

# The European IXP Scene

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euro-IX

Where networks meet

[www.de-cix.net](http://www.de-cix.net)

# ***Definition Internet Exchange Point (IXP)***

- An Internet Exchange Point (IXP) is a **network facility** that enables the interconnection of **more than two independent Autonomous Systems**, primarily for the purpose of facilitating the **exchange of Internet traffic**.
  
- 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.

Based on: <http://www.ix-f.net/ixp-definition.html>

# Definition Internet Exchange Point (IXP)

→ Goal: Peering between ASes

- Save on (transit-) cost
- Keep local traffic local

→ Scientific Study by A. Ahmed et al.

A. Ahmed et al. "Peering vs. transit: Performance comparison of peering and transit interconnections," *ICNP 2017*

- Peering outperforms transit for 91% of ASes
- Shorter paths and smaller propagation delays for 95% of ASes

# ***Data Source: EURO-IX***

→The European Internet Exchange Association (EURO-IX)

→73 members

- 54 in the Euro-IX Region
  - 49 countries
  - Operating over 100 IXPs
- 19 from other continents
- Operating over 150 IXPs globally

→Euro-IX Operates IXPDB

- Data on 628 IXPs around the globe

# Euro-IX

216 IXPs  
49 Countries  
176 Cities  
465 Locations

AF-IX

APIX

# Global IXP Development by IX-F Region

Region	IX-F Member	2011	2019	Growth
Europe	Euro-IX	132	218	65%
Asia/Pacific	APIX	60	159	165%
Africa	AF-IX	22	43	95%
Latin America & Caribbean	LAC-IX	27	76	181%
North America		80	134	68%



# *The Euro-IXP Community*

→ Euro-IX

- Represents ~100 European IXPs
- ~46% of the entire IXP community

→ European Peering Forum (for 14 years)

→ Partner programs between IXPs

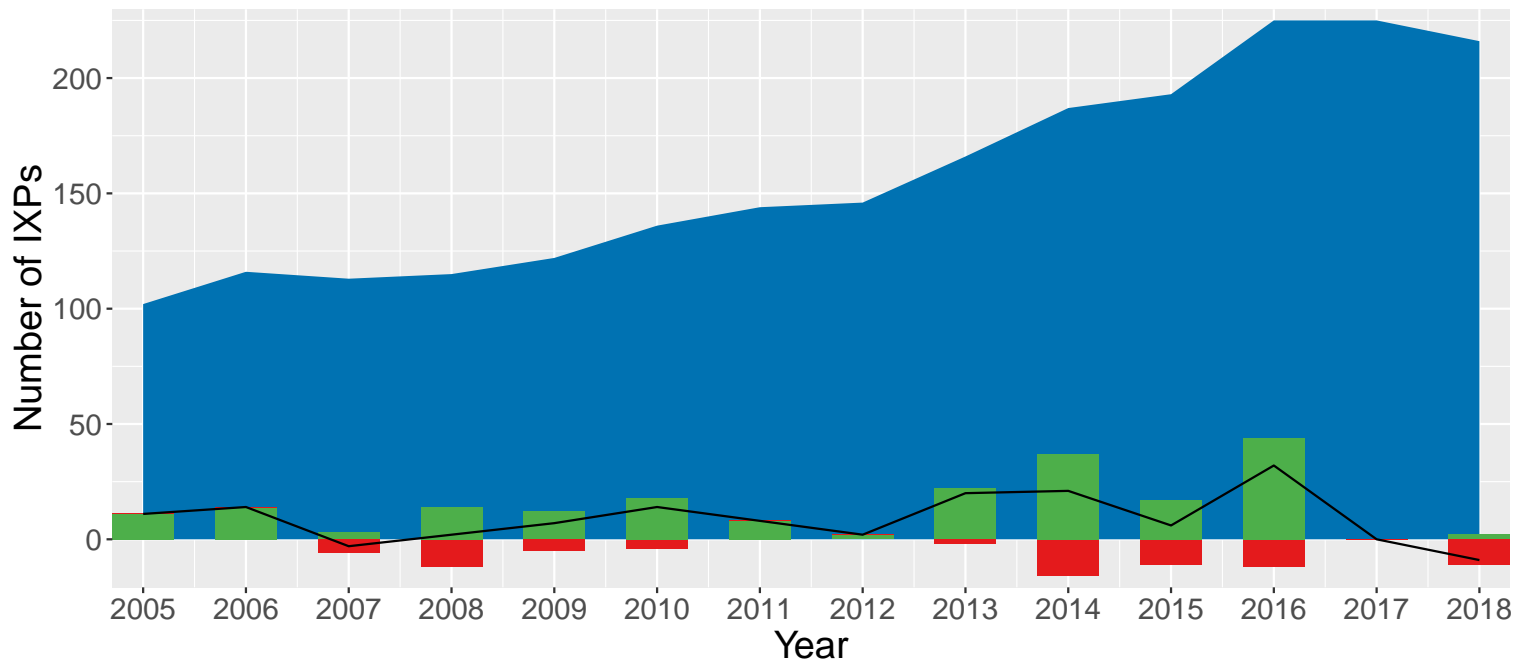
→ IXPs promoting each other

→ Inviting each other to GM, anniversaries, etc.

