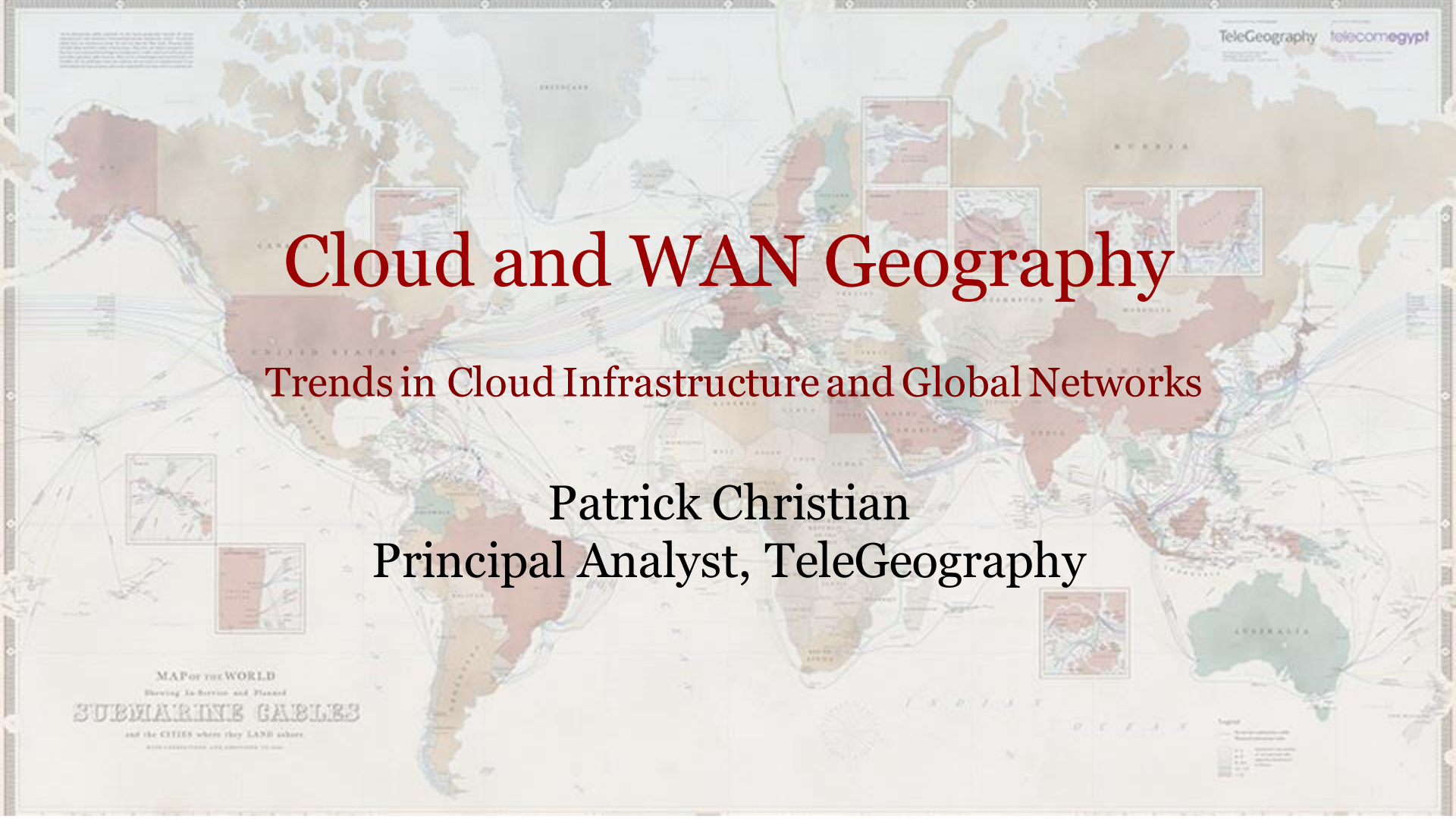


Cloud and WAN Geography

Trends in Cloud Infrastructure and Global Networks

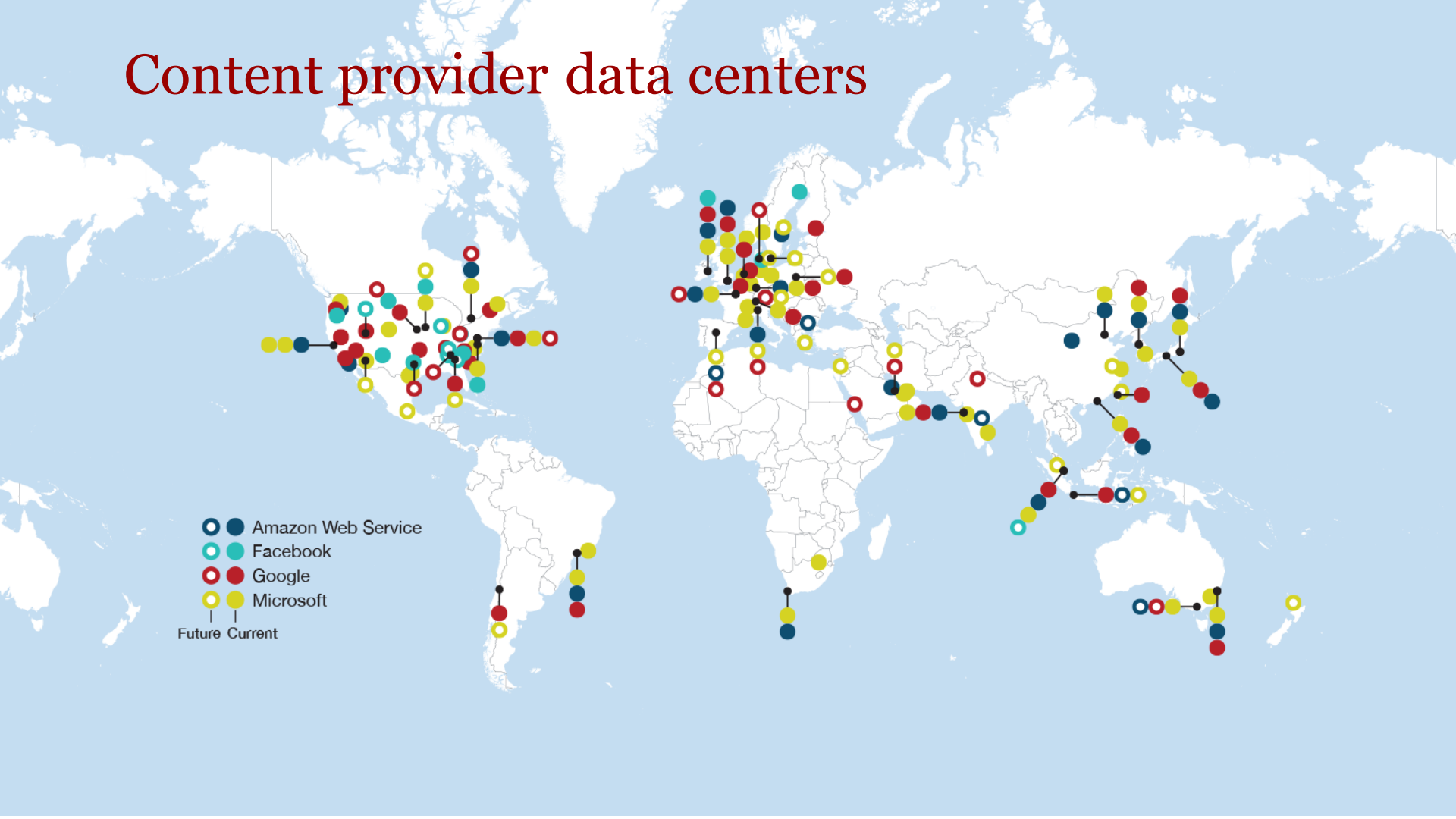
Patrick Christian
Principal Analyst, TeleGeography

What we'll cover

- Factors shaping global networks
  - Location of content and int'l bandwidth deployment
  - Content provider data centers and networks
  - Bandwidth and IPT pricing
- Cloud Geography – what it means for WANs
  - Where to find the cloud - locations of data centers, on-ramps
  - How DC location has an impact on cost and performance
  - Where the cloud is moving, new cloud regions

Global Network Trends

Content provider data centers



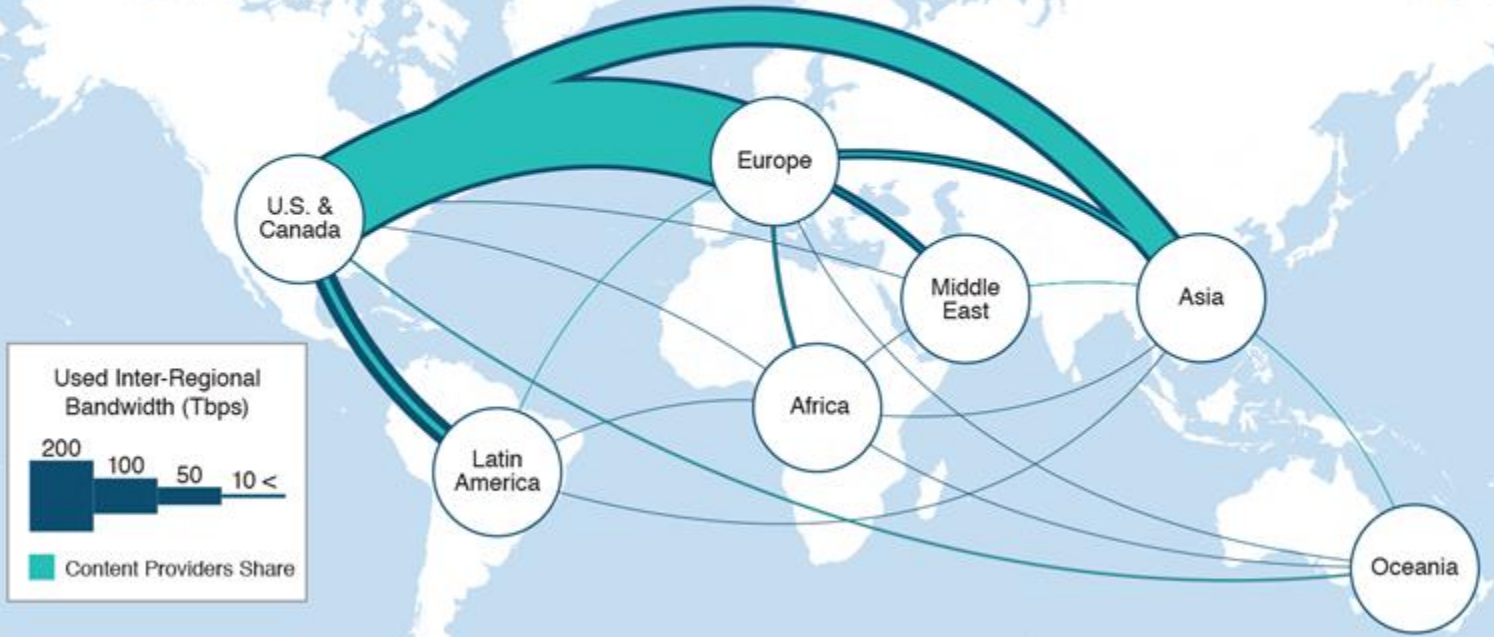
Content networks

- Inter-data center demand (DC to DC)
  - Higher capacity routes, lower price
  - Surge in bandwidth on traditional routes, plus new landings in some smaller markets
  - Emphasis on cost: favorable regulatory environments, affordable power, etc.

