

Rethinking the "easy button" of connectivity

The internet now requires diversified network exchange points for survivability and reliable economics

Executive overview

The internet has evolved to become the lifeblood of businesses worldwide. Businesses expect the internet to support their needs and deliver their services—without fail and without delay. This reliance on the internet positions downtime to be financially and operationally devastating to businesses and the IP carriers that service them. In fact, a 2019 ITIC report indicates that one-in-three organizations say the cost of an hour of downtime can exceed $1 million.

There is a lot on the line when service disruptions rear their ugly heads. IP carriers must be prepared to manage these threats, especially in an atmosphere of rising risks from a variety of sources.

To optimize uptime, IP carriers need to deploy routers in at least two unique facilities within a metro area. With multiple node sites, carriers can pick up or deliver traffic at an alternate facility if one site is compromised. This connectivity strategy mitigates risk to promote availability and maintain low-latency connections. It also introduces competition into a financial stalemate that has allowed carrier hotels to dictate costs without negotiation. Diversification changes this landscape to promote a resilient and more cost-effective connectivity ecosystem.

> "34% of organizations say the cost of an hour of downtime can exceed $1 million."
>
> ITIC

The economic impact of intensifying internet capacity

In our modern world, the internet has become an epicenter for business productivity, performance and profitability, and as a result, risk. With more than 4.5 billion global internet users—a number that has more than doubled in the last 10 years and shows no sign of slowing—businesses rely on the internet to connect them to their customers, drive employee productivity and deliver services.

While the amount of internet traffic is staggering, it is not surprising considering the digital revolution that has occurred. The internet is central in personal and business lives, allowing users to stream movies, play games, interact with friends and conduct virtual meetings. Social media has evolved to dominate communication and our ability to stay in touch. Facebook usage alone has skyrocketed from 500 million users in 2010 to 2.32 billion in 2019.

And it is not just social media. Media consumption, including streaming video through services like Netflix, Hulu and Amazon Prime, has grown 504% since 2011. Advertising has largely shifted from print media to online media, and online shopping is consistently chipping away at storefronts with ecommerce growing almost five times faster than retail sales since 2013.

Even on the go, we expect to be connected. Smart phone use has increased 29% since 2016 reaching 3.5 billion global users. Navigation systems like Waze and Google Maps get us where we are going, and video conferencing apps such as WebEx and Zoom are allowing businesses to conduct meetings across remote locations.

Additional increases in internet consumption are on the horizon. The Coronavirus pandemic in 2020 forced the wide-spread adoption of virtual conferencing as millions of workers, students and the general population became quarantined in their homes. Analysts suggest that this mandated foray into virtual interaction may have a lasting impact on the way businesses, educational institutions and government deliver services and manage productivity in the future.

The advent of 5G will further drive internet bandwidth growth with IoT, artificial intelligence applications, machine learning and higher resolution graphics. The increasing use of drones and the anticipated introduction of autonomous cars will add to surging internet traffic and underscore the criticality of uninterrupted, low latency connections for not only business profitability, but for public safety as well.

THE RISING COSTS OF DOWNTIME

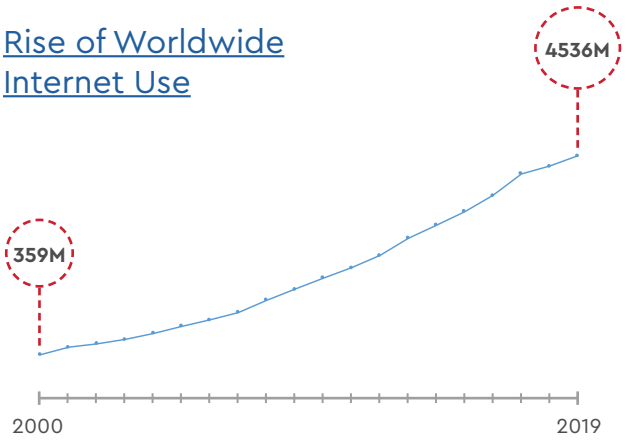
Clearly, the world around us has changed to become more reliant on the internet. Users expect on-demand access without interruption, making downtime devastating to a business and its bottom line. A 2019 ITIC survey, reports that 98% of businesses accumulate downtime costs over $100,000 per hour, 86% at over $300,000 and a third between $1 million and $5 million—and these figures exclude litigation fees and noncompliance fines.

