TeleGeography Workshop

PTC

January 20, 2019

Beyond the Hype

Is the data center sector shifting from the hub to the edge?

Jon Hjembo

TeleGeography

Outline

1. Defining our scope

2. Is the colocation market moving to the edge?

3. How about content?

4. Where is the peering taking place?

5. Will new subsea routes bring new interconnection hubs?

1. Defining our scope

First things first

- **What are the hubs?** The most critical converging points of global network interconnection. The regional markets with the most connected international bandwidth and the largest interconnection facilities.
  - Examples: London, New York, Hong Kong
- **What are the edge markets?** All other communications markets. These range from secondary hubs that are essential upstream nodes for lower regional markets to more localized communications markets that depend on access to networks in hubs upstream for global connectivity.
  - Examples: Madrid, Warsaw, Boston, Osaka

The scope of this talk

- Will NOT delve into the applications driving the need for distributed data center development

- NOR discuss the various concepts of what the "edge" is

- But WILL discuss historical and current trends in data center development, comparing hub and secondary market growth

Which cities are hubs?

Europe

- **F**rankfurt
- **L**ondon
- **A**msterdam
- **P**aris

Asia

- Tokyo
- Hong Kong
- Singapore

North America

- New York
- Washington (NoVA)
- Chicago
- San Francisco
- Los Angeles
- Dallas
- *Miami*

The Network Effect – *why hubs are hubs*

- "As more bandwidth runs to the hub, economies of scope and scale make that hub a key destination for still more bandwidth, because everyone else is already there."

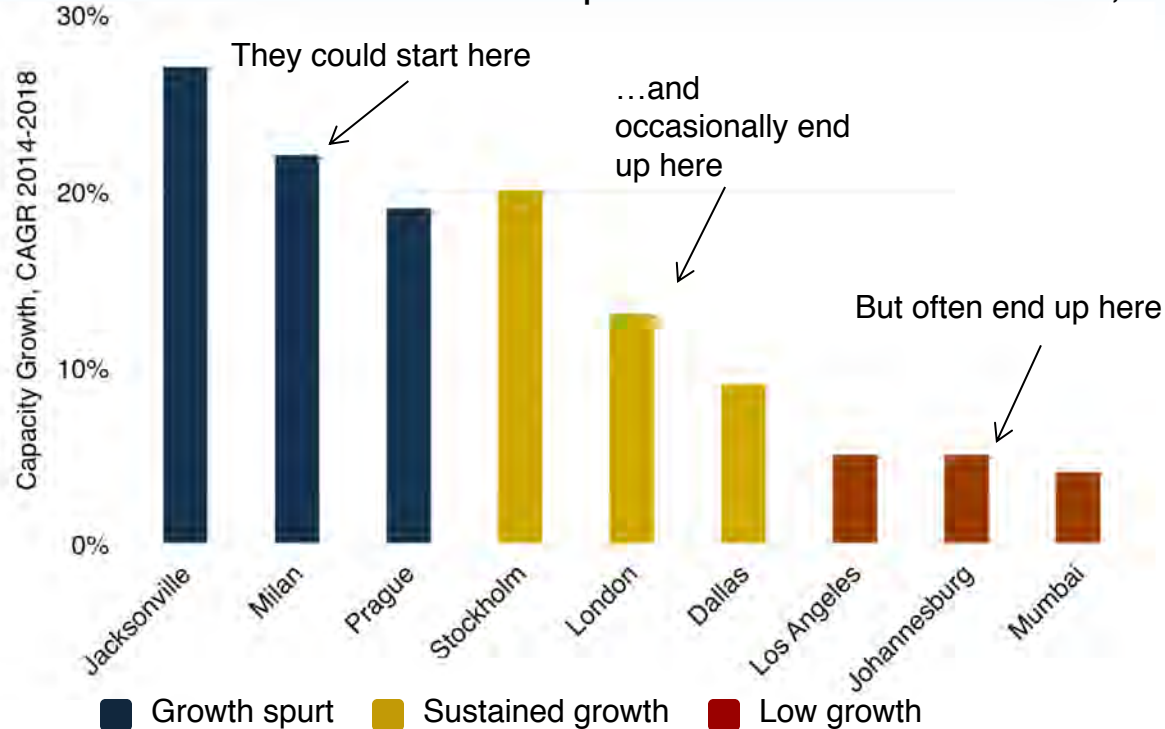 – *Hubs + Spokes, A TeleGeography Internet Reader, 2000*

HUBS + SPOKES
A TELEGEOGRAPHY
INTERNET READER
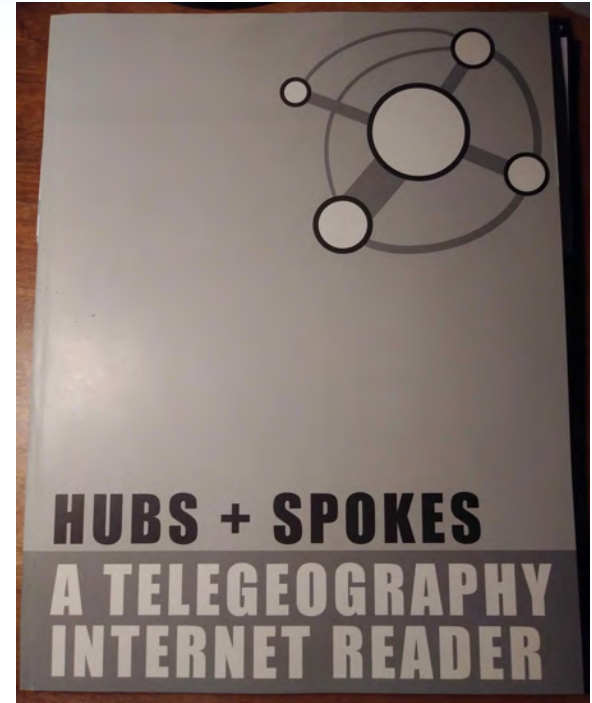
Why edge markets matter

