Edge data centers: Riding the 5G and IoT wave

How to participate in the coming boom

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Edge data centers are already booming, and market growth is likely to accelerate.

The global market for edge data centers is expected to nearly triple to $13.5 billion in 2024 from $4 billion in 2017[1]. The potential of smaller, locally located data centers to reduce latency, overcome intermittent connections, and store and compute data close to the end user make them ideal for many new, low-latency, data-heavy technologies. They may enable all-new business models, based on decentralization and speed.

However, this boom does not mean that every company should immediately start moving all its data centers (and related services) to the edge. Many companies may want to move more slowly and selectively.

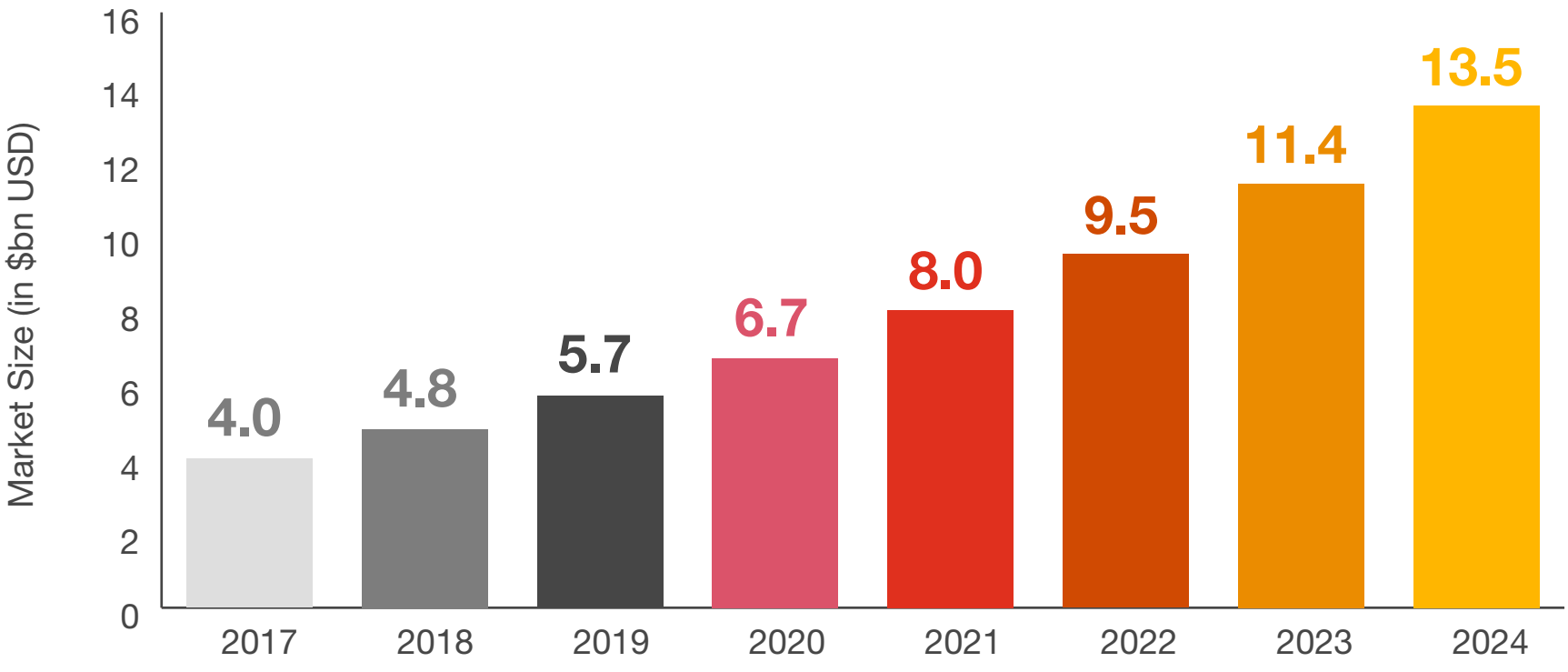
The right strategy will be different for each organization, depending on the conditions, environment, and business opportunities in its marketplace.

