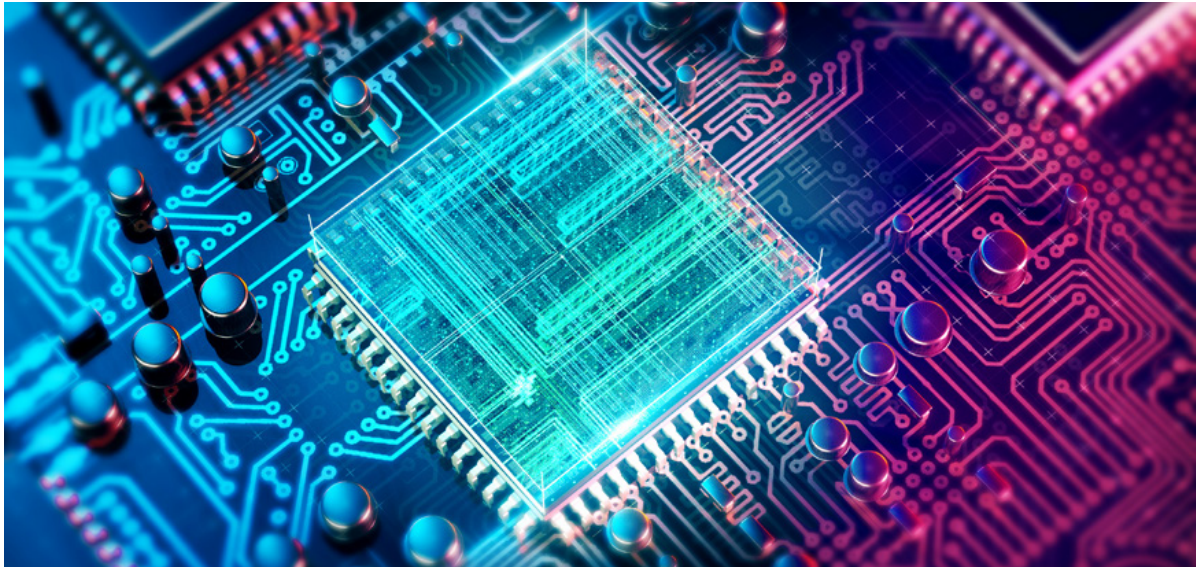


Hyperscale cloud providers & enterprises set supply/demand records in H2 2018



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Executive Summary

- Surging demand from hyperscale cloud providers led to a record 303 megawatts (MW) of absorption in the seven primary U.S. data center markets in 2018.
- Development pipelines ramped up in primary markets in 2018 to more than 500 MW.
- To put the scale of development activity into perspective, the amount of under-construction capacity in Northern Virginia is more than the existing inventory of any data center market in the U.S.
- Adoption of hybrid-IT strategies, including combining physical real estate with cloud footprints, continued to shift deployment approaches for enterprises as companies implemented smaller capacity requirements with higher-density computing.
- Asking rents for 250 kilowatts (kW) of turnkey wholesale colocation remained steady at \$120 to \$140 per kW modified gross at N+1 redundancy. Depending on lease size, an approximate 10% discount is possible for larger hyperscale cloud provider and enterprise users.
- As investment in single assets and portfolios increased, capitalization rates for stabilized data centers approached rates for industrial properties, typically ranging from 5.5% to 7.5%.

What is Driving Data Center Growth?

Strong demand for data and technology capacity fueled the wholesale data center market in North America in 2018. There were two primary drivers of data center demand in 2018:

1. **Significant data traffic and storage:** Global data center and cloud IP traffic since 2016 are forecast to triple by 2021 at a compound annual growth rate (CAGR) of 25%.¹ With the enormous growth of data consumption—driven by big-data analytics, 5G, gaming and streaming services—wholesale data centers will remain positively impacted.
2. **Evolution of hyperscale and enterprise requirements:** The spread in the scale of requirements was a standout driver in 2018, as enterprise users remained active but started with lower-size requirements.

The primary U.S. wholesale data center markets—Atlanta, Chicago, Dallas/Ft. Worth, New York Tri-State, Northern Virginia, Phoenix and Silicon Valley—tallied a record-setting 303 MW of net absorption in 2018, up by 16% year-over-year. The supply pipeline also continued to ramp up in these primary markets with current projects totaling 502 MW.



¹Cisco Global Cloud Index, 2016-2021.

Figure 1: H2 2018 Wholesale Primary Market Fundamentals

Market	Inventory	Y-o-Y Change	Available MW/ Vacancy Rate	Y-o-Y Change*	2018 Net Absorption	Y-o-Y Change	Rental Rates (kW/mo)**
Northern Virginia	860.2 MW	▲ 167.8 MW	32.2 MW / 3.7%	▼ 210 bps	175.5 MW	▲ 54.2 MW	\$115-\$135
Phoenix	212.8 MW	▲ 46.0 MW	16.7 MW / 7.8%	▲ 40 bps	41.6 MW	▲ 35.5 MW	\$120-\$135
Dallas/Ft. Worth	300.8 MW	▲ 53.2 MW	64.8 MW / 21.5%	▲ 120 bps	38.6 MW	▲ 2.4 MW	\$115-\$135
Silicon Valley	255.6 MW	▲ 31.6 MW	18.0 MW / 7.0%	▲ 190 bps	25.1 MW	▼ -36.5 MW	\$135-\$165
Chicago	243.0 MW	▲ 16.6 MW	26.0 MW / 10.7%	▲ 180 bps	10.7 MW	▼ -16.0 MW	\$125-\$140
Atlanta	126.8 MW	▲ 6.0 MW	14.0 MW / 11.0%	▼ 240 bps	8.2 MW	▲ 6.7 MW	\$115-\$130
New York Tri-State	157.3 MW	▲ 1.2 MW	21.3 MW / 13.5%	▼ 170 bps	3.6 MW	▼ -3.8 MW	\$125-\$145

*Vacancy Y-o-Y changes are calculated by comparing the difference between H2 2017 and H2 2018.

**Rental rates are quoted asking rates for N + 1 requirements.

Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 2: H2 2018 Wholesale Secondary Market Fundamentals

Market	Inventory	Y-o-Y Change	Available MW/ Vacancy Rate	Y-o-Y Change*	2018 Net Absorption	Y-o-Y Change	Rental Rates (kW/mo)**
Southern California	106.0 MW	▲ 10.7 MW	16.2 MW / 15.2%	▼ 140 bps	10.3 MW	▲ 1.9 MW	\$130-\$160
Boston	68.1 MW	▲ 6.7 MW	13.4 MW / 19.7%	▼ 50 bps	5.7 MW	▲ 0.8 MW	\$160-\$180
Denver	96.6 MW	▲ 4.0 MW	18.5 MW / 19.2%	▼ 150 bps	4.7 MW	▼ -0.3 MW	\$125-\$145
Austin/ San Antonio	149.9 MW	0 MW	6.7 MW / 4.5%	▼ 270 bps	4.1 MW	▼ -35.0 MW	\$140-\$155
Minneapolis	57.1 MW	0 MW	15.6 MW / 27.3%	▼ 680 bps	3.9 MW	▼ -2.4 MW	\$130-\$145
Houston	112.9 MW	0 MW	29.1 MW / 25.8%	▼ 290 bps	3.3 MW	▼ -4.1 MW	\$140-\$165
Seattle	104.5 MW	▲ 2.0 MW	16.0 MW / 15.3%	▼ 120 bps	2.9 MW	▼ -0.4 MW	\$125-\$145
Charlotte/Raleigh	55.6 MW	0 MW	12.4 MW / 22.3%	▲ 230 bps	-1.3 MW	▼ -8.6 MW	\$120-\$135

*Vacancy Y-o-Y changes are calculated by comparing the difference between H2 2017 and H2 2018.