- They are hubs too, just smaller ones
- Optimal functionality of cloud-based services necessitates proximity of applications to the end-user
- Advanced applications will drive demand for storage and compute in secondary regional markets for lower-latency service delivery

2. Is the colocation market moving to the edge?

Edge markets are often hot..for a while

Growth in Gross Retail Colocation Floor Space for Select Metro Areas, 2014-2018


They could start here

…and occasionally end up here

But often end up here

Legend:
- **Growth spurt** (dark blue)
- **Sustained growth** (yellow)
- **Low growth** (dark red)

Y-axis: Capacity Growth, CAGR 2014-2018 (0% to 30%)

X-axis categories: Jacksonville, Milan, Prague, Stockholm, London, Dallas, Los Angeles, Johannesburg, Mumbai

Many edge nodes are already well-established

- Las Vegas
- Sydney
- Atlanta
- Moscow
- Osaka
- Boston
- Madrid
- Taipei
- etc., etc..

Gross Floor Space (million sq ft)

4

0.5

TeleGeography
AUTHORITATIVE TELECOM DATA
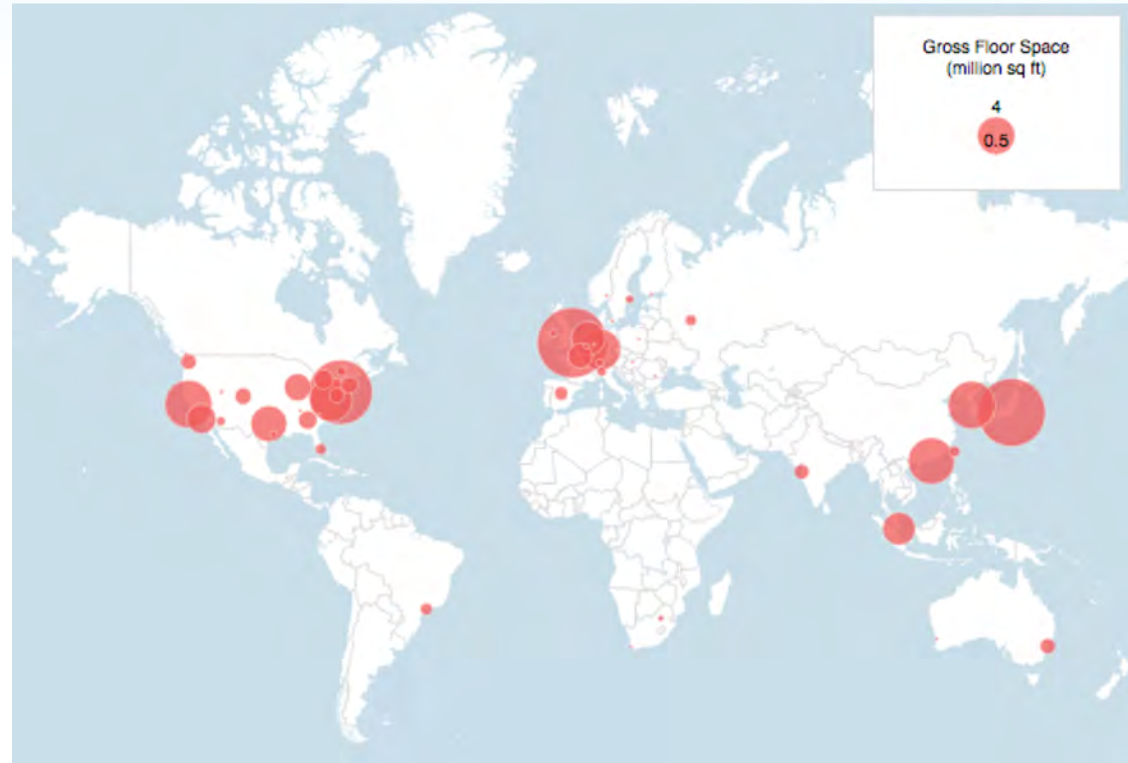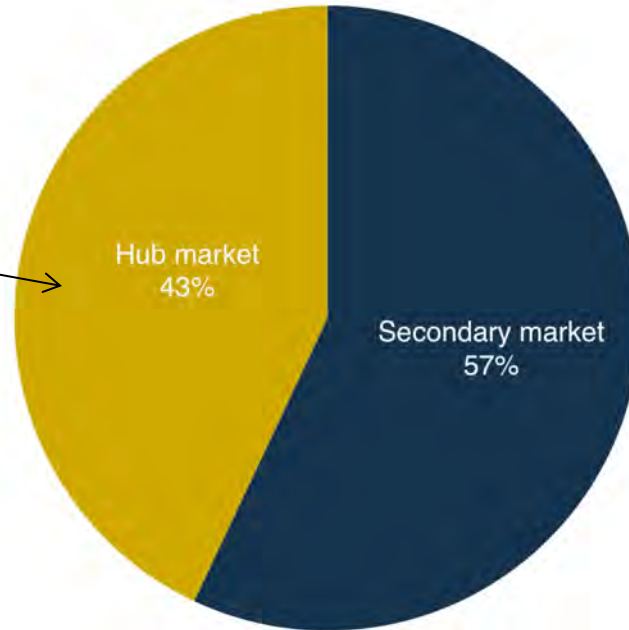
Where are the biggest operators?