- Content distribution and cloud services (DC to end-user)
  - Smaller bandwidth requirements than inter-DC routes
  - Capacity extending to secondary developed markets and major emerging markets
  - Emphasis on distribution of content to end user from DCs to major and secondary hubs

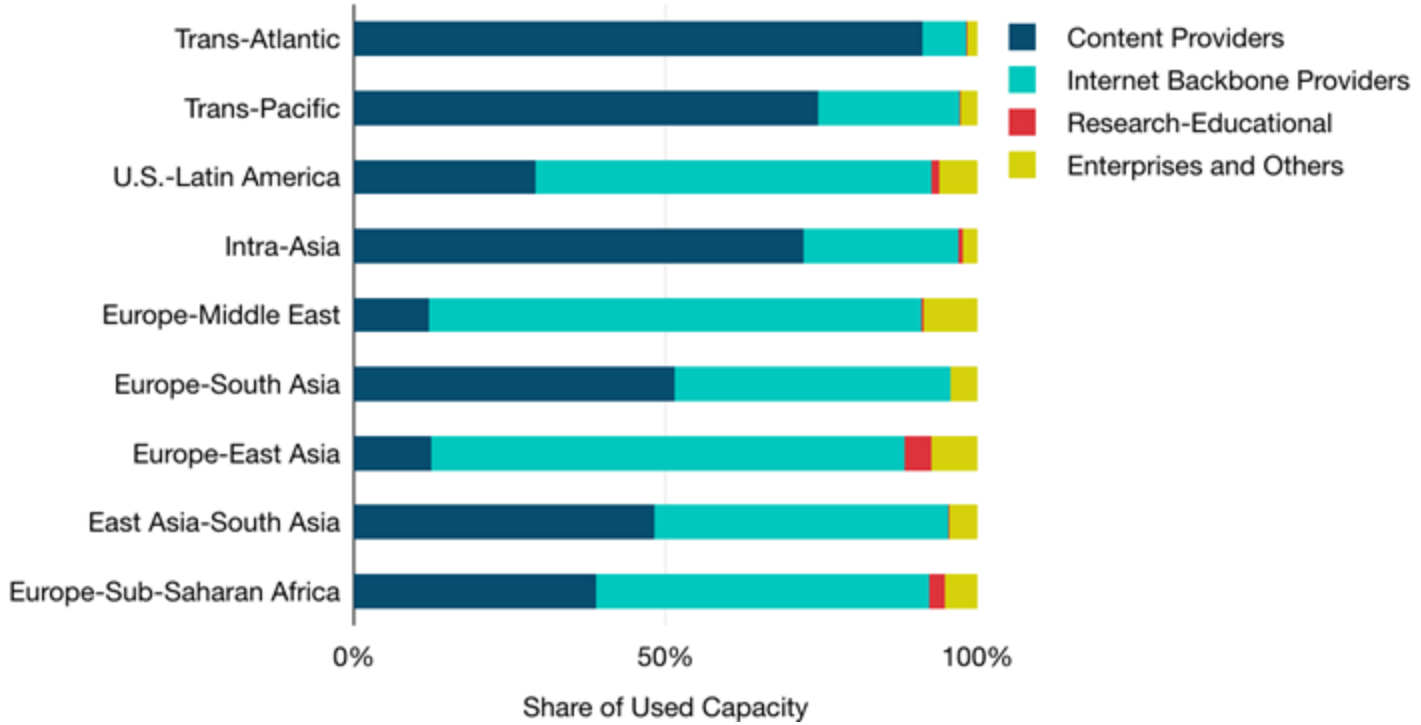
Inter-regional capacity and the cloud

Used inter-regional bandwidth showing content provider share



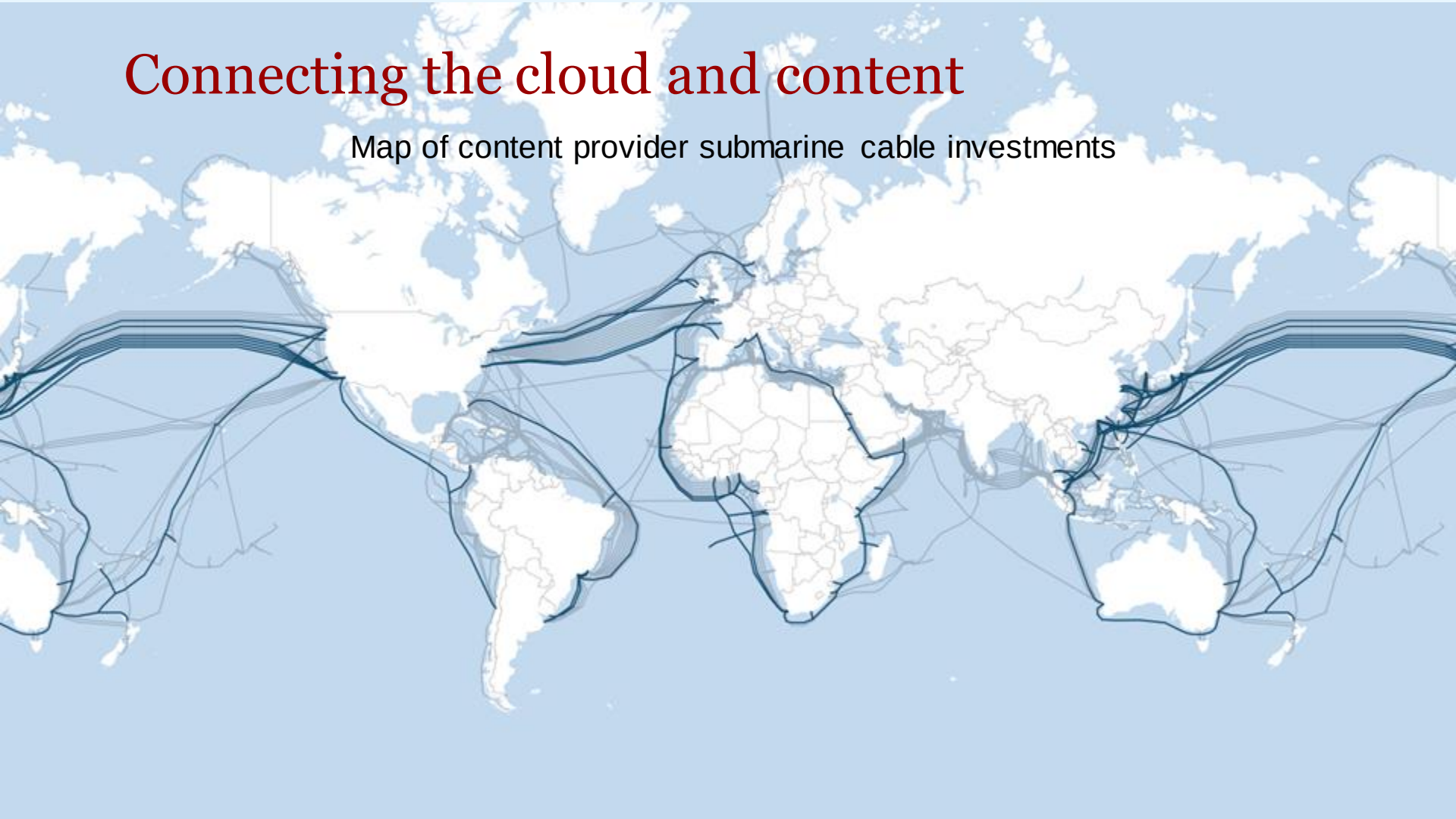
Content share depends where

Share of used bandwidth by category for major routes



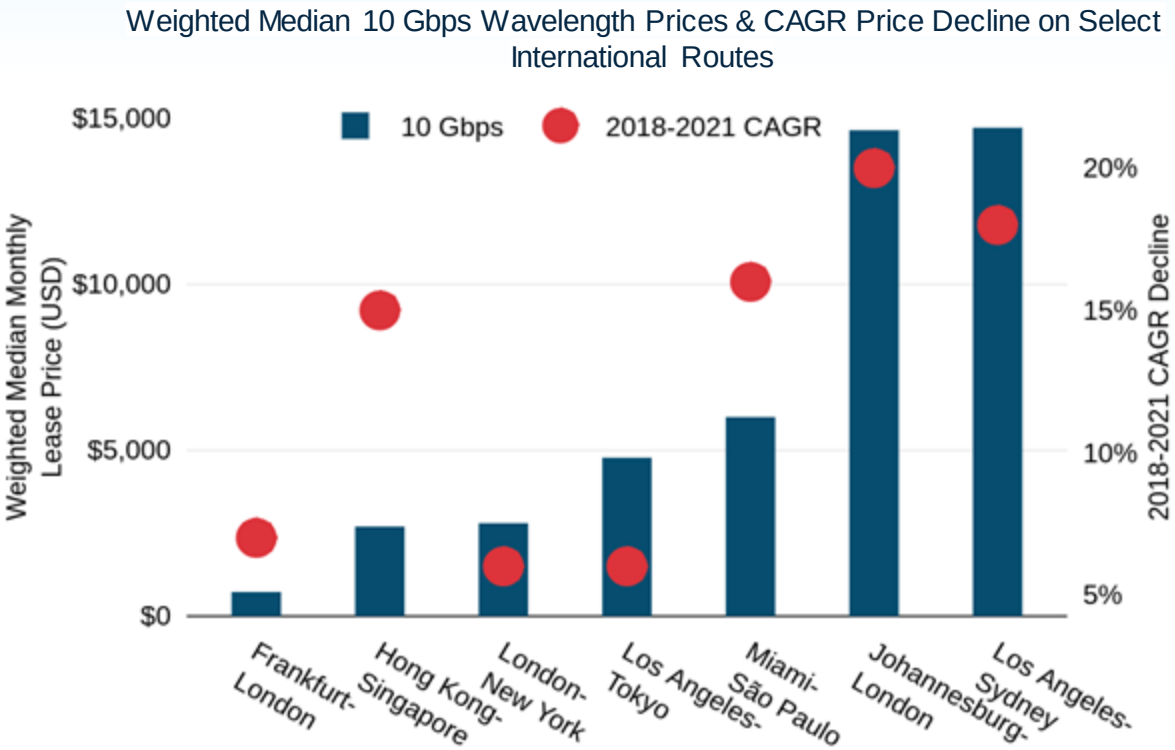
Connecting the cloud and content

Map of content provider submarine cable investments

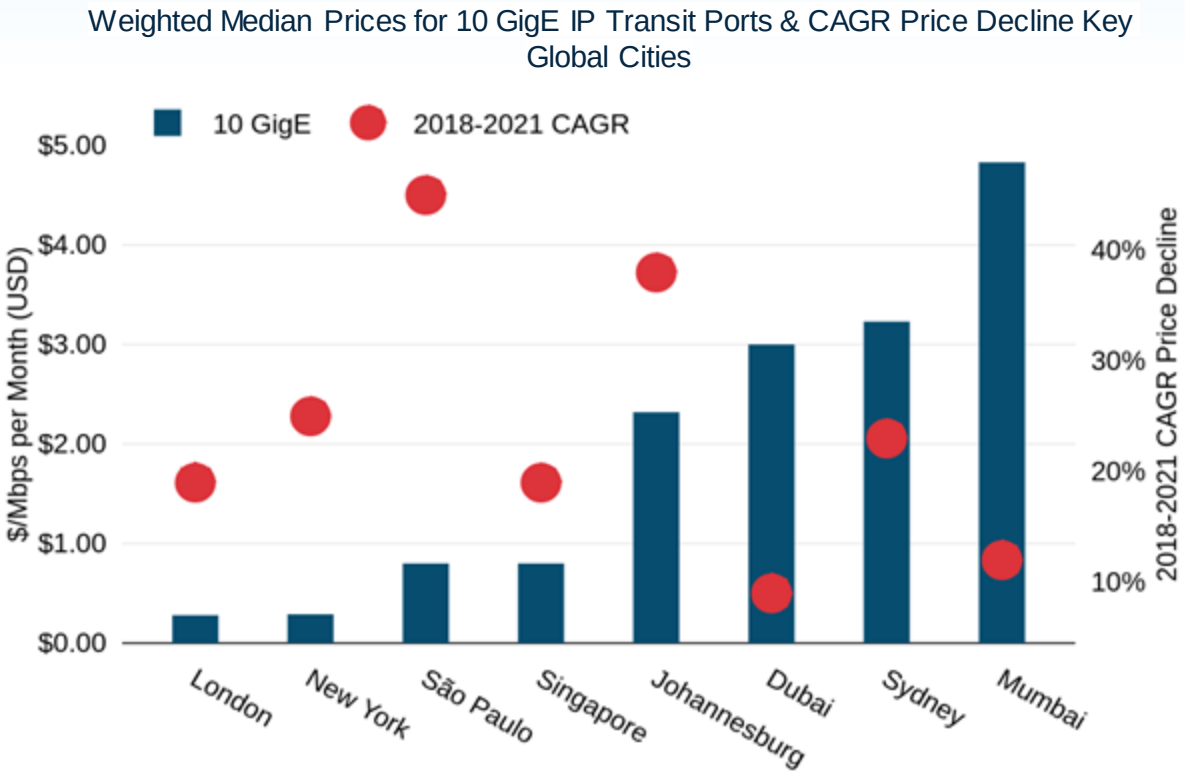


