CloudEngine 12800 Series
Data Center Core Switches

HUAWEI TECHNOLOGIES CO., LTD.

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Product Overview

The CloudEngine 12800 (CE12800 for short) series switches are next-generation, high-performance core switches designed for data center networks and high-end campus networks. Using Huawei's next-generation VRP8 software platform, CE12800 series switches provide stable, reliable, and secure high-performance L2/L3 switching capabilities to help build an elastic, virtualized, and high-quality network.

The CE12800 series switches use an advanced hardware architecture design and have the highest performance among all core switches in the industry. The CE12800 series provides as much as 178 Tbit/s (scalable to 1032 Tbit/s) switching capacity and has up to 576*100GE, 576*40GE, 2,304*25GE, or 2,304*10GE line-rate ports.

The CE12800 series switches use an industry-leading Clos architecture and provide industrial-grade reliability. The switches support comprehensive virtualization capabilities along with data center service features. Their front-to-back airflow design suits data center equipment rooms, and the innovative energy conservation technologies greatly reduce power consumption.

Product Appearance

The CE12800 series is available in six models: CE12816, CE12812, CE12808, CE12804, CE12808S and CE12804S.

Product Characteristics

Next-Generation Core Engine with the Highest Performance

1032 Tbit/s Switching Capacity

- The CE12800 provides up to 178 Tbit/s (scalable to 1032 Tbit/s) switching capacity. This high capacity

can support sustainable development of cloud-computing data centers for the next 10 years.

- The CE12800, together with the CE8800/CE7800CE6800/CE5800 series Top-of-Rack (ToR) switches, can implement the largest non-blocking switching network in the industry. This network can provide access for tens of thousands of 25GE/10GE/GE servers.

4T High-Density Line Cards

- The forwarding capacity of a line card can reach up to 3.6 Tbit/s.
- The CE12800 supports 36*40GE, 36*100GE, 144*25GE, and 144*10GE line cards, which provide line-rate forwarding.
- The CE12800 provides as many as 576*100GE, 576*40GE, 2,304*25GE, or 2,304*10GE line-rate ports.

Super-Large Buffer Size of 24 GB

- All service ports (100GE/40GE/10GE/GE) provide a super high buffer capacity (up to 200 ms).
- The distributed buffer mechanism on inbound interfaces can effectively handle incast traffic loads in data centers.
- A line card provides up to 24 GB buffer, which is dynamically shared by interfaces to improve usage efficiency.

2M FIB Entries

- The CE12800 series switches support up to 2M FIB entries for use in large-scale container networks.
- MAC, FIB, ARP, and ACL entries can be changed flexibly to suit dynamic service requirements.

Comprehensive Virtualization Capabilities Implement Simple, Efficient Networking

VS Implements On-demand Resource Sharing

- Highest device virtualization capability: The CE12800 uses Virtual System (VS) technology to provide an industry-leading virtualization capability that enables one switch to be virtualized into as many as sixteen logical switches. This 1:16 ratio enables one core switch to manage services for an enterprise's multiple service areas such as production, office, and DMZ, or for multiple tenants.
- Higher security and reliability: VS technology divides a network into separate logical areas for service isolation. The failure of one virtual switch does not affect other virtual switches, enhancing network security.
- Lower CAPEX: VS technology improves the use efficiency of physical devices by implementing on-demand resource allocation. This ensures network scalability and reduces investment in devices.
- Lower OPEX: Using one physical device to implement multiple logical devices saves space in a data center equipment room and reduces the cost of device maintenance.

CSS Simplifies Network Management

- The CE12800 uses industry-leading Cluster Switch System (CSS) technology, which can virtualize multiple physical switches into one logical switch to facilitate network management and improve reliability.
- The CE12800 provides the dedicated system inter-connect port and separates the control channel from the service channel, improving reliability.
- The CE12800 provides a cluster bandwidth of 3.2 Tbit/s. This super-high bandwidth prevents traffic bottlenecks on data center networks.

- The CE12800 switches establish a cluster using service ports with distances of up to 80 km between cluster member switches.
- The CE12800 combines CSS and VS technologies to turn a network into a resource pool, enabling network resources to be allocated on demand. This on-demand resource allocation is ideal for the cloud-computing service model.

Dual Management and Control Planes of M-LAG Guarantee High Availability of Services

- The management and control planes on one Multichassis Link Aggregation Group (M-LAG) node are independent from that on the other, which substantially improves system reliability.
- The two nodes of an M-LAG can be upgraded independently from each other. During the upgrade of one node, the other node takes over forwarding the services on the first node, ensuring that the services remain uninterrupted.
- M-LAG is able to seamlessly collaborate with CSS, thus enabling highly reliable 4-to-1 virtualization.

Large-Scale Routing Bridge Supports Flexible Service Deployment

- The CE12800 supports the IETF Transparent Interconnection of Lots of Links (TRILL) protocol and can connect to 10G and 1G servers simultaneously. CE12800 switches can establish a large Layer 2 TRILL network with more than 500 nodes, enabling flexible service deployments and large-scale Virtual Machine (VM) migrations.
- The TRILL protocol uses a routing mechanism similar to IS-IS and sets a limited Time-to-Live (TTL) value in packets to prevent Layer 2 loops. This significantly improves network stability and speeds up network convergence.
- On a TRILL network, all data flows are forwarded quickly using Shortest Path First (SPF) and Equal-cost Multi-path (ECMP) routing. SPF and ECMP avoid the problem of suboptimal path selection in the Spanning Tree Protocol (STP) and increase link bandwidth efficiency to 100 percent.
- The CE12800 supports up to 32 TRILL-based Layer 2 equal-cost paths, greatly improving links' load-balancing capabilities. The network's fat-tree architecture supports easy expansion.

