Cisco NCS 4000 400G Packet Optical Line Card

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A growing number of network events are generated every day as billions of programmable devices connect to one another over the internet. This imposes new expectations on network performance. As the Internet of Everything (IoE) builds, the role of the network to support, manage, and control these programmable device-driven events becomes critical, as these tasks are rapidly surpassing the capacity of manual intervention. Networks must evolve to support new levels of virtualization, programmability, and performance. They must now scale not just bandwidth, but also compute and control functions to manage policies and generate the proper responses within the expected timeframe.

The Cisco® Network Convergence System 4000 (NCS 4000) Series is a converged optical service platform designed to cope with this dynamic and service-driven environment.

With just one line card, the Cisco NCS 4000 400G Packet Optical Line Card, network operators are able to enhance programmability, scale, and convergence across the photonic and packet switching layers.

Product overview

The Cisco NCS 4000 400G Packet Optical Line Card converges Dense Wavelength-Division Multiplexing (DWDM) and packet services into a single line card. The line card can be provisioned to provide any combination of 25G, 100G, and 400G Ethernet services as well as 100G, 200G, 300G, and 400G DWDM services, with a maximum bandwith of 400G.

The Cisco NCS 4000 400G Packet Optical Line Card dramatically enhances system density and performance, delivering 400G capacity per slot (6.4 Tbps per NCS 4016 chassis) and the ability to map traffic across the different ports on the faceplate. Selecting the type of pluggable optics, on a port-by-port basis, defines the unique profile of each line card.

Cards have eight pluggable interfaces on the front plate:

- Four Quad Small Form-Factor Pluggable – Double Density (QSFP-DD) ports:
  - One QSFP-DD port will be able to support a Bright QSFP-DD up to full speed (400G 16-QAM), a ethernet QSFP-DD for a 400G client, and a QSFP8 client.
  - One QSFP-DD port will be able to support a Bright QSFP-DD up to 200G Quadrature Phase Shift Keying (QPSK) speed as well as a QSFP client.
  - The remaining two QSFP-DD ports will be able to support a Bright QSFP-DD up to 100G QPSK speed as well as QSFP28 clients.
- Four SFP-25G ports. Due to resource limitations within Meta-DX1, there are some impacts on the line card-supported bandwidth when 25G clients are used:
  - If two 25G ports are used, the line card's maximum bandwidth will drop from 400G to 350G.
  - If four 25G ports are used, the line card's maximum bandwidth will drop from 400G to 300G.

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Figure 1.
Cisco NCS 4000 400G Packet Optical Line Card

Features and benefits

The Cisco NCS 4000 400G Packet Optical Line Card provides multiple improvements in flexibility, performance, savings, and density.

Flexibility

A single 400G Packet Optical Line Card provides any mix of photonic and packet services, supporting rates that include 25G, 100G, and 400G Ethernet services. The line card also supports Digital Coherent Optics (DCO) capabilities on the QSFP-DD ports.

Performance improvement

Moving from the embedded (digital signal processor, or DSP) technology of the previous generation toward QSFP-DD DCO dramatically increases the performance of the WDM interfaces. Supported WDM DCO can support 100G QPSK, 200G QPSK, 300G 8-QAM, and 400G 16-QAM optical signals.

Savings

The ability to configure multiple ethernet and DWDM ports simply by changing the pluggable type dramatically reduces operational costs. With only one line card to maintain, forecasting and ordering are greatly simplified, sparing is significantly reduced, and designing network expansion is far less complex, resulting in accelerated time to market for new services.

Density

Configuring a single NCS 4016 chassis with sixteen 400G Packet Optical Line Cards delivers 6.4 Tbps of packet service capacity, including up to 64 high-speed coherent DWDM interfaces (100G QPSK), all in a single 24-Rack-Unit (RU) chassis.

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Packet service flexibility

The Cisco NCS 4000 400G Packet Optical Line Card supports packet features on a per-interface basis. The focus is mainly on IP/MPLS transport as well as CE applications:

- Resource Reservation Protocol for Traffic Engineering (RSVP-TE) (IS-IS) with Fast Reroute (FRR) and auto-bandwidth
- Labeled unicast Border Gateway Protocol (BGP) label imposition/disposition
- Pseudowire services with various Ethernet Flow Point (EFP) encapsulations
- Policing per Ethernet Virtual Circuit (EVC) with Committed Information Rate/Committed Burst Size (CIR/CBS) and Excess Information Rate/Excess Burst Size (EIR/EBS)
- Hierarchical policing
- 8 port-level queues per port
- Layer 2 Control Protocols (L2CP) filtering
- Connectivity Fault Management (CFM)
- Bidirectional Forwarding Detection (BFD)
- Y.1731 performance monitoring (Synthetic Loss Measurement [SLM] and Delay Measurement Message [DMM])
- Y.1564 service activation testing
- Ethernet Dataplane Loopback (EDPL) for Y.1564 service activation testing
- Layer 3 VPN for remote management (management VPN)

The following list gives further details on the features of the 400G Packet Optical Line Card:

Layer 2/AC Link Aggregation Group (LAG)
Flex LSP (mid only) with control plane (Pseudowire Call Admission Control [PW CAC])
IPv4 unicast (static route included)
Open Shortest Path First (OSPF), OSPF-TE, Intermediate System to Intermediate System (IS-IS), IS-IS-TE
IPv4 Access Control List (ACL)
Equal-Cost Multipath Routing (ECMP)
Egress port-based shaping/queuing
Ingress per-EFP policing (per port incl) – single-Rate Two-Color (1R2C), Two-Rate Three-Color (2R3C)
3-level Hierarchical Quality Of Service (HQoS) (shaping/queuing)
Synchronous Ethernet (SyncE): G.8262, G.8261, G.8264
Link integrity
Y.1731 (DM)
Y.1731 (LM, SLM)

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RFC 2544 Generation and Responder, Y.1564
CFM (802.1ag)
Link Operations, Administration, and Management (OAM) (802.3ah)
Remote Network Monitoring (RMON)
Command-Line Interface (CLI)/Simple Network Management Protocol (SNMP)
XML/CTC
NETCONF/YANG
Transport Performance Monitoring (GR-820) L1/L2/L2+: Optical, Ethernet, and MPLS
Per-port statistics
Per-Label Switched Port (LSP) statistics
Per-EVC statistics
Transport alarms L1/L2/L2+: Optical, Ethernet, and MPLS

Platform support

Table 1. NCS 4000 platform support for 400G Packet Optical Line Card

Product family	Platforms supported	Cisco IOS® images (feature sets) supported
NCS 4000	NCS 4016 and NCS 4009	Cisco IOS XR Release 6.5.35 onward

Product specifications: Physical data

Table 2. Physical data specifications

Power	
Maximum	260W

Physical dimensions	
Dimensions (W x L x D)	280.6 x 315.3 x 38.4 mm (11.05 x 12.41 x 1.51 in)
Weight	2.968 kg (6.54 lb)

Reliability and availability	
Mean Time Between Failures (MTBF)	312,010 hours

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Environmental conditions	
Storage temperature	-40° C to 70° C (-40° F to 158° F)
Operating temperature – normal	0° C to 40° C (32° F to 104° F)
Operating temperature – short-term[1]	-5° C to 55° C (23° F to 131° F)
Relative humidity – normal	5% to 85%, noncondensing
Relative humidity – short-term[1]	5% to 90% but not to exceed 0.024 kg water/kg of dry air

[1] Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year (a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period).

Ordering information

Table 3. Line card ordering information

Product ID	Product description
NCS4K-4H-4QDD-P=	NCS 4000 400G Packet - QSFP-DD - Line Card

Table 4. Supported pluggable products

Product ID	Product description
Coherent WDM DCO	
DP04QSDD-HE0=	QSFP-DD 400G-ZR+ High TX Power DCO Pluggable - C-Band
QSFP-DD 400G Ethernet	
QDD-400G-FR4-S=	400G QSFP-DD Transceiver,400G-FR4, Duplex LC,2km Duplex SMF
QDD-400G-LR4-S=	400G QSFP-DD Transceiver,400GBASE-LR4, SMF Duplex LC,10km
DP04QSDD-ER1=	400GBPS QSFP-DD, ER
QSFP28 100G Ethernet	
QSFP-100G-FR-S=	100G QSFP28 Transceiver 100G-FR, 2km SMF, duplex, LC
QSFP-100G-ER4L-S=	100GBASE QSFP Transceiver, 40KM reach over SMF, Duplex LC
QSFP-100G-ZR4-S=	100GBASE QSFP Transceiver, 80KM reach over SMF, Duplex LC
ONS-QSFP28-LR4=	100Gbps Multi-rate QSFP28, LR
QSFP-100G-LR4-S=	100GBASE LR4 QSFP Transceiver, LC, 10km over SMF
QSFP-100G-LR-S=	100G QSFP28 100G-LR, 10km SMF, duplex, LC Connector

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Product ID	Product description
25G SFP+ Grey	
SFP-10/25G-LR-I=	10/25GBASE-LR-I SFP28 iTemp Module
SFP-25G-ER-I=	25GBASE-ER SFP28 iTemp Module

Warranty information

Find warranty information on Cisco.com at the Product Warranties page.

Product sustainability

Information about Cisco's Environmental, Social, and Governance (ESG) initiatives and performance is provided in Cisco's CSR and sustainability reporting.

Table 5. Cisco environmental sustainability information

Sustainability Topic		Reference
General	Information on product-material-content laws and regulations	Materials
	Information on electronic waste laws and regulations, including our products, batteries, and packaging	WEEE Compliance
	Information on product takeback and reuse program	Cisco Takeback and Reuse Program
	Sustainability inquiries	Contact: csr_inquiries@cisco.com
Material	Product packaging weight and materials	Contact: environment@cisco.com

Cisco and partner services

Service provider services

Services from Cisco and our partners help you get the most value from your investments in the Cisco converged IP + optical solution, quickly and cost-effectively. We can help you design, implement, and validate your solution to speed migration and cutover. Coordinate every step through to interworking. Strengthen your team. And make the most of tomorrow's opportunities. Learn more at https://www.cisco.com/go/spservices.

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