WHITE PAPER

DATA CENTER CONTAINMENT — NOT ALL SYSTEMS ARE BUILT THE SAME

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(Data Center Knowledge, Data Center Frontier, InformationWeek, ITPro Today)

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DATA CENTER CONTAINMENT— NOT ALL SYSTEMS ARE BUILT THE SAME

Digital infrastructure is more critical than ever before. It's key to architect around efficiency, resiliency, and security when creating data center solutions to support emerging applications and use cases. However, not all systems are built the same for containment. So, how do you decide?

Executive Summary

Data center design has come a long way. During initial builds, engineers didn't really understand how containment worked and if it was somewhat functional; most were happy.

Fast-forward to today. We have massive hyperscale ecosystems, multi-tenant data centers, and even edge computing operating at peak efficiency levels.

Or are they? Containment solutions are certainly not built the same. So why are some leaders transferring legacy containment architecture into new designs? Or, even more troubling, out to the edge?

New considerations around light exposure, heat transmission, and security are very much a concern. On security, did you know that according to the latest AFCOM State of the Data Center report, insider human threats were the number two threat to data center operations behind ransomware? This means that leaders in the data center space are afraid of poor designs, human errors, and faults in physical security.

This paper will review modern designs, containment systems, and where security plays a key role.

INTRODUCTION

The central question wasn't that long ago: "What is data center containment?" As the term began to gain some traction in the industry, the question became, "What is the value or benefit of data center airflow containment?"

Today, we can safely say that the concept and value of containment are established in the industry. The more meaningful discussion may now drift toward determining how much containment is enough. As with the differences between hot aisle containment, cold aisle containment, and cabinet-level containment, there is no one-size-fits-all answer to the optimum degree of containment.

Architectural environments, business objectives, deployment constraints, and cost-benefit curves will weigh on intelligent decisions. Data center containment is no longer a well-kept secret. Readily available research by the Lawrence Berkeley National Laboratory and ASHRAE recommends containment. It is specified as a minimum requirement for new data centers in the current draft of California Title 24-2013 Energy Code. European Data Center Code of Conduct defines it as a best practice. We'll discuss ASHRAE and new guidelines during our use case review.

Before we dive into containment solutions in the data center, it's key to understand the defining trends impacting how we select and design around data center containment. First, we continue to see rack density grow. In the latest AFCOM State of the Data Center Report, the typical respondent reported an estimated mean rack density of 7kW in their primary data center. A majority (69%) said that their rack density has increased over the past three years, and 13% of respondents indicated that the rack density increased significantly. Containment doesn't only help with density; it also impacts data center sustainability. And this is very important. Almost 3 out of 4 respondents (73%) have an ESG strategy or planning committee. About half of the respondents (51%) reported that ESG is critical to their organizations and key stakeholders, including 19% who said it is vital. As more investment happens around sustainable infrastructure, more data center leaders will focus on greener solutions, better containment strategies, and the structure of their ESG practices.

This paper will explore airflow management, emerging containment solutions, designing around new infrastructure requirements, and how containment impacts the future of digital infrastructure efficiency and security.

SECTION 1: DATA CENTER CONTAINMENT, THEN AND NOW

Let's look at the Airflow Management Market, in general, to get us started. The AFM industry was valued at $419.8 Million in 2016. However, according to MarketsandMarkets Research, the market is expected to reach $807.3 Million by 2023, at a CAGR of 9.24% between 2017 and 2023. What's driving this growth? The growing demand for green data centers globally. An increasing number of data centers worldwide and *improving cooling efficiency and thermal management* in data centers are driving factors around the growth of green solutions and the evolving environmental management market. It is essential to note the difference between a computer room and a data center.

While they are mission-critical spaces, ASHRAE 90.4 Energy Standard for Data Centers defines a computer room as a room or portion of a building serving an ITE load of less than or equal to 10 kW or 20 W/sq. ft. or less of conditioned floor area. A data center is a room or building, or portions thereof, including computer rooms served by the data center systems, serving a total ITE load more significant than 10 kW and 20 W/sq. ft. of conditioned floor area.

