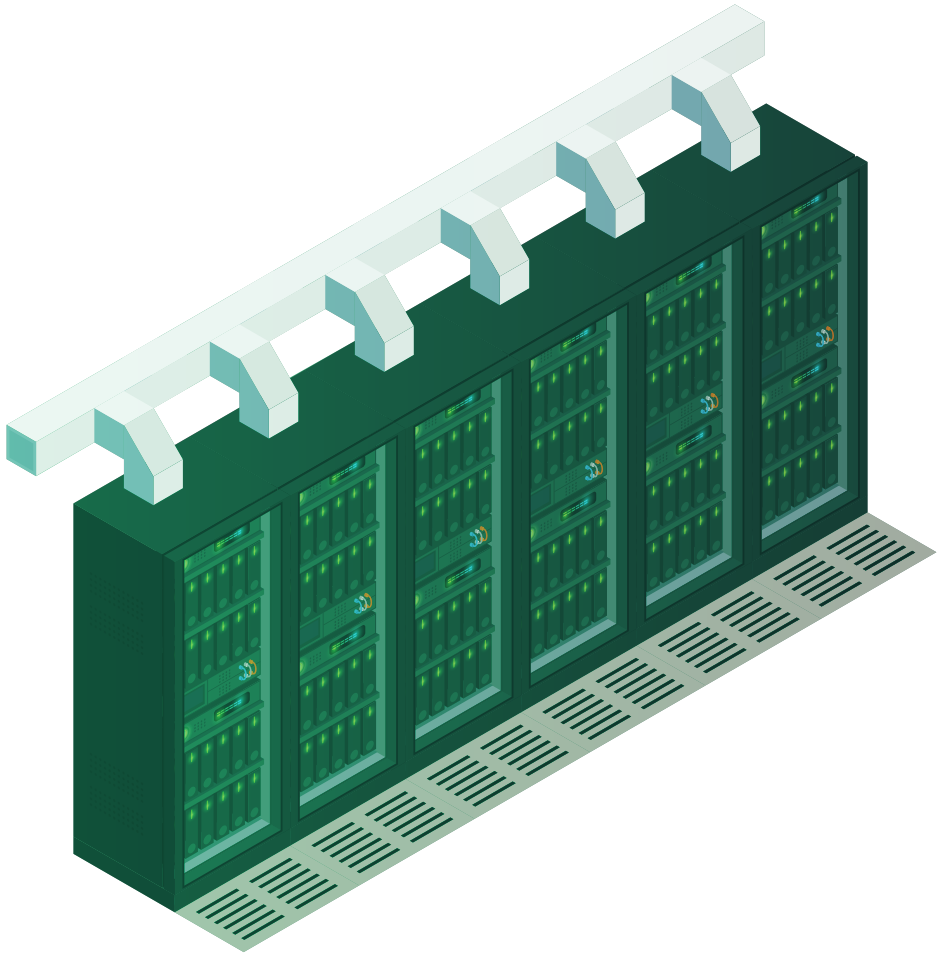
FITTING OUT A FUTURE-READY WHITE SPACE

Strategies to Save Time and Capital Throughout the Data Center Lifecycle



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As our world digitizes, the data center industry has experienced unprecedented growth, putting pressure on owners to "future-ready" their white space.

The necessity for increased use of digital technologies to support new ways of working, communicating and doing business has greatly increased our day-to-day and even minute-to-minute reliance on data centers. Key drivers include the following:

- **Internet of Things (IoT) convergence**
  Home, smart building, industry 4.0
- **Content delivery**
  Video conferencing, streaming, social media, cloud apps, gaming
- **Disruptive models**
  Bitcoin, blockchain, vehicle sharing

What Is White Space?

WHITE SPACE

White space in data centers is the space allocated for IT equipment or the space where IT equipment is placed. White space includes servers, storage, network gear, racks, air conditioning units and power distribution systems.

