

International Bandwidth and Interconnection Trends

Europe, The Balkans, Albania

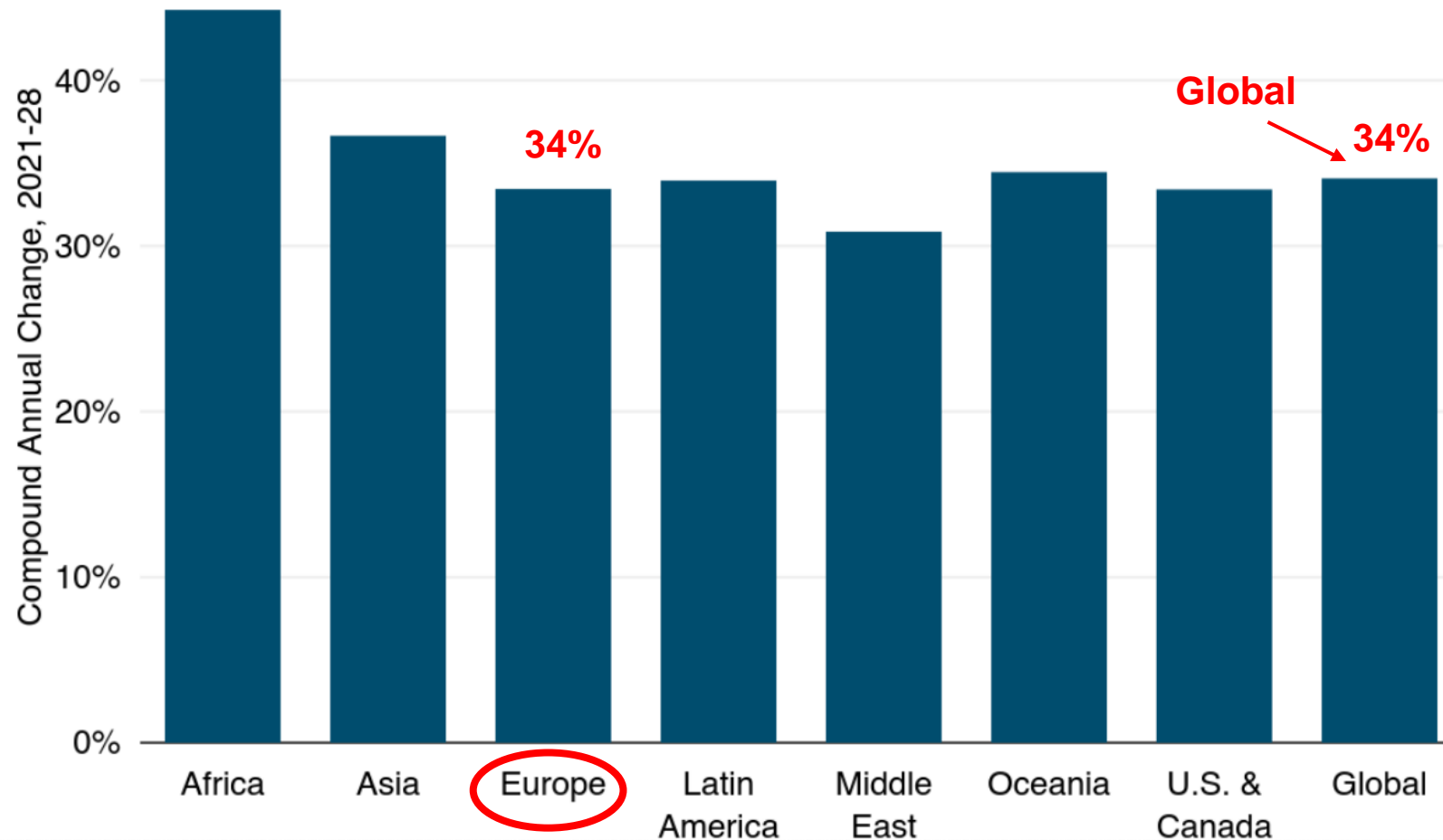
Patrick Christian

ANIX Meeting 2022
December 13, 2022

What we'll cover

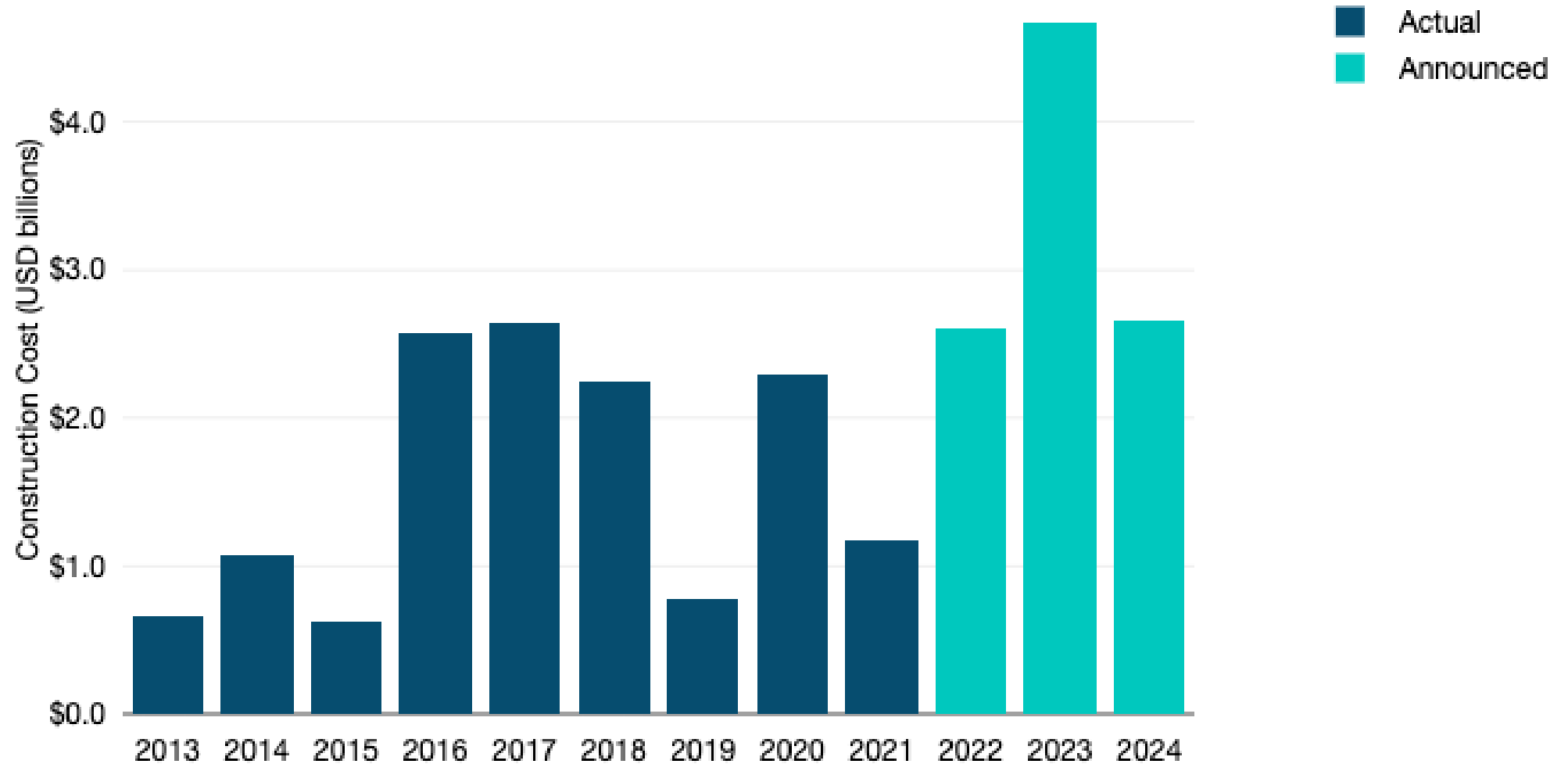
- **Global Int'l Bandwidth Developments**
 - New developments in sub cable deployment
 - Forecasts and pricing
- **European Int'l Bandwidth Developments**
 - Sub cable landings – focus on the Balkans
 - Growth and trends of intra-European networks
 - Growth and trends of networks connecting to Europe
- **European pricing trends**
- **Quick view of CDN and cloud DC growth**
- **Trends we're tracking**
 - Looking ahead at European growth

Forecasted bandwidth growth by region

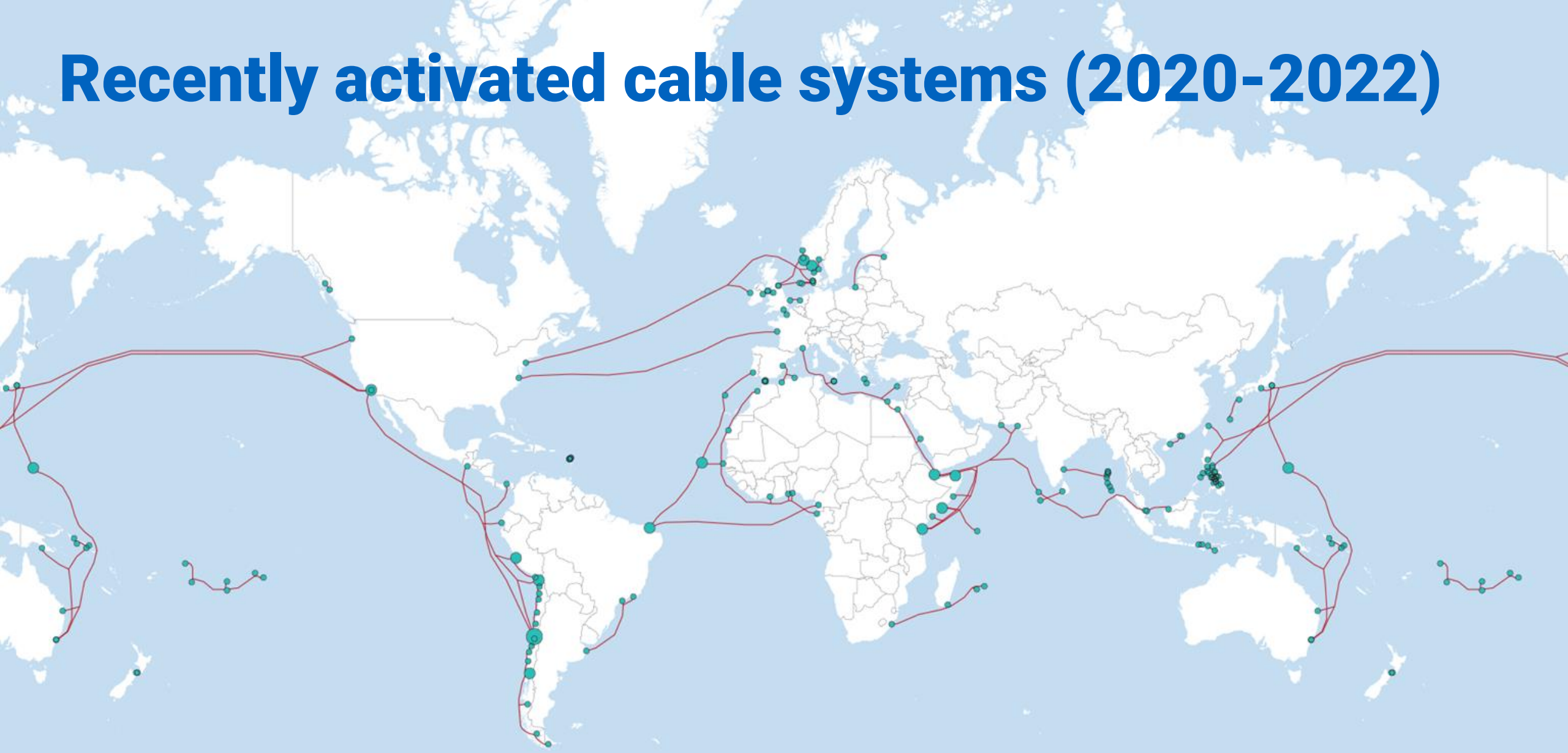


- Globally, used international bandwidth is expected to grow at a 34% CAGR from 2021-28.
 - This rate of growth implies a doubling roughly every 2.5 years.
- International links connected to Europe are expected to match global growth, increasing at a 34% CAGR.