What is an edge data center?

An edge data center is a small data center—they have no more than 2 megawatts (MW) in power capacity, and often less—which enterprises can put in many locations "at the edge": close to the people, machines, and processes that generate and use data.

The small size reduces costs and deployment time. Their large numbers and location at the edge can cut latency, saves bandwidth, and reduces the risk of intermittent connections. This combination makes them ideal for many rapidly-growing technologies of the Fourth Industrial Revolution[2].

Global edge data centers market size



Source: Bhutani and Bhardwaj, Global Market Insights, November 2018

[1] Bhutani and Bhardwaj, Global Market Insights, November 2018
[2] PwC, *Are you ready for tomorrow—no matter what tomorrow brings?*, 2019

Why the edge is growing

The benefits of edge data centers are undeniable. They also aren't new. There are five main reasons why edge data centers have become highly attractive for many companies now, and why they may likely become even more attractive in the years to come.

1 5G is coming

Next generation telecom services may depend, not only on a few thousand macrocell towers as existing wireless networks do, but on a network of hundreds of thousands of small cells[3]. To support this highly decentralized small cell network, a decentralized network of edge data centers are expected to provide the lowest costs, the lowest latency, and the lowest risk of intermittent connections. Edge computing is essential to Cloud Radio Access Networks (C-RAN) which are helping bring increased flexibility, lower costs, and improved performance to telecommunications networks. And edge computing enables many 5G use cases, especially those requiring low latency and high device density such as autonomous vehicles and many smart-city applications.

2 IoT is growing

The Internet of Things (IoT) will include 25 billion connected things by 2021, according to Gartner[4] and $1 trillion in annual spending by 2022, according to IDC[5]. Autonomous vehicles, commercial robotics, smart planes and farm equipment, and home automation are just some of the reasons why the IoT's growth is accelerating. If done centrally, analyzing and reacting to the data from all these billions of sensors would tie up bandwidth and lead to unacceptably high latency. Edge computing is considered to be a better alternative.

Edge computing also offers the potential for greater reliability and security, especially when coupled with private communications networks. Industrial automation is an early adopter for this use case. Wirelessly connected equipment, driven by low latency edge processing is key to the factory of the future allowing machine vision and advanced analytics even in high volume production environments.

3 The data gap is widening

It's not just the IoT gathering new data. 5G applications and digitized machines and human lives may create ever more data. If current trends persist, by 2021 (see chart on next page) usable data can possibly quadruple data center capacity, leaving a 64 zettabyte gap. By filtering data close to the source, low-cost edge centers can fill this capacity gap and support better geographical coverage and flow through volume.

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[3] PwC, *Why 5G Networks Can't Succeed Without a Small Cell Revolution*, 2018

[4] Gartner Press Release, *Gartner Identifies Top 10 Strategic IoT Technologies and Trends,* November 7, 2018

[5] IDC Press Release, *IDC Forecasts Worldwide Spending on the Internet of Things to Reach $745 Billion in 2019, Led by the Manufacturing, Consumer, Transportation, and Utilities*

