



DATA CENTER

Frontier Special Report

Performance, Efficiency, and Sustainability: The New Cloud and Data Center Balance

In a world consumed by digital infrastructure, new considerations must be taken to ensure rapid deployments, optimized application delivery, and streamlined operational support.

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Performance, Efficiency, and Sustainability: The New Cloud and Data Center Balance

Executive summary

There are more users, complex applications, and data points accessing your infrastructure than ever before. New demands require modern organizations and cloud leaders to rethink their data center environment and delivery model to leverage the cloud effectively. In a world of constant connectivity – performance, efficiency, latency, and security (physical and logical) take center stage as leaders make decisions around their digital infrastructure.

2020 was a defining year for all of us. New IT computing scenarios are driving growth in cloud and data center services. These include more connected devices, broader use-cases around mobility, and a greater reliance on data center reliability. These new IT solutions are being deployed by migrating traditional IT services to **cloud service and data center** alternatives.

However, not all data centers are created equally, and not all data center components can support your requirements.

This special report will dive into a new balance between the cloud and the modern data center. We'll discuss new requirements around performance, latency management, supply chain requirements, and, very importantly, creating a new level of sustainability.

Introduction

Before the wide adoption of newer technologies like the cloud, data centers were seen as cost-centers, supporting the business's basic or mechanical function. Today, data centers and digital infrastructure are as tightly bonded to the business as ever. These strategic parts of the organization are no longer simply 'supporting' the business. *In many cases, they run and are the business.* This is a primary reason so many cloud leaders actively seek to partner with regional multi-tenant data center providers.

A new report from Fortune Business Insights indicates that the global demand for more efficient IT technologies combined with the economic advantages of modern, consolidated connectivity applications has contributed to the exponential rise in the scale and power of data centers. As the report points out, the global data center infrastructure market size is projected to reach \$142.31 billion by 2027, compared to 2019, when the global market value stood at \$94.56 billion.

Expanding utilization of data centers by companies amid the COVID-19 pandemic is fueling the growth of this market. Furthermore, the rapidly evolving competitiveness in the global market and advanced technologies such as cloud computing and Big Data have made it **simpler and cheaper for enterprises to shift their workload to self-contained data centers.** Trends around emerging connected solutions and critical workloads have forced cloud leaders to reevaluate their go-to-market strategy. Specifically, in working with regional and hyperscale partners, they've been able to improve their time-to-market capabilities by deploying workloads and cloud ecosystems faster.

The cloud and data center balance: A new perspective

There is now a maturity around cloud solutions where organizations understand what needs to be in a public cloud and what should live on-premise.

This is a balancing of applications around Cloud, Colo, and On-Prem where premise-based solutions are Edge-like, smaller than traditional on-prem solutions, right-sized for the environment, and deployed for optimized data efficiency and security.

So, what does this **new balance** resemble?

1. Organizations realize the **actual cost** of cloud and are asking better questions around the longevity of their cloud solutions.
2. Many that are deploying new workloads are now asking: "How much does it cost me to deliver this widget in the cloud today? What about ten years from now?" Just because something was deployed in the cloud initially doesn't mean it should stay there forever.
3. Edge, colocation, and hyperscale solutions are helping organizations balance critical workloads, resiliency, and economics better than going cloud-only.
4. Many are now deploying cloud solutions with repatriation in mind. They see the direct value in the data center ecosystem to support the future of their organization.
5. Finally, the cloud and data center balance is taking on an executive perspective. It's no longer cloud-first. Instead, industry experts are shaping their workloads to ensure that they can support hybrid ecosystems.

The new balance between cloud and data center requires industry professionals to look at workload delivery from a new perspective. This paper will explore critical new considerations as data center and IT professionals design the future of digital infrastructure. Specifically, we'll cover:

- ▶ **The new cloud and data center balance**
Understanding the emerging trends around cloud computing and the hyperscale shift.
- ▶ **New digital infrastructure decision points**
A look at performance, reducing latency, new data center design considerations, and overcoming common challenges.
- ▶ **Sustainability in a digital world**
We'll discuss ESG, the importance of focusing on the environment, and how becoming a better steward for the world is good for business.
- ▶ **Safety and security**
There's no balancing act here. Both of these are necessary. We'll discuss human threats, accidents, and how to improve the safety and security of your ecosystem.

Finally, we'll also dive into real-world use-cases, design considerations, and how you can move away from legacy concepts and create a new balance between the cloud and the data center.

Section 1

The Data Center and Cloud Balance – New Key Considerations

Over the past few years, emerging trends, statistics, and non-anecdotal research indicate a certain level of maturity in the cloud and data center market. For two years in a row, most respondents to the AFCOM State of the Data Center [Report](#) have indicated that they are seeing cloud repatriation happening.

Why are we seeing this happening more today than ever before? The tremendous savings seen from the switch to up-front CapEx investments in information

technology to subscription mode soon gets soured as the rising monthly bills come in for services nobody knows where and when used. And so, new technology and operational disciplines were born: FinOps. In this profession, people leverage tools and new methodologies to monitor, measure, and mitigate the costs and value delivered from the cloud. FinOps practitioners' perspectives (yes, they are out there) provide a good understanding of what lies ahead in the cloud:

“The dirty little secret of cloud spend is that the bill never really goes down,” says J.R. Storment, executive director of the [FinOps Foundation](#).

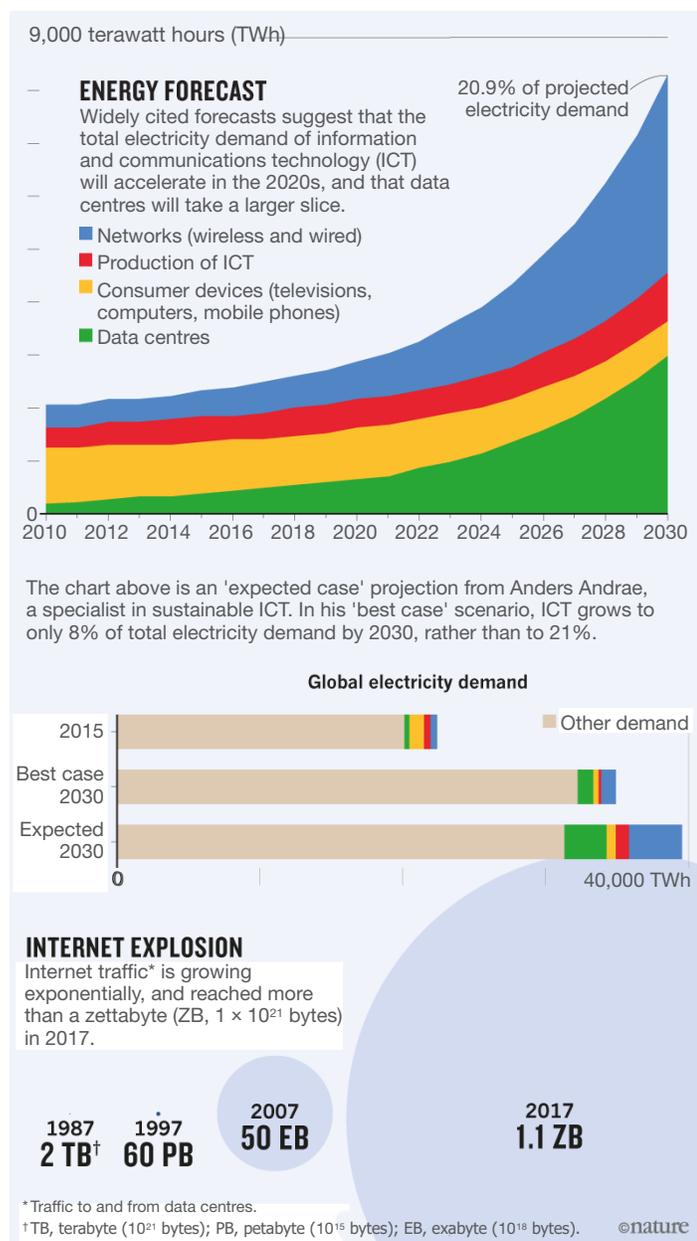
In a recent article from Nature, we learned that in a 2016 report, the Lawrence Berkeley National Laboratory estimated that if 80% of servers in small US data centers were moved over to hyperscale facilities, this would result in a [25% drop in energy use](#). If you look at the data center and hyperscale market today, you'd see that this is very much already underway.

