RF CODE
CRITICAL ASSET TRACKING AND PROTECTION

WHITE PAPER

# Standing at The Edge? Look Before You Leap

## Understanding the Advantages — and the Risks — of Edge Deployments

## What — and Where — is the Edge?

The Financial Times calls it the future of computing. Carnegie Mellon University runs the Living Edge Lab to better understand how to use it in the real world. Forrester warns that with global telecom companies set to implement or expand edge computing and empower their 5G networks in 2019, it's much bigger than just the Internet of Things (IoT). And Gartner's Tom Bittman claims it will eat the cloud – and that "the time to have an edge strategy is very, very soon."

But what the heck is "it?" It's "The Edge," and "it" seems to be all anyone can talk about. The edge is the "next big thing," promising to deliver vast improvements in network speed, scalability, security and resiliency over traditional network architectures.

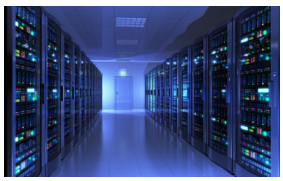
But what unique qualities of edge computing do IT teams need to understand? In broad terms, edge computing refers to any distributed computing topology where the storage and processing of data occurs close to the point where it's generated and used rather than at a traditional, centralized data center.

And while distributed computing is a decades old concept, judging by all the chatter about edge computing this particular distributed computing approach has clearly reached a tipping point.

> *The edge will eat the cloud. The time to have an edge strategy is very, very soon.*
>
> *- Tom Bittman, Gartner*

However, even with all this interest and attention, despite all the value and benefit edge deployments promise to deliver, no one seems to have agreed on any standardized definitions or architectures for the edge yet. And without that, organizations seeking to reap the much-touted benefits of edge deployments are left to try to define the edge for themselves.

So, how to start? How about with figuring out where the edge is in the first place.

| Edge Deployments | |
|---|---|
|  | ***Remote Edge Data Centers*** *such as a small equipment rack in multiple remote locations or multiple large data centers.* |
|  | ***Container IT Edges*** *A solution stack comprising of one or more of the following; servers, OS, storage, network and optimized power and cooling to support all the equipment in the contained environment.* |
|  | ***Internet of Things (IoT),*** *where highly available processors enable real-time analytics for applications that can't wait to make decisions.* |

## Finding the Edge

In practice, the edge is found almost anywhere anyone can use a connected device. There are many variations, but all edge approaches share the same basic goal: computational efficiency. Rather than send data to the cloud or a central data center, edge deployments allow data processing or service delivery to occur closer to the source of data, on or near the computing device itself. This distributed topology enables organizations to greatly increase the efficiency and resiliency of their networks while ensuring the low latency and availability of local storage required for efficient and time-sensitive operations.

When discussing the edge, there are four practical components to address – topology, enterprise data centers, edge data centers, and edge devices.

- **Edge topology:** Edge topology refers to an organization's entire IT infrastructure – network layout and architecture, including all of the components of an edge deployment.
- **Enterprise (or core) data centers:** Centralized data center facilities that are primarily designed to support the overall operational needs of an organization.
- **Edge data centers:** Remote computing and processing facilities that independently handle localized activity and connect back to the core data center.
- **Edge devices:** Equipment deployed at the end of the network that deliver the computing services and process transactions for that location, such as servers in a retail location or branch office server closet or sophisticated, network-connected devices that work independently of the data center,

## Edge Computing Benefits

The market is moving towards this type of decentralized computing and it's a large opportunity for enterprises that leverage edge computing effectively. According to Gartner within the next four years 75% of data generated by enterprises will be processed at the edge, up from just 10% today[1]; and Intel predicts more than 200 billion devices will be connected by 2020.[2]

Computing at the edge provides a technical advantage, which then drives business value. The move from centralized computing to distributing processing and storage throughout the network closes the gap between the network and end user, providing processing and storage in proximity to locations with specific computing demands and delivering three major benefits: decreased latency, reduced traffic, and scalability.

