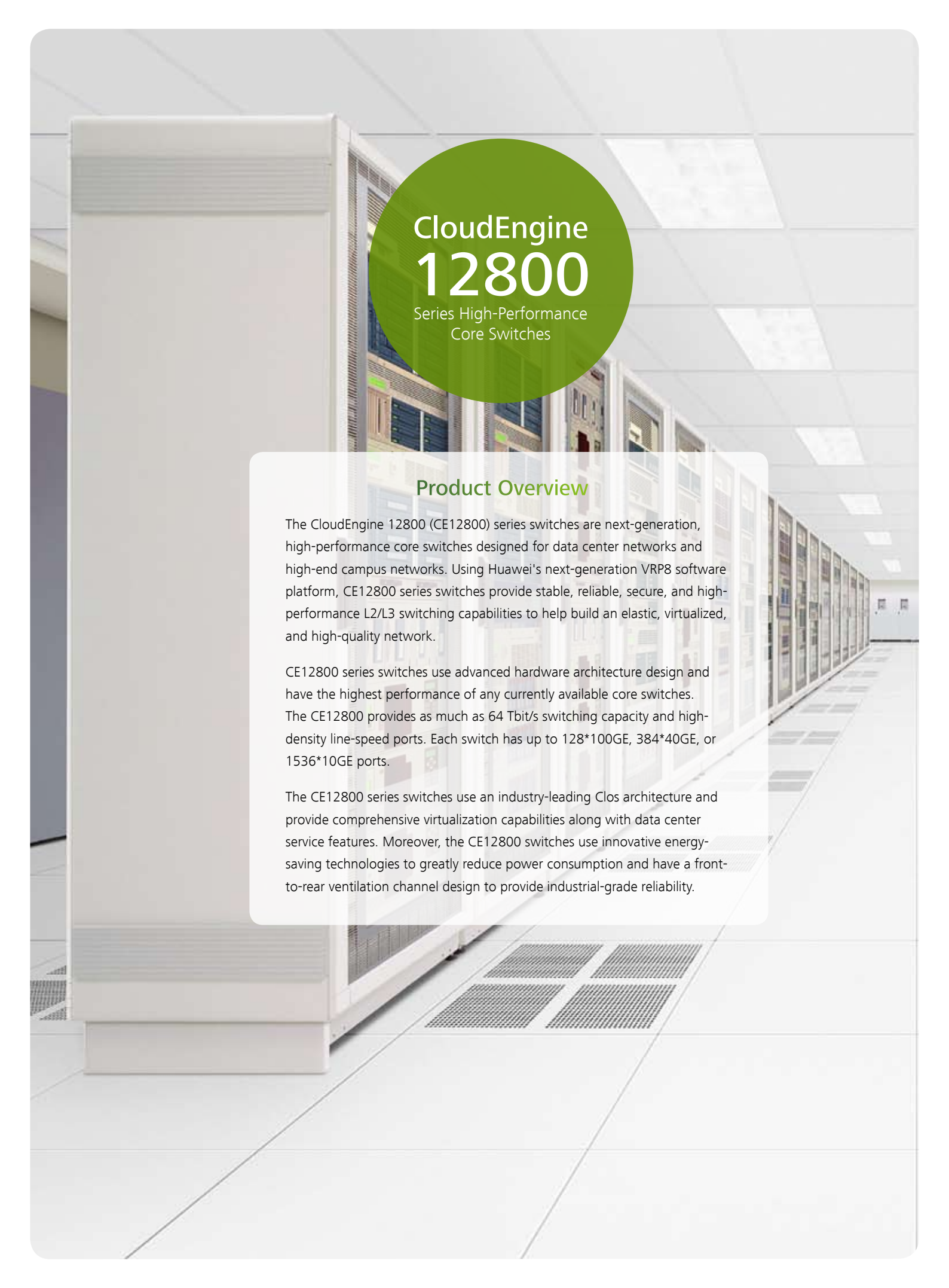# CloudEngine 12800 Series
High-Performance Core Switches

CloudEngine 12800

Series High-Performance Core Switches

Product Overview

The CloudEngine 12800 (CE12800) 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, secure, and high-performance L2/L3 switching capabilities to help build an elastic, virtualized, and high-quality network.