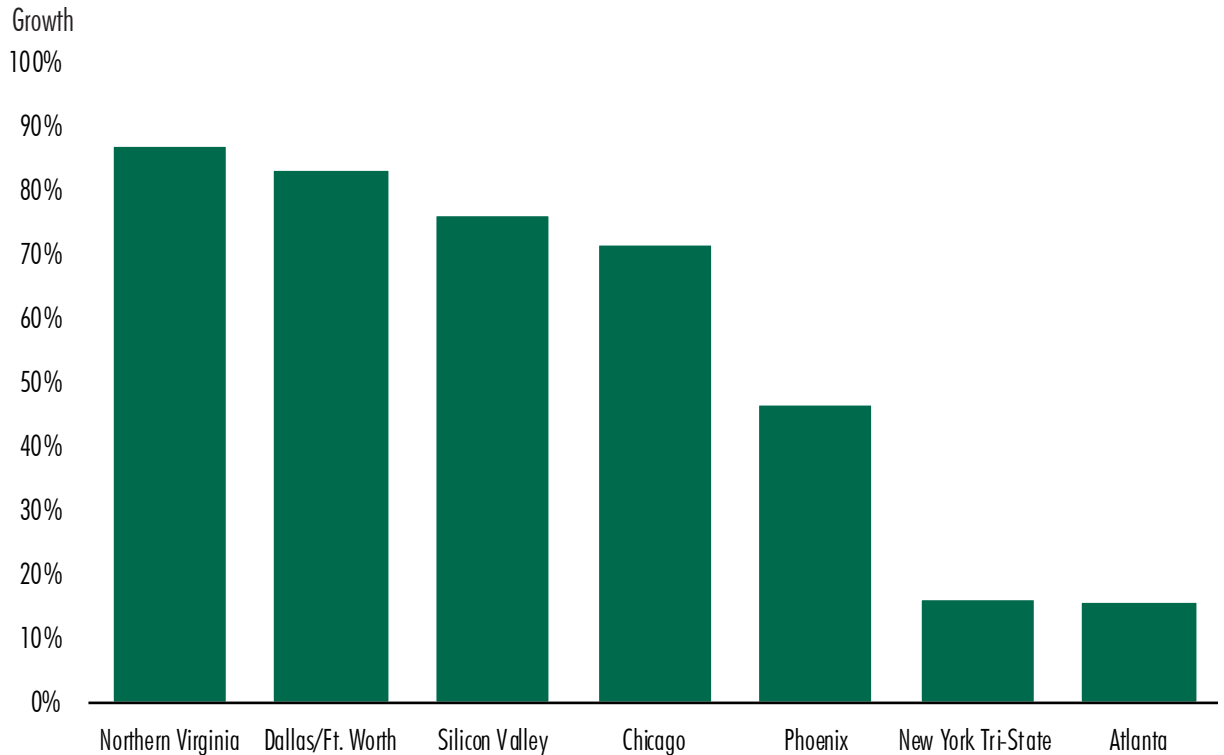
**Rental rates are quoted asking rates for N + 1 requirements.

Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Demand across the U.S. was fueled by larger hyperscale cloud providers (typically 5+ MW) and enterprise deployments (200 to 700 kW). Hyperscale cloud providers are active in both the third-party wholesale and build-to-suit segments. The demand for both segments has led to increased deliveries since 2015, with Northern Virginia and Dallas/Ft. Worth growing by 87% and 83%, respectively.

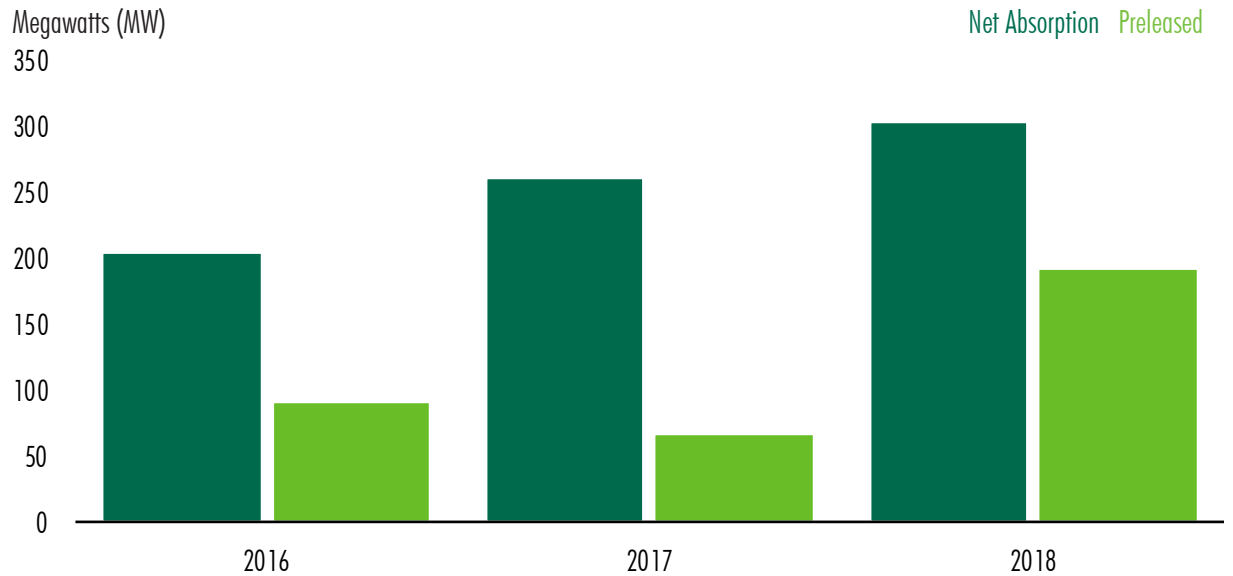
Northern Virginia accounted for 58% of the multi-tenant wholesale demand in 2018 and 50% over the past three years. This absorption was primarily attributed to significantly larger deployments of hyperscale cloud providers and enterprise activity. In Dallas/Ft. Worth, there were numerous organic and existing corporate expansions, as data center tenants are proving to be “sticky” due to the high costs of relocating.