The effect of any service degradation or outage reaches beyond lost sales and revenue to include costs associated with stalled productivity, negative customer experiences, SLA and legal fees, brand damage and customers cancelling service. While downtime impacts all businesses, it is particularly devastating for organizations such as Facebook, YouTube and Netflix that supply internet-based services. Case and point: a 14-hour outage in March 2019 cost Facebook an estimated $90 million. Latency can also influence revenue as Google reported that "53% of visits are abandoned if a mobile site takes longer than three seconds to load."

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The financial services and healthcare industries are also heavily impacted by downtime and latency. Financial services organizations rely on the availability of low-latency connections to quickly buy and sell investment shares, while the healthcare sector demands rapid-response connections to manage health-stabilizing technology.

Rise of Worldwide Internet Use



Mitigating risk with a diversified connectivity strategy

The message is clear, businesses are increasingly reliant on the availability, resilience and performance of the internet, and IP carriers are in the hot seat when it comes to providing unwavering uptime and reliable, low-latency connections. Dissatisfied businesses can—and will—take their business elsewhere, leaving carriers with declining revenue as customers turn down bandwidth to match declining capacity needs.

Network suppliers have too much at stake to not to address these risks. The pressing question is, can the existing internet infrastructure withstand an incident that challenges a carrier's network?

In a world with an increasing number of planned attacks, disruptive weather patterns and simple human error, the risk of downtime is all too real. This has spotlighted the importance of diversifying connectivity nodes to bolster internet resilience as single points of failure invite risk. To mitigate this risk, IP carriers need alternate pathways to ensure the continuity of internet service should an outage or disaster impact a connectivity hub.

The rise—and risk—of the "easy button"

The risk of downtime is significant when you consider the existing infrastructure of internet connectivity. Today, the majority of internet traffic is traded in 10 facilities across the United States. An incident in one of these buildings exposes networks to wide-scale downtime or, at a minimum, increased latency as traffic is diverted to the nearest facility housing the carriers' next available network node, often hundreds of miles away.

By putting all their nodes in a single metro location, IP carriers expose themselves to tremendous risk and a financial stalemate. With 10 buildings in the U.S. largely responsible for exchanging the bulk of internet traffic, risk is prevalent.

Diversifying this current infrastructure by putting core routers in additional data centers within the same metro area as an existing connectivity hub, minimizes risk and controls the impact of an outage by allowing IP carriers to pick up and/or deliver traffic at the alternate site in the same metro. This solution also introduces competition into a business model that has given a handful of data center providers a financial stronghold over the costs of connectivity.

Deploying routers in additional data centers within the same metro area as an existing connectivity hub, minimizes risk by allowing IP carriers to pick up and/or deliver traffic at the alternate site, if necessary.

HOW WE GOT HERE

To understand the full implications of this situation, it is important to understand how the industry evolved to this point. After the deregulation of the telecommunications industry in 1996, the number of IP carriers spiked with each carrier putting nodes in data centers in key markets across U.S. Over the years, the internet grew and IP carriers and enterprises placed more network routers in these data centers, expanding their presence within a concentrated area, and ultimately creating 10 meaningful carrier hotels across the U.S. These connectivity points were viewed as the "easy button" because they allowed businesses to exchange traffic with a multitude of carriers and other businesses within their four walls.

This scenario has continued for more than 20 years with carriers and enterprises continuing to increase capacity within these facilities to accommodate

mounting internet traffic. A quick peek at PeeringDB and the reality hits home: the bulk of internet nodes reside in these 10 locations, exposing internet traffic to single points of failure in these concentrated sites.

THE SHIFT TOWARD DIVERSIFICATION IS TAKING SHAPE

While the status quo works, it is unwise, unsafe and fiscally perilous. IP carriers need to harden their networks to ensure they can continue to provide low-latency connections in even the most adverse conditions.

Businesses are beginning to recognize the risks associated with the legacy "easy-button" solution. Leading the way in diversification efforts are hyperscalers like Facebook and Microsoft. For both enterprises, the damage, wide-spread outages and havoc that Hurricane Sandy inflicted on the East Coast served as the event that drove them to action. With concentrated network access in the New York area, the powerhouses recognized the need for alternate network routes. Indeed, this is why the newest subsea cables connecting Europe to the United States (MAREA) and LATAM/South America to the United States landed in a brand new cable landing station in Virginia Beach versus any of the legacy sites in New York, New Jersey or Florida.

