



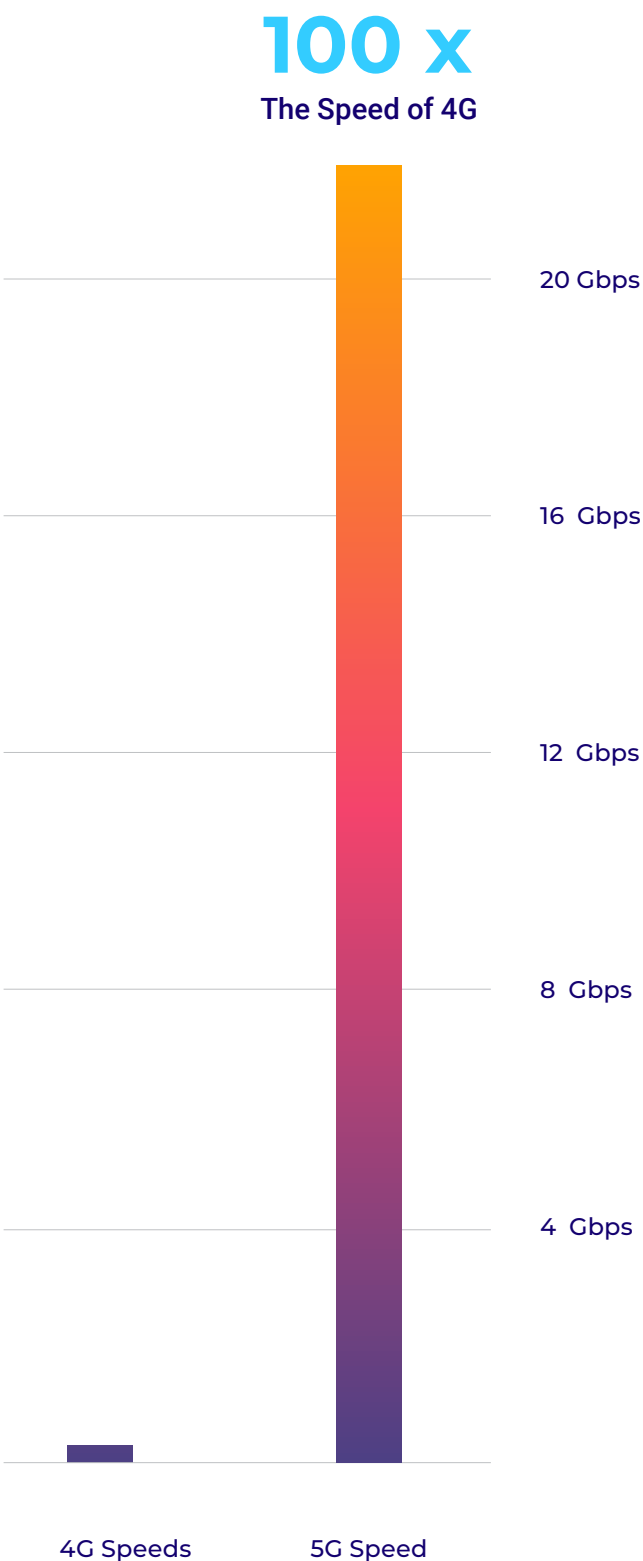
Our Radical 5G Future

WHY COLOCATION DATA CENTERS WILL BE THE CORNERSTONE OF TOMORROW'S TECH

Summary

Traditional 4G networks are no longer sufficient for processing and relaying the magnitude of data that next-generation technologies demand. To enable modern day innovations of a digitally connected world, the future is being built on the fifth generation of wireless connectivity, commonly referred to as 5G.

The performance of 5G wireless far exceeds that of traditional 4G networks. With up to 100 times the speed and up to 1,000 times the capacity, the transition from 4G to 5G is a much more consequential milestone than prior transitions of wireless connectivity. 5G is revolutionizing our daily lives with unprecedented processing power and real-time data relay on any device. It is also unleashing a new industrial era with advancements in autonomous vehicles, healthcare and telemedicine, virtual reality (VR) and augmented reality (AR) gaming, drones and aerospace technology, and millions of connected Internet of Things (IoT) devices functioning as entire smart cities.



However, the speed and bandwidth demands of 5G are far greater than that of 4G, and cannot be supported by centralized cloud servers. For 5G to proliferate and for enterprises to take advantage of the advancements and potential new revenue streams that 5G makes possible, organizations must interconnect at numerous edge data centers with rich carrier profiles. Edge computing, where data is processed on site or in devices rather than within a centralized server, limits the distance between the data source and the end user and provides unparalleled proximity to service providers in the data center's ecosystem. This greatly reduces latency and increases capacity and reliability to levels that are necessary for 5G to work.