Figure 3: Inventory Growth of Primary Data Center Markets since 2015



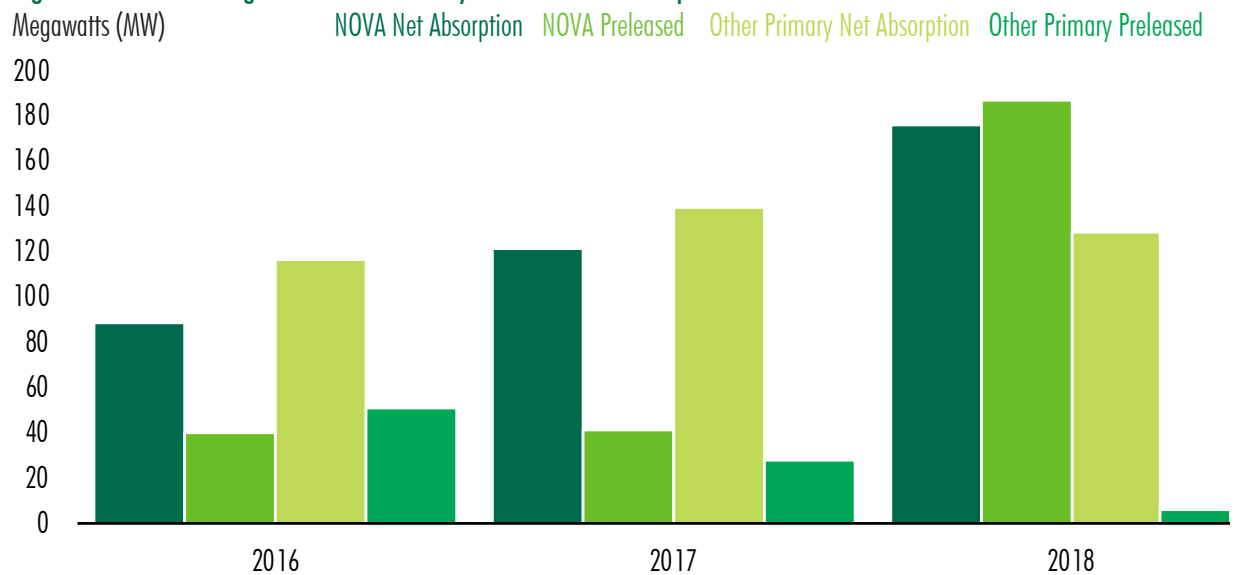
Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 4a: Primary Markets - Net Absorption & Preleased



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 4b: Northern Virginia vs. Other Primary Markets: 2018 Absorption vs. Preleased



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

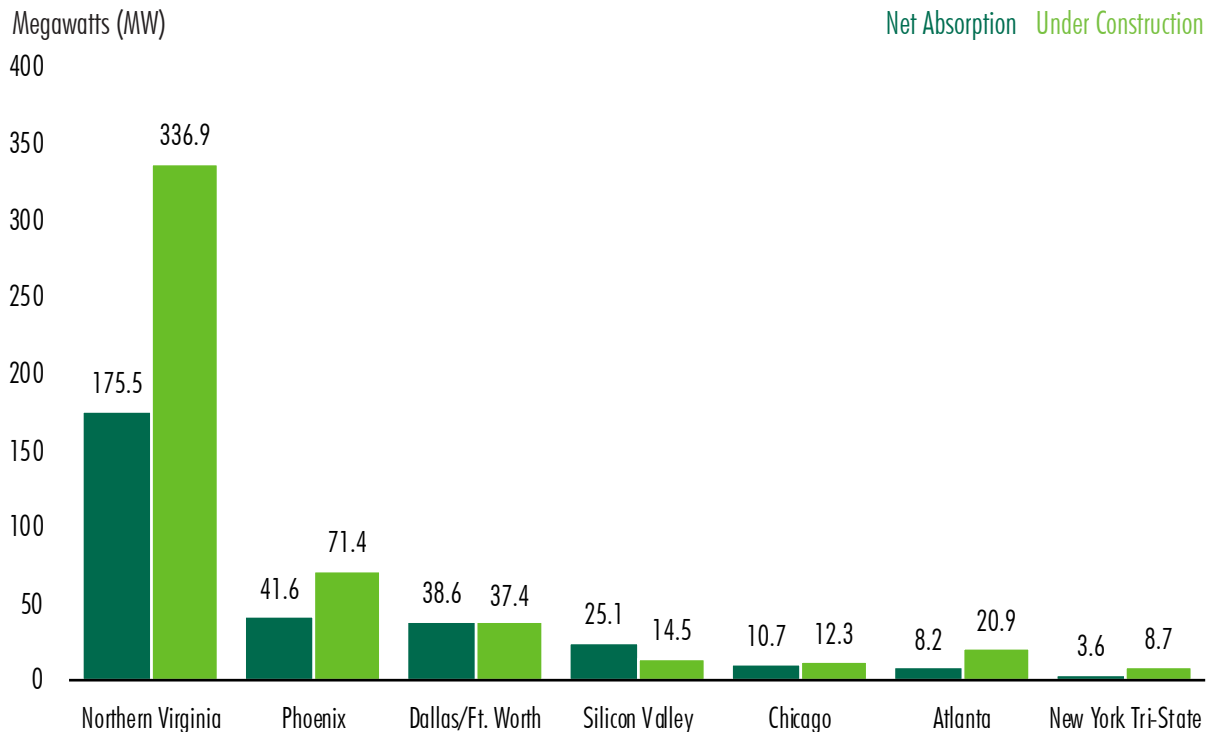
A Surge in Supply

Primary markets added 322 MW of new capacity in 2018 and had a construction pipeline of more than 500 MW. Specific market characteristics dictated the type and size of developments. Northern Virginia accounted for 67% of 2018 construction activity as numerous 20 MW and larger requirements came from hyperscale providers.

Providers continue to tentatively balance speculative builds and supply limitations. Many operators often miss leasing opportunities simply because they don't have product that can be delivered within user time constraints. Phoenix's second-highest under-construction level among the primary markets was a direct result of providers land banking from previous quarters and positioning themselves to capture larger deployments from in-market expansions and hyperscale-cloud-provider growth. Furthermore, in Atlanta, numerous facilities are planned as wholesale hyperscale requirements haven't deployed at scale yet. Enterprise demand, however, is reflective of both a strong corporate presence and favorable economic factors.

At the secondary market level, the sentiment shared by providers is even more so aligned with delivering turnkey capacity on an as-needed basis. For example, in Houston, commitment for a multi-megawatt deployment broke ground to meet demand from the oil & gas sector. The overall fundamental equilibrium within these markets is primarily caused by smaller enterprise activity ranging from 50 kW to 300 kW, with built-in growth ramps leading to potentially larger deployments that are focused on increasing efficiencies while maximizing connectivity.

