CAPIF 3
September 2024

IXP Tracker, Resilience Index, and Content Locality

Measuring the Health and Resilience of the Internet with Internet Society Pulse and the role of IXPs.

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pulse.internetsociety.org

Your Data Dashboard

- Launched December 2020.
- We curate Internet measurement data from trusted sources to help everyone gain deeper, data-driven insight into the Internet.

Trusted data from multiple sources:

- **Benefit**: Helps to assess whether efforts to ensure that the Internet remains open, globally connected, secure, and trustworthy are working.
- **Benefit:** Allows policymakers, researchers, journalists, network operators, civil society groups, and others to better understand the health, availability, and evolution of the Internet.

Pulse Data Partners

Pulse tracks

Shutdowns: Where do Internet shutdowns take place?

Net Loss: Estimate the economic impacts of Internet shutdowns.

Technologies: Tracking the deployment of technologies critical for the evolution of the Internet.

Concentration: How much are services concentrated in the hands of a few?

Resilience: How robust is the Internet ecosystem?

Pulse tracks

- **Shutdowns**: Where do Internet shutdowns take place?
- **Net Loss:** Estimate the economic impacts of Internet shutdowns.
- **Technologies**: Tracking the deployment of technologies critical for the evolution of the Internet.
- **Concentration**: How much are services concentrated in the hands of a few?
- **Resilience**: How robust is the Internet ecosystem?
- **IXP Tracker**: monitors the growth of IXPs globally

IXP Tracker

IXP Tracker (now and future)

Monitors growth and development

Tracks key growth metrics of IXPs globally

Evaluates performance and reliability

Provides information on the performance and resilience of networks at the IXP.

Facilitates network optimization

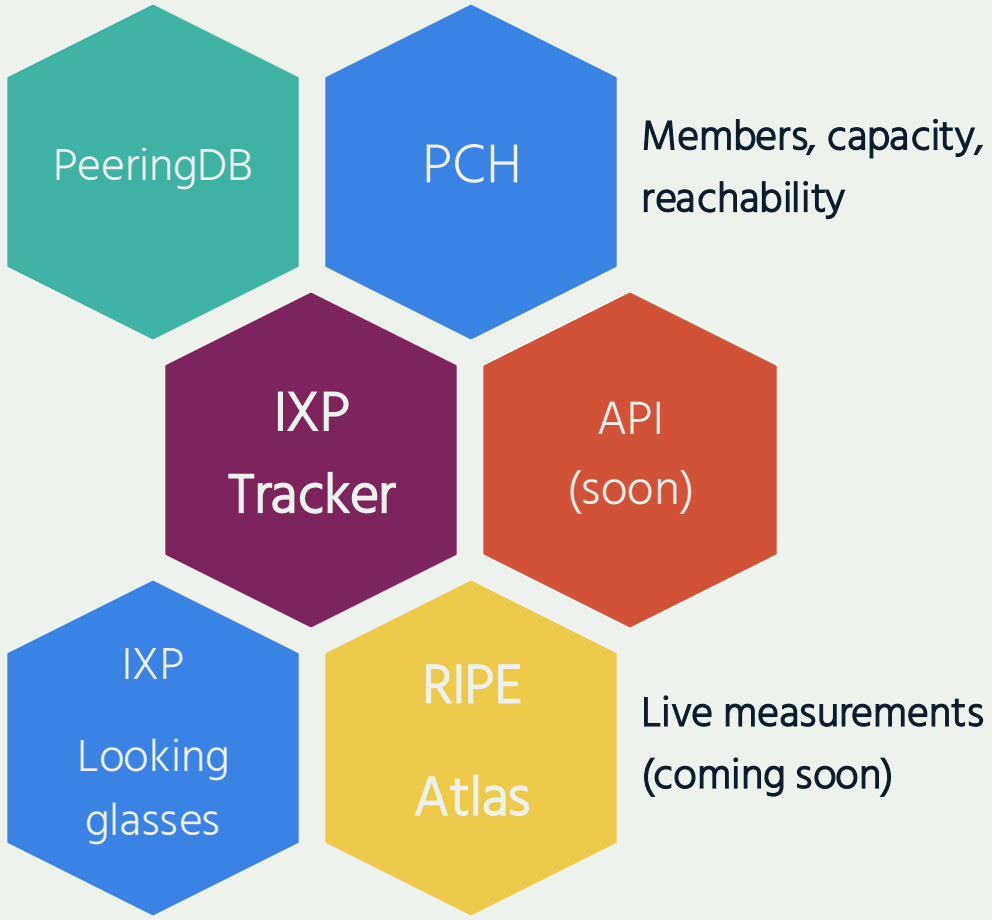
Provides up-to-date information to enable data-driven peering decisions.

Foster community engagement

Provides a platform for IXP members to connect, share knowledge, and collaborate.

Components

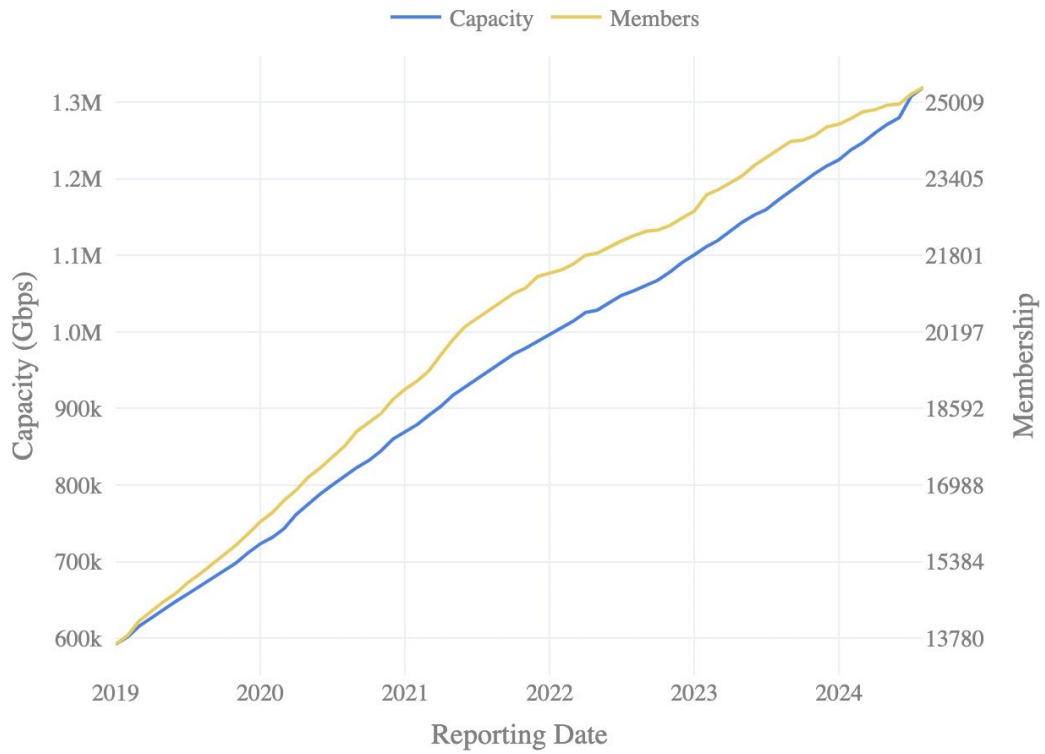
1. Collects data on more than 1000 IXPs globally from PeeringDB/PCH.
2. Provides information about capacity and membership growth.
3. Shows a country and an IXP view.



Global view

IXP capacity growth over time

The global total of IXPs over time, shown along with the growth in combined capacity offered by the world's IXPs.



