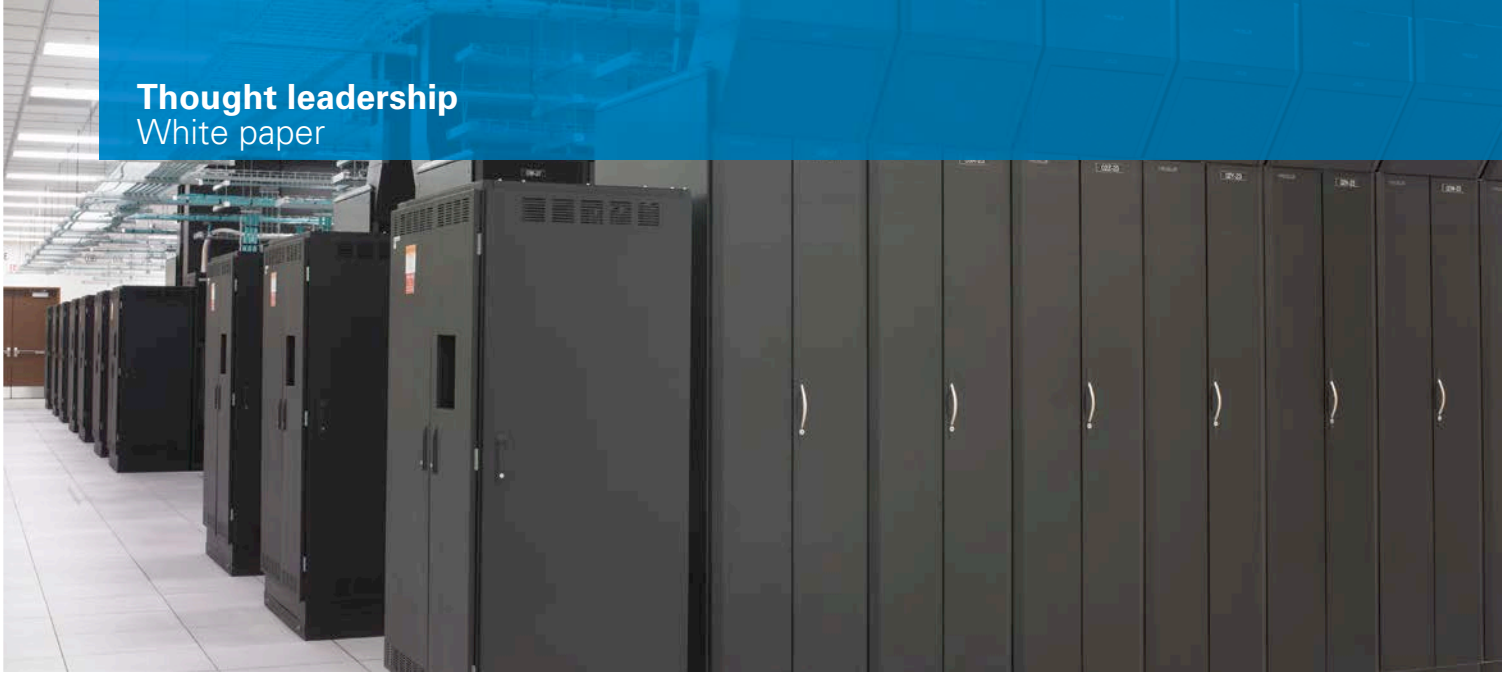
Thought leadership
White paper



Top reasons to upgrade vintage data centers

Part 1: Explore top trends, issues and recommended upgrades to data centers

John Collins
Product Line Manager, Eaton

Executive summary

According to the National Resources Defense Council (NRDC), "nearly 3 million U.S. data centers help power our economy, make our lives easier, and render our buildings and electricity grid 'smarter.'" At the same time, data centers are now rapidly driving the construction of new power plants as they become one of the nation's largest and fastest-growing consumers of electricity.

With the explosion of trends such as big data and cloud computing actively disrupting the space, rising costs of energy and economic hard times mean resource efficiency has never been more important.

Disaster recovery is also increasingly a top priority and data center requirements vary greatly by industry and business model. As organizations evaluate their optimization and sustainability options, in many cases it is the existing data center facilities that continue to carry the proverbial load.

Implementation of more highly efficient power and cooling designs plays a significant role in saving money and recouping earlier investments in the data center. By modernizing vintage power and cooling equipment and employing emerging technologies—such as economizers—many data center expenses can be more fully contained while increasingly scarce energy resources are conserved.

Emerging trends and issues put vintage data centers under pressure to perform beyond their current means. A variety of beneficial MEP infrastructure upgrades can alleviate concern while adding stability and longevity to existing facilities. This paper explores common problems and pressures while identifying simple solutions that can be readily implemented to achieve more performance-optimized, value-driven data center operations in vintage spaces.

