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Infrastructure Implications for Edge Deployments

Moving Compute Functions to the Edge Makes Infrastructure More Critical

WHITE PAPER

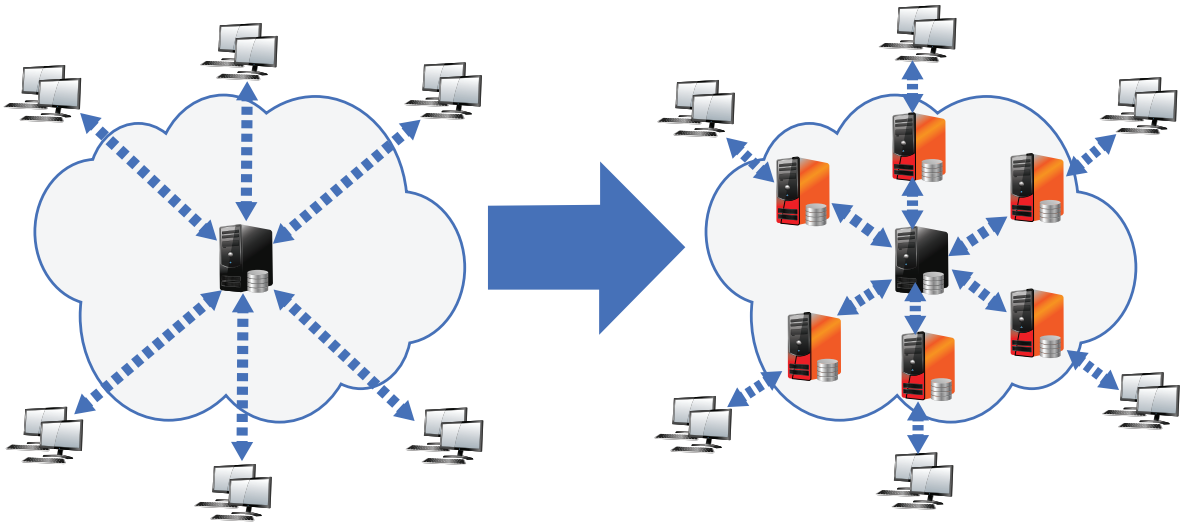
Introduction

Remember ten years ago (2009)? Facebook was this fairly new thing that all the kids did, and mom and dad were recently exposed to. Twitter was 140 characters of new hotness. And then there was this buzz word that everyone used called "cloud."

Fast-forward to 2019. Grandma and Grandpa have joined the crowd on Facebook. The kids have added new platforms like Snapchat and Instagram to their social routine. Twitter is 280 characters of wittiness, news and entertainment. And that "cloud" buzzword is a part of everyday life. Everyone uses a cloud technology in one form or another, even though they may not know it. The current day buzzword that will have a similar impact is "Edge compute." Edge compute is, simply put, a trend that is pushing the compute power of the cloud closer to the end user. This makes sense from couple of different aspects. First, it reduces the latency between the end use and the compute resource (i.e.; cloud or servers). Second, it reduces the bandwidth across the Internet by placing the compute in closer proximity to the end use. This white paper will explore Edge compute and some of the physical infrastructure impacts it will have and will call out the four environments of Edge compute deployments.

Edge Compute Explained

At its core, Edge compute is a shift from a centralized compute model to a hybrid distributed compute model. What exactly does that mean? For the past 20 years or so, the compute model has been almost strictly centralized. Whether your company used an on-premise data center, cloud compute, or hybrid cloud model, it is a centralized compute model. All the data is processed and stored in a central location (i.e.; data center, cloud data center, etc.). Edge compute is supplementing that model with additional compute resources at the edge or in closer proximity to the end use. Industry thought leader Rajashree Rao succinctly defines Edge computing as “the practice of collecting and analyzing data where it’s generated – at the network edges.”*

