THE NEXT EVOLUTION IN MODULAR DATA CENTERS

Organizations in the process of developing a new data center often find themselves with several difficult questions to answer. "How do we make sure we have enough data center capacity without paying for more than we need? How can we get our data center operational as fast as possible without compromising on quality? How can we meet our sustainability goals while keeping construction and operating costs down?" Historically, these organizations have been forced to make tough choices about which qualities are priorities and which can be sacrificed.

The emergence of modular data center capabilities in the mid-2000s was a great leap toward making these choices easier. In a modular data center, prefabricated blocks of IT power and cooling infrastructure can be added over time to increase capacity as needed. The current generation of modularization has evolved from containerized data centers: IT infrastructure packaged into International Standards Organization (ISO) shipping containers.

Today's modular data centers offer greater scalability and flexibility than container data centers, and they're faster to deploy, but there is plenty of room for modularization to advance beyond where it was in the mid-2000s. Goals for the next generation of modular data centers include even higher degrees of flexibility and performance, more efficient use of capital, global repeatability, and improved sustainability, along with increased IT capacity. Forward-thinking data center infrastructure specialists are actively working on new products that will meet high expectations for improved modular processes.

What Are Modular Data Centers?

A modular data center is a data center system configured from predetermined blocks of IT power and cooling infrastructure that can add capacity to an existing data center or bring capacity to an entirely new area. Modular data centers allow organizations to scale their data center capacity up as demand requires, thereby giving them the ability to scale their capital deployment as well.

Modularization as we know it today grew out of the development of containerized data centers in the early 2000s. In a data center container, IT infrastructure is packaged into an ISO shipping container. While containerized data centers can either be individual small-scale data centers or part of a modular data center system, they are not modular themselves—capacity cannot be added once the initial IT package is complete, and they require additional infrastructure to operate modules to scale capacity. Data center containers have their uses, but they are too small for large-scale IT deployment.

Fully modular data centers emerged around the mid-2000s. These were scalable data centers with power and cooling infrastructure that needed no additional support to operate

effectively. Unlike containerized data centers, which arrive as a complete package, modular data centers are assembled from prefabricated components (and modules) and can be built onto as needed to meet a business' growing demand for capacity. With the next generation of modularization, the entire data center—the building included—could be assembled from pre-engineered pieces that fit together like Legos.

Modular data centers may not be the best choice for organizations on the hyperscale level, but they're an excellent solution for small to mid-sized data centers (250kW-10W). They offer a more effective use of assets than traditional data centers, handling large amounts of data with less physical space and fewer materials. They also go from pad-ready to fully operational much faster than traditional data centers, reducing the time to market.

Edge computing is the concept of aggregating the initial data closer to the source for analysis before sending the most important data to the cloud or a colocation facility, enabling a quicker response and reducing the flood of data (data gravity) to the central data center. There are thousands of cities globally with over 100,000 people, but only a fraction of them have built out data center capacity within their area. With the propagation of content caching, cloud computing, IoT, 5G technology, and localized services needing to be delivered within the edge, the need for small to mid-sized data center capacity increases around the planet. These small and mid-sized modular data centers can be installed closer to the data source, facilitating edge computing.

Goals for the Next Generation of Modular Data Centers

With advancements in technology and streamlined deployment processes, everything that makes current modular data centers successful can be improved for the next generation. Newer modular data centers can do more to optimize costs by reducing time to market and increasing leasable white space, and with global repeatability and more available configurations, they can be more flexible solutions as well. Data center specialists are also trying to pack high-performance critical infrastructure into smaller blocks, which would make modular data centers easier to deploy in dense areas. Lastly, one of the primary goals for the next phase of modularization is to be more sustainable, driving excellent results while consuming fewer resources. Let's take a closer look at how each of these goals can be met by the latest iterations of modular data centers.

Increasing the Benefit to Your Bottom Line

Keeping capital expenditures (CapEx) to a minimum is a top priority for organizations in need of a data center. Containerized data centers solve a lot of customer needs, but IT white space becomes very expensive to deploy in prefabricated modules when you begin to exceed 40-50 racks. Modern modular data centers can blend prefabricated power and

mechanical modules with a kit-built, pre-engineered structure and white space, solving expensive prefabricated white space problems and allowing for scalable capital deployment tied to customer demand.

Reducing time to market is another crucial way to decrease CapEx. Solutions that minimize on-site installation through reduced engineering and construction time, essentially converting data center projects from construction to assembly projects, can take data centers from pad-ready to fully operational in as little as five months. The reduced engineering and construction time allows organizations to be operational 35-45% sooner, resulting in earlier revenue recognition and reduced construction costs. Data center specialists have been able to accelerate the construction process by designing smaller modular data centers, maximizing revenue per delivered sq ft/sq m of space—some modular data centers of the next generation deliver a minimum of 70% leasable (revenue-generating) space for every block.

The cost of maintenance is another major factor in data center expenses. Newer modular data centers can minimize operating expenses (OpEx) not only through energy efficiency savings but through maintenance savings as well. By using equipment chosen for serviceability by OEMs with a global scale, the next generation of modular data centers can minimize the need for maintenance. Lithium ION batteries, EC fan cooling units, and modular UPS systems, for example, all have minimal UPS maintenance needs. The right equipment selections should also minimize the need for proprietary software to perform routine maintenance. These efforts can extend the structural life expectancy of a next-generation modular data center well beyond 30 years.

A More Flexible Critical Infrastructure Solution

Modular data centers allow for more flexibility to not only reduce CapEx requirements but also to deliver a solution that meets local requirements. Global repeatability can be achieved by creating designs that are deployable in all 50hZ and 60hZ locations, offering localization for climatic concerns (including Seismic Zone 4 compliance) and making cooling selections based on climate conditions to deliver lower power usage effectiveness (PUE).

