



DATA CENTER

# Frontier Special Report

## Five Things To Know About Data Center Site Selection

*Written by: Paul Gillin*



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## Contents

Introduction.....	2
1. Know Your Surroundings .....	3
Climate .....	3
Seismic activity .....	3
Accessibility .....	3
Talent.....	3
2. Know the Grid.....	4
What are my current and future power requirements?.....	4
How robust is the grid? .....	4
How accessible are renewable energy sources? .....	4
3. Know the Network.....	5
4. Know Local Stakeholders .....	6
5. Expect the Unexpected.....	7
Conclusion .....	7

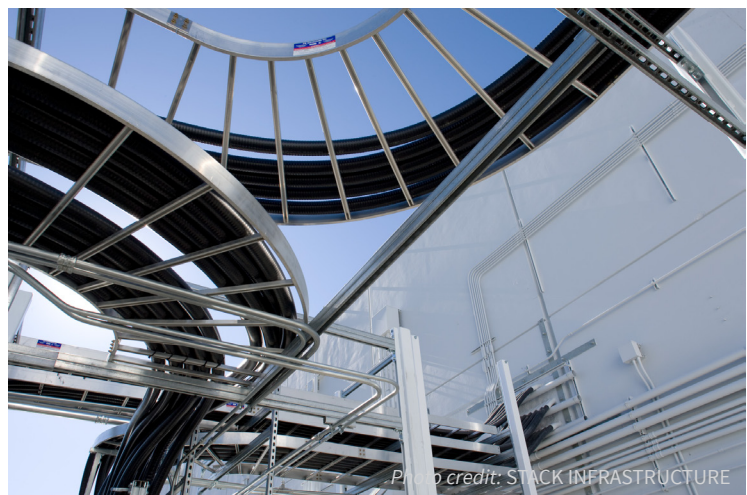
## Introduction

When selecting a site for a hyperscale facility, obey these five rules of the road to keep your business and the surrounding community in perfect harmony.

The global data center market is expected to grow 18% annually to over \$270 billion through 2024, [according to Infiniti Research](#). With such powerful momentum, the need to find the perfect site and deploy capacity quickly has never been greater. Site selection brings together financial modeling, community relations, engineering design, construction planning, and even a little fortune telling to deploy capacity where digital businesses need it.

The choice of site needs to take into account a wide variety of factors, not all of which are intuitive. A data center is a long-term investment, and choosing a location requires being sensitive both the needs of the business and the surrounding community.

As you begin your journey toward siting a new data center, follow these five rules of the road.



## 1. Know Your Surroundings

More than one-third of companies estimate that server downtime costs [more than \\$1 million per hour](#) and 15% estimate the toll at greater than \$5 million. Data centers are subject to the same forces of nature as any building, but the impact of a devastating loss is potentially much greater. Physical resilience is important, but so disaster response. Take the following factors into account.

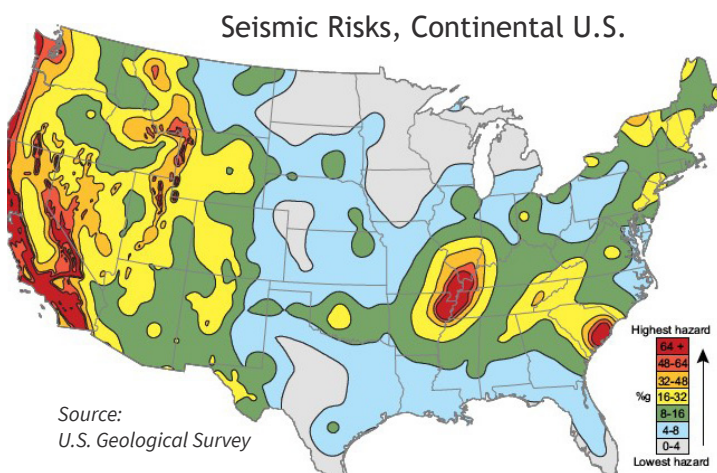
### Climate

The incidence of high temperatures, record precipitation and damaging storms has been rising for several years due to climate change. The impact of climactic forces goes beyond the wind and rain damage of a storm event. Hurricane Harvey, which slammed into the Texas coast in 2017, produced storm surges of up to 12 feet. The Mississippi River [was at flood levels for nearly three months](#) following heavy rains in 2019. Areas that were once considered safe may not be as secure years in the future.