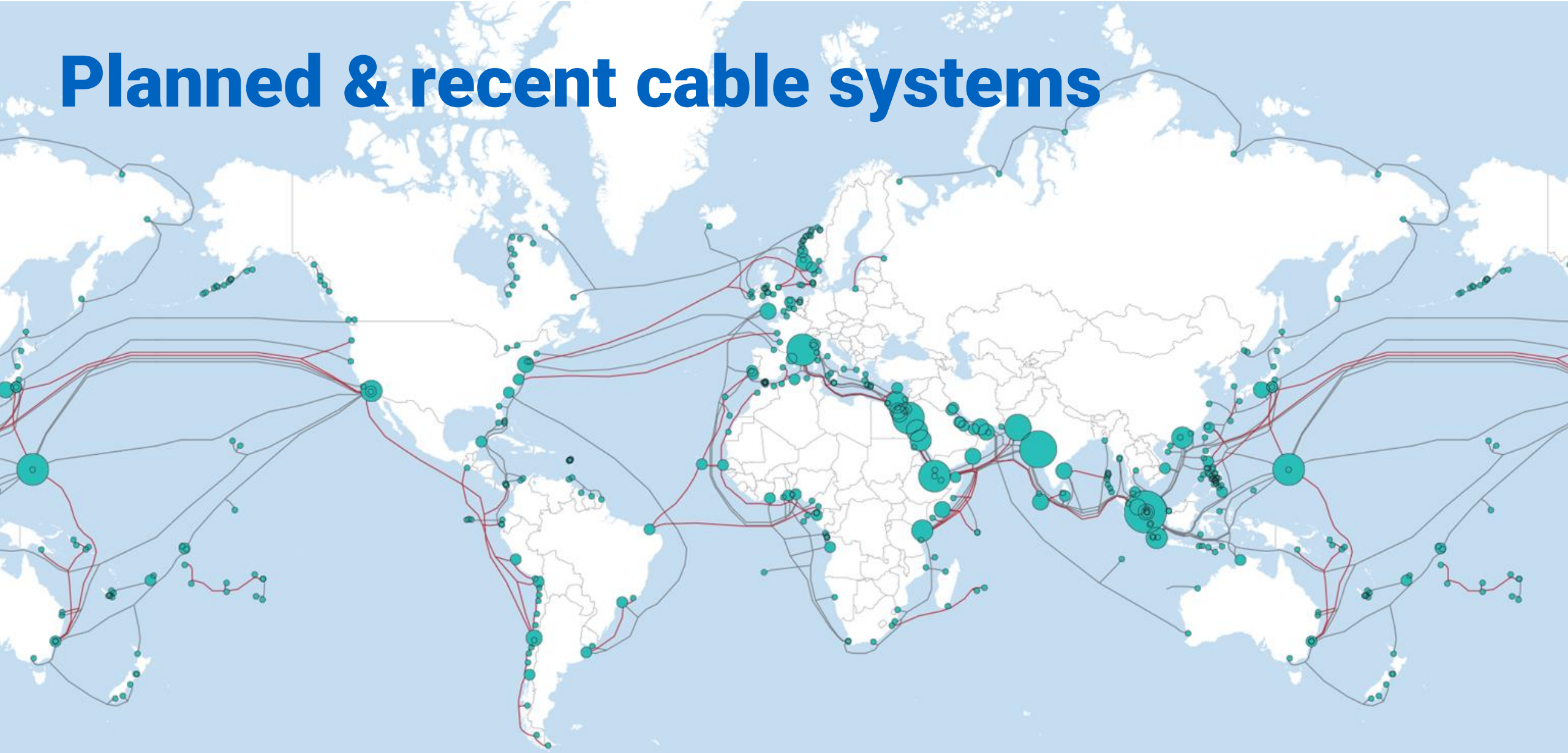
Submarine cable investment



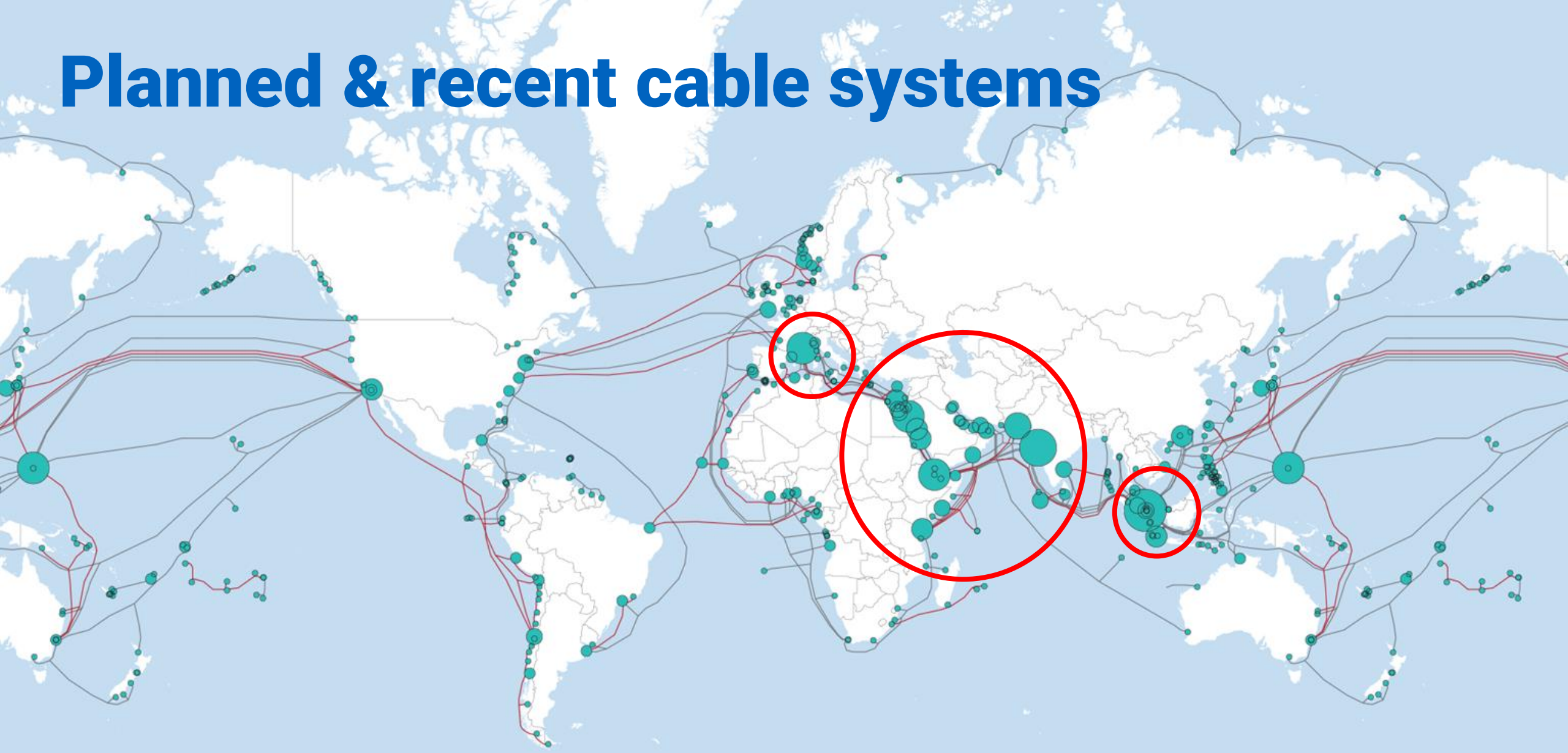
Recently activated cable systems (2020-2022)



Planned & recent cable systems



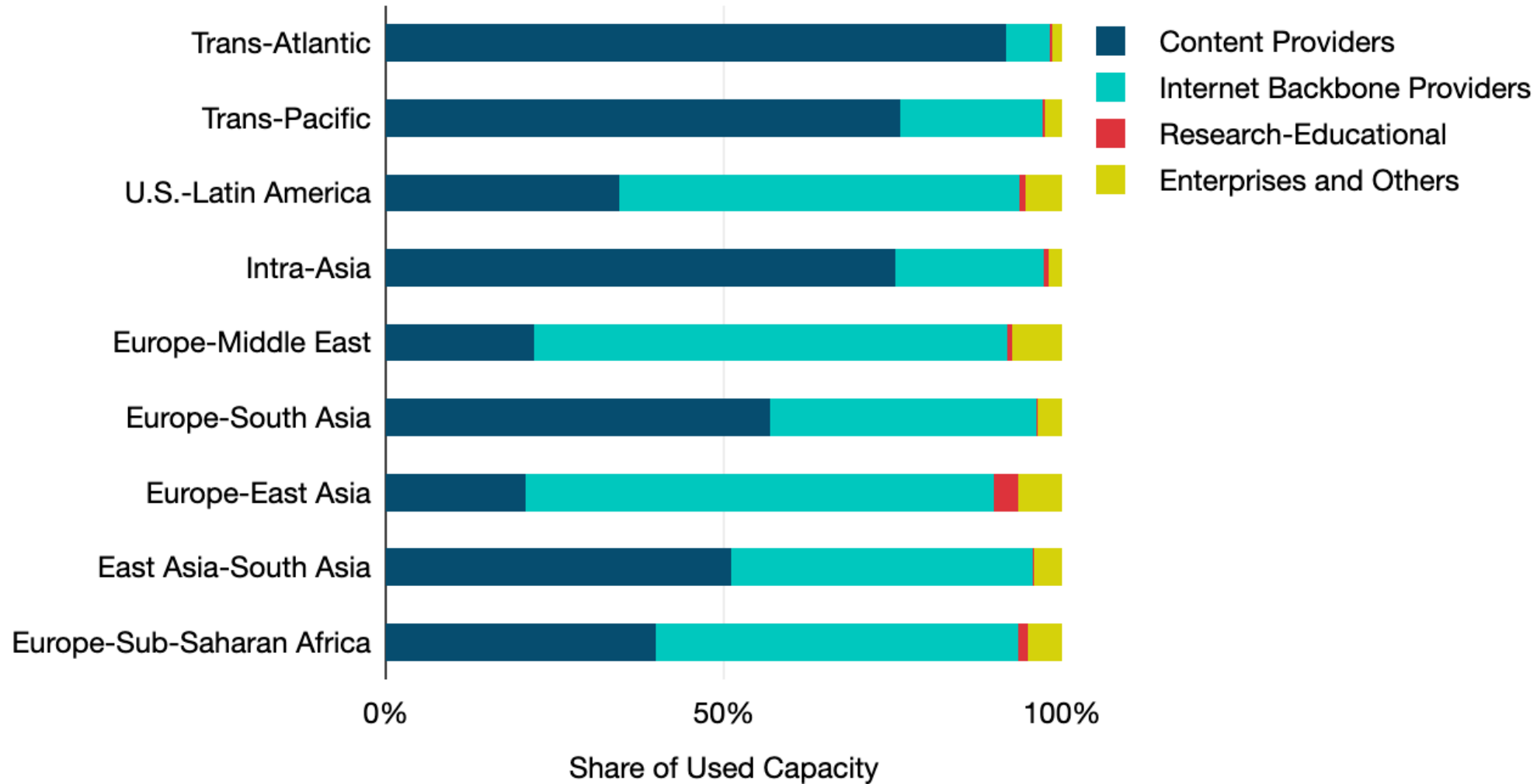
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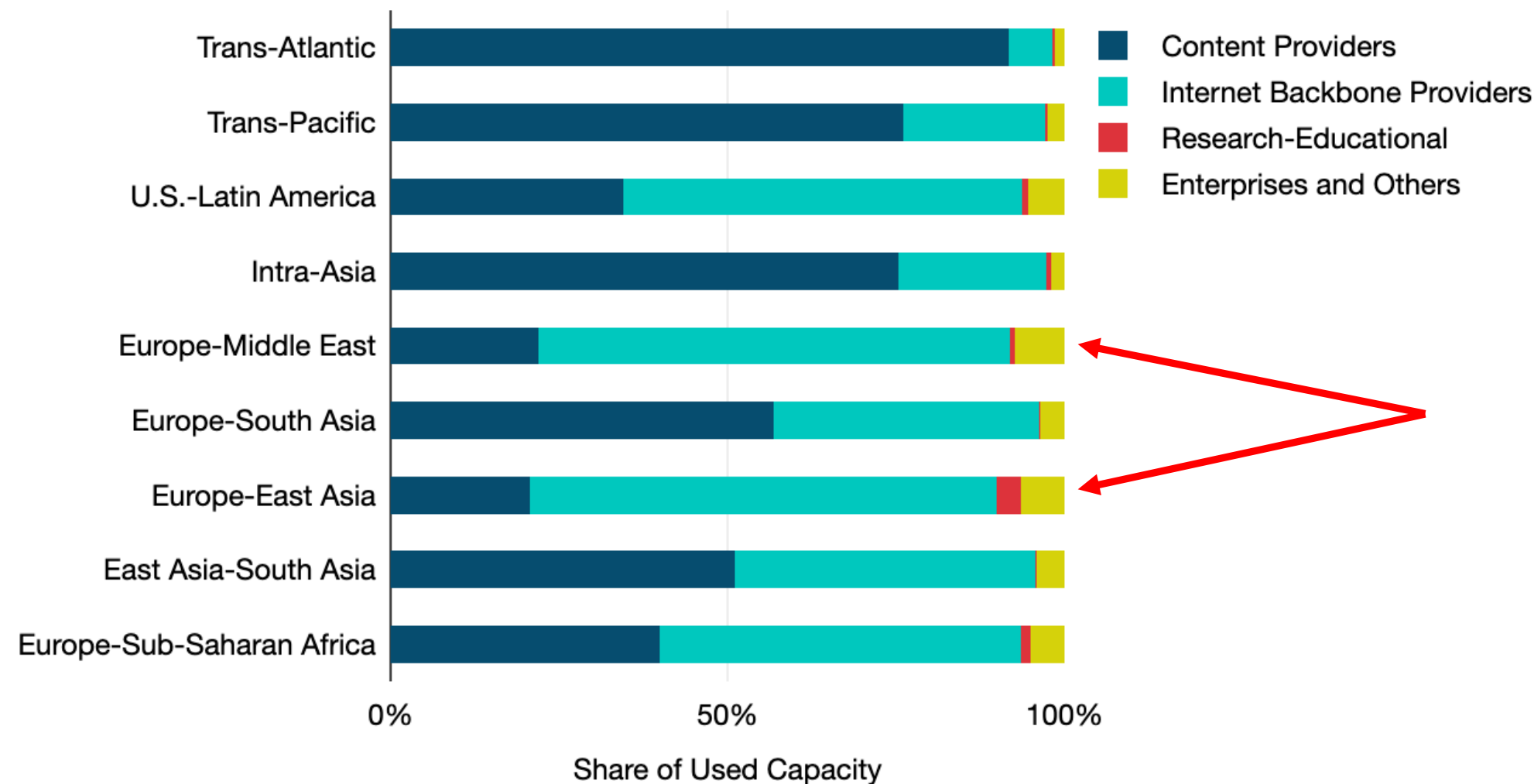
Planned cloud data centers