GRAY SPACE

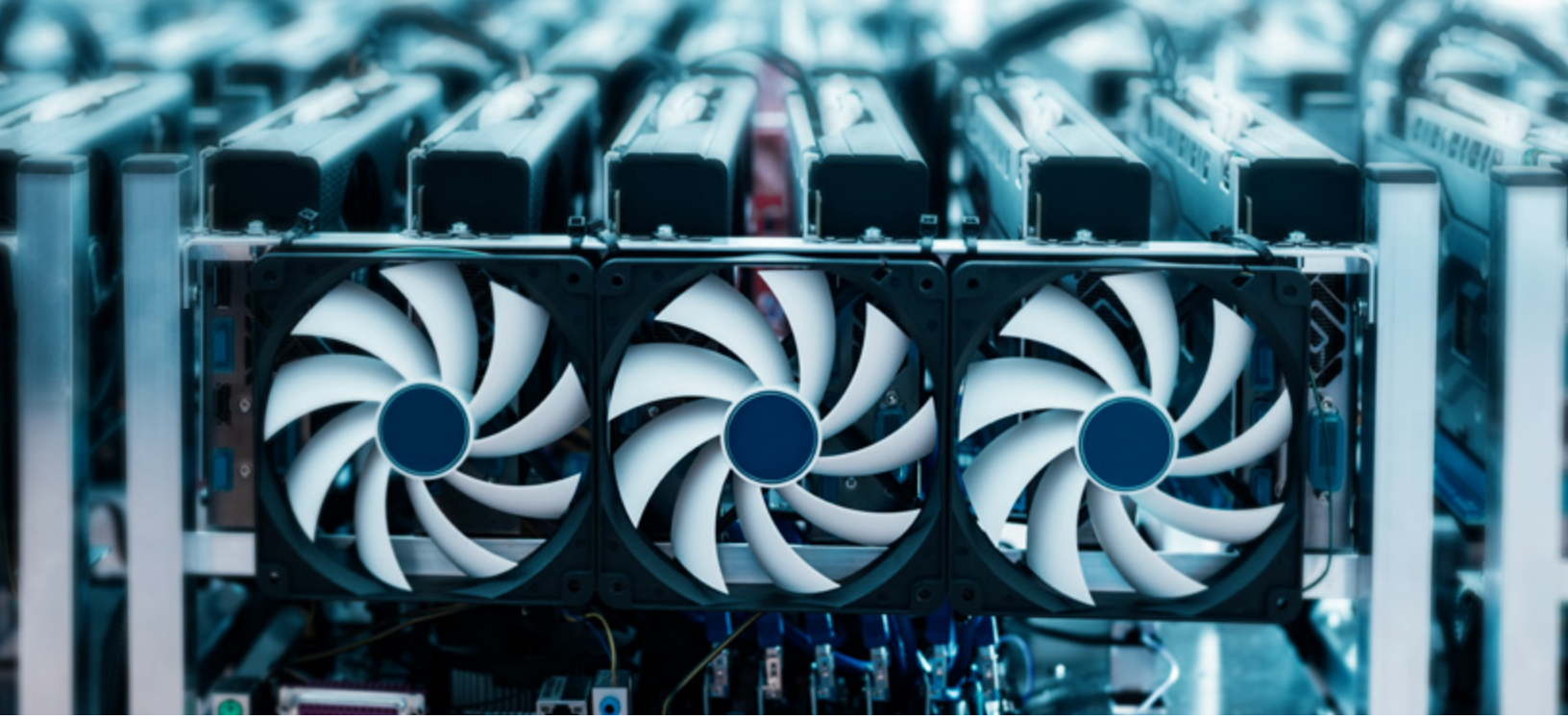
Gray space includes the area(s) where supporting mechanical and electrical infrastructure is located, including generators, UPS, switchgear, chillers and transformers.

Exponential Growth

The demand for compute capacity has increased exponentially. Driven by cloud compute services, there is unprecedented pressure on colocation providers and hyperscalers to provide capacity across existing and emerging markets.

