contacted through emails, phone calls, and social networks such as LinkedIn, and asked to reply.
 - d.** Data obtained from the survey form was consolidated.
 - e.** An executive report including the analysis of data obtained from IXPs in Latin America and the Caribbean, as well as conclusions and recommendations for IXPDB was drafted.
 - f.** A graphic design of a map including the data collected from IXPs in Latin America and the Caribbean was created.
-

CHART 1: Map of IXPs and active sites in Latin America and the Caribbean

In Latin America
and the Caribbean,
98 sites
are distributed across
different countries

Some countries in Latin America and the Caribbean have more than one site. For example, Brazil has 36 sites; Argentina has 27, Chile and Mexico have 4 each; Ecuador has 3; Nicaragua, Colombia, and Peru have 2 each and each of the other countries in the region has one site.



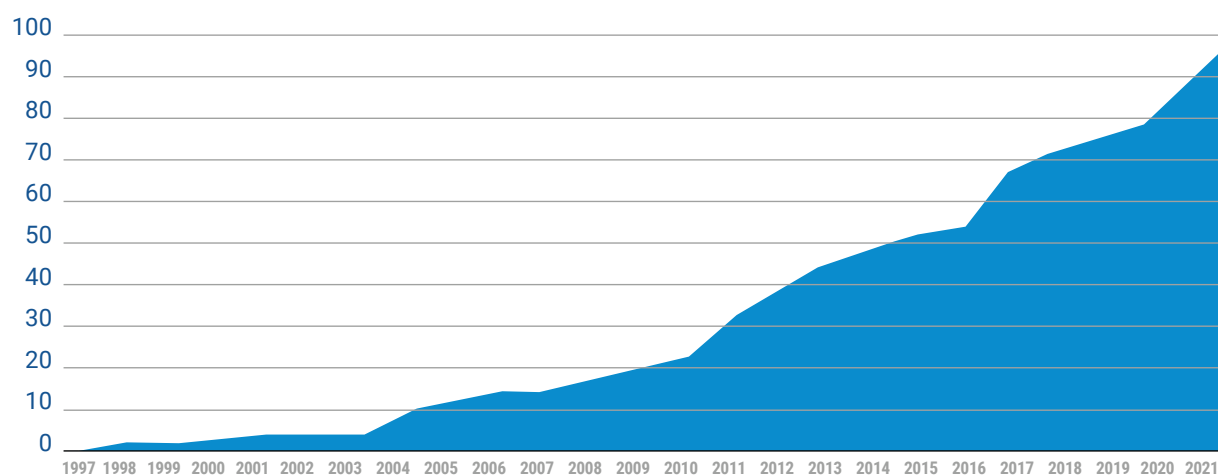
You can see the interactive map in this QR code.