Share of bandwidth by category for major routes

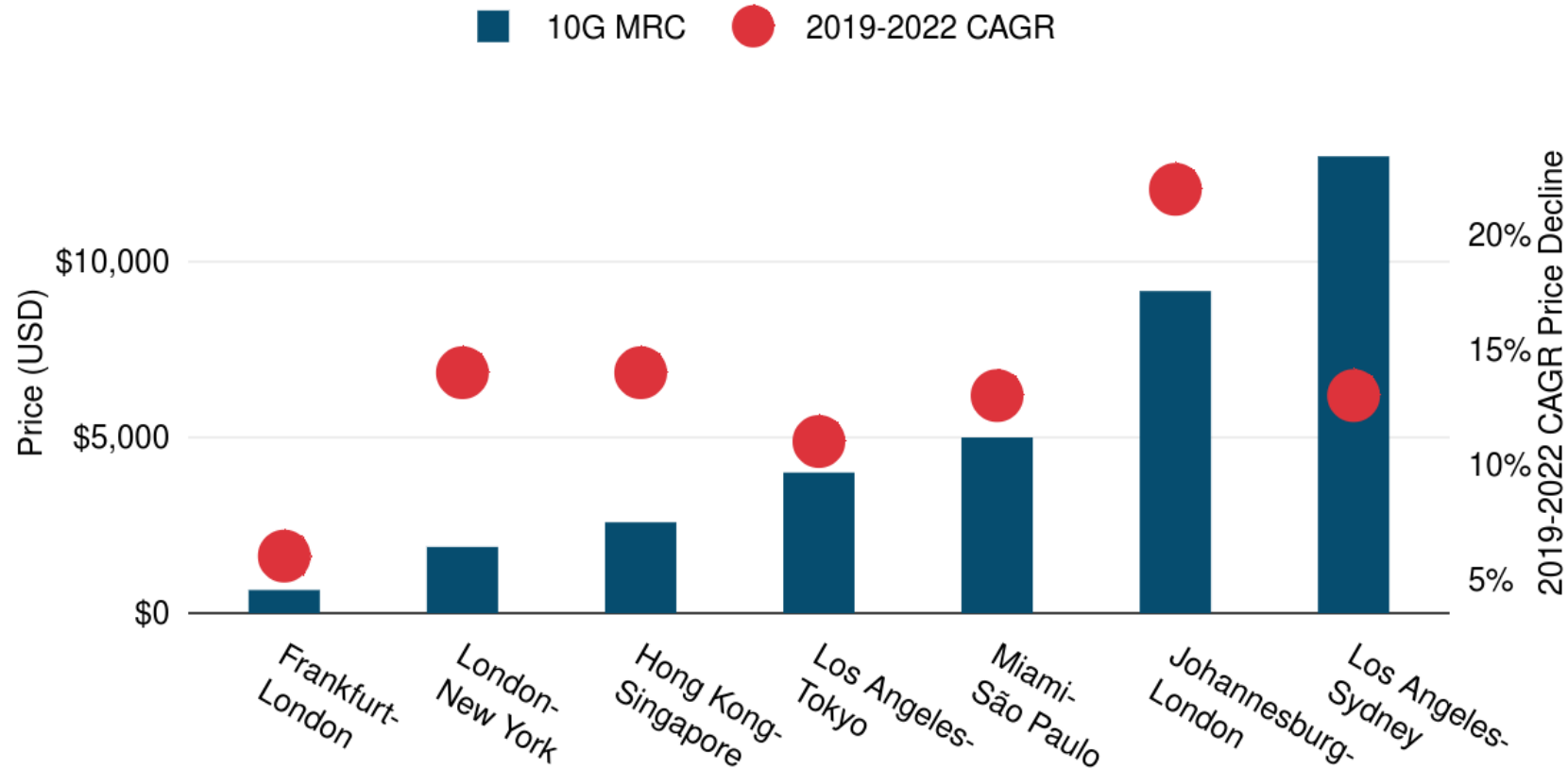


Share of bandwidth by category for major routes



10 Gbps median prices and erosion rates varies by route

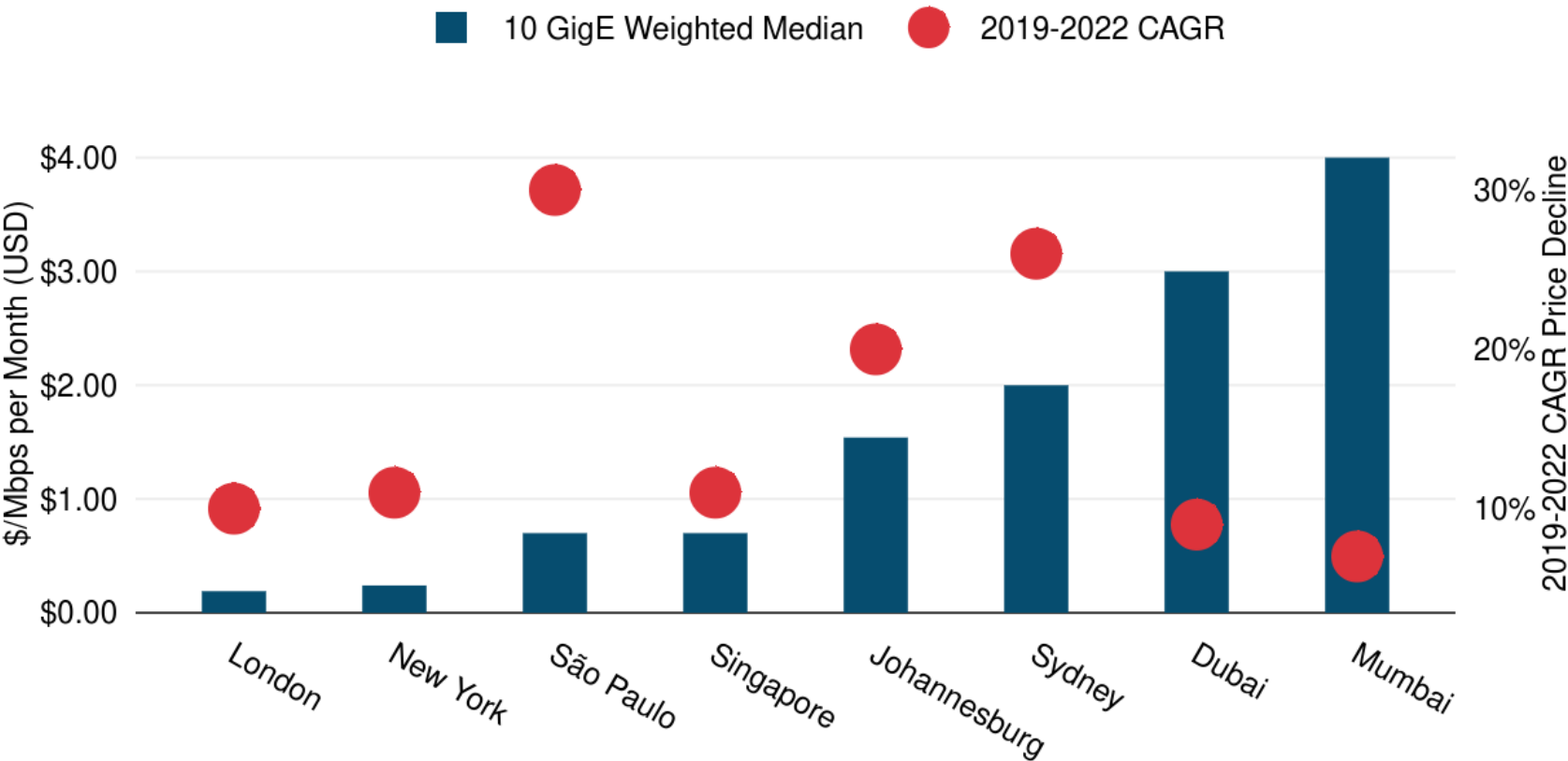
Weighted Median 10 Gbps Wave Prices & CAGR Price Decline on Select Int'l Routes



- Intra-Europe, North America-Europe, parts of (intra) East Asia – most competitive, lowest prices
- US-Asia, US-Oceania, Europe-Africa higher prices
- Most regions still dropping 10%+ per year, except Europe now where prices are very low
- Europe-Africa rates falling fastest at more than 20%

10 Gbps median prices and erosion rates varies by region

Weighted Median 10 Gbps IPT Monthly Lease Prices

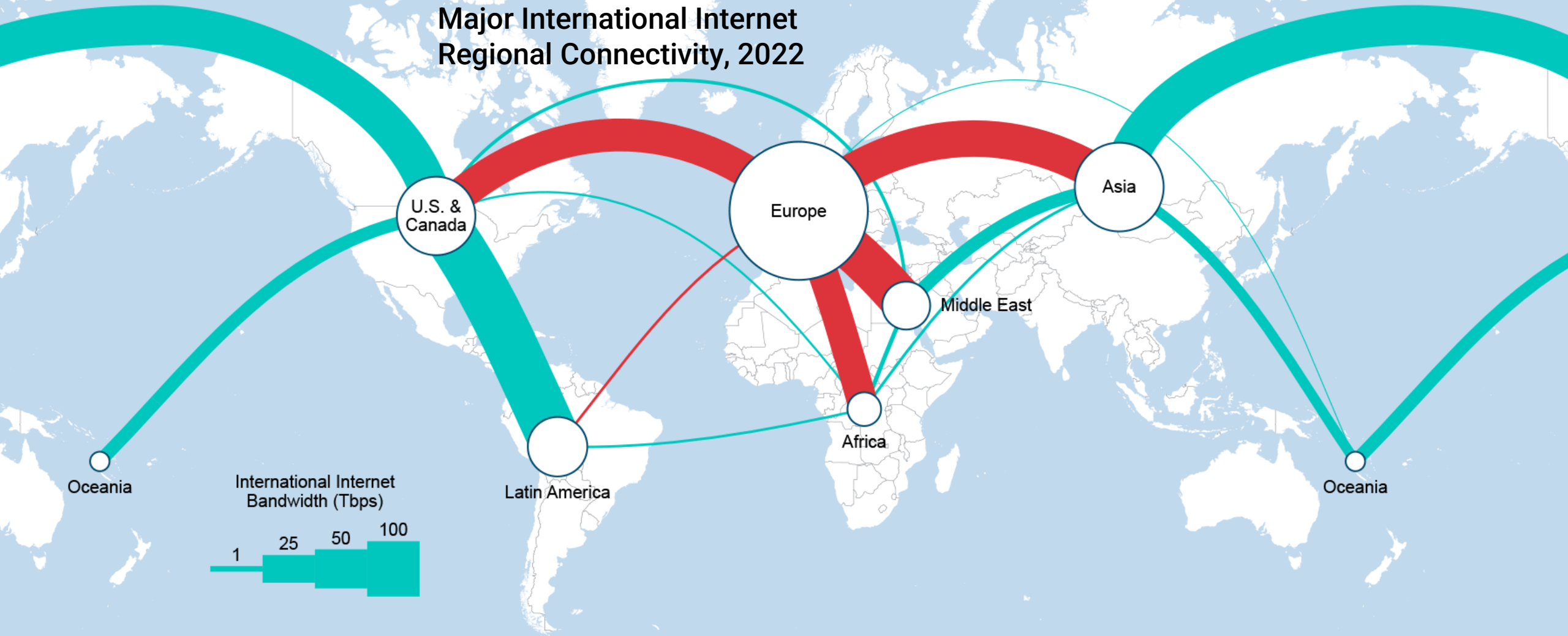


- Europe and North America – content sources, most competitive, lowest prices
- Latin America dropping fastest at 30%, Africa and Australia dropping but prices still high vs Europe
- Middle East and India prices are still high and dropping very slowly still