Largest Retail Operators by Gross Floor Space by Region, 2018 (million sq ft)
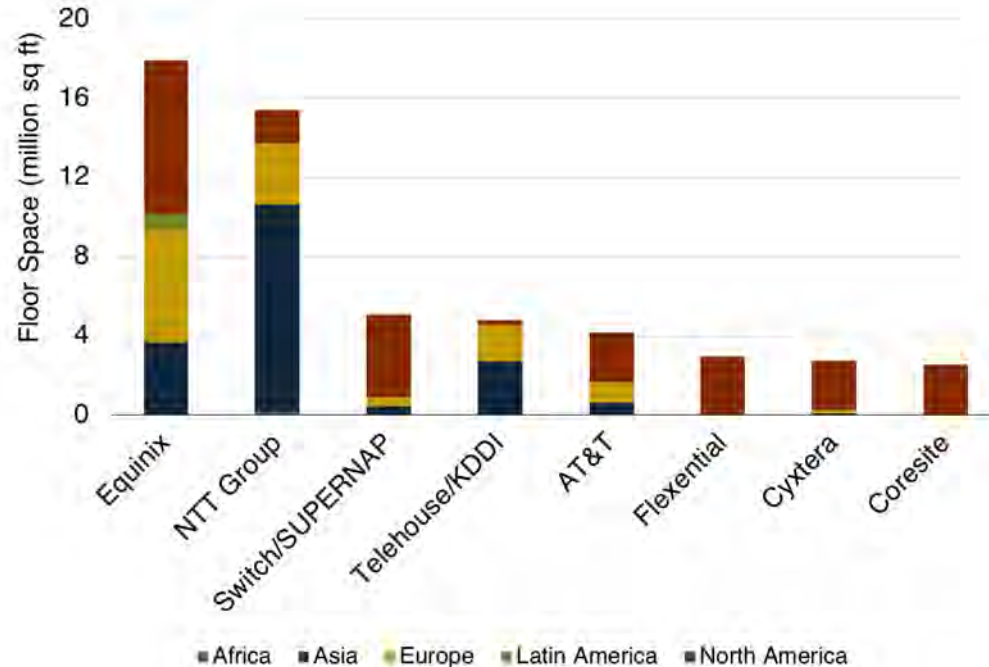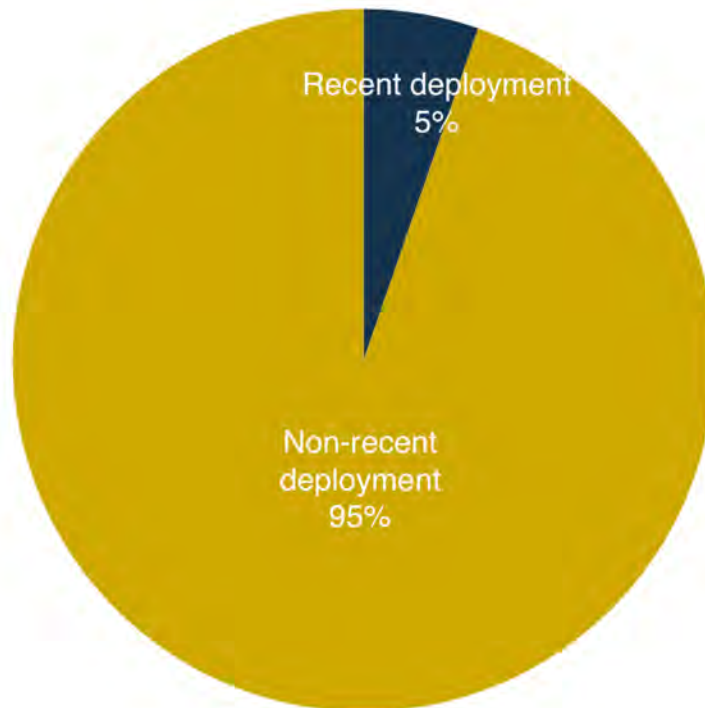
They're already at the edge

Percentage of Sites in Hub vs. Secondary Markets, Group of Largest Operators

Although the hubs (9% of metros covered) have more than 40% of the total site deployments

Hub market
43%

Secondary market
57%
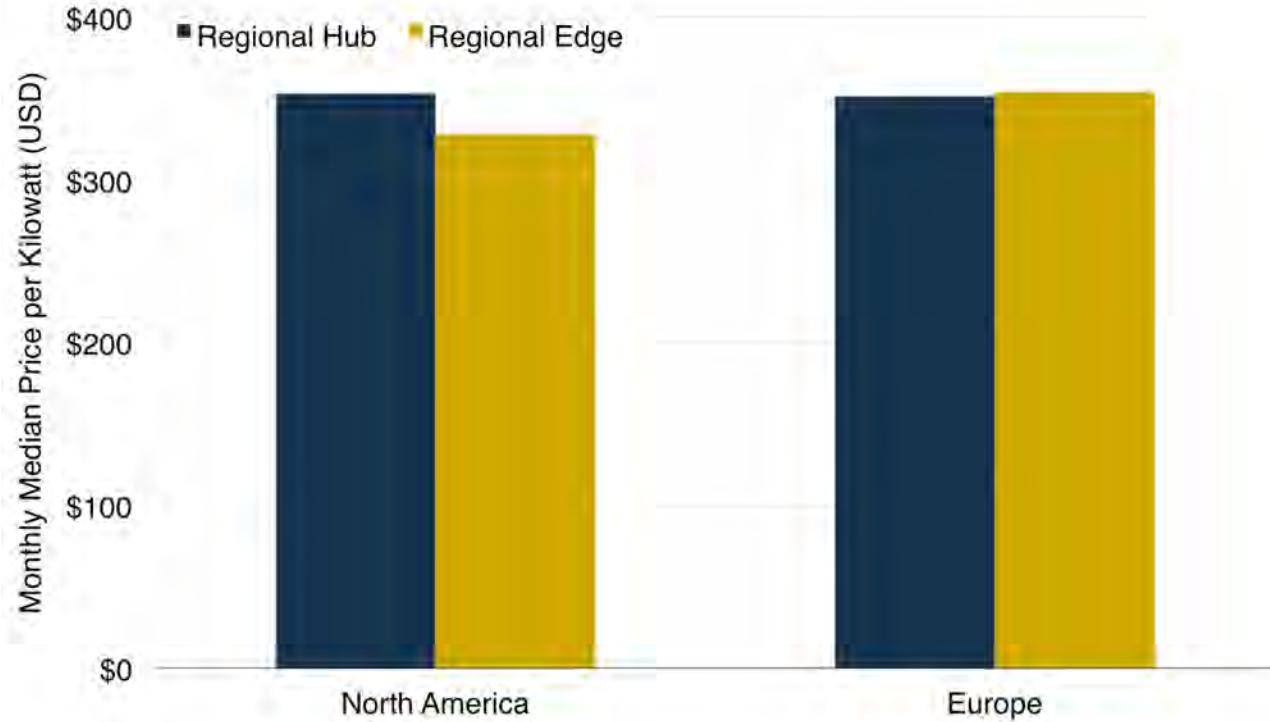
Is this a new trend?