Today, the world [has around 600 hyperscale data centers](#), many of them mopping up services for small corporations or universities that would have previously had their servers. And, there are [approximately 6,600+ colocation and wholesale data center facilities](#) across North America, EMEA, Asia-Pacific, and Latin America.

For cloud leaders, this is a new era in terms of how they work with local markets, support emerging solutions, and partner with data center pros. Here's a key consideration for the cloud and data center balance:

Cloud computing is seeing a pivot away from massive centralized cloud ecosystems to more distributed platforms designed to support new compute and connectivity requirements.

Today, centralized cloud solutions need to complement regional strategies to provide services like IaaS and PaaS. This is the new type of balance that cloud enthusiasts need to approach when working with data center designs.



Source: Panduit

Balancing cloud and the data center

With all of this in mind, it's important to note that cloud computing solutions have a place in our digital space. It's evident that cloud computing isn't going anywhere. Cloud computing has a firm footing in our digital world, with many new and emerging application and services projects currently underway. So, what's changed? How can cloud and data center experts better impact a growing and more distributed market?

Let's dive a bit further into the new **cloud and data center balance**.

Our understanding of cloud workloads, where specific resources should live, and how we can plan for the future are all considerations when we think about what needs to be deployed where. The fun part is that we see a better balance between the cloud and the data center.

Emerging cloud solutions need to be complemented with edge data centers, modular solutions, faster deployments, and more intelligent infrastructure.

Another critical point is what's happening to smaller, traditional, and even enterprise data centers. They're going away, quickly. We're removing infrastructure that was there to fulfill a computing purpose and not much else. They're often not efficient and prone to issues like outages and downtime. It's exciting that engineers and executives see this new balance and are embracing it.

They see the direct benefits of moving from less efficient infrastructure to highly resilient and efficient hyperscale and colocation solutions. This is where cloud leaders can make an impact with the right type of partner. Emerging cloud solutions need to be complemented with edge data centers, modular solutions, faster deployments, and more intelligent infrastructure.

Leaders in the technology space even see how Micro Data Centers and edge solutions play into their overall cloud strategy. For example, real-time information exchange between the business, cloud ecosystems, and IT has become vitally important. Integrated and intelligent solutions that allow for

Cloud computing and even the edge is not just all about the large public cloud providers. There are considerations around edge computing, micro data centers, private and hybrid clouds, and even cloud colocation services.

central control can help you take advantage of advances in innovation and increase productivity across multiple manufacturing environments.

To remain agile and responsive to the organization's needs, data center and cloud designers include intelligent control and telecommunications room designs in their network architectures.

This is a big reason why so many revolutionize their edge, cloud, and data center solutions are looking for designs that bridge corporate IT, cloud, and industrial networks. For example, working with a [Micro Data Center](#) approach (think pre-configured edge) provides a flexible and scalable infrastructure to enable network convergence of your operations with the enterprise and support network servers, switches, firewalls/DMZ, UPS, and backup systems. If you're a cloud provider, this is a great way to impact regional locations and support edge as well as latency-reduction operations.

With this approach, network designers and system integrators can enjoy design flexibility, lower cost of ownership, and reduced time to market.

What does this all mean for data center and cloud experts? *This is a time to understand the digital market better and capture an opportunity to help others become technology and data center leaders.* Remember, cloud computing and even the edge is not just all about the large public cloud providers. There are considerations around edge computing, micro data centers, private and hybrid clouds, and even cloud colocation services. All of these will see a boost in market demand. In working with this demand, cloud leaders in the technology space need to have a focused, repeatable solution delivered quickly to address customer and market needs.

Repeatable solutions for emerging data center and cloud requirements

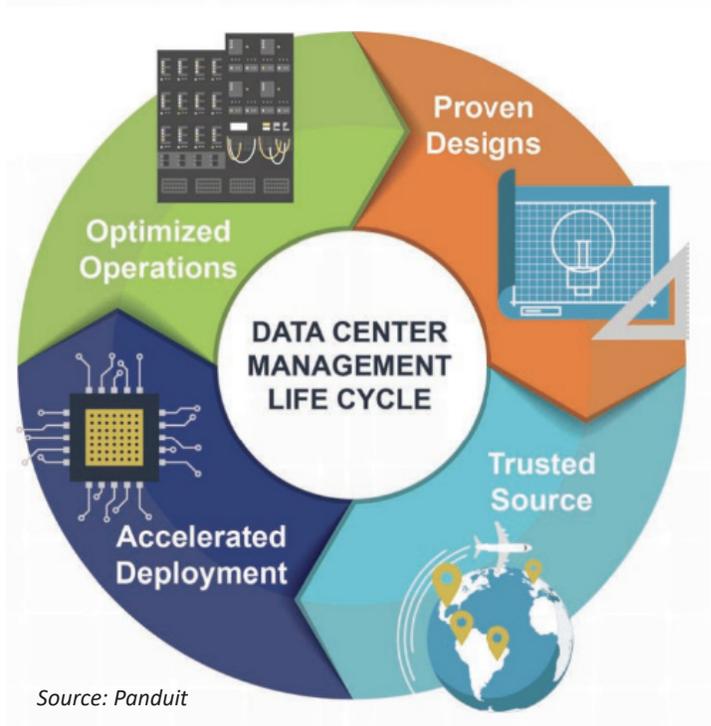
A big part of the cloud and data center balance is delivering critical architecture quickly to support market demands. Designed and built as an interoperable end-to-end solution, working with architecture that facilitates convergence allows you to have faster implementation by streamlining the process of designing, specifying, installing, and managing the increasingly complex physical infrastructure necessary to optimize your data center.