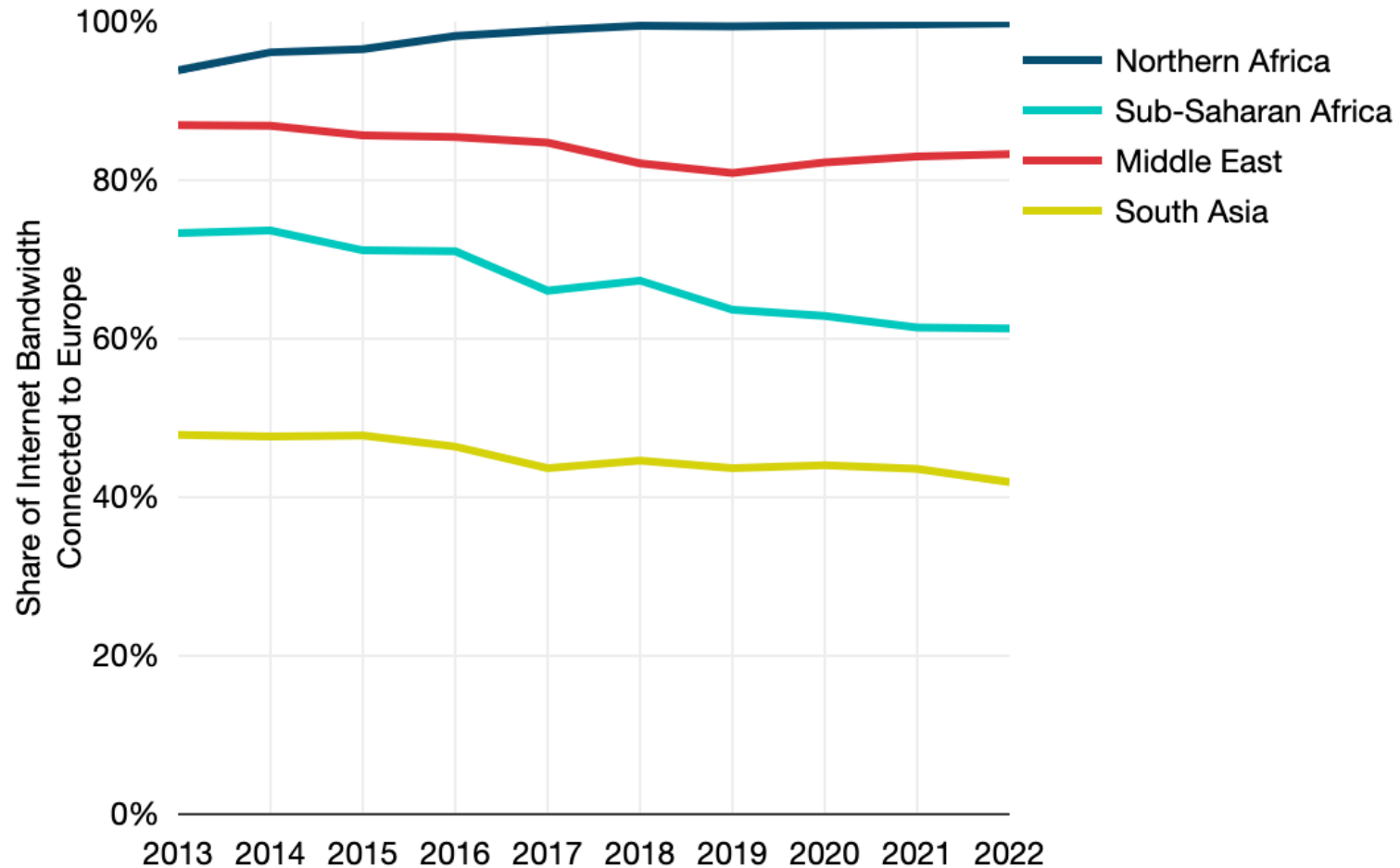
European Bandwidth Trends

European hub

Major International Internet
Regional Connectivity, 2022

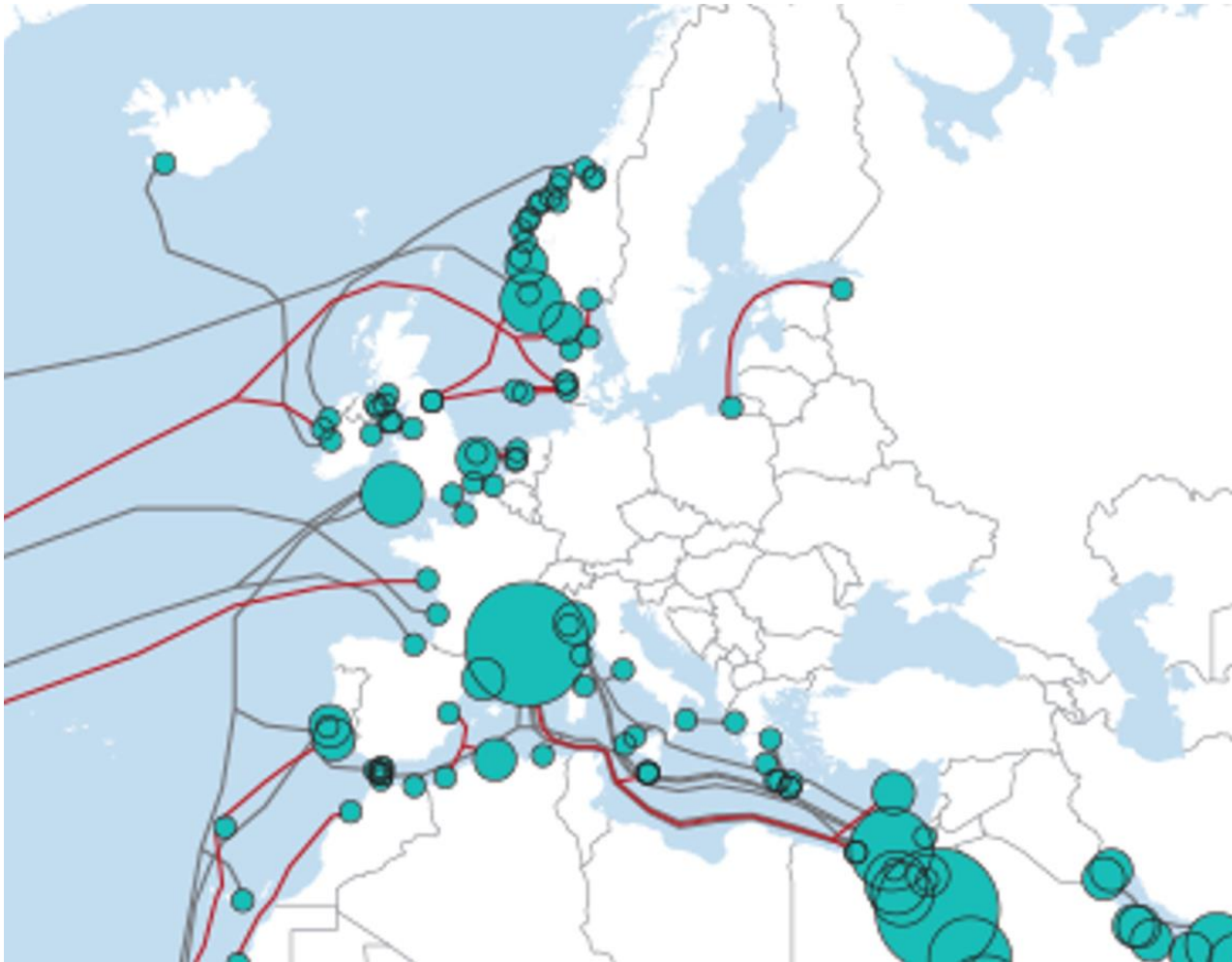


Changes in subregional (*share of*) capacity connected to Europe



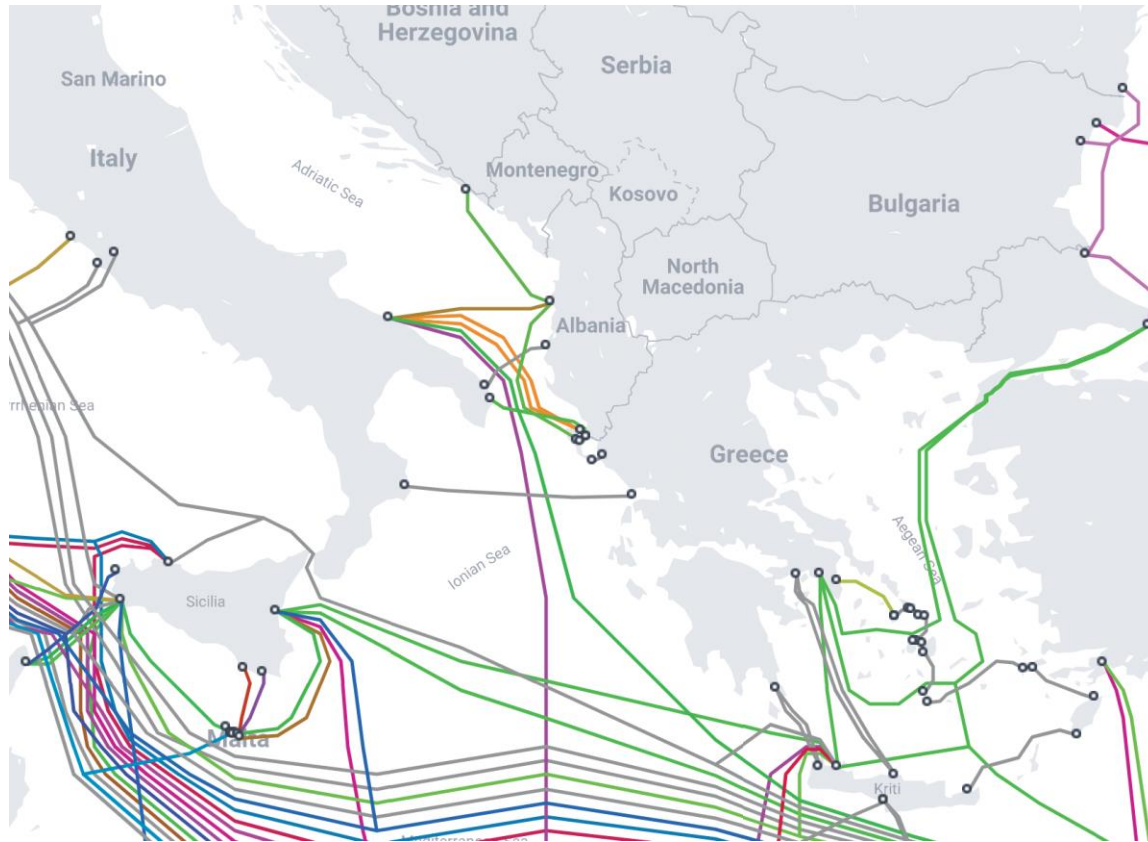
- Top 3: North Africa, Middle East then Sub-Saharan Africa
- Middle East still has high share of its int'l capacity connected to Europe
- South Asia's share to Europe not decreasing very quickly

Planned sub cable landings



- 5 major cable systems planned in coming years- 2Africa, IEX, Blue, SMW-6, Medusa
- Another 10+ small point-to-point intra-European cables. Both domestic and int'l
- Concentrations in France (Marseille) and UK but rest spread out – several in Greece and Italy

Recent and planned sub cables in SE Europe



Landing in Crete/Greece

- 2Africa (2023)
- Blue (2024)
- Medusa (Q3 2024)
- IEX (India-Europe Express) (2024)

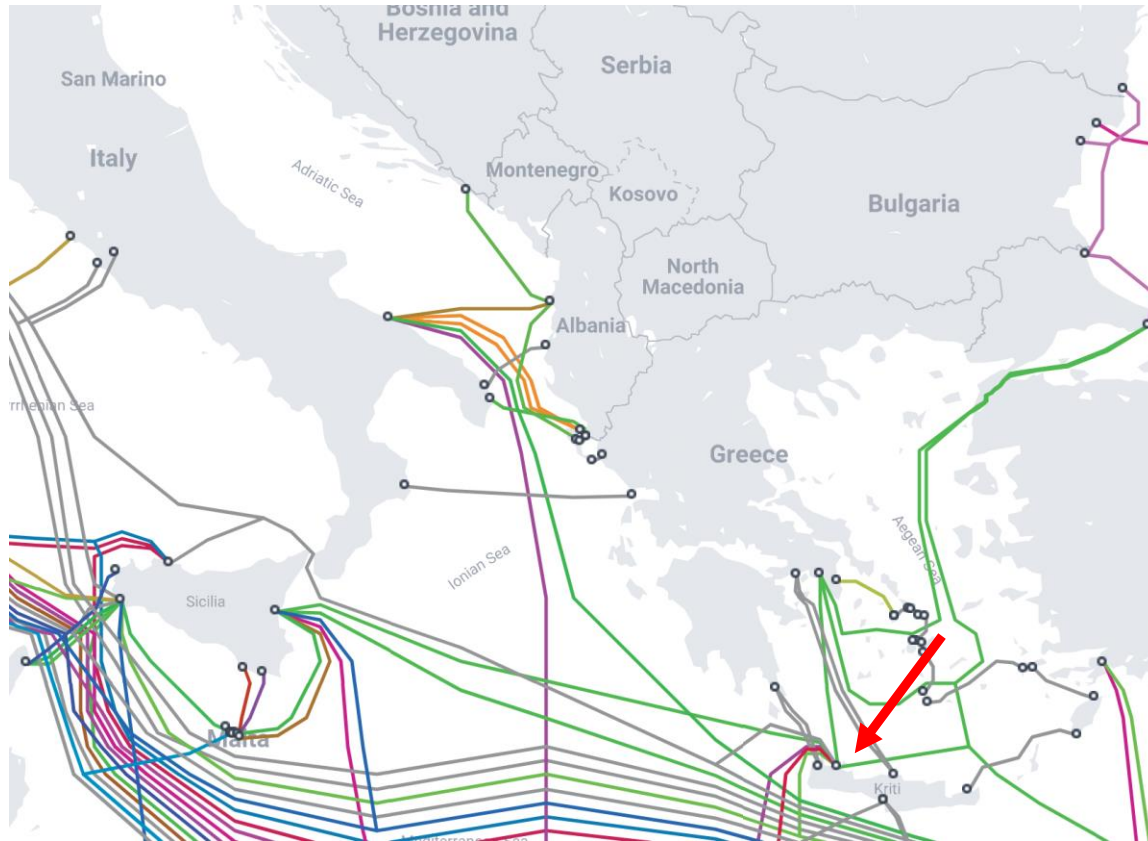
Connecting Crete to mainland

- Minoas East and West (2021)
- Apollo East and West (Q2 2024)

Connecting Italy & Greece

- Ionian (Q4 2022)
- Trans Adriatic Express (Q1 2023)