Percentage of Secondary Market Sites Deployed, 2017-2018

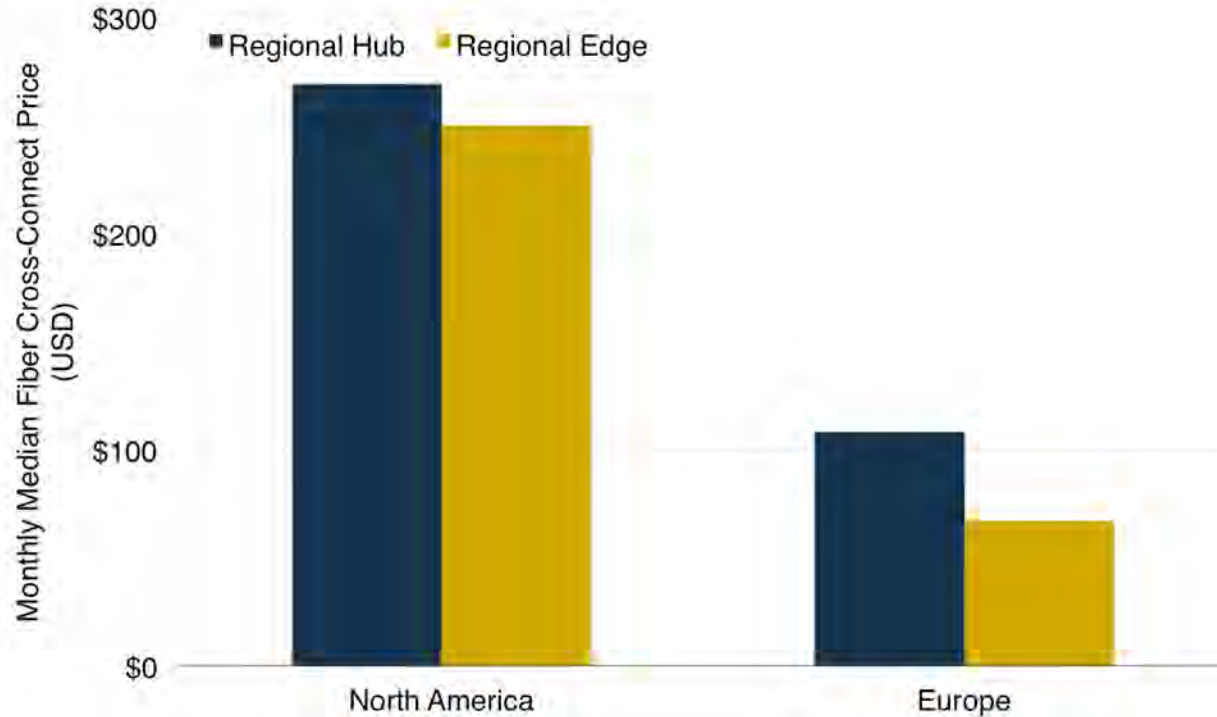Note: "Recent" deployments refer to sites launched in 2017 or 2018.

A few things about pricing – prices per kilowatt

Median Price per Kilowatt at 4-Kilowatt Density by Region and Metro Type, H2 2018