Figure 5: 2018 Net Absorption Vs. Under Construction by Primary Market



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 6: 2018 Net Absorption Vs. Under Construction by Secondary Market

Megawatts (MW)

25

20

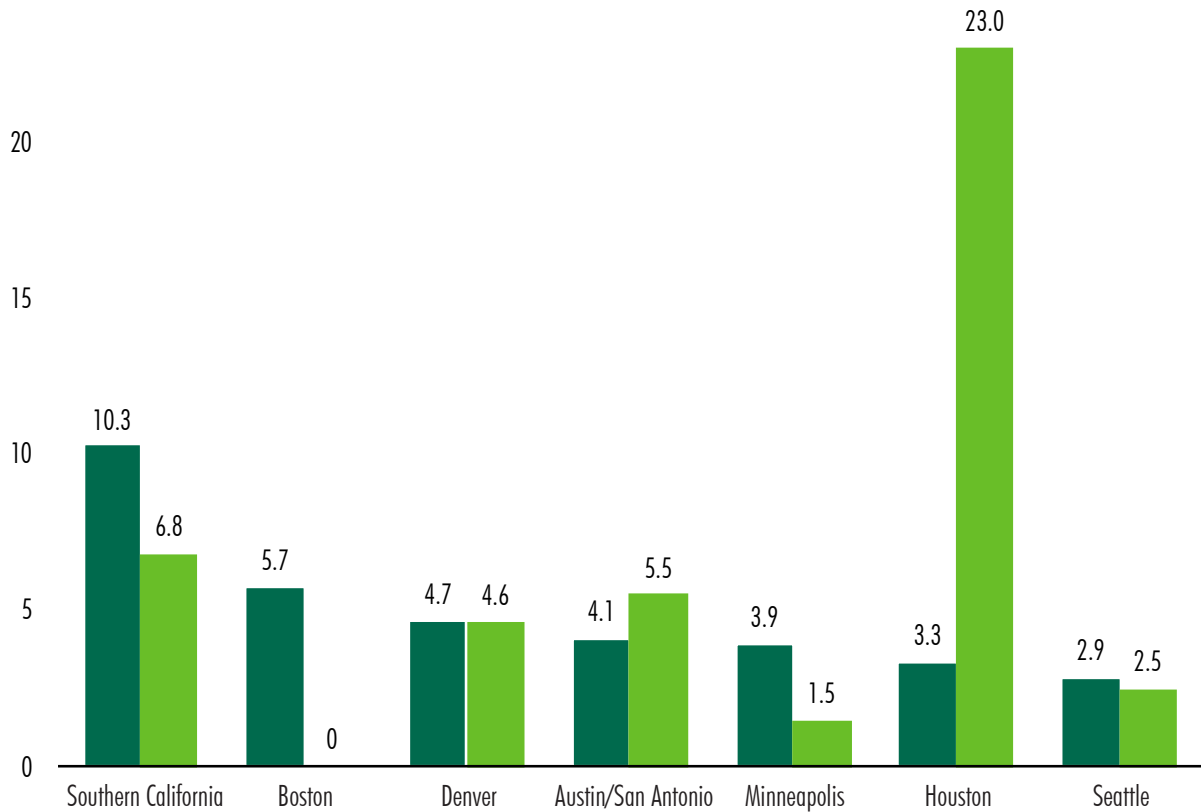
15

10

5

0

Net Absorption Under Construction

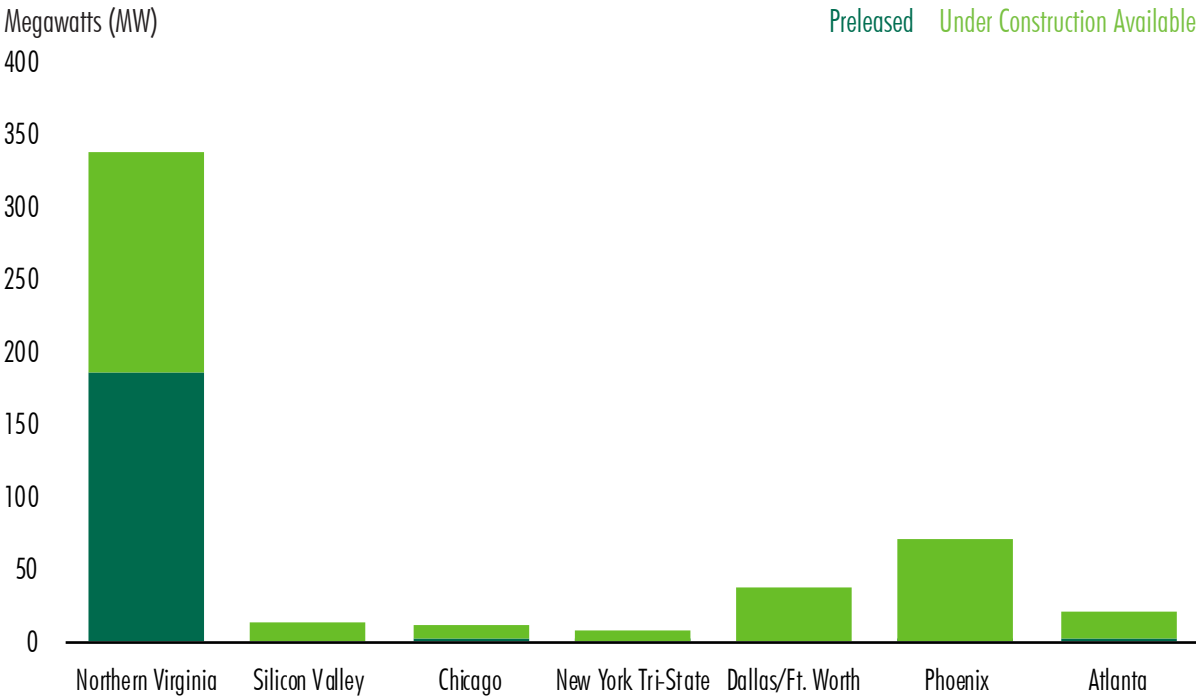


Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Due to the elevated levels of new supply, construction and net absorption, the national wholesale vacancy rate across both primary and secondary markets ended 2018 at 11.0%.

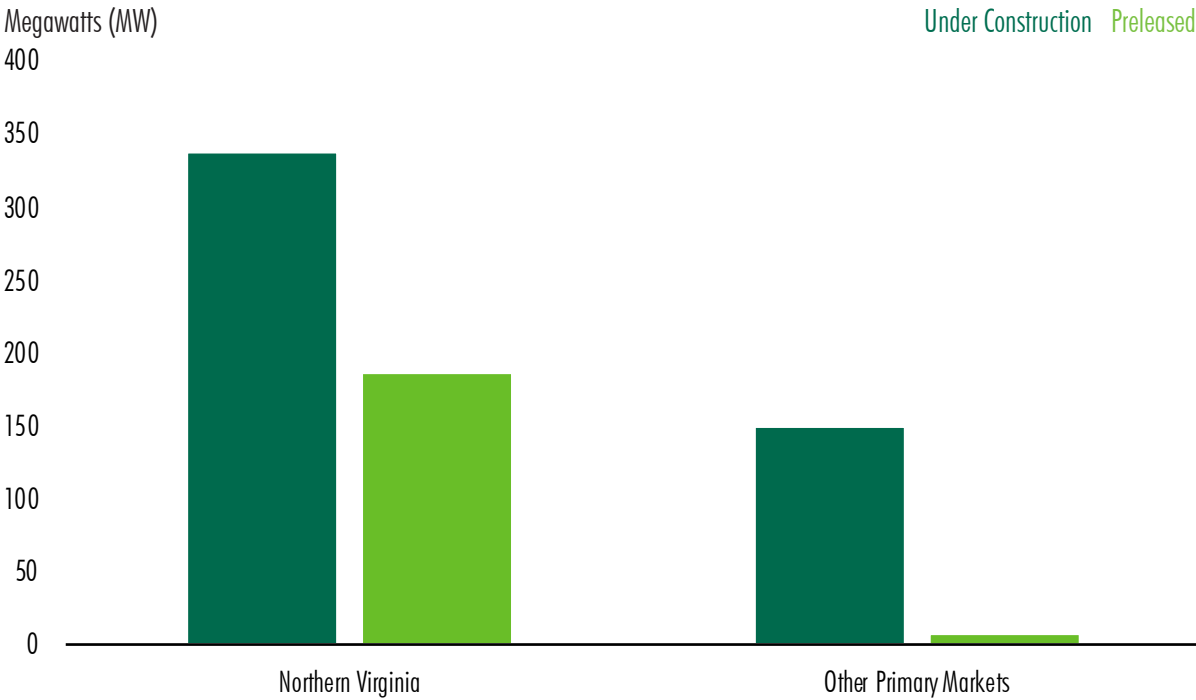
Unlike traditional real estate classes, the location of a data center is only one of many factors impacting costs. Connectivity and latency sensitivity, size of deployments and municipal and state incentive programs all impact overall data center pricing. A split in deal sizes affects provider asking rates for capacity. For markets traditionally most impacted by enterprise activity and deals of around 250 kW, asking rates remained stable in 2018 at \$120 to \$140 kW modified gross for N+1 wholesale deployments. Larger (multi-megawatt) deals from hyperscale cloud providers can secure a discount of approximately 10% on rent. However, the somewhat static growth of base rents per kW over the past several years discounts the rapid evolution of the space, including layering in managed services, more efficient build costs, changes in design, changes in requirement sizes and needs that can further widen the gap in realized costs.

