



Global Neutral Host Index

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Foreword



The telecom industry has undergone major change this decade, driven by rising connectivity demands, cloud and digital services, macroeconomic shifts, and global policy changes. Growing mobile and fixed data use – fueled by rapid AI adoption – has increased pressure on networks and Data Centers to deliver high-performance connectivity, storage, and compute power. Investment in digital infrastructure like fiber, towers, and Data Centers has surged, as investors see strong, long-term returns. Policymakers are also prioritizing broadband expansion to underserved areas, an issue highlighted during the pandemic. Meanwhile, stricter environmental regulations have limited Data Center and equipment deployments, especially in urban areas.

These factors have led to new business models, notably shared digital infrastructure. Here, multiple providers use common resources, enabled by mature network-sharing technologies in both fixed and mobile domains. This has given rise to **neutral hosts** – operators transporting services from various providers across shared infrastructure assets. These entities can take many forms: independent firms, joint ventures, investor-owned, government-backed, spun off from service providers, and network builders. By reducing capital expenses and deployment barriers, neutral hosts help service providers focus on enhancing service offerings, while enabling cost-effective and scalable network infrastructure. They optimize network economics, support digital inclusion, and accelerate smart city growth.

At Nokia, we have been tracking this evolution closely, working with infrastructure companies expanding into digital services. To better understand the neutral host market and its trends, we commissioned the **Global Neutral Host Index** from **Téral Research**, a telecom industry leader. This report explores how neutral hosts are transforming the telecom sector, offering valuable insights for infrastructure providers, operators, investors, enterprises, and analysts preparing for the next wave of innovation.



Michel Chbat, Head of Neutral Hosts Segment, Nokia

Note from the authors

In my 36 years of experience in telecoms, including 29 years in Silicon Valley as an industry analyst, I went through all boom and burst cycles. In this current environment of sluggish telecom revenue and flattish capex, the Neutral Host business is firing on all cylinders: fiber, cell towers, and Data Centers. What is amazing is that each of the 4 segments we have studied – TowerCos, FiberCos, Data Center Colos and Network Builders – is growing faster than the Global Telecom market. The Neutral Host business is definitely on a roll. In fact, it embodies the future of sustainable digital infrastructures. We believe that this report is the first of its kind to study in depth all digital infrastructure types of companies.

Bottom Line: As Neutral Host ineluctably emerges as the global telecom market's brightest spot, Nokia has made the right decision to deploy adequate resources to leverage its broad products and services portfolio to capture a piece of this vibrant segment.



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Contents

Key takeaways

Definitions

Market overview

Tower companies (TowerCos)

Fiber companies (FiberCos)

Data Center Colos

Network Builders

Methodology

Key takeaways

The Neutral Host business is on a roll

In the depressed telecom landscape that shows little sign of growth, the Neutral Host business is shining

The 4 major Neutral Host business drivers we have identified include: CSP separating from core infrastructure assets, environmental restrictions on active equipment in urban areas, institutional investors pouring capital into digital infrastructure, and regulators / policymakers advocating for infrastructure sharing to accelerate wide access to broadband.

Despite its essentiality and the unabated demand for bandwidth, the telecom industry continues to be challenged by a combination of factors including saturated markets, rising infrastructure costs, the shift towards over-the-top (OTT) services like Netflix and WhatsApp which bypass traditional telecom revenue streams, rapidly evolving technology requiring significant investment to stay current, and regulatory pressures, leading to stagnant revenue growth and decreasing profitability for traditional communications service providers (CSPs).

To address this situation, CSPs all over the world have found the Neutral Host approach as a convenient way to shift their focus toward the customer experience and service differentiation from doing everything, particularly non-differentiating tasks such as network infrastructure building and maintenance in complex environments.

Consequently, the Neutral Host model gradually emerged and developed at a fast pace; its origins are as follows:

- TowerCos, which arose in the 1990s, come from the idea of unlocking the value of towers by selling space to multiple tenants.
- FiberCos emerged from dark fiber providers in the late 20th century, when CSPs began installing significantly more fiber optic cables than they needed to meet immediate demand while anticipating future growth in data usage. This excess capacity could be leased out to other companies, effectively creating the dark fiber market.
- Distributed Antenna Systems (DAS), a neutral, operator-independent system that allows multiple mobile network operators (MNOs) to utilize it for better coverage within buildings like stadiums or large complexes, is still utilized today and augmented with small cells and WiFi.

Neutral Host's share of global telecom capex to grow from **13% in 2024**

to **17%** in 2030

[See page 14](#)

In 2024, Global Neutral Host revenue hit

\$165B
and accounted for **9%** of global telecom services revenue

[See page 12](#)

The Neutral Host business is on a roll

More fixed and wireless broadband and the AI multiplier effect will boost the Neutral Host business

As the need for more robust fixed and wireless broadband connectivity continues to grow, most governments and policy makers worldwide believe the Neutral Host model is the most efficient way to meet the demand as well as capacity requirements while ensuring sustainability. In addition, the arrival of artificial intelligence (AI) presents a new opportunity for the global telecom industry and has the potential to further boost the Neutral Host business. AI needs more Data Centers interconnected with fiber. Once AI models are fully trained in those Data Centers, AI agents will be deployed and will eventually spread across all types of network accesses. As a result, the current 4 Neutral Host business models are poised for strong growth:

- **Network Builders:** an emerging category worth \$1B+ revenue in 2024 when only considering independent pure-play companies like Boldyn Networks and Freshwave for example. High demand for the construction of more dedicated networks will fuel fast and strong revenue growth at an 18% 6-year CAGR.
- **Data Center Colos:** already a \$54B business worldwide in 2024 propelled by the unabated demand for Data Centers, this segment is expected to grow at an 8% 6-year CAGR.

- **TowerCos:** the oldest and largest Neutral Host category with \$57B in global revenue in 2024. With more than 350 TowerCos worldwide, the market is mature and remains very competitive with lots of asset swapping and spinoff activity. As the outlook remains positive, revenue will grow at a 2% 6-year CAGR.
- **FiberCos:** the most mature, competitive and established Neutral Host category that totaled \$52B in revenue in 2024. While consolidation is expected in some markets such as Brazil, the high demand for fiber will produce a 6-year CAGR of 1%.

Finally, adding more fiber and Data Centers for AI model training will drive the need for a wide range of active fixed and mobile technologies. In fact, the sustainability mandate enacted in many countries will fuel the need for more active equipment: from \$14B in 2024 to \$18B in 2030.

Bottom Line: As Neutral Host ineluctably emerges as the global telecom market's brightest spot, Nokia has made the right decision to deploy adequate resources to leverage its broad products and services portfolio to capture a piece of this vibrant segment.

