IXP REPORT 2021

European Internet Exchange Association

A report on the situation of IXPs in Europe and a general overview of the global situation

euro-IX

Contents

About Euro-IX

Since it was established in Amsterdam on 28 June, 2001 the European Internet Exchange Association (Euro-IX) has operated as an Association according to Dutch law. Euro-IX is a non-profit association.

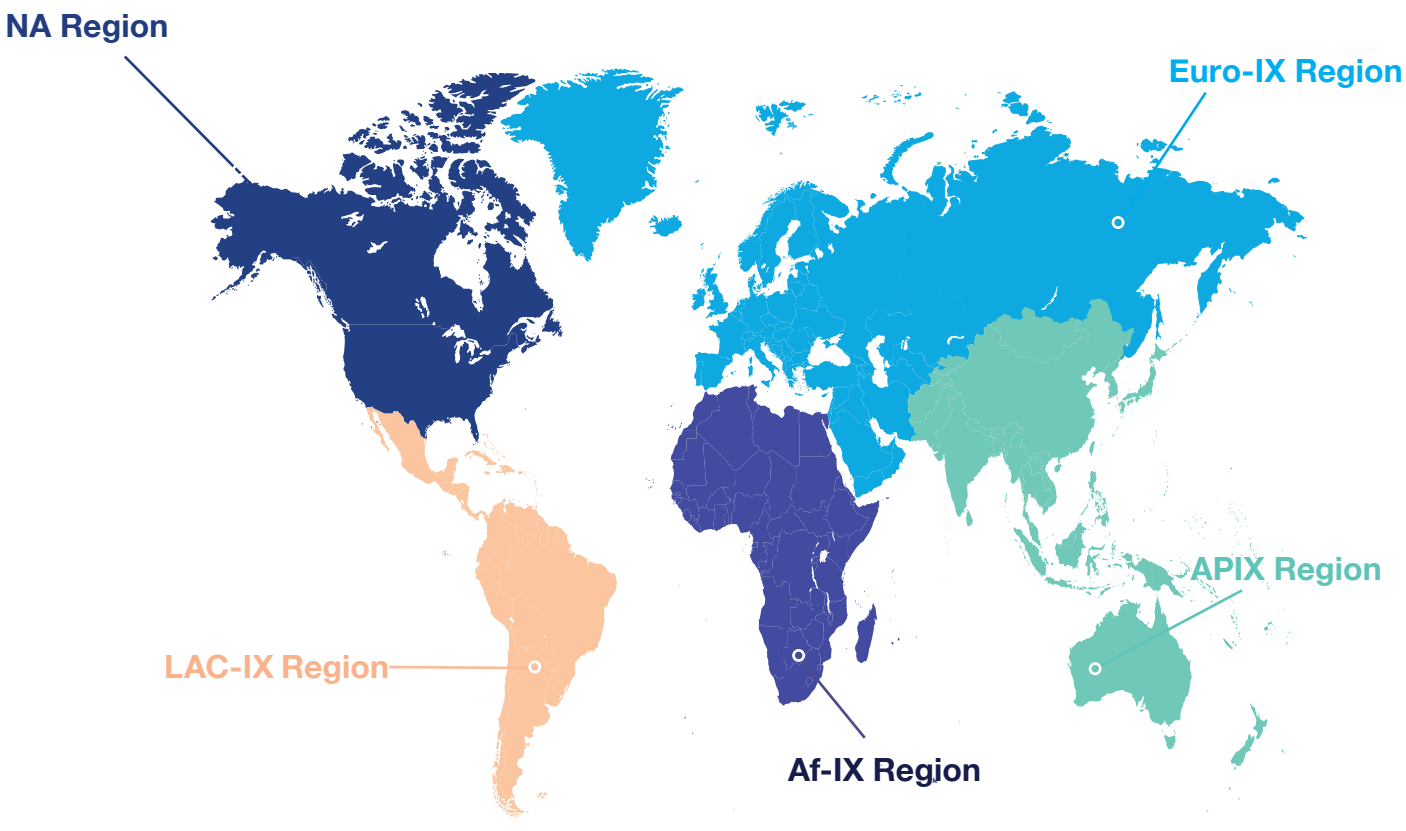
Euro-IX is a focus for the Internet community to share ideas and experiences. It is also a place to coordinate input to technical standards, develop common procedures, and to publish statistics and other useful information. To compile this report on IXPs, we used data from the Internet Exchange Point Database (IXP{DB}) - https://www.ixpdb.net

The IXP{DB} provides data about IXPs. Every hour it collects data directly from IXPs integrate their data with third-party sources to give a deeper view of the global interconnection landscape. It shows networks that have not reported their IXP connections in PeeringDB. It shows which IXPs are MANRS compliant. The combined data can be viewed, analyzed, and exported through this web-based interface and an API.

In 2021, Euro-IX counted 69 Members and 12 Patrons from the IXP-related equipment-vendor and colocation sectors of the community.

The 69 member IXPs are from 48 countries and the affiliations are as follows:

- Standard Members: 39 IXPs from 28 countries
- Associate Members: 8 IXPs from 6 countries (Brazil, Japan, Saudi Arabia, UK, Luxembourg and USA)
- Remote Members: 22 IXPs from 20 countries, including 13 IXPs from Europe (Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Finland, Iceland, Italy, Macedonia, Russia, Serbia, Sweden and UK), 5 from the Af-IX region (Angola, Congo, Kenya, Nigeria, South Africa), 2 IXPs from the APIX region (Australia and Sri Lanka) and 2 IXPs from the LAC-IX region (Costa Rica and Curaçao).



*Note: North America does not yet have an IXP association

1. Introduction

1.1 Foreword

- This report has been compiled by the European Internet Exchange Association (Euro-IX) to give an overview of the current status of IXP deployment in Europe including:
- The number of Internet Exchange Points (IXPs) currently operating in Europe
- Related statistics and trends that are appearing in the European IXP market and a general global overview
- The evolution over the last couple of years

1.2 Notes on this report

- Not all IXPs share their traffic statistics. We have not estimated values where public figures were not presented.
- All information has been gathered on a best effort basis and relies on the information that is provided by individual IXPs. This report is only as accurate as the information that has been published by these IXPs. If you want to base decisions on this information contained in this report, we advise you to check the information against up-to-date data.
- Not all IXPs measure their peak traffic using the same periodic average or use the same method. Most IXPs choose to take samples every five minutes, some have chosen to take these samples more or less frequently.
- A best effort was made to list all known operational IXPs in Europe. We might not know of some IXPs and so they do not appear in the list (Appendix 1). We welcome any information about IXPs missing from this report.
- Some IXPs that were listed in the 2020 report have not been included in this edition because we could not contact them to verify if they are still operational. We also removed IXPs without a working website or if we were told that they are no longer operational.

1.3 Internet Exchange Point (IXP)

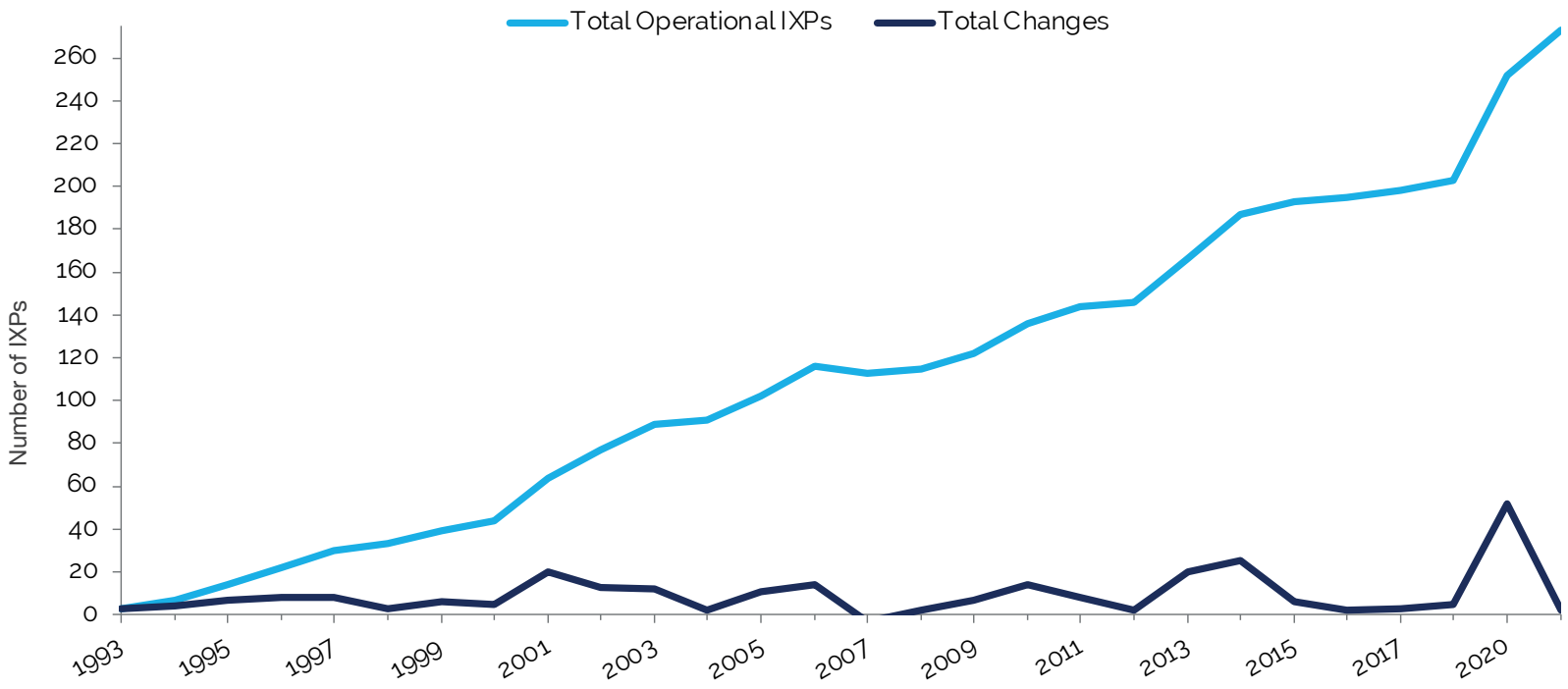
Euro-IX has accepted the Internet Exchange Federations (IX-F) definition of an IXP being:

“A network facility that enables the interconnection and exchange of Internet traffic between more than two independent Autonomous Systems. An IXP provides interconnection only for Autonomous Systems. An IXP does not require the Internet traffic passing between any pair of participating Autonomous Systems to pass through any third Autonomous System, nor does it alter or otherwise interfere with such traffic.”

2. Situation of IXPs

2.1 Number of Operational IXPs in Europe

» IXP Growth in Europe over 10 years



Graph 2.1.1

YEAR	IXPs STARTED	IXPs CLOSED OR INACTIVE	GROWTH	OPERATIONAL
2011	8	0	8	144
2012	2	0	2	146
2013	22	2	20	166
2014	37	16	21	187
2015	17	11	6	193
2016	44	12	32	225
2017	5	2	3	198
2018	7	2	5	203
2019	21	2	19	224
2020	59	7	52	255
2021	**17**	**2**	**15**	**273**

Table 2.1.1

OPERATIONAL IXPs IN EUROPE

The number of operational IXPs in Europe has increased by 89% over the past 10 years, going from 144 in 2011, to 273 in 2021. 2020 saw significant growth for IXPs, partially due to the number of IXPs added to the IXP[DB].

90%

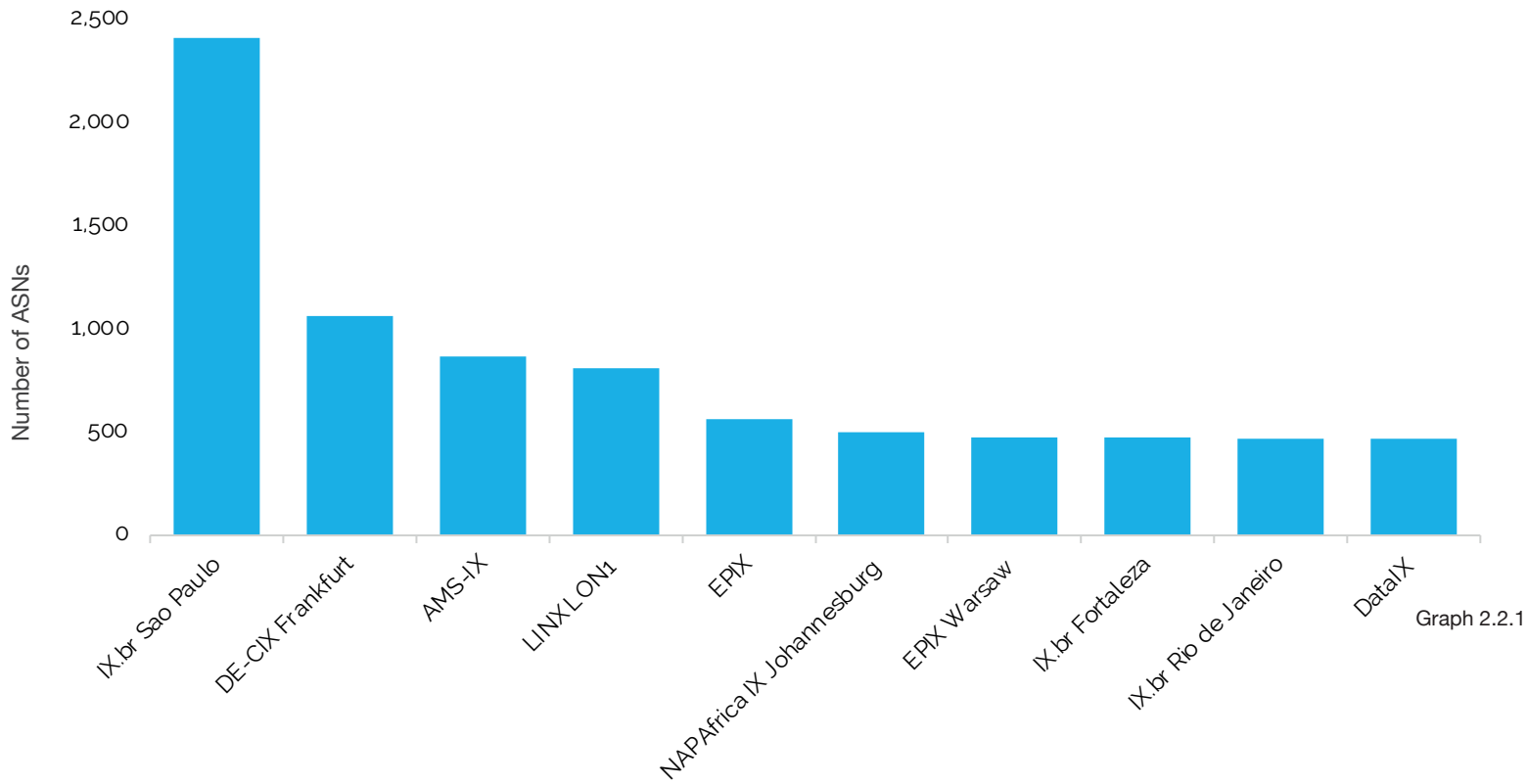
GROWTH IN 2021

There was a 7% increase in the number of active IXPs, from 2020 to 2021.

7%

2.2 Number of connected parties globally - Top 10 by IXP

» The data below show the top 10 IXPs by connected parties globally. More complete data can be found in the IXP{DB}.



Graph 2.2.1

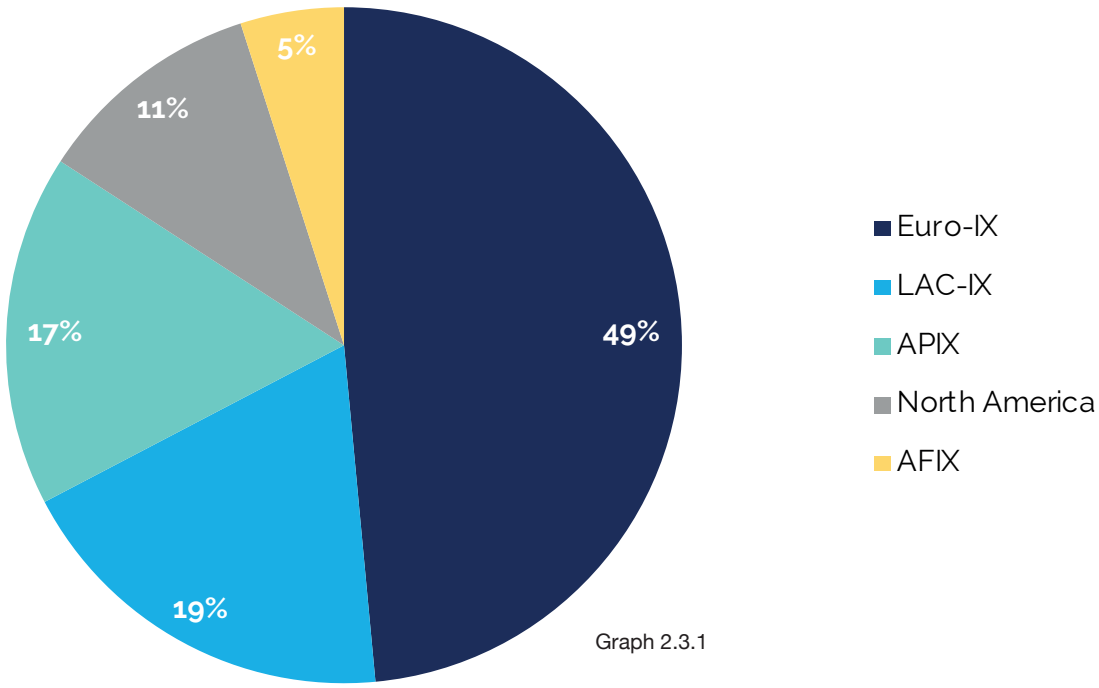
This data shows the total listed ASNs globally. The highest participants' distribution is from IX.br - São Paulo, Brazil, with 2,413 ASNs, followed by DE-CIX Frankfurt with 1,065 ASNs connected. There has been a steady growth of participants at IX.br with 1,900 ASNs connected in 2019 and 2,203 in 2020.

	IXP	Number of listed ASNs
1	IX.br São Paulo	2,413
2	DE-CIX Frankfurt	1,065
3	AMS-IX	868
4	LINX LON1	811
5	EPIX	561
6	NAPAfrica IX Johannesburg	502
7	EPIX Warsaw	475
8	IX.br Fortaleza	474
9	IX.br Rio de Janeiro	470
10	DataIX	467

Table 2.2.1

Note: If you see that an IXP is missing, please speak to us or the IXP to get their data included.