→ Regular survey and updates



# Growth of IXPs in the Euro-IX Region



Legend ■ closed ■ growth ■ operational ■ started



# *IXP Traffic*



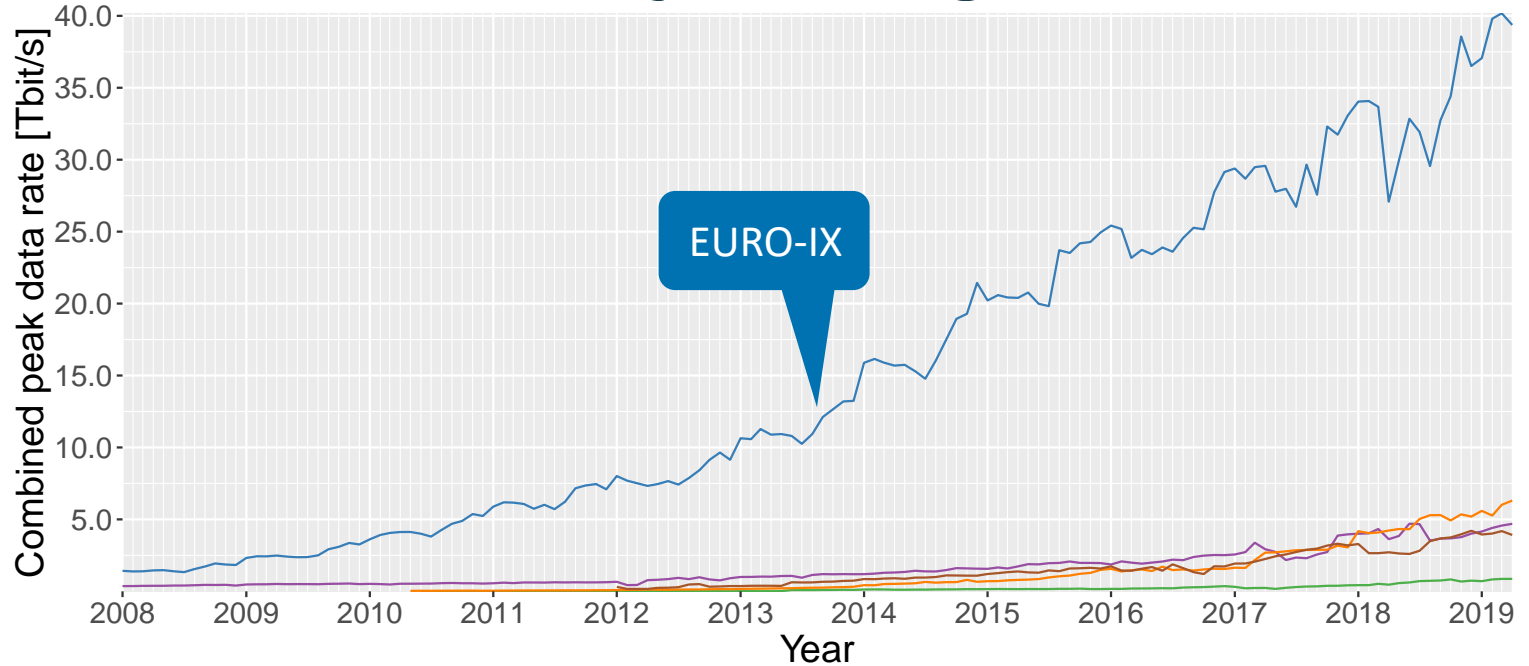
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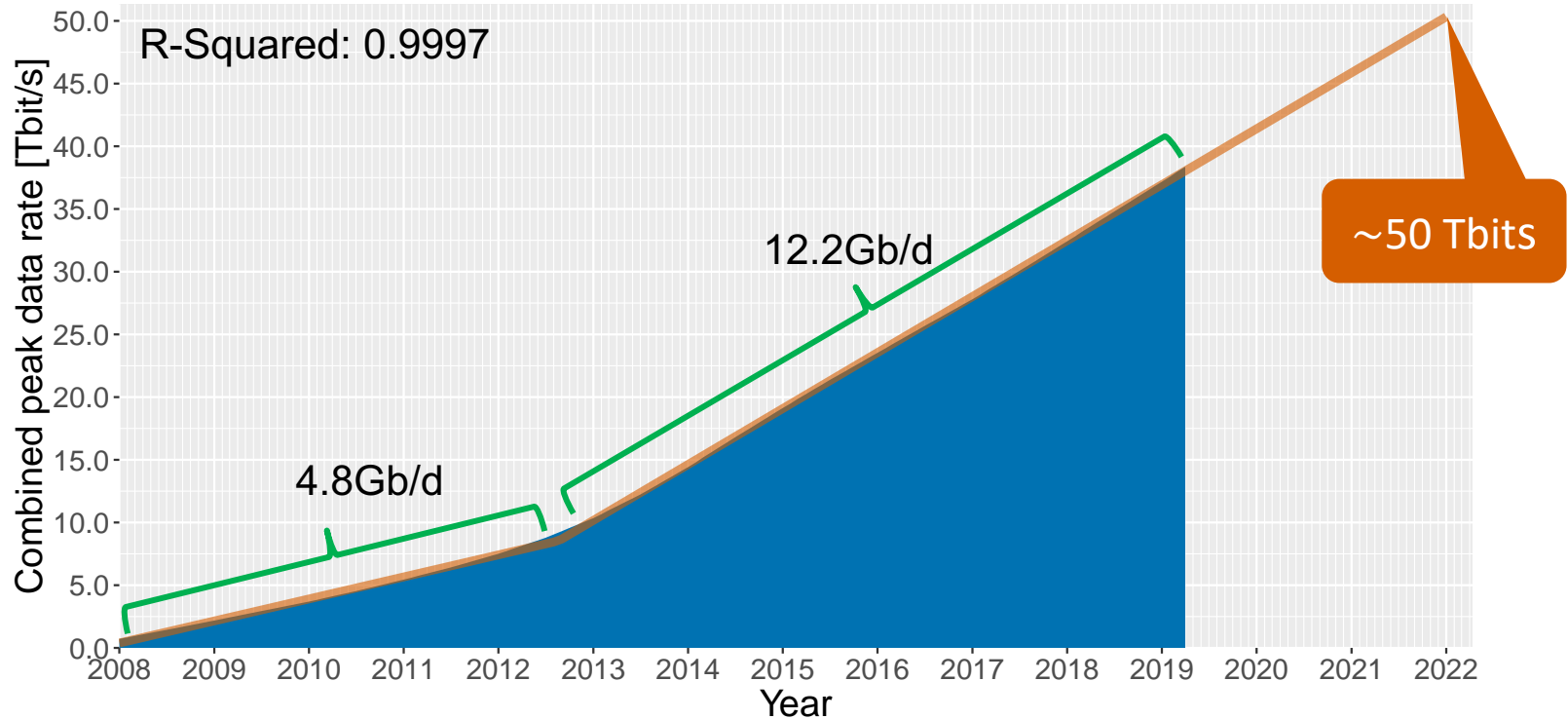
[www.de-cix.net](http://www.de-cix.net)

# Peak Data Rates by IXP Region



Region — Africa — Asia — Europe — Latin America and the Caribbean — North America