Table of contents

Powering Business Worldwide

Top trends affecting vintage data centers

IT continues to evolve at a rapid rate, introducing changes few data center designers could have anticipated a decade or more ago. The following are among the most important recent technologies and priorities affecting existing facilities:

Mobile computing and big data

There are over 2.5 billion Internet users worldwide, with roughly 250 million in the U.S. alone. As of 2013, it was observed that a full 90 percent of the world's data had been produced within the previous two years. As smartphone adoption evolves and rapidly gives way to a new generation of wearable computing devices, big data will continue to explode, with new needs emerging for real-time data access, storage and processing.

Ubiquitous computing

As more and more ordinary devices and appliances essential to everyday living are equipped with sensors, processing power and networked capabilities, the Internet of Things (IoT) will further introduce a more mind-boggling and unprecedented state of data proliferation. Analysts assert that the processing needs associated with this trend may dictate data center build and location decisions on the basis of achieving and managing optimal processing conditions closer to the end user. Distributed data center architectures may not support the exponential data needs of future computing power; instead, smaller, regional sites are expected to provide more acceptable latency.

Consolidation and virtualization

Seeking to lower capital and operational expenses by consolidating underutilized hardware, businesses today are making widespread use of server virtualization, which enables a single physical server (or host) to support multiple virtual machines, each with its own operating system and applications. Often used in conjunction with virtualization, blade servers are plug-and-play processing units with shared power feeds, power supplies, fans, cabling and storage.

By compressing large amounts of computing capacity into small amounts of space, blade servers can dramatically reduce data center floor space requirements. For many organizations, the ratio of physical to virtual servers is literally flip-flopping through virtualization. Consolidation is a popular strategy for medium size data centers that want to identify a path for return on investment with least risk over time so they can focus more on delivering core IT services.

Cloud computing

A key question many organizations now face is that of determining where data processing occurs best. Some companies looking to lower overhead and improve efficiency are rapidly adopting cloud computing in either public, private or hybrid implementations. Public cloud solutions deliver applications and infrastructure resources via the Internet, whereas private cloud infrastructures employ the same basic technologies, but reside behind an individual organization's firewall. While cloud-based strategies continue to attract interest and hype in the news media, enterprise data centers are not disappearing any time soon, especially if prior investments in them were significant. Organizations also need to be careful to understand their consolidation needs well before moving to the cloud as a quick-fix solution. In some cases, the newness of a computing need inadvertently influences and skews data processing location decisions.

Commoditization via colocation

Multi-tenant data center (MTDC) services have become a hot trend for companies looking to reduce operational cost. Analysts predict these data centers may make up more than 25 percent of all data center capacity as early as 2016. Colocation favors OPEX over CAPEX; some companies find the management of data center facilities detracts focus from other core business competencies and thus, colocation is a viable solution. In these cases, the location, language and ease of access often become significant factors in selecting a colocation service provider. Other factors that can weigh strongly in the decision to colocate include latency, performance and disaster recovery requirements.

While colocation does support cost effectiveness and reliability well, it introduces challenges with respect to improved energy-efficiency. Operational billing, utility incentives and other motivating factors are often split among multiple organizations. At the same time, consolidating space and power capacity in MTDCs can provide new opportunities to create and distribute shared savings and benefits among multiple customer organizations. For this reason, going forward MTDCs may consider offering "green lease" contract templates to make it easier for customers to establish contracts that incentivize efficiency.

Automation and predictive analysis

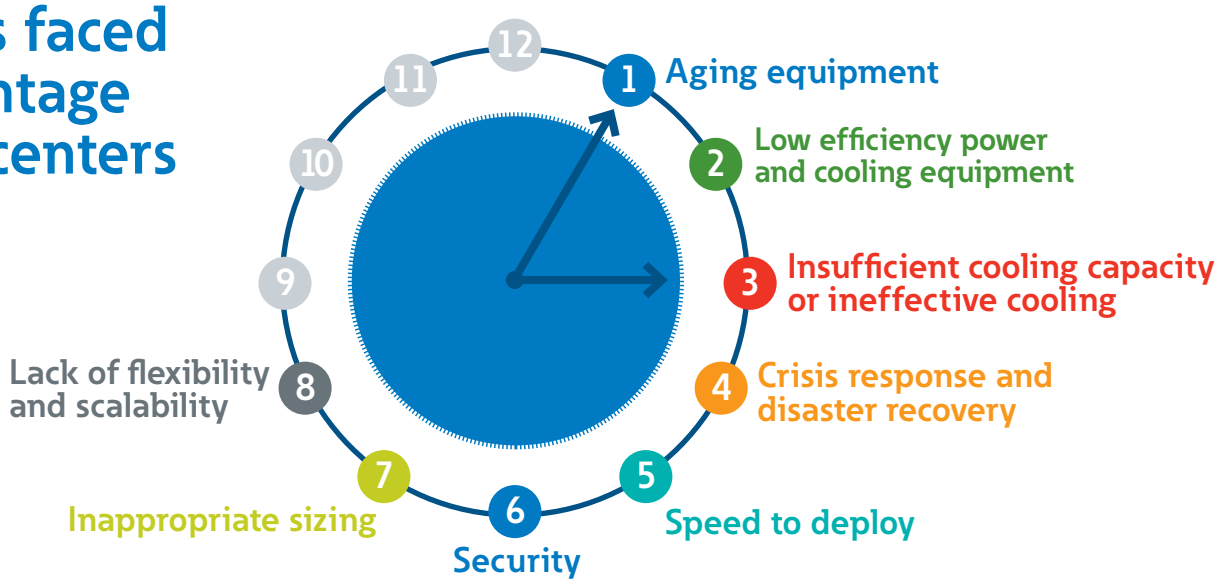
Data from operational and IT system monitoring today provides valuable operational insights on energy consumption and reveals where extra capacity resides so data centers can assign power usage specific to each piece of equipment. The availability of a range of data center information management (DCIM) tools now affords a convergence of monitoring tools, analytics, and management algorithms that can further drive and even automate additional energy-efficiency, asset management, and enhanced IT workflows. Nearly half of operating data centers have invested in intelligent power distribution units (PDUs) and utilize feature-rich options for better analytics on power use and efficiency. Likewise, advanced monitored and managed rack enclosure power distribution units or ePDUs enable similar information-based gains and controls at the outlet-level with high accuracy. Interest in DCIM solutions is on the rise and can yield significant operational and energy-efficiency gains pertinent to assuring faster return on investment (ROI). DCIM also supports higher levels of integration for facilities and IT around critical data management needs.