Figure 7a: Construction Pipeline by Primary Market – 2018 Available & Preleased Supply Under Construction



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 7b: 2018 Northern Virginia vs. Other Primary Market Construction



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

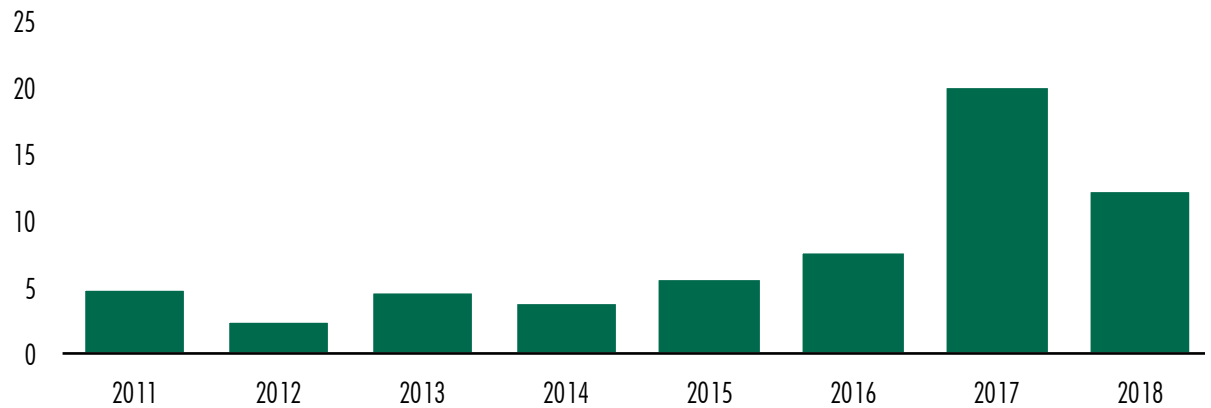
Note: Other primary markets are Atlanta, Chicago, Dallas/Ft. Worth, New York Tri-State, Phoenix and Silicon Valley.

Capital Investment

North American data center investment volume totaled more than \$12 billion in 2018, inclusive of single-asset, portfolio and entity-level transactions. Capital availability remained abundant throughout the year, with 33% of total investment volume focused on single-asset and portfolio transactions versus 27% in 2017. Investors directed funds to opportunistic data center assets, as capitalization rates for stabilized data centers approached levels achieved for industrial assets, ranging from 5.5% to 7.5%. While investment is down year-over-year, it does not reflect the land acquisitions earmarked for data center development in 2018. In supply-constrained primary markets, there is a high degree of competition for development opportunities.

Figure 8: North American Investment

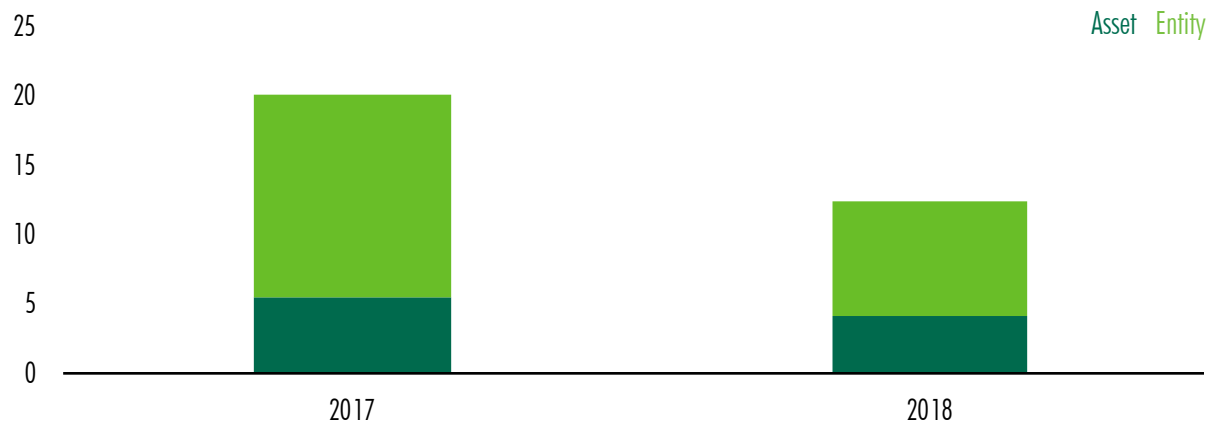
Investment Volume (\$ Billions)



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 9: North American Investment

Investment Volume (\$ Billions)



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

The three most notable data center transactions in H2 2018 were:

1. Digital Realty's acquisition of Ascenty for \$1.8 billion. This furthers Digital Realty's global hyperscale focus and establishes its presence in Latin America with eight data centers and potential expansion opportunities. Digital Realty also entered into a separate agreement with Brookfield Infrastructure to fund half of the equity investment.
2. Brookfield Infrastructure's acquisition of 31 data centers from AT&T for \$1.1 billion and formation of Evoque Data Center Solutions. AT&T continues to offer colocation services.
3. CyrusOne's acquisition of Zenium Data Centers for \$442 million, including four data centers in London and Frankfurt. The sale furthers CyrusOne's hyperscale expansion.

