

**Huawei CX311 Switch Module
V100R001C10**

White Paper

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About This Document

Purpose

This document describes the E9000 CX311 10GE / FCoE converged switch module (CX311 for short) in terms of its functions, advantages, appearance, specifications, internal networking, standards and certifications. You can learn about the CX311 by reading this document.

The product features and commands for the ethernet switching plane of the switch modules vary according to the software version. For details, see the documents listed in the following table.

Huawei Support Website Version	Ethernet Switching Plane Software Version	Reference Document
V100R001C00 or V100R001C00SPCxxx	1.1.3.300.3	See the <i>Huawei CX311 Switch Module V100R001C00 White Paper</i> .
	1.1.3.301.6	
	1.1.3.330.13	
V100R001C10 or V100R001C10SPCxxx	1.2.1.0.39	See this document.
	x.xx, for example, 2.05	






Intended Audience

This document is intended for:

- Huawei presales engineers
- Channel partner presales engineers
- Enterprise presales engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	DANGER indicates a hazard with a high level or medium level of risk which, if not avoided, could result in death or serious injury.
 WARNING	WARNING indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 CAUTION	CAUTION indicates a potentially hazardous situation that, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.
 TIP	TIP indicates a tip that may help you solve a problem or save time.
 NOTE	NOTE provides additional information to emphasize or supplement important points of the main text.

Change History

Changes between document issues are cumulative. The latest document issue contains all changes made in previous issues.

Issue 02 (2015-07-17)

This issue is the second official release.

Mode	Change Description
Modified	The reference to the throughput is added to 1.8 Technical Specifications .

Issue 01 (2015-02-16)

This issue is the first official release.

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1 Overview

About This Chapter

1.1 Function

This topic describes the functions, protocols, and ports of the CX311 10GE / fiber channel over Ethernet (FCoE) converged switch module (CX311 for short).

1.2 Advantages

The CX311 provides high performance, high-density ports, and high specifications, and supports large data center networks, high-performance stacking, and various data center features. In addition, the CX311 switch module can be easily deployed and maintained.

1.3 Appearance

This topic describes the CX311 in terms of its appearance, panel, and installation positions in the chassis.

1.4 Ports

This topic describes the features, number rules, names, types, and quantity of the CX311 ports.

1.5 Indicators

This topic describes the indicators on the CX311.

1.6 Internal Chassis Networking

This topic describes connection relationships between the CX311 and mezz modules on compute nodes.

1.7 Software and Hardware Compatibility

This topic describes mezz modules that can work with the CX311 and pluggable modules and cables supported by ports on the CX311 panel.

1.8 Technical Specifications

This topic describes the physical, environmental, power, and network switching specifications of the CX311.

1.1 Function

This topic describes the functions, protocols, and ports of the CX311 10GE / fiber channel over Ethernet (FCoE) converged switch module (CX311 for short).

The CX311 is installed in the rear slot of the E9000 chassis and connected to compute nodes, storage nodes, management modules through the E9000 midplane. The CX311 performs switching of internal data packets and control management packets to provide high-speed data transmission.

Table 1-1 describes functions of the converged switching plane of the CX311. **Table 1-2** describes functions of the FCoE gateway of the CX311.

Table 1-1 converged switching plane function description

Function		Description
Ethernet features	Ethernet	<ul style="list-style-type: none"> ● Operating modes of full-duplex and auto-negotiation ● Ethernet ports support the rate of GE, 10GE and 40GE. <p>NOTE</p> <ul style="list-style-type: none"> ● 10GE optical ports support passive direct attached cables (DACs). ● 10GE optical ports support GE and 10GE multi-mode and single-mode optical modules. ● 10GE optical ports support SFP electrical modules. ● 40GE port for interconnecting switch modules through the backplane. ● 40GE optical port, four SFP+ ports on the panel, using the QSFP+ to 4*SFP+ high-speed cables or MPO-4*DLC fibers to connect to the peer 40GE port. <ul style="list-style-type: none"> ● Port traffic control <p>NOTE</p> <p>10GE optical interfaces do not support flow control.</p> <ul style="list-style-type: none"> ● Jumbo frames ● Link aggregation ● Load balancing among links within a trunk ● Interface isolation and forwarding restrictions ● Broadcast storm suppression

Function		Description
	Virtual Local Area Network (VLAN)	<ul style="list-style-type: none"> ● Access modes of access, trunk, and hybrid ● VLAN assignment: port-based, MAC address-based, IP subnet-based VLAN assignment ● VLAN aggregation ● MUX VLAN ● Transparent Transmission of Protocol Packets in a VLAN
	QinQ	<ul style="list-style-type: none"> ● Basic QinQ ● Selective QinQ
	VLAN Mapping	<ul style="list-style-type: none"> ● 1 to 1 VLAN mapping. ● 2 to 1 VLAN mapping. ● 2 to 2 VLAN mapping.
	Media Access Control (MAC)	<ul style="list-style-type: none"> ● Secure MAC addresses ● Automatic learning and aging of MAC addresses ● Static, dynamic, and blackhole MAC address entries ● Packet filtering based on source MAC addresses ● Interface-based MAC learning limits
	Link Layer Discovery Protocol (LLDP)	Support for LLDP
Ethernet loop protection	Multiple Spanning Tree Protocol (MSTP)	<ul style="list-style-type: none"> ● Spanning Tree Protocol (STP) ● Rapid Spanning Tree Protocol (RSTP) ● MSTP ● Bridge protocol data unit (BPDU) protection, root protection, and loop protection ● Partitioned STP and Layer 2 protocol transparent transmission
IP features	Address Resolution Protocol (ARP)	<ul style="list-style-type: none"> ● Static and dynamic ARP entries ● ARP in a VLAN ● Aging of ARP entries ● ARP and Reverse Address Resolution Protocol (RARP) ● ARP proxy ● Auto-detection

Function		Description
	IPv6	<ul style="list-style-type: none"> ● IPv4/IPv6 dual-stack ● Neighbor Discovery (ND) ● IPv6 over IPv4 Manual Tunnel ● IPv6 over IPv4 GRE Tunnel ● 6to4 Tunnel
	Dynamic Host Configuration Protocol (DHCP)	<ul style="list-style-type: none"> ● DHCP server ● DHCP snooping ● DHCP relay ● DHCPv6 Relay
IP forwarding	Unicast routing features	<ul style="list-style-type: none"> ● IPv4/IPv6 static routing ● Routing Information Protocol version 1 (RIP-1), RIP-2, and RIPng ● Open Shortest Path First (OSPF), including OSPFv2 and OSPFv3 ● Intermediate System to Intermediate System (IS-IS) ● Border Gateway Protocol 4.0 (BGP4) and Border Gateway Protocol for IPv6 (BGP4+) ● Routing protocol ● Policy-based routing ● Unicast Reverse Path Forwarding (URPF) check
	VPN features	<ul style="list-style-type: none"> ● MCE (Multi-VPN-Instance CE) and IPV6 MCE ● GRE Tunnel
	Multicast routing features	<ul style="list-style-type: none"> ● Internet Group Management Protocol Version 1/2/3 (IGMPv1/v2/v3) ● PIM-SM (IPv4) and PIM-SM (IPv6) ● PIM-SSM (IPv4) and PIM-SSM (IPv6) ● MLDv1 and MLDv2 ● MLD SSM Mapping ● Multiprotocol BGP (MBGP) ● Multicast Source Discovery Protocol (MSDP) ● Multicast routing policies ● Reverse Path Forwarding (RPF) ● Bidirectional PIM ● Bidirectional PIM (IPv4) and Bidirectional PIM (IPv6)