A few things about pricing – cross-connect rates

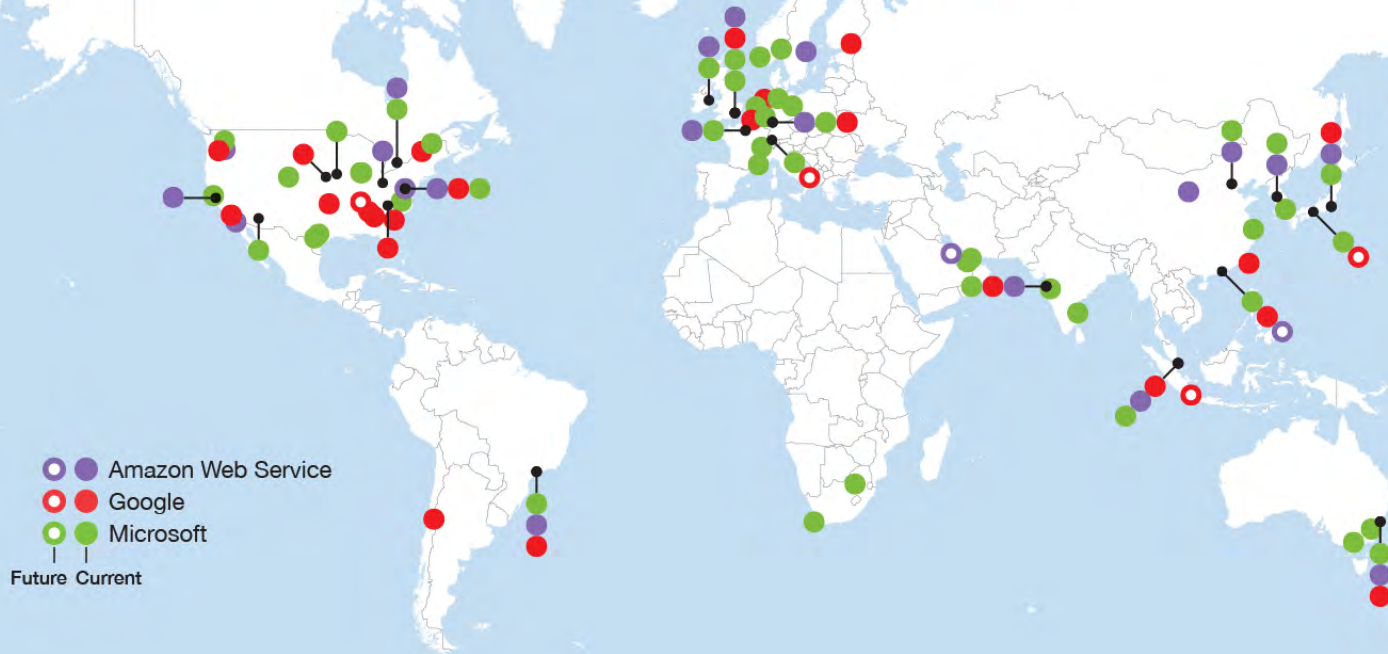## Median Fiber Cross-Connect Price by Region and Metro Type, H2 2018

3. How about content?

Cloud providers 2017 zone footprint

Amazon Web Service
Google
Microsoft

Cloud providers 2018 zone footprint

Amazon Web Service
Google
Microsoft

Future Current

TeleGeography
AUTHORITATIVE TELECOM DATA

Carlsbad, CA I Washington, DC I Exeter, UK I Singapore I www.telegeography.com I info@telegeography.com

Content is at the edge, but also focuses heavily on hubs

Percentage of Site Presence in Hub vs. Secondary Markets, Select Content Providers, 2018
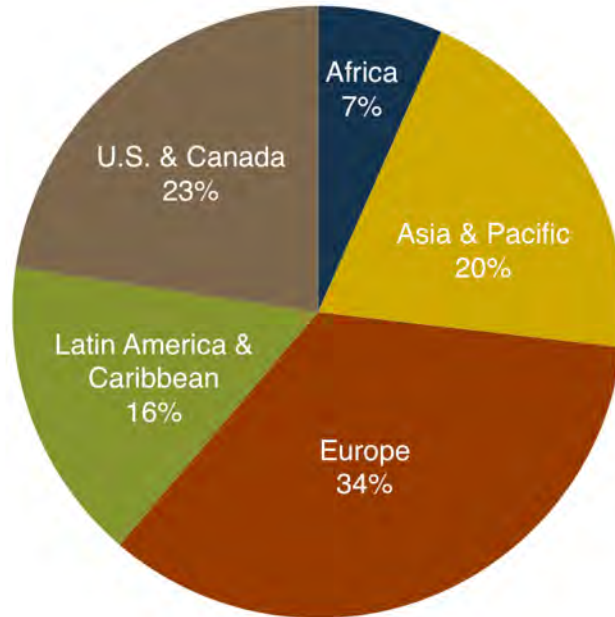

Hub market
48%

Secondary market
52%
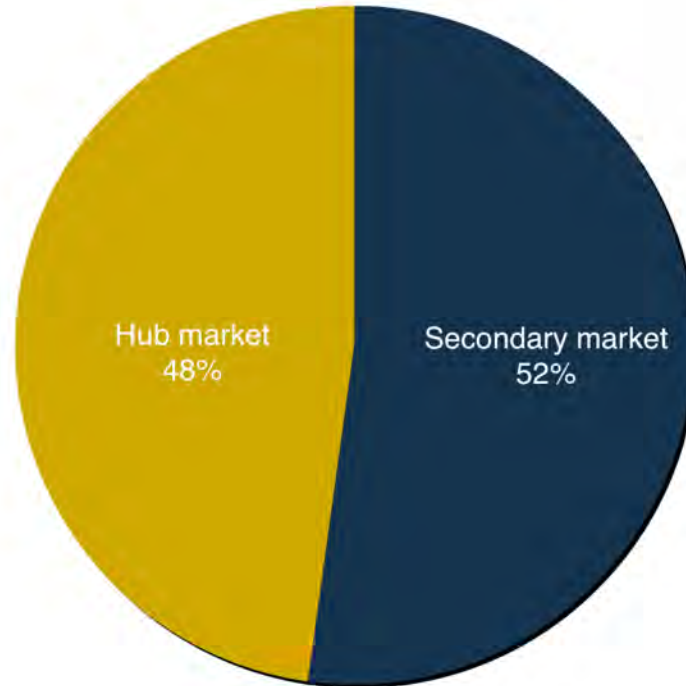
Based on sampling of 8 of the largest content/cloud providers: Google, Microsoft, Akamai, CloudFlare, Amazon, Facebook, Apple, Netflix