Additionally, a number of owner-operated colocation facilities can provide space and an unparalleled ecosystem of providers for 5G innovation hubs, where enterprises can develop and test 5G equipment and applications right on the network backbone. This gives organizations the resources they need to gain competitive advantage and expedite the development and time to market of 5G-empowered products and solutions.

5G is no longer a dream of the future. It is here, and it needs the edge and colocation.

"5G is much more than a 'G.' It is much more transformative. With 5G, we will be moving from a user-centric world to one of massive machine-type communications, where the network will move from enabling millions to billions of devices—an era that will connect these devices intelligently and usher in the commodification of information and intelligence."

Asha Keddy

General Manager of Next
Generation and Standards, Intel



The Endless Possibilities

5G wireless represents an orders-of-magnitude upgrade over 4G. But 5G is more than just an enhancement to its predecessors. With 5G, end users can download and upload speeds of above 1 gigabit per second—enabling unprecedented connectivity on any device, in any location—while enterprises can harness this power to create new strategic opportunities and innovative product and service offerings that significantly broaden their market presence.

Indeed, 5G is revolutionizing our daily lives by making all of our digital experiences faster, more reliable and more enjoyable. 5G cuts response time from 4G's average of 50 milliseconds (0.05 seconds) to 1-2 milliseconds (0.001 or 0.002 seconds).

To put this in perspective, 5G's ultra-low latency means that a typical web page can load completely in one second, versus the several seconds or longer it takes on 4G. No more endlessly waiting for software to download. Video conferencing calls don't freeze up or drop altogether. Streaming videos don't buffer or suddenly stop and reload. Entire HD movies can be downloaded to mobile phones in just a few seconds.

What's more, 5G is enabling science fiction-esque technological advancements such as driverless cars, telemedicine, virtual reality (VR) and augmented reality (AR) gaming, and even entire smart cities. A new wave of entrepreneurship is flourishing, with countless enterprises pursuing innovative technologies and business models—all dependent on ultra-low latency data transmission. Which will gain the most ground? Technologies that enable autonomous vehicles, smart cities, telemedicine, drones, biotechnology, and gaming.

Autonomous Vehicles

Imagine a world where car accidents are rare. It's possible with 5G.

Self-driving cars are becoming a reality. But in order for a car to drive itself, it must be able to take in all of its surroundings and react to circumstances as fast as a human being. These vehicles utilize many cameras and sensors, which produce extraordinary amounts of information. Processing and analyzing this much data in real time requires a much faster, more powerful network than 4G. 5G delivers the speed and processing capabilities needed to match the timing of human reflexes and handle the millions of decisions per second the vehicles have to make.

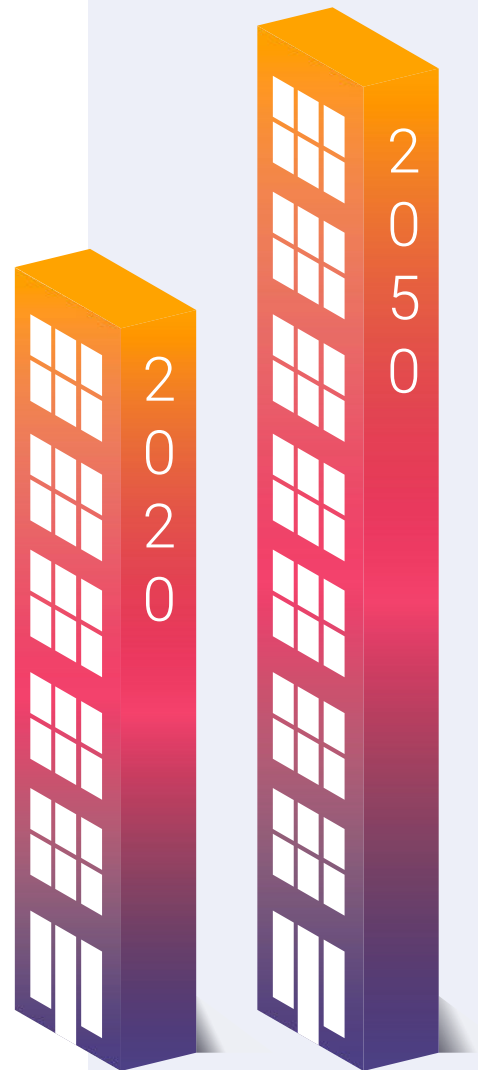
With 5G-powered autonomous vehicles in constant communication with each other, collisions on the road will be significantly reduced or eliminated altogether, and traffic and congestion can be optimized at all times.