Function		Description
Device reliability	Bidirectional Forwarding Detection (BFD)	<ul style="list-style-type: none"> ● BFD (IPv4) and BFD (IPv6) ● Association between BFD and Eth-Trunk ● BFD for OSPF ● BFD for OSPFV3 ● BFD for IS-IS ● BFD for IS-IS IPV6 ● BFD for BGP ● BFD for BGP4+ ● BFD for PIM(IPv4) ● BFD for PIM(IPv6) ● BFD for static routing(IPv4) ● BFD for static routing(IPv6) ● BFD for VRRP BFD for VRRP ● BFD for VRRP BFD for VRRP6
	Others	<ul style="list-style-type: none"> ● Virtual Router Redundancy Protocol (VRRP) and VRRP6 ● Device Link Detection Protocol (DLDP) ● Smart Link ● Ethernet in the First Mile (EFM), defined in 802.3ah
Layer 2 multicast features	Layer 2 multicast features	<ul style="list-style-type: none"> ● IGMP snooping ● IGMP proxy ● Fast leave ● Multicast traffic control ● Multicast VLAN
QoS features	Traffic classification	<ul style="list-style-type: none"> ● Traffic classification based on combination of the L2 protocol header, IP 5-tuple, outbound interface, and 802.1p priority ● Traffic classification based on the C-VID and C-PRI of QinQ packets
	Traffic behavior	<ul style="list-style-type: none"> ● Access control after traffic classification ● Traffic policing based on traffic classifiers ● Re-marking based on the traffic classification result ● Class-based packet queuing ● Association between traffic classifiers and traffic behaviors

Function		Description
	Queue scheduling	<ul style="list-style-type: none"> ● Priority queuing (PQ) scheduling ● Deficit round robin (DRR) scheduling ● PQ+DRR scheduling ● Weighted round robin (WRR) scheduling ● PQ+WRR scheduling
	Congestion avoidance	Weighted Random Early Detection (WRED)
	Rate limiting on outbound interfaces	Rate limiting on outbound interfaces
Virtualization	Many-to-one virtualization	<ul style="list-style-type: none"> ● Intelligent Stack (iStack) ● Stack split and merge ● Dual-active detection ● Version and configuration synchronization
Data center features	TRILL	<ul style="list-style-type: none"> ● TRILL features ● TRILL NSR ● TRILL ECMP ● IGMP over TRILL ● TRILL multi-homing active-active
	Data Center Bridging (DCB)	<ul style="list-style-type: none"> ● Data Center Bridging Exchange Protocol (DCBX) ● Priority-based Flow Control (PFC) ● Enhanced Transmission Selection (ETS)
	Fibre channel over Ethernet (FCoE)	FIP Snooping Bridge (FSB)
	VM detection	<ul style="list-style-type: none"> ● Virtual awareness ● Automatic policy deployment ● Automatic policy migration ● Cluster of NLB servers <ul style="list-style-type: none"> - Association between virtual IP addresses of NLBs and multicast MAC addresses - Association between one multicast MAC address and multiple outbound interfaces

Function		Description
	Forwarding mode based on the Virtual Ethernet Port Aggregator (VEPA)	Forwarding mode based on the Virtual Ethernet Port Aggregator (VEPA)
Configuration and maintenance	Terminal service	<ul style="list-style-type: none"> ● Configuration using command lines ● Error messages and online help in English and Chinese ● Login through console and Telnet terminals ● Send function and data communications between terminal users
	File system	<ul style="list-style-type: none"> ● Directory and file management ● File upload and download using File Transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP) and Secure File Transfer Protocol (SFTP)
	Debugging and maintenance	<ul style="list-style-type: none"> ● Unified management of logs, alarms, and debugging information ● Electronic labels ● User operation logs ● Detailed debugging information for network fault diagnosis ● Network test tools such as tracert and ping commands ● Port mirroring and traffic mirroring
	Version upgrade	<ul style="list-style-type: none"> ● Device software loading and in-service software loading ● In-service upgrade using the basic input/output system (BIOS) menu ● In-service patching <p>NOTE To ensure secure service application, periodically upgrade the switch module software version.</p>

Function		Description
Security and management	System security	<ul style="list-style-type: none"> ● Hierarchical command-line protection based on user levels, preventing unauthorized users from using commands to access switch modules ● Secure Shell (SSH) ● RADIUS (IPv4) and RADIUS (IPv6) authentication for login users ● HWTACACS (IPv4) and HWTACACS (IPv6) authentication for login users ● Access control list (ACL) filtering ● Dynamic ARP inspection (DAI) ● DHCP packet filtering (appending the Option 82 field) ● Defense against control packet attacks ● Defense against attacks of source address spoofing, LAND, SYN flood (TCP SYN), smurf, ping flood (ICMP echo), teardrop, and ping of death ● Logs about attacking MAC addresses
	Network management	<ul style="list-style-type: none"> ● ICMP-based ping and tracer ● Simple Network Management Protocol Version 1/2c/3 (SNMPv1/v2c/v3) ● Standard management information base (MIB) ● Remote network monitoring (RMON) ● NetStream, with output statistics packets in the V5, V8, or V9 format ● sFlow ● Network quality analysis

Table 1-2 FCoE gatewayfunction description

Function		Description
FC switching	FC optical port	Supports 4G/8G FC autonegotiation, full duplex, and the storage port function.
	Switching	<ul style="list-style-type: none"> ● Supports full fabric mode and transparent mode.
	NPIV	Supports N_Port ID virtualization (NPIV). A physical port supports access of multiple N_Port_IDs.
FC switching	Load sharing	Supports load sharing.

Function		Description
Configuration and maintenance	Configuration and management modes	<ul style="list-style-type: none"> ● Supports configurations using command lines. ● Supports the HTTPS-based Webtool (GUI). ● Simple Network Management Protocol Version 1/3 (SNMPv1/v3). ● Supports the FC Fabric Element management information base (MIB).
	Connection mode	<ul style="list-style-type: none"> ● ETH connection (over SSH, SNMP, or the Web). ● SOL connection.
	Version upgrade	<p>Supports online upgrades for software. Services are not interrupted during an upgrade. The upgrade takes effect after the restart.</p> <p>NOTE To ensure secure service application, periodically upgrade the switch module software version.</p>
Network security	System security	<ul style="list-style-type: none"> ● Hierarchical rights management based on user levels, preventing unauthorized users from accessing switch modules. ● Supports Secure Shell (SSH) and Secure Sockets Layer (SSL). ● Supports SNMPv1/v3. ● Supports Remote Authentication Dial In User Service (RADIUS) for user logins.