Today, administrators are tasked with delivering much more while still retaining optimal efficiency levels. Remember, globally, data center power consumption has been growing. Global market research firm IDC reports that energy consumption per server is increasing by 9% per year globally as growth in performance pushes energy demand. As more organizations place their environments into the data center, energy efficiency and data center management have become extremely important. Data center administrators are working hard to cut costs and work overtime to minimize management overhead and improve infrastructure agility.

So, how do you keep up with the pace of demand? How do you ensure that your business and data center ecosystem operate as efficiently as possible? **You deploy next-generation containment solutions which elevate your airflow capabilities.** Future designs must consider airflow and containment efficiency early in the data center architecture and deployment process.

Containment and Airflow Management Have Come a Long Way

With organizations embracing new technologies — from AI to IoT — and generating more data that will get us into the yottabyte age, data centers are under pressure to do more and do it more efficiently and swiftly.

Performance demands on servers and storage packed tightly in data center racks — in turn, are creating new burdens on data center power, airflow, and density.

Energy use is expected to increase by around 4 percent a year. Based on current trend estimates, U.S. data centers consumed about 73 billion kWh in 2020. A recent study from the United States Data Center Energy Usage Report indicates that along with the considerable energy efficiency resource already achieved, additional energy efficiency strategies and technologies could significantly reduce data center electricity consumption. Many of these efficiency strategies are already successfully employed in some data centers.

But what about airflow management and the science behind moving air in the data center? **Just how far have we come?**

In 2010, *ASHRAE 90.1, Energy Standard for Buildings Except for Low Rise Residential,* eliminated the process exemption for data centers and added prescriptions for economization, variable flow on fans, and restrictions on humidity management as a reflection of evolving best practices for data center airflow management. As data center airflow management reached mainstream status in the past few years, the evolution of this field has focused on fine-tuning all the developments of the preceding decade.

So — what's changed? Why has the perception and value around AFM grown so much? What are the key drivers behind an AFM market slated to reach $807.3 Million by 2023? The main driver is the vast evolution of the market itself. Consider this, leaders like Legrand are already using new containment solutions for data center efficiency management.

Furthermore, the focus also revolves around the vast offerings of AFM itself. For example, you now have new and emerging options around CRAC designs, condensers, fluid coolers, advanced system controls, containment solutions, various cooling systems like chilled water or direct expansion, and even process cooling equipment engineered for the precision cooling of non-server or data-related spaces. Designs and architecture around AFM and cooling have come a long way.

In the past, AFM solutions may have been a 'nice-to-have' or even a luxury for some data centers to implement. Now, it is becoming a necessity for many market reasons (data center energy usage, growing business needs, focus on green solutions). When retrofitting or designing a data center, you no longer think twice about adding AFM solutions and containment systems to improve data center efficiency. However, some organizations are still catching up to AFM and containment requirements and best practices.

For some, the challenge is realizing the massive efficiency gains that a good airflow and containment solution can bring.

Containment: Legacy vs. Modern

In the past, data centers were primarily designed to support continuous operations, and efficiency wasn't considered nearly as much as today. In modern digital infrastructure, we can see where we are running efficiently and where there can be improvements. Computational fluid dynamics (CFD) is a specific tool that helps data center leaders see where they can improve their infrastructure. CFD is **a tool that allows engineers to understand the behavior of airflow and heat transfer within a space.** CFD can be used for data centers to construct models of proposed or existing data hall spaces that reveal attributes related to thermal performance, air distribution, and resiliency.

With this in mind, defining the three levels of containment efforts within the data center is essential.

- **No containment.** This design allows you to see free-standing data center racks with zero containment efforts. In this case, you'll see significant recirculation to the IT equipment in the cabinet. Hot exhaust air pulled around the side of the cabinet is mixing with the cold air and entering the IT equipment. This is, of course, extremely inefficient and will cause the PUE of a data center to rise. From a security perspective, it's much easier to get into racks, and you'll have no capability to integrate smart security solutions like RFID readers or biometric scanners.

