S Series Switches

iStack Technology White Paper

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1 Feature Introduction

1.1 iStack Overview

Currently, two models of Huawei switches are available on the network: box switches and chassis switches.

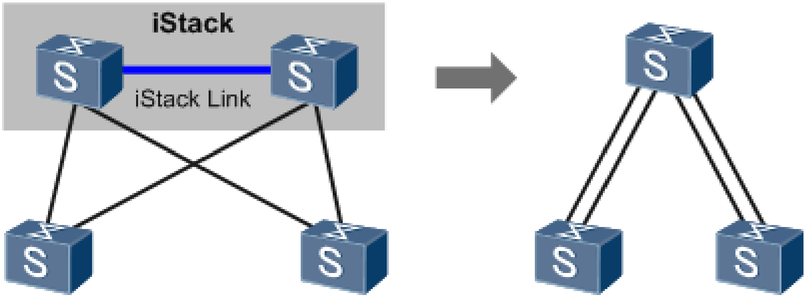
- Box switches have low costs but lack uninterrupted service protection, and cannot apply to the scenarios that require high availability, such as the aggregation layer, core layer, and data center. On complex networking, box switches have low scalability, requiring you to maintain many network devices and modify the existing network structure to support these devices.
- Chassis switches are often used in important scenarios (such as the aggregation layer, core layer, and data center) due to its high availability, high performance, and high port density. However, chassis switches are more expensive than box switches and use high-cost ports.

Intelligent Stack (iStack) technology is a stacking technology used on Huawei box switches. It improves the availability of box switches by using the advantages of Huawei chassis switches.

iStack combines multiple stacking-capable switches into a logical switch. iStack is a virtualization technology, which virtualizes multiple devices at the same network layer into one logical device without changing the existing network physical topology. This technology simplifies network structure, facilitates network protocol deployment, and improves network reliability and manageability.

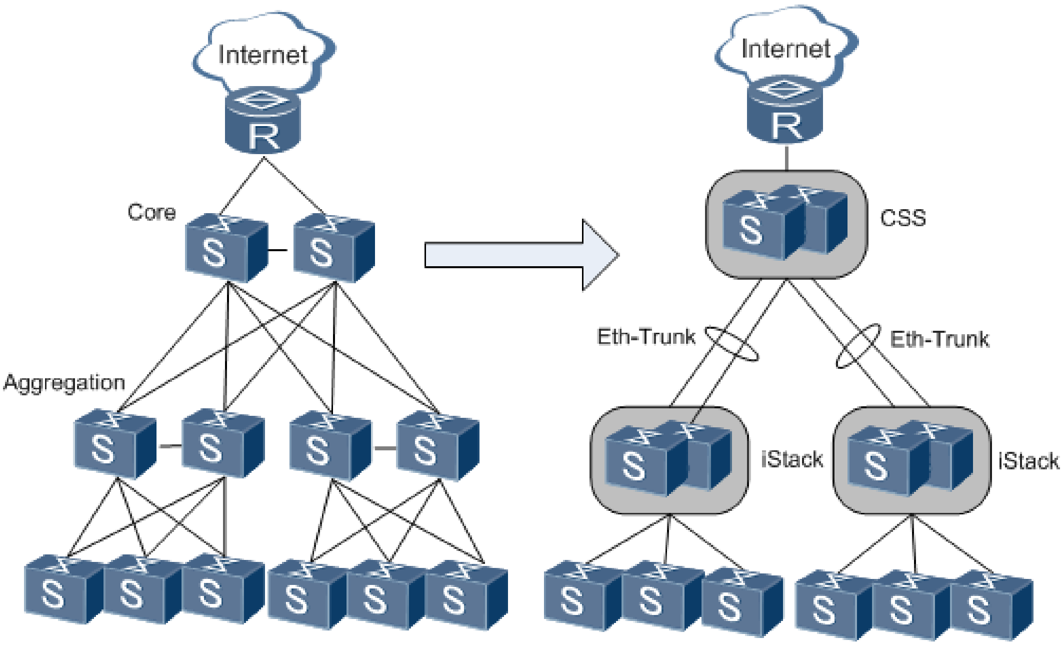
Figure 1-1 shows iStack networking. The logical device virtualized from multiple physical devices has low costs of box switches and high scalability and reliability of chassis switches.

Figure 1-1 iStack networking



In Figure 1-2, iStack virtualizes multiple devices at the same network layer into one logical device without changing the existing network physical topology. This technology simplifies network structure, facilitates network protocol deployment, and improves network reliability and manageability.

