

FROM DINOSAUR TO DIGITAL

A Practical Guide to Your Data Center Automation Journey



Seconds after an online consumer clicks the checkout button, an order arrives at an e-commerce distribution center and a series of automated tasks fire into action: picking the item from the correct SKU, moving it to a dispatch processing point, preparing for dispatch, loading it on to a vehicle—all happen with little human intervention.

Yet, in between the consumer clicks and the order fulfillment, these inputs and outputs will pass through one or many data centers. To the consumer, the data center is another invisible marvel of automation and modern technology—connecting them to the world, bringing them information (and goods) at record speeds. Data centers are now at a crossroad, embarking on a digital transformation of their own, delivering our omnipresent digital services.

“Automation” is a subject often remarked upon at data center seminars and conferences with discussions about robotics and dark data centers trending across all channels. The industry agrees that the future of the data center lies with an automation-enabled operational model. Just as automation has reshaped distribution and manufacturing, so too will it reshape the data center. This exciting future for our digital infrastructure is both inspiring and intimidating. With unprecedented demand for capacity and enormous data center inventory already operational, how can an operator get from here to there? How do data center leaders assess where to start? What changes will this bring for personnel, processes and total cost of ownership (TCO)? Most of all, how can you bring your data center from today to an automated tomorrow without sacrificing reliability and uptime?

For owners and operators of data centers, creating a practical path forward toward automation will be critical to meeting the needs of the market while maximizing the efficiency, availability and utility of the facility.

The Time Is Now

While it's easy to imagine a newly built data center with high degrees of process automation and even robotic intervention, the majority of the world's data center real estate is preexisting stock not designed with automation in mind. Many data centers are designed with control systems that might be 5–10 years old, forcing operators to use operational methods that are equally dated. Data centers must shift toward strategies driven by scale and business growth, leveraging technology and innovation from other sectors.

The opportunities which robotics and automation have afforded to sectors including automotive, supply chain and pharmaceuticals are yet to be fully realized by data centers, largely due to operational leads taking a risk-averse approach that has led to the environment's continuing to be built for primarily human operation, relying on Building Management Systems designed primarily to support office and commercial environments. This practice has resulted in an environment that is designed around the needs of human operatives.

By contrast, a modern factory, such as those seen in automotive and pharmaceuticals, is designed around the outcome, meaning that areas of the factory are exclusively populated by robotic manufacturing systems which perform repetitive or preordained tasks rapidly and reliably. This design enables robots to work at maximum speed and efficiency while the organization has the assurance that its human staff are at a safe distance working elsewhere in the facility on those higher order activities that still require the flexibility and "real intelligence" that a human brings to the process. The benefits of robotics and other technologies include a data center that can run at a higher temperature, reducing the cooling demands, which in turn reduces operational costs and improves sustainability. Further cost savings will be achieved with the move toward higher-value roles for data center technical staff.

It's time to stop thinking about data center as an office building packed with technology, but as an industrial facility, supported by technology.



The critical nature of the data center means that many operators will not be comfortable with a sudden leap toward robot-operated data centers. **But, just like in the enterprise, steps can be taken now to begin the journey toward an automated future.**

Even with these steps toward automation being taken at a cautious pace, the data center market has been inundated with technology offerings, all promising to deliver exceptional capabilities. Many of these platforms, however, have failed to deliver for several reasons (in order of significance):

1. Lack of a complete vision/roadmap
2. Lack of adaption of the operating model
3. Limited appetite from operators for release of their data and information
4. Closed architecture—difficult to integrate with other systems
5. Overly complex architectures and expensive implementation pathway
6. Designed for other building classes and not suitable for complex critical environments
7. Lack of correctly configured data sources to supply platform



Where to Begin

Automation of data management is not entirely new. Tape-based data backup solutions have had robotic solutions for many years. As with enterprise business processes, the first steps toward automation will be software-based. While existing data center stock remains in operation and must accommodate staff, we expect to see the gradual deployment of technologies which will interface with legacy control systems and offer some of the advantages of more comprehensive automation strategies.