A well-designed modular data center can be globally repeatable while also being flexible in order to meet different capacities and different environmental and local requirements. Using standard components that are serviceable in even the most challenging locations and doing away with bespoke design will make it possible to deliver data center capacity as a utility all over the world. A modular solution that is repeatable will help deliver cost consistency, site consistency, and quality consistency thanks to the standard design blocks.

Superior Sustainability

The next generation of modular data centers should aim to offer full-circle sustainability, going beyond energy efficiency alone. Modern modular data centers can be constructed with reduced carbon building materials, like low-carbon concrete foundation and recycled steel, with wall panels made from mineral wool, which delivers a very high insulating value, fire rating, and thermal resistivity.

On the energy efficiency front, modular data centers can now be equipped with green solutions like high-efficiency cooling and natural gas, bifuel, or biodiesel backup generation (with hydrogen backup available for telecom data centers). Setting them up for renewable energy/solar integration is critical for meeting sustainability goals as well.

Meet GENIUS

Modular   Speed to Market   Savings   Repeatable   Flexible   Sustainable

Mission Critical Facilities International, a team of data center infrastructure experts with decades of experience in the industry, is taking modularization into the next generation with GENIUS. This proprietary modular data center solution was designed to exceed expectations for more advanced modular processes, driving the concept to a new stage of evolution. Our team of professionals collaborated to create an excellent modular data center solution that delivers between 500kW and 10mW of IT capacity space, serving the vast portion of the market that needs more than 500kW (the maximum amount required by most modular data center customers) but less than the 30mW needed only in a hyperscale campus environment. Our focus is on deploying mid-range data centers from 250kW to 10MW.

GENIUS is more efficient, flexible, sustainable, and cost-effective than other modular data centers because of exactly the engineering methods, materials, and deployment methods previously mentioned as goals for the next generation of modular technology in general. It is available in multiple sizes and configurations to meet any organization's needs:

- **Colocation/Retail** (8-15kW/rack, up to 250 racks per block-accommodating cages if required)
- **Hyperscale/Warehouse** (8-15kW/rack, segmented infrastructure/secure rooms)
- **Edge/SuperNode** (10-15kW/rack, 500kW blocks)
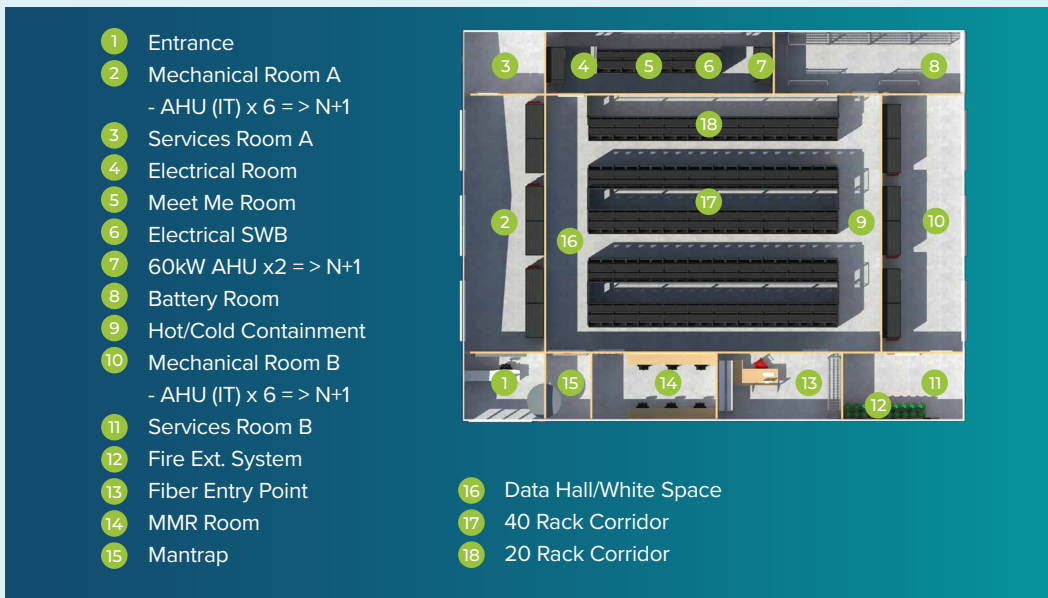- **Edge HD** (+20kW/rack, 500kW blocks, water-cooled)

Scale Your Business With GENIUS Today

How do you describe a modular data center solution that is: eloquent/simple, flexible, rapid, cost-effective, changing construction to assembly, globally repeatable, efficient and sustainable?

In a word: GENIUS. Learn more about our **GENIUS modular data center** and contact Mission Critical Facilities International to begin a project that will take your organization to the next level in modular data centers.

Data Center Plan View

1. Entrance
2. Mechanical Room A
   - AHU (IT) x 6 = > N+1
3. Services Room A
4. Electrical Room
5. Meet Me Room
6. Electrical SWB
7. 60kW AHU x2 = > N+1
8. Battery Room
9. Hot/Cold Containment
10. Mechanical Room B
    - AHU (IT) x 6 = > N+1
11. Services Room B
12. Fire Ext. System
13. Fiber Entry Point
14. MMR Room
15. Mantrap
16. Data Hall/White Space
17. 40 Rack Corridor
18. 20 Rack Corridor

Equipment Yard Plan View

1. Power Modules A & B
   - Modular UPS
   - Electrical SWB
   - Battery System
2. Grey Space
3. Diesel Generators x 2
4. Buffer Tanks x 2
5. Air/Water Chillers x 3