Data centers: Make mine modular

Be prepared for a tight squeeze, though; prefab units are not known for being spacious

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When John Campbell, associate vice president of academic technologies at Purdue University, talks about his school's soon-to-be implemented modular data center, he can hardly hide his enthusiasm. "From a business position, on keeping costs down [and] trying to get as efficient a solution as possible, this is a very, very viable solution," he says.

Campbell isn't alone in his admiration of modular data center design, which relies on inexpensive building materials and construction practices such as preconfiguring a shipping container with server racks and other IT equipment for easy drop-off and deployment.

For Guardian Life Insurance Company, it's a matter of reducing the firm's data center footprint, according to Frank Wander, senior vice president and CIO. The firm is reducing its six data centers down to two -- one it will own and one it will lease, Wander explained at the recent Computerworld Premier 100 conference.

Modular ups and downs

Pros

- Deployment speed -- Modular data centers can be deployed very quickly, usually within a matter of weeks, as opposed to the months or even years typically required for traditional data center construction.
- Cost -- Inexpensive building materials and techniques trim costs for pod and pre-fab adopters. Adopters in some jurisdictions may also see tax and regulatory benefits. Hybrid customers -- those that use pods within traditional data centers -- get savings by sharing facility space with other data centers.
- Placement -- Pod and prefab units can be placed at any location the adopter specifies.
- Scalability -- More space in the form of extra pods, prefabs or square footage can be added as needed.
Cons
- Durability -- The jury's still out on how well pod and pre-fab modular data centers will withstand the ravages of time and weather.

"We'll have a pod and go down tremendously in terms of space," he said. "We haven't done it yet, but that's where we're heading," Wander said.

Confounding early skeptics, who often compared modular data center construction to that of mobile homes, interest in the technology is now growing to the extent that some observers feel that the modular model is destined to become the standard for virtually all future data center construction.

"I like to say that the large, monolithic data center is dead," declares Michelle Bailey, data center trends researcher for IDC in Framingham, Mass. Bailey feels that within five years the modular model will become "almost the default approach" to data center construction.

"You would probably have to have a really good reason for wanting to build a very large, over-provisioned data center," Bailey says, noting that enterprises are sometimes forced to build such facilities simply to meet local zoning

- Service availability -- Provisioning utility and network resources to pods and pre-fabs placed in remote locations can be difficult and expensive.
- Lack of space to work in -- Most modular facilities, particularly pods, are designed to accommodate equipment, not people.
- Vendor lock-in -- Many modular data center offerings require adopters to commit to a vendor's hardware and/or support offerings.
- Security -- An isolated pod or pre-fab may be easier to break into or vandalize than an ordinary building.

requirements. Some cities and towns don't allow modular containers, requiring traditional structures instead.

Albert Lee, a senior analyst at Enterprise Management Associates, an IT analysis firm located in Boulder, Colo., also believes that the modular model is on a roll. "From the overall technology trending perspective, I think this is the right way to go and [is] the next generation of the data center," he says. He points to the growing number of modular providers as proof of the approach's growing popularity.

Over the past few years, IBM, Dell, HP and Oracle, as well as a gaggle of other players large and small, have worked hard to change the way enterprises view and create data centers.

That said, it's still very early going for modular data centers. IDC's Bailey estimates that around 85 were sold in 2010, and she predits that this year's sales will be in the neighborhood of 145. The customers interviewed for this article are still in implementation mode, with only a handful of companies, primarily vendors, in full-fledged production.

Modular data center popularity is growing because the approach, promises to help almost any enterprise, regardless of size or industry sector, add IT space in less time and at a lower cost than by building or expanding a conventional operations hub. Additionally, unlike a traditional data center, a modular facility can be located almost anywhere -- next to an office building, on a spare piece of land, on a company parking lot or inside a warehouse -- as long as there's access to energy, water and network resources. "The two big things that people consider are reducing the cost and cutting the time to deployment," Lee says.

Like a prefab home, modular data centers rely on inexpensive building materials and construction practices. Photo credit: Nikola Solic / Reuters

Another advantage offered by modular data centers is that they allow adopters to start out small and add on extra space as they need it. "It starts to become more affordable for mid-size companies that want more of a true data center room rather than just a small server room," Bailey says. "It's very different again from having to build a traditional brick-and-mortar data center, where you're trying to figure out how much capacity you'll need for the next 20 years instead of just the next three years."

Three styles fit most

As Bailey explains, modular offerings now come in three basic styles. There's the original concept of a reconfigured shipping container (usually referred to as

a "pod") that the vendor typically packs with IT gear and drops off at the customer's selected location.

Alternatively, some vendors have begun offering pre-fab structures that are designed to provide more flexibility in both interior space and layout configuration. "It's almost like the modular home market, where it gets built in a factory," Bailey says. "It gets either partially or completely built in a factory and shipped to your site; then the building is completed on site."

The third approach is a hybrid model that combines both modular and traditional features. Vendors lease quickly configurable and expandable modular spaces, located inside large office buildings or plant-style facilities, to customers.

As the modular data center market grows and matures, the concept is gradually shedding its "IT plan in a can" reputation. "It's evolving from the container to a pre-configured type of environment," Lee says.

Many modular vendors, particularly pod makers, market their offerings as all-in-one packages that include servers and related infrastructure equipment, as well as power, cooling and other resources. Such systems can give customers a complete solution from planning to rollout. "It can be a convenience or a trap, depending on how you look at it," Lee says, noting that customers may find themselves inadvertently trading speed, cost and convenience in the short term for future customization, configuration and support/service opportunities with other vendors.

A compelling case at Purdue University

Purdue's Campbell began exploring his modular options after it became apparent that the university's high-performance data center was in dire need of additional electrical power. The facility's seemingly unquenchable energy thirst -- including three large server clusters built within the past three years -- was threatening to drain away its co-tenants' power resources. "It's a 10-story building; we are in the basement of that building and we consume 85% of the power," Campbell says. The other occupants consist of multiple research projects from various departments within Purdue.

Purdue University's move to data-center pods was prompted by a needed electrical upgrade in its primary data center, at least a two-year process. "We just didn't have time for the process to work its way through," says John Campbell, associate vice president of academic

An electrical upgrade was vital, but Campbell couldn't wait for the required bureaucratic approvals. "Getting an electrical upgrade ... is a two- to three-year process," he says. "We just didn't have time for the process to work its way through and (also) meet our growing needs."

Campbell realized that he needed to do something fast, or the university's research projects would soon begin suffering. He and his staff examined and rejected several potential options. "We looked at other places on campus that might have space and power available, but couldn't find any," he explains. Colocation was also considered and eventually rejected due to logistical and cost concerns.

Running out of choices, Campbell and the team turned their attention to modular offerings. They immediately saw several benefits. Pod-based structures could be deployed quickly, located on land close to the main data center and used to reduce the pressure on existing resources while accommodating future growth.

Most importantly, the modular structures wouldn't have to be submitted for planning approval. "They are considered a piece of equipment, rather than a

building/construction expense," Campbell says. "So we could quite literally take this off the shelf and, in two or four months, have it up and going."

After some further analysis, Campbell ordered a pod from Hewlett-Packard with the idea that additional structures could be added as the need arose. "We're getting ready to plan our cluster" for this summer, Campbell says, "and right now the vendor says in 60 days or less they can have [a pod] over here," Campbell states. The modular facility will be an adjunct to the main data center.

The approach also turned out to be significantly less expensive than any of the other options Campbell and his staff considered. "It was about half the cost of what we would pay for co-lo space," he says. There were other benefits, too. "It's extremely energy efficient, compared to our older data center," he says. "It's more flexible . . . we can build and add as we need the growth."

The Purdue pod holds one research cluster, a model that will continue as more pods are added. Working space, however, can be problematic. "There's plenty of room to work in the front, but tighter in the back," Campbell says. "You really want [to use] it for something that you don't plan on accessing all the time."

The only deployment challenge, Campbell says, was getting some of his staff accustomed to working with a facility located in an external structure. "The service support staff was already familiar with accessing anything and fixing anything in a remote way, but it seemed a lot easier when the data center was still down the hall," he says. "This [new data center] is down the street, and while they've been using all the remote stuff for years, it's made things a little bit different when an on-site visit is needed."

In winter, for example, staff members need extra time to dress appropriately.

Supporting the "final frontier"

Raymond G. Obrien, project manager of [Nebula](), NASA's open source-based [cloud]() computing initiative, is exploring modular data centers with a pod supplied by San Diego-based Cirrascale. He plans to see if the approach could help NASA better manage its voracious computing appetite.

"Growth estimates and other factors showed we could be on a course to exhaust available data center capacity at Ames Research Center, and possibly some other NASA centers in the future, if we didn't aggressively formulate a cutting-edge solution," he says. "We decided to acquire a containerized data center to better understand if this alternative would be a good way to address our planned growth."

NASA juggles scores of different research projects, each with its own computing needs, an environment that seems almost ideal for the use of modular facilities. NASA's container is configured to allow a variety of server form factors, "giving us the ability to test different server and [storage]() configuration approaches," Obrien says. "This is proving essential in determining which configurations will best support the usage patterns being demonstrated by NASA projects."

Being able to quickly and easily add computing and storage resources without having to deal with space constraints in existing data centers is a big potential benefit, Obrien says. Additionally, the standard size and minimal connection interfaces needed for containerized data centers make it easier to project future site space requirements and facility preparation costs to accommodate planned growth, he says.

While Obrien hasn't yet reached a final conclusion on the modular possibility, he says the Nebula team has already learned one important lesson: Pay close attention to cable management. "There isn't much room inside containers," Obrien says. "The server equipment is very densely packed, so

having a good cable management approach will ensure [that] your technical support team can move around inside and easily identify the cabling associated with server and network resources requiring attention or maintenance."

Raymond G. Obrien, project manager of Nebula, NASA's open source-based cloud computing project, hasn't yet reached a final conclusion on the modular possibility. But he says the Nebula team has already learned one important lesson: Pay close attention to cable management. Photo credit: Nick Theodore / NASA.

Modular not a good fit for everyone

While modular data centers present a variety of potential benefits, adopters also need to be aware of some hidden gotchas. Vendor lock-in is perhaps the biggest drawback. "You're very heavily reliant upon the providers ... to give you service," Bailey says. "So if you buy an HP container, you've really got to go to HP for the service on that."

Potential modular buyers also need to remember that innovations such as [virtualization](#) and cloud computing can be used alleviate the need for additional space, says Richard Fichera, a modular data center analyst for Forrester Research in Cambridge, Mass. "People keep buying all this new stuff and packing it more densely into existing data centers," he observes. "I've known data centers that five years ago were out of capacity, but they keep re-engineering inside the existing structure and they keep stretching it out."

Bailey notes that while modular facilities are meeting the needs of a growing number of enterprises, they still aren't a good match for some organizations. "If you're a company that has a fairly predictable understanding of what your growth is going to be regarding IT technology, and if you can fairly well forecast the amount of power you'll need to service that IT load, perhaps you should go with a more traditional approach to building a data center," she says.

Bailey says that careful planning and smart utilization practices can allow such organizations to reap long-term benefits from conventional data center facilities. An existing facility -- already bought and paid for -- may be able to be more densely populated, making it a better financial bet than adding a modular unit.

Paul Major, managing director of information technology at Aspen Skiing Co., which manages a ski

Modular data centers use techniques including preconfiguring a shipping container with server racks and other IT equipment for easy drop-off and deployment. Photo credit: Lee Celano / Reuters

resort in Aspen, Colo., explains why prefab wasn't in the cards for his new data center, due to open in May. In addition to the environmental enhancements over the old data center -- including an estimated 60% to 70% reduction in some cooling costs -- one of the largest benefits will be "getting all our IT people together in one place, for the first time." (To hear Major speak more about Aspen Skiing's new data center, watch the video below.)

Paul Major, managing director of information technology at Aspen Skiing Co., talks about his new data center at the recent [Computerworld Premier 100 conference.](#)

For his part, Campbell "strongly encourages" managers considering a modular data center acquisition to visit an operating facility before making a final commitment. "Take the time to visit, walk into them to see how they're cabled up and make sure it fits your environment," he says. "There are a number of [modular data centers] and many of them are very similar."

Obrien, meanwhile, advises managers to keep a close eye on the swiftly evolving modular market.

"There's a lot of rapid innovation taking place," he says. "It's up to you to keep your antenna up and stay on top of all the latest developments."

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