- **Legacy Containment.** These designs are usually "full" containment as a constructed enclosure encompassing selected cabinet rows or a section of the data center space. With this design, minimal air recirculation happens to the IT equipment in the cabinet. You will see a significant improvement over no containment. However, you'll have to worry about airflow leaks. Furthermore, data centers run at temperatures far lower than they need to with legacy containment. Although this can contain air, you'll still have efficiency challenges running the optimal temperatures.
- **Modern Containment.** These designs offer a fully enclosed solution that practically removes air recirculation to the IT equipment in the data center cabinet. IT gear can operate at the best possible temperatures, the infrastructure is more secure, and you'll see functional improvements with things like maximum IT inlet temperature. These designs are often modular and offer greater efficiency and scalability in the data center.

As containment structures have become more sophisticated and server loads have introduced more variables, measuring containment has become more complicated.

With legacy containment, you will see more inefficiencies. For example, containment leaks, including conductive heat transfer through cabinet skins, tend to be less visible and not amenable to measurement. In addition, as IT equipment manufacturers work to improve their energy efficiency, we will see design trends toward higher ΔT's or high fixed exhaust temperatures, incorporating variable speed server fans to control and reduce that fan energy.

For these reasons and test and validation purposes, it may be better to test for containment leakage rates with load banks rather than with IT equipment. With load banks, exact flow rates and ΔT's can be measured on the workbench. Then when the load banks are populated into the containment cabinets, whether it be hot aisle containment (HAC) or CAC, or cabinet containment (vertical exhaust duct, chimney, or heat collars), differentials from the pre-determined benchmark can be measured.

Further testing can be accomplished with Computational Fluid Dynamics (CFD) to see more accurately where there are containment challenges.

With all of this in mind, let's jump into how containment impacts the data center and what are some of the new approaches to data center design and efficiency.

SECTION 2: DATA CENTER CONTAINMENT TECHNIQUES: MODERNIZATION, RETROFITTING, BUILDING NEW

To better understand the containment, let's take a second and focus specifically on cooling and airflow. Data center leaders need to understand that today's data centers are unique, and there needs to be an approach to understanding airflow and which design will be best. Here are some ways to approach this.

- **Identifying your data center type.** If you're deploying a cooling or HVAC system into your data center — it's essential to know your exact requirements. For example, custom cleanroom HVAC systems (think labs and medical environments) can differ from a traditional data center room deployment. Furthermore, optimizations around filtration, exhaust systems, ceiling grid architectures, and tight temperature controls are critical definitions of your data center type and requirements.
- **Calculate and understand your space.** It is crucial to identify the type of space you have; computer room or data center. While they are mission-critical spaces, ASHRAE 90.4 Energy Standard for Data Centers defines a computer room as a room or portion of a building serving an ITE load of less than or equal to 10 kW or 20 W/sq. ft. or less of conditioned floor area.
- **Advanced climate controls.** It's not just about controlling airflow and temperature. The next-generation data center introduces new ways to optimize the infrastructure for even greater levels of efficiency. We have precision air control, DX and chilled-water air handlers, data center cooling, process cooling, humidification, and new fluid cooling technologies. These systems can directly impact how a data center operates and supports your business.

For example, if you're wondering what to use, DX or chilled water, know that it all comes down to the use case. Both will have pros and cons, and both will largely depend on your needs. For example, DX Units vary between supplemental or emergency building AC or primary AC at tented events or relief structures. Chiller units cool water for use in other AC systems like chilled water air handlers.

- **Understanding heavy-duty optimizations.** Sometimes your data center is hosting some intense workloads. Whether for big data or massive cloud infrastructure, there will be cases where consequential environmental controls are required. Sometimes, working with direct expansion air conditioning systems and industrial air handlers is critical to meet complex demands. There will be cases where your airflow requirements may range from 500 to over 400,000 cfm, and you should have an HVAC system to support those needs in these situations.
- **Taking HVAC outdoors.** The progression around air and cooling processing has allowed the modern data center to recover new types of resources. New outdoor air solution products recycle waste energy from the exhaust air stream and use it for preconditioning. Efficiency at this level significantly reduces the heating, cooling, and humidification loads required to maintain proper temperature and humidity levels within occupied spaces. In these cases, you recycle precious resources and optimize your data center.

Now that we've talked about airflow, let's jump into containment.

Containment Options

The choice of the solution used will depend on both the required flexibility and building structure. So, when designing a containment solution, you must know what you are working with: existing, refurbished, or new build. Consider the following three options:

When the highest level of flexibility is required, the most optimal solution is free-standing containment.