2.3 Number of connected parties by Association

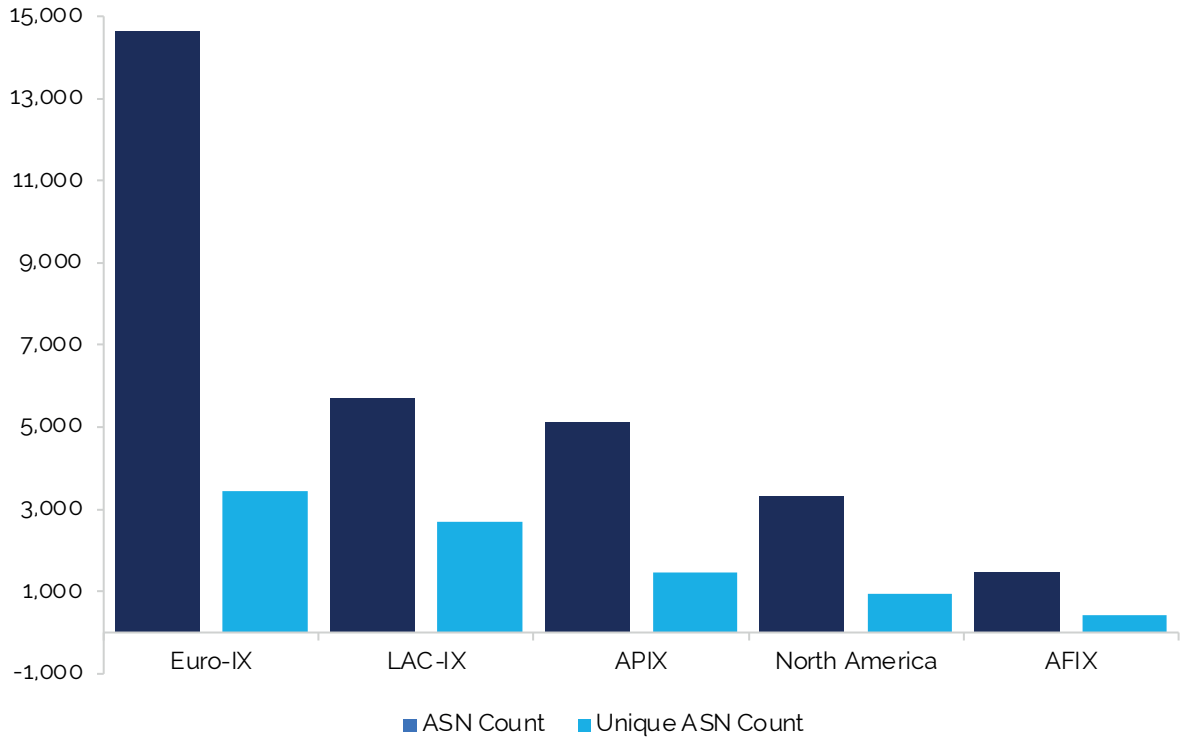


Graph 2.3.1

Association	ASN count	% of ASN
Euro-IX	14,688	49%
LAC-IX	5,701	19%
APIX	5,092	17%
North America	3,291	11%
AFIX	1,446	5%

Table 2.3.1

The data shows the distribution of connected parties by Association (Euro-IX, Af-IX, APIX, LACIX and North America). From the data, you can see that the Euro-IX region has the most connected parties with 14,688 ASNs, this makes up a 49% share of globally connected parties. This is followed by LAC-IX with 5,701 ASNs, making up 19% of all connected parties.



Graph 2.3.2

Unique ASNs are connected parties that are present at one IXP and not at another. From the data below, you can see that although the Euro-IX region has the most unique ASNs, LAC-IX has the largest share in comparison to their ASN count.

Association	ASN count	Unique ASNs
Euro-IX	14,688	3,438
LAC-IX	5,701	2,691
APIX	5,092	1,455
North America	3,291	938
AFIX	1,446	421

Table 2.3.2

2.4 MANRs Compliance

» IXPs who are MANRs Compliant in the IXP{DB}

*New Metric

MANRS COMPLIANCE - EURO-IX REGION

26%

MANRS COMPLIANCE - ALL REGIONS

53%

2020 - 2021 GROWTH

33%

Of the 273 IXPs in the Euro-IX region, the IXP{DB} indicates that 71 are MANRS compliant.

In 2021, there were a total of 725 IXPs in the IXP{DB}, 145 of these were MANRs compliant (including the IXPs in the Euro-IX region).

There was a 33% increase in IXPs who are MANRs compliant in the IXP{DB}, going from 109 in 2020 to 145 in 2021

IXPB Data	2020	2021
Total IXPs	651	725
New IXPs added	59	74
MANRS Compliant IXPs	109	145

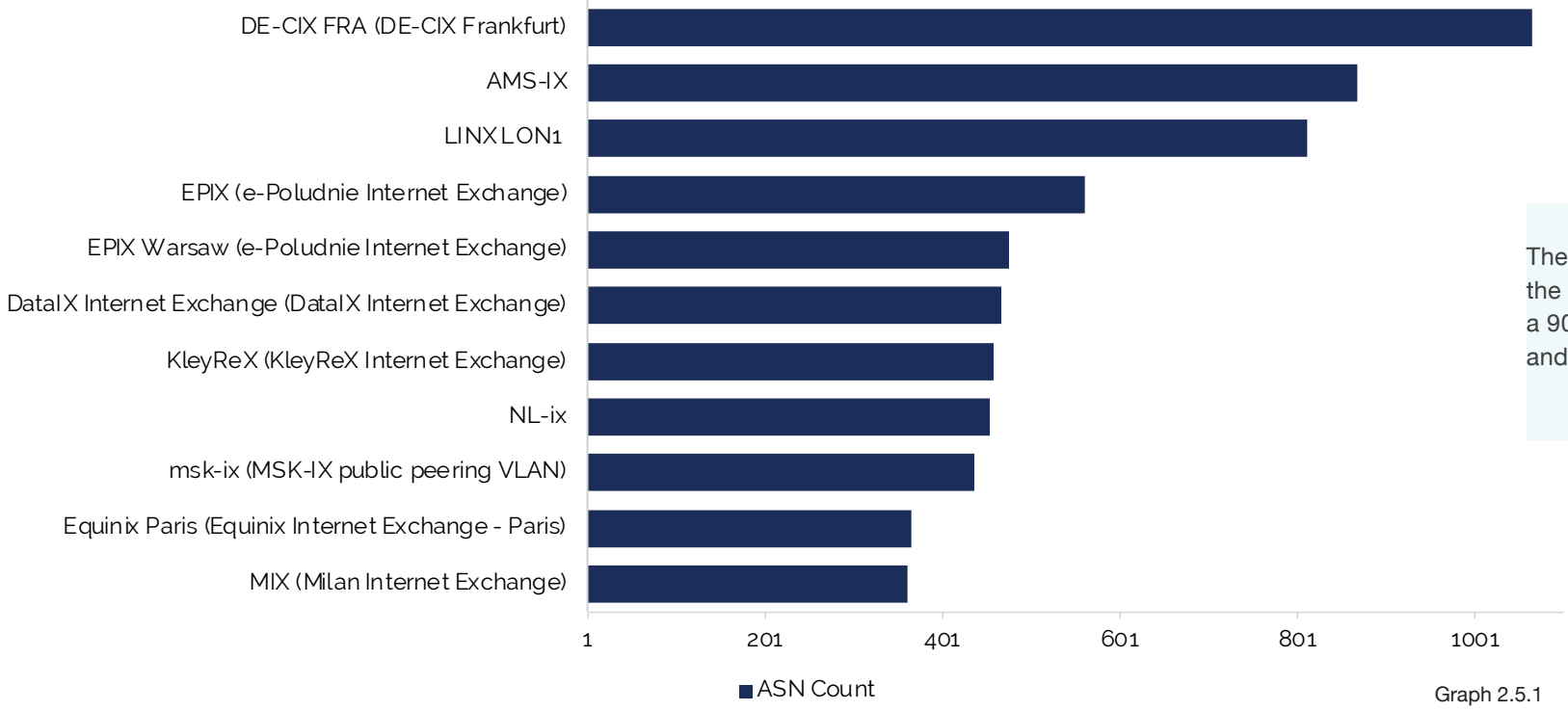
Table 2.4.1

Learn more about the MANRS Program

2.5 Number of connected parties by Association - Top 10 by IXP

» Top 10 IXPs by connected parties in the Euro-IX region

» Euro-IX Region



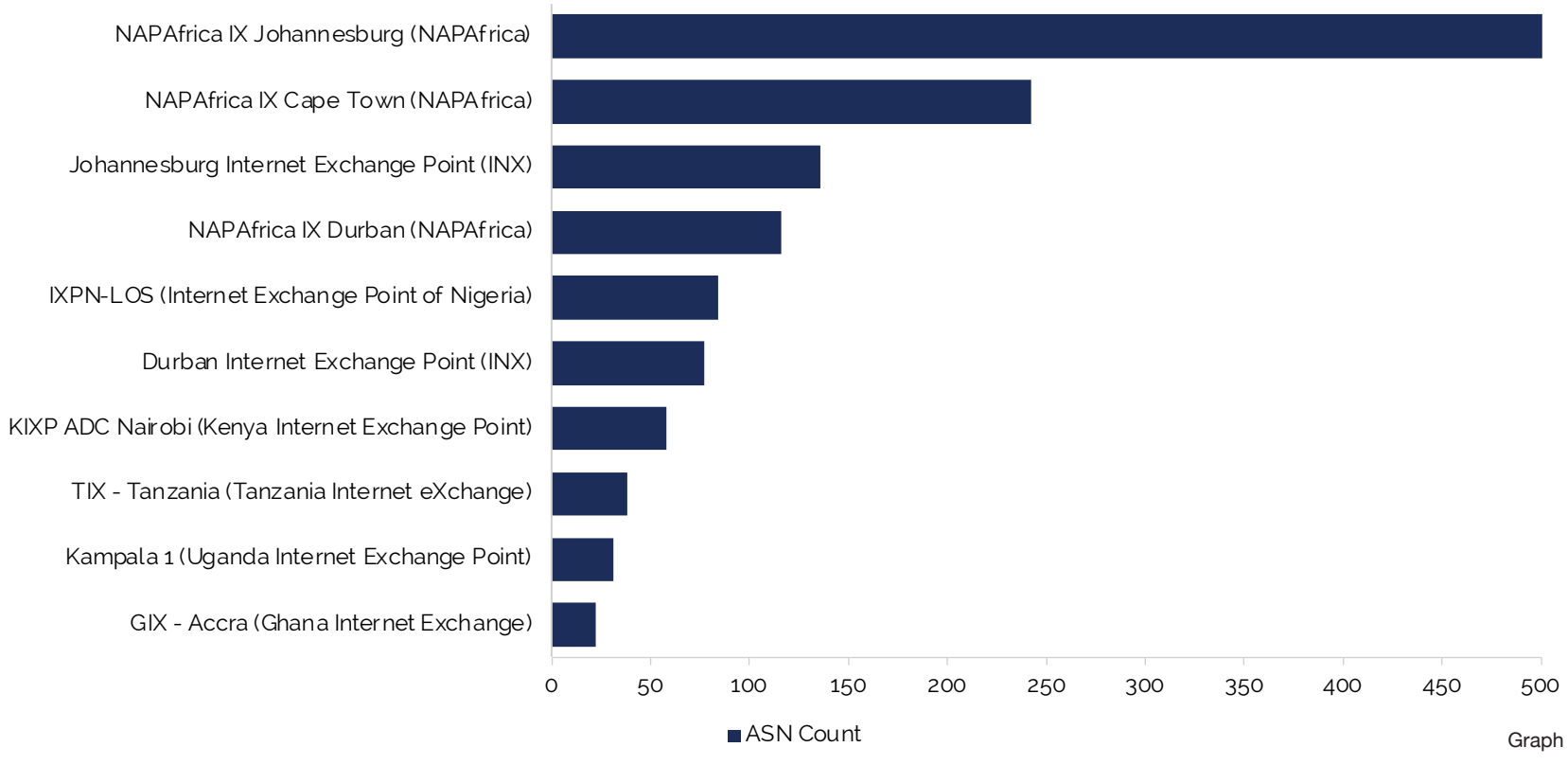
Graph 2.5.1

The data here shows the total listed ASNs in the Euro-IX region at the end of 2021. There is a 90% difference between the top three IXPs and EPIX.

#	IXP	Number of listed ASNs
1	DE-CIX Frankfurt	1,065
2	AMS-IX	868
3	LINX LON1	811
4	EPIX	561
5	EPIX Warsaw	475
6	DataIX Internet Exchange	467
7	KleyReX	458
8	NL-ix	454
9	MSK-IX	437
10	Equinix Paris	366

Table 2.5.1

» Af-IX Region



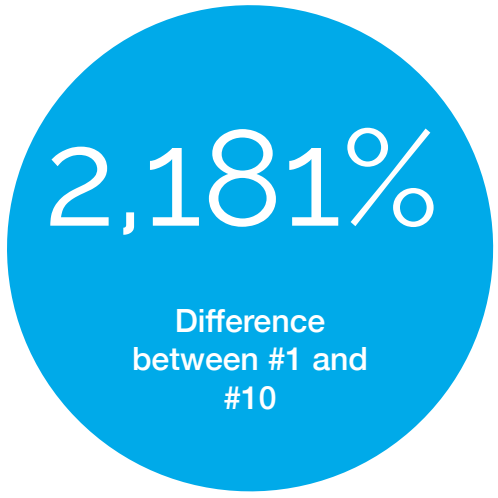
Graph 2.5.2

In Africa, we see that NAPAfrica IX holds the top two spots for the most connected parties, followed by INX in third place with 136 listed ASNs.

ASNs in this region are asigned by AFRINIC. The proportion of ASNs assigned to networks based in South Africa on 31 December 2021 was 672 of 3,326 - about 20%.[1]

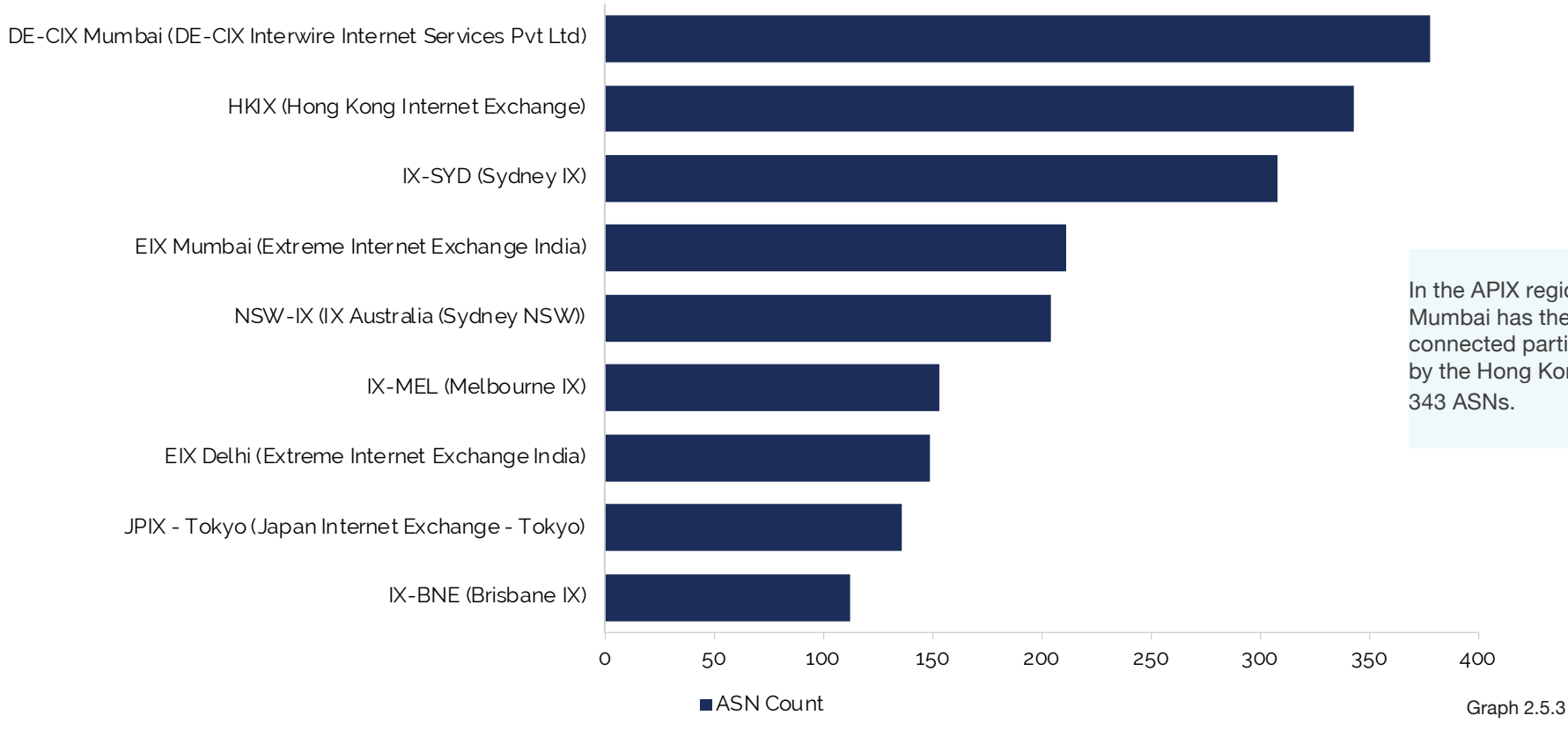
#	IXP	Number of listed ASNs
1	NAPAfrica IX Johannesburg (NAPAfrica)	502
2	NAPAfrica IX Cape Town (NAPAfrica)	242
3	Johannesburg Internet Exchange Point (INX)	136
4	NAPAfrica IX Durban (NAPAfrica)	116
5	IXPN-LOS (Internet Exchnage Point of Nigeria)	84
6	Durban Internet Exchange Point (INX)	77
7	KIXP ADC Nairobi (Kenya Internet Exchange Point)	58
8	TIX - Tanzania (Tanzania Internet eXchange)	38
9	Kampala 1 (Uganda Internet Exchange Point)	31
10	GIX - Accra (Ghana Internet Exchange)	22

Table 2.5.2



— [1] AFRINIC daily stats file published on their FTP site

» APIX Region



In the APIX region, we see that DE-CIX Mumbai has the most ASNs with 378 connected parties. This is closely followed by the Hong Kong Internet Exchange with 343 ASNs.

