Network Data Center Interconnection Solutions



Overview

Data center interconnect refers to the solutions and technologies that link multiple data centers, enabling them to function as a cohesive network.

Key Takeaways

Data Center Interconnect (DCI) networks provide high-speed, secure, and reliable connectivity between multiple data centers, enabling them to operate as a unified infrastructure.

Overview

Data Center Interconnect (DCI) refers to dedicated network connections that link two or more data centers, allowing them to share resources, replicate data, and support distributed applications across geographic locations. Unlike internet-based connections, DCI uses private circuits such as dark fiber, wavelength services, Ethernet circuits, or MPLS networks, providing predictable latency, guaranteed bandwidth, and enhanced security. This is critical for disaster recovery, live workload migration, centralized backups, and multi-site application deployments.

Key Functional ComponentsLAN Extension: Extends a Layer 2 domain across multiple data centers, supporting legacy applications and virtual machine mobility. Technologies like Overlay Transport Virtualization (OTV) allow Layer 2 connectivity while maintaining fault isolation and resiliency. Layer 3 Extension: Provides routed connectivity for segmentation, virtualization, and file server backups.

This often involves Layer 3 VPNs and requires careful bandwidth and QoS planning.

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N Extension: Extends storage networks over long distances, addressing latency and distance challenges, particularly for Fibre Channel traffic. Path Optimization: Ensures efficient routing between client devices and servers across stretched VLANs, optimizing server-to-server communication in multi-tier applications. TopologiesPoint-to-Point: Direct connection between two data centers, offering low latency and high bandwidth.

Hub-and-

Spoke: Remote sites connect to a central hub, reducing the number of circuits but adding an extra hop for traffic. Full Mesh: Every site connects directly to every other site, providing optimal performance but higher circuit costs. Hybrid: Combines direct and hub-and-spoke connections to balance performance and cost.

Technologies

Modern DC

I networks rely heavily on optical fiber communication and packet-optical transport. Key technologies include: Dense Wavelength Division Multiplexing (DWDM): Transmits multiple data channels over a single fiber using different wavelengths, supporting 400 Gbit/s and beyond per wavelength. Coherent Optical Transmission: Enhances signal integrity over long distances, enabling ultra-long-haul interconnects.

Subsea and Terrestrial Fiber: Connects data centers across continents, supporting global cloud and AI workloads. Emerging Technologies: Silicon photonics and co-packaged optics improve performance, energy efficiency, and scalability.

Performance Considerations

Latency: Critical for database replication and real-time applications. Direct fiber routes and private interconnections minimize delays. Bandwidth: High-capacity links are essential for large-scale data transfers and distributed AI workloads.

Security: Private circuits reduce exposure to internet-based attacks and simplify encryption management. Reliability: Redundant paths and resilient topologies ensure continuous operation during failures.

Modern Trends

Hyperscale cloud providers like Google, Amazon, and Microsoft increasingly build their own DCI infrastructure, including terrestrial and submarine fiber networks, to achieve lower latency, higher reliability, and greater control over data traffic. The growth of AI, cloud computing, and global data traffic drives the adoption of high-capacity optical technologies, with research focusing on 1. 6T systems and beyond.

DC

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I is now a critical component for active workload balancing, resource sharing, and real-time application support across multiple data centers.

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Data Center Interconnect Solutions | Hyperscale and ...

Data center interconnect refers to the solutions and technologies that link multiple data centers, enabling them to function as a cohesive network. This capability is essential for supporting cloud computing,

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