

Data Center Solutions: Reducing the Risk of Change

What is provoking change in the data center industry?



EBOOK

Who should read this

- Senior management of data center operations
- Data center designers and consultants
- Engineers working in IT and Facilities management

Embracing Change

Change in the data center industry is not just “coming soon” anymore, it’s already here. From new applications to new cooling technologies, the data center industry is at a turning point.

Developing technologies, such as Artificial Intelligence (AI), Internet of Things (IOT), and Virtual Reality (VR) to name a few, are creating increasingly compute-intensive workloads and, in turn, **rising power density per rack**. This change is significant because power density per rack impacts all facets of the data center – design, capacity planning, cooling, and power provisioning.

It is also clear that changes in the industry are bringing more disruption than was previously thought. Data center outages are becoming **more frequent and severe**. In **2018** and **2019**, 50% of data center operators had suffered an IT outage. This number is on the rise, with 78% of data center operators reporting an IT outage in **2020**. Significantly, 75% of data center operators believe their **downtime was preventable**.

While change in the data center industry is evidently already here, it’s surprising how many data center professionals are comfortable with the status quo. In a recent webinar cohosted by BISNOW and Future Facilities, only 34% of polled registrants were exploring new solutions to optimize data center capacity, operational planning, and / or safeguard IT resilience. Those that were looking into new solutions cited wanting to learn how they could accommodate high-density, implement liquid cooling, or optimize capacity management.

To better understand how data center professionals are overcoming the current changes they are facing and what solutions they are implementing, we brought together a panel of thermal and operational experts to discuss changes and challenges in the data center industry, as well as the tools they’re using to overcome them.

Meet the Experts



CLAE ANDERSON

Director
IT Support
Kaiser Permanente



NIGEL GORE

Global Offerings
High Density & Liquid Cooling
Vertiv



ALI HEYDARI

Distinguished Engineer
Nvidia



BILL KLEYMAN

Executive VP
Digital Solutions
Switch



BAHGAT SAMMAKIA

Distinguished Professor,
VP Research & Director, CHIRP
Binghamton University

New Applications Drive New Solutions

New applications bring with them a host of cascading complications. The sheer amount of data that Machine Learning (ML), Artificial Intelligence (AI), and automation introduce requires more powerful, high-performance systems.

The increase in data has brought with it more pressure for digital infrastructure to perform. The average mean rack density in data centers is **steadily rising**. High-density drivers, although powerful, present a complex thermal challenge for the data center.

Bill Kleyman, Executive VP, Digital Solutions at Switch, explains this issue in more detail: “What we’re putting into our data center is changing. What we’re seeing in the data center are these high-density machines, GPU driven technologies that are allowing us to make better, data-driven decisions. We’re going to see this happen in not just hyperscale data centers, but traditional data centers as well.”

In other words, data center operators in hyperscale data centers are already noticing a shift in IT and other data center technologies. Kleyman predicts this will soon be the case in more traditional data center configurations as well.

While the benefits that new applications bring are clear, that is more data-driven, powerful decision-making systems, it is also evident that the pressure ultimately falls on digital infrastructure to perform in new ways and support new thermal loads.

“

What we’re seeing in the data center are these high-density machines, GPU driven technologies that are allowing us to make better, data-driven decisions.

Bill Kleyman, Executive VP, Digital Solutions at Switch

”



Nigel Gore, Global Offerings, High Density & Liquid Cooling at Vertiv, described the situation the data center industry finds itself in as follows: "We have a huge amount of data coming into the tech space. If we look at the volume of data coming in, based on the needs around high-density compute around GPU and CPU components, which are bringing in new applications around machine learning, HPC, AI, automation, as well as new uses in the medical industry, manufacturing industry, and so on, there's clearly a new burden on infrastructure to be able to support these applications. To deal with all this volume of data coming through, the right thermal loads must be in place to support this."

New applications require new levels of support from digital infrastructure. While conceptually this is quite simple, implementation can be notably more difficult. Data center operators are already tasked with figuring out how best to maximize data center performance while catering for existing density requirements. Now, operators must be able to anticipate the "where and when" of changing IT and what this will mean for their workflow.

Accommodate Evolving Thermal Requirements with New Cooling Technology

Data centers must be capable of providing the right thermal loads to host high-density equipment. Many are considering new cooling technology to make this happen.

Our participants have found new efficiencies as a result. This is unsurprising given that when rack densities exceed 20-25 kW, direct liquid cooling and precision air cooling are **more economical and efficient**.

