The Mystery of International Bandwidth Demand

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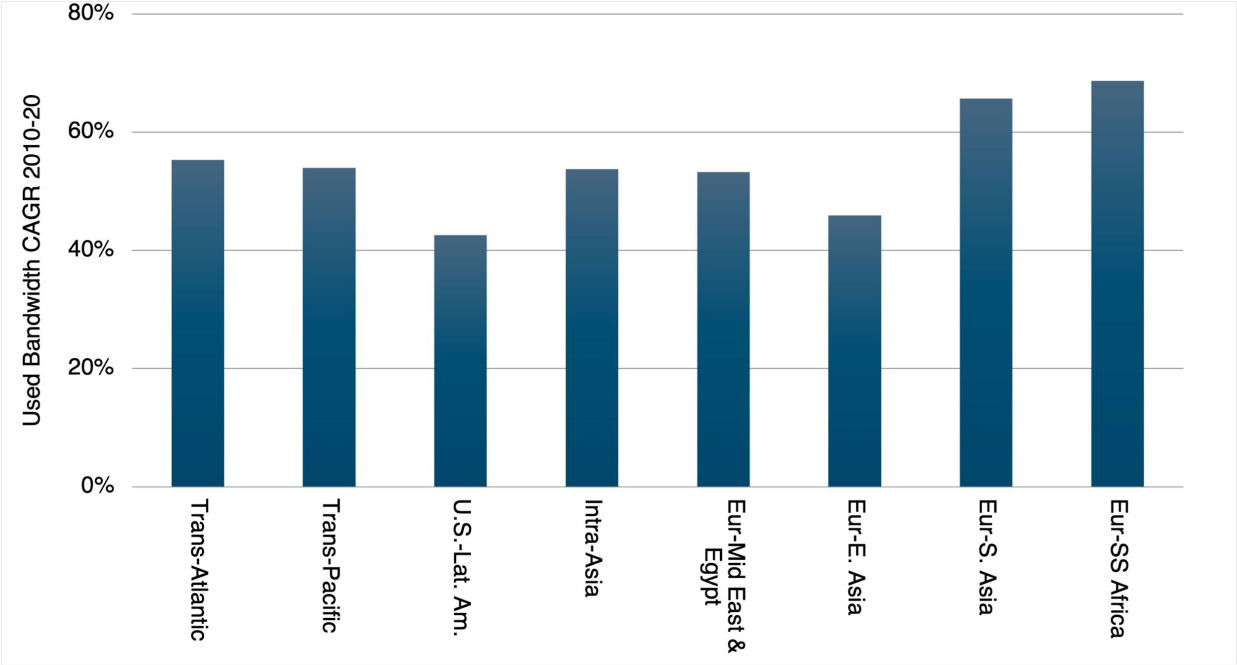
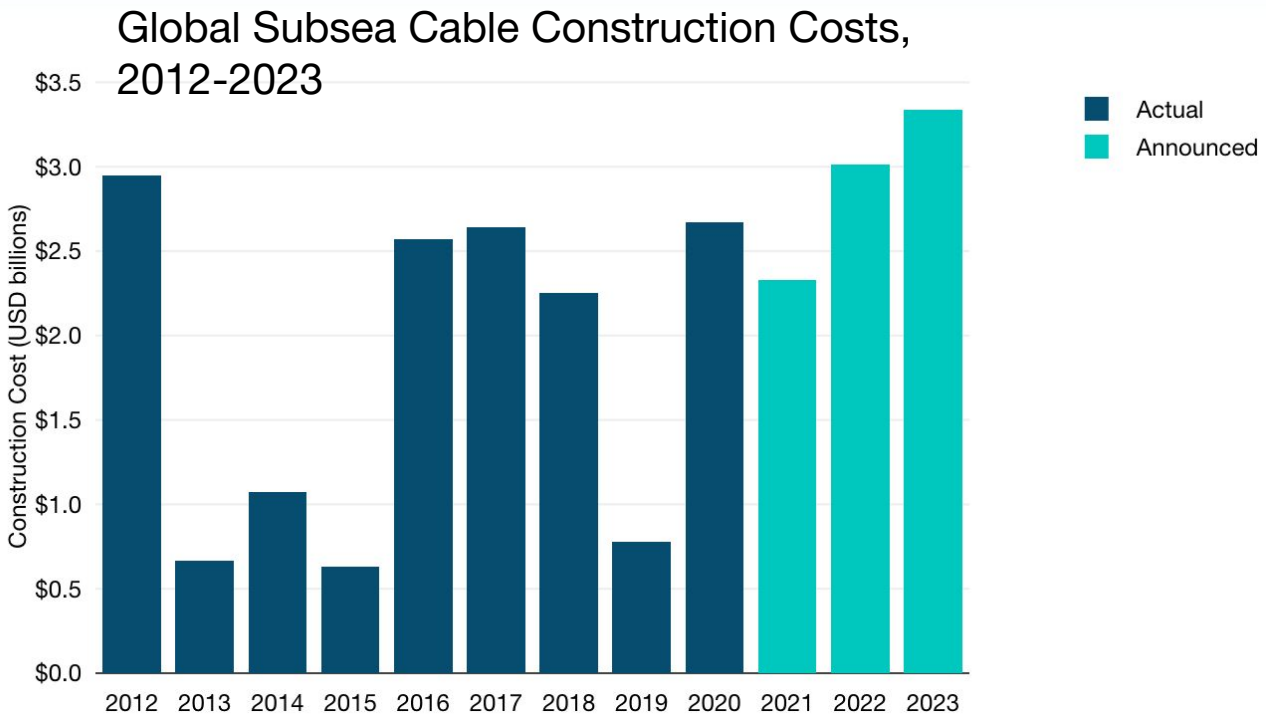
TeleGeography