However, new generation modular or even large-scale facilities will self-optimize and automate the monitoring and operational elements of the data center. Early examples of these technologies are being seen in the advent and proliferation of Edge. Edge data centers are a cost-effective proposition only when the need for human interaction and associated cost are virtually eliminated.

Automation cannot be achieved overnight, as each data center will have a unique starting point on the journey, with each operating team having a different attitude toward and acceptance of risk.

As a result, the automation of the data center will take place in five steps:

→ **Stage One: Operational Assessment of Existing Processes and Systems**

To start any journey, it's essential to know your starting point. In the case of data center automation, it will be essential for owners of existing sites to ensure they fully understand the capabilities and limitations of the procedures and systems already deployed at the site before contemplating any migration toward a more automated future.

→ **Stage Two: Digitization and Optimization of Operations**

Once a roadmap to automation (whether full or partial, depending on site condition, appetite for risk and budget) has been defined, the first practical step is to look to digitize existing processes where possible. This provides a low-risk entry to the world of technology-led operations while also starting to gather operational data which will be vital in any future analytics-based maintenance regime (whether condition-based or predictive).

→ **Stage Three: Augmentation of Human Processes**

Once sufficient operational data has been acquired and technologies are in place to enable more automated control of operations, then it's time for the humans to be guided by automation and allow further optimization of processes. Our recommendation is a phased approach with the automation systems operating in "advisory" mode initially and moving to full control with human observation as a second phase.

→ **Stage Four: Automation of Data Center Operations**

When confidence in the "advisory" phase has grown and decisions can be demonstrably "correct," it is then possible to connect analytics and controls and let humans take a step back. Controls can be implemented to monitor the new "intelligent" system and validate that all decisions continue to be correctly implemented.

→ **Stage Five: Robotic Interaction**

This end state may not be viable in all cases, but where it is, the final stage on the automation journey is the deployment of robotic technologies to replace human hands and eyes on a subset of manual tasks. Examples include visual auditing of facilities to maintain asset management records (as we already see in play for retail stock control in some outlets) and simple part replacement.

Often data centers are not making use of the technologies in which they have already made significant investment. By harnessing the data already available in disparate systems and bringing it into a cohesive format, large steps toward digitization and automation of tasks can be achieved while gaining valuable insights.



For legacy facilities, these steps should be approached sequentially, and data center owners and operators should expect their assessment and execution to take time—especially in cases where organizations are self-performing all areas of data center operations. Full automation may not make sense for all data centers, but owners and operators will still benefit from an understanding of what may be possible and the assessment of their data center against these steps so that opportunities for singular or even system-wide enhancements can be identified and deployed.

For automation to succeed, companies are advised to drive toward increased standardization across their data center portfolios. Standardization will simplify the automation process and create more meaningful repositories of operational data to better inform predictive analytics. Edge data centers, which are typically modular in nature, already demonstrate these characteristics, gaining production advantages and cost efficiencies by minimizing the number of configuration options and maximizing the opportunity for automated remote monitoring and control.

As these technologies enter the enterprise, CBRE believes the mechanical and electrical engineering arms of data center management will become better aligned with the strategic demands of the Chief Information Officer or Chief Technology Officer, and we will see increased integration between the IT “payload” in a data center and the plant that supports it. At present, mechanical and electrical operations are within the remit of the facilities teams, and in many organizations, there are completely independent budgets and often limited alignment between facilities leaders and CIO/CTOs. Alignment will have to improve as the role of technology becomes ever more vital in the business and its strategic direction. We need to start treating all the components – be they facilities, network or technology – that support the business outcome as a single system and making smart decisions around investment and operational models such that the entire “system” works as efficiently and effectively as possible to deliver business outcomes reliably and at best cost.

A Low-Risk Transition

When setting out on your journey to automation, please resist the urge to make fast progress by implementing some new technologies quickly without having first considered your end state. Time spent upfront planning how the site will eventually operate will pay huge dividends in simplifying the future model and ensuring that any new technologies purchased to support the future operating model are able to share common underlying data and interact functionally in a smooth and logical manner. Failure to do so is likely to move you from a world where humans are operating a data center to a world where just as many humans are required to “operate the automation” — clearly the most expensive and unsatisfying outcome.