Graph 2.5.3

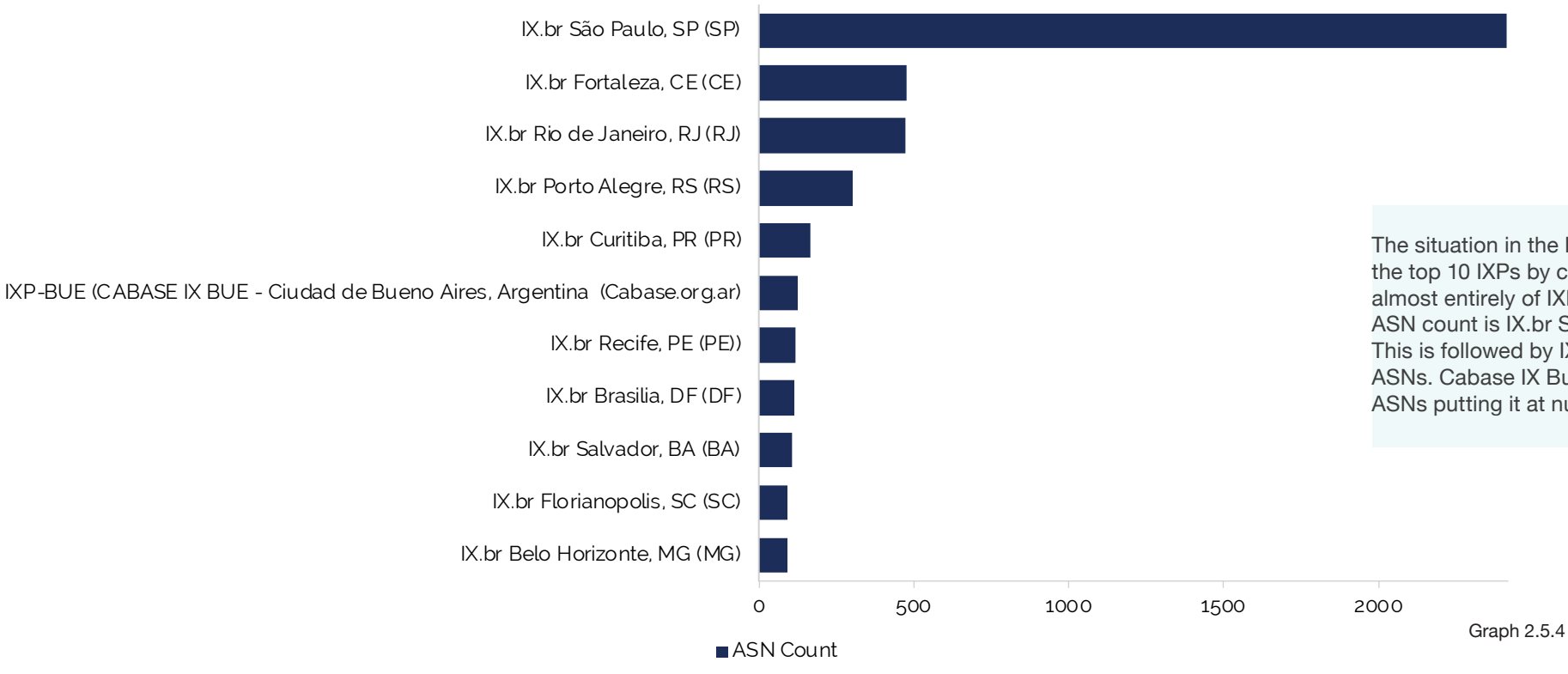
#	IXP	Number of listed ASNs
1	DE-CIX Mumbai (DE-CIX Interwire Internet Services Pvt Ltd)	378
2	HKIX (Hong Kong Internet Exchange)	343
3	IX-SYD (Sydney IX)	308
4	EIX Mumbai (Extreme Internet Exchange India)	211
5	NSW-IX (IX Australia (Sydney NSW))	204
6	IX-MEL (Melbourne IX)	153
7	EIX Delhi (Extreme Internet Exchange India)	149
8	JPIX - Tokyo (Japan Internet Exchange - Tokyo)	136
9	IX-BNE (Brisbane IX)	112

Table 2.5.3

238%

Difference between #1 and #10

» LAC-IX Region



Graph 2.5.4

The situation in the LAC-IX region is unique as the top 10 IXPs by connected parties is made up almost entirely of IXPs from IX.br. The top IXP by ASN count is IX.br São Paulo with 2413 ASNs. This is followed by IX.br Fortelaza with 474 ASNs. Cabase IX Bue breaks up this list with 125 ASNs putting it at number 6 on the top 10 list.

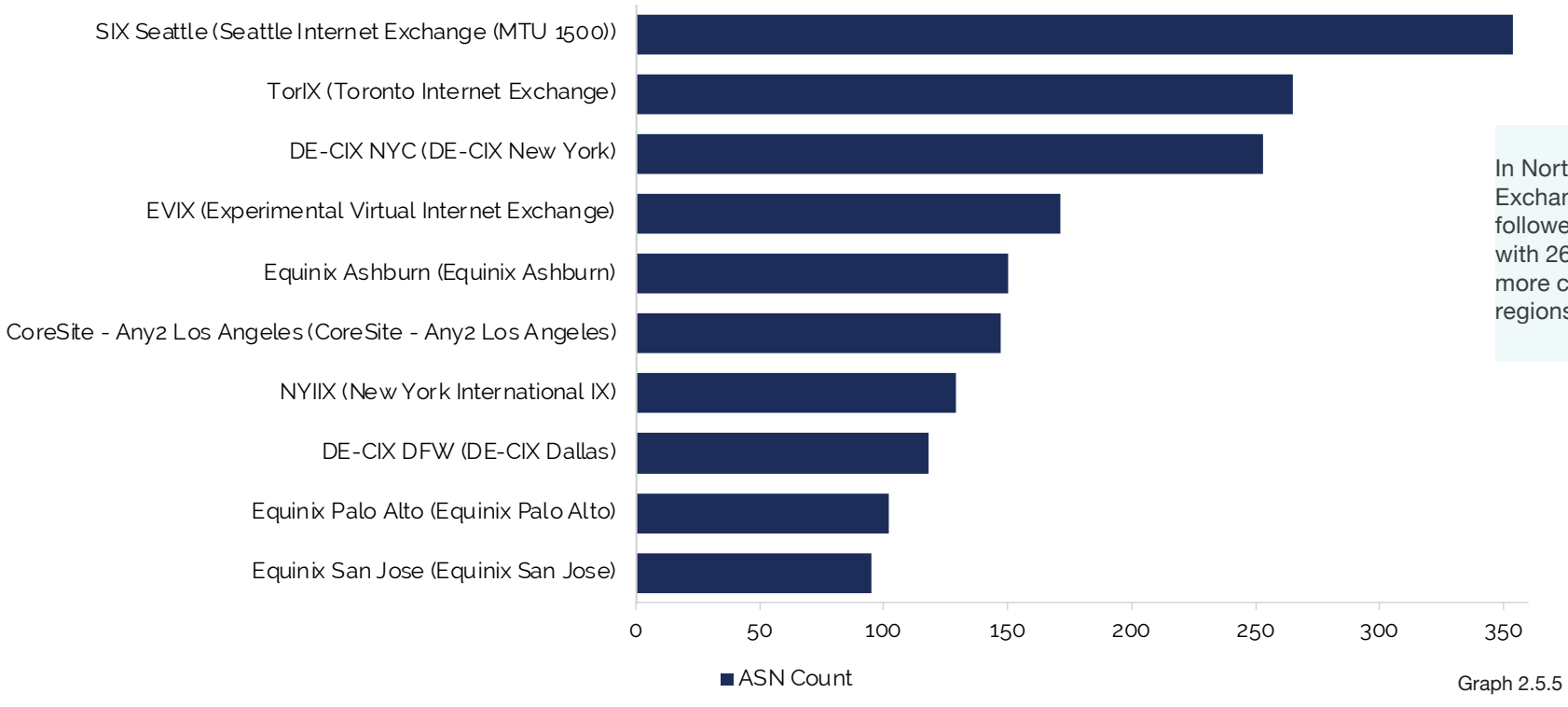
#	IXP	Number of listed ASNs
1	IX.br São Paulo, SP (SP)	2,413
2	IX.br Fortaleza, CE (CE)	474
3	IX.br Rio de Janeiro, RJ (RJ)	470
4	IX.br Porto Alegre, RS (RS)	301
5	IX.br Curitiba, PR (PR)	166
6	IXP-BUE (CABASE IX BUE - Ciudad de Bueno Aires, Argentina (Cabase.org.ar)	125
7	IX.br Recife, PE (PE)	118
8	IX.br Brasilia, DF (DF)	112
9	IX.br Salvador, BA (BA)	106
10	IX.br Belo Horizonte, MG (MG)	92

Table 2.5.4

2,522%

Difference between #1 and #10

» North America Region

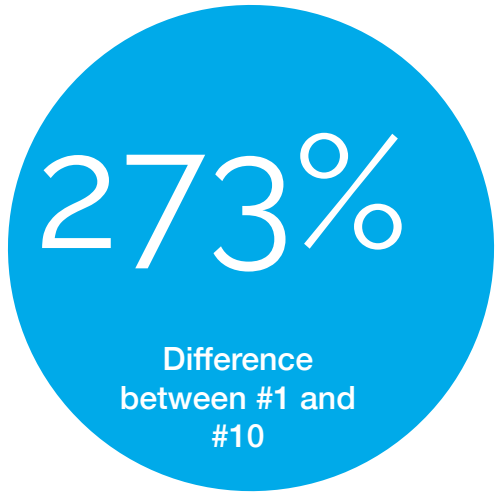


Graph 2.5.5

In North America, the Seatle Internet Exchange has the most ASNs at 354, followed by the Totonto Internet Exchange with 265. The top 10 numbers here are more close together in comparison to other regions.

#	IXP	Number of listed ASNs
1	SIX Seattle (Seattle Internet Exchange (MTU 1500))	354
2	TorIX (Toronto Internet Exchange)	265
3	DE-CIX NYC (DE-CIX New York)	253
4	EVIX (Experimental Virtual Internet Exchange)	171
5	Equinix Ashburn (Equinix Ashburn)	150
6	CoreSite - Any2 Los Angeles (CoreSite - Any2 Los Angeles)	147
7	NYIIX (New York International IX)	129
8	DE-CIX DFW (DE-CIX Dallas)	118
9	Equinix Palo Alto (Equinix Palo Alto)	102
10	Equinix San Jose (Equinix San Jose)	95

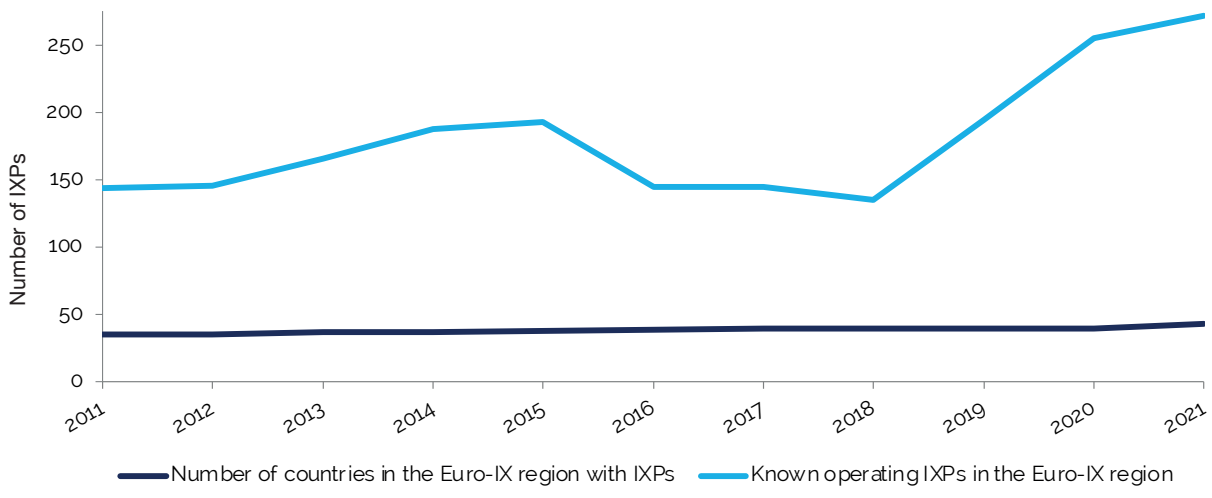
Table 2.5.5



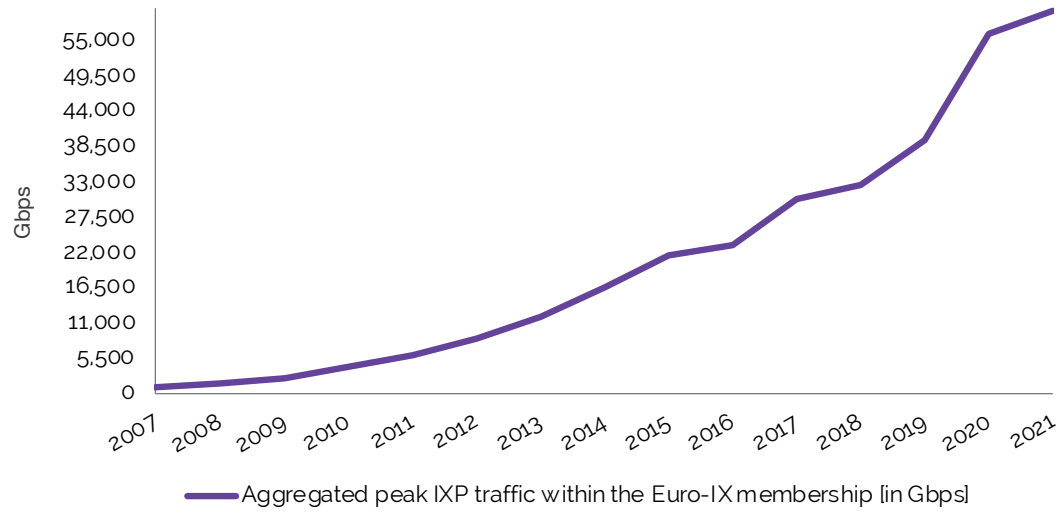
3. Global Traffic Statistics

3.1 Traffic Statistics in Europe

» Traffic growth over 10 years among Euro-IX membership



Graph 3.1.1



Graph 3.1.2

The average number of IXPs we collected data from was 56. These include Euro-IX members and “sub-members”, i.e. other IXPs or PoPs operated by our members in Europe, such as LINX Manchester, Netnod Gothenburg etc.

Note: the aggregated peak traffic volume is determined by collecting publicly available traffic statistics from Euro-IX Member IXPs. The data was captured during 12-month periods, from January to December each year, and varied from one month to the other depending on the data available. Please refer to section 1.2 for details on how traffic data is collected.

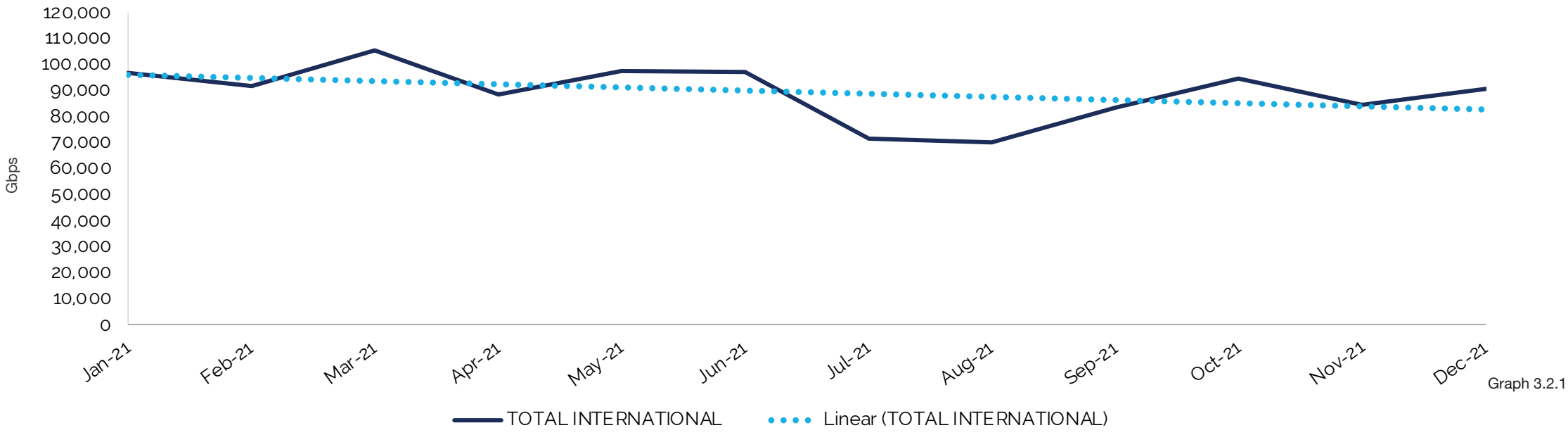
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Known operating IXPs in Europe	144	146	166	188	193	225	198	203	224	255	273
Number of countries in Europe with IXPs	35	38	43	48	48	49	49	42	40	40	43
Average number of IXPs we collected traffic data from in 2021	44	43	45	54	55	58	54	57	56	56	68
Average aggregated peak traffic per year within Euro-IX membership (in Gbps)	6,080	7,629	10,515	13,877	18,765	23,192	26,136	27,117	34,342	45,325	59,592
Maximum aggregated peak traffic per year within the Euro-IX membership (in Gbps)	7,072	9,099	11,903	16,169	21,469	27,198	30,987	30,009	39,609	56,172	72,493

Table 3.1.1

3.2 Global Traffic Statistics

» Total Aggregated Global Traffic Statistics (in Gbps)

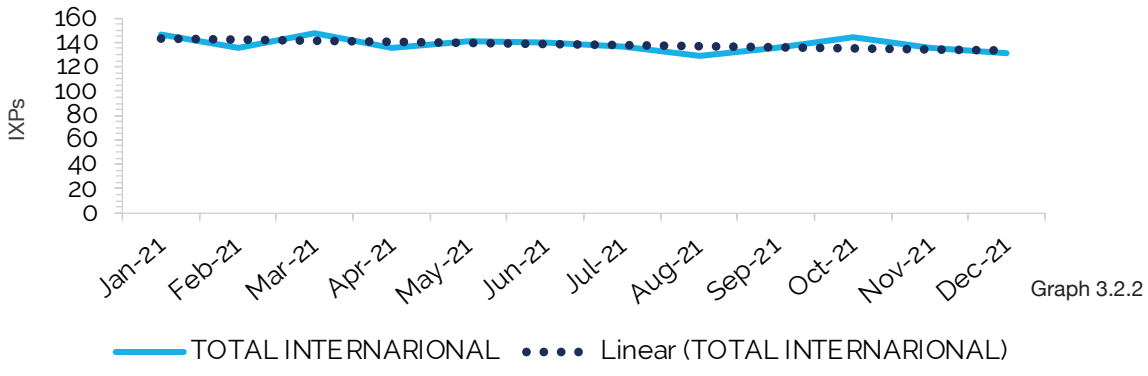
These charts show general trends based on reported data. Not all IXPs report data or use the same measurement intervals. These charts should be used to understand trends in data flows and not to place boundaries on total traffic passing through IXP infrastructure.