Top 10 countries/territories by IXP coverage

Internet users in these countries have the highest proportion of access to their local Internet via IXPs.

- Suriname : 85.71%
- Sint Maarten (Dutch part) : 75.00%
- Saint Martin (French part) : 71.43%
- Trinidad and Tobago : 66.67%
- Saint Kitts and Nevis : 62.50%
- Djibouti : 60.00%
- Grenada : 60.00%
- Réunion : 57.14%
- Burundi : 55.56%
- South Africa : 53.77%

Country view

Country:

Congo (the Democratic Republic of the)

Select

IXP capacity growth over time in Congo (the Democratic Republic of the)

The total of IXPs over time, shown along with the growth in combined capacity.

Congo (the Democratic Republic of the)

Active Internet Exchange Points

The total number of IXPs in operation in Congo (the Democratic Republic of the), as of August 2024.

4

Active IXPs

33.33 %

Proportion of the local Internet that can be reached through IXPs in this country.

IXPs in Congo (the Democratic Republic of the)

IXP Name	▲ Location
Africa Congo Internet eXchange - ACIX	Kinshasa
Goma Internet eXchange - GOMIX	Goma
KINshasa Internet eXchange - KINIX	Kinshasa
Lubumbashi internet exchange point - LUBIX	Lubumbashi

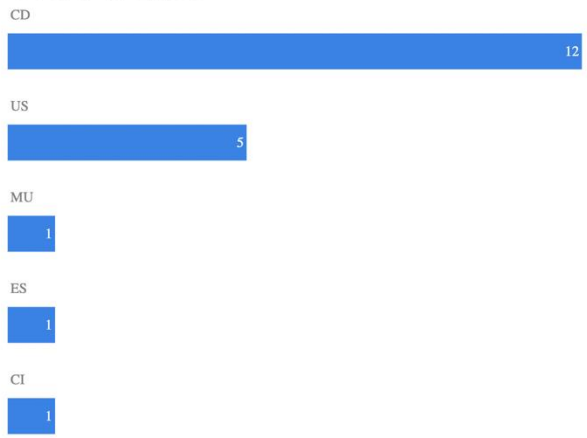
IXP view - KINIX

23.53 %

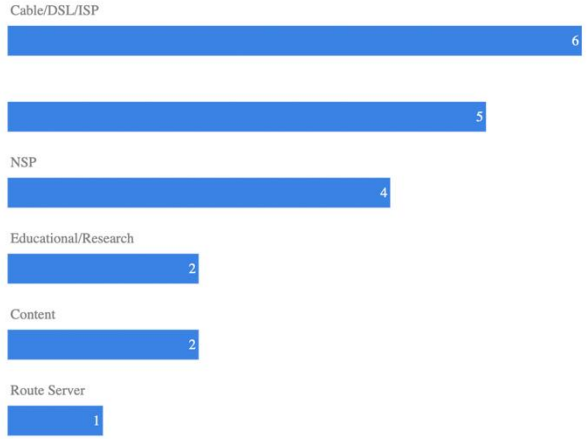
of ASNs

Members

Countries of registration



AS Types



How this IXP has grown over time

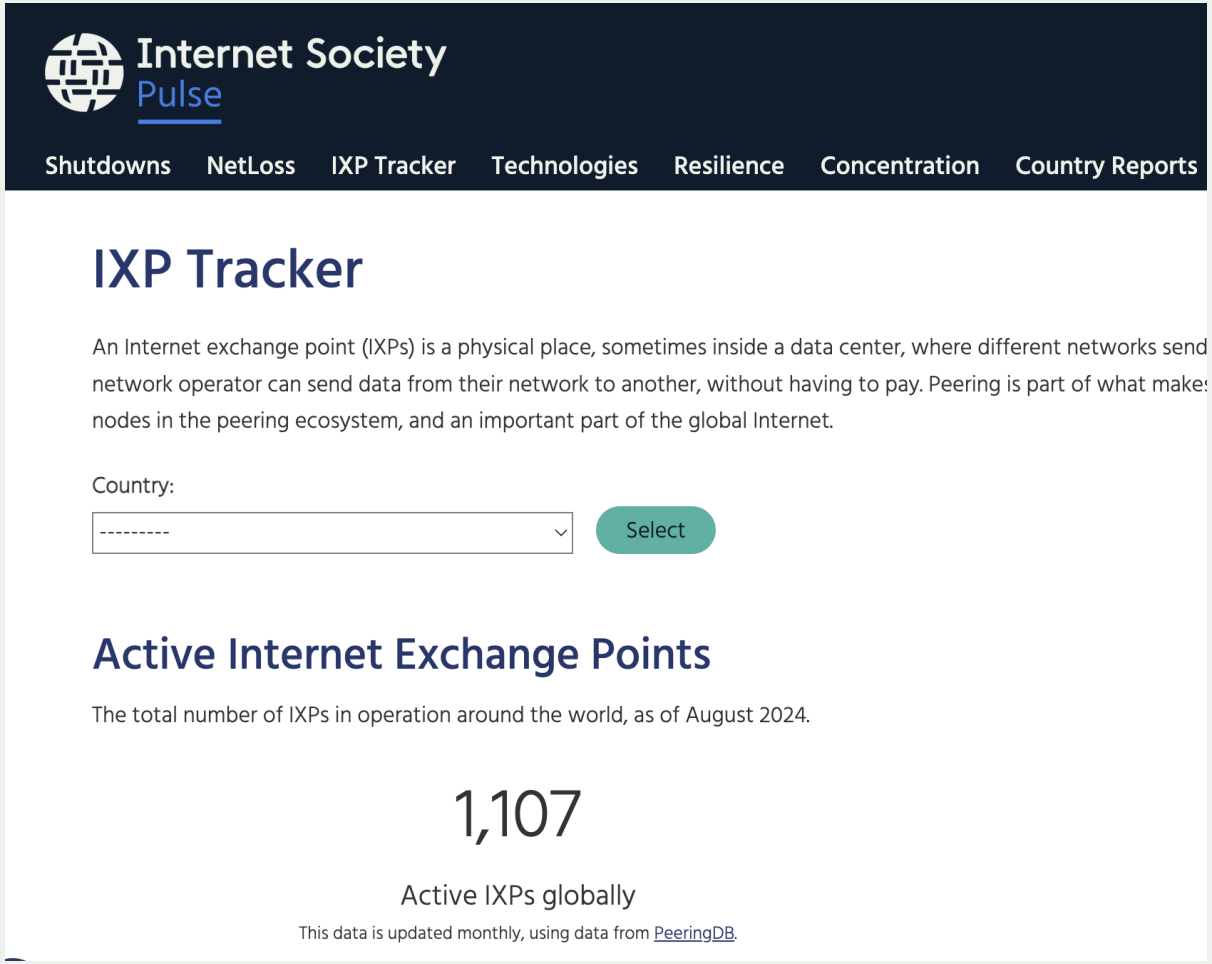
The number of members in this IXP, shown along with the total capacity available.

AS Name	ASN	AS Type	Member Since	RS Peer	Speed	Registration Country
Afrinet	37415	NSP	Sept. 23, 2020	Yes	1000	Congo (the Democratic Republic of the)
AFR-IX Telecom	60171	NSP	March 22, 2021	Yes	10000	Spain
Airtel DRC AS37020	37020	—	Nov. 6, 2019	Yes	20000	Congo (the Democratic Republic of the)
Cloudflare	13335	Content	April 12, 2023	Yes	40000	United States of America
Global Broadband Solution	43256	NSP	Dec. 2, 2019	Yes	1000	United States of America
GVA	36924	Cable/DSL/ISP	Oct. 26, 2023	No	10000	Côte d'Ivoire
ITM DR Congo	37571	—	March 9, 2023	Yes	1000	Congo (the Democratic Republic of the)

IXP Tracker 2.0

Additional features

- **AS level:** shows details about IXPs where a given AS is connected, including prefixes, address space and customer cone.
- **Prefix level:** displays information about all the IXPs a given prefix is reachable, including AS Path length metrics.
- **Compare two IXPs:** reachability (prefixes and networks reachable), customer cone, AS Path length.
- **Network benefits calculator**: We can ask an AS to upload its routing table into the IXP Tracker and select an IXP to see the networking benefits.