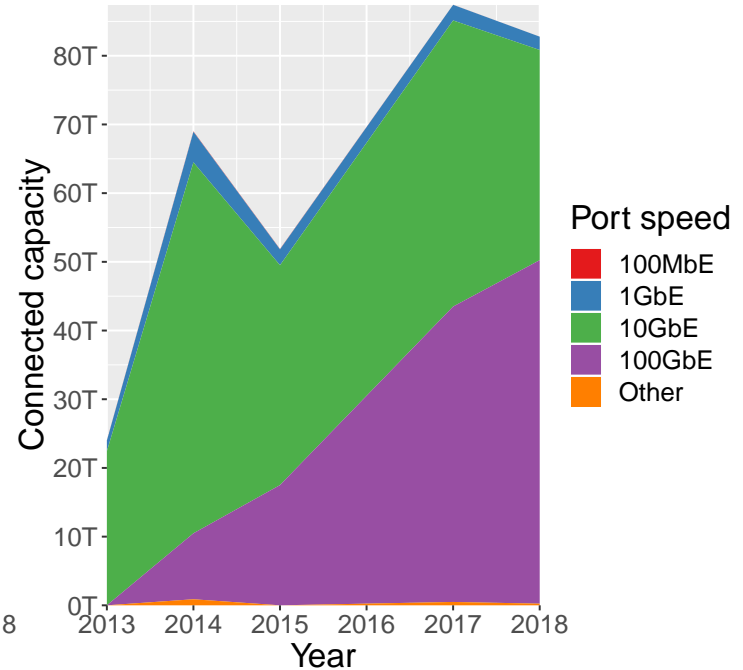
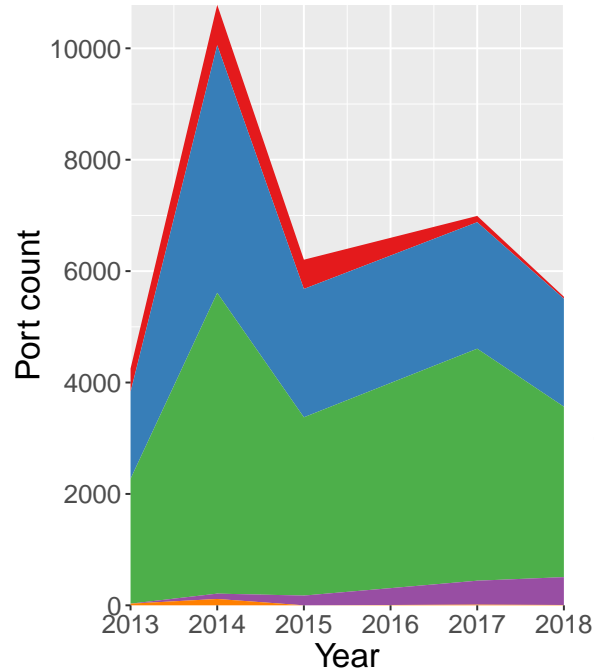
# Euro-IX IXP Peak Data Rate Trend



# Euro-IX Port Speed Trends

→Data

- 2016 is missing
- Changing participation over time



# *Euro-IX Monthly Avg. Customer Port Costs*

Port	2013	2018	Decrease
100MbE			-4%
1GbE			46%
1GbE trunked			49%
10GbE			44%
10GbE trunked			54%
100GbE			60%



# Euro-IX: Mid-Sized and Large IXPs



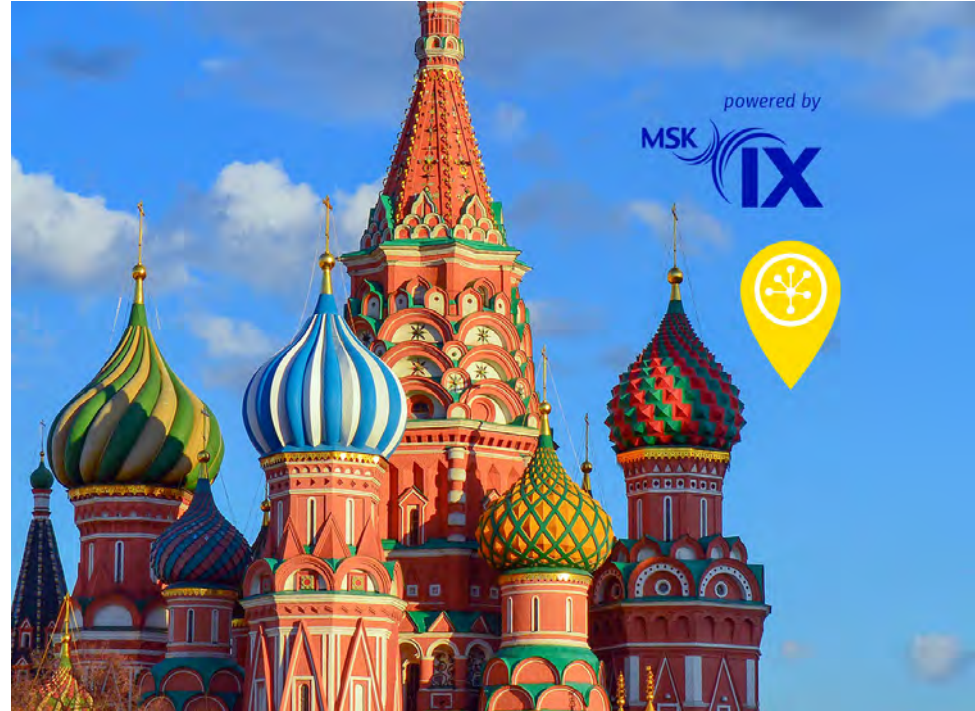
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# IXPs: Eastern Europe

- Eastern Europe is home to multiple top 10 IXPs
  - Global
    - MSK-IX, DATA-IX
  - Europe
    - NIX.CZ, Peering.cz
- Some of the fastest growing IXPs 2009-2011