Given the enormous expense of operating data centers, organizations must design and deploy an architecture built to meet future needs, which requires scalability to meet changing business demands and optimization of IT investments. Repeatable converged solutions not only help with time to deployment and speed to market, but they also address delivering value throughout the data center lifecycle. So, by eliminating or reducing the complexity of multiple engaging vendors, organizations can dramatically improve procurement speed and time-to-market.

Organizations can lower operational expenses, including reduced cooling energy costs by up to 50 percent, via cooling optimization and power management.

By deploying a comprehensive yet complementary suite of hardware and software, supported by an expert services team who understands them intimately, installation can be executed quickly, efficiently, and with quality assurance.

It's important to note that it's not just about repeatable solutions and reducing complexity. You're also improving the operations of your technology ecosystem as well as your business. Look for a suite of purpose-built solutions for interoperability, facilitating data centers optimized for capacity, efficiency, resilience, and security. This approach works equally well for existing data centers, new developments, cloud deployments, and even edge computing by applying intelligence to the operations to identify opportunities for improvement.



Source: Panduit

An example is in-line metering to monitor power consumption. This not only helps create new operating efficiencies but also helps to measure – and verify – actual power consumption, a growing compliance demand for today's high-performance data centers. By simplifying each of these stages of data center management, organizations can address the entire lifecycle and identify opportunities for operational efficiencies that can then be incorporated into the design, which influences procurement and deployment on an ongoing basis. The result is a framework for continuous improvement throughout the data center lifecycle.

Now that we understand the cloud and data center balance better let's examine the design considerations to help you create a more balanced architecture.

Section 2

Design Considerations to Support Cloud and Digital Infrastructure

Working with digital infrastructure solutions, specifically those designed to support cloud and data center operations, can be challenging. Growth around distributed computing, more requirements around application resiliency, and ensuring optimal uptime have all placed new stressors on data center and technology pros. This is all a part of the greater digital transformation effort. A recent [report](#) indicated that Digital Transformation spending would grow to more than 53% of all information and communications technology (ICT) investment by 2023, up from 36% today. Funds continue to pour into Digital Transformation efforts as business leaders see the category as a long-term investment. As we look ahead, further spending will approach the \$2 trillion mark by 2022. But where do data centers and our digital infrastructure fit in with all of this? And, where are some challenges they face with all of these modernization efforts?

Emerging challenges around cloud; efficiency, resiliency, safety, and latency

We often get so excited about our digital infrastructure efforts that we don't always see the potholes on the roads. Emerging challenges are complicating our deployment strategies. Although frustrating, professionals working in the technology space and those trying to balance cloud and data center solutions often encounter these challenges.

Keeping things modern and efficient

When it comes to the innovation part of the cloud and data center balance, complacency and a fear of testing new technology will impact your ability to be a part of the digital economy. A challenge often seen within data centers is the approach to modernization as only a partial effort. Even if everything does not need to be updated, you still need to review each component in your data center. For example, are you leveraging the latest high-speed copper and fiber cabling connecting switches to servers within edge data center cabinets? Or, are you using new solutions around power distribution, environmental, and connectivity hardware to improve availability, scalability, power, cooling efficiency, and product quality? Remember, these considerations not only help you create the right type of infrastructure balance they also minimize network downtime and increases data center productivity. Keeping this modern and efficient also involves a look at processes as well as technology.

Overcoming latency and connectivity issues

Latency, connectivity challenges, and flat-out outages are incredibly detrimental to business operations. This is why network technologies must continually adapt. To the network infrastructure professional, that means an ongoing effort to support

exponentially increasing application speeds and bandwidth requirements with the capacity and flexibility to efficiently deliver critical network services to the enterprise. But even as network technologies advance at a breakneck pace, one thing remains constant: *The LAN is the backbone of the enterprise, and the cabling infrastructure is the backbone of the LAN.* There is a further focus on the LAN for the modern data center as systems become more converged and efficient.

Further, LANs are being tasked with handling more traffic from various solutions, including hyperconverged architecture, high-performance computing, and more. Remember, not every cable is made the same, and not every networking solution can handle high-performance, high-density, and reliable communications. Working with network and connectivity in the data center space requires good partners and the right solutions.



Source: Panduit

Here's an example. Emerging Category 6A UTP copper cabling systems now utilize innovative technologies directly in the cable and patch cords along with advanced connector compensation techniques to achieve channel bandwidth performance above industry standard requirements. These unique cabling solutions are constructed of discontinuous metallic elements that provide a high degree of alien crosstalk suppression. Further, these cables are smaller with helps with deployment and bundle size. These Category 6A UTP cabling systems also excel in performance without the need for bonding and grounding. They also eliminate the concern for shielding current flow arising from ground potential differences.

Managing an overwhelming amount of complexity and fragmentation

The more connectivity we work with and the more users connecting into our infrastructure, the more complicated it can become. Many deploy the latest and greatest to find themselves looking at more screens, checking more sensors, and examining even more data even with modernization efforts.

This is why you need to look for systems that provide easy-to-use navigation that renders powerful hierarchical and subcomponent diagrams of data centers, IT inventory, and networks. You need to have visibility, control, and governance to improve capacity planning and energy consumption to reduce complexity. Furthermore, a reduction in complex systems helps administrators isolate troubleshooting and minimize downtime for improved service levels.

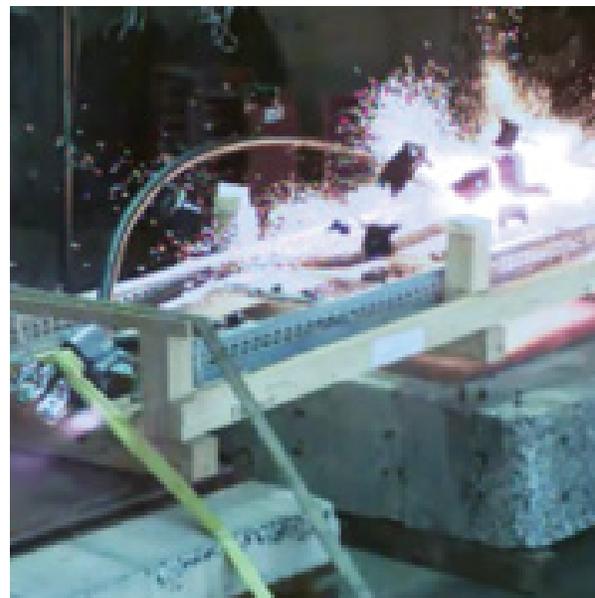
Time-to-market issues

As a new challenge facing many cloud providers, leaders in the cloud space suddenly face a boom in demand but have inefficient methods to deploy new infrastructure. Some of the largest cloud providers are actively looking at ways they can improve their speed-to-deployment and time-to-market. They're doing this to support new edge requirements, new applications that require latency controls, and more connected users leveraging cloud solutions. The challenge has been the legacy focus on large, centralized ecosystems. Although these cloud solutions are still essential, they're missing the mark in going after a market that's already booming. This is a reason why cloud providers are pivoting from the early focus on building these massive centralized data centers to now partnering with colocation

companies for regional coverage to improve latency, sustainability, and time-to-market approaches.