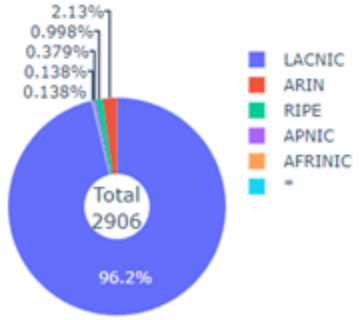


Region view - Statistics

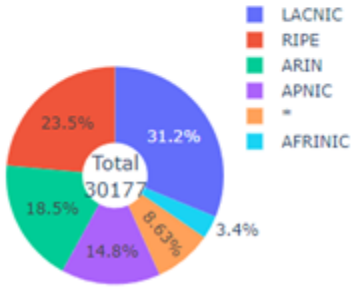
Select Region: LACNIC **IP Version:** v4

35 Number of IXPs	**1** Number of Countries	**2906** ASes connected to at least one IXP in the region.
30177 ASes reachable through IXPs in the region.	**272398** IPv4 prefixes announced at IXPs in the region.	**1282468** IPv4 prefixes (/24) announced at IXPs in the region.
20.84 % of total region allocated ASes are members of at least one IXP from the region	**70.39 %** of total region allocated ASes are reachable through IXPs from the region	**31.36 %** of total region address space is reachable through IXPs from the region

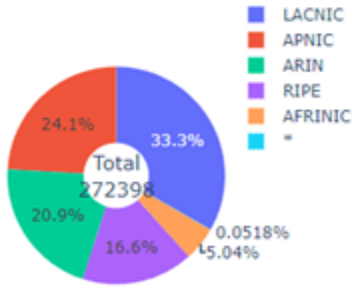
ASes connected to at least one IXP in the region.



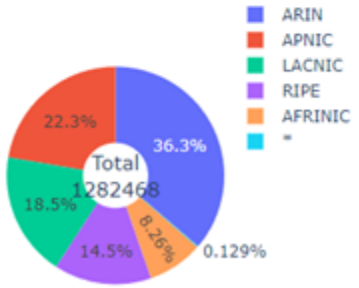
ASes reachable through IXPs in the region.



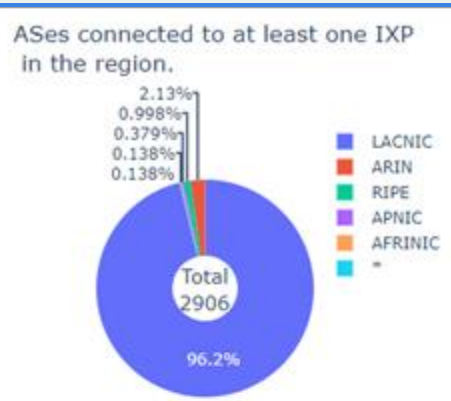
IPv4 prefixes announced at IXPs in the region.

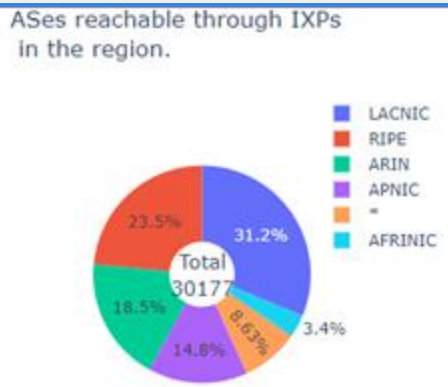


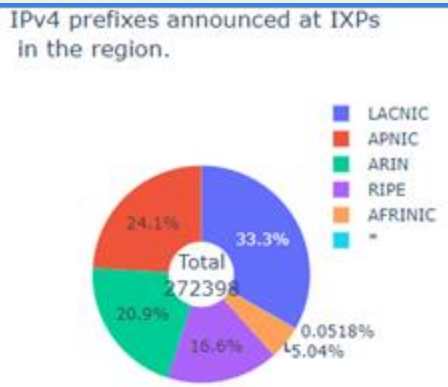
IPv4 prefixes (/24) announced at IXPs in the region.

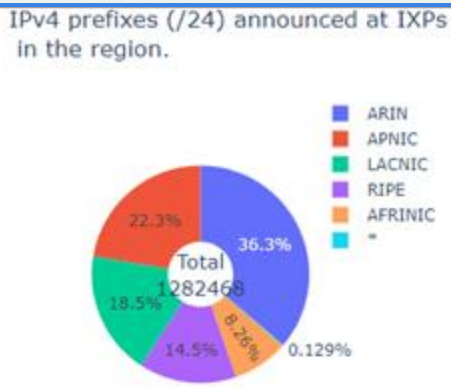


Region view - Table **(ASes)**









AS Numbers in LACNIC Region

Rows per page: 10

	ASN	ASN Type	ASN Name	Member at Regional IXPs	Reachable at Regional IXPs	Member at Other Region's IXPs	Reachable at Other Region's IXPs
○	278			0	0	0	0
○	676			0	0	0	0
◉	1251			1	23	0	0
○	1292			0	0	0	0
○	1296			0	0	0	0
○	1797			0	4	0	0
○	1831			0	0	0	0
○	1840			0	0	0	0
○	1916			23	0	0	0
○	2146			0	0	0	0

« ‹ 1 / 1340 › »

Member at Regional IXPs:

- IX.br São Paulo

Reachable at regional IXPs:

- IX.br Aracaju

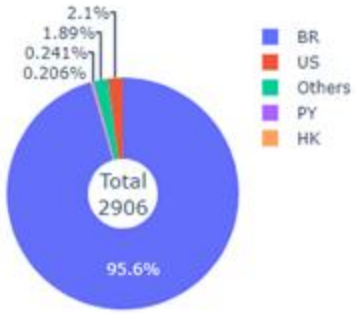
Same analysis for **Country view…**

Select Region: LACNIC **IP Version:** v4

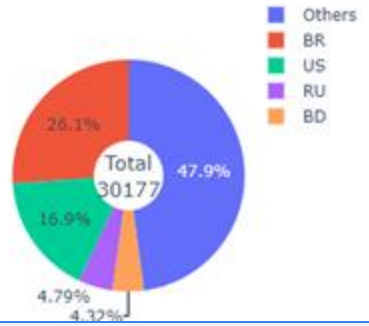
Select Country: Brazil

35 Number of IXPs in the country	**2906** ASes connected to at least one IXP in the country	**30177** ASes reachable through IXPs in the country
272398 IPv4 prefixes announced at IXPs in the country	**1282468** IPv4 prefixes (/24) announced at IXPs in the country	**30.84 %** of total Country allocated ASes are members of at least one IXP in the Country
87.73 % of total Country allocated ASes are reachable through IXPs in the Country	**51.63 %** of total Country address space is reachable through IXPs in the Country	

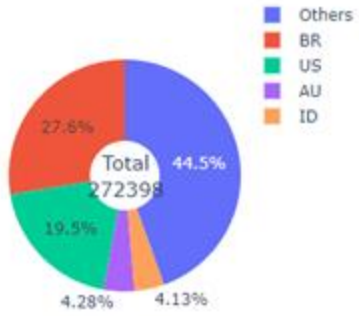
ASes connected to at least one IXP in the Country.