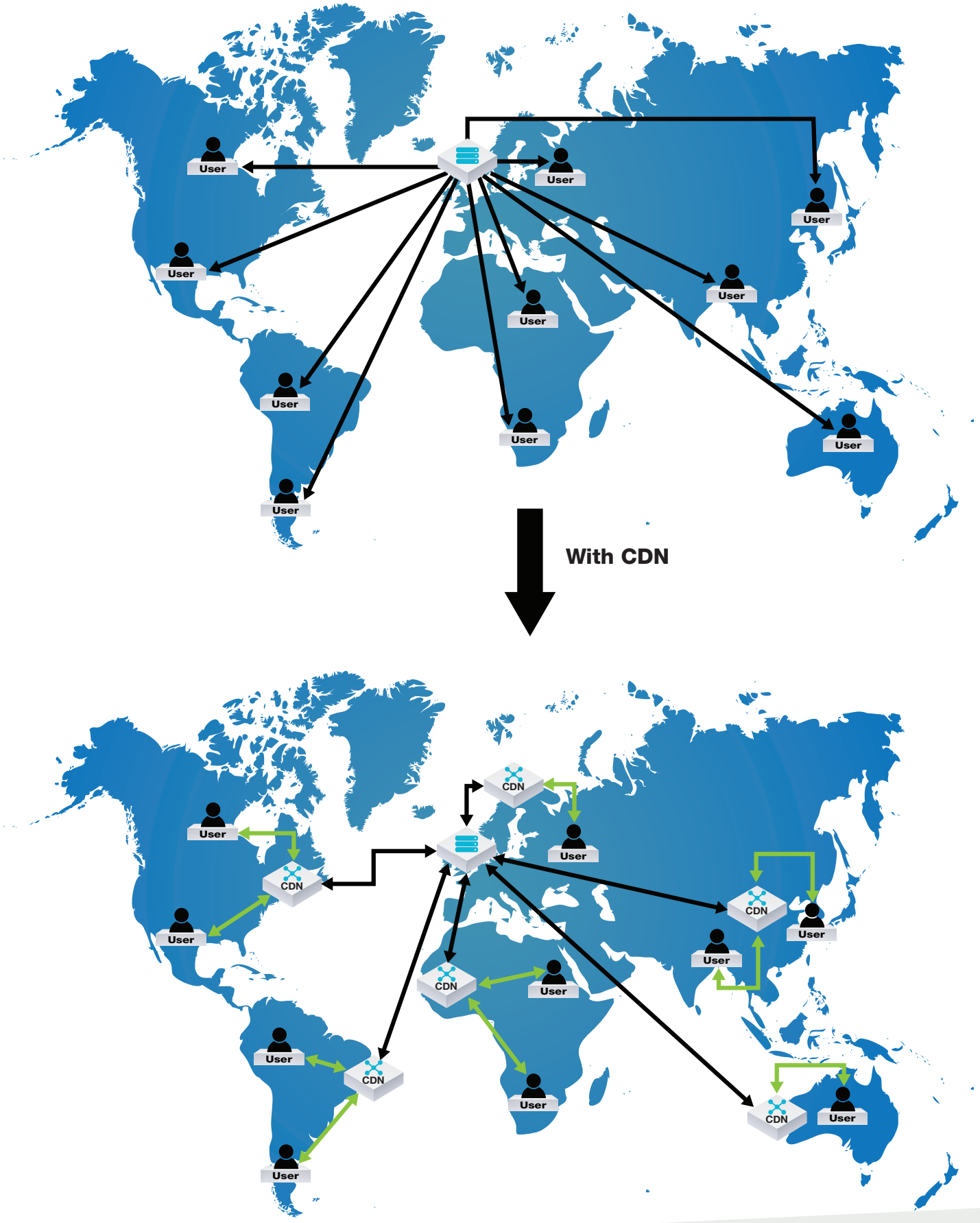


Centralized Compute Architecture **Distributed Compute Architecture**

CDN the Original Edge Compute Application

Content Delivery Networks or CDNs are a service that you take advantage of every time you watch a video or download anything from the Internet or your favorite social media platform. With a CDN, content is uploaded to an origin server, after which the CDN distributes it to all the Points of Presence (PoPs) in the CDN. Once distributed, end users pull the content from the closest CDN PoP, rather than the origin server.