Bandwidth demand on subsea routes remains strong

Used International Bandwidth, CAGR 2010-20



Investment in new subsea cables is soaring

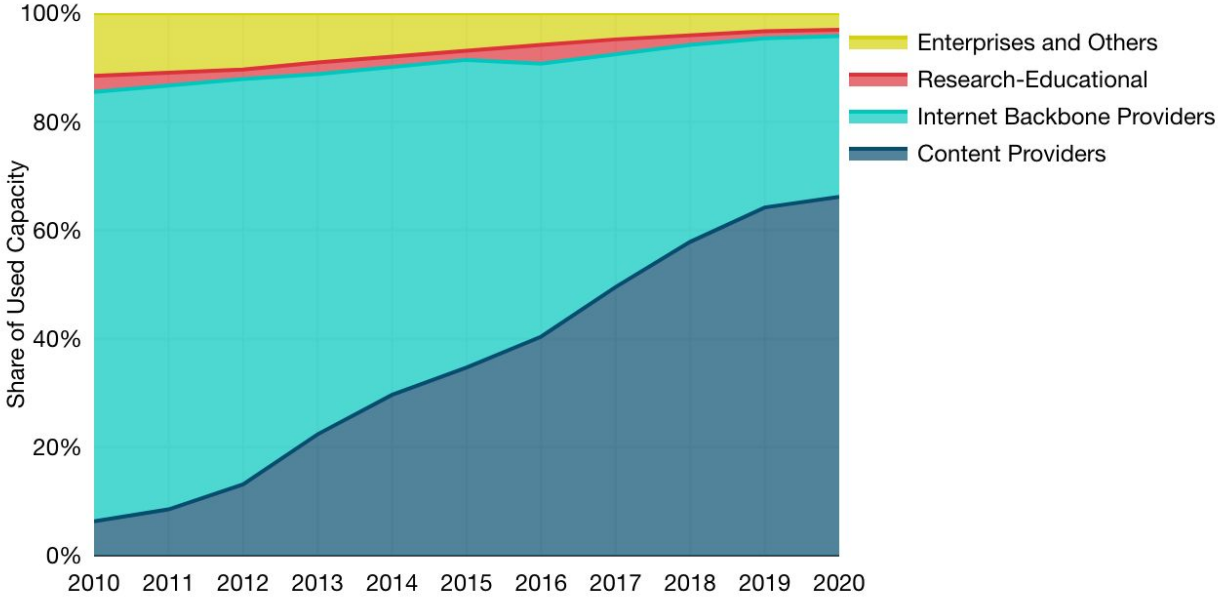


So what's the mystery here?

