



# Fresh Thinking About Datacenter Cooling

# CONTENTS

Executive Summary	p1
Introduction	p2
Rack Based Cooling	p3
The High Density Advantage	p4
About the Author	p6

# EXECUTIVE SUMMARY

## **Fresh Thinking**

Every so often a disruptive technology changes the way an industry needs to think about what it does.

High density (HD) computing in the datacenter is one of those technologies. It offers compelling performance and economic advantages, and there's little doubt that it represents the future, but its adoption has been inhibited by established thinking about physical space and IT equipment.

We established Datacentience because we wanted the freedom to challenge that thinking.

We believe that far from being complex and difficult, HD in the datacenter simplifies things, and can bring new power to your business. Here's a little background, and a better way forward.

# INTRODUCTION

## Evolution

Datacenters have evolved in an ad-hoc way, with computing capacity specified and managed by IT people and power and cooling required to safeguard that capacity specified by facilities engineers. The servers generated a lot of heat. Traditional air conditioning was used to reduce that heat (because when servers get too hot they slow down or stop working). Usually this meant using computer room air conditioning (CRAC) units which force cooled air down into the raised floor of the room.

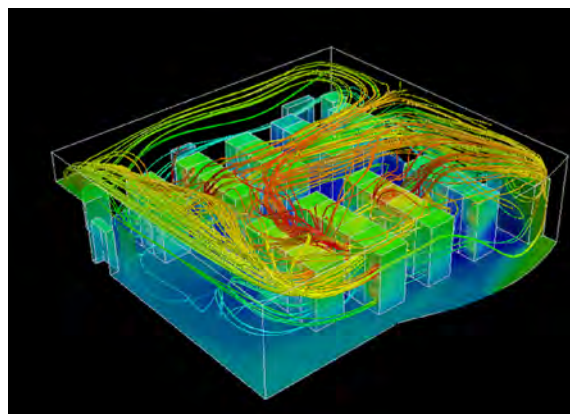
This approach does not work well with high density computing. The scalability of HD servers is a critical aspect of their value: they can meet the escalating need of an organization for computing capacity without demanding new physical space, but only if the underlying infrastructure is similarly scaleable.

The traditional approach to cooling computer rooms is inherently inflexible, because underfloor cool air distribution is limited by obstructions and the air delivery capacity of the floor tiles. Accordingly the effectiveness of additional cooling units to deliver adequate airflow is in reality unpredictable. That unpredictability makes true cooling redundancy tricky and expensive with traditional CRAC units.

These issues reflect the division of IT and facilities management, but the advent of HD has made that separation untenable. The IT team will increasingly tend to have overall responsibility for the specification of the datacenter equipment.

That's why we have set out to empower the IT team by making the server rack the self-contained basis of datacenter design, removing the need to consider the more complex physics of room-based cooling, as well as the structural barriers to upgrades or retrofit.

It's accepted that HD is the future of the datacenter. We have created an easy universal solution for its implementation, a solution which does not require attention to the room characteristics, and which works with standard racks and servers from any manufacturer.



# RACK BASED COOLING

## A better approach

Hot and cold aisle designs have superseded traditional cooling solutions, in part driven by the need to tackle high density heat loads. (Take a look at our white paper Rethinking Datacenter Cooling for a full discussion.)

The row-based approach to separation of hot and cold aisles is a first step, though it may still use underfloor air distribution with its inherent disadvantages.



