Huawei E9000 Server
V100R001

easyLink Feature White Paper (HMM)

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Contents

1 E9000 easyLink Feature Description

1.1 Background Information

With the development of services, the scale of data centers becomes larger, network converged, and networking more complex. A flat network will prevail in the future. A chassis-type blade server has switch modules installed in its chassis, that is, a switching layer is added to the network. How to reduce networking complexity?

As a chassis-type blade server, the E9000 server has switch modules installed in its chassis and connections exist between compute nodes, compute node NICs (mezzanine cards), and switch modules. It is more complex to configure a service network because a user has to understand connections between each compute node NIC and switch modules, configurations between switch modules, and connections between switch modules in chassis and external switches.

The E9000 easyLink feature allows compute nodes in the chassis to serve as a combination of servers running virtual services and switch modules to serve as server NICs. Therefore, not only is a flat network achieved (networking of switch modules in the chassis and external switches is simplified.), but also internal switch configuration can be completed automatically to simplify internal network management and configuration because a user can ignore physical connections between compute nodes and the switch modules in the chassis by setting service belonging of the compute node NICs.

Figure 1-1 shows connections between E9000 mezzanine cards and switch modules.

Figure 1-1 Connections between mezzanine cards and switch modules
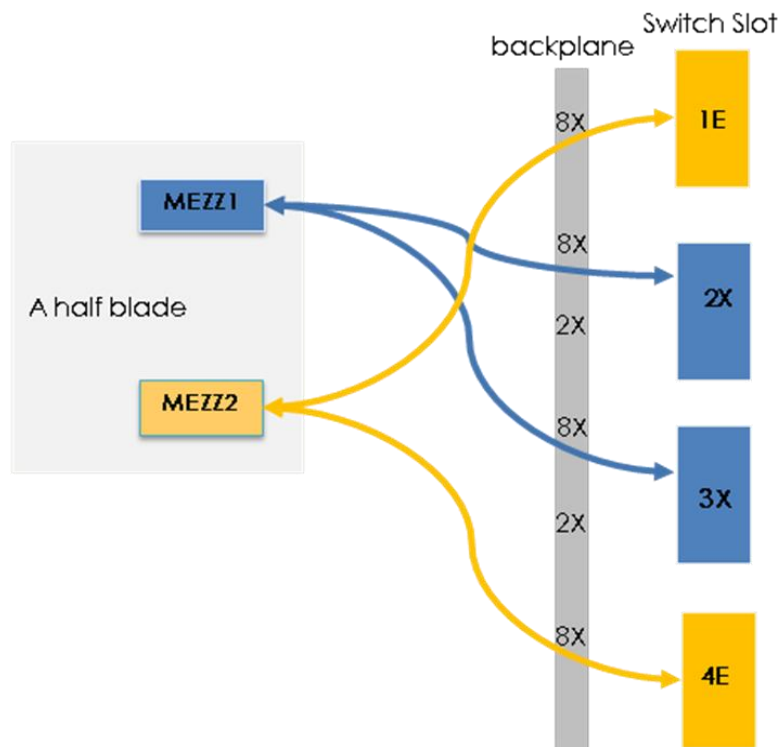
Figure 1-2 shows an easyLink service model.

Figure 1-2 easyLink service model
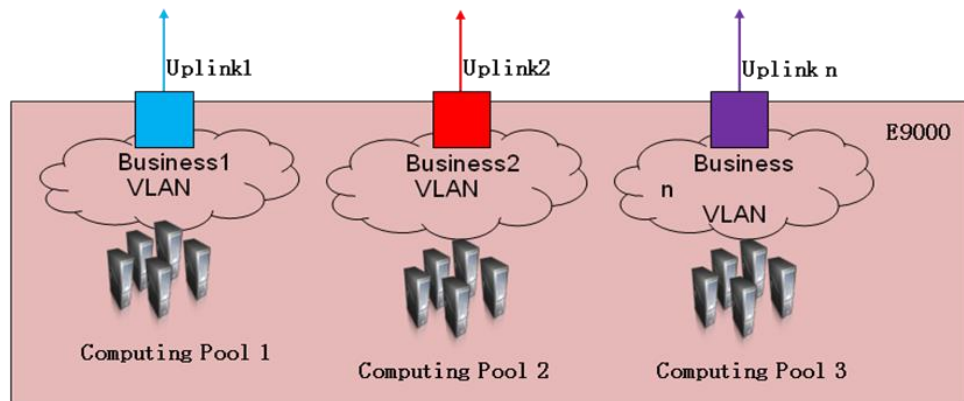
Compute nodes in the E9000 chassis are divided into different computing resource pools. The computing resource pools that provide the same services communicate with each other through the same business VLAN. Each business VLAN serves as a service NIC that communicates with external switches using uplink ports on the business VLAN. In easyLink configuration, associate compute nodes with business VLANs to complete the switch configuration.

1.2 Working Principle and Related Concepts

The E9000 easyLink feature allows users to use the Hyper Module Management (HMM) WebUI to perform end-to-end management of the network connecting switch modules in the chassis to server NICs.

easyLink Management Functions

easyLink management provides switch module configuration and information query:

- Switch module configuration consists of switch profile and NIC profile configuration.

Switch Profile Configuration

A switch profile defines the relationships between business types and external switches and includes the following:

Business VLAN: indicates the type of business data transmitted between the chassis and external switches.

Uplink: indicates switch module panel ports for business data transmission.

FC configuration: indicates FC SAN connection attributes, including FC mode, FCoE port DCB, and zone configuration.

NIC Profile Configuration

A NIC profile defines the relationships between physical computing resources and service types.

NIC profiles are associated with compute nodes and consist of three parts: NIC teaming, vNICs based on NIC teaming, and relationships between vNICs and business VLANs.

- NIC teaming indicates combining NIC ports into a group for redundancy.
- vNICs are based on NIC teaming and serve as communication interfaces of compute nodes in blade servers. Create vNICs for NIC teams based on the service types.
- Associate vNICs with business VLANs to complete the association between service types of compute nodes and those of switch modules.

  In this way, computing services on the compute nodes can communicate with external switches through vNICs. After the preceding configuration, the system will automatically configure the interfaces between compute nodes and switch modules and form a link that connects NICs, internal switch modules, and external networks. During the configuration, users do not need to focus on relationships between switch module ports and compute nodes.

Figure 1-3 shows the easyLink configuration diagram.

Figure 1-3 easyLink configuration
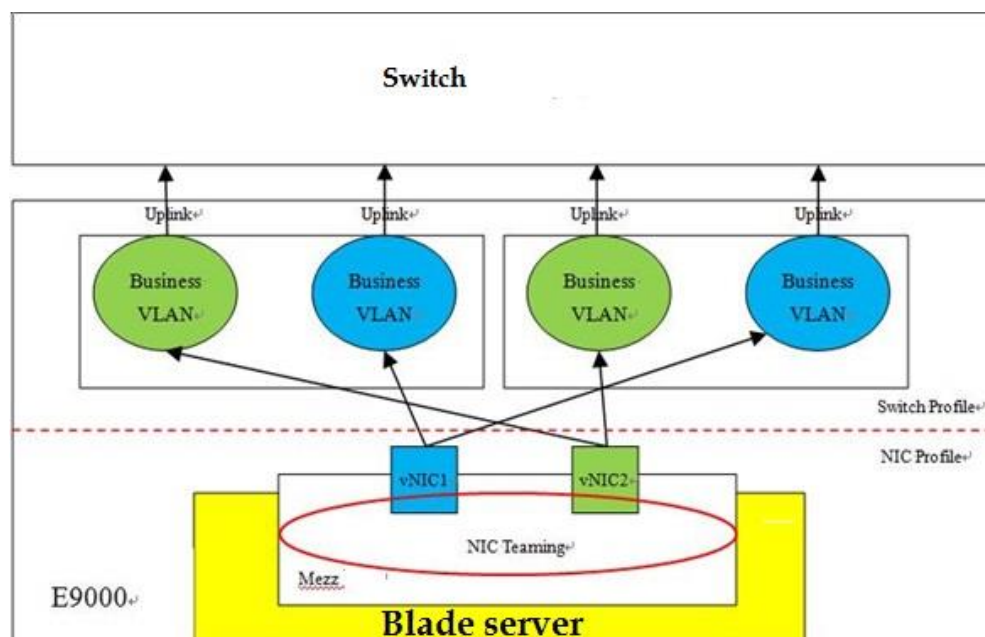
- Switch module information query enables query of Ethernet plane, FC plane, and MAC address information, including physical and statistical information of ports.

Concepts

Concepts related to the E9000 easyLink configuration are as follows:

For switch profiles:

- EndHost
- Stack and Twin
- Business VLAN types: Normal and Trans
- Uplink types: Share Uplink, Normal Uplink, and Cascade Uplink
- Interface types: Eth Trunk, SmartLink, and Physical Link

For NIC profiles:

- NIC teaming and vNIC
- NIC teaming modes: Active-Backup, Balance, and LACP
- vNIC types: Ethernet, FCoE, FC, Port, PF, and VF

Concepts Related to Switch Profile Configuration

- EndHost: indicates the host mode of E9000 switch modules. In this mode, switch modules serve as service NICs and connect to external switches, and STP and other protocols are disabled. This simplifies the internal switch module architecture and configuration and prevents network loops.
- Stack: indicates that two paired switch modules (in slots 1E and 4E or in slots 2X and 3X) are stacked and work as a switch. The easyLink feature allows users to manage and configure the paired switch modules as one unit, simplifying operations.

- Twin: indicates that two switch modules are not stacked, but they have the same service configuration (except switch module management information), so that dual planes are provided for the service network for backup.

- Business VLAN: indicates a bearer that carries services on switch modules. Specify VLAN IDs for business VLANs and the IDs range from 2 to 4063. Business VLANs include Trans VLANs and normal VLANs. Multiple business VLANs can be created, but duplicate VLAN IDs are not allowed. When multiple VLAN IDs are required for data transmission, use a Trans VLAN. If only one VLAN ID is required, use a normal VLAN.

- Trans VLAN: indicates a transparent transmission VLAN that consists of one or more VLAN ranges. Packets in all VLAN ranges can be transparently transmitted to external switches through the Trans VLAN. See Figure 1-4.

Figure 1-4 Trans VLAN
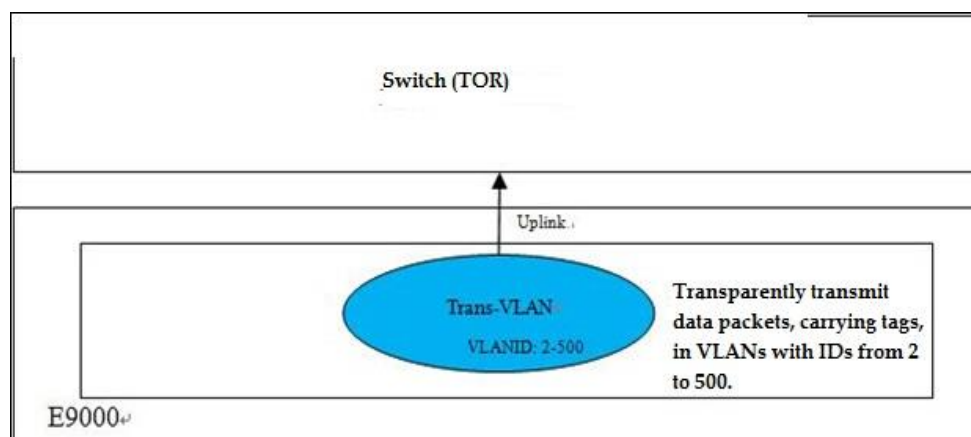
- Normal VLAN: indicates a normal VLAN with only one ID.

- Domain VLAN: easyLink enables switch modules to be divided into up to 16 domains. A domain supports transparent transmission of data packets carrying any VLAN tags. Data packets in different domains can have the same VLAN tags. Domain VLANs are unique IDs of domains. Domain VLAN IDs cannot be the same as any normal or Trans VLAN IDs. For example, if the compute node in slot 1 requires VLANs 1 to 100 with uplink 1 and the compute node in slot 2 requires VLANs 1 to 100 with uplink 2, the two compute nodes need to be separated by using different domain VLANs.

- Uplink: corresponds to an internal switch module port, connects internal switch modules to external switches, and serves as the communication channel between business VLANs and external networks.

- Share uplink: indicates a shared uplink. Multiple normal VLANs and Trans VLANs can share a shared uplink to connect to external networks. Packets over a shared uplink carry VLAN tags.

- Normal uplink: serves as the uplink interface of a single normal VLAN. A user can specify whether packets over a normal uplink carry VLAN tags.

- Cascade uplink: indicates an uplink used for cascading chassis. A cascade uplink can be associated with Trans VLANs and normal VLANs. The interface between cascaded chassis must be configured as a cascade uplink. Packets over the cascade uplink carry VLAN tags. The cascade uplink can be used only when switch modules work in stack mode.

- Uplink types: Eth Trunk, SmartLink, and Physical Link

- Eth Trunk: indicates an Ethernet trunk, which is a logical interface formed by bonding multiple physical ports. Traffic is shared among active physical ports based on MAC addresses, which increases bandwidth and provides port redundancy.

- SmartLink: consists of an active link and a standby link, both of which can be Ethernet trunks. In active/standby mode, the active link is activated and the standby link does not forward traffic. When the active link is faulty, traffic is switched over to the standby link. The SmartLink feature requires external switches, which must be Huawei switches.

- Physical Link: corresponds to a physical port.

  Chassis 2 is cascaded with chassis 1 over the cascade uplink and connects to an external switch over the shared uplinks and normal uplink of chassis 1. See Figure 1-5.

Figure 1-5 Links
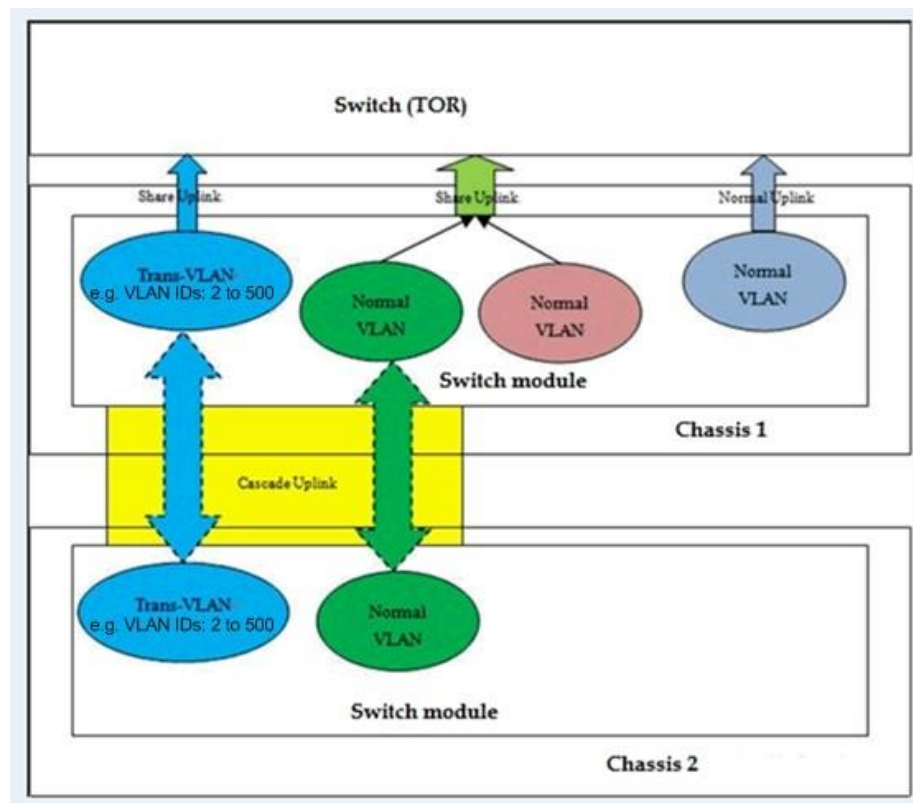
- FC SAN: Two FC SANs can be configured when switch modules support FC. Each of the paired switch slots corresponds to an FC SAN. FC SANs work in NPV or Switch mode. In NPV mode, the N port in the chassis connects to external FC switches. In Switch mode, the E port (license required) connects to external FC switches, or the N port connects directly to storage devices.