Virtualized Gateway Achieves Fast Service Deployment

- The CE12800 can work with a mainstream virtualization platform. As the high-performance, hardware gateway of an overlay network (VxLAN), a CE series switch can support more than 16 million tenants.
- The CE12800 can connect to a cloud platform using open API, allowing for unified management of software and hardware networks.
- This function implements fast service deployment without changing the customer network. It also protects customer investments.

VxLAN and EVPN Enables Flexible Expansion Within and Across Data Centers

- The CE12800 supports Border Gateway Protocol - Ethernet VPN (BGP-EVPN), which can run as the VxLAN control plane to simplify VxLAN deployment.
- BGP-EVPN triggers automatic VxLAN tunnel setup between virtual tunnel endpoints (VTEPs), removing the need for full-mesh tunnel configuration. BGP-EVPN also reduces flooding of unknown traffic by advertising MAC routes on the control plane. With this protocol, large Layer 2 networks can be established for data centers.
- Because BGP-EVPN is a standard protocol, the CE12800 is interoperable with devices from other vendors,

enabling long-term network evolution.

- The CE12800 supports centralized and distributed VxLAN deployment and supports various VxLAN access modes, including QinQ in VxLAN and IPv6 over VxLAN. This allows for flexible customization of heterogeneous networks.
- EVPN and VxLAN can be used to set up Layer 2 interconnections between data centers, enabling active-active VxLAN deployment across data centers and conserving DCI link bandwidth.
- The CE12800 supports IP packet fragmentation and reassembling, enabling oversized IP packets to travel across a WAN network without limited by the MTU. The switch can also identify fragmented packets to seamlessly interconnect with routers.

Fully Programmable Switches Enable Agile Network Deployment and O&M

OPS Implements Programmability at the Control Plane

- The CE12800 uses the Open Programmability System (OPS) embedded in the VRP8 software platform to provide programmability at the control plane.
- The OPS provides open APIs. APIs can be integrated with mainstream cloud platforms (including commercial and open cloud platforms) and third-party controllers. The OPS enables services to be flexibly customized and provides automatic management.
- Users or third-party developers can use open APIs to develop and deploy specialized network management policies to implement extension of fast service functions, automatic deployment, and intelligent management. The OPS also implements automatic operation and maintenance, and reduces management costs.
- The OPS provides seamless integration of data center service and network in addition to a service-oriented, Software-Defined Network (SDN).

Standard Interfaces Provide Openness and Interoperability

- The CE12800 supports OpenFlow 1.3 and is compatible with the common mode and OpenFlow forwarding mode. It can work with Huawei Agile Controller or third-party controllers.
- The CE12800 provides the standard NETCONF interface for third-party software to invoke. This enables programming of functions and integration with third-party software, providing openness and flexibility.
- The CE12800 supports Linux containers technology and allows you run standard Linux Shell scripts for programming.
- You can load various third-party software (such as Puppet and Ansible software) to containers to expand network functions and simplify device management and maintenance. Through in-depth collaboration with mainstream cloud platforms, controllers, and O&M tools, the CE12800 series switches can be integrated into SDN and cloud computing platforms flexibly and quickly.

Zero Touch Provisioning, Agile Network Deployment

- The CE12800 supports Zero Touch Provisioning (ZTP). ZTP enables the CE12800 to automatically obtain and load version files from a USB flash drive or file server, freeing network engineers from onsite configuration or deployment. ZTP reduces labor costs and improves device deployment efficiency.
- ZTP provides built-in scripts for users through open APIs. Data center personnel can use the programming language they are familiar with, such as Python, to provide unified configuration of network devices.
- ZTP decouples configuration time of new devices from device quantity and area distribution, which

improves service provisioning efficiency.

Refined O&M with the Fabric Insight Solution

- The CE12800 supports global precision time synchronization based on IEEE 1588v2, which achieves nanosecond-level delay detection.
- Huawei's Packet Conservation Algorithm for Internet (iPCA) technology implements accurate per-hop packet loss, delay, and jitter measurement for real service flows, so that network problems can be located quickly.
- The CE12800 provides proactive path detection on the entire network. It periodically checks sample flows to determine connectivity of all paths on the network and locates failure points, enabling you to know the network health in real time.
- The CE12800 supports service-oriented Dynamic Load Balancing (DLB). It can accurately identify elephant, mice, and real-time flows, and adjust service paths accordingly.
- The Segment Routing (SR) capability of the CE12800 implements label-based packet forwarding, regardless of service types. This feature enables automatic optimization and switching of end-to-end links.