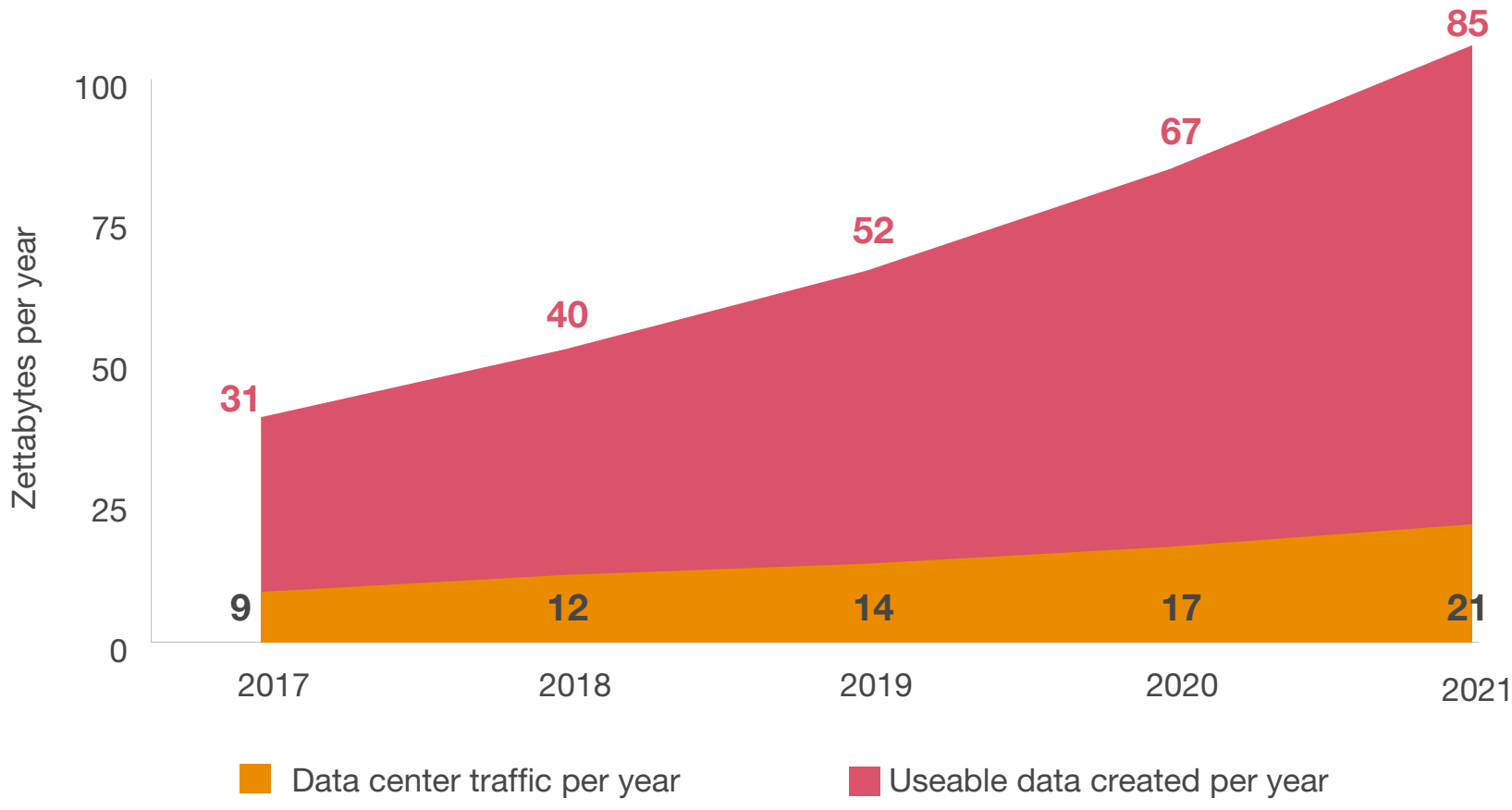
4 SDN and NFV support the edge

Software-defined networking and network functions virtualization are spreading, enabling software running on data centers to replace costly specialized hardware. Two-thirds of data centers are expected to partially or fully deploy SDN by 2021, according to Cisco[6]. As data centers perform more functions traditionally done by other purpose-built hardware, the demand may grow, especially on the edge, where they can provide faster performance at lower cost.

5 Video streaming and AR/VR are surging

Global video streaming could triple by 2021 compared to 2017, while global traffic for augmented and virtual reality could grow 12 times over, according to Cisco[7]. For both, low latency is a necessity. Time delays in AR/VR headsets can miss critical data and cause headaches or motion sickness in users if the projected data can't keep pace. Decentralized, low-cost edge data centers provide the performance that consumers and business users demand.

