DATA CENTER FAQ

UNDERSTANDING DATA CENTERS

DATA CENTER FREQUENTLY ASKED QUESTIONS

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National has been an active investor in one of the largest private data center companies in the U.S. since 2010. Over the last 10 years we have received our fair share of questions from investors interested in this fast growing and increasingly critical aspect of our modern economic infrastructure. The following is a selection of the most common questions we receive.

HOW DO TENANTS CHOOSE THE LOCATION OF THEIR DATA CENTER OPERATIONS?

Like any real estate investment, location is one of the most important factors to consider for data center users. Below is a description of some of the competing factors that must be weighed by tenants when deciding on a location and the ultimate decision will most likely depend on the ultimate application running in the data center:

Cost:

Users will obviously try to minimize the cost of their data center operations. This can drive users away from central cities and towards locations with lower cost of electricity—often the single largest expense for users. Abundant and low-cost power leads to data center concentrations in relatively remote places like the Pacific Northwest and Iceland.

Connectivity:

Data centers are more desirable in locations where they can provide access to many backbone networks that connect the numerous smaller networks that make up the global internet. The presence of many network connections engenders the formation of data center hubs, such as those in Northern Ashburn, Silicon Valley, Tokyo, and Amsterdam.

Latency:

The distance and number of network exchanges from the data center to the end user can be a factor in the amount of time that data takes to load from a data center. All things being equal, webpages, music and videos will load faster and perform better if the distance traveled is relatively short and there are multiple pathways to the destination. The desire to be near large numbers of users leads some data centers with latency-dependent applications to cluster outside major cities around the world.

Security:

Data centers often house sensitive information for corporations, governments, and consumers. They also need to be reliably accessible 24 hours a day, 365 days per year. The requirement to be reliable and safe leads to data center concentrations in politically, seismically, and environmentally stable regions of the world.

Jurisdiction:

Corporations and other data collectors must comply with data protection laws which often require data to stay within the country or jurisdiction in which it was collected. The most notable of these laws is the EU's General Data Protection Regulation (GDPR) which has led to increased growth in data centers in Europe.[1]

Environment:

Data centers are large users of power and water for cooling. A cold location with access to sustainable water and power can be the driving force for cost and environmentally conscious users.

Proximity/Accessibility:

Data centers often contain critical operating functions of organizations causing many users to prefer to operate in data centers that are in the same city or even on the same premises as the organization.

WHAT ARE THE DISTINCTIONS BETWEEN EDGE LOCATION AND DESTINATION/CORE DATA CENTERS?

Edge data centers are located near large population centers where there is a lot of connectivity and many users. They are able to provide data with low latency to users in the surrounding area but also tend to be higher cost than core centers. Core data centers tend to be located where it is cheaper to operate often in more remote or rural locations. They will be located where there is connectivity and secure power but are more likely to be optimized for efficient operation rather than low latency.

In recent years, the number of edge data centers have mushroomed as consumers have become accustomed to receiving data with low latency. It is tempting to assume then, that the future for all data centers will be the massive proliferation of edge locations since surely it is always better to get content faster (i.e., reduce latency), but there is likely to still be a significant role for destination data centers. While massive streaming video and cloud providers need to have their content located in many markets around the country and world in order for their products to operate smoothly for all of their users, other types of uses, like data processing and data storage, are less latency sensitive and can be located centrally or where it is relatively cheap to operate. Both edge and destination locations benefit from the propagation of data in every part of our lives but in slightly different ways, and each location will likely see growth of data centers long into the future.

WHY INVEST IN AN OPERATING COMPANY RATHER THAN A STAND-ALONE PROPERTY?

Data centers house the critical operations of their tenants who cannot afford downtime. Therefore, reliability is often the most important issue for data center tenants. When evaluating data centers, tenants are keenly focused on the operating history of the owner and operator of the data center. It is therefore a competitive advantage to have a long and robust track record across multiple sites in order to attract tenants.

In addition to having a long track record, operating companies can benefit from having multiple data center locations. Large users need multiple

operations across the country to reach their customers efficiently and ensure reliability. These tenants often prefer leasing in multiple locations with the same operator rather than having to get comfortable with new operators in each location.

This network advantage is similar to the phenomenon commonly witnessed in retail properties. Large retail operators that own malls and locations across the country can be more competitive than their stand-alone peers in attracting large tenants because they can offer similar experiences in multiple markets where tenants can access more customers and create redundancy in their networks.