Advanced Architecture Ensures Industry-Leading Network Quality

High-Performance, Non-blocking Switching Architecture

- The CE12800 has a non-blocking switching architecture that is characterized by its orthogonal switch fabric design, Clos architecture, cell switching, Virtual Output Queuing (VoQ), and super-large buffer size.
- Orthogonal switch fabric design: CE12800 service line cards and switch fabric units (SFUs) use an orthogonal design in which service traffic between line cards is directly sent to the SFUs through orthogonal connectors. This approach reduces backplane cabling and minimizes signal attenuation. The orthogonal design can support signal rates as high as 25 Gbit/s per Serdes, which is 2.5 times the industry average. This design greatly improves system bandwidth and evolution capabilities, enabling the system switching capacity to scale to more than 100 Tbit/s.
- Clos architecture: The CE12800's three-level Clos architecture permits flexible expansion of switch fabric capacity. The architecture uses Variable Size Cell (VSC) and provides dynamic routing. Load balancing among multiple switch fabrics prevents the switching matrix from being blocked and easily copes with complex, volatile traffic in data centers.
- VoQ: The CE12800 supports 96,000 VoQ queues that implement fine-grained Quality of Service (QoS) based on the switch fabrics. With the VOQ mechanism and super-large buffer on inbound interfaces, the CE12800 creates independent VOQ queues on inbound interfaces to perform end-to-end flow control on traffic destined for different outbound interfaces. This method ensures unified service scheduling and sequenced forwarding and implements non-blocking switching.

Highly Reliable Industry-grade Hardware Architecture

- Hot backup of five key components: Main Processing Units (MPUs) and Centralized Monitoring Unit (CMUs) work in 1+1 hot backup mode. SFUs work in N+M hot backup mode. Power supplies support

dual inputs and N+N backup and have their own fans. Both fan trays work in 1+1 backup mode; each fan tray has two counter-rotating fans working in 1+1 backup mode, ensuring efficient heat dissipation.

- Redundancy of three types of major buses: Monitoring, management, and data buses all work in 1+1 backup mode. Bus redundancy ensures reliable signal transmission.
- Independent triple-plane design: The independent control, data, and monitoring planes of the CE12800 improve system reliability and ensure service continuity.

High-Performance VRP8 Software Architecture

- The CE12800 takes advantage of Huawei's next-generation VRP8, a high-performance, highly reliable modular software platform that provides continuous services.
- Fine-grained distributed architecture: VRP8, the industry's high-end software platform, uses a fine-grained, fully distributed architecture that can process network protocols and services concurrently using multiple instances. This architecture takes full advantage of multi-core/multi-CPU processes to maximize performance and reliability.
- Highly reliable In-Service Software Upgrade (ISSU): VRP8 supports ISSU.

Pioneering Energy-saving Technology

Strict Front-to-Back Airflow Design

- The CE12800 uses a patented front-to-back airflow design that isolates cold air channels from hot air channels. This design meets heat dissipation requirements in data center equipment rooms.
- Line cards and SFUs use independent airflow channels, which solve the problems of mixing hot and cold air and cascade heating, and effectively reduce energy consumption in equipment rooms.
- Each fan tray has two counter-rotating fans, ensuring efficient heat dissipation.
- The fan speed in each area can be dynamically adjusted based on the workload of line cards in the area. This on-demand cooling design lowers power consumption and reduces noise.

Low Power Consumption

- The CE12800 uses innovative energy saving technologies. The port power consumption is merely half of the industry average. It greatly reduces power consumption in the data center equipment room.
- Miercom has performed a series of strict tests for the CE12800, proving its low power consumption.

Efficient, Intelligent Power Supply System

- The CE12800 incorporates the industry's most efficient digital power modules, which provide power efficiency of 96 percent.
- The power supply system measures power consumption in real time and puts one or more power modules into sleep mode when system power demands are low.
- The CE12800 can save energy dynamically by adjusting the power consumption of components to adapt to changes in service traffic volume.

Product Specifications

Item	CE 12804S	CE 12808S	CE 12804	CE 12808	CE 12812	CE 12816
Switching capacity (Tbit/s)	45/258[1]	89/516[1]	45/258[1]	89/516[1]	134/774[1]	178/1032[1]
Forwarding rate (Mpps)	17,280	34,560	17,280	34,560	51,840	69,120
Service slots	4	8	4	8	12	16
Switching fabric module slots	2	4	6	6	6	6
Fabric architecture	Clos architecture, cell switching, VoQ, and distributed large buffer					
Airflow design	Strict front-to-back					
Device virtualization	Virtual System (VS)					
	Cluster Switch System (CSS) [2]					
	Super Virtual Fabric (SVF) [3]					
Network virtualization	M-LAG					
	TRILL					
	VxLAN routing and bridging					
	EVPN					
	QinQ in VxLAN					
VM awareness	Agile Controller					
Network convergence	FCoE					
	DCBX, PFC, ETS					
Data center interconnect	BGP-EVPN					
	Ethernet Virtual Network (EVN) for inter-DC Layer 2 network interconnections					
Programmability	OpenFlow					
	ENP programming					
	OPS programming					
	Puppet, Ansible, and OVSDB plugins released on open source websites					
	Linux container for open source and customization programming					

1 Roadmap
2 For details about the configuration, please see: http://support.huawei.com/onlinetoolsweb/virtual/en/dc/stack_index.html?dcf
3 For details about the configuration, please see: http://support.huawei.com/onlinetoolsweb/virtual/en/dc/svf_index.html?dcf