Cloud demand, driven by pandemic-related changes in virtual work requirements, have fueled the record levels of uptake, but the significant factor is the amount being pre-let. The market used to see 2-3MW deals at a time and now sees 20-30MW deals happening, which is also fueling a new build-to-suit market aimed solely at the cloud service providers (CSPs).

Cloud service providers want this increased capacity in metro locations, and they want it delivered as quickly as possible, driving developers to accelerated construction schedules with penalties for late delivery. Accelerated construction schedules mean standardization, prefabrication and modularization, and this is the same for the tenant's white space fit out.



Scalability and Standardization

Building at scale and at speed requires standardization of design, process and supply chain. Global CSPs are now trying to execute in local markets, and growth and expansion from Tier 1 into the newer Tier 2 & 3 markets may also mean dealing with new colocation providers to meet the ever-increasing demand.

CSPs want speed to market, high quality and consistency at a reduced price point through any deployment, anywhere in the world. This is driving a need for global partnerships and supply chains—from manufacturers to installers that can scale with their needs. Colocation providers need the same support to help navigate expansion into new markets.

Global design standards don't always translate into perfect execution in local markets, with unique electrical and fire regulations in each region, and so familiarity with both their design and localization of their designs is crucial.

Regional and Global Partnerships Are Becoming More Important

Enterprise, Cloud & Hybrid Cloud

In addition to the new requirements of CSPs, enterprises are facing similar challenges. In a drive to reduce costs, cloud adoption has accelerated and, for many, this means migration to cloud. However, with GDPR and other data sovereignty issues, many are looking at hybrid cloud—a blend of owned, on-premise data centers and public or private cloud. Examples may include companies that want to keep sensitive IP hosted locally, such as pharmaceutical.

Enterprises still face the same constraints of space, power and cooling in their own data centers and so they need to focus on their IT and white space strategies, from increasing rack densities and rack type and layout, fiber and copper design standards and cooling practices.

Execution and Technology Adoption

Speed to market for the construction of new data centers places the same demand on the completion of the white space fit outs. Since the pandemic's onset and the exponential increase in demand for data center capacity, the industry has had to adapt, move quickly and identify efficiencies to ensure the white space fit out could keep up with the speed of market demands. This demand has seen hyperscalers moving towards colocation sites who can both satisfy their demand for space and the speed to market they require. This has resulted in the need for white space fit-outs to commence in the early access period that typically happens towards the end of construction of a new

data center.

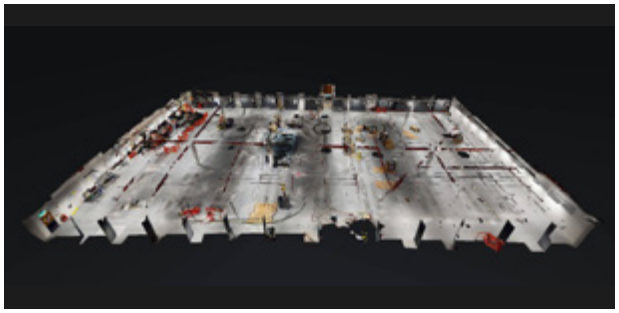
Getting early access to new data centers is still not enough to satisfy demand; new methodologies are required to drive efficiencies and find ways to reduce our projects' programs. CBRE recommends and leverages 3D Building Information Modeling (BIM) as a means of adopting a precision engineering approach and the capability to execute off-site fabrication for large parts of the installation. For example, on a typical 2MW fit out, BIM and off-site fabrication has allowed CBRE's White Space practice to reduce our program of works from 12 to 10 weeks while also driving improvements in quality assurance.