Figure 10: 2018 Largest Global Transactions

Transaction Type	Buyer	Seller	Sale Price (M)*	Buyer Type	Location
Entity	GTT Communications	Interoute	\$2,300	Occupier/Operator	EMEA
Entity	Digital Realty	Ascenty	\$1,800	Occupier/Operator	Global
Entity	Iron Mountain	IO Data Centers	\$1,315	Occupier/Operator	North America
Asset	Equinix (REIT)	ASB Real Estate, DCI Technology Holdings	\$800	Occupier/Operator	North America
Entity	Equinix (REIT)	Ontario Teachers'/Metronode	\$792	Occupier/Operator	APAC
Asset	Mapletree	Carter Validus	\$750	Investment	North America
Asset	IPI Data Center Partners Management	ASB Real Estate	Undisclosed	Occupier/Operator	North America
Entity	CyrusOne	Zenium Data Centers	\$442	Occupier/Operator	EMEA
Asset	Ensono	Wipro	\$405	Occupier/Operator	North America
Entity	Landmark Partners	Stonepeak Infrastructure Partners	\$350	Investment	North America
Asset	Keppel DC REIT	Kingsland Development, Nylect Holdings	\$295	Occupier/Operator	APAC
Asset	Iron Mountain	Evoswitch	\$235	Occupier/Operator	EMEA
Entity	InfraVia	Green Data Centers	\$217	Occupier/Operator	EMEA
Entity	Vantage Data Centers	4Degrees Colo	\$200	Occupier/Operator	North America

*Millions

Note: includes closed deals over \$100 million.

Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

The maturity and availability of capital to the data center segment has led to two recent investment trends:

1. **Land acquisition and development:** There were significant land acquisitions in 2018, the amounts of which varied by market. For example, Atlanta, Houston and Phoenix offer numerous developable lots; however, in Northern Virginia and Silicon Valley, available land remains scarce and expensive. Even with tight conditions, Northern Virginia saw more than \$600 million in land sales in H2 2018 for future data center development.
2. **Cross-border capital investment:** Fewer North American equity investments occurred in 2018, due to both the limited available investment offerings in the region and the expansion opportunities in Europe, Asia-Pacific and Latin America. Large providers continued to strategically deploy capital to expand existing offerings and roll out new services to pursue new customer bases.

Overall, the data center market has evolved and adapted to today's demands. In 2019, the industry will undergo further evolution, characterized by:

- A rise in sale-leasebacks/partial-leasebacks from enterprise users seeking to capitalize on legacy and underutilization challenges and to implement a hybrid IT strategy.
- Increased focus on investment and expansion in global regions previously untapped by providers and hyperscale cloud users.
- Continued influx of capital from new investors and infrastructure funds seeking investment diversification.



What We're Watching

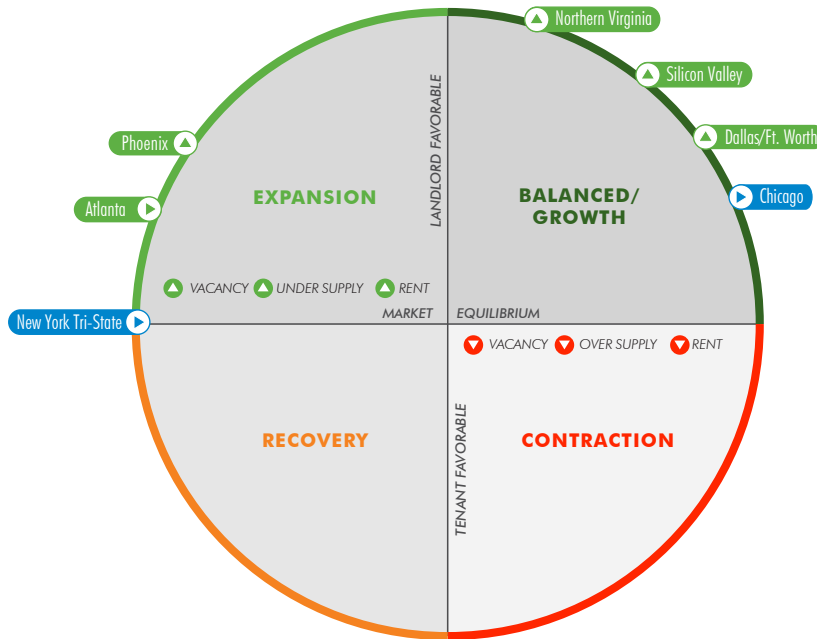
The Shape of Future Demand

- What impacts will edge computing and the Internet of Things have on data center demand?
- What will be the impact of new providers delivering their first supply to the market in 2019?
- How do providers deal with a growing supply pipeline and a potentially more competitive pricing environment?
- How does the data center sector compare with traditional commercial property types in a potential economic slowdown?
- How will geopolitical events impact global expansion by North American operators?
- Will the trend of renewable and green power initiatives by hyperscale users and their site selection strategies migrate to smaller operators and enterprise users?

Capital Investment

- How do providers and developers deal with expensive and scarce available land in key data center markets?
- Which data center operators will continue to expand their global footprints and seize opportunities outside of key data center markets?
- As IT infrastructure systems age and enterprise users tackle refresh cycles, how will this drive investors' data center-related decisions?

Figure 11: Data Center Market Cycle: Primary U.S. Markets



This graph reflects current wholesale market conditions, taking into consideration the following variables:

- Demand (leasing, absorption, requirements in the market)
- Supply (existing vacancy, future availabilities, construction pipeline)
- Rental rate trend

Distance from the horizontal market equilibrium line generally implies the relative strength and/or weakness of markets relative to one another and their historical trends. Arrows indicate most recent trend.

Categories typically represent the following conditions:

Expansion: landlord/provider-favorable conditions; under-supplied market, strong demand, declining vacancy and higher pricing.

Balanced/Growth: landlord/provider-favorable conditions; new supply more evenly balanced, stable or slightly increasing vacancy, rent growth slowing or flat.

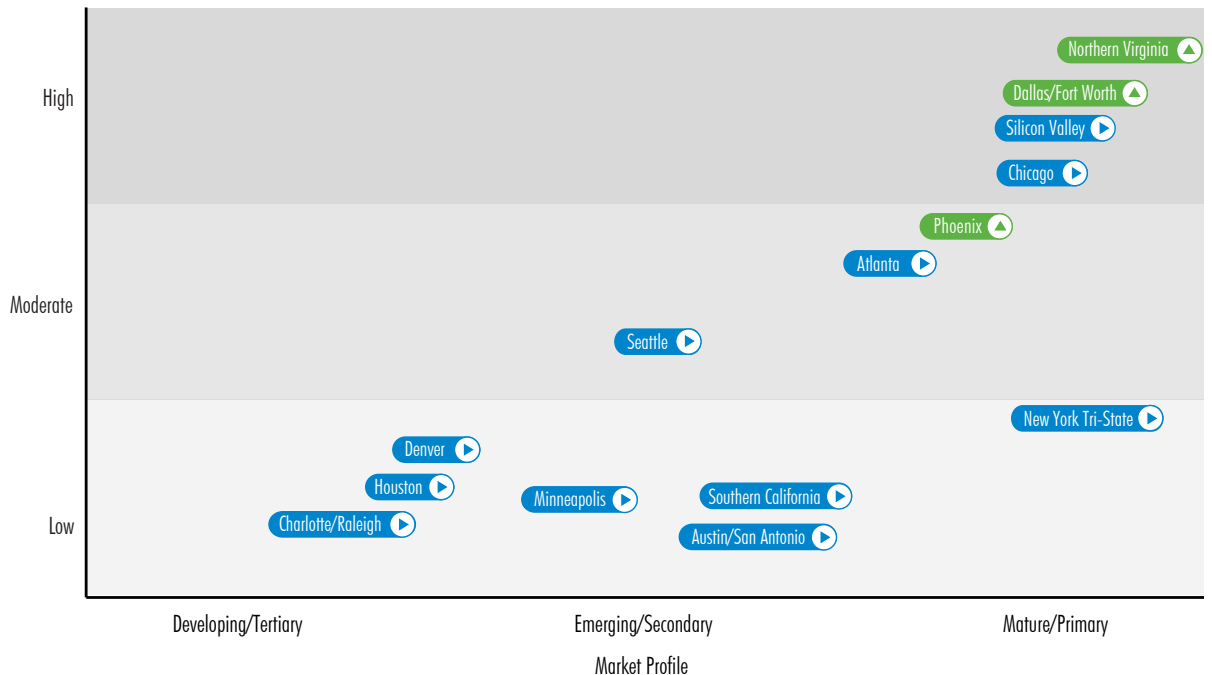
Contraction: tenant-favorable conditions; over-supplied market, increasing vacancy, weak demand, lower pricing.