1.2 Advantages

The CX311 provides high performance, high-density ports, and high specifications, and supports large data center networks, high-performance stacking, and various data center features. In addition, the CX311 switch module can be easily deployed and maintained.

High Performance and High-Density Ports

Underpinned by the leading hardware platform, the CX311 provides high-density ports and a line-speed forwarding capability. It supports next-generation server application of high performance and high density.

The CX311 provides sixteen 10GE SFP+ optical ports (or four 40GE ports) for connecting upstream to convergence/core switches, thirty-two 10GE electrical ports for interconnecting with high-performance compute nodes, eight 8G fibre channel (FC) optical ports for connecting to the FC storage area networks (FC SANs), one 40GE port for interconnecting with switch modules, and two GE ports for interconnecting with MM910s.

The CX311 provides low-latency forwarding. Supports the line speed switching capability of 1.204 Tbit/s (throughput) and line-speed forwarding for Ethernet frames. The forwarding latency for layer-2 Ethernet frames in cut through mode is lower than 1.5 us.

High Specifications and Support for Large Data Center Networks

The CX311 provides the highest specifications in the industry. It supports a maximum of 131,072 MAC addresses and 16,384 forwarding information bases (FIBs) entries.

High-Performance Stacking, Easy Deployment and Maintenance

The CX311 supports stacking of four devices. It has the following advantages:

- High performance: A single stacking system can provide more than thirty-two 10GE ports.
- High bandwidth: The CX311 supports 160GE stacking bandwidth. The stacking system has small bandwidth bottlenecks.
- Easy deployment and maintenance:
 - Pre-deployment and offline configuration are supported. The system can be pre-planned and pre-configured. Devices can be added as required, supporting plug-and-play.
 - The slot ID of a device is the ID in a stacking system, facilitating device identification and maintenance.
 - Indicators on the front panel indicate the role and status of a stacking system. The stacking system can be maintained without a terminal.
- Simple upgrade: The stacking system supports quick and automatic software upgrades, simplifying upgrade operations and reducing upgrade workload.
 - Rapid software upgrades: When two switch modules are stacked, the standby switch module is upgraded before the active switch module. This ensures that at least one switch module is operating.
 - Automatic software upgrades: When two switch modules are stacked, the software version is automatically synchronized from the active switch module to the standby one.

Various Data Center Features

- Fibre channel over Ethernet (FCoE) and Data Center Bridging (DCB)
 - Supports FCoE, Data Center Bridging Exchange (DCBX), 802.1Qbb-compliant priority-based flow control (PFC), and 802.1Qaz-compliant Enhanced Transmission Selection (ETS). With these features, the fibre channel (FC) architecture can run on the enhanced Ethernet without packet loss issues to achieve a converged network and reduce networking costs.
 - Supports seamless intercommunication with the FC infrastructure, protecting investments on the FC SAN.
- Virtual/virtual machine (VM) access
 - Supports virtualized servers, improving data center utilization.
 - Supports virtual resource discovery. During migration of VMs, VM network policies can be automatically migrated using the virtual resource discovery function so that network resources can be allocated as required. Working with the large-scale layer 2 network, VMs can be freely migrated inside the whole data center.
- Transparent Interconnection of Lots of Links (TRILL) protocol

- Complying with the Internet Engineering Task Force (IETF) standard, the TRILL protocol supports ultra-large networks and flexible networking modes.
- The TRILL protocol supports load balancing by paths, so that traffic can be shared between multiple paths according to service requirements.
- The TRILL protocol supports sub-second network convergence. Any changes on the network can be quickly sensed and then fast convergence is performed.
- Convergence of the Ethernet and storage networks
 - Supports convergence of the Ethernet and storage networks, reducing switching planes and network interface cards (NICs) and facilitating network management.
 - Supports full fabric mode and transparent mode (that is, NPV mode). NPV is short for N-Port virtualization.
 - Supports N_Port ID virtualization (NPIV). A physical port supports access of multiple N_Port_IDs.

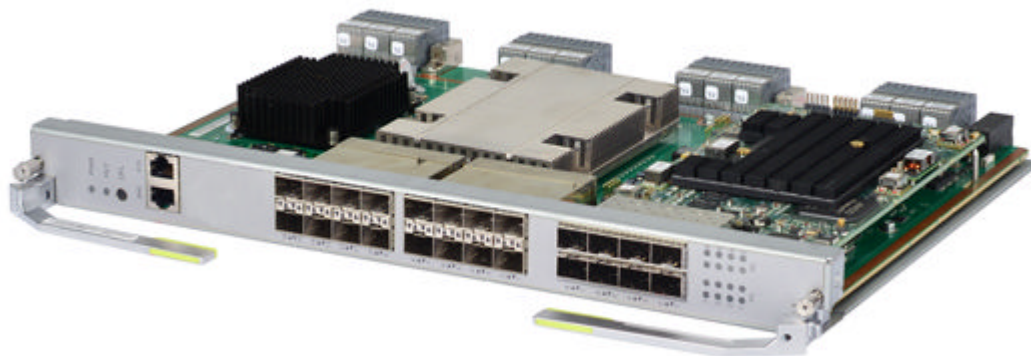
1.3 Appearance

This topic describes the CX311 in terms of its appearance, panel, and installation positions in the chassis.

Appearance

[Figure 1-1](#) shows the CX311.

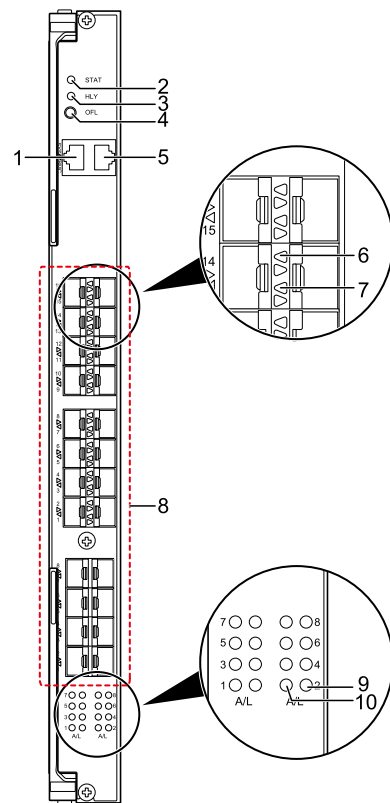
Figure 1-1 Appearance



Panel

[Figure 1-2](#) shows the CX311 panel.