1. Who is actually using this capacity?
2. Will international demand continue to grow rapidly?

Who is using this bandwidth?

Used International Bandwidth by Source, 2010-2020



Really…WHO are these users?

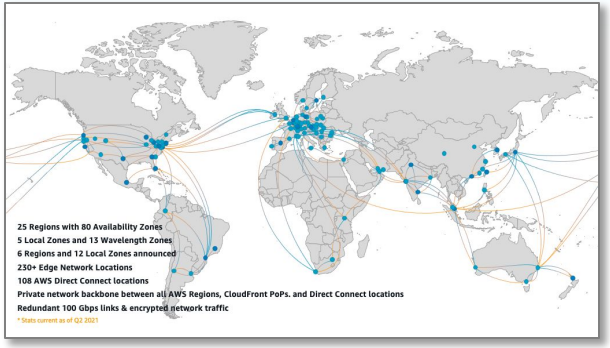
Content providers

- This category includes content providers, CDNs, cloud providers, interconnection providers, data center operators, gaming companies, SaaS companies.
- Why do they need to buy capacity?
  - Linking data centers to each other AND data centers to edge POPs (this is where they interconnect with other networks).
  - Traffic for many of them is massive and growing rapidly, more affordable to build a network than use a carrier.
  - Prefer to have control over the network and reduce reliance on the public internet to better control quality.

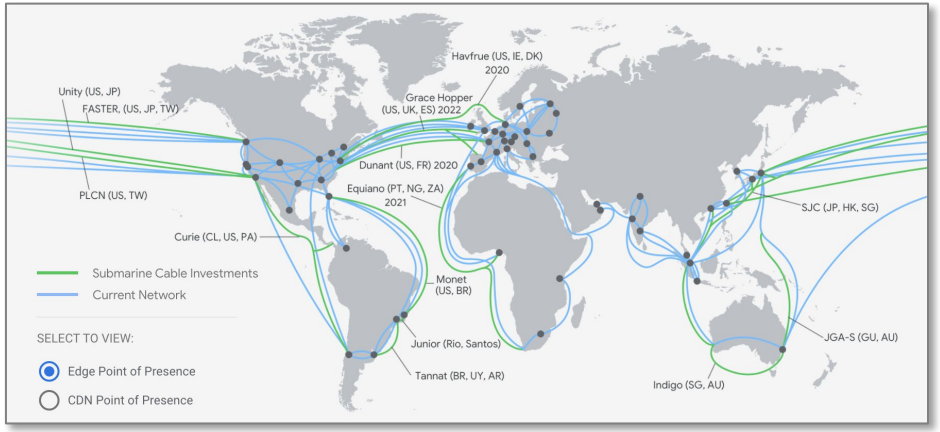
Content providers

- Type 1 - Investors in sub cables
  - Google, Facebook, Amazon, and Microsoft
  - Continue to lease capacity as well on some routes.