Source: PeeringDB, www.peeringdb.com
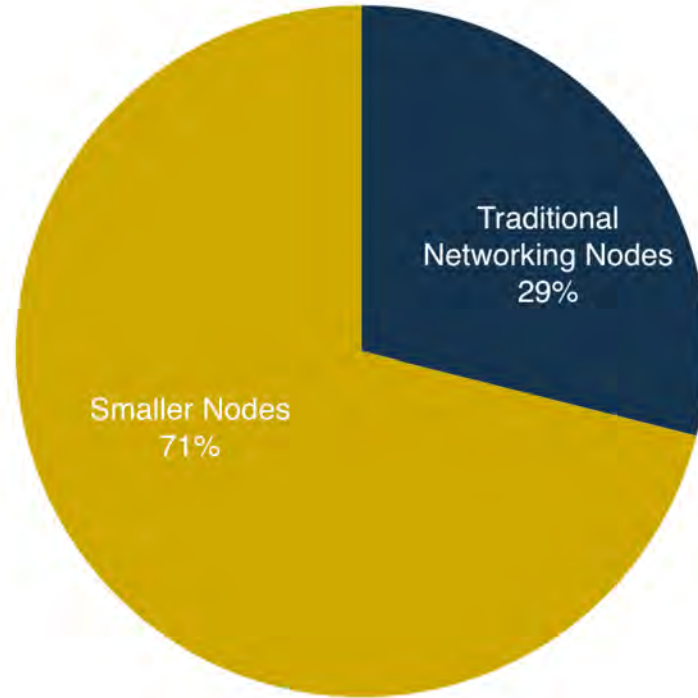
4. Where is the peering taking place?

