EXECUTIVE SUMMARY

TeleGeography Transport Networks Research Service

Executive Summary

To many people, the concepts of global network infrastructure and bandwidth markets are difficult to grasp. But to those who follow this sector, it's one of the most fundamental building blocks of the global economy. As with other areas of industry, the capacity market sees growth, struggle, uncertainty, and advancement. Our *Transport Networks Research Service* assesses the state of the global telecom capacity market and evaluates the factors that shape long-term demand and price movements. We look at market conditions on both a global level and on a regional level, focusing on critical submarine cable routes.

Features of this service include:

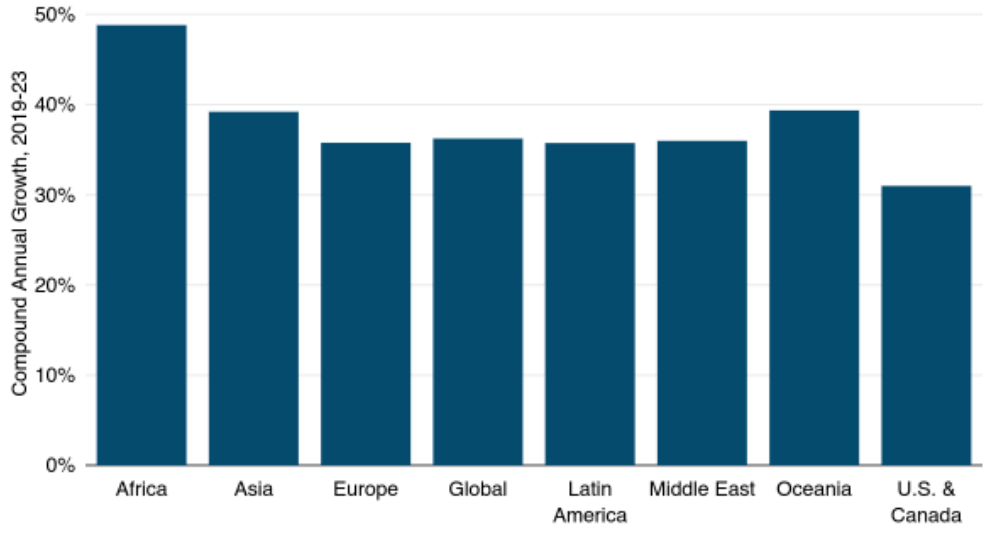
- Robust market datasets that can be found in the Summary Data and Charts section of the report.
- Detailed profiles of over 440 network service providers and more than 600 submarine cable systems.
- Downloadable database materials found in profile Excel exports. These allow customers to delve into their own analysis of our full dataset.
- A regularly-updated table of Planned Submarine Cables, containing ownership, landings, cost, and other critical information, and divided by route deployment.
- Several search portals, allowing customers to find carriers and submarine cables by location.
- A enhanced Submarine Cable Map including tools to search by cable owner, a feature not available in our free map.

Demand Trends

Worldwide bandwidth demand continues to grow at a steady pace. Annual demand growth has decelerated slowly, but aggregate demand more than tripled between 2019 and 2023 to reach an eye-popping 5 Pbps.