*https://techutzpah.com/edge-computing-event-horizon-part-i/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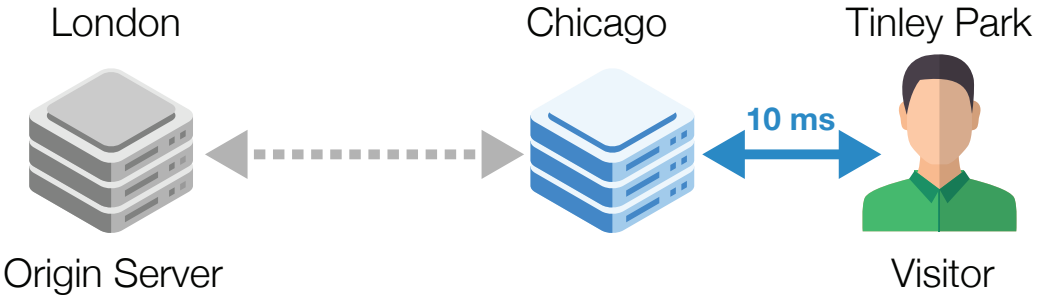
Consider this example: An end user near Chicago wants to download content housed on a server in London, with no CDN. The downloading of that content will suffer from high latency, potentially 220ms. This will appear as buffering, lagging, or pixilation. If a CDN is present, with a PoP in or near Chicago, the content downloads quickly and consistently with the latency potentially 10ms. The end user experience is much better.

Without Cached Content

With Cached Content



CDNs are mutually beneficial to both the content provider and the end user. Content providers see benefits in the reduced cost, due to a reduction in bandwidth requirements. End users see benefits in improved quality of user experience and higher available quality of video.

Content Provider Benefits

- Reduced latency
- Reduced bandwidth requirements
- Cost reduction
- Scale
- Security

End User Benefits

- Higher quality end user experience (less buffering video and pixilation)
- Higher quality video (HD/4K UHD) available

Use Case for Different Verticals

Edge Colocation

The colocation market has been growing for decades. For the most part, growth has been driven by colocation facilities located in or near larger Tier 1 cities (i.e. New York, San Francisco, Chicago, etc.). Applications that were running in these facilities were not particularly latency sensitive, and thus the distance of the colocation facility from a company's office was of little concern. The Edge computing trend is changing that view. Some applications are becoming more sensitive to latency, and thus the closer a facility is located to the end user, the better the performance of that application. Edge colocation is taking advantage of the trend to move colocation facilities into more Tier 2 and Tier 3 cities. This is allowing companies with operations in more rural locations to gain the benefits of colocation, while not compromising latency sensitivity in the process.

Healthcare

Patient-generated health data (PGHD) is a perfect healthcare use case. In a perfect world, data generated by IoT devices like wearables, blood glucose monitors, home scales, telehealth tools, mHealth apps, and other sensors could be collected and analyzed for patterns in one's health, allowing for detailed preventative healthcare and event detection. Patient data could be analyzed at a macro level to detect patterns in a multitude of different areas. Unfortunately, we do not live in a perfect world. In 1996, The Health Insurance Portability and Accountability Act (HIPAA) was passed in the United States, due to concerns about sensitivity of healthcare information and the lack of security in place for that data. HIPAA restricts how healthcare information can be transferred and analyzed. The challenge becomes transferring PGHD securely within the boundaries that HIPAA necessitates. Published reports show that an estimated 40% of IoT sensors will be PGHD devices, so this going to become an industry-wide challenge very quickly.*

Industrial/Manufacturing

The Industrial Automation space has been collecting and analyzing data for decades. This data has historically been processed in centralized data centers, which in some cases can be in a location quite some distance from the factory floor. Many newer industrial automation applications require real-time or near real-time interaction with compute resources. Due to this requirement, many factories are moving the compute resources closer to the factory floor or on the factory floor. This opens up a whole other realm of issues when you expose data center servers and networking equipment to the harsh environments of the factory floor. Contamination from water, dust and corrosives become potential hazards. Harsh environment enclosures, equipment, and physical infrastructure are required to properly address these issues.

*https://medium.com/datadriveninvestor/7-staggering-stats-on-healthcare-iot-innovation-fe6b92774a5c

Retail

The brick and mortar retail space has been under assault from online retailers for quite some time. To counteract this assault, brick and mortar retailers are always searching for advantages they can leverage to provide a competitive edge. A lot of the innovations driving this competitive edge require a significant amount of additional compute power at the retail location.

- Augmented reality (AR) mirrors can show shoppers in different clothing without physically trying them on
  - Amazon has patented a mirror that dresses viewers in virtual clothes
  - Magic Mirror is an independent free-standing console with a digital screen, that allows you to "try" on different outfits using simple hand gestures
- Coca-Cola Freestyle machines have servers attached to them that collect and process customer preferences on site, then send information to the cloud
- Amazon Go stores enable customers to grab items off the shelves and simply leave

Agriculture

Smart farms are becoming the standard in today's ultra-competitive agricultural landscape. Any advantage that can be obtained by technology is directly attributable to higher yields resulting in higher profits. Many companies are competing in this space to provide farmers with the best and most comprehensive data about their fields. This is allowing farmers to make informed decisions about planting, irrigation, and harvesting based on multiple data sources, which include direct sensor data from the fields and even satellite data.