- FCoE VLAN: If CX311 switch modules are used in the chassis, two FCoE VLANs must be set.

- Zone: If FC SANs work in Switch mode, zones can be configured based on ports or world wide port names (WWPNs), depending on the switch modules.

📖 **NOTE**

A cascade uplink is only used for cascading chassis. If a cascade link belongs to the same business VLAN as other uplink types, do not connect the cascade uplink to external switches; otherwise, network loops will occur.

NIC Profile

- NIC teaming: Multiple physical ports are bonded together to improve bandwidth and provide link redundancy.
- NIC teaming modes: Active-Backup, Balance, and LACP
- Active-Backup: indicates that physical NIC ports in a bond work in active/standby mode.
- Balance: indicates the Ethernet trunk mode. Physical NIC ports in a bond form a static Ethernet trunk. Data packets are shared among healthy NIC ports.
- LACP: indicates the static LACP mode of the Ethernet trunk. LACP is used between NIC ports and switch modules.

📕 NOTE

If UMC or FCoE is enabled on the NIC, LACP mode is not supported.

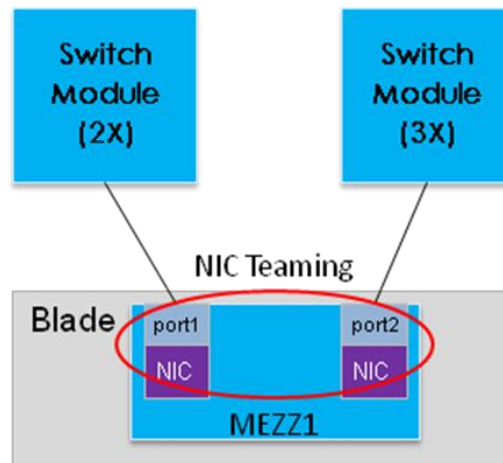Two ports on Mezz1 are bonded to form a NIC team. See Figure 1-6.

Figure 1-6 NIC teaming

Table 1-1 shows the relationships between OSs, bonding modes, and NIC teaming modes.

📕 NOTE

Only NIC ports that correspond to paired switch modules can form a NIC team.

For example, port 1 on the switch module in slot 2X and port 2 on the switch module in slot 3X can form a NIC team.

However, port 1 on the switch module in slot 1E and port 2 on the switch module in slot 2X cannot form a NIC team.

Table 1-1 Relationships between OSs, bonding modes, and NIC teaming modes

OS	Bonding Mode	NIC Teaming Mode
Linux	balance-rr or 0 (default) balance-xor or 2 broadcast or 3	Balance
	active-backup or 1 balance-tlb or 5	Active-Backup

OS	Bonding Mode	NIC Teaming Mode
	balance-alb or 6	
	802.3ad(LACP) or 4	LACP
VMware	**Routing based on VM source ports** Hash routing based on the VM source MAC address Routing based on the failover sequence	Active-Backup
	Hash routing based on the source and destination IP addresses	Balance
	LACP	LACP

📖 NOTE

The Balance or LACP mode is available only when the corresponding paired switch modules work in stack mode. If FCoE vNICs are involved, the Balance and LACP modes are unavailable even if the corresponding paired switch modules work in stack mode.

- vNIC: vNICs must be created when NIC teaming is used. Configure vNICs based on service requirements. FCoE vNICs can be created if NICs support FCoE. Ethernet vNICs must be associated with business VLANs.

  vNIC types: Port, PF, and VF

  - Port: Only one Port vNIC can be created for a NIC team. If a Port vNIC has been created for a NIC team, vNICs of other types cannot be created. If a NIC team is not used as multiple virtual interfaces, a Port vNIC can be created and associated with a Trans VLAN or normal VLAN. FC network ports support only Port vNICs.

  - PF: PF vNICs can be created only for NICs that support multiple physical functions (PFs). When PF vNICs are created, the support for multiple PFs must be enabled for the NICs. PFs can be Ethernet or FCoE PFs. A NIC team supports only one FCoE PF. PF vNICs can be associated with Trans VLANs or normal VLANs. When PF vNICs are created, vNICs of other types cannot be created.

  - VF: indicates vNICs created in the software system of a blade server. The number of VF vNICs is not limited but cannot exceed the maximum number of vNICs. VF vNICs have no requirements for physical NICs and can be associated with Trans VLANs or normal VLANs. When VF vNICs are created, vNICs of other types cannot be created.

  Create Port, PF, and VF NICs based on actual requirements.

Domain

easyLink enables switching modules in the E9000 to be divided into multiple areas, each functioning as an independent virtual switch. This function is suitable for shared leasing environment. These areas are called domains. easyLink supports a maximum of 16 domains. Each domain can independently and transparently transmit data packets with VLAN IDs ranging from 1 to 4094.

easyLink domain VLANs are a type of business VLAN. Domain VLANs are unique IDs of domains. Domain, normal, and Trans VLANs can coexist, but VLAN IDs must be unique. Domain VLAN IDs are used to differentiate domains and isolate transparent data transmission between domains.
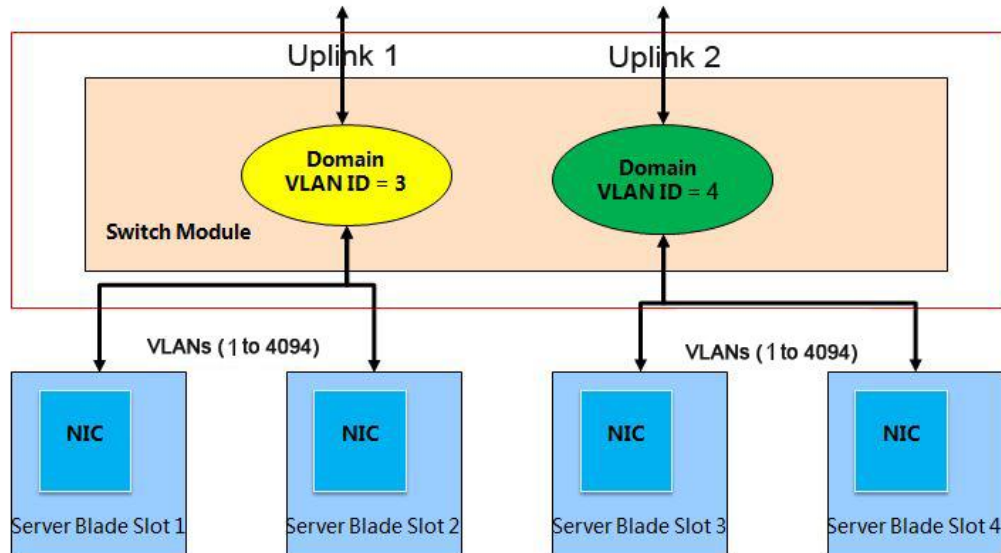
□ **NOTE**

easyLink divides a switch module into domains by port, so only Port vNICs can be associated with domains. PF and VF vNICs cannot be associated with domains.

□ **NOTE**

easyLink supports online and offline delivery. Offline delivery must be performed first if easyLink is used for the first time.

1.3 E9000 easyLink Reliability Assurance

In easyLink configuration, all links are in 1+1 redundancy mode. Ethernet switching planes of switch modules have two reliability assurance modes: stack and twin. Pay attention to the two modes when configuring uplinks. If the paired switch modules have FC switching planes, the FC switching planes work independently, and the application on compute nodes selects one of the links to achieve link redundancy. The details are not described here.

Stack Mode

Paired switch modules are stacked as a unit when working in stack mode. When one switch module is faulty, the other one works properly. To ensure data transmission on the business VLAN, uplink ports on the business VLAN should support redundancy across switches. For example, if the uplink ports are Ethernet trunk ports, the ports in the trunk must contain ports on two switch modules, ensuring data links working properly when one switch module is faulty. See Figure 1-7.

**Figure 1-7** Stack mode
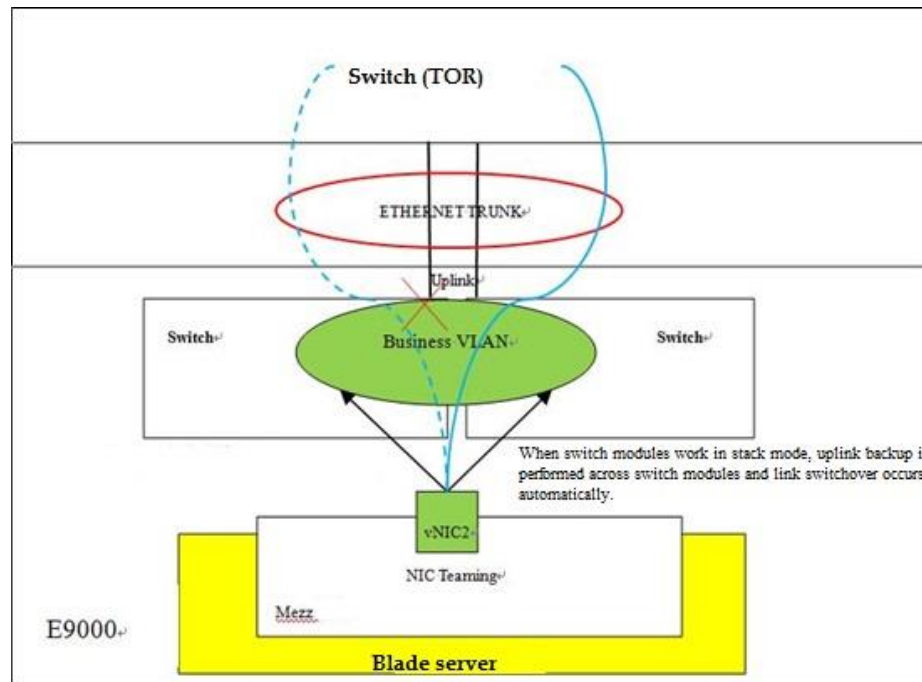
Twin Mode

When working in twin mode, two switch modules are independent of each other and are in mutual backup mode. Therefore, configurations for the two switch modules are independent and switchover is required when one data link is faulty.

In twin mode, a switch system enables the link monitoring function. When the uplink (connecting to an external switch) is down, the system disables the downlink (connecting to server NICs). Therefore, when the uplink is detected faulty, services are switched to the backup link.

Note: Virtual links exist between virtual NICs and business VLANs. When a physical link is down, all virtual links are down. This requires that the virtual links on the same physical link must have the same uplink, facilitating link switchover. See Figure 1-8.

Figure 1-8 Twin mode
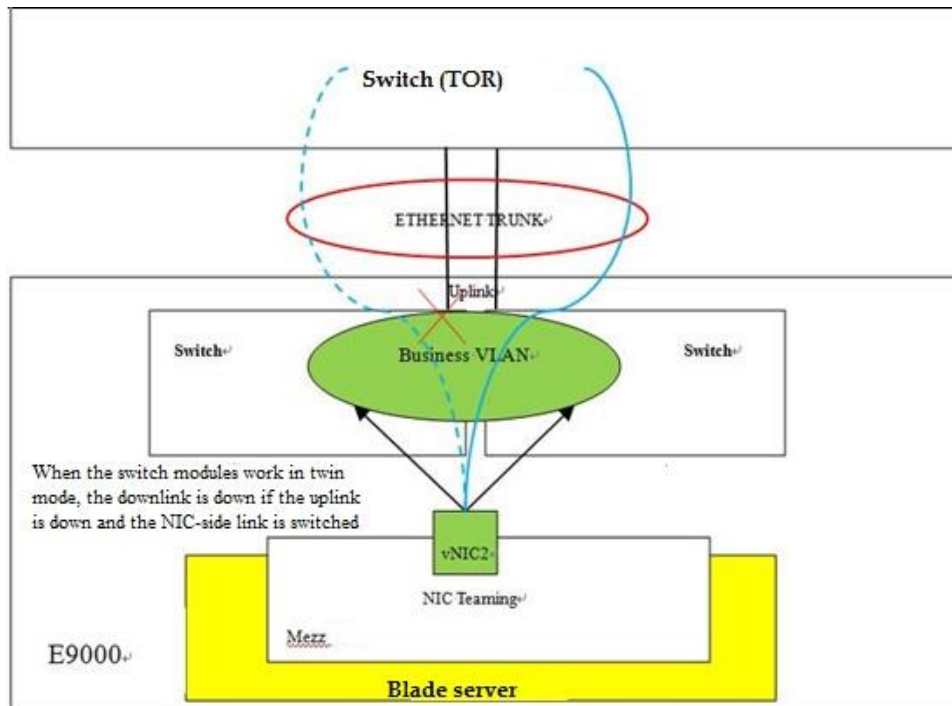
1.4 VLAN Tags

VLAN tags are involved in all easyLink configurations. Whether data packets carry VLAN tags depends on the actual configuration. See Table 1-2.

Table 1-2 easyLink VLAN tags

easyLink Configuration			Data Packets from Compute Nodes to Internal Switch Modules Carry VLAN Tags	Data Packets from Internal Switch Modules to External Switches Carry VLAN Tags
Uplink Configuration	**Business VLAN Configuration**	**vNIC Configuration**		
Normal uplink (without tags)	Normal VLAN	Port	No	No
		PF	Yes	No
		VF	Yes	No
Normal uplink (with tags)	Normal VLAN	Port	No	Yes
		PF	Yes	Yes
		VF	Yes	Yes

Shared uplink	Normal VLAN	Port	No	Yes
		PF	Yes	Yes
		VF	Yes	Yes
Shared uplink	Trans VLAN	Port	Yes	Yes
		PF	Yes	Yes
		VF	Yes	Yes
Normal uplink	Domain VLAN	Port	Yes	Yes
Normal uplink	Domain VLAN	Port	No	No
Cascade uplink	Trans VLAN	N/A	N/A	Yes (between chassis)
	Normal VLAN	N/A	N/A	Yes (between chassis)

☐ NOTE

Uplinks:

For shared uplinks and cascade uplinks, all data packets carry VLAN tags.

For normal uplinks, you can set whether data packets carry VLAN tags.

