Metro Data Center Interconnect Solution

The Cisco Metro Data Center Interconnect (Cisco Metro DCI or Cisco DCI) solution is optimized for high density with a small footprint and is deployed with a single operating system across the routing and optical layer. Delivered with a unified management system, the solution lets you do more with less.

Cisco Metro DCI benefits

- High-capacity transport with data-center-friendly power, rack, and cooling.
- Common network operating system across all platforms with IOS XR.
- Built with automation, orchestration, and flexibility in mind to increase operational efficiencies.
- Support for resiliency designs for multiple topology deployments.

What if you could reduce your routing and optical footprint while adding more capacity to expand bandwidth while simultaneously reducing costs? What if you had more visibility into your network and more control over how you wanted it to run at both the optical and routing layer? With the Cisco Metro DCI solution, you can do all that and much more.
Network traffic keeps growing

It seems there’s no limit to the growth of network traffic. Per month, IP traffic is set to reach 278 exabytes and Internet traffic 235.7 exabytes by 2021. The average Internet user will generate 57.0 gigabytes of Internet traffic per month in 2021. This amount is up 139 percent from 23.9 gigabytes in 2016. By 2021, average broadband speeds will be 53 Mbps.¹

Within data centers, global IP traffic is expected to grow at a compound annual growth rate (CAGR) of 27 percent between 2015 and 2020. This growth will be driven by several factors: the increasing amount of machine-to-machine (M2M) traffic, the demand for higher bandwidth for cloud services, and increases in digitization, mobility, and the Internet of Things. Cloud traffic will nearly quadruple during the forecast period; it’s projected to represent 92 percent of data center traffic by 2020. Data center-to-data center IP traffic will grow at a CAGR of 31.9 percent to 1,381 exabytes annually.²

It’s clear that this growth in network traffic will affect all data centers globally. The challenge for large businesses and service providers will be to deploy infrastructure and solutions that maintain a high-quality experience for employees and customers at the lowest possible cost. This task will require automation tools for provisioning and network management, telemetry data collection and analysis, and flexibility in the control and use of existing transport resources. It also will require network intelligence that provides actionable data to enable proactive resource scaling instead of reacting too late to traffic growth or network events.

Cisco DCI solutions are designed to simplify, automate, and optimize multiple types of data center interconnection (DCI) deployments. They are used to interconnect intradata center campus locations, an enterprise to a data center, to interconnect metropolitan or long-haul data centers both local and globally. The Cisco DCI solution uses routers built with a single operating system, IOS XR, for the IP and optical portions of the network. Using a common operating system offers several compelling benefits for combined DCI solutions.

Addressing growing demands and costs

The consumption of traffic has increased the pressure on in data centers. Configuration of gear and manual turn-up of optical wavelengths and services is too cumbersome given the speed of today’s operations. Automation and centralized service orchestration are better ways of provisioning, deploying, and managing DCI solutions. With an automated services environment, deployment timeframes drop from days to hours, and change requests can drop from hours to minutes. For service providers, these time savings translate into operational savings and efficiency improvements, so your teams can focus on more productive and helpful networking tools.

Additional data center operator concerns are:

- Data center footprint costs for rack, power, and cooling.
- Packet flow level visibility for monitoring operational status and health.
- Efficient use of available bandwidth.
- Ability to quickly scale the DCI infrastructure with demand.

Service providers need leaner infrastructure components. Hardware must have high-density capabilities in a smaller, more efficient package. However, the smaller package can’t sacrifice processor power or memory because those elements will be needed to support the automation tools required to operate at today’s need for agility.

The Cisco DCI solution is built to pack a powerful punch in a small 1 rack unit (RU) or 2-RU package. DCI uses IP advances such as segment routing to reduce your routing table size and provide scalability to the network. Also, optical advances such as Flexible Light Orchestration of Wavelengths let you pack more capacity into an individual fiber and balance the tradeoffs between capacity and distance.
For DCI, you need clear visibility into all of the packet flows, optical ports, and Dense Wavelength Division Multiplexing (DWDM) trunks. Automation can help you correlate alarms to understand what actions are required. The Cisco automation environment along with real-time telemetry provides end-to-end visibility for more control and better management of services.