FIGURE 2

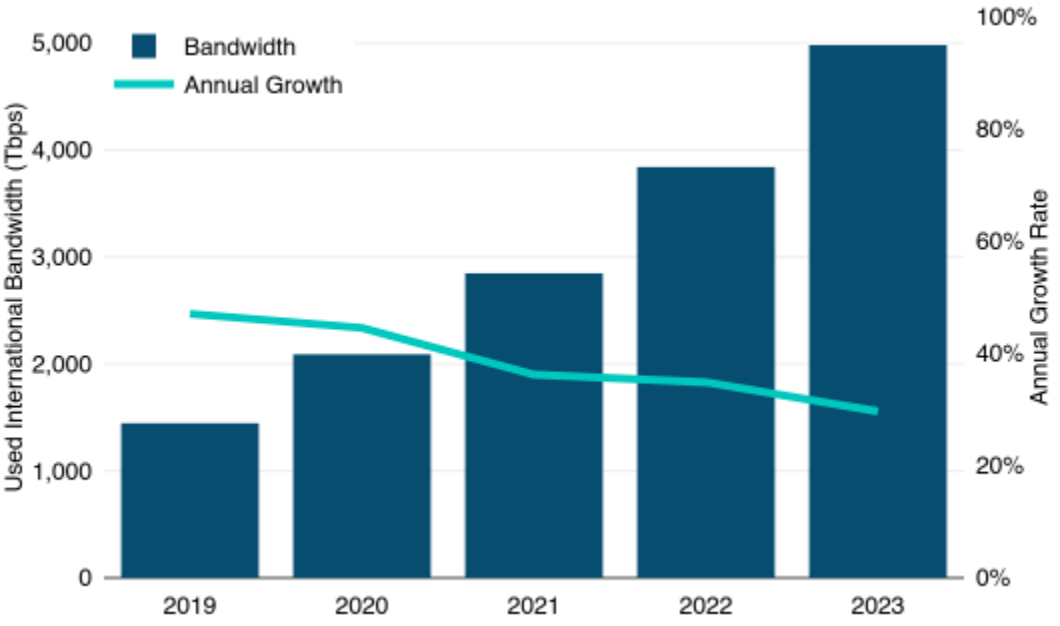
Used International Bandwidth Growth by Region



Source: TeleGeography

FIGURE 1

Worldwide International Bandwidth Growth



Source: TeleGeography

Now take a look at the bar chart below. On a regional level, most parts of the world have seen very comparable growth at about 35-40% CAGR since 2019. The markets that stand out are Africa, where capacity growth is still surging at a nearly 50% CAGR, and the U.S. & Canada, where market maturity has slowed demand to around 30% CAGR.

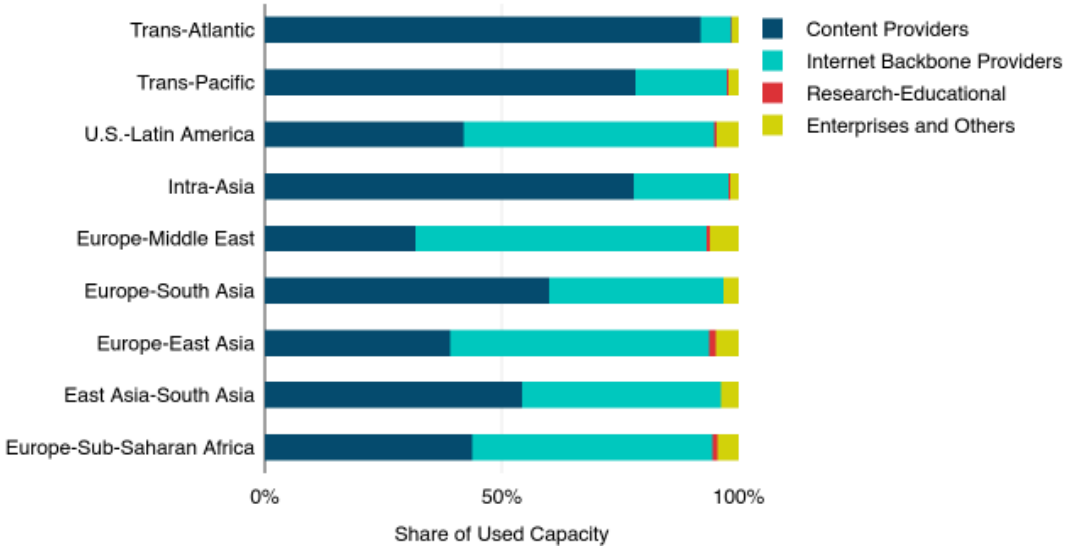
The Role of Content Providers

Content and cloud providers—most specifically a handful of companies like Google, Meta, Microsoft, and Amazon—are firmly entrenched as the biggest users of network capacity globally. As recently as 2016, internet backbone providers accounted for the majority of demand. Not anymore. As of 2023, content and cloud networks accounted for more than 70% of all bandwidth usage.