TowerCos

\$57B

Global revenue
in 2024

TowerCos

2%

6-year CAGR

FiberCos

\$52B

Global revenue
in 2024

FiberCos

1%

6-year CAGR

Data Center Colos

\$54B

Global revenue
in 2024

Data Center Colos

8%

6-year CAGR

Network Builders

\$1B+

Global revenue
in 2024

Network Builders

18%

6-year CAGR

Definitions

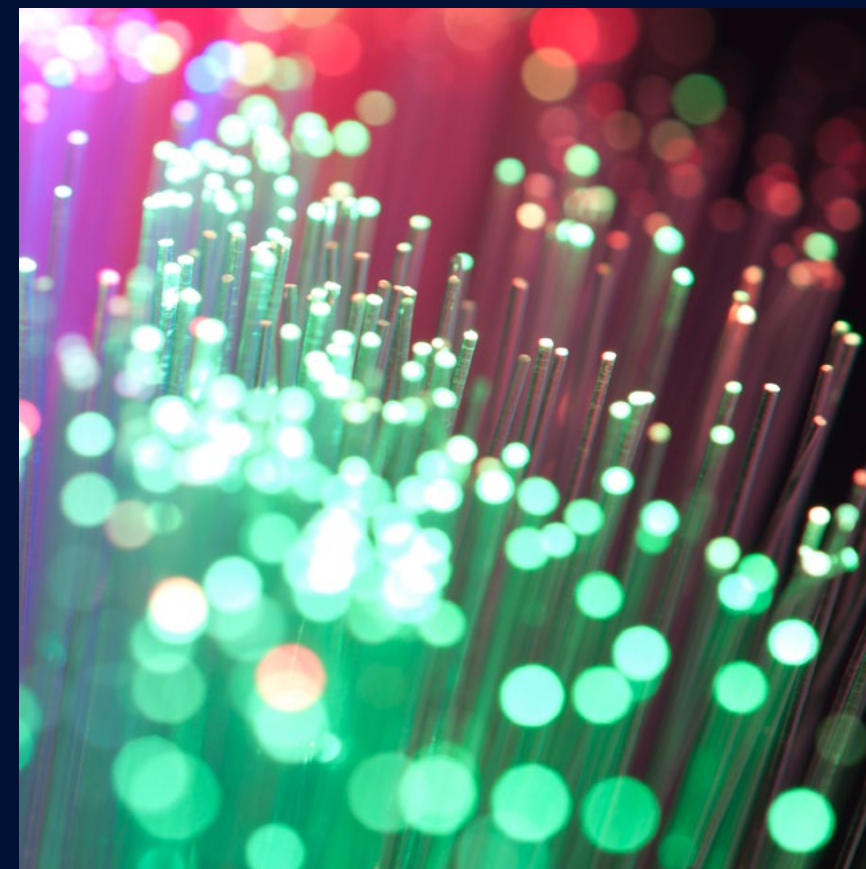


Neutral Host definition and types

Neutral Host: companies that invest/build/manage network infrastructure assets for long-term recurring multi-tenancy revenue - as a primary business. These companies are involved in both passive and active infrastructure, and the active services include residential broadband, connectivity-as-a-service (aaS), indoor and rural coverage, network densification, smart cities, etc.



TowerCos: independent owners, operators and developers of multitenant communications real estate (e.g. ATC*). Their primary business is the leasing of space on communications sites to wireless service providers, radio and television broadcast companies, wireless data providers, government agencies and municipalities and tenants in a number of other industries.



FiberCos: fiber-optic networks-based communications companies that provides a broad array of integrated products and services to domestic (e.g. FiBrasil*) and global business customers and/or domestic mass markets customers (e.g. nbn*).



Data Center Colos: provides vendor-neutral multi-tenant Data Center Colos, interconnection and data exchange, and edge platform services to global enterprises, communications service providers (CSPs), digital media and content providers, and business ecosystems of industry partners (e.g. OpenColo*).



Network Builders: design, build and also operate various types of Neutral Host infrastructures including fiber, cellular, WiFi, and Data Centers (e.g. Freshwave*) on demand.

InfraCos: companies that combine several assets.

NetCos: InfraCos that are Communication Service Provider (CSP) spin offs

*Note: see case study later in the report

Use cases

Active use cases
deployed / explored
by Neutral Hosts

Mobile connectivity

- 1 Wide area network
- 2 Rural expansion
- 3 Urban densification
- 4 Private shared networks
- 5 Fixed in-building coverage

Fixed connectivity

- 6 Fiber to the cell site
- 7 Any-haul
- 8 Data Center interconnection
- 9 Optical infra connectivity
- 10 Mobile in-building coverage

Fixed broadband

- 11 Connectivity to the residence / business
- 12 Connecting to the last splitter
- 13 Fixed-Wireless Access

Edge Data Center

- 14 Enterprise Cloud migration
- 15 Network function connectivity
- 16 Hosting & storage
- 17 MEC / GPUaaS

Market overview



The Neutral Host business is thriving and here to stay

TowerCos and FiberCos in the 1990s, and DAS in the 2000s created a solid, viable and irreplaceable model

The assets built over the past 3 decades are being leveraged and utilized and everyone's happy! Communications service providers (CSPs) lower their cost and Neutral Host companies generate value from their assets. Given CSPs' constrained capital expenditure (capex) and meager ROI, the early TowerCo, FiberCo and DAS models laid the foundation for today's broader "Neutral Host" ecosystem defined in this report, where a third-party entity builds and operates a network that can be accessed by various CSPs, reducing costs and improving network reach across different areas. Over the past 25 years, CSPs all over

the world have found the Neutral Host approach as a convenient way to shift their focus toward the customer experience and service differentiation from doing everything, particularly non-differentiating tasks such as network infrastructure building and maintenance in complex environments. In fact, CSPs get it right: sell non-differentiating assets, cash in, and lease them back!

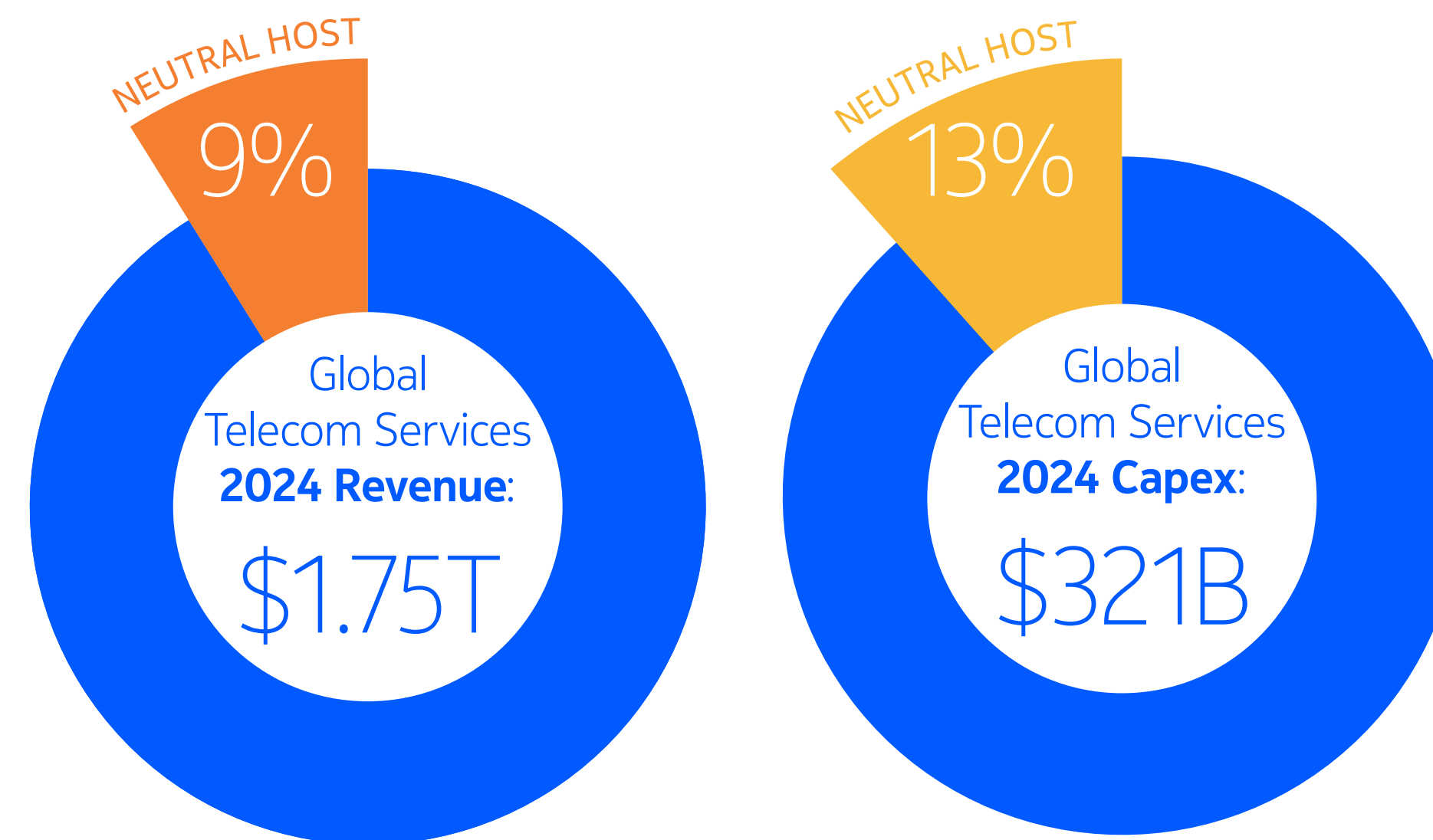
As a result, the Neutral Host business has been growing steadily, primarily originating from the practice of sharing passive infrastructure such as towers, fibers, antennas, and Data Centers.