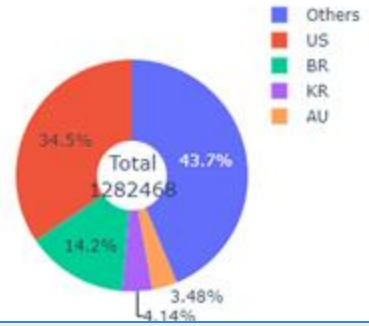
ASes reachable through IXPs in the Country.



IPv4 prefixes announced at IXPs in the Country.



IPv4 prefixes (/24) announced at IXPs in the Country.



IXP view - Statistics

Select Region: LACNIC **IP Version:** v4

Select Country: Brazil **Select IXP:** IX.br São Paulo

2048
ASes connected to the IXP

24173
ASes reachable through the IXP

179989
IPv4 prefixes announced at the IXP

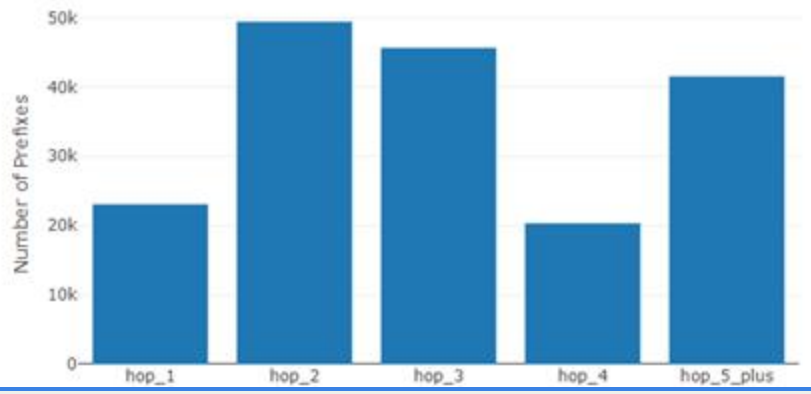
851446
IPv4 prefixes (/24) announced at the IXP

21.40 %
of total Country allocated ASes are members of the IXP

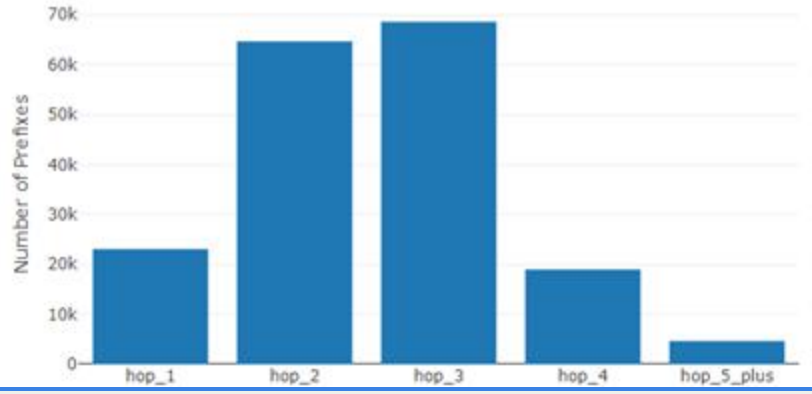
83.34 %
of total Country allocated ASes are reachable through the IXP

37.72 %
of total Country address space is reachable through the IXP

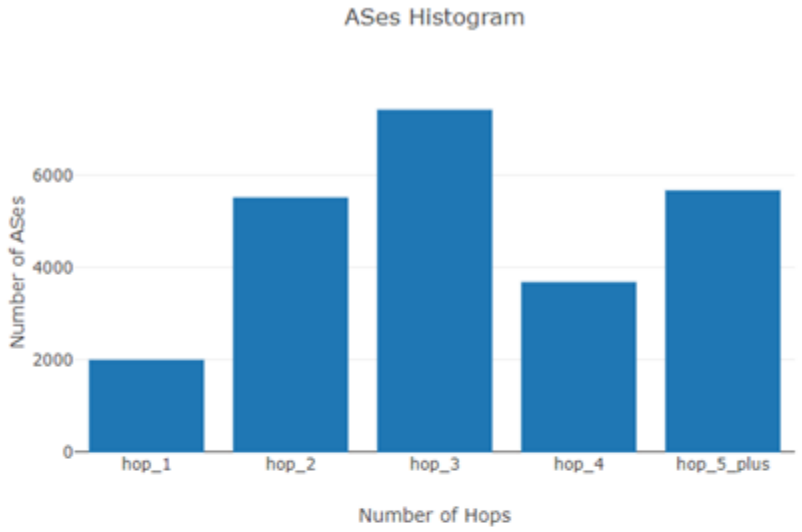
Prefixes Histogram

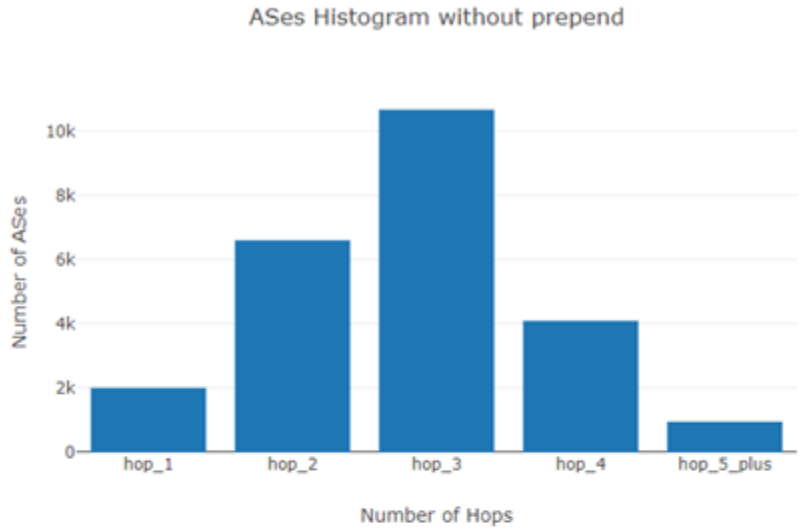


Prefixes Histogram without prepend



IXP view - Table





AS Numbers in IX.br São Paulo

Rows per page: 10

ASN	ASN Type	ASN Name	Country	Originated Prefixes	Cone Prefixes	Originated Adress space (/24)	Cone Adress space (/24)
328366				7	2	56	5
37468				13	1275	32	8480
37645				40	2	308	5
37721				21	157	60	804
137831				0	5	0	5
139341				15	0	15	0
10099				1	0	1	0
23764				1	47	1	96
45474				37	25	37	25
135391				2	0	2	0

« ‹ 1 / 205 › »

AS view

Select ASN: 1916

IXP Name	Member or Reachable	Originated Prefixes	Cone Prefixes	Originated Address space(/24)	Cone Address space(/24)
IX.br Belém	?	85	511	2041	5955
IX.br Boa Vista	?	86	511	2045	5955
IX.br Manaus	?	85	510	2041	5955
IX.br Fortaleza	?	85	430	2806	8593
IX.br Aracaju	?	85	508	2041	5908
IX.br Campina Grande	?	85	511	2041	5955
IX.br Maceió	?	86	511	2045	5955
IX.br Natal	?	85	506	2041	5891
IX.br Recife	?	85	495	2041	5744
IX.br Salvador	?	85	508	2806	9002
IX.br São Luís	?	86	510	2045	5954
IX.br Teresina	?	85	508	2041	5951
IX.br Brasília	?	85	495	2041	5733
IX.br Campo Grande	?	86	508	2045	5908
IX.br Cuiabá	?	85	497	2041	5881
IX.br Goiânia	?	85	494	2041	5744
IX.br São Paulo	?	86	397	2810	8107
IX.br Rio de Janeiro	?	166	485	2043	5448
IX.br Belo Horizonte	?	85	484	2041	5565
IX.br Vitória	?	85	506	2041	5906
IX.br Curitiba	?	85	421	2806	7916
IX.br Florianópolis	?	169	557	2048	5244
IX.br Porto Alegre	?	85	372	2041	4876

Research Study

Benefits of peering

Network benefits of peering

Let's suppose a new network wants to join an IXP. We want to understand the benefits to the incoming network and the benefits to other networks?

