



WhiteSpace Field Guide

How to Decide if Containment is Right for Your Existing Facility

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Introduction

If you are running into issues with heat or computing capacity then you are probably considering a number of different solutions. However, before you start planning a new facility or ordering additional A/C units, you may want to consider a containment system to optimize your existing facility.

Like many, you may have thought that containment won't work in your facility, or that it is only for new builds. The good news is that neither of those is true. While most promotional photos show containment systems in shiny new data centres, containment is a perfectly viable option in any environment. In fact, roughly 90 percent of our containment installations are carried out in existing facilities.

“Retrofit containment” – as we call it here at WhiteSpace – is a growing trend because it offers many advantages over the alternatives.

To help you decide if containment is an option in your facility, this guide provides an overview what it is, what you can expect, and what the business case looks like.

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Retrofit Containment: What it is and What it isn't

To help you fully understand the containment option, we'll walk through the essential facts.

Containment is all about the efficient use of cool air.

In an ideal world, you would only need to provision cooling on a 1:1 basis. In other words, for every kilowatt of heat generated by your equipment you would supply exactly one kilowatt of cooling. This would all be fine if the cool air could be delivered with perfect efficiency wherever it is needed, but this never happens in the real world.

What does happen in the real world is that cold air mixes with hot air on the way to your equipment. Or in extreme cases, it bypasses the equipment altogether before returning to the A/C. The heart of the problem is a practice known as "chaos cooling", in which cold air is circulated freely within the facility. This approach can be extremely inefficient and forces data centre managers to compensate by increasing the A/C settings or installing additional A/C units.

How bad is chaos cooling? In our experience, the average data centre that uses chaos cooling requires three to six times the theoretical minimum A/C in order to maintain adequate cooling levels. In other words, 67-to-83 percent of the cool air is going to waste.

Retrofit containment solves this problem by containing either the hot or the cold air and channeling it directly to/from the A/C unit. This reduces air mixture and dramatically increases the efficiency of cold-air delivery.

Containment is an option for everyone.

We frequently hear the statement: "Containment won't work in our facility". The truth is that containment has evolved in recent years to make it a viable option in any facility, with any layout and with any style of enclosures. It doesn't matter how wide your racks are, or how tall; whether you have a raised floor or not; or what equipment you have installed in your racks. The only trick is to find a containment partner that offers a complete range of containment solutions. (WhiteSpace CIS one such provider, and the only one of its kind in Canada.)

There are many different approaches to containment.

When the word "containment" gets tossed around, many data centre managers assume it only means one thing: aisle-based containment. In fact, you can choose from three high-level approaches to containment to address your particular situation and needs:

- **Rack-based containment**, in which individual racks are ducted in order to isolate hot exhaust air and channel it directly into the ceiling plenum or ductwork for efficient return to the A/C.
- **Aisle-based containment**, in which racks are arranged to exhaust into (or draw cold air from) a common aisle space.
- **Independent containment**, which is a free-standing, vendor-neutral containment solution. It can be used for: individual, high-density server/storage racks; odd-sized equipment racks; and partial aisles or aisles with gaps.

How to Decide if Containment is Right for Your Existing Facility



Single-rack containment



Cold-aisle containment



Independent containment

Containment is not an all-or-nothing solution.

Again, when you look at the promotional images of containment solutions, they generally show an entire facility outfitted with an aisle-based containment system. This leads to the misconception that containment is an all-or-nothing solution that must be applied to an entire set of racks. In fact, containment can be installed on smaller scales – even on a single rack – with great results. The key is to choose the right level of containment and the right approach for your particular facility and needs.

Containment is scalable.

Many containment solutions are specifically designed to scale as your facility grows. This is accomplished through pre-engineered, modular components which are extendable and reconfigurable. This means you can implement containment today without having to “overbuild”, and without worrying that it will have to be torn down when you expand your facility at a later date.

What you can expect from containment

Installing a containment system is a bit like modifying a variable within a natural eco-system. When a change occurs to that variable – say, increasing the amount of rainfall – then all sorts of things start to happen as a result.

It is the same with containment, and in this case, the consequences are all good. While the precise impact will vary from facility to facility and from installation to installation, these are the kinds of outcomes that containment can deliver:

1 The ability to grow your computing capacity

In many facilities the A/C units are simply maxed out. However, when a containment system is installed, the A/C units don't have to work as hard to maintain the right temperatures. This creates cooling “headroom” that frees you to install higher-density equipment and fill those vacant u-spaces. The same things also applies to power. Containment reduces your requirements for “fan energy”, which creates power headroom that can be used for additional equipment.

How to Decide if Containment is Right for Your Existing Facility

2 Elimination of hotspots and equipment shutdowns

The first thing you get from containment is a steadier supply of cool air delivered exactly where it is needed: to the inlets of your equipment. With chaos cooling, whatever air does make it to your equipment has warmed up considerably by the time it gets there. With containment you can be sure that the air from the A/C arrives as intended: cold.

3 Reduced operating costs

When you are looking to cut operating expenditures, containment delivers some impressive wins. Because the A/C units don't have to work as hard to supply cool air, your operating costs can fall dramatically.

4 Free back-up cooling

Many facilities have been forced to install additional A/C units over the years to compensate for higher computing densities and increased heat. As we've learned, the problem isn't a lack of cooling, it is the inefficient use of the cooling you have. After installing a containment system, it is not uncommon to find that you no longer need one or two of your A/C units because of the increased efficiency of air delivery. This allows data centre managers to keep spare A/C units on standby in case of failure, or use them as backups when performing maintenance on other units.