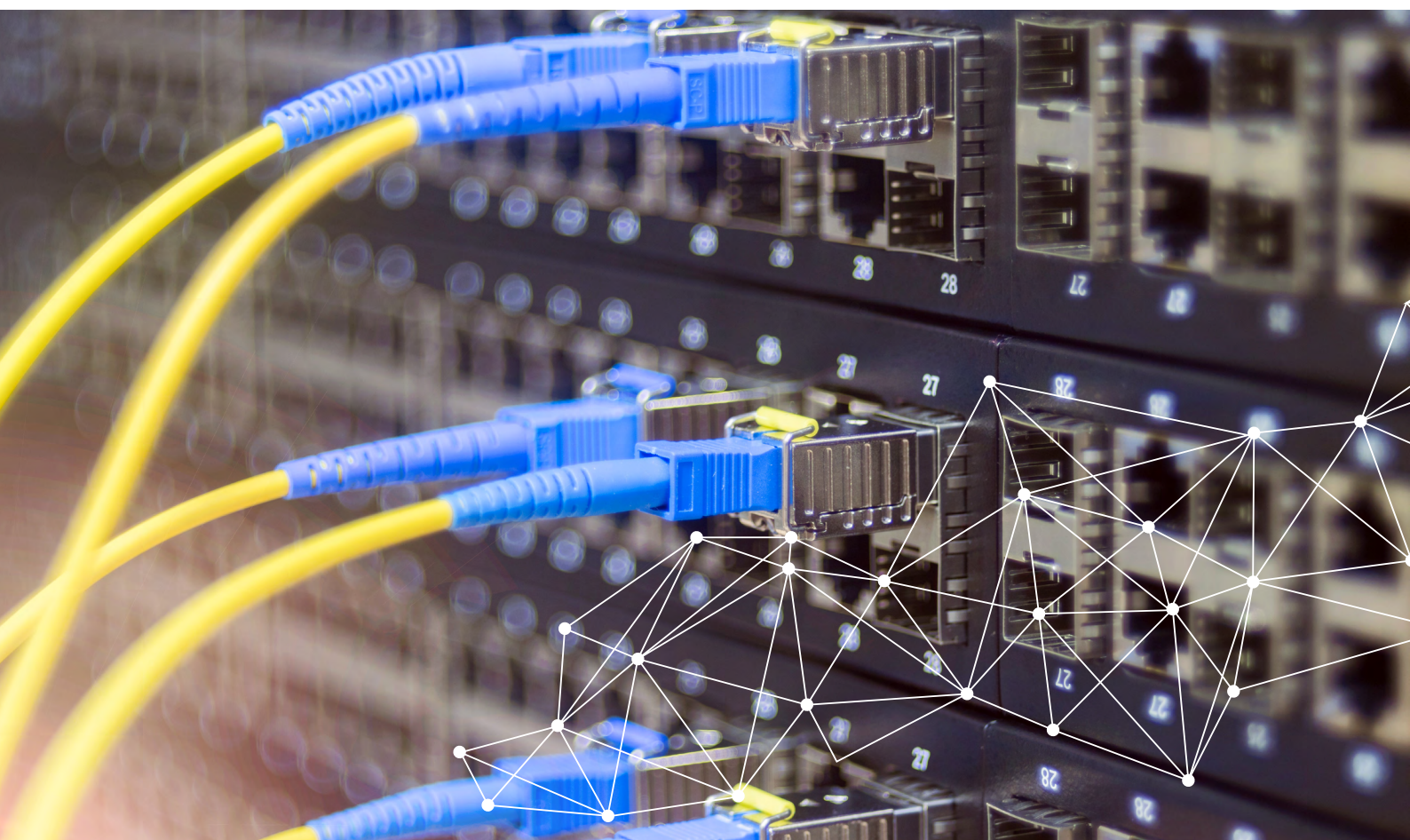
5 Timeline for the growth of IXPs in Latin America and the Caribbean

As shown below, the number of sites in the region as of 2021 has increased in comparison to the number of sites existing when the first IPXs such as *InteRed Panamá* (April 24, 1997) and *NAP Colombia* (November 21, 1997) were created.

CHART 2: Timeline




Source: drafted by LAC-IX, by January 2022.



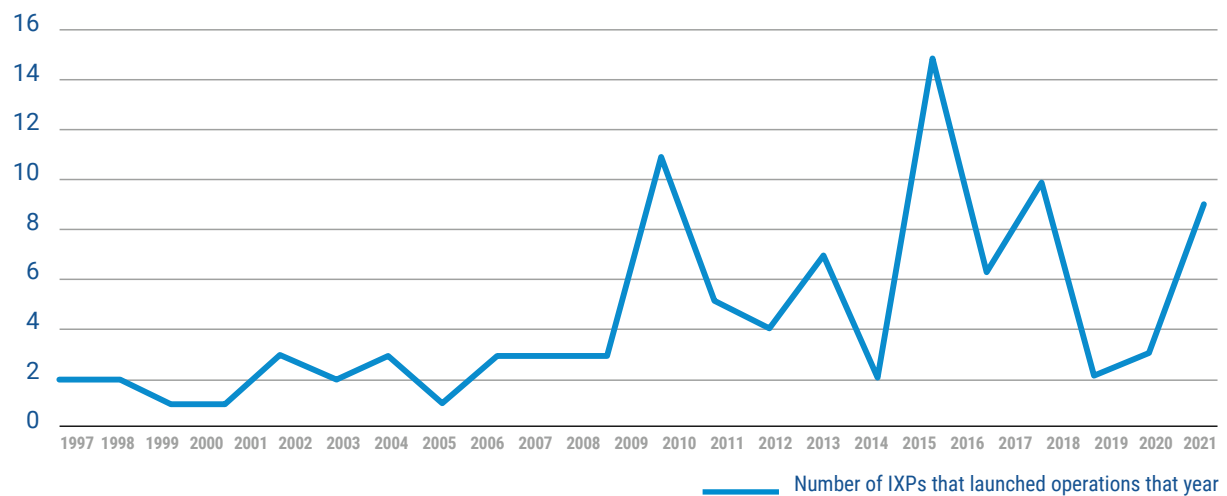
The timeline shows data by year. Nevertheless, information on the number of sites that launched operations each year is displayed in the following chart and graph:

CHART 1: Number of sites created by year in Latin America and the Caribbean



Year operations started	Number of IXPs that launched operations that year
1997	2
1998	2
2000	1
2001	1
2004	3
2005	2
2006	3
2007	1
2008	3
2009	3
2010	3
2011	11
2012	5
2013	4
2014	7
2015	2
2016	15
2017	6
2018	10
2019	2
2020	3
2021	9

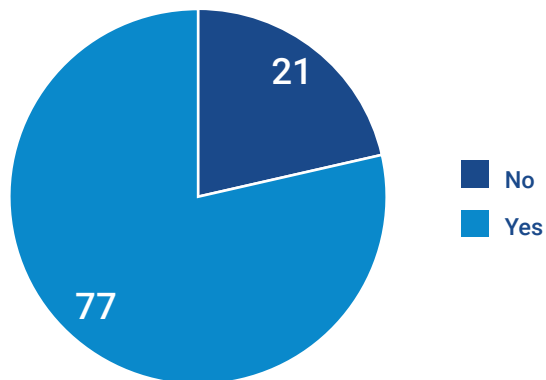
Source: drafted by LAC-IX, by January 2022.

GRAPH 1: Number of sites created by year in Latin America and the Caribbean

Source: drafted by LAC-IX, by January 2022.

GRAPH 2: Locations associated with LAC-IX

Out of the 98 locations where traffic is currently exchanged, 77 belong to organizations connected to LAC-IX, the Association of Traffic Exchange Points of Latin America and the Caribbean.

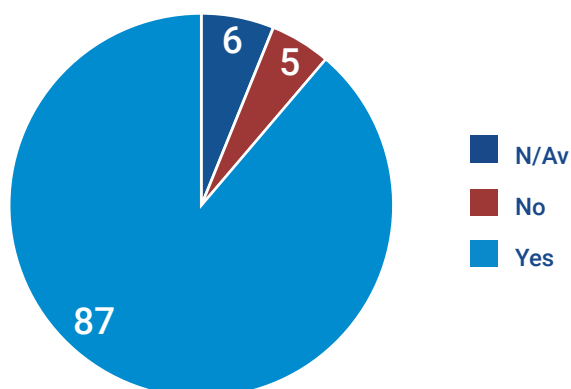


Source: drafted by LAC-IX, by January 2022.

Among the services offered by the IXPs surveyed are IPv6, IRR filtering, RPKI, AS112, and providing support for members of PeeringDB, among others. The following graphs showcase how these services are distributed:

GRAPH 3: IPv6 Availability

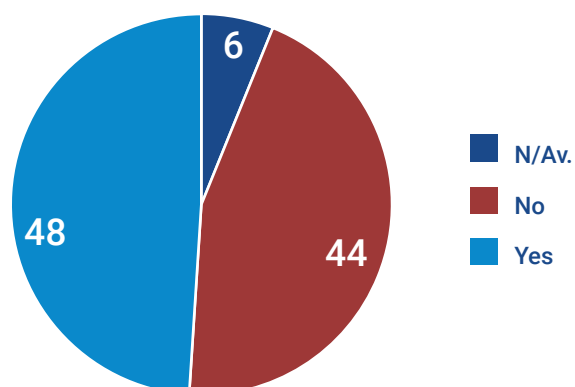
87 sites offer IPv6, 5 sites do not have IPv6, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 4: IRR Filtering Availability