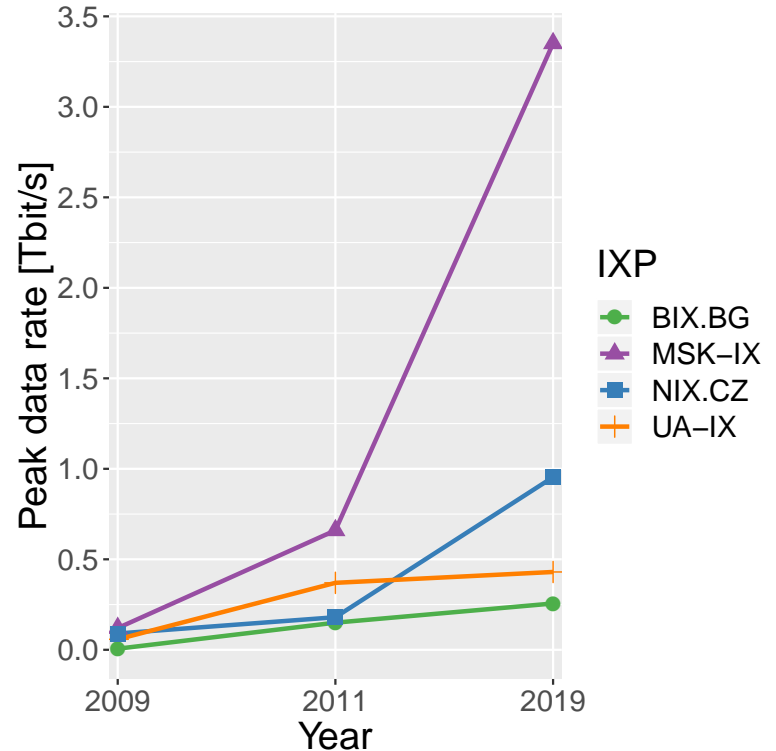


# IXPs: Eastern Europe

→ Peak data rates for four IXPs

- Growth has slowed down
- Still tremendous growth

IXP	2009-2011	2011-2019
MSK-IX	275,00%	63,47%
UA-IX	318,97%	14,53%
BIX.BG	1250,00%	21,33%
NIX.CZ	100,00%	66,25%





# Top-10 European IXPs

→ Europe is home to some of the largest IXPs

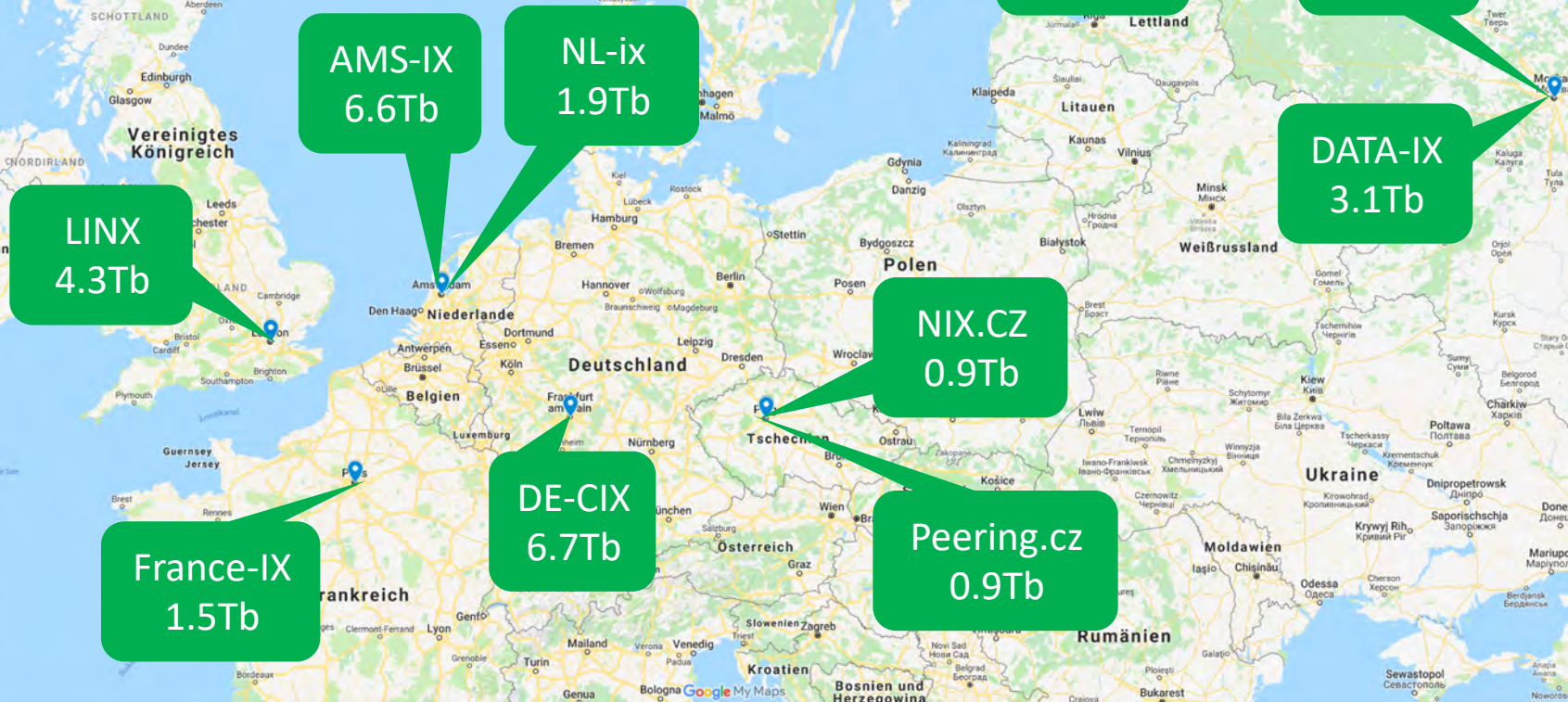
- By peak data rate
- 7 of the top 10 IXPs in the world are located in Europe

→ Top 10 European IXPs

- Transport ~75% of the European IXP traffic
- 6 IXPs with more than 5 Tb/s peak data rate
- 8 IXPs with more than 1Tb/s peak data rate
- 2 IXPs with more than 0.5Tb/s peak data rate

Data: [https://en.wikipedia.org/wiki/List\\_of\\_Internet\\_exchange\\_points\\_by\\_size](https://en.wikipedia.org/wiki/List_of_Internet_exchange_points_by_size), IXP homepages, 2019

# Top-10 European IXPs



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Source: <https://www.internetexchangemap.com/> based on IXPDB

[www.de-cix.net](http://www.de-cix.net)