Incorporating safety into a physical design

Cloud and data center solutions must be safe and secure. Those in the cloud and data center space working towards the right balance actively architect around safety from the beginning. By utilizing a Prevention through Design (PtD) approach, leading technology partners are developing a groundbreaking new electrical safety technology to help build a safer industrial infrastructure. From automating the absence of voltage verification process to "no tool" circuit breaker lockout devices, leading data center partners have created safety and security solutions that provide increased risk reduction from the front gate to the facility's back without sacrificing productivity.



Source: Panduit

Here's another critical challenge often faced when designing cloud and data center ecosystems. When it comes to a power distribution system, the potential damage from a short circuit fault can be catastrophic – resulting in an arc flash event at a piece of equipment or power cables whipping about violently.

These types of events pose a serious safety hazard to anyone nearby when it occurs, either during the initial power-up or afterward. This is why, to protect electrical infrastructure when using power cables in a tray, installing an IEC 61914:2015-compliant cable cleat is the best option when facing a peak short circuit fault.

This is quite a bit to take in. However, it's essential to now dive into some design considerations as it relates to digital infrastructure. After reviewing emerging trends and some of the associated challenges, let's examine real-world solutions that help create a more solid cloud and data center design balance.

How digital infrastructure and data center designs have changed

Since the dot-com bubble, data centers have only continued to grow in size and importance. They've also changed in how they're being designed and delivered for digital solutions, new types of workloads, and of course, the cloud.

Building a data center for the future

The rate of changing business demands and the explosive growth of the amounts of data being transmitted today require that data centers and cloud ecosystems be "purpose-built," based on business direction and long-term growth projections. This calls for an architecture that enables fast and efficient scalability to meet capacity needs or migrate to higher data speeds. The pressure to sustain this pace is putting increasing strain on both IT and Facilities. Emerging Converged Infrastructure Solutions deliver a complete family of data center hardware, software, and services. These solutions are modular, pre-tested, and proven to work together, allowing IT and Facilities stakeholders to stay ahead of demands, minimize required resources and expenses and reduce the total cost of ownership. This approach helps to:

- ▶ Build or refine data centers to address changing IT and business demands
- ▶ Simplify and accelerate data center design and deployment of physical to logical convergence
- ▶ Reduce total cost of ownership by increasing operational efficiencies
- ▶ Minimize integration issues
- ▶ Rely on a primary vendor backed by a large ecosystem of world-class partners

By deploying a comprehensive yet complementary suite of hardware and software, supported by an expert services team who understands them intimately, installation can be executed quickly, efficiently, and with quality assurance. This translates to faster deployment speeds and an improved time to market for business operations. For cloud providers aiming at new markets, this is a great way to alleviate their growth challenges and deliver intelligent infrastructure to support their centralized cloud while improving networking and latency control capabilities. Let's pause here and focus on a design consideration.

By deploying a comprehensive yet complementary suite of hardware and software, supported by an expert services team who understands them intimately, installation can be executed quickly, efficiently, and with quality assurance.

Cloud and data center experts need efficient, fail-proof cabling and the underlying infrastructure to operate at maximum uptime. As your business needs grow, you also need a way to seamlessly migrate to higher data rate speeds (40G/100G or beyond). Professionals in the data center architecture space provide the products and services needed to support uptime requirements for the most complex environments, including those that employ software-defined networking, application-centric infrastructures, and two-tier network providers. Look for solutions that include:

- ▶ Modular cabinets for serviceability and flexibility for moves adds and changes
- ▶ Seamless migration path for higher data rates and next-generation network architectures (fiber and copper connectivity)
- ▶ Passive airflow remediation product suite (thermal management, cooling control, and containment)
- ▶ Pre-configured cabinets, including plug-and-play solutions and POD containment designs
- ▶ Security, safety, and remote operational capabilities

Although we'll discuss your capability to address a digital economy, one of the significant differences when looking at legacy data center solutions versus those deployed today is the ability to increase your time to market and improve deployment speeds. Consider this, pre-configured cabinet solutions can reduce time-to-production by up to 80 percent. This translates to faster builds, more efficient deployments, and a better competitive stance in a digital market.

Infrastructure Visibility and Management

A significant change in how we control today’s most advanced cloud and data center environments revolves around visibility, monitoring, and management. New DCIM solutions, used by some of the most prominent vendors in the industry, are designed to add intelligence to the data center, using dynamic solutions to derive actionable information about equipment locations, connectivity points, power usage, and power capacity. Armed with this information, organizations can identify areas for ongoing optimization of data center operations.

DCIM solutions serve as a “bookend,” working cohesively together at each end of the physical infrastructure. At one end, DCIM solutions bridge the IT stack by delivering visibility into asset and connectivity management to help streamline capacity management efforts and accelerate work order management tasks. At the other end, DCIM bridges the facilities stack by monitoring power usage and cooling efficiencies to help drive operational effectiveness and data center uptime.

For advanced data center design, look for DCIM software solutions that include a DCIM software suite, available separately or bundled, that includes individual modules for:

- ▶ Power management
- ▶ Thermal management and cooling optimization
- ▶ Asset and connectivity management

Similarly, look for intelligent hardware offerings that include:

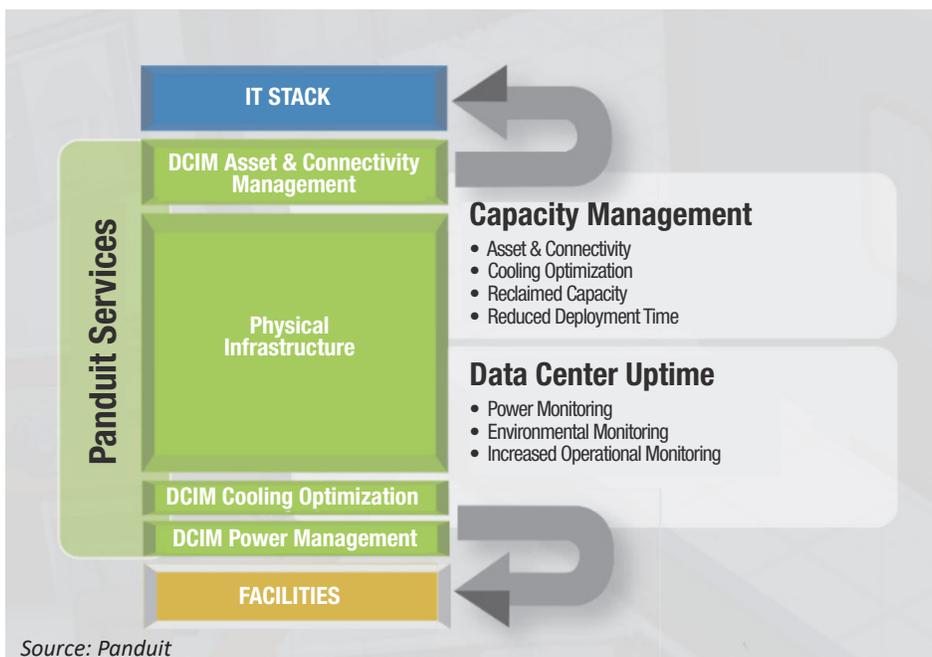
- ▶ Monitored rack PDUs that provide management down to the outlet level
- ▶ Environmental monitoring, including wireless nodes that use a mesh network that is self-configurable, self-healing and non-invasive
- ▶ Intelligent patch panels that offer port-level connectivity traceability
- ▶ Pre-configured cabinets that offer DCIM plug-and-play benefits for day-one interoperability and performance
- ▶ Security and remote operations

Remember, in a digital economy, an outage or any extended downtime is very costly. And that cost only continues to rise. [According to Gartner](#), the average cost of IT downtime is \$5,600 per minute but can be as much as \$540,000 per hour. This is why it’s essential to have direct visibility into all aspects of your data center operations. It becomes even more critical as your cloud and data center system become further distributed.