Amazon



Google



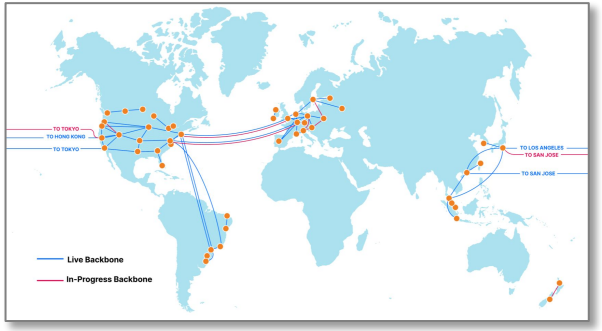
Microsoft

Content providers

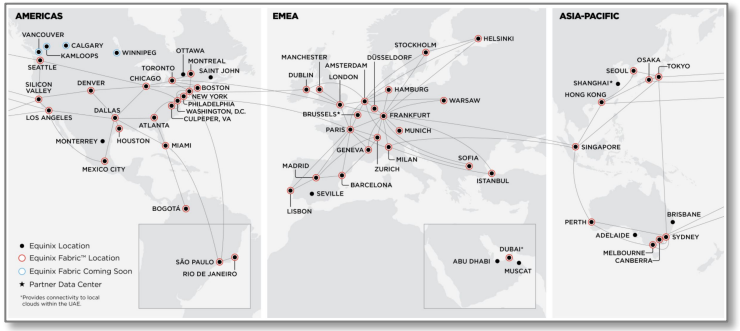
- Type 2 - Not investors in sub cables
  - E.g. Apple, Dropbox, Akamai, Cloudflare, OVH, CDN77, Equinix, Megaport, Alibaba, Oracle, Yahoo, IBM
  - Largely leasing capacity now, but some could eventually move towards cable ownership.

OVH

Cloudflare

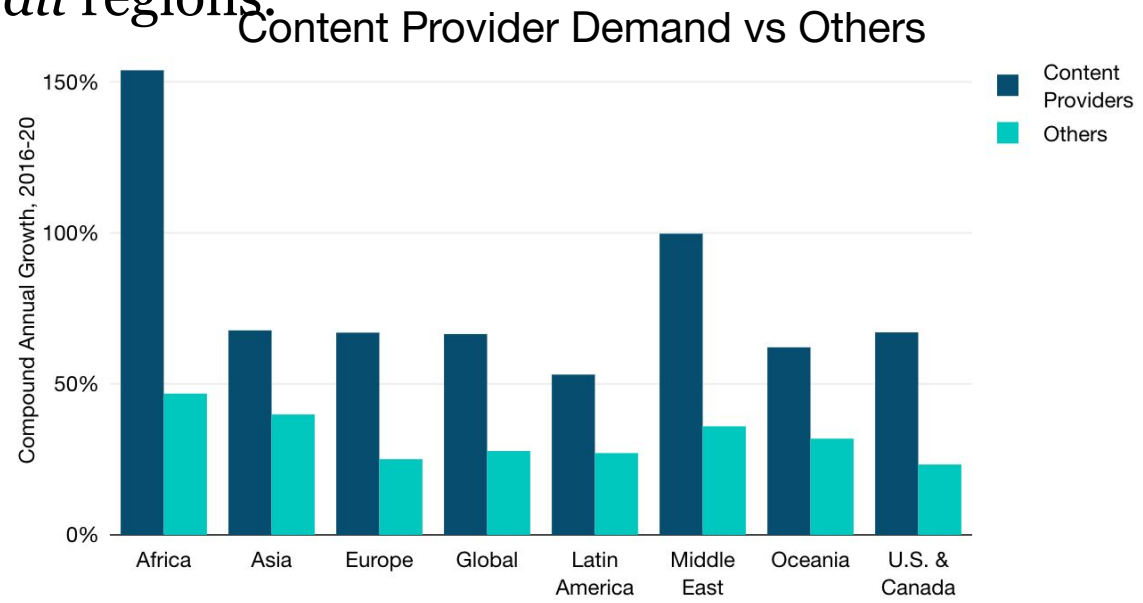


Equinix



Content providers

- Content provider demand has risen at a 66% CAGR 2016-2020, and is outpacing *all* other sources of demand across *all* regions.