**Cisco Metro DCI solution overview**

The Cisco Metro DCI solution is meant to interconnect metro data centers located between 2 and up to 100 kilometers apart. Two common topologies that are deployed are optical meshed and point-to-point. As shown in Figure 1, the Cisco DCI can fit into both topologies.

In Figure 1, multiple enterprise customers may be connected to a large colocation site in a metropolitan area. The colocation providers within a metro may sell space and power to other service providers or to over-the-top (OTT) providers or allow the location to be used as an Internet Exchange (IX) and peering point. These providers may locate large portions of their data centers into these colocation sites. They will want to interconnect their data centers at the optical and the routing layers.

The Cisco Metro DCI solution provides optical mesh topology interconnection with high reliability and resiliency at a low cost. The network architecture includes several Cisco products.

**Cisco NCS 5500**

The Cisco Network Convergence System (NCS) 5500 series routers provide Layers 2-3 switching in addition to high capacity routing. The NCS 5500 is a low-power, high-density router that offers flexible chassis options. It runs IOS XR software that includes segment routing and enhanced scalability with options that include external ternary content-addressable memory (TCAM).

**Cisco NCS 1004**

Designed for ultra-high capacity applications, the Cisco NCS 1004 at 2 RU supports up to 4.8 Tbps of both client and 4.8 Tbps of trunk traffic. It can transport 100G to 600G in 50G increments through software provisioning. Using a software-configurable modulation scheme per slice, you can customize the spectral efficiency and reach characteristics of individual wavelengths. The NCS 1004 provides AES256-based MACSec encryption.
Cisco NCS1001
Cisco NCS 1001 is a dense wavelength-division multiplexing (DWDM) line system that is mechanically optimized for data center environments. Its performance optimized for maximum capacity and provides complete automation of installation and configuration with real-time and fine-grained monitoring. The Cisco NCS 1001 is a 1-RU system that is capable of supporting up to three pluggable modules. The modules can be amplifiers or protection switch modules.

Cisco NCS 2000
The Cisco NCS 2000 series delivers agility, programmability, and massive scale across ultra-long-haul, metro, and enterprise optical networks. It has a touchless, flex-spectrum reconfigurable optical add-drop multiplexer (ROADM) and offers massive scale with 100-Gbps and 200-Gbps transponding and muxponding.

Point-to-point architecture considerations
Metro data centers have a higher potential for fiber cuts, so the added resiliency of a meshed optical network using ROADMs alleviates the need to create expensive diverse routes. Point-to-point architectures were often the topology chosen by OTT and web providers, but they too are now deploying mesh networking in the metro.

The metro DCI point-to-point topology has a single point-to-point high-speed optical connection from one data center to another. This topology has been popular among cloud providers and web-based companies because of its operational simplicity, cost, and its ability to maximize the bandwidth capacity used between two links. The point-to-point architecture is generally selected by companies that don’t need or want protection and restoration at the optical layer. One way to add resiliency without migrating to a full mesh topology is to have the NCS 1001 bonded to the NCS 1004 for protection and restoration for higher loss spans or spans that extend slightly beyond 100 km. This point-to-point network architecture includes all the same benefits and features of the NCS 1001 and NCS 1004.

Key features and technologies of the Cisco DCI solution
The Cisco routing platforms used to build a Cisco DCI solution can run on a single operating system: Cisco IOS XR. The software is packed with features that represent more than 15 years of global development and deployment. Cisco IOS XR is modular so that major features are available as independent packages. This modular design means that providers and data center operators can load only the features they need. Using an industry-standard Route Processor Module Package Manager (RPM-PM), the operator can align updates and upgrade procedures with those used in the data center, which improves the consistency of the updates across the infrastructure.

Key benefits of the IOS XR software include:

- Zero-touch provisioning and iPXE to automate device onboarding:
  - Boot and day-zero provisioning are fast and bring devices online in minutes instead of hours.
  - The iPXE feature allows an administrator to boot from TFTP, HTTP, or FTP.