Figure 1-2 Panel



1	BMC serial port	2	Stacking status indicator
3	Healthy indicator	4	Offline button/indicator
5	SYS serial port	6	10GE/40GE optical port
7	Connection status indicator of the 10GE/ 40GE optical port	8	Data transmission status indicator of the 10GE/40GE optical port
9	8G FC optical port	10	Connection status indicator of the 8G FC optical port
11	Data transmission status indicator of the 8G FC optical port	-	-

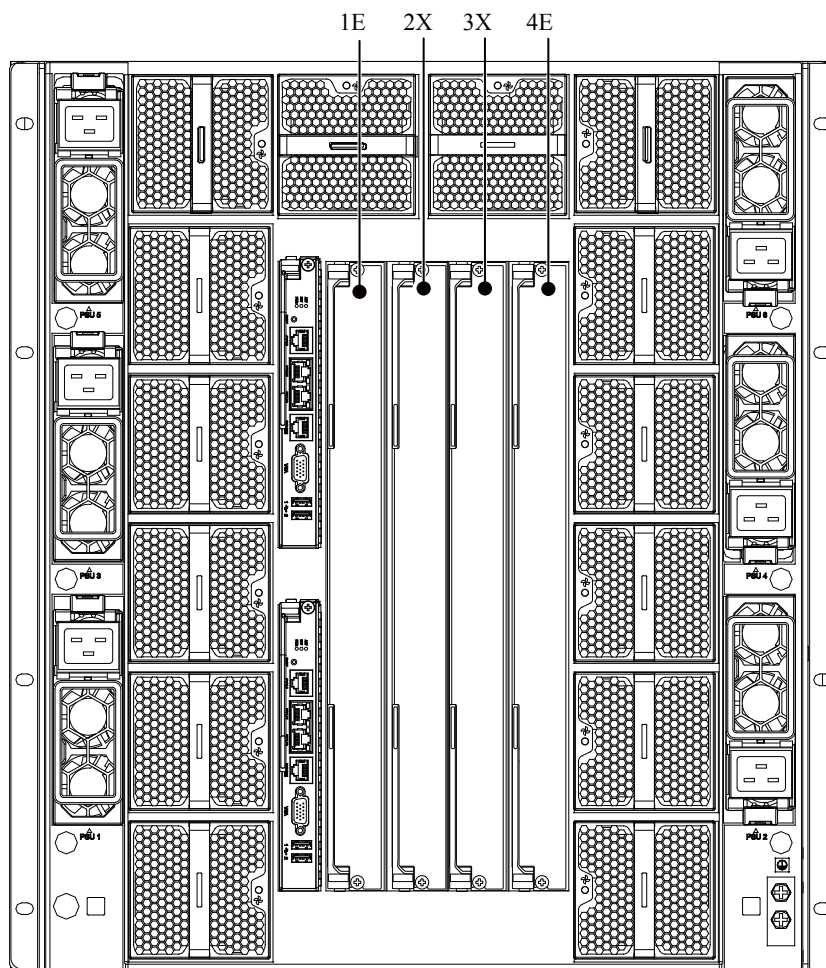
NOTE

The numbers on the left side are port serial numbers. The arrow direction of a triangle indicates the direction of a port.

Installation Positions

The CX311 can be installed in the four slots at the rear of the E9000 chassis. The four slots are 1E, 2X, 3X, and 4E, as shown in [Figure 1-3](#).

Figure 1-3 Installation positions and slots



1.4 Ports

This topic describes the features, number rules, names, types, and quantity of the CX311 ports.

The CX311 provides ports for users to operate and configure. The ports are used to send and receive data.

The CX311 ports are numbered in *Slot number/Subcard number/Port number* format.

- *Slot number*: indicates the slot number of the current switch module. Its value ranges from 1 to 4, from left to right mapping to slot numbers 1E, 2X, 3X, and 4E.
- *Subcard number*: indicates the number of a subcard supported by service ports. The value ranges from 1 to 20. [Table 1-3](#) and [Table 1-4](#) describe subcard numbers.
- *Port number*: indicates the sequence number of a port on a subcard. [Table 1-3](#) and [Table 1-4](#) describe port numbers and subcards.

For example, if the CX311 is in slot 2X, the first GE port on the upper right on the panel is numbered as 10GE 2/17/16, as shown in [Figure 1-4](#).

The numbers of the FC optical ports on the CX311 are Ext1:0–Ext8:7, which map to ports 1–8 for FC optical ports on the panel, as shown in **Figure 1-4**.

Figure 1-4 Port naming rules

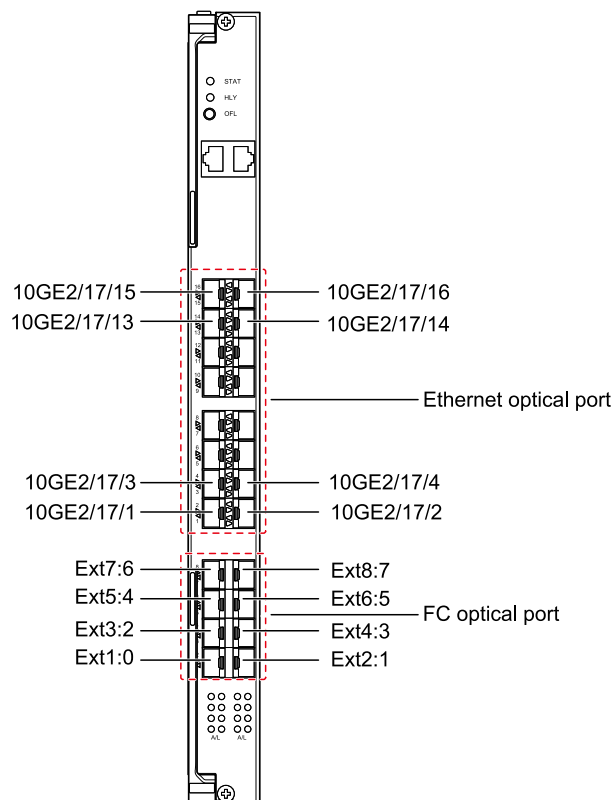


Table 1-3 describes the external ports on the CX311.

Table 1-3 External ports

Port	Type	Quantity	Subcard Number	Port Number	Description
Serial port	RJ45	2	-	-	<p>The serial ports include the baseboard management controller (BMC) serial port and the SYS serial port. The ports comply with RS232. No indicator is available.</p> <ul style="list-style-type: none"> ● BMC serial port: The port is used to log in to the BMC command-line interface (CLI). ● SYS serial port: This port is used for managing, maintaining, and commissioning the converged switching plane and FCoE gateway. The SYS serial port connects to the converged switching plane by default. You can run systemcom to switch the plane on the BMC CLI. <p>The BMC serial port and the serial port of the converged switching plane support the baud rate of 115,200 bit/s.</p> <p>The serial port of the FCoE gateway supports the baud rate of 9,600 bit/s.</p>

Port	Type	Quantity	Subcard Number	Port Number	Description
10GE optical port or 40GE optical port	SFP+	16 or 4	17	<ul style="list-style-type: none"> ● 10GE optical port: the value ranges from 1 to 16. ● 40GE optical port: the value ranges from 1 to 4. <p>The ports are numbered from 1 in ascending order from left to right and then from bottom to top.</p>	<p>The sixteen ports in the higher of the panel are used to exchange data with an external network.</p> <ul style="list-style-type: none"> ● 10GE optical port: Two indicators are provided for each port. The orange indicator is the data transmission status indicator for the 10GE optical port, and the green indicator is the connectivity status indicator for the 10GE optical port. ● 40GE optical port: The four ports numbered 1/2/3/4, 5/6/7/8, 9/10/11/12, and 13/14/15/16 can be configured as a 40GE port. Each 40GE port has four orange data transmission status indicators and four green connection status indicators.
8G FC optical port	SFP+	8	-	-	<p>The lower eight ports on the panel are used to connect to a FC storage network.</p> <p>Two indicators are provided for each port. The orange indicator is the data transmission status indicator for the 8G FC optical port, and the green indicator is the connectivity status indicator for the 8G FC optical port.</p>

Table 1-4 describes the internal ports on the CX311.