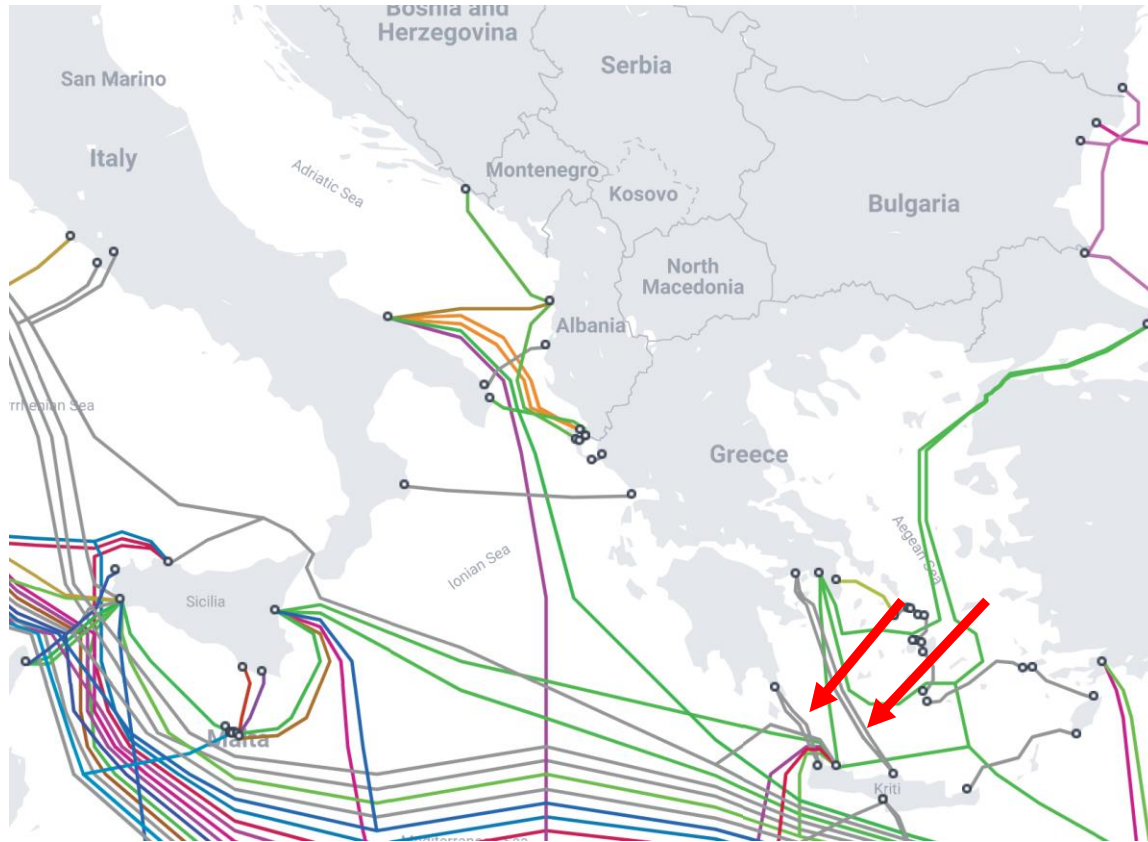
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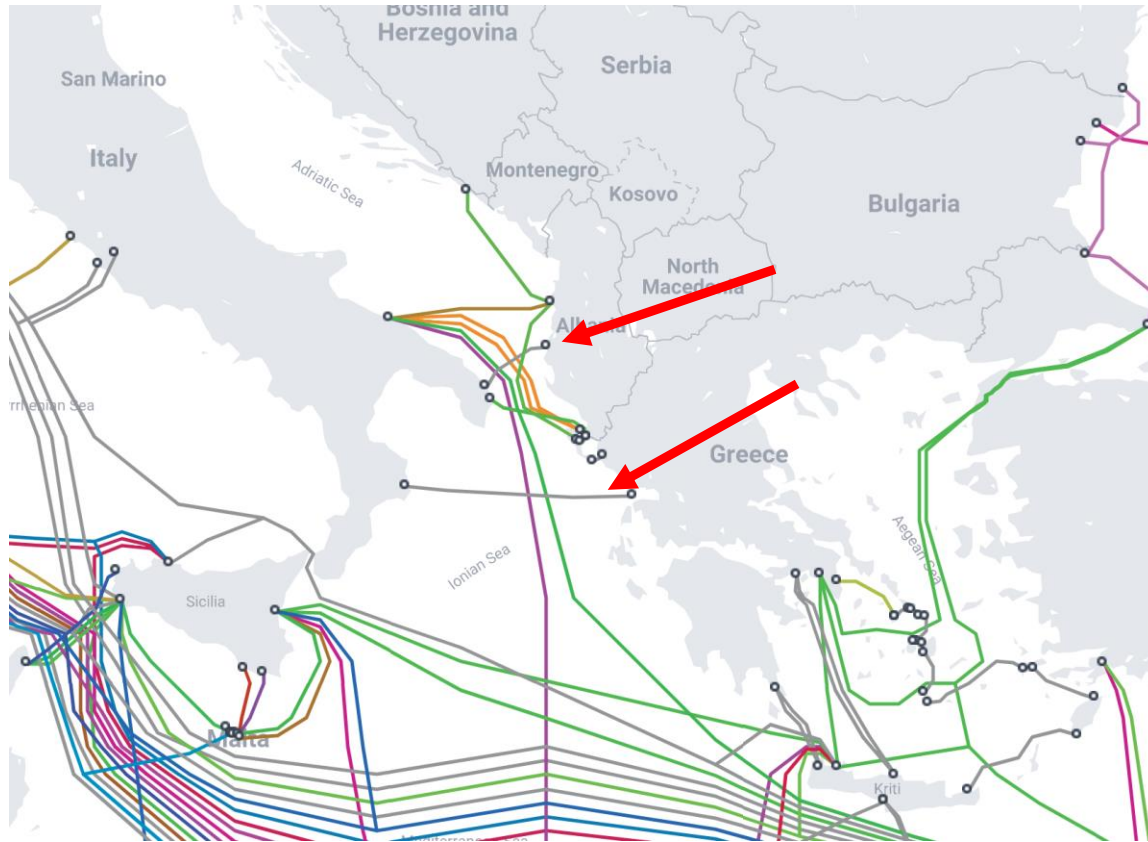
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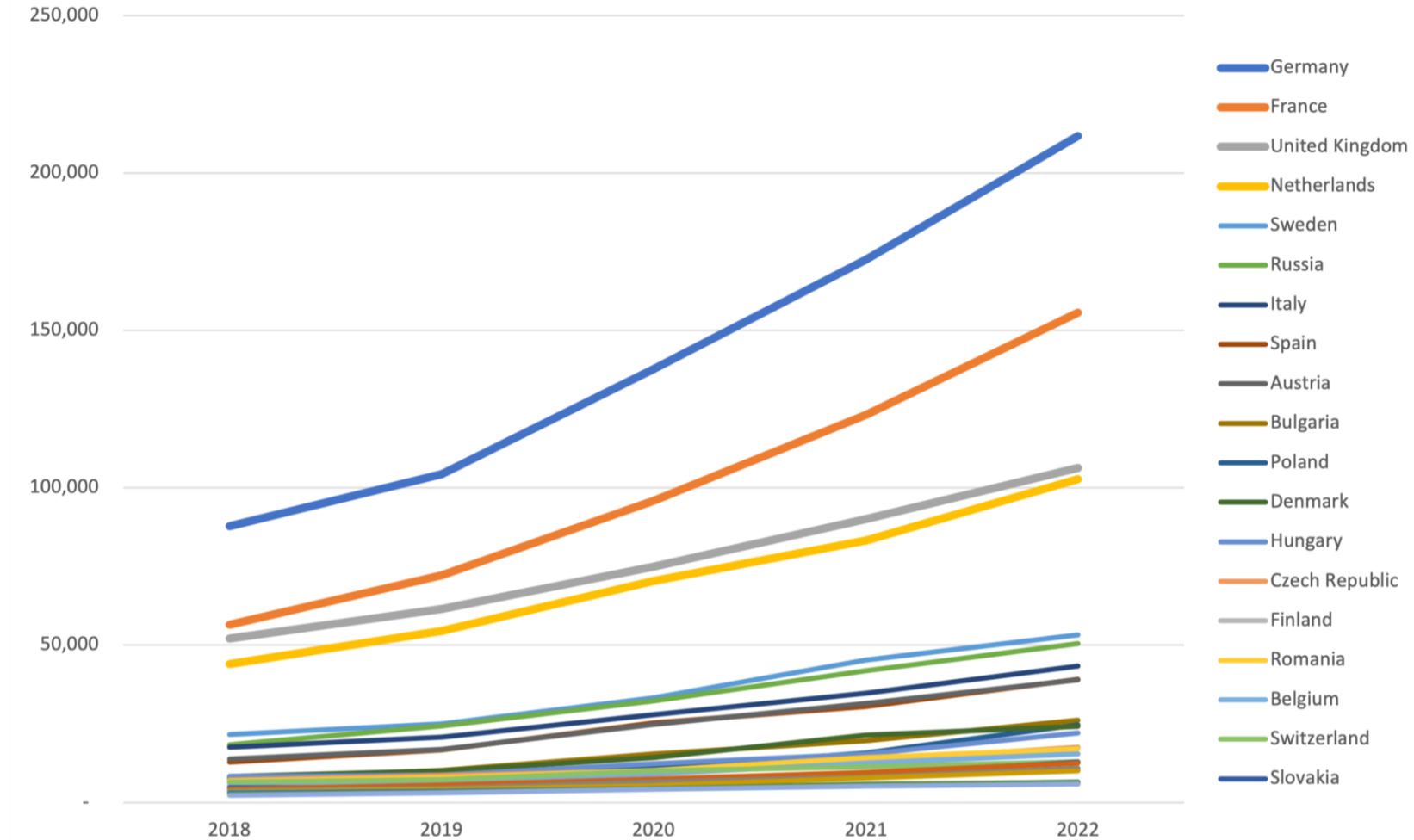
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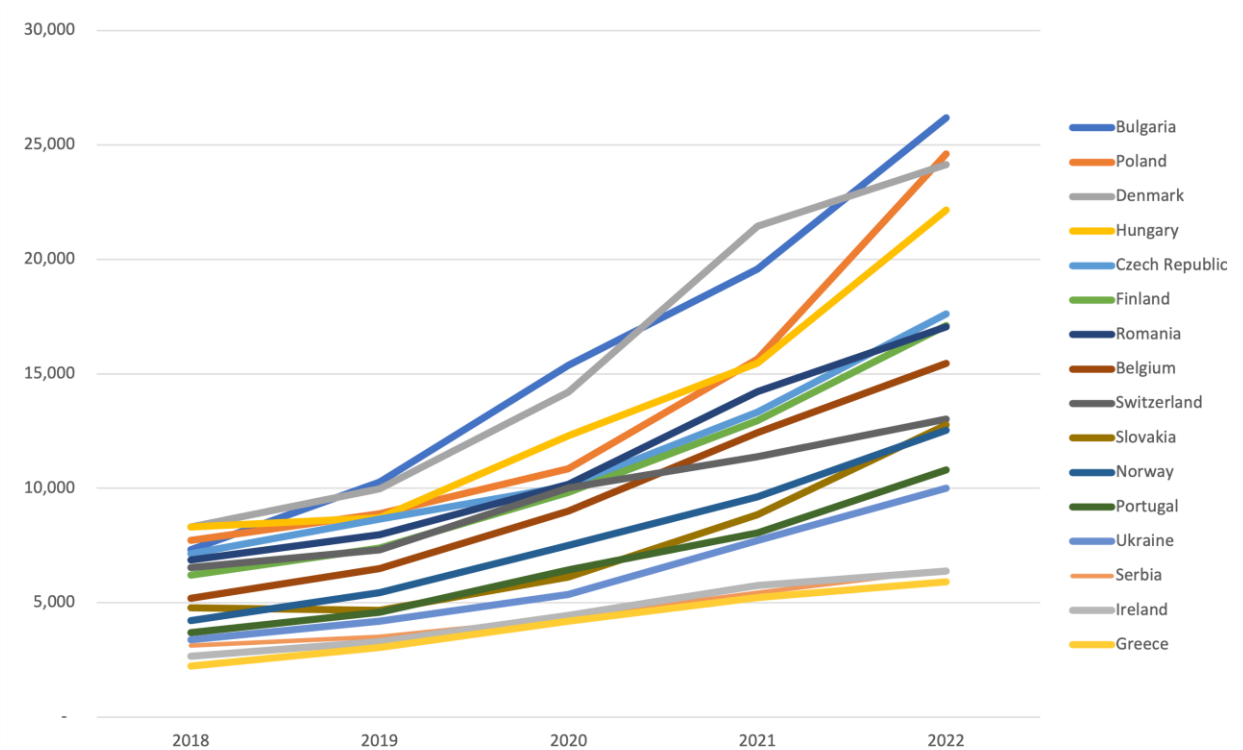
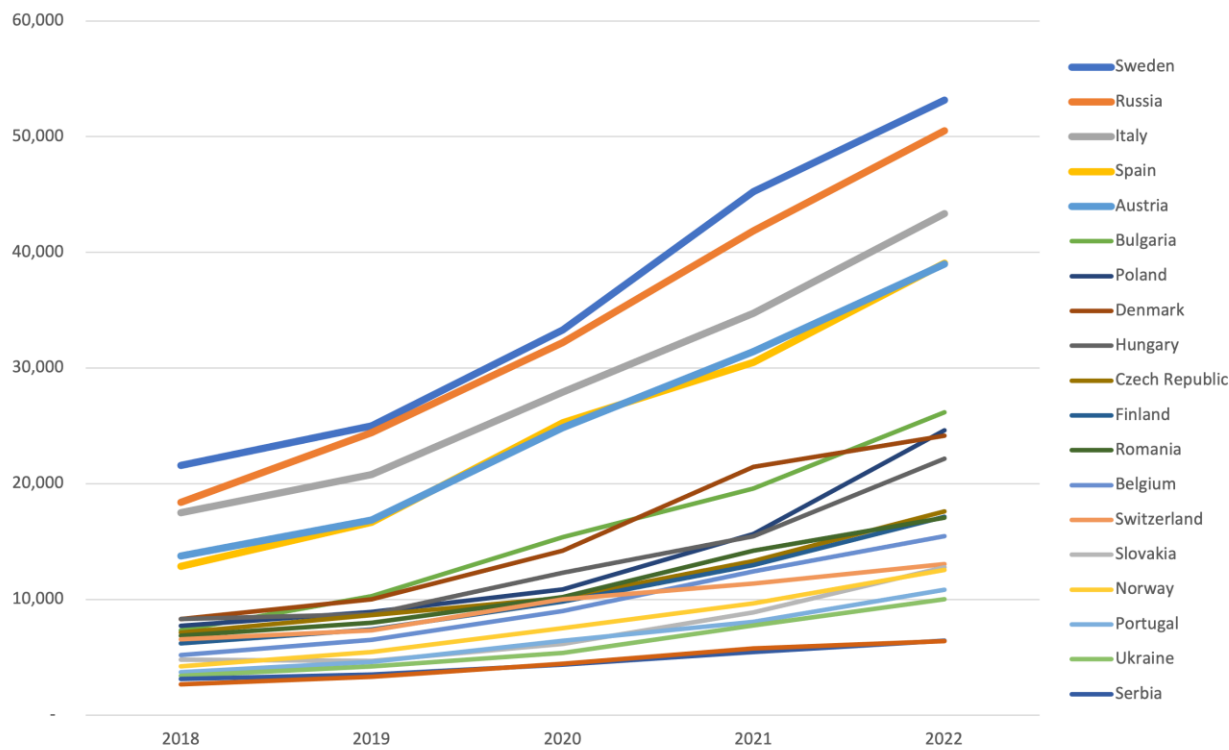
Connecting Greece & Italy

- Ionian (Q4 2022)
- Trans Adriatic Express (Q1 2023)

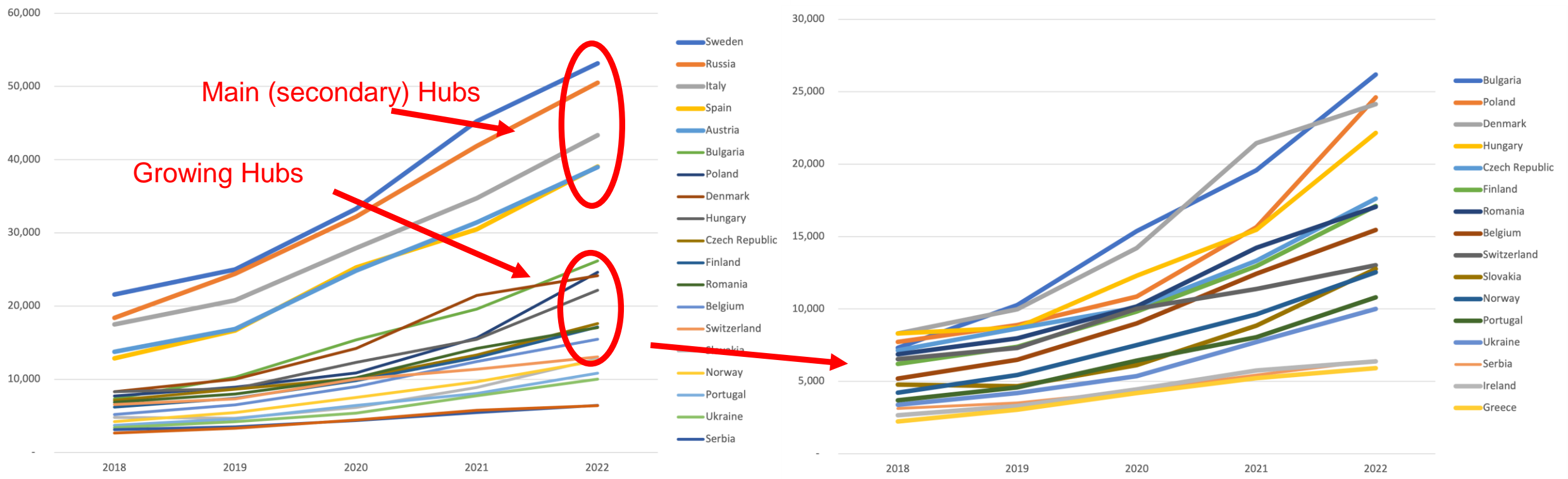
European int'l IP bandwidth growth by country



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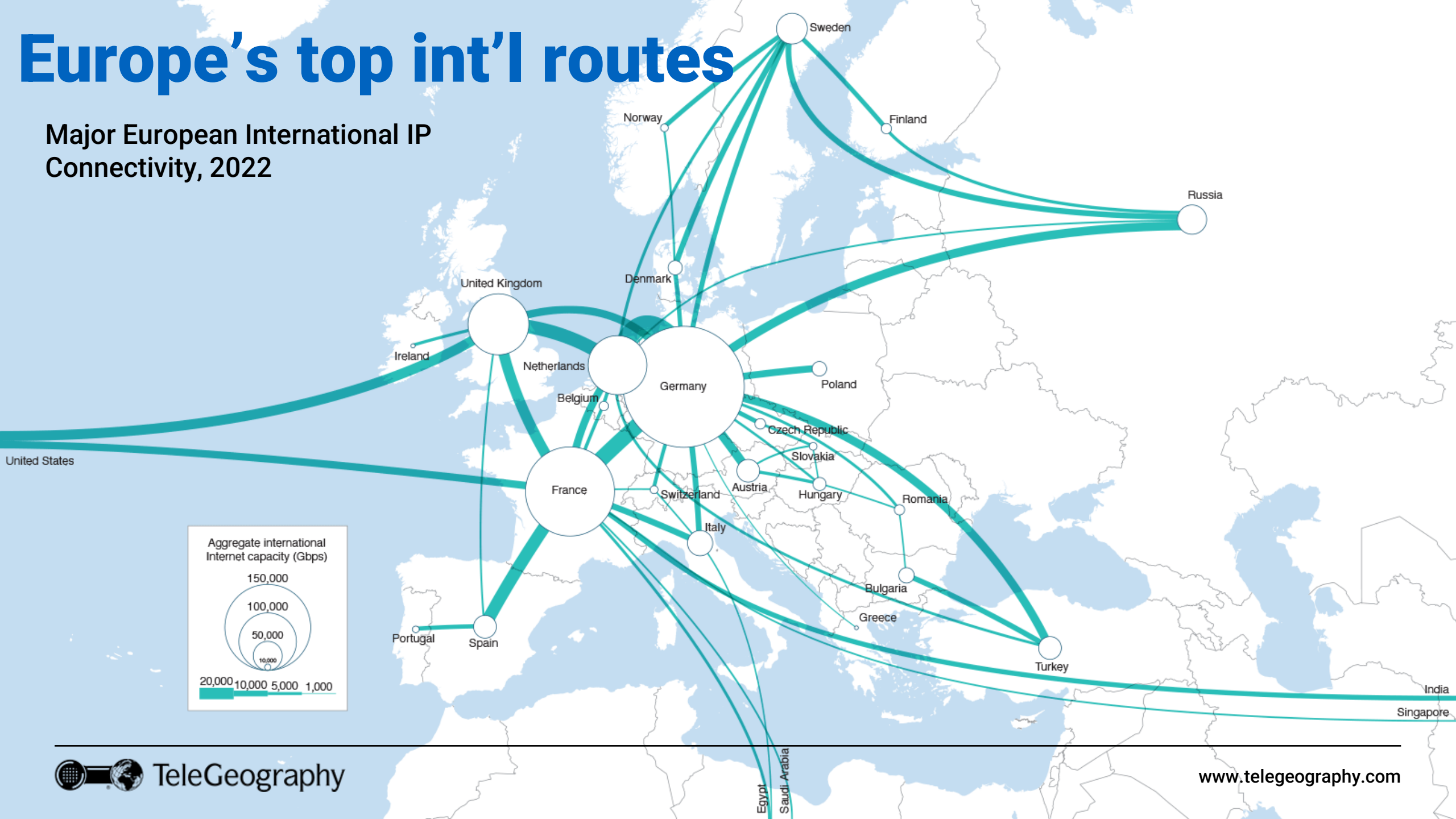