Global Pricing Trends

10 Gbps median prices and erosion rates varies by route



Transit prices follow transport pricing trends



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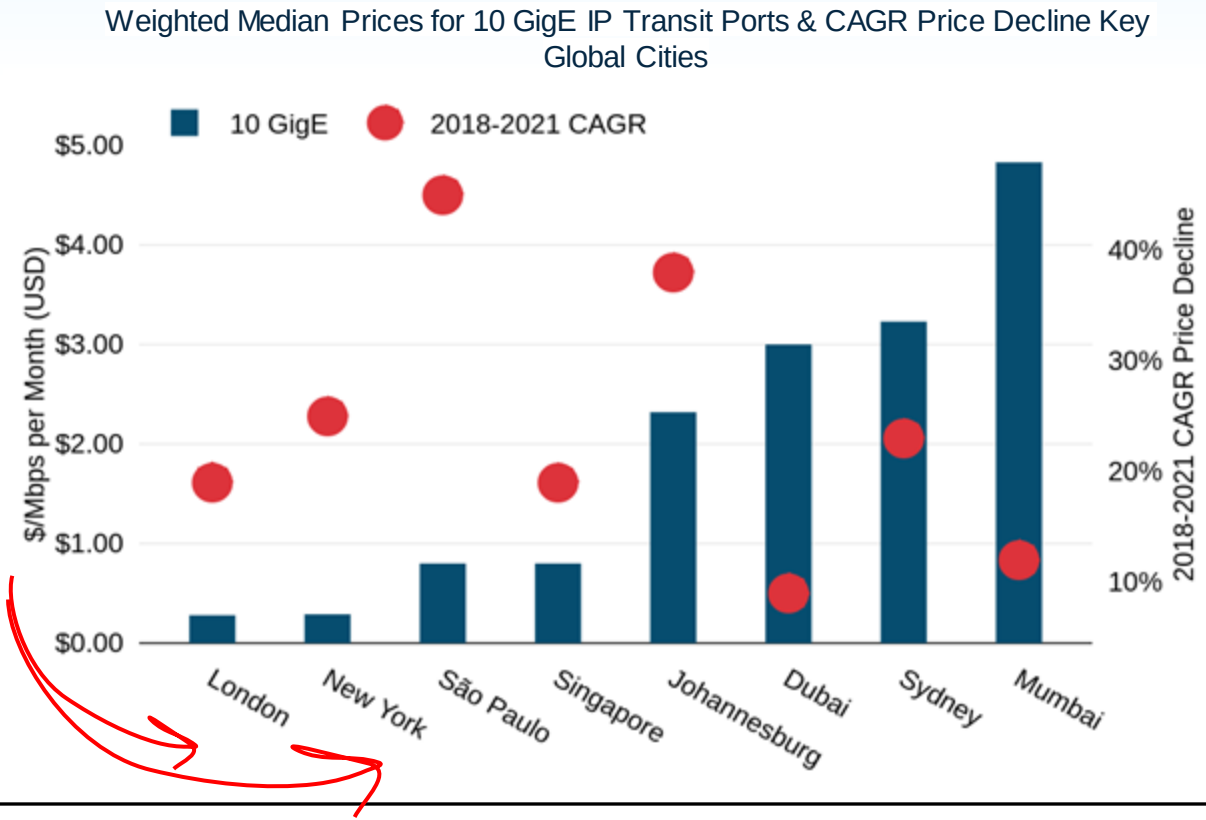

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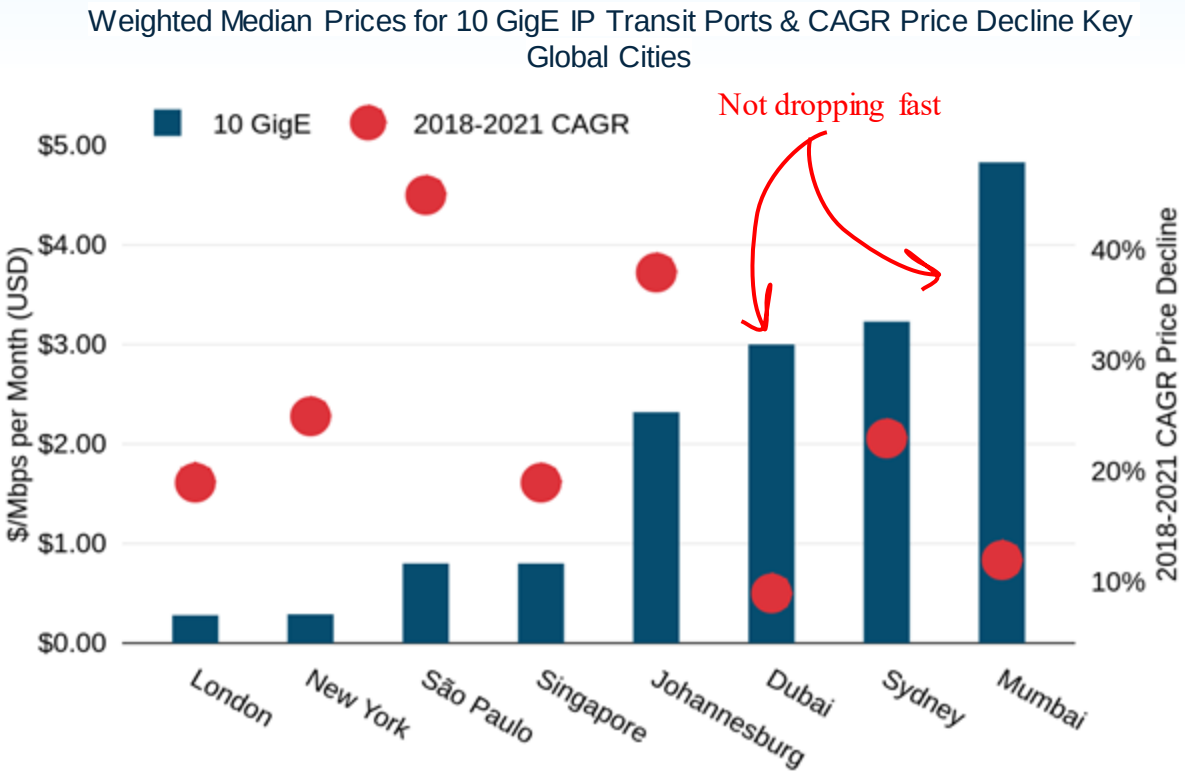

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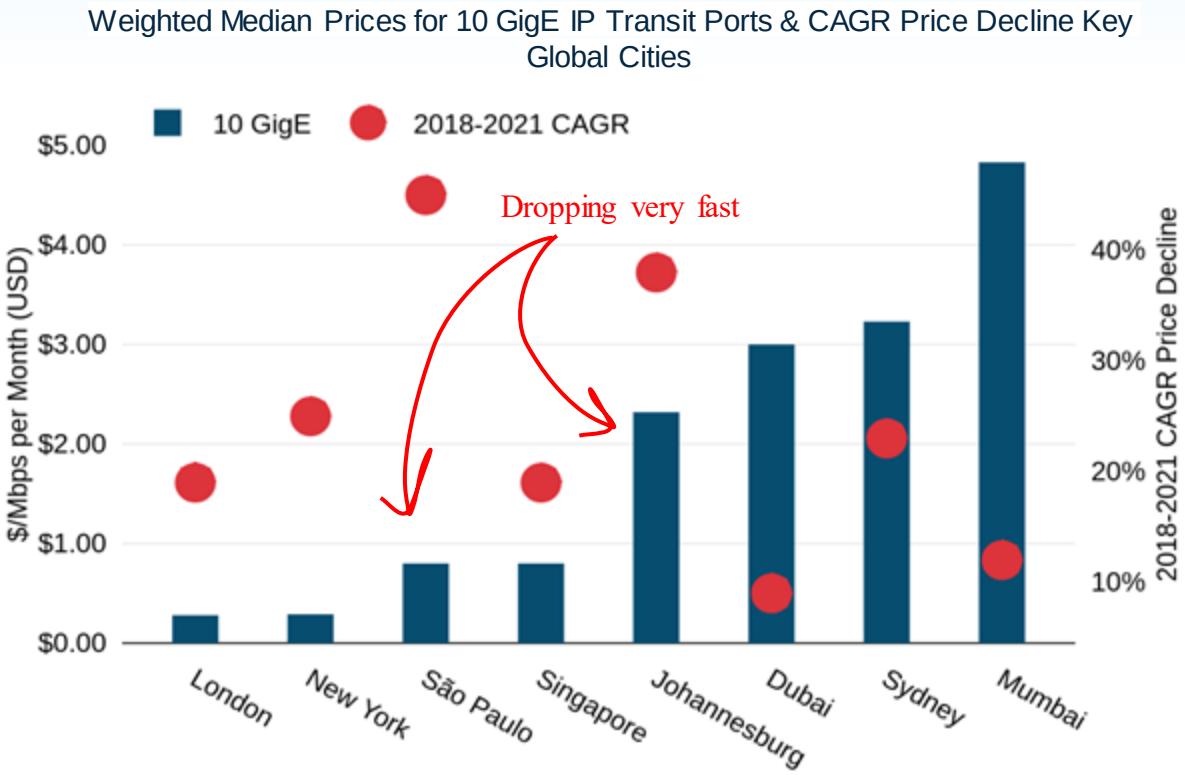
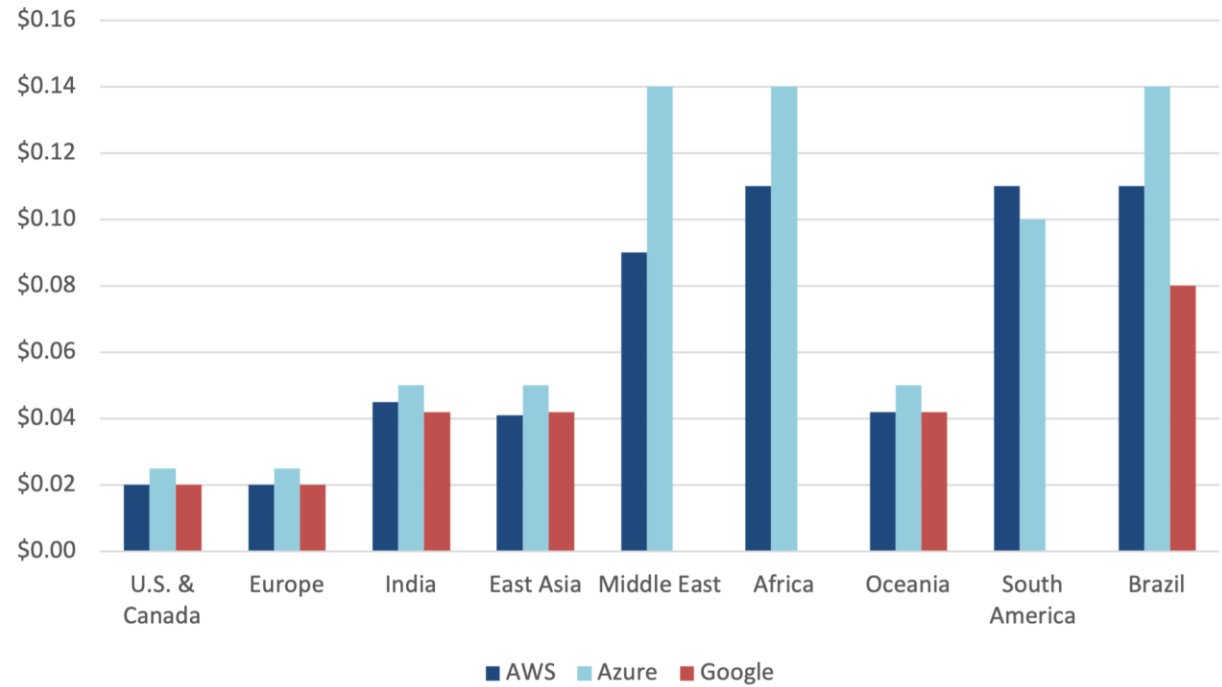


Cloud traffic prices track with capacity/ipt cost, mostly

Outbound data transfer rates per GB on dedicated connections, Q1 21



Note: Prices reflect metered data plans at the lowest tier of usage from U.S. East cities. Per-GB rates typically fall at higher levels of usage.

