



# Introduction to Data Centers

COPYRIGHT © TA REALTY LLC, OCTOBER 2022

This material is provided for informational purposes only and nothing herein constitutes investment, legal, accounting or tax advice, or a recommendation to buy, sell or hold a security. Information is obtained from sources deemed reliable, but there is no representation or warranty as to its accuracy, completeness or reliability. All information is current as of the date of this material and is subject to change without notice. Any views or opinions expressed may not reflect those of the firm as a whole. TA Realty LLC products and services may not be available in all jurisdictions or to all client types. This material is not intended as a formal research report and should not be relied upon as a basis for making an investment decision. The firm, its employees and advisory accounts may hold positions of any companies discussed. This material may include estimates, outlooks, projections and other “forward-looking statements.” Due to a variety of factors, actual events or market behavior may differ significantly from any views expressed. Investing entails risks, including possible loss of principal. Investments in real estate and private equity are speculative and involve a higher degree of risk than more traditional investments. Investments in real estate and private equity are intended for sophisticated investors only. Past performance is no guarantee of future results.

## INTRODUCTION

Digital infrastructure is critical to the world's economy and data centers play a key role. Technology and the creation of digital data are bringing us many new ways to see and interact with the world around us. Businesses, governments, and consumers all rely on data centers to house, process and analyze the data they are creating through the digitization of retail, manufacturing, entertainment, transportation, healthcare, and workflows across organizations of all types. Data centers are the backbone of that digitization creating opportunities for investment.

In the decade from 2010-2020, more than \$100 billion flowed into the data center ecosystem, with pension funds, PE firms, infrastructure funds, sovereign wealth and many other organizations recognizing the growth potential of the sector<sup>1</sup>. 2021 alone saw more than \$25 billion in M&A activity including Blackstone's \$10 billion purchase of QTS, American Tower's \$10 billion purchase of Coresite, and nearly \$5 billion of individual property and portfolio sales. In the first five months of 2022, KKR and Global Infrastructure Partners completed their \$15 billion acquisition of CyrusOne and DigitalBridge announced the \$11 billion acquisition of Switch.

This significant capital inflow has been matched by an equally major technical shift throughout the industry, as enterprises have chosen to move workloads off premises – first to colocation facilities and more recently to a mixture of colocation and public and private cloud computing. This shift has caused the largest cloud platform providers to become the most important players in many markets, signing leases so large they have altered data center sizing by a factor of ten. The 10-megawatt (MW) data center that was impressively sized a few years ago now pales in comparison to 30+ MW leases that are now signed with increasing regularity.

Just as cloud computing has created the largest data center campuses, end user needs are driving the creation of the so-called "edge". Devices that are part of the Internet-of-Things (IoT), 5G wireless networks, and the prospect of self-driving vehicles will require considerable spend on infrastructure, particularly in dense urban areas.

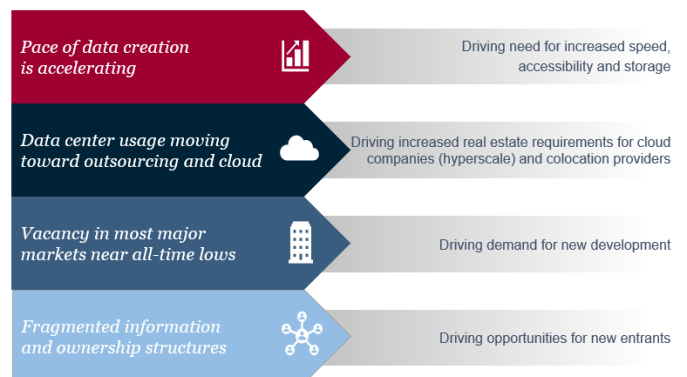
The shift to outsourcing data storage and the demand for significant processing power located near end users is still in the early stage of the real estate cycle. Demand from public cloud providers and data center operators has led to shortages of affordable land serviced by significant

power and fiber infrastructure. Sustainable designs have become more important to end users and the communities in which the data centers reside.

Access to buildings with the latest designs, efficiency advancements and technology capabilities is key for future growth. Each of these drivers suggest an opportunity in data center development and due to the mission critical nature of the business, there is a strong case for long-term investment in the asset class.

## MARKET FUNDAMENTALS

The data center market is driven by four key dynamics: 1) the accelerating pace of data creation; 2) the shift to outsourcing for data storage and processing; 3) record-low availability in most major markets; and 4) the fragmented information and ownership structures of this asset class. Each of these dynamics contributes to a compelling thesis for investment in the data center asset class.