Table 1-4 Internal ports

Port	Type	Quantity	Subcard Number	Port Number	Description
10GE port	-	32	1-16	The value is 1 or 2.	The ports connect to the front half-width slots 01 to 16, and map to subcard numbers from 1 to 16.
40GE port	-	1	18	The value is 1.	The port is used to connect switch modules in the 1E and 4E slots or in the 2X and 3X slots.
GE port	-	2	19	The value ranges from 1 to 2.	Two GE ports connect to two MM910s respectively. They are used to communicate with the eth0 and eth2 in the internal MM910.
10GE port	-	8	20	The value ranges from 1 to 8.	The ports connect to MX510.



1.5 Indicators

This topic describes the indicators on the CX311.

You can observe the indicators to determine the current operating status of the CX311. [Table 1-5](#) describes the indicators.

Table 1-5 Indicators

Silkscreen	Meaning	Color	Description
STAT	Stacking status indicator	Green	<ul style="list-style-type: none"> ● Off: The CX311 is not powered on. ● Blinking green for 10 times: The CX311 is being powered on. ● Blinking green: The CX311 is standby in stacking mode and is operating properly. ● Steady green: The CX311 is active in stacking mode or is not stacked, and is working properly.

Silkscreen	Meaning	Color	Description
HLV	Healthy indicator	Red and green	<ul style="list-style-type: none"> ● Off: The CX311 is not powered on. ● Steady green: The CX311 is working properly. ● Blinking red (1 Hz): A major alarm is generated. ● Blinking red (4 Hz): A critical alarm is generated. ● Blinking red (5 Hz): The CX311 is not installed properly. <p>NOTE It is difficult to distinguish a blinking frequency of 4 Hz from a blinking frequency of 5 Hz. When the HLV indicator is quickly blinking red, you are advised to check whether the device is securely inserted and then check whether a critical alarm is generated.</p>
OFL	Offline button/ indicator (reserved)	N/A	None.
	Connection status indicator of the 10GE/40GE optical port	Green	<ul style="list-style-type: none"> ● Off: The port is not connected or not properly connected. ● Steady green: The port is properly connected.
	Data transmission status indicator of the 10GE/40GE optical port	Orange	<ul style="list-style-type: none"> ● Off: No data is being transmitted over the port. ● Blinking orange: Data is being sent or received over the port.

Silkscreen	Meaning	Color	Description
A	Data transmission status indicator of the 8G FC optical port	Orange	<ul style="list-style-type: none"> ● Off: No data is being transmitted over the port. ● Blinking orange (twice/second): If the green indicator (L) is blinking twice per second at the same time, a high temperature alarm is generated. ● Blinking orange (more than twice/second): Data is being sent or received over the port.
L	Connection status indicator of the 8G FC optical port	Green	<ul style="list-style-type: none"> ● Off: No optical module is installed, or an exception occurs when the port is receiving optical signals. ● Steady green: The link properly connected. ● Blinking green (once/second): The device is registering or the port is in the diagnosis state. ● Blinking green (twice/second): The port is not properly connected or the port is faulty. If the orange indicator (A) is blinking twice per second at the same time, a high temperature alarm is generated.

1.6 Internal Chassis Networking

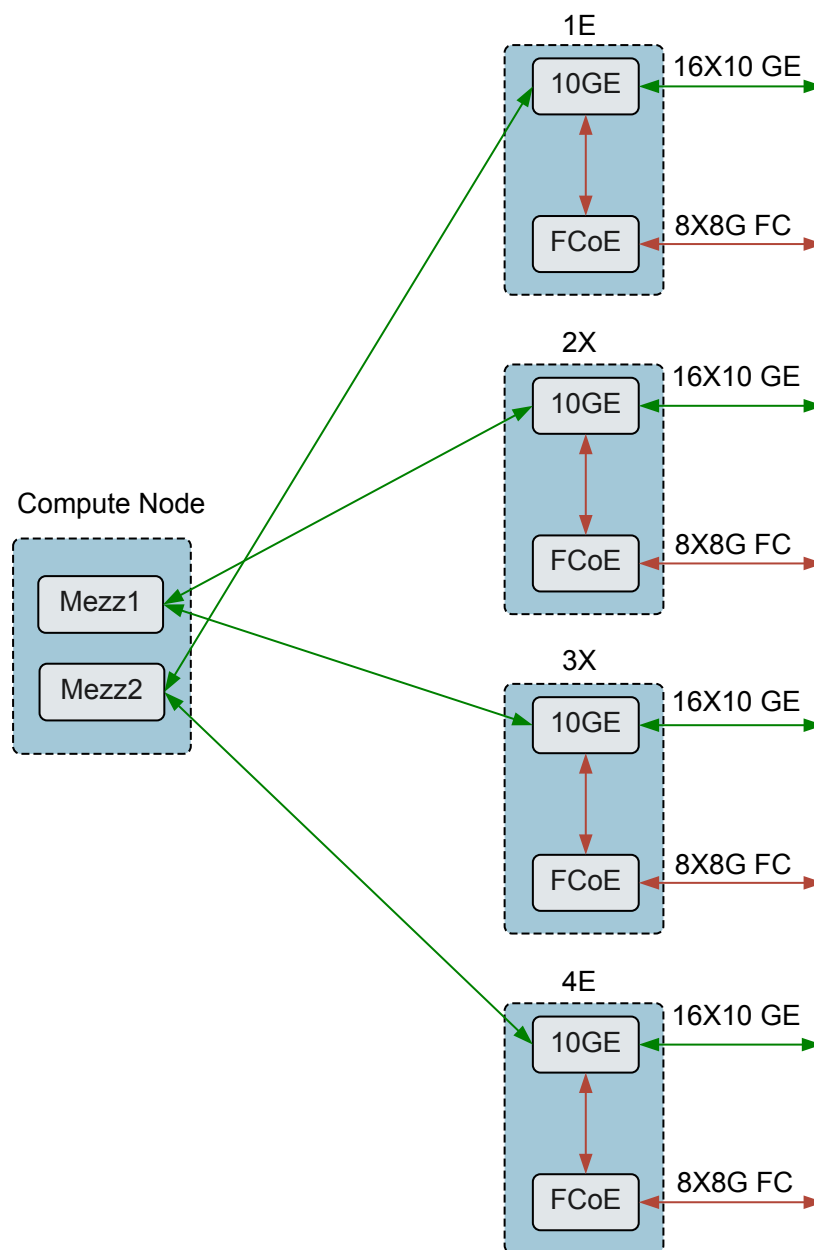
This topic describes connection relationships between the CX311 and mezz modules on compute nodes.