- **TowerCos** come from the idea of unlocking the value of towers by selling space to multiple tenants.
- **FiberCos** originate from dark fiber providers, which emerged in the late 20th century, when CSPs began installing significantly more fiber optic cables than they needed to meet immediate demand while anticipating future growth in data usage. This excess capacity became "dark fiber" and could be leased out to other companies, effectively creating the dark fiber market.
- **Distributed Antenna Systems (DAS)**, a neutral, operator-independent system that allows multiple mobile network operators (MNOs) to utilize it for better coverage within buildings like stadiums or large complexes, is still utilized today along with small cells and WiFi.
- **Data Center Colos** gained traction when the Internet became essential and network connectivity and colocation services were suddenly business critical. As a result, Internet service providers and hosting companies started to build large external facilities to provision their services.

The Neutral Host business is thriving and here to stay

In 2024, Neutral Host revenue and capex growth continued to outpace those of Global Telecoms

Global Neutral Host revenue hit \$165B and accounted for 9% of global telecom services revenue while capex reached \$43B or 13% of global telecom capex, which peaked in 2022 and declined 8%. Data Center Colos, Network Builders, TowerCos, and FiberCos, respectively, drove the YoY growth in Neutral Host revenue and capex. It's important to note that the world's top 20 largest communications service providers (CSPs) ranked by revenue account for 72% of the \$1.75T total. In addition, many of them also run their own TowerCo, FiberCo and Data Center Colo business, either as a subsidiary or a separate entity. On the one hand, CSPs are essentially spinning off their assets and leasing them back to improve their balance sheets. On the other hand, Neutral Host companies have successfully developed lucrative business models to run these assets.



AI and Data Centers will also boost the Neutral Host business

AI needs more Data Centers and more fiber, and will inevitably spread to all types of access networks

AI is joining the Internet, which is part of everyday activity, and requires more Data Centers at core locations where interconnection of networks, compute and data storage occurs. For now, AI models are trained in Data Centers and cloud infrastructures. Soon, inferencing and delivery will be needed at the edge of all types of access networks. Training and using generative AI models requires more data movement at faster speeds than the other types of Internet traffic currently seen in telecom network infrastructures.

More Data Centers mean more fiber in metro and access areas, and edge computing requires significant upgrades in access networks, which in turn will drive growth in FTTx, fiber-to-the-tower, and mobile network densification.

- More people will use chatbots and agents, which will likely talk to even more agents. All that requires more data, computing, reliable access networks and back-end technologies.
- Neutral host players will be the front runners doing the networking plumbing to ensure that data and applications inside and between Data Centers, as well as between Data Centers and Internet-connected devices travel smoothly.

As more Data Centers need to be built and interconnected, all types of Neutral Host companies benefit from this trend: more fiber will be added to backbones, metro, edge and access networks, and more cell towers and small cells will be connected to fiber. Although the entire Neutral Host ecosystem will benefit from the widening adoption of AI and the multiplication of Data Centers in all regions (from central to far edge), some of the active intra-/inter-Data Center connectivity will be done by the Data Center Colos themselves.



As a result, the Neutral Host business outlook is looking up

As CSPs continue to sell off their assets, Neutral Host capex will go up

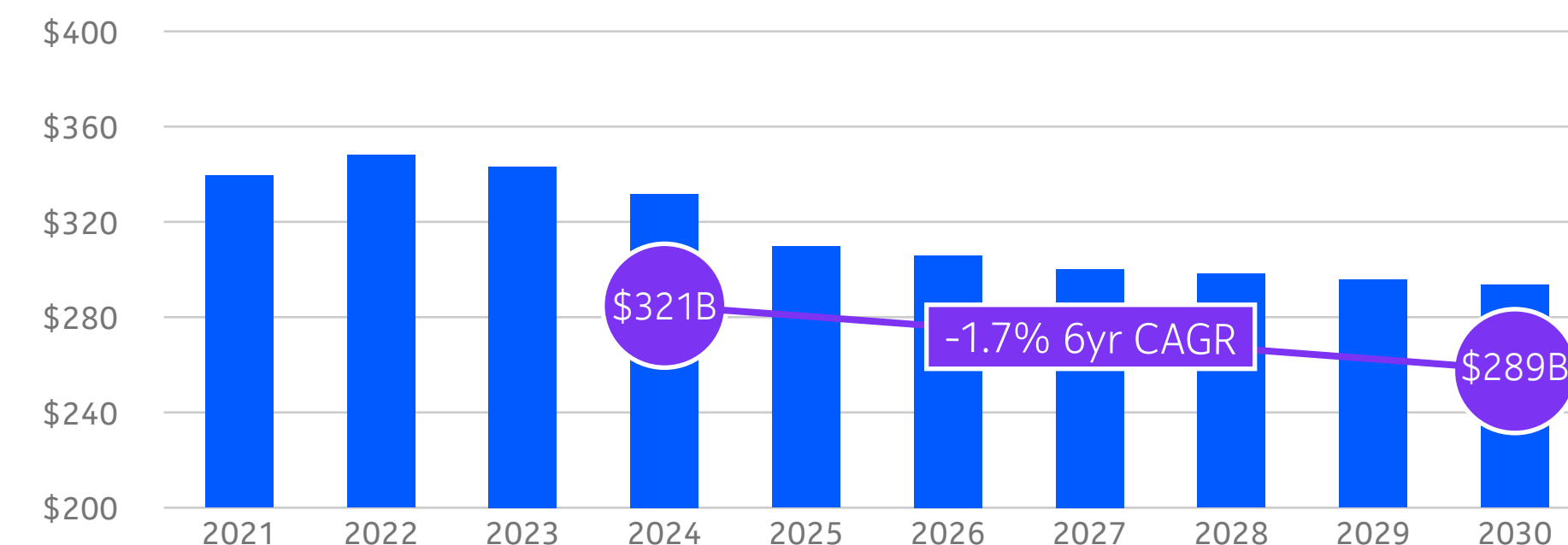
In this global capex-constrained environment, Neutral Hosts are well positioned to increase their role in network buildouts and cellular densification, and all types of fixed and mobile network upgrades.

Therefore, TÉRAL RESEARCH expects:

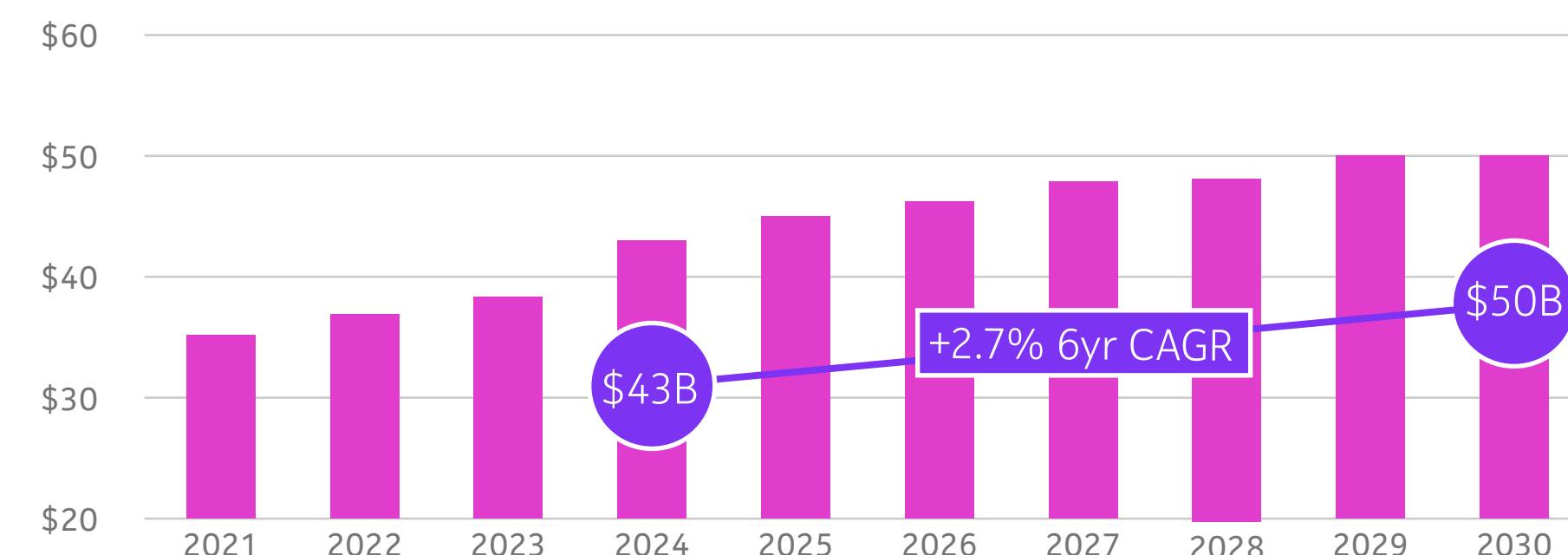
- Global Telecom capex to decline at a 1.7% 6-year CAGR by 2030 resulting from the absence of a new investment cycle; neither the migration from 5G NSA to 5G SA nor the adoption of 5G-Advanced will create a spike. Lastly, while being defined and designed, 6G remains out of the investment picture and will likely be less capital intensive. Fixed broadband, IP and optical transport along with sweating and transferring the assets will be the name of the game moving forward.
- More and more CSPs to sell or spin off their tower and fiber businesses and lease the assets back. CSPs will cash in and lower their opex, and Neutral Host companies will thrive.
- Neutral Host's share of global telecom capex to grow from 13% in 2024 to 17% in 2030. Neutral Host's capex, which is a subset of global telecom capex will grow at a 6-year CAGR of 2.7%. Typically, Neutral Host companies' capex are characterized by tactical investments in new assets and network footprint expansion that require specific passive and active fixed and equipment, and software.

