TSS

2024

TRENDS IN DATA CENTER TECHNOLOGY

TOTAL SITE SOLUTIONS (TSS): CAPACITY, COMPLEXITY SIMPLIFIED.

AI's evolution from an emerging trend to transformative technology is driving unprecedented growth in data center construction, capacity, and technology demands. To keep up with that growth and stay ahead of market needs, data center technology and infrastructure are rapidly evolving. Understanding the latest technology trends and how AI is reshaping virtually every sector is essential as we navigate today's needs and prepare for the future.

Introduction

In 2023, the data center technology landscape transformed more rapidly than ever before in the industry's history.

The explosive development and adoption of generative artificial intelligence (AI) and machine learning (ML) across every industry has revolutionized the data center market. Demand for infrastructure and capacity is at record levels and data center space is often reserved before the facility is completed.

According to IDC, 60 percent of businesses rate capacity as their top initiative in 2024 and expect it to remain a priority for the next two years. Sustainability and energy efficiency are close behind and advancing quickly.

This paper examines four pivotal trends, driven by AI, that are revolutionizing the data center technology landscape in 2024: The Adoption and Growth in Modular Data Centers (MDC), Security and Compliance, Energy Efficiency and Sustainability, and Continued Skills Gaps and Increase in Training.

While many trends are affecting the market, TSS believes these four will have the most significant impact in shaping the current state of data center technology. Recognizing direction and anticipating needs will assist providers in planning for future advancements and strategies.

TREND #1

Adoption and Growth in Modular Data Centers

In the fast-paced world of technology, the need for secure, efficient, scalable, rapidly deployed, and cost-effective solutions has never been greater. Enter the modular data center (MDC) – a game-changer in data storage and processing. According to Precedence Research, the global modular data center market size was valued at USD 22.4 billion in 2022 and is projected to hit around USD 112.6 billion by 2032, poised to grow at a CAGR of 17.52% between 2023 and 2032.

MDCs are an effective alternative solution to expanding existing enterprise data centers. MDCs are designed for rapid deployment, energy efficiency, and high-density computing. They are prefabricated units that can be custom engineered, quickly shipped, and assembled on-site, encompassing advanced technology like racks, cooling systems, power units, and security devices. MDCs have been quality tested and validated before shipment, ensuring reliability and the ability to use the technology more rapidly and efficiently.
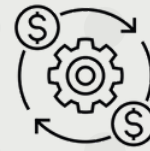
TOP 3 BENEFITS OF USING MODULAR DATA CENTERS:

① **Scalability:** Modular data centers offer greater deployment and technology adoption, scalability, and flexibility. With the rush to AI, organizations do not know their full capacity needs. MDCs allow them to move quickly to satisfy today's needs and the ability to add or adjust in the future. They can be easily reconfigured or relocated to meet changing business needs or to incorporate the latest technologies. MDC design supports customization and is conducive to experimenting with new data center configurations, cooling technologies, or energy sources. MDCs can also be deployed in various environments, from urban to remote locations.

② **Cost-Effectiveness:** Modular Data Centers often have lower upfront investment than traditional data centers. The prefabricated nature of these modules means they are manufactured in a controlled environment, reducing construction and labor costs. The efficient design of an MDC can lead to substantial savings in power and cooling expenses over time. In addition, companies can pay for space and capacity as needed or as IT equipment is received, resulting in a more effective use of capital.

③ **Rapid Deployment:** The ability to deploy an MDC quickly is a typical benefit. Traditional data centers can take months or even years to construct and become operational. In contrast, modular units can be deployed in a fraction of the time, enabling businesses to respond swiftly to market demands or operational needs.

Another advantage of MDCs is their energy-efficient design (supporting Trend #3: Energy Efficiency and Sustainability). Advanced cooling techniques, such as liquid cooling and efficient power usage, make them more environmentally friendly and appealing to organizations looking to reduce their carbon footprint and achieve sustainability goals.

Security and Compliance

Deploying robust cybersecurity and compliance technologies while partnering with knowledgeable software technology providers and physical security specialists is imperative to business in 2024.

Data centers are the custodians of vast amounts of sensitive information, making them prime targets for cyberattacks. The consequences of a breach can be catastrophic, ranging from monetary loss to irreparable damage to a company's reputation. Therefore, data centers must implement comprehensive cybersecurity measures encompassing physical security, network security, and data encryption.