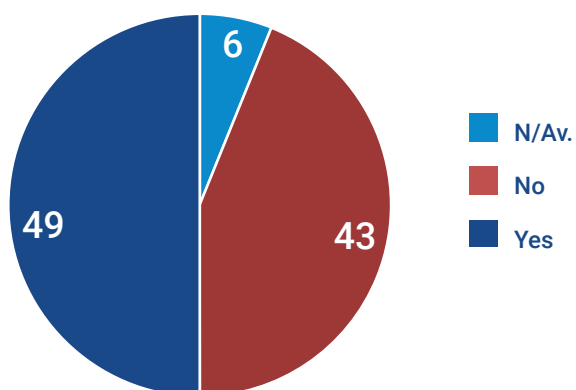
48 sites offer IRR, 44 sites do not offer IRR and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 5: RPKI Validation Availability

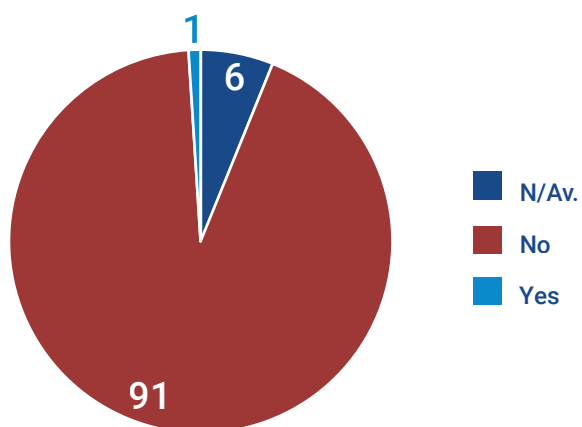
49 sites have RPKI validation, 43 sites have no RPKI validation, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 6: AS112 Availability

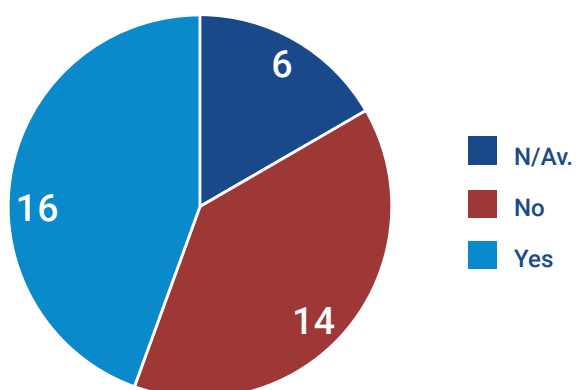
One site has AS112 available, 91 sites have no AS112, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 7: MANRS IXPP Registration

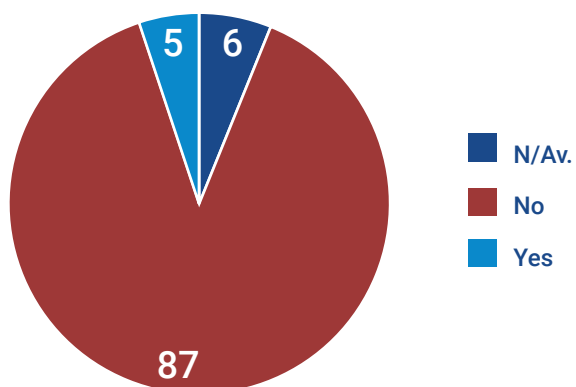
16 IXPs are registered for the MANRS IXPP, 14 sites are not registered for the MANRS IXPP, and 6 IXPs have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 8: LACNIC Route Collection Service

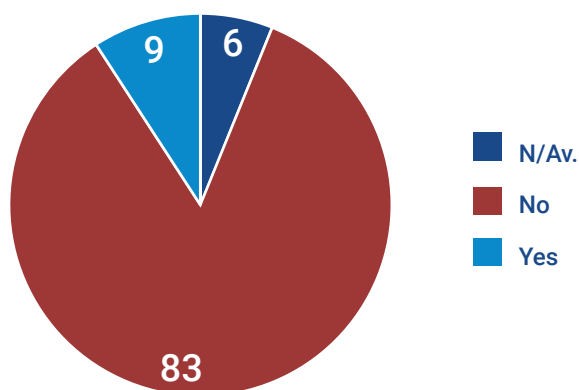
5 sites provide the LACNIC Route Collection Service, 87 sites do not provide this service and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 9: LACNIC's DNS Anycast

