

Network Rack Functional Architecture



Overview

Data Center Server Rack Guide (2026): Types, Design, This guide provides a deep engineering overview of rack architecture, cooling integration, power redun.

Key Takeaways

Network rack architecture organizes and interconnects compute, storage, and networking resources within racks to optimize performance, scalability, and manageability in modern data centers.

Traditional Networking Racks

A networking rack is a metal frame designed to house rack-mountable devices such as routers, switches, patch panels, and UPS units, providing a structured and secure environment for network equipment. Standard racks are typically 19 inches wide, with heights ranging from 48 to 83 inches, and vertical spacing measured in rack units (U), where 1U equals 1.75 inches.

Accessories like cable organizers, sliding shelves, and vented panels enhance functionality, improve airflow, and simplify maintenance.

Rack-

Scale Architectures (RSAs) Modern data centers increasingly adopt rack-scale architectures, which integrate compute, storage, and networking into cohesive units called rack nodes or pods. Each pod contains application storage, compute resources, and top-of-rack (ToR) networking, often connected via high-speed fabrics such as 25-400 GbE. This design reduces latency by keeping most application traffic within the pod and allows pods to scale out efficiently across rows using leaf/spine networks.

Disaggregated and Composable Racks

Disaggregated racks separate compute, storage, memory, and networking into independent modules that can be dynamically composed into logical systems based on workload requirements. Intel® Rack Scale Design (RSD) exemplifies this approach, enabling software-defined composition of resources, flexible management, and efficient utilization of hardware. Each module typically has dual network connections: a high-bandwidth data link and a management link, often connected to ToR switches and orchestrated via open APIs like Redfish.

Power-

Efficient Intra-

Rack Networking High-density disaggregated racks require efficient intra-rack networks. Solutions like Shoal use fast circuit switches to interconnect numerous resource nodes with minimal power consumption and nanosecond reconfiguration. This approach eliminates in-network contention, provides bounded throughput, and achieves high performance while reducing energy usage compared to traditional server-centric architectures.

Network Topology Considerations

Two common network designs in racks are: Top-of-Rack (ToR): Switches are installed at the top of each rack, connecting directly to servers within the same rack. This simplifies maintenance, isolates faults, and reduces cable clutter.

End-of-

Row (EoR): Aggregation switches are placed at the end of each row, connecting all servers in the row. This reduces switch costs but requires extensive cabling and can impact multiple racks if a switch fails.

Summary

Network rack architecture has evolved from traditional 19-inch racks housing fixed servers and switches to dynamic, disaggregated, and composable designs that optimize resource utilization, reduce latency, and improve scalability. Modern approaches leverage high-speed fabrics, software-defined orchestration, and power-efficient intra-rack networking to meet the demands of hyperscale and enterprise data centers.

Article Content

Data Center Server Rack Guide (2026): Types, Design,

This guide provides a deep engineering overview of rack architecture, cooling integration, power redundancy, cable routing, and real-world

Networking Rack Guide: Organizing Your Devices

The primary function of a network rack is to provide a centralized and structured space to mount and organize critical network infrastructure components. These components can include

Intel® Rack Scale Design Architecture White Paper

This paper describes the Intel® Rack Scale Design (Intel® RSD) hyperscale reference architecture, an open, interoperable approach to composable disaggregated infrastructure (CDI), the technology on

The Complete Guide to Server Racks: Functions,

Server racks are more than IT equipment “containers”—they are the backbone of high-density, reliable, and sustainable data centers. By combining

Shoal: A Network Architecture for Disaggregated Racks

Shoal is a network architecture for disaggregated racks. It comprises a network stack at the rack nodes which is tightly coupled with a circuit-switched physical fabric.

Rack Scale Architecture

Rack Scale Architecture refers to a technology where data center administrators can purchase preconfigured and tested racks from vendors, eliminating the need to individually set up servers,

Racks | NetBox Documentation

The rack model represents a physical two- or four-post equipment rack in which devices can be installed. Each rack must be assigned to a site, and may optionally be assigned to a location

Open All-Photonic Network Functional Architecture

To meet these next-generation requirements, the IOWN GF aims to establish an end-to-end architecture for computing and networking that can support various data flows and workloads, as

What Is a Network Rack? Types, Depth & When You Need One

This article breaks down the types of network racks, how depth and unit size work, the differences between network and server racks, and how to determine which setup fits your facility.

NVIDIA GB300 NVL72 AI Supercomputer Rack | Rack

Frequently Asked Questions What is the NVIDIA GB300 NVL72 and what's included in a rack? + The GB300 NVL72 is a liquid-cooled, rack-scale AI

Rack Diagram: Definition, Uses, Examples, and How to Draw One

Choose a logical rack diagram when you need to show system relationships, network paths, or functional connections. Choose a physical rack diagram when exact device placement,

Data Center Network Architecture

Data center network architectures are complex, so we've created this overview to explain essential data center components and networks.

How to Ensure Network Efficiency With Rack and

Proper rack and cabling organization not only improves the aesthetics of your server room, but also enhances performance, simplifies

The Role of Rack Systems in Modern Network

Key Takeaways Rack systems are foundational in housing, organizing, and securing network equipment. Proper rack design impacts cooling, scalability, security, and

The Complete Guide to Server Racks: Functions,

Server racks feature precision-engineered airflow management via ventilation holes, built-in fans, or integration with data center cooling systems,

What Is a Network Rack? Types, Depth & When You Need One

Learn what is a network rack, how to choose the right depth, and how to organize your IT hardware for better airflow, security, and scalability.

Inside the AI Rack: Power, Fabric, and Fiber %

Optical connections are expected to become necessary for higher-bandwidth, multi-rack scale-up fabrics, bringing fiber inside the rack. The scale-out network between racks is (and will

Network Architecture: Types, Components, and How Modern ...

Network architecture defines how devices, protocols, and services connect across your infrastructure. Learn about architecture types, the OSI model, and how hybrid cloud and SD-WAN

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