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Edge Data Centers:
Opportunities for Northeast Real Estate
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Authored by:

**Lisa M. Zana and Nikolas D. Kittredge,
Shipman & Goodwin LLP's Data Centers Team**

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> *"Out on the edge, you see all the kinds of things you cannot see from the center"*
>
> *Kurt Vonnegut*

Edge Data Centers

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Introduction
to Edge Data Centers

Latency[1] has always proved to be a problem for organizations and data center operators alike; particularly as demand for big data, wearable technologies, cloud and streaming services and other technological trends continues to grow both in number of devices and users. Now, more than ever, end users and devices demand faster, more reliable and more immediate access, from anywhere and at any time, to the applications, services and data housed in data centers, and latency is no longer an acceptable obstacle. Edge computing and edge data centers ("EDCs") present a unique and cost-effective solution to these increasing demands that, with the right plan, may offer interested real estate owners, investors and entrepreneurs an opportunity for enticing financial returns.

An EDC is a smaller data storage facility located close to the population that it serves and that delivers cloud computing resources and cached content to end users.[2] Typically connected to a larger, central data center or multiple EDCs, the EDC processes data and services as close to its users as possible, allowing organizations to minimize latency and increase user experience.[3] EDCs derive their name from the concept of edge computing. Edge computing is the "distributed computing model which takes place near the physical location where data is being collected and analyzed" and which securely processes that data in real time, on-site.[4] IDC, a global market intelligence firm, estimates that by 2025, nearly half of data generated around the globe will utilize edge devices.[5] Edge computing is likely to revolutionize and transform the way organizations process and analyze data and opens the door for endless possibilities.

This white paper serves to identify and discuss: (i) the key characteristics of EDCs; (ii) their key industry uses; and (iii) the Northeast-specific opportunities that exist for property owners, investors and entrepreneurs, for their development and operation.

> "...EDCs may offer an opportunity for enticing financial returns."

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1   *See* PC Magazine, https://www.pcmag.com/encyclopedia/term/latency (last visited May 24, 2021) ("Latency may refer to the time between a query and the results arriving at the screen or the time between initiating a transaction that modifies one or more databases and its completion.")

2   *What is an Edge Data Center?*, Sunbird DCIM, https://www.sunbirddcim.com/edge-data-center#:~:text=Edge%20data%20centers%20are%20smaller,cached%20content%20to%20end%20users.&text=By%20processing%20data%20and%20services,and%20improve%20the%20customer%20experience (last visited May 24, 2021).

3   *Id.*

4   *What is Edge and Why is it Important,* Stratus, https://www.stratus.com/edge-computing/?Lead_Source=Search%20Engine%20Marketing&Media=Google%20Ads&Current_Campaign=20FY-AMER-Edge-PPC-Edge-Computing&utm_source=google&utm_medium=cpc&utm_campaign=20FY-AMER-Edge-PPC-Edge-Computing&gclid=CjwKCAjwtJ2FBhAuEiwAIKu19qzfeBgwSXnD5j9_HvB_w3QKAr9IShJVz4uZQGxUFP5oJk3dmnR25xoCmoUQAvD_Bw (last visited May 24, 2021).

5   *Id.*

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The Key Characteristics of the Edge Data Center

In achieving the goals of reduced latency and increased end user satisfaction, it is important to understand what defines an EDC. EDCs are defined differently amongst different industries and due to their relative infancy as a trend, but the common key characteristics which generally define any EDC include that they are: (i) local to the population they serve; (ii) small; (iii) part of a larger, complex network; and (iv) just as "mission-critical" as their larger, centralized counterparts.[6]

Local:

EDCs are generally defined by their proximity to the population that they serve and are typically found outside of smaller metro areas. Generally, through the repurposing of underused commercial, industrial and office spaces, EDCs serve to bring cloud services and connectivity options to organizations while acting as an intermediary between local and national resources in an effort to reduce network congestion and provide quicker, less expensive and more reliable access to distantly located services.[7] For example, Netflix may deploy its own hardware by placing an edge device into an EDC in order to provide the benefits of the proximity of its services to its users, i.e., a reduction in traffic and latency thereby giving end users a better experience while cutting its own bandwidth costs.[8] The local proximity of these EDCs effectively addresses the problem of latency by managing the flow of data more efficiently than where all users are connecting to the central core of the network in order to access the data.[9] Utilization of local centers by larger companies such as Netflix is likely to expand in the years ahead.