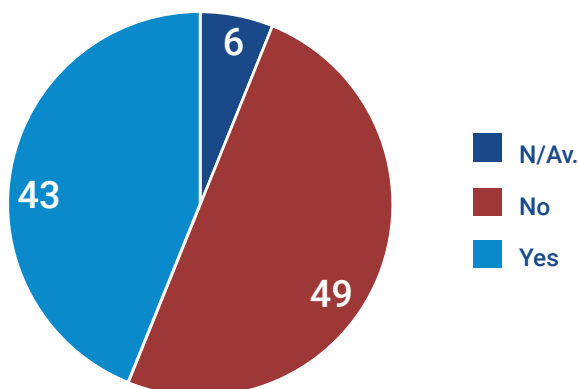
9 sites have LACNIC's DNS Anycast technology, 83 sites do not have this technology, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 10: IXP Manager

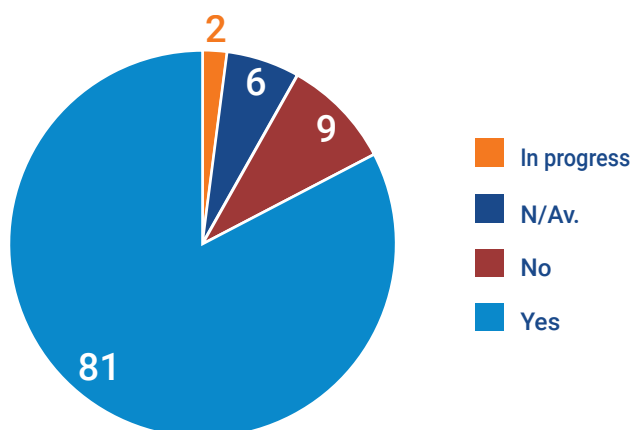
43 sites have IXP Manager, 49 sites do not have IXP Manager, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 11: Sites registered in IXPDB

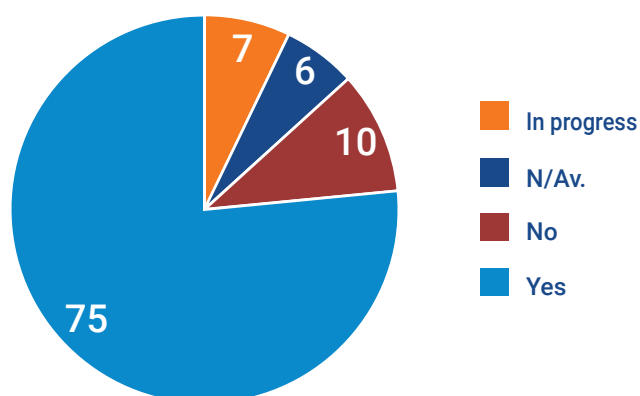
81 sites are registered in IXPDB, 2 sites are undergoing the registration process, 9 sites are not registered in IXPDB, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 12: Sites using JSON

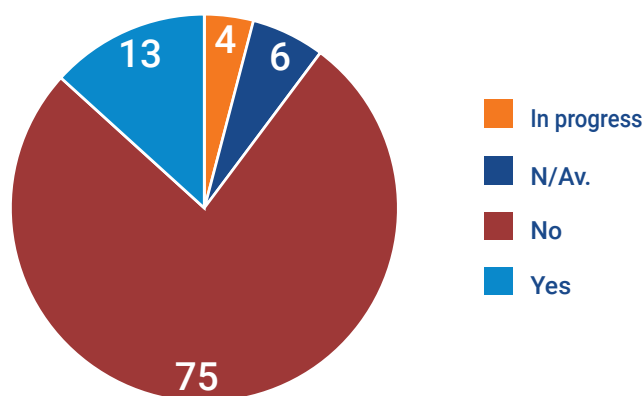
75 sites are registered in IXPDB and export the JSON IX-F Member Export, 7 sites are undergoing the registration process, 10 sites do not have it yet, and 6 sites have no information available.



Source: drafted by LAC-IX, by January 2022.