A New Kind of Supply Chain and Partnership

We rely on our partners to ensure that our infrastructures stay operational. Resiliency and efficiency go beyond your data center walls. Working with a good partner with a solid supply chain methodology is critical to ensuring you meet SLAs and keep your digital ecosystem healthy. Even though you

might not be the one sourcing equipment or cables, you need to ensure that your partners have reliable supply chains in place.



Source: Panduit

Having locally based professionals is a significant advantage that leading data center partners leverage for understanding various cultures, codes, and standards, all intending to provide a solution that suits your need in any given geography.

This is why it's critical to ask questions and challenge your partners on their supply chain management. As an essential point regarding supply chains, look for partners with an extensive worldwide network of local distributors and regional warehouses. A significant consideration for those looking to better balance cloud and data center operations is a partner's ability to grow beyond traditional centralized ecosystems. A good partner that will help you improve your time-to-market will also help you expand your regional coverage.

These types of partners allow you to deliver the right solutions when and where they are needed. Having locally based professionals is a significant advantage that leading data center partners leverage for understanding various cultures, codes, and

It'll be essential to have alliance partnerships with industry-leading technology companies that enable you to design state-of-the-art solutions.

standards, all intending to provide a solution that suits your need in any given geography. In short, select suppliers that operate globally while excelling at local execution; high touch account management, local contractors and installers, purposeful deliveries that may require regional manufacturing, and in-market inventory.

As customer needs and technologies evolve, your partner needs to be prepared for tomorrow. It'll be essential to have alliance partnerships with industry-leading technology companies that enable you to design state-of-the-art solutions.

Controlling Latency, Enabling Performance

There have been significant changes in delivering data, applications, and workloads between cloud and data center ecosystems. As data center convergence becomes more commonplace, so do the demands placed on the physical infrastructure.

Emerging High-Speed Data Transport (HSDT) systems can help, whether you're trying to:

- ▶ increase your network's throughput
- ▶ reduce latency
- ▶ enable improved service levels

From a broad perspective on latency control and enabling performance, look for an offering that includes a comprehensive set of end-to-end HSDT solutions, including:

- ▶ optical fiber
- ▶ direct attach copper cable assemblies
- ▶ twisted-pair copper cabling

This gives data center architects and managers maximum flexibility in designing, layout, and implementing their data centers.

Remember, HSDT enables advanced network designs such as fabric-based architectures and FCoE and higher bandwidth deployments such as 10/40/100 Gig Ethernet LANs and 8/16/32 Gig Fibre Channel SANs to be deployed independently or in various combinations. HSDT also works with [pre-configured infrastructures](#), which lowers speed-to-deployment, enhances thermal performance, decreases energy usage, and reduces the total cost of ownership.

Let's pause here and focus on one of the statements in that last sentence. Cloud business leaders poised to take on the digital revolution are constantly looking to improve time to market; to do so, you'll need a partner offering solutions that are both highly available and easily deployable.

Section 3

Digital Infrastructure Decision Points: Speed to Deploy, Time to Market

Your ability to work within a digital market entirely depends on how you deliver cloud and data center workloads. Today's markets move at the speed of data. This means that partners need to find ways to be creative, improve customers' deployment speed and reduce overall times to market.

Whether updating existing systems or planning expansions, the amount of development and implementation rework time can be costly. The ability to deliver decentralized critical cloud infrastructure revolves around the ability to deploy infrastructure quickly. A pre-built building block approach can reduce deployment time up to 75%.

According to the IDG Research Services [survey](#), when planning for data center construction or expansion, companies prioritize scalability/upgradeability (82%). Reducing the risk of deployment (65%) is a critical/high priority for respondents. Consistency of deployment across multiple sites is a critical/high priority for survey participants. These priorities are expressed against the backdrop of a dynamically growing and evolving data center. As the report points out, reducing the total cost of ownership (TCO) and maintaining network reliability are the top physical infrastructure challenges when building or expanding the data center. More than half (53%) also cite planning for and predicting power and cooling needs.

On that note, predicting things like deployment time, performance, and even latency is critical. Eighty-five percent of respondents cite predictable performance as a critical/high priority. Another essential benefit is assured integration of all physical infrastructure components, with 75% citing this as a critical/high priority. Data center managers appreciate the pre-validation and testing of pre-configured physical infrastructure as it reduces the overall risk of the data center project.

Finally, more than 70% also cite fast, repeatable deployments as a substantial benefit. Survey respondents who rate themselves very likely to leverage a pre-configured approach repeatedly cite the reason to be ease/speed of design/implementation, consistent design, the lower total cost of ownership, ease in multisite deployment, simpler logistics, and support

Pre-configured cloud for speed to deploy and time to market

Respondents to the IDG survey indicate the items with the most significant appeal for being pre-configured are cable management (87%); power strips (86%); patch panels (81%); pre-defined, tested racking strategy designed to optimize power, stability, cooling and space (80%); and pre-sized, labeled patch cable kits with cabling instructions (80%). The varying answers suggest that an à la carte method of customizing specific pre-configured components would generate the broadest appeal among potential buyers.

Pre-configured solutions appeal to customers who need to maximize speed and those that need validation and pre-testing that the solution will work as intended. This is about repeatability, consistency, speed to deploy.

Pre-configured physical infrastructures are flexible solutions. For cloud providers, the strategy is to respond to the customer and the overall market needs. The pre-configured solution does facilitate the speed of deployment but does not prevent the ability to tweak according to customer needs. Pre-configured solutions appeal to customers who need to maximize speed and those that need validation and pre-testing that the solution will work as intended. This is about repeatability, consistency, speed to deploy. This is why it's essential to work with partners that, for example, already have network configurations that customers can repeat as a standalone modular cabinet.

When working with solutions that are aimed explicitly at created repeatability alongside improving your time to market and speed to deployment, look for partners that offer a consultative approach to identify customer needs.

In creating your digital infrastructure balance between the data center and cloud solutions, know that Pre-Configured Physical Infrastructure offerings

are based on proven reference architectures that map the logical to the physical layer. These solutions are pre-engineered, tested, and validated to lower the infrastructure speed of deployment, enhance thermal performance, decrease energy usage and reduce TCO, resulting in reduced risk and increased sustainability.