### Latency

A request to or from a central data center

1 What Edge Computing Means for Infrastructure and Operations Leaders, Gartner, 3 October 2018, https://www.gartner.com/smarterwithgartner/what-edge-computing-means-for-infrastructure-and-operations-leaders/

2 Paper SAS645-2017 Real-time Analytics at the Edge: Identifying Abnormal Equipment Behavior and Filtering Data near the Edge for Internet of Things Applications Ryan Gillespie and Saurabh Gupta, SAS Institute Inc.

| Example Edge Use Cases | |
|---|---|
| **Consumers**  | • Special offers or sales in the consumer's vicinity via mobile device<br>• Automatic reordering of supplies for equipment like printers or refrigerators<br>• Faster streaming video and social media<br>• Ability to send data to health professionals via medical device |
| **Enterprises**  | • Monitoring and optimizing operations of manufacturing equipment<br>• Identifying equipment maintenance issues<br>• Tracking environmental conditions for perishable products throughout shipping<br>• Processing retail in-store data to analyze and predict purchase patterns and plan inventory<br>• Decreasing transaction time at retail point-of-sale<br>• Monitoring temperature and humidity in specialized spaces, like data centers or laboratories |

may take several milliseconds to several seconds to travel back to the end user, which can add up to a significant delays when considering the massive amounts of data an individual network sends and receives. Even a slight delay can be a problem – lost business or worse – in some applications or circumstances where swift resolution is beneficial.

The average web page needs to load over 100 resources (such as graphics, files, and scripts). Given that Forrester research suggests that online shoppers will only wait about 3 seconds for a page to load before leaving a website,[3] any small delay in these individual transmissions can add up to significant load times and possibly lost business.

Delays can even be dangerous. For example, the sensors in self-driving vehicles generate nearly 1 gigabyte of data every second. Any delay in processing that vast amount of data could mean the difference between swerving to miss an obstacle or hitting another car ... or worse.

3 E-Commerce: Website Speed Impacts Your Bottom Line, Verizon, 6 February 2013, https://www.verizondigitalmedia.com/blog/2013/02/ecommerce-performance-website-speed-impacts-your/

## Traffic

Because edge deployments allow data to be processed and stored at the edge, this dramatically reduces network traffic load. This, in turn, has the potential to increase energy efficiency through computational offloading (such as to an IoT device or local server) and reduce operating costs in the central data center or cloud storage, or reduce traffic costs (especially when paying by volume or connection).[4]

Consider retailers or banks that use edge data centers to handle transactions locally. Edge data centers allow point-of-sale systems, ATMs, bank branch offices and so forth to complete transactions rapidly regardless of network conditions outside the branch office or store. Once complete, they can then transmit all necessary data to their central sales and accounting systems in the enterprise data center later, perhaps after business hours.

4 Papageorgiou, Apostolos, and, Bin Cheng, Erno Kovacs Real-Time Data Reduction at the Network Edge of Internet-of-Things Systems, 201 http://dl.ifip.org/db/conf/cnsm/cnsm2015/1570153299.pdf

Or think about end user devices, such as health monitors. A healthcare facility may have thousands of these devices constantly collecting data from patients. By utilizing intelligent edge devices to process and analyze the data independently and in real time, any data that does not need to be stored or acted on can be filtered out altogether, with only the refined data being sent to the data center for further processing or storage.

### Scalability

As enterprises deal with greater amounts of data, network scalability becomes a critical issue. Edge networking equipment combined with edge-connected devices provide on-demand resources that can store and process data locally, expanding the available network when needed. This eliminates the need to overbuild centralized data centers, while enabling expansion and provisioning of resources on demand.

Think about live streaming video. If only 10% of New York City's approximately 8 million residents want to stream movies from Netflix at the same time, that would generate 1.6 terabytes — 1,600,000,000,000 bytes — of data ***per second*** of network traffic. Rather than attempting to design a massive enterprise data center with enough data transfer capability to deliver such an enormous amount of data, Netflix instead uses edge data centers to operate at this scale, distributing delivery and caching popular content locally; and only accessing content in the core data center when necessary.

Using an edge topology with data centers at the fringes of the network to deliver and cache data reduces network traffic for providers and reduces latency for those watching the video. By adding data center resources at unmanned (aka lights out) edge locations, rather than expanding centralized data center facilities to meet demand, providers like Netflix deliver these services without having to increase either the footprint or staffing requirements of their data center.

## Edge Computing Challenges

Between delivering reduced latency, ensuring localized and distributed data and service availability, and greatly improving data center scalability, the benefits and value of edge deployments are clear. Yet, as companies move to adopt edge computing, the need to manage and monitor valuable assets in remote and often unstaffed locations can grow exponentially. Edge computing deployments present IT professionals with unique and significant challenges, particularly when it comes to managing critical assets, , physical security, and environmental conditions.