For details about the networking of the CX311 and Mezz cards on compute nodes, see [E9000 Server Mezz Card-Switch Module Networking Assistant](#).

Figure 1-5 shows the internal chassis networking for the CX311 and compute nodes. Ports on compute nodes for connecting to the CX311 are provided by two mezz modules as follows:

- Mezz 1 connects to converged switching plane of the CX311s in slots **2X** and **3X**.
- Mezz 2 connects to converged switching plane of the CX311s in slots **1E** and **4E**.

Figure 1-5 Mapping between the CX311 and mezz modules on compute nodes



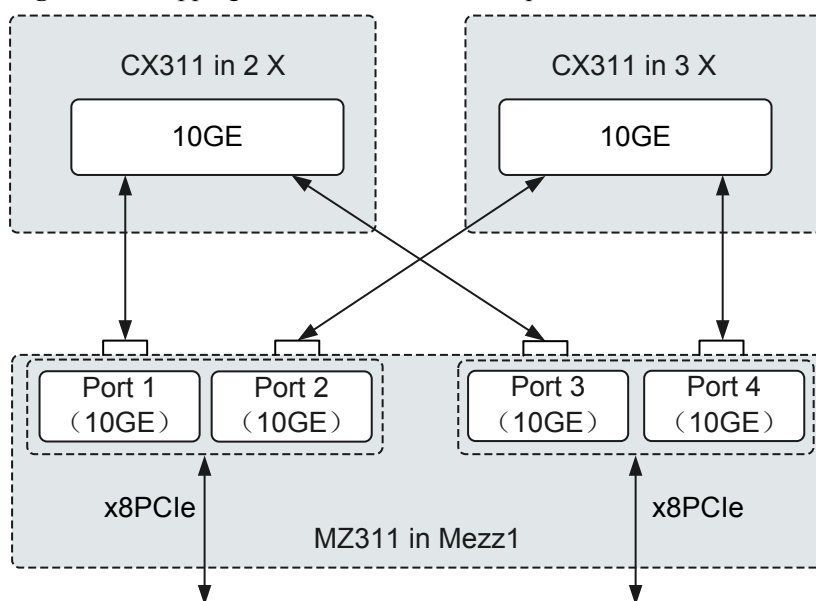
The following describes the mapping between the CX311s and mezz modules. For example, the CX311s are installed in slots **2X** and **3X** and connect to Mezz 1.

Port Mapping Between a Switch Module and a Mezz Module

Mapping between the CX311 and ports on the MZ311

The MZ311 provides four 10GE optical ports, including ports 1, 2, 3, and 4. Ports 1 and 3 map to the converged switching plane of the CX311 in slot **2X**, and ports 2 and 4 map to the converged switching plane of the CX311 in slot **3X**, as shown in [Figure 1-6](#).

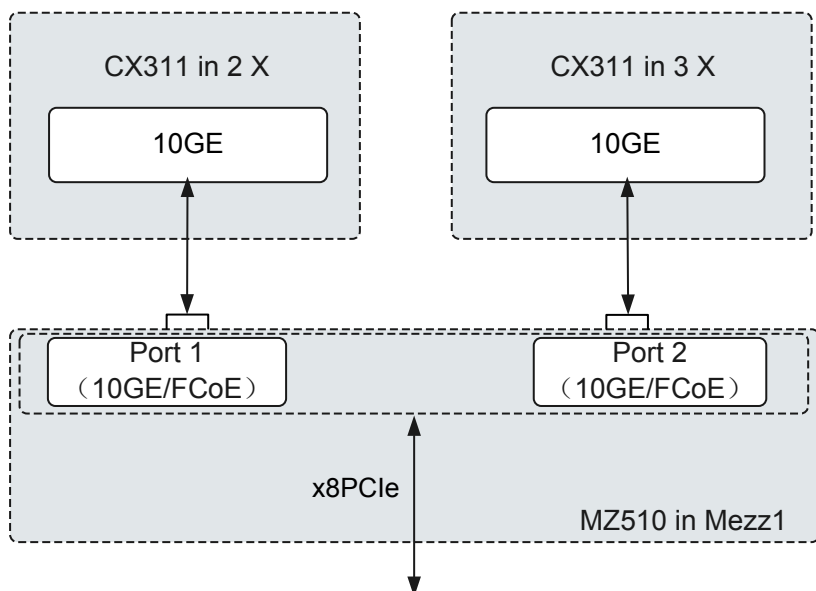
Figure 1-6 Mapping between the CX311 and ports on the MZ311



Mapping between the CX311 and ports on the MZ510

The MZ510 provides two 10GE ports (ports 1 and 2). Ports 1 and 2 map to the converged switching plane of the CX311s in slots 2X and 3X respectively, as shown in [Figure 1-7](#).

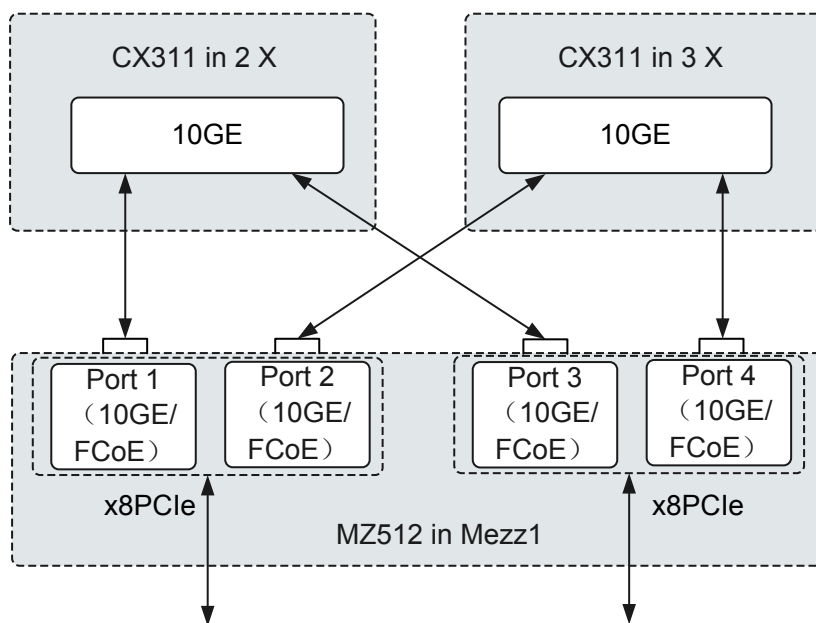
Figure 1-7 Mapping between the CX311 and ports on the MZ510



Mapping between the CX311 and ports on the MZ512

The MZ512 provides four 10GE optical ports, including ports 1, 2, 3, and 4. Ports 1 and 3 map to the converged switching plane of the CX311 in slot 2X, and ports 2 and 4 map to the converged switching plane of the CX311 in slot 3X, as shown in [Figure 1-8](#).

