Scale, Simplify, and Optimize Data Center Connections Across Your Network

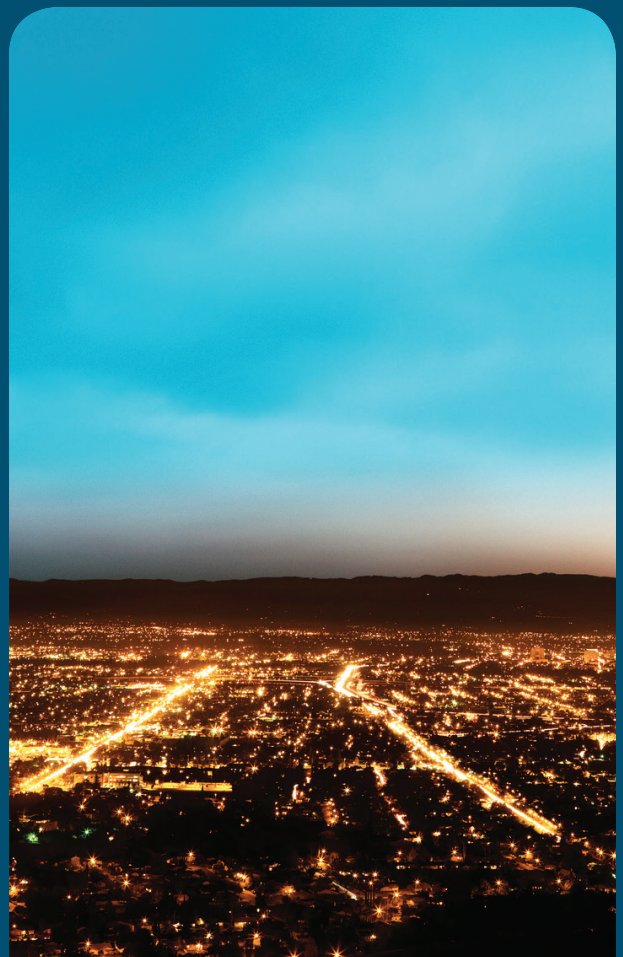
What if you could reduce your routing and optical footprint while adding more capacity to expand bandwidth and simultaneously lower your costs? What if you had more visibility into your network, more control over how you wanted it to run, and greater agility to support new services?

Overview

It seems there's no limit to the growth of network traffic. Digitization is driving IP traffic within data centers at a Compound Annual Growth Rate (CAGR) of 23.4 percent between 2016 and 2021 to 14.7 Zettabytes annually. In turn, this drives data center to data center IP traffic growth at a CAGR of 32.7 percent during that time to 2.8 Zettabytes annually.[1]

For large organizations operating high-performance networks, this growth in traffic is impacting your networking between data centers. You face challenges to deploy solutions that maintain a high-quality experience for employees and customers at the lowest possible cost. You need data center interconnect solutions that promote greater density among existing transport resources and a long-term vision that embraces a high degree of automation, intelligence, and flexibility in resource sharing.

Cisco® Data Center Interconnect (DCI) solutions facilitate various enterprise data center interconnect requirements. They are designed to help you simplify, automate, and optimize different types of data center connections, including intra-data center campus connections, enterprise data centers and disaster recovery connections, as well as connecting to colocation sites, for routing to content providers and carriers across metro and long-haul networks. (See Figures 1 and 2.)



Benefits

- Accelerate your response to increasingly dynamic service environments with flexible network scaling.
- Reduce the price per bit with industry-leading capacity and density, lowering your infrastructure CapEx as well as your data center power and cooling requirements.
- Lower your OpEx with simplified and automated operations that reduce the time for deployment and change requests from days to minutes.
- Simplify your network operations with IP advances in segment routing.
- Gain better control of your network services with end-to-end visibility and real-time telemetry across your network topology, allowing you to correlate alarms and respond faster.