Small:

EDCs are constructed to be small-to-mid-sized versions of their counterparts within the larger network. These centers maintain all of the same components as the larger, central data centers, but are packed into a far smaller footprint.[10] Given their size, EDC infrastructure is often less costly to acquire and maintain than the larger, central data centers.[11] A study conducted by Schneider-Electric found that development of an EDC represents "a 42 % savings over a centralized data center."[12] EDCs can also more easily be adapted and scaled to accommodate growth in IT gear and the number of users and devices as the need for more computing arises.[13] The adaptability of these smaller data centers results in cost savings by allowing operators and organizations to utilize only those services and IT gear that are necessary. Further, as organizations grow, it is difficult to anticipate IT infrastructure needs further down the road and building a dedicated data center for their own enterprise may prove too costly. EDCs allow these organizations an affordable and adaptable outlet to tap into as their IT infrastructure needs change thereby increasing their demand.[14]

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6   *4 Key Characteristics of Edge Data Centers,* Sunbird DCIM, https://www.sunbirddcim.com/blog/4-key-characteristics-edge-data-centers (last updated Sept. 21, 2018).
7   David Chernicoff, *Postcards from the Edge,* Datacenterdynamics.com (Oct. 26, 2015), https://www.datacenterdynamics.com/en/analysis/postcards-from-the-edge/.
8   *Id.*
9   Simon Besteman, *Why Does 5G Need Edge Computing in a Micro Data Center, Kingston Technology,* https://www.kingston.com/unitedstates/us/solutions/servers-data-centers/the-need-for-edge-data-centers (last visited May 24, 2021).
10   *4 Key Characteristics of Edge Data Centers, supra* note 6.
11   Ernest Sampera, *Enterprise vs Edge Data Center: Which is Right for You,* VxChnge (Dec. 11, 2020), https://www.vxchnge.com/blog/enterprise-vs-edge-data-center.
12   Victor Avelar, *Cost Benefit Analysis of Edge Micro Data Center Deployments,* Schneider-Electric, Page 7, https://download.schneider-electric.com/files?p_Doc_Ref=SPD_VAVR-9X6SVK_EN#:~:text=The%20capital%20expense%20for%20building,%244.05%20million%20or%20%244.05%2Fwatt (last visited May 24, 2021).
13   *Id.*
14   Kaylie Gyarmathy, *The Benefits, Potential, and Future of Edge Computing,* VxChnge (April 29, 2021), https://www.vxchnge.com/blog/the-5-best-benefits-of-edge-computing.

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Part of a Larger Deployment:

EDCs serve as a point of contact within a larger network. The weak point of centralization is that all of the data is at the core of the network and, therefore, all users must connect to the central point in order to access it.[15] This is where the problem of latency arises. As a solution, an EDC operates within a larger system composed of a central data center and multiple EDCs interconnected with one another to expand reach and connectivity to particular regions.[16] Any single EDC will typically connect back to the larger deployment that provides the cloud resources and centralized data processing.[17] This format allows organizations to more directly serve a targeted region. Reduced latency is not the only benefit of processing this data locally; EDCs may offer organizations increased security. Since more data is being processed on local devices rather than transmitting it back to a central point, the amount of data actually at risk in a single moment is reduced. In other words, there is less data to be intercepted during transit, and even if a device is compromised, it is likely to only compromise the data that has been collected locally rather than the trove of data that could be exposed by a compromised central server.[18]

Characteristics of EDCs:

- **Local**
- **Small**
- **Part of a Larger Development**
- **Mission Critical**

Mission Critical:

The term "mission critical" refers to the need for an EDC to be just as reliable as its larger, central counterpart. Such a characteristic is vital since many of the uses identified in the next section require services and data to be accessible nearly 24 hours per day with minimal latency and just as sophisticated security and connectivity options as their larger counterparts. EDCs being "mission critical" cements their position as a necessity in the processing, delivery and analysis of data.