- It can be used with existing infrastructure; it can adapt and fit on top of any manufacturer's cabinets already in place at most heights while dramatically improving its airtightness/energy efficiency.
- It can be used for a new building where the end-user will populate the containment solution per its future customers' or own requirements.
- This allows having a minimum initial investment and filling it step by step as per the needs.
- It can add, up to 40 cabinets, depending on the lengths of the corridor, while maintaining the required airtightness of the containment.
- Perfect integration with supporting infrastructures like cooling, power distribution, fire detection & suppression, monitoring, security, UPS, etc.; no new certification or monitoring adoption is needed with future extensions.

If rows of cabinets are already in place, installing a next-generation containment system can be more effective.

- It should be used with existing infrastructure and cabinets and adapt to any manufacturer's cabinet heights while improving airtightness/ energy efficiency.
- Perfect integration with supporting infrastructure like cooling, power distribution, fire detection & suppression, monitoring, security, UPS, etc.

A Vertical Exhaust Duct system can be installed when a ceiling plenum extracts the hot return air.

- On top of an airtight cabinet, a height-adjustable column is placed to guide the hot air to the ceiling.
- The room is flooded with cold air providing optimal working conditions.
- This setup gives freedom of placement of the cabinet rows, which can be face-to-face or face-to-back. The latter gives maximum volume for the cold airflow as every row is used for air transport.

Let's examine a few of these containment solutions.

Free-Standing Containment General Specification

A free-standing containment system shall be used to separate hot and cold airflows between rows of cabinets to improve energy efficiency, cooling performance, and the reliability of the infrastructure. The containment system shall consist of the following:

- **Free-standing frame**— basic self-supporting containment frame.
- **Roof systems**— This includes high transparency or drop-away panels.
- **Sliding door systems**— You can work with mechanical or electrical double doors to close aisles at the front and back.
- **Corridor Walls & Vertical panels/Chimneys**— To close gaps between or above cabinets.

The best result for energy saving potential shall be achieved when combining these systems into a complete airtight aisle containment system. This means airflow management on all systems (roofs, doors, and walls/ vertical panels). Referencing the three general containment types, this architecture falls under the current containment category as it supports higher operating temperatures, allowing for greater efficiency and resiliency.

This type of containment system should easily be able to integrate the following solutions without any special parts or modifications

- (server) cabinets with:
  - Roofs with cable duct system.
  - Cutouts in roofs for cable entry.
  - Integrated busbar systems.
- Row-based cooling with:
  - Open, closed, and hybrid loop airflows.
- Monitoring system.
- Fire Suppression & Detection systems.
  - Gas-based.
  - Water/ water mist based.
- Security.
  - RFID card systems.
  - Rack level and Containment level security.
- Row-based modular UPS systems.
- The dimensions shall comply with the IEC 62966-1

Next Generation Containment General Specification

This containment system separates hot and cold airflows between rows of cabinets to improve energy efficiency, cooling performance, reliability, and sustainability. The system can be used for cold aisle containment and hot aisle containment.

The containment system shall consist of the following:

- **Roof systems** that are high transparency or drop away.
- **Sliding door systems**— to close aisles at the front and back.
- **Corridor Walls & Vertical panels/Chimneys**— to close gaps between or above cabinets.

Much like the previous design, these systems should be able to integrate the following systems without any special parts or modifications

- (server) cabinets
- Row-based cooling
- Monitoring system
- Fire Suppression & Detection systems.
- Security.
- Row-based modular UPS systems.

Roof Systems

There are Important aspects when choosing the proper roof system for the containment solution:

- Application of the containment system.
- Integration with fire suppression and detection systems, e.g.:
  - A high Transparency roof shall typically not be used with water mist or sprinkler installations but is suitable for gas suppression systems.
  - Drop Away is generally used in combination with water mist/ sprinkler systems. Drop-away panels are for single use only and cannot be reused or tested (the manufacturer tests the system).
  - Do local authorities require regular testing?
- Amount of lighting required for regular operation in the aisle. Drop-away panels are less translucent than the high-transparency roof panels.
- Aisle Heights: The roof systems shall be built on top of a uniform-height double row of supporting cabinets. The height of the aisle door system shall correspond with the cabinet height.