Smart Cities

It is estimated that 68% of the world's population will live in cities by 2050, a significant increase from the current 54%. In order for cities to accommodate this rapid growth while remaining functional and responsive to people's needs, they need to become smarter.

5G enables real-time data from thousands of cloud-based IoT devices to give cities the ability to monitor events as they unfold, understand citizens' needs, and respond with faster and lower-cost solutions. This has the potential to significantly raise the quality of life in urban areas, from public safety and disaster response and recovery, to shorter, more seamless commutes, to cleaner, more sustainable environments.



Telemedicine

There is probably no industry where low latency is more important than healthcare. Advances in telemedicine have enabled virtual appointments where patients can see their doctor from their home, increasing healthcare accessibility to patients who can't easily get to a doctor.

Clipboards and paper charts are being replaced by digital devices and databases. Even surgery can now be done remotely. High-speed, worry-free connectivity is now vital for the healthcare industry.

5G is spearheading this monumental transformation in healthcare. The bandwidth and ultra-low latency of 5G connectivity provides much higher-res video and images, substantially increasing the quality and value of virtual interactions between doctors and patients. Data between people and devices can be shared much faster and more efficiently, affecting crucial healthcare decisions. 5G-enabled apps and wearables can use powerful machine learning to analyze health data in multiple situations, from diagnosing conditions to detecting the need for emergency medical attention.

With its unmatched speed and availability, the 5G network will enable a host of new possibilities for the healthcare field, significantly improving patient care and outcomes.



Drones/Aerospace

5G is driving new use cases for unmanned aerial vehicles that were previously impossible with 4G. A.I.-enabled drones with advanced perception capabilities can process exponentially more data and report that data in real time. The enhanced capabilities 5G brings to drones are immense and the use cases are bountiful.

Drones can now be used for first responder assistance, monitoring wildfires and other natural disasters, and delivering medical supplies to specific locations. They can assist in search and rescue operations and even use facial recognition technology to locate missing persons and combat human trafficking.

Smart cities can utilize drones for traffic monitoring, line inspections (gas, electricity, railway etc.), safety inspections of buildings and towers, and security and public safety initiatives. Farmers can use drones for soil assessment and crop monitoring. Industries such as construction, timber, mining, and oil and gas can utilize drones for terrain scanning and underground analyses. The possibilities are endless with the ultra-reliable and low-latency connectivity that 5G brings.



Biotechnology

Biotech is one of the most data-intensive industries in the world. Staggering amounts of data are required to develop and trial new specimens, new products, new cures, and new solutions. But limited speed and bandwidth means limited progress.

It is common for sudden, dynamic changes in laboratory specimens to occur, and when breakthroughs happen, there are massive surges in computation, processing and data collection that are seldom seen in other fields. Results in one lab need to be emulated in multiple locations, sometimes worldwide. Genomics, crowd-sourced research and development, electronic clinical research, biotech analytics, drug discovery and testing all depend on the ability to process and manage rapid flows of voluminous data.

The power of 5G is redefining innovation in biotechnology by enabling labs and devices to process and transmit exponentially more information much more quickly, and empowering AI and machine learning to track and analyze millions or even billions of molecular interactions and glean valuable insights, expediting the development of new advancements. From shortening the R&D time for new drugs to gaining deeper understandings of the relationship between genetics and diseases to creating new gene and cell therapies and potential cures, 5G is fundamental to a new era in biotech and life sciences.