Internal interfaces connecting switch modules to compute nodes:

If the interfaces are associated with Trans VLANs, all data packets carry VLAN tags.

If the interfaces are associated with normal VLANs, VLAN tags are not carried only in the case of Port vNICs.

1.5 FC Configuration

- FC SAN description:

  A storage area network (SAN) is a technology that integrates storage and connection devices into a high-speed network. Fibre Channel (FC) is a data transmission protocol used in a SAN. An FC SAN is a SAN that uses the FC protocol stack.

- FCoE description:

  Fibre Channel over Ethernet (FCoE) is a converged network technology defined by the T11 Technical Committee of the American National Standards Institute (ANSI) and is an I/O consolidation solution based on FC.

FCoE enables transport of FC frames on the Ethernet so that LAN and SAN environments can share network resources.

- FCF description:

A Fibre Channel Forwarder (FCF) switch supports both FCoE and FC protocol stacks for connecting to SAN and LAN environments. In an FC SAN, an FCF is mainly used for transmitting FC data. An FCF forwards FCoE packets and encapsulates or decapsulates FCoE packets.

- NPV description:

A SAN has high demands for edge switches directly connected to node devices. N-Port virtualization (NPV) switches do not occupy domain IDs and enable a SAN to exceed the limit of 239 edge switches.

- Zone description:

In an FCoE network, users can use zones to control access between node devices to improve network security.

- FSB description

An FIP Snooping Bridge (FSB) functions as a bridge in FCF networks. The access switch serves as an FCoE switch without complete FCF functionality.

1.6 Hardware Requirements

easyLink has no special hardware requirements and supports all E9000 hardware. However, different features have different requirements:

- Version requirements:
    - Switch module software version: 2.14 or later
    - MM910 version: 5.00 or later (FC configuration requires version 5.09 or later.)
    - BMC version: iBMCv1 5.21 or later; iBMCv2 1.62 or later
    - FCoE gateway (MX510 FC module on the CX311) firmware version: later than 9.8.1.04.00
- Requirements of port splitting and flexible subcards:
    - Hardware requirement: CX320 switch module
    - MM910 version: 5.75 or later

2 Configuring E9000 easyLink

2.1 Configuration Procedure

The easyLink configuration procedure is as follows:

First, based on service requirements of switch modules in slots 1E, 4E, 2X, and 3X, configure switch profiles, which include internal business VLANs and uplinks connecting to external switches. Uplinks are not required for intra-chassis communication.

Second, import NIC information of compute nodes and create NIC profiles. If all slots have the same compute nodes and mezzanine cards, import the NIC information only once. Bond NIC ports based on the imported NIC information. Ports in the same group are redundant to each other. Then create vNICs for NIC teams based on service requirements. vNIC information includes relationships between vNICs and business VLANs.

Finally, bond NIC profiles to corresponding slots. Restart the switch modules or forcibly deliver the switch configuration for the configuration to take effect.

Figure 2-1 Configuration guidelines
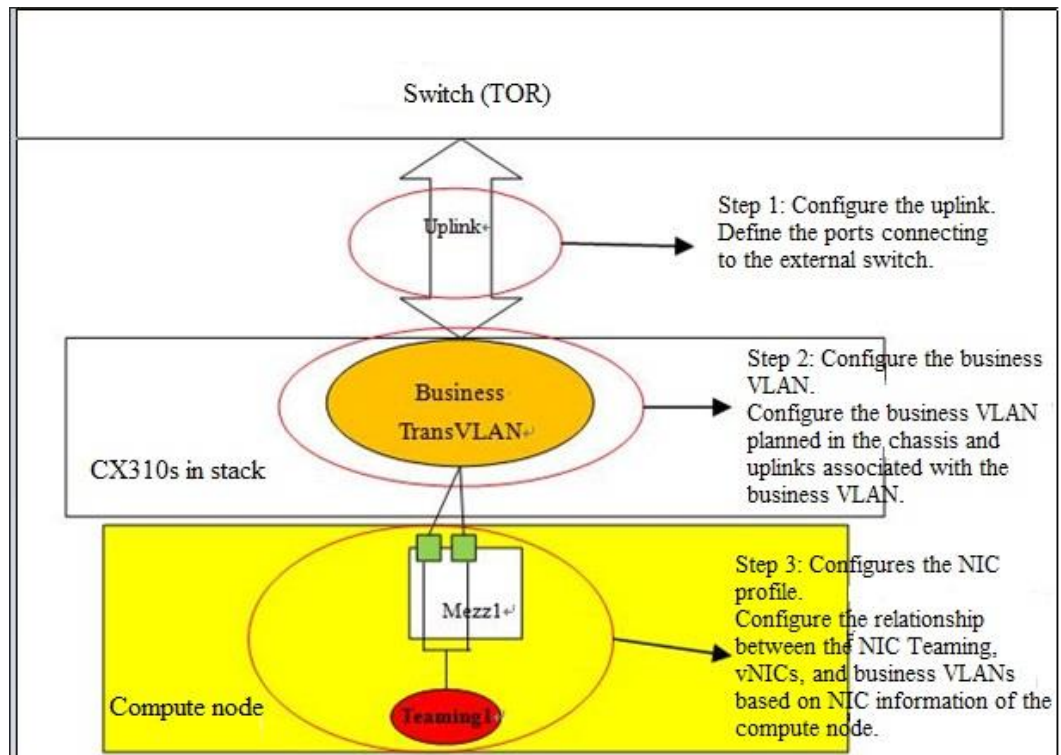
☐ **NOTE**

If an FC storage network is included, FC SAN configuration is required. FC SAN configuration includes the working mode (NPV/Switch), FCoE VLAN (required for CX311 switch modules), and zoning (available in Switch mode).

Enabling Switch Centralized Management

Step 1 Enable **Switch Centralized Management Configuration**.

The corresponding configuration window is displayed. Because the original configuration page (see Figure 2-3) is invalid, configure the switch module management IP addresses in the basic information about switch profiles. Figure 2-2 shows the page for enabling centralized switch management.

⚠ **NOTICE**

1. After centralized switch management is enabled, the configuration for the switch modules using the CLI cannot be saved and the saved configuration will be invalid. After the compute nodes are restarted, the configuration saved using the CLI will be lost and only the easyLink configuration takes effect.

Figure 2-2 Enabling Switch Centralized Management
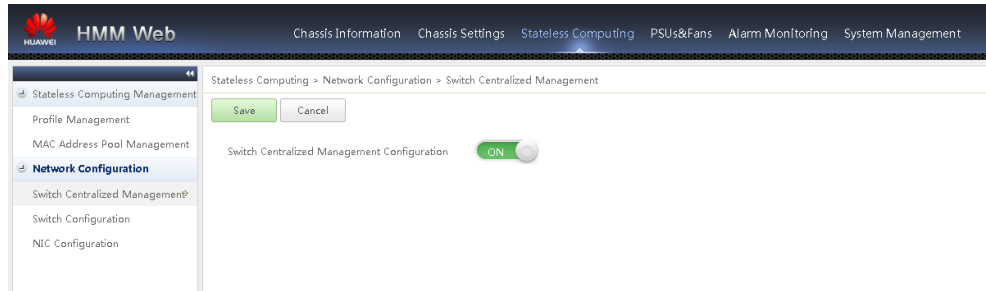
Figure 2-3 Invalid page for configuring the switch management IP address
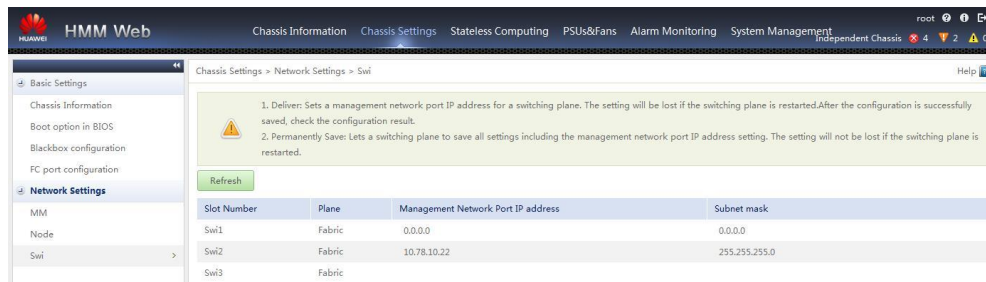
----End

Configuring a Switch Profile

Step 1 Create a profile.

Create a switch profile based on the switch module type.

Select the switch module type, switch module slot, and work relationship (stack or twin). See Figure 2-4.

Figure 2-4 Creating a profile

Step 2   Configure basic management information.

On the **Switch Configuration** page, set the IP address of the management port, administrator, **root** user password, and serial port password. See Figure 2-5.

Figure 2-5 Configuring basic management information

Step 3   Create an uplink.

1.   On the uplink creation page, set the uplink type and switch module ports. See Figure 2-6.

📖 **NOTE**

There is no channel between the paired switch modules CX111s or CX915s (in slots 1E and 4E or in slots 2X and 3X). When the CX111s or CX915s work in stack mode, 10GE ports 3 and 4 on the panels serve as stack ports and cable connection is required.

Figure 2-6 Creating an uplink

2. Select uplink ports based on ports connected to external switches. See Figure 2-7.

📖 NOTE

Port types:

- **10GE 2:1**: This port type is available only when the switch modules work in stack mode. **10GE** indicates a 10GE port, **2** indicates slot 2X, and **1** indicates the first port on the switch module panel (the silkscreen is 1).
- **10GE 1**: This port type is available only when the switch modules work in twin mode. It indicates the first 10GE port on the switch module panel (the silkscreen is 1).
- **10GE 2:1 M** or **10GE 1 M**: **M** indicates that the port is an expansion port on a switch module, for example, the eight 10GE ports in the lower section of a CX312 and four 10GE ports on a CX110.

Figure 2-7 Uplink ports
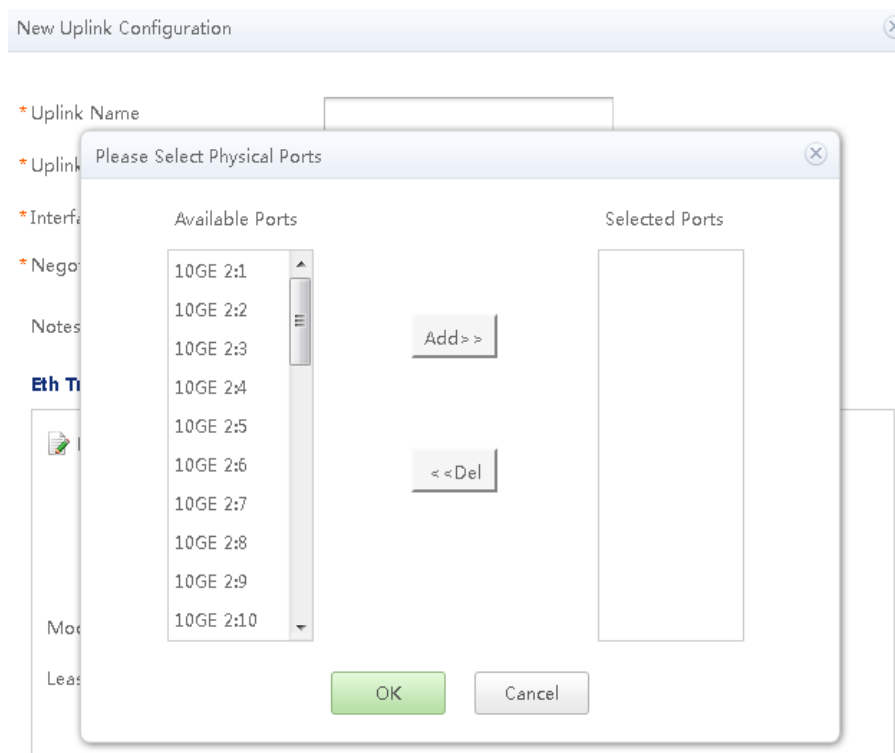
Step 4 Create business VLANs.

Create business VLANs based on service requirements and associate the business VLANs with uplinks. See Figure 2-8.

Figure 2-8 Creating a business VLAN

Step 5   Configure the FC SAN.

Configure the FC SAN based on the business plan. Configuration includes the IP address for FC switch module management, user password, work mode, and zoning. See Figure 2-9.

☐ **NOTE**

- For the converged switch module CX311, FCoE VLAN configuration is required. The FCoE VLAN ID is 1002 or 1003 by default and cannot be the same as business VLAN IDs.

- FC configuration does not include uplink configuration. The connected ingress FC port is used automatically.

Figure 2-9 FC configuration
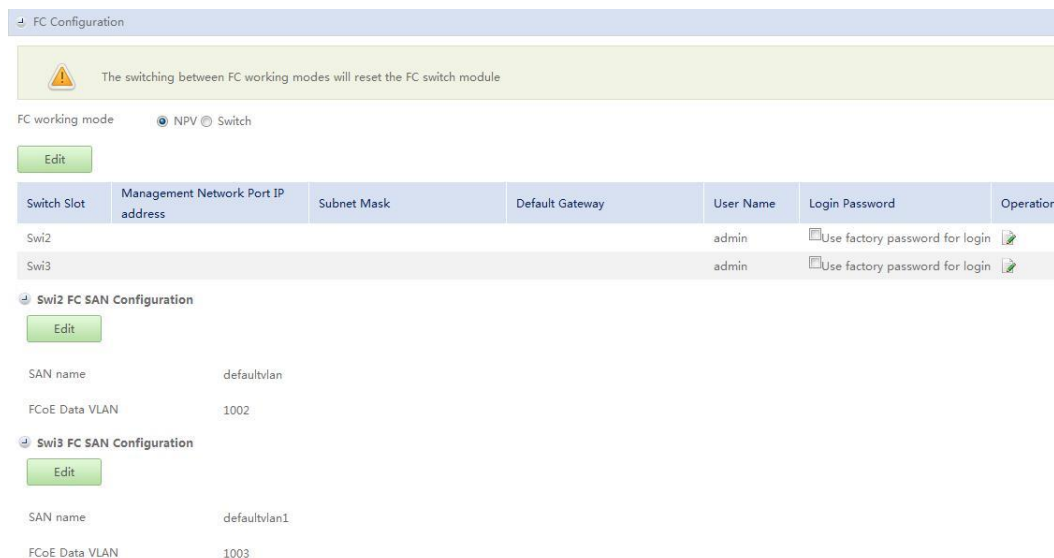
When FC switches work in Switch mode, zoning configuration based on ports or WWPNs is available. To create a zone, first create an alias based on a port or WWPN, and then create a zone using the alias.

◫ NOTE

- If a switch profile includes zoning configuration, it will replace the zoning configuration on the switch modules. **When E ports are connected to external switches, zoning configuration in the switch profile will be synchronized to all switch modules. Therefore, it is recommended that zoning be configured on external FC switches instead of in the switch profile.**

- The CX311 supports zoning configuration based on WWPNs, but does not support zoning configuration based on ports.

Figure 2-10 Creating an alias

Figure 2-11 Creating a zone

----**End**

Configuring a NIC Profile

Step 1 Create NIC profiles.