Figure 1. Data Center Interconnect for enterprise disaster recovery

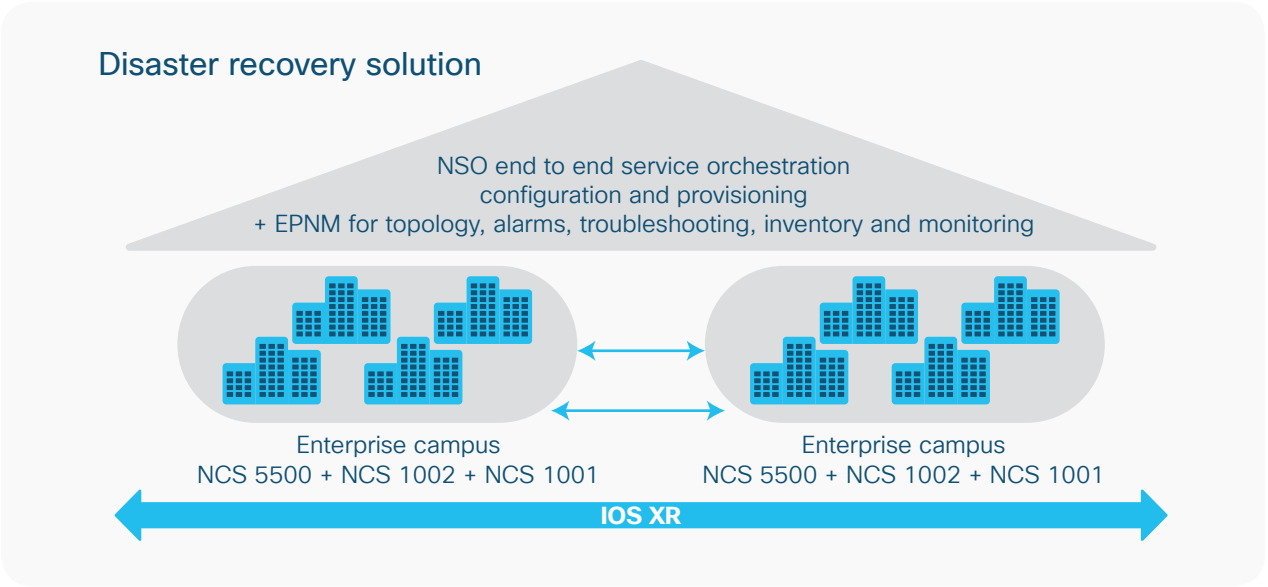
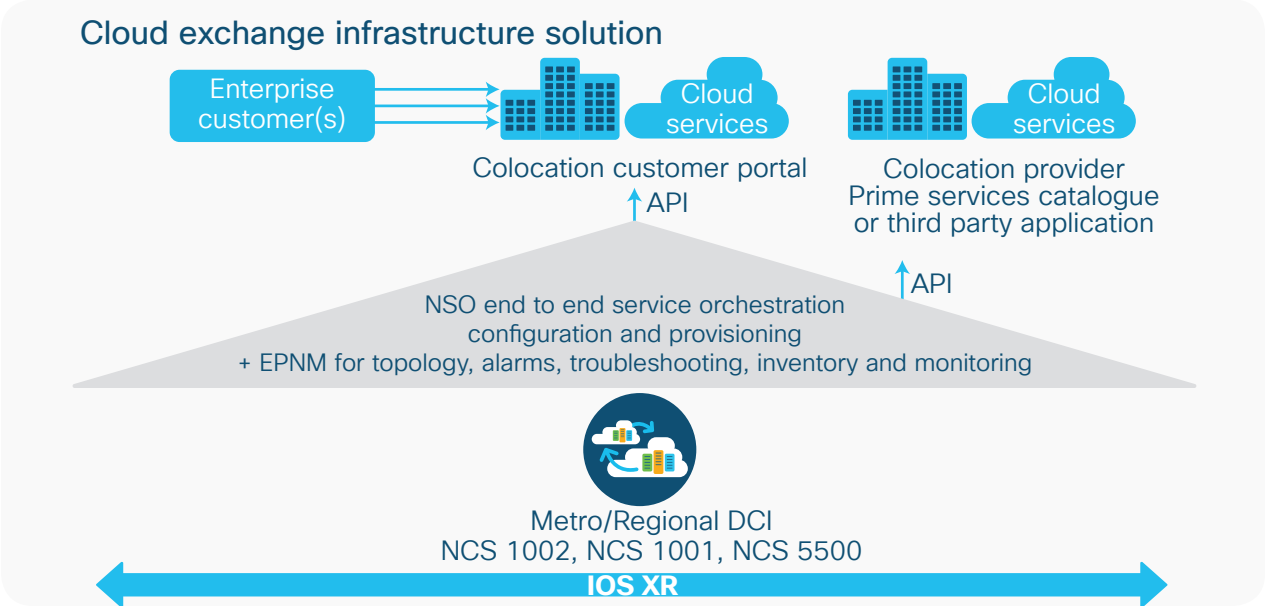


Figure 2. Data Center Interconnect for access to cloud infrastructure



Increasing demands of high-performance critical infrastructure

As more data traffic flows between data centers, you need solutions that allow you to quickly deploy and manage optical and routing infrastructure so you can deliver high-quality experiences for employees and customers, at the lowest possible cost. As a result, you need:

- High density so you can reduce your network transport footprint to accommodate increasing network traffic.
- Automation so you can provision, deploy, and manage your infrastructure more rapidly and simply.
- Programmability to simplify network management.
- Flexibility to allow the same infrastructure to more easily accommodate various services and traffic.
- Visibility and control across your network topology so you can quickly identify and resolve issues.