Climate can also influence surrounding areas in a way that affects the data center. For example, heat waves can cause brownouts that force data center operators to rely on backup generators. Blackouts caused by hurricanes and tornadoes can have the same effect. Extreme weather may also influence the ability of critical employees to get to work. Site selection needs to anticipate these factors and put appropriate backups and redundancies in place.

### Seismic activity

While the west coast of the U.S. is known to be at high risk of earthquakes, pockets of frequent seismic activity exist all across North America.



In fact, two of the most seismically active areas of the U.S. are Missouri and South Carolina. Parts of the southeast, northeast and northern Rocky Mountains are also shaken on a regular basis.

Seismic activity can be quite localized. For example, the U.S. Geological Survey [estimates the likelihood](#) of a magnitude 7 earthquake striking the San Francisco Bay area during the next 30 years at 51% but Sacramento, which is less than a 90-minute drive away, is considered one of the least vulnerable areas of the state. Seismic events can cause disruptions other than property damage, including power loss, water line ruptures and damage to roads and bridges. Site selection needs to incorporate risk analysis and appropriate failover strategies.

### Accessibility

Constructing and equipping a data center involves moving lots of heavy-duty equipment. The condition of nearby roads can be a significant factor in ensuring safe and efficient transportation. Data center operators should also consider the ease of moving people, especially during an emergency. Accessibility is a classic “last mile” issue. The U.S. National Highway System accounts for only about 4% of the nation’s total public road miles. The area of greatest risk are the access roads to the data center site. The facility should be safely accessible by multiple routes. Owners should also consider proximity to airports and rail transport, keeping in mind that rail lines and aircraft approach patterns can also be hazards.

### Talent

Often overlooked in the siting decision is the importance of having the right skills in the area. The importance of talent varies with the needs and uses of the facility, ranging from basic hardware maintenance, network and system administration to facilities and operations management. Uptime Institute’s 2018 global survey of data center operators found that [more than half](#) said they were either having difficulty finding or retaining data center staff.

Urban centers with a concentration of large businesses and academic institutions provide the best access to technical talent, but at the highest prices. Low-cost regions may be a good option for data center owners that can affordably relocate employees or that run primarily “lights out” operations.



## 2. Know the Grid

Electrical power is one of the largest ongoing operational costs of running a data center. U.S.-based data centers alone [consumed more than 90 billion kilowatt-hours of electricity in 2017](#), or 40% more electricity than that used by the 65 million people in the United Kingdom. This consumption is certain to change over time, as servers are continually packing more processing power into a smaller space. A decade ago, a typical server rack's power density was in the [13kW to 5kW range](#). Today it isn't unusual to find rack power density of up to 13kW range or more. A data center that is in operation for 30 years may thus see its power density requirements triple over that time, with a proportional increase in power and cooling demand



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Operators require access to reliable, scalable and affordable power. The ability to access power from renewable sources is also an increasingly important consideration. Access to power requires understanding local power utilities, their capabilities and capacity to provide for redundancy and protection against failures. Among the factors to consider are:

### What are my current and future power requirements?

This process is different for every data center, but one approach is to calculate the nameplate power rating for all devices in use along with their voltage requirements and whether they are single- or three-phase devices. Because nameplate power requirements are the worst-case power consumption scenario as required by Underwriter's Laboratory, actual power usage is likely to be at least one-third less. Similar calculations should be performed for

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**Data center developers should request written copies of proposed increases in capacity, specifying right-of-way obligations, construction milestones and financial commitments.**

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the operating power requirements of air handlers/cooling/heating/ventilation equipment, lighting, uninterruptible power systems, generators, fire suppression systems and alarm systems. There are power consumption [calculators available online](#) that can help you with these calculations.

### How robust is the grid?

If power capacity is constrained in the area, upgrades may be needed to support the data center. While current capacity may be sufficient, operators need assurance from the utility that service levels will be maintained if capacity requirements grow. Electric utilities move more slowly than hyperscale providers and are subject to more regulations and approvals. They also may operate on a first-come, first-served basis when accommodating additional demand. Data center developers should request written copies of proposed increases in capacity, specifying right-of-way obligations, construction milestones and financial commitments. These costs can total tens of millions of dollars, with the data center owner usually expected to bear much of the burden.