CE12800 series switches use advanced hardware architecture design and have the highest performance of any currently available core switches. The CE12800 provides as much as 64 Tbit/s switching capacity and high-density line-speed ports. Each switch has up to 128*100GE, 384*40GE, or 1536*10GE ports.

The CE12800 series switches use an industry-leading Clos architecture and provide comprehensive virtualization capabilities along with data center service features. Moreover, the CE12800 switches use innovative energy-saving technologies to greatly reduce power consumption and have a front-to-rear ventilation channel design to provide industrial-grade reliability.

CloudEngine 12800 Series High-Performance Core Switches

Product Appearance

The CE12800 is available in four models: CE12816, CE12812, CE12808, and CE12804. The CE12800 series uses interchangeable components to reduce costs on spare parts. This design ensures device scalability and protects customers' investment.

| CE12804 | CE12808 | CE12812 | CE12816 |

Product Characteristics

Next-Generation Core Engine Provides the Industry's Highest Performance

64 Tbit/s Switching Capacity

- The CE12800 provides 2 Tbit/s per-slot unidirectional bandwidth (scalable to 4 Tbit/s) and a maximum of 64 Tbit/s switching capacity (scalable to more than 100 Tbit/s). This capacity can support sustainable development of cloud-computing data centers for the next 10 years.

- The CE12800, together with the CE6800/5800 series of top-of-rack (ToR) switches, can implement the largest 360 Tbit/s non-blocking switching network in the industry. This network can provide access for up to 13,000 10GE servers or 50,000 GE servers and support data center server evolution across four generations (from GE, 10GE, 40GE, and finally to 100GE).

Terabit High-Density Line Cards

- Forwarding capacity of a line card can reach up to 960Gbit/s.

- The CE12800 has line cards that provide the industry's highest port densities, such as 8*100GE and 24*40GE/96*10GE line cards.

- The CE12800 provides as many as 128*100GE, 384*40GE, or 1536*10GE line-speed ports.

Super-Large Buffer on 100GE Ports

- All service ports (100GE/40GE/10GE/GE) support super-large buffer.

- The distributed buffering mechanism on inbound interfaces can effectively handle incast traffic loads in data centers.

- Each line card has a 12 GB buffer, which is dynamically shared by interfaces to improve usage efficiency.

Advanced Architecture Ensures Industry-Leading Network Quality

High-Performance Non-blocking Switching Architecture

- The CE12800's non-blocking switching architecture has five features: an orthogonal switch fabric design, Clos architecture, cell switching, Virtual Output Queuing (VoQ), and super-large buffer.

- Orthogonal switch fabric design: The CE12800 service line cards and switch fabric units use an orthogonal design in which service traffic between line cards is directly sent to switch fabric units 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 allows flexible switch fabric capacity expansion. The architecture uses Variable Size Cell (VSC) and has the dynamic routing capability. The implementation of load balancing among multiple switch fabrics prevents the switching matrix from being blocked and easily copes with complex and volatile traffic in data centers.

- VoQ: The CE12800 supports 96,000 VoQ queues to implement fine-grained 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

- Industry-grade reliability: The CE12800 has a mean time between failures (MTBF) of more than 30 years. Long-term stable operation of a core switch can ensure service continuity.

- Hot backup of five key components: The MPUs and CMUs work in 1+1 hot backup mode. The SFUs work in N+M hot backup mode. The power supplies support dual inputs and N+N backup and have their own fans. Each two fan trays work in 1+1 backup mode and 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 buses, management buses, and data buses all work in 1+1 backup mode. Bus redundancy ensures reliable signal transmission in the system.

- 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 software platform that provides continuous services.

- High-performance fine-grained distributed architecture: As the industry's high-end software platform, VRP8 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 process to maximize performance and reliability.

- Highly reliable non-stop anything (NSA) technologies: VRP8 support for NSA technologies includes non-stop routing (NSR), non-stop bridging (NSB), non-stop forwarding (NSF), non-stop upgrade (NSU), and non-stop patching (NSP). These NSA technologies protect network services and ensure continuous operation of the CE12800.

Comprehensive Virtualization Capabilities Implement Simple, Efficient Networking

Virtual System (VS) Implements On-Demand Resource Sharing

- Highest device virtualization capability: The CE12800 provides an industry-leading virtualization capability of 1:8, so one switch can be virtualized into as many as eight logical switches. This capability allows one core switch to manage services for multiple parts of an enterprise (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, and therefore network security is enhanced.