Consequently, the Neutral Host market will reap the benefits and see strong revenue and capex growth. Established and emerging Neutral Host companies are reporting strong demand for their products and services. Investment in new Neutral Host companies remains robust as well.

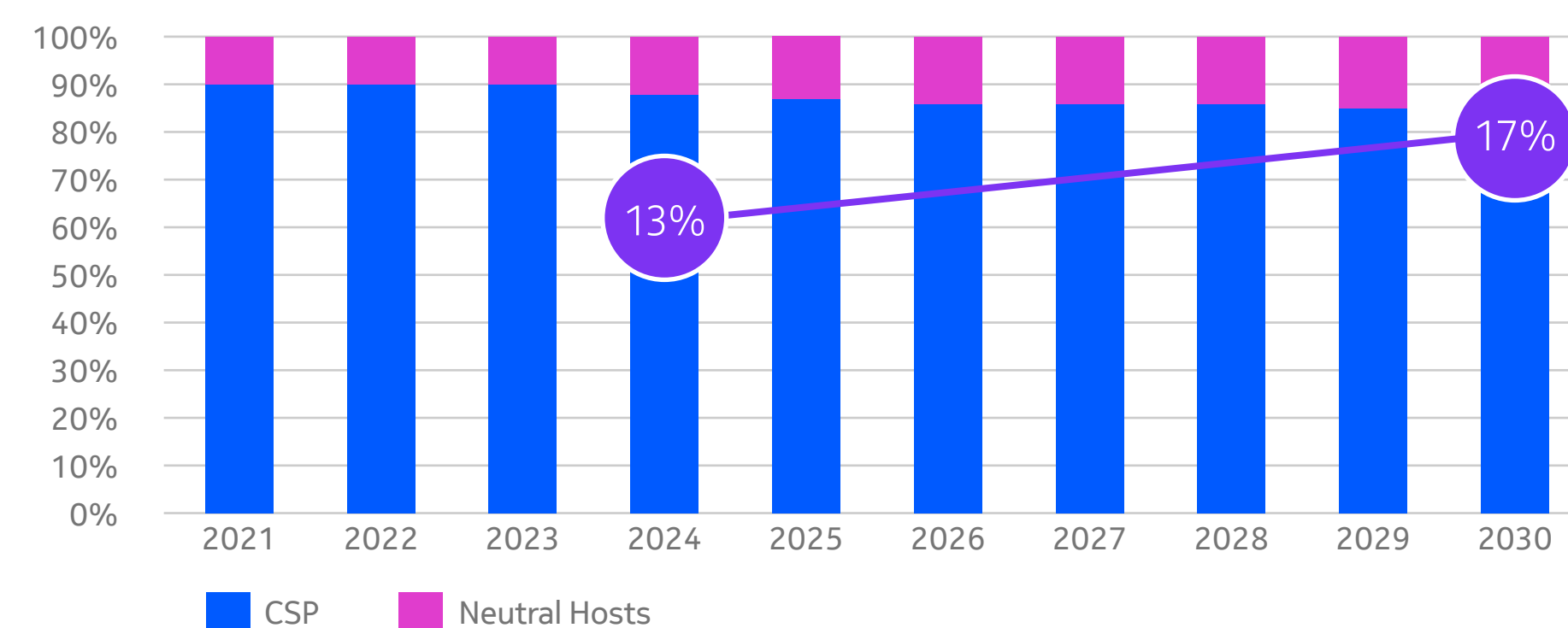
Global Telecom Capex (\$B)



Neutral Host Capex (\$B)



Share of Neutral Host Capex



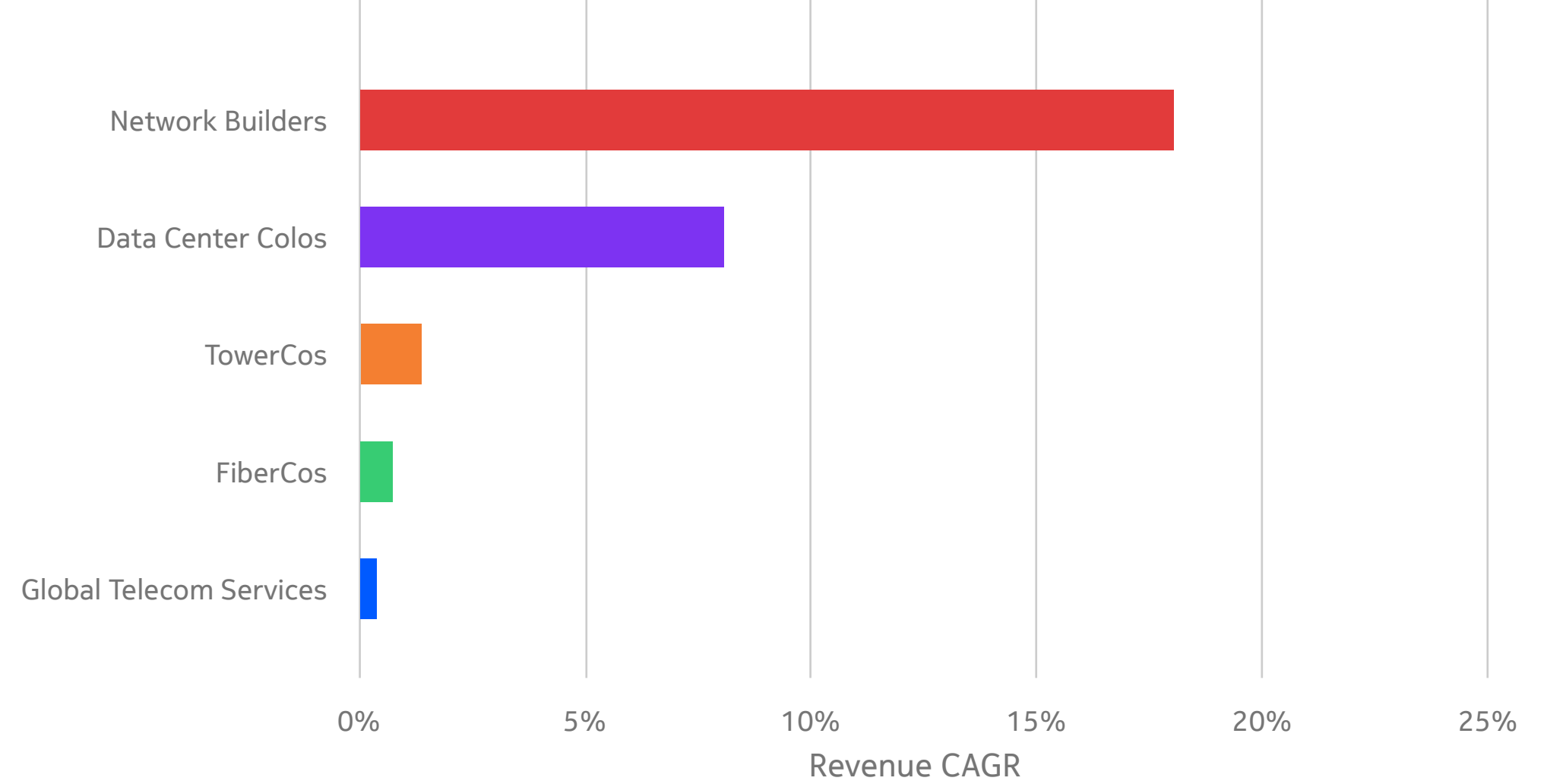
As a result, the Neutral Host business outlook is looking up