Energy efficiency and sustainability

The NRDC finds that: "U.S. data centers are on track to consume roughly 140 billion kilowatt-hours of electricity annually by 2020, equivalent to the output of 50 large power plants (each with 500 megawatts capacity) and emitting nearly 150 million metric tons of carbon pollution." Within vintage data centers, "up to 30 percent of servers are 'comatose' and no longer needed; other machines are grossly underutilized, and a number of strategic and tactical barriers still remain." Today's energy resource assessments further find, "If just half of the savings potential from adopting energy-efficiency best practices were realized, America's data centers could slash their electricity consumption by as much as 40 percent. In 2014, this represented a savings of $3.8 billion and 39 billion kilowatt-hours, equivalent to the annual electricity consumption of all the households in the state of Michigan." (Statistics courtesy of the NRDC.)

For help in measuring a data center's power efficiency while setting realistic efficiency improvement targets, most data center operators rely on a metric called Power Usage Effectiveness (PUE). Many utility companies offer energy-efficiency incentive programs that can help ward off the threat of penalties. Flexible, proportionate, modular and scalable solutions for the data center can qualify for these incentives, help address issues and improve PUE, but making businesses more sustainable also requires looking beyond the present to anticipate future growth and asset utilization.

Issues faced by vintage data centers



Issues faced by vintage data centers

On average, most data centers in use today are roughly eight to ten years old with an average power density of 5 to 7 kilowatts (kW) per rack enclosure. These older data centers are usually ill equipped to fully handle trends like those just discussed for the following reasons:

1. **Aging equipment.** In vintage data centers, core mechanical and electrical components such as uninterruptible power systems (UPSs), static transfer switches (STSs), building switchgear, and PDUs are often nearing the end of their recommended service life. Regular inspection and maintenance must be kept up to assure equipment is functioning properly, safely, and efficiently. Over time, such systems inevitably become less reliable, more expensive to maintain and significantly riskier. It's easy to forget that even equipment like capacitors and circuit breakers has a usable shelf life. Further, as conditions evolve in the data center, additional generators and backup power may become necessary. It's often better to take action to replace, upgrade or add these components than to respond to a crisis upon a preventable failure. (See the white paper, "Best Practices for Modernizing Vintage Data Centers" for lifespan and replacement recommendations on a variety of aging MEP equipment.)

2. **Low efficiency power and cooling equipment.** The more work a server performs, the more energy-efficient it is. Fully loaded equipment runs best, but sometimes older mechanical and electrical systems are not fully loaded; in addition, this hardware tends to deliver lower energy-efficiency than newer, more modern products, further increasing operating costs. According to the NRDC, "the average server operates at no more than 12 to 18 percent of its capacity while still drawing 30 to 60 percent of maximum power. Even sitting virtually idle, servers draw power 24/7, which adds up to a substantial amount of energy use. To put this in perspective, much of the energy consumed by U.S. data centers is used to power more than 12 million servers that do little or no work most of the time." Weak power and cooling efficiency can also make compliance with environmental regulations exceedingly difficult, if not impossible, as the current data trends continue to evolve.

3. **Insufficient cooling capacity or ineffective cooling.** Cooling alone accounts for 30 to 40 percent of the power costs for the entire data center. The cooling systems used in most vintage data centers date back to an era of significantly lower power densities. As a result, they often struggle to cope with the intense heat generated by today's dense, power-hungry IT equipment. In other cases, some facilities do have sufficient cooling capacity, but they are unable to deliver it where needed. Or, the data center may not be running at the capacity originally anticipated. The typical response has been to overcool instead of stabilizing cooling at a comfortable, even temperature.