NIC profiles are based on the imported NIC information of compute nodes. See Figure 2-12.
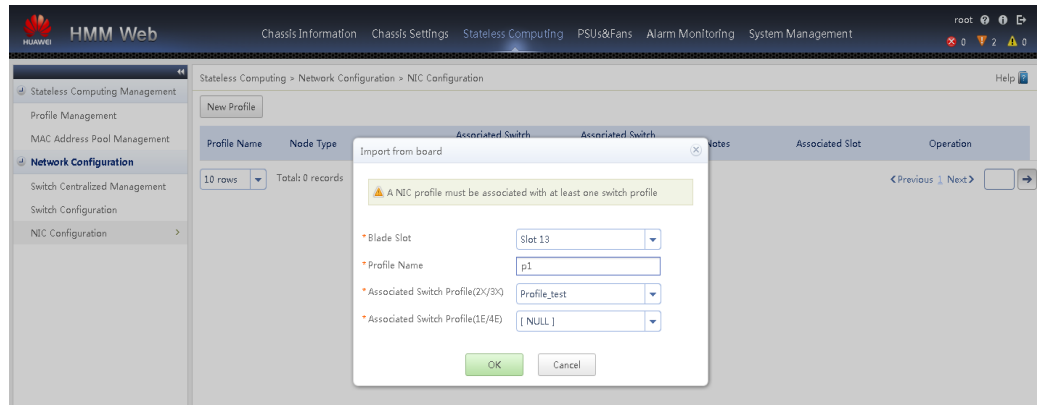
Figure 2-12 Creating a NIC profile

Figure 2-13 shows the NIC information.

Figure 2-13 NIC information

**Step 2** Create a NIC team.

Configure NIC teaming based on NIC information. See Figure 2-14.

☐ **NOTE**

To bond NIC ports into a NIC team, the NIC ports must correspond to paired switch slots and the port types (such as 10GE) must be the same.

For example, for a four-port NIC on Mezz 2, if two ports connect to the switch module in slot 1E and the other two connect to the switch module in slot 4E, these four ports can form a NIC team. Three ports cannot form a NIC team, nor can two ports that correspond to the same switch slot. Likewise, Mezz 2 ports and Mezz 1 ports cannot form a NIC team because their corresponding switch modules are not in paired slots.

Figure 2-14 Creating a NIC team
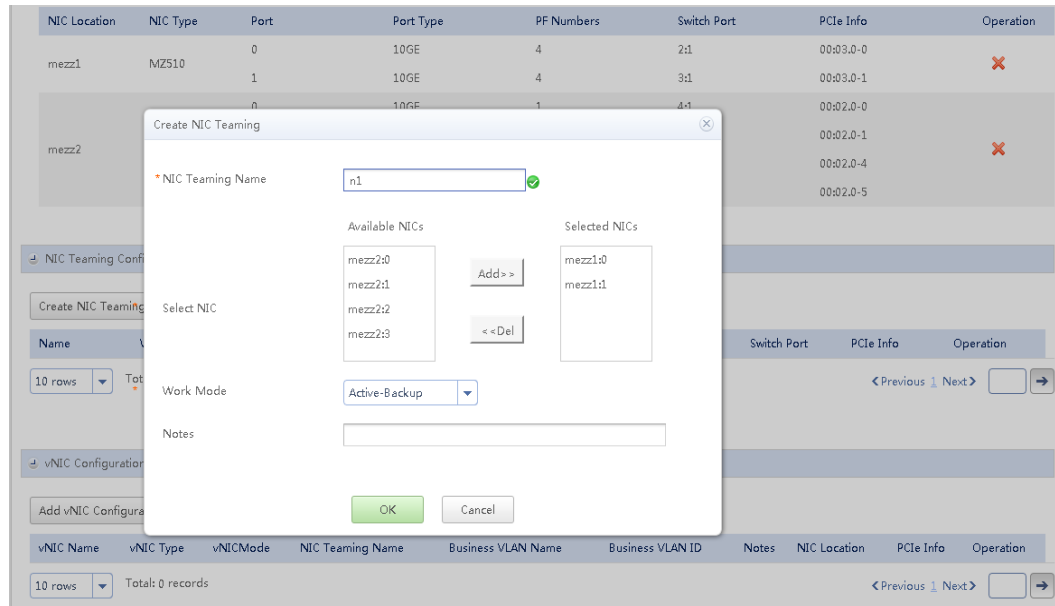
Step 3 Create vNICs.

Create vNICs based on NIC teaming. See Figure 2-15.

📖 **NOTE**

- The number of PF vNICs cannot exceed the maximum number of PFs supported by the NICs.
- FCoE vNICs can be created only if switch modules and NICs support FCoE.

Figure 2-15 Creating a vNIC

Step 4 Bond the NIC profiles to slots.

Bond the NIC profiles to required slots. See Figure 2-16.

📖 NOTE

Bond the NIC profiles to the slots in which the compute node types, NIC types, and NIC installation status are consistent to the profiles. Otherwise, alarms are generated and the compute node network may fail.

Figure 2-16 Bonding a NIC profile to slots
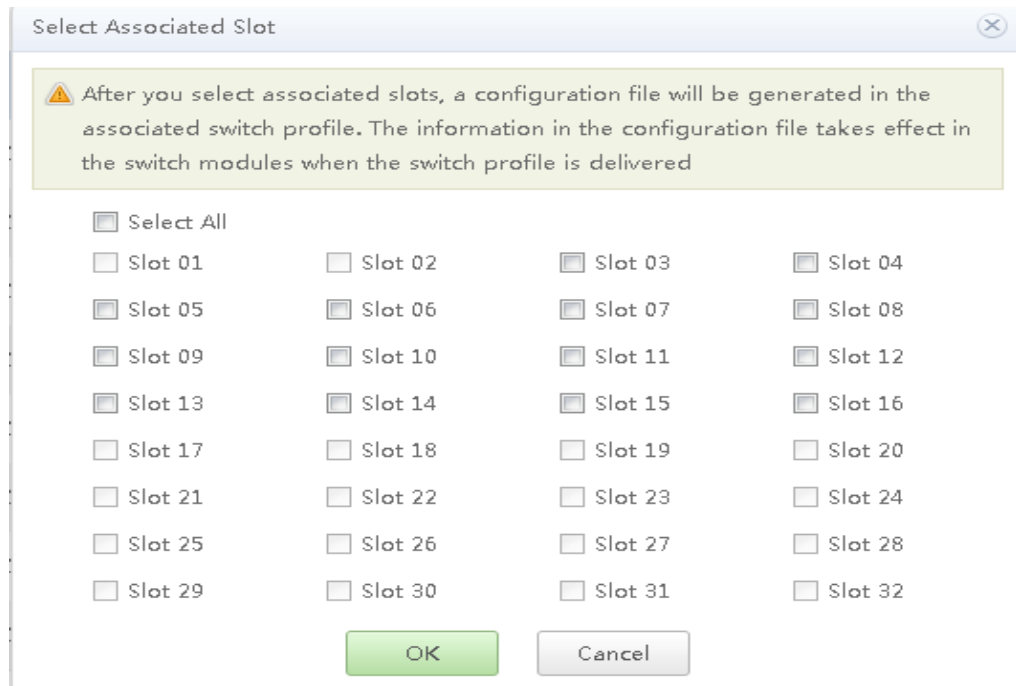
----**End**

Enabling the configuration

To enable the configuration, click the button for delivering configuration or install switch modules. The switch module types must be consistent with the configuration; otherwise, the configuration will not be delivered.

As shown in Figure 2-17, operation icons from left to right are Edit, Copy, Delete, and Deliver respectively.

Figure 2-17 Operation icons

📖 **NOTE**

There are two methods for enabling a configuration:

1. Offline delivery: restarts the Ethernet switching plane of switch modules.

2. Online delivery: delivers the configuration without restarting switch modules. This method has less impact on services.

Delivery of new switch configurations must be offline. Delivery of updated switch configurations can be online or offline.

# 2.2 Service Configuration Instances

2.2.1 Stacked Networking (1)

In a cloud resource pool project, four data service planes are required: VM management plane, VM migration plane, virtualization service data plane, and FC storage plane.

MZ910s in Mezz 1 and Mezz 3 and MZ510s in Mezz 2 and Mezz 4 are installed in a CH242. External switches are stacked.

See Figure 2-18.

Figure 2-18 Networking
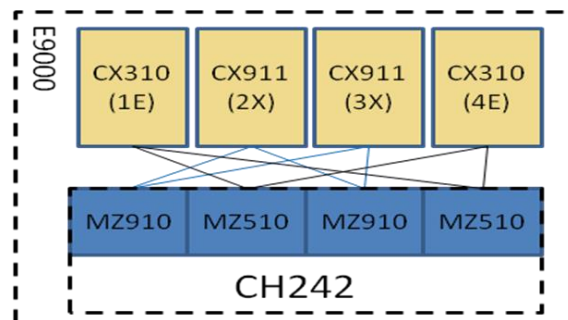
Step 1 Create a switch profile for switch modules in slots 2X and 3X.

As the switch modules are CX911s and the external switches are stacked, set the working mode of the CX911s to **Stack**.

**Step 2** Create two normal uplinks in the CX911 profile for connecting to external switches.

The two uplinks are the VM uplink and VM migration uplink. The uplink ports are Ethernet trunk ports across switch modules.

Step 3 Create two normal business VLANs in the CX911 profile and associate the VLANs with the VM management uplink and the VM migration uplink respectively.

Step 4 Configure the FC SANs in the CX911 profile and set the SAN working mode to NPV.

Step 5 Bond the CX911 profile to slots 2X and 3X.

Figure 2-19 CX911 networking
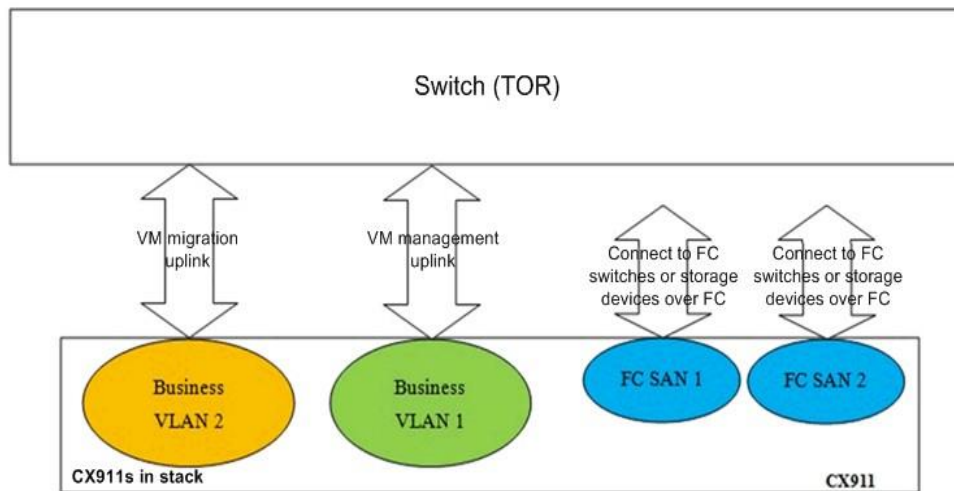
**Step 6** Create a switch profile for switch modules in slots 1E and 4E.

As the switch modules are CX310s and the external switches are stacked, set the working mode of the CX310s to **Stack**.

Step 7 Create a shared uplink in the CX310 profile to connect to external switches. Create a Trans VLAN to serve as a data service business VLAN. Associate the business VLAN with the shared uplink.

Set the transparent VLAN ID range based on service requirements, for example, 100 to 228.

Step 8 Bond the CX310 profile to slots 1E and 4E.

Figure 2-20 CX310 networking
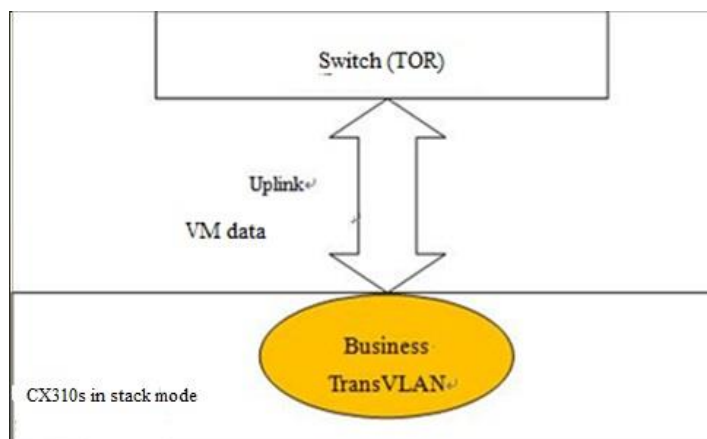
Step 9 Import the NIC configuration from the installed CH242 and create three NIC teams.

Teaming 1: two Ethernet ports on Mezz 1, which are in LACP mode; Teaming 2: four Ethernet ports on Mezz 2 or Mezz 4, which are in LACP mode; Teaming 3: two Ethernet ports on Mezz 3, which are in LACP mode.

**Step 10** Create vNICs based on the NIC team.

Create Port vNICs on Teaming 1 and associate the vNICs with the VM management business VLANs (switch profiles for CX911s in slots 2X and 3X).

Create Port vNICs on Teaming 2 and associate the vNICs with the VM data transparent transmission business VLANs (switch profiles for CX310s in slots 1E and 4E). Create Port vNICs on Teaming 3 and associate the vNICs with the VM migration business VLANs (switch profiles for CX911s in slots 2X and 3X).

FC ports do not need to be configured and automatically associate with the FC SAN.

Step 11 Bond the NIC profile to slots 1 to 8 and deliver the NIC profile for the configuration to take effect.

Figure 2-21 E9000 networking
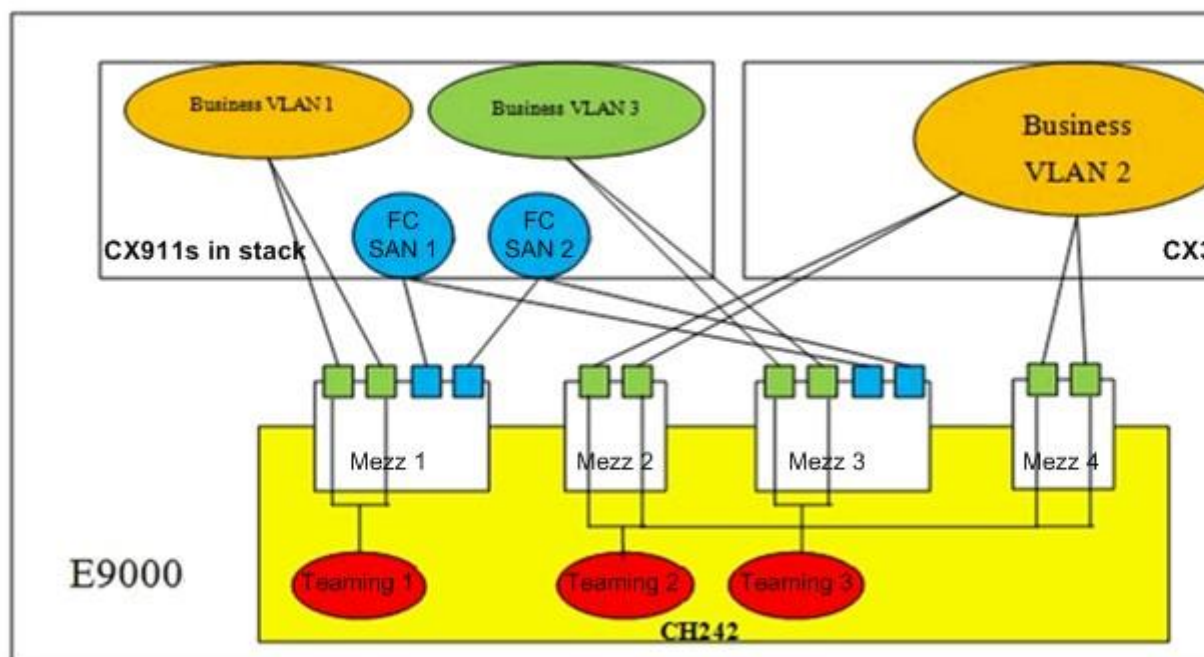
----End

2.2.2 FCoE Networking (2)

In a desktop cloud FCoE SAN solution, four 10GE uplink ports connect to external switches. The MZ510 in Mezz1 is installed in a CH121 and UMC is enabled. vNIC 0 and vNIC 1 are bound to serve as a service plane, and vNIC 2 and vNIC 3 are bound to serve as a management plane. Configure different VLANs for management and services. Enable FCoE ports for connecting NICs to storage devices. See Figure 2-22.