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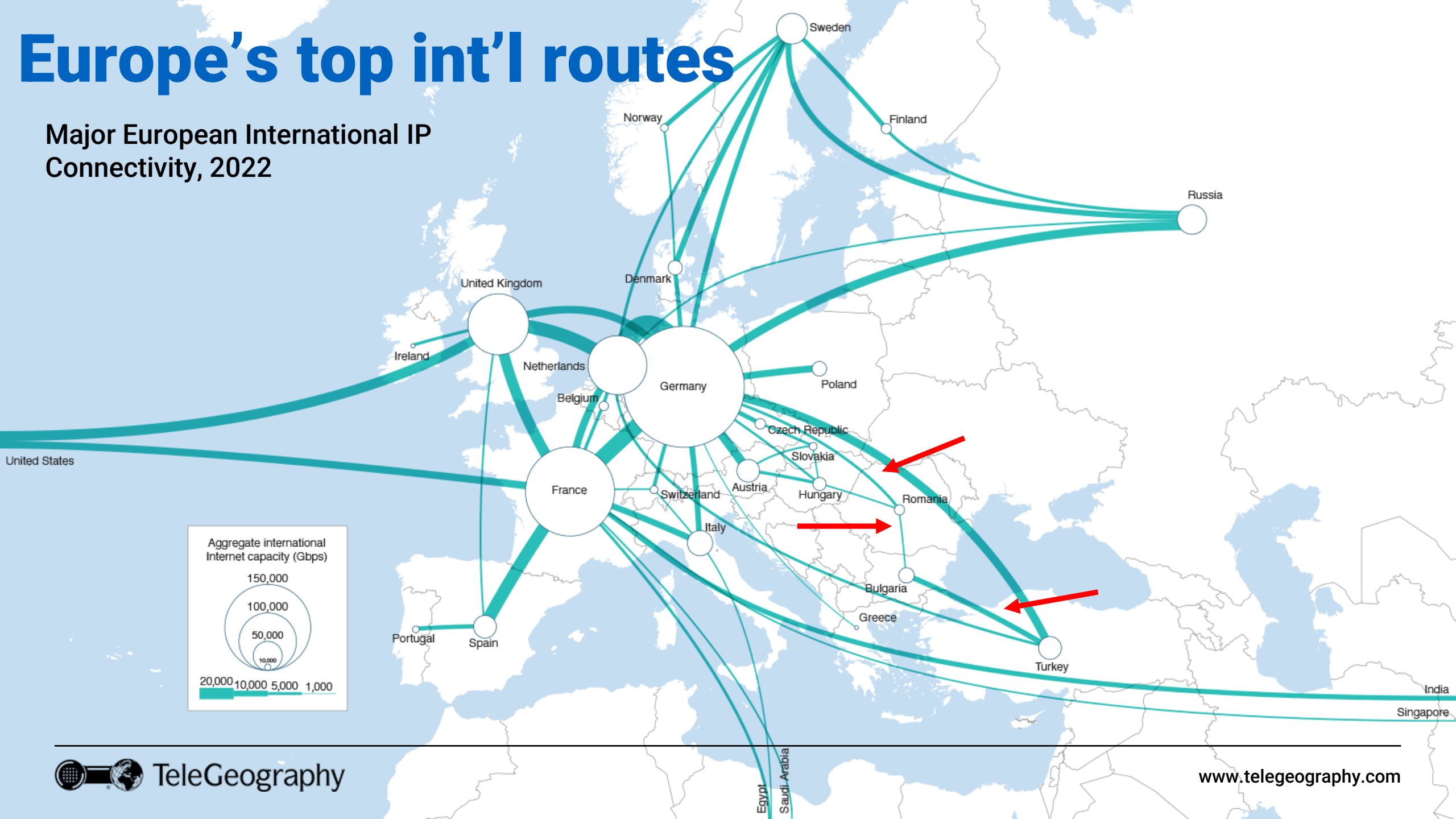
Europe's top int'l routes

Major European International IP Connectivity, 2022

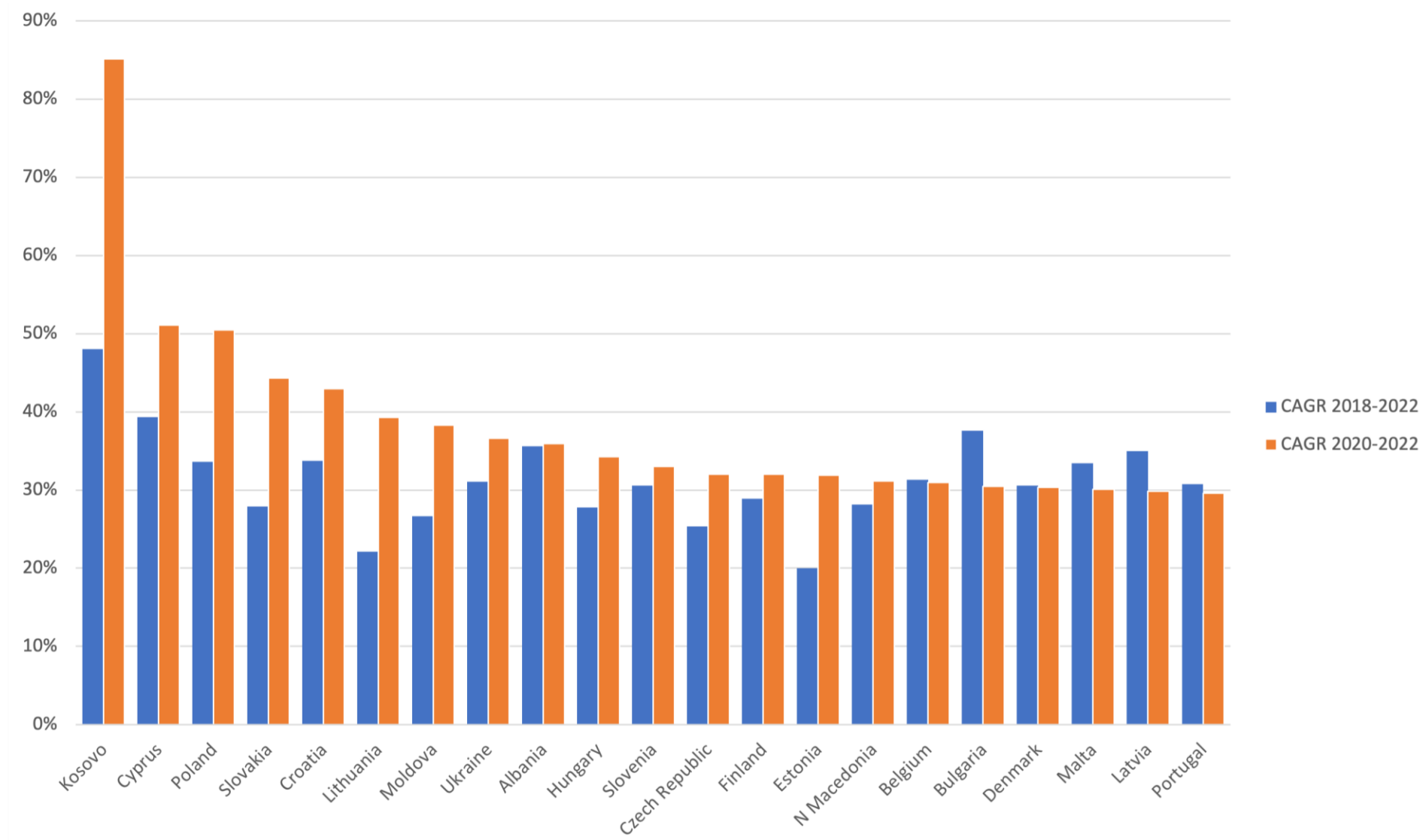


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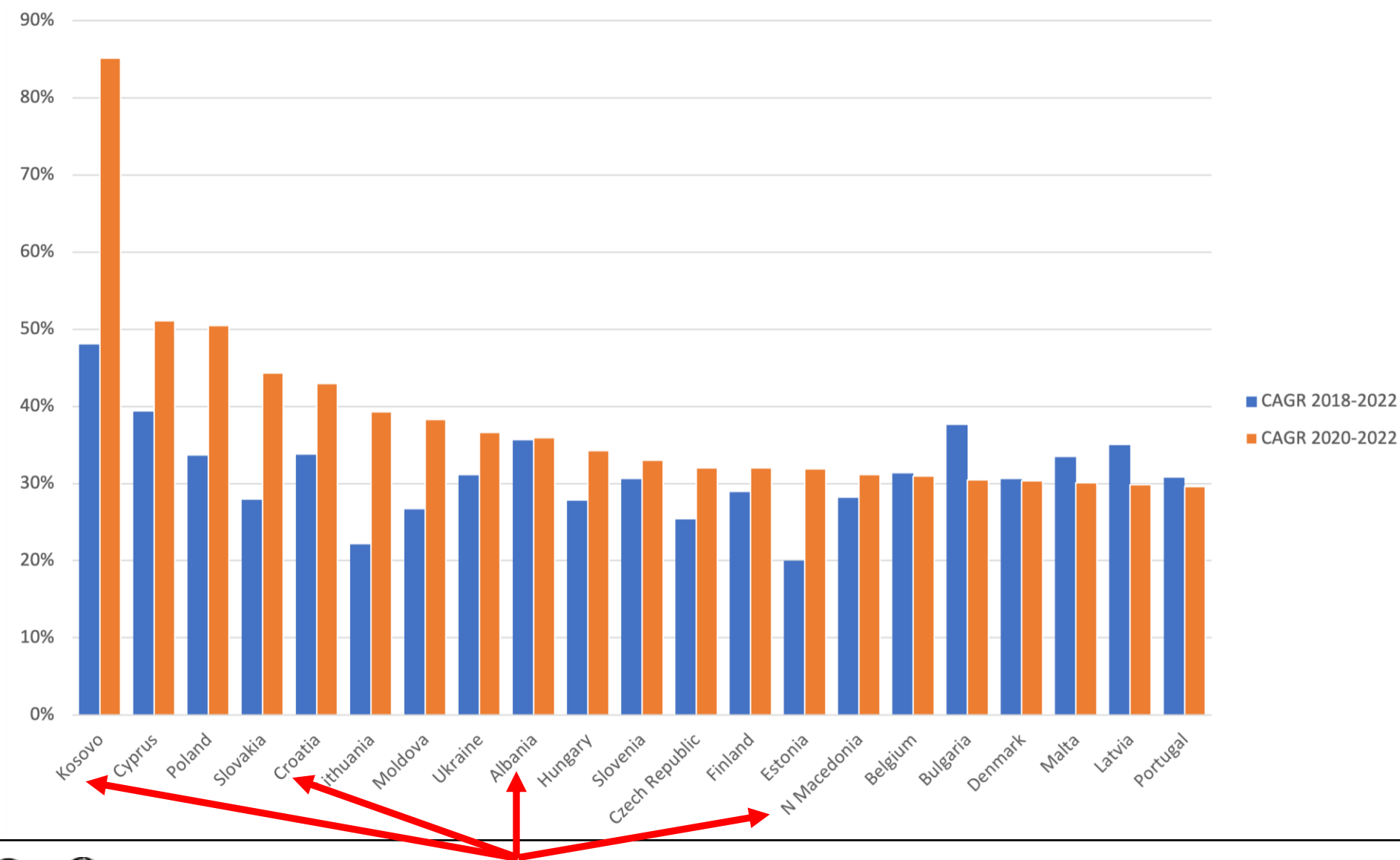
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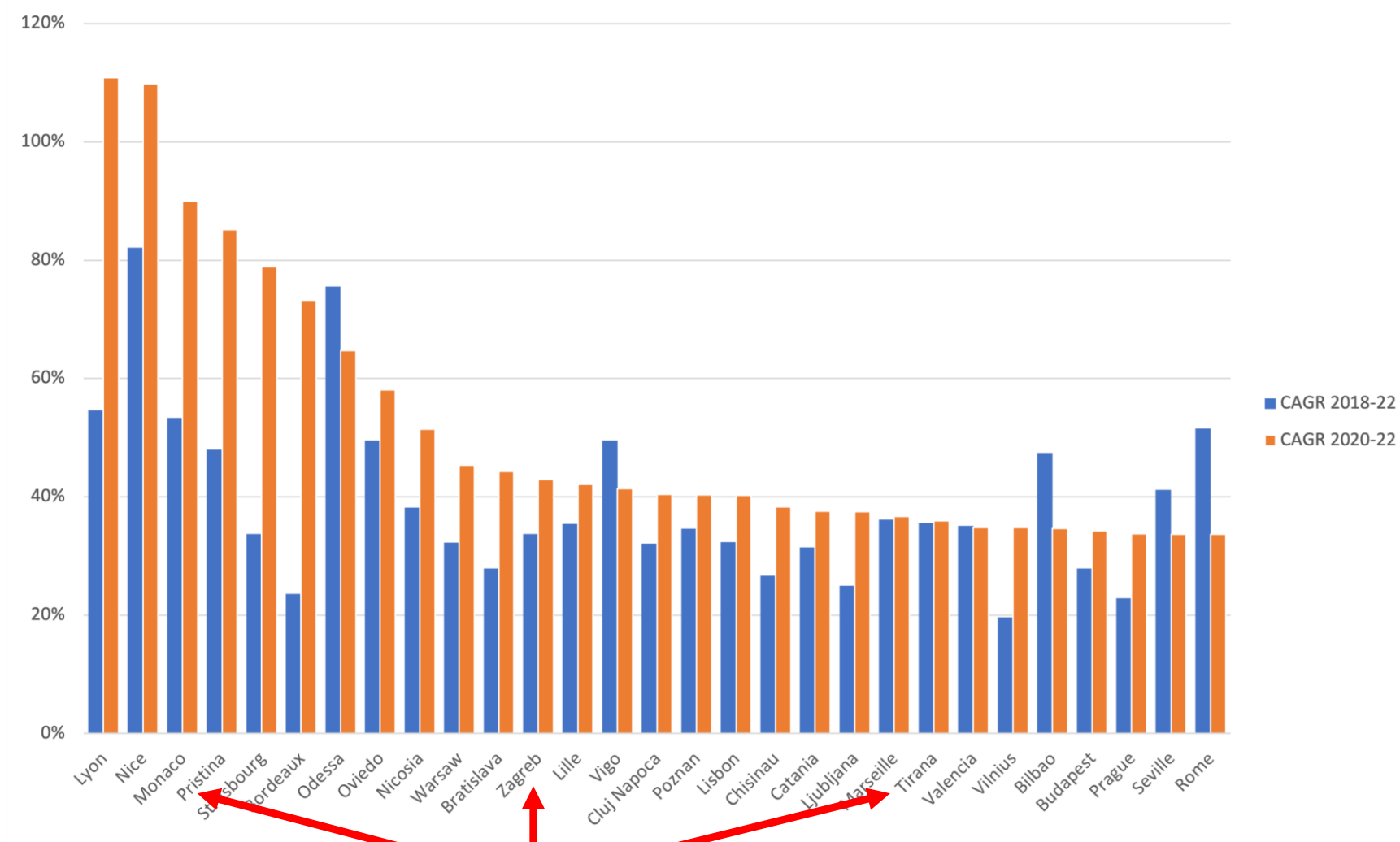
Fastest int'l IP bandwidth growth rates by country



