Planning Now for the Future: Hybrid Edge Data Centers

WHITE PAPER

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Introduction

No one can deny the mobility surge we're experiencing. Take a close look the next time you sit down in a meeting, head to the grocery store or sit in the waiting area for a doctor's appointment. Nearly everything we do involves the use of a smart device.

This reliance on constant communication and connectivity is boosting the amount of traffic being generated and moving us closer to 5G wireless technology—which makes bidirectional (send and receive) traffic a significant consideration.

Relying on one central location to send and receive all this data wastes valuable time and money. It can also create congestion and long transmission times that interrupt users and lead to downtime or failure—which aren't options in mission-critical applications.

For this reason, more devices will start to send data to the "edge" and the cloud—and we'll need to rely on more than one type of infrastructure (a "hybrid" approach) to make it happen.

To achieve faster response times, edge computing repackages traditional, on-premises computing and moves latency-sensitive applications (like multimedia streaming and telehealth) closer to the people and devices using them.

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In order for edge computing to flourish, it needs the hybrid cloud (public and private) as support—and this comes together with edge computing to form hybrid edge data centers. These data centers need interconnections with each carrier possible, which allows the site to fulfill all applications—no matter what they are.

This way, hybrid edge data centers can deliver latency-sensitive data close to users and

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integrate with core or centralized applications in public clouds or corporate data centers. Instead of supporting only outward-bound data, they also support bidirectional data we mentioned earlier as part of 5G.

Hybrid edge computing can be thought of like the hub and spokes of a wheel. Although each spoke is located at a different point around the outer part of the wheel (the "edge"), each one connects to the same location. In this example, all the spokes could be considered edge data centers, sitting closer to end-users. Hybrid computing allows you to use third-party services to connect the components of the edge to the wheel's other components. This creates a mesh network instead of a hub-and-spoke network.

Because edge data centers can live in multiple locations and take on different forms, a hybrid approach makes it easier to accommodate these variations in terms of cost and operation. It allows you to choose the best approach for each task or workload.

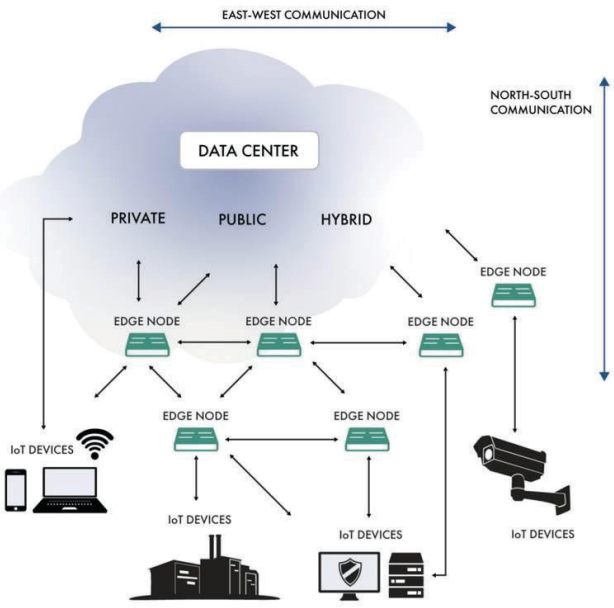

Photo: ZDNet

Where Hybrid Edge Data Centers Are Being Deployed

Retail Locations

Stores and restaurants with brick-and-mortar locations spread out across a region often struggle with efficient data and workload distribution because network communications are routed from the centralized data center to locations that are hundreds or thousands of miles away.

These issues are further complicated by the strain stores and restaurants face as they compete not only with each other, but also with e-commerce options. To stay competitive and offer amenities that will lure customers through their doors, retailers are turning to automation and IoT. This demands a new level of network intelligence as more devices are brought into these sites.

For example, Kroger supermarkets are using digital price tags that can be managed remotely so they're always in sync with the POS and stay up to date. Fashion retailer Zara uses AR technology to let shoppers use their phones to view models wearing Zara clothes. If a customer doesn't have time to head to the dressing room, they can see right on the retail floor how the clothes fit and move on the model.

In quick-service restaurants, IoT is being used to support more automation. When a customer orders a malt, for example, the POS system can automatically a send signal to the correct machine so it starts churning the ice cream.