Global data center traffic vs. useable data created



Source: Cisco® Global Cloud Index (GCI): Forecast and Methodology 2016-2021. November 2018

[6] Cisco® Global Cloud Index (GCI): Forecast and Methodology, 2016–2021, November 19, 2018
[7] Cisco® Visual Networking Index: Forecast and Trends, 2017–2022, February 27, 2019

Use cases at the edge

Edge data centers may soon handle much of the data that flows through our society. For example:

- **Banking:** Edge data centers provide the low latency that traders and asset managers increasingly depend on.
- **Agriculture:** Billions of farm animals are scattered all over the world. Farm analytics to manage disease are adding to the data gap—which edge centers can close.
- **Mining:** When analyzing data from mines that could indicate dangerous geological or chemical conditions, edge computing's low latency can save lives.
- **Inventory:** Analytics at the edge can increase efficiency for robotic picking and inventory management, as well as for delivery fleet management and package tracking.
- **Health care:** Robotic surgeries depend on ultra-low latency computing and uninterrupted network access, which edge data centers supply.
- **Defense:** Military drones connected to edge computing react faster and relay information more quickly.
- **Industry 4.0:** Multiple smart factory use cases including machine predictive maintenance and predictive quality management.

Why it may pay to wait

The five trends driving edge data center growth are accelerating, but even so, some companies may choose not to ride this wave—at least not right away. There are two big headwinds facing companies considering edge data centers.

Different timing for different markets

The global market for edge data centers is expected to be strong, due to the need to gather, store, analyze, and use ever greater amounts of data at ever greater speeds. However, different sectors and geographies can show sharp variations in the pace of adoption. Companies should conduct a careful analysis to accurately forecast needs in their particular marketplace.

In telecom, for example, 5G is the future—but it is uncertain how soon that future will arrive in a given marketplace. Some country's telecom operators have heavy debt loads that could constrain investments. In the US, for the small cell revolution on which 5G depends to take place, governments and industry leaders will need to align on regulations and more. Other countries and sectors also face challenges that could make the technologies that most benefit from edge data centers—such as the IoT and AR/VR—grow at varying speeds.

Edge data centers aren't easy

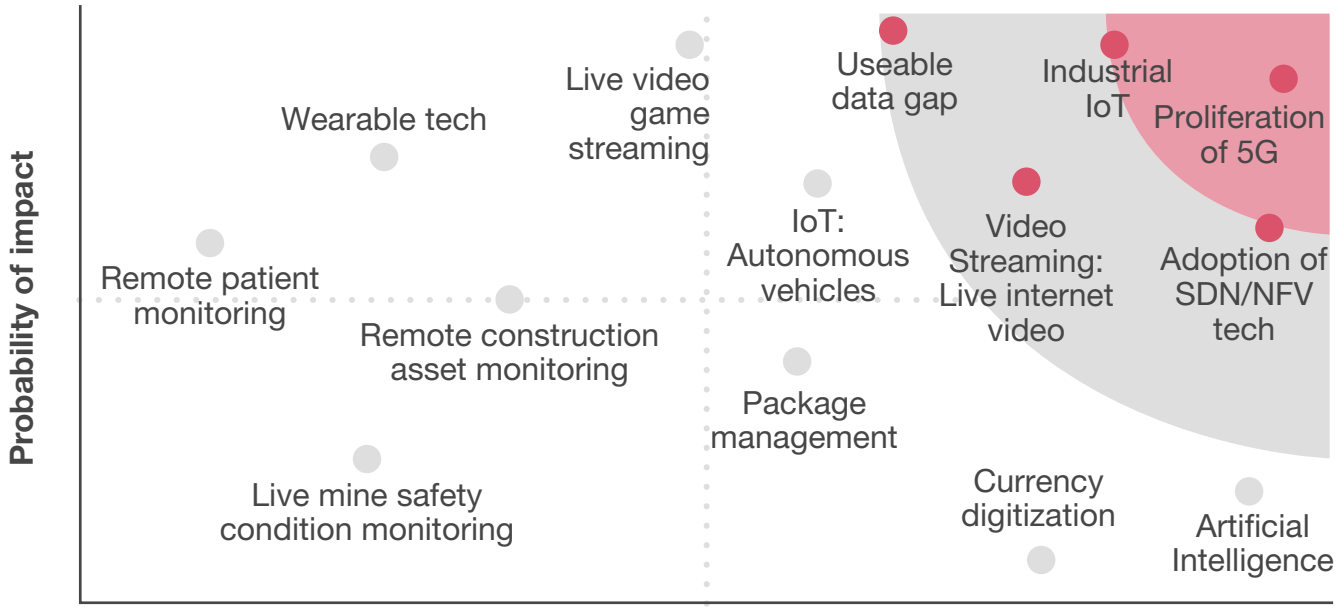
It is easier and cheaper to build and operate a single small edge data center than to build and operate a much larger centrally-located one. However, to meet the needs of hundreds of thousands of small cells, millions of IoT devices, or zettabytes of data, companies may need a network of many edge data centers. If not carefully built and managed, the complexities of managing and securing such a network could dilute or even overwhelm the potential cost savings and efficiencies.