Item	CE 12804S	CE 12808S	CE 12804	CE 12808	CE 12812	CE 12816
Traffic analysis	NetStream					
	Hardware-based sFlow					
VLAN	Adding access, trunk, and hybrid interfaces to VLANs					
	Default VLAN					
	QinQ					
	MUX VLAN					
	GVRP					
MAC address	Dynamic learning and aging of MAC addresses					
	Static, dynamic, and blackhole MAC address entries					
	Packet filtering based on source MAC addresses					
	MAC address limiting based on ports and VLANs					
IP routing	IPv4 routing protocols, such as RIP, OSPF, IS-IS, and BGP					
	IPv6 routing protocols, such as RIPng, OSPFv3, ISISv6, and BGP4+					
	IP packet fragmentation and reassembling					
IPv6	IPv6 over VxLAN					
	IPv6 over IPv4					
	IPv6 Neighbor Discovery (ND)					
	Path MTU Discovery (PMTU)					
	TCP6, ping IPv6, tracert IPv6, socket IPv6, UDP6, and Raw IP6					
Multicast	IGMP, PIM-SM, PIM-DM, MSDP, and MBGP					
	IGMP snooping					
	IGMP proxy					
	Fast leave of multicast member interfaces					
	Multicast traffic suppression					
	Multicast VLAN					
MPLS	Basic MPLS functions					
	MPLS VPN/VPLS/VPLS over GRE					

Item	CE 12804S	CE 12808S	CE 12804	CE 12808	CE 12812	CE 12816
Reliability	Link Aggregation Control Protocol (LACP)					
	STP, RSTP, VBST, and MSTP					
	BPDU protection, root protection, and loop protection					
	Smart Link and multi-instance					
	Device Link Detection Protocol (DLDP)					
	Ethernet Ring Protection Switching (ERPS, G.8032)					
	Hardware-based Bidirectional Forwarding Detection (BFD)					
	VRRP, VRRP load balancing, and BFD for VRRP					
	BFD for BGP/IS-IS/OSPF/Static route					
	In-Service Software Upgrade (ISSU)					
	Segment Routing (SR)					
QoS	Traffic classification based on Layer 2, Layer 3, Layer 4, and priority information					
	Actions include ACL, CAR, and re-marking					
	Queue scheduling modes such as PQ, WFQ, and PQ+WRR					
	Congestion avoidance mechanisms, including WRED and tail drop					
	Traffic shaping					
O&M	IEEE 1588v2					
	Packet Conservation Algorithm for Internet (iPCA)					
	Dynamic Load Balancing (DLB)					
	Dynamic Packet Prioritization (DPP)					
	Network-wide path detection					
	Microsecond-level buffer detection					
Configuration and maintenance	Console, Telnet, and SSH terminals					
	Network management protocols, such as SNMPv1/v2c/v3					
	File upload and download through FTP and TFTP					
	BootROM upgrade and remote upgrade					
	Hot patches					
	User operation logs					
	Zero Touch Provisioning (ZTP)					

Item	CE 12804S	CE 12808S	CE 12804	CE 12808	CE 12812	CE 12816
Security and management	802.1x authentication					
	RADIUS and HWTACACS authentication for login users					
	Command line authority control based on user levels, preventing unauthorized users from using commands					
	Defense against MAC address attacks, broadcast storms, and heavy-traffic attacks					
	Ping and traceroute					
	Remote Network Monitoring (RMON)					
Dimensions (W x D x H, mm)	442 x 620 x 352.8 (8U)	442 x 620 x 708.4 (16U)	442 x 813 x 486.15 (11 U)	442 x 813 x 752.85 (17 U)	442 x 813 x 975.1 (22 U)	442 x 905 x 1597.4 (36 U)
Chassis weight (empty)	<60kg/ 132lb	<100kg/ 220lb	<110kg/ 242lb	<150kg/ 330lb	<190kg/ 418lb	<290kg/ 639lb
Operating voltage	AC: 90 V to 290 V DC: -38.4 V to -72 V HVDC: 240 V					
Max. power supply (W)	6000	12000	6000	12000	18000	30000

Ordering Information

Mainframe	
Basic Configuration	
CE-RACK-A01	FR42812 Assembly Rack (800x1200x2000mm)
CE12804S-AC	CE12804S Assembly Chassis (with Fans)
CE12808S-AC	CE12808S Assembly Chassis (with Fans)
CE12804S-DC	CE12804S DC Assembly Chassis (with Fans)
CE12808S-DC	CE12808S DC Assembly Chassis (with Fans)
CE12804-AC	CE12804 AC Assembly Chassis (with CMUs and Fans)
CE12808-AC	CE12808 AC Assembly Chassis (with CMUs and Fans)
CE12812-AC	CE12812 AC Assembly Chassis (with CMUs and Fans)
CE12816-AC	CE12816 AC Assembly Chassis (with CMUs and Fans)
CE12804-DC	CE12804 DC Assembly Chassis (with CMUs and Fans)
CE12808-DC	CE12808 DC Assembly Chassis (with CMUs and Fans)
CE12812-DC	CE12812 DC Assembly Chassis (with CMUs and Fans)