If you look at the 100% bar chart below, you can see that this demand scale is not the same on every route that we track at TeleGeography. On some of the biggest subsea routes like the trans-Atlantic, trans-Pacific, and intra-Asia, content providers account for the vast majority of demand (80% or more). Other routes remain more carrier-driven, such as the U.S.-Latin America routes, and routes connecting Europe to Africa, Asia, and the Middle East. Why the contrast? Content providers are focused on connecting data centers across different zones. Due to the concentration of service delivery in major Asian, European, and U.S. markets, core routes connecting these regions are of highest priority to the content providers.

FIGURE 3

Share of Used Bandwidth by Category for Major Routes



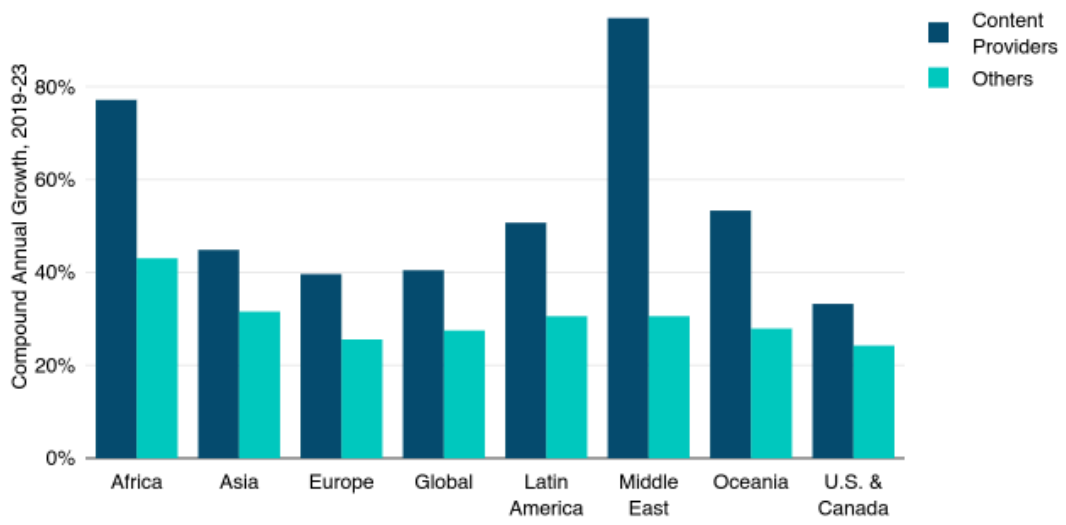
Notes: Data shows used bandwidth as of year-end 2023.

Source: TeleGeography

That said, content provider demand is rapidly growing everywhere and outpaces demand growth even on routes where carriers continue to drive overall capacity usage. As might be expected, content provider demand growth is fastest in regions where carriers are still dominant, like Africa, Latin America, and the Middle East. But there's no part of the globe where content demand growth isn't outpacing that of internet backbone providers.