### Asset Management

Managing network resources is a challenging task and gets more difficult with each device added to the system. In addition to logical considerations of load balancing, capacity management, and energy use issues, a key aspect of managing edge equipment is simply keeping track of the number and physical location of the equipment and devices connected to the network.

The physical distance and distributed nature of edge data centers and devices mean that any activity requiring personnel to physically interact with assets – such as annual inventory, service and upgrades, removing older equipment from service, etc. – is automatically more complicated and expensive. You need to know exactly where a given piece of equipment is to avoid unnecessary time and money wasted on truck rolls, visits to the wrong facility, and the like.

### Physical Security

Because most edge networking equipment, like servers or base stations, are far from the main network and have no IT personnel on site to monitor and protect these assets containing critical data, they are less secure. While obviously helpful, physical security measures like locks can't prevent

all unauthorized access. But the lack of on-site personnel limits the company's ability to quickly detect and respond to breaks-ins and adds to response time.

### Environmental Conditions

Many things can contribute to changes in the environmental conditions around equipment – increased compute load resulting in heat generation that outpaces the capacity of existing cooling systems; failure of the computer room air conditioning (CRAC) or heating ventilation and air conditioning (HVAC) systems; power failures; even leaky pipes. The remote nature of these facilities mean increased time to respond and resolve unanticipated environmental changes.

## Edge Computing Risks

The major risk of not understanding what's happening in your edge environments – asset management, physical security, or environmental hazards – is loss of business. Whether it's downtime or slow service, businesses require many transactions to happen in real time and it can result in financial damages when they can't meet that standard.

### Loss of Business: Retail

Retailers are increasingly relying on edge technologies for business opportunities, and delays, both in online retailers and in physical locations, can be costly. For example, Amazon calculated that for every 100 milliseconds of latency, they lose $1.6 billion of sales annually. Brick and mortar retailers rely on beacon technology and augmented location services from themselves and third parties like Apple Passbook and Groupon to drive in-store sales and offer customers ads or deals to increase their purchase intent. Retailers lose out on this unique market targeting opportunity when processing or delivery of data is delayed.

### Loss of Business: Supply Chain

Warehousing and supply chain applications require real-time, secure services and enable users along the supply chain to make key business decisions as early as possible in the process. For example, food products data can be captured and analyzed during processing in the field, informing early decisions about inventory or pricing; or users can track data during transit to ensure food storage temperatures are optimal. With devices on-board delivery trucks, users along the supply chain can track delivery speed and the trucking company can monitor maintenance issues and provide optimal routing for vehicles.

### Loss of Business: Remote Health

The medical field is heavily using the edge – with wearable devices, remote monitoring equipment, and telemedicine capabilities. Wearable medical devices are a revolution in healthcare and the market is expected to grow more than 18% to $14.41 billion by 2020. These devices, as well as remote monitoring devices like glucose meters and heart monitors, enable consumers to keep track of their own health and share vital information with distant medical professionals. These technologies are logical uses for the IoT and an example of the critical need for local processing of time-sensitive data and low-latency for communication between the distributed edge device, the edge networking equipment, and a central processing location.

# Monitoring, Managing, and Securing the Edge

How each enterprise defines the edge is based on how they get value from their IT resources. Every company and industry defines the edge differently based on their assets, business model, and network use. But no matter which equipment, devices, or platforms you include in your definition of the edge, the unifying theme is that to effectively and efficiently manage them, you have to know where each piece of equipment is, the environmental conditions surrounding each, and how they're being used. And to know that, you have to monitor them.

Effectively monitoring edge equipment requires understanding some unique issues

about edge computing: Managing the edge (asset management and inventory), securing the edge (physical security, visibility and unauthorized access issues), and monitoring the edge (environmental hazards and the ability to respond).

Edge data centers can be just as complex as centralized data centers. Even in remote locations, the equipment and technology is the same (i.e., servers, storage, power, cooling), and requires the same management. Yet, it isn't just another data center, it's a highly distributed business-facing IT infrastructure. And it's costly to maintain edge facilities and equipment with the same methods and technology as a data center – it requires holistic management and an understanding of the overall health of the hardware and environment across and within each edge location to optimize skills and resources.

Because of traditional data center thinking and technology that can't adapt and manage the highly distributed edge environment, edge facilities can experience unique inefficiencies, such as slow issue remediation, no remote visualization, and lack of physical access control. They also may have uncoordinated support resources – due to the nature of edge data centers and devices, responsibilities may fall with different vendors. With shared responsibility like this, such as one vendor responsible for cabling and infrastructure, another for power and cooling, it's critical to understand as much as possible about a problem to deploy the right resources to fix it.