Figure 2-22 FCoE networking
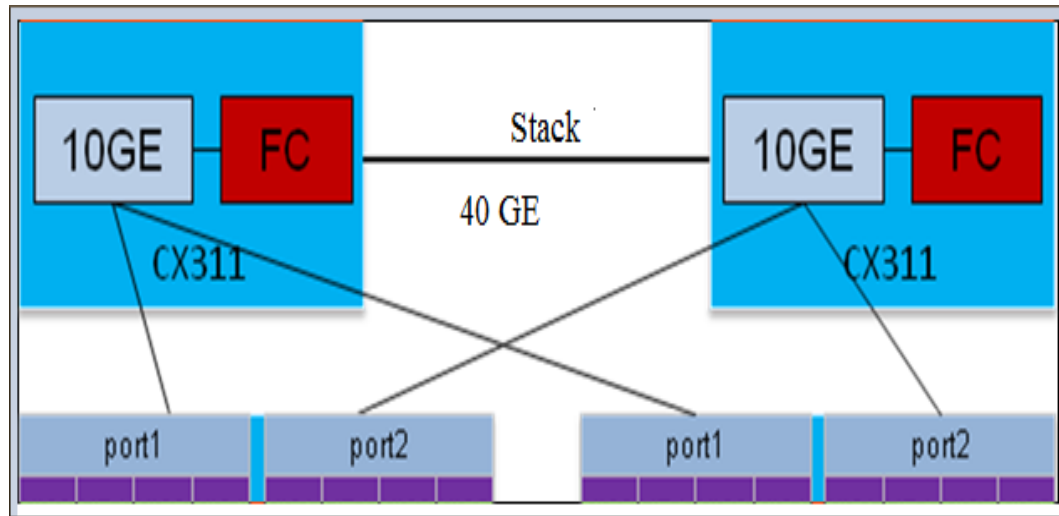
Step 1 Create a switch profile for switch modules in slots 2X and 3X. The switch modules are CX311s that work in stack mode.

Step 2 Create two normal uplinks in the CX311 profile for connecting to external switches.

The two uplinks are the management uplink and service data uplink. The uplink ports are Ethernet trunk ports across switch modules.

Step 3 Create two normal business VLANs in the CX311 profile.

Associate the two VLANs with the management uplink and service data uplink.

**Step 4** Deliver the CX311 profile to slots 2X and 3X.

Figure 2-23 CX311 networking
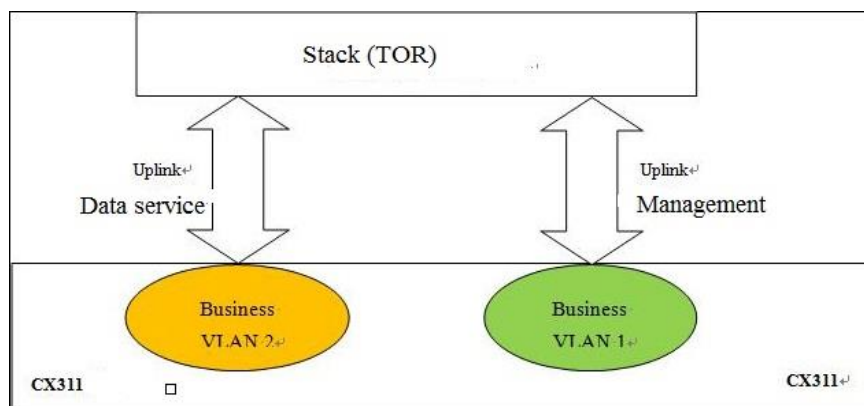
Step 5 Import NIC (the MZ510 in Mezz1) configuration from the installed CH121, and create the NIC Teaming (two ports on the MZ510 in Mezz1). Two Ethernet ports work in active/backup mode and FCoE ports must work in active/backup mode.

Step 6 Create three vNICs in the NIC Teaming. Two are Ethernet or PF vNICs that associate with the data service business VLAN and management VLAN respectively, and the other one is an FC or PF vNIC that does not associate with a VLAN.

Step 7 Bond the NIC profile to slots 0 to 6 and deliver the NIC profile for the configuration to take effect.

Figure 2-24 E9000 networking
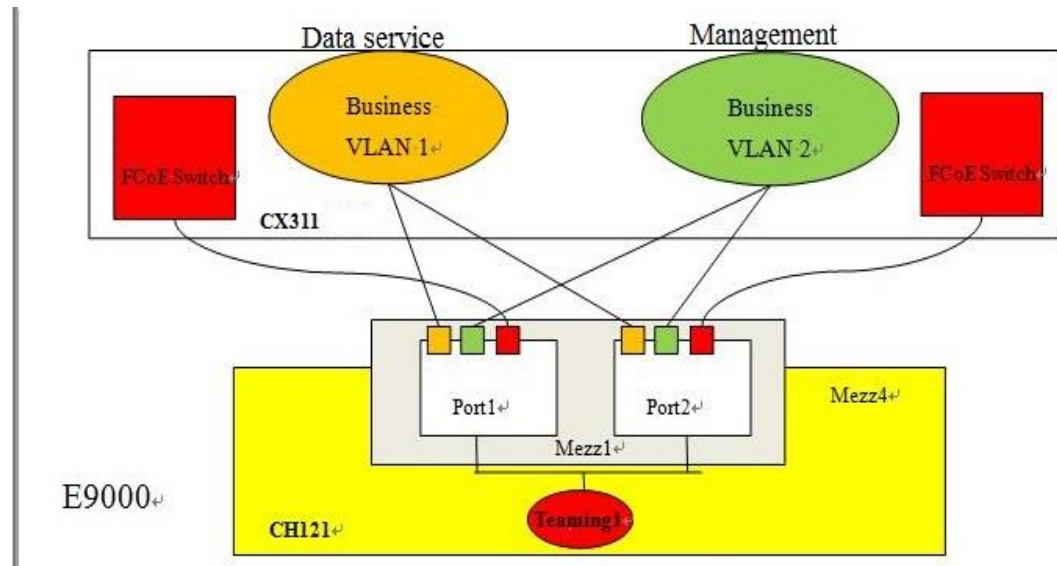
----End

2.2.3 FCoE Networking (3)

2.2.3.1 FCF Application Scenario

A Fibre Channel Forwarder (FCF) switch supports both FCoE and FC protocol stacks for connecting to SAN and LAN environments. In an FC SAN, an FCF is mainly used for transmitting FC data. An FCF forwards FCoE packets and encapsulates or decapsulates FCoE packets.
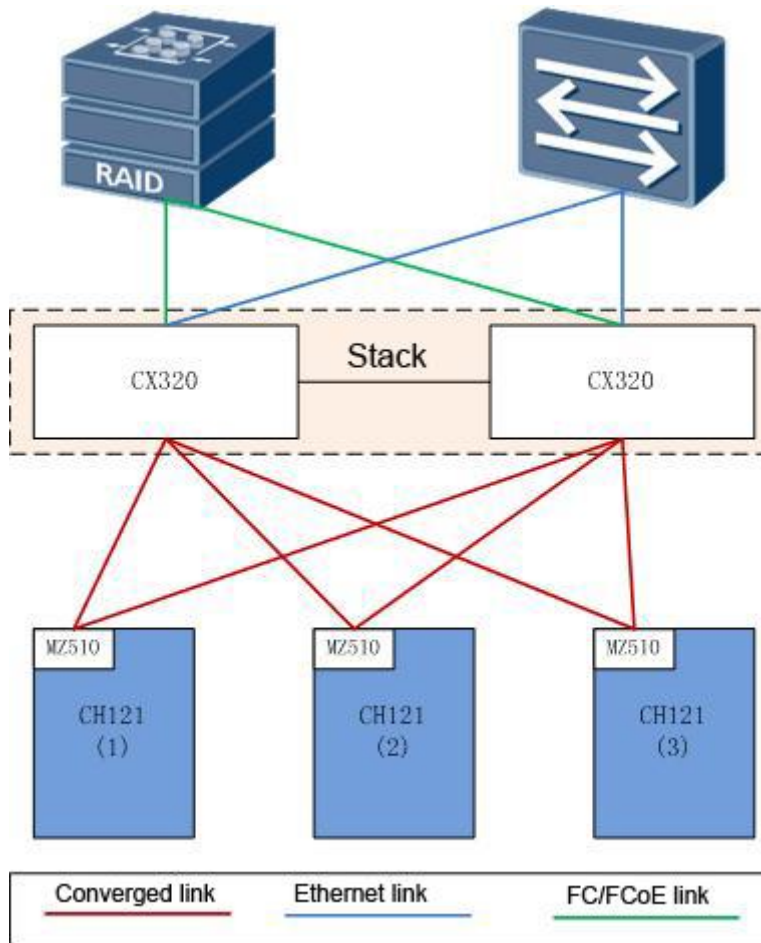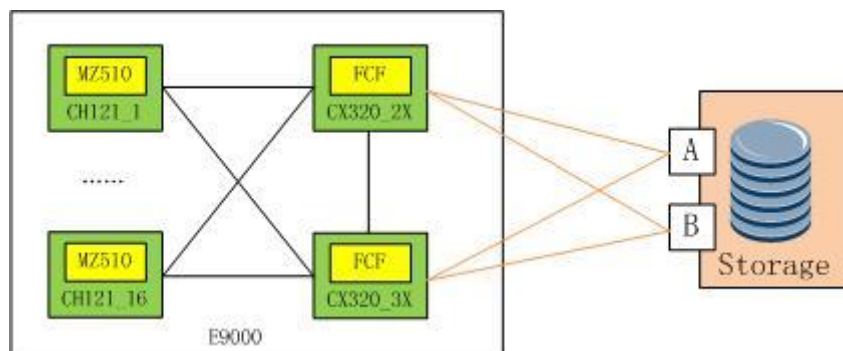
Figure 2-25 Overall networking

Figure 2-26 FC networking

2.2.3.2 Networking Requirements

1. The chassis provides eight 10GE uplinks to connect to aggregation switches. The switch modules are redundant to each other.

2. The chassis provides four 8 Gbit/s uplinks to directly connect to dual-controller FC storage (such as S3900), or provides four 10 Gbit/s uplinks to directly connect to dual-controller FCoE storage.

☉ **NOTE**

The CX320 switch module can directly connect to storage by using FC or FCoE ports. To use FCoE ports to connect to storage, the storage device needs to provide FCoE ports.

3. Three types of services run on different physical network adapters of each compute node. Multiple physical network adapters share two 10GE uplinks.

☉ **NOTE**

In this scenario, FC ports are directly connected to storage. To directly connect FC ports to external FC switches, see 2.2.4 FCoE Networking (4).

2.2.3.3 Physical Networking Description

- Install two CX320 converged switch modules in slots 2X and 3X, which use FC or FCoE uplinks to connect to storage and Ethernet uplinks to connect to the aggregation switch.
- Configure the two CX320 switch modules as a stack by using the default stack IDs and the 40GE midplane links as cascading channels. Enable local preferential forwarding for the uplink Eth-Trunk ports.
- Install CH121 half-width compute nodes in slots 1, 2, and 3, install MZ510 converged network adapters in their Mezz1 positions. Each MZ510 provides one 10GE link to connect to each CX320.
- Connect ports 10GE 2/17/1 to 2/17/4 and 3/17/1 to 3/17/4 of the CX320 panels to the uplink aggregation switch.
- Connect subcard ports FC 2/21/1, FC 2/21/2, FC 3/21/1, and FC 3/21/2 of the CX320 to the uplink FC storage, or connect panel ports 10GE 2/17/7, 10GE 2/17/8, 10GE 3/17/7, and 10GE 3/17/8 on the CX320 to the uplink FCoE storage.

☉ **NOTE**

The CX320 switch module can directly connect to storage by using FC or FCoE ports. If FC ports are used to directly connect to storage, only subcard ports can be converted to FC ports. If FCoE ports are used to directly connect to storage, use panel ports or subcard ports. The two situations require different configurations, which are described in the following sections.

## 2.2.3.4 easyLink Configuration Procedure

⚠ **NOTICE**

After centralized switch management is enabled, switch module configurations on the CLI cannot be saved and the saved configurations will be

invalid. After switch modules are restarted, the configurations saved on the CLI will be lost and only the easyLink configuration takes effect.

Step 1 On the MM910 WebUI, choose **Stateless Computing** > **easyLink Configuration** > **Switch Centralized Management**. Enable **Switch Centralized Management Configuration**, as shown in Figure 2-27.