FIGURE 4

Content Providers versus Others Bandwidth Growth by Region

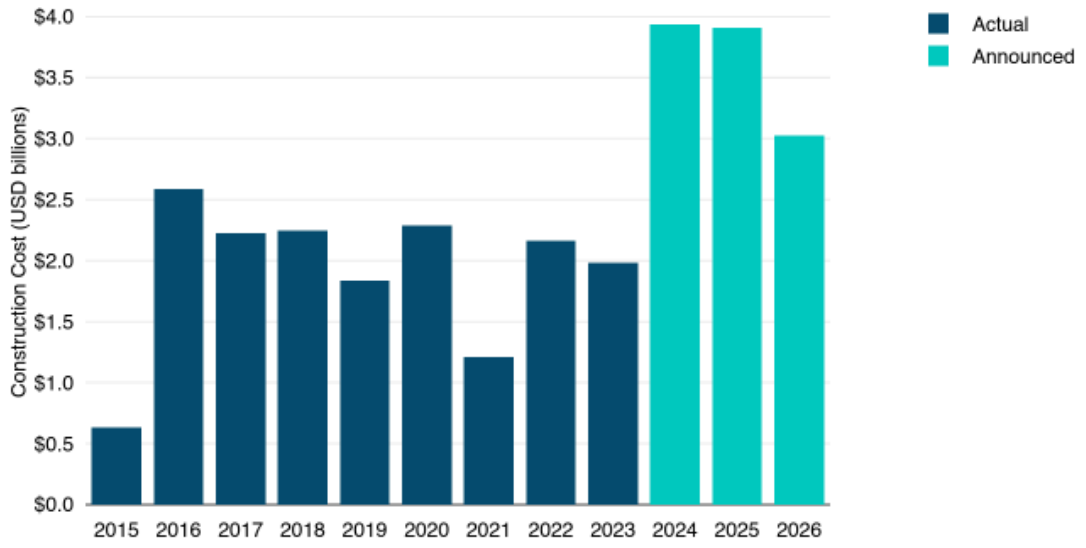


Source: TeleGeography

Meeting Demand Requirements

Investment in new submarine cables has surged in recent years. Despite some fluctuations, new cable investment has averaged over $2 billion per year in the past 8 years. The value of new submarine cables entering service from 2024-2026 is forecasted to reach over $10 billion.

FIGURE 5
Construction Cost of Submarine Cables

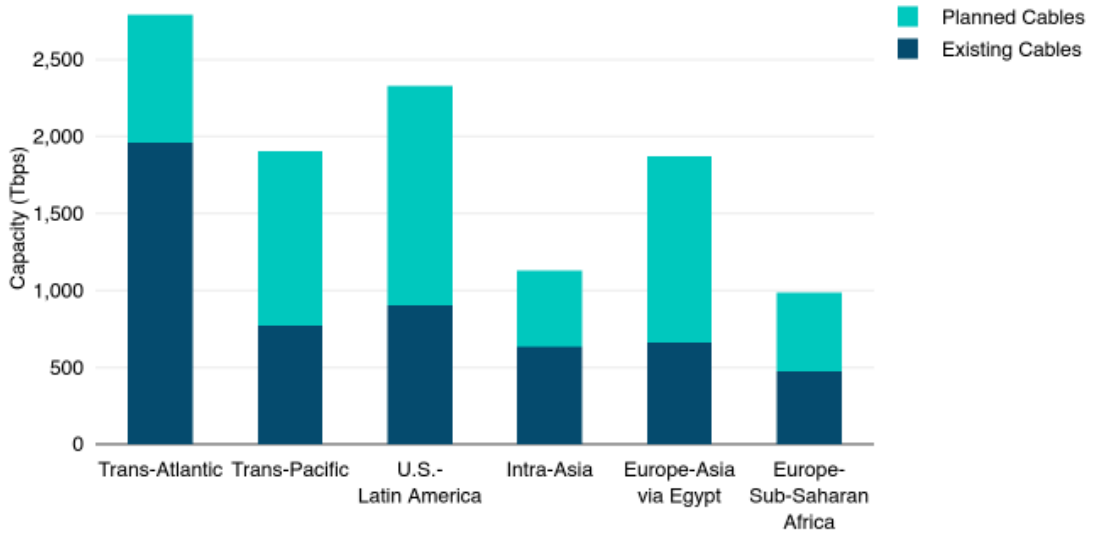


Notes: Total construction costs of all international and domestic submarine cables entering service in designated years. Construction costs exclude the cost of subsequent capacity upgrades and annual operational costs. 2024-2026 construction costs based on announced contract values and TeleGeography estimates. Not all planned cables may be constructed.

Source: TeleGeography

The amount of potential capacity the newest generation of cables will provide is incredible. The chart below shows that several major routes will see their potential capacity more than double once new cables are completed.

FIGURE 6
Existing and Planned Potential Cable Capacity by Route



Notes: Planned cable capacity on announced values and TeleGeography estimates. Not all planned cables may be constructed.