Ali Heydari, Distinguished Engineer at Nvidia, predicts an increase in the implementation of new cooling technologies. He explains that “as we go through this revolution of machine learning and artificial intelligence, we’ll see more cold plate, single phase or two phase, and immersion cooling in the next five to seven years.”

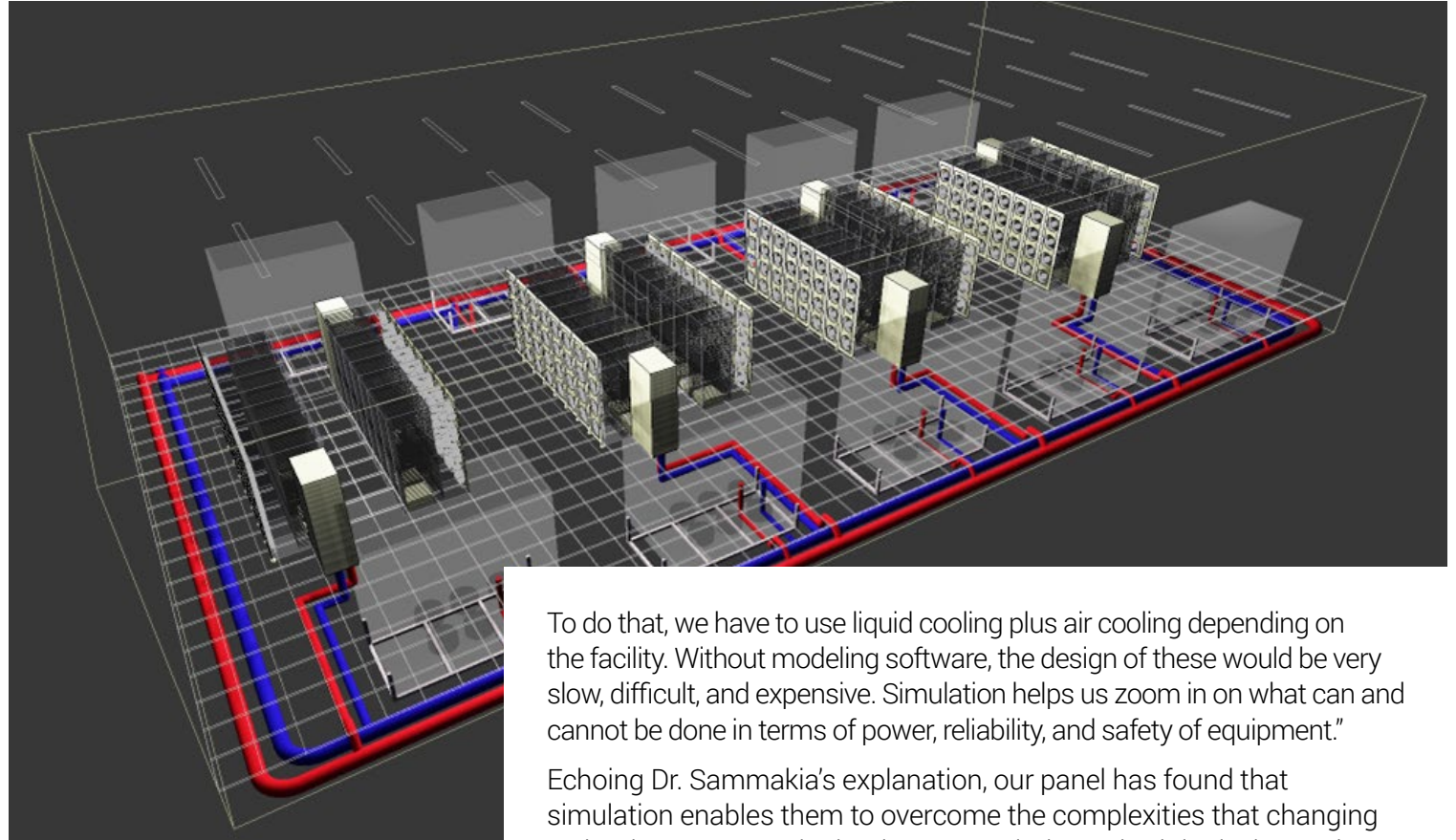
Despite such efficiencies, implementing new cooling technologies, such as liquid to air, liquid to liquid, or liquid to refrigerant, does add another layer of complexity to data center design. This complexity, Bahgat Sammakia, Distinguished Professor, VP, Research & Director, CHIRP, Binghamton University, says is best tackled with simulation software: “We’re looking at very high-powered systems, in the range of 100 KW per rack.

“

As we go through this revolution of machine learning and artificial intelligence, we’ll see more cold plate, single phase or two phase, and immersion cooling in the next five to seven years.