Managing the edge requires the same skills as managing the disparate complexities of data centers, but used in a different way. The reduced amount of technology in each edge data center requires fewer skills to manage, yet increased skills to understand how the edge facilities supports and impacts other edge areas and the central data center. Each also requires physical changes and maintenance, via remotely enabled visibility that software, video and phone support alone cannot provide.

## Monitoring the Edge

Monitoring environmental conditions means sensors that track the atmosphere in the physical space, whether it's the primary data center or an edge facility – including temperature, humidity, airflow, air pressure, water, vibration, etc. Monitoring the environmental conditions across what can be thousands of edge facilities is equally as complicated as tracking physical location. For example, different weather conditions in disparate geographical locations require unique understanding of climate, seasonal fluctuations, and local weather and how that impacts sensitive IT equipment.

Keeping track of locations and conditions is only the first half of the reason monitoring matters. The other half is using the information to make informed decisions and take action. Monitoring and exception alerting can reduce the time to resolution for servicing equipment or environmental hazards; it can determine if unauthorized personnel have accessed equipment and enable IT to take the proper security steps.

## Managing the Edge

Monitoring critical assets means using sensors to understand their state of being – on or off, provisioned or idle, etc., and their physical location – such as in storage or on the loading dock or in-service at an edge location (in a rack in the edge data center or a device deployed to an end user). This becomes more difficult and complex when these assets are deployed across potentially hundreds or thousands of edge locations.

For example, if you need to take a specific number of servers out of service because they're at the end of their lifecycle, it makes the job simpler and cost effective when you know where they're located. It also makes the job easier when you know what servers you have in inventory to deploy as replacements, to prevent overprovisioning and ensure you're effectively using your capital assets.

### Securing the Edge

Monitoring the physical location of assets and access to edge data centers alerts you to unauthorized access to remote facilities to access the data or remove the equipment, which can result in theft of equipment or sensitive data and even regulatory violations because of inadequate privacy policies.

Proper monitoring protects companies from additional regulatory fines or reputational risk after theft or a security breach by proving that equipment was protected at an acceptable level.

## Edge Visibility Drives ROI

The major return on investment for monitoring your edge computing resources is cost savings. Downtime is expensive – the Uptime Institute reports that about a third of outages cost over $250,000. And this return on investment is three-fold: reduced energy costs from more efficient control of air temperatures and humidity, proactive response to hazards, and maximizing the lifecycle and use of your IT equipment.[5]

### Energy efficiency

Because of the importance of cooling IT equipment many data centers and edge facilities operate with unnecessarily low temperatures, wasting energy (and money) because they err on the side of caution rather than risking downtime from overheating. With increased monitoring, operators can get more granular temperature data and track the temperatures of individual devices or the micro-environments within server racks. This additional visibility enables you to increase the temperature set points in the facility while ensuring the equipment is cooled properly. Power use accounts for 70-80% percent of ongoing operational costs within a traditional data center with similar costs for edge facilities, so any reduction in cooling reduces power use and saves money.

5 Uptime Institute data shows outages are common, costly, and preventable, June 2018, https://uptimeinstitute.com/data-center-outages-are-common-costly-and-preventable

### Addressing hazards

Disaster prevention is better than disaster recovery. Whether that's dealing with environmental conditions that could threaten downtime, such as increasing temperatures on a specific device or increasing humidity within a facility, or identifying unexpectedly missing assets, real-time monitoring and alerts to changes enables a swift response before the situation gets out of hand. This is especially critical in edge facilities, which are usually remote from the central data center and IT support teams. Responding may require deploying a team to the location or notifying local resources to assist – both of which add to response time.

### Maximizing equipment

Managing assets across multiple locations increases the chance of error – when assets are being transported back and forth they could get lost in transit. Missing or failing assets, whether they have been misplaced or are sitting in storage forgotten and unused, can lead to service outages and unnecessary costs for new hardware.

## The Solution: CenterScape Edge Manager

RF Code's CenterScape Edge Manager is the answer to your edge deployment needs. This solution monitors the edge environment (power and cooling, access and activity) and the assets (servers, networks, storage, racks and mobile devices) holistically and at scale. This hardware and software solution provides value beyond hub data centers and into retail locations, server closets, warehouses, and more. With real-time visibility and monitoring, exception alerting, and advanced reporting, this complete solution presents your IT team with actionable data to ensure safe, secure, and uninterrupted operations.