The pandemic has driven the world to cloud services more rapidly. The move to virtual meeting platforms has enhanced the industry's ability to manage remotely and globalize processes but will still not be enough to manage projects effectively in the long term. Adding an additional virtual layer through virtual touring platforms with 3D scanning tools allow project contributors to "walk through" a site together. CBRE recommends utilizing these platforms at the initial planning stage to help with coordination, clash analysis and BIM to reduce the need for site surveys. As the project progresses, the same platforms can be leveraged for progress reporting and quality assurance inspections. This not only drives efficiencies for the project team but also allows the client and their customer to manage the project from anywhere in the world.

Technologies are now ingrained into everything we do and the cloud is where we all work and live, but it is important not to lose sight of the fact that we need the right people in the right positions on-the-ground to ensure project success.

Available Methodologies:

- Live 3D modeling of the space from start to finish
- Automated site plans, floor plans, and elevation renderings
- Dimensionally accurate space and equipment
- Automatically generated video tours
- Progress reporting like no other



White Space Strategy

With this industry growth, data center owners and operators need to have a white space strategy to ensure their facilities are future-ready. When developing this strategy, there are key considerations to weigh:

Migration strategy: It's important to think about what migration will look like in the beginning of your process to ensure it does not affect the reliability of the live data center. As it's a balance between cost, time and risk, the owner's goals and ultimate purpose of the data center need to be included in the strategy.

Scalability: The white space in a data center is typically upgraded every 5-10 years, and using a global supply chain will usually ensure more advantageous pricing and payment terms than an individual owner can secure. Even the smallest customers will see cost and consistency benefits from having access to a global supply chain.

Speed to market: Having access to a global supply chain and an ability to optimize product lead times will greatly impact the speed to market of the white space and the deployment of the IT equipment and, for the customer, the realization of economies of scale.

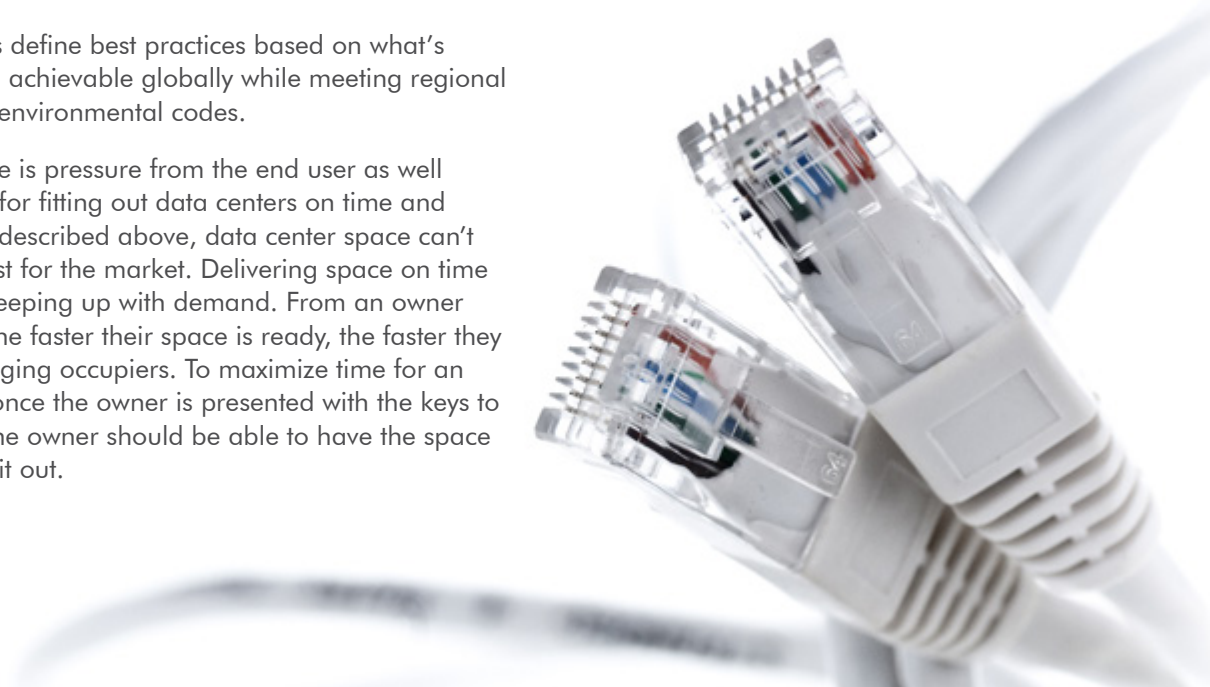
The standardization and layout of the white space has evolved substantially since the introduction of data centers as we know them today—from a room full of mismatched equipment on a carpeted floor to a globally streamlined set of equipment in a regulated space. Ongoing improvements occur to white space standardization and layouts with each new technology, sustainability requirement or design strategy that is introduced.