Ali Heydari, Distinguished Engineer at Nvidia

”



To do that, we have to use liquid cooling plus air cooling depending on the facility. Without modeling software, the design of these would be very slow, difficult, and expensive. Simulation helps us zoom in on what can and cannot be done in terms of power, reliability, and safety of equipment.”

Echoing Dr. Sammakia’s explanation, our panel has found that simulation enables them to overcome the complexities that changing technology presents in the data center industry both in design and operations. It is interesting to note that, while the mental connection between simulation and design is readily available to almost everyone in the data center industry, many do not extend that same line of thinking to operations.

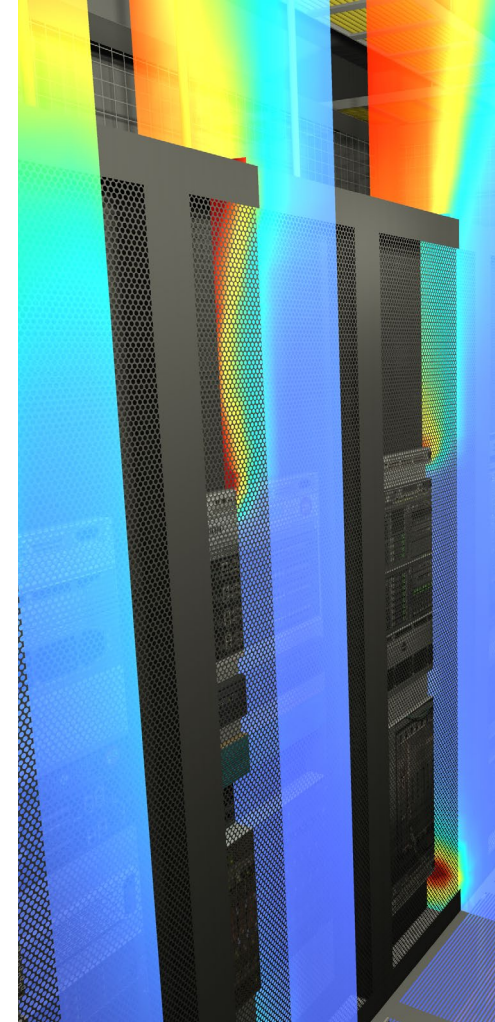
Implementing Changes in Data Center Operations

Most data centers aren't starting from a blank sheet. A legacy data center must accommodate new applications and cooling technologies, all while keeping the business cost to a minimum. This third layer of complexity demonstrates how change in the data center industry impacts both design and operations.

Clae Anderson, Director, IT Support at Kaiser Permanente, describes how the status quo is no longer enough when it comes to accommodating new applications and cooling technologies: "We can't continue to do what we've always done and expect a different result. Power and real estate are costly commodities that we must manage efficiently. Flooding the space with 65-degree air with no containment at one time was the common practice, but the costs associated with operating a data center now dictate effective and efficient tools and methods."

He continues by explaining how important it is for legacy data centers to not only keep costs to a minimum, but that they must be able to justify those costs to the business: "Data centers are long-term investments that many companies make and there's a life cycle associated with these facilities. We have to maintain the facilities' longevity and relevancy to the business."

Simply put, legacy data center operators must justify costs and balance space and resource utilization to simply maintain their relevance. Building on this important consideration,





Bill Kleyman, Executive VP, Digital Solutions at Switch, stated, "If you want your data center to run optimally, with HPC and traditional workloads, you need to do modeling to understand how these technologies are being impacted as well as how they are impacting your overall ecosystem."

Here, Kleyman highlights that maintaining optimal data center operations is more than just figuring out how to install a new piece of IT, it's about understanding how that one piece of IT will impact the performance of your entire data center. Understanding this level of impact is vital for data center operators who need to know how their data center will react to change and, better yet, how to keep the data center running optimally and within the financial bounds that the business sets.