Network Builders, the smallest category ranked by revenue, is showing the highest CAGR

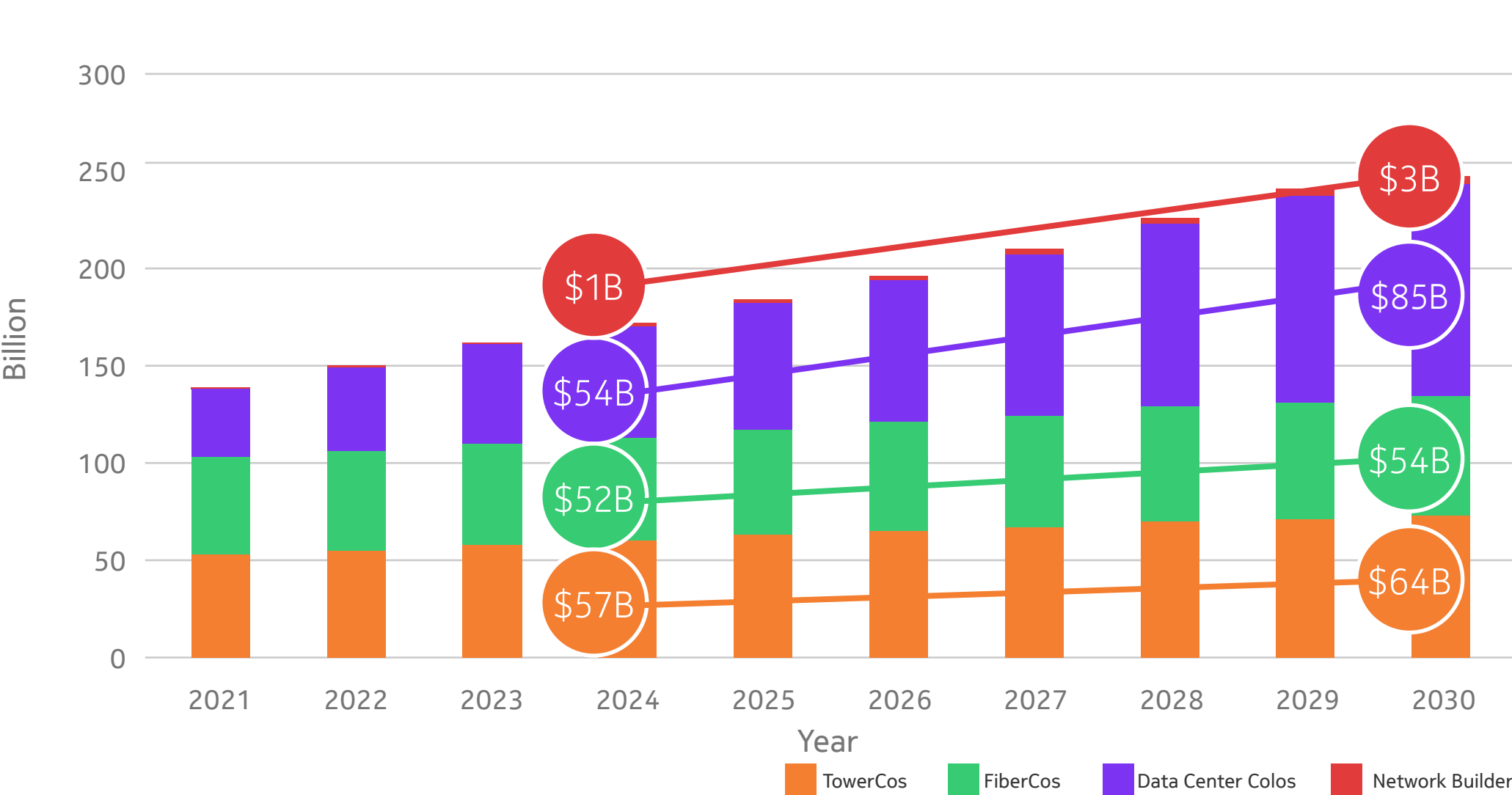
While FiberCos and TowerCos are more established and mature businesses, Data Center Colos and Network Builders’ revenues are growing at a faster pace.

- **Network Builders:** \$1B+ revenue in 2024 when only considering independent pure-play companies like Boldyn Networks and Freshwave for example. However, as explained earlier, the high demand for the construction of more networks will fuel fast and strong revenue growth at a 18% 6-year CAGR.
- **Data Center Colos:** colocation services is already a \$54B business worldwide in 2024 propelled by the unabated demand for Data Centers and will grow at an 8% 6-year CAGR.
- **Towers:** saw \$57B in global revenue in 2024. With more than 350 TowerCos worldwide, the market is mature and remains very competitive with lots of asset swapping and spinoff activity. As the outlook remains positive, revenue will grow at a 2% 6-year CAGR.
- **Fiber:** is the most mature, competitive and established Neutral Host category that totaled \$52B in revenue in 2024. While consolidation is expected in some markets such as Brazil and the U.K., the high demand for fiber will produce a 6-year CAGR of 1%.

6-Year Revenue CAGR



Neutral Host Revenue



Key active technologies to benefit

Adding more fiber and Data Centers for AI model training will drive the need for a wide range of active fixed and mobile technologies

The \$40B+ Neutral Host capex bucket is composed of fixed, wireless, and other types of spending, and can also be broken down into passive, active and software categories. The table showing the key technologies to benefit from the presented market drivers only considers the active and software components.

Network domains	Description
Fiber Access	Migration from copper and HFC to FTTN, and from FTTN to FTTC/B and FTTH GPON upgrades to XG-PON to XGS-PON , 25G-PON, and beyond leading to OLT and ONU upgrades Fixed wireless access (FWA) rollouts Fiber-to-the-tower and fiber to street furniture
Transport	Optical: WDM for backbones, mobile backhaul and midhaul, and Data Center interconnection (DCI) IP: metro, edge, and aggregation routers; cell site gateway/routers, and Data Center fabric (e.g. intra-Data Center switching)
Wireless and Mobile	Small cells, including multi-carrier small cells for neutral host use cases Multiband radios DAS upgrades, including open vRAN- and cloud RAN-based DAS platforms Open RAN/vRAN and cloud RAN implementations for edge computing WiFi-7 and -8 access points, controllers, and management
Network Management	Software-defined analytics and automation platforms for fixed and mobile broadband networks. This also includes network slicing for multi-tenant access to network resources Next generation inventory platforms and quantum-safe networking (QSN)

The business diversification mandate shifts the focus from passive to active

The share of active capex is expected to grow from 34% in 2024 to 37% by 2029

On the one hand, the world's macro cellular infrastructure is essentially built but improving coverage and capacity at the edge of the mobile networks by acquiring more street furniture and various real estate and equipping them with active equipment is going to be crucial. On the other hand, the broad regional variation in fiber penetration combined with many countries' willingness to bridge the digital gap with earmarked funds suggests that fiber rollouts will continue for the next 5 years or so. At some point, these new fibers will be lit with active equipment. Add AI as the new multiplier effect and the Neutral Host spending needs evolves as follows:

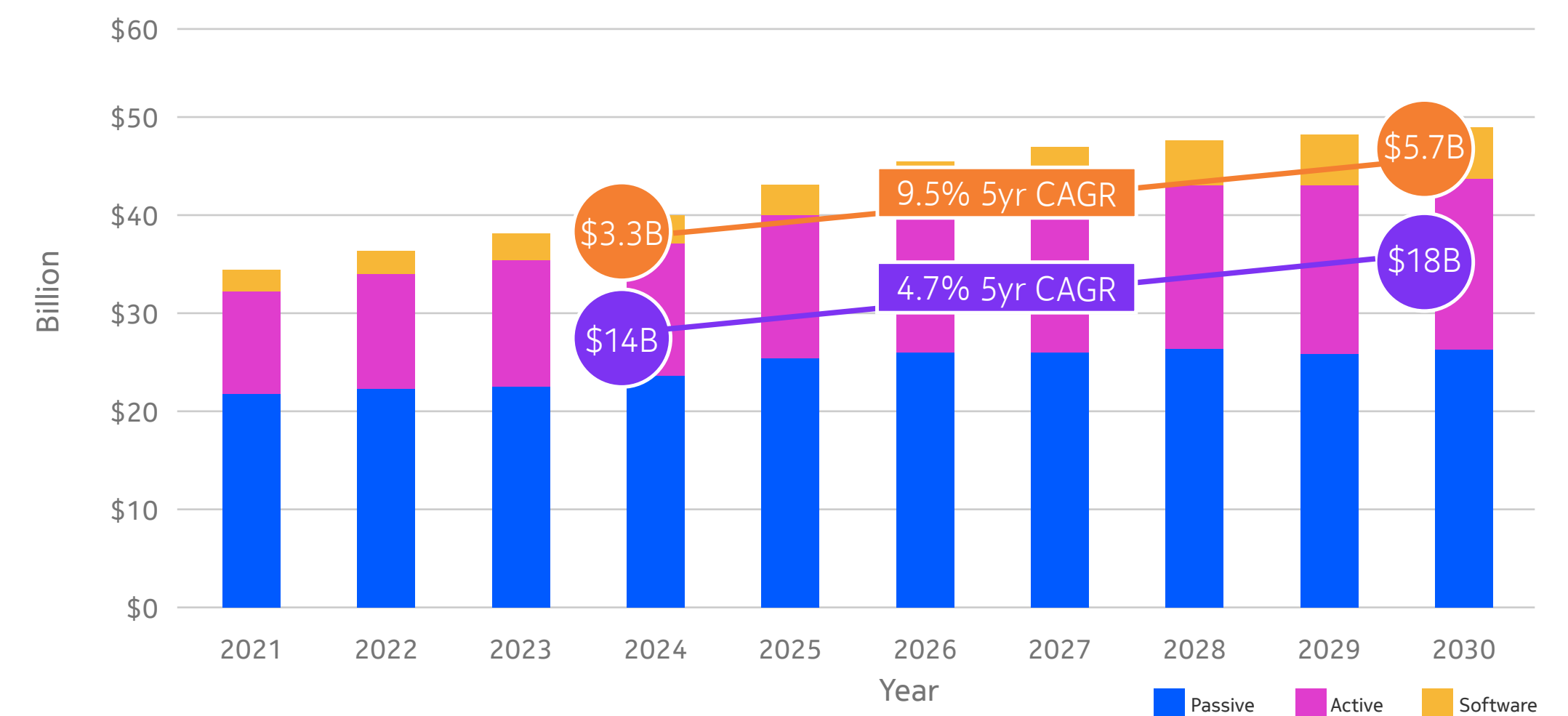
Passive: \$25.5B in 2024, growing at a 0.3% 6-year CAGR. It consists mainly of towers, fiber and copper plant, real estate, street furniture...

As sustainability requirements keep rising everywhere in the world, it has been getting more and more difficult to add new towers in many countries and it will remain so in the future. Consequently, fiber, real estate and street furniture will make the bulk of spending. Its share of the total will shrink to 52% in 2030 from 60% in 2024.

Active: \$14B in 2024, growing to \$18B in 2030 at a 6-year CAGR of 4.7%. It includes broadband aggregation equipment (e.g. DSL, PON, HFC...), IP routers and switches, optical equipment (e.g. WDM, ROADMs), wireless and mobile equipment (e.g. RAN, small cells, DAS, WiFi), and voice infrastructure.

Software: \$3.3B in 2024 to \$5.7B in 2030; the 6-year CAGR is 9.5%.

Neutral Host Capex Breakdown



Emerging business models

Smart city infrastructure and edge computing services are the low Neutral Host hanging fruits

Overall, fixed broadband as a service will remain the largest low-hanging fruit but our global research, which included a series of interviews, indicates that so far, Neutral Host companies are continuously reassessing their business and looking at new business opportunities. While doing so, most focus on the current “real-estate like” model based on lease, rent and other types of subscription services, which explains the emergence of smart city infrastructure and edge computing services. Spectrum scarcity and sustainability requirements are pushing the need for RAN and spectrum sharing, and as such, TowerCos are expected to be heavily involved in the active network sharing game in the short to medium term.

Business models	Description
Smart city infrastructure	In smart cities, Neutral Host players are poised to play a major role to provide connectivity for IoT and IT sensors, install and run public WiFi, and manage interactive screens, and e-chargers. Case in point: Vantage Towers is already doing this in its European footprint
Edge computing as a service	The Neutral Host company provides access to edge computing infrastructure and capabilities through a subscription service to allow users to process data closer to its source without having to manage the underlying hardware or software. It’s about renting the edge computing power users need instead of building their own dedicated system
RAN as a service	A Neutral Host company owning and managing an open virtualized RAN (Open vRAN) can provide software independence between the tenants. With traditional RAN, the parties sharing the RAN must align their software decisions. With containerization of network functions on cloud infrastructure, it becomes possible for each operator to run different RAN software versions on the same shared hardware
Spectrum as a service	The Neutral Host company provides the technology and infrastructure to enable multiple users to dynamically share the same radio frequency bands, essentially acting as a middleman to manage access and minimize interference between different users, allowing them to utilize the spectrum more efficiently without having to invest heavily in their own spectrum sharing systems

Tower companies (TowerCos)

TowerCos business model

More than 95%
of revenue is
generated from
tenant leases

TowerCos grow their tower or cell site real estate portfolio through acquisitions, long-term lease arrangements and site development.

Their portfolio primarily consists of towers that they own and towers that they operate pursuant to long-term lease arrangements, as well as distributed antenna system (DAS) and sometimes small cell networks, which provide seamless coverage solutions in certain in-building and outdoor wireless environments.

In addition, some TowerCos manage rooftop and tower sites for property owners under various contractual arrangements.

TowerCos may also hold other ...

- Telecommunications infrastructure and property assets that they lease primarily to communications service providers (CSPs) and third-party tower operators. For example, many TowerCos own fiber assets.
- Portfolios of Data Center facilities and related assets that they provide for the leasing of space primarily to enterprises, network operators, cloud providers and supporting service providers.

As part of a long-term expansion plan, some TowerCos may also consider active assets to become an integrated passive and active service providers to CSPs.

Tenants lease space on the TowerCos real estate and install and maintain their equipment

Recurring stable cash flow...

Depending on how much equipment, the type of the equipment and where it is located on the tower, rental payments can vary significantly. However, tenants ensure constant revenue growth with very low cash flow volatility, which is driven by the 3 following factors:

- Long term tenant leases
- High lease renewal rates
- Unabated demand for cell sites.

This is certainly not an exhaustive list, as rents also depend on location, topology, type and height of tower (required to ensure coverage).

...and low operational and capital expenditures.

TowerCos' costs typically include inter alia ground rent (payment for the use of the land), power and fuel costs; some or all of which may be passed through to the tenants, as well as property taxes and repair and maintenance expenses.

The operating costs of adding new tenants or equipment to an existing communications site are relatively minimal. Therefore, as tenants or equipment are added, the bulk of incremental revenue flows through to gross margin and operating profit. In addition, depending on the country, certain expenses, such as ground rent or power and fuel costs, are reimbursed or shared by the TowerCos tenant base.

TowerCos' cost efficiencies mostly stem from being more specialized, sharing-driven (e.g. multitenancy), and more energy efficient. Lastly, site maintenance requires low capital expenditures.

TowerCos case study example: American Tower Corporation (ATC)



AMERICAN TOWER®

Unabated demand for mobile broadband and the spectrum license owner nationwide coverage requirement are driving the TowerCo business. To ensure timely coverage, including regulatory coverage obligations, and future-proof quality, TowerCos have emerged as important enablers for MNOs because their model rely on openness and sharing has proven efficient while also meeting sustainability requirements. Overall, the neutral host's tenancy ratio is much higher than that of the MNOs, and opex and capex are much lower. It comes down to sharing one network versus everyone building its own network.

The business model involves many parties and stakeholders including landlords, property owners, tenants, and MNOs. In Europe, ATC has 32,000 sites and works with authorities and municipalities, including in rural areas. The TowerCo business model is inherently a more efficient model for stakeholders to get economic and environmental benefits. The share of independent TowerCos has increased from 13% in 2014 to 50% in 2024.

The TowerCo business starts by acquiring assets and portfolios through different ways and then shifts to build and grow multi-tenant assets to create value and long-term returns.

Time to market is critical, as MNOs constantly need sites in a timely manner, engaging with a TowerCo is the fastest and cheapest way to eliminate the burden of site permitting, securing sites, and civil engineering. It's always better to add tenants to an existing site than building a new one from scratch. TowerCos cannot be pure financial players any longer, they now need to have best-in class operations.