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15   Simon Besteman, *supra* note 9.
16   *Key Characteristics of Edge Data Centers, supra* note 6.
17   Kaylie Gyarmathy, *How to Define an Edge Data Center,* VxChnge (March 8, 2021), https://www.vxchnge.com/blog/what-is-an-edge-data-center.
18   Kaylie Gyarmathy, *supra* note 14.

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The Key Uses of the Edge Data Center

Edge computing and EDCs are generally thought of in connection with the Internet of Things ("IoT"), i.e. the network of physical objects embedded with sensors, software and other technologies for the purposes of connecting and exchanging data with other devices and systems[20], as well as the development and deployment of the long-anticipated 5G mobile networking connectivity.[21] However, the opportunity for utilization of EDCs in nearly every industry is set to explode.

To appreciate the myriad opportunities that lie with the development of EDCs, it is important to understand the numbers. The value of the global edge computing market in 2019 was around 3.5 billion dollars.[22] In 2020, the value of this market rose to an estimated 4.68 billion dollars.[23] North America, alone, accounted for a staggering 44 % revenue share within the global edge computing market.[24] The value of this global market is expected to increase to over 43 billion dollars by 2027.[25] In the short term alone, a survey conducted by Forrester Analytics found that 57 % of mobility decision makers surveyed said that they had edge computing on their roadmap for the next 12 months.[26] Further, Gartner predicts that by 2025, nearly 75 % of enterprise-generated data will be created and processed at the edge and outside of a centralized data center or cloud.[27]

So, what industries and sectors will make up this explosion in the global edge computing market? Consider the following industries and some of the potential uses within them:

1 ## Banking/Financial Industry

Trader and asset manager reliance on EDCs to effectively assist in day-to-day operations and to execute transactions more quickly. Further, with cryptocurrencies rapidly becoming more widely-accepted, EDCs stand in unique position to help facilitate these types of financial transactions.[28]

2 ## Healthcare

Robotic surgeries depend on low latency and uninterrupted services in order to properly perform.[29] Further, increases in telehealth present opportunities for EDCs to reduce latency and provide more immediate, uninterrupted access to healthcare data and monitoring.[30]

19   *Id.*
20   *What is IoT,* Oracle, https://www.oracle.com/internet-of-things/what-is-iot/ (last visited May 24, 2021).
21   Stephanie Overby, *How to Explain Edge Computing in Plain English* (Nov. 30, 2020), enterprisersproject.com, https://enterprisersproject.com/article/2020/4/edge-computing-9-compelling-stats.
22   *Id.*
23   *Edge Computing Market Size, Share and Trends Analysis Report* (May 2021), Grand View Research, https://www.grandviewresearch.com/industry-analysis/edge-computing-market.
24   *Id.*
25   Stephanie Overby, *supra* note 21.
26   Abhijit Sunil, *Predictions 2020: Edge Computing Makes the Leap* (Nov. 4, 2019), Forrester, https://go.forrester.com/blogs/predictions-2020-edge-computing/.
27   Rob van der Meulen, *What Edge Computing Means for Infrastructure and Operational Leaders* (Oct. 3, 2018), Gartner, https://www.gartner.com/smarterwithgartner/what-edge-computing-means-for-infrastructure-and-operations-leaders/.
28   *What is an Edge Data Center?, supr*a note 2.
29   *Id.*
30   *Id.*

3 **Inventory**

Increased efficiency in robotic picking and inventory management, as well as for delivery fleet management and package tracking.[31] Each of these measures requires business intelligence gathered in real-time.