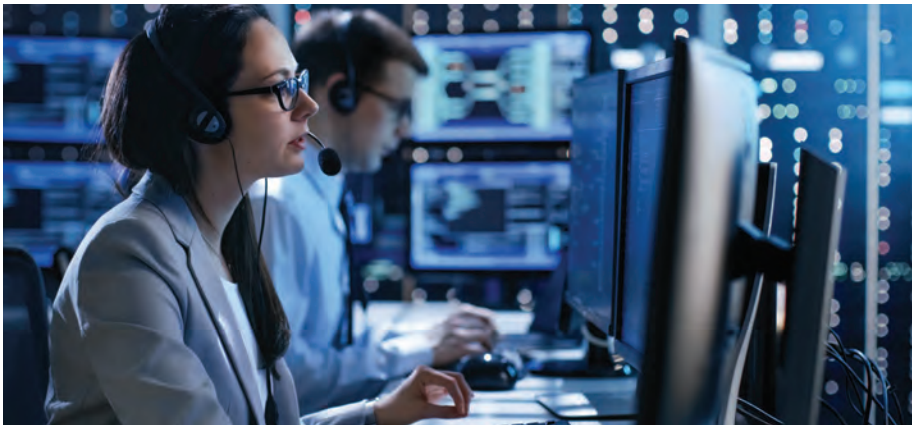
The Four Physical Infrastructure Environments of Edge

We have identified four types of physical infrastructure environment that will be prevalent in Edge compute deployments. The four environments are listed below.

Highly Protected Indoor

The Highly Protected Indoor environment is going to feel very familiar. It's basically the data center space that you currently have, just potentially in an area you're not used to. This environment will have most or all the amenities of a traditional data center space, including power, cooling, connectivity, physical security, and a highly protected setting that you would expect in a traditional data center. What it could lack is the trained data center staff to handle every need, so remote management will be key to a successful deployment.

A great example of this environment would be Edge colocation. Several colocation companies have adopted the Edge as their business strategy. These colocation data centers are in non-traditional second and third tier cities, closer to the end user/use.



- Remote data center or similar deployment including highly controlled environment and room/data hall level security
- Example: Edge Colocation DC

General Indoor

The General Indoor environment is also going to feel somewhat familiar. A great example of this environment would be a telecom room, server room, or closet.

- Indoor deployment with controlled environment but limited cooling, and basic security
- Example: Retail stores, healthcare facilities