Recovery: tenant-favorable conditions; stable or slightly declining vacancy, moderate but improved demand, rents flat or increasing.

Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Figure 12: Data Center Market Maturity

Market Growth



Source: CBRE Research, CBRE Data Center Solutions, H2 2018.

Primary Market Insights

Atlanta

Atlanta's data center market ended 2018 with positive momentum as 14 MW of availability was matched by a supply pipeline of more than 20 MW. Providers have acquired significant development parcels over the past few years to capture future demand. Atlanta is attractive for larger enterprise and possible hyperscale deployments because of its relatively low power and land costs and its generous incentive programs. Capacity requirements typically come from organic growth and from net new financial and content service providers needing larger deployments. While their options are currently limited to a few facilities, multiple providers are already building or planning new supply, including CyrusOne, DataBank, T5, Switch and zColo.

Net absorption in 2018 totaled more than 8 MW, lowering the market's vacancy rate to 11.0% from 13.4%. Atlanta's undersupply may be remedied by future facilities, which includes a redevelopment by QTS that would increase its market footprint by 300,000 sq. ft. If all of Atlanta's planned projects are developed, the market's total capacity will nearly triple.

Atlanta's most immediate need is for new supply to meet existing demand. Atlanta has historically been a build-to-own market, and there are numerous legacy assets that could provide a multi-tenant/sale leaseback opportunity.

Chicago

The Chicago data center market continued to mature in 2018 as nearly 17 MW of wholesale capacity was delivered and almost 11 MW was absorbed. The most notable delivery of the year was more than 10 MW at Digital Realty's facility in the extremely tight market of Elk Grove. While vacancy is above historical averages and demand from hyperscale speed-to-market requirements has softened, enterprises are focused on smaller deployments but emphasizing high-density computing. The current large blocks of availability (greater than 2MW), along with growth

announcements from Digital Realty, QTS and T5, may position Chicago to capture mid-sized enterprise and speed-to-market hyperscale demand.

Natural growth of enterprise demand, especially from the financial-technology (fintech) and health-care sectors, could be attracted to the network-dense, low-latency connectivity that exists in the region. From a longer-term perspective, more than 200 MW of announced future capacity and potential government incentives could make Chicago one of the most attractive data center markets in the U.S. once again.

Dallas/Ft. Worth

Dallas/Ft. Worth (DFW) ended 2018 with 38.6 MW of positive net absorption, making it one of the most active markets in the country. The strong demand led to inventory growth of 53 MW in 2018, up by 83% since 2015—the second-largest percentage increase in the U.S. With all of the new supply added to the market, vacancy ended the year at 21.5%, inclusive of legacy wholesale facilities, which is just slightly above historical averages.

Growth in 2018 was fueled by deliveries from CyrusOne, Digital Realty, Raging Wire and Lincoln Rackhouse. Further deliveries are planned in seven active developments, including those by CyrusOne, DataBank, Flexential, Stream, QTS and the newly formed Stack Infrastructure. Digital Realty, EdgeCore and Skybox control prime data center sites and should begin development in 2019. Available land was limited in 2018 as providers increasingly secured long-term development sites with abundant power and fiber infrastructures, especially in north Dallas.

While there are more contiguous big blocks of availability in DFW than most other markets, the region remains attractive to providers due to efficient and resilient infrastructure, support for enterprise migration to multi-tenant data centers and numerous private providers that have found more flexibility in their spending allocations and managed-service offerings. These factors have created a blend of attractive features that allow facilities to compete on more than just power rates per kW.

From a user perspective, the market was largely driven by enterprise users taking advantage of numerous quality facilities, inexpensive power and strong connectivity. This combination of user and provider balance is unique and showcases why Dallas/Ft. Worth was a top-performing market in 2018.

New York Tri-State

The New York Tri-State data center market remained driven by enterprise activity focused on retail and smaller colocation deployments. The market recorded nearly 4 MW of positive absorption in 2018, which brought vacancy to a five-year low of 13.5%. While the region is faced with limited incentives and relatively high power costs, some users are eager to take advantage of the low-latency and world-class connectivity, particularly in the financial and health-care sectors.

Supply and demand are nearing equilibrium with more than 8 MW currently under construction by various service providers, such as Cyrus One, Digital Realty, Iron Mountain and QTS. Demand from organic expansion should continue in 2019 and be met with strategic capacity deployments from providers. The high cost of operations in the Tri-State's more urban areas have led to expansions into other submarkets. One example of this is Orangeburg, N.Y., where providers have been offered unrivaled tax incentive packages.

Northern Virginia

Northern Virginia posted the strongest year of any data center market in history with net absorption of more than 175 MW in 2018. Most of this absorption occurred in H1, while providers accelerated their construction for the next wave of demand during the second half of the year. CyrusOne recorded the most leasing in 2018 at its Kincora campus. Northern Virginia accounted for almost 58% of the total absorption in U.S. primary markets in 2018.

While headline demand has been dominated by larger-sized hyperscale deployments over the past few years, enterprise activity remains healthy. Non-hyperscale deployments accounted for more than 50 MW of absorption in 2018. This alone would be the highest mark across all primary

markets. Increased demand led to a tight vacancy of 3.7% at year-end 2018. Providers have more 336 MW under development in 2019, 55% of which is preleased. Large projects are underway by Aligned Energy, CoreSite, CloudHQ, CyrusOne, Digital Realty, Iron Mountain, RagingWire, Sentinel, Sabey, QTS and Vantage. To put the scale of development activity into perspective, the amount of under-construction capacity in Northern Virginia is more than the existing inventory of any data center market in the U.S.

Providers are remaining competitive by meeting customization, moment-in-time availability and expansion needs to secure users and to position the market for continued growth.

Phoenix

The Phoenix data center market registered more than 41 MW of absorption in 2018, overtaking Dallas/Ft. Worth as the second most-active wholesale market in the U.S. The absorption primarily was of newly delivered capacity by Aligned Data Centers, CyrusOne and Iron Mountain. Although new supply was delivered, wholesale vacancy ended 2018 at 7.8%, nearing a two-year low. More than 70 MW of capacity is under construction, with another 240 MW planned. Significant projects are underway by Aligned Data Centers, Cyrus One, EdgeCore and Iron Mountain Data Centers.