The dynamic nature of cyber threats and regulatory requirements is driving companies to partner with vendors who are not only providers, but partners in the true sense. Organizations strive to find a partner that brings:

✔ **Expertise**: These vendors offer the latest cybersecurity and compliance, helping you stay ahead of the curve in tackling emerging threats and regulatory changes.

✔ **Swift and Reliable Deployment:** The right vendor ensures quick deployment of security solutions, minimizing any potential disruptions to your operations.

✔ **Flexibility and Scalability:** As cyber threats evolve, these vendors can swiftly adapt strategies and solutions, providing you with a security infrastructure that grows with your needs.

Comprehensive cybersecurity measures that cover all aspects of your data center's security are essential:

① **Physical Security Measures:** This includes safeguarding the physical infrastructure of your data center from unauthorized access or harm. Biometric access controls and surveillance systems are your first line of defense.

② **Robust Network Security:** This aspect safeguards the data traversing your networks. Utilizing firewalls and intrusion detection systems and conducting regular security assessments are crucial to protect against cyber threats.

③ **Data Encryption:** Encrypting your data, both stored and in transit, ensures that even if data is compromised, it remains secure and indecipherable.

④ **Data Isolation and Governance:** In the digital transformation era, an isolated data center environment that is disconnected from corporate and backup networks and restricted from users without proper clearance is a requirement for most enterprises. Tools like automated data copy/transfer and air gap technology create unchangeable data copies in a secure digital vault and protect data between locations. An air-gapped computer is physically segregated and incapable of connecting wirelessly or physically with other computers or network devices.

Energy Efficiency and Sustainability

Companies that embrace environmental, social and governance (ESG) initiatives are becoming more appealing to consumers, current and potential employees, and other stakeholders. A responsible focus on the environmental impact requires end users, original equipment manufacturers, and component vendors to prioritize energy efficiency and sustainability in their data center technology choices. This includes considering technologies that support advanced cooling methods (like direct liquid cooling), energy-efficient hardware, materials, and designs that reduce the overall carbon footprint.

TOP 4 BENEFITS OF ENERGY-EFFICIENT AND SUSTAINABLE DATA CENTERS:

1. **Cost Reduction:** Energy-efficient technologies significantly reduce electricity consumption, one of the most significant operational costs in data centers. Implementing solutions like energy-efficient hardware or advanced cooling methods can lead to substantial cost savings in the long term.

2. **Enhanced Corporate Responsibility and Brand Image:** Companies prioritizing sustainability in their data centers are often viewed as responsible and forward-thinking. This enhances brand image and increases customer loyalty and investor interest.

3. **Compliance and Competitive Advantage:** With increasing regulations on carbon emissions and energy usage, energy-efficient and sustainable practices ensure compliance and offer a competitive edge. Companies leading in sustainability are often ahead of regulatory curves, avoiding future compliance costs.

4. **Long-term Business Sustainability:** Sustainable practices contribute to a business's long-term viability by reducing dependency on finite resources and mitigating the risk of energy price fluctuations.

Technologies Driving Energy Efficiency and Sustainable Practices

Advanced Cooling Methods: Traditional cooling methods are often inefficient and costly. Direct liquid cooling (DLC) is a method of cooling data center equipment by circulating a liquid coolant directly over the components or through microchannels within the components, such as CPUs and GPUs. This absorbs and dissipates heat with significantly higher efficiency.

Modular Data Centers: MDCs represent an innovative offering and sustainable alternative to traditional data center infrastructure. MDCs are designed for efficient energy use, reducing the carbon footprint associated with data storage and processing. With advanced cooling technologies and the ability to leverage renewable energy sources, MDCs minimize environmental impact. Their scalability and flexibility support rapid deployment and dismantling, reducing waste and promoting resource efficiency. MDCs can also be deployed in underserved areas, enhancing digital inclusivity, and promoting social equity.

Energy-Efficient Hardware: Modern servers and storage solutions are designed to do more with less energy. Energy-efficient CPUs, SSDs, and other components reduce power consumption and generate less heat, further reducing cooling needs.