Source: TeleGeography

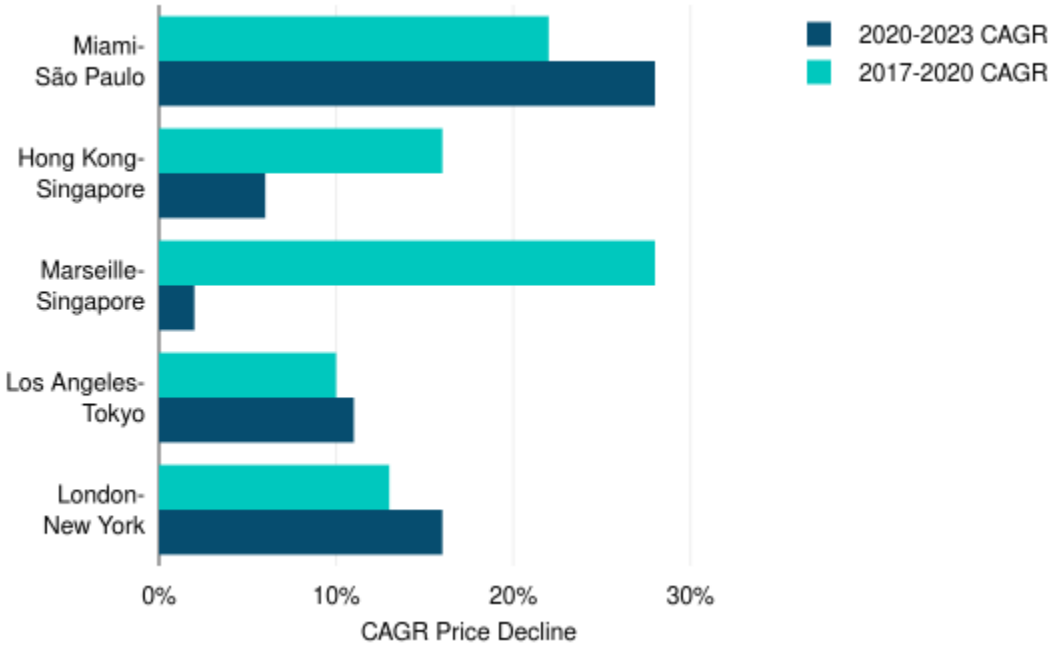
Pricing

We've witnessed an unprecedented slowing of bandwidth price erosion globally over the past few years, as network investors, carriers, and customers grappled with delays in new network projects, existing system upgrades, and rising equipment costs. For the first time, many customers found themselves asking if prices were actually increasing and when price declines would return to typical levels. While the supply chain constraints and card shortages that spurred this trend have resolved themselves, the geopolitical issues that contributed as well, have not. As a result, recent price trends vary dramatically by region. Price erosion has started to accelerate on some routes, but remains stalled on others.

The figure below highlights the compound annual price decline for 100 Gbps wavelengths from 2020 to 2023 (the dark blue bars) versus the prior three years, 2017-2020 (turquoise bars). Across all the routes featured here, 100 Gbps wavelength prices decreased an average of 13% between 2020 and 2023. That's compared to 18% over the prior three years (2017-2020).

FIGURE 7

Weighted Median Monthly 100 Gbps Wavelength Price Erosion



Notes: Each bar represents the percentage decline of the weighted median price calculated as a three year compound annual growth rate for the listed route and time period.

Source: TeleGeography

On routes with more ample supply, price erosion has returned to form as new high capacity cables enter service. For example, the U.S.-Latin America route continues to fall at a brisk pace, still feeling the effects of new cables, diverse fiber pair ownership, and upgrades to existing systems. The route is also anticipating the launch of the Firmina cable in 2024. Between 2020 and 2023, 100 Gbps wavelength prices on Miami-São Paulo decreased 28% compounded annually. That has exceeded the 22% decrease between 2017 and 2020. While not featured here, Johannesburg-London, which saw a massive influx of new capacity from the launch of Equiano last year, recorded an annual 22% price drop for 100 Gbps wavelengths over the past three years.