"There is diversity needed," said Frank Rey, director of global network strategy at Microsoft. "You can't be too big to fail."

The "too big to fail" message rings true for IP carriers as well. With highly concentrated connectivity points in few locations, IP carriers expose themselves to a potential failure at a single address. As a result, the "easy button" solution is no longer a safe option, and will certainly not be easy—or cheap—if faced with an outage.

"As the traffic volume on the internet goes up, any single site becoming so big that it cannot fail, becomes a real problem for us. We need multiple paths to provide the diversity," said Najam Ahmad, Vice President of network engineering at Facebook.

"Our philosophy is if anything fails no one should have to move a muscle, no one should have to do anything and things should work. That gets harder and harder when any individual site gets that big."

As these large businesses diversify their networks, other businesses will follow their lead to be able to connect with them, and these businesses will want their IP carriers there as well. Carriers who are ahead of this curve will improve their business survivability—from both an uptime and customer service perspective.

> "There is diversity needed. You can't be too big to fail."

FRANK REY, Director of Global Network Strategy, Microsoft

INTERNATIONAL CONNECTIVITY THRIVES WITH NEW SUBSEA CABLES

While diversification of terrestrial connections is critical, international connectivity should not be overlooked. Subsea cable systems allow continents and countries to connect, handling $10 trillion of transactions every day. The first submarine cables were driven by the financial market, connecting New York and London. While additional subsea cables have been completed including ones that connect South America and the U.S. via Jacksonville and Miami, Florida, and Los Angeles and Hillsboro on the West Coast, more submarine cable systems are needed to support international capacity with diversified paths and improved latency. This is critical for international organizations like Facebook which has 2.7 billion users across the globe, 90% of whom are outside the U.S.

Recently, two alternative subsea cables—MAREA and BRUSA—were deployed in Virginia Beach, Virginia. Two of the highest capacity, lowest latency subsea cable systems ever built, they reduce latency from 10 milliseconds to 5 milliseconds and offer a third subsea

cable landing on the East Coast for more efficient routes to South America, the Caribbean, Europe and the Middle East. This improved speed and alternate option provides a critical differentiator to industries and individual businesses that rely on low-latency network access from the U.S. to international markets.

Built by Facebook and Microsoft in partnership with Telxius, the infrastructure company of the Telefónica Group, the MAREA subsea cable connects the U.S. to Sopelana, Spain and offers 200 terabits per second of ultra-high transmission capacity. This offers another route for U.S.-bound traffic that originally travelled through Marseille and points of entry in the Mediterranean to relieve congestion and improve latency. BRUSA, a private cable built by Telxius, offers one of the lowest latency connections between the U.S., Puerto Rico and Brazil.

Both subsea cables terminate in Telxius' Virginia Beach cable landing station, and Telxius has established a key point of presence (PoP) within the 1.5 million square-foot QTS Richmond Network Access Point (NAP). This allows the QTS Richmond NAP to offer the highest on-net capacity and lowest latency for the MAREA and BRUSA subsea cables, and also offers the closest traffic exchange point for internet traffic that is not consumed in Ashburn, Virginia.

"With the establishment of the Mid-Atlantic NAP of Virginia featuring Telxius, QTS has effectively removed the requirement for customers with international networking needs to colocate in or connect through Ashburn unless they absolutely have to," said Sean Baillie, chief of staff at QTS. "By eliminating unnecessary network components, QTS' Richmond data center is now the fastest, lowest latency network distribution center in Virginia to and from three continents."

The introduction of these new submarine cables adds to the already robust infrastructure of Henrico County, and establishes Richmond as a new connectivity hub for organizations with international data needs. To capitalize on the rich infrastructure of the region, Facebook is building a new mega campus near the QTS Richmond NAP. This campus will bring a massive amount of compute and storage to the area and provide opportunities for IP carriers and other businesses to connect with Facebook within the QTS Richmond NAP.

"If you have an area that is so concentrated, you want to get away from it so if there is a problem, you have other options to go to," said Ahmad. "If you have a landing station, you can bring it to a NAP and get direct access to both the subsea side and peering on the other side. Both things are important, and this is what [QTS' Richmond NAP] offers."

"We're looking to replicate this model other places as well," continues Ahmad, noting that Facebook establishes four point-of-entry paths for every body of water to accommodate for the time it takes to repair a subsea cable. "You can't really have too many interconnection points."