Combining easy-to-deploy wire-free sensors, a dedicated and secure infrastructure, and powerful data management software, CenterScape provides the continuous monitoring and the instant alerting necessary

to safely and securely deploy edge locations, anywhere, worldwide. It is designed to address the unique challenges and complexity of edge computing environments, increase operational efficiencies, improve security posture, reduce costs of managing equipment and deliver the simplicity, savings, and visibility needed to effectively operate on the edge.

If you've got data on the edge — like Garter forecasts that by 2025 75% of enterprise-generated data will be[6] — you need a comprehensive edge management strategy for these highly distributed and difficult to monitor facilities. CenterScape Edge Manager is a key element of that strategy, tracking all your assets and their current location, down to the rack level, and monitoring environmental conditions and facility access.

Specifically designed to address the unique monitoring and notification requirements of edge deployments, CenterScape provides real-time insight, and control over operational risks, costs, and compliance. This easy-to-use solution, accurate to the rack level and operating 24/7, provides reporting and accountability for compliance with regulations and service level agreements (SLA). As an open platform, this solution is designed to easily integrate with other data center management solutions like building management (BMS), data center infrastructure (DCIM), and integrated systems management (ITSM).

Edge facilities can only bring that value when they're working efficiently, effectively, and at capacity. That requires granular, real-time intelligence and alerts. RF Code's CenterScape Edge Manager empowers enterprises to leverage the edge effectively, quickly make more informed decisions, and optimize their performance to support business growth.

6 What Edge Computing Means for Infrastructure and Operations Leaders, Gartner, 3 October 2018, https://www.gartner.com/smarterwithgartner/what-edge-computing-means-for-infrastructure-and-operations-leaders/

## Additional Sources


*The Future of Computing is at the Edge; https://www.ft.com/content/1dba534a-5857-11e8-bdb7-f6677d2e1ce8*

*Get Ready For Edge Computing's Rise In 2019 ; https://go.forrester.com/blogs/get-ready-for-edge-computings-rise-in-2019/*

*Carnegie Mellon Researchers Tap Edge Computing to Resolve Real-World Challenges ; https://statetechmagazine.com/article/2019/04/carnegie-mellon-researchers-tap-edge-computing-resolve-real-world-challenges*

*The Edge Will Eat the Cloud; https://blogs.gartner.com/thomas_bittman/2017/03/06/the-edge-will-eat-the-cloud/*

*Potentials, trends, and prospects in edge technologies: Fog, cloudlet, mobile edge, and micro data centers, Computer Networks, Kashif Bilal, Osman Khalid, Aiman Erbd, Samee U. Khan, 130 (2018) 94-120 (POT)*

*Data Security and Privacy-Preserving in Edge Computing Paradigm: Survey and Open Issues. IEEE Access, Jiale Zhang, Bing Chen, Yanchao Zhao, Xiang Cheng, Feng Hu, 23 April 2018 (DSP)*

*Edge Computing for the Internet of Things: A Case Study, IEEE, Gopika Premsankar, Mario Di Francesco, and Tarik Taleb (EIoT)*

*Paper SAS645-2017 Real-time Analytics at the Edge: Identifying Abnormal Equipment Behavior and Filtering Data near the Edge for Internet of Things Applications Ryan Gillespie and Saurabh Gupta, SAS Institute Inc. (REA)*

*Top 10 Strategic Technology Trends for 2018 Published: 03 October 2017 ID: G00327329 Analyst(s): David W. Cearley, Brian Burke, Samantha Searle, Mike J. Walker (Gartner 2018)*

*A Reliable, Non-Invasive Approach to Data Center Monitoring and Management, Moises Levy*1, Jason O. Hallstrom2 Advances in Science, Technology and Engineering Systems Journal Vol. 2, No. 3, 1577-1584 (2017) (R non)*

*Data Center Knowledge Guide to DCM*

*Edge computing and industrial internet of Things: https://www.rfidjournal.com/articles/view?18111*

*Gartner Identifies the Top 10 Strategic Technology Trends for 2019: https://www.apnews.com/b06c31aadb6d4d7484435f6a31ed2c30*

*Industrial Internet Consortium, Introduction to Edge Computing in IIoT https://www.iiconsortium.org/pdf/Introduction_to_Edge_Computing_in_IIoT_2018-06-18.pdf*