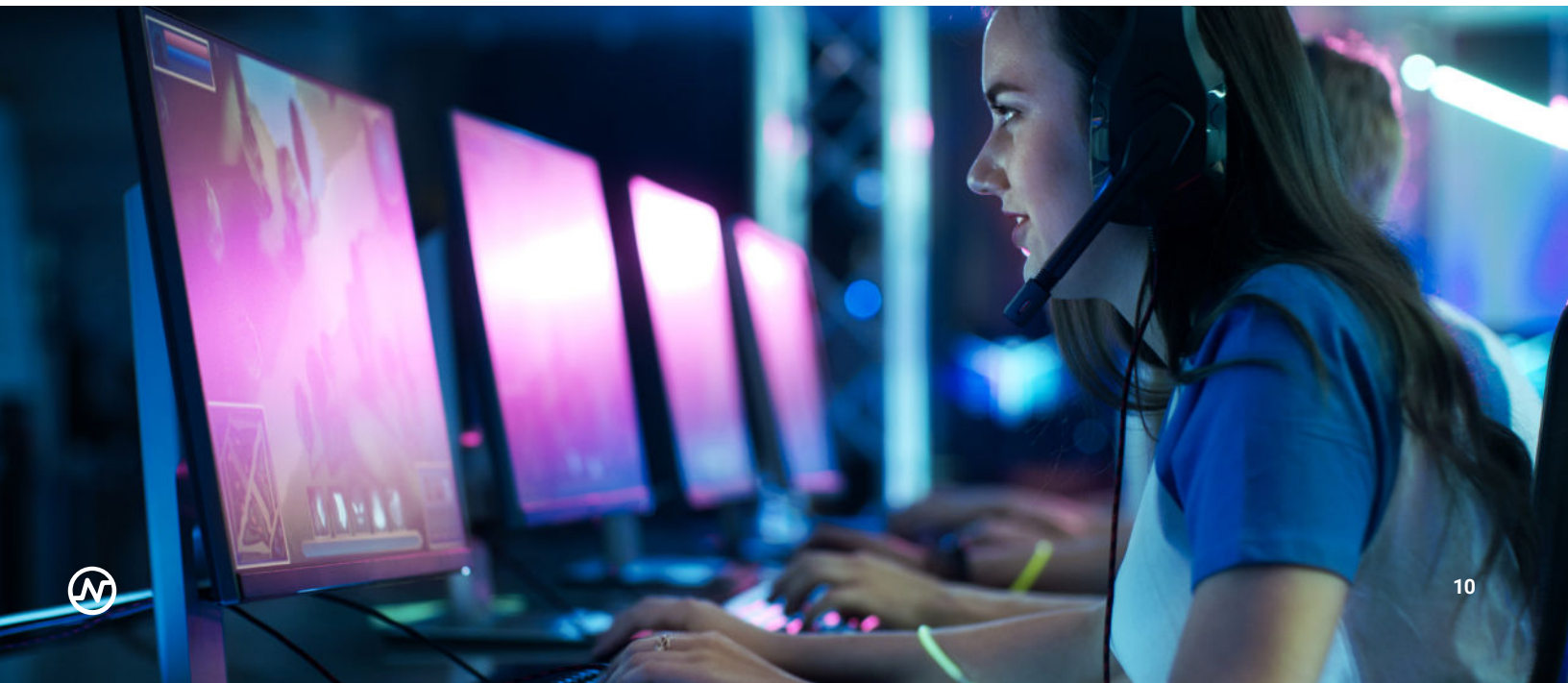


Gaming

If there's one thing gamers hate, it's latency, so the 4G network was quite limited in expanding cloud gaming capabilities. Gamers are twice as likely to abandon a game when they experience even milliseconds of delay.

With the number of gamers substantially increasing all over the world, along with demand for new data-intensive gaming technologies such as augmented reality (AR) and virtual reality (VR), the 4G network could no longer provide the capacity and connectivity the cloud gaming industry needed to serve its customers.

5G wireless technology, however, has propelled cloud gaming into another dimension. With 5G, players can enjoy richer, more sophisticated games that can be played on many more devices, including mobile phones. With up to 100 times the speed and up to 1,000 times the capacity of what's possible on 4G, an explosion in new gaming innovations is upon us, especially in live streaming, esports, and AR and VR-based gaming. 5G ensures the response time between pushing a button or moving one's body in a VR or AR game is instantaneous, with no delays, buffering or packet loss, and opens up unprecedented revenue streams for cloud gaming and esports companies.