- Number of hops to other networks
- Number of networks reachable
- Route stability and redundancy
- Latency to other peers
- Latency to content providers and CDNs (present at the IXP)
- Reachability over transit vs reachability over peering

Expected outcome: *A "calculator" that network operators can use to estimate their networking benefits.*

Economic benefits of peering

- **Cost-benefit analysis**: Estimate the "financial" benefit of using a peering link instead of a transit link, using existing datasets on pricing.

- **Economic impact of IXPs**: Estimate the longer-term impact of IXPs on the local Internet ecosystem. (E.g. affordability, Internet penetration, infrastructure).

The 50/50 Vision

The 50/50 Vision

Our 50/50 Vision is our ambitious, yet achievable, vision to keep at least half of all Internet traffic local in selected economies.

When we reach this goal, the people who need it most will have faster, stronger, and cheaper Internet access.

50/50 Vision Partners

With **technical communities**, we seek engagement between local stakeholders to support knowledge exchange and organize events and peering forums to share best practices.

For **policymakers**, we seek policies that promote open markets, foster strong technical communities, and streamline regulatory processes.

The **Internet Society's organization members, individual members, chapters, special internet groups, and partners** play an integral role by taking training courses and defending peering in their communities.

Popular Content Locality

Metrics for the 50/50 Vision

Locality definitions

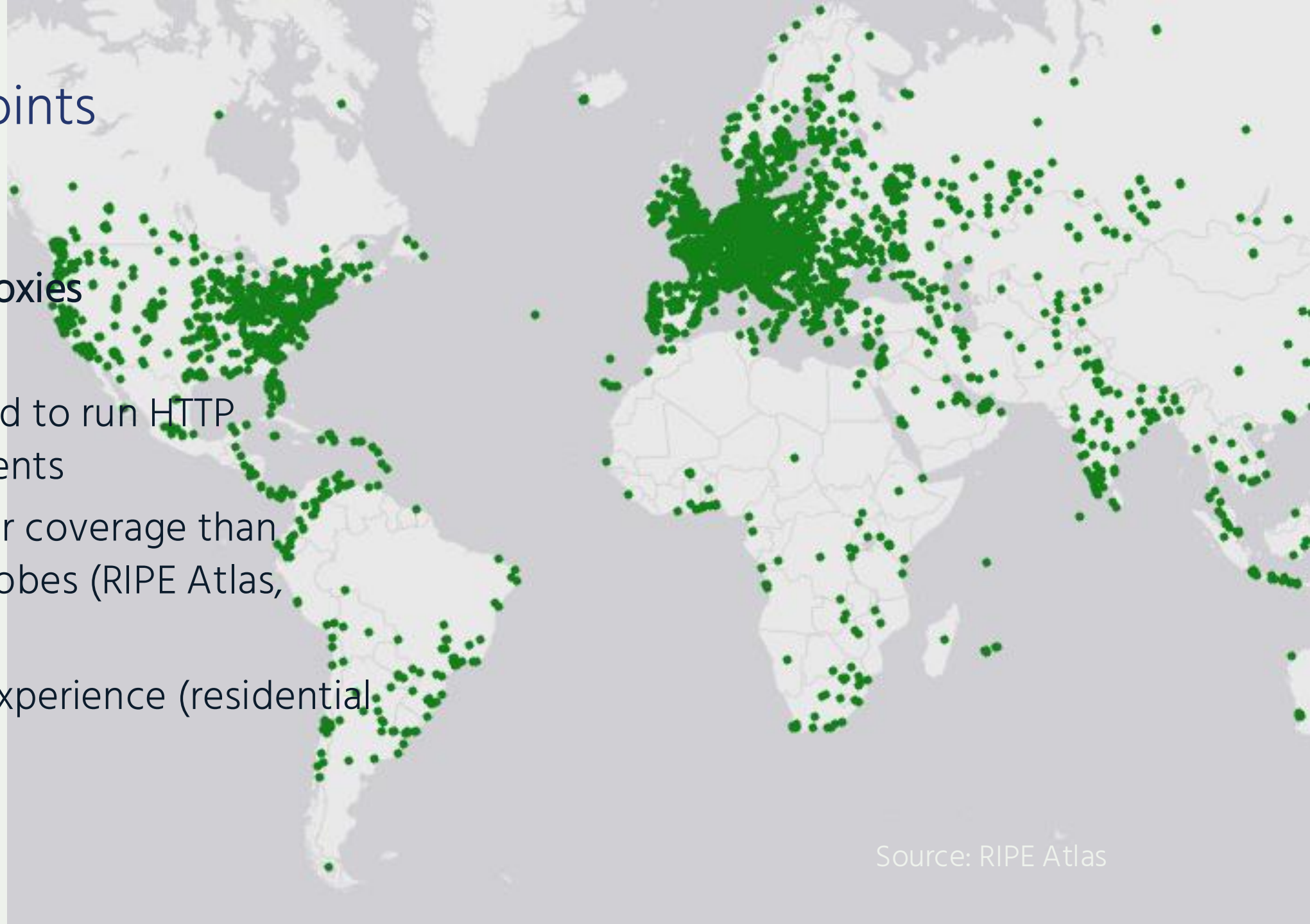
- **Local traffic**: Sourced locally from an in-country server.
- **External traffic**: Sourced from a remote (out-of-country) server.
- **Content Delivery Networks**: operators responsible for delivering content to the edge.
- **Content caches**: content hosting equipment placed by a content provider close to the end-users.
- **Edge Network**: access network where eyeballs (consumers) are located.

https://opentelecomdata.org/cdns/

Vantage points

Residential Proxies

- Can be used to run HTTP measurements
- Much larger coverage than physical probes (RIPE Atlas, OONI, etc)
- Real user experience (residential networks)