4. **Crisis response and disaster recovery (DR).** In many vintage data centers, updated or brand new crisis response plans need to be established and implemented as a high priority for centralized sites as well as all secondary data center sites. What will happen if something goes wrong in a smaller but mission-critical site? Downtime and lost data are simply not permissible in today's culture, making DR a key driver for every data center project.

5. **Speed to deploy.** Some data centers have a requirement for avoiding hot electrical or mechanical work during peak operations time, but often the site may not have the same level of discipline or structure with respect to the wiring. This double standard should be avoided; there is a need to take the higher transfer of data into account and not put the data center at risk due to piping.

6. **Security.** Early consolidation efforts have already resulted in a heavily increased emphasis on security, as organizations are forced to assure the protection of massive amounts of mission-critical or regulated data. In many vintage data centers, appropriate infrastructure was not fully considered to be able to account for today's strictest data security and increased privacy needs. In many cases, modernization efforts may be advisable simply to avoid being hacked. One strategy for keeping a primary facility anti-hackable has been to pursue deck-to-deck security at a colocation site.

7 **Inappropriate sizing.** Organizations now face a delicate balancing act with respect to managing data load levels amidst the proliferation of data and rising power densities. While many data centers built in the last decade assumed growth would occur on massive scale, they now find themselves inefficiently over-provisioned in some respects. Bigger data centers are not always better; in today's data centers, utilization rates tend to range between 30 and 50 percent on average. At the same time, with data generation continuing to explode, some may yet face an exponential increase in demand for compute and storage. To meet these demands, power must be abundant, reliable, renewable, and energy-efficient. Two critical questions are whether the existing electrical infrastructure is able to cope with all the data generated today (and in the near future) and whether enough power can be provided to help support the growing data needs. The ability to flexibly "right-size" the data center is critical to cutting cost and improving efficiency.

8 **Lack of flexibility and scalability.** The integration of newer IT technologies requires the MEP infrastructure to adapt to changes and load demands to meet future business drivers while minimizing additional capital expenditures. Virtualization and cloud environments can cause roaming hot spots in the data center due to dynamic shifting of workloads. Related variations in power demand can be managed safely with planning and technology, as the operators of the electrical grid have shown. According to the NRDC, "The data center industry should follow the lead of the utility industry, which ramps its power plants up and down depending on demand." Vendors, data centers, and utilities will need to work together to find viable solutions for supporting increasingly dense IT environments and fluctuating data processing conditions more sustainably.

Protect against fluctuating data processing conditions

Power density level	Equipment protected	Power in the rack
Standard density	5 to 15 1U servers	2 to 4 kW
Medium density	15 to 30 1U servers	4 to 8 kW
High density	42–1U, or 2-3 blades	8 to 15 kW
Ultra high density	4 to 6 blade servers	15 to 30 kW

Figure 1. Virtualization, blade servers and cloud computing have combined to increase data center power densities dramatically.

Recommended MEP infrastructure backbone upgrades

Data centers face tremendous challenges with respect to maintenance, alignment of the business and IT strategy, and proliferation of risk due to the explosion in emerging technologies. For many companies, updating an older data center is significantly less costly than constructing an entirely new facility. Below are some of the most cost-effective and practical steps organizations can take to increase the reliability, efficiency and capacity of a vintage computing facility.

Update data center electrical distribution equipment

Data center electrical distribution equipment is the backbone of the data center, as it provides the power to all of its IT equipment and supporting infrastructure. Many existing data centers rely on power distribution architecture that was developed for previous generations of IT equipment, often exceeding 10 years in age and typically consisting of power cabling, transformers, panelboards, power distribution units (PDUs) and automatic transfer switches (ATS), etc.

Today's electrical distribution designs are rapidly evolving, driven by needs such as increasing power densities, energy-efficiency, flexibility, and the benefits of minimizing maintenance while retaining reliability. Dramatic changes, such as DC distribution systems, have been explored, but there are some practical and affordable options to significantly improve a vintage data center.

Upgrade PDUs

Modern PDUs and busway solutions have advanced greatly over previous generations of PDUs, providing efficient and flexible distribution for today's data centers. Modern PDUs offer a footprint that has been significantly reduced, conserving valuable data center space, and many utilize energy-efficient TP-1 transformers that provide energy savings that can offset upgrade costs. (In 2016, dry-type distribution transformers will need to meet new Department of Energy standards.)

Flexibility is enhanced with units capable of both panelboard and subfeed distribution, and management has been significantly improved with comprehensive metering packages, allowing visibility down to the branch circuit level; remote monitoring available via IP; and support for common protocols (SNMP, Modbus TCP, etc.). Busway is a modular power distribution system that consists of preassembled busbar track fixed or adjustable vertical dropdowns from plug-in power tap-off boxes available with receptacles, circuit breakers and drop cords. These systems offer significant flexibility, modularity, safety and reliability. Regardless of which system is used as a replacement, modern PDUs or busway will allow your vintage data center to support the unique needs of today's data centers.