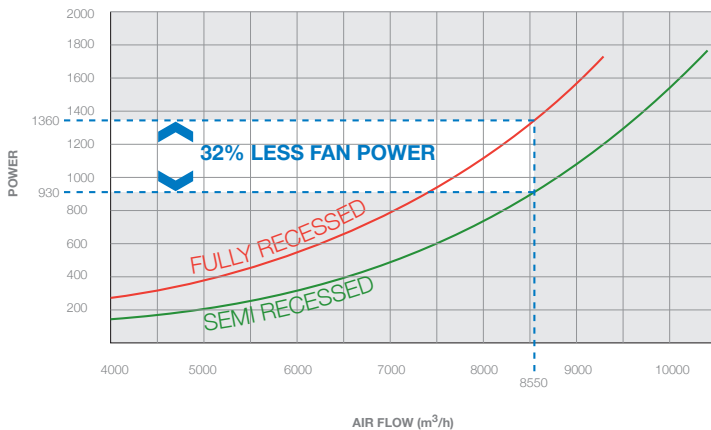
The next logical step is to use rack-based cooling units; properly designed, a rack-based cooling unit can be added and removed almost as easily as a blade server chassis, transforming the options for retrofitting or upgrading cooling capacity.

This flexibility is one of the primary benefits of rack based cooling solutions. Making the rack the basic infrastructure building block of the datacenter offers a number of additional and important performance advantages such as increased cooling capacity and reduced energy and in carbon emission.

A rack-based cooling unit in a hot aisle layout can harness the warm exhaust air from the servers to improve the effectiveness of its cooling coil. In northern climates this can significantly reduce energy consumption for much of the year by enabling the 'free cooling' cycle of the chiller.

Use of high efficiency fan motors further reduces power draw and when placed in the semi-recessed position the Datacentience delta T measurably reduces fan motor power consumption by more than 30%.

In a commercial environment where every organization is under pressure to demonstrate their commitment to social responsibility, any feature that reduces energy consumption is important.



Lower energy consumption cuts costs too, as does the flexibility of rack-based cooling. In fact, it is far easier to achieve reliable cooling redundancy with fewer cooling units using a rack-based approach.

The delta T rack based cooling unit is the first example of our rethinking the assumptions that have held back datacenter development. Every detail has been designed and engineered to address the real pressures on organizations to enhance performance while controlling costs. It is the beginning of a new approach.

delta T50

## HIGH DENSITY ADVANTAGE

### Floor Space Savings

The need to reduce carbon emissions produced by datacenters is focused primarily on the usage of electrical power for running the IT servers and the mechanical and electrical support systems.

While it is imperative to reduce energy consumption for ongoing power savings, there is also much that can be done in reducing carbon emissions that is more closely related to initial construction of the datacenter.



For example, floor area for a datacenter can be reduced by 70% by increasing average density from 4 kW to 16 kW per cabinet.

Savings in construction time with higher density datacenters are evident. A raised floor is not required.

Datacenter construction methods have changed little over the last 40 years. Reduction in the total carbon foot print of the datacenter can begin simply by elimination of the manufacture of unnecessary construction materials.

Close coupled cooling (CCC) systems for high density datacenters solve the IT performance problems associated with overheating, enabling significant operational energy savings and faster datacenter construction time.

### Cooling High Density is Easy

Manufacturers of cooling equipment have responded to the ever increasing heat loads in datacenters with high density cooling systems that are rack rather than room based.

These close coupled cooling (CCC) units are compact but powerful. They cool the load; not the room, by removing heat at the source before it exits the IT cabinet. They fit into a standard IT rack without disruption to the datacenter operation.

This more logical approach to the problem of heat removal reduces energy consumption and construction complexity. Valuable floor space is optimised while both running and first costs are reduced.

## ABOUT THE AUTHOR

**Thom Brouillard, BSc CE**, is the Chief Technical Officer of Datacentience. He relocated from the USA to Europe in 1983 with Liebert. Following the acquisition by Emerson, he assumed responsibility for three phase UPS and all cooling products for EMEA. Prior to his current role, he was instrumental in bringing APC into the cooling arena in EMEA. From 2004 he pioneered close coupled cooling designs for high density applications. He is accredited by the Chartered Institute of Building Services Engineers as a Continuing Professional Development consultant on scalable high density cooling solutions for datacenters.





Datacentience  
26/27 Great Sutton Street  
London EC1V 0DS  
United Kingdom

T +44 (0)20 7250 5787  
F +44 (0)20 7250 5790

[www.datacentience.com](http://www.datacentience.com)