Finally, there are two types of roof systems to consider:

High Transparency roof:
This roof type shall allow maximum ambient light to enter the containment structure. The modular roof girders made of sheet metal shall be bolted to the roof rails system. Panels (600 or 700 mm wide) shall be made of layered security glass. The girders used to support the glass panels shall also be capable of integrating fire suppression nozzles and sensors for monitoring systems. This includes proper cable management capabilities and air sealing of cutouts and holes.

or

Drop Away roof:
This roof type shall be designed to allow the plastic panels to drop out of the construction before activating water sprinkler/ mist systems. This enables fire suppression gases or liquids to enter the containment construction. The plastic panels shall be UL-certified ceiling panels for use beneath sprinklers and are installed inside a metallic, powder-coated frame. The roof panels shall be FM Approved and are classified as Class Number 4651" Suspended Plastic Ceilings."

This frame shall be attached to the roof rails system. The roof panels shall be designed to give way and drop in case a water load accumulates due to the activation of a sprinkler system to guarantee the sprinkler system protects the contained aisle.

This is a lot to take in. Understanding that different containment solutions are vital to creating a more efficient data center solution. Let's explore a real-world containment solution impacting today's modern data center designs.

SECTION 3: CONTAINMENT IN THE REAL-WORLD

Building containment with modular solutions is one of the best ways to build a secure, efficient, and scalable data center design. With modular containment, you improve airflow and thermal management in your data center without the risk of downtime or incurring the cost of a complex retrofit. New innovative, modular containment designs adapt to your installation to maximize energy efficiency while creating a predictable operating environment that increases equipment reliability.

And there are direct benefits to getting containment right. This includes:

- **Quicker Deployment—**Fast and easy to install, resulting in lower labor costs and no downtime. Much of the installation can be done with tool-less containment designs
- **Improved Thermal Management—** See increased energy efficiency and equipment uptime through optimizing environmental conditions
- **Easy to Retrofit—** Customize the modular system onsite and reduce installation cost and time
- **Short Lead Times—**All components are ready to ship for shorter lead times and faster installation time
- **Time Savings—** Customizable onsite, eliminating manufacturing lead time
- **Maximum Performance—** Maintains airflow integrity in horizontal and vertical applications
- **Maximum Density—** Maximizes density per cabinet for lower OpEx
- **Sustainability—** Helps reduce your carbon footprint

Examining real-world technologies that make all of these benefits possible is vital. With that in mind, let's explore a Hot and Cold Aisle Containment Solution: Legrand's Contain-IT Flex solution.

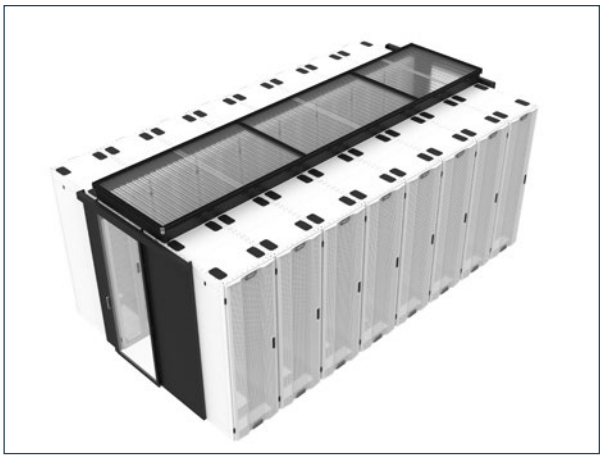
Defining Modern Containment Solutions

Contain-IT FLEX containment was designed to maximize efficiency while creating a predictable operating environment that would ensure maximum reliability of the equipment. With airflow integrity greater than 97.5%, the solution eliminates bypass airflow and recirculation and helps mitigate over-temperature alarms or equipment shutdowns due to thermal overload. Deploying containment reduces operating costs and the carbon footprint of the data center.