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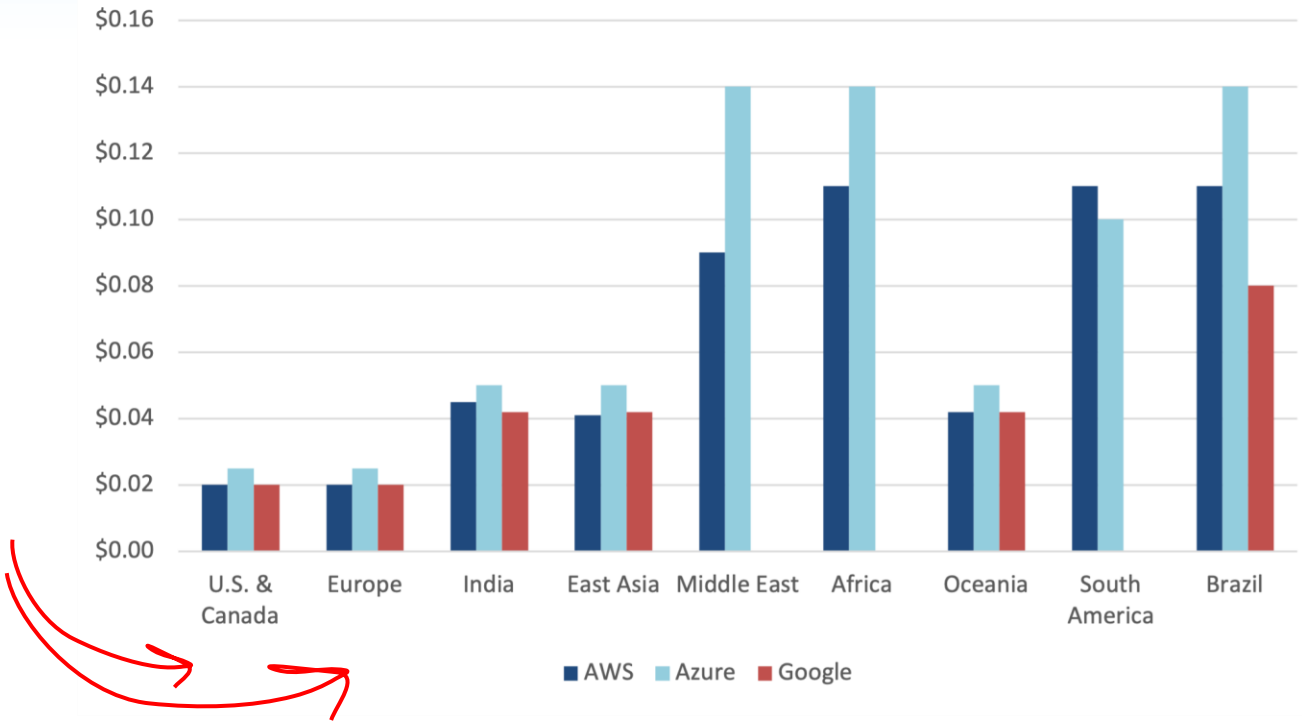

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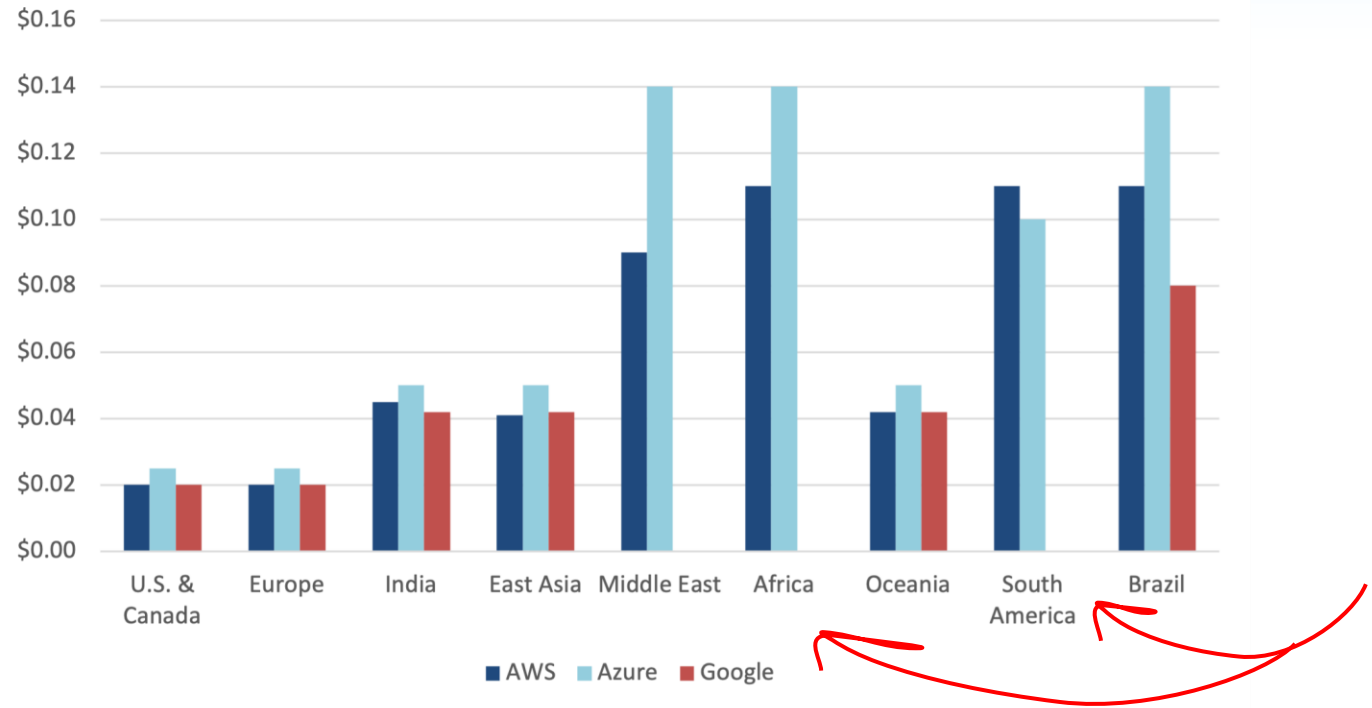

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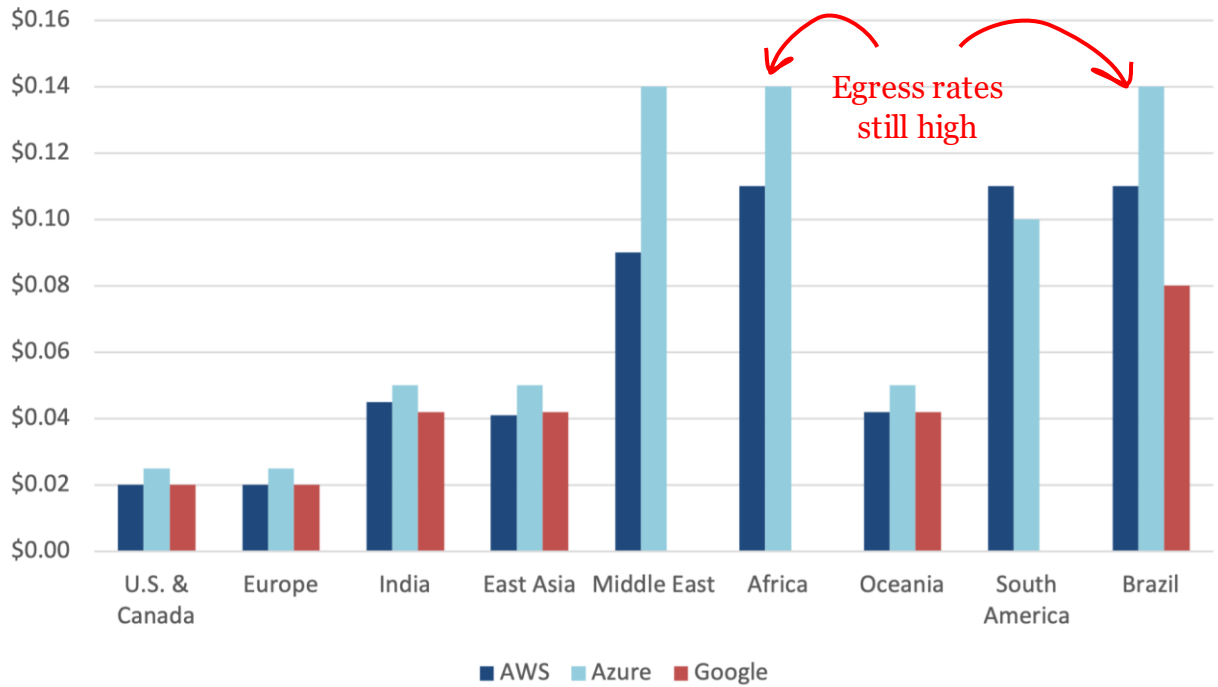