Figure 1-8 Mapping between the CX311 and ports on the MZ512



1.7 Software and Hardware Compatibility

This topic describes mezz modules that can work with the CX311 and pluggable modules and cables supported by ports on the CX311 panel.

For details about the software and hardware that are compatible with the CX311, see [Compatibility](#).

Supported Mezz Modules

The CX311 connects to mezz modules of compute nodes. [Table 1-6](#) describes models and specifications of the supported mezz modules.

Table 1-6 Supported mezz modules

Model	Specifications
MZ311	Four-port 10GE RDMA over Converged Ethernet (RoCE) mezz module
MZ510	Two-port 10GE CNA mezz module
MZ512	Four-port 10GE CNA mezz module

Supported Pluggable Modules and Cables

Table 1-7 Supported pluggable modules and cables

Module/Cable	Description
SFP+ multi-mode optical module (10GE)	Supports 10GBASE-SR.
SFP+ single-mode optical module (10GE)	Supports 10GBASE-LR.
SFP+ cable (10GE)	Supports 10GBASE-CR. The 7 m and 10 m active high-speed cables or 1 m, 3 m, and 5 m passive high-speed cables can be used.
QSFP+ to 4*SFP+ cables (40GE/4*10GE)	Supports passive high-speed cables of 1 m, 3 m, and 5 m
SFP+ multi-mode optical module (4G/8G)	Supports FC-PI-4.
SFP+ single-mode optical module (4G/8G)	Supports FC-PI-4.
SFP multi-mode optical module (GE)	Supports 1000BASE-SX.
SFP single-mode optical module (GE)	Supports 1000BASE-LX.
SFP electrical module (GE)	An electrical module, supporting the RJ45 port and 1000BASE-T (10/100 Mbit/s is not supported)
Multi-mode fiber (MMF)	Supports the MMF of 850 nm OM1/OM2/OM3 with a transmission distance of 300 m.
Single-mode fiber (SMF)	Supports the 1310 SMF with a transmission distance of 10,000 m.
MPO-4*DLC fiber	The MPO end is inserted in to the QSFP+ optical module, and the DLC end is inserted into the SFP+ optical module.
Cat-5 unshielded twisted pair (UTP) cable	Category 5 UTP cables that support RJ45 ports
Cat-5e UTP cable	Category 5e (Category 5 enhanced) UTP cables that support RJ45 ports
Console cable	Supports the RJ45 port and serves as the connection cable for RS232 serial ports.

CX311 supports multiple pluggable optical modules, fibers, and network cables. You can choose the modules and cables based on site requirements.

- The CX311 provides the following functions for GE applications:
 - Provides SFP optical ports and supports single-mode and multi-mode SFP optical modules.
 - Supports SFP electrical modules.
- The CX311 provides the following functions for 10GE applications:
 - Provides SFP+ optical ports and supports single-mode and multi-mode SFP+ optical modules.
 - Supports SFP+ 10GE cables, which can be 7 m or 10 m active high-speed cables or 1 m, 3 m, or 5 m passive high-speed cables.
 - Supports QSFP+<->4*SFP+ cables, which can be 1 m, 3 m, and 5 m passive high-speed cables.

1.8 Technical Specifications

This topic describes the physical, environmental, power, and network switching specifications of the CX311.

Table 1-8 describes the technical specifications of the CX311, and **Table 1-9** describes the network switching specifications of the CX311.

Table 1-8 Technical Specifications

Category	Item	Specifications
Physical specifications	Dimensions (H x W x D)	388.55 mm x 35.06 mm x 272.15 mm (15.30 in. x 1.38 in. x 10.71 in.)
	Color	Silver white
	Weight	3kg
Environmental specifications	Temperature	<ul style="list-style-type: none"> ● Operating temperature: 5°C to 40°C (41°F to 104°F) ● Storage temperature: -40°C to +65°C (-40°F to +149°F)
	Temperature change rate	15°C/h (27°F/h)
	Humidity	<ul style="list-style-type: none"> ● Operating humidity: 5% RH to 85% RH (non-condensing) ● Storage humidity: 5% RH to 95% RH (non-condensing)
	Altitude	900 m (2952.72 ft) at 40°C (104°F) When the device is used in an altitude of 900 m to 3000 m, the operating temperature decreases by 1°C (1.8°F) as the altitude increases by 300 m (984.24 ft).

Category	Item	Specifications
Input power supply	Rated input voltage	12 V DC
Power consumption	Maximum power consumption	172 W

Table 1-9 Network switching specifications

Attribute	Service Feature	Specifications
Device performance	Number of ports on the panel	<ul style="list-style-type: none"> ● One BMC serial port and one SYS serial port ● A maximum of sixteen 10GE optical ports or four 40GE optical ports, or both 10GE optical ports and 40GE optical ports are configured. ● Eight 8G FC optical ports
	Port rate	10GE ports are support 10GE optical ports and GE optical ports.
	Service port stacking	Four 10GE ports on the panel or one 40GE ports on two switch modules can be stacked (10GE ports and 40GE ports cannot be stacked into one logical interface.)
	Switching capability (throughput)	1.28 Tbit/s
	Packet forwarding rate	960Mpps
Ethernet service	Number of Media Access Control (MAC) addresses	65,536
	Number of VLANs	4063 NOTE A switch module reserves 31 internal virtual local area networks (VLANs). The default value ranges from 4064 to 4094. The range of consecutive VLANs must be reserved for configuration.
	Number of Eth-Trunk interfaces	128 Eth-Trunk interfaces, with each Eth-Trunk interface supports a maximum of 16 member interfaces

Attribute	Service Feature	Specifications
	Number of Address Resolution Protocols (ARPs) for the device	16384
	Jumbo frame length (in byte)	9216 byte
Quality of service (QoS)	Number of queues for a port	8
	Number of CARs	<ul style="list-style-type: none"> ● Ingress: 2048 ● Egress: 1024
	Packet cache	4 MB
ACL	ACLv4	<ul style="list-style-type: none"> ● Pre-Ingress: 750 ● Ingress: 1500 ● Egress: 1000
L3VPN	VRF	128 (MPLS is not supported) MPLS is short for Multiprotocol Label Switching.
	Number of virtual private network (VPN) routes	16384
IP address unicast	Number of route entries	16384
	Number of IPV4 forwarding information bases (FIBs)	16384
	Number of IPV6 FIBs	8000 (The subnet mask length is less than or equal to 64 bits)
Multicast	Number of layer 3 multicast forwarding entries	2000

Attribute	Service Feature	Specifications
Reliability service	Bidirectional Forwarding Detection (BFD)	<ul style="list-style-type: none"> ● Number of BFD sessions: 128 ● Minimum interval for transmitting and receiving packets: 50 ms
	Virtual Router Redundancy Protocol (VRRP)	<ul style="list-style-type: none"> ● Number of VRRP backup groups: 64 ● Number of VRRP management groups: 64 ● Number of virtual IP addresses for each VRRP backup group: 16
	Multiple Spanning Tree Protocol (MSTP)	Maximum number of instances in the device: 64
Enhanced Ethernet	Transparent Interconnection of Lots of Links (TRILL)	<ul style="list-style-type: none"> ● Number of network nodes: 512 ● Number of CE-VLANs: 4062 ● Load-sharing specifications: 16 links

2 Standards and Certifications

About This Chapter

[2.1 Standards Compliance](#)

This topic describes the international and industrial standards and communication protocols that the CX311 complies with.