How it works

The Cisco Data Center Interconnect solution is optimized for high density with a small footprint, is deployed with a single operating system across both routing and optical layers, and is delivered with a unified management system.

Network architecture:

- **Cisco NCS 1000 Network Convergence System** (NCS) series is a Dense Wavelength-Division Multiplexing (DWDM) line system that is mechanically optimized for data center environments and are designed for interconnecting data centers. The NCS 1000 increases network capacity, control, and visibility while simplifying and automating customer's operations.
  - **Cisco NCS 1004** uses state of the art silicon along with automation and real-time visibility to deliver a universal transponder solution that provides best-in-class performance for metro, long-haul and submarine applications while being simple to deploy and manage. At 2RU, the Cisco NCS 1004 maximizes capacity at minimum spaces and power footprint, supporting up to 4.8Tbps of client and 4.8Tbps of trunk traffic with four modular line card slots.
  - **Cisco NCS 1002** has an optimized 2-Rack-Unit (RU) footprint that supports up to 2 Tbps of both client and trunk traffic. It can transport 100-, 200-, or 250-Gbps wavelengths on the same platform. The NCS 1002 features a software-configurable modulation scheme per slice, allowing you to customize the spectral efficiency and reach characteristics of individual wavelengths. The system uses Cisco IOS XR Software. The NCS 1002 provides AES256-based MACSec encryption for 10-GE, 40-GE, and 100-GE clients.
  - **Cisco NCS 1001** is a 1RU system that is capable of supporting up to three pluggable modules. The modules can be amplifiers or protection switch modules. The NCS 1001 is performance-optimized for maximum capacity and provides complete automation of installation and configuration with real-time and fine-grained monitoring.
- **Cisco NCS 2000 Network Convergence System** maximizes optical performance for ultra-long-haul scale and throughput up to 28 Tbps on a fiber pair. It provides touchless programmability for simplified deployment and ultra-low noise for long-distance, high bit-rate transmission. The NCS 2000 supports colorless, omnidirectional and contentionless architecture along with Flex spectrum through the use of ROADM solutions.

The Cisco DCI solution is optimized for high density with a small footprint, is deployed with a single operating system across both routing and optical layers, and is delivered with a unified management system.

- **Cisco ASR 9000 Aggregation Services Routers** is a modular, high density, power efficient, and secure platform with software virtualization capabilities. It offers more control, higher speeds, greater routing efficiency, and streamlined service provisioning for interconnecting data centers. The ASR 9000 provides layers 2-3 switching and routing. The ASR 9000 is a low-power platform (0.5 watts per gigabit), supporting high-density 100-GE interfaces (up to 32 port 100 GE fourth-generation line cards). These routers feature a purpose-built, multi-hard drive architecture to mitigate failures, flexible chassis options, and run highly resilient Cisco IOS® XR software that includes segment routing and enhanced scalability.

Key features:

- **Cisco IOS XR Software** – Cisco IOS XR Software provides an array of features representing over 15 years of use and development. Cisco IOS XR is modular. Major features are available as independent packages. Just get the code you need and put it to work faster. Industry-standard Route Processing Modules (RPMs) align update and upgrade procedures with those used in the data center.
- **Cisco IOS XR zero-touch provisioning and enhanced Pre-boot execution Environment (iPXE)** – Bring devices online in minutes instead of hours with automated device onboarding enabling fast boot and day-zero provisioning. The iPXE feature supported in Cisco IOS XR Software allows an administrator to boot from TFTP, HTTP, or FTP.
- **YANG data models for automated provisioning** – Cisco IOS XR integration with structured, data model-driven, high-performance APIs allow you to move beyond the Command-Line Interface (CLI).
- **Model-driven telemetry for real-time, detailed visibility** – Cisco model-driven telemetry, available with Cisco IOS XR software, enables streamed data to be captured continuously from devices with efficient, incremental updates. Model-driven telemetry is fully configurable using YANG models. The increased visibility provided by the streaming telemetry push model enables highly efficient techniques of segment routing for near-real-time network optimization.

The Cisco advantage

As a global networking innovator, Cisco understands your needs to harness the latest cost benefits and features of the network to survive and thrive. Our DCI solutions span the broadest range of platforms, technologies, and topology options 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. New, simplified, more efficient, more automated, and lower-cost ways of interconnecting data centers are here. Trust Cisco to be at the forefront of these developments and look to us as a valuable partner.