- Lower CAPEX: The VS technology virtualizes a physical switch into multiple logical switches to implement on-demand resource allocation, improving the usage efficiency of physical devices. This technology ensures network scalability and reduces investment on 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.

Cluster Switch System (CSS) Simplifies Network Management

- The CE12800 uses industry-leading CSS technology, which can virtualize as many as four physical switches into one logical switch to facilitate network management and improve reliability.

- The CE12800 provides a cluster bandwidth of 640 Gbit/s (scalable to 1.6 Tbit/s). This super-high bandwidth prevents traffic bottlenecks on data center networks.

- The CE12800 switches establish a cluster using service ports and allow distances of up to 80 km between cluster member switches.

- The CE12800 innovatively uses CSS+VS synergy technology to turn a network into a resource pool so that network resources can be allocated on demand. This on-demand resource allocation is ideal for the cloud-computing service model.

Large-Scale Routing Bridge Supports Flexible Service Deployment

- All CloudEngine series switches support Transparent Interconnection of Lots of Links (TRILL), a standard IETF protocol. The TRILL protocol helps build a large Layer 2 network with more than 500 nodes, which allows flexible service deployment and VM migration. 10GE/GE servers can be used on a TRILL network.

- 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 multipath (ECMP) routing. SPF and ECMP avoid the suboptimal path selection problem in the Spanning Tree Protocol (STP) and increase link bandwidth efficiency to 100%.

- The CE12800 supports up to 32 TRILL-based Layer 2 equal-cost paths, greatly improving load balancing capabilities of links. The network has a fat tree architecture to support smooth expansion.

Innovative Energy Saving Technologies Build a Energy Saving Pioneer

Efficient, Intelligent Power Supply System

- The CE12800 incorporates the industry's most efficient digital power modules, providing power efficiency of 96%.

- The system measures power consumption in real time and sets one or more power modules in sleep mode when system power demands are low.

- The CE12800 can adjust the power consumption of components to adapt to changes in service traffic volume, saving energy dynamically.

Strict Front-to-Rear Ventilation Channel Design

- The CE12800 uses a patented front-to-rear ventilation channel design that isolates cold air channels from hot air channels. This design meets heat dissipation requirements in data center equipment rooms.

- The straight ventilation channels of line cards eliminate channel cascading and separate cold air from hot air to improve heat dissipation efficiency.

- The CE12800 supports a maximum of 23 fan trays, and each fan tray has two counter-rotating fans. The fan trays are divided into several groups, with each group serving line cards in an area. 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.

Product Specifications

Item	CE12804	CE12808	CE12812	CE12816
Total Switching capacity	16 Tbit/s	32 Tbit/s	48 Tbit/s	64 Tbit/s
Total forwarding performance	4800 Mpps	9600 Mpps	14400 Mpps	19200 Mpps
Service slot quantity	4	8	12	16

Item	CE12804	CE12808	CE12812	CE12816
Device virtualization	Virtual system (VS)			
	Cluster switch system (CSS)			
Layer 2 multipath protocol	TRILL			
VLAN	Adding access, trunk, and hybrid interfaces to VLANs			
	Default VLAN			
	QinQ			
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			
STP	STP, RSTP, and MSTP			
	BPDU protection, root protection, and loop protection			
IP routing	IPv4 dynamic routing protocols, such as RIP, OSPF, IS-IS, and BGP			
	IPv6 dynamic routing protocols, such as, RIPng, OSPFv3, ISISv6, and BGP4+			
Multicast	IGMP v1/v2/v3, IGMPv1/v2/v3 snooping			
	PIM-SM, PIM-SSM			
	MSDP, MBGP			
	Multicast VLAN			
	Prompt leave			
	Multicast querier			
MPLS	Basic MPLS functions			
	MPLS VPN/VPLS			
Traffic Analysis	Netstream			
Reliability	LACP			
	VRRP and BFD for VRRP			
	BFD for BGP/IS-IS/OSPF/static route			
	DLDP			
	In-service software upgrade (ISSU)			