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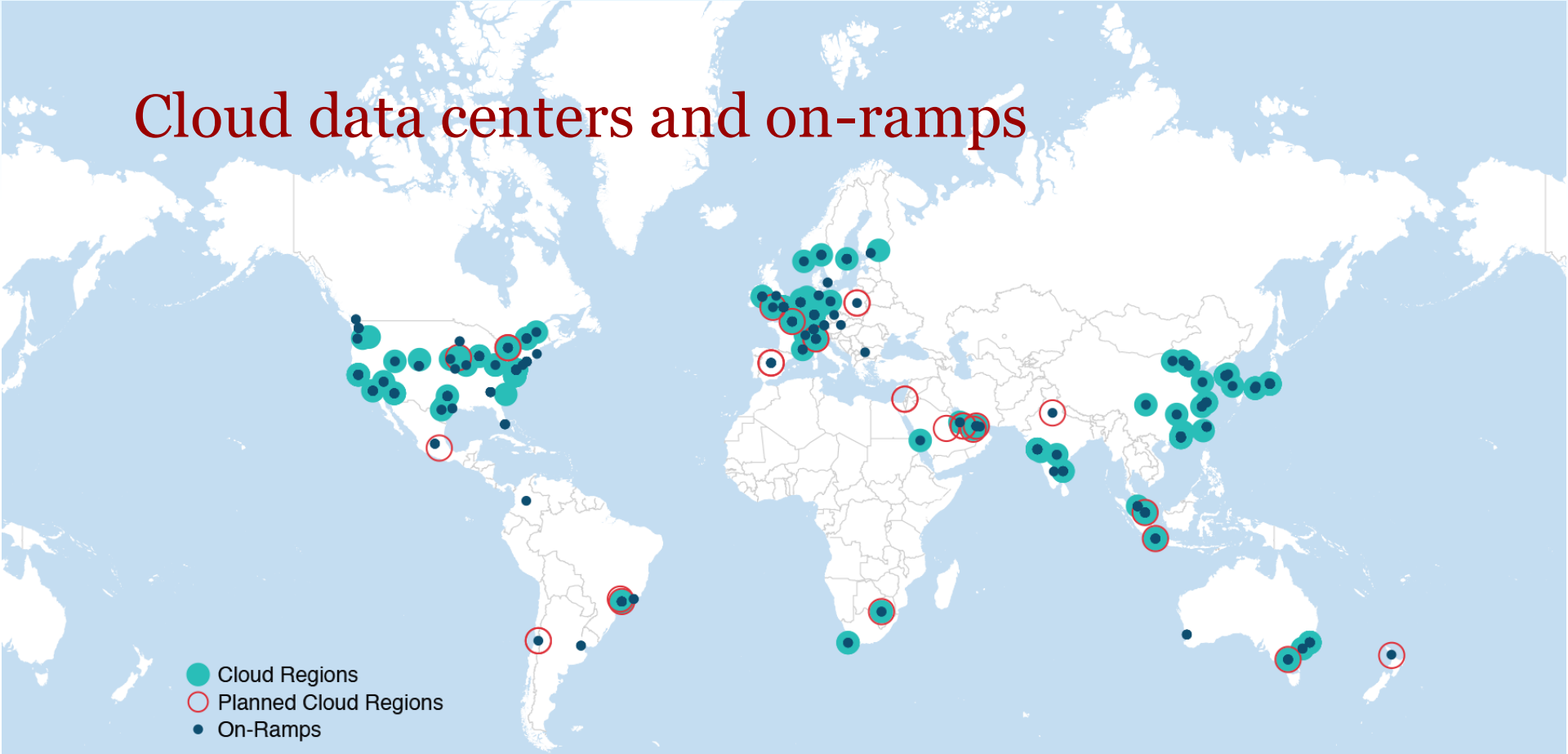
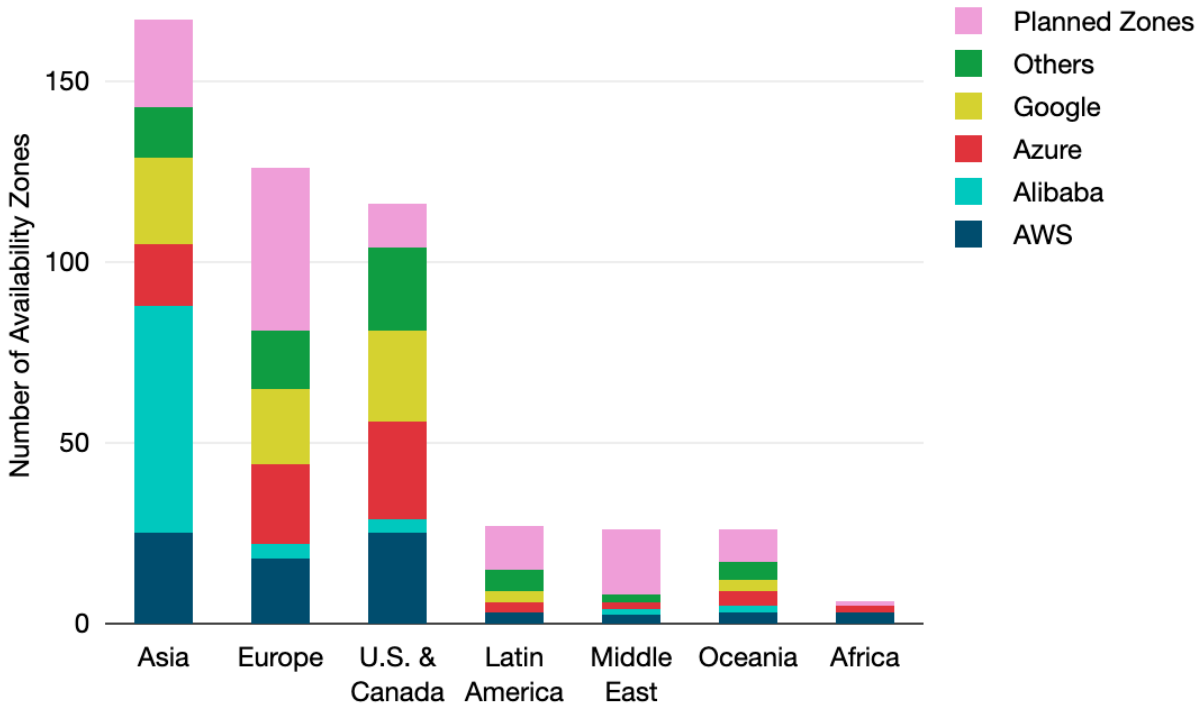
Cloud Geography

Cloud data centers and on-ramps



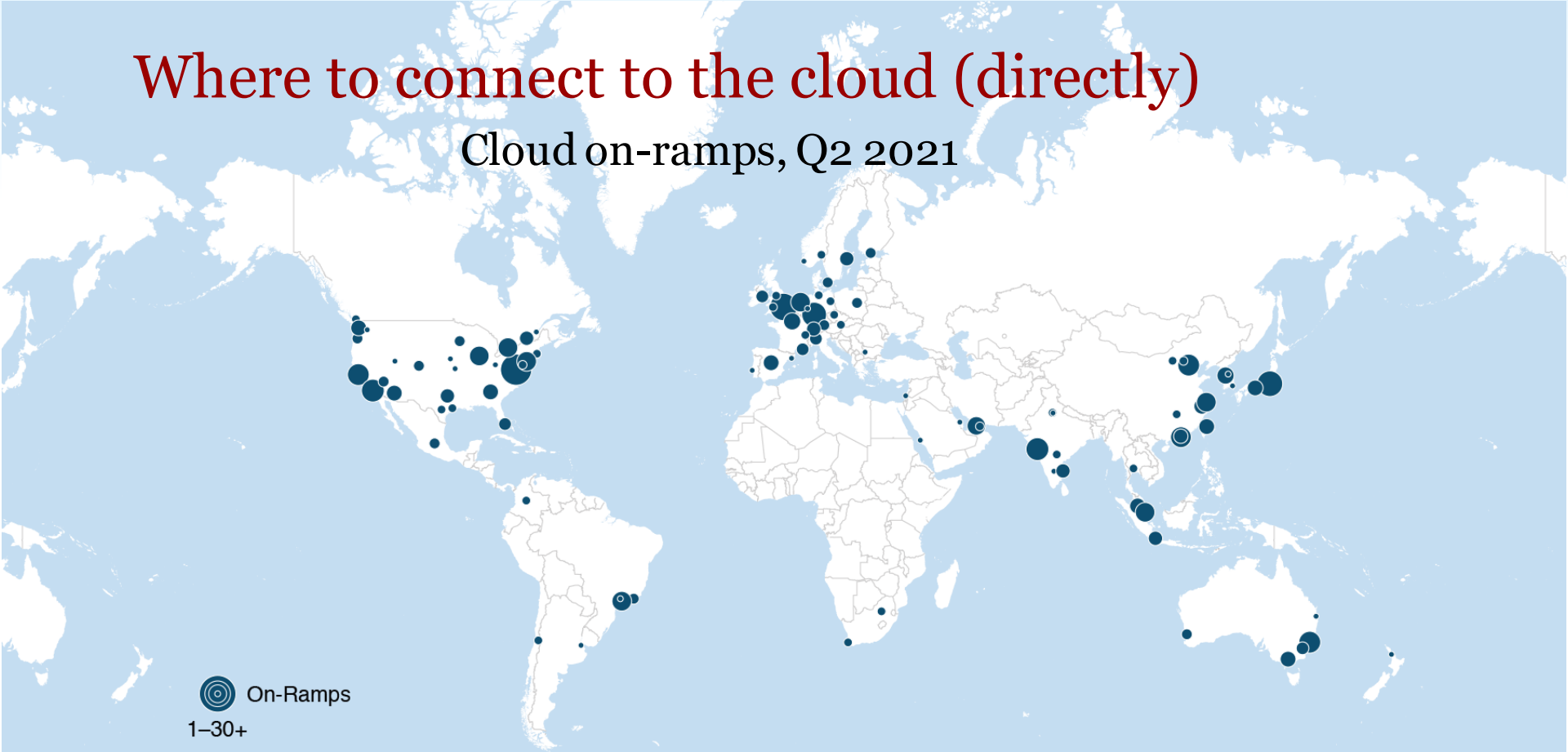
Asia leads in cloud zones, thanks Alibaba!

Service Availability Zones by Region, 2021



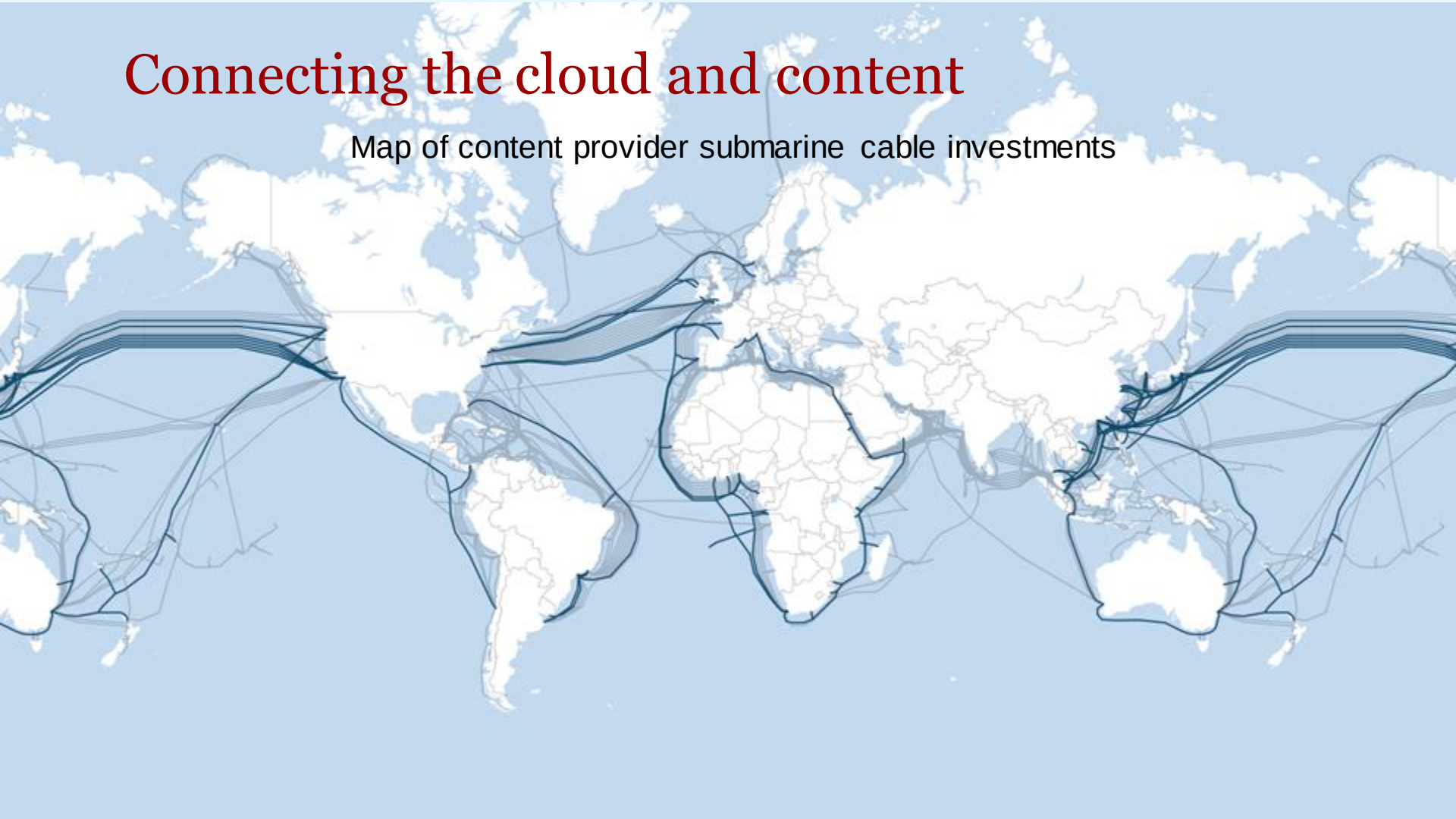
Where to connect to the cloud (directly)