Implement high power distribution

In many parts of the world, power is distributed to IT loads at 400/230 Vac. In North America, however, power is traditionally distributed at 208/120 Vac, resulting in greater cost, lower efficiency and greater space consumed. Higher AC voltages to the rack can increase efficiency in multiple ways. Delivering 400 V or 480 V in place of 208 V enables data center managers to decrease losses in distribution cabling and remove transformers from the PDUs. Modern PDUs or busway systems enable such an architecture and can deliver efficiency improvements between 1 and 3 percent in most data center configurations. It also, however, introduces heightened arc flash risks. For more information, see the Eaton white paper: Arc flash safety in 400V data centers.

Install modern rack PDUs

With data center devices smaller than ever—often served by dual or triple power supplies—a single rack of equipment might produce 80 or more power cords to manage. With virtualization and converged infrastructure, computing capacity is dynamic; workloads, applications and storage are moved around both within and among data centers as business needs dictate.

Traditional power strips just don't deliver enough power or flexibility for these realities. To ensure peak operating efficiency—an absolute necessity given modern business demands—data centers must monitor and manage power distribution at a granular level. Advanced rack PDUs have the features and reliability that today's data centers need to maintain their own operations, but more importantly, to support the changing and accelerating demands of the business.

The process of selecting a rack PDU should begin with its power rating. Once this is considered, data center personnel should next evaluate technologies when selecting a PDU. Typically, rack PDUs come in three categories: basic distribution, metered distribution, and managed or switched distribution. Moving up the stack from basic to metered will provide data centers with the ability to locally measure current and load balance—not to mention the capability to remotely monitor branch circuits and facilitate capacity planning. With advanced meters, data centers gain the capability to meter power at the outlet level—advanced functionality needed for accurate Level 3 PUE calculations. In addition, managed PDUs facilitate outlet switching, an ideal capability for lights-out data centers or in situations where fast response to remotely cycle power in the rack is needed. With outlet switching, data centers can also turn off outlets when not in use, thereby preventing accidental overloading of the rack PDU. Finally, outlet switching enables data centers to sequence power-up and perform load shedding—advanced features that can be important elements of an overall power strategy.

Upgrade or install automatic transfer switches

With advances in generator technology, the advent of renewable energy storage, and increased availability of multiple power sources, many data centers typically utilize a secondary emergency power source or are adding this functionality. Transfer switches are reliable, rugged, versatile and compact assemblies for transferring essential loads and electrical distribution systems from one power source to another. They are available as contactor and circuit breaker construction and as open-delayed, open-in-phase and closed transition switching that allows for bypass isolation, plus they feature advanced controllers and meters for proactive management. Upgrading or adding these capabilities allows your data center to evolve with today's business requirements, as dual source capabilities are not just for the world's largest data centers.

Replace UPS power train

Replacing older UPSs with newer models is a low-risk, relatively low-cost way to boost reliability and generate annual savings. Furthermore, it can also slash energy waste while ensuring the right size UPS is deployed. While late-model UPSs are often as little as 80 to 82 percent efficient under standard loading conditions, newer models routinely achieve 92 to 96 percent efficiency over a wide band of operating capacity under maximum power control. The latest, most advanced UPSs, meanwhile, have a high efficiency mode delivering 99 percent even at light loads.

With the advent of virtualization, loading on UPSs has typically decreased significantly as the load in data centers has decreased pushing you further away from the optimal efficiency of the UPS especially with older UPSs.

And, typically the UPS is oversized because virtualization has decreased the overall load in many data centers. Rightsizing optimizes the overall investment of the UPSs, saves space, and costs less to maintain.

Also, remember to think of the UPS power train as an integrated system; don't forget to regularly maintain the batteries and bypass connections.

Implement rack enclosures or aisle containment systems

While the footprint of equipment and hardware is shrinking, just as much power or more is drawn and it typically requires more cooling. Many vintage data centers employ cooling schemes based on so-called "chaos" air distribution methodologies, in which computer room air conditioning (CRAC) units around the perimeter of the white space pump out chilled air that cools IT equipment and pushes hot server exhaust air toward the facility's return air ducts. By allowing air to move freely throughout the data center, however, such techniques permit exhaust air to find its way back into server air intakes and cool supply air to join the return air stream, lowering cooling efficiency.

Legacy hot aisle/cold aisle rack enclosure orientation configurations, in which only hot air exhausts or cool air intakes face each other in a given row of server racks, marginally improves efficiency by generating convection currents that produce a cooling, continuous air flow.

The most effective cooling schemes utilize server rack containment technologies for active cooling rather than controlled ventilation. Designed to organize and control air streams, containment solutions enclose server racks in sealed structures that capture hot exhaust air, vent it to the CRAC units and deliver chilled air directly to the server equipment's air intakes. The end results include enhanced efficiency, better reliability and lower energy bills.