### How accessible are renewable energy sources?

Green energy is an increasingly important consideration due to corporate social responsibility initiatives, demand from data center tenants and the need to reduce power costs. Data centers can reduce their power costs by leveraging sources such as solar, wind and biomass. This has the additional benefit of potentially mitigating public interest pressures that complicate siting and operation. Where 100% renewable sources aren't practical, there may be offsets available that compensate for the power your facility consumes, such as an on-site solar farm.

### 3. Know the Network

Network latency is bad for business and getting worse as customers grow increasingly intolerant of slow response times. The business impact can be substantial.

- ▶ Akamai reported in 2017 that a 100-millisecond delay in website load time [can hurt conversion rates by 7 percent](#) (an eyeblink takes about 300 milliseconds) and that a two-second delay in web page load time increases bounce rates by 103%.
- ▶ Google reported that as page load times increase from one to 5 seconds [the probability that users will leave increases by 90%](#).
- ▶ Mux estimated that a single buffering event [reduces viewership of an online video by 39%](#) and the amount of time visitors spend with a video by nearly 40%.
- ▶ [Kissmetrics found](#) that 47% of consumers expect a webpage to load in two seconds or less and 40% abandon a page that takes more than three seconds to load.

Data centers require reliable, robust and scalable network connections. These needs should be considered early in the planning process.

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**A data center may get better performance from interconnecting with a network dense facility 500 miles away than from a resource-starved one 150 miles away.**

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A common misconception is that latency is a function of the data center's proximity to end-users. In fact, a more important factor is proximity to exchanges and cloud on-ramps. A data center may get better performance from interconnecting with a network dense facility 500 miles away than from a resource-starved one 150 miles away.

The bandwidth and latency needs of individual data centers vary by the type of traffic that traverses the network. For example, financial applications are likely to be more sensitive to latency issues than website hosting. Capacity and performance demands are also likely to change due to financial conditions, application availability needs and target markets. It is important to understand the nature of the traffic that will be passing over the network.

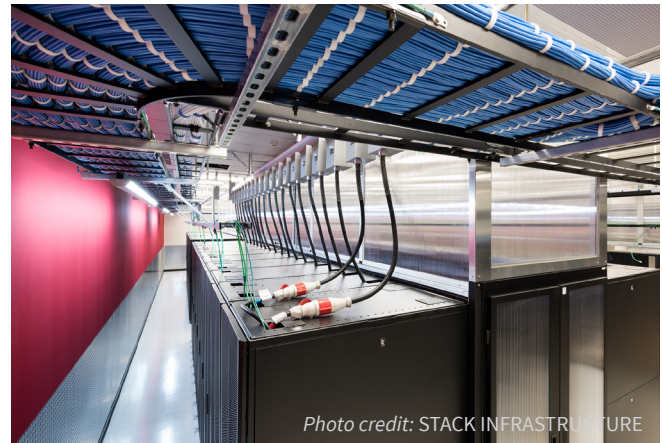


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It's also important to know what percentage of responses can be generated internally versus requiring queries over the public Internet.

For example, traditional OLTP workloads largely generate predictable north-south traffic between users and servers. With the growth of social media and mobile apps, those traffic patterns are more complex. A single query may now generate a significant amount of east-west traffic as user demographics, browsing history and recent purchases are factored into the response as well as ad-serving choices generated by real-time auctions. Hyperscale applications are also increasingly making use of microservices, which can cause a single query to generate hundreds of downstream requests to other servers. The slowest microservice can drag down overall response times.

The availability of dark fiber is also a key concern because installing fiber is expensive and time-consuming. At the right scale, dark fiber allows for rapid and cost-effective deployment of network capacity, by adding new channels on the existing dark fiber in the ground. Installing fiber is an expensive proposition, so take the time to determine if there is dark fiber in the area and the cost of activating it.

## 4. Know Local Stakeholders

Local stakeholders and community members can sometimes be overlooked in data center site selection, but they can be the data center operator's most important ally.

Operators know all the benefits their data centers can bring the surrounding areas, including tax revenue, high-quality jobs, clean operations and improvements to local infrastructure. Many regions offer abatements on sales, property, and energy taxes to demonstrate their eagerness to host data centers. Operators should reciprocate by displaying a willingness to work with local officials and community groups. But even then, the community often needs to be informed of the benefits.