5 The ability to plan with a greater accuracy

Containment is truly the opposite of chaos. By containing and directing airflows, you create a more stable and predictable environment. You'll know, for example, that the inlet temperature for a given rack will always be 73 degrees at the bottom, 73 degrees in the middle and 73 degrees at the top. This is a massive improvement over chaos cooling, which causes wide variations in inlet temperatures for individual racks and across the facility as a whole. The predictability you get from containment allows you to plan expansions and other changes with greater confidence in the result. No more guesswork.

How does the ROI compare to other options?

Containment clearly has a lot going for it, but that counts for nothing if the dollars and cents don't add up. Before we explore that, we will get the bad news out of the way first: **Predicting the ROI of containment is very difficult.**

This is primarily for two reasons. The first is that there is very little hard data on which to base a prediction. Measuring the actual ROI of a containment installation takes a lot of time and money. To do so with any accuracy, you would have to perform a cooling assessment of your facility before and after the installation and then track numerous variables over a long period in order to determine the exact impact of the solution.

The other challenge in predicting the ROI of containment is that every facility is different and every solution is therefore different. Even if you could find a reliable case study that quoted, for example, a full return on investment within one year, you couldn't be certain that you would experience the same impact in your facility.

How to Decide if Containment is Right for Your Existing Facility

So how are other data centre managers building a business case for retrofit containment?

Despite the challenges in predicting the ROI of containment, it is still possible to compare it to other options and build a defensible business case.

Generally, this is done in two ways:

In the first scenario – when the facility is already experiencing issues with heat – it is taken as a given that containment will deliver greater cooling efficiency and avoid a host of potential problems. The cost of the containment solution is compared to the potential downsides of doing nothing, and in most cases it becomes a no-brainer for data centre managers. In other words, while they can't predict the exact impact, data center managers in these cases are confident that it will solve today's heat problems and deliver a positive ROI over time. And this approach seems justified – we've never encountered any regrets over a containment installation.

In the second scenario, the data centre manager is looking to add computing capacity and is probably considering a few different options. These might include a new build, the installation of additional cooling units, or expanding into a colocation facility. In these scenarios, the best way to make the decision is to take a structured look at the costs and likely outcomes of each option.

To illustrate, let's consider a representative example in which a data centre manager is looking to add computing capacity and is already running into heat issues within the existing facility.

How to Decide if Containment is Right for Your Existing Facility

Objective:

- Alleviate existing heat issues and create additional capacity for new equipment

Situation overview:

- 40 racks in the existing whitespace
- Chaos cooling approach using multiple A/C units
- Plenty of spare u-spaces to expand into, but the A/C is maxed out

Options:	1. Build a new facility	2. Install another A/C unit	3. Expand into a colocation facility	4. Containment
Marginal capex outlay	\$ Millions	\$200,000 - 600,000	\$0	\$16,000 – 20,000 (\$400-500 per rack)
Increase to monthly opex	\$ Tens of thousands	\$ Hundreds or thousands	\$ Thousands	\$ 0 With likely savings on monthly cooling costs.
Timing	Months to years	Months	Weeks	Days to weeks
Outcomes	<ul style="list-style-type: none"> ✗ Does not address heat issues in existing facility ✓ Solves additional capacity problem 	<ul style="list-style-type: none"> ✗ Uncertain. No guarantee that it will alleviate existing heat issues, let alone add enough cooling to accommodate new equipment 	<ul style="list-style-type: none"> ✗ Does not address heat issues in existing facility ✓ Solves additional capacity problem ✗ Leaves you with two facilities to manage 	<ul style="list-style-type: none"> ✓ Solves heat issues in existing facility ✓ Creates cooling headroom, allowing you to install new equipment in existing facility ✓ May result in redundant A/C unit(s), which can be shut down or kept on standby as a backup

While this is just a hypothetical scenario, the numbers we have used are very similar to ones that we see on a regular basis in the real world. Given that, it is easy to see why so many facilities are making the choice to go with retrofit containment.

Whatever your actual numbers may be, a simple grid like the one above is a great tool for deciding which option is best and preparing the business case.

How to Decide if Containment is Right for Your Existing Facility

Where should you start?

Before you consider a containment solution, we recommend that you first make an assessment of your facility's airflow management situation. Are all the best practices in place? Have you done everything you can to improve airflow?

Only when you have performed such an assessment will you be sure whether containment is the right option for your facility.

To get things started, we recommend that you look at the following:

- Are your racks properly sealed with blanking panels, brush strips, etc. to prevent hot air recirculation?
- Are you using proper cable management techniques to allow hot air to exhaust out the back of the rack without obstruction?
- Have you removed all airflow obstructions underneath the raised floor?
- Have you sealed any gaps between the floor tiles in order to prevent cold air from escaping in the wrong locations?
- Do you have enough perforated floor tiles in place to service the facility?
- Are the perforated tiles located in close proximity to the racks that need them the most?
- Have you checked that high-velocity cold air isn't bypassing some of the perforated tiles?

Putting these best practices in place can dramatically improve airflow and help you get more from your existing A/C units.

If you have already employed these best practices and you are still experiencing difficulties, then it is probably time to explore containment.

The best way to do that is with an experienced containment provider and installer – preferably one that provides the full range of containment approaches. This will save you a lot of time working out which containment approach would work best and trying to calculate the cost.

Summary

At the highest level, retrofit containment does two things: it reduces capital expenditures and extends the life of your existing facility. These are two outcomes that please everyone, which makes it relatively easy to build a business case for containment. The fact that it can be done quickly makes it all the more attractive.

Need a hand?

If you are having trouble deciding if containment is right for your facility, we can help. Get in touch to speak with one of our experts, book a site audit and get an estimate for a containment solution.



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