4 **Smart Cities**

Real-time gathering and analysis of data on traffic, utilities and infrastructure, as well as emergency services response capabilities. [32]

5 **Smart Industry**

Smart factories, including machine predictive maintenance and predictive quality management are becoming innovative measures in reducing costs and injury while increasing productivity.[33] Each of these measures will require real-time analysis with minimal latency.

6 **Agriculture**

Analytics used to track livestock movements present an important mechanism of infectious diseases transmission and could highlight vulnerabilities and inform targeted surveillance, which could assist in identifying and managing animal health-related risks earlier.[34]

Other Potential Uses

 Augmented Reality; AI Virtual Assistants and other Artificial Intelligence; Retail Point-of-Sale Transactions; Gaming; Video Monitoring; Autonomous Vehicles; Defense Systems; and Mining & Oil.[35]

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31   *Id.*
32   *Id.*
33   *Edge Data Centers: How to Participate in the Coming Boom,* PwC, https://www.pwc.com/us/en/industries/capital-projects-infrastructure/library/edge-data-centers.html (last visited May 24, 2021).
34   *Edge Data Centers: How to Participate in the Coming Boom, supra* note 33; *See* Damien Barrett, *Potential for Big Data in Animal Disease Surveillance in Ireland* (Oct. 6, 2017) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5635564/.
35   *What is an Edge Data Center?, supra* note 2.

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Northeast-specific Opportunities for Development of Edge Data Centers

The Northeast presents an interesting opportunity for property owners, investors and entrepreneurs. This region encompasses the first, seventh and ninth largest regional U.S. economies, includes the national and global capital of finance, i.e., New York City, and possesses more than half of the world's top pharmaceutical companies, over 200 universities, and some of the nation's (and world's) leading medical institutions.[36] Yet, despite the region's economic prowess, it lacks the quantity and quality of data center development seen in other parts of the country, e.g., Northern Virginia, Dallas and Silicon Valley.[37] Much of this lack of development is due to the fact that the Northeast continues to be one of the most expensive locations to locate a data center due to its high costs for both land and electricity. As a result, in 2020, rental rates in Boston (measured in kilowatts/month) averaged between $150-$175 whereas rental rates in Northern Virginia averaged between $85-$120.[38] This difference in rental rates implies that operators are facing higher operating costs in the region. For example, in 2019, the most recent year for which data are available, electricity costs in Connecticut averaged about 18.7 cents per Kilowatt hour, while Massachusetts and New York averaged 18.4 cents and 14.3 cents per Kilowatt hour, respectively.[39] However, year over year, average asking rental rates have steadily declined, suggesting a reduction in operating costs, and thereby creating potential opportunities for those considering utilization of EDCs.[40]

In addition to year over year declines in asking rental rates, data center operators and developers are not devoid of options in lowering their operating costs. For example, as renewable energy becomes less expensive and local, state and federal governments continue to offer a variety of tax credits associated with green energy and economic development, including programs such as Property Assessed Clean Energy (PACE), cost savings can accumulate quickly.[41] Further, owners can take advantage of Connecticut's Brownfield Remediation and Revitalization Program (and similar programs in other states) pursuant to which owners can benefit from certain liability protections and would not be required to remediate the site to residential standards. By building the EDCs on slabs, rather than subsurface foundations, owners can further lower costs and turn a previously undervalued, low-price property into a high-performing EDC, while managing risks through strategic use of GFPR contracts and environmental insurance policies.[42]