Implementation

All services are modular and build around an open architecture to integrate with existing investment in equipment and technology. Implementation is via the following phases:

1	2	3	4	5
Site Audit	Preparation Phase	Implementation Phase	Handover Phase	Ongoing Service
Full review of M&E assets, metering, documentation metering and site ops procedures and existing technologies	Physics-based model applied. Secure data links established. Additional metering/software implemented	Existing services are augmented by new services. Operated in parallel	Services and procedures migrate to new model	Continuous monitoring and condition-based maintenance implemented. Site optimization projects identified and executed

Realizing the Fruits of Automation

Automating for your people, not in place of

As data centers continue to grow, the time effectiveness of team members must be carefully managed, and new technologies can be used to help drive the most effective use of time. Again, the data center industry has lagged against sectors such as engineering. For example, global leaders in the manufacturing and supply of railway infrastructure use data analytics and automation to optimize the maintenance service they offer to railway operators. The insights gained from data analytics help predict likely failures, ensuring the right spare parts for rolling stock are available in the right location at the right time. This saves money by simultaneously minimizing stock levels and time to repair, thereby keeping rolling stock available and generating income longer.

A high proportion of current data center outages are attributed to human factors and can quickly escalate to become financial and reputational loss risks for any enterprises. With less human interaction required, the environment within the data center will be able to operate in a way that is not compromised by the limitations and fallibility of humans. Just as robotics enabled the automotive industry to continue evolving and operating more flexible production lines, offering customers almost unlimited configuration combinations while containing costs, so too will the data center industry be able to accommodate more dynamic technology loads while reducing OpEx and improving sustainability credentials.

As has taken place within enterprise IT teams, automation will result in data center technicians moving up the value chain, spending less time carrying out core tasks and instead taking responsibility for outcomes that automation alone cannot resolve. This is an important message for your teams—automation is an opportunity to evolve their careers.

For automation to succeed, the migration process will need the willing input and collaboration of today's skilled and experienced technicians, so it is imperative that data center managers invest in education and training for these individuals to help them transition from core administrative roles and into new value-added functions.

Change management for evolving career paths

The automated data center creates a beneficial interface between technology and human technicians, reaping the benefits of improved efficiency, lower costs and improved environmental credentials. Those technicians who embrace change will be rewarded with increasingly interesting roles and long careers. Change management will be a vital factor in ensuring that people are properly and comfortably invested in their new roles and understand the part they will play in both the introduction of new technologies to the data center and its future operation. Offering sustainable and cutting-edge career paths will pay dividends in hiring and retaining top talent in your facility.

Risk Reduction Through Data-Driven Decisions

Using data to drive your decision-making process can significantly reduce your operating risk by moving from the traditional reactive model (simply responding to alerts and alarms and calendar-based maintenance) to a proactive approach. By trending meter and other sensor data and combining it with readily available analytics, it is perfectly feasible to move to a condition-based model. Take the example of filter changes on CRAHs: Traditionally these would be changed at a set interval depending on the manufacturer's recommendations. By monitoring the fan motor's power draw against a baseline, you can gain insight into whether changing the filters is necessary. Even better, automate it so it triggers a work action only when the meter data varies past a threshold from the expected value. This will save time and material, but let's say the filter was not the problem and the trend would not return to normal: Then a further deviation could indicate impending motor failure, enabling preventative maintenance action to occur.