### Accelerating Pace of Data Creation

The acceleration of data creation, which in turn drives demand for data centers, is happening at unprecedented levels. In 2018, 33 zettabytes (ZB) of data were created, captured, copied, and consumed around the globe (one zettabyte equals one trillion gigabytes). This number increased to 64ZB in 2020 and IDC predicts that by 2025 the global datasphere will grow to 175ZB of data<sup>2,3</sup>. The digitization of our world is a result of integrating intelligent data into everything we do. It is impacted by "smart" devices including cars, appliances and phones, and the move toward digital transformation of businesses including

Industry 4.0. That data needs to be stored and processed and that's where data centers come in. As the pace of data creation accelerates, it drives a need for increased speed, accessibility, and storage through data centers.

## Outsourcing Trends

According to Cisco, data center traffic has grown over 300% in the last 5 years due primarily to the data creation trends previously mentioned<sup>4</sup>. This growth in traffic comes at a time when the industry is shifting from enterprises owning and operating their own data centers to outsourcing that function to public cloud providers and colocation operators. Companies have determined that outsourcing is often more economical than operating a facility on their own. According to Gartner, worldwide end-user spending on public cloud services is forecast to grow 20.4% in 2022 to \$494.7 billion, up from \$410.9 billion in 2021. In 2023, that number is expected to reach nearly \$600 billion<sup>5</sup>. This growth has also led to a shift within the industry to larger lease sizes to accommodate the cloud providers and large technology companies. In the U.S. in 2017 there were no leases recorded over 25MW, in 2021 there were 11 leases recorded over 30MW<sup>6</sup>. Given the demand drivers, this trend is expected to continue.

## Market Trends

2021 was an historic year for the U.S. data center industry with a surge of demand toward year end. New leasing activity across the top U.S. markets reached well-above previous records in 2021. In the fourth quarter alone, commissioned power in the top 18 North American markets grew by 488MW as compared to an average growth rate of 130MW per quarter<sup>7</sup>. While pre-leasing of large-scale developments by hyperscalers continued at a robust pace, demand from the enterprise sector also saw an uptick in activity, specifically in the 1-5MW segment of the market.

The historic growth in the latter half of 2021 reduced supply availability in both primary and secondary markets. 18 of the top markets globally and 14 of the top 23 North American markets recorded vacancy rates under 10%<sup>8</sup>. Additionally, 10 U.S. markets reached the lowest vacancy rate in the last two years. Markets with sub-10% vacancy are considered very tight, creating issues for users with large requirements. Rental rates began to stabilize, and in key markets, such as Northern Virginia and Silicon Valley, asking rates have ticked up as limited power availability and new development limitations constrain supply.

## Market Fragmentation

Data centers have historically been considered a niche sector with the primary owners of the real estate being enterprises and colocation operators. As a result, the information available has been limited with minimal disclosures about cap rates and lease rates and terms.

That dynamic is beginning to shift as more institutional investors have entered the space and the increased awareness of the asset class is expected to drive further efficiencies in the market over time. As of 3Q21, the 10 largest data center operators globally only accounted for 37% of the revenue market share<sup>9</sup>. The other 63% of operators are all less than 1% of total market share. This fragmentation means opportunities for new entrants into the space.

# INVESTMENT CHARACTERISTICS

---

## TYPES OF DATA CENTER INVESTMENTS

Data centers are facilities that house critical IT applications and data. Unlike other types of real estate, they are dependent on redundant power systems, elaborate cooling infrastructure and strong network connections. Services and equipment for processing and storing data are owned and often maintained by the tenant and can cost as much or more than the rest of the building.

In many ways data center real estate looks a lot like logistics/industrial real estate. The buildings are used to process and store data and are connected via the highway of fiber that runs along familiar logistics routes (railways, highways, and local roads). There are extremely large facilities used primarily for storage capacity and smaller edge facilities located in close proximity to population centers focused on providing low latency service to homes and offices for video and other real time applications.

Data center facilities can vary greatly in their physical attributes, functionality, and economics. Most types of data centers can be leased on either a single-tenant basis or to multiple tenants if the building has been designed to accommodate more than one user. Unlike industrial real estate, complicated infrastructure requirements (notably power generation and distribution, cooling and fire suppression, and enhanced security) make the construction of multi-tenant data centers, or the adaptation of existing buildings into multi-tenant facilities, a difficult and costly undertaking.

Entire data centers are often leased or owned by large "enterprise" users that need a secure facility entirely for their own use. There is a wide array of companies that lease such facilities, including public cloud providers, large technology companies, including SAAS, social media and gaming, healthcare service providers, life insurance and other financial service companies, government or educational institutions, as well as telecommunications and other information technology firms. A typical enterprise-level data center might have 5MW of power, while hyperscale data centers servicing cloud and other technology companies are often significantly larger with some recent deployments housing nearly 100MW.