Graph 3.2.1

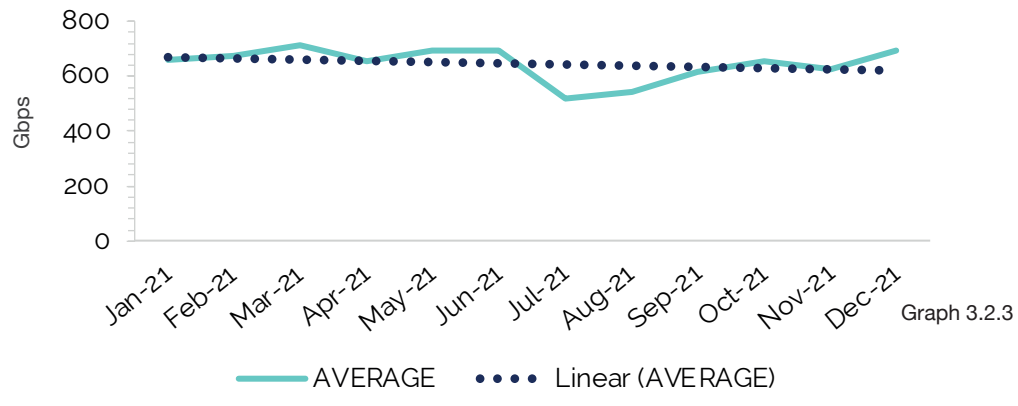
The average peak per IXP decreased from 96,846 Gbps in January to 90,660 in December, there were some minor peaks and troughs, which can be attributed to the "lockdown" and "relaxing of lockdown" measures around the world. However, traffic increased worldwide largely due to an increase in digital activities.

» Number of IXPs monitored worldwide



Graph 3.2.2

» Average Peak traffic per IXP (in Gbps)



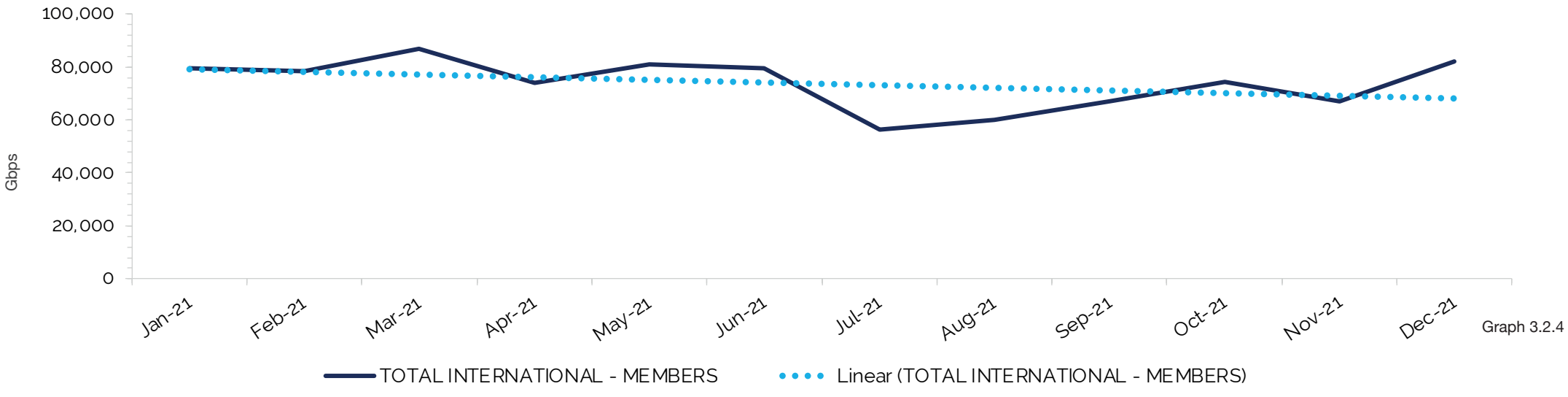
Graph 3.2.3

The number of IXPs monitored fluctuated throughout the year, starting with 147 in January, decreasing to 131 in December. However, looking at the chart, you can see that the number of IXPs monitored remained fairly stable.

The average peak traffic per IXP increased by 5%, going from 658 Gbps to 692 Gbps.

The averages shown above are therefore not representative for most of the Exchanges and the IXP community remains diverse.

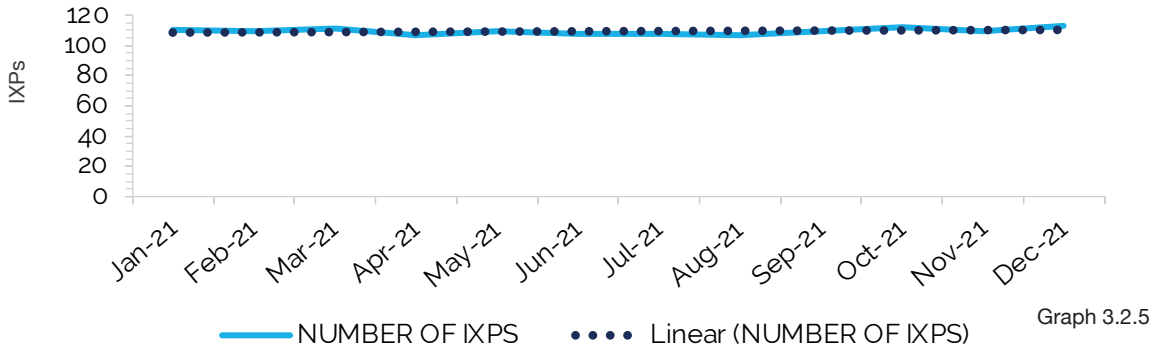
» Traffic - All Euro-IX Members (in Gbps)



Graph 3.2.4

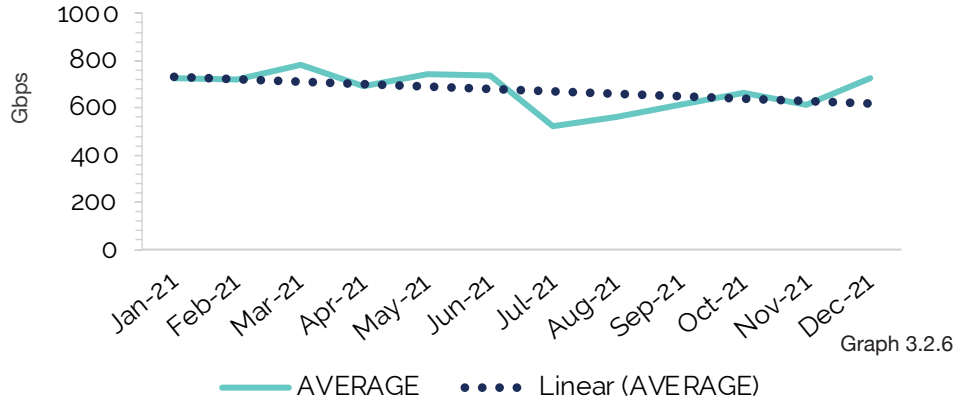
In the Euro-IX region, the average peak per IXP increased from 79,621 Gbps in January to 81,968 Gbps in December. The peaks and troughs generally follow the same pattern as that in the global traffic.

» Number of IXPs monitored - All Euro-IX Members



Graph 3.2.5

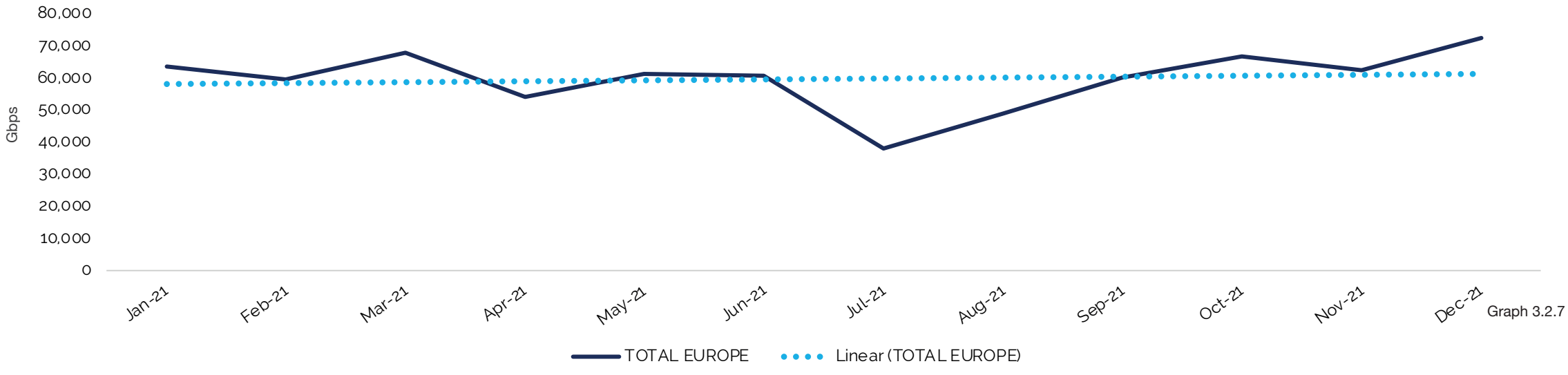
» Average Peak traffic per IXP (in Gbps)



Graph 3.2.6

The number of IXPs monitored throughout the year was fairly stable, going from 110 in January, slightly decreasing to 109 in December. The average peak traffic per IXP increased by 0.1%, going from 724 Gbps in January to 725 Gbps in December. The traffic peaks ranged from 74 Mbps to 11,006 Tbps in January and 75 Mbps to 15,220 Tbps in December.

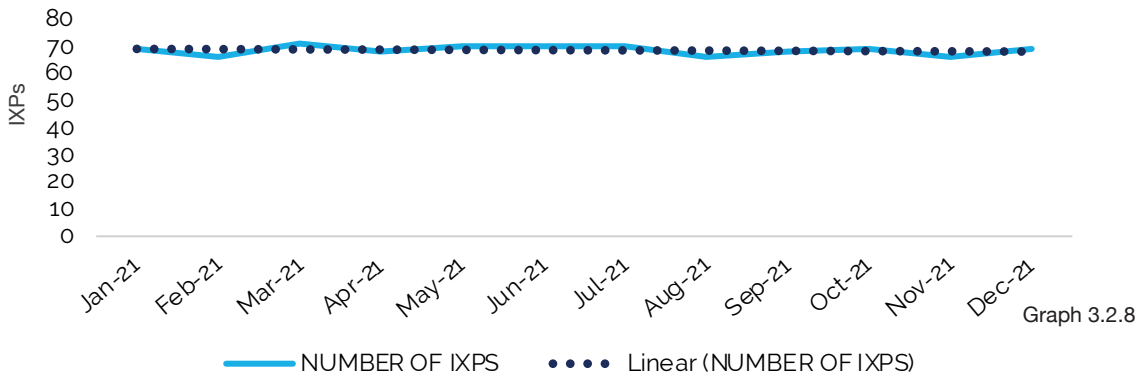
» Total Aggregated Traffic in the Euro-IX Region (in Gbps)



Graph 3.2.7

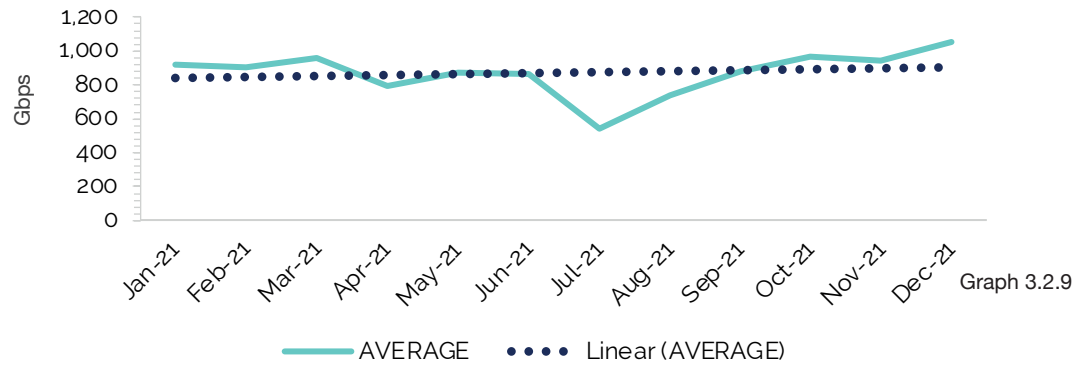
In the Euro-IX region, the average peak per IXP increased from 6,348 Gbps in January to 7,249 Gbps in December. Although there was some fluctuation throughout the year in April, September and November, this can partially be explained by the temporary decrease of IXPs monitored during those months (with some IXP data unavailable at the time). In general, traffic has increased within the whole region.

» Number of IXPs monitored in the Euro-IX region



Graph 3.2.8

» Average Peak traffic per IXP (in Gbps)

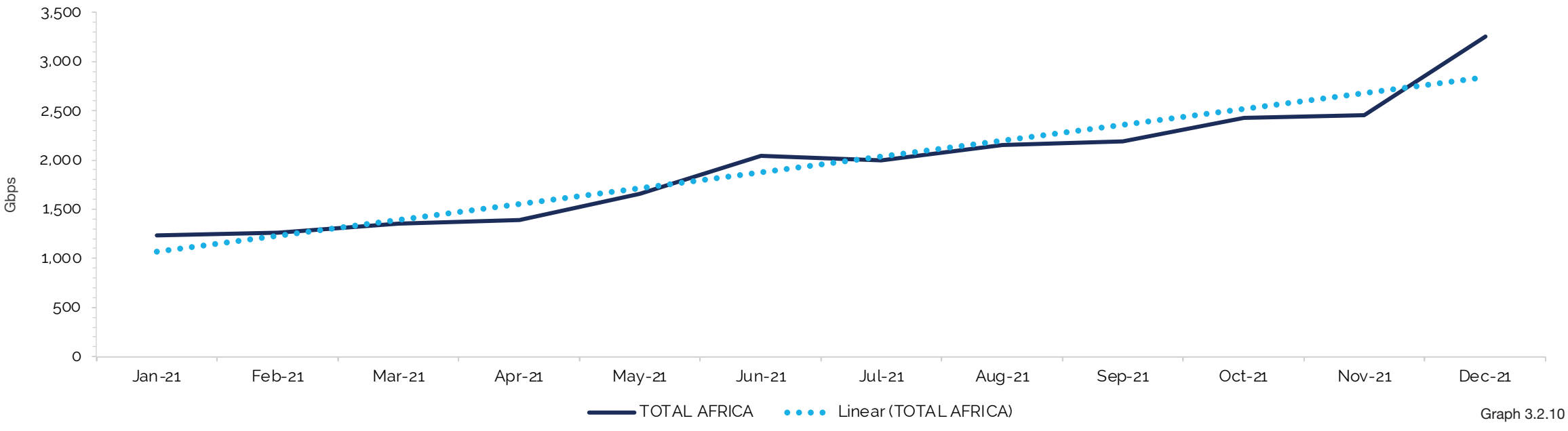


Graph 3.2.9

The average peak traffic per IXP increased with 2.3%, going from 920 Gbps to 942 Gbps. The traffic peaks in this region ranged from 449 Mbps and 7,102 Tbps in January and from 250 Mbps in January to 10,759 Gbps in December.

The largest IXP in terms of traffic is DE-CIX Frankfurt, peaking above 9 Tbps each month.

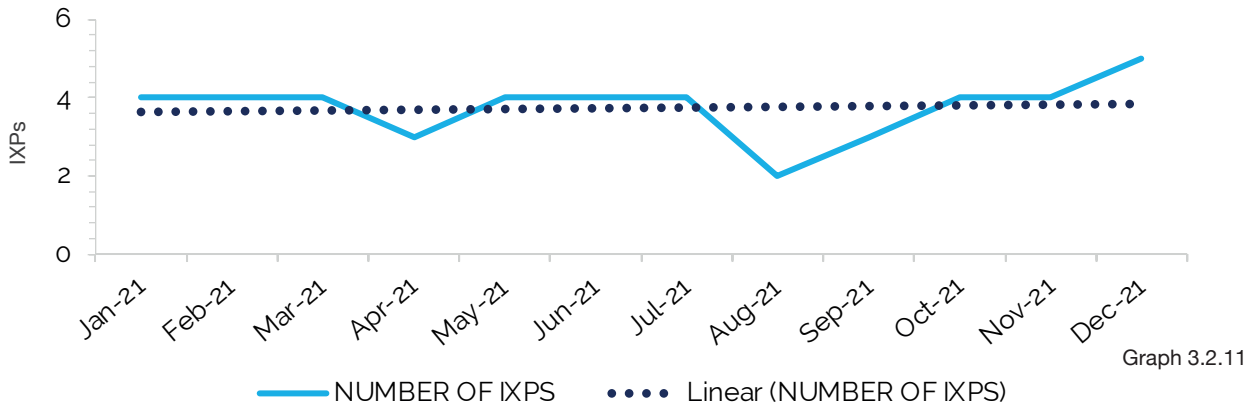
» Total Aggregated Traffic in the Af-IX Region (in Gbps)



Graph 3.2.10

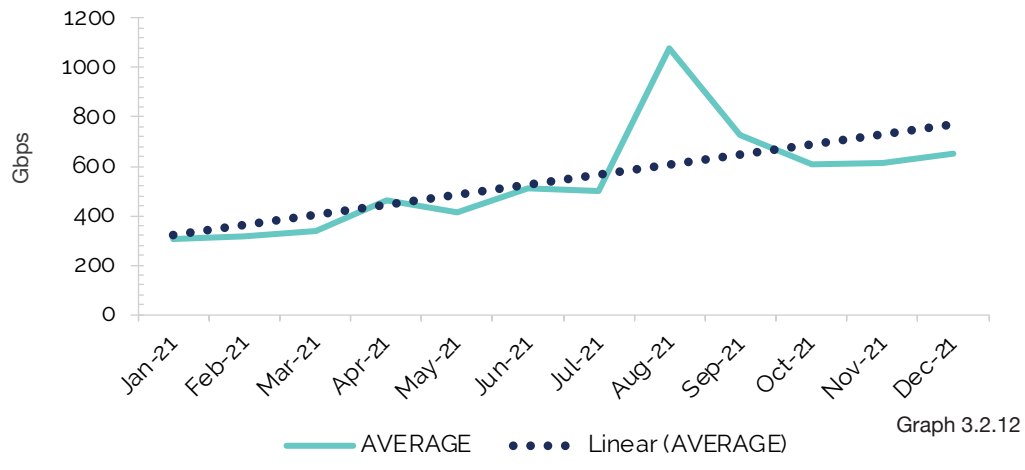
In the Af-IX region, the average peak per IXP increased from 1,034 Gbps in January to 1,556 Gbps in December. There were no significant fluctuations throughout the year, and the traffic seemed to keep growing.