Sustainable Design and Materials: Data center designs focusing on natural cooling, renewable energy sources, and efficient layouts reduce energy consumption and carbon footprint. Developers and providers are incorporating sustainable materials across the design, build, and maintenance of data centers to support these initiatives. The integration of green spaces and the use of environmentally friendly materials also contribute to sustainability.

TREND #4

Continued Skills Gap and Increase in Training

A workforce skills gap poses a formidable challenge to organizations striving to keep pace with advancements. Traditional skill sets are being challenged by the progress made in Artificial Intelligence (AI), hyperscale solutions, modular data centers, and the integration of green technologies, creating an urgent demand for professionals with new and different skill sets. To meet this demand, collaboration between industry leaders, educational institutions, technical institutions, and government entities is essential to developing curricula that address the specific needs of the data center sector.

The trends we addressed earlier in this paper, driven by the need to harness the power of AI, require a concerted effort to elevate the workforce's skills. We expect to see the industry invest more in professional development and training to close the skills gap and to secure the future of data centers worldwide.

There are three areas where the need is particularly acute:

① **Specialized Knowledge for AI and Hyperscale Solutions:** The specialized knowledge required to design, manage, and optimize AI systems is in short supply. Professionals skilled in AI algorithms, machine learning models, and the architecture of hyperscale environments are increasingly sought after, highlighting a critical need for targeted training programs.

② **Adapting Skills to Modular Technologies:** The benefits of MDCs require a unique set of skills for assembly, integration, management, and maintenance. Their more mobile nature means deploying and maintaining the MDC in environments much different than the traditional data center facility. The modular approach demands professionals who are not only versed in the technical specifications of data center components but also adept at adapting to the rapid changes and innovations in the field. Innovative power and cooling technologies require new knowledge, regular training and, in some cases, professional certifications.

③ **Energy and the Environment:** The data center sector is focused on energy efficiency and environmental impact. Professionals now consider the broader implications of their energy consumption and carbon footprint. This necessitates a new breed of data center professionals proficient in green technologies, energy management solutions, and sustainable practices.

Conclusion

Data centers and the infrastructure technologies that enable them were critical to our daily lives, even before the explosion of AI and machine learning. The impact of these technologies across every industry has revolutionized the data center market and, as such, these technological trends and their impact cannot be understated.

Historically, a company's technology leader was responsible for ensuring that the capacity and technology supported the needs of the enterprise. However, lately, the CEO, CFO, and other C-suite executives have been involved in infrastructure modernization, expansion strategies and decision-making. Many new companies are increasingly engaged in this business. Because of the sensitive nature of data, there is also more regulatory and compliance scrutiny than in the past. Sharing these trends within your enterprise can improve mutual understanding and aid in making the best decision for your needs. They also require that OEMs and end-user enterprises team up with technology integration partners that can build, test, deploy, and maintain their high-performance computing infrastructure to efficiently utilize the technology they need to thrive in our modern world.

About Total Site Solutions (TSS)

TSS specializes in simplifying the complex. The TSS mission is to streamline the integration and deployment of high-performance computing infrastructure and software, ensuring that end users quickly receive and efficiently utilize the technology they need. Known for flexibility, the company builds, integrates, and deploys custom, high-volume solutions that empower data centers and catalyze the digital transformation essential for the modern Internet. TSS provides advanced integration services enabling complex generative AI solutions in our Integration Facility in Round Rock, Texas or on site in a customer location. TSS's reputation is built on passion and experience; as trusted partners of the world's leading data center technology providers, the company manages and deploys billions of dollars in technology each year.

Speed and quality define TSS' service. The company is committed to rapidly delivering technology to clients, significantly accelerating their time-to-value. TSS is dedicated to **simplifying** the **complex** and providing the **capacity** and flexibility original equipment manufacturers and end users need. Capacity, complexity, simplified.

TSS offers a comprehensive suite of Data Center Services:

- *Modular Data Center/Edge integration, deployment & maintenance.*
- *Rack integration and deployment, including direct liquid cooling, and high-performance computing (onsite/remote).*
- *Data Center Moves.*
- *Structured Cabling.*
- *Facility and Site Surveys Assessments.*
- *Cybersecurity Solutions.*
- *IT Procurement Integration Services – client, server, software.*

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