Cloud on-ramps, Q2 2021

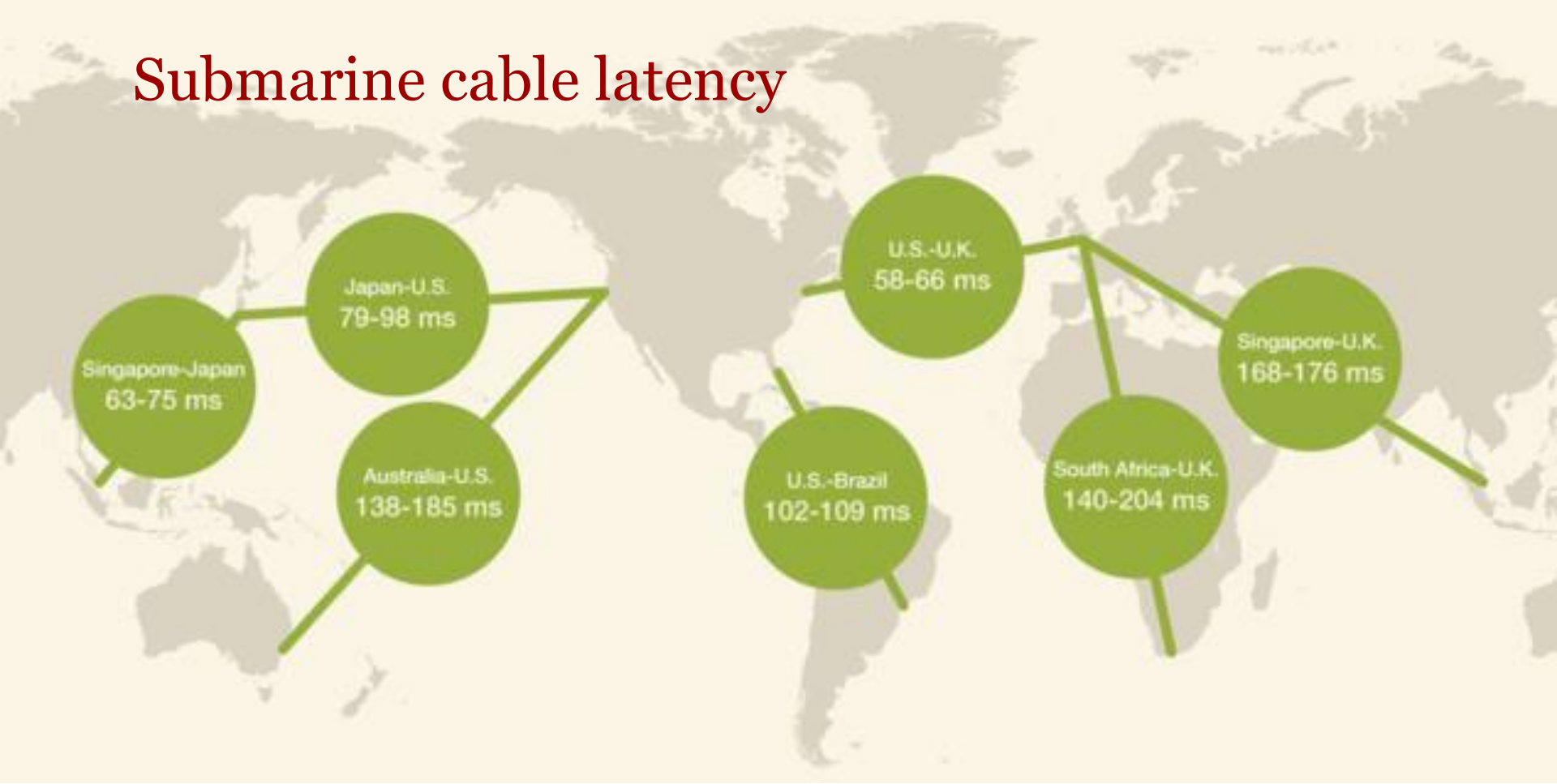


Connecting the cloud and content

Map of content provider submarine cable investments

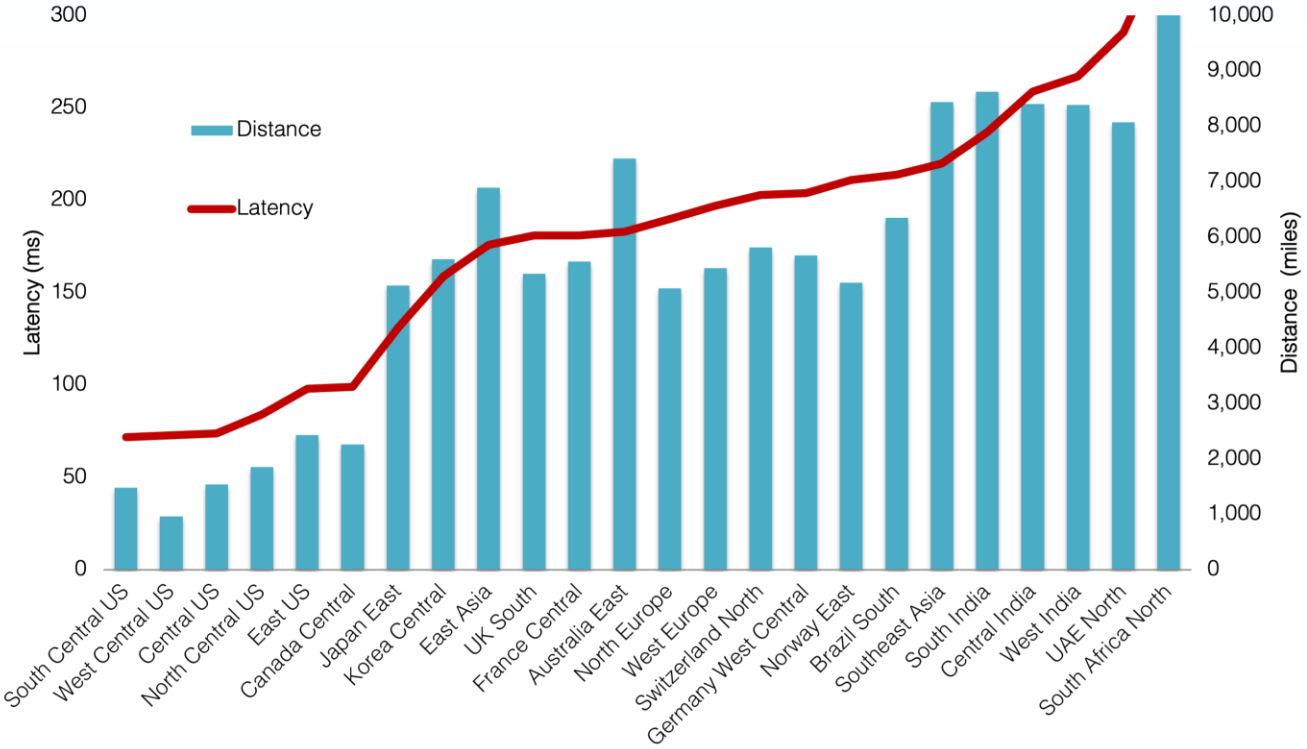


Submarine cable latency



Distance isn't the only thing that matters…

Azure cloud data center latency and distance from LA via internet



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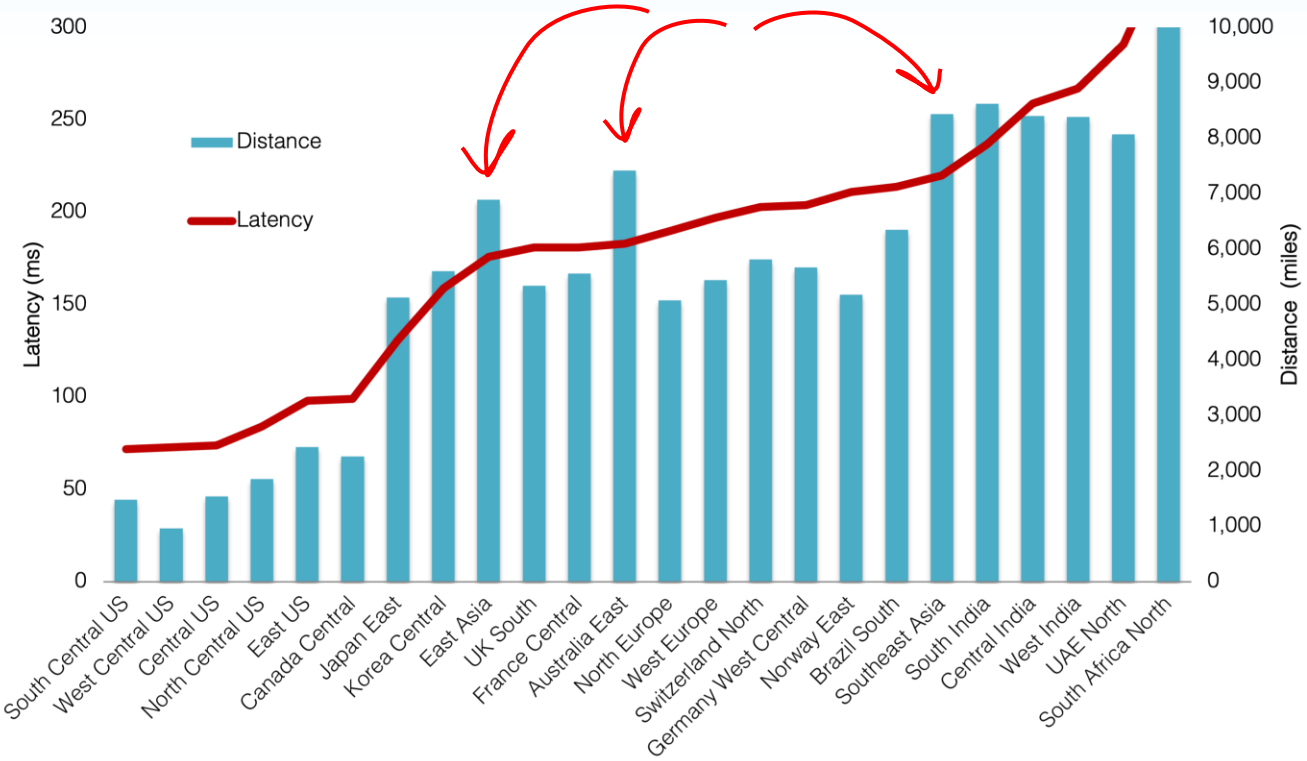
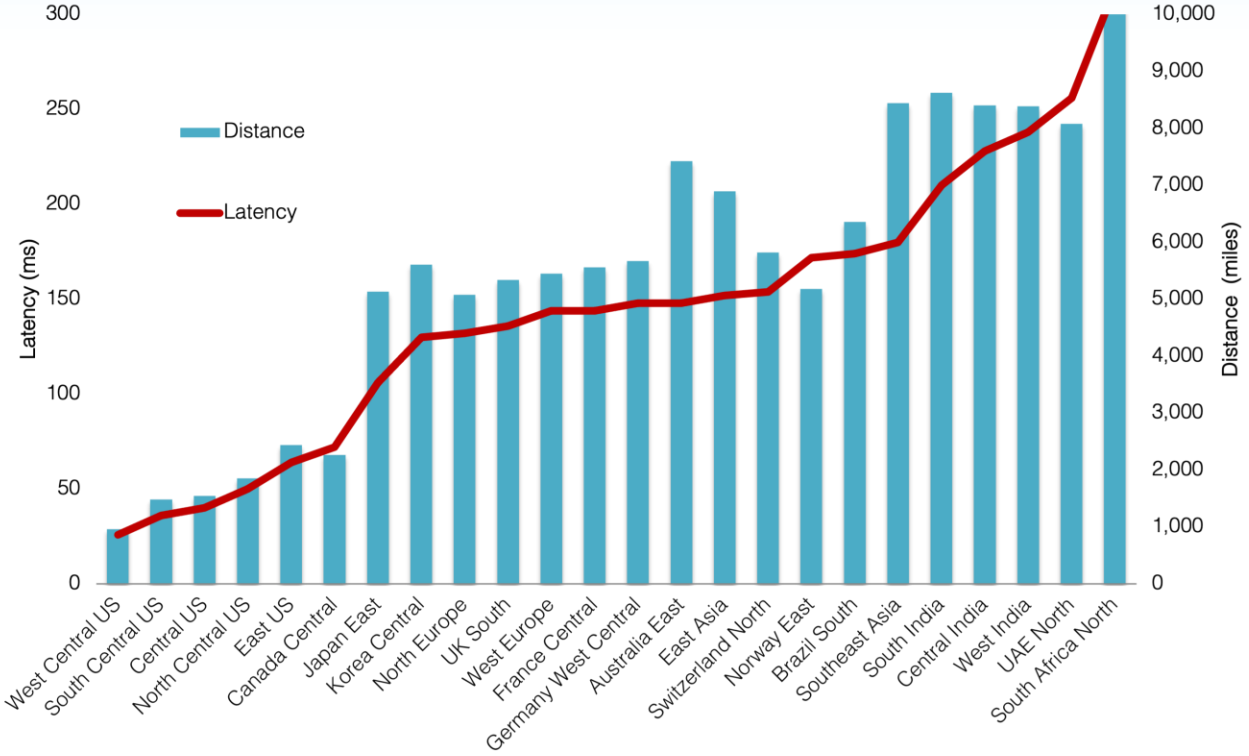
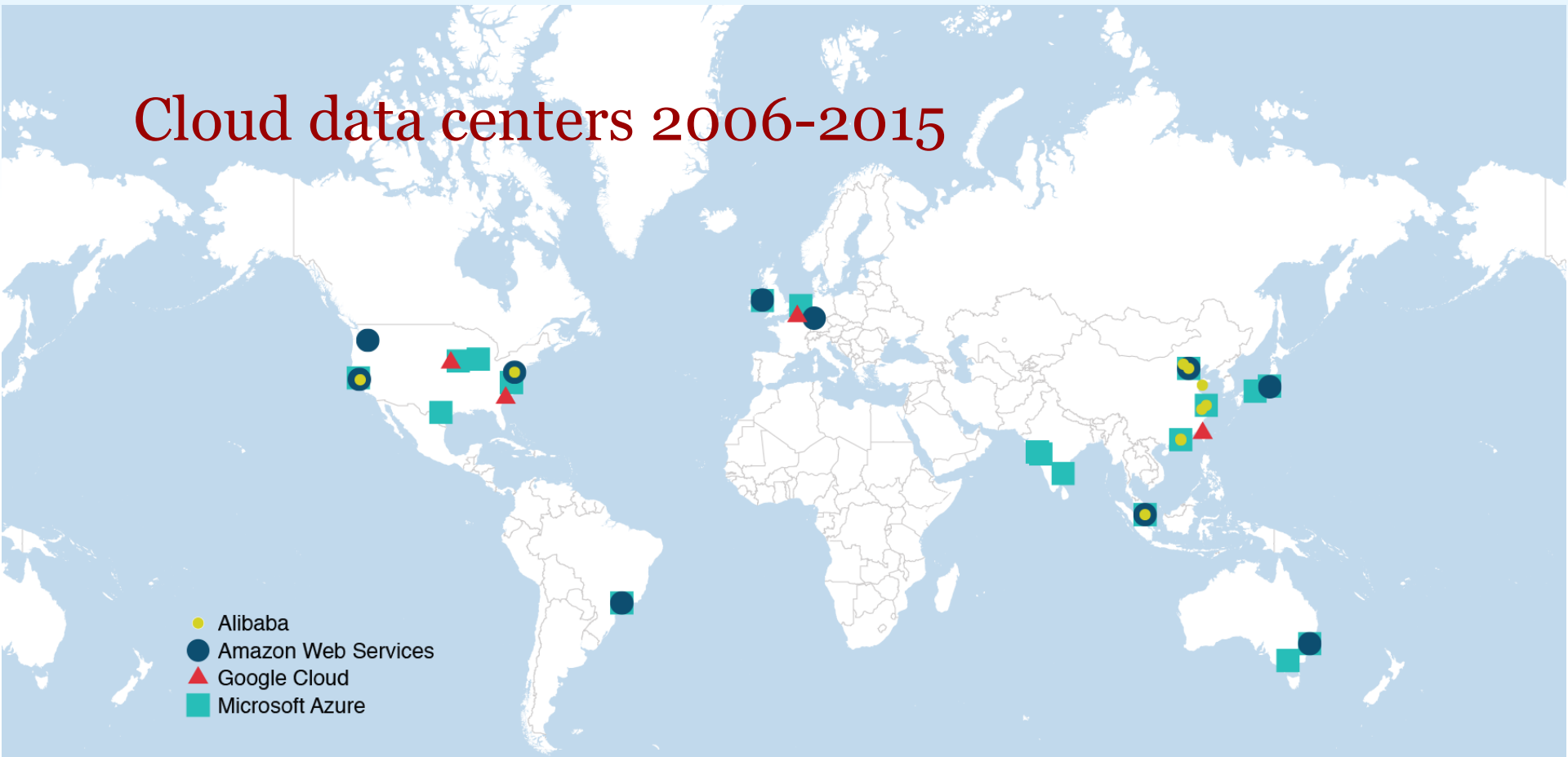