CE12816-DC	CE12816 DC Assembly Chassis (with CMUs and Fans)
Main Processing Unit	
CE-MPU-S	CE12800S Main Processing Unit
CE-MPU	Main Processing Unit
Switch Fabric Unit[4]	
CE-SFU-S	CE12800S Switch Fabric
CE-SFU04	CE12804 Switch Fabric
CE-SFU08	CE12808 Switch Fabric
CE-SFU12	CE12812 Switch Fabric
CE-SFU16	CE12816 Switch Fabric
GE BASE-T Interface Card	
CE-L48GT	48-Port 10/100/1000BASE-T Interface Card (RJ45)
GE BASE-X Interface Card	
CE-L48GS	48-Port 100/1000BASE-X Interface Card (SFP)
10GBASE-T Interface Card	
CE-L48XT	48-port 100M/1000M/10G BASE-T Interface Card (RJ45)
10GBASE-X Interface Card	
CE-L24XS	24-Port 10GBASE-X Interface Card (SFP/SFP+)
CE-L48XS	48-Port 10GBASE-X Interface Card (SFP/SFP+)
40GE Interface Card	
CE-L06LQ	6-Port 40G Interface Card (QSFP+)
CE-L12LQ	12-Port 40G Interface Card (QSFP+)
CE-L24LQ	24-Port 40G Interface Card (QSFP+)
CE-L36LQ	36-Port 40G Interface Card (QSFP+)
100GE Interface Card	
CE-L04CF	4-Port 100G Interface Card (CFP)
CE-L12CF	12-Port 100G Interface Card (CFP2)
CE-L12CQ	12-Port 100G Interface Card (QSFP28)
CE-L16CQ	16-Port 100G Interface Card (QSFP28)
CE-L36CQ	36-Port 100G Interface Card (QSFP28)

4 Fx series interface cards must be used with F or G series switch fabric units. For example, a CE-L36CQ-FD interface card must be used with CE-SFUxxG switch fabric units.

Power	
PHD-3000WA	3000W HVDC Power Module
PDC-2200WA	2200W DC Power Supply
Software	
CE128-LIC-B	CloudEngine 12800 Basic SW
CE128-LIC-TRILL	TRILL Function License
CE128-LIC-MPLS	MPLS Function License
CE128-LIC-VS	Virtual System Function License
CE128-LIC-IPV6	IPV6 Function License
CE128-LIC-EVN	EVN Function License
CE128-LIC-FCFAL	CloudEngine 12800 FCF All Ports
CE128-LIC-FCF48	CloudEngine 12800 FCF 48 Ports
Document	
CE128-DOC	CloudEngine 12800 Series Switches Product Documentation

Optical transceivers and Cables

Part Number	Product Description
FE-SFP Optical Transceivers	
SFP-FE-SX-MM1310	Optical Transceiver,SFP,100M/155M,Multi-mode Module (1310nm, 2km,LC)
eSFP-FE-LX-SM1310	Optical Transceiver,eSFP,100M/155M,Single-mode Module (1310nm, 15km, LC)
S-SFP-FE-LH40-SM1310	Optical Transceiver, eSFP, FE, Single-mode Module (1310nm, 40km, LC)
GE-SFP Optical Transceivers	
SFP-1000BaseT	Electrical Transceiver, SFP, GE, Electrical Interface Module (100m, RJ45)
eSFP-GE-SX-MM850	Optical Transceiver, eSFP, GE, Multi-mode Module (850nm, 0.55km, LC)
SFP-GE-LX-SM1310	Optical Transceiver, eSFP, GE, Single-mode Module (1310nm, 10km,LC)
S-SFP-GE-LH40-SM1310	Optical Transceiver, eSFP, GE, Single-mode Module(1310nm,40km,LC)
S-SFP-GE-LH80-SM1550	Optical Transceiver, eSFP, GE, Single-mode Module(1550nm,80km,LC)
eSFP-GE-ZX100-SM1550	Optical Transceiver, eSFP, GE, Single-mode Module(1550nm,100km,LC)