On routes with continued delays in new supply, price erosion is still stalled. For example, 100 Gbps prices on Marseille-Singapore and Hong Kong-Singapore decreased just 2% and 6% annually from 2020-2023. That's compared to 28% and 16% annually from 2017-2020. The Europe-Asia and intra-

Asia routes have been especially impacted by recent delays in supply. While card shortages have resolved themselves, geopolitical issues play a key role in delays of new systems on both routes. Until new systems start coming into service this year, available inventory is going for 2023 prices or potentially higher.

Outlook

What's fueling the changes we see in the global bandwidth market? Let's look at some of the key trends shaping long-haul capacity demand and pricing.

Geopolitical Concerns

While geopolitical concerns have always played a role in determining which companies deploy long-haul networks where, several recent developments are reshaping network deployment trends.

The Red Sea is the focus of major problems. Even before the recent spate of rebel attacks on commercial shipping vessels, the Yemeni civil war created permitting headaches. Cable laying vessels require permits to enter a country's territorial waters. When two different entities claim the same swath of sea, the situation becomes complicated. The near simultaneous cable faults on three cables off the coast of Yemen in late February have create a major challenge. Given the location of these faults, it is uncertain when maintenance vessels may be able to conduct repairs due to Houthi rebel attacks.

Subsea cable activity is also geopolitically challenging in the South China Sea. Cable builders find it increasingly difficult to receive Chinese permits for cable deployment in this region. Builders of the planned Apricot cable hope to avoid this problem by linking Japan to Singapore via the east side of the Philippines. In addition, U.S. government opposition to direct China-to-U.S. cables has boosted the development of several cables from Southeast Asia to the U.S.

Artificial Intelligence (AI)

There's hardly a hotter topic in the network world right now than AI. As the broader economy braces for the massive but unknown impact of this technological development, we have to ask what kind of effect AI will have on the transport network market. The answer? It depends:

- **Model training.** If a given model is pulling data from all over the world, it will increase demand for long-haul bandwidth, but if data used is stored locally in the same campus or data center, it won't. Data residency requirements will also factor into the use of long-haul networks for model training.
- **Training clusters to inference clusters data transfer.** If models are largely trained in more remote locations with cheaper and more abundant power sources, long-haul capacity will be needed to transfer data from training to inference locations. The size and frequency of training model updates will also factor into this aspect of demand. Of course, if training needs to be located closer to inference zones, long haul capacity won't come into play as much.
- **Inference.** The location of inference clusters will also be critical in determining the ultimate effect of AI on long haul capacity requirements. If inference is deployed in zones close to end users, it may not impact long-haul demand as much. If the model requires data pulls from multiple locations though, it could increase long haul demand.

These are just a few of the many factors to consider. As AI technology rapidly evolves, we expect that long-haul demand will grow, even if metro area demand increases more rapidly.

Private Cable Expansion

Google and, to a lesser degree, Meta are increasingly deploying their own subsea cables. This approach allows them to control the system design and landings, but also to move swiftly and avoid potential delays from working with partners. Google is the owner of 15 active and planned private cables, with many more in development—particularly in the Pacific. Meta is also planning the Anjana trans-Atlantic cable, its first proprietary cable.

However, even on a private cable, content providers are not the only users. Some portion of the fiber pairs are typically available for sale or swaps. In the case of swaps, a content provider would swap fiber pairs in exchange for fiber pairs on other cables, for landing rights in a country, or for terrestrial backhaul within a country.

Content providers are not just swapping fiber pairs but also selling them. Google is also selling IRUs for whole and partial fiber pairs on the company's private cables. Presumably, Meta would also make fiber pairs available for sale on Anjana.

Google's private cable investment is spread globally, but especially focused in the Pacific where the company's Pacific Connect Initiative is crisscrossing the ocean with multiple cables. Notably, Google is receiving some financial support from the U.S. and Australian governments for these projects, largely to enhance connectivity to islands in the South Pacific.

Completely private content provider cables are unlikely to become the dominant model on every route. In some countries, they may not possess the legal or regulatory authority to land cables themselves and may need to rely on carriers or specialist companies who can operate a cable on their behalf. Also, few content providers currently have enough bandwidth demand to justify investing alone in a new cable.

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