Figure 1-2 Horizontal network virtualization



1.2 Concepts

Roles

Each device in a stack is a member device and plays one of the following roles:

- Master switch: manages the entire stack. A stack has only one master switch.
- Standby switch: provides backup to the master switch. When the master switch fails, the standby switch takes over all services from the master switch. A stack has only one standby switch.
- Slave switch: any switch except the master switch in a stack. The standby switch is also a slave switch.

Stack ID

A stack ID uniquely identifies a member switch in a stack. It is also called a member ID.

Stack Domain

Switches that set up a stack form a stack domain. Multiple stacks can be deployed on a network. Therefore, a network has multiple stack domains, which have different domain IDs.

Stack Priority

The stack priority is an attribute of a member device and determines the role of the member device during role election. A larger value indicates a higher priority and higher probability that the member device competes to be the master device.

Physical Member Port

A physical member port is a physical port used for stacking. It forwards service packets or stack protocol packets between member devices.

Stack Port

A stack port is a logical port exclusively used for stacking and needs to be bound to physical member ports. Each member device in a stack supports two stack ports: stack-port n/1 and stack-port n/2. **n** indicates the stack ID of a member device.

1.3 iStack Advantages

1.3.1 Simplified Configuration and Management

After a stack is set up, multiple physical devices are virtualized into one logical device. You can log in to the stack to uniformly configure and manage all the member devices.

1.3.2 1:1 Redundancy of Control Planes

Huawei chassis switches use the 1:1 redundancy mode. That is, each chassis switch has two MPUs installed. The active MPU processes services, and the standby MPU functions as a backup of the active MPU and synchronizes information with the active MPU. When the active MPU fails, the standby MPU becomes the new master MPU and starts to process services.

A Huawei box switch has only one control plane and cannot implement redundancy. If a box switch fails, the connected network is interrupted. iStack technology can implement 1:1 redundancy on box switches. The master switch processes services, and the standby switch functions as backup of the master switch and synchronizes information with the master switch. If the master switch fails, the standby switch becomes the new master switch, and a new standby switch is selected from the other slave switches. Configuration and data on the standby switch are completely synchronized with the master switch. Therefore, when the standby switch becomes the new master switch, it can immediately replace the original master switch to manage other switches in the stack with a very small impact on existing network functions and services. Multiple slave switches in the stack further improve system reliability. User services on the original master switch cannot be ensured because the original master switch cannot work properly. As shown in Figure 1-3 and Figure 1-4, when the master switch fails, the standby switch immediately becomes the new master switch.

Figure 1-3 Data forwarding before the master switch fails

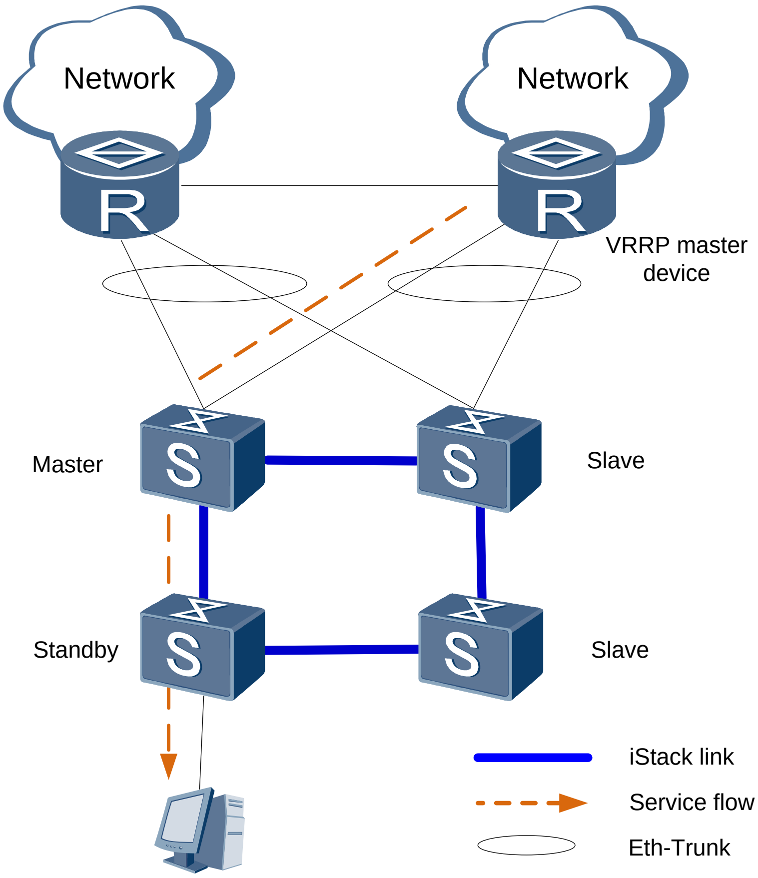