BIDI-SFP Optical Transceivers	
SFP-FE-LX-SM1550-BIDI	Optical Transceiver, eSFP, FE, BIDI Single-mode Module (TX1550/RX1310, 15km, LC)
SFP-FE-LX-SM1310-BIDI	Optical Transceiver, eSFP, FE, BIDI Single-mode Module (TX1310/RX1550, 15km, LC)
SFP-GE-LX-SM1490-BIDI	Optical Transceiver, eSFP, GE, BIDI Single-mode Module (TX1490/RX1310, 10km,LC)
SFP-GE-LX-SM1310-BIDI	Optical Transceiver, eSFP, GE, BIDI Single-mode Module (TX1310/RX1490, 10km, LC)
LE2MGSC40ED0	Optical Transceiver, eSFP, GE, BIDI Single-mode Module (TX1490/RX1310, 40km, LC)
LE2MGSC40DE0	Optical Transceiver, eSFP, GE, BIDI Single-mode Module (TX1310/RX1490, 40km,LC)
SFP-10G-ER-SM1330-BIDI	Optical Transceiver,SFP+,10G,BIDI Single-mode Module(TX 1330nm/RX 1270nm,40km,LC)
SFP-10G-ER-SM1270-BIDI	Optical Transceiver,SFP+,10G,BIDI Single-mode Module(TX 1270nm/RX 1330nm,40km,LC)
SFP-10G-BXU1	10GBase,BIDI Optical Transceiver,SFP+,10G,Single-mode Module (TX1270nm/RX1330nm,10km,LC)
SFP-10G-BXD1	10GBase,BIDI Optical Transceiver,SFP+,10G,Single-mode Module (TX1330nm/RX1270nm, 10km, LC)
10G-SFP+ Optical Transceivers	
SFP-10GE-T-30M	Electrical Transceiver,SFP+,10G,Electrical Interface Module(30m,RJ45)
SFP-10G-USR	10GBase-USR Optical Transceiver,SFP+,10G,Multi-mode Module (850nm, 0.1km, LC)
OSXD22N00	Optical Transceiver,SFP+,10G,Multi-mode Module(1310nm,0.22km,LC,LRM)
OMXD30000	Optical Transceiver,SFP+,10G,Multi-mode Module(850nm,0.3km,LC)
SFP-10G-LR	Optical Transceiver,SFP+,10G,Single-mode Module(1310nm,10km,LC)
OSX040N01	Optical Transceiver,SFP+,10G,Single-mode Module(1550nm,40km,LC)
SFP-10G-ZR	10GBase-ZR Optical Transceiver, SFP+, 10G, Single-mode Module (1550nm, 80km, LC)
SFP-10G-iLR	Optical Transceiver,SFP+,9.8G,Single-mode Module(1310nm,1.4km,LC)
25GE-SFP28 Optical Transceivers	
SFP-25G-SR	Optical Transceiver,SFP28,25GE, Multi-mode Module(850nm,0.1km,LC)

40GE-QSFP+ Optical Transceivers	
QSFP-40G-SR-BD	40GBase-BD Optical Transceiver,QSFP+,40G,Multi-mode (850nm,0.1km,LC)
QSFP-40G-iSR4	40GBase-iSR4 Optical Transceiver, QSFP+, 40G, Multi-mode (850nm, 0.15km, MPO) (Connect to four SFP+ Optical Transceiver)
QSFP-40G-eSR4	40GBase-eSR4 Optical Transceiver, QSFP+, 40G, Multi-mode (850nm, 0.3km, MPO) (Connect to four SFP+ Optical Transceiver)
QSFP-40G-iSM4	40GBase-iSM4 Optical Transceiver, QSFP+, 40G, Single-mode Module (1310nm, 1.4km, MPO) (Connect to four SFP+ Optical Transceiver)
QSFP-40G-LX4	40GBase-LX4 Optical Transceiver, QSFP+, 40GE, Single-mode (1310nm, 2km, LC), Multi-mode(1310nm, 0.15km, LC)
QSFP-40G-eSM4	40GBase-eSM4 Optical Transceiver, QSFP+, 40G, Single-mode Module (1310nm, 10km, MPO) (Connect to four SFP+ Optical Transceiver)
QSFP-40G-LR4	40GBase-LR4 Optical Transceiver, QSFP+, 40GE, Single-mode Module (1310nm, 10km, LC)
QSFP-40G-ER4	40GBase-ER4 Optical Transceiver, QSFP+, 40G, Single-mode Module (1310nm, 40km, LC)
QSFP-40G-SDLC-PAM	40GBase-SDLC Optical Transceiver, QSFP+, 40G, Multi-mode (850nm, PAM4, 0.1km, LC)
QSFP-40G-eSDLC-PAM	40GBase-eSDLC Optical Transceiver, QSFP+, 40G, Multi-mode (850nm, PAM4, 0.3km, LC)
40GE-CFP Optical Transceivers	
CFP-40G-LR4	High Speed Transceiver, CFP, 40G, Single-mode Module (1310nm band, 41.25G, 10km, straight LC)
CFP-40G-ER4	High Speed Transceiver, CFP, 40G, Single-mode Module (1310nm band, 41.25G, 40km, straight LC)
100GE-CFP Optical Transceivers	
CFP-100G-SR10	High Speed Transceiver, CFP, 100G, Multimode Module (850nm, 10*10G, 0.1km, MPO)
CFP-100G-LR10	High Speed Transceiver, CFP, 100G, Single-mode Module (1550nm band, 10*10G, 10km, straight LC)
CFP-100G-LR4	High Speed Transceiver,CFP,100G,Single-mode Module(1310nm band,4*25G,10km,stright LC)
CFP-100G-ER4	High Speed Transceiver,CFP,100G,Single-mode Module(1310nm band,4*25G,40km,stright LC)
CFP-100GE-ZR4	100GBase,CFP Module,100G,Single-mode Module(1310nm band,4*25G,80km,stright LC)