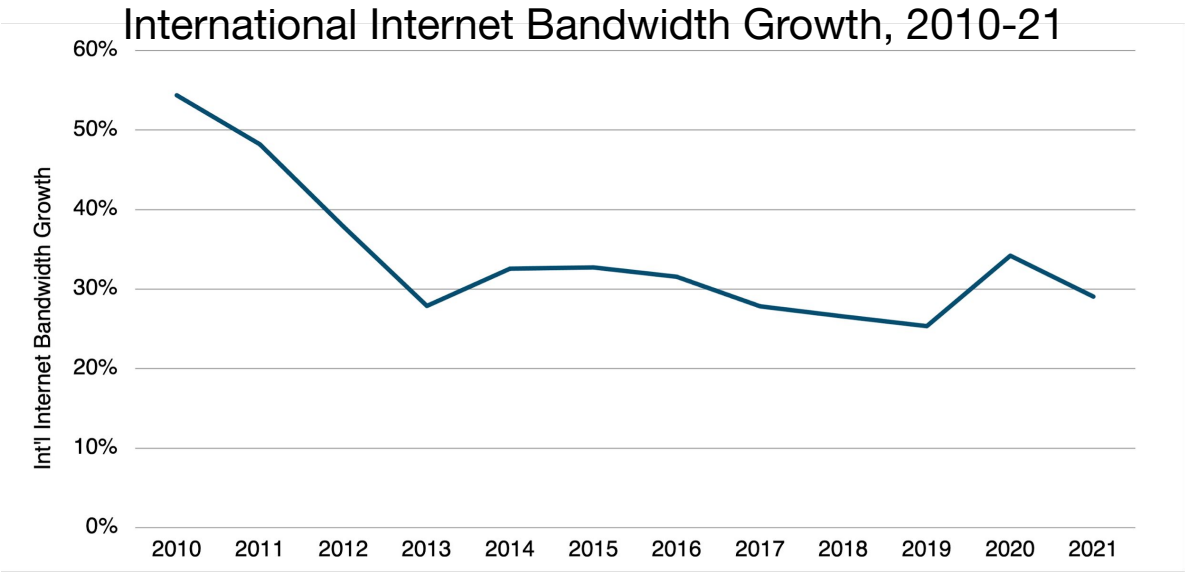


Internet backbone providers

- Many kinds of companies here:
  - Traditional carriers
  - Wholesalers
  - Mobile operators
- Some are investors in sub cables:
  - E.g. NTT, Tata, Lumen, Vodafone, Telefonica, Sparkle, GTT, Telstra, China Telecom, China Mobile, SEACOM, MTN
- But many major IP backbone operators are not:
  - E.g. Telia, Cogent, Hurricane Electric, RETN

Internet backbone providers

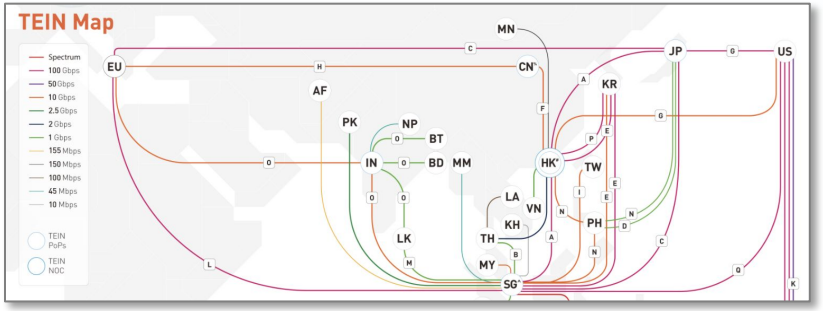
- Internet backbone provider demand has grown 21x from 2010-2021, but the annual rate of growth has slowed substantially.



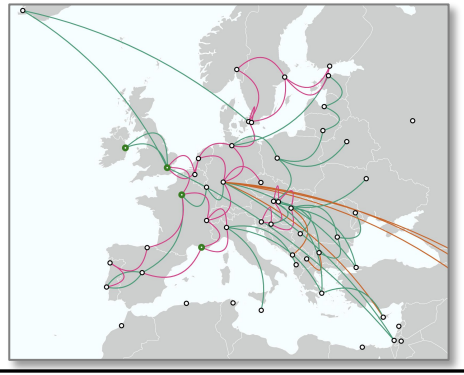
Research-educational networks

- Networks all across the globe.
  - E.g. GEANT, NEA3R, TEIN.
- Bandwidth increased at a CAGR of 38% 2010-2020.
  - Smallest category.
  - Demand growth is lumpy and influenced by funding for new initiatives.