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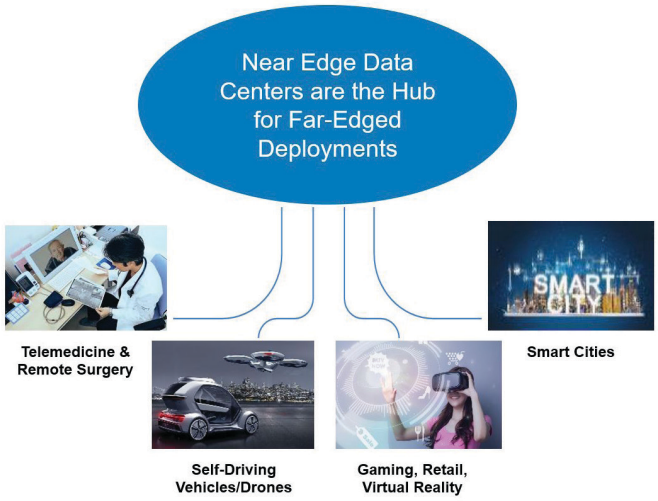
All these new services and technologies depend on low latency—the kind offered by hybrid edge data centers—to keep customers engaged. While some compute functions are designed to take place at the edge, other data and applications are better suited for the public cloud or main data center. Hybrid edge data centers can handle this mixed approach as well.



Healthcare

Many patients use devices that monitor and report vitals to healthcare providers, whether it's a pacemaker, CPAP or glucose meter. Clinicians are using tablets to access clinical information and EHRs. The industry is also shifting from providing in-person care to a combination of in-person and virtual visits—spurred in part by the pandemic—which makes hybrid edge computing more crucial in these applications.

While short delays here and there may not seem like a big deal, they quickly add up in a healthcare environment. For instance, slow uploading of patient data can create scheduling issues and extend patient wait times. Spotty or dropped telehealth interactions create frustration and the risk of dangerous miscommunication. Lag time when moving data from a patient monitor or device to a clinician can negatively impact care.

To reduce latency, hybrid edge data centers move computing closer to patients and providers so data like high-res imagery and patient information can be processed and managed close to the edge for faster upload and processing speeds.

Considerations for Hybrid Edge Data Center Operation

Although every hybrid edge data center is different, they all have a few characteristics in common: automation, connectivity, redundancy and elasticity. To support this type of operation, hybrid edge data centers are often unmanned, rely on SD-WAN architecture and deploy leaf-spine topology.

Lights-Out/Unmanned Data Centers

In traditional data center environments, there are people nearby to monitor performance and troubleshoot issues. Hybrid edge data centers are usually unmanned, which means they are often fully automated, are remotely managed and operate without the need for constant onsite staff. The lights can literally be turned off to save the operator money. Instead of engineers and operations managers being nearby, data center services and equipment are monitored and managed from other locations.

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This means that conditions don't necessarily have to be suitable for long-term occupancy. Decisions about things like location, aisle layouts, temperature and server rack heights may not need to put human operators at the forefront—instead, the focus can be on maximizing square footage.

When people are needed onsite (for a hardware change, for example), the data center sends an alert to let them know.

Lights-out data centers may not be mainstream yet (although many IT departments already work with technology like software-defined networking [SDN] and virtualization), but COVID-19 showed many operators what they might look like. In many cases, the pandemic proved that data centers could still operate with much less human involvement than originally thought—which is a good sign for the future of hybrid edge data centers.

SD-WAN/Automation

Because of the shift to lights-out data centers, software-defined infrastructure (SDI) is becoming a necessity. It supports the operation and control of IT infrastructure through the use of software—and without any human involvement. In particular, SD-WAN (a software-defined wide-area network) has proven to be a valuable tool in delivering certain types of connectivity.

SD-WAN and hybrid edge computing can work together to share infrastructure and route traffic to appropriate edge resources.

Through SD-WAN, application traffic can be directed to onsite or edge resources with available service, which can be particularly helpful for organizations that have multiple locations spread across a metro area (such as banks, big-box stores or gas stations, for example).

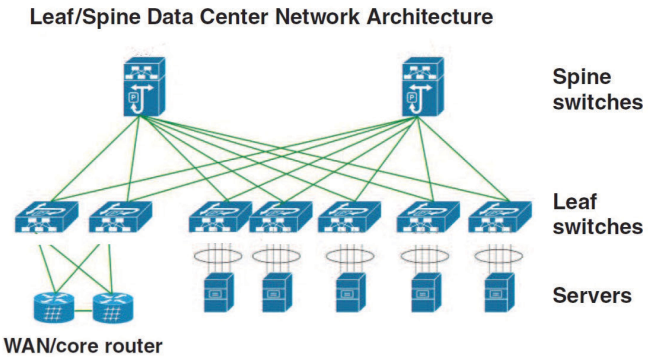
SD-WAN can run on edge computing hardware or act as a platform to support edge computing. It also helps automate moves, adds and changes by decreasing the amount of time and number of resources required while automating network programming.