The use of containment systems is truly one of the simplest steps that can be taken to optimize data centers. A wide range of partial and total containment solutions is available; in-row and end-of-row cooling solutions support a variety of configurations, including open or contained aisle configurations.

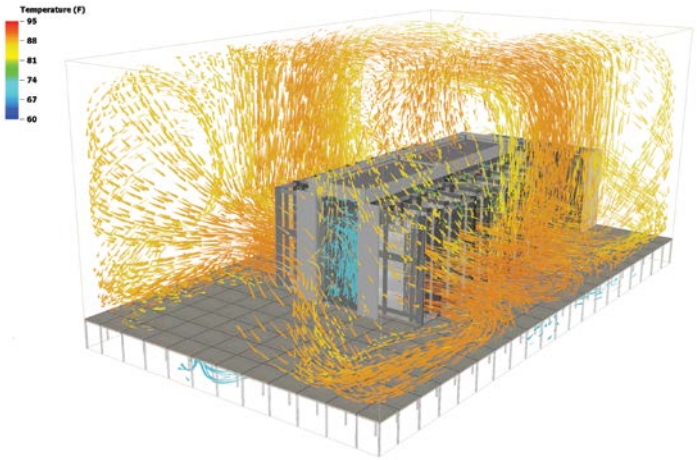


Figure 2. Containment-based cooling strategies improve efficiency by completely isolating the supply and return air streams.

Many additional improvements have also been made to rack power distribution equipment in recent years. Equipment is available now that is capable of operating at 50 °C in the rear, where it's usually blazing hot. Other features include better communications, lighter weight, ease of maintenance and enhanced security.

Use next-generation rack enclosures

Today's rack enclosures allow integration of third-party first architectures to maximize security, airflow and power distribution. Plugging airflow leaks within the rack enclosure can be a big problem if not addressed with a blanking strategy. The ease of hanging or inserting the PDUs in the latest rack enclosures has been improved to allow pop in and out capabilities. The design also assures there is less interference and proper airflow to the rack enclosure. Premium rack enclosure systems offer the industry's broadest range of compatibility for mission-critical data center equipment.

Customized rack enclosure solutions can also include special accessories and options for easy and efficient airflow management, cable management, and power delivery. For example, some rack enclosures and racks are now available in a brighter, white color—an option that greatly simplifies the ability to service and troubleshoot equipment inside the rack enclosure. It is significantly easier to see inside a white cabinet than a dark, black one, and the lighter color also reduces some energy absorption in the data center.

Update components in electrical switching or distribution systems

The switching equipment used in many vintage data centers is designed to provide up to 20 years of service if properly maintained. Organizations can improve the performance, safety, and efficiency of their switches by servicing them regularly and updating circuit breakers and relay schemes after 10 to 12 years. ATSs are a good place to provide additional redundancy of multiple power sources. Some bypass isolation transfer switches are designed for mission-critical applications where maintenance, inspection, and testing must be performed while maintaining continuous power to the facility.

The use of arc flash–resistant switchgear can be leveraged to protect personnel and improve the safety of electrical systems. Updating components could change access requirements and service clearances, thus reducing wasted space. To comply with arc flash regulations, proper signage must be posted with each change. Often a coordination study is required, a compliance date is set, and labels must reflect safe clearances and other critical information.

Improve the cabling infrastructure

The challenge of maintaining order and ease of access in the cabling infrastructure is an issue that affects almost every data center, particularly as changes are layered in gradually over time and as local network closets sometimes facilitate distributed resources as stop-gap strategies.

Cable management products make it easy to manage the miles of power and data cabling in the data center—from distribution to the rack enclosures. A key area of note is the overhead space. New thinking looks to utilize overhead cable management systems that put cabling just beyond reach, above the rack enclosures. By ensuring proper labeling at install, interdependencies in various cables can be kept clearer to help prevent unnecessary losses due to error or physical obstacles.

Cable runway

Innovative cable tray solutions can also be used to make the process of following wires into or out of the data center much more apparent and user-friendly. Look for products that combine strength, lightweight construction, depth, and unmatched jobsite adaptability to support power and data cables in a fast and economical way. Some solutions also include UL classification as an equipment-grounding conductor, making them ideal for data center cable management applications.

Feature-rich patented cable management systems are available that offer simple, modular and easy-to-install designs. These solutions can address any structured cabling need with open architectures that can meet the specific needs unique to each data center's circumstances. This added agility and flexibility is particularly important in today's adaptive environments.

Deploy a redundant electrical architecture

With today's current emphasis on reliability, many data centers are now seeking to employ active-active architectures for continuous availability and improved DR. Organizations must have the ability to avoid downtime. To keep critical workloads fully operational, dual bus architecture can also be employed for additional protection and regular maintenance or servicing needs. A dual bus solution typically contains two UPSs (or sets of UPSs), each with its own power path to the server rack enclosures. This approach assures uptime if one UPS fails or requires maintenance. While adding dual buses dramatically improves redundancy and availability, it can also drive up capital and operational spending, making it an advisable option only for facilities that place an especially high premium on maintaining uptime.