The Benefits of Pre-Configured Cloud-Ready Physical Infrastructures

Arrive factory designed, tested, and validated to improve:

- ✓ Assessment time up to 80%
- ✓ Planning time up to 80%
- ✓ Design time up to 80%
- ✓ Fulfillment time up to 90%
- ✓ Deployment time up to 65%

Optimized performance

- ✓ Explicitly designed to optimize power, cooling, space, speed, and performance, reducing operating risks.

Sustainability

- ✓ Offer enterprises an IT solution that reduces energy consumption and arrives pre-configured to reduce packaging waste.

Scalability

- ✓ Designed to grow without affecting existing equipment by simplifying maintenance and upgrades and enabling a migration path from 10G to 40G/100G.

Here's why this is important to help you keep pace with a digital market.

Safety and security

Validated designs with rigorous testing will consider safety and security before anything is delivered to an end-user. As discussed in a previous section, look for leaders that leverage a Prevention through Design (PtD) approach. This approach utilizes tools and best practices that range from voltage verification processes to safety products that help you reduce your risk posture in a physical facility without impacting your workforce or productivity.

Improving the time to market and speed to deploy

As discussed earlier, leading partners can significantly reduce the amount of time it takes you to deploy market-critical systems. Pre-configured designs that support cloud and data center solutions reduce deployment time by up to 65% and decrease planning time by 80%. This takes the guessing game out of your capability to scale with the market and deploy solutions rapidly.

Improving performance

We all know what an ethernet cable looks like. But they're certainly not all built the same. For example, the horizontal and patch cable design utilizes UTP Copper Cabling Systems with Advanced MaTriX Technology and advanced connector compensation techniques to achieve channel bandwidth performance above industry standard requirements. This innovative design reduces the weight and diameter of Category 6A UTP cabling, improving pathway capacity up to 30%, resulting in improved airflow through dense data center enclosures without compromising alien crosstalk performance.

Working with networking technologies and improving cabling are all great ways to help reduce latency. Another critical factor is understanding distance and could potentially cause latency.

Reducing latency

Cloud professionals aiming to decentralize large cloud ecosystems must look to emerging data center solutions to help them distribute their solutions and approach a broader market. Working with networking technologies and improving cabling are all great ways to help reduce latency. Another critical factor is understanding distance and could potentially cause latency. For example, the ideal location for the shortest network latency may not be ideal for environmentally delicate equipment and cabling. It may be that the best place to locate the edge computing resources is on a harsh factory floor. This might necessitate ruggedized compute and storage equipment but may impact the networking infrastructure as well. Electromagnetic interference (EMI) may also be a part of a harsh environment.

This might require using shielded copper cabling that has improved immunity to EMI or fiber optic cabling that is entirely immune.

One thing to consider would be deploying environmental sensors to monitor the environment in proximity of the edge computing equipment. Look for partners that offer temperature, humidity, and other sensors as part of an overall IoT Remote Monitoring Sensor Solution.

Reducing complexity

Complexity and fragmentation will slow down innovation and the business. Emerging data center technologies, including virtualization, consolidation, and automation, can add complexity and increase implementation time. Leading partners in the data center and cloud space deliver pre-configured infrastructures that help solve this problem. Further, these pre-validated designs reduce the risks associated with adopting new technologies by optimizing the physical infrastructure to the logical elements of the network.

When you need to go after a market quickly and deploy reliable solutions, you can reduce planning, design, fulfillment, and procurement times, with cloud and data center-ready pre-configured physical infrastructure. Leading solutions can actually include all necessary systems under one part number.

Leading partners will also put all product designs through a ‘Design for Environment’ product lifecycle approach, including operational energy efficiency, end-of-life, and disposal considerations.

Reducing waste

A Unified Physical Infrastructure approach is specifically designed to connect, manage and automate critical systems in an optimized way to save energy, resources, and time. Furthermore, leading partners will also put all product designs through a ‘Design for Environment’ product lifecycle approach, including operational energy efficiency, end-of-life, and disposal considerations.

Select the degree of preconfiguration that makes sense for your application. Work with partners that offer value in the supply chain and use flexible solutions to accommodate the varying degrees of pre-configuration you choose to employ.

Finally, pre-configured infrastructure can take on many forms and myriad delivery models. Fully configured directly from the factory, prepackaged for onsite assembly and installation, distributor, SI, or other delivery partner enabled. Each end customer and every site are unique, as is your ability to adopt pre-configured solutions. So this is not necessarily an individual component or turn-key solution. Select the degree of preconfiguration that makes sense for your application. Work with partners that offer value in the supply chain and use flexible solutions to accommodate the varying degrees of pre-configuration you choose to employ. It’s not all or nothing; it’s all and nothing!

With all of this in mind, it’s time to look more closely at the data center and cloud balance. Further, let’s discuss how efficiency, reliability, and the future of digital infrastructure will be impacting your market strategies.

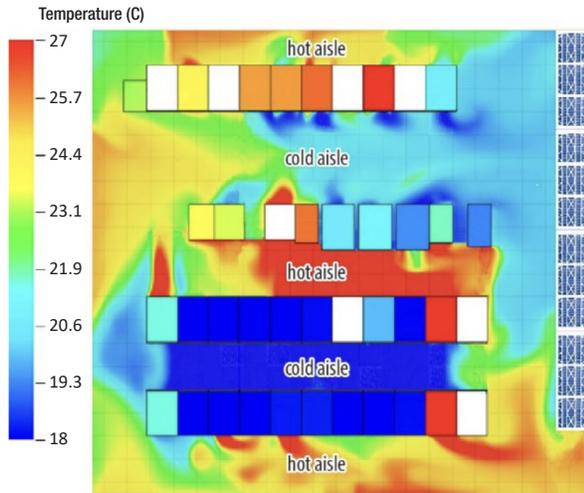
Section 4

The Partners That Evolve Digital Design

It's an exciting time to be in the data center space. We continue to see growth around digital solutions as organizations work hard to modernize their business and technology solutions. Working with a good partner can make or break a transformation effort. For cloud providers, ensuring that you have a decentralized and diversified approach to a distributed market is critical.

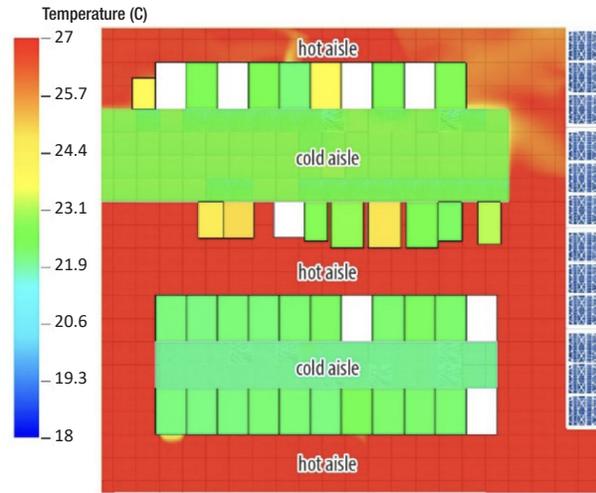
So, when balancing cloud, data center, and even edge operations, here are some essential services and partner-specific capabilities to look for:

- 1** ***Data center design***
Although data centers can be unique, deploying them modularly with repeatable solutions ensures that you reduce your time deploying and improving your speed to market. It's vital to work with a partner that sees the bigger technology and business picture. That is, ensuring that you have the right infrastructure to support your business today and as you scale into the future.
- 2** ***Data center assessments***
Working with a third party to assess data centers, both currently existing and new constructions, is vital to ensure you don't have any surprises as you build out your digital infrastructure. Often, leaders in the data center space don't see efficiency gains that can be addressed within a data center. Partners work with you to shed light on how you can improve your ecosystem and create better levels of efficiency and resiliency.
- 3** ***Hardware and software implementation services***
This is where that repeatable and predictable design comes into the picture. Partners that can help you assess, design, and deploy physical infrastructure can ensure that you don't miss a beat. For example, through their relationships with industry-leading partners like CISCO, EMC 2, and VCE, Panduit has applied best-in-class reference architectures to pre-validate all their data center products, helping you further accelerate and simplify across the data center lifecycle.
- 4** ***Cooling optimization services***
There are many new ways to isolate, segment, and compartmentalize various parts of the data center. However, cooling considerations must be an ongoing process. As your workloads and services evolve, you will need to optimize the way you manage and cool critical infrastructure persistently. It's essential to leverage tools and partners that will help fill the gap in expertise and demonstrate where you can create efficiencies. Consider this, Panduit's Thermal Assessment and Optimization Service can reduce your operating expenses between 10 and 30 percent and maximize IT equipment capacity by employing advanced modeling techniques to identify hot spots, improper equipment layout, and other issues that reduce the cooling efficiency.
- 5** ***Ongoing support and maintenance services***
As an important consideration, you need to focus on your business while data center and cloud experts help you optimize your digital infrastructure. These support and maintenance services ensure that you don't run into data center issues that can create outages and downtime. Further, a good partner will help support your ongoing innovation efforts by emphasizing optimal operation best practices and using the latest efficiency and resiliency solutions.



without cold aisle containment

Source: Panduit



with cold aisle containment

Here's another important consideration: **Computational Fluid Dynamic (CFD) Analysis.** In the past, you could do a CFD once in a while to make sure everything is working correctly. Today, CFD takes data and analytics to a new level. Working with digital clones, data-driven solutions, and even AI, CFD helps you predict what you will need in the near future as well as catch inefficiencies today. Working with CFD is a crucial part of designing a next-generation data center and cloud ecosystem.

CFD is a technique that produces quantitative predictions of fluid flow within a defined system based on the conservation laws governing fluid motion (conservation of mass, momentum, and energy). These predictions are made for a system where physical geometry, physical properties of a fluid, and the boundary and initial conditions of a flow field are well defined. The prediction focuses on a set of fluid variables, such as temperature, pressure, and velocity, describing the fluid flow and heat transfer within the system. CFD complements experimental and theoretical fluid dynamics and is an effective research and design tool.

Some of the advantages of CFD include:

- ▶ Generates air temperatures, pressures, and velocities for any location in the system
- ▶ Useful in design optimization as modifications and variations can be easily modeled and tested
- ▶ Features in the model can be easily switched on and off to allow for faster solution time
- ▶ Inexpensive and quick when compared to building and testing design mockups

In the case of CFD, where do partners fit in? The Panduit Professional Services team relies heavily on CFD modeling to assess IT facilities and validate proposed designs. Panduit has found that using CFD to predict the future state of the IT space before deploying proposed designs helps establish a level of trust with customers. It allows various options to be evaluated and the best configuration to be selected with confidence before incurring the cost of deployment. When it is impossible to test or collect data physically, CFD analysis can be used to:

- ▶ Determine the optimal configuration of cooling equipment and layout of an IT space
- ▶ Identify areas of inefficiency, such as airflow leakage and obstructions
- ▶ Identify airflow issues that cannot be seen, such as vortices in the distribution plenum and recirculation of hot air in and around cabinets
- ▶ Analyze what-if scenarios, such as an increase in the heat load with the deployment of additional IT equipment, the deployment of additional cabinets, the rearrangement of existing cabinets, or cooling unit failure
- ▶ Test the effectiveness of proposed thermal management solutions, such as aisle containment or Vertical Exhaust Systems (VESs)
- ▶ Demonstrate to customers the savings associated with different options and predict the Return on Investment (ROI)

With all of this in mind, it's time to look at how these components and recommendations play out in the real world.

Balancing data center and cloud: Real-world use cases

The following use cases showcase how cloud leaders partner with data center providers to ensure that they decentralize their cloud approach and support a broader market. Both CyrusOne and Datapod act as regionalized cloud and edge ecosystems specifically designed to support data center and cloud operations.

For those cloud leaders aiming to pivot away from an earlier focus on a large centralized ecosystem, these following examples are excellent cases in ways cloud can work with colocation and data center leaders to create regional coverage, improve time-to-market, and reduce latency. Another critical factor is that these designs are built explicitly around efficiency and sustainability. In creating a more robust cloud platform, these must be vital considerations.

CyrusOne

Creating an energy-efficient, automated monitoring system for temperature and humidity at a world-class data center is not an easy task. But with Panduit, CyrusOne, a world-renowned enterprise data center provider that offers 31 data centers across the U.S., Europe, and Asia with three million-plus square feet of total net rentable space, did just that.

The Challenge

CyrusOne's Austin Data Center II is one of 11 locations in Texas alone: located in the Met Center business park. This 70,000 square-foot facility is the first of an optional four-phase, 288,000 square-foot data center campus. Since it is conveniently located just seven minutes from Austin-Bergstrom International Airport, it is ideal for production and co-production server environments for national, international, and local companies. To optimize Data Hall 1 within the data center (a 20,000 square-foot facility), CyrusOne needed to monitor temperature and humidity for its customers' SLAs and conserve as much energy as possible. Even though the data center had been built only a few years prior, CyrusOne felt that it could make its state-of-the-art facility even better.

The Strategic Objectives

CyrusOne's main goals for Data Hall 1 at the Austin Data Center II site were to:

- ▶ provide environmental monitoring
- ▶ optimize the space by improving operational reliability and energy savings

By doing this, CyrusOne could achieve its end goal, which was to:

- ▶ lower its operating costs while exceeding power cooling standards for its customers

In addition, the data center was equipped with 13 chilled water cooling units that were not working at their highest efficiency. This needed to be addressed as it was causing the other 11 units to work at a faster rate, therefore burning more energy.

The Active Control™ feature is a technology that provides energy savings and increased efficiency by continuously aligning cooling capacity with changes in IT load. Its granular deployment of wireless sensors measure server inlet temperature and sub-floor pressure differential to manage computer room air handler (CRAH) return temperature set points and variable fan speeds.

The Solution

CyrusOne chose Panduit's Active Control™ feature to help achieve its goals. The Active Control™ feature is a technology that provides energy savings and increased efficiency by continuously aligning cooling capacity with changes in IT load. Its granular deployment of wireless sensors measure server inlet temperature and sub-floor pressure differential to manage computer room air handler (CRAH) return temperature set points and variable fan speeds. This unique approach optimizes cooling capacity and saves a great deal in cooling costs by minimizing the fan energy needed to meet server CFM and ASHRAE requirements.