100GE-CFP2 Optical Transceivers	
CFP2-100G-SR10	High Speed Transceiver, CFP2, 100G, Multimode Module(850nm, 10*10G, 0.1km, MPO)
CFP2-100G-LR4	High Speed Transceiver, CFP2, 100G, Single-mode Module(1310nm band, 4*25G, 10km, straight LC)
CFP2-100G-ER4	High Speed Transceiver, CFP2, 100G, Single-mode Module(1310nm, 4*25G, 40km, straight LC)
100GE-QSFP28 Optical Transceivers	
QSFP28-100G-SR4	100GBase-SR4 Optical Transceiver, QSFP28, 100G, Multi-mode (850nm, 0.1km, MPO)
QSFP28-100G-LR4	100GBase-LR4 Optical Transceiver, QSFP28, 100G, Single-mode module (1310nm, 10km, LC)
QSFP28-100G-PSM4	100GBase-PSM4 Optical Transceiver, QSFP28, 100G, Single-mode module (1310nm, 0.5km, MPO)
QSFP-100G-CWDM4	100GBase-CWDM4 Optical Transceiver, QSFP28, 100G, Single-mode module (1310nm, 2km, LC)
AOC High-Speed Cables	
SFP-10G-AOC-5M	Active Optical Cable , SFP+, 10G, (850nm, 5m, AOC)
SFP-10G-AOC-7M	Active Optical Cable , SFP+, 10G, (850nm, 7m, AOC)
SFP-10G-AOC10M	AOC Optical Transceiver, SFP+, 850nm, 1G~10G, 10m
SFP-10G-AOC20M	Optical transceiver, SFP+ AOC, 850nm, 2.5G~10.5G, 20m
SFP-10G-AOC-3M	Optical transceiver, SFP+, 1G~10.5G, (850nm, 3m, AOC)
QSFP-H40G-AOC10M	Optical transceiver, QSFP+, 40G, (850nm, 10m, AOC)
QSFP-4SFP10-AOC10M	Optical transceiver, QSFP+, 40G, (850nm, 10m, AOC)(Connect to four SFP+ Optical Transceiver)
SFP-25G-AOC-3M	Active Optical Cable , SFP28, 25G, (850nm, 3m, AOC)
SFP-25G-AOC-5M	Active Optical Cable , SFP28, 25G, (850nm, 5m, AOC)
SFP-25G-AOC-7M	Active Optical Cable , SFP28, 25G, (850nm, 7m, AOC)
SFP-25G-AOC-10M	Active Optical Cable , SFP28, 25G, (850nm, 10m, AOC)
QSFP-100G-AOC-10M	Active Optical Cable ,QSFP28,100G,(850nm,10m,AOC)
QSFP-100G-AOC-30M	Active Optical Cable ,QSFP28,100G,(850nm,30m,AOC)

Copper Cable	
SFP-10G-CU1M	SFP+, 10G, High Speed Direct-attach Cables, 1m, SFP+20M, CC2P0.254B(S), SFP+20M, Used indoor
SFP-10G-CU3M	SFP+, 10G, High Speed Direct-attach Cables, 3m, SFP+20M, CC2P0.254B(S), SFP+20M, Used indoor
SFP-10G-CU5M	SFP, 10G, High Speed Cable, 5m, SFP+20M, CC2P0.254B(S), SFP+20M, LSFRZH For Indoor
SFP-10G-AC7M	SFP, 10G, Active High Speed Cable, 7m, SFP+20M, CC2P0.254B(S), SFP+20M, LSFRZH For Indoor
SFP-10G-AC10M	SFP+, 10G, Active High Speed Cables, 10m, SFP+20M, CC2P0.32B(S), SFP+20M, Used indoor
SFP-25G-CU1M	SFP28, 25G, High Speed Direct-attach Cables, 1m, (SFP28), CC8P0.254B(S), SFP28
SFP-25G-CU3M	SFP28, 25G, High Speed Direct-attach Cables, 3m, (SFP28), CC8P0.254B(S), SFP28
SFP-25G-CU3M-N	SFP28, 25G, High Speed Direct-attach Cables, 3m, (SFP28), CC2P0.4B(S), SFP28
SFP28-25G-CU5M	SFP28, 25G, High Speed Direct-attach Cables, 5m, (SFP28), CC2P0.4B(S), SFP28
QSFP-40G-CU1M	QSFP+, 40G, High Speed Direct-attach Cables, 1m, QSFP+38M, CC8P0.254B(S), QSFP+38M, Used indoor
QSFP-40G-CU3M	QSFP+, 40G, High Speed Direct-attach Cables, 3m, QSFP+38M, CC8P0.32B(S), QSFP+38M, Used indoor
QSFP-40G-CU5M	QSFP+, 40G, High Speed Direct-attach Cables, 5m, QSFP+38M, CC8P0.40B(S), QSFP+38M, Used indoor
QSFP-4SFP10G-CU1M	QSFP+, 4SFP+10G, High Speed Direct-attach Cables, 1m, QSFP+38M, CC8P0.254B(S), 4*SFP+20M, Used indoor
QSFP-4SFP10G-CU3M	QSFP+, 4SFP+10G, High Speed Direct-attach Cables, 3m, QSFP+38M, CC8P0.32B(S), 4*SFP+20M, Used indoor
QSFP-4SFP10G-CU5M	QSFP+, 4SFP+10G, High Speed Direct-attach Cables, 5m, QSFP+38M, CC8P0.4B(S), 4*SFP+20M, Used indoor
QSFP28-100G-CU1M	QSFP28, 100G, High Speed Direct-attach Cables, 1m, (QSFP28), CC8P0.254B(S), QSFP28, Used indoor
QSFP28-100G-CU3M	QSFP28, 100G, High Speed Direct-attach Cables, 3m, (QSFP28), CC8P0.254B(S), QSFP28, Used indoor
QSFP28-100G-CU5M	QSFP28, 100G, High Speed Direct-attach Cables, 5m, (QSFP28), CC8P0.4B(S), QSFP28, Used indoor