The Solution Offers:

- Horizontal and vertical solutions
- Ideal for hot aisle, cold aisle, or stratification applications
- Ceiling-supported (threaded rod), cabinet supported or attached to Cablofil basket tray
- Modular solution for maximum adaptability
- Pre-configured aisle sizes
- Configure to order for non-uniform aisles
- Snap-to-fit for ease of installation
- Minimal installation time
- Cost-effective
- Ability to support 8 pounds per linear foot of auxiliary equipment
- The ability to overcome obstacles including:
  - Building columns
  - City-scape aisles
  - Gaps in rows
  - Overhead cable management
  - Overhead trades
  - In row cooling

Vertical Containment



Horizontal Containment

In creating a modern containment solution, data center engineers need to work with designs that make it easier to scale and become more resilient. This is why near-toolless designs are optimal for quicker installation and improved scalability. Here are some key factors to consider with toolless architecture:

- The components snap together during installation.
- Beams are spliced together, and the splice snaps in and seals the joint.
- The outside corner allows the beams to form a 90-degree angle and seal the joint.
- The inside corner snaps into place and adds strength to the joint.
- The multi-wall panel can be installed after the frame is in place; simply lift it into place and drop it in.
- The multi-wall panels are held in place with a toolless retention clip.
- A cabinet seal is installed with a toolless retention feature in the rail splice.
- The hanger bracket is deployed without tools and snaps onto the beam or Cablofil tray.
- A seal to the ceiling is accomplished using a bulb seal.
- Pieces snap together for an airtight fit allowing the system to maintain integrity with nominal pressures or vacuums from within the aisle.
- The ability for the pieces to snap together provides ease of installation and labor savings
- No need to scrap products after use, reuse product for new applications.

Modern Containment. Real-World Applications

Let's start to put all of this together. In working with modern containment solutions, it's key to see how they can be applied in an actual data center. Before we go on, it's important to note that, like containment solutions, not all data center designs are identical. There are several emerging use cases for digital infrastructure in today's growing digital market. So, as we examine the applications below, it's critical to view these designs beyond traditional definitions of data halls. The following can be applied to data centers focusing on various new use cases, including edge and regional data centers, telecommunications, high-density infrastructure focusing on HPC, and even micro-data centers used for small strategic deployments. This means working with containment solutions that can quickly adapt to meet your parameters, whether a Greenfield or Brownfield installation of varying data center use cases.

Earlier, you saw an image of the Legrand Contain-IT FLEX containment system. We'll use this design to discuss the applications below.

- **Vertical Containment.** Vertical containment can be suspended from the roof and be cabinet-supported or attached to a Cablofil wire tray. The solution can be used with a return plenum or a stratification application. Designed to work in new or retrofit installations with any cabinet, the solution is easily modified to conform to the length of the aisle. Custom panels are easily made onsite to fill open spaces if cabinets need to be removed.
- **Horizontal Containment.** Horizontal containment can be suspended from the roof, and this can also be cabinet-supported or attached to a Cablofil wire tray like vertical containment. Horizontal containment will adapt to a Greenfield or Brownfield installation regardless of the cabinet manufacturer. The solution is easily modified to conform to the length of the aisle. Custom filler panels are easily made onsite to fill open spaces if cabinets need to be removed.
- **Horizontal and Vertical Containment.** This is where flexibility in data center deployments becomes a key consideration. Using standard components, the Legrand containment design reference can transform from horizontal to vertical within the same aisle. This allows the end-user to contain large obstructions, such as ductwork, while maintaining the airflow integrity of the system. The system's flexibility provides a pathway for future moves, adds, and changes in a live environment without disrupting data center operations.
- **End of Row Doors.** Sliding end-of-row doors are available for cabinets up to 52U high and are available for three to six-foot wide aisles. The cabinet at the end of the row is generally the hottest in the aisle due to recirculation from the hot aisle to the cold aisle, making the end of row doors a critical component in the containment solution. Windows are clear or Multi-wall.