Figure 2-27 Enabling Switch Centralized Management
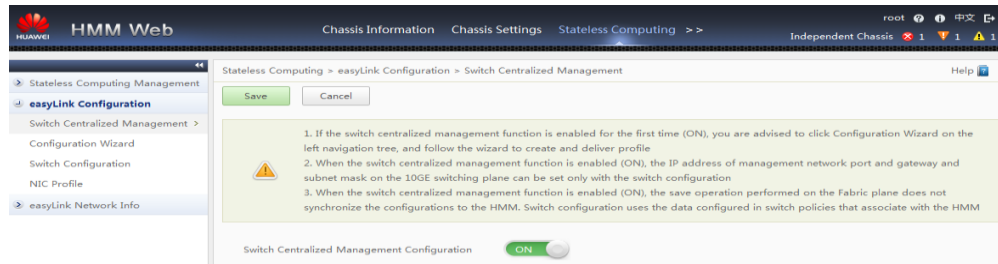
Step 2 Choose **Stateless Computing** > **easyLink Configuration** > **Switch Configuration** and click **New Profile**. On the displayed dialog box, set **Switch Slot** to **2X/3X**, **Switch Type** to **CX320**, and **Work Relation** to **Stack**, as shown in Figure 2-28. Ensure that the flexible card configuration under **Panel Port Configuration** is correct, as shown in Figure 2-29.
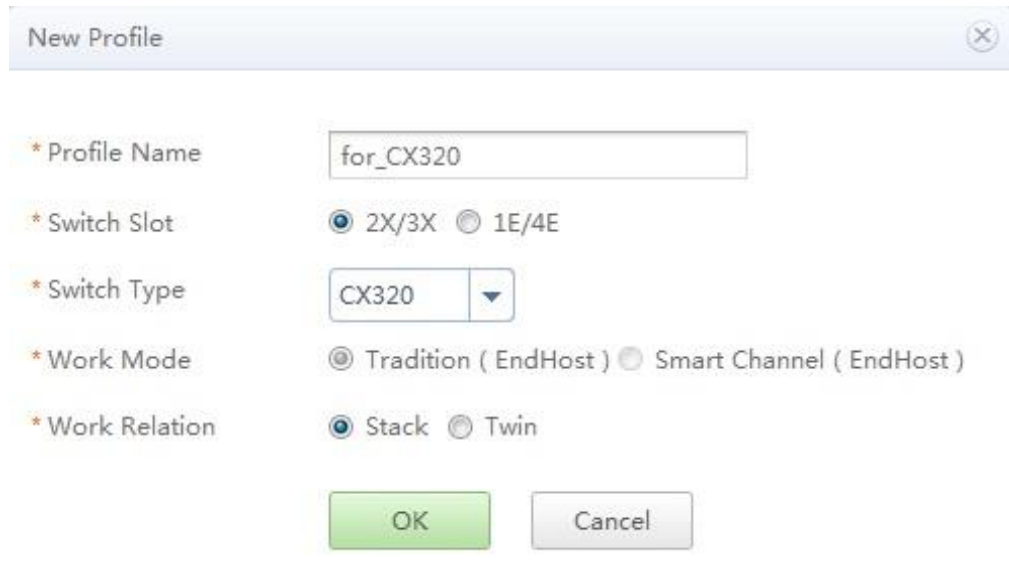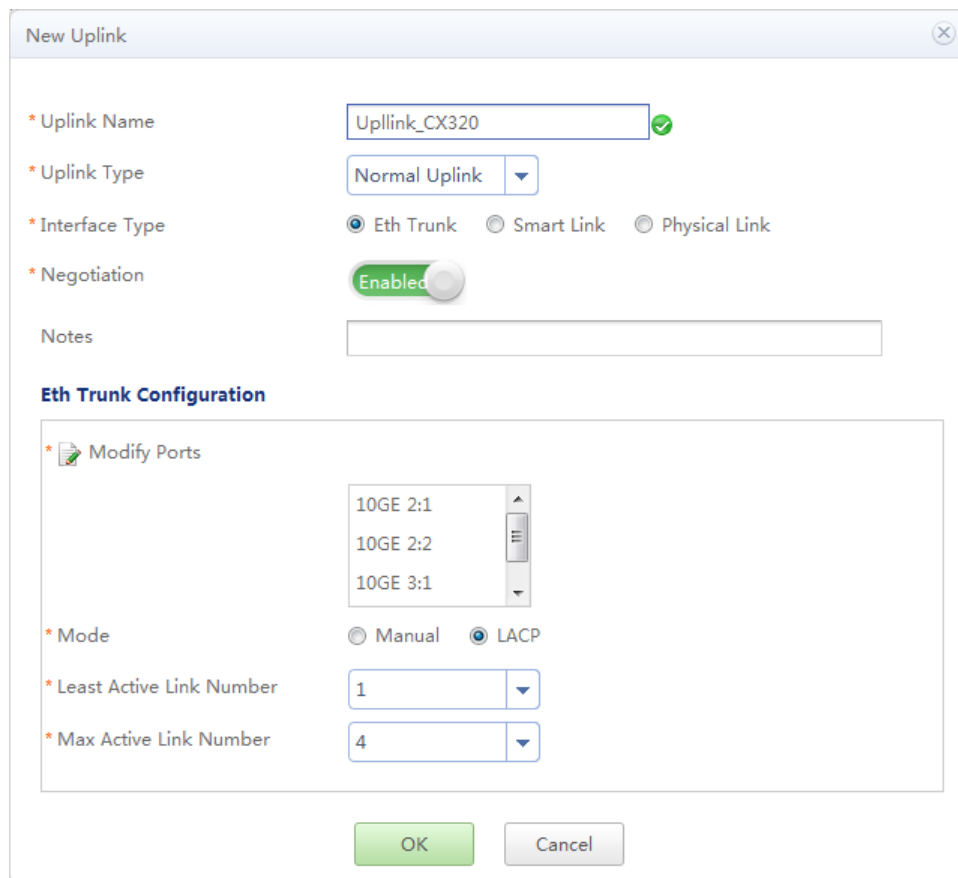
Figure 2-28 Creating a switch profile

Figure 2-29 Panel Port Configuration

Step 3   Under **Uplink Configuration**, click **New Uplink** and set **Uplink Type** to **Normal Uplink**, as shown in Figure 2-30.

Figure 2-30 Creating an uplink

Step 4 Under **Business VLAN Configuration**, click **New Business VLAN**, set **VLAN Type** to **Normal Vlan**, and associate with the uplink created in Step 3.

Step 5 Under **FC Configuration**, set **Enable FC** to **Enable**, set **FC working mode** to **Switch (FCF)**, and retain default values for DCBX configuration, as shown in Figure 2-31.

Figure 2-31 FC configuration
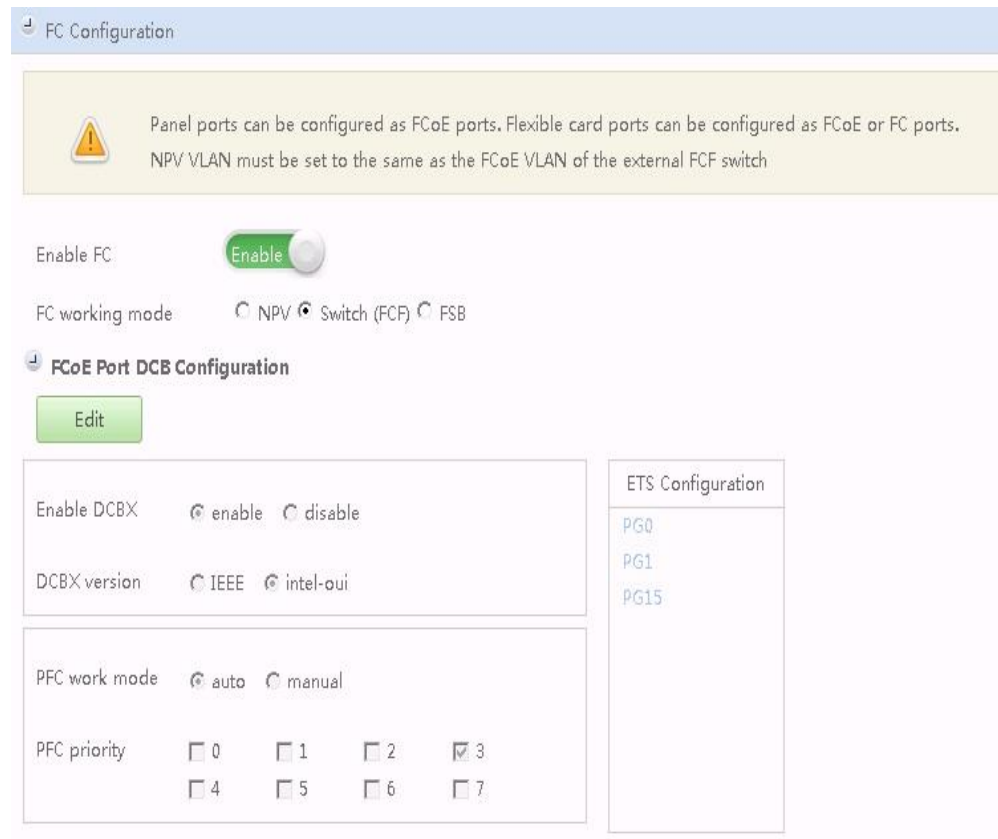
Step 6 If FC ports are used to directly connect to storage, go to Step 7. If FCoE ports are used to directly connect to storage, go to Step 8.

Step 7 Under **Swi2 FC SAN Configuration** and **Swi3 FC SAN Configuration**, click **FC Port Settings** and add ports, as shown in Figure 2-32.

Figure 2-32 Swi2 FC SAN configuration
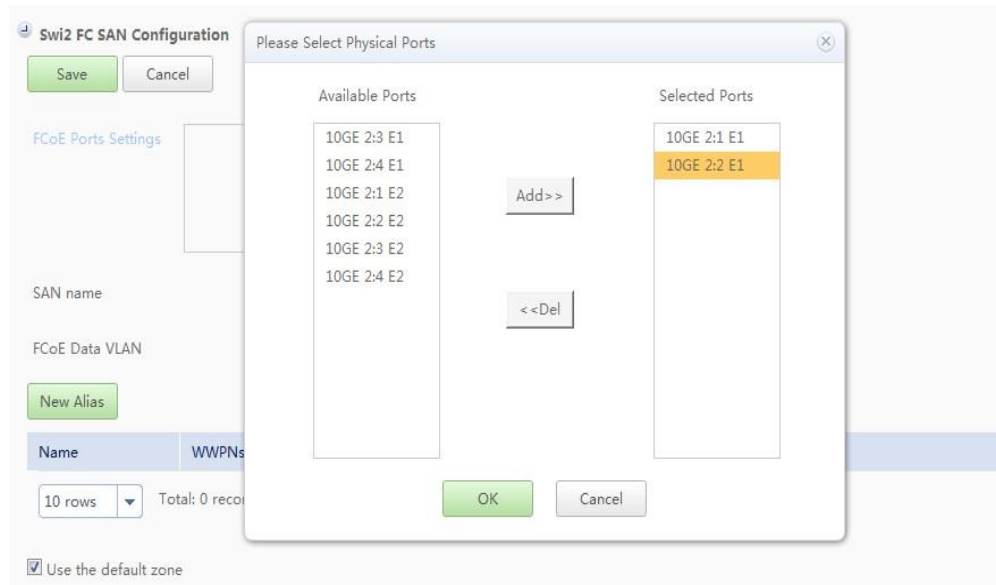
Step 8   Under **Swi2 FC SAN Configuration** and **Swi3 FC SAN Configuration**, click **FCoE Port Settings** and add ports, as shown in Figure 2-33.

Figure 2-33 Swi2 FC SAN configuration
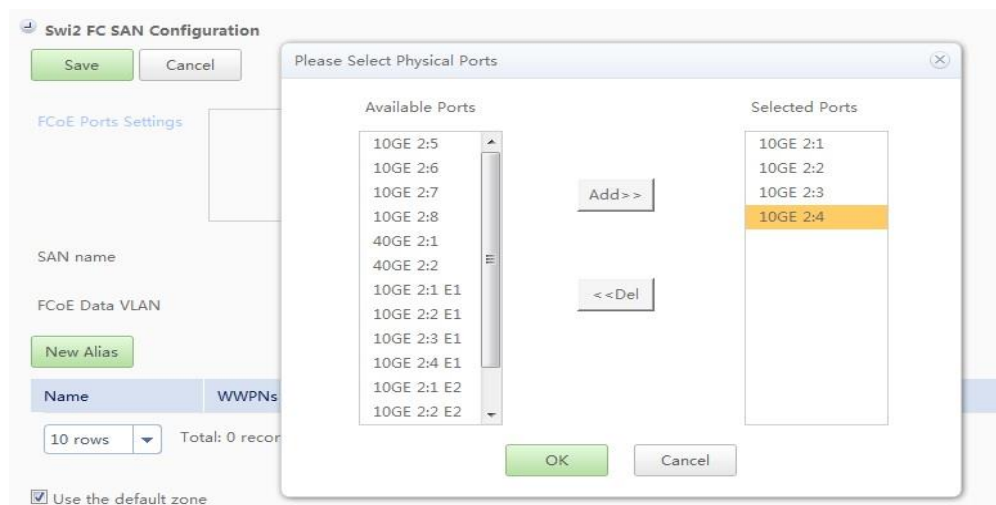
Step 9   Choose **Stateless Computing** > **easyLink Configuration** > **NIC Profile**, click **New Profile**, select **Slot 01**, enter the profile name, associate with the switch profile of slots 2X and 3X, and click **OK**. Figure 2-34 shows NIC information.

Figure 2-34 NIC information

NIC Location	NIC Type	Port	Port Type	Maximum Number of PFs	Switch Port	PCIe Info	Operation
mezz1	MZ510	0	10GE	4	2:1	00:02.0-0	✖
		1	10GE	4	3:1	00:02.0-1	
mezz2	MZ510	0	10GE	4	1:1	80:02.0-0	✖
		1	10GE	4	4:1	80:02.0-1	

Step 10 Click **Create NIC Teaming**, add NIC ports, set the PVID (optional and usually left empty), retain the default work mode **Active-Backup**, and click **OK**, as shown in Figure 2-35.

Figure 2-35 Creating a NIC team

Step 11 Click **Add vNIC Configuration**, enter the vNIC name, select the NIC team created in Step 10, set **vNIC Type** to **FCoE**, set **Mode** to **PF**, and click **OK**, as shown in Figure 2-36. Click **Add vNIC Configuration**, enter the vNIC name, select the NIC team created in Step 10, set **vNIC Type** to **Ethernet**, set **Mode** to **PF**, select the business VLAN created in Step 4, and click **OK**, as shown in Figure 2-37.

Figure 2-36 Creating an FCoE vNIC

**Figure 2-37** Creating an Ethernet vNIC

Step 12   Return to the NIC profile list, click **None** in the **Associated Slot** column, and select **Slot 01**, **Slot 02**, and **Slot 03**, as shown in Figure 2-38.