GRAPH 13: Sites exporting traffic

13 sites export traffic statistics to IXPDB, 4 sites are in the process of doing so, 75 sites do not export traffic, and 6 sites have no information available.

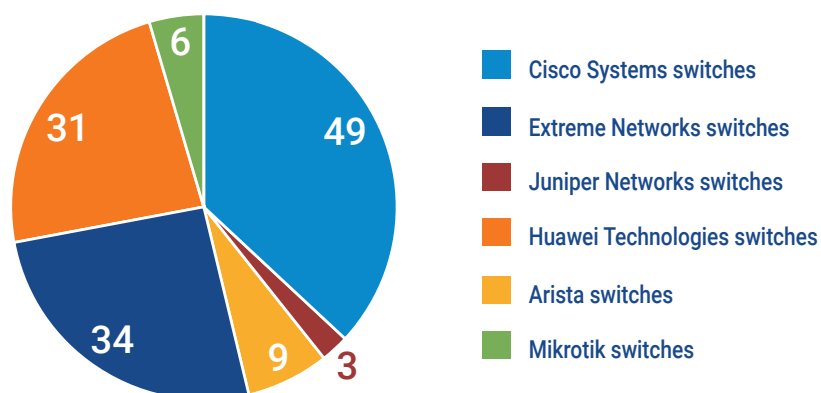


Source: drafted by LAC-IX, by January 2022.

GRAPH 14: Switch providers

IXPs in Latin America and the Caribbean use switches from manufacturers such as Cisco Systems, Extreme Networks, and Huawei Technologies, among others. The following list showcases the technologies used in detail.

- 49 sites have Cisco Systems switches.
- 3 sites have Juniper Networks switches.
- 9 sites have Arista switches.
- 34 sites have Extreme Networks switches.
- 31 sites have Huawei Technologies switches.
- 6 sites have Mikrotik switches.

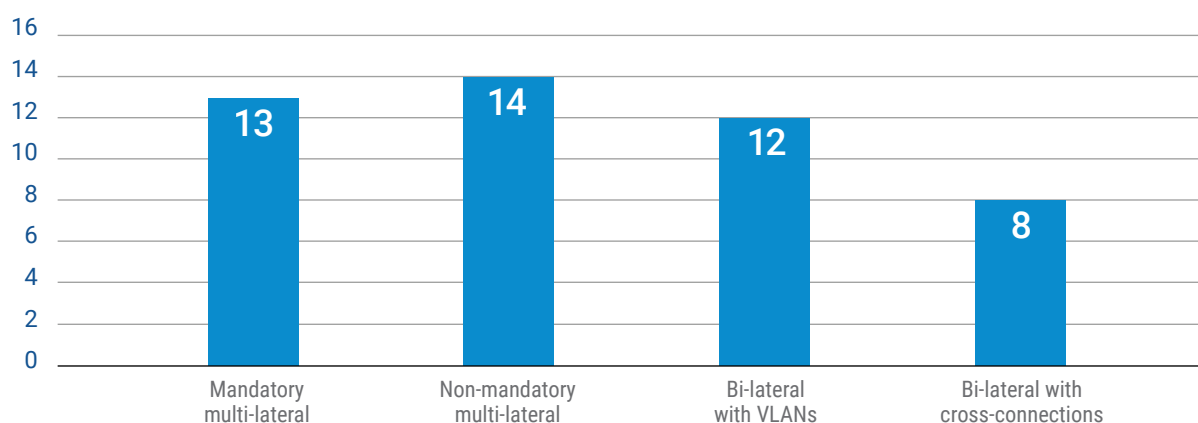


Source: drafted by LAC-IX, by January 2022.

GRAPH 15: Interconnection models

The interconnection models under which IXPs are managed range from mandatory multi-lateral, non-mandatory multi-lateral, bi-lateral with VLANs, and bi-lateral with cross-connections. This data is disaggregated as follows:

- 13 IXPs are managed under the mandatory multi-lateral interconnection model.
- 14 IXPs are managed under the non-mandatory multi-lateral interconnection model.
- 12 IXPs are managed under the bi-lateral interconnection model with VLANs.
- 8 IXPs are managed under the bi-lateral interconnection model with cross-connections.