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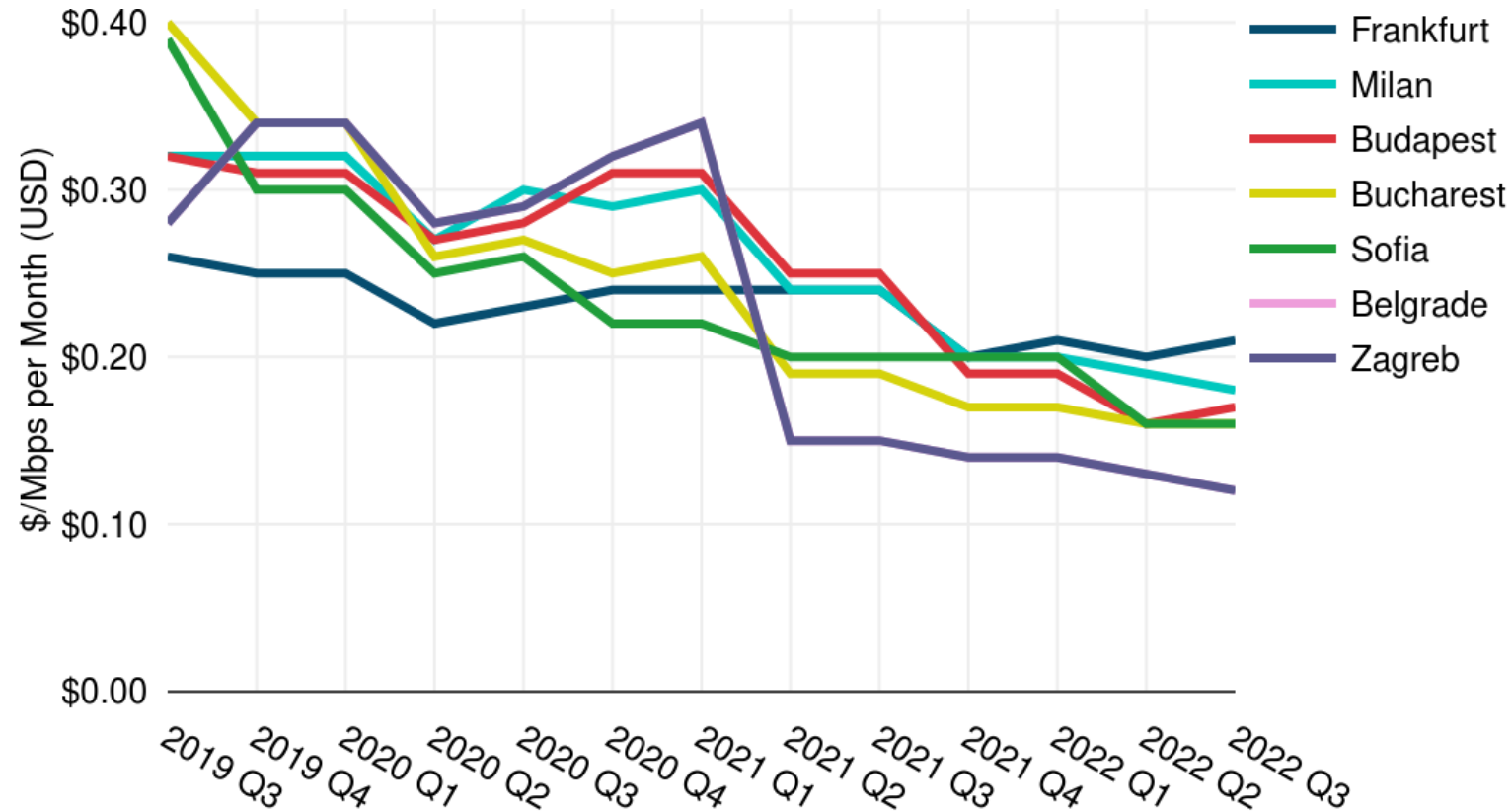


Fastest int'l IP bandwidth growth rates by metro



Widespread price erosion on European 10 Gbps waves

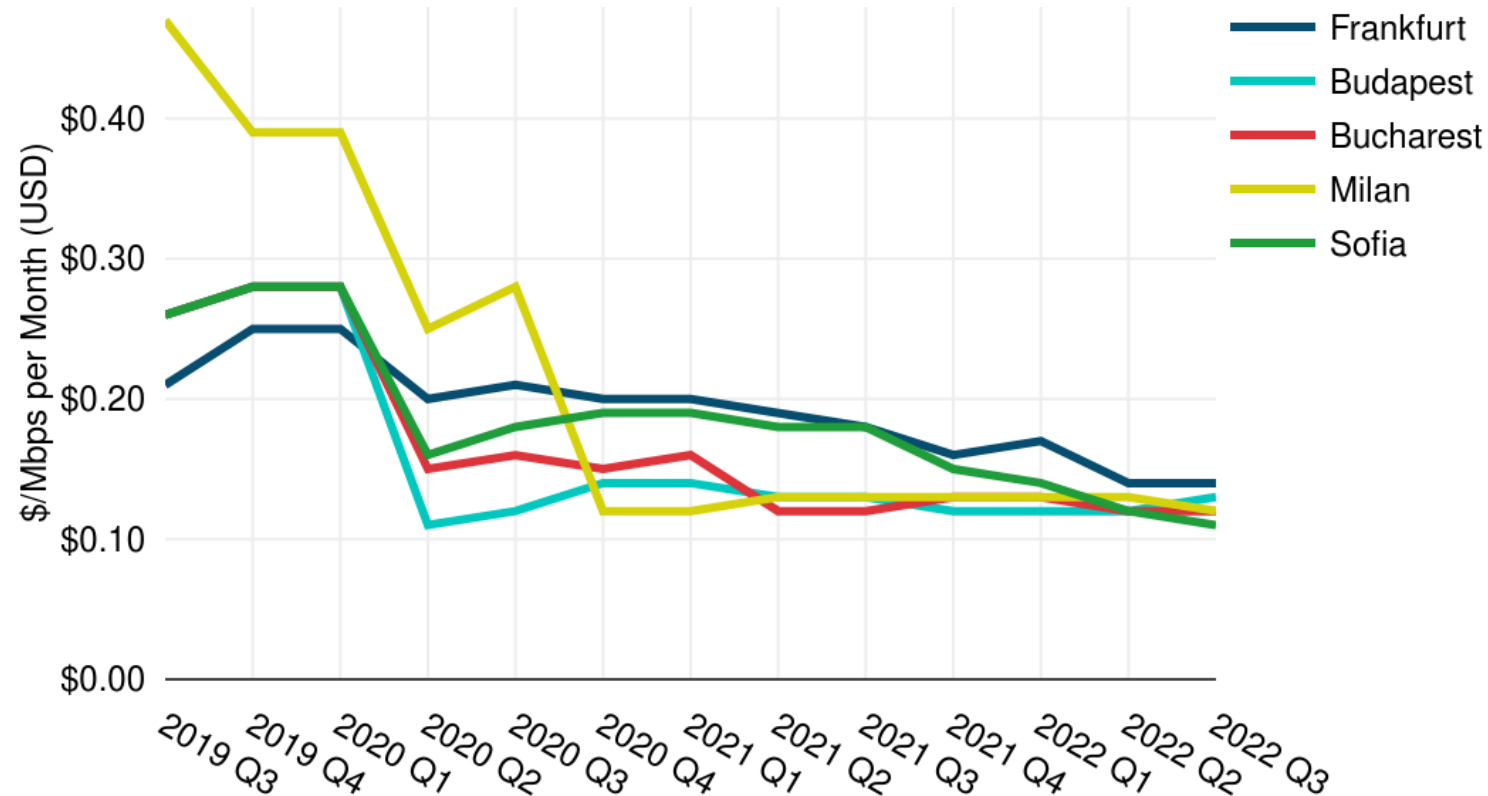
Weighted Median Prices for 10 Gbps Wavelengths on Selected European Routes



- For 10G waves, Balkan countries are at same price or lower than Frankfurt & Milan
- 10G is not as competitive in Frankfurt now with 100G

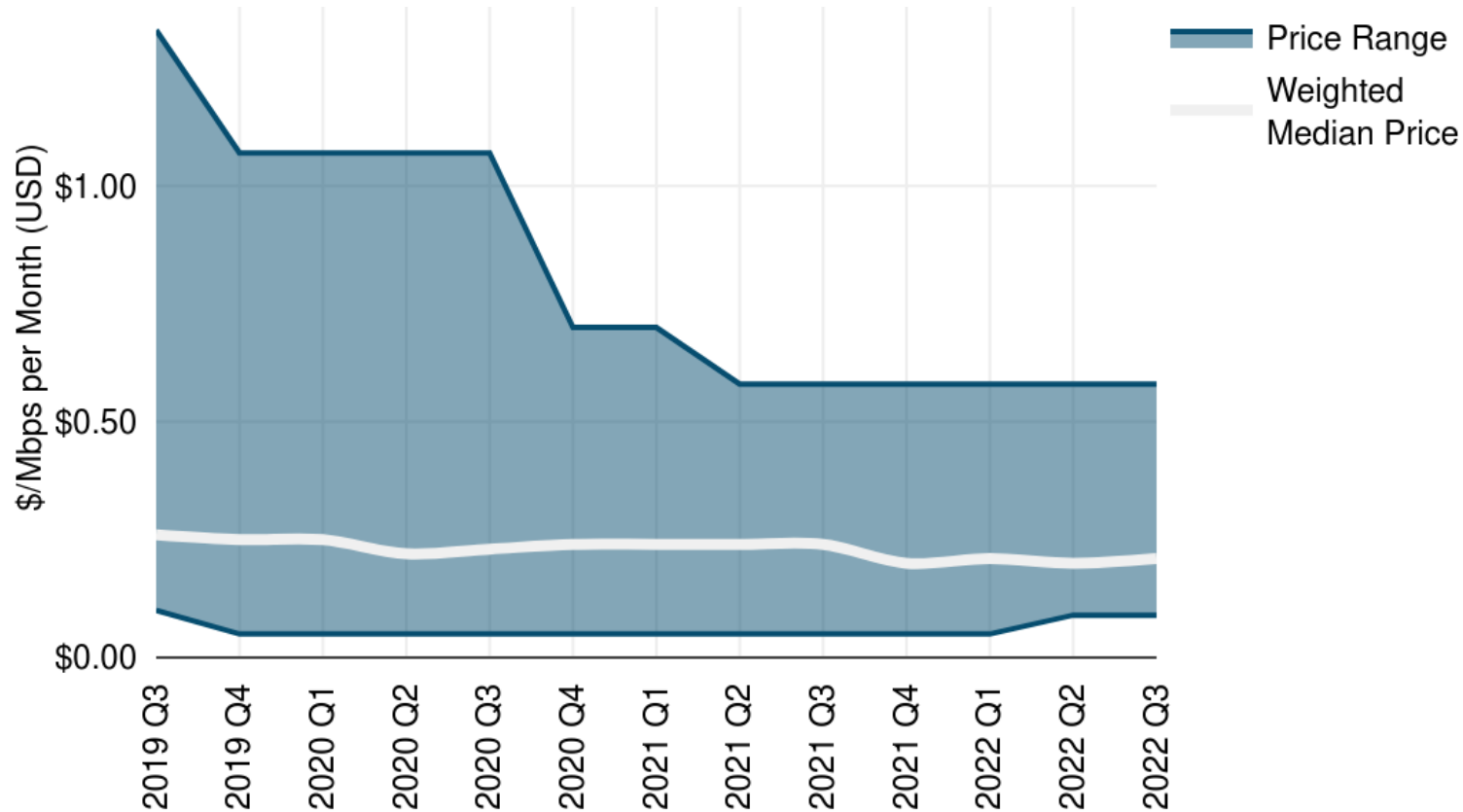
Widespread price erosion on European 100 Gbps waves