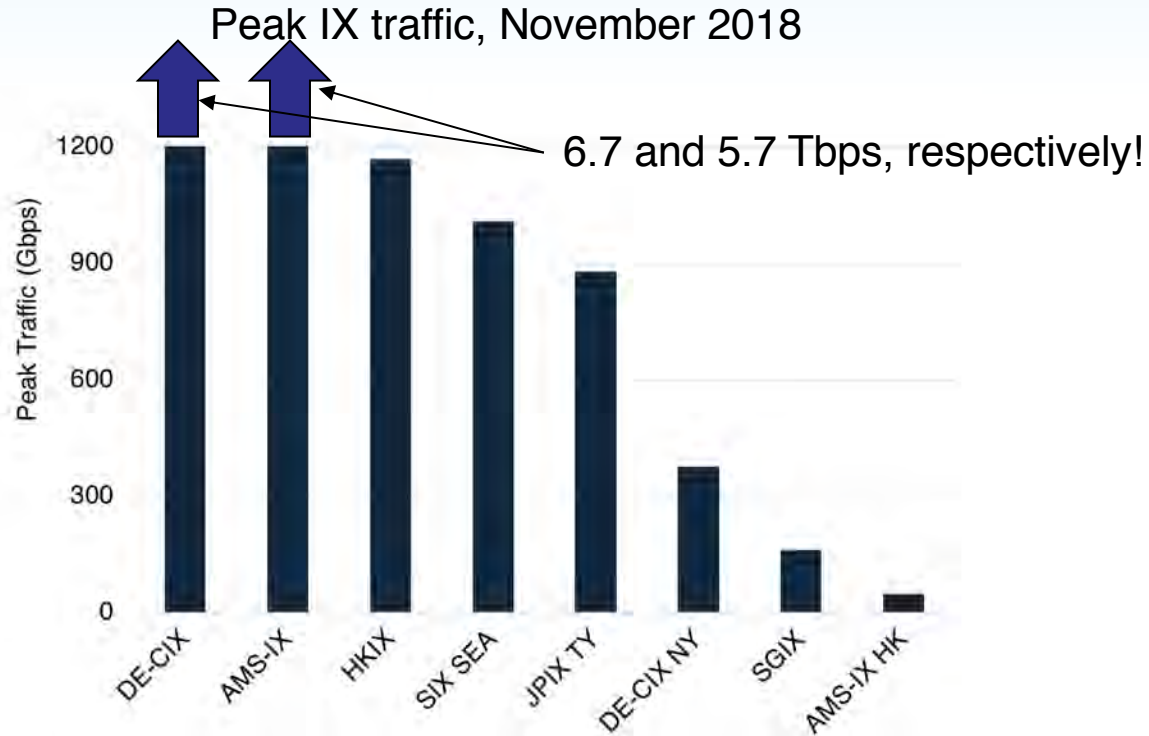# Internet exchanges are everywhere

Share of IX's by Region, 2018

...and most are in small, local markets

Share of IXs, Traditional Networking Nodes vs. Smaller Nodes, 2018

Traditional
Networking Nodes
29%

Smaller Nodes
71%

However, a few hubs still dominate peering traffic

Peak IX traffic, November 2018
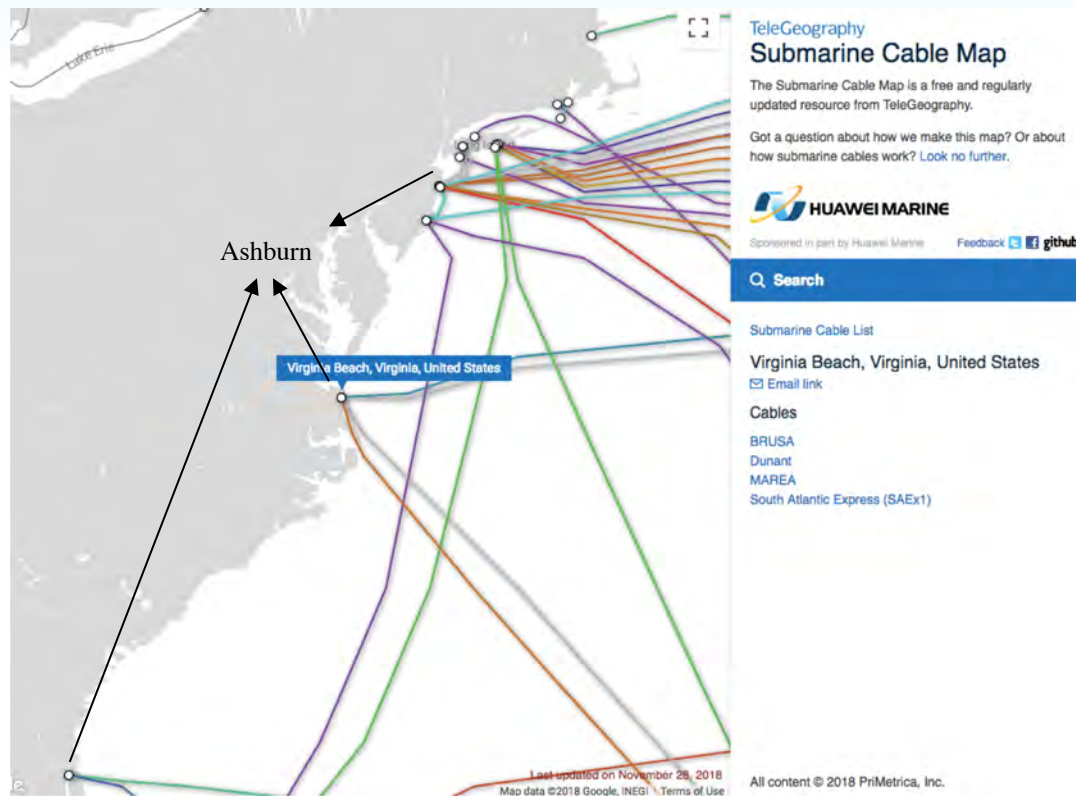
6.7 and 5.7 Tbps, respectively!
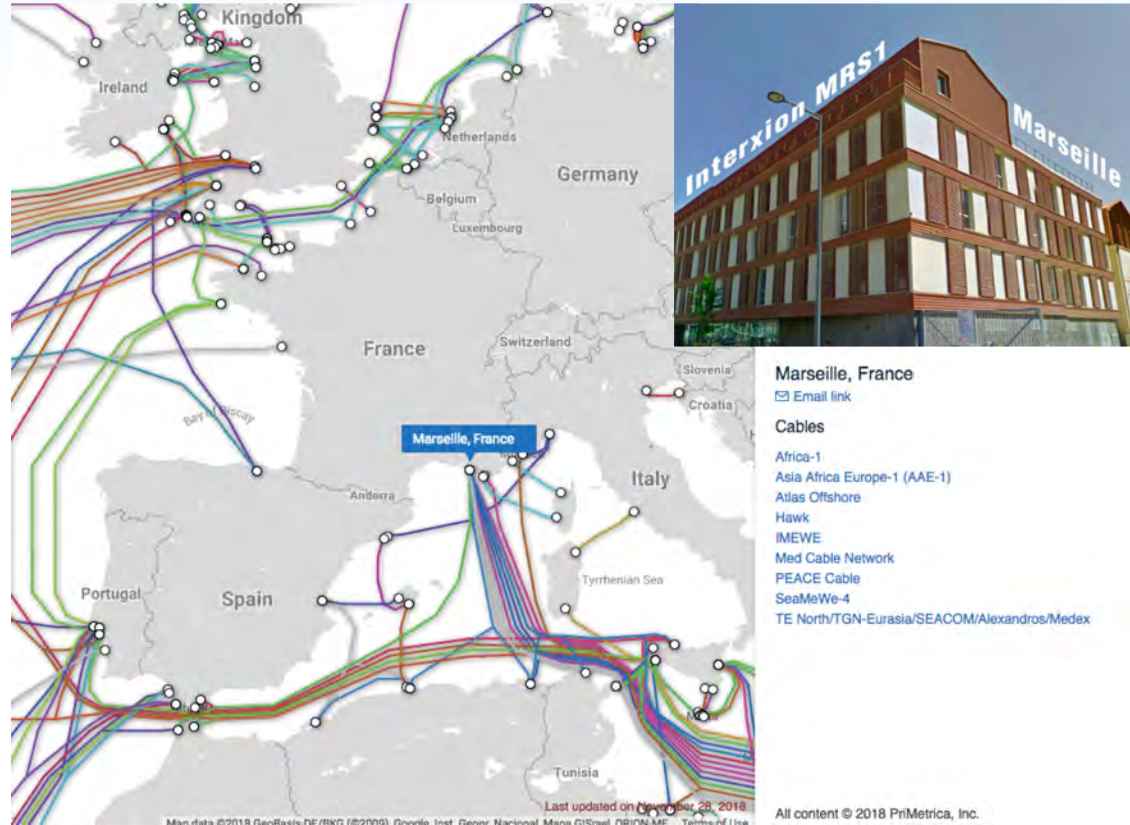
5. Will new subsea routes bring new interconnection hubs?

What about the new routes to VA Beach?

- They cut out the terrestrial backhaul from New York and Florida to an existing hub

Ashburn

Virginia Beach, Virginia, United States

How about Marseille?

- Highly-connected location that's quickly developed beyond edge node status

Marseille, France

✉ Email link

Cables

Africa-1
Asia Africa Europe-1 (AAE-1)
Atlas Offshore
Hawk
IMEWE
Med Cable Network
PEACE Cable
SeaMeWe-4
TE North/TGN-Eurasia/SEACOM/Alexandros/Medex

All content © 2018 PriMetrica, Inc.

And what about the new routes to Africa?

