

The Evolving Needs of the Modern Data Center

—
This is not your father's data center



Introduction

Data centers play a pivotal role in ensuring an organization's continuing operations and strategic growth. They serve as an organization's nerve center for data storage, processing, and distribution. However, due to a confluence of technological, environmental, and business factors, data centers are undergoing significant transformation. With the explosion of data, the ubiquity of artificial intelligence (AI), and to remain competitive, organizations are evolving IT infrastructure strategies and expanding capabilities to meet the new demands. McKinsey expects data center demand, owned and operated by businesses and co-location companies, to grow by approximately 10% a year until 2030¹.

Avoiding disruptions and downtime is more critical than ever. Data centers must ensure the availability, security, and accessibility of vital proprietary corporate data, applications, and services. At the same time, they must enable organizations to adapt and scale to meet dynamic customer demands, drive innovation, and maintain a competitive edge. Server technology, in particular, has improved significantly, enabling data centers to keep up with quickly changing organizational demands.

Accelerating Data Center Workloads

The rise of AI has brought about a transformative era

for organizations seeking to maintain and enhance their competitiveness. Predictive analytics, machine learning and generative AI enable organizations to harness the power of data for more informed decision-making, improved operational efficiency, and enhanced customer experiences. Further, the rapid adoption of generative AI and other AI technologies, is driving the need for more compute power and ultimately, more or expanded data centers. The growing complexity of newer applications and workloads, especially in areas like AI and data analytics, requires more server horsepower to efficiently process large datasets and execute complex algorithms. This is driving the demand for higher-performing servers. CBRE predicts that the growth of AI and other modern technologies is expected to drive continued strong data center demand².

For some data-intensive or AI tasks, like genomic sequencing, weather prediction, and natural language processing (NLP), standard CPUs are often insufficient to handle the workload. Enter GPUs (graphics processing unit), and DPUs (data processing unit). In an ideal world, data center infrastructure includes a portfolio of servers with a balanced and optimized combination of CPUs, GPUs, and DPUs to ensure it can deliver high performance across a wide range of workloads, from traditional database management to advanced AI and machine learning tasks. Today, most current data centers are capable of managing mixed workloads and maintaining scalability, but as the AI revolution grows they will need to address an evolving array of challenges, including more robust power and cooling solutions.



Cooling Under Pressure

Energy management and sustainability are paramount concerns as organizations seek to reduce the environmental impact, footprint and operational costs of their data center, while maintaining peak performance and reliability. Cooling accounts for up to 40% of the total energy used within a data center³ as electricity is used to both power the servers and to maintain the cooling systems for the equipment. According to the IEAE, the estimated global data center electricity consumption in 2022 was 240-340 TWh¹, or approximately 1-1.3% of global final electricity demand⁴ or about 2 percent of all global carbon emissions⁵. Considering that the chemical and petrochemical industry contributes 3.6 percent of global carbon emissions⁶, this is no small number. And, as more complex and AI-driven workloads grow, the numbers will continue to rise.

To achieve a harmonious balance between data center performance, energy efficiency, and sustainability, organizations are using advanced cooling systems, airflow management, and other methods to minimize energy consumption. Liquid cooling solutions for servers, are more efficient at dissipating heat than traditional air cooling, but updating a data center to a liquid cooling environment can be a big and costly undertaking. So, organizations are increasingly adopting less expensive servers with disruptive cold aisle chassis designs, allowing technicians to improve serviceability from both the hot and cold aisles.

Dell PowerEdge servers provide customers with a choice as to how they want to cool their servers. The servers incorporate [Smart Cooling technology](#), which leverages cutting-edge thermal and mechanical improvements to guarantee to deliver both efficient cooling and long-term system performance. PowerEdge servers include advanced air-cooling capabilities with a Smart Flow design or direct liquid cooling (DLC) configurations. This approach is crucial for high-density server configurations and energy efficiency. Servers with direct liquid cooling allow for greater computational density because the need to design space for the required airflow is eliminated. For example, Dell DLC allows customers to deploy 58% more CPU cores using

PowerEdge C6620 per rack than air-cooled C6620⁷. PowerEdge Smart Cooling technology also employs intelligent fan control algorithms to maintain optimal cooling while minimizing fan power consumption, reducing operational costs and promoting a more sustainable data center infrastructure.

Cold aisle-optimized server designs are also gaining popularity due to their role in enhancing safety and ensuring compliance with regional regulations. These designs isolate hot and cold air streams, preventing the mixing of airflows. Cold aisle containment has a significant influence on energy consumption, operational efficiencies, and overall performance in data center environments.

Versatility and Adapting to the Unpredictable

Once a monolithic fortress of servers, storage and networking, the data center has undergone a remarkable metamorphosis. It has evolved from static, rigid facilities into dynamic, flexible ecosystems that are not just responsive, but proactively addressing the needs of a quickly changing world. In the age of big data, cloud computing, AI, and the edge, data centers must provide reliable, efficient, and scalable services while remaining agile in an ever-changing environment. Servers, built with higher core count CPUs, GPUs, and DPUs, play a pivotal role in the data center's ability to be flexible. They can be flexibly provisioned and managed to quickly respond to shifting data requirements, security concerns, energy efficiency, and environmental sustainability. However, the sheer number of servers and mix of models and configurations has grown significantly, making security and uniform management more challenging.