Leaf-Spine Architecture

The data center's traditional approach to networking has not kept up with technology. As applications and goals change, a more flexible topology is needed. Traditional networks tend not to be as scalable, agile or flexible as they need to be to support automation and lights-out data centers.

As hybrid edge data centers move toward automation, many get stuck as they attempt to automate layer 1 (the physical layer), which "plays" with cabling, connectivity and local area networks (LANs). Software-defined networking (SDN) is one way to facilitate automation at this level. While IT operations teams have been providing on-demand services and change requests, layer 1 networking has remained stubborn.

Leaf-Spine



Traditional Three-Tier

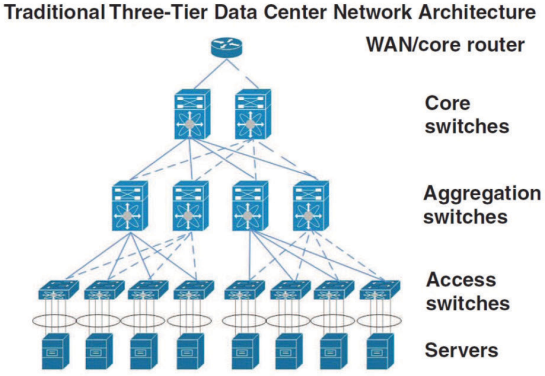


Photo: www.fiber-optic-tutorial.com

To facilitate automation, you can eliminate cross-connects from meet-me rooms and instead create a full mesh-network topology with leaf (aggregation) switches (which connect servers and storage) and spine switches with high port density (which connect leaf switches). This is called leaf-spine architecture.

The spine switches in the main distribution area don't connect to one another. Instead of running multiple point-to-point connections, each leaf switch connects with each spine switch. The spine provides traffic-forwarding options for leaf switches. Traffic only moves from an ingress leaf switch to a spine switch and out to an egress leaf switch, which decreases bottlenecks and latency for faster data transmission.

With cloud infrastructure on the rise, east-west traffic (traffic that moves from server to server) is growing. This kind of traffic requires low latency to support time-sensitive, data-intensive applications. Leaf-spine architecture supports this effort by making sure traffic is always the same number of hops from its next destination.

What Hybrid Edge Data Centers Mean for Your Cabling

What it takes to achieve success in hybrid edge computing is different for everyone.

Because of the way hybrid edge data centers are set up, however, it's likely that your approach to cabling, connectivity and management will need to change.

The success of a hybrid edge data center comes down to interconnection points (meet-me rooms). These managed spaces allow cable companies, internet service providers (ISPs), telecommunications carriers and other carriers to cross-connect. They support physical connections (mostly fiber) of different companies and ISPs in the same building, allowing them to exchange data before distributing services to the internal network. They also support inter- and intra-campus cross-connects.

Meet-me rooms are critical to support uninterrupted internet exchange and smooth data transmission. They connect companies and carriers in the same data center space while removing round-trip traffic and ensuring that data doesn't have to leave the facility (lowering costs and boosting security as well).

In hybrid edge data centers, meet-me rooms handle connections to cloud providers, to the core network and even other to hybrid edge data centers, as well as to disaster recovery or offsite storage locations.

Belden's Focus on Hybrid Edge Data Centers

The cloud is moving toward the edge to be closer to users, and the edge helps accelerate deployment to the cloud from anywhere.

If hybrid edge data centers are in your future, then Belden has the in-house expertise, services and end-to-end solutions to help you deploy them efficiently and effectively.

Belden's enhancements support the density, scalability, uptime assurance, space-saving, efficiency and ease-of-use requirements for every type of data center. Our holistic data transmission technologies range from cable and connectivity to power and cooling, security, access control, monitoring and more.

We support a collaborative approach to working with customers, designing tailored systems that adapt to your specific, mission-critical facility requirements.

Our data center solutions are designed to be used anywhere within white space and gray space—from the rack space to the parking space—including facilities management and core IT, Ethernet over IP (EoIP) and OT requirements for building controls, command and control, security and surveillance.

Visit www.belden.com/markets/data-centers to learn more.