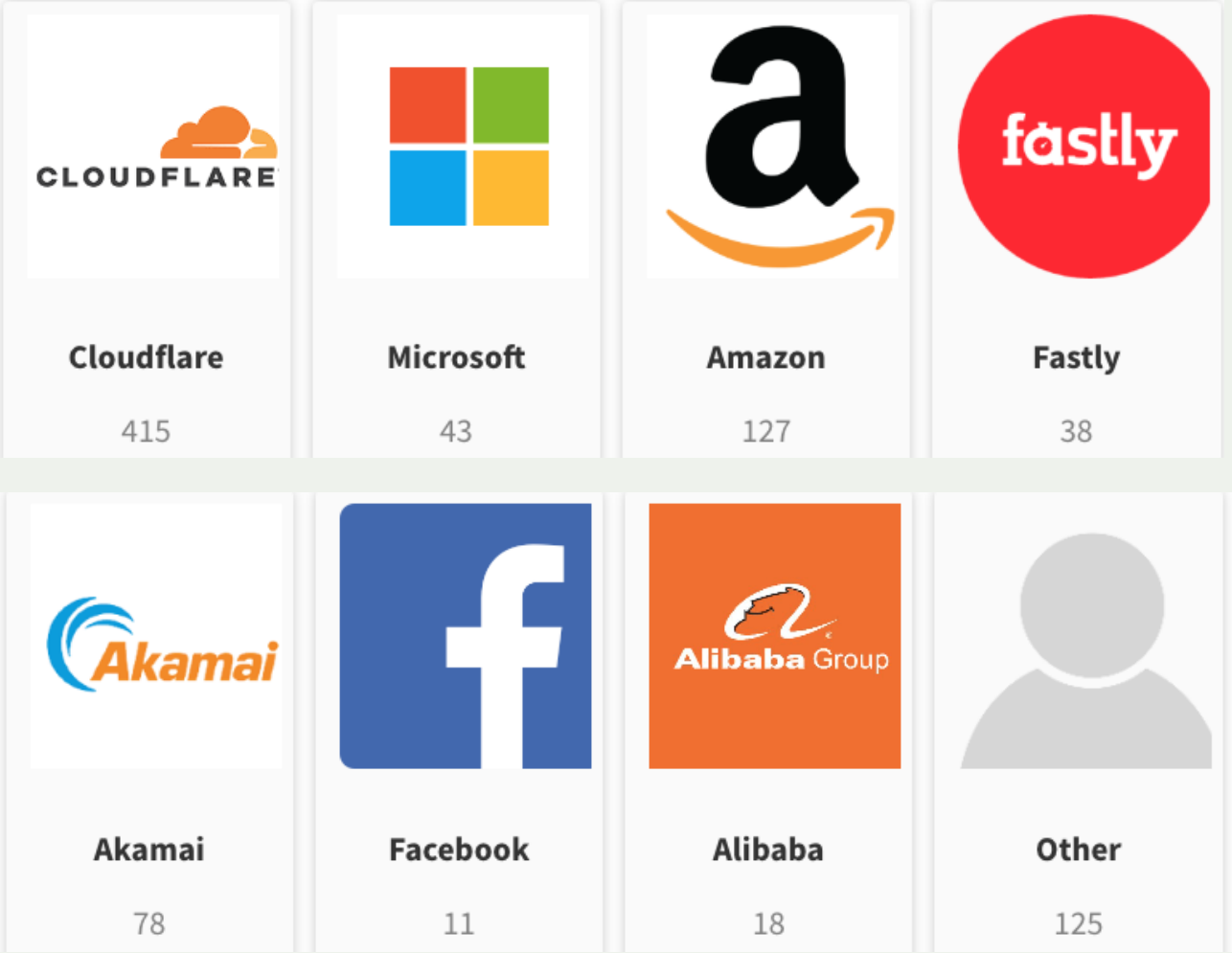


Source: RIPE Atlas

Hosting mode: CDN or Native?

- For all 1000 websites (by country), we run a test to determine the CDN provider.
- We extract CDN information from WHOIS, CNAME, HTTP Header.
- We categorize by CDN provider or "other" for natively hosted websites.