Today, fit-out strategies focus heavily on three key areas:

Risk management: For sites that are live, risk management plays a crucial role to ensure that the reconfiguration does not impact the live data center's reliability. Coordinating with all stakeholders can help account for resiliency, redundancy, service level agreements and site constraint risks

Consistency: This shift toward consistent sites enables owners to have the same look and feel across all their data centers. For example, consistency involves using the same suppliers for cabinets, structured cabling and fiber in addition to having all supply and buying decisions made once globally rather than many times locally. Therefore, having global vendor connections ensures best pricing, coverage, supply and priority in all of the regions where the owner expects to grow. Additionally, having a global vendor network helps define best practices based on what's available and achievable globally while meeting regional building and environmental codes.

Timing: There is pressure from the end user as well as the owner for fitting out data centers on time and efficiently. As described above, data center space can't deliver too fast for the market. Delivering space on time is crucial to keeping up with demand. From an owner perspective, the faster their space is ready, the faster they can start charging occupiers. To maximize time for an existing site, once the owner is presented with the keys to their space, the owner should be able to have the space immediately fit out.



The Evolution of the White Space

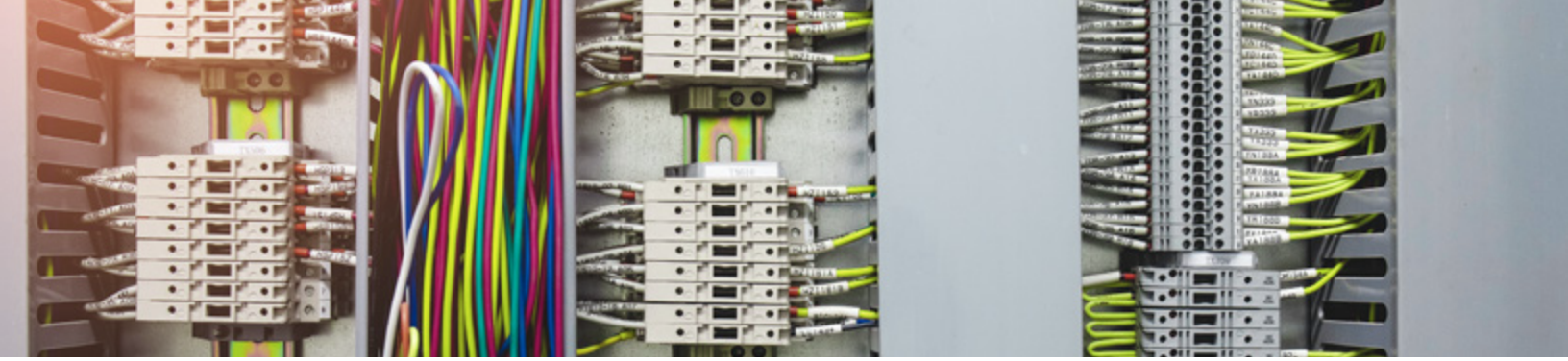
White space fit out strategies have evolved towards maximizing risk management, consistency and timing.

