

Micro Modules for Supercomputing Center Computer Rooms



Overview

Micro-Module Data Centers: Architecture, Advantages, and. Driven by the "dual carbon" policy and digital transformation, the advantages of micro-module.

Key Takeaways

Micro and modular supercomputing modules provide scalable, energy-efficient, and rapidly deployable solutions for high-performance computing centers.

Overview of Micro Modular Supercomputing

Micro modules are prefabricated, self-contained units designed to house compute, storage, power, and cooling infrastructure for supercomputing centers. They allow HPC facilities to expand capacity incrementally, optimize energy usage, and reduce construction timelines compared to traditional data centers. These modules can range from single-rack units to multi-rack systems, supporting both small-scale and large-scale deployments.

Key Features

1. **Scalability and Flexibility** Micro modules enable incremental expansion of computing resources without overbuilding, allowing centers to add new modules as demand grows. NASA's modular supercomputing approach demonstrates this, with modules added over time to increase peta-scale computing power while minimizing disruption.



2. Integrated Cooling and Power Modern micro modules incorporate advanced cooling systems, including liquid-to-air sidecars, in-row cooling distribution units (CDUs), and rear door heat exchangers, which remove heat at the source and reduce overall energy consumption. Power delivery is integrated with battery backup units and high-density power shelves, ensuring resilience for mission-critical workloads.

3. Prefabrication and Rapid Deployment Modules are prefabricated off-site, allowing for faster construction and deployment. This reduces upfront capital expenditure and accelerates time-to-operation.

Pre-installed components, such as hose kits and cabling, enable plug-and-play integration into existing facilities. 4. Heterogeneous Compute Support Modular supercomputing architectures, like the DEEP project's Modular Supercomputing Architecture (MSA), support heterogeneous HPC systems, integrating different compute modules optimized for specific workloads, including AI, simulation, and data-intensive tasks.

This allows applications to run on the most suitable hardware, improving time-to-solution and energy efficiency. 5. Energy Efficiency and Sustainability Micro modules often leverage environmentally conscious cooling strategies, such as outdoor air and adiabatic water cooling, which can reduce energy consumption by over 90% compared to traditional computer floors.

Optimized designs also support green IT initiatives and lower operational costs.

Applications

Micro modular supercomputing modules are suitable for: National research centers and supercomputing facilities (e.g., NASA Ames Research Center) Enterprise AI and HPC workloads Edge computing and remote deployments for telecom, healthcare, and IoT Educational and government institutions requiring scalable compute resources.

Conclusion

Micro modules for supercomputing center computer rooms provide a flexible, energy-efficient, and scalable approach to deploying high-performance computing infrastructure. By integrating compute, storage, power, and cooling into prefabricated units, these solutions enable rapid deployment, incremental expansion, and optimized operational efficiency, making them ideal for modern HPC and AI workloads.

Article Content

Micro-Module Data Centers: Architecture, Advantages, and ...

Driven by the "dual carbon" policy and digital transformation, the advantages of micro-module data centers such as high efficiency, energy saving, and flexible expansion have made them

FitDC Modular Data Center

The modular architecture can be easily assembled on-site to complete business delivery, which can save 50% of the delivery time and personnel investment compared to the traditional construction

Data Center Building Block Solutions®

Supermicro DCBBS includes all critical computing, power, cooling infrastructure, software, and services. The modularized building block solution architecture—from system, to rack, to data center—reduces

Technical functional characteristics of micro-module computer rooms ...

Integrating the cabinet system, refrigeration, power supply and distribution, centralized monitoring and other systems into one, with a fully redundant design, it ensures the safe and reliable

What is a micro-module computer room

A Micro Module refers to an independent operating unit that takes several functional cabinets such as IT cabinets, power supply units, and air conditioning terminal units as the basic unit, and includes

Prefabricated Data Center Modules

Scalable prefabricated IT infrastructure comprised of factory built IT modules ganged together on site, with minimal construction, to form a large, functional IT room.

Micro Data Center

Delta's modular datacenter solution offers a datacenter environment that provides safe equipment operations within the racks, and supports the development and

OCP Solutions for the Modern Data Center | Supermicro

With extended support of open standards, including OpenBMC for version control, AIOM modules that support the OCP3.0 SFF standard, and power-optimized design, data center operators

Micro and Modular Data Center Construction

From single rack to multiple data modules, we can design and deploy a wide range of prefabricated data center modules tailored to specific needs, ensuring scalability,

Electra: A Modular-Based Expansion of NASA's Supercomputing

In the remainder of this chapter, we detail how modular data center technology can be used to expand an existing compute resource. We begin by describing NASA's requirements for supercomputing and

Modular Supercomputing

Modular Supercomputing S The NASA Advanced Supercomputing Division's innovative modular approach to expand NASA's high-end critical computing capabilities reflects the agency's continued

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SAN JOSE, Calif. and ST. LOUIS, Nov. 17, 2025 /PRNewswire/ -- Supercomputing Conference --Super Micro Computer, Inc. (SMCI), a Total IT Solution Provider for AI/ML, HPC,

Expanding a Supercomputer Facility Using Modular Data Center

The facility, a ~1000 square-foot module on a concrete pad with room for 16-18 compute racks, was completed in fall 2016 and an SGI computer system, named Electra, was deployed there in early

Super Micro Computer, Inc.

Supermicro at Supercomputing Conference 2024 Supermicro will showcase a full AI and HPC infrastructure solutions portfolio at the Supercomputing Conference, including our liquid-cooled

Super Micro Computer, Inc.

Easy-to-design, easy-to-build, easy-to-deploy, and easy-to-operate solution for all critical computing and cooling infrastructure Quick time-to-deployment and quick time-to-online with

High Performance Computing (HPC) Server Solutions

HPC server solutions for solving the most complex real-world problems, with plug-and-play deployment to maximize performance, scalability, and efficiency

Supermicro Showcases Largest Portfolio of HPC-Optimized Multi

Supermicro will showcase a full AI and HPC infrastructure solutions portfolio at the Supercomputing Conference, including our liquid-cooled GPU servers for AI SuperClusters.

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