As data is the major focus, knowing what's hitting the towers becomes critical. To stay ahead of the curve, ATC is looking at energy sharing, solar panels, tower reinforcement, drones, digital twins, fiber-to-the-tower and is also testing some edge computing use cases.



Thierry Amarger,
CEO of Europe

Fiber companies (FiberCos)

FiberCos business model

More than 70%
of revenue
is generated
from **dark fiber**
business services

FiberCos’ portfolio primarily consists of consists principally of fiber-optic and metallic cables, high-speed transport equipment, electronics, switches, routers, gateway and transmission facilities, central office equipment, land and buildings related to their operations. While dark fiber leasing makes the bulk of a fiberco business, some like nbn in Australia sells Ethernet business services to retailers.

FiberCos typically have a small number of wholesale customers on long-term contracts. Dark fibers are unlit optical fibers that have been laid but not yet been lit with the equipment necessary for it to transmit data. FiberCos provide access to this unlit optical fiber to customers who are interested in building their networks with this high-bandwidth, highly secure optical technology. They also provide professional services to engineer these networks, and in some cases, manage them for customers.

The primary component of dark fiber lease pricing is the monthly recurring charge, which varies among providers, and the most common kind of agreement is an “indefeasible right of use” (IRU). Or upfront payment plus maintenance cost.

A typical dark fiber lease contract contains 2 elements:

1. the lease or rent.
2. the IRU, typically for a minimum of 15 years, is a long-term, permanent contractual agreement for unconditional right to use a fiber-optic cable, for a specified period. The term “indefeasible” means that the right cannot be undone or voided.

Fixed broadband (FTTx) as a service is by far the largest active wireline business for FiberCos. In addition, some FiberCos are diversifying their business and offer active services along with high-speed IP access, edge cloud, managed security, software-defined wide area (SD-WAN), Data Center (DC), and security access service edge (SASE) services.

Beyond dark fiber, veteran FiberCos offer a wide range of complementary active services

Leveraging their fiber network, active equipment and real estate assets, they offer high-speed Internet access and IP transit connectivity services to corporate customers, which primarily include small and medium-sized businesses, enterprise customers, and net-centric customers, which include, content providers, applications service providers and access networks, comprised of ISPs, cable operators, mobile operators and phone companies.

Corporate customers primarily purchase dedicated Internet access on-net or off-net through other carriers’ “last mile” connections to those customer facilities in metropolitan markets. Speeds range from 100 Mbps to 1 Gbps per second and in some cases up to 10 Gbps. The continued growth in demand for increased bandwidth has led to a rapid shift towards higher capacity circuit.

Net-centric customers purchase IP connectivity and other services in carrier neutral Data Centers (CNDC) as well as in the FiberCos’ DC. These bandwidth intensive organizations typically purchase circuits (e.g. wavelength services) ranging from 10 Gbps up to 400 Gbps, designed to provide them high-speed, bi-directional, symmetric circuits with a high degree of reliability and 100% all time access to the contractual capacity.

In addition to contractual capacity, certain net-centric customers also purchase metered service that enables customers to pay for actual volume of bits delivered on a per bit per second basis.

Some also offer a burst product that allows net-centric customers to utilize capacity when they exceed their contractual capacity. The per bit charge for this burst capacity typically exceeds the rate for contractual services.

Dark Fiber case study example: FiBrasil



FiBrasil Infraestrutura e Fibra Ótica S.A. or FiBrasil was created in July 2021 as a 50:50 JV between Vivo (Telefónica Brasil and Telefonica Infra), and the global investment group Caisse de dépôt et placement du Québec (CDPQ). On Day 1, Vivo became FiBrasil’s first wholesale customer with a long-term contract. As of December 2024, FiBrasil boasts 50 different tenants.

As thousands of ISPs are competing against each other in Brazil, consolidation is looming and FiBrasil intends to be an important player in this process because the neutral host solution delivers a more profitable and stable business. However, as almost 100% of the fiber footprint are aerial and few parts underground, FiberCos are facing high maintenance costs that need to be carefully addressed while trying to lower the cost per connection to make the neutral host model more attractive. FiBrasil thinks that a substantial decrease in \$/connection will trigger massive migration to neutral host facilities.

Advanced technologies such as TM Forum standardized open APIs, and OSS automation are providing a major boost to stay ahead of competition. Case in point: onboarding has gone down from 6 months to 20 days.

FiBrasil is aiming to “increase take-up rates as fast as we can” and “increase the number of tenants” on its neutral host infrastructure using open APIs and automation, and leveraging the OSS it has constructed over the last two years alongside IT and telecoms service partner Open Labs—a Brazilian subsidiary of Altice Labs, Portugal. It’s a very open system that allows the FiBrasil team to add its own features, increase inventory with more precision, which in turn drive the success of the business.

Fibrasil developed an important feature that takes advantage of external geographic data sources to improve the inventory and avoid losing sales. This resulted in a significant increase in sales for the ISPs. For the Neutral Host, it accelerates the take-up rate with a

more balanced network occupancy. Fibrasil’s demarcation usually stops with the box on the pole while the ISP owns the ONT.

While GPON remains the focus, evolving customer requirements are leading FiBrasil to look at XGS-PON as the next step in its expansion. The company is looking at being a complement to any kind of infrastructure including backbone and fiber to the cell site.



Átila Araujo Branco,
Chief Technology &
Information Officer

Fiberco case
study example:
National
Broadband
Network (nbn)



nbn was established in 2009 by the Commonwealth of Australia as a Government Business Enterprise (GBE) with the objective of designing, building and operating a wholesale broadband access network for Australia.

15 years later, the nbn network supports the needs of more than 20M people nationwide every day. Its network relies on a mix of technologies including FTTN, FTTC, FTTB, FTTP, HFC, FWA and GEO satellites for very remote areas; fiber accounts for more 90% of the mix.

nbn sells an Ethernet business service to retailers such as phone and Internet service providers. To access the nbn network, retailers pay a monthly charge that includes both an access and a bandwidth charge. As of December 2024, over 12.52M premises are ready to connect to the nbn network with 8.62M connected. 82% of premises on the fixed line network can access close to gigabit speed. nbn will offer 2Gbps products from September 2025.

Upgrades to the local fibre network will enable 3.5M premises served by FTTN and 1.5M served by FTTC to upgrade to FTTP by the end of December 2025.

To stay ahead of the curve, nbn is testing 100G-PON technology, which will coexist with its current XGS-PON and 25GS-PON systems.

In fact, competition is real and fierce because some of nbn’s customers are MNOs offering 5G services, and the arrival of GigaComm, which defines itself as a “non-nbn” alternative focused on the last mile, adds another threat. LEO services are available in regional and remote parts of Australia. nbn is exploring options for its own LEO solution in regional areas but believes that fibre delivers more capacity, reliability and faster speeds than other technologies.

nbn’s long-term network roadmap includes exploring next generation technology. The company has demonstrated 100 gigabit technology on the live nbn full fibre access network.



Guy Scott, EGM
Technology and
Solutions

Data Center colo companies (Data Center Colos)

Data Center Colos business model

Colocation & related interconnection and managed infrastructure services account for more than 90% of total revenue

The business is primarily based on a recurring revenue model comprised of colocation and related interconnection and managed infrastructure services.

Customers rent cabinets and are billed on a fixed and recurring basis each month for the duration of their contract, which is generally 1 to 3 years in length, and thereafter automatically renews in one-year increment.

The “cabinet space billed to total cabinet capacity ratio” is the metric used to measure how efficiently a Data Center Colo is managing its cabinet capacity. This cabinet utilization rate varies from market to market among DCs across the Americas, EMEA and Asia Pacific regions.

Non-recurring revenues are primarily derived from fees charged from installations related to a customer’s initial deployment and the professional services performed. These services are non-recurring because they are billed typically once, upon completion of the installation or the professional services work performed. Most of these non-recurring revenues are billed on the first invoice distributed to the customer in connection with their initial installation.

More than 2,200 companies provide vendor-neutral multi-tenant Data Center (MTDC) services worldwide. Historically, this market was served by large telecommunications carriers who bundled their products and services with their colocation offerings. The Data Center market landscape has evolved to include private and vendor-neutral MTDC providers, hyperscale cloud providers, managed infrastructure and application hosting providers, and systems integrators.

Data Center Colos case study example: OpenColo



Santa Clara, CA, OpenColo is a Data Center that offers cloud hosting (e.g. cloud services), colocation—rent data space and pay for resources used, and managed services to businesses of all sizes.