» Number of IXPs monitored in the Af-IX region



Graph 3.2.11

» Average Peak traffic per IXP (in Gbps)

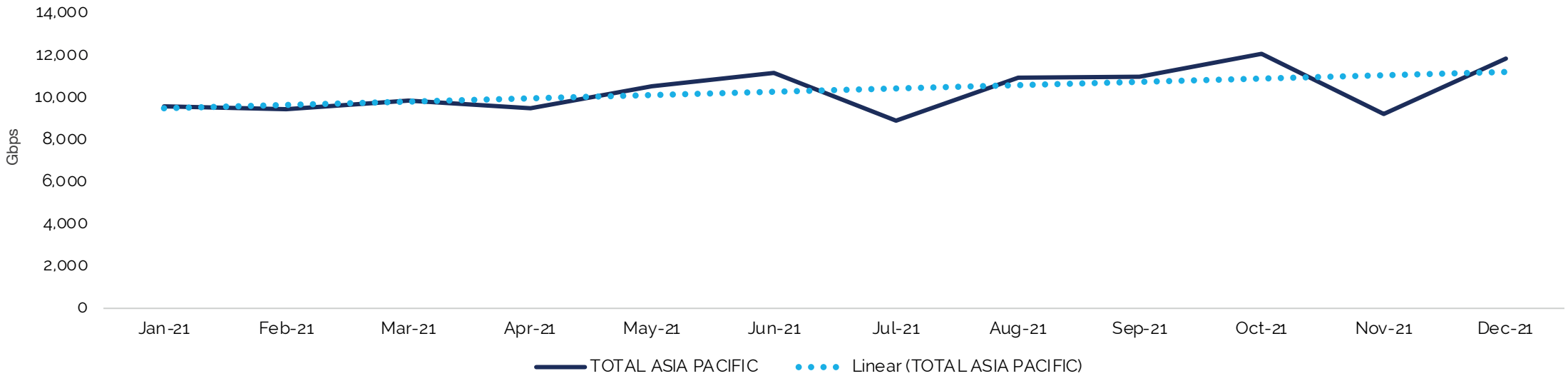


Graph 3.2.12

The average peak traffic per IXP increased with 112%, going from 307 Gbps to 651 Gbps. The traffic peaks in this region ranged from 740 Mbps and 1 Tbps in January and from 16 Gbps in January to 2,069 Gbps in December.

The largest IXP in terms of traffic is NapAfrica (Johannesburg, Durban and Cape Town), which is still peaking above 1 Tbps each month. Nigeria has also experienced large growth in Internet traffic.

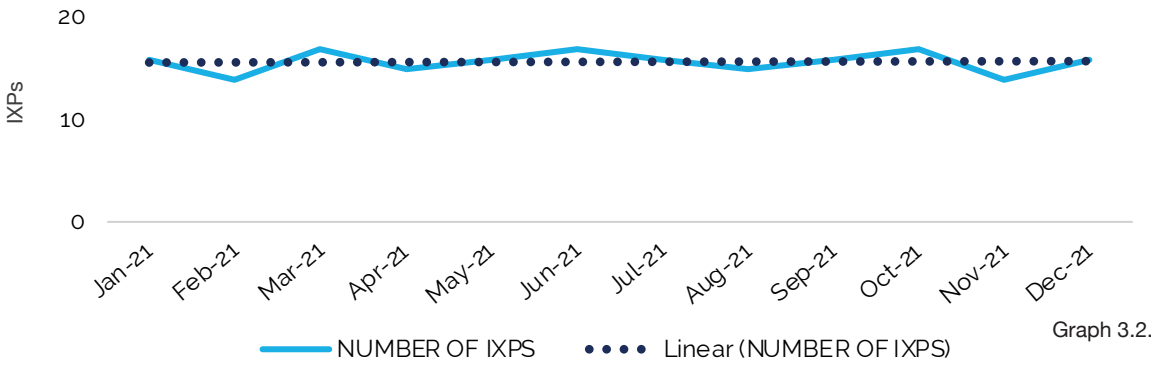
» Total Aggregated Traffic in the APIX Region (in Gbps)



Graph 3.2.13

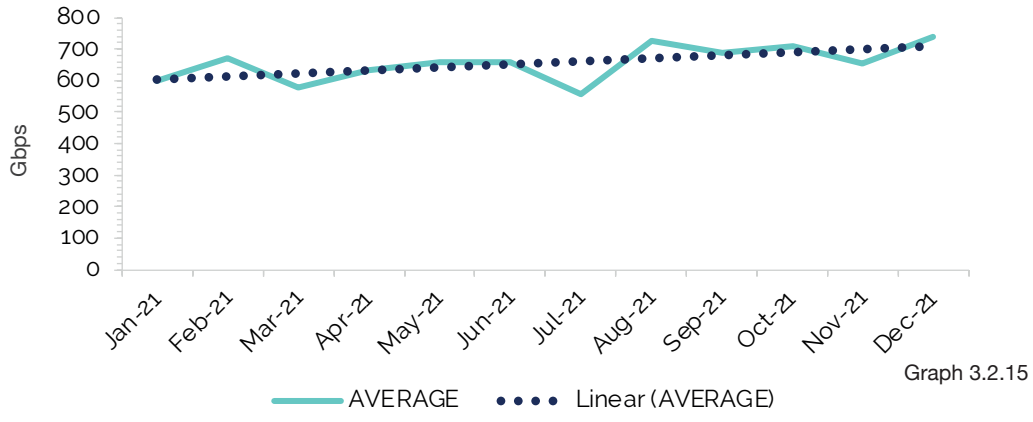
In the APIX region, the average peak per IXP increased from 9,572 Gbps in January to 11,847 Gbps in December. The fluctuations seen in July and November can be explained by the temporary decrease of IXPs monitored during that month (with some IXP data unavailable at the time).

» Number of IXPs monitored in the APIX region



Graph 3.2.14

» Average Peak traffic per IXP (in Gbps)

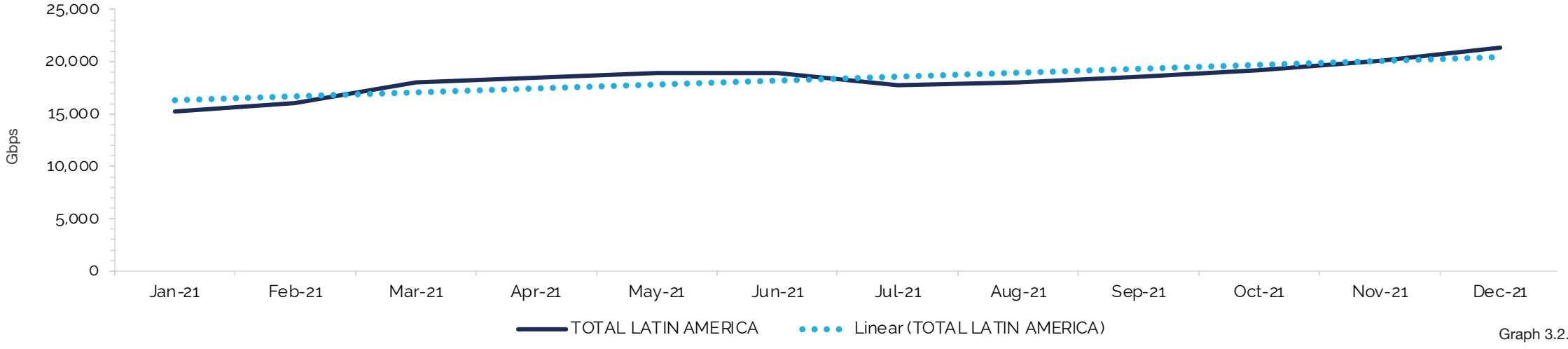


Graph 3.2.15

There was an average of 19 IXPs monitored throughout the year. The average peak traffic per IXP increased with 24%, going from 598 Gbps to 740 Gbps. The traffic peaks in this region ranged from 35 Gbps to 3,001 Gbps in January and 21 Gbps to 4,350 Gbps in December.

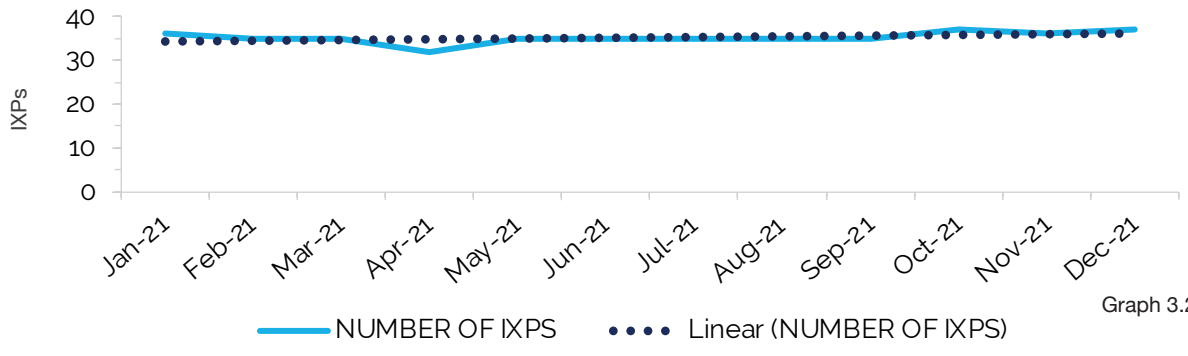
As in 2020, the largest three IXPs in terms of traffic in this region are JPNAP, JPIX and Hong Kong IX.

» Total Aggreagted Traffic in the LAC-IX Region (in Gbps)



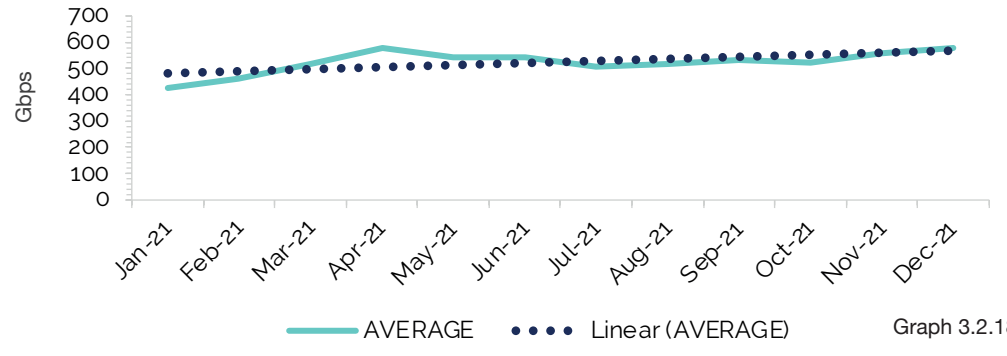
Graph 3.2.16

» Number of IXPs monitored in the LAC-IX region



Graph 3.2.17

» Average Peak traffic per IXP (in Gbps)

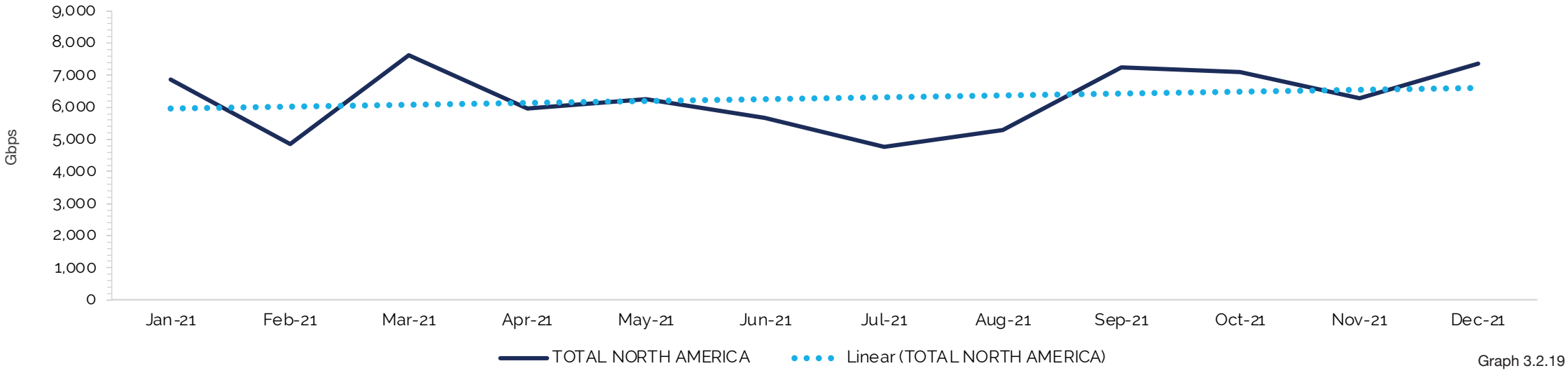


Graph 3.2.18

The number of IXPs monitored throughout the year varied between 35 in January to 37 in December. The average peak traffic per IXP increased with 36%, going from 424 Gbps to 577 Gbps. The traffic peaks in this region ranged from 802 Mbps to 11,006 Tbps in January and 755 Mbps to 15,220 Gbps in December.

The largest IXP in terms of traffic in this region is IX.br (São Paulo), where the traffic peaks above 11 Tbps each month, compared to 7 Tbps each month in 2020. IX.br (São Paulo) and DE-CIX Frankfurt remain the top two IXPs with the most data throughput worldwide.

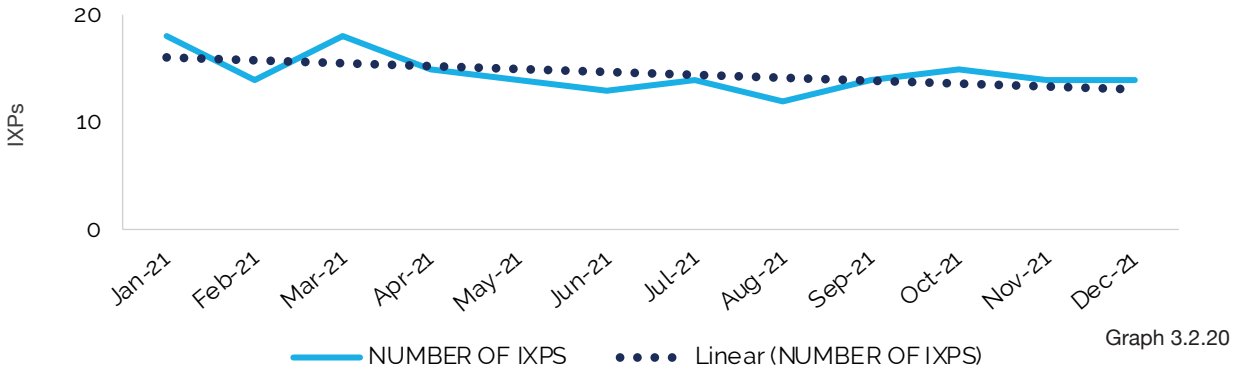
» Total Aggreagted Traffic in the North America Region (in Gbps)



Graph 3.2.19

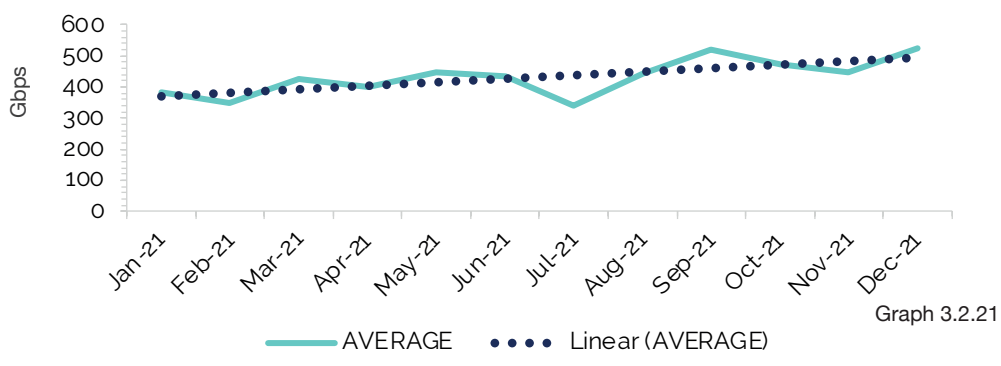
In the North America (NA) region, the average peak per IXP increased from 6,869 Gbps in January to 7,352 in December. The NA region experienced some fluctuations similar to the Euro-IX region, with traffic growing to the right at the end of the year.

» Number of IXPs monitored in the NA region



Graph 3.2.20

» Average Peak traffic per IXP (in Gbps)



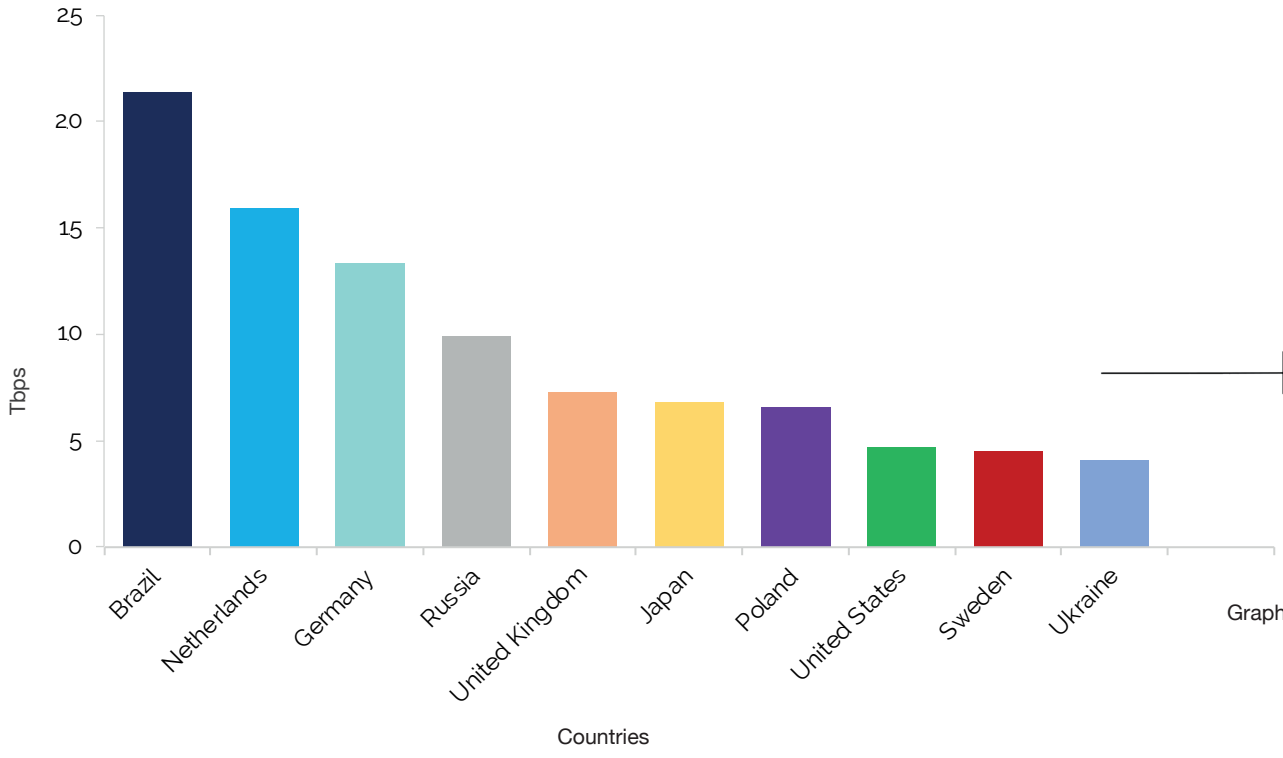
Graph 3.2.21

The number of IXPs we collect data from went from 18 in January to 14 in December. The average peak traffic per IXP increased with 38%, going from 381 Gbps to 525 Gbps. The traffic peaks in this region ranged from 1,58 Gbps to 1,176 Tbps in January and 3 Gbps to 1,500 Tbps in December.