Data Center Simulation Presents a Way Forward

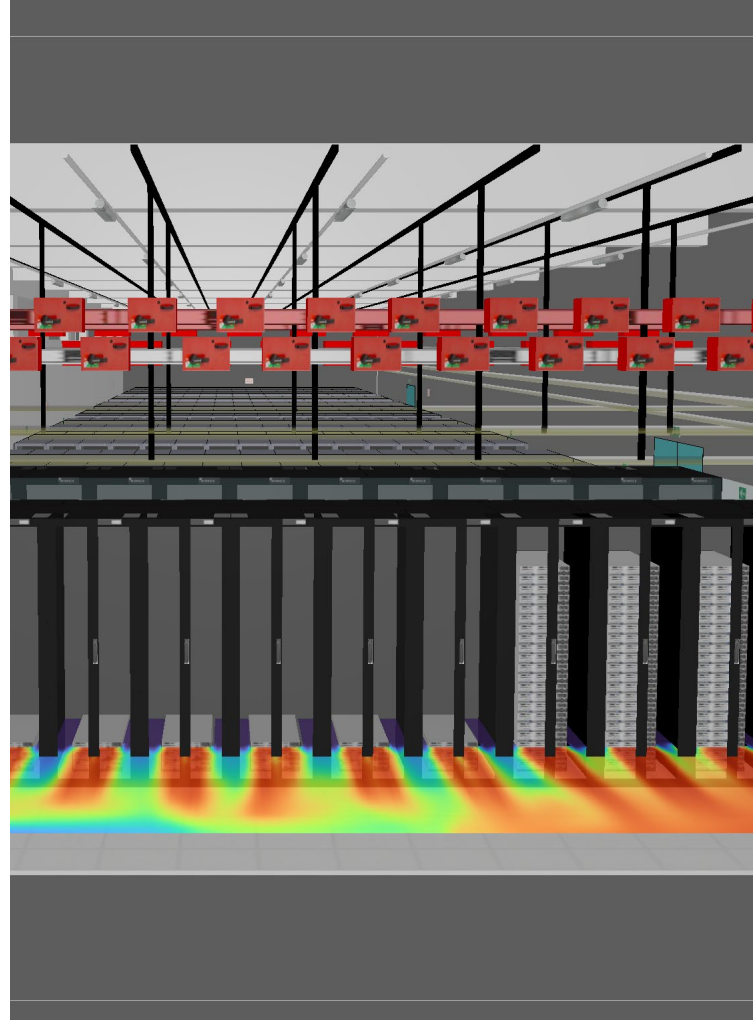
Simulation is typically thought of as a design tool—and it is critical in designing IT, infrastructure, and cooling solutions that integrate effectively into the overall data center design. However, that design is going to change many times over the lifespan of an operating data center.

In this way, operators are continuously designing or redesigning. That's where simulation comes in. Throughout the supply chain and into operations, our panel has all found success with simulation software.

For some, they highlighted the speed and agility that simulation makes possible. Ali Heydari, Distinguished Engineer at Nvidia noted that "We are able today to build data centers with high-density super computers very quickly with the CFD tools that we have. Partially due to the COVID-19 situation and partially due to the advancements of science, we have been building virtual data centers extensively throughout the world. CFD tools allow us to do that quite rapidly."

Specifically, he highlighted the speed with which his team created Cambridge 1: "We built a supercomputer called Cambridge 1 in under 20 weeks. That's the world record for building a supercomputer. We couldn't have done it without CFD software."

In line with this thinking, Nigel Gore, Global Offerings, High Density & Liquid Cooling, Vertiv, describes the many uses of simulation and how they simplify the design process: "You can examine flow characteristics, part diameters, and pressures in a series of 'What if?' scenarios quickly using a library of pre-made items available in simulation software, whether for sustainability, energy efficiency, or performance."



Others noted how simulation makes it easier to tackle the complexities of data center design and operations. Bahgat Sammakia, Distinguished Professor, VP, Research & Director, CHIRP, Binghamton University explains that “We very strongly believe in using simulation coupled with measurements to design a data center. We do not think you can design something as complex as a data center without simulation.”

For Clae Anderson, Director, IT Support at Kaiser Permanente, he emphasized how simulation helps him overcome the complexity of fixed utilities and strict business objectives: “For legacy operators with fixed utilities, it’s imperative to use modeling software to continue to satisfy the demands of the business with these new high-density platforms coming in. We can’t continue to rely on spreadsheets and experience. Simulation software helps us optimize planning and work towards a balanced approach to ensure we maintain our relevance to the business.”

Bill Kleyman, Executive VP, Digital Solutions at Switch summarized many of the panelists’ points succinctly: “Data centers are going to change. What we put in the data center is going to evolve and that’s why simulation — this science of understanding a data-driven living data center — is going to become even more important.”

About Future Facilities

Future Facilities is a simulation software company that believes the successful design and operation of systems, from chip to data center, lies in predicting the impact of change.

Our 6SigmaDCX product suite creates a digital twin of your data center that provides a collaborative framework and the necessary design tools to drive informed, real-time decisions regarding thermal risk and capacity utilization.

Used by data center owner/operators, colocation providers, consultants, and vendors alike, our product suite streamlines data center design, as well as day-to-day data center operations management.

The 6Sigma Digital Twin enables you to predict the impact of change by visualizing and quantifying performance, without risk.