Rethink lighting

While lighting is only a small percentage of need in data centers, many companies can look toward this area for additional cost savings and efficiency gains that can add up significantly over time. Simple changes such as moving lighting from the ceiling to the aisle can speed productivity. Likewise, the use of modular, engineered, reliable, lighting fixture wiring capabilities—sometimes known as MWS—reduces installation cost for data center retrofit projects while adding flexibility and capacity for future growth.

Of course, significant flexibility, control, and cost savings can also be found through the adoption of more energy-efficient light-emitting diode (or LED) options and integrated lighting controls throughout the facility. LED lighting solutions that feature integrated individually addressable controls make it possible to employ multi-sensor strategies to automate lighting efficiency gains using innovative strategies such as daylighting, occupancy sensors, or even temperature metrics.

Remember to fully assess the entire data center and egress for potential updates to lighting needs. Lighting is now moving into rack enclosures for better visibility and to reduce over-lumination. At the rack enclosure level, paint and finish selections may also have some impact; color choices can be leveraged to optimize lighting for a range of user benefits, including health and safety aspects. Quality vendors can provide guidance on creating an optimal lighting design strategy appropriate to the unique space and equipment requirements while maximizing improvements to user comfort, space aesthetics, and overall data center functionality.

Leverage automated controls, sensors and economizers

Other automated controls and sensors can support a variety of needs in the data center. Sensors can detect higher than normal data center temperatures—such as those of greater than 80 degrees Fahrenheit. They can also enable greater use of economizer cooling and airflow management solutions, which improve efficiency and comfort in the space.

Safety and fire suppression are among the biggest concerns for facilities, and they become much more critical in the enclosed data center environment. Fire suppression systems are recommended—and in some cases required—at the room, row and rack enclosure levels. It is necessary to make sure all these levels have been taken into account with respect to how all the different systems interact with each other. Automated controls can alleviate these concerns by addressing such needs as built-in features. One example includes overhead containment panels that drop away if a fire issue is detected, allowing room- level fire suppression systems to operate properly.

Install or upgrade monitoring and management systems

Many older data centers do not properly monitor resource usage, and those that do often use outdated monitoring and management hardware and software platforms. Installing or upgrading advanced power and energy metering devices and reporting software allows data center managers to collect and archive enterprise-wide power usage data that can be used to fine-tune energy management practices, calculate PUE ratios, and perform forensic analysis of system failures and maintenance issues throughout the power system. In short, monitoring the data center vastly improves the ability to fully manage, measure and control power equipment.

Today's monitoring and management software solutions combine hardware, software and communication elements to bring diverse power components into a unified system. For the data center, a wide range of software solutions is available that can address the complexities of large system deployments of over 100 rack enclosures or simply manage multiple UPS and ePDU devices across a network. For example, one remote monitoring solution collects performance data on the UPS and battery systems and sends out status messages. With 24x7 real-time monitoring, it continually evaluates the health of the UPS by comparing current and historical performance data with specified parameters, facilitating accuracy in performance reports of UPS status. The remote diagnostics and field technician dispatch also expedite service response time to improve reliability and minimize necessary downtime.

Harmonics, voltage fluctuations, transient over-voltage conditions, and more can wreak havoc on equipment and processes. Advanced power and energy meters provide accurate real-time system values, capture waveforms and system events, and display data directly on the devices through on-board Web servers or software monitoring solutions. Using a simple energy management system upgrade kit, data centers can continuously measure the current on all breaker levels, and receive warnings of impending trouble to be proactive.

Many newer monitoring systems can further assist with operational tasks such as moves, adds and changes (MAC) and capacity planning. Features might include the ability to trigger the migration of mission-critical applications to transparently move virtual machines to an available server on the network, for improved data integrity and zero downtime. The best solutions are those that are more predictive than reactive as well as automated. Such application services can manage themselves across the physical infrastructure such the optimization of the data center need not require a live operator at all times.

Consider DCIM solutions carefully

DCIM systems are a special variety of monitoring and management solutions that allow a data center manager to centrally control two or more functional areas of the data center – i.e. power, cooling, space, environment/security, networking and connectivity, servers and storage, etc. in an effort to bring together the data from both the Information Technology (IT) and Mission Critical Facility (MCF) management disciplines. They usually include modules that assist with infrastructure management, virtualization management, power monitoring and management, dependency modeling and overall performance metrics. Oftentimes, the way DCIM is implemented can make a significant difference in whether it delivers the desired optimizations and benefits. Many companies have a variety of tools to accomplish the desired tasks, but require the ability to share information across the disciplines it may be helpful to keep in mind that DCIM is really a management strategy for choosing a proper implementation of controls that fits the specific needs and cultures of the organization holistically. From there, DCIM can be instrumental in further developing the additional tools that may be necessary to go forward. Look for providers that have the appropriate IT partnerships in place to help data centers take control of their systems in the ways that make the best sense for the organization's individual circumstances. DCIM needs to be a strategic evolution as opposed to a fresh endeavor or "do-over" effort. The high cost of the software license and associated service fees have been a barrier to adoption, especially in cases where customers are not convinced of the return on investment, but a well thought out strategy will help to deliver the return and benefits desired.