Land development that began a few years ago resulted in new projects positioned to absorb organic and net-new enterprise and hyperscale cloud-provider deployments. For the first time in more than two years, users have multiple newly developed facilities to select from. From an occupier perspective, the attractiveness of a tax incentive program, lower build and operating costs and the competition for larger deployments remain a draw for future data center activity.

Silicon Valley

Silicon Valley ended 2018 as the second-most supply constrained data center market in the U.S., with a 7% vacancy rate. Amid limited availability, 25 MW of capacity was absorbed in 2018 and 32 MW of new capacity was added. Very few large blocks of capacity are available in the near term, with 14.5 MW under construction as of year's end. Operators including CyrusOne, Digital Realty and EdgeCore purchased land for development, which will provide additional future capacity.

With acquisition and land costs in Silicon Valley increasing more than in other primary markets, providers are limited in development of speculative

capacity as build-outs are focused on efficiency and increasing density. While providers have announced more than 140 MW of additional capacity, they are challenged by obtaining permits in a timely manner. Occupiers from the content provider, IT and public cloud industries continued to drive demand for wholesale capacity in 2018. Market conditions have led to higher pricing in Silicon Valley compared with other U.S. primary markets, but delivery of additional supply and facility expansions could remedy this. If not, Bay Area demand could migrate to metros like Reno, Las Vegas and Hillsboro, where new supply is in the pipeline.

Market Spotlight: Eastern Canada

The Eastern Canada data center market is largely driven by activity in Toronto and Montreal. Toronto is the economic center of Canada and therefore the leader in managed-service demand and connectivity. Conversely, Montreal has become the country's leading hyperscale market due to low-cost hydroelectric power, relatively low real estate costs and targeted promotion from local government.

Toronto has seen significant announcements of cloud and managed-service deployment and expansion. Most recently, Oracle announced plans to deploy its cloud infrastructure in Toronto. Digital Realty Trust boasts the largest turnkey available facility in the Toronto market and has quickly seized market share. In Montreal, data

center construction and the development pipeline include new facilities and significant expansions by eStruxture Data Centers, AWS, GI Partners, Colo-D/Cologix and Vantage Data Centers. Among these, eStruxture Data Centers, Cologix and Vantage Data Centers have made significant acquisitions of established local providers to capture market share and spur growth.

While Toronto has been the recipient of the greater and more diverse share of demand, there is an expectation that the Montreal data center market will experience significant demand in 2019. Together, Toronto and Montreal are among the fastest-growing data center markets in North America and are certainly ones to watch in years ahead.

Secondary Market Insights

Austin/San Antonio

- Demand remained stable with more than 4 MW of absorption in 2018—the second-highest level among secondary markets tracked by CBRE—largely driven by technology companies and leased primarily in CyrusOne, Data Foundry, Digital Realty and Stream data centers.
- Austin remains a booming tech market, but data center construction activity is limited. The largest current construction project is by Data Foundry. However, the prospect of future hyperscale demand will keep major players engaged in the market with an eye on expansion opportunities. CyrusOne and Data Foundry recently landed large hyperscale deployments.
- 2018 activity was led by enterprise users. As business and economics improve, larger users could be drawn to the area.
- Austin and San Antonio rely on municipally-owned electric utilities, which are more expensive than alternative, deregulated options across the rest of the state.

Charlotte/Raleigh

- After posting a significant amount of negative net absorption in the first half of the year, the market posted 1.7 MW of positive net absorption in the second half.
- Year-end vacancy of 22.3% was 3.6 percentage points below the three-year average and represented only 12.4 MW of available capacity.
- Overall market demand should remain driven by enterprises from the financial, health-care and technology sectors due to the robust and diverse local economy. These factors are drawing regional companies seeking relocation opportunities.

Denver

- 4.7 MW was absorbed in 2018, lowering the total market availability to 18.5 MW. Absorption of capacity from a hyperscale cloud provider with specific application needs highlighted the 2018 leasing activity.
- Flexential's multi-megawatt delivery in Englewood highlighted the new supply added to the market.
- Development activity totaled 4.6 MW as providers were focused on smaller colocation deals (less than 250 kW). Current availability reflects the sensitivity to power density and the potential for favorable pricing for new tenants.
- Future inventory growth is possible as EdgeConnex, Iron Mountain and H5 Data Centers combined have more than 30 MW of planned capacity.

Houston

- Houston fundamentals mirrored historical averages with 3.3 MW of absorption in 2018.
- 23 MW of construction activity was underway at year's end, 15 MW of which was preleased by an oil & gas company.
- Houston typically competes with Austin/San Antonio and Dallas/Ft. Worth for enterprise site selection because the latter two markets are more accommodating for disaster recovery facilities.
- Demand is largely from local enterprises, whose high need for low-latency requirements is greater than averting natural disaster risk.

Minneapolis

- Wholesale vacancy ended 2018 at 27.3%. The market has a blend of first-generation and aging legacy assets that need infrastructure upgrades.
- DataBank is the sole provider developing capacity, with 1.5 MW under construction and 26% preleased.
- Demand for capacity in 2018 primarily came from financial and health-care enterprises with requirements of under 500 kW.
- A blend of power and tax incentives offered by the state of Minnesota have aided in driving third-party demand and have kept Minneapolis on the radar for regional site-selection requirements.

Seattle

- Absorption totaled 2.9 MW in 2018 and wholesale vacancy decreased to 15.3%, down by 1.2 percentage points year-over-year.
- As the second-largest technology employment market in the country, Seattle has many companies that are ready adopters of hybrid-IT deployments.
- Notable investment activity included Clarion's sale of a Seattle-area data center to IPI Data Center Partners of Chicago in Q4 for \$53.5 million.

Southern California

- CoreSite delivered its LA2 facility, marking the most significant new supply in Southern California in several years.
- The average deal size in 2018 was under 250 kW and was connectivity driven.
- CoreSite remains the market-share leader of inventory in Southern California and has more than 24 MW of capacity under development or planned, primarily consisting of its LA3 project that will deliver 180,000 sq. ft. and 20 MW.
- Enterprise companies from entertainment and financial industries, as well as online content providers, continued to generate the most significant activity.

Appendix

Figure 13: Market Definitions

Term	Definition
Powered Shell	Purpose built or hardened shell; power and fiber to site; no equipment included.
Hyperscale Cloud Service Provider	Multi-megawatt user, typically 5+ MW and larger.
Wholesale Colocation	Building shell & infrastructure to PDU providing space, power & cooling; Generally in demised suites above 250 kW.
Retail Colocation	Building shell & infrastructure in shared environment, space generally divided by racks or cages; may include IT hardware as well as a menu of services.
Hybrid IT	A combination of cloud services, third-party colocation and owned, on-premise infrastructures.
Enterprise Data Centers	Hardened data centers; houses "mission critical" operations of individual companies.
Data Center Net Absorption	Net change in existing/commissioned wholesale power capacity.
Data Center Power	measured in kilowatts (kW) and megawatts (MW).

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