The 5G Rollout

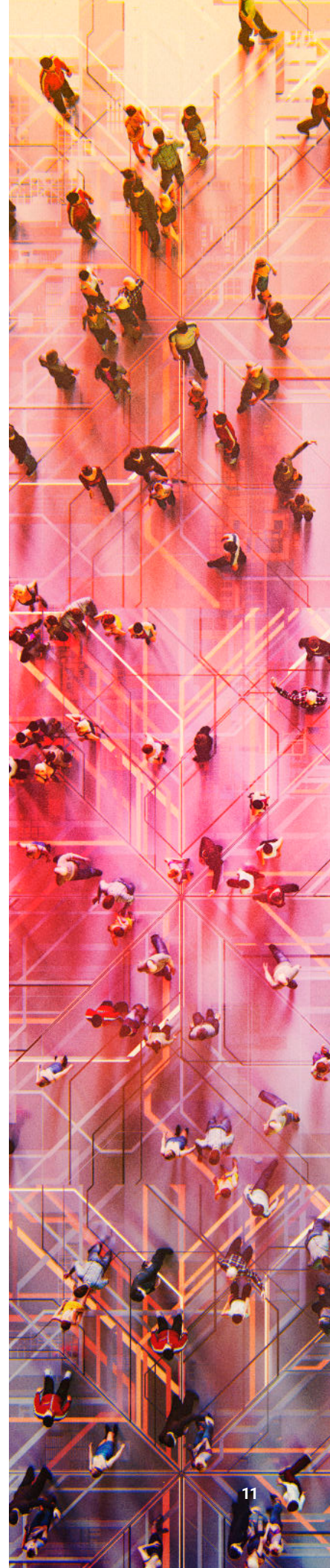
5G is being rolled out in cities across the country at varying speeds and scope. However, 5G service is more complicated than 4G or any of its predecessors, and there are some key prerequisites to providing adequate 5G coverage.

The widespread rollout of 5G requires ample planning and significant enhancements to existing communication infrastructure. Since 5G waves can't travel as far as 4G waves, 5G coverage requires many more cell towers, antennas, connective nodes and central switches. Most importantly, 5G requires many edge computing and interconnection hubs located close to dense populations.

Today's 4G LTE network operates on established frequency bands below 6 gigahertz (GHz). However, 5G requires frequencies that fall into the 30 GHz to 300 GHz range. This higher-frequency range, known as the millimeter wave (mmWave) spectrum, allows for data rates up to 10 Gbps.

While the mmWave spectrum can handle substantially more data than 4G bands, waves at these higher frequencies have high atmospheric attenuation and get easily absorbed by gases in the atmosphere. This significantly limits their range, so adequate 5G coverage requires a highly distributed infrastructure. 5G antennas (typically the size of a pizza box) have to be fixed to existing infrastructure such as utility poles, lamp posts, rooftops and the sides of buildings, at least one per square mile.

While these antennas can rapidly transmit data between them, they can't process the data. 5G, therefore, requires antennas that are placed in close proximity to the data source and are located at data centers where data can be processed on site. In other words, 5G needs the Edge.



5G Needs the Edge and Colocation

Since 5G requires an unprecedented level of rapid data transmission, organizations of all types will need to shift to the network edge in order to enable 5G-level applications and services. With edge computing, data is processed on site or in devices rather than at a centralized server, limiting the distance between the data source and the end user and greatly increasing performance, capacity, and reliability.

In traditional telecommunications architecture, data is transferred from tower to tower and compute power is located within centralized server farms. However, the performance demands of 5G are far too great for centralized cloud servers to support. Centralized clouds can't handle 5G bandwidth requirements, and it takes too long for data packets to travel from 5G devices to centralized servers and back again. 5G therefore requires organizations to interconnect at numerous edge data centers located near the data source.

Interconnected colocation facilities—located in close proximity to end users—support 5G's low latency and high bandwidth requirements by placing dense processing power at localized points of presence (PoPs) geographically close to users and their devices. This enables the fastest and most seamless delivery of 5G services.

Colocation facilities also provide direct access to multiple disparate long-haul and metro carriers and direct cloud on-ramps, supplementing existing IT delivery infrastructure options, such as on-premises data centers, private clouds or public clouds. Enterprises can directly access an ecosystem of carriers and network providers while keeping pace with the data processing and transmission demands of 5G. In fact, Gartner predicts that 75 percent of enterprise-generated data will be created and processed at the edge by 2025—an enormous spike from just 10 percent in 2018.



5G Innovation Centers at Colocation Facilities

5G is opening new opportunities and novel possibilities for drones, autonomous vehicles, telemedicine, gaming, biotechnology and content delivery of all types. But one of the most difficult challenges for enterprises today is ensuring apps, devices and services are optimized for 5G. Enterprises need the right space, partner and resources to innovate with 5G and bring your 5G technologies and services to life.

Many colocation facilities, especially those that are owner-operated, can provide enterprises with an ideal controlled testing environment to simulate 5G use cases. Wireless carriers, RAN equipment manufacturers, 5G application developers, oil & gas companies, and many other industries can create 5G testbed labs to research, develop, and test 5G-empowered technologies.