	30 YRS AGO	25 YRS AGO	15 YRS AGO	TODAY	FUTURE
Standardization of White Space	White space was designed ad hoc by local teams resulting in little standardization throughout an owner's portfolio.	While designs remained locally driven, some corporate standards and industry best practices started to emerge.	While still reliant on local supply chains, corporate standards became established and stronger moves were made towards globally consistent performance specifications.	Designs and supply chain are typically standardized across regions to deliver globally consistent design, with tailoring implemented only to meet the demands of local code.	Expect to see continued focus on standardization of technologies to drive increased efficiency and optimization (DCIM, energy efficiency, etc.), along with closer integration between plant and technology monitoring and control systems.
White Space Layout	Data centers were large, cold, carpeted halls with collections of mismatched, disorganized equipment. Temperature management was not targeted, meaning the entire white space was covered with cold air.	Nineteen-inch cabinets were introduced, and equipment was built to fit within. Rows and aisles with these cabinets started to form. Hot and cold aisles were arranged to improve airflow and cooling efficiency.	Equipment was colocated with areas for the central network, storage and density. Power and cooling customization began to allow for targeted temperature adjustments in different areas of the floor.	Standardized cabinet layouts with contained hot and/or cold aisles have become the market norm with increased focus on decluttering the subfloor void to maximize airflow cooling efficiency.	Expect to see increased sustainability focus and a new iteration of white space design to accommodate increased use of immersive liquid cooling solutions to support high performance compute applications.

Aligning a Global Standard to Local Requirements

While every customer will have different attitudes towards risk and contracting models, we tend to see the following general trends in markets:

REGION	UNITED STATES	EUROPE	ASIA
Partnership / Outsourcing Model	Data center owners are comfortable with a time and materials (T&M) contract.	Data center owners are comfortable with a fixed price contract and turnkey solution.	Data center owners are comfortable with more design control and checkpoints throughout the fit-out process.
White Space Fit-Out Impact	In this model, risk is shared between the owner and the fit-out partner. The owner is required to have staff who are technically and commercially aware of the project and its activities and to participate in issue resolution.	The fit-out partner bears risk associated with project delivery while the owner provides some oversight and governance. From an owner perspective, this is the least onerous approach.	Typically the owner will have a relatively large team who owns the design and planning process, while the fit-out partner is retained to provide execution expertise and capacity where the owner lacks it. Most of the design and execution risks sit with the owner.



White Space Considerations Throughout the Data Center Lifecycle

	STAGE	SCOPE	CONSIDERATIONS
1	**Space and power lease deals are negotiated: MRC (Monthly Recurring Charges)**	Available power and floor space is negotiated with colocation providers or hyperscalers and test fits of rack layouts are produced.	
2	**Tenant fit-out costs and schedules are negotiated: NRC (Non-recurring Charges)**	High level designs and specifications are shared with colocation providers. Typically, they have go-to-market to get supply chain pricing and local installation costs. If it's a new customer, rounds of RFIs will be completed to understand the fixed costs and schedule. A new build often is completed by a main contractor who isn't an expert in white space fit out, and the customer incurs margin on margin and increased costs. Pricing at this stage is usually "Not to Exceed" pending a more detailed design.	Global supply chain partners and specialist installers will be able to provide better pricing, lead times and quality with an understanding of customers' design standards. Partners with experience of execution in multiple markets and global supply chain options will be able to provide detailed pricing more quickly and speed up negotiations.
3	**Space and power deals are completed**	Space and power deals are agreed to alongside a ready for service (RFS) date for the tenant fit out to be completed. This will often include delay penalties for late delivery.	The provider is committed to delivering on time. With new markets, delivery often happens when the facility is still under construction.
4	**Detailed tenant fit out design**	Detailed design is released by the tenant. At this point, pricing can be firmed up and any RFIs and technical submittals can be completed.	If the facility is a new build, it's key to have a federated model that is fully coordinated between the base build of the data center and the tenant's requirements. Having a partner with access to supply chain and preferred lead times will decrease risk on the project. Offsite fabrication of containment and other equipment will accelerate the fit-out schedule and limit risk by taking lbor hours offsite. This is dependent on a coordinated model.