OpenColo has a neutral host mindset and solely focuses on providing space power and connectivity. In other words, customers are building a network rack and getting an Internet handoff with full BTP tables or whatever they want from OpenColo.

As a colocation provider, OpenColo is not telling the customer what to do, it delivers space and power and if they want to connect to another provider, they can order a cross connect and OpenColo will charge a fee from the carrier to the rack. What's interesting with the rise of AI is that OpenColo does not see it the same way as their customers do, it only translates into more racks, more space and

more power. All this means is that it does not change the Data Center colocation business.

However, more power requires more efficient cooling. In this AI world, renovating or upgrading the current legacy Data Center footprint is a great challenge because every Data Center was never conceived for high power capacity and just built with an air-cooled mindset. Now, the industry is pushing everyone to adopt a liquid cooling architecture, which requires significant hard to find capital investment. OpenColo thinks it is cheaper to build a brand-new building than renovate an outdated one.

But power availability, which is already scarce in California with no more capacity for additional power, is the greatest challenge. As a result, a Data Center collocation runs out of power before running out of space, nothing was built for super AI!

Finally, the rise of GPU-as-a-service and the fast-evolving GPU landscape are creating some concerns. OpenColo's customers typically know software well but are inexperienced with networking and do not understand what's happening in their racks, a comprehensive end-to-end network monitoring and overview is needed. A significant opportunity exists to improve data visibility for all users.



Scott Brookshire,
Chief Technology
Officer

Network Builders

Network Builders business model

It's really like a **real estate business**

The work of Network Builders, including TowerCos, FiberCos, and Data Center colos, revolves around identifying fixed and wireless connectivity opportunities, assessing the feasibility of projects, securing financing, overseeing construction, executing and delivering the network, and sometimes, operate the asset through a leasing model.

In some cases, Network Builders acquires existing assets and street furniture, which they often purchase at a favorable price. They consider factors like location, zoning, and growth potential. Once the assets acquired, they build the fixed or wireless communications network.

Before committing to a project, they conduct extensive market research and feasibility studies that help assess the demand for the proposed project, potential competition and associated risks. Then, they secure financing through various means, including bank loans, private investors, and partnerships. In many cases, they charge fees for arranging and managing these financial arrangements, which can include loan origination fees or a percentage of equity investments.

Typically, their income comes from the following sources:

- 1. Development profits:** they oversee the planning, design, and construction phases, managing costs and timelines. They contract with construction firms for civil engineering and system integrators firms and earn a profit margin on the construction cost.
- 2. Rental income:** they lease connectivity and/or bandwidth/capacity on the network asset. This provides a steady cash flow.
- 3. Asset management fee:** this income includes design, deployment of the needed telecom solution with a managed service that includes maintenance and administration.
- 4. Joint ventures and partnerships:** this can involve profit sharing arrangements generated from the asset.
- 5. Tax benefits and incentives:** they can leverage tax benefits and incentives associated to the neutral host model that significantly reduce network duplication. Municipalities around the world love this model because it meets their sustainability targets.

Network Builders case study example: Freshwave



Launched in 2020, Freshwave offers connectivity infrastructure-as-a-service offering, and provides indoor connectivity via small cells, distributed antenna systems (DAS) and WiFi to thousands of buildings across the UK, with customers including skyscrapers, stadiums, acute hospitals and central and local government buildings. Working closely with the UK mobile network operators, Freshwave also supports hundreds of outdoor mobile networks and builds masts and outdoor small cells on the behalf of them and local authorities.

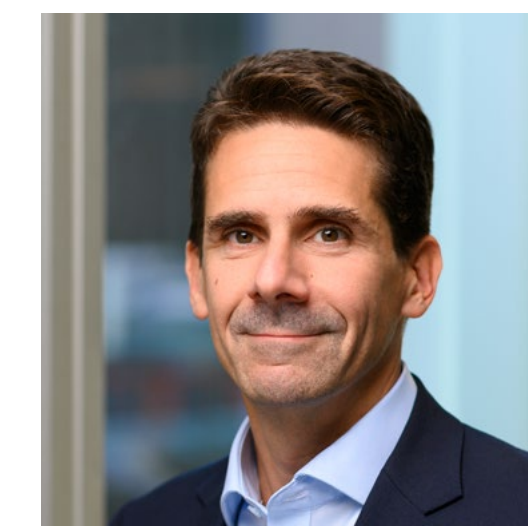
Freshwave sees a huge demand for enterprise-paid in-building connectivity, which is a shift away from the mobile operator-paid model. The highly competitive market conditions have lowered the ARPUs to a point where MNOs can no longer afford to build their own infrastructure, particularly for indoor use cases.

Freshwave works closely with MNOs' roadmaps with engineering capabilities as a differentiator.

Named Omni Network, Freshwave's neutral host small cell network service is MORAN-based and conformed to the NHIB JOTS protocol, a UK operator-led specification that lays out the architecture for aggregating small cell traffic from neutral host infrastructure to mobile operator cores via a NHIB gateway.

Freshwave's business model is like that of the commercial real estate one and based on shorter- and longer-term contracts (3, 5 and 10+ years), which vary depending on who is going to pay for the service. For example, starting during the pandemic, health care providers at hospitals wanted to have excellent connectivity, and the NHS began paying for dedicated in-building or campus-wide mobile connectivity.

Due to high demand, this business evolves constantly and must be neutral to all dimensions and directions, from devices, technology to CSPs. As a result, Freshwave works with everyone involved in the ecosystem and invests in small cell technologies and leads on the integration of new products with vendors and all the mobile network operators. Lastly, for private network uses cases, Freshwave provide a similar managed service, including the design, deployment, ongoing maintenance and customer service.



Simon Frumkin, CEO

Methodology



The foundation is based on 30 years of telecoms stats tracking

TÉRAL RESEARCH's forecasting begins with a deep knowledge of telecom network footprint and rollout patterns, upgrades, and expansion plans tracked over the past 30 years; then uses a combination of historical data extrapolation, expert opinions, and various methods explained below.

- **Historical Trend Extrapolation:** Extrapolation of historical rollout patterns of a new generation of network (e.g. FTTx, GPON, 5G migration...), existing network expansions, and software upgrades. Information on historical and cyclical patterns is obtained by means of TÉRAL RESEARCH's regular discussions with CSPs, TowerCos, FiberCos, Data Center colos, Network Builders, and vendors.
- **Ecosystem Expert Opinion:** Involvement of industry expert opinions as well as discussions with the global ecosystem including CSPs, TowerCos, FiberCos, Data Center colos, Network Builders, infrastructure vendors, their suppliers (including semiconductor vendors) and customers. It is through the synthesis of these opinions that a final forecast is refined.
- **Cross-impact Analysis:** Relationships often exist between legacy (e.g. 2G/3G, copper) and new infrastructure products (e.g. 5G, fiber) that may not be revealed by any forecasting techniques. TÉRAL RESEARCH forecasting recognizes that the occurrence of an event can, in turn, affect the likelihoods of other events.
- **Trends Analysis:** TÉRAL RESEARCH monitors developments such as geopolitical events, new regulatory frameworks, and new technology introductions such as cloud networking, AI, open virtual/cloud RAN, XGS-PON... that may impact infrastructure buildouts and upgrades. Ecosystem expert opinions are often used to evaluate and compare different outcomes and pick the most likely one.
- **Macroeconomic Analysis:** TÉRAL RESEARCH monitors global macroeconomic developments and conducts financial analysis of specific companies, using publicly available information such as SEC filings, company presentations and other market research findings as inputs to the forecasting.

Sizing & forecasting methodology details

Business models	Description
Global Telecom Revenue and Capex Size	Bottom-up of Top 100 telecom service providers ranked by revenue, including CSPs, TowerCos and FiberCos. No Network Builder made this Top 100 list. It's important to note that some of the world's largest CSPs operate their own Neutral Host business units; their revenues are included in this total. Private companies' financials are estimated.
Global Neutral Host Revenue Size	Bottom-up of Top 40 TowerCos + Top 20 FiberCos + Top 10 Data Center colos + Top 12 Network Builders.
Global Neutral Host Capex Size	Combination of hard data available from 10K filings and extrapolation crosschecked with expert opinion.
Global Telecom Capex Forecast	Historical trend extrapolation, including cycle analysis. For the first time in history, there is no indication of a potential upswing in the long term forecast; 2G, 4G LTE, fiber and 5G drove the past cycles of this century.
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About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs, which is celebrating 100 years of innovation.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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