- YANG data models for automated provisioning:
  - Integration with model-driven, high-performance APIs so you can move beyond the command line interface (CLI).
  - YANG-based configuration and operational data models (native, OpenConfig, IETF) let you control the rich feature set of the operating system.
  - Encoding is decoupled from the model, so you can deploy with JSON, XML, or Google protocol buffers (GPB) format.
  - Transport is decoupled for further flexibility, so you can use NETCONF, RESTCONF, or Google RPC (gRPC).
  - Developers auto-generate model-driven APIs from any YANG model for Python and C++ using the included YANG Development Kit (YDK) within IOS XR.
Solution overview
Cisco public

- Model-driven telemetry improves network monitoring:
  - Data is streamed and captured continuously from devices with efficient, incremental updates.
  - Ability to specify what data to stream, where to capture it, and the frequency of the stream and its encoding.
  - Provides fine-grained control at scale of your network allowing for near real-time network optimization.

Other technologies that can be used with the Cisco DCI solution include:

- Flex Spectrum:
  - Supports a new flexible control plane for the NCS optical platforms and provides more capacity and spectral efficiency per fiber.
  - Targeted for use in both point-to-point and mesh topologies.
  - Allows for a higher modulation to boost capacity by up to 30–50 percent.
  - Automatically adjust bandwidth to take advantage of the physical tradeoffs that exist.

- Cisco Evolved Programmable Network Manager (EPNM):
  - Provides simplified, converged, end-to-end lifecycle management for carrier-grade networks of all sizes.
  - Increases operational scale and efficiency through integrated and automated device operations, network provisioning, and network assurance.
  - Proactively assure service performance and minimize future service disruption through real-time fault management.
  - Service agility is increased through integrated lifecycle management and standards-based northbound interfaces (NBIs) to third-party operations support systems (OSSs).

- Cisco WAN Automation Engine (WAE):
  - Flexible optimization platform that automates the engineering and operations of multivendor physical and virtual WAN infrastructures.
  - Use WAE to deploy new services, including global load balancing, bandwidth on demand, and latency-based network routing.
  - Optimize traffic load-balance over core MPLS and segment routing links.
  - Minimize service downtime through worst-case failure analysis and reduce both OPEX and CAPEX costs through efficient asset utilization.

- Cisco Network Services Orchestrator (NSO):
  - Deliver services faster and more easily through network automation.
  - Accelerate revenue-generating services with automated, self-service, on-demand provisioning that reduces activation times from months to minutes.

Diverse DCI solutions

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<th>Enterprise Intra DCI</th>
<th>Long Haul DCI</th>
<th>Enterprise</th>
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<tr>
<td>Metropolitan and regional links.</td>
<td>Within a campus of data centers.</td>
<td>National and global long-distance link, including submarine.</td>
<td>Enterprise connection to colocation center, Internet Exchange and peering point, and disaster recovery.</td>
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<td>Distance: 10s to 100s of km.</td>
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<td>Cisco DCI supports both mesh and point-to-point topologies.</td>
<td>Cisco DCI with a point-to-point optical topology.</td>
<td>Cisco DCI supports both mesh and point-to-point long-haul topologies.</td>
<td>Cisco DCI supports both point-to-point routing and optical topologies.</td>
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Cisco Services

Cisco Services has decades of professional services experience helping enterprise businesses, content providers, service providers and others plan, build, and manage network migration projects.

Cisco DCI solutions can be slightly different from customer to customer. We have the flexibility to understand and help you achieve your specific goals. Cisco Services delivers innovative solutions, unmatched expertise, and smart service capabilities using a collaborative partner approach. Learn more.

Financing to help you achieve your objectives

Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there’s just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

Why Cisco?

As a global networking innovator, Cisco understands the needs of network operators and businesses that need to harness the latest cost benefits and features of the network to survive and thrive. Our DCI solutions span a broad range of platforms, technologies, and topology with options that are designed to provide you with the right solution to address your specific needs.

Our customers are pursuing DCI solutions to enhance workload mobility and to provide business continuity and disaster recovery. Simplified, efficient, automated, and lower-cost ways of interconnecting data centers are here. Trust Cisco to be at the forefront of their development and look to us as a valuable partner within the data center and beyond.

Next Steps

Learn more about Cisco solutions for Metro DCI. Contact your Cisco account representative today.

Cisco NCS 5500
Cisco NCS 2000
Cisco NCS 1001
Cisco NCS 1004