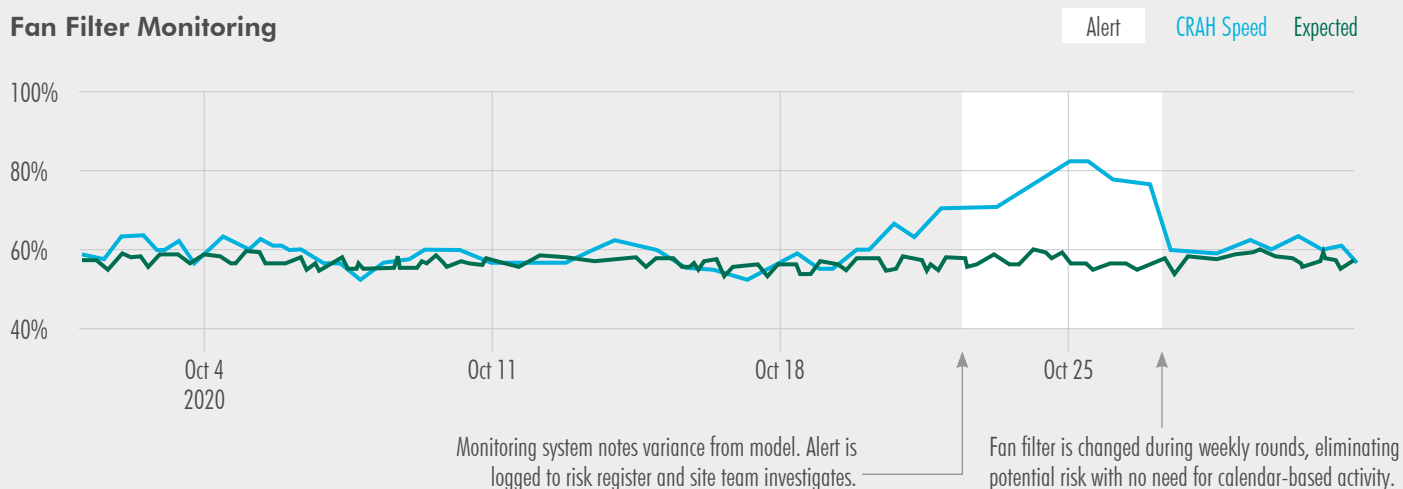
Data-driven decision-making like this can be applied to almost any device class and metric without even applying complicated machine learning (ML) systems. However, adding an ML layer to the data can enable you to begin predicting future events and diagnosing impending faults automatically, enabling proactive intervention to prevent the failure rather than simply being able to respond more quickly after the fact.

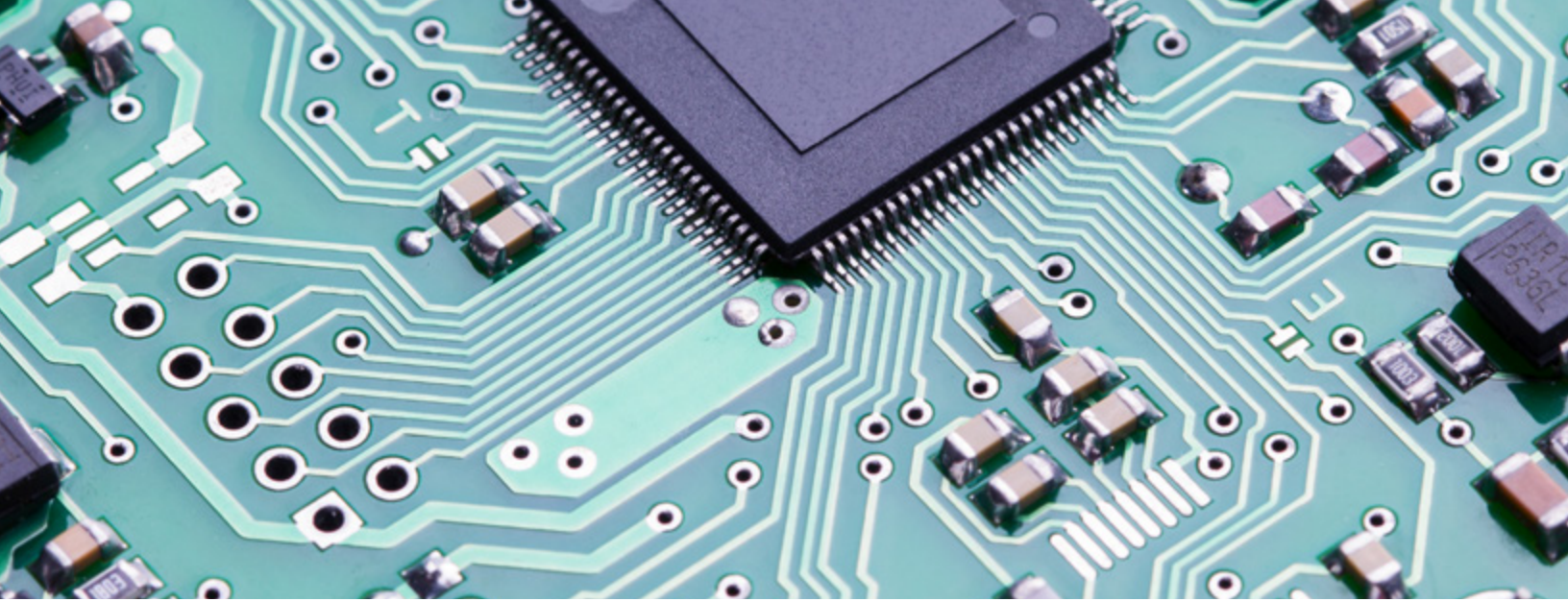
Hyperscale campuses, where the operation of the IT load is linked to the performance of the M&E infrastructure, have already seen adoption of a higher degree of automation. This means that the IT can dynamically respond to changes in the building and vice versa—for example, ramping down or offloading processing tasks during equipment outages or ramping up cooling when IT demand is peaking. This integration between technology and facilities will play a vital role in future optimization of data center operations and will require a convergence of thinking between facilities and technology in terms of design and operating models—ideally with a single, converged operations team responsible for all services within the data center. Using automation and data-driven processes not only reduces risk but also makes it possible for a single, streamlined operations team to have the knowledge and skills to deliver the expected business outcomes—compute power to drive just about everything in our modern lives.