Properties that provide data center services to multiple users include “colocation facilities”, which can lease space as small as the individual cabinet or rack within a data center room. Some facilities offer wholesale colocation, which are typically characterized by larger leases and often whole data halls, but not an entire building. Other data centers provide retail colocation, in which space within a data hall is shared by smaller users (often divided into cages and cabinets, or divided racks). Retail colocation centers can also provide the use of other IT hardware or software and services, on a fee or contractual basis.

From an investment perspective, a single tenant powered shell data center is at one end of the risk spectrum while a retail colocation building is at the other with turn-key solutions in the middle.

A powered shell is a large, scalable facility most similar to an industrial box with enhanced power supply. Typically designed for a single tenant, often cloud or other hyperscale user, the space within the building is delivered undeveloped, and the tenant is responsible for the build-out of mechanical and electrical equipment. Leases are typically long-term, triple net and based on square feet.

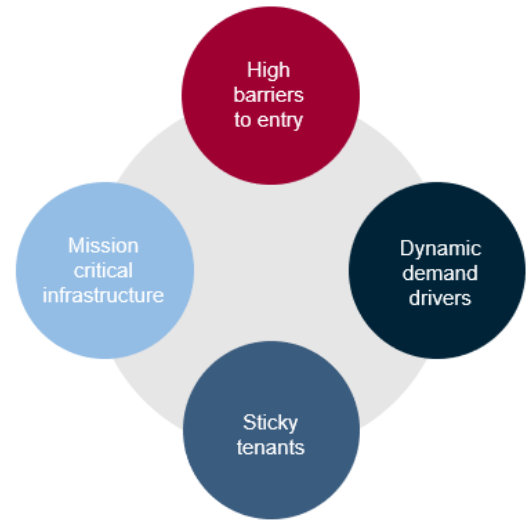
A turn-key facility is a powered shell plus all of the mechanical and electrical equipment (MEP) including predefined power, cooling and fiber infrastructure built out. These facilities, designed for enterprise and hyperscale/cloud providers, tend to be large and may be leased to a single-tenant or subdivided into wholesale colocation housing several tenants. The leases are typically long-term, modified gross and based on power usage. A facilities manager and/or operator may be required.

A retail colocation facility is a turn-key building plus a services package for tenants. These facilities typically house multiple tenants from Fortune 100 customers down to small business owners whose needs range from a single server in a shared rack up to a dedicated cage housing many racks. The leases tend to be short-term (1-3 years), based on power usage and are often written as services level agreements with cross-sell and value-add services offered on top of the leased space. An experienced operator is required.

### Unique Investment Dynamics

There are four distinct dynamics at play that make the investing in a data center unique. First, data center management is complex and data center developments require significant capital commitments which create high barriers to entry. In addition, traditional real estate information including lease rates and cap rates can be difficult to source creating asymmetric information that can only be overcome by spending the time to cultivate relationships across the industry. Second, as noted previously, the data center industry underpins the

exponential growth of the digital economy. The more data produced by advancing technologies, the more data centers we will need. Third, is the mission critical nature of data centers. Most data center real estate is considered mission critical and the industry’s business model has held up well during previous recessions. The recent Covid-19 pandemic was a prime example of data centers seeing growth right through a situation that caused most other industries to slow down or halt altogether. Lastly, the high renewal rates of tenants. Most data center tenants face high switching costs both in terms of capital and risk to service which creates sticky landlord/tenant relationships.



### Role of JV’s and Operating Partners

Based on the specialized nature of the buildings and the demands of tenants, the use of joint ventures and partnership agreements with or ownership of an operating company are common in the data center industry. The development and/or operating partners bring expertise specific to data center requirements and long-term relationships with key tenants. These established tenant relationships in turn provide extensive background on the business requirements and strategies driving the tenant’s search for data center space.

The ability to tap into the expertise of a data center partner makes scaling in this niche sector much easier and appropriately structured incentives can provide significant benefits to the project. Working with a strong partner reduces the need to hire extensively and allows for the flexibility of working with different partners in different markets or on different product types, ensuring the project gets the expertise it needs to achieve its goals.

## MARKETS

From the very beginning, data centers have been charged with housing servers in locations that provide accessibility

of data to the end user. That accessibility is typically tied to fiber or other telecommunication lines. Today, proximity and access to fiber optic services is one of the key components in data center site selection. Equally important is the availability and reliability of power, and the access to renewable power sources. Proximity to other data centers, specifically public cloud providers and other large technology companies, is another factor. The ecosystems that are created where data centers cluster tend to drive further growth driven by demand from the existing users and new users looking for low latency solutions near their partners. As our society continues to produce more data and the need for that data to be processed in real time increases, proximity to population centers is likely to become increasingly important for new deployments.