Item	CE12804	CE12808	CE12812	CE12816
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			
Configuration and maintenance	Console, Telnet, and SSH terminals			
	Network management protocols, such as SNMPv1/v2/v3			
	File upload and download through FTP and TFTP			
	BootROM upgrade and remote upgrade			
	Hot patches			
	User operation logs			
Security and management	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)	442mm×970mm ×486.15mm (11U)	442mm×970mm ×752.85mm (17U)	442mm×970mm ×975.1mm (22U)	442mm×1065mm ×1597.4mm (36U)
Chassis weight (empty)	< 75 kg	< 90 kg	< 110 kg	< 192 kg
Operating voltage	AC: 90 V to 290 V			
Maximum power supply capacity	5400W	10800W	16200W	27000 W

Order Information

Mainframe

CE12800 AC Bundle

CE-RACK-A01	FR42812 AC Assembly Rack(800x1200x2000mm)
CE12804A-B00	CE12804 AC Bundle0 (AC Assembly Chassis,2*MPUA,3*SFU04A,3*PAC-2700WA)
CE12804A-B01	CE12804 AC Bundle1 (AC Assembly Chassis,2*MPUA,5*SFU04A,3*PAC-2700WA)

CE12804A-B02	CE12804 AC Bundle2 (AC Assembly Chassis,2*MPUA,5*SFU04B,3*PAC-2700WA)
CE12808A-B00	CE12808 AC Bundle0 (AC Assembly Chassis,2*MPUA,3*SFU08A,4*PAC-2700WA)
CE12808A-B01	CE12808 AC Bundle1 (AC Assembly Chassis,2*MPUA,5*SFU08A,4*PAC-2700WA)
CE12808A-B02	CE12808 AC Bundle2 (AC Assembly Chassis,2*MPUA,5*SFU08B,4*PAC-2700WA)
CE12812A-B00	CE12812 AC Bundle0 (AC Assembly Chassis,2*MPUA,3*SFU12A,6*PAC-2700WA)
CE12812A-B01	CE12812 AC Bundle1 (AC Assembly Chassis,2*MPUA,5*SFU12A,6*PAC-2700WA)
CE12812A-B02	CE12812 AC Bundle2 (AC Assembly Chassis,2*MPUA,5*SFU12B,6*PAC-2700WA)

Basic Configuration

CE12804-AC	CE12804 AC Assembly Chassis (Including 2 CMUs and 9 Fans)
CE12808-AC	CE12808 AC Assembly Chassis (Including 2 CMUs and 13 Fans)
CE12812-AC	CE12812 AC Assembly Chassis (Including 2 CMUs and 17 Fans)
CE12816-AC	CE12816 AC Assembly Chassis (Including 2 CMUs and 23 Fans)
CE12804-DC	CE12804 DC Assembly Chassis (Including 2 CMUs and 9 Fans)
CE12808-DC	CE12808 DC Assembly Chassis (Including 2 CMUs and 13 Fans)
CE12812-DC	CE12812 DC Assembly Chassis (Including 2 CMUs and 17 Fans)
CE12816-DC	CE12816 DC Assembly Chassis (Including 2 CMUs and 23 Fans)

Main Processing Unit

| CE-MPUA | Main Processing Unit A |

Switch Fabric Unit

| CE-SFU04A | CE12804 Switch Fabric Unit A |
CE-SFU08A	CE12808 Switch Fabric Unit A
CE-SFU12A	CE12812 Switch Fabric Unit A
CE-SFU04B	CE12804 Switch Fabric Unit B
CE-SFU08B	CE12808 Switch Fabric Unit B
CE-SFU12B	CE12812 Switch Fabric Unit B
CE-SFU04C	CE12804 Switch Fabric Unit C
CE-SFU08C	CE12808 Switch Fabric Unit C
CE-SFU12C	CE12812 Switch Fabric Unit C

CE-SFU16	CE12816 Switch Fabric
Main frame spare part	
CE-CMUA	Centralized Monitoring Board A
FAN-12C	Fan Box
GE BASE-T Interface Card	
CE-L48GT-EA	48-Port 10/100/1000BASE-T Interface Card(EA,RJ45)
GE BASE-X Interface Card	
CE-L48GS-EA	48-Port 100/1000BASE-X Interface Card(EA,SFP)
10GBASE-X Interface Card	
CE-L24XS-EA	24-Port 10GBASE-X Interface Card(EA,SFP/SFP+)
CE-L48XS-EA	48-Port 10GBASE-X Interface Card(EA,SFP/SFP+)
40GE Interface Card	
CE-L24LQ-EA	24-Port 40G Interface Card(EA,QSFP+)
100GE Interface Card	
CE-L04CF-EA	4-Port 100G Interface Card(EA,CFP)
CE-L08CC-EA	8-Port 100G Interface Card(EA,CXP)
Power	
PAC-2700WA	2700W AC Power Supply
PDC-2200WA	2200W DC Power Supply
Software	
CE128-LIC-B11	CE12800 Basic SW,V100R001
CE128-LIC-B12	CE12800 Basic SW,V100R002
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
Document	
CE128-DOC-02	CE12800 Series Data Center Switch Product Documentation