In the era of data, security has become a greater challenge. Cyber-attacks continue to increase, and organizations face the real risk of malicious offenders. In fact, the cost of cybercrime is predicted to hit \$8 trillion in 2023 and grow to \$10.5 trillion in 2025⁸. To combat the growing cyber threats, security protocols and measures at both the data center and server have significantly evolved.

More powerful CPUs can handle demanding and compute-intensive applications, such as AI (inferencing), machine learning (ML), and big data analytics, contributing to more efficient and data-driven decision-making.

GPUs are optimized to handle large-scale data processing and complex mathematical calculations, making them instrumental in accelerating AI (training), deep learning (DL) and natural language processing (NLP) workloads.

DPUs, a newer technology, offload data processing tasks related to networking and security, so the CPU is free to focus on compute-intensive tasks.

PowerEdge servers' comprehensive security features function in harmony to ensure both cyber resilience and facilitate a zero-trust strategy. They are designed to safeguard against potential threats, identify any unusual activity, and rapidly recover in the event of a breach. Simultaneously, these features maintain a "verify before trust" stance in support of a zero-trust approach, adhering to the principle of least privilege, where access is granted only as necessary for users and devices to carry out their tasks. Through this coordinated effort, PowerEdge's security controls deliver a robust security solution that enables cyber resiliency while enforcing the principles of zero trust.

I/O, memory bandwidth, and system usage), location information, and power consumption data for carbon footprint estimates. The fully integrated extension can also organize data into reports and dashboards, helping IT staff identify energy-intensive or underutilized physical and virtual resources. The detailed information can aid IT in optimizing server loads, planning for capacity, preventing overloads, and accurately allocating power usage through a single console. Having a unified management platform provides a single interface for monitoring and configuring both hardware and firmware, thereby reducing complexity. These capabilities are instrumental in ensuring the optimal performance, security, and reliability of PowerEdge servers.

Services that Have Your Back, At All Times

With the latest innovations in GenAI, smart cooling and security, comes the need to ensure your server technology is always running optimally. According to a Forrester study⁹, 67% of respondents stated new technology deployment milestones were slipping due to competing priorities for their internal team's IT resources. Dell Technologies Services allow you to focus on your core business and meet your IT goals simultaneously by providing offerings that back you through every step of your data center journey. From consulting services to strategize your optimal data center needs for GenAI, multicloud and beyond, to 24x7 expert deployment and configuration, proactive and predictive support, security monitoring and more, our services experts ensure the maximization of your technology while saving you time and resources.

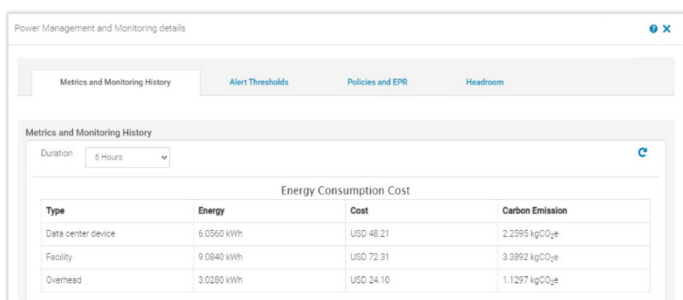


Figure 1: Carbon emissions information from the Metrics and Monitoring history tab under the Power Manager 3.0 Power Management and Monitoring header. Source: Principled Technologies

To manage the servers in the data center, Dell recommends Dell OpenManage Enterprise, which includes a comprehensive suite of tools and features designed to simplify provisioning, monitoring, and maintenance of server infrastructure. A plug-in, the Dell OpenManage Enterprise Power Manager 3.0 automatically gathers server utilization metrics (CPU,



Looking Forward

A notable transformation is occurring in the modern data center. They have evolved from static server fortresses into dynamic, flexible ecosystems. In the age of AI, big data, cloud and edge computing, data centers must provide reliable, efficient, and scalable services while adapting to an ever-changing landscape. PowerEdge servers, equipped with GPUs, DPUs, advanced cooling solutions, comprehensive security features, and streamlined management via Dell OpenManage Enterprise, provide a solid foundation for this transformation. The servers are flexible, adaptable and resilient against mounting cyber threats, paving the way for a future where data centers remain secure, sustainable, and ready to meet the modern world's evolving demands.

Learn more about [Dell PowerEdge Servers](#) and [Dell OpenManage Systems Management](#)

References

1. [Investing in the rising data center economy](#), McKinsey
2. [Global Data Center Trends](#), CBRE, 2023
3. [How to Stop Data Centres from Gobbling Up the World's Electricity](#)
4. IEAE (International Energy Agency), [Data Centres and Data Transmission Networks](#)
5. Forbes Tech Council, May 2021
6. Environmental Protection Agency
7. TBD – Dell Technologies internal testing, 2023
8. Cybersecurity Ventures, ["2022 Official Cybercrime Report"](#)
9. [Dell Services Forrester Spotlight Report 2023](#)



Learn more about
Dell PowerEdge Servers



Contact a Dell
Technologies Expert



View more resources



Join the conversation
with #PowerEdge