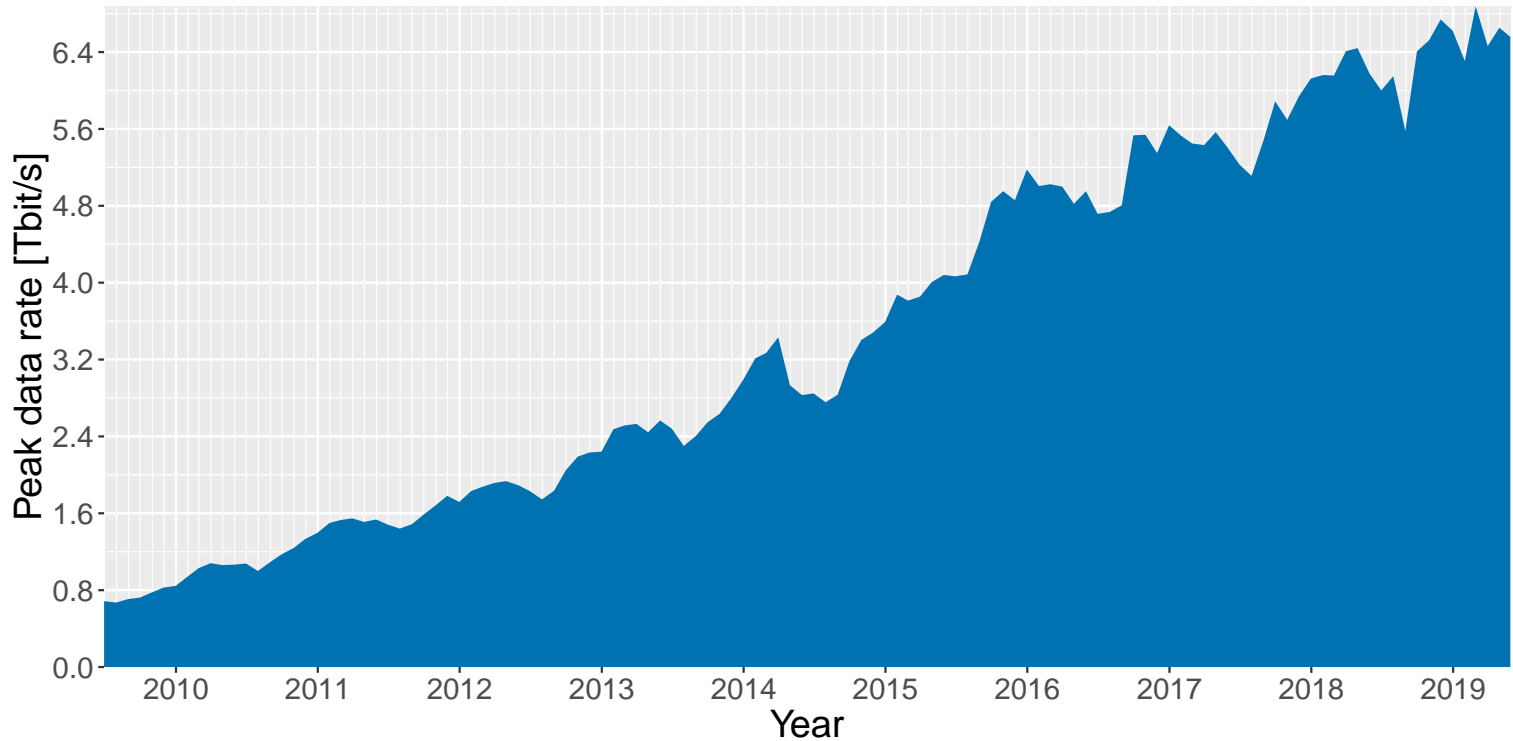
# Large IXP: DE-CIX Frankfurt

→ Largest IXP by peak & ASNs

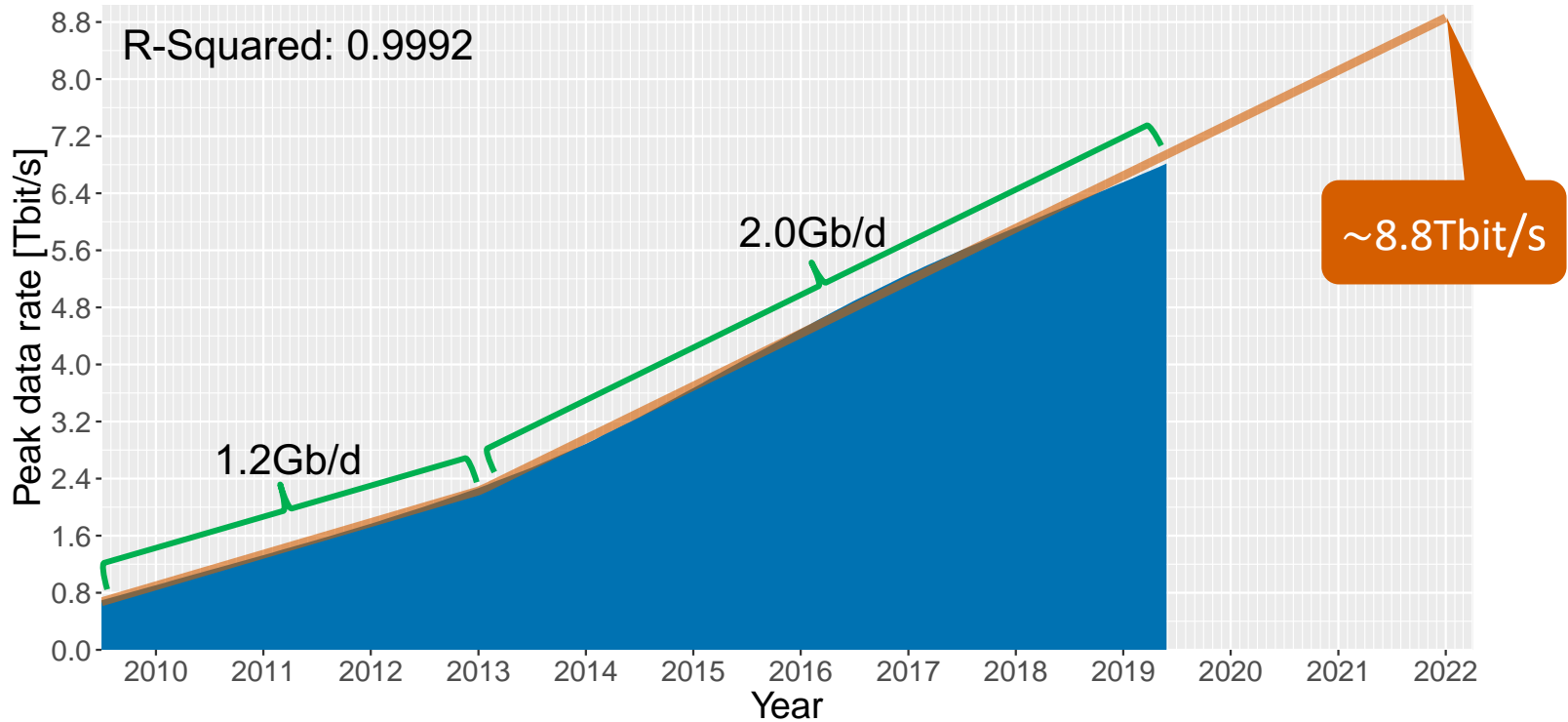
- 6.7 Tbit/s peak data rate
- 863 connected networks
- More than 480,000 routes
- More that 30 access sites
- Interconnection to the 8 of the other DE-CIX locations