> **"The subsea cables that terminate in Richmond have opened an amazing opportunity for Henrico County to become a LOCUS for both domestic and international applications. That gives good reason for the creation of the QTS Richmond NAP, a place where multiple providers and Internet services can meet, connect and reach the international cables that link Virginia to other parts of the world."**
>
> VINT CERF, Chief Evangelist for Google and widely recognized as a co-inventor of the Internet

QTS is replicating the Richmond NAP philosophy in Piscataway, NJ, Hillsboro, OR and Eemshaven, Netherlands to continue to support the proliferation of diversified internet connectivity options that are the subject of this paper.

RELIABLE ECONOMICS AND A COMPETITIVE ENVIRONMENT

As an added bonus, diversification introduces competition into the carrier hotel supplier model. The existing single supplier, concentrated connectivity hub solution has allowed carrier hotels to control pricing, leaving carriers with no credible alternate connectivity hubs and no choice but to pay. With multiple connectivity hubs in major metropolitan markets, IP carriers will introduce competition into their supplier base, the only development which will swing pricing leverage to the consumer versus the supplier.

Championing the diversity message

QTS, a leading provider of hybrid colocation and mega-scale data center solutions, has been educating the industry on the risks of centralized connectivity and highlighting the economic benefits of diversification.

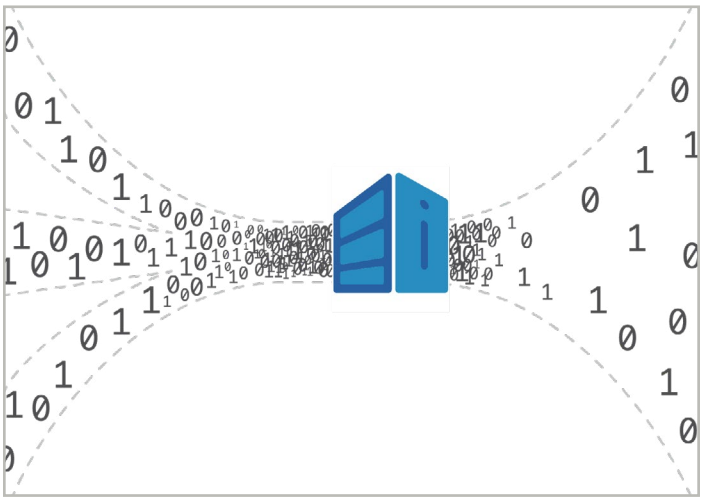
"For the past two years we have been talking to internet network providers about this issue," said Baillie. "Exchanging traffic in a single location presents undo risk and creates undo expense. IP carriers need to diversify their core infrastructure to support the internet and create the opportunity for pricing leverage."

By continuing to build partnerships with businesses and IP carriers in its robust, connectivity-rich data centers, QTS is laying the groundwork to help IP carriers achieve a diversified connectivity strategy.

With data centers located in most existing carrier hotel markets in the U.S. and two in the Netherlands, QTS provides carriers with a reliable alternative to the existing carrier hotels. QTS' open and neutral policies on internet traffic promote the seamless flow of information between networks, allowing customer traffic to enter and exit QTS facilities at non-discriminatory rates. Additionally, QTS prioritizes sustainability and is committed to being 100% sustainable across its fleet of data centers by 2025.

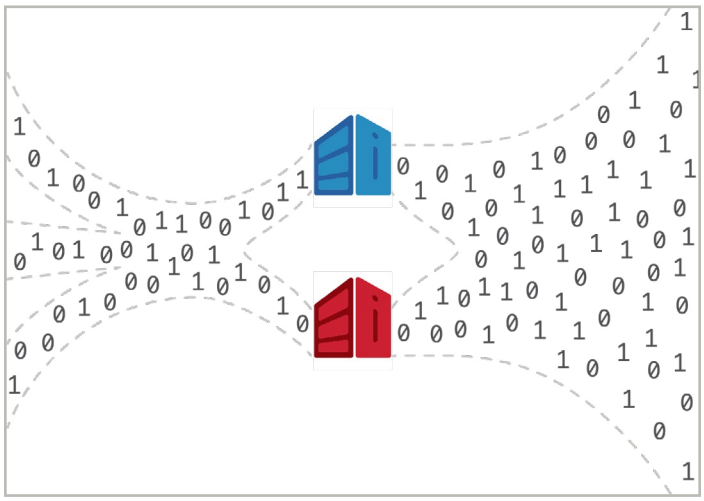
A DIVERSIFIED CONNECTIVITY STRATEGY MINIMIZES RISK OF FAILURE; CONTROLS IMPACT WHEN ADVERSE EVENTS OCCUR; MAINTAINS LOW LATENCY; INTRODUCES COMPETITIVE PRICING FOR SUPPLIERS AND CLIENTS

One Connectivity Hub Bottleneck



Presents risk; increased congestion and latency at entry and exit points.