Distance isn't the only thing that matters…

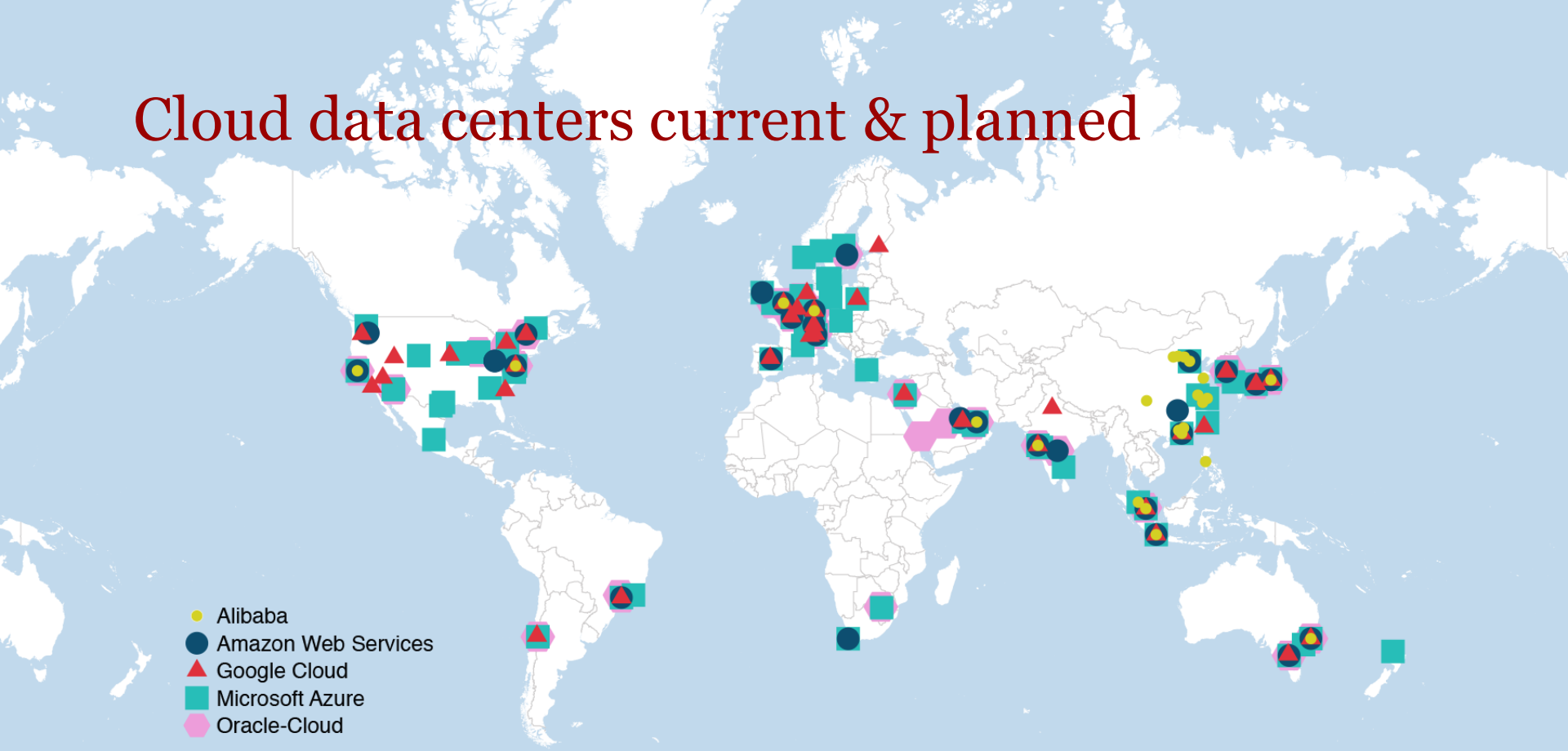
Inter-DC latency and distance from SF area on Azure's backbone