Companies may need to skillfully maintain and administer hundreds of edge data centers, scattered around the country or world, instead of a handful in a single location.

Companies should consider adapting to physical and cyber security strategies in order to protect a geographically dispersed network, which will not just gather and store, but also quickly analyze and act on data in multiple locations. Such strategies may also have to include compliance with privacy regulations such as GDPR and CCPA.

It is possible to overcome these obstacles, but for companies that lack deep experience in edge computing, the challenges are real.

A qualitative view on drivers that affect adoption of edge data centers



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Primary Drivers

Looking through the lens of probability and impact, these five drivers stand out as most critical to the success or failure of edge data centers.

Source: PwC analysis

How to build an edge data center

PwC research[8] has identified the five common factors in determining whether a company can succeed in building a new edge data center on time and on schedule.

- **Capital portfolio management.** Each edge data center project needs a business case, a stage-gate process, and clearly assigned decision-making authority.
- **Integrated project technology.** New project tools such as modular construction, digital twins, VR, and artificial intelligence need appropriate controls, governance, and risk mitigation processes.
- **Data-driven project planning.** Systematic data capture and project analytics can drive better transparency, forecasts, and decision-making.
- **Dynamic project control.** With the help of data analytics, it's possible to adjust controls to align with the needs and risks of each stage of the project lifecycle.
- **Holistic project assurance.** Rigorous data collection and analysis can offer the board and management clarity on a project's status and on new opportunities for efficiency.

[8] PwC, *Gaining The Competitive Edge in Data Center Capital Projects,* 2017

Edge or no edge? Here's how to decide

Edge data centers are projected to be a $13.5 billion market by 2024[9]. To make the right strategic choice about how to approach this technology and related markets and applications, companies should look for answers—which will vary for each organization—to these following five questions.

How fast? Companies should analyze technology and market trends to forecast how quickly the key technologies (see "Net-Net qualitative view on drivers" chart above) will impact their lines of business. Multinationals should be sure to consider regional perspectives: the tailwinds in favor of 5G or IoT may be stronger or weaker in China than in the US, for example.

Where's the competition? Since edge data centers offer lower latency and lower intermittency for end users, they offer a competitive edge. Companies should look at how competitors are using edge data centers, to assess the need to keep up—or opportunities to take the lead.

What are the new value chains? Edge data centers can create new value chains and need for services, including maintenance and repairs of a distributed asset base. Companies should understand these new value chains and how they fit with present and future business models.

What's the cost? Assessing the cost of edge data centers may be more complex than for traditional data centers. Aside from capital expenditures, companies are expected to prepare to maintain, administer, and secure a geographically dispersed network of edge data centers.

What are the new opportunities? Besides the possible advantages to a company's own operations, edge data centers can offer companies new revenue from building them, servicing them, and offering managed services based on their low latency and distributed footprint.

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[9] Bhutani and Bhardwaj, Global Market Insights, November 2018

Are you ready for the edge?

Edge data centers are expected to be at the center of many companies' approaches to data and to the technologies and business opportunities that depend on quickly analyzing and using data. Edge data centers' advantages—low latency, reliable connections, and storage and computing power close to the user—are simply too great to ignore.

But companies should still proceed cautiously, assessing their specific environment, needs, and business opportunities before choosing a strategy, which may be critical to their future business models.

Given the speed with which edge data centers are advancing, the time to develop that strategy is today.

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