THE MODULAR DATA CENTER: DEFINITIONS, PROS & CONS, MARKET STATUS

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CBRE

DATA CENTER
SOLUTIONS

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1. Introduction

The data center sector has changed dramatically over the last decade or so as rapidly increasing data traffic is driving the demand for fast, inexpensive, reliable data storage. Not long ago the focus of the sector was primarily on costly, highly redundant, custom-designed private enterprise data centers. Today, the focus is primarily on the cloud, where speed to market, energy efficiency, and rapidly deployable incremental growth are the key drivers. In order to address these drivers, the modular data center, with its promise of factory- manufactured products that can easily scalable and quickly and reliably installed, was born.

A 2015 MarketsandMarkets report shows considerable expansion in store for the global modular data center market over the next few years. Researchers have predicted that the modular data center sector will increase at a 31.9 percent compound annual growth rate through 2019. This will cause the industry to expand to $26.02 billion over the next five years, a significant uptick from 2014's $6.52 billion.

This growth has caused a lot of interest among data center owners and operators who need fast deployment, low-risk scalability, and energy efficiency. This growth has also caused a lot of confusions, as many companies that manufacture and install modular data centers present different approaches and designs, at different cost-points and fabrication schedules.

The intent of this White Paper is to present an overview of the modular data center sector today and provide information to help those who are considering a modular approach to better understand the terminology, pros and cons, market status, and metrics.

2. Definitions

The first challenge that those who wish to understand the modular data center market face is deciphering the language. Many terms, with varying definitions and scopes, have been used to describe data center systems or subsystems that are pre-assembled in a factory. These terms can create confusion and lead to misunderstanding because they overlap and are ambiguous in meanings. These terms include the following:

• Modular
• Containerized
• Prefabricated
• Scalable

There are as-yet no agreed industry definitions for these terms, so for the purpose of this White Paper they will be defined as follows:

Modular

DataCenter Knowledge defines "Modular Data Center" as, "A deployment method and engineered solution for assembling a data center out of modular components in, many times, pre-fabricated solutions that enable scalability and a rapid delivery schedule." In this White Paper, "modular" will be used as a general catchall for any pre-manufactured system or facility.

2. Definitions

Containerized

Containers are built using an ISO (International Standards Organiza¬tion) intermodal-shipping container, and are designed to house infrastructure that support power, cooling systems, or racks of IT equipment. Containers were the first type of modular data center system, and are the type that most are most familiar with. Due to limitations of size and construction, though, ISO containers are losing popularity and are being replaced by pre-fabricated data centers (see next item).

Prefabricated

This refers to a data center that is pre-engineered and has its systems (hardware & software) pre-assembled, integrated, and tested in a factory environment to shorten deployment time frame and improve predictability of performance. These can be one of three kinds:

- **Semi-prefabricated:** A combination of prefabricated functional blocks and traditional "stick built" systems.

- **Fully prefabricated:** Completely prefabricated IT, power, and cooling modules

- **All-in-one:** A data center that is self-contained in a single enclosure, with IT, power, and cooling systems

Scalable

The ability of a computer application or product (hardware or software) to continue to function well when it is changed in size or volume in order to meet a user need.

3. Attributes

In addition to the definitional differences described, modular data center are also comprised of the three main attributes:

- Modular
- Containerized
- Prefabricated
- Scalable

Below is a brief overview of each:

Functional Block

The functional block refers to the system that is enclosed in a modular component – either the power plant, the cooling plant, or the IT space. Some modular manufacturers produce only one or two of these, and others supply all three.

3. Attributes

Form Factor

This refers to the physical form of the modular component. As mentioned earlier, the form may be an ISO container, but it can also be a custom-fabricated enclosure, - designed to be installed either indoor or outdoor – or skid mounted, which is a method of distributing and storing machinery where the machinery at point of manufacture is permanently mounted in a frame or onto rails or a metal pallet.

Configuration

The functional blocks may be deployed in various configurations. Some data centers include a mix of prefabricated modules and "stick built" systems, while others are fully prefabricated, containing all three prefabricated functional blocks.

Some modular manufacturers provide a fully integrated solution – an "all-in-one" - where the power, cooling, and IT co-exist in a single prefabricated enclosure.