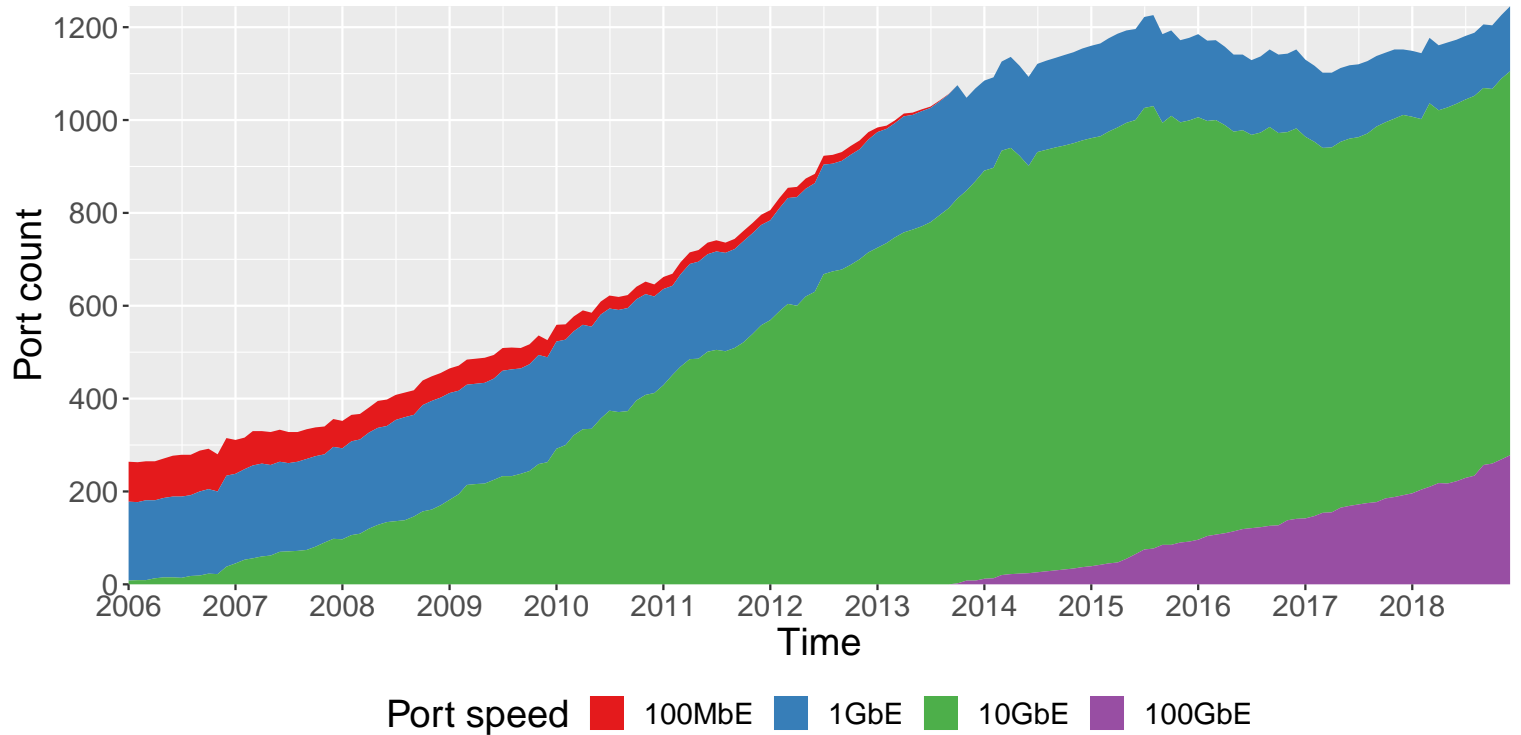
# DE-CIX Peak Data Rate



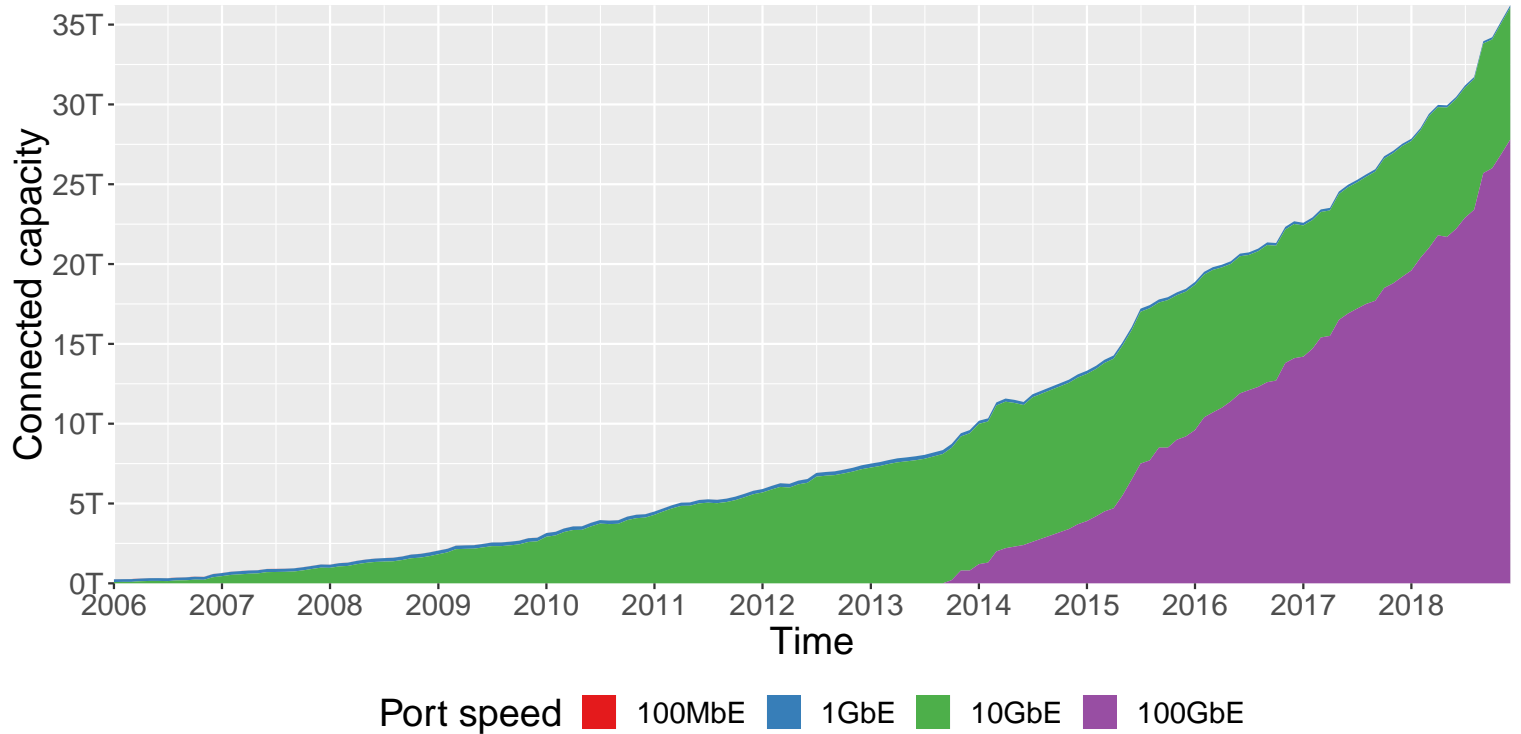
# DE-CIX Peak Data Rate Trend



# DE-CIX Port Speed Distribution



# DE-CIX Connected Capacity by Port Speed

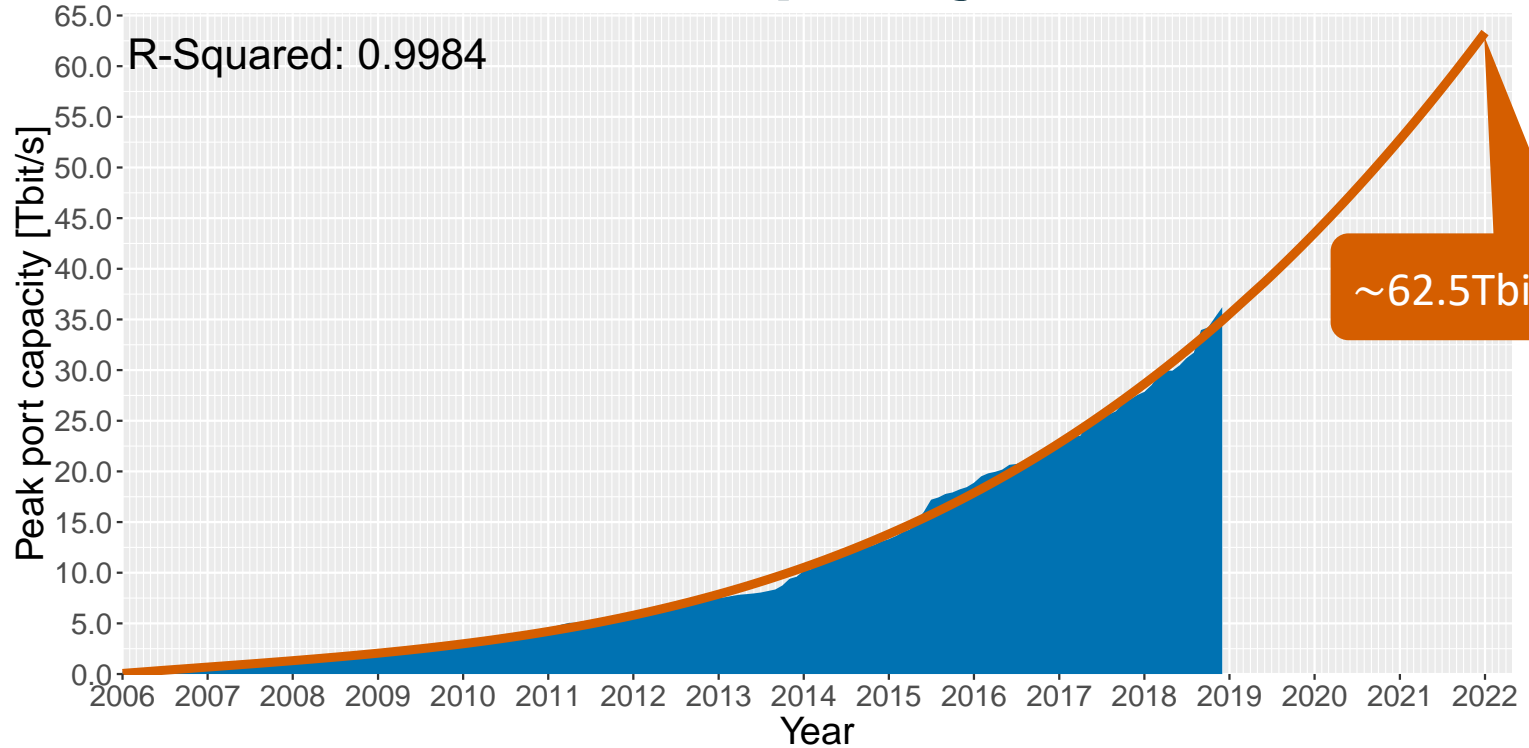


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# DE-CIX Connected Capacity Trend





# *Port Speed Developments at Large IXPs*

## → 1GbE ports

- Are going to be deprecated
- Serve low capacity needs with 10GbE ports

## → 10GbE ports

- Deprecation plans by hyper-scale customers

## → 400GbE Ports

- Very interesting for backbone connections
- Customer stated their interest
- 400GbE ➔ 100GbE fan out becomes interesting



## ***Euro-IX Tools: IXPDB***

# ***IXPDB - Some History***

- Not new, the original code was written around 15 years ago...
- Membership feedback clearly showed IXPs want a place to publish an accurate and complete data set.
- As members of IX-F it didn't make sense for all of us to create individual regional databases or directories
- We wanted to move forward with automation and work started on the IXP Member List JSON Schema, which is now also used in PeeringDB
- In 2017 we contracted the website and IXP Database work to CZ.NIC.