- No evidence yet that Angola and Cameroon will develop as interconnection hubs due to the activation of SACS and SAIL
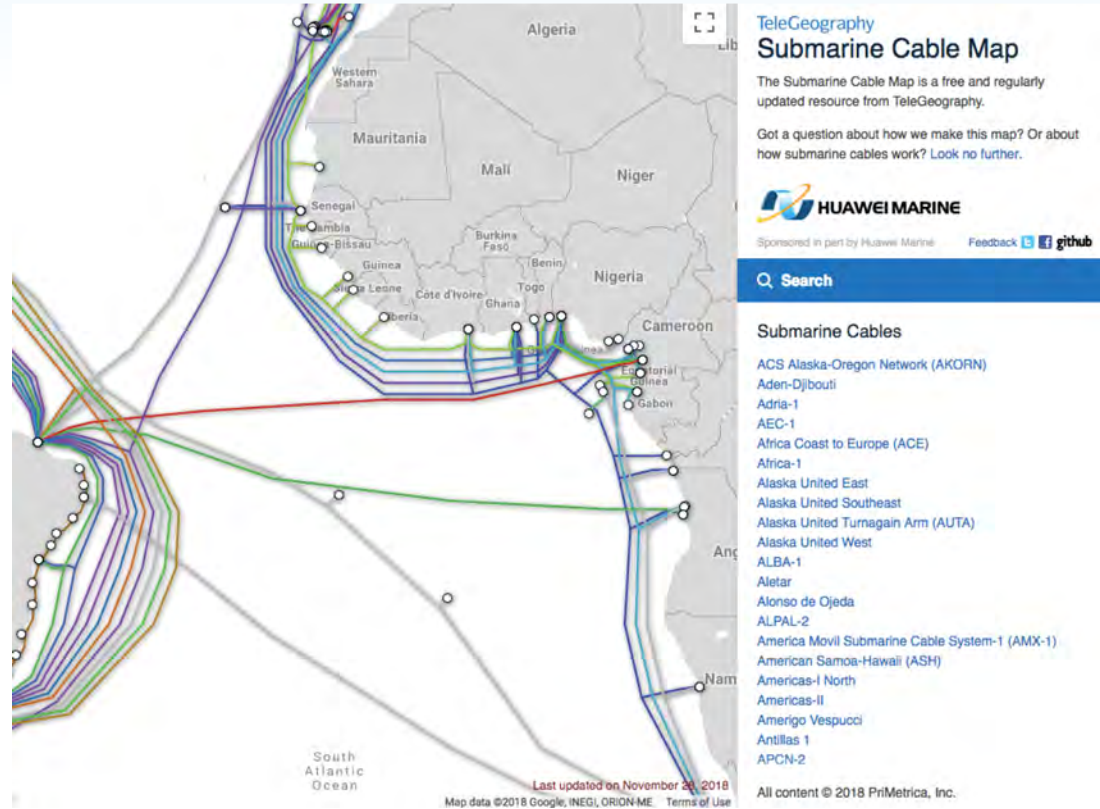
Other examples

- Lisbon
  - *Could* serve as a interconnection hub for Africa, or could remain as a transit point on the way to existing European hubs
- Mumbai
  - Lots of potential as a node on the Europe-Asia route if local conditions improve

Dubai – a cautionary tale

- Has two major interconnection facilities – Etisalat Smarthub and Datamena

- On route for 15 subsea cable systems

Middle Eastern International Internet Bandwidth by Region, 2014-2018 (Tbps)
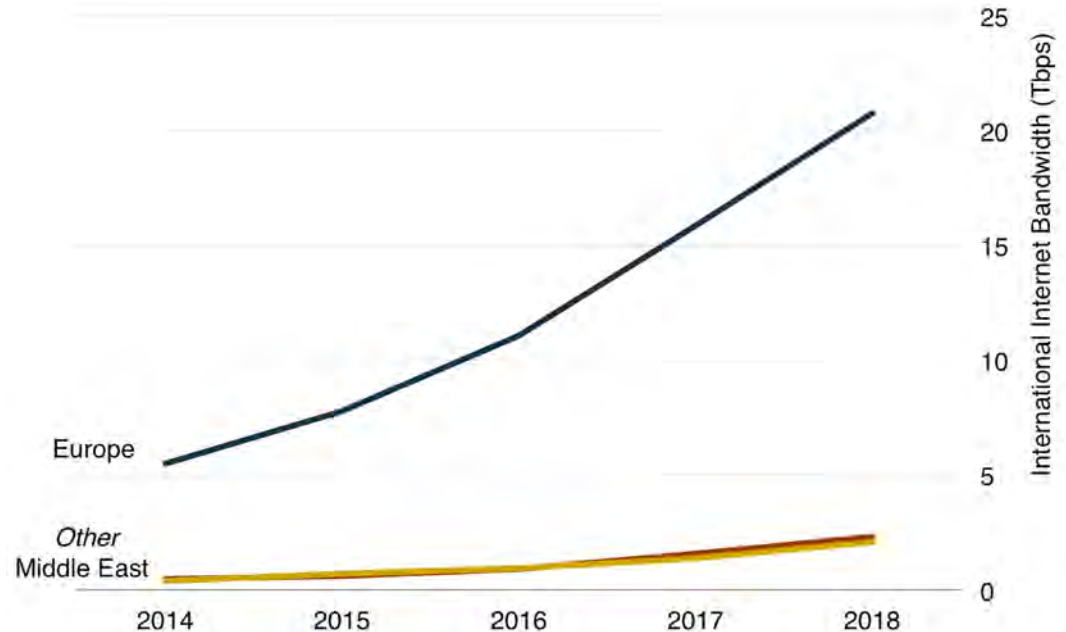
Conclusion: is there a shift to the edge?

- Data centers and networks are already at the edge (secondary markets) and investments will continue to grow here as well as at the hubs
- Some edge markets are already sizable
- Content and IXs have already expanded to the edge in order to reach major population centers
- Traffic continues to concentrate at the hubs
- New subsea routes will open up new interconnection nodes in some cases…but not always!

Jon Hjembo

Senior Manager, Infrastructure Research

TeleGeography

jhjembo@telegeography.com

+1 202 741 0046