4. The Pros & Cons

A modular data center approach offers many possible advantages, but it is not necessarily the right approach to every data center project, as there are areas of concern that must also be considered. Below is a bullet-point list of pros and cons related to modular data centers:

Pros:
- ✓ *Consistency:* Standard design with a repeatable implementation in the future providing consistency of product and performance.
- ✓ *Speed to Market:* Manufactured off-site allowing for concurrent activities to occur resulting in a better deployment schedule.
- ✓ *"Right-Sizing":* IT requirements requiring larger systems can be built utilizing smaller standard sub systems resulting in less stranded capacity.
- ✓ *Scalability:* Modular systems provide the ability to deploy a scalable solution as IT load grows with minimal operational interruption.
- ✓ *Power Efficiency:* Pre-engineered systems can result in very low Power Utilization Effectiveness (PUE), and the ability to "right size" reduces over-provisioning.
- ✓ *Possible Lower TCO:* When deployed effectively, modular data centers can result in lower overall Total Cost of Ownership due to lower power and maintenance costs than traditional data centers.
- ✓ *Flexible Depreciation:* Due to the off-site constructed nature of modular data centers, these components can be depreciated faster than traditional real estate assets.
- ✓ *Greater Densities:* Compared to traditional data centers, modular solution densities can be more efficient, allowing for very high-density racks

4. The Pros & Cons

Cons:

– *Untested Products:* The majority of modular and pre-manufactured vendors have been in business for less than 10 years, and there is a limited track-record of performance over long periods

– *Restrictive Sizing:* Most manufacturers have pre-determined sizes for modular components, and sizing requirements may result in less than optimal capacities and limited or stranded capacities.

– *Restrictive Topology:* The mechanical and electrical system topology and capacities are often defined per the manufacturer, and some manufactures have proprietary and patented solutions.

– *Shipping Risks:* Modules are shipped over the road to the facility, resulting in vibration and G forces that can cause damage.

– *Limited Controls Options:* BAS and DCIM systems are often integrated to the module, introducing compatibility and potential communication issues with existing facilities or owner standards

– *Enterprise Limitations:* Most modular systems work best for small IT loads. Larger IT loads may require customization or compromising block size or topology.

– *Increased Capital Costs:* Designs and installations that vary from the manufacturers module, or complex all-in-one system installations, may cost more than a traditional "stick-built" solutions due to expensive customization, testing, and fabrication times. On a recent large enterprise project managed by CBRE, costs for a pre-fabricated solution came in approximately $3M more per megawatt than a stick-built design.

– *Unfamiliar Operational Practices:* Maintaining and operating a modular data center can be quire different than a traditional data center, and data center owners and operators may struggle to understand the systems, leading to possible down time.

– *Market Uncertainty:* Given the relative infancy of the modular data center market, it is not clear which manufacturers will success and which ones will fail. Once a modular product is selected and installed, however, the data center owner may be locked-in to the manufacturer for parts, maintenance, and future expansion.

5. Market Status

There are many high-quality modular data center products available today, from manufacturers such as Dell, Commscope, Schneider Electric, SGI, Cisco, HP, Flexenclosure, Baselayer, Bladeroom and Huawei. Many very large data center owners have utilized these products, including Facebook, Ebay, Google, IBM, Goldman Sachs, Fidelity Investments, Cyrus One, and the University of Montana.

As mentioned in the Introduction of this White Paper, industry analysis are projecting dramatic growth for modular data centers, and developing markets such as China, India, and Brazil are expected to lead the speedy growth of the modular market. In spite of this projected growth, though, the future of modular data centers is far from clear, especially in the USA.

5. Market Status

Although modular data centers can trace their origin to the advent of the cloud, Microsoft – an early adopter of container solutions – recently announced that it would no longer utilize modular products, and other cloud providers are taking a second look, having discovered that modular solutions have not consistently given the expected speed and cost reduction benefits. DataCenter Knowledge recently noted the following:

"The pre-manufacture industry for data centers was driven in large part by the large internet firms who were exploring methodologies for deploying smaller load footprints in an expedited time frame. In our experience with these firms they have abandon pre-manufactured data center soluteions in favor of standardized data center deployments."

The small size and portable nature of modular data center, however, have attracted mobile network providers who are looking at distributed data centers to carry network virtualization. Modular solutions are well suited to such small, numerous "edge" data centers, and many market-watchers expect substantial growth in this area.

6. Conclusions

The basic questions that anyone who is exploring modular data centers must ask are "How do they compare to the traditional stick-built data center? How do they compare in costs, schedule, and performance?" At this time, the answers must be, "It depends": It depends on the size and complexity of the project, the form and configuration of the design, the block loads, the level of redundancy and reliability, the location, and the experience of the delivery team.

Clearly, modular data centers are the right solution for many projects, and the industry is here to stay, although it may go through many iterations as it struggles to keep up with the ever-changing demands of the data center market.

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