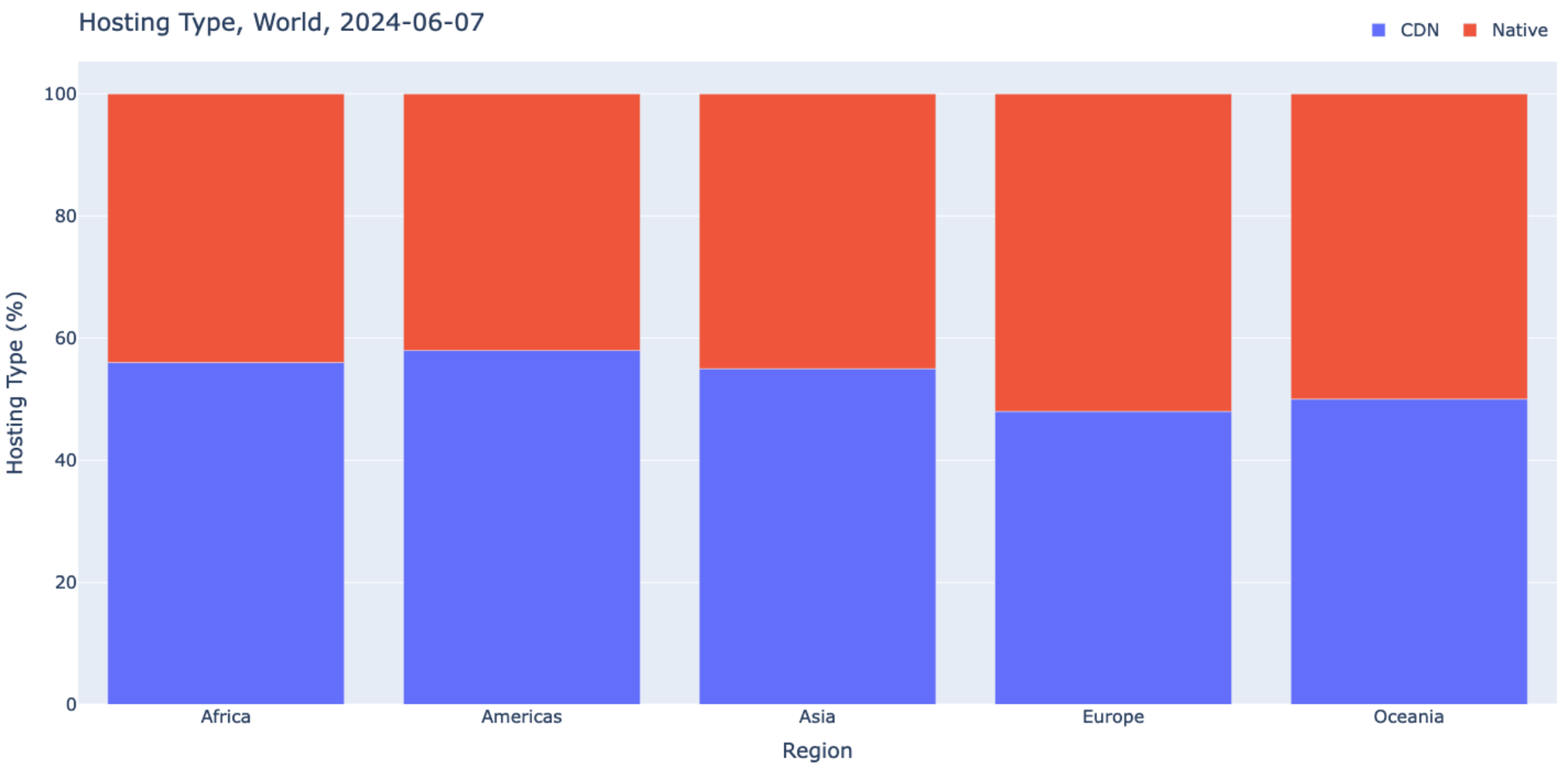
Website hosting in ZA



Source: Pulse

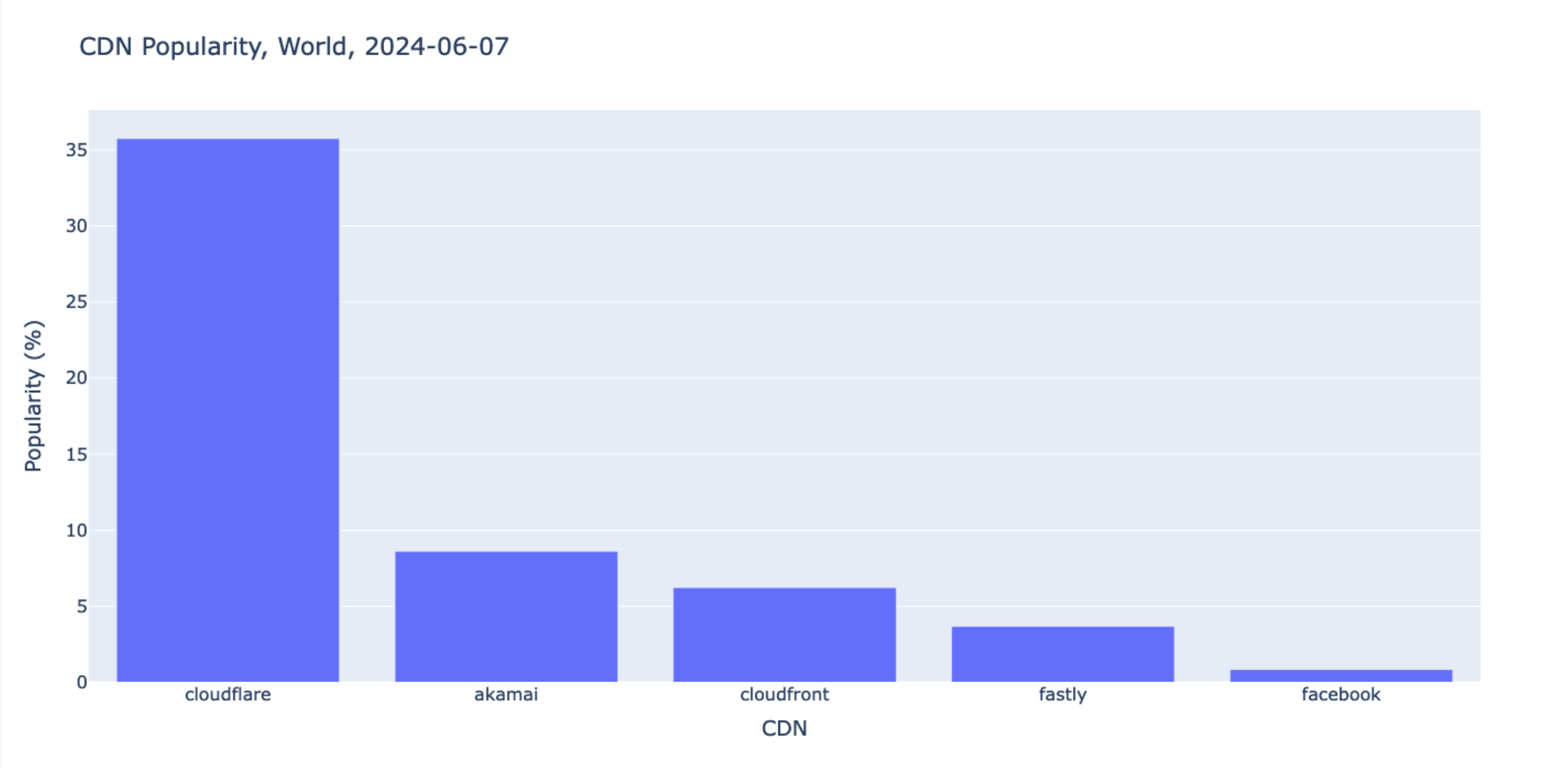
Aggregation

Hosting type (85k unique websites)



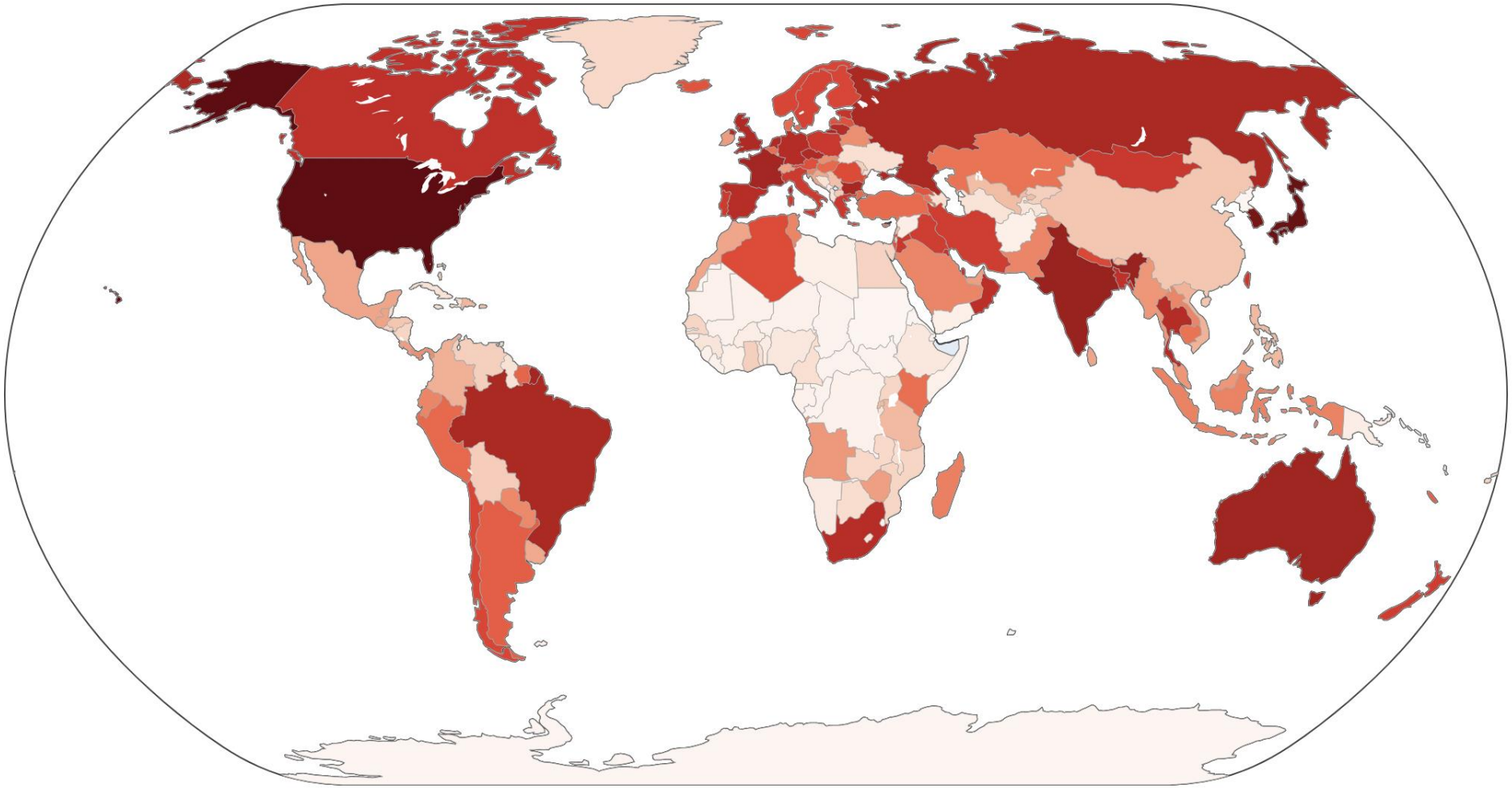
Source: Pulse

Most popular CDNs (World)