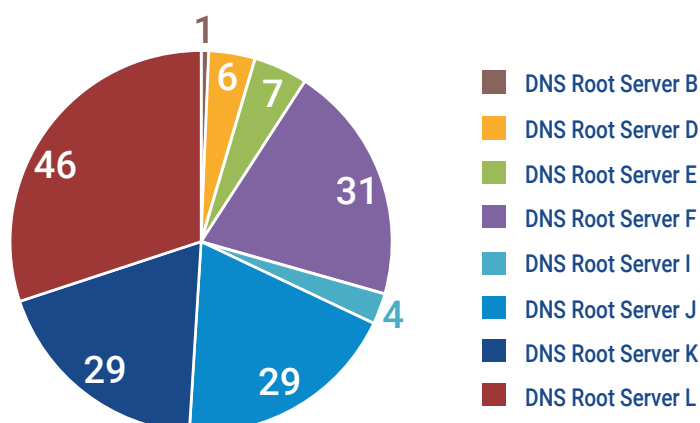


Source: drafted by LAC-IX, by January 2022.

GRAPH 16: Root Servers in IXPs

Having a copy of the root server in the IXP provides more efficiency to traffic queries from each IXP. Many IXPs in Latin America have at least one copy of their different Root Servers, as shown below.

- 1 site has a copy of Root Server B.
- 6 sites have a copy of Root Server D.
- 7 sites have a copy of Root Server E.
- 31 sites have a copy of Root Server F.
- 4 sites have a copy of Root Server I.
- 29 sites have a copy of Root Server J.
- 29 sites have a copy of Root Server K.
- 46 sites have a copy of Root Server L.

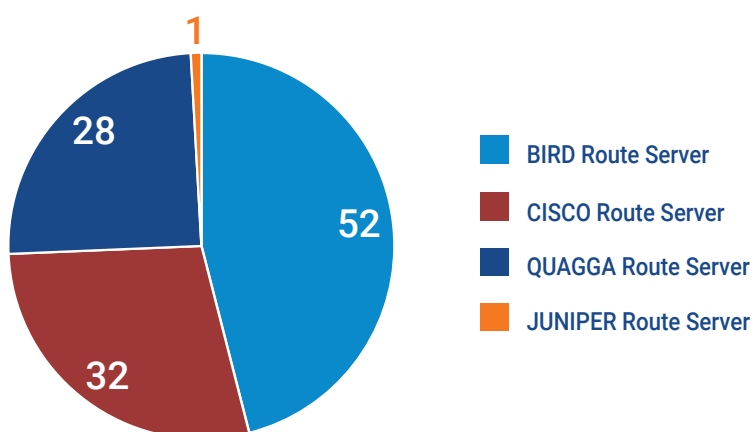


Source: drafted by LAC-IX, by January 2022.

GRAPH 17: Route Servers per site

IXPs exchange traffic through Route Servers of commercial brands, as shown in the following list:

- 52 sites have BIRD Route Servers.
- 28 sites have QUAGGA Route Servers.
- 32 sites have CISCO Route Servers.
- 1 site has JUNIPER Route Servers.

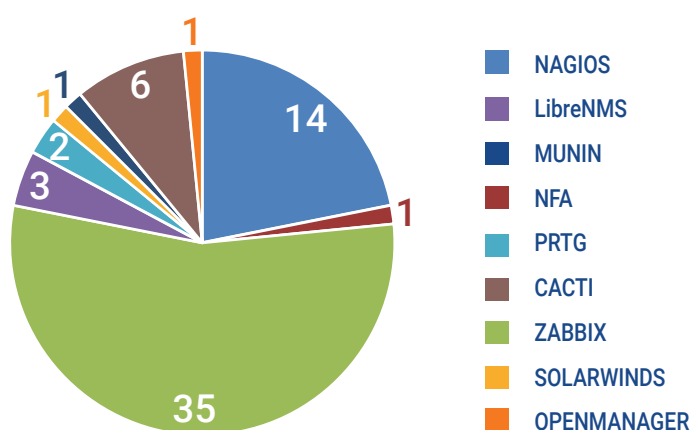


Source: drafted by LAC-IX, by January 2022.