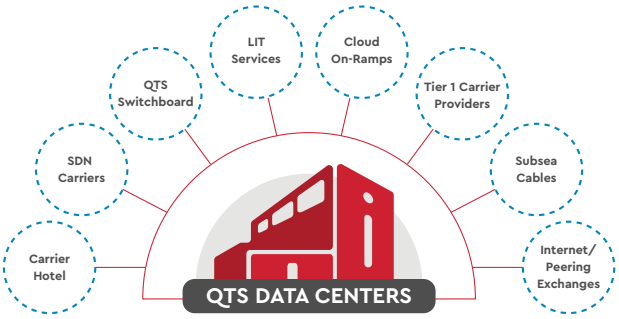
Secondary Connectivity Hubs Keep Data Moving



Minimizes risk; removes congestion – keeps data flowing seamlessly.

ADDITIONAL NAPS

In addition to its Richmond NAP, QTS operates three additional NAPs, which provide access to a variety of connectivity options including SDN networks, Internet Exchanges, cloud providers and subsea cables.



Piscataway, New Jersey. The QTS Piscataway NAP provides a rich ecosystem of multiple fiber entrances, 18+ on-net, carrier-neutral partners, two SDNs and a variety of cost-effective QTS solutions as well as access to the DE-CIX New York Internet/Peering Exchange and regional subsea landing stations. With three underground fiber entry laterals, the Piscataway NAP eliminates single points of failure and maximizes carrier network diversity throughout the region. The LEED Gold-certified facility also utilizes 100% renewable sourced power and an onsite rain collection system.

Hillsboro, Oregon. The QTS Hillsboro NAP offers diversity for U.S. traffic on the West Coast. The multi-facility campus offers 100% renewable energy sourced power and provides express fiber to each building and between future buildings. It also delivers access to the Hillsboro fiber rings for open, lowest cost dark fiber access to existing subsea cable landing stations. Hillsboro also offers property tax abatements, Energy Trust incentives and no state sales tax.

Eemshaven, Netherlands. Located near the Netherlands' largest wind park, the QTS Eemshaven NAP offers a mix of renewable energy sources. Home to the Google cloud platform northern Europe on ramp, the Eemshaven NAP delivers the lowest latency access to Google cloud and serves northern Europe, the former eastern blocks and the Nordics. Eemshaven is also the landfall point for the Cobra cable, a fiber optic submarine cable that connects the Netherlands to Denmark with the ability to connect to the newly delivered AEC-2 cable landing in New Jersey. It also offers a direct link to the Groningen Internet Exchange (GN-IX) and dark fiber access to the Amsterdam Internet Exchange (AMS-IX).