Data driven decisions live example

Monitoring the performance and condition of your equipment allows you to replace or conduct maintenance on equipment when it is needed as opposed to on a pre-determined schedule. This can save money by replacing or servicing equipment only when it is needed while minimizing outage risk due to malfunctions.

Fan Filter Monitoring





Sustainability Strategies, Maximized

Most data center operators have a strong focus on sustainability and its associated targets. Data centers have dramatically improved the efficiency of their IT equipment and facilities over the last 10 years, where many of the early improvements have focused on the different aspects of operations, from the chips that power servers to the larger power infrastructure and ever more efficient cooling systems. These efforts have led to huge savings in water usage, electricity and carbon impact, but at the current moment many companies have paused in their improvements in energy efficiency with the easy wins already accomplished. Automation is a key enabler of the next phase of water utilization and energy efficiency measures for both power and cooling plants.

Automation technology can be used to continually check the environment and find ways to save resources. It can be as simple as a system that automatically turns off the light or keeping a thermostat at a temperature that saves energy without compromising the function of the servers. An automated solution can analyze thousands of assets to see if the data center is running at peak performance at every moment in time. Automated control makes it practical to deploy more granular environmental monitoring and for the control system to respond in near time to localized changes in power or cooling demand—as such, data centers can be run much closer to their design loads, driving efficiency and usable capacity upward.

Another aspect where automation can help drive sustainability is in reducing waste. When a piece of equipment is continually checked, you can dare to operate it until its actual end of useful life based on how it is performing rather than being exclusively dependent on the manufacturer's age-based recommendation. This can lead to massive savings both for the environment (including the environmental impact of manufacturing new equipment) and for the cost of operating.



Next Steps and Guiding Principles

Automation is set to transform every aspect of the data center. As businesses digitally transform their strategies, the data center must take its place as a central pillar and, just as the IT department has done, become business-outcome oriented. These technical buildings must no longer be treated like warehouses hosting racks, but as automated digital factories for the digital age.

While not every data center will need to fully automate (perhaps yours has a short residual life as your technology systems migrate to cloud or co-location sites), the wise data center owner or manager will conduct an assessment today and be in a position to make an informed decision about the appropriate strategy for the site and whether there is a business case for change.