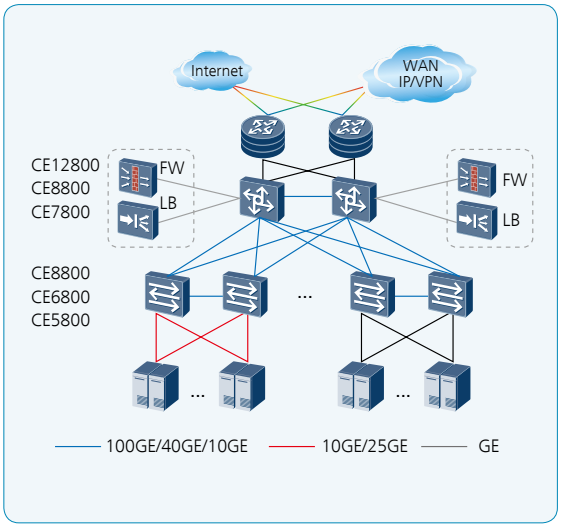
QSFP-4SFP25G-CU1M	100GE QSFP28-4SFP25G, High Speed Direct-attach Cables, 1m, (QSFP28), (4*(CC2P0.254B(S))), (4SFP28)
QSFP-4SFP25G-CU3M	100GE QSFP28-4SFP25G, High Speed Direct-attach Cables, 3m, (QSFP28), (4*(CC2P0.254B(S))), (4SFP28)
QSFP-4SFP25G-CU3M-N	100GE QSFP28-4SFP25G, High Speed Direct-attach Cables, 3m, (QSFP28), (4*(CC2P0.4B(S))), 4SFP28
QSFP-4SFP25G-CU5M	100GE QSFP28-4SFP25G, High Speed Direct-attach Cables, 5m, (QSFP28), (4*(CC2P0.4B(S))), 4SFP28

Networking and Application

Data Center Applications

On a typical data center network, CE12800/CE8800/CE7800 switches work as core switches, whereas CE8800/CE6800/CE5800 switches work as ToR switches and connect to the core switches using 100GE/40GE/10GE ports. These switches a fabric protocol, such as TRILL or VxLAN, to establish a non-blocking large Layer 2 network, which allows large-scale VM migrations and flexible service deployments.

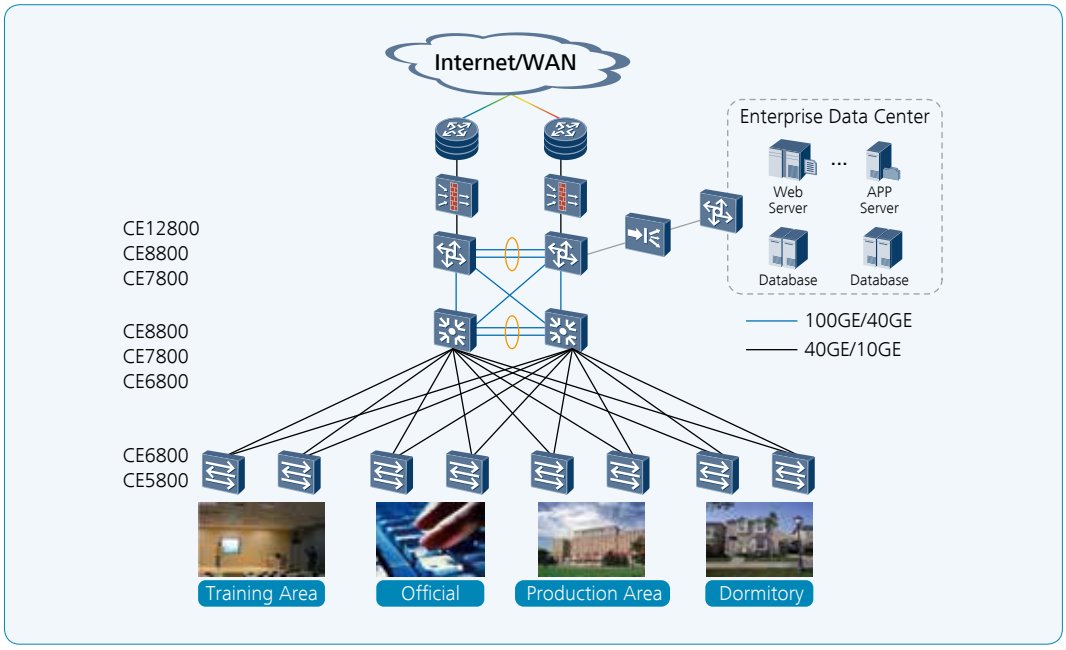
Note: TRILL and VxLAN can be also used on campus networks to support flexible service deployments in different service areas.



Campus Network Applications

On a typical campus network, multiple CE12800/CE8800/CE7800 switches are virtualized into a logical core switch using CSS or iStack technology. Multiple CE8800/CE7800/CE6800 switches at the aggregation layer form a logical switch using iStack technology. CSS and iStack improve network reliability and simplify network management. At the access layer, CE6800/CE5800 switches are virtualized with SVF to provide high-density line-rate ports.

Note: CSS, iStack, SVF, and M-LAG are also widely used in data centers to facilitate network management.



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