GRAPH 18: Monitoring tools

The monitoring tools used by each of the IXPs surveyed are detailed below.

- 14 sites use NAGIOS as a monitoring tool.
- 1 site uses NFA as a monitoring tool.
- 35 sites use ZABBIX as a monitoring tool.
- 3 sites use LibreNMS as a monitoring tool.
- 2 sites use PRTG as a monitoring tool.
- 1 site uses SOLARWINDS as a monitoring tool.
- 1 site uses MUNIN as a monitoring tool.
- 6 sites use CACTI as a monitoring tool.
- 1 site uses OPENMANAGER as a monitoring tool.

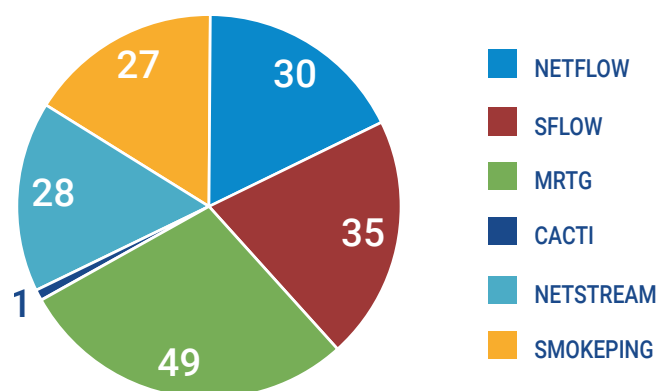


Source: drafted by LAC-IX, by January 2022.

GRAPH 19: Monitoring tools

Traffic measurement tools used by each of the IXPs surveyed are detailed below.

- 30 sites use NETFLOW as a traffic measurement tool.
- 35 sites use SFLOW as a traffic measurement tool.
- 49 sites use MRTG as a traffic measurement tool.
- 1 site uses CACTI as a traffic measurement tool.
- 28 sites use NETSTREAM as a traffic measurement tool.
- 27 sites use SMOKEPING as a traffic measurement tool.

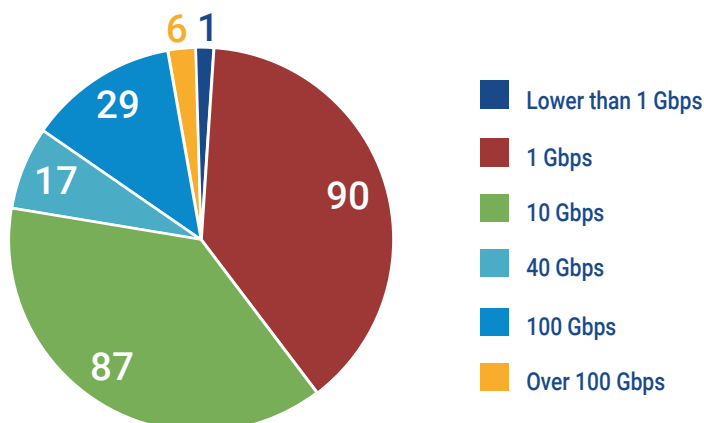


Source: drafted by LAC-IX, by January 2022.

GRAPH 20: Port speed

The port speed available in each of the IXPs surveyed is detailed below.

- 1 site has a port speed lower than 1 Gbps.
- 90 sites have a port speed equal to 1 Gbps.
- 87 sites have a port speed equal to 10 Gbps.
- 17 sites have a port speed equal to 40 Gbps.
- 29 sites have a port speed equal to 100 Gbps.
- 6 sites have a port speed of over 100 Gbps.



Source: drafted by LAC-IX, by January 2022.



6 General conclusions

- As an association, LAC-IX brings together most sites where traffic is being exchanged in the region.
- In the last 5 years, growth and automatization through tools such as IXP Manager were accelerated, and so were the deployment of RPKI and the process of joining the MANRS program, tools that improve the quality of interconnections and routing security across the region's IXPs.
- Every day, more IXPs continue deploying added-value services thus increasing the benefits produced by the IXPs, both for the development of new technologies as well as for the decrease in latency for end-users.



info@lac-ix.org



LAC-ix
LATIN AMERICA AND CARIBBEAN IXPS