Figure 2-38 Associating with slots
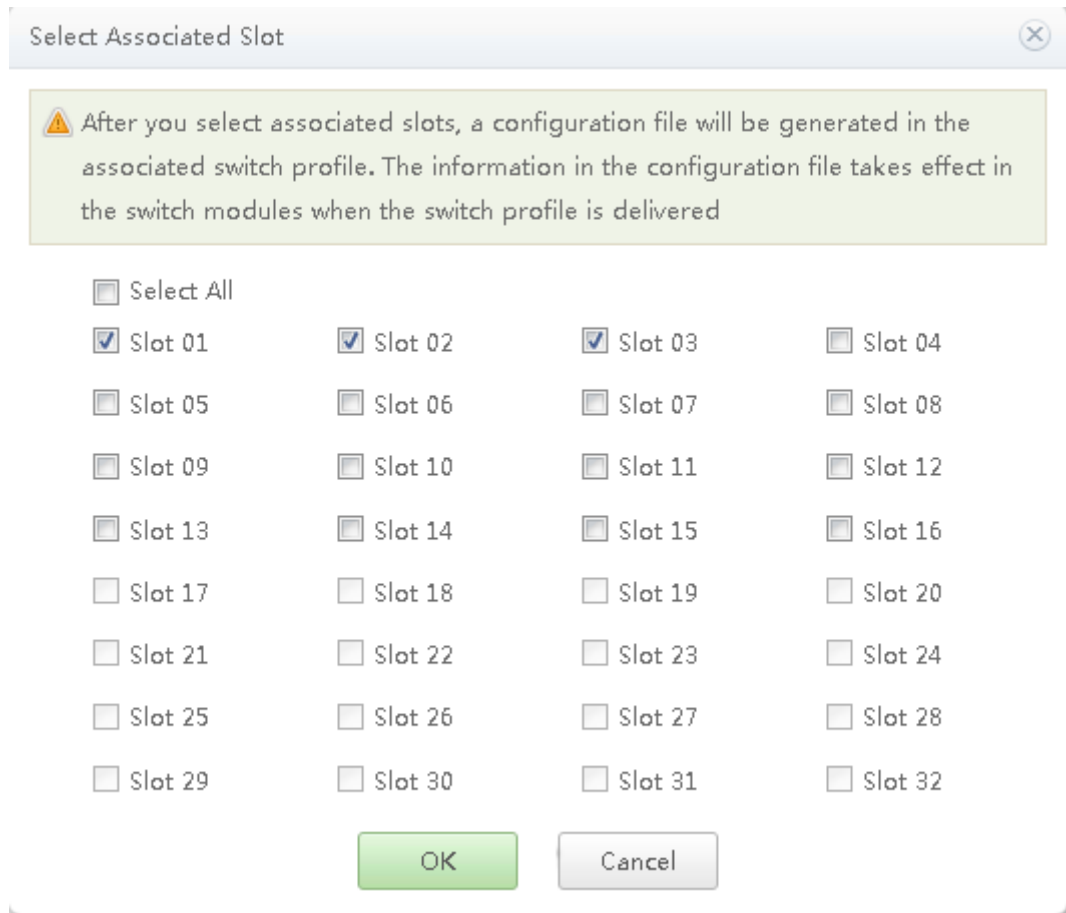
Step 13 Choose **Stateless Computing** > **easyLink Configuration** > **Switch Configuration**, click **None** in the **Associated Slot** column, select **Swi2/Swi3**, and click **OK**, as shown in Figure 2-39.
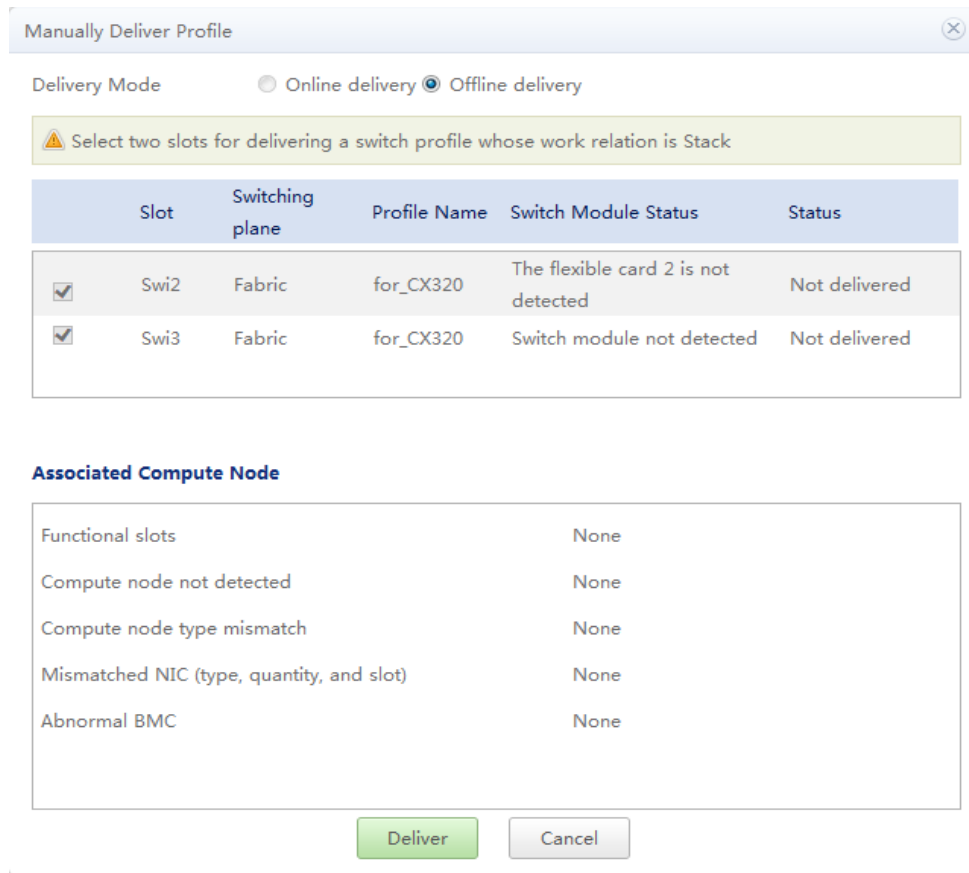
Figure 2-39 Associating with slots
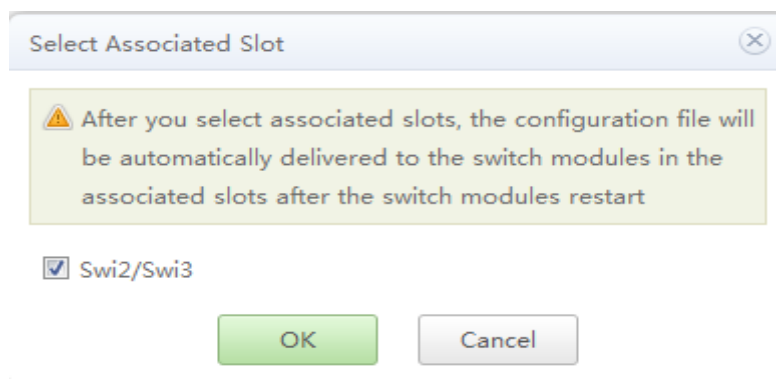
Step 14 Click [icon], select **Offline Delivery**, and select **Swi2** and **Swi3**, as shown in Figure 2-40.

Figure 2-40 Manually delivering a profile


----End

2.2.3.5 NIC Configuration in the OS

In the OS, create three bonds and associate each bond with two NIC ports (ethx), which are one PF on port 0 and one on port 1. For details, see the E9000 Server V100R001 Deployment Guide.

2.2.4 FCoE Networking (4)

2.2.4.1 NPV Application Scenario

A SAN has high demands for edge switches directly connected to node devices. N-Port virtualization (NPV) switches do not occupy domain IDs and enable a SAN to exceed the limit of 239 edge switches.

Figure 2-41 Overall networking

| Converged link | Ethernet link | FC/FCoE link |
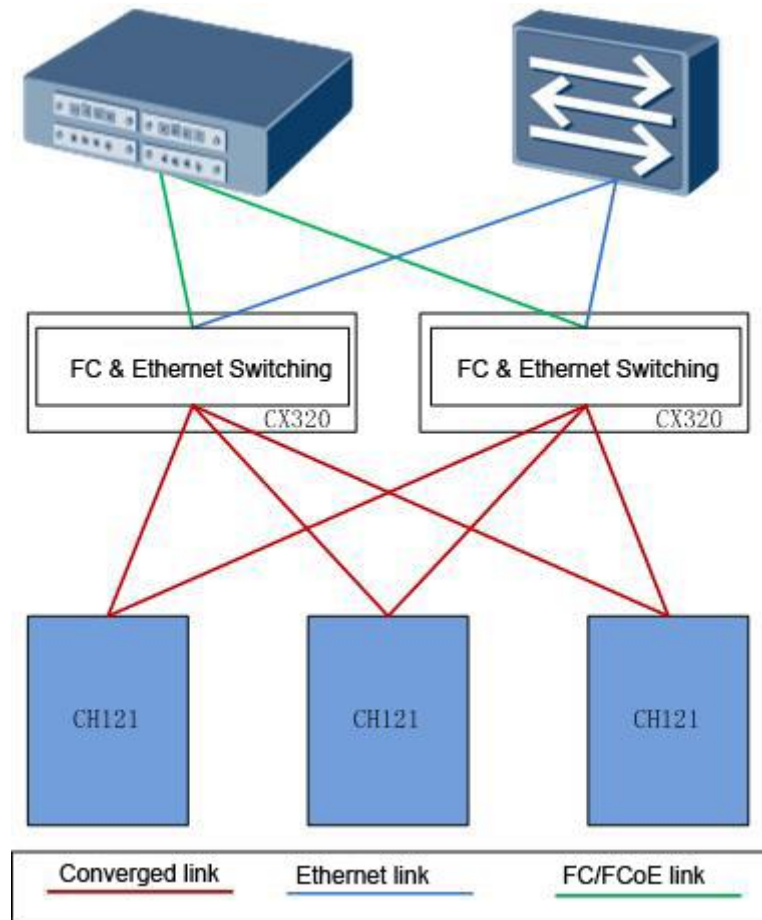
2.2.4.2 Networking Requirements

1. The CX320 switch modules forward FC traffic in NPV mode and directly connect to FC or FCoE switches. Ethernet traffic is sent to the customer's network through Ethernet aggregation switches. The switch modules are redundant to each other.

2. The chassis provides eight 10GE uplinks to connect to Ethernet aggregation switches, and provides four 8 Gbit/s uplinks to connect to FC switches.

📕 NOTE

If the FC switch supports FCoE ports, the FCoE ports can also be used for connections.

3. Each compute node provides two 10GE uplinks.

📕 NOTE

In this scenario, FC ports are used to connect to an external FC switch. If FC ports are directly connected to storage, see 2.2.3 FCoE Networking (3).

The CX320 switch modules can provide FC ports to connect to FC switches if NPV is configured.

2.2.4.3 Physical Networking Description

*   Install two CX320 converged switch modules in slots 2X and 3X, which use FC or FCoE uplinks to directly connect to FC switches and use Ethernet uplinks to connect to aggregation switches.

- Configure the two CX320 switch modules as a stack by using the default stack IDs and the 40GE midplane links as cascading channels. Enable local preferential forwarding for the uplink Eth-Trunk ports.

- Install CH121 half-width compute nodes in slots 1, 2, and 3, install MZ510 converged network adapters in their Mezz1 positions. Each MZ510 provides one 10GE link to connect to each CX320.

- Connect ports 10GE 2/17/1 to 2/17/4 and 3/17/1 to 3/17/4 of the CX320 panels to the uplink aggregation switch.

Connect ports FC 2/21/1, FC 2/21/2, FC 3/21/1, and FC 3/21/2 of the CX320 subcards to the uplink FC switch, or connect ports 10GE 2/17/7, 10GE 2/17/8, 10GE 3/17/7, and 10GE 3/17/8 on the CX320 panels to the uplink FCoE switch.

📖 NOTE

CX320 switch modules can use FC ports to directly connect to FC switches or use FCoE ports to directly connect to FCoE switches. To directly connect to FC switch, only subcard ports can be used. To directly connect to FCoE switch, use panel ports or subcard ports. The two situations require different configurations, which are described in the following sections.

## 2.2.4.4 easyLink Configuration Procedure

⚠️ **NOTICE**

After centralized switch management is enabled, switch module configurations on the CLI cannot be saved and the saved configurations will be

invalid. After switch modules are restarted, the configurations saved on the CLI will be lost and only the easyLink configuration takes effect.

Step 1 On the MM910 WebUI, choose **Stateless Computing** > **easyLink Configuration** > **Switch Centralized Management**. Enable **Switch Centralized Management Configuration**, as shown in Figure 2-42.

Figure 2-42 Enabling Switch Centralized Management
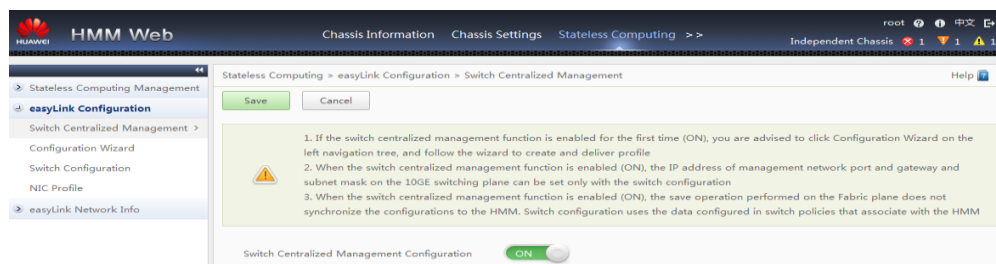
Step 2 Choose **Stateless Computing** > **easyLink Configuration** > **Switch Configuration** and click **New Profile**. On the displayed dialog box, set **Switch Slot** to **2X/3X**, **Switch Type** to **CX320**, and **Work Relation** to **Stack**, as shown in Figure 2-43. Ensure that the flexible card configuration under **Panel Port Configuration** is correct, as shown in Figure 2-44.

Figure 2-43 Creating a switch profile


Figure 2-44 Panel Port Configuration

Step 3 Under **Uplink Configuration**, click **New Uplink** and set **Uplink Type** to **Normal Uplink**, as shown in Figure 2-45.

Figure 2-45 Creating an uplink

Step 4   Under **Business VLAN Configuration**, click **New Business VLAN**, set **VLAN Type** to **Normal Vlan**, and associate with the uplink created in Step 3.

Step 5   Under **FC Configuration**, click **Enable FC**, set **FC working mode** to **NPV**, and retain default values for DCBX configuration, as shown in Figure 2-46.

Figure 2-46 FC configuration
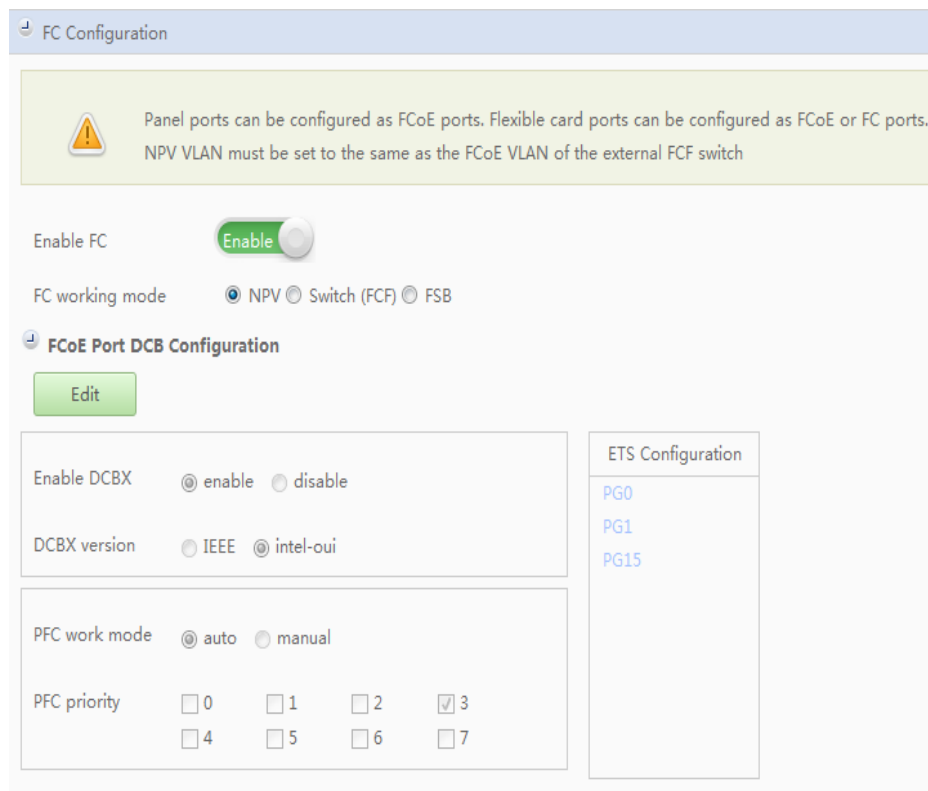
Step 6 If FC ports are used to directly connect to FC switches, go to Step 7. If FCoE ports are used to directly connect to FCoE switches, go to Step 8.