Networking and Application

Application in a Data Center

On a typical data center network, CE12800 switches function as core switches, and CE6800/CE5800 switches function as ToR switches. CE6800/CE5800 switches connect to CE12800 switches through 40GE/10GE ports. The CE12800 and CE6800/CE5800 switches use the TRILL protocol to build a non-blocking large Layer 2 network, which allows large-scale VM migration and flexible service deployment.
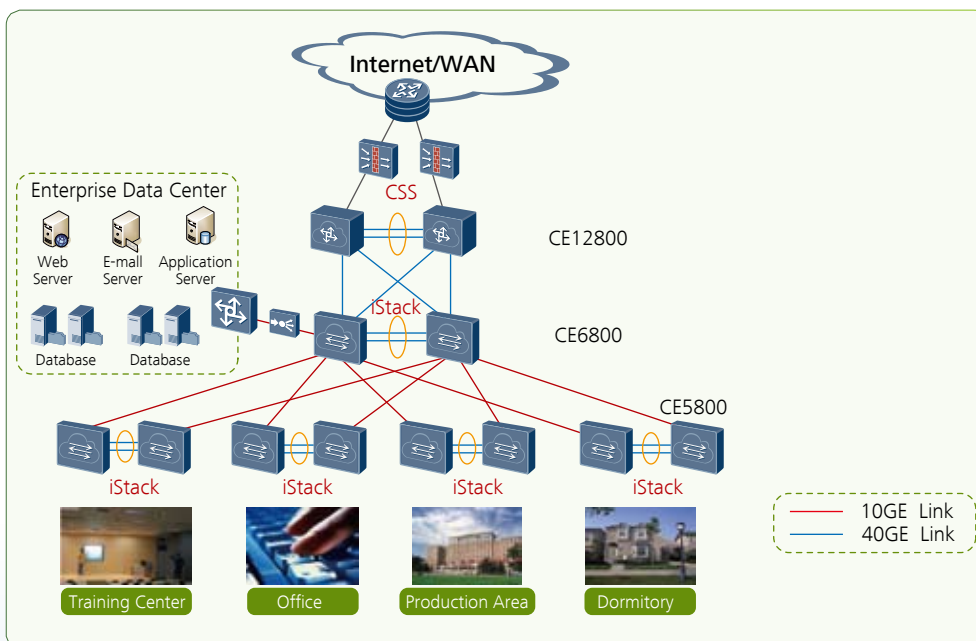
Note: The TRILL protocol can also be used on campus networks to support flexible service deployment in different service areas.
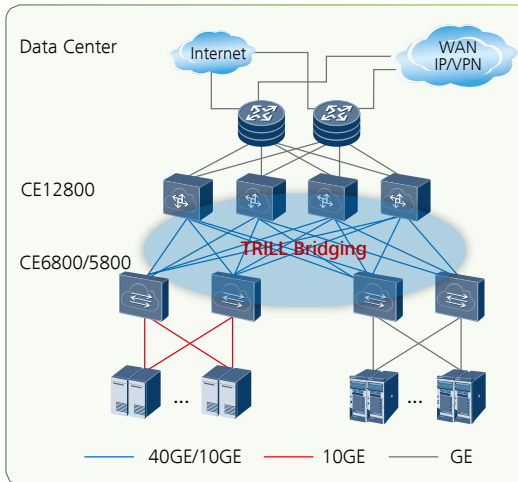
Application on a Campus Network

On a typical campus network, two CE12800 switches are virtualized into a logical core switch using CSS technology. Multiple CE6800 switches at the aggregation layer form a logical switch using iStack technology. The CSS and iStack technologies improve network reliability and simplify network management. At the access layer, CE5800 switches are stacked using iStack technology to provide high-densities of line-speed ports.

Note: CSS technology is also widely used in data centers to facilitate network management.