Harsh Indoor

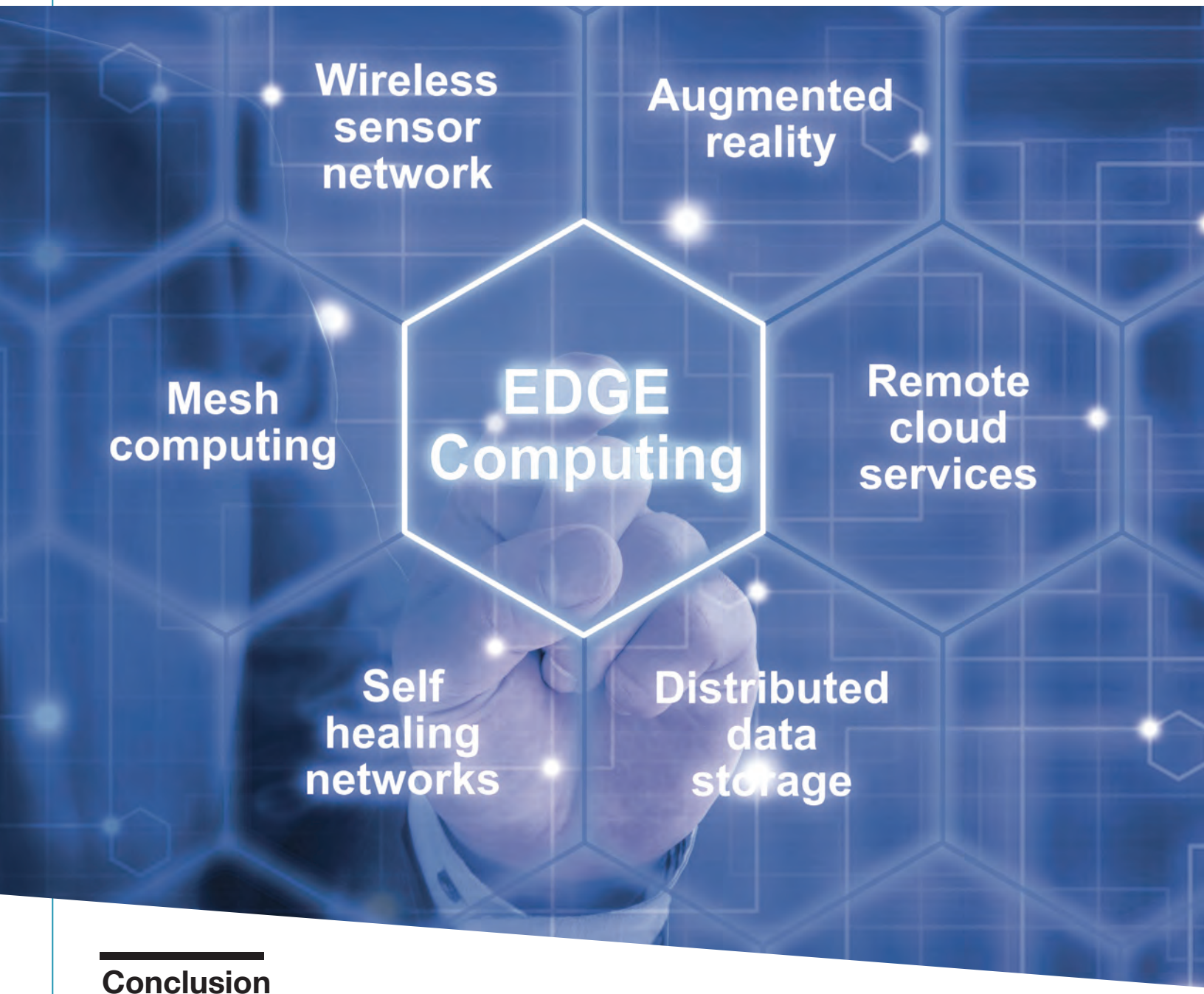
The Harsh Indoor environment is where the familiarity begins to end. A great example of this environment would be on the manufacturing floor. A lot of applications on the manufacturing floor are requiring lower latency to perform at an optimum level. This requirement is causing equipment to be placed in closer proximity to the end use. When the use case is in an industrial, warehouse, or similar setting, this may require the use of a cabinet and connectivity rated for a harsher environment. A harsh environment enclosure provides protection from water and/or dust and environmental protection and services.

- Limited protection from the outdoor environment and limited security; potential for dry or liquid hazards (dust, water)
- Example: Manufacturing floor, warehouse

Outdoor

The Outdoor environment is where the familiarity is completely over. When compute equipment is required to be placed in the outdoor environment, it must either be placed in an enclosure that is able to provide a “data center” like space within that enclosure or be hardened to the point that it can withstand the extremes that the outside environment can bring, or both. When dealing with the outdoor environment several factors must be considered in the selection of the equipment and enclosure including:

- Temperature control (heating, cooling, solar loading)
- Sealing (against liquids, particulates, corrosives, and flora and fauna)
- Physical security (access control, anti-vandalism)
- Electromagnetic shielding
- Vibration and shock isolation
- Example: Agriculture, Mining



Conclusion

As you can see, Edge compute is changing the way that network and compute resources are being deployed. Many new and unfamiliar decisions will have to be made to have a successful Edge compute deployment. Physical infrastructure is foundational to Edge deployments. Robust, standards-based physical infrastructure solutions enable consistency and reliability across a geographically distributed Edge footprint. Panduit facilitates Edge environments with a market leading end-to-end infrastructure portfolio and a proven history of innovation in the infrastructure space.

Since 1955, Panduit's culture of curiosity and passion for problem solving have enabled more meaningful connections between companies' business goals and their marketplace success. Panduit creates leading-edge physical, electrical, and network infrastructure solutions for enterprise-wide environments, from the data center to the telecom room, from the desktop to the plant floor. Headquartered in Tinley Park, IL, USA and operating in 112 global locations, Panduit's proven reputation for quality and technology leadership, coupled with a robust partner ecosystem, help support, sustain, and empower business growth in a connected world.

For more information

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