The Active Control™ feature is one technology element included in the SynapSense® SynapSoft® Software and it is precisely what CyrusOne needed. After conducting a careful and thoughtful assessment

“Panduit has enabled our customers to essentially keep tabs on their servers in CyrusOne’s facility with a level of data access and detail comparable to operating a data center of their own. Plus, we’ve experienced both operational and power efficiencies. It’s quite incredible!”

- Amaya Suarez Vice President, Data Center Systems & Security, CyrusOne

at the data center, the Panduit team first turned on the two Stulz units which had not been in use. This helped prevent air leaks in the sub-floor and caused the other units to run slower. Then they installed and ran all of the 13 chilled water cooling units with the Active Control™ feature and replaced 63 perforated tiles with solid floor tiles, which allowed them to raise the sub-floor pressure and lower the fan speeds. The Active Control™ feature works alongside the existing Computrols Building Automation System (CBAS).

Because CBAS was already wired into the data center’s Stulz units, communicating via Modbus, Panduit could streamline the process by sending its control setpoints to CBAS and having CBAS pass the setpoints to the Stulz units. This setup left all the existing BMS functionality in place while providing another layer of redundancy should the SynapSoft® Software experience downtime for any reason. Because the SynapSoft® Software does not make any control decisions based on humidity, the humidification and dehumidification settings on the Stulz units were disabled. This ensures that the Stulz units do not override the SynapSoft® Software fan speed setpoints by going into dehumidification mode. A Stulz representative was onsite to make any necessary changes. At the same time, he also increased the fan speed and valve position limits. Initially, the fan speeds were limited to 60-80% and the valves from 25-100%. Today, the limits are 50-100% and 0-100%, respectively.

As for environmental monitoring, Panduit installed:

- ▶ several sensors throughout the data center’s cabinet, including temperature sensors in both the front and back and humidity and pressure sensors
- ▶ CRAH nodes that measure the supply and return temperatures and the return air’s relative humidity

The Business Outcome

Before Panduit implemented the Active Control™ feature, 11 CRAH units ran with an average fan speed of 73%, all with return air temperature setpoints of 70°F. The two fan units that were turned off were not sealed, and cold air from the sub-floor was blowing back into the return plenum. After implementing the Active Control™ feature, all 13 fans ran with an average speed of 62%, which brought the power used down from 64.3kW to a startling 37.9kW. This is especially impressive since the 64.3kW accounted for 11 out of 13 fans working, while the 37.9kW represents Panduit turning on the two fans that were turned off, bringing the fan total to 13.

At the start of the project, the average rack inlet temperature in the data hall was 67°F. The average under-floor pressure was slightly under 0.030 inches of H2 O. Panduit set the target point for the rack inlet temperatures at 78°F, and the control system increased the return air temperature (RAT)

Today, CyrusOne is experiencing a 2-7°F increase in the RAT set points throughout the data hall, with the refrigeration power decreased to 137.4kW from 149.9kW. In addition, the floor pressure is perfectly balanced.

set point to meet this inlet temperature since the majority of the rack inlet temperatures were below recommended values. Today, CyrusOne is experiencing a 2-7°F increase in the RAT set points throughout the data hall, with the refrigeration power decreased to 137.4kW from 149.9kW. In addition, the floor pressure is perfectly balanced.

Before and After - Optimization you can see

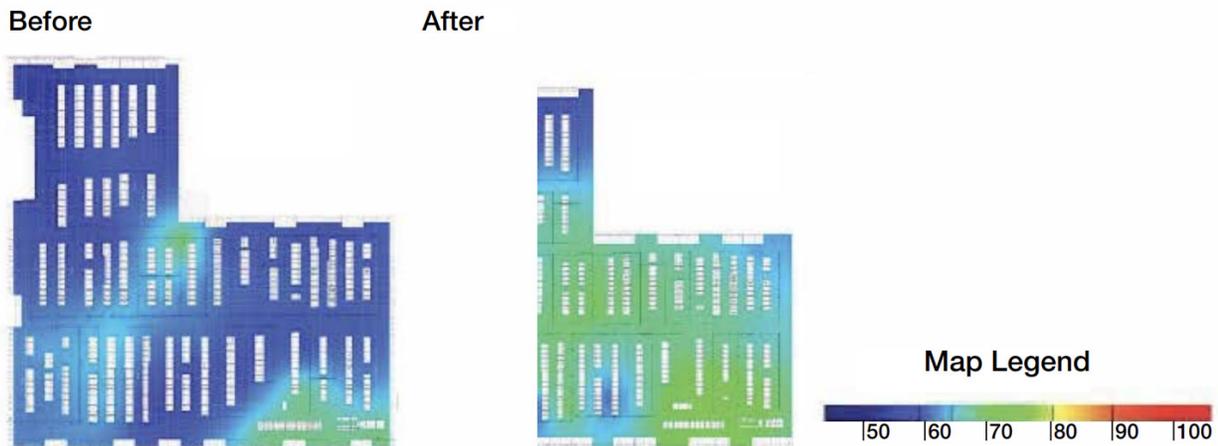
Livelmaging™ Pressure Map, Pre/Post Active Control, Pressure



Source: Panduit

After optimizing and implementing the Active Control™ feature, there was a decrease in fan speeds overall 11 units that were previously on, even though the average floor pressure in the data hall increased. There was also a 2-7 °F increase in the return air temperature (RAT) set points throughout the data hall.

Sub-floor Temperatures Before and After the Active Control™ Feature



Source: Panduit

This Livelmaging™ Temperature map illustrates the increased sub-floor temperatures resulting from the increased RAT set points sent by the Active Control™ feature. The upper portion of the data center remains cold due to the dense IT load in that area and corresponding high return temperatures.

Working with partners delivering real-world cloud and data center solutions

With a proven reputation for excellence and innovation, data center and cloud leaders can leverage Panduit and their partners to help you overcome challenges and implement real-world solutions that create a competitive business advantage. These types of leading organizations that help design digital infrastructure offer the broadest range of solutions, from data centers and intelligent buildings to manufacturing operations, to help you build a more intelligent, unified business foundation.

Final Thoughts and a Look into the Future

Our world is more connected than ever before. According to Gartner, 2012 was the first time the amount of digital data in the world first exceeded a zettabyte; that's a trillion gigabytes of information. Today, even more data is being generated, new digital services being deployed, connected devices coming online, and even further reliance on our data center ecosystems.

As a growing cloud organization working to embrace a digital economy, look to immersive partners that can help you navigate a new digital balance between the cloud, the data center, and your users.

To support the future of digital infrastructure, cloud pros will need to work with partners with a diverse set of skillsets. These include the ability to help you build that balance between cloud, edge, micro data center, and even colocation data center solutions. Know that the market is poised to continue to grow. More organizations are turning to data center solutions than ever before. So, as a growing cloud organization working to embrace a digital economy, look to immersive partners that can help you navigate a new digital balance between the cloud, the data center, and your users.