The largest IXPs in this region are Telx Atlanta, SIX in Seattle, NYIIX in New York and DE-CIX New York.

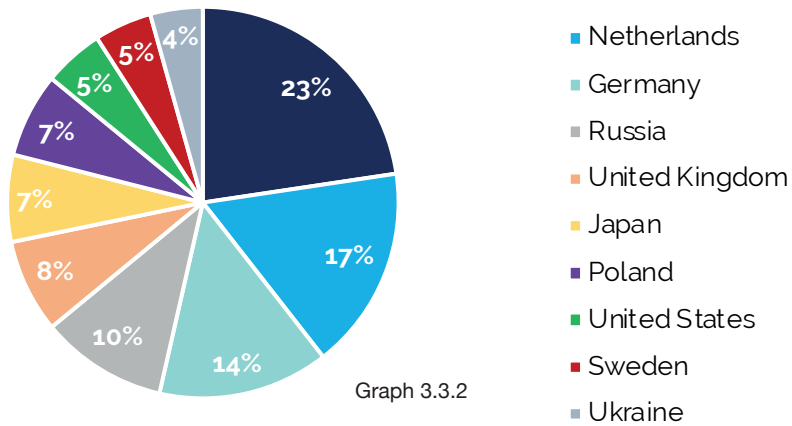
3.3 Traffic Statistics Top 10

» Top 10 countries with the most IXP traffic in the world in 2021 - all regions (in Tbps)



Graph 3.3.1

» Market share of the traffic



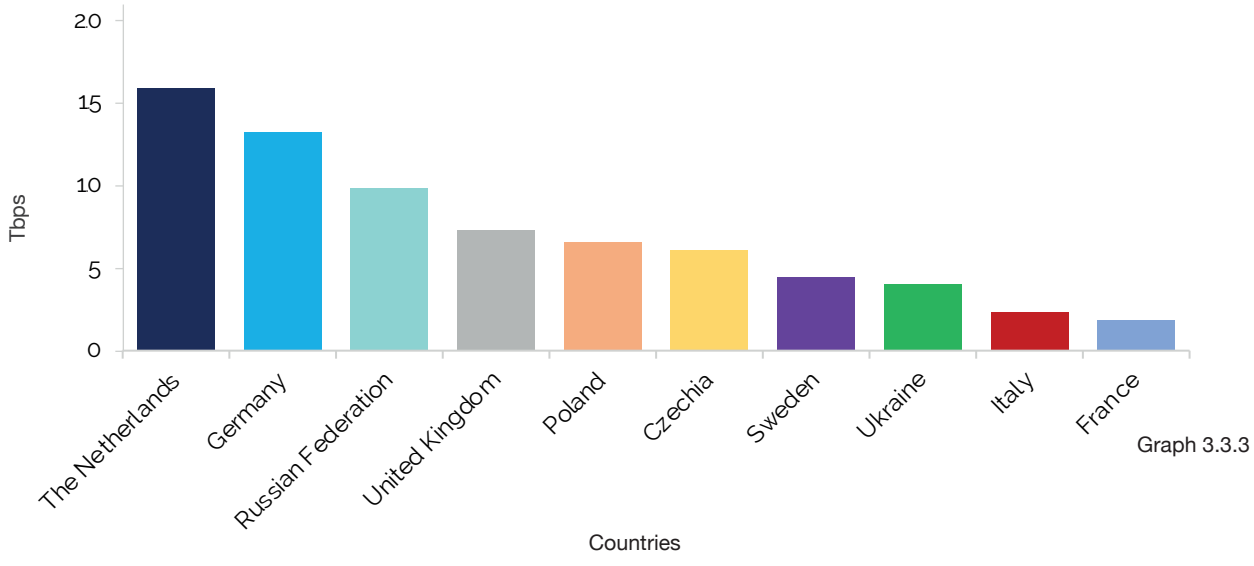
Graph 3.3.2

	Country	Aggregated Peak Traffic (in Tbps)
1	Brazil	21.4
2	The Netherlands	15.9
3	Germany	13.3
4	Russia	9.9
5	United Kingdom	7.3
6	Japan	6.8
7	Poland	6.6
8	United States	4.7
9	Sweden	4.5
10	Ukraine	4.1

Table 3.3.1

Brazil continues to carry the most traffic in the world, followed by The Netherlands and Germany. However, there has been a significant increase in traffic in countries such as India, Luxembourg, Nigeria and Turkey.

» Countries with the most IXP traffic in Europe



Graph 3.3.3

	Country	Aggregated Traffic Peaks (in Tbps)
1	The Netherlands	15.9
2	Germany	13.3
3	Russian Federation	8.3
4	United Kingdom	7.3
5	Poland	6.6
6	Czechia	6.1
7	Sweden	4.5
8	Ukraine	4.1
9	Italy	2.4
10	France	1.9

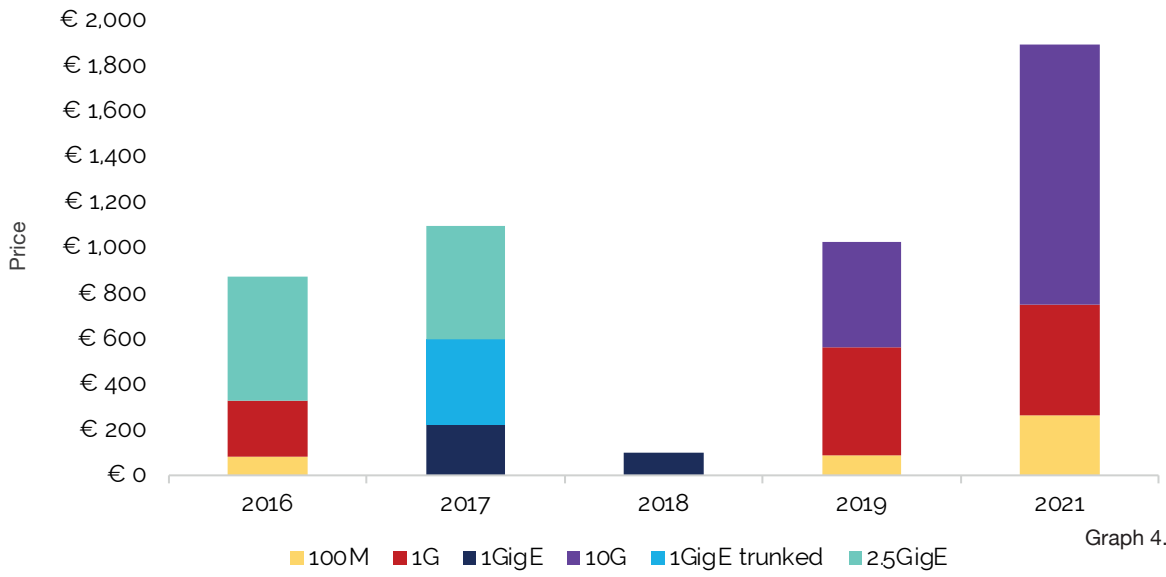
Table 3.3.2

4. Port Price Distribution

4.1 Port price distribution over 5 years - all available ports

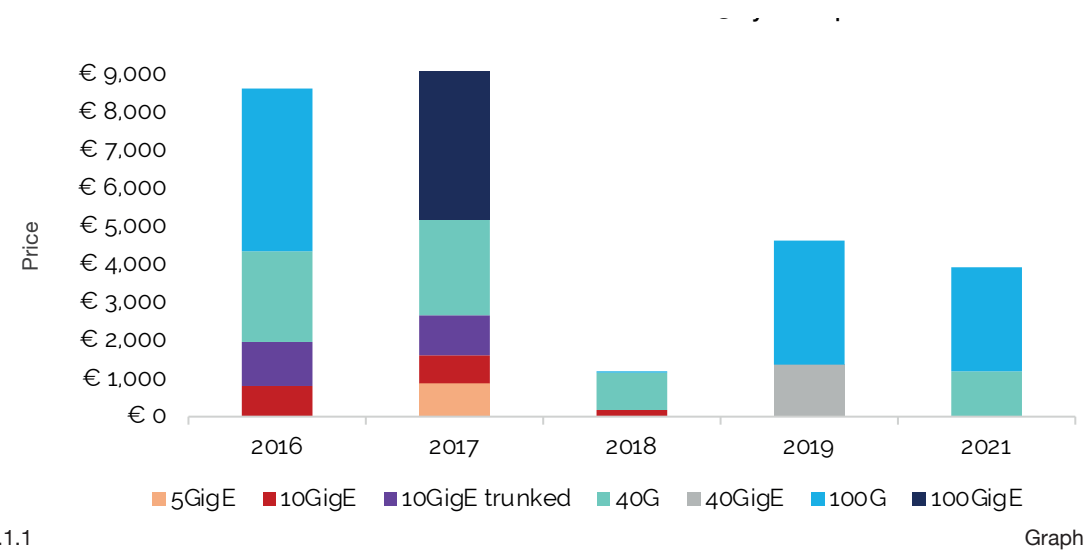
» Price data for each port is taken from the IXP{DB}. All prices reported in 2021 have been converted to EUR using the exchange rate at June 19, 2021. Port prices in 2016-2019 was collected and converted to EUR using the FX rate on the day of conversion.

» 100M - 2.5GigE Ports



Graph 4.1.1

» 5GigE- 100GigE Ports



Graph 4.1.2

- The graph shows the price distribution for 100M - 2.5GigE ports and for 5GigE - 100GigE ports from 2016-2021
- We can see that 10G ports and 100G ports were the most used from 2016-2021, with 10G ports being the most used in 2021
- The drop in 2018 signifies a lack of data in that year
- The table shows the average prices for each available port in that year

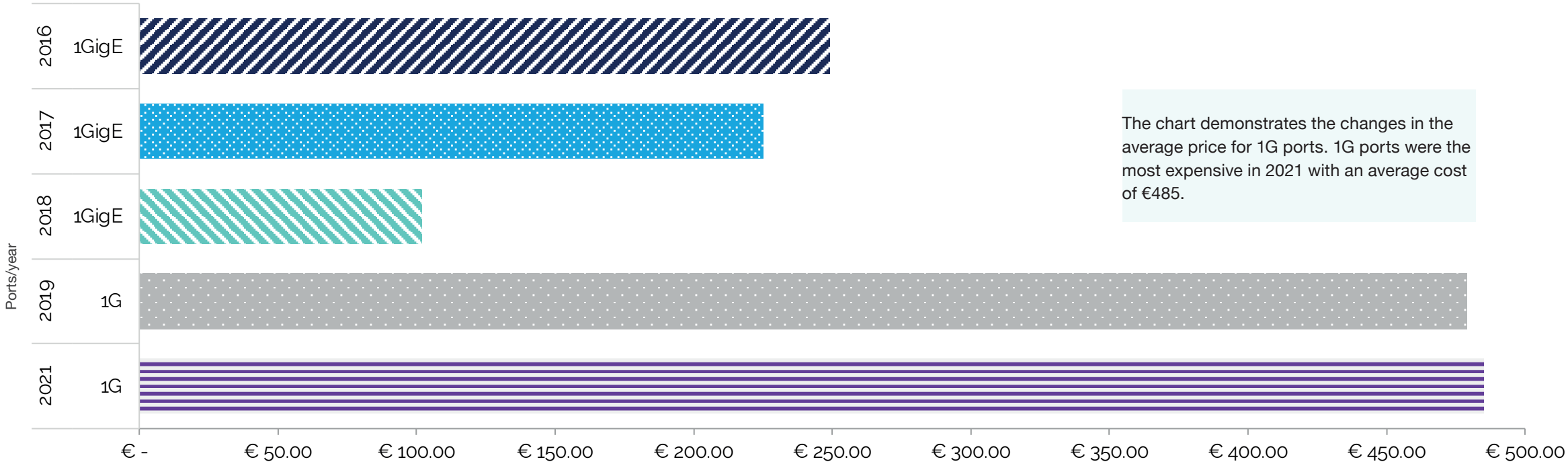
Port #	2016	2017	2018	2019	2021
100M	€80	-	-	€86	€264
1G	€249	-	-	€479	€485
1GigE	-	€225	€102	-	-
1GigE trunked	-	€373	-	-	-
2.5GigE	€547	€500	-	-	-
5GigE	-	€883	-	-	-
10Gig	€804	€754	€170	€463	€1,144
10GigE	€1,165	€1,038	-	-	-
40G	€2,366	€2,516	€990	€1,376	€1,209
40GigE	-	-	-	-	-
100G	€4,292	-	€50	€3,247	€2,726
100GigE	-	€3,879	-	-	-

*key; - = data unavailable

Table 4.1.1

4.2 Port price distribution over 5 years

» Port price over 5 years for 1G/1GigE ports



The chart demonstrates the changes in the average price for 1G ports. 1G ports were the most expensive in 2021 with an average cost of €485.

Graph 4.2.1

Price

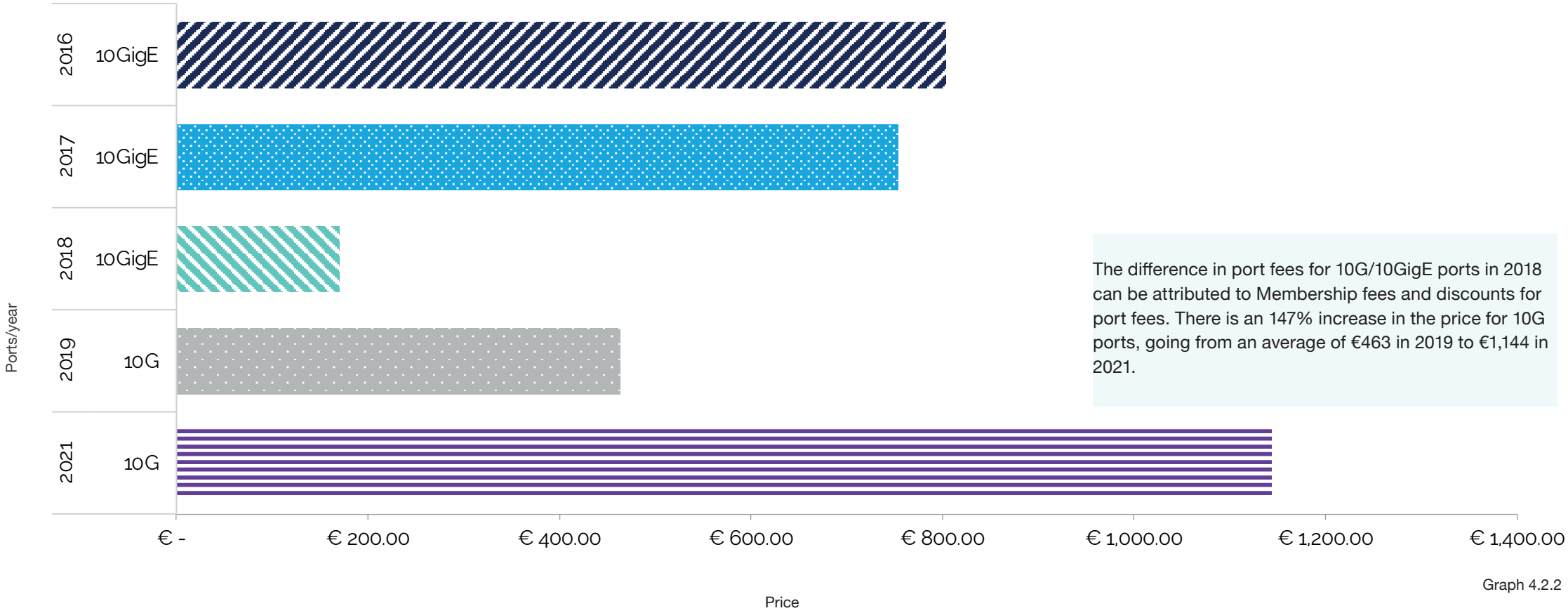
Port #	2016	2017	2018	2019	2021
1Gig (range)	€26-€600	€27-€500	-	€77-€367	€116-€1,600
Average €	€249	€225	-	€479	€485
1GigE (range)	€104-€950	€70-€700	€1-€792	-	-
Average €	€337	€373	€102	-	-

*key; - = data unavailable

Table 4.2.1

The difference in the price range can be attributed to Membership fees and discounts.

» Port price over 5 years for 10g/10GigE ports



The difference in port fees for 10G/10GigE ports in 2018 can be attributed to Membership fees and discounts for port fees. There is an 147% increase in the price for 10G ports, going from an average of €463 in 2019 to €1,144 in 2021.