The largest and arguably the most important data center market in the world is Northern Virginia<sup>10</sup>. With 1.7 gigawatts of power and 70% of the world's internet traffic on a daily basis, Northern Virginia is more than three times the size of the next largest market in the US, Silicon Valley. Dallas, Chicago and NYC/NJ round out the top five in the US and are considered the primary data center markets. Phoenix, Atlanta, Toronto, Los Angeles, and Portland/Hillsboro make up the next group of North American data center markets and collectively the top ten are often referred to as the major North American markets.

Globally, London is the second largest data center market with over 800MW, followed by Tokyo, Shanghai, Singapore, Frankfurt, Hong Kong, Amsterdam, Beijing, Sydney and Mumbai.

## CONCLUSION

---

Data centers are still commonly viewed as a niche real estate asset class, but as the market increases in size and proves the strength and sustainability of demand, real estate investment across the globe is increasingly attracted to the sector. Data center infrastructure will need to expand around the world driven by data sovereignty requirements, the overall acceleration of data creation and the move toward population centers and edge deployments. Given its importance in our global economy and society, we view long term investment in this real estate as compelling.

## GLOSSARY

---

**PUE (Power Usage Effectiveness)** – Measures energy efficiency of infrastructure within the data center by calculating how much incoming power is utilized by IT

equipment. A PUE value of 1.0 represents a data center operating at 100% efficiency. PUE can range from 1.1 to 3.0 depending on a number of factors. A data center is considered efficient when operating below 1.5 PUE and most hyperscale facilities are expected to operate at 1.25 PUE or better. (PUE = Total Facility Energy/IT Equipment Energy)

**Total Power vs Critical Power** – Total power is the amount of power going into the data center. Critical power is the amount of power that gets to the IT equipment to be used for computing. The lower the PUE the closer the two numbers will be. On its path to the IT equipment, power is used by all of the supporting mechanical and electrical equipment (cooling, switchgear, security, UPS, lights, etc). Leases are typically based on critical power provided.

**MW (Megawatt)** – One megawatt is equal to 1,000kW, enough to power nearly 800 homes<sup>11</sup>. One gigawatt is equal to 1,000MW.

**Data Center Infrastructure** – Data centers contain significant mechanical, electrical and plumbing equipment (MEP) to support the IT equipment in the data halls. The primary goals are to maintain a consistent temperature in the data hall and ensure no interruptions to the power supply. Temperatures are maintained through massive cooling equipment typically relying on either air or water to remove heat created by the servers. Significant redundancy is built into the system to maintain continuous power. This equipment includes an Uninterrupted Power Supply (UPS) in the form of batteries, and generators that are designed to run within seconds of an unplanned power outage. Additional infrastructure includes fire suppression and physical security.

**Hyperscale** – Refers to large data center users with flexible/scalable technology demands. Typically includes the public cloud providers (Amazon Web Services, Google Cloud, Microsoft Azure, Oracle Cloud) and large technology companies (examples include Meta, Apple, ByteDance, Salesforce, etc.)

**Latency** – Refers to the time it takes for a message (data packet) to travel from one location to another. Low latency is important for real-time applications such as video streaming.

**Data Sovereignty** – A country-specific requirement that data is subject to the laws and governance structures of the country in which it is collected or processed and must remain within the borders of the jurisdiction where it originated. This concept is closely linked to data security and the desire to maintain control over encryption and access to data.

## AUTHORS

---



**Allison O'Rourke**  
Vice President, Portfolio  
Management



**Lisa Strobe**  
Vice President, Research

TA Realty is among the largest and most experienced providers of real estate investment management services to U.S. and non-U.S. institutional investors. Since its inception in 1982, TA Realty has managed \$38.5 billion of real estate assets through value-add and core strategies and customized separate/advisory accounts. TA Realty's investment philosophy focuses on creating diversified real estate portfolios that aim to generate strong cash flow, receive intensive asset management, and seek to achieve long-term value creation. For four decades, TA Realty has maintained this philosophy through multiple real estate and economic cycles, a strength recognized by pension funds, endowments, foundations and high-net-worth individuals. For more information, please visit [www.tarealty.com](http://www.tarealty.com).

## SOURCES

---

1. Cushman & Wakefield, Data Center Global Market Comparison 2020
2. <https://www.idc.com/getdoc.jsp?containerId=prUS47560321>
3. <https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf>
4. Cisco Global Cloud Index
5. <https://www.gartner.com/en/newsroom/press-releases/2022-04-19-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-reach-nearly-500-billion-in-2022#:~:text=Worldwide%20end%20user%20spending%20on,to%20reach%20nearly%20%24600%20billion.>
6. North American Data Centers, Data Center Real Estate Review: 2021
7. DataCenterHawk, Fourth Quarter 2021, Data Center Market Recap
8. CBRE North American Data Center Trends Report H1 2021
9. 451 Research; Cowen and Company
10. Cushman & Wakefield, Global Data Center Market Comparison 2022
11. <https://www.nwcouncil.org/reports/columbia-river-history/megawatt/>