TEIN



GEANT



NEA3R

Enterprises and others

- There is a long-tail of users that have their own international networks.
  - E.g. media companies, banks, governments, satellite operators.
  - Bandwidth requirements can vary dramatically across users.

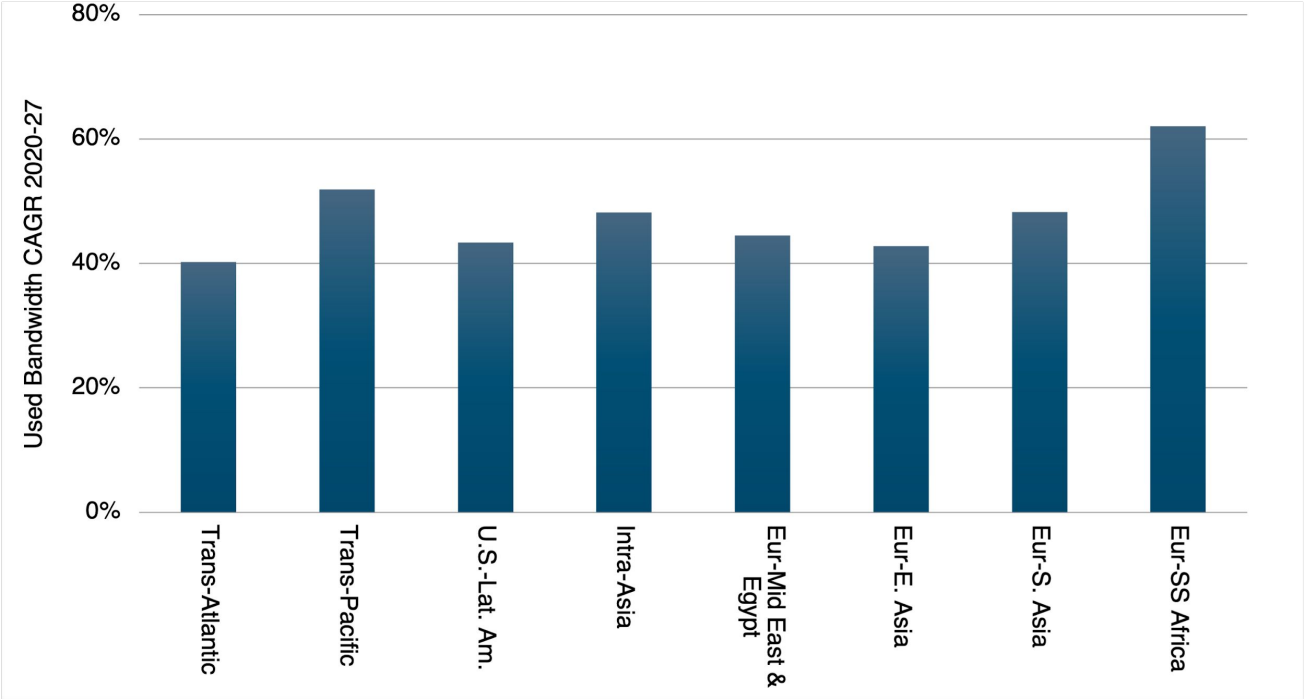
Citi

U.S. DISN

SES

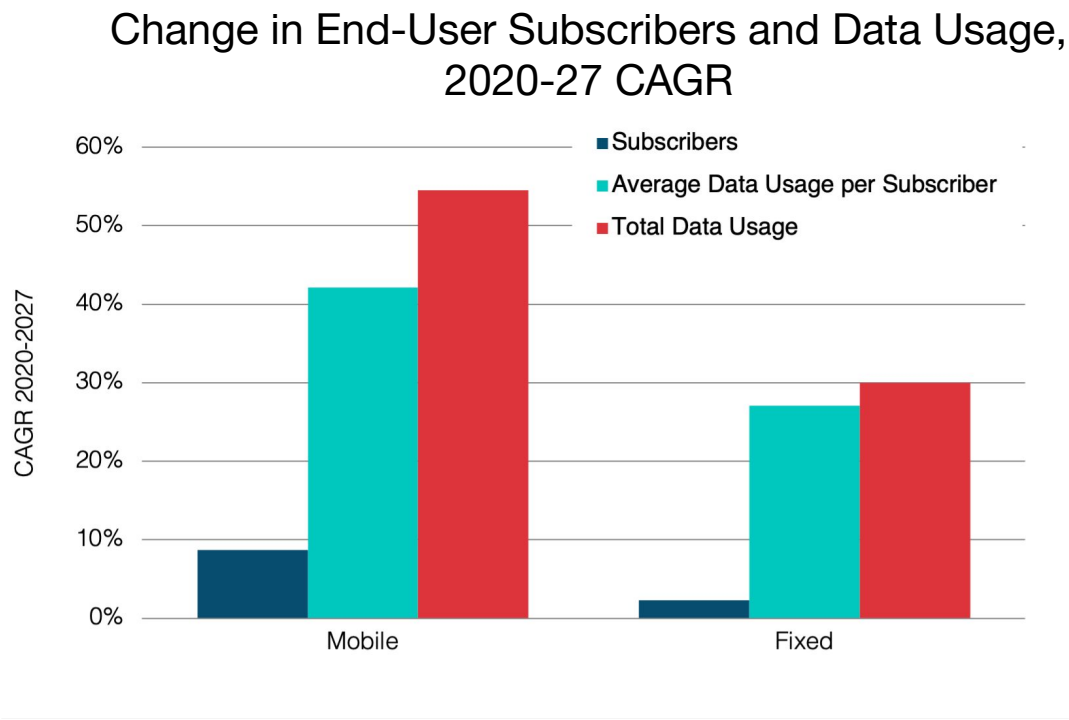
Will international demand continue to grow rapidly?

Forecasted Used International Bandwidth, CAGR 2020-27



Reason #1

- End-users and access bandwidth is still increasing.