Step 7 Under **Swi2 FC SAN Configuration** and **Swi3 FC SAN Configuration**, click **FC Port Settings** and add ports, as shown in Figure 2-47.
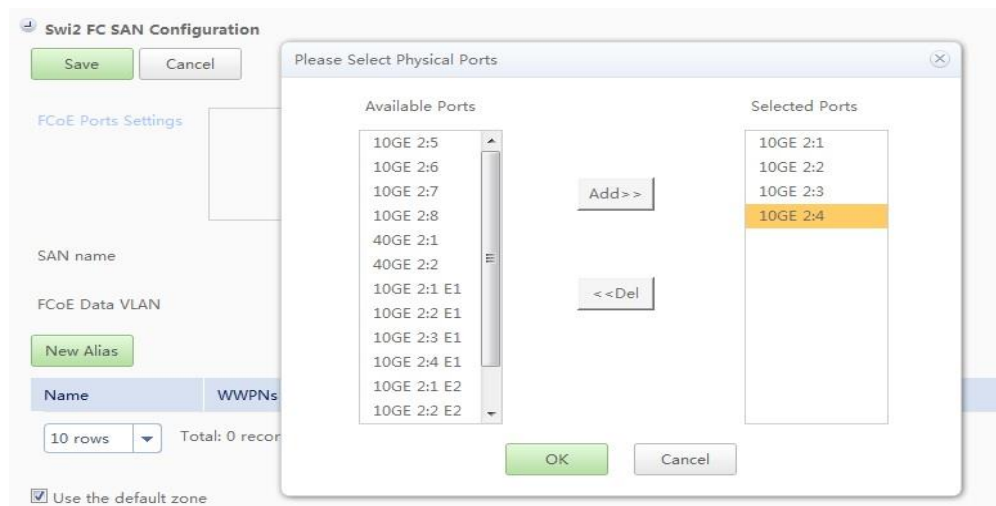
Figure 2-47 Swi2 FC SAN configuration
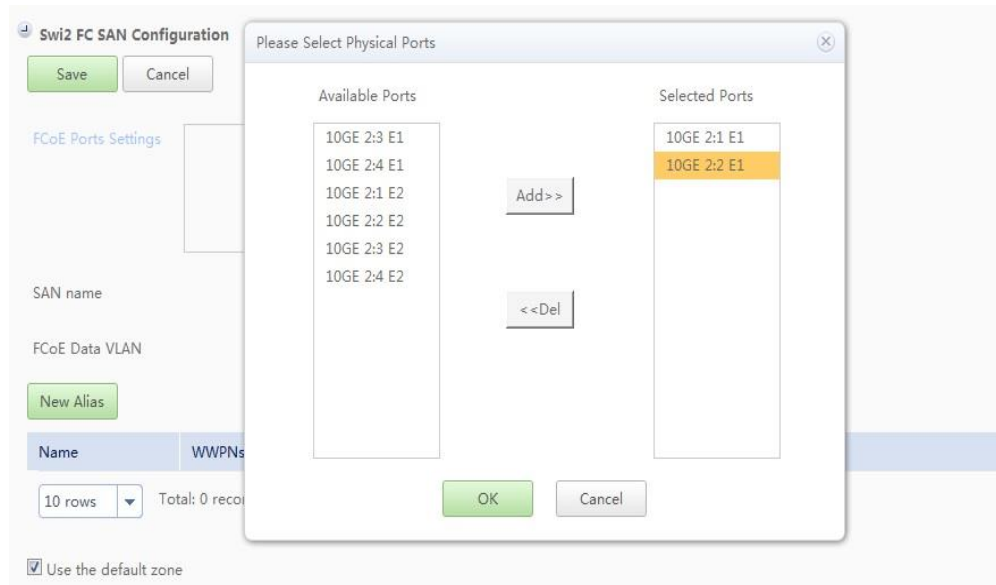
Step 8 Under **Swi2 FC SAN Configuration** and **Swi3 FC SAN Configuration**, click **FCoE Port Settings** and add ports, as shown in Figure 2-48.

📖 **NOTE**

NPV VLAN configuration of the CX320 must be consistent with the FCoE VLAN configuration of the external FCF instance.

Figure 2-48 Swi2 FC SAN configuration

Step 9 Choose **Stateless Computing** > **easyLink Configuration** > **NIC Profile**, click **New Profile**, select **Slot 01**, enter the profile name, associate with the switch profile of slots 2X and 3X, and click **OK**. Figure 2-49 shows NIC information.

Figure 2-49 NIC information

NIC Location	NIC Type	Port	Port Type	Maximum Number of PFs	Switch Port	PCIe Info	Operation
mezz1	MZ510	0	10GE	4	2:1	00:02.0-0	✖
		1	10GE	4	3:1	00:02.0-1	
mezz2	MZ510	0	10GE	4	1:1	80:02.0-0	✖
		1	10GE	4	4:1	80:02.0-1	

Step 10 Under **NIC Teaming Configuration**, click **Create NIC Teaming**, add NIC ports, retain the **Active-Standby** work mode, and click **OK**, as shown in Figure 2-50.

Figure 2-50 Creating a NIC team

Step 11 Click **Add vNIC Configuration**, enter the vNIC name, select the NIC team created in Step 10, set **vNIC Type** to **FCoE**, set **Mode** to **PF**, and click **OK**, as shown in Figure 2-51. Click **Add vNIC Configuration**, enter the vNIC name, select the NIC team created in Step 10, set **vNIC Type** to **Ethernet**, set **Mode** to **PF**, select the business VLAN created in Step 4, and click **OK**, as shown in Figure 2-52.

Figure 2-51 Creating an FCoE vNIC

Figure 2-52 Creating an Ethernet vNIC

Step 12 Return to the NIC profile list, click **None** in the **Associated Slot** column, and select **Slot 01**, **Slot 02**, and **Slot 03**, as shown in Figure 2-53.

Figure 2-53 Associating with slots
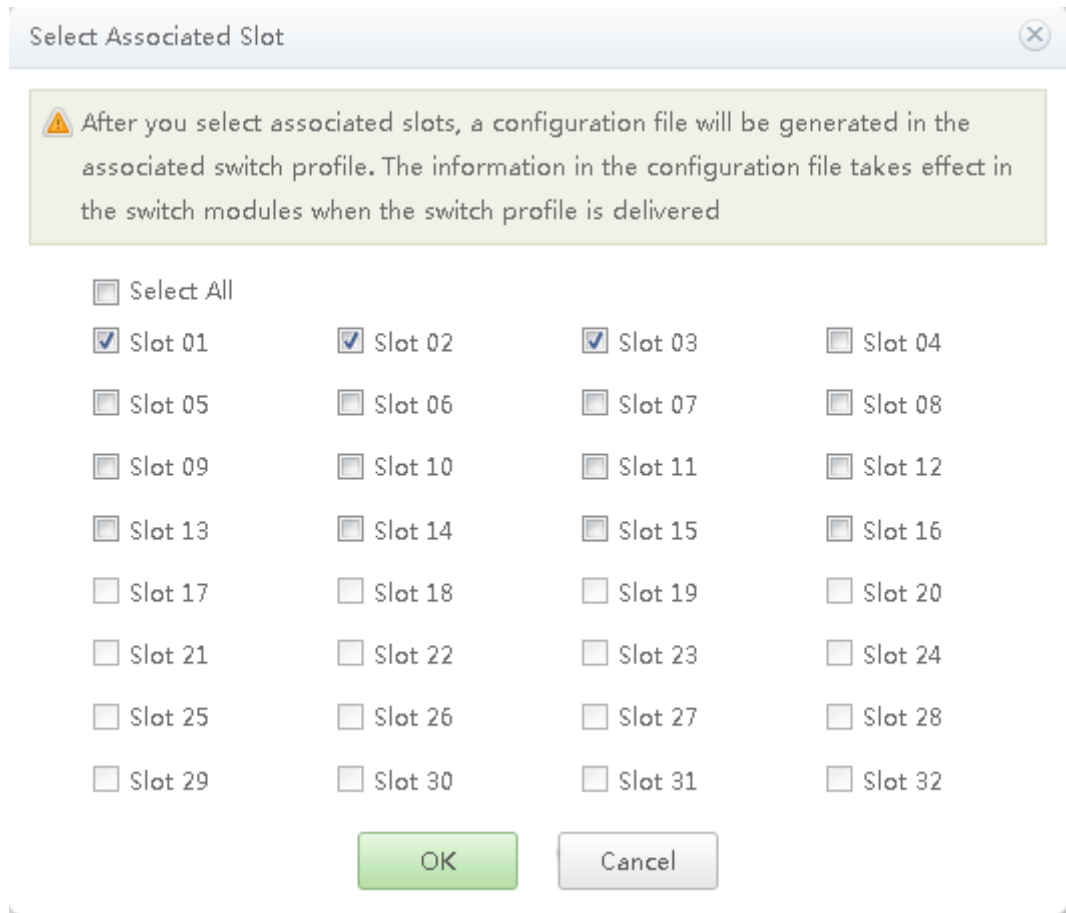
Step 13 Choose **Stateless Computing** > **easyLink Configuration** > **Switch Configuration**, click None in the **Associated Slot** column, select **Swi2/Swi3**, and click **OK**, as shown in Figure 2-54.

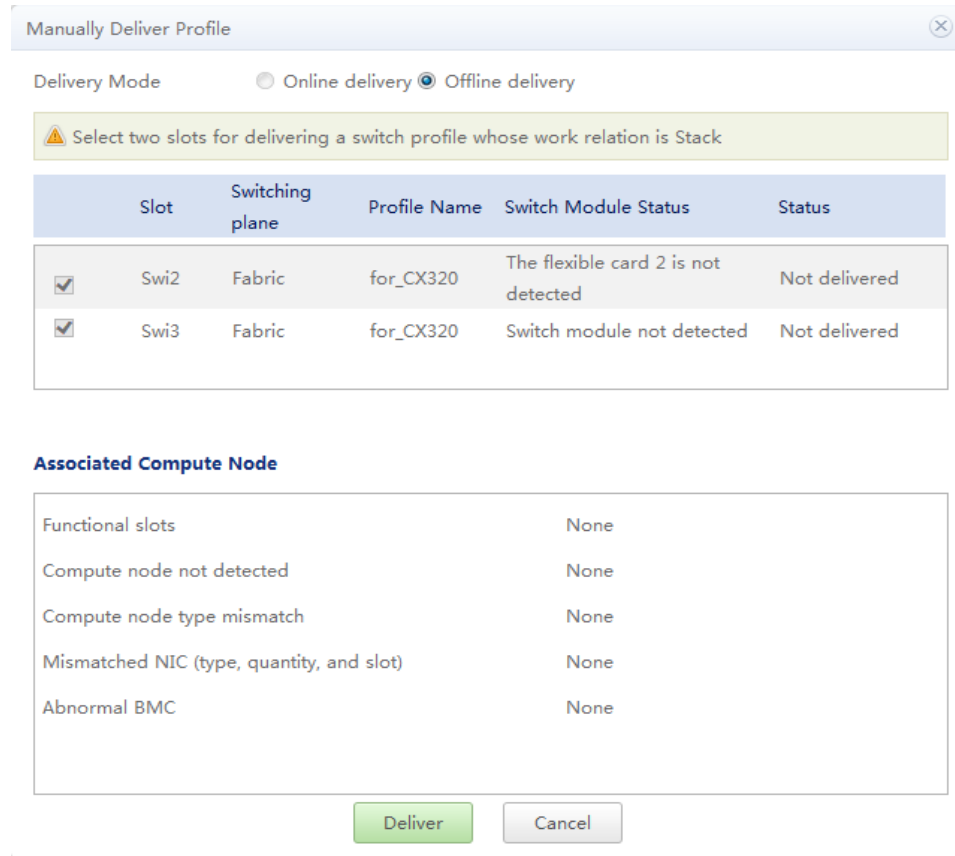**Figure 2-54** Associating with slots
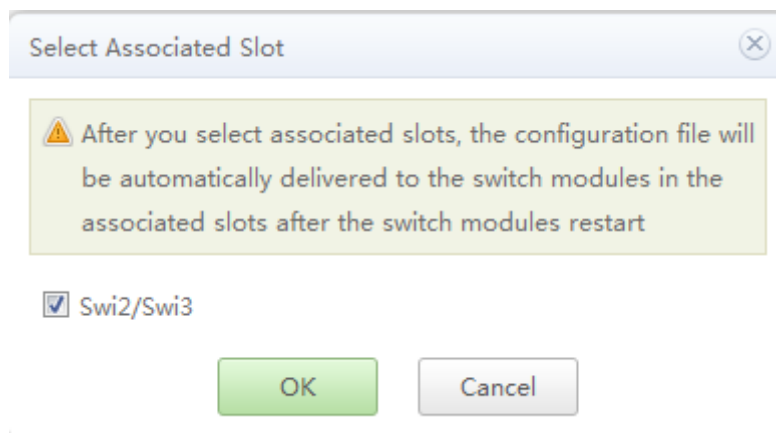
Step 14 Click , select **Offline Delivery**, and select **Swi2** and **Swi3**, as shown in Figure 2-55.

Figure 2-55 Manually delivering a profile

Manually Deliver Profile

Delivery Mode   ○ Online delivery ● Offline delivery

⚠ Select two slots for delivering a switch profile whose work relation is Stack

	Slot	Switching plane	Profile Name	Switch Module Status	Status
☑	Swi2	Fabric	for_CX320	The flexible card 2 is not detected	Not delivered
☑	Swi3	Fabric	for_CX320	Switch module not detected	Not delivered

Associated Compute Node

Functional slots	None
Compute node not detected	None
Compute node type mismatch	None
Mismatched NIC (type, quantity, and slot)	None
Abnormal BMC	None

Deliver   Cancel

----End

2.2.4.5 NIC Configuration in the OS

In the OS, create three bonds and associate each bond with two NIC ports (ethx), which are one PF on port 0 and one on port 1. For details, see the E9000 Server V100R001 Deployment Guide.

A Acronyms and Abbreviations

B

BIOS   Basic Input Output System

BMC   Baseboard Management Controller

F

FC   Fiber Channel

FCoE   Fiber Channel over Ethernet

M

MAC   Medium Access Control

L

LACP   Link Aggregation Control Protocol

P

PF   Physical Function

T

TOR   Top of Rack

V

VF   Virtual Function

W

WebUI   Web User Interface