Weighted Median Prices for 100 Gbps Wavelengths on Key European Routes



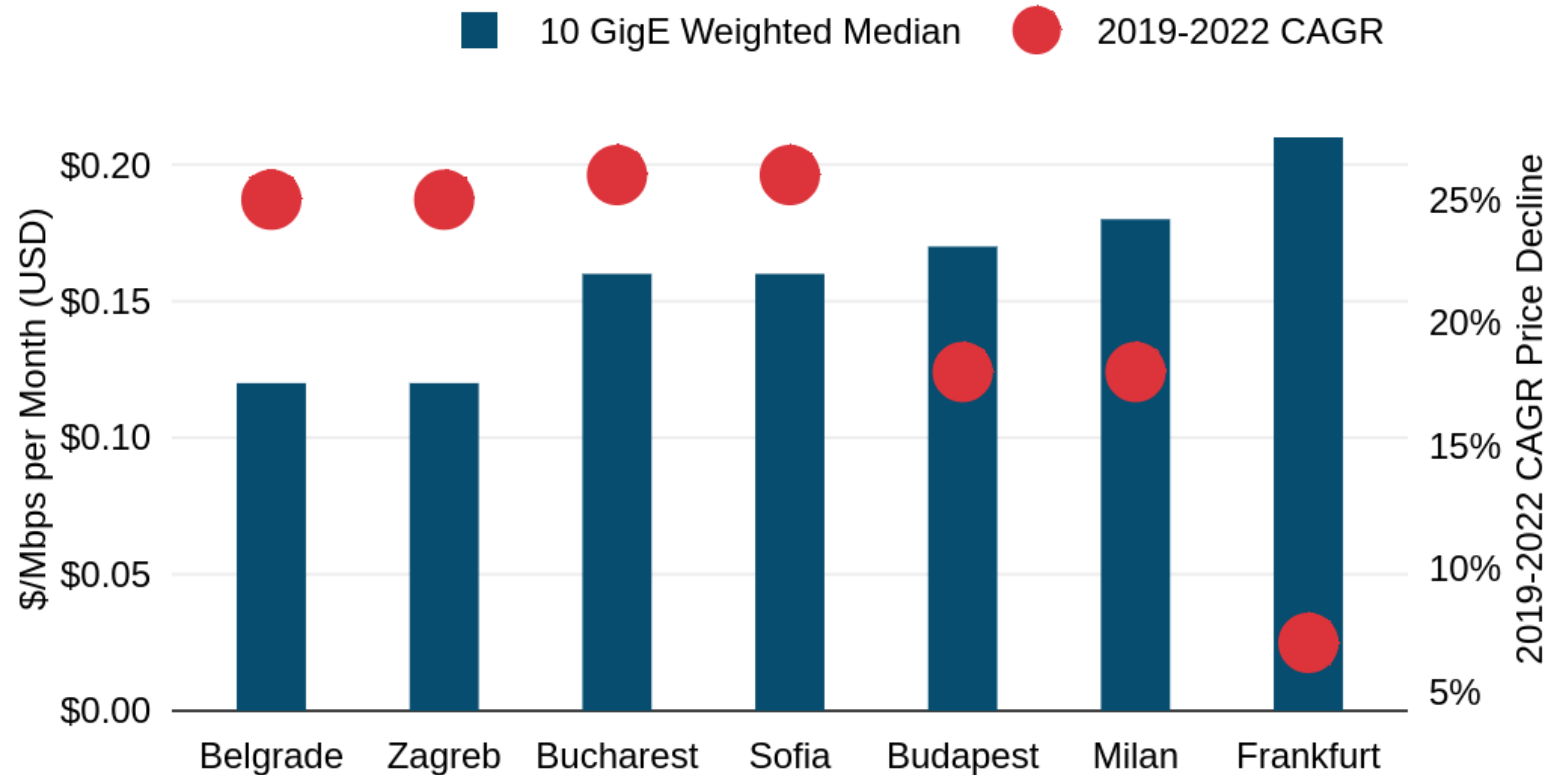
- 100G prices are converging in Europe
- More providers offering flat rates for most European destinations, not just FLAP countries/cities

Weighted median and price range for 100 GigE IP transit ports in Frankfurt



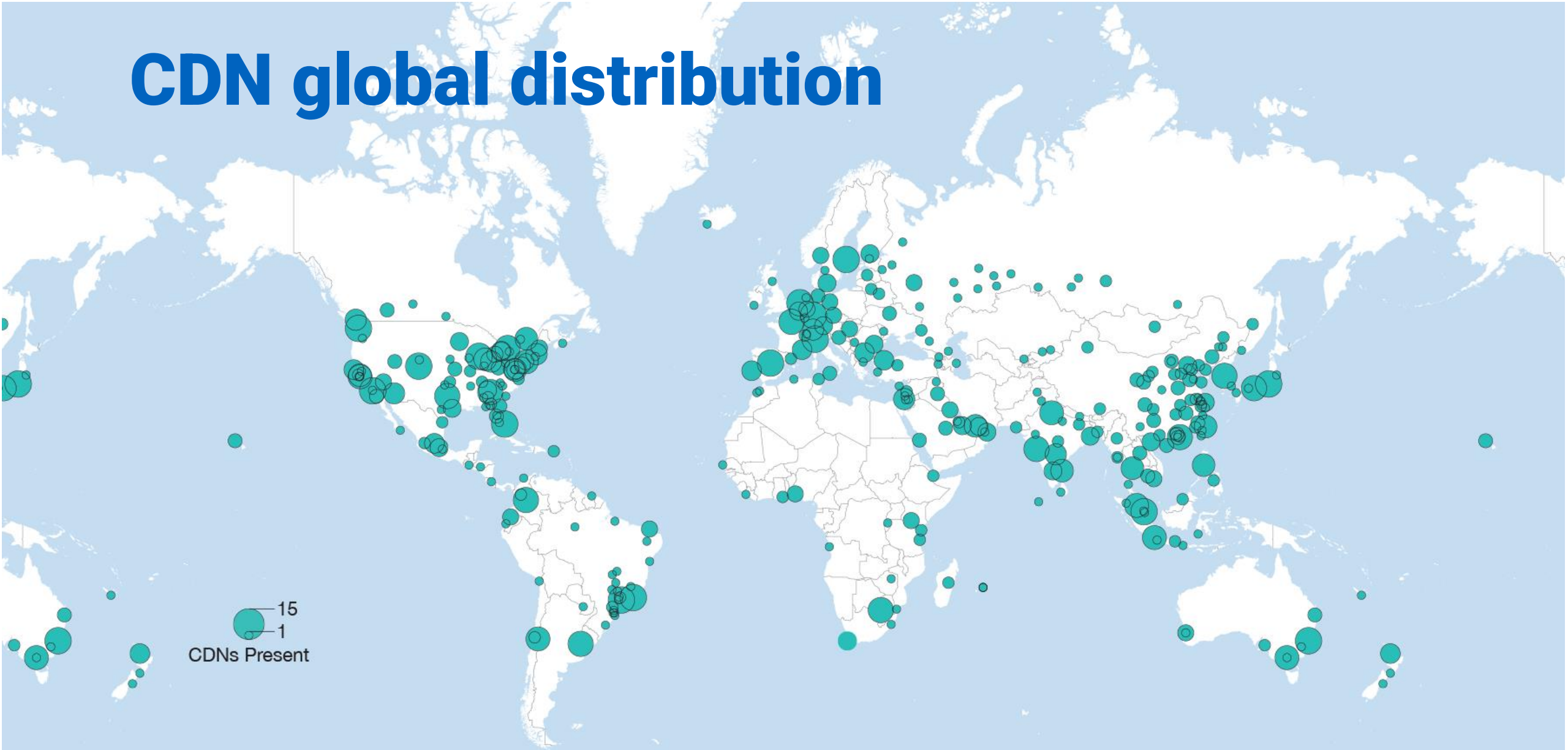
Transit prices follow transport pricing trends

Weighted Median 100 GigE IP Transit Prices in Europe



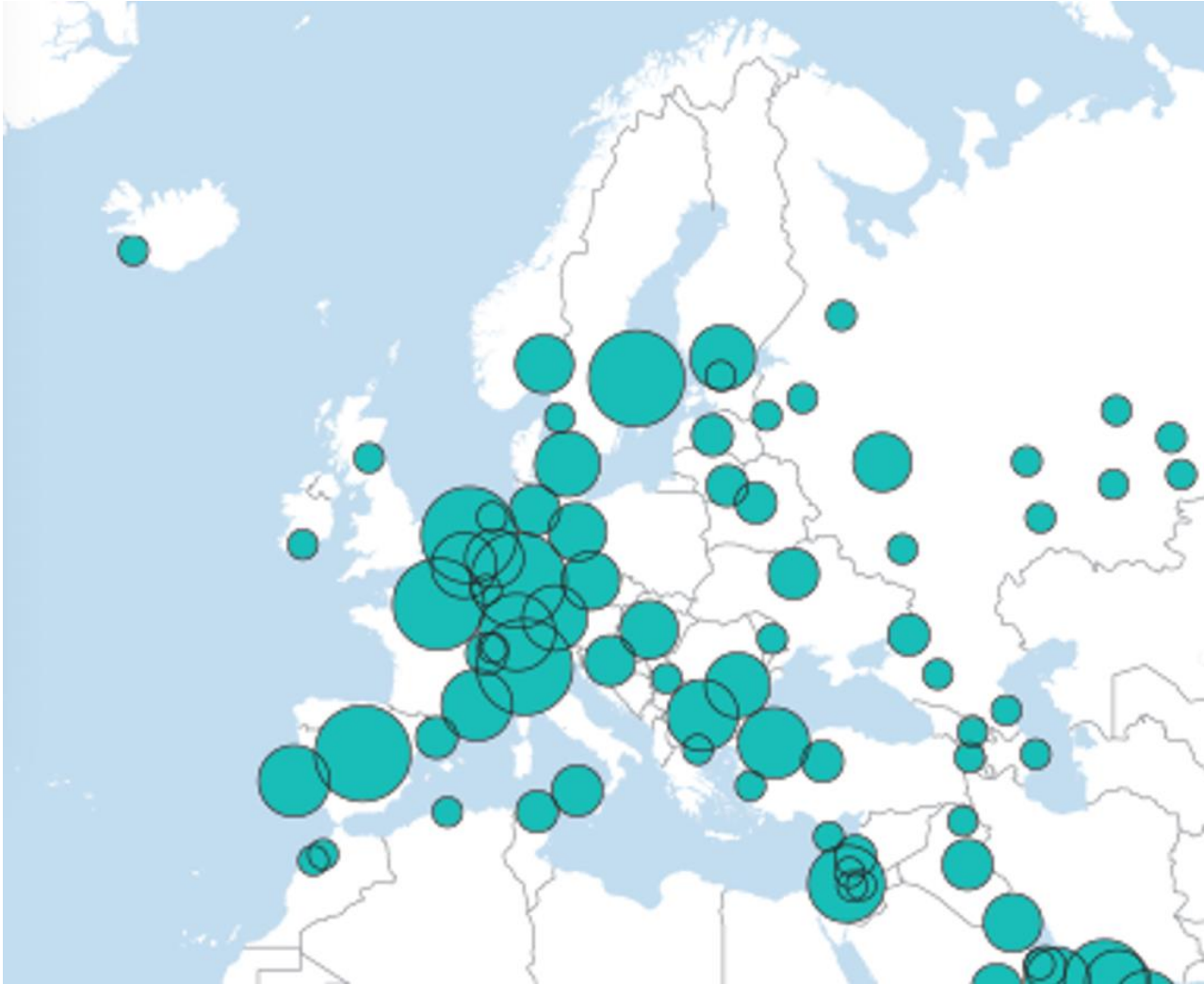
- Prices in mature markets (Frankfurt) dropping at a slow rate
- Prices in the Balkans are dropping 20-30%

CDN global distribution



15
1
CDNs Present

CDN geography



- 270+ CDN nodes in Europe from 13 providers
- 190+ in Western Europe
- 80+ in Eastern Europe

CDN deployments of CSPs+

- Athens (3)
- Sofia (6)
- Bucharest (5)

Zagreb

- AWS, Azure, Cloudflare

Belgrade

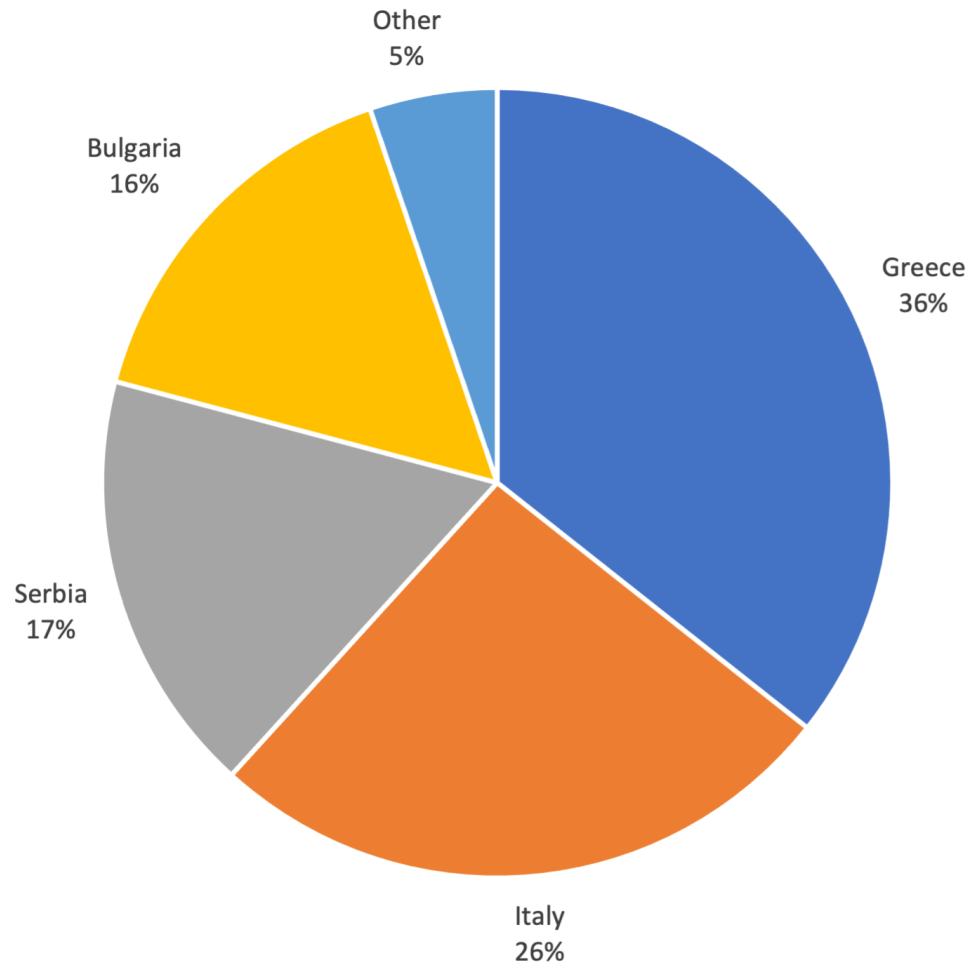
- Cloudflare

Cloud data center landscape



- **Greece** – 2 planned regions coming online in the next couple years. Azure & Google (AWS local zones)
- **Serbia** – Oracle plans to launch a cloud data center
- **Italy** – 3 regions by AWS, Google and Microsoft in Milan and Turin.
- In **Europe**, other cloud regions in Austria, Poland, Switzerland, Germany.
- **Middle East** – 4 regions in Israel. Others in UAE, Qatar, KSA. 3 regions came online in 2022

Albania - Connectivity



Int'l IP Capacity

- Most connectivity to Greece & Italy – over half of int'l capacity
- Next tier – Serbia & Bulgaria

Sub cables

- 3 – two 20+ yrs, + new one on the way (TAE)

IXP

- ANIX

Content provider presence (CDN)

- At least two – Meta & Netflix

End-User demand

- Mobile 103% pen
2.9m subs (2.2m 4G)
- Fixed BB – 63% HH pen
up from 31% 2016!

Trends we're tracking

- **Within Europe – increased growth southward and eastward**
 - South - Spain & Italy increasing int'l capacity, cloud DCs
 - East - Austria, Poland, Bulgaria, Hungary
- **Balkans growing**
 - East - increased int'l growth for several years (Bulgaria, Romania...)
 - Gateway to Turkey and eventually terrestrial routes to the Middle East
 - Sofia and Bucharest developing into regional interconnection hubs
 - From the south
 - New cloud data centers in Greece
 - New ME and Asia cable landings in Greece
 - West - fastest growth but lower capacity volume (Albania, Kosovo, Croatia, North Macedonia...)
 - May develop as an alternative route between Greece (or Middle East/Asia) to FLAP countries

Thank You

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