# What we've been working on..

You can access the IXPDB via <https://ixpdb.euro-ix.net/>



# What we've been working on – IXP Directory

IXP S IXPDB | IXPDB | IXP Directory

IX-F ID, name, city or country  Only with API  AFIX  APIX  Euro-IX  LAC-IX  North America

COMPARE	IX-F ID	Name	City	Country	Last updated	API	MANRS	# of ASNs ↓
+	9	DE-CIX FRA (DE-CIX Frankfurt)	Frankfurt am Main	DE	April 5, 2019, 3:07 p.m.	✓	✓	861
+	2	AMS-IX	Amsterdam	NL	April 5, 2019, 3:07 p.m.	✓	✓	837
+	1	LINX LON1	London	GB	April 5, 2019, 4 p.m.	✓	✓	775
+	548	EPIX (e-Poludnie Internet Exchange)		PL	March 13, 2019, 10:12 p.m.	✓	✗	506
+	13	msk-ix (MSK-IX public peering VLAN)	Moscow	RU	April 5, 2019, 3:07 p.m.	✓	✓	455
+	39	Equinix Paris (Equinix Internet Exchange - Paris)	Paris	FR	April 5, 2019, 3:07 p.m.	✗	✓	366



# IXPDB – Aggregate data

## New: Regional ASN Count

	AFIX	APIX	EURO-IX	LAC-IX	North America
# of ASNs	958	2954	11691	769	2773
# Unique ASNs	394	1416	2992	478	1038

# IXPDB – Aggregate data

## IXPs With the Most ASNs Connected

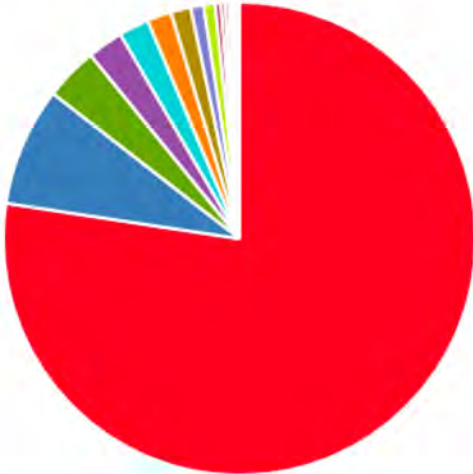
IX-F ID	Name	City	Country	Last updated	API	MANRS	# of ASNs
9	DE-CIX FRA (DE-CIX Frankfurt)	Frankfurt am Main	DE	May 29, 2019, 11:04 a.m.	✓	✓	859
2	AMS-IX	Amsterdam	NL	May 29, 2019, 11:04 a.m.	✓	✓	844
1	LINX LON1	London	GB	May 29, 2019, 11:04 a.m.	✓	✓	777
548	EPIX (e-Poludnie Internet Exchange)		PL	March 13, 2019, 10:12 p.m.	✓	✗	506
13	msk-ix (MSK-IX public peering VLAN)	Moscow	RU	May 29, 2019, 11:04 a.m.	✓	✓	454
27	NL-ix	The Hague	NL	May 29, 2019, 11:04 a.m.	✓	✓	387
39	Equinix Paris (Equinix Internet Exchange - Paris)	Paris	FR	May 29, 2019, 11:04 a.m.	✗	✓	366
351	NAPAfrica IX Johannesburg (NAPAfrica)		ZA	May 29, 2019, 11:01 a.m.	✓	✗	362
600	LINX LON2	London	GB	May 29, 2019, 11:04 a.m.	✓	✓	360
41	France-IX (FranceIX Paris)		FR	March 1, 2019, 12:02 p.m.	✓	✗	356



# IXPDB – Hardware at IXPs

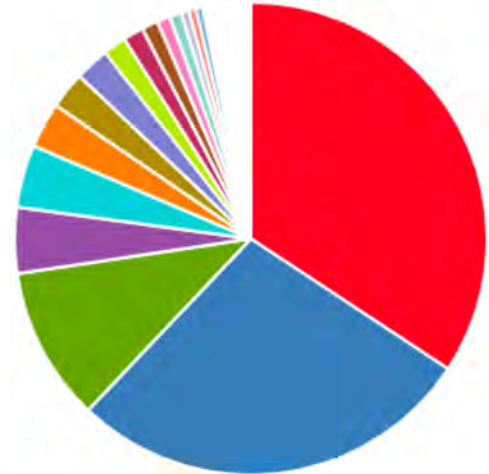
IXP Peering Platform

**Switches**



Peers at IXPs

**Network's hardware**





# IXPDB – IXP aggregated traffic via automation

All traffic in the last week



# Recent Features – IXP Member List

NAMEX (NAMEX ROMA IXP) IXP Participants

IXP Networks Points of presence **ASNs** Traffic

ASN I	Organisation	Type	IP addresses	MAC addresses	MANRS	Entry in PeeringDB	# of IXP connection
112	RIPE NCC	Non-Profit			✗	✗	24
137	GARR	Educational/Research			✗	✓	5
174	Cogent Communications	NSP			✓	✗	9
1267	Wind International Services S. p. A.	NSP			✗	✓	8
1299	Telia Carrier UK Limited	NSP			✓	✗	4
2906	Netflix Streaming Services International B.V.	Content			✗	✓	36
3257	GTT Communications, Inc.	NSP			✗	✗	15
3269	TIM	Not Disclosed			✗	✗	4
3302	Infracom	NSP			✗	✓	5
3549	CenturyLink Communications UK Limited	NSP			✓	✗	12
4809	China Telecom Z	NSP			✗	✗	4
5394	Unidata	Cable/DSL/ISP			✗	✓	4
5396	MC-link	Cable/DSL/ISP			✗	✓	2
5397	CINECA	Enterprise			✗	✓	1
5602	KPNQwest Italia	Cable/DSL/ISP			✗	✗	3
6762	Telecom Italia	NSP			✗	✗	11
6939	Hurricane Electric	NSP			✗	✓	166
8220	COLT Telecom Ltd.	NSP			✗	✓	21
8234	RAI				✗	✗	2
8265	Fastnet	NSP			✓	✓	2



## *IXPDB Sponsors*

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CZ.nic



A person is holding a globe of the world in front of a wall covered in newspaper clippings. The globe is the central focus, showing the continents of Africa and Asia. The person's hands are visible at the top and bottom of the globe. The background is a collage of various newspaper articles and photos, creating a textured, news-like background.

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