Additional technologies that can be used with this solution include:

- **Flex spectrum** – This feature 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, Flex Spectrum allows for a higher modulation to boost capacity by up to 30 to 50 percent. By using the flexible control plane, you can adjust your bandwidth automatically to take advantage of the physical tradeoffs that exist.
- **Cisco Evolved Programmable Network (EPN) Manager** – Cisco EPN Manager provides simplified, converged, end-to-end network lifecycle management. It helps you increase operational scale and efficiency through integrated and automated device operations, network provisioning, and network assurance. You can proactively assure service performance and minimize future service disruption through real-time fault management. With EPN Manager, you can perform service provisioning, monitoring, and change and compliance management to accelerate device and services deployment and rapidly resolve problems.
- **Cisco WAN Automation Engine (WAE)** – is a powerful and flexible optimization platform that automates the engineering and operations of multivendor physical and virtual WAN infrastructures. You can use WAE to deploy new services, including global load balancing, bandwidth on demand, and premium/latency-based network routing. It can help you optimize traffic load-balance over core MPLS and segment routing links. It can also minimize service downtime through worst-case failure analysis and reduce both OpEx and CapEx through efficient asset utilization.
- **Cisco Network Services Orchestrator (NSO)** – Cisco NSO lets you deliver services faster and more easily through network automation. It can drastically reduce the time to on-board new services in the network using model-driven orchestration. You can increase business agility with the capability to create, reconfigure, and repurpose services in real time. NSO allows you to dramatically reduce downtime with exceptional control over network changes and the capability to reconfigure devices and services during live production.

Cisco Capital

Flexible payment solutions to help you achieve your objectives.

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services, and complementary third-party equipment in easy, predictable payments. Learn more.

Ethernet VPN control plane for Data Center Interconnect

Ethernet VPN (EVPN) was designed to meet key requirements for data center interconnect environments. EVPN provides the next-generation layer 2 VPN service infrastructure. It enables the ASR 9000 running multiprotocol Border Gateway Protocol (BGP) to advertise and learn MAC addresses for access topology and VPN endpoint discovery. This eliminates the need for signaling of separate point-to-point pseudowire VC labels for each remote PE, enabling tremendous scale. EVPN also brings seamless host mobility for near-instantaneous failover. If a VM in one data center goes down, another VM in a different data center is automatically created, so service is not lost.

Figure 3. Cisco ASR 9000 Aggregation Services Routers with Data Center Interconnect

Ethernet VPN

The EVPN was designed to meet key requirements for Data Center Interconnect (DCI) environments.

Benefits include flow-based active/active load balancing to and from multi-homed Ethernet segments and greater flexibility and control over the MAC learning process.

100 GE/10 GE Density MACSec

The IEEE 802.1AE standard for authenticating and encrypting packets between two MACSec devices.

It enables service provider links from different data centers going to public areas to be encrypted faster so they can handle massive scale without over-whelming CPUs.

Segment routing

Segment routing lets you take advantage of enhanced packet forwarding via Cisco NSO. NFV, automation and other programmable features simplify complex service deployment and management.

Multiservice edge

The ASR 9000 provides an array of edge services: Layer 2 VPN (L2VPN), Layer 3 VPN (L3VPN), Broadband Network Gateway (BNG), Internet Protocol Television (IPTV), and Content-Delivery Networks (CDNs).

Use cases

Use case	Description
Disaster recovery	▪ Business continuity and compliance requirements to ensure reliability of critical data. ▪ Replicate data from one or more data centers at disaster recovery site. ▪ Dynamically access all interconnected data centers.

Next steps

Learn more about Cisco solutions for Data Center Interconnect. Contact your Cisco account representative today.

- Cisco ASR 9000
- Cisco NCS 1001
- Cisco NCS 1002
- Cisco NCS 1004
- Cisco NCS 2000

Use case	Description
Metro and regional DCI	▪ Interconnect metro-area data centers from 10s and up to 100s of kms apart. ▪ Support for mesh and point-to-point topologies. ▪ Mesh topology features high reliability and resiliency at a low cost point. ▪ Point-to-point topology features high-speed optical connections.
Cloud exchange	▪ Enterprise connections to colocation center, peering point, or Internet exchange. ▪ Support for mesh and point-to-point topologies. ▪ Mesh topology features high reliability and resiliency at a low cost point. ▪ Point-to-point topology features high-speed optical connections.

Cisco Customer Experience

Cisco Customer Experience helps customers worldwide design, manage, and maintain sophisticated, secure, intelligent platforms for their business. Our innovation, expertise and services quality, coupled with advanced analytics, automation, and security, help you bridge the talent gap, manage risk, deliver excellence, and differentiate your business with a unique customer experience.

Cisco Data Center Interconnect solutions can be slightly different from customer to customer. We have the flexibility to understand and help you achieve your specific goals. Cisco Customer Experience uniquely delivers innovative solutions, exceptional expertise, and smart service capabilities using a collaborative partner approach. Learn more.

Figure 4. Cisco Customer Experience

1. Cisco Global Cloud Index, 2018