	STAGE	SCOPE	CONSIDERATIONS
5	**Base build complete**	Once the base build is complete, fit out of the white space can commence.	Commissioning is usually a driving factor for delay. Consideration as to how priority racks for tenants are powered vs commissioned should be considered along with any cooling requirements. Consideration should also be given to ancillary spaces required to serve the space—access routes, loading docks, storage and staging areas, goods lifts and safe routes to the customer areas.
6	**White space fit out**	Tenant fit out commences, with installation of racks, containment and power distribution.	Progress updates and communication are key at this point, especially when customer teams could be remote. Changes in design are inevitable and consideration should be given to how stage gates can be implemented to ensure sign off of quality standards
7	**Tenant fit out**	Delivery of customer equipment, power and cabling installation and quality assurance (QA) takes place.	Consideration to supply chain and who does QA and installation of fiber splicing, testing and copper patching to customer standards, usually a different skillset to electrical and mechanical installation teams. Customer stakeholders are also different and have differing needs.
8	**Go live**	Customer equipment will be live and usually within a secured location.	Access to do remedial works will be very challenging. Change Requests may be required for certain works. Customer's expectations around uptime and service will kick in along with SLAs.
9	**BAU operations**	Operational maintenance of the whitespace and supporting infrastructure occurs.	Customers may only install a minimum number of racks on day one. Consideration should be given as to how additional racks will be installed and connected (power & fiber/copper) within a secure environment to meet the customer's timelines.

CBRE's global white space and technology infrastructure division supports customers with the mobilization of new or expansion of existing installations within their data centers across the globe. We offer turnkey delivery service from concept to commissioning; engage at an early stage to solution and design the white space environment. Our global scale combined with local, on-the-ground expertise ensure that end-user ready for service dates are met with minimal capital outlay or operational risk.

- **Global partner:** CBRE's global network ensures a pace, scale, quality and consistency that is unmatched by other providers. Your fit out benefits from best practices accumulated around the globe.
- **Global supply chain:** Our global distribution network and established network of vendors makes setting up your new locations its most efficient. CBRE's global supply chain capabilities and multi-billion dollar buying power guarantee the lowest fit-out costs.
- **Local expertise:** On-the-ground experts who understand local regulations and standards and maintain local vendor relationships add additional strength to our global strategy. This ideal combination of local-meets-global creates the worldwide consistency and buying power you require while ensuring on-time delivery, day-to-day management and access to local talent networks.

Services offered:

- Electrical & Mechanical Design
- ICT & Connectivity Design
- Electrical & Mechanical Install
- ICT – Fiber & Copper Install
- Rack Install
- PDU Install
- Hot Aisle Containment
- Cold Aisle Containment
- PDU Install
- CFD Analysis
- Test & Commissioning

The Global Leader in Data Center Operations

- 45 Countries
- 2,175 Data Center Technicians
- 200+ Data Center Project Managers
- ~700 Managed Data Centers
- 99.99968% Uptime
- $74B Supply Partnerships
- >4M Hours/Year DC Operation

CBRE's Data Center Services

Critical Engineering & Management

We maintain the mission critical engineering and infrastructure that is essential for data center business continuity.

Supply Chain

We have built the most advanced and comprehensive procurement networks to leverage our aggregated spend and deliver significant client savings.

Analytics & Monitoring

Our automated analytics and monitoring improve the speed and quality of critical decision making for data center operations.

Technology Operations

Our teams will significantly improve the efficiency of your site management through our deep experience and the use of innovative technology.

Energy Optimization

We help data centers operators optimize their energy performance through efficient cooling systems and cost-effective energy contracting.

Project Services

Our dedicated projects division specialize in delivering project services to data center clients globally.

For more information on Data Center Solutions, please visit cbre.com/datacenters or contact:

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