36   Jonathan Tombes, *Why the Northeast Needs Advanced Data Centers and How it Can Get Them,* http://www.keystonenap.com/why-the-northeast-needs-advanced-data-centers/ (last visited May 24, 2021).
37   CBRE Research, *A Source of Stability: Digital Infrastructure in 2020* (March 8, 2021), http://cbre.vo.llnwd.net/grgservices/secure/North%20Amer%20Data%20Centers%20H2%202020.pdf?e=1621818323&h=6d797f28422fd42f2a3aa2649b116139
38   *Id.*
39   https://www.eia.gov/electricity/state/
40   CBRE Research, *A Source of Stability: Digital Infrastructure in 2020, supra* note 37.
41   *See* Lisa M. Zana, *Incentives for Qualified Data Centers to Locate in the State,* Shipman & Goodwin LLP, https://www.cttaxalert.com/2021/05/incentives-for-qualified-data-centers-to-locate-in-the-state/ (May 17, 2021).
42   *See* Andrew N. Davis, Ph.D. and Aaron D. Levy, *Redeveloping Brownfields: The Need for Risk Transfer Strategies,* Shipman & Goodwin LLP, https://www.shipmangoodwin.com/insights/redeveloping-brownfields-the-need-for-risk-transfer-strategies.html (April 9, 2021); *See also Brownfields in Connecticut,* CT.Gov, https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/Brownfields/Brownfields-in-Connecticut (last visited June 8, 2021).

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CBRE has researched and provided insight as to the potential future in data center development in the following metro areas:

Boston

CBRE found that several major cloud providers intend to provide local cloud sources in and around Greater Boston, which would make the area a dominant force in 2021 and beyond.[43] CBRE notes that prices are starting to stabilize and expected returns for investors and operators are beginning to match those of more traditional real estate sectors, which is a positive light in a market traditionally burdened by high costs.[44] There exists in the region about 77.8 megawatts of inventory with a vacancy rate of 16.5 %.[45]

New York Tri-State

CBRE found that interest from cloud providers has increased over the past six months and vacancy within the region's market remains near all- time lows.[46] There exists in the region about 149.1 megawatts of inventory with a vacancy rate of 8.8 % as compared with Northern Virginia, which maintains nearly 1,377 megawatts of inventory with a 5.5 % vacancy rate.[47]
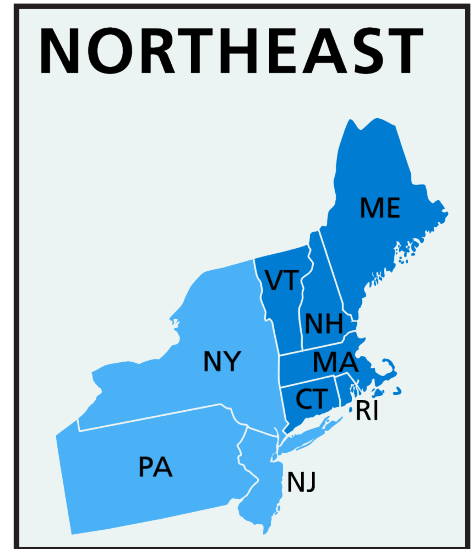
NORTHEAST

As noted, when compared with North America's hottest data center market in Northern Virginia, total inventory in the Northeast is substantially lower.[48] However, as the need for edge computing develops, major medical, educational and financial hubs such as that of Boston, New York and their surrounding regions will require data processing and analysis closer to those utilizing it. As outlined throughout this paper, as wearable technologies, the proliferation of 5G and the demand placed on content delivery and access continues to grow, EDCs are likely to step in to fill the void in smaller metro areas. Demand, economic, medical and educational prowess and lack of inventory in the Northeast have positioned the region for a potential boom in edge development. If EDCs can increase in availability within the region, the Northeast stands a chance at becoming more cost-competitive and – as lower costs follow – so too will the organizations competing to be closer to their end users.

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43   CBRE Research, *A Source of Stability: Digital Infrastructure in 2020, supra* note 37 at 20.
44   *Id.*
45   *Id.*
46   *Id.* at 28.
47   *Id.* at 28, 29.

Contact:

Lisa M. Zana

(203) 324-8171
lzana@goodwin.com

Nikolas D. Kittredge

(860) 251-5015
nkittredge@goodwin.com

Authors, Lisa Zana and Niko Kittredge are both lawyers in Shipman's Real Estate group and members of the firm's Data Centers team. Please feel free to contact either of them if you have any questions regarding Edge Data Centers.

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