Improve security

Security in the data center has become an ever more pressing need, especially as mission-critical data, resources and assets undergo centralization and consolidation. At present, there are not many power management products available that address security directly, but the physical and logical layers should be addressed. Physical security may include efforts such as locking systems on data center doors or the creation of partitions throughout the space. At least two levels—rack enclosure and row—are recommended for logical security of power systems. State-of-the-art security features such as biometric locks and gates are now realistic options, regardless of the data center size. It's best to choose security options as appropriate based on the application area. Consider whether the equipment is cost-effective and necessary based on the location, type of business, type of industry, and type or types of regulations required for the facility and for the data it stores and enables.

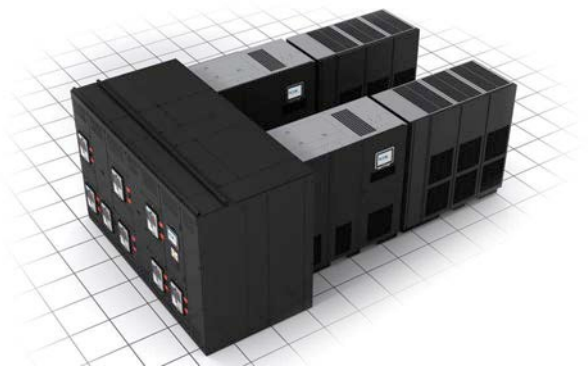
Investigate new options in prefabricated modular data centers

Prefabricated modular data centers (PFMs) include ISO shipping containers and a variety of new offerings that have since evolved from this very agile concept. In fact, some analyst forecasts now assert that PFM will begin to top $4 billion in the next three to five years.

PFM data centers typically rely on one or more standard structural building blocks prepared and shipped from factory for final onsite integration. The resulting technical facility is ready-made to accommodate power and cooling units or can be transported with some or all of such systems already in place and tested to minimize onsite install and startup work. The emphasis on modularity allows for greater scalability and reuse of the design across sites and can also better accommodate a wide array of design flexibility requirements. With containerized and custom rack enclosure-based data center form factors, virtually any size, shape, or type of facility can be configured using prefabricated modules. The facility can also evolve gradually over time as future, unexpected needs arise; PFM can be leveraged to add capacity, rack enclosure space, or more power and cooling at any time.

PFMs can be considered for IT and infrastructure support. A major benefit of these solutions is the opportunity to speed efficiency gains (energy and operational). Power and cooling equipment can be packaged in containerized solutions for plug-and-play implementation capable of bringing PUE to an optimized range of 1.15 to 1.3. Because of their precision manufacturing, PFMs typically deliver enhanced predictability and lower risk while the use of structural building blocks lends greater agility and productivity.

An especially attractive variety of PFM are those combining customization and standardization. For example, containerized skid power and more standardized UPS designs can significantly enable greater reliability, speed of deployment, and cost reductions. Learn more about available PFM options.



Prefabricated modular data centers

Conclusion

The world of technology has seen plenty of change in recent years. To keep up with it, organizations with data centers that are 10 years of age or older should seriously consider modernizing those facilities. Upgrading a vintage data center's mechanical and electrical infrastructure can boost reliability, efficiency, flexibility and scalability while reducing operational spending. It can also save companies the considerable expense of building entirely new facilities.

Though upgrading a vintage data center isn't simple, careful planning and skilled execution can dramatically streamline the process and strengthen ROI. Above all, organizations contemplating a retrofit of an older data center's MEP infrastructure should seek assistance from a skilled vendor with deep and relevant experience.

About Eaton

Eaton's electrical business is a global leader with expertise in power distribution and circuit protection; backup power protection; control and automation; lighting and security; structural solutions and wiring devices; solutions for harsh and hazardous environments; and engineering services. Eaton is positioned through its global solutions to answer today's most critical electrical power management challenges.

Eaton is a power management company with 2015 sales of $20.9 billion. Eaton provides energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton has approximately 100,000 employees and sells products to customers in more than 175 countries. For more information, visit Eaton.com.

About the author

John Collins is a product line manager for large data center solutions at Eaton. He has more than 24 years of experience in the data center industry. At Eaton, he is focused on ensuring Eaton's data center products and solution offerings evolve with the market. He is involved in many industry groups including The Green Grid, 7x24 Exchange, and AFCOM. John received his Bachelor of Science in Electrical Engineering from the University of Rhode Island and an MBA from NC State University.

For more information, please visit
Eaton.com/datacenters

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Printed in USA
Publication No. WP083013EN / Z17968
March 2016

Follow us on social media to get the latest product and support information.

Powering Business Worldwide