It's important to note that with these applications come several benefits. This includes:

- **Maximum Performance.** The performance of the Contain-IT™ FLEX system was tested at positive and negative pressures far exceeding a typical application—the system-maintained airflow integrity with minimal leakage in both horizontal and vertical applications. Testing was conducted on aisles that were twenty-four feet long.
- **Time-Saving.** Contain-IT FLEX is lightweight, requiring fewer threaded rods for support. The system can be supported from a Cablofil tray eliminating the need for threaded rods. The near toolless lightweight solution snaps together, reducing overall installation time. The components are in stock (except doors) and are customizable onsite, eliminating manufacturing lead time, the need for custom components, or site visits from field engineers.
- **Space Availability.** Once deployed, Contain-IT FLEX provides a predictable and reliable operating environment for your IT equipment allowing the end-user to maximize the density per cabinet, which provides the lowest OpEx per port. Density can be further increased by following airflow integrity best practices, such as deploying the cabinets with blanking panels, seal kits, air dams, and angled airflow baffles.
- **Customer Experience.** The modular design was created to integrate with Brownfield or Greenfield installations seamlessly. System components are available individually, allowing for moves, adds, and changes without custom engineering, custom components, or manufacturing lead times. The system's flexibility allows the end-user to lengthen or shorten rows

in a live environment without disruption.

- **Sustainability.** Deploying Contain-IT FLEX will reduce your PUE while maximizing network availability and density per square foot. Energy savings can be realized by slowing variable fan drives on CRAC units or even turning CRAC units off. The solution allows the end-user to comply with California's Title 24 law. The solution reduces the data center's carbon footprint, and many public utility companies have incentive programs that provide rebates to reduce energy consumption in data centers.
- **Pre-fabricated Containment.** Legrand's engineered-to-order aisle containment systems complement airflow and cable management accessories to deliver more customization and control for any data center infrastructure need.

Let's stay on that last point for a few minutes. ESG and sustainability have been critical concerns for data center leaders. And it's a focus for a good reason, and new investment directly aligns with a data center's capability to be green and sustainable.

A good design means everything for a healthy data center, and a good design also focuses on efficiency and the environment. A significant trend around working with the modern data center has been ensuring that new data center solutions are running as efficiently as possible.

Most data centers use almost as much non-computing or "overhead" energy (like cooling and power conversion) as they do to power their servers.

Better airflow management for lower PUE and a greener data center

AFM and containment don't just mean ensuring you have hot and cold aisles; it goes beyond ensuring you don't have hot spots in your data center. These are all essential concepts; deploying true AFM means taking a creative approach to making your data center run more efficiently. New air distribution methods, free cooling, and even application-specific containment methods all allow you to do fantastic things with airflow management.

You can understand your ecosystem by deploying powerful monitoring solutions that enable real-time decisions and actions for data center managers.

Remember, designing a green data center revolves around the solutions you deploy and how you design your building. For example, LEED Platinum certification illustrates that a building takes efficiency to the next level. Working with emerging containment solutions helps buildings become LEED certified and stay as sustainable as possible.

Working with emerging containment solutions will also help critical infrastructure leaders innovate. Let's examine a use case with one of the world's largest data center providers to understand the impact.

Using Containment, How a Hyperscaler raises data center temperature to save energy

Data center leaders constantly look for ways to run their infrastructure more efficiently. One way to do this is by raising operating temperatures.

Here's why this is important. A recent report from the 8th International Conference on Applied Energy Modern states that data centers are complex systems involving IT facilities, power systems, and cooling and ventilation systems. As energy consumption by cooling data center IT equipment can be over 40% of total energy consumption, efficient cooling for large data centers is essential for reducing operating costs.

The report indicates that new models further demonstrate that distributed airflow control and optimized server placement can help with

energy efficiency. What else helps? Raising the temperature of the data center. However, you need the right airflow and containment model to do so.

With that in mind a multinational digital infrastructure organization specializing in Internet connection and data centers, recently announced that it would immediately increase the temperature in its colocation data centers worldwide. Increasing the temperature in the data center can help colocation clients better manage their costs. But getting there required an excellent partner.

The Challenge: Lowering power consumption and improving efficiency

Hyperscale and data center industry leaders are face rising energy consumption costs. And the way they were running their data centers could use some improvement.

"Our cooling systems account for approximately 25 percent of our total energy usage globally," said **Raouf Abdel, Executive Vice President, Global Operations at Equinix.** "With this new initiative, we can intelligently adjust the thermostat in our data centers in the same way that consumers do in their homes. Once rolled out across our current global data center footprint, we anticipate energy efficiency improvements of as much as 10 percent in various locations."

In a recent HostingJournal post, the hyperscaler stated that they will start defining a multi-year global plan for thermal operations within its data centers immediately to achieve much more efficient cooling and lower carbon footprints.