Importantly, investing at the platform level also eliminates the conflicts that can occur when an investor invests in a single data center developed and owned by a data center operator who has interests in other data centers that might compete for tenants across the country, in the market or even within the same campus.

IS TECHNOLOGICAL OBSOLESCENCE A SIGNIFICANT RISK FACTOR IN DATA CENTER INVESTMENT?

Considering Moore's Law and the continued exponential growth in computing power generally, potential investors are often worried that technological progress will reduce the current vast demand for data center space. There are several reasons this should not be a concern for data center investors from the way that leases are typically structured to the history of technological growth vs. demand over the past two decades:

Lease Structures/Power:

Under the most common long-term lease structures at data center properties, landlords provide physical space and electrical power capacity to tenants. Often, the landlord also provides HVAC and backup power. In all cases, the tenants, install their computer servers and other IT equipment. Although the server models may become obsolete relatively quickly as computing power becomes ever more compact, this changing technological burden is largely borne by tenants and is easily addressed

by installing more modern equipment. The landlord's provision of reliable power in a safe, secure, and well-connected location will always be a necessity even as technology becomes more efficient.
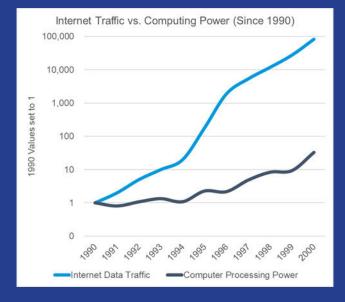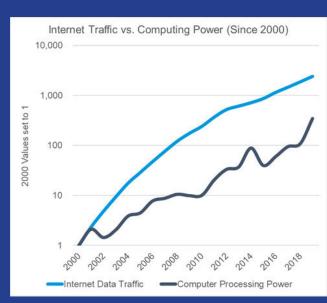
The Illusion of Smaller Devices:

As smartphones, laptops and other consumer devices shrink while growing ever more powerful, it is tempting to think that data centers will eventually be obsolete as everything consumers need will be in the palms of their hands. This thinking, however, is incorrect. As devices get smaller and smaller, more of the tasks they appear to perform are really being outsourced to servers in a data center. Cell phones and IoT devices generate data stored in data centers and make queries that are often answered in data centers, which are then sent back to the device (think of searching for directions).

Data usage is growing faster than computers are shrinking:

Below are two charts that compare the growth of data traffic on the internet against the gains in computer power over time. In the first chart, you can see that from 1990 until 2000 when the internet was just beginning, the amount of data flowing over the internet grew by nearly 100,000 times, while the processing of computers per area grew less than 100 times. In the second chart, you can see that even as the internet has matured as a technology, the growth rate of data travelling over the internet has kept up, or slightly outpaced, the speed at which computers are advancing: that is, consumption measured by data usage outstrips the increasing efficiency of processing power as described by Jevon's paradox, which can be thought of as a mitigant to Moore's Law. In summary, as computers become more powerful, they are often barely keeping up with the ever increasing demands made by new technology, which will likely be the case as AI, IoT, and virtual reality continue to generate tremendous data and require significant computer power.

Internet Traffic vs. Computing Power (Since 1990)

Internet Traffic vs. Computing Power (Since 2000)

WHAT ARE CURRENT AND FUTURE DEMAND DRIVERS FOR DATA CENTERS?

The ultimate demand driver for data centers is the continuing digitization of every facet of modern life. Nearly every activity done on a computer or smart phone, from sending email, to visiting websites, to mapping directions, to streaming video, is ultimately taking place in a data center. The scale and decentralized nature of the phenomenon makes it hard to be comprehensive, but below is a discussion of some of the most prominent demand drivers for data centers today and in the future.

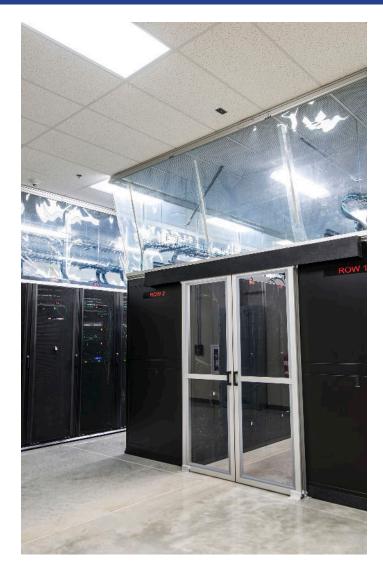## CURRENT DEMAND DRIVERS:

Streaming Video:

As of 2019, streaming video on sites like Netflix and YouTube accounted for nearly 60% of all internet traffic.[3] This makes streaming video by far the largest user of the internet and by extension a huge driver of data center usage. Video streaming sites typically operate within data centers around the world near population centers and dense internet connections where they can provide video to users around the world efficiently and without delay. Since 2019 streaming video has only continued to grow, while the pandemic has exploded demand for video conferencing which has grown by multiples since March 2020 as people work and learn at home.
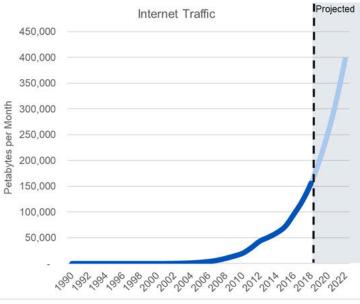
Data Processing and Software as a Service (the Cloud):

There are many data processing activities that often do not generate a large proportion of internet traffic but create a lot of activity inside data centers. These activities include things like running a Google search or booking an Uber, which causes an algorithm to run in a data center but presents the consumer with a simple list or map as the end-product. It also includes software-as-a-service applications that operate in the cloud. These applications include products like Microsoft Office 365, Slack, and Salesforce, as well as many customized business applications. These cloud operations, and the software that runs in them, have driven companies like Microsoft and Amazon to be among the most valuable corporations in the world.[4]

Data Storage (the Cloud):

Data storage is fundamental to the demand drivers above, as well as activities that are outside of consumers' view. Services like YouTube and Facebook have incredible amounts of data uploaded onto their platforms daily. This data must not only be stored, but backed-up in accessible locations. Additionally, services like Dropbox store customers' data, cloud services like Microsoft hold office users' data, and healthcare companies store sensitive imaging data and genetic information.

Source: Cisco Visual Networking Index[5]

FUTURE DEMAND DRIVERS:

Artificial Intelligence (AI):

Virtual assistants like Siri and Alexa illustrate a phenomenon that is evident in emerging technologies that use sensors and artificial intelligence to increase automation. All of these examples require an incredible amount of data to operate. While the human brain is very good at filtering large amounts of data in order to make decisions or recognize faces, artificial intelligence can only become competent when it can "practice" the task with a large number of examples. For example, as companies like Waymo pilot driverless car technology, they are recording tens of millions of miles driven in the real world, recording up to a gigabyte of data per second as they drive.[6] Additionally, when Amazon's Alexa is awake, it records and stores everything it hears in order to train itself.[7] As these systems proliferate, their need for and ability to collect data will only grow.

Gaming:

In 2019, gaming was the 7th largest activity on the internet, representing about 2.0% of all internet traffic.[8] This includes activity and downloads occurring on platforms like Xbox and PlayStation, as well as online games like World of Warcraft. Over the course of 2020, it was the fastest growing area of internet traffic, more than doubling its share of total traffic.

Internet of Things (IoT):

The internet of things has the potential to grow exponentially as everyday devices like appliances, cars, and medical devices become connected to the internet and start collecting data in order to better perform their tasks. In the vanguard of this space is the Nest thermostat, which is currently one of the most prolific connected device—constantly collecting data on home energy performance. Beyond thermostats, cars are another of the prolific connected devices collecting data that are able to stream music, get directions and even download software updates at a moment's notice. They are also collecting data about maintenance and performance, traffic, and even passenger behavior.

Driverless Cars:

Driverless cars are at the nexus of artificial intelligence and the internet of things. They are therefore expected to be among the most prolific data generating machines around. Each driverless car is expected to produce a petabyte of data per year through its array of cameras and radar sensors. This equates to two million driverless cars on the road producing as much data as the entire internet uses today.[10]

5G Wireless Networks

5G networks are currently being expanded around the world and promise to bring download speeds that will compete with traditional cable internet providers. This increased speed will only serve to increase internet traffic as broadband service becomes untethered from homes and businesses, making all the other future drivers of internet traffic from virtual reality to driverless cars more feasible. With greater traffic, comes greater consumption, processing and storage of data - all requiring the increased investment in data centers.

National was an early investor in data centers, and our front row seat has provided us with a hands-on perspective to experience the evolution of our economy and the digitization of the human experience. It seems clear to us that the demand for data centers and the overall telecommunication infrastructure the supports our modern economy will increase. We therefore believe it is critical to also educate the investment community on this incredibly fascinating and unique asset class.

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FOOTNOTES

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