[2.2 Certifications](#)

This topic describes the certifications that the E9000 has passed.

2.1 Standards Compliance

This topic describes the international and industrial standards and communication protocols that the CX311 complies with.

International Standards

Table 2-1 lists the international standards.

Table 2-1 Standards and protocol compliance

Standard	Protocol
DCBX	Data Center Bridging eXchange
FC-BB-5	Fibre Channel - Backbone – 5 (FCOE)
FC-DA	FC Device Attach
FC-FS-2	FC Framing and Signaling
FC-GS-5	FC Generic Service
FC-LS	FC Link Service
FC-MI-2	FC Methodologies for Interconnects
FC-PI-4	FIBRE CHANNEL. Physical Interface-4 8G FC Interface
FC-SW-4	FC Switch Fabric
FC-VI	FC Virtual Interface Architecture Mapping
FCP-3	Fibre Channel Protocol for SCSI
IEEE 802.3x	Flow control and Back pressure
IEEE 802.3z	1000BASE-X Gbit/s Ethernet over Fiber-Optic at 1 Gbit/s
IEEE 802.3aq	10GBASE-LRM 10 Gbit/s Ethernet over multimode fiber
IEEE 802.1Qbb	Priority-based Flow Control (PFC)
IEEE 802.1Qaz	Enhanced Transmission Selection (ETS)
IEEE 802.1Q	Virtual Bridged Local Area Networks (VLAN)
IEEE 802.1s	Multiple Spanning Trees(RSTP)
IEEE 802.1w	Rapid Reconvergence of Spanning Tree (RSTP)
IEEE 802.1ab	Station and Media Access Control Connectivity Discovery (LLDP)
IEEE 802.1ad	Virtual Bridged Local Area Networks: Provider Bridges (QinQ)
IEEE 802.3ad	Link Aggregation Control Protocol (LACP)

Standard	Protocol
IEEE 802.1Qbg	Edge Virtual Bridging (VEPA)
IEEE 1149.1-2001	IEEE Standard Test Access Port and Boundary-Scan Architecture
RFC2837	Fabric Element MIB Specification
SFF-8431	Enhanced Small Form Factor Pluggable Module SFP+

Industrial Standards

Table 2-2 lists the industrial standards.

Table 2-2 Industrial standards

Organization	Standard
ECMA TR/70	Environment protection
EN60950	Safety (Europe)
IEC60950	Safety
GR-929	Reliability
IEC 812	Failure Mode and Effects Analysis (FMEA)
IEC 863	Reliability, maintainability, and availability compliance standard
IEC60297	Chassis compliance
IEC60825-1/2/6	Safety
IEC60215	Safety
IEC61000	EMC standard
Telcordia SR-332	Reliability
UL60950	Safety (North America)

Communication Protocols

Table 2-3 lists the communication protocols.

Table 2-3 Communication protocols

Protocol	Description
ARP	Address Resolution Protocol

Protocol	Description
BFD	Bidirectional Forwarding Detection
BGP	Border Gateway Protocol
DHCP	Dynamic Host Configuration Protocol
DLDP	Device Link Detection Protocol
FTP	File Transfer Protocol
GMRP	GARP Multicast Registration Protocol
GVRP	GARP VLAN Registration Protocol
HTTP	Hypertext Transfer Protocol
ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IPMI	Intelligent Platform Management Interface
IPv4/IPv6	IPv4/IPv6 Internet Protocol
MSTP	Multiple Spanning Tree Protocol
NTP	Network Time Protocol
OSPF	Open Shortest Path First
RADIUS	Remote Authentication Dial In User Service
RIP	Routing Information Protocol
RSTP	Rapid Spanning Tree Protocol
SNMP	Simple Network Management Protocol
SSH	Secure Shell
SSL	Secure Socket Layer
STP	Spanning Tree Protocol
TCP	Transmission Control Protocol
TELNET	Remote terminal protocol
TFTP	Trivial File Transfer Protocol
TRILL	Transparent Interconnection of Lots of Links
UDP	User Datagram Protocol
VRRP	Virtual Router Redundancy Protocol

2.2 Certifications

This topic describes the certifications that the E9000 has passed.

Table 2-4 lists the certifications.

Table 2-4 Certifications

Country /Region	Certification	Standard
Europe	WEEE	2002/96/EC, 2012/19/EU
Europe	RoHS	2002/95/EC, 2011/65/EU, EN 50581: 2012
Europe	REACH	EC NO. 1907/2006
Europe	CE	Safety: EN 60950-1:2006+A11:2009+A1:2010+A12:2011 EMC: <ul style="list-style-type: none"> ● EN 55022:2010 ● CISPR 22:2008 ● EN 55024:2010 ● CISPR 24:2010 ● ETSI EN 300 386 V1.6.1:2012 ● ETSI ES 201 468 V1.3.1:2005
China	RoHS	SJ/T-11363-20006 SJ/T-11364-20006 GB/T 26572-2011
China	China Environmental Labeling	GB/T24024:2001 idt ISO14024:1999 HJ 2507-2011
Australia	C-tick	AS/NZS CISPR22: 2009
America	UL	UL 60950-1
America	FCC	FCC Part 15 (Class A)
America	NTRL-UL	UL 60950-1, 2nd Edition, 2011-12-19 (Information Technology Equipment - Safety - Part 1: General Requirements) CSA C22.2 No.60950-1-07,2nd Edition,2011-12 (Information Technology Equipment-Safety-Part 1:General Requirements)
Canada	IC	ICES-003 Class A
Nigeria	SONCAP	IEC 60950-1: 2005 (2nd Edition) + A1:2009 EN 60950-1:2006+A11:2009+A1:2010 + A12:2011

Country /Region	Certification	Standard
Kingdom of Saudi Arabia (KSA)	SASO	IEC 60950-1: 2005 (2nd Edition) + A1:2009 EN 60950-1:2006+A11:2009+A1:2010 + A12:2011
Global	CB	IEC 60950-1
Japan	VCCI	VCCI V-4:2012