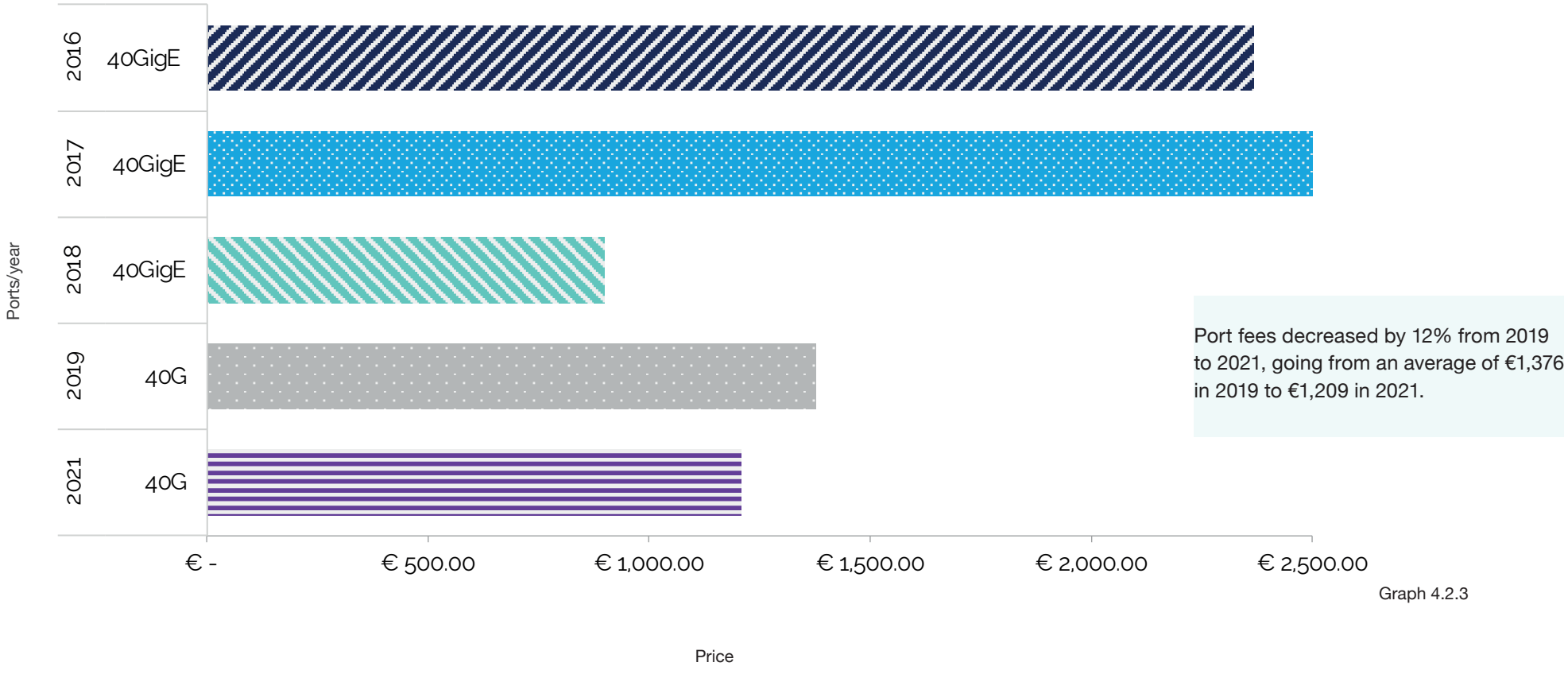
Graph 4.2.2

Port #	2016	2017	2018	2019	2021
10GigE (range)	€169-€2,500	€163-€2,336	€4-€980	€54-€800	-
Average €	€804	€754	€170	€463	-
10Gig (range)	-	-	-	€54 - €800	€400-€5,100
Average €	-	-	-	€463	€1,144

*key; - = data unavailable

Table 4.2.2

» Port price over 5 years for 40G/40GigE ports



Port fees decreased by 12% from 2019 to 2021, going from an average of €1,376 in 2019 to €1,209 in 2021.

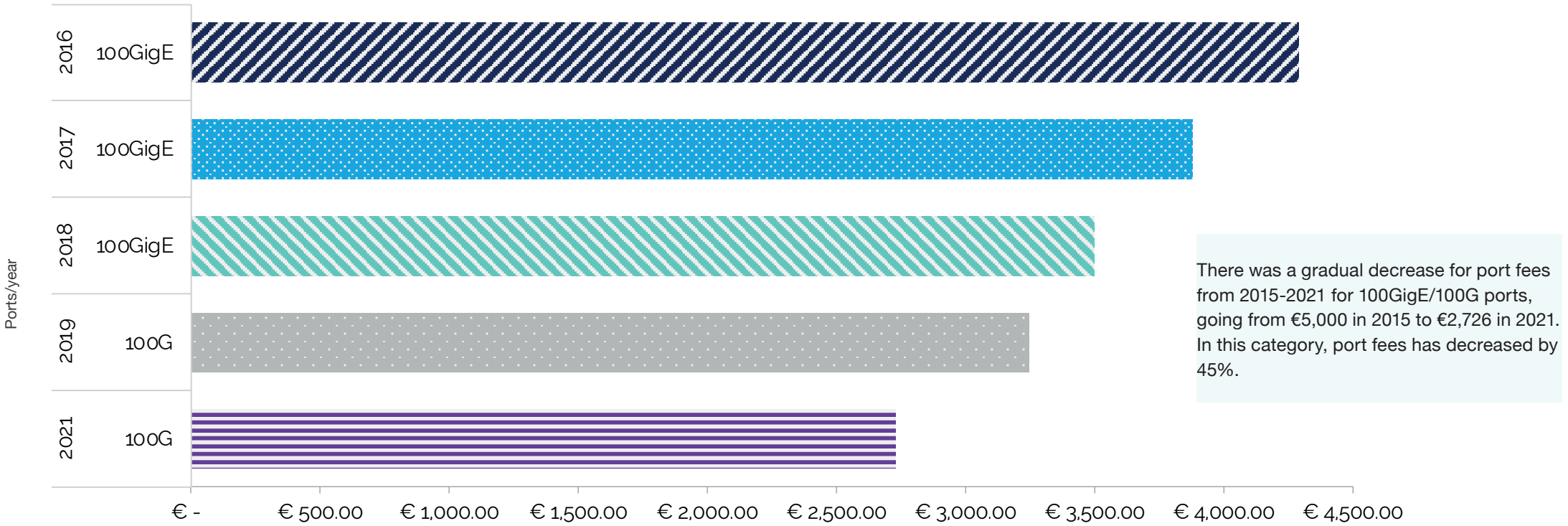
Graph 4.2.3

Port #	2016	2017	2018	2019	2021
40GigE (range)	€1,300-€4,412	€781-€4,500	€300-€1,660	-	-
Average €	€2,366	€2,516	€990	-	-
40Gig (range)	-	-	-	€155 - €1,700	€402-€5,100
Average €	-	-	-	€1,376	€1,209

*key; - = data unavailable

Table 4.2.3

» Port price over 5 years for 100g/100GigE ports



There was a gradual decrease for port fees from 2015-2021 for 100GigE/100G ports, going from €5,000 in 2015 to €2,726 in 2021. In this category, port fees has decreased by 45%.

Graph 4.2.4

Price

Port #	2016	2017	2018	2019	2021
100GigE (range)	€2,046-€9,500	€1,304-€7,500	€1-€5,255	-	-
Average	€4,292	€3,879	€3,500	-	-
100Gig (range)	-	-	-	€194 - €9,400	€750-€7,672
Average	-	-	-	€3,247	€2,726

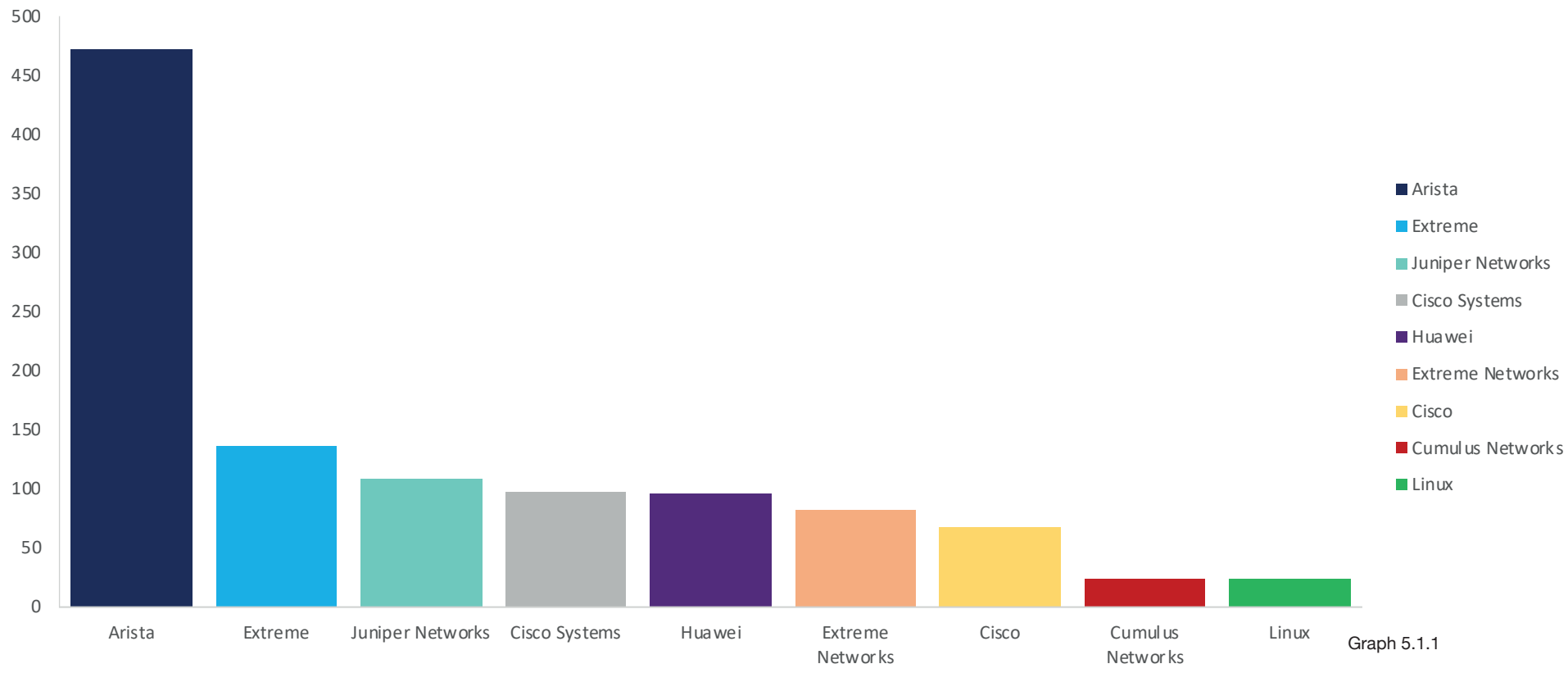
*key; - = data unavailable

Table 4.2.4

5. IXP Switching Platform Technology

5.1 Switches in use at IXPs

» Number of switches in use - *Data source: IXP{DB}



Graph 5.1.1

» Market Share of Vendors

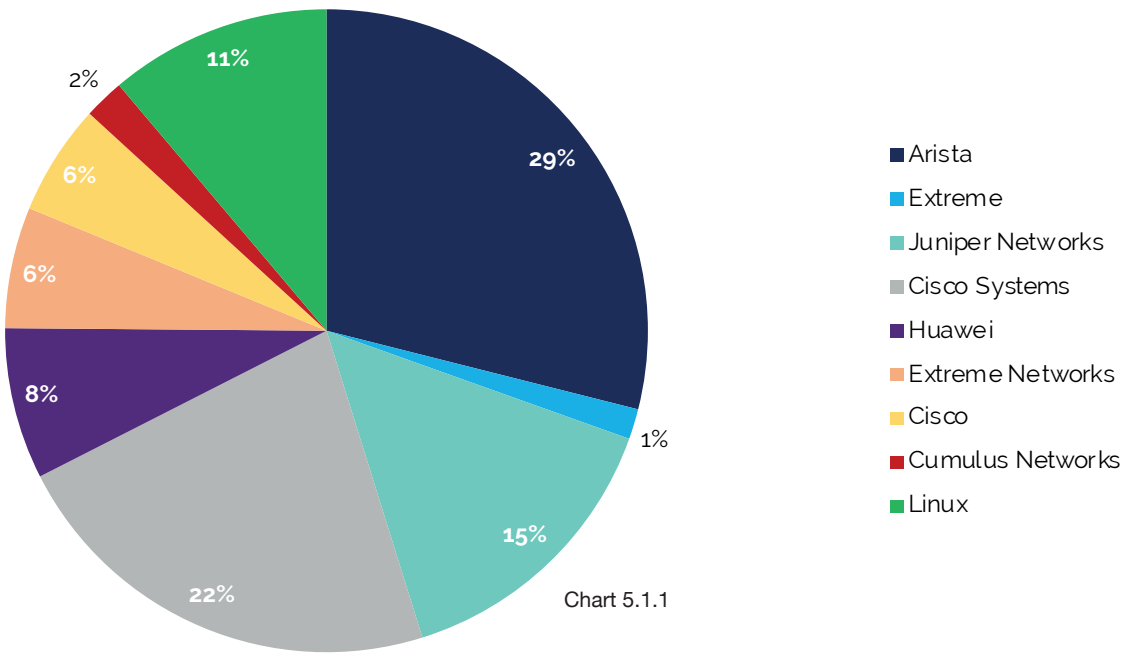
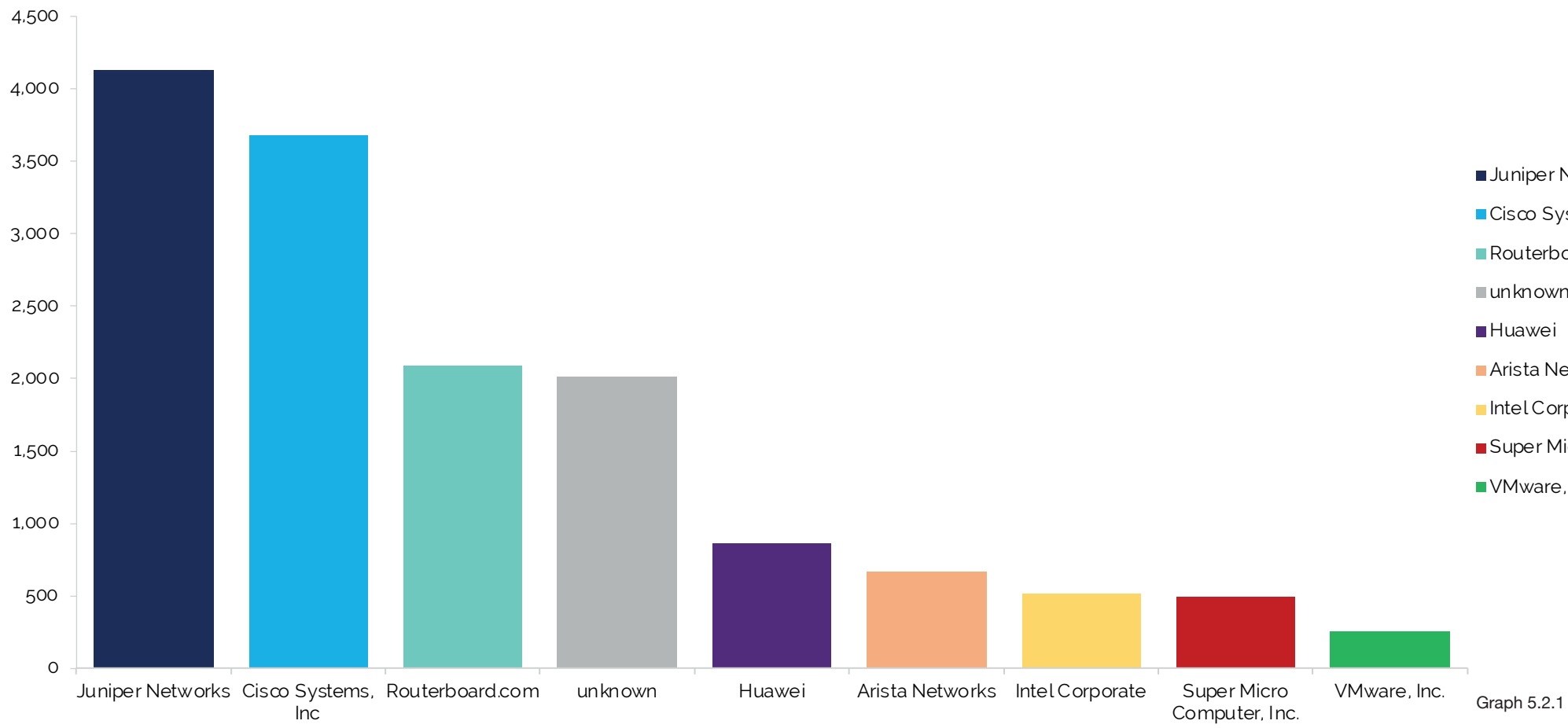


Chart 5.1.1

5.2 Network Peering Hardware

» Hardware used by the IXP participants - *Data source: IXP{DB}
*Work is being done to identify the unknown vendors



Graph 5.2.1

» IXP Participants' Market Share by Vendor

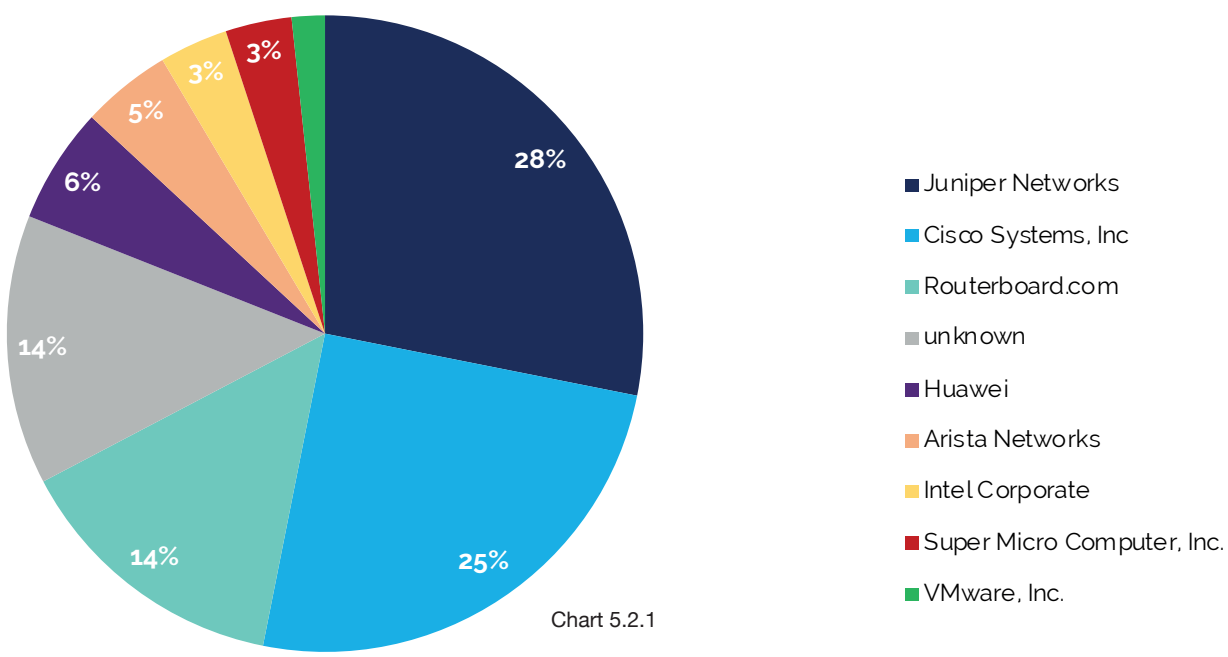


Chart 5.2.1

6. Further information

6.1 Resources

IXP{DB} - The data in the IXP{DB} is automatically updated from JSON feeds supplied directly by the IXPs. The data, in addition to member lists and location information, also includes details of hardware used at IXPs.

We thank all sponsors of the IXP{DB}, Euro-IX Members and Patrons. We additionally thank all IXPs and especially those that provide publicly available information.

6.2 Contact

We welcome all forms of feedback and suggestions concerning this report and will do our best to answer any further requests for information.