  - 5G roll outs are underway, fixed line access rates also still increasing.
  - Higher end-user access bandwidth has some impact on int'l demand requirements.



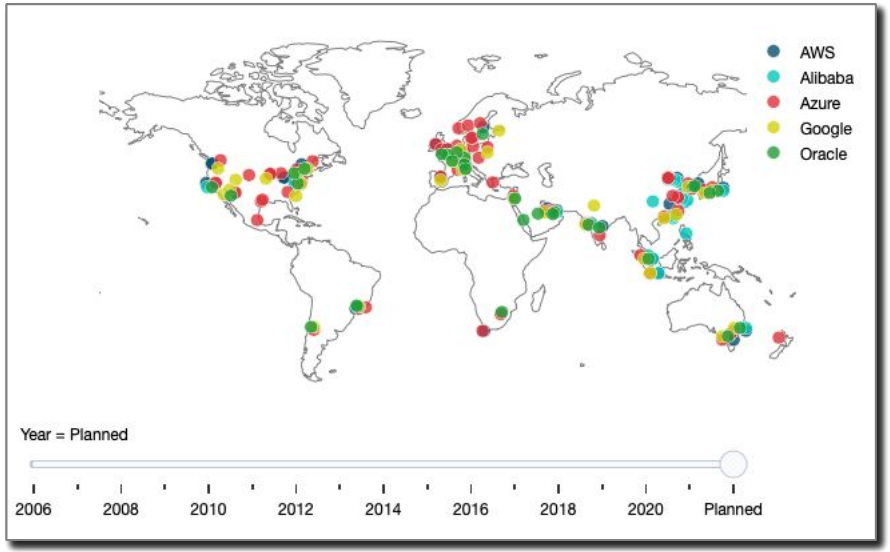
Reason #2

- New applications and services continue to emerge.
  - Virtual reality/the “Metaverse”.
  - Artificial intelligence/machine learning.
  - The degree to which they will require int’l bandwidth is unclear but will almost certainly have some impact.

Reason #3

- Cloud computing has room to grow.
  - As cloud regions expand to new regions, additional capacity will be needed to link them.