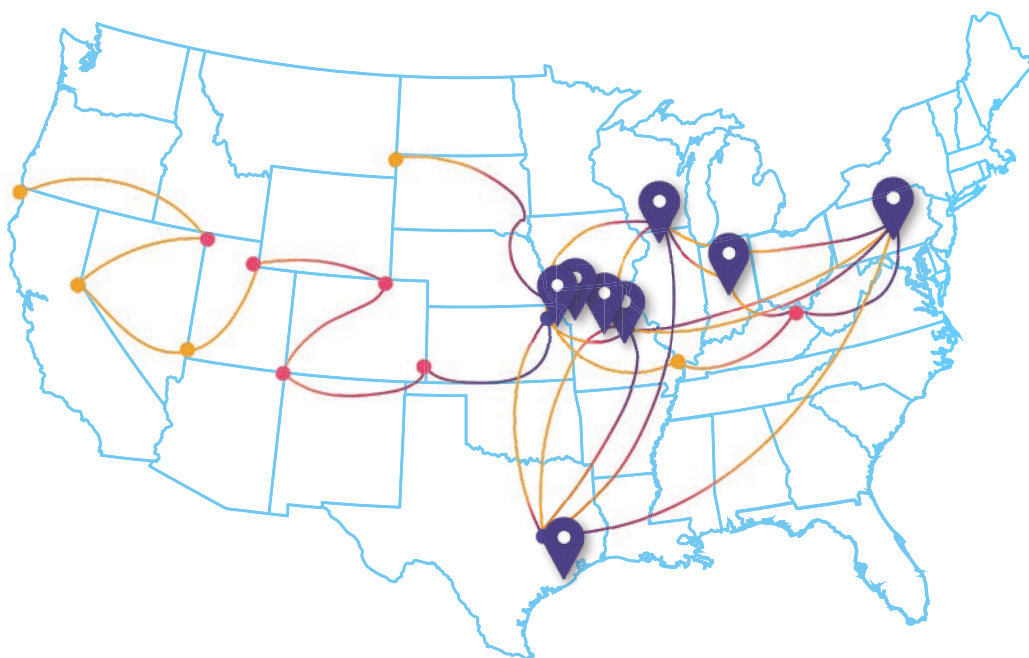
With a 5G innovation hub located in a colocation facility, enterprises can test their equipment right on the network backbone. With 5G connectivity, edge computing, roof space, line of sight for 5G towers, charging stations, antenna deployments, mobile networks and other amenities available on site, organizations have the resources they need to gain competitive advantage by expediting the development and time to market of 5G-empowered products and solutions.



Our Revolutionary 5G Future

5G is raising our quality of life in many ways. Better access to healthcare and improved healthcare quality through telemedicine; safer and more efficient transportation through self-driving vehicles; safer and greener cities through smart technology and IoT; revolutionary advances in everything from video games to biotechnology. It is an exciting new era for technology and connectivity.

Highly interconnected colocation data centers, located at the convergence of long-haul and metro fiber, allow for optimal 5G data transmission. For enterprises running applications that require ultra-low latency, interconnected edge data centers and colocation facilities located in close proximity to their end users deliver the processing capabilities necessary to remain competitive. Every industry—from logistics to healthcare to gaming—stands to benefit from bringing the last mile of data processing closer to where their customers are.



Colocation providers like Netrality are pivotal to the expansion of 5G coverage and powering 5G-enabled innovations. Netrality's interconnected colocation facilities are located in densely populated urban centers close to millions of end users, enabling smooth delivery of critical services at key edge locations. Leveraging edge facilities like Netrality's enables enterprises to directly access multiple disparate long-haul and metro carriers and direct cloud on-ramps while keeping pace with the data processing and transmission demands of 5G. These direct connections also provide unparalleled reliability and the ability to scale virtually indefinitely, accommodating enterprises' needs for flexible, cost-efficient growth.

As the building owner and operator, Netrality can provide both data center and unique office space that enable a 5G test-bed environment for the whole development life-cycle. Enterprises can custom-build 5G innovation hubs to design, test and optimize 5G technologies and services. Hubs can be refurbished and customized, and any necessary equipment can be added as needed. There are no management hoops to jump through, permits to worry about, or complications to hinder progress.

As Netrality's footprint continues to expand across major US cities, and as more CDNs, cloud and network service providers, and enterprises join each building, connectivity grows and the value delivered to the community of stakeholders steadily increases. In turn, Netrality's facilities become the hub for those who need direct 5G connectivity and bandwidth flexibility across multiple networks and clouds and those who provide those services. Netrality is with its customers every step of the way.



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