The Euro-IX Secretariat
secretariat@euro-ix.net

Note: IXP{DB} sponsors in 2021

Appendix 1

List of known IXPs in Europe in 2021
Note: * indicates Euro-IX Member / ** indicates IXPs operated by our Members

ECONOMY	# OF IXPS	CITY	FULL NAME OF IXP	ACRONYM
Albania	1			
		Tirana	Albanian Neutral Internet Exchange	ANIX**
Armenia	1			
		Yerevan	Armenia Internet Exchange	ARMIX*
Austria	5			
		Graz	Grazer Internet Exchange	GraX
		Klagenfurt	Alpes Adria Internet Exchange	AAIX
		Hall in Tirol	Tirol-IX	Tirol-IX
		Vienna	Equinix Internet Exchange - Vienna	Equinix Vienna**
		Vienna	Vienna Internet eXchange	VIX*
Belarus	1			
		Minsk	Belarus National Internet Exchange Point	BY-IX
Belgium	2			
		Brussels	Belgian National Internet Exchange	BNIX*
		Waasmunster	Belgium Internet Exchange	BelgiumIX
Bosnia and Herzegovina	1			
		Sarajevo	Bosnia and Herzegovina Internet Exchange	BHNIX*
Bulgaria	6			
		Sofia	Balkan Internet Exchange	Balkan-IX
		Sofia	Bulgarian Internet Exchange	BIX.BG*
		Sofia	Sofia Internet Exchange	IX-SOF
		Sofia	NetIX	NetIX*
		Sofia	T-CIX	T-CIX
		Varna	VarnaIX	VarnaIX
Croatia	1			
		Zagreb	Croatian Internet eXchange	CIX*
Cyprus	1			
		Nicosia	Cyprus Internet Exchange	CyIX
Czech Republic	3			
		Brno	Brno Internet Exchange Point	BR-IX
		Prague	Neutral Internet eXchange of Czech Republic	NIX.CZ*
		Prague	Peering.cz	Peering.cz*
Denmark	3			
		Copenhagen	Danish Internet eXchange point	DIX*
		Copenhagen	Netnod - Copenhagen	Netnod - Copenhagen**
		Copenhagen	Stockholm Internet Exchange - Copenhagen	STHIX Copenhagen**
Estonia	4			
		Riga	PITER-IX	PITER-IX Riga
		Tallinn	Tallinn Governmental Internet Exchange	RTIX
		Tallinn	Tallinn Internet eXchange	TIX Tallinn
		Tallinn	Tallinn Internet Exchange	TLLIX

Finland	8		
	Espoo	Finnish Communication and Internet Exchange	FICIX - Espoo**
	Helsinki	Equinix Helsinki	Equinix Helsinki**
	Helsinki	Finnish Communication and Internet Exchange	FICIX - Helsinki*
	Helsinki	Helsinki (Stockholm Internet eXchange AB)	STHIX Helsinki**
	Helsinki	Netnod Internet Exchange - Helsinki	Netnod Helsinki**
	Oulu	Finnish Communication and Internet Exchange	FICIX - Oulu**
	Tampere	Tampere Region Exchange	TREX*
	Tuusula	Securebit AG	SBIX TUU
France	14		
	Béarn	BéarnIX	BéarnIX
	Clermont Ferrand	AuvernIX	AuvernIX
	Grenoble	Grenoble Internet Exchange Point	GrenoblIX**
	Lille	Lille Internet Exchange	Lillix
	Lyon	Lyon Global Internet Exchange	LyonIX**
	Marseille	France Internet Exchange - Marseille	France-IX Marseille**
	Marseille	Deutscher Commercial Internet Exchange	DE-CIX Marseille**
	Nantes	OuestelX	OustelX
	Paris	Equinix Internet Exchange - Paris	Equinix Paris**
	Paris	France Internet Exchange	France-IX*
	Paris	Service for French Internet eXchange	SFINX
	Rennes	Breizh-IX	Breizh-IX
	Strasbourg	European Global Internet eXchange	EuroGIX
	Toulouse	GIX de la grande region Toulousaine	TOUIX**
Germany	24		
	Berlin	Berlin Commercial Internet Exchange	BCIX*
	Berlin	Europen Commercial Internet Exchange - Berlin	ECIX Berlin*
	Bremen	Bremen Internet Exchange	BREM-IX
	Dortmund	Dortmund Internet Exchange	DO-IX*
	Düsseldorf	Deutscher Commercial Internet Exchange	DE-CIX Düsseldorf**
	Düsseldorf	European Commercial Internet Exchange - Dusseldorf	ECIX Dusseldorf**
	Düsseldorf	Local Internet Exchange	LocIX Düsseldorf
	Düsseldorf	OpenCarrier e.G. Member IX Dusseldorf	OCIX Düsseldorf
	Düsseldorf	Securebit AG	SBIX DUS
	Frankfurt	Deutscher Commercial Internet Exchange	DE-CIX Frankfurt*
	Frankfurt	European Commercial Internet Exchange - Frankfurt	ECIX Frankfurt**
	Frankfurt	Equinix Internet Exchange - Frankfurt	Equinix Frankfurt**
	Frankfurt	KleyReX Internet Exchange	KleyReX
	Frankfurt	Local Internet Exchange	LocIX Frankfurt
	Frankfurt	Staclar Internet Exchange	STACIX
	Hamburg	Deutscher Commercial Internet Exchange	DE-CIX Hamburg**
	Hamburg	Europen Commercial Internet Exchange - Hamburg	ECIX Hamburg**
	Karlsruhe	Baden-Württemberg Internet Exchange Karlsruhe	BW-IX
	Munich	Deutscher Commercial Internet Exchange	DE-CIX Munich**
	Munich	Europen Commercial Internet Exchange - Munich	ECIX Munich**
	Nuernberg	Nuernberger Internet eXchange	N-IX
	Ruhr area	Ruhr-Cix	Ruhr-Cix
	Saarbrücken	Saarcix	Saarcix
	Stuttgart	Baden-Württemberg Internet Exchange Stuttgart	BW-IX Stuttgart
Greece	4		
	Athens	Greek Internet Exchange	GR-IX*
	Athens	South East Europe Cloud & Interconnection Exchange	SEECIX
	Thessaloniki	Greek Internet Exchange	GR-IX Thessaloniki**
	Thessaloniki	Thessaloniki neutral Internet Exchange Point	THESS-IX

Hungary	1		
	Budapest	Budapest Internet eXchange	BIX*
Iceland	1		
	Reykjavik	Reykjavik Internet Exchange	RIX*
Iran	1		
	Tehran	TEHRAN-IX	TEHRAN-IX
Ireland	3		
	Cork	Internet Neutral EXchange	INEX Cork**
	Dublin	Internet Neutral EXchange	INEX*
	Dublin	Equinix Internet Exchange - Dublin	Equinix Dublin**
Israel	1		
	Tel-Aviv	Israeli Internet eXchange	IIX - Tel Aviv
Italy	11		
	Florence	Tuscany Internet eXchange	TIX Tuscany*
	Milan	Equinix Internet Exchange - Milan	Equinix Milan**
	Milan	Milan Neutral Access Point	MiNAP
	Milan	Milan Internet eXchange	MIX-IT*
	Padova	VSIX Nap del Nord Est	VSIX*
	Palermo	Deutscher Commercial Internet Exchange - Palermo	DE-CIX Palermo**
	Piacenza	Piacenza Internet Exchange	PCIX
	Rome	Nautilus Mediterranean Exchange Point	NaMeX*
	Rome	Southern Internet Exchange	SIEX
	Torino	Torino Piemonte Exchange Point	TOP-IX*
	Udine	Friuli Venezia Giulia Internet eXchange	FVG-IX*
Kazakhstan	2		
	Almaty	Kazakhstan Traffic Exchange	KAZ-IX
	Semey	KazNIX Exchange Point	KazNIX
Kosovo	1		
	Prishtinë	Kosovo Internet Exchange Point	KOSIX*
Latvia	3		
	Riga	Latvian Internet eXchange	LIX - Latvia
	Riga	Moscow Internet Exchange - Riga	MSK-IX Riga**
	Riga	Santa Monica Internet Local Exchange	SMILE
Lebanon	2		
	Beirut	Advanced Internet eXchange	A-IX
	Beirut	Beirut Internet Exchange	Beirut-IX*
Liechtenstein	2		
	Balzers	Securebit AG	VIXP
	Eschen	Rheintal IX Internet Exchange	Rheintal IX
Lithuania	3		
	Vilnius	Baltic Internet Exchange	BALT-IX
	Vilnius	Lietuvos Interneto paslaugų tiekėjų apsikeitimo mazgu	LIPTAM
	Vilnius	Lithuania Internet Exchange	Litix
Luxembourg	1		
	Luxembourg	Luxembourg Commercial Internet Exchange	LU-CIX*
North Macedonia	1		
	Skopje	Faculty of Computer Science and Engineering	IXP.mk
Moldova, Republic of	2		
	Chisinau	Chisinau Internet Exchange	KIVIX
	Chisinau	Moldova Internet Exchange	MD-IX
Netherlands	13		
	Amsterdam	Amsterdam Internet Exchange	AMS-IX*
	Amsterdam	Asteroid Amsterdam IX	Asteroid*
	Amsterdam	Equinix Internet Exchange - Amstedam	Equinix Amsterdam**

	Amsterdam	Global Internet Exchange - Amsterdam	Global-IX Amsterdam
	Dronten	Speed Internet Exchange	SPEEDIX
	Enschede	Nederlands-Duitse Internet Exchange	NDIX
	Groningen	Groningen Internet Exchange	GN-IX
	Leeuwarden	Friese Internet Exchange	FR-IX
	Rotterdam	Rotterdam Internet Exchange	R-iX
	The Hague	Data Facilities Internet Exchange	DF-IX
	The Hague	LayerSwitch Internet Exchange	LSIX
	The Hague	Neutral Internet Exchange	NL-ix*
	The hague	Local Internet Exchange	LocIX Netherlands
Norway 8			
	Bergen	Bergen Internet Exchange	BIX**
	Oslo	Free Internet eXchange Oslo	FIXO
	Oslo	Norwegian Internet eXchange	NIX*
	Oslo	Norwegian Internet eXchange	NIX2**
	Sandefjord	Free Sandefjord IX	FSIX
	Stavanger	Stavanger Internet Exchange	SIX - Stavanger
	Tromsø	Tromsø Internet Exchange	TIX
	Trondheim	Trondheim Internet Exchange	TRDIX
Palestinian Territory, Occupied 1			
	Ramallah	Palestine Internet Exchange Point	PIX Palestine
Poland 11			
	Gdansk	Gdansk Internet eXchange	GIX Gdansk
	Gdynia	APLIX.PL	APLIX
	Katowice	E-Poludnie Internet Exchange - Katowice	EPIX Katowice
	Krakow	Cracow Internet Exchange	CIX KR
	Lodz	Lodz Telecommunication Node	IX.LODZ.PL
	Poznan	Poznan Internet Exchange	PIX
	Warsaw	KIX - Poland	KIX - Poland
	Warsaw	Equinix Internet Exchange - Warsaw	Equinix Warsaw **
	Warsaw	Orange Polska Internet Exchange	TPIX*
	Warsaw	Warsaw Internet eXchange	WIX - Poland
	Warsaw	E-Poludnie Internet Exchange - Warszawa	EPIX Warszawa
Portugal 3			
	Lisbon	Deutscher Commercial Internet Exchange - Lisbon	DE-CIX Lisbon**
	Lisbon	GIGAbit Portuguese Internet eXchange	GigaPix*
	Lisbon	Equinix Internet Exchange - Lisbon	Equinix Lisbon**
Romania 8			
	Bucharest	Balcan-IX Internet Exchange	BALCAN-IX
	Bucharest	InterLAN Internet Exchange	InterLAN*
	Bucharest	Romanian Commercial Internet Echange	RoCix
	Bucharest	Romanian Network for Internet eXchange	RoNIX
	Bucharest	DreamServer Internet Exchange	DSIX
	Bucharest	Romanian Open Internet Exchange	ROPN-IX
	Constanta	Tomis Internet Exchange	Tomix
	Targoviste	LNK Internet Exchange	LNK-IX
Russian Federation 31			
	Barnaul	SFO-IX	SFO-IX
	Chelyabinsk	Chelyabinsk Peering Point	CHEL-PP
	Ekaterinburg	Moscow Internet Exchange - Ekaterinburg	MSK-IX Ekaterinburg**
	Kazan	Moscow Internet Exchange - Kazan	MSK-IX Kazan**
	Khabarovsk	DataIX - Khabarovsk	DataIX - Khabarovsk

	Krasnodar	South Russia IX	Sea-IX
	Krasnoyarsk	Krasnoyarsk Internet Exchange	SIBIR-IX
	Moscow	Dataline Internet Exchange	DatalineIX
	Moscow	DataIX - Moscow	DataIX - Moscow
	Moscow	MPIX	MPIX
	Moscow	Eurasia Peering IX	Eurasia Peering IX*
	Moscow	Moscow Internet Exchange	MSK-IX*
	Moscow	PITER-IX Moscow	PIETER-IX Moscow
	Nizhny Novgorod	IX of Nizhny Novgorod	NNOV-IX
	Novosibirsk	DataIX - Novosibirsk	DataIX - Novosibirsk
	Novosibirsk	Moscow Internet Exchange - Novosibirsk	MSK-IX Novosibirsk**
	Omsk	OMSK-IX	OMSK-IX
	Perm	Perm traffic exchange point	PERM-IX
	Rostov on Don	Moscow Internet Exchange - Rostov on Don	MSK-IX Rostov-on-Don**
	Samara	Moscow Internet Exchange - Samara	MSK-IX - Samara**
	St.Petersburg	DataIX - St Petersburg	DataIX - St. Petersburg
	St.Petersburg	Global Internet Exchange	Global-IX
	St.Petersburg	PIRIX Internet Exchange	PIRIX
	St.Petersburg	Moscow Internet Exchange - St. Petersburg	MSK-IX - St. Petersburg**
	St.Petersburg	PIETER-IX St.-Petersburg	PITER-IX St.-Petersburg
	Simferopol	Crimea-IX	Crimea-IX
	Stavropol	Moscow Internet Exchange - Stavropol	MSK-IX - Stavropol**
	Ufa	DataIX - Ufa	DataIX - Ufa
	Ulyanovsk	Ulyanovsk Internet Exchange	ULN-IX
	Vladivostok	Moscow Internet Exchange - Vladivostok	MSK-IX - Vladivostok**
	Yaroslavl	Yaroslavl Internet Exchange	YAR-IX
Saudi Arabia 2			
	Jeddah	JEDIX	JEDIX*
	Riyadh	Saudi Arabia Internet Exchange	SAIX*
Serbia 1			
	Belgrade	Serbian Open eXchange	SOX*
Slovakia 3			
	Bratislava	Slovak Internet eXchange - Bratislava	SIX - Bratislava
	Bratislava	Neutral Internet eXchange of Slovakia	NIX.SK**
	Kosice	Slovak Internet eXchange - Kosice	SIX - Kosice
Slovenia 1			
	Ljubljana	Slovenian Internet Exchange	SIX*
Spain 7			
	Barcelona	Catalunya Neutral Internet Exchange	CATNIX*
	Barcelona	Equinix Internet Exchange - Barcelona	Equinix Barcelona**
	Madrid	Espana Internet Exchange	ESPANIX*
	Madrid	Deutscher Commercial Internet Exchange	DE-CIX Madrid**
	Madrid	Equinix Internet Exchange - Madrid	Equinix Madrid**
	Madrid	IXPlay España	IXPlay España
	Valencia	Neutral Internet Exchange Valencia	NIXVAL
Sweden 16			
	Gavle	Switch #1 (Gavlix)	Switch #1 (Gavlix)
	Gothenburg	Gothenburg Internet Exchange	GIX
	Gothenburg	Internet Exchange i Sverige - Gothenburg	Netnod - Gothenburg**
	Gothenburg	Stockholm Internet Exchange	STHIX - Gothenburg**
	Gothenburg	Stockholm (Sweden Open Network Internet Exchange	SONIX

	Lulea	Internet Exchange i Sverige - Lulea	Netnod - Lulea**
	Malmoe	Internet eXchange point of the Oresund Region	IXOR
	Stockholm	Global Internet Exchange - Stockholm	Global-IX - Stockholm
	Stockholm	Internet Exchange i Sverige - Stockholm	Netnod - Stockholm*
	Stockholm	SOLIX	SOLIX - Stockholm
	Stockholm	Stockholm Internet Exchange	STHIX*
	Stockholm	Equinix Internet Exchange - Stockholm	Equinix Stockholm**
	Sundsvall	Internet Exchange i Sverige - Sundsvall	Netnod - Sundsvall**
	Sundsvall	Stockholm Internet Exchange - Sundsvall	STHIX - Sundsvall**
	Umea	Stockholm Internet Exchange- Umea	STHIX - Umea**
	Umea	NorrNod	NorrNod
Switzerland 9			
	Geneva	CERN Internet eXchange Point	CIXP*
	Lousanne	RomandIX	RomandIX
	Rümlang	Infrastructure #1 (Free IX)	Free IX
	Zurich	4B42 Internet Exchange Point	4IXP
	Zurich	CH-IX	CH-IX
	Zurich	Equinix Internet Exchange - Zurich	Equinix Zurich*
	Zurich	Swiss Internet Exchange	SwissIX*
	Zurich	Securebit AG	SBIX
	Zurich	Community-IX.ch	Community-IX ch
Turkey 5			
	Denizli	Turk IX	TR-IX
	Istanbul	Deutscher Commercial Internet Exchange	DE-CIX Istanbul**
	Istanbul	Turkish internet eXchange	TR-IX
	Istanbul	Turk-IX	Turk-IX
	Istanbul	GIBIRNETIX	GIBIRIX
Ukraine 9			
	Donetsk	Donetsk Internet Exchange	DN-IX
	Kherson	Kherson Traffic Exchange Point	Kherson Traffic Exchange
	Khmelnytskiy	Khmelnytskiy Internet Exchange	KM-IX
	Kiev	Digital Telecom Internet Exchange	DTEL-IX
	Kiev	Giganet	Giganet
	Kiev	Ukrainian Internet Exchange	UA-IX
	Kiev	RUDAKI INTERNET EXCHANGE	RUDAKI-IX
	Kremenchuk	Kremen-IX	Kremen-IX
	Ivano-Frankivsk	Ivano-Frankivsk Internet Exchnage	IF-IX
United Arab Emirates 2			
	Abu Dhabi	SmartHub Internet Exchange	SH IX
	Dubai	United Arab Emirates Internet Exchange	UAE-IX*
United Kingdom 11			
	Bradford	Bradford Internet Exchange	BFD-IX
	Cardiff	LINX Wales	LINX Wales**
	Edinburgh	LINX Scotland	LINX Scotland**
	Leeds	IXLeeds	IXLeeds*
	Liverpool	Liverpool Internet Exchange	IX Liverpool
	London	Equinix Internet Exchange - London	Equinix London**
	London	London Internet Exchange	LINX*
	London	London Network Access Point	LONAP*
	Manchester	Equinix Internet Exchange - Manchester	Equinix Manchester**
	Manchester	LINX Manchester	LINX Manchester**
	Newcastle	Newcastle Internet Exchange	NCL-IX*

Appendix 2

IXP API exports in the IXP{DB}

» There were 242 API's in the IXP{DB} at the end of 2021