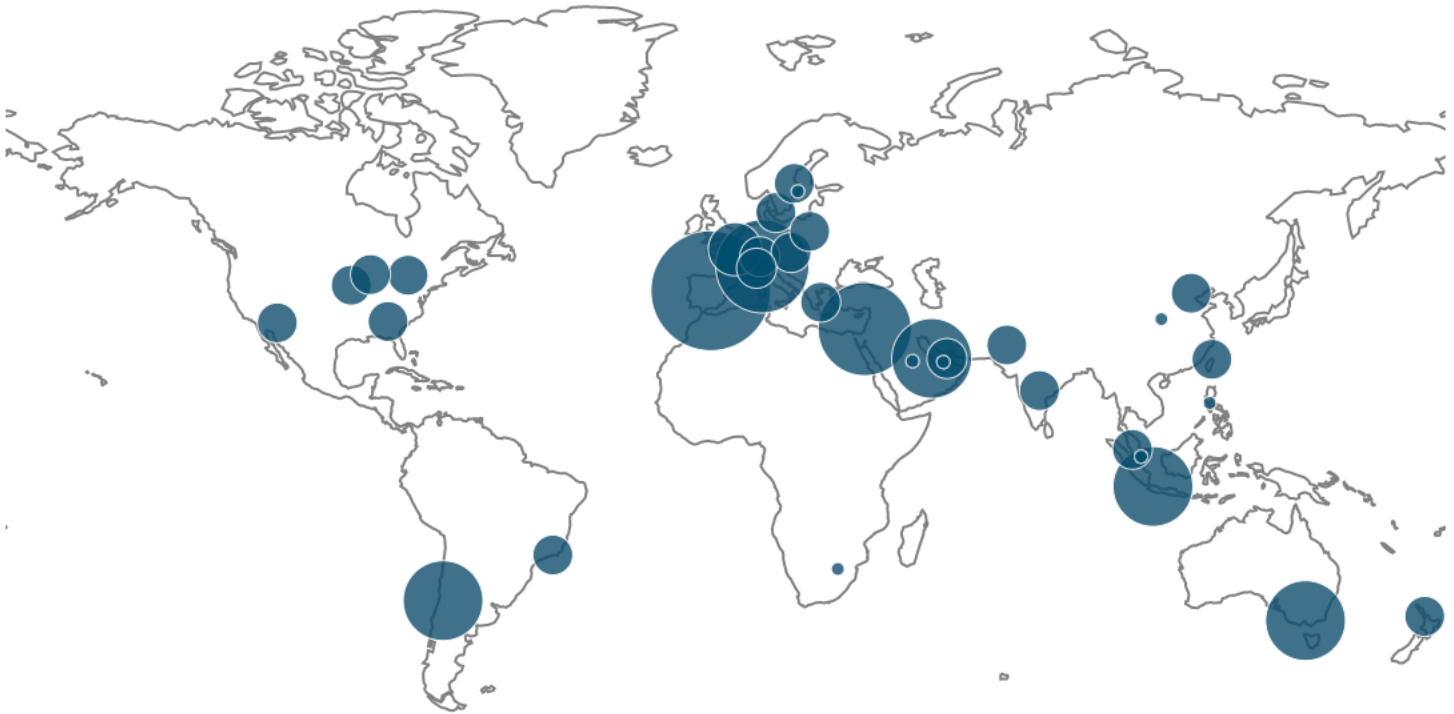
Cloud data centers 2006-2015



Cloud data centers current & planned



Planned cloud data centers



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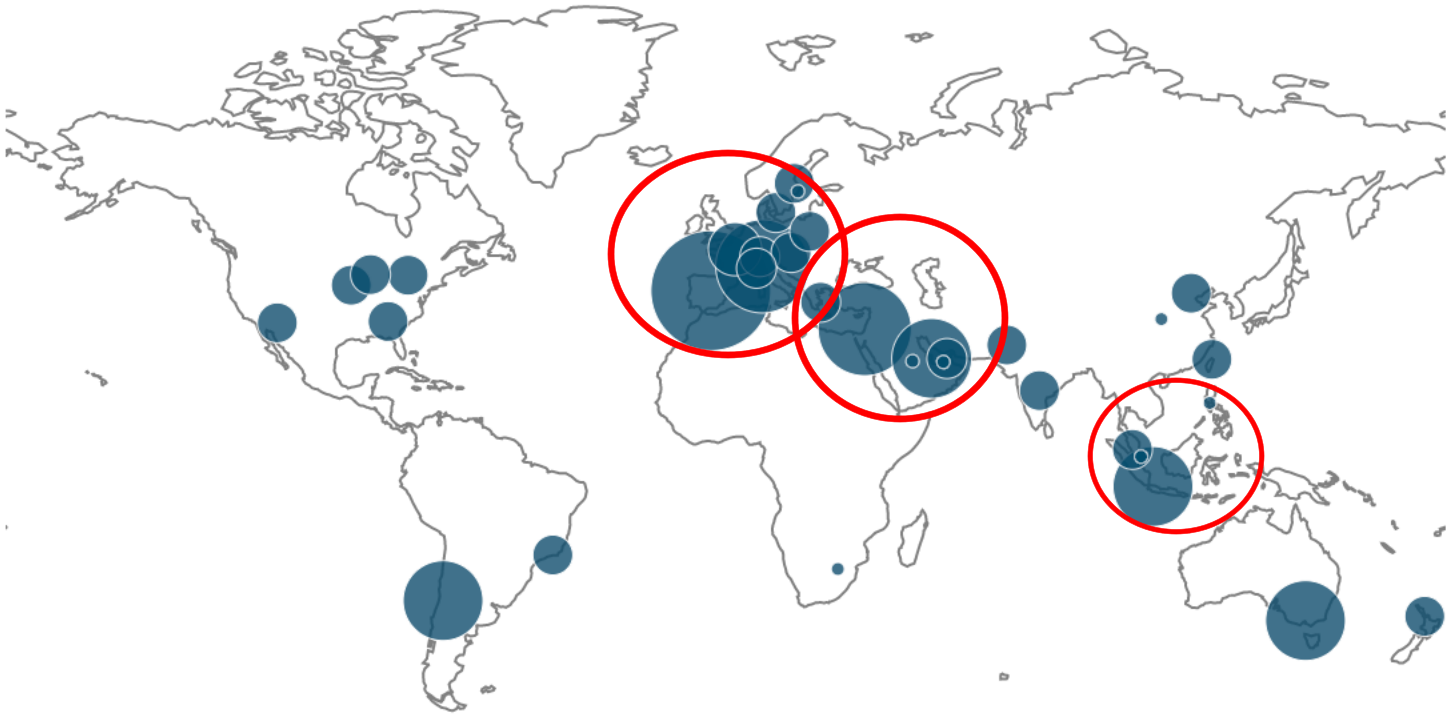
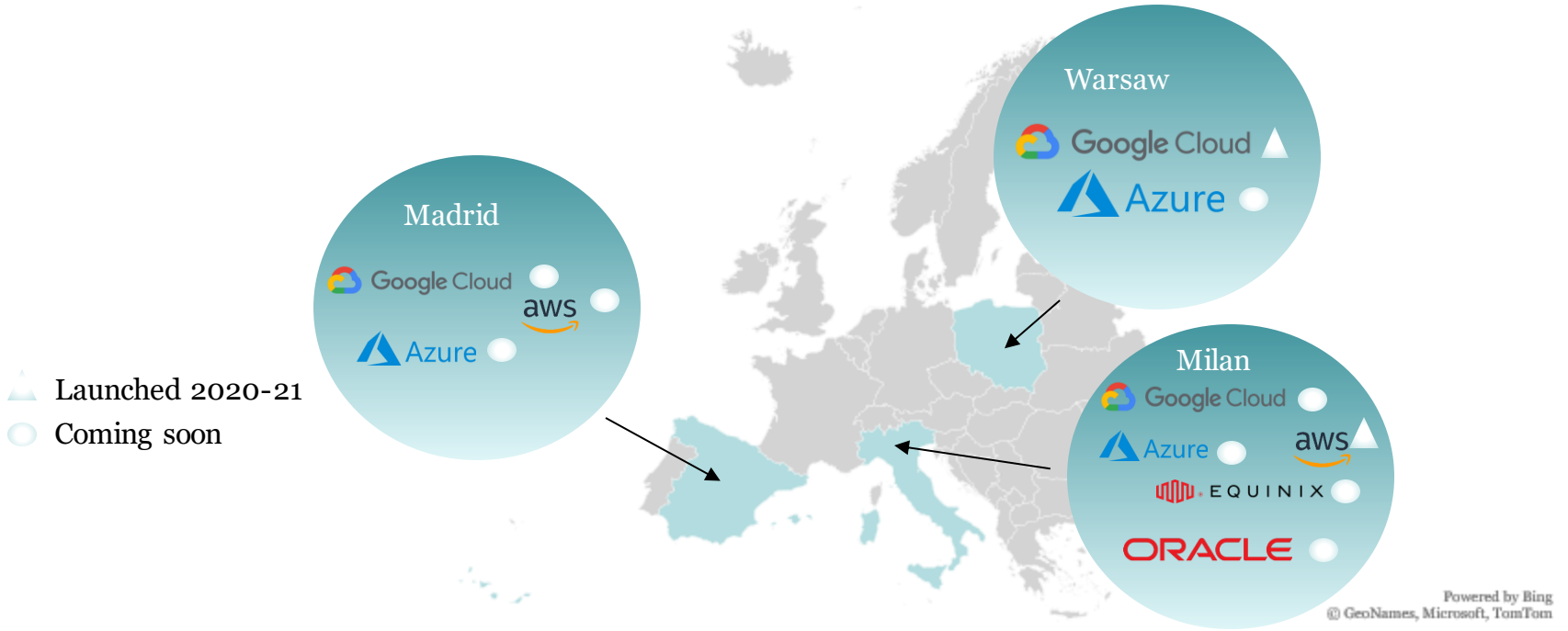


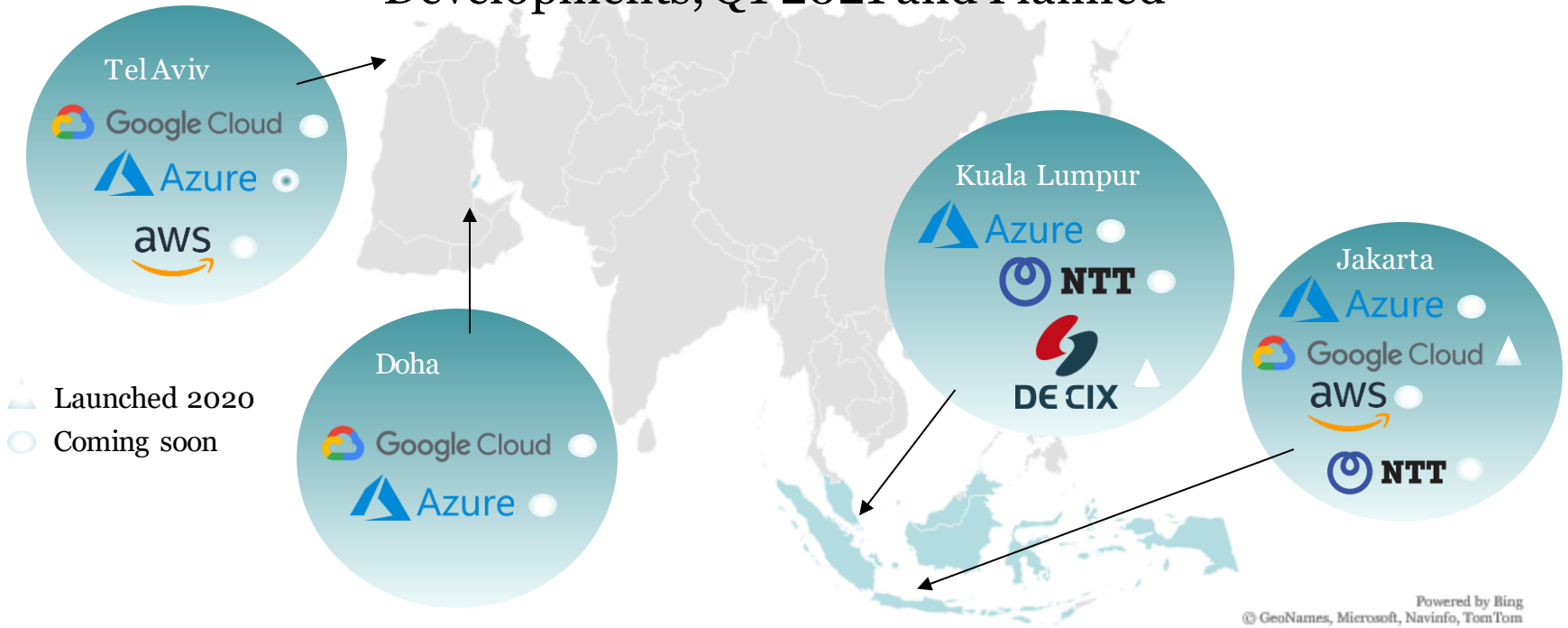
Push into Non-Core European Markets

Latest International Interconnection Developments, 2020-21 and Planned



Build up in Southeast Asia and Middle East

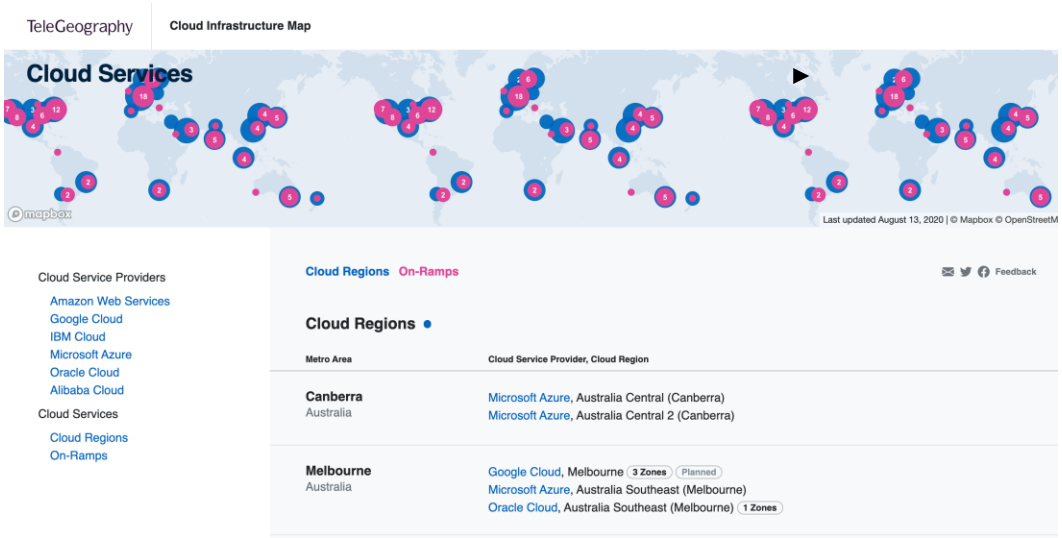
Latest International Interconnection Developments, Q1 2021 and Planned



Cost of Cloud Geography

- Cloud service providers pass on network costs to customers
  - Higher costs in maturing vs established markets
- Fewer data centers in maturing markets
  - Higher latency and lower performance
- CSPs and NSPs are improving global coverage, route diversity
  - Pushing into regions outside of mature hub markets
  - Increasing performance and lowering cost
  - Offering WAN services that were previously only offered by NSPs

How to view our cloud map



← **Cloud Infrastructure Map**
www.cloudinfrastructuremap.com