Data center operators can partner with local officials to make their presence a point of pride as happened in Loudoun County, Va., which branded a corridor housing numerous processing facilities as "[Data Center Alley](#)" in a bid to position itself as an alternative to Silicon Valley.

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Each community is different and understanding the interests of local stakeholders is critical to avoid unforeseen conflicts. These include local elected officials, regulators and community groups.

Community relationships need to be continually cultivated. Turnover among elected officials and civil servants requires new outreach to build constructive partnerships. Operators should be aware of any history of local activism and reach out to leaders of relevant groups with offers of complete transparency.

### To avoid surprises, owners should also take the following steps

- ✓ **Prepare a public relations plan** that lists the many benefits to the local region of having a hyperscale data center as a neighbor. Attend and participate in meetings of local groups that may take an interest in the siting and operation of the facility. Take a proactive approach to contacting local media and educating them about the project. Ensure that designated company officials are always available to respond to any concerns.
- ✓ **Understand what approvals are required** for zoning, variances and easements. Such requests invite additional scrutiny and objections can create significant delays in planning and construction.
- ✓ **Inquire about staffing levels** at local fire, police and emergency medical services and inform officials of the need to consider expanding capacity, if necessary.
- ✓ **Learn about the political and regulatory environment.** Elected officials who are receptive to a data center neighbor today may be out of office in two years. Think of the long term.
- ✓ **Study the track record of regulatory bodies and officials** to understand any preconceptions they may have. Be prepared to reach out to influential officials and their staffs to establish long-term relationships.
- ✓ **Research any new regulations** that may be percolating under the surface, such as those relating to renewable energy or greenhouse gas emissions. Understand the likelihood that any new rules will come into effect and the potential impact on your business. In some cases, it may be necessary to engage experts.

## 5. Expect the Unexpected

Despite your best efforts to thoroughly vet a location for seismic activity, vulnerability to natural disasters, talent availability and abundance of bandwidth, unforeseen circumstances can still derail a project.

- ▶ The sheer complexity of data center construction is a risk. The project typically involves multiple vendors, subcontractors and as many as 50 different disciplines in areas like structural, electrical, HVAC, plumbing, fuel pumps, networking and security. Uptime Institute reported that the [vast majority of data center failures are caused by human error](#) and that in the most severe cases nearly three-quarters of operators believed that better management, processes or configuration could have avoided downtime. It is essential that competent and experienced project managers oversee the effort through to smooth operation.
- ▶ A site evaluation should investigate whether there are underground mineral or energy deposits that could invite drilling or mining by companies in other locations. Depending upon local regulations these activities could be entirely legal. The result can be disruptive vibrations or even catastrophic events like sinkholes that threaten physical infrastructure.
- ▶ Be aware of nearby transportation sources. For example, if hazardous materials are transported on nearby railroad lines or by truck on adjacent highways, the impact of a derailment or crash could be disastrous.
- ▶ Many data centers are in office or industrial parks. Know the business of your neighbors. For example, a chemical plant down the street may issue noxious fumes that could interfere with your cooling system or create an unpleasant work environment. The same risk applies to groundwater pollutants that could contaminate the area and force businesses to shut down.
- ▶ Be aware of easement rules that could make parts of your property accessible to outsiders. For example, a walking or bicycle path that goes inside your property creates a security problem.
- ▶ Sometimes there are opportunities to find win-win solutions. One data center owner struck a deal with a nearby greenhouse to take its heated exhaust air, thereby reducing both the data center's cooling costs and the greenhouse owners' heating expenses. In another example, a data center owner took in wastewater from a neighboring chemical plant and used it for cooling purposes, sharing the cost of disposal with its neighbor.

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## Conclusion

When it comes to siting a hyperscale data center, the principle of “think globally, act locally” can’t be over-emphasized. Building a data center is a long-term commitment. Time spent up front on mission-critical factors such as ensuring a secure location with access to ample power and high-speed bandwidth can prevent costly repairs and retrofits down the line. Both the owner and operations team also need to be aware of the importance of stakeholder relations, since the data center and staff will be important members of the community for years to come. By investing time at the front end to make cautious decisions with an eye toward the future, operators can ensure that they have the support of all stakeholders in the project’s ongoing success.