A PROUD MEMBER OF THE IEIC

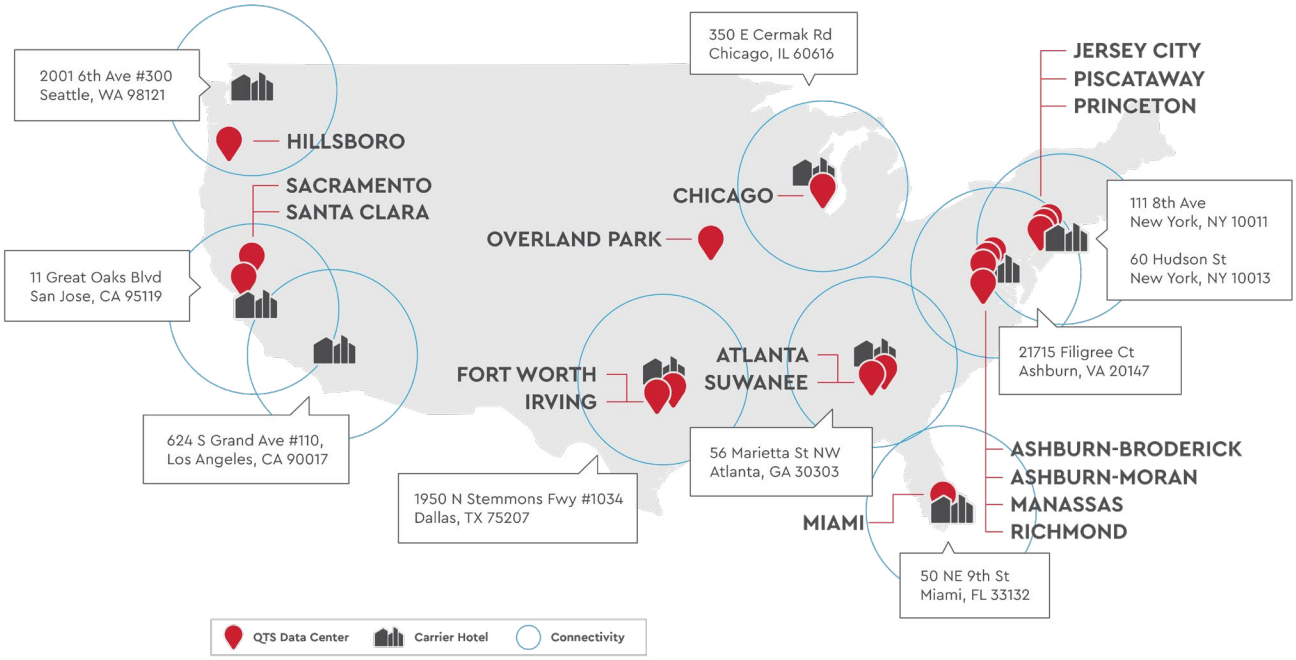
QTS continues its message of diversification and reliable economics through its membership in the Internet Ecosystem Innovation Committee (IEIC). Formed in 2019, the IEIC's membership includes large global brands that recognize the inherent risks of centralized internet exchange points and are taking action to support and safeguard the health of the internet. The IEIC is dedicated to encouraging resilient network designs that minimize single points of failure and build alternate peering points that promote diversity; alleviate concentrated, crowded exchange points; and bolster the health of the internet.

Diversification in action: Network provider strengthens resilience with alternate paths

The diversification message is beginning to make an impact on IP carriers. Recognizing the potential risk of its internet traffic being exchanged in a centralized, congested area, one major IP carrier diversified its presence in the Atlanta market by supplementing its existing carrier-hotel-based router bank with a router in QTS' Atlanta data center. This additional router location allows businesses the flexibility to access the carrier's network at 56 Marietta or QTS Metro. This solution ensures two things. First, QTS customers can gain direct access to a large IP network using an in building cross connect. There is no longer need to incur the expense of metro backhaul. Second, this architecture change ensures that if Marietta has an issue, traffic can quickly be diverted to QTS without impacting latency. Prior to establishing this alternate core router location, the network provider had to divert traffic to its next closest core router hundreds of miles away, introducing cost and latency.

The ability to swing connections to another local node also puts the IP carrier in a more powerful position to negotiate costs with both data center providers and achieve more competitive pricing.

QTS SUPPORTS A DIVERSIFIED INTERNET STRATEGY WITH PRESENCE IN EIGHT OF THE TEN U.S. CONNECTIVITY HUBS.



Conclusion

The internet has reached an importance level for businesses and individuals where the status quo of connectivity design is no longer viable as it risks the stability and the welfare of the internet, and of those companies that supply it. IP carriers need to get ahead of this evolution to minimize risk and cost exposure. By deploying core routers in additional data center locations within the same metro regions as existing router banks, IP carriers can bolster the strength and stamina of their connectivity infrastructure to ensure they can weather an outage without introducing downtime or latency—or impacting customers' businesses.

It's time for IP carriers to diversify their core infrastructure. The risks of not doing so, and the benefits of action, are too compelling to ignore.

Join our Connectivity Ecosystem.

ABOUT QTS

QTS Realty Trust, Inc. (NYSE: QTS) is a leading provider of data center solutions across a diverse footprint spanning more than 7 million square feet of owned mega scale data center space within North America and Europe. Through its software-defined technology platform, QTS is able to deliver secure, compliant infrastructure solutions, robust connectivity and premium customer service to leading hyperscale technology companies, enterprises, and government entities. Visit QTS at www.qtsdatacenters.com, call toll-free 877.QTS.DATA or follow on Twitter @DataCenters_QTS.