Cloud Region Deployments



Reason #4

- Optimization of data storage/processing locations to reduce carbon footprint and lower power costs (aka “carbon intelligent computing”).
- Google is planning to shift computing tasks between data centers to take advantage of carbon-free energy sources.
  - This requires a global network and lots of bandwidth.
  - Other companies may employ similar approaches.

Google data centers

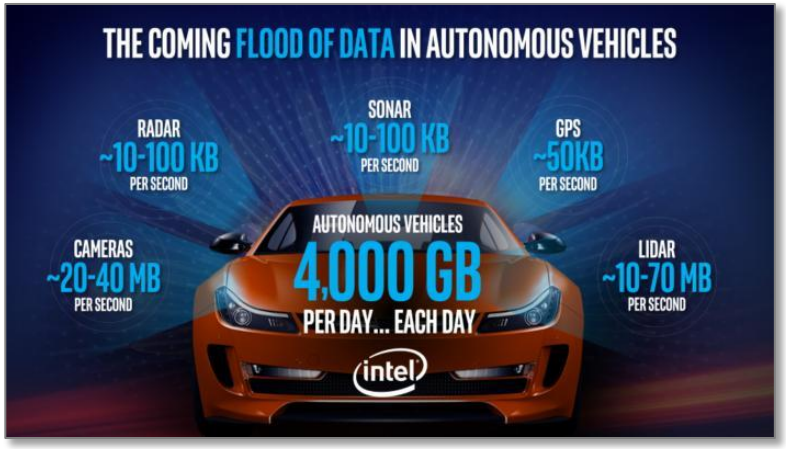
Counterargument #1

- Caching/CDNs could slow the growth of int'l demand.
  - Reductions in int'l demand from caching/CDNs have largely already been realized; over 2 decades with them now, and international demand is still growing rapidly.
    - Google Global Caches handle 70%-90% of Google cacheable traffic.
  - Caching everything would massively *increase* international demand, not slow it, as you'd have to constantly fill caches with every obscure piece of content.

Google GGC locations

Counterargument #2

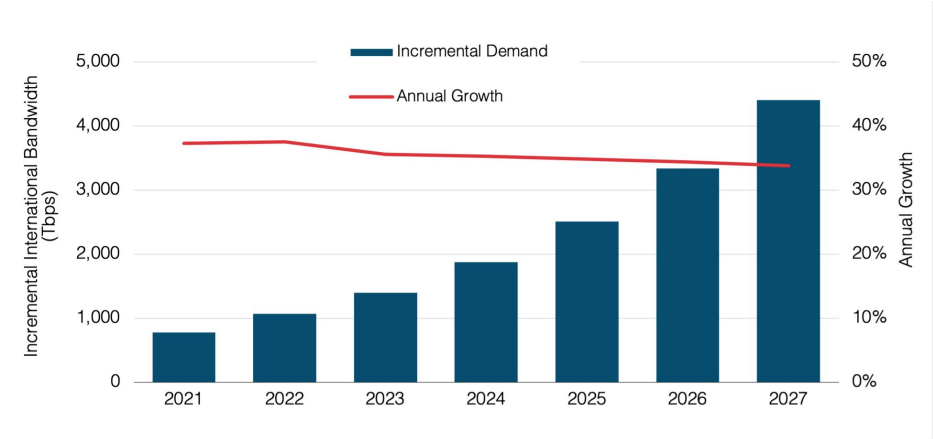
- Edge computing could limit the international demand generated by many emerging sources of demand, especially IoT and sensors.
  - Edge computing will certainly help to reduce unneeded long-haul transmission of data.
  - Some amount of capacity will still be needed to connect edge sites to each other.



Counterargument #3

- The law of large numbers = "a large entity which is growing rapidly cannot maintain that growth pace forever".
  - We *have* seen some slowing of annual demand growth
  - Compound growth still leading to massive *incremental* demand each year.

Incremental Used International Bandwidth, 2021-2027



The Blurry Future of Demand

- A handful of companies (major content providers) account for a massive share of international demand, but a large number of other users should persist and even grow.
- The rate of demand growth is challenging for individual companies to predict.
- Even if the rate of overall demand growth were to slow, new investment in subsea cables will still be required.

Thank You

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