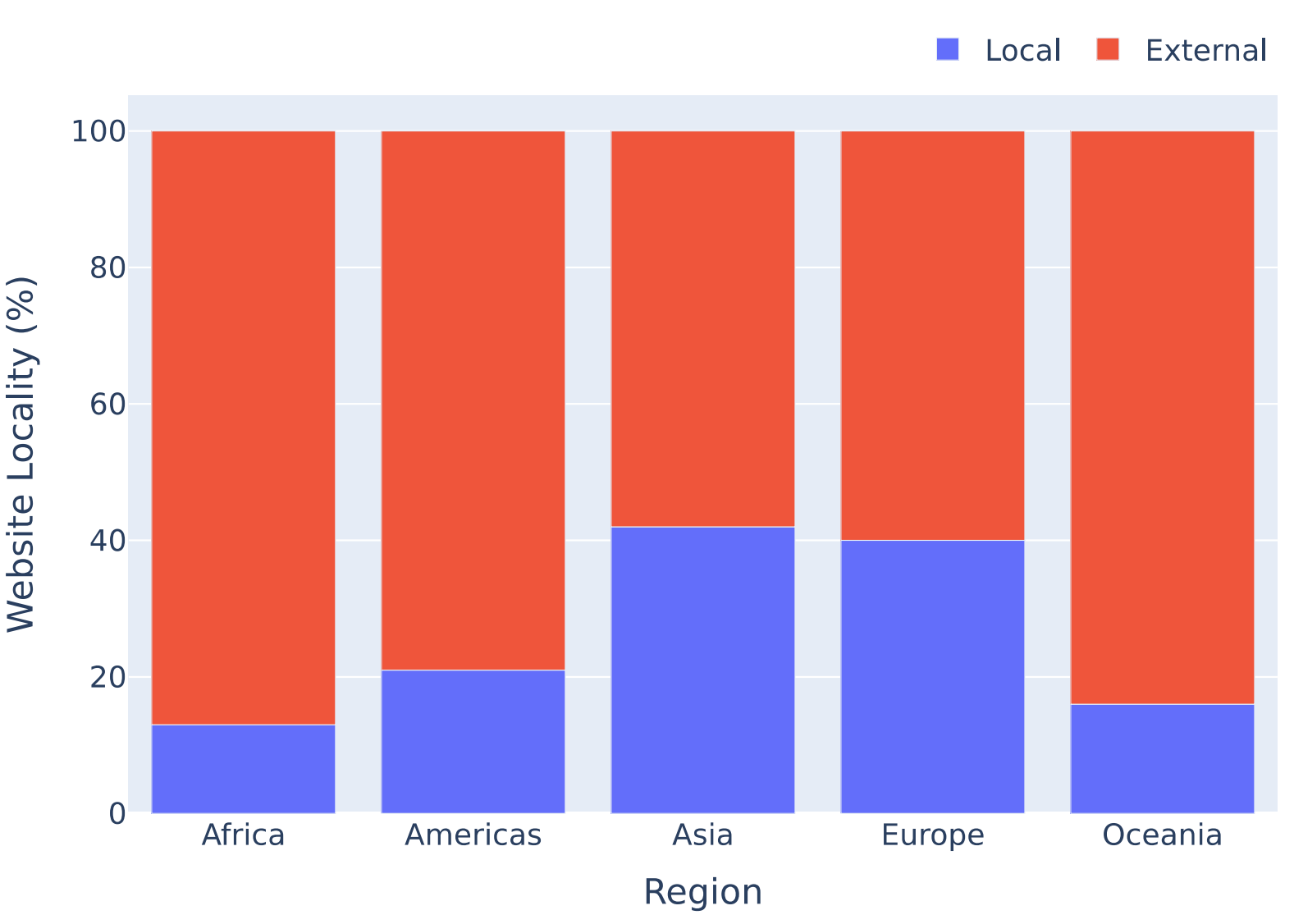
Source: Pulse

Locality (World)



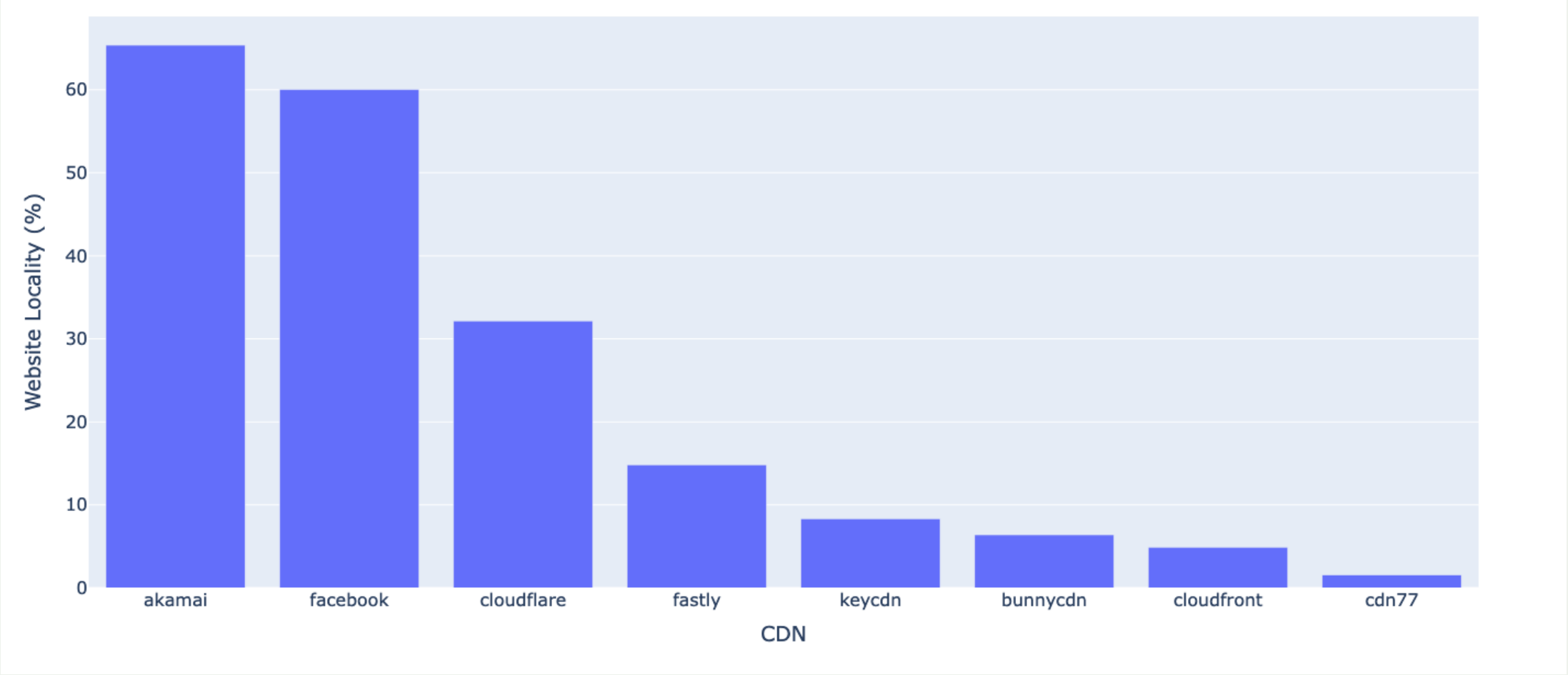
July 2024, Source: Pulse

Locality by region



July 2024
Source: Pulse

Locality ranking of CDNs



July 2024, Source: Pulse

Central Asia metrics

Visualization of content locality in sample countries of the region

How do we help

Achieving Our Goal Together

Grant Program

We fund local communities to:

- Build IXPs in markets where they are needed
- Level-up existing IXPs to realize their full potential
- Develop regional organizations and communities that support peering and interconnection.

Grants assist in training, capacity building, community development, and equipment purchases.

https://www.internetsociety.org/funding-areas/sustainable-peering-ixp/

Our Grant Partners

The Internet Society's work is partially funded by generous grants from Meta, ICANN, and AMS-IX.

Our peering and interconnection work endeavors to:

- Further our 50/50 Vision
- Strengthen our collaboration with regional partners on IXP development

Subscribe, Review, Contribute

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Contribute to Pulse

pulse@isoc.org

Review the Pulse IRI methodology

Thank you.

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