The Solution: Implement an Engineered Containment Solution to optimize operations

According to the article, Equinix expects to operate its facilities closer to 27°C (80°F), aligning operating limits across its global data center portfolio with the globally accepted boundaries of the A1A standards from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

To get to a point where they could effectively raise their temperature, hyperscale and data center leaders can partner with Legrand to leverage their airflow containment solutions. An engineered product, such as Legrand's ContainIT Flex containment solution offers a modular design that adapts to your needs in any Brownfield or Greenfield applications. Because of this, data centers can upgrade and modify its existing data centers easily to support new temperature requirements. Legrand's containment architecture helps digital infrastructure leaders maximize efficiency while creating a predictable operating environment that increases equipment reliability.

The Outcome: Supporting new initiatives sustainably and efficiently

"Most data centers operate within the restrictive temperature and humidity bands, resulting in unnecessarily cooler environments than required," said Rob Brothers, Program Vice President, Data Center Services, IDC. "Equinix will work with enterprises to change how we think about operating temperatures within data center environments and how the industry can ensure optimal service levels for mission-critical digital infrastructure while improving data center efficiencies."

This hyperscale leader will now be able to support more customers, grow its business, and create a positive impact on the environment. "With this initiative, Equinix will play a key role in driving change in the industry and help shape the overall sustainability story we all need to participate in."

SECTION 4: THE PARTNERS HELPING RESHAPE CONTAINMENT AND EFFICIENCY

In today's digital infrastructure, facilities' environmental and efficiency needs demand application-specific solutions. As discussed in our Equinix example, finding the right partners to help you innovate around your data center architecture is critical.

In addition to delivering higher performance, sustainability, and efficiency, containment solutions must be sufficiently agile to meet flexibility and implementation speed requirements. In the specific case of data centers, design is also essential to maximize the available space.

Partners like Legrand meet these needs with containment designs that achieve energy-efficiency goals through transformational changes in architecture.

Beyond the ability to deliver more sustainable and efficient containment solutions, Legrand also takes a different approach to supply chains to ensure that you have the parts you need to build at the speed of our digital market.

Legrand's Strategic Sourcing and Procurement Vision

Creating a leading supply chain architecture is to establish a world-class innovative, and competitive supply base that exceeds Legrand's needs and that of Legrand's customers. This includes enhancing material productivity, improving supply chain risk management and optimization, working with new product development and sourcing best practice, and persistently benchmarking supply chain solutions. As a supplier, Legrand is responsible for providing the data center industry with high-quality materials and services.

Today, thousands of customers choose Legrand's products for their design and quality. Achieving these results always requires a more robust execution of Supply Chain Management. Suppliers play a vital role in our industry's supply chain. Legrand expects its suppliers to understand its requirements, policies, and standards to achieve the best possible results. Strong relationships are built based on the results, and it's our responsibility to monitor suppliers' performance by maintaining proper scorecards for suppliers.

> "Every day, our procurement team plays an integral role in understanding our carbon emissions while reducing risk to our supply chain. It's amazing how much the procurement industry has evolved to understand how the supply chain is connected to our ecosystems. Leading companies like Legrand embrace the knowledge that understanding true supply chain risks and life cycle costs requires looking beyond the price on a page to incorporate environmental impacts, labor volatility, resource constraints, and more. I am excited to continue our work on this topic and to see how our products improve."
> —Alan Byrne, director of indirect strategic sourcing and purchasing, Legrand

What are the results of these efforts? Even in the most challenging supply chain times, **Legrand delivers their products more than 90% of the time on time.** As you build out your digital infrastructure, you'll know that you'll have critical containment components ready for deployment.

Getting Started: Don't Take the AFM Journey Alone

As digital transformation accelerates and cloud adoption reshapes the digital landscape, Legrand supports customers with solutions designed for traditional, on-premises IT and partnerships with colocation and cloud providers. Legrand also offers data center design and deployment services to help achieve the benefits of increased integration.

With all this in mind, we're left with a straightforward question: What are data center infrastructure containment challenges? In working with containment design, it's essential to leverage a leading technology organization that can help guide you along the entire process. For all the reasons that matter to today's most challenging spaces and modern data centers, partners like Legrand have the experience and innovative technology necessary to help you succeed.

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