→ **Step 1: Back to Basics**

Audit your site(s) and ensure that schematics, asset lists, work processes etc. are all up to date and available in a consistent digital format. Evaluate what metering your current equipment is capable of providing and what language (protocol) it speaks. Build a connectivity schematic showing what is connected to what and where your current data is both stored and flowing between devices/BMSs/CMMSs/DCIMs etc. Doing this will help you understand where you are now. Wherever possible, this exercise should include plant and technology assets so that you have a detailed understanding of the entire infrastructure supporting the business outcomes in the data center.

→ **Step 2: Find the Inefficiencies**

Conduct a work time study of your playbooks and ask yourself if any of the manual processes can be automated or even eliminated if your current control systems and data sets were logically joined up. Where you don't have the data available (e.g., devices not connected to a monitoring system), work out what is the minimum data you require to automate that task and devise a strategy for obtaining it, either from existing systems or possibly through deployment of low-cost Internet of Things (IoT) sensor technology. Don't fall into the trap of installing metering or collecting additional data without understanding how you will operationally use it.

→ **Step 3: Develop a Phased Plan**

1. Immediately—Having conducted your baseline assessment, facilities and technology teams should work collaboratively to define a roadmap for the future of the data center. Facility leaders should learn from technology colleagues who have been working in highly automated environments for many years and can bring significant experience to bear in this process.
2. Now—With minimum reconfiguring of existing technology, identify processes that can be automated now by using the data you have available.
3. Near term—Decide what additional changes can be made by consolidating platforms into a consistent data view and adding useful data points to the environment. Many software solutions are available which will enable a data bridge to be built between your disparate legacy control and monitoring systems to deliver a single, consolidated data view. Either your technology colleagues or a systems integrator with experience in industrial automation can assist greatly with this task.
4. Future—As equipment nears its end of life or if there is opportunity for capital investment, ask what level of automation and centralization of resource can be achieved using the tools available and emerging in the marketplace. Can you join up the M&E outcomes (energy/operations) with the IT outcomes (availability/compute power/connectivity)?

→ **Step 4: Implement in Parallel**

Build a change management plan to deliver the roadmap from Step 1 (above) to manage new systems and processes being brought online in parallel to current manual tasks, and then switch to the new process when ready. Work with your Human Resources team to ensure you have the right transition plans in place for your people so they are prepared for changes in operating models and the new skills they may need.

→ **Step 5: Don't Stop with Small Gains**

Establish a Continuous Improvement Program, where the site's activities are routinely reviewed with specific focus on identifying further opportunities for improvement and automation, and evaluate new technologies as costs to implement. The market for automation technologies is evolving very quickly, so it's important to remain current and have a flexible approach to selecting technologies to drive automation.

Begin your journey toward automated operational excellence with CBRE

CBRE maximizes data center uptime, placing talent and risk management at the heart of our operational approach.

We develop a deep understanding of your portfolio, applying our global scale, expertise and buying power in the right configuration to make your data center work harder for you.

Our focus is your data center's uptime. Our clients benefit from experience and best practices accumulated by managing ~700 data centers in 45 countries—more than any firm in the world.

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What our customers expect from us

- **Uptime** – zero unplanned downtime
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- **Operational Excellence** – quality and operational excellence
- **Predictability** – use monitoring and analytics to reduce risk and forecast capacity
- **Access to Talent** – consistent supply and retention of quality data center professionals
- **Operating Efficiency** – balance site performance with cost to operate and maintain
- **Supply Chain** – leverage our global buying power to provide resiliency and competitive prices
- **Cost Reduction** – unlock maximum value of data center assets



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OF THE FORTUNE 100



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- ~700 Managed Data Centers
- 99.99968% Uptime
- \$74B Supply Partnerships
- >4M Hours/Year DC Operation

CBRE's Data Center Services

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Our automated analytics and monitoring improve the speed and quality of critical decision making for data center operations.
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Our teams will significantly improve the efficiency of your site management through our deep experience and the use of innovative technology.
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- **Project Services**
Our dedicated projects division specialize in delivering project services to data center clients globally.

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