

Data center hot-aisle/cold-aisle containment how-tos

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Though data center hot-aisle/cold-aisle containment is not yet the status quo, it has quickly become a design option every facility should consider. Server and chip vendors packing more compute power into smaller envelopes has caused sharp rises in data center energy densities. Ten years ago, most data centers ran 500 watts to 1 kilowatt (kW) per rack or cabinet. Today densities can get to 20 kW per rack and beyond, and most expect the number to continue to increase.

Data center hot-aisle cold aisle containment can better control where hot and cold air goes so that a data center's cooling system runs more efficiently. And the method has gained traction. According to a SearchDataCenter.com's "Data Center Decisions 2009" survey of data center managers last year, almost half had already implemented the technology or planned to last year. But there are several considerations, and various questions that data center managers should ask themselves:

- * Is containment right for you?
- * Should you do hot-aisle containment or cold-aisle containment?
- * Should you do it yourself or buy vendor products?
- * What about fire code issues?
- * How do you measure whether containment actually worked as hoped?

Do you need hot/cold aisle containment?

First, a data center manager needs to decide whether hot-aisle/cold-aisle containment is a good fit for his facility. Dean Nelson, the senior director of global data center strategy at eBay Inc., said it's not a question for his company, which already uses the method

The hot-aisle/cold-aisle method has gained traction. But as Bill Tschudi, an engineer at Lawrence Berkeley National Laboratory who has done research on the topic, said, it's all about taking the right steps to get there.

"You can do it progressively," he said. "Make sure you're in a good hot-aisle/cold-aisle arrangement and that openings are blocked off. You don't want openings in racks and through the floors."

These hot- and cold-aisle best design practices are key precursors to containment, because when they're done incorrectly, containment will likely fail to work as expected.

Containment might not be worth it in lower-density data centers because there is less chance for the hot and cold air to mix in a traditional hot-aisle/cold-aisle design.

"I think the ROI in low-density environments probably won't be there," Nelson said. "The cost of implementing curtains or whatever would exceed how much you would save."

But that threshold is low. Data centers with densities as low as 2 kW per rack should consider hot-aisle/cold-aisle containment, Nelson said. He suggests calling the utility company, or other data center companies, who will perform free data center assessments. In some cases, the utility will then offer a rebate if a data center decides to implement containment. Utilities have handed out millions of dollars to data centers for implementing energy efficient designs.

Hot aisle containment or cold aisle containment?

Next up for data center managers is deciding whether to contain the hot or the cold aisle. On this score, opinions vary. For example, American Power Conversion Corp. (APC) sells a pre-packaged hot -aisle containment product. Liebert Corp. sells cold-aisle containment. Not surprisingly, both APC and Liebert argue that their solution is best.

Containing the hot aisle means you can turn the rest of your data center into the cold aisle.

Containing the hot aisle means you can turn the rest of your data center into the cold aisle, as long as there is containment everywhere. That is how data center colocation company Advanced Data Centers built its Sacramento, Calif., facility, which the U.S. Green Building Council has pre-certified for Leadership in Energy and Environmental Design (or LEED) Platinum status in energy efficiency.

"We're just pressuring the entire space with cool air where the cabinets are located, said Bob Seese, the chief data center architect of Advanced Data Centers. "The room is considered the cold aisle."

This approach includes concerns that when contained the hot aisle might get too hot for the IT equipment and uncomfortable for people to work in the space. Nelson, however, said that as long as there's good airflow and the air is being swiftly exhausted from the space, overheating shouldn't be a problem.

Containing the cold aisle means you may more easily use containment in certain sections of a data center rather than implementing containment everywhere. But it also requires finding a way to channel the hot air back to the computer room air conditioners (CRACs) or contending with a data center that is hotter than normal.

Cold-aisle containment proponents cite the flexibility of their approach. Cold aisle can be used for raised-floor and overhead cooling environments. Cold-aisle advocates also say that containing the cold aisle means you can better control the flow and volume of cool air entering the front of the servers.

Then, of course, data centers could contain both the hot and cold aisles.

Do-it-yourself methods vs. prepackaged vendor products

There are many ways to accomplish data center containment. If a company wants, it can hire APC, Liebert, Wright Line LLC or another vendor to install a prepackaged product.

Homegrown methods of containment are often cheaper and, if done correctly, are just as effective as vendor-provided approaches.

This may bring peace of mind to a data center manager who wants accountability should containment fail to work as advertised.

"They're good if you want someone to come in and do the work," Nelson said. "You can hire them."

But these offerings come at a price. Homegrown methods of containment are often cheaper and, if done correctly, are just as effective as vendor-provided approaches. Nelson and Tschudi said they prefer do-it-yourself methods because of the lower cost.

If a data center staff does undertake data center containment strategies themselves, there are various options. Some data centers have installed thick plastic curtains, which can hang from the ceiling to the top of the racks or on the end of a row of racks, or both. In addition, a data center can build something like a roof over the cold aisles or simply extend the heights of the racks by installing sheet metal or some other product on top of the cabinets. All these structures prevent hot and cold air from mixing, making the cooling system more efficient.

Fire code issues with hot/cold aisle containment

Almost every fire marshal is different, so getting a marshal involved early in the process is important. A data center manager must know what the local fire code requires and design accordingly, as hot-aisle/cold-aisle containment can stoke fire-code issues.

"The earlier you get them involved, the better," Tschudi said.

A fire marshal will want to ensure that the data center has sprinkler coverage throughout. So if a data center has plastic curtains isolating the aisles, they may need fusible links that melt at high temperatures so the curtains fall to the floor and the sprinklers reach everywhere. In designs with roofs over the aisles, this may require a sprinkler head under the roof.

"We made sure we could adapt to whatever the fire marshal required," Seese said.

Measuring hot/cold containment efficacy

It's also crucial to determine whether containment has worked; otherwise, there's no justification for the project.

Containment benefits can reverberate throughout a data center. If hot and cold air cannot mix, the air conditioners don't have to work as hard to get cool air to the front of servers. That can mean the ability to raise the temperature in the room and ramp down air handlers with variable speed drive fans. That in turn could make it worthwhile to install an air-side or water-side economizer. Because the data center can run warmer, an economizer can be used to get free cooling for longer periods of the year.

Experts suggest taking a baseline measurement of a data center's power, which compares total facility power with the power used by the IT equipment.

Nelson said that one of eBay's data centers had a power usage effectiveness rating of more than 2, which is close to average. After installing containment in his data center, eBay got the number down to 1.78.

"It was an overall 20% reduction in cooling costs, and it paid for itself well within a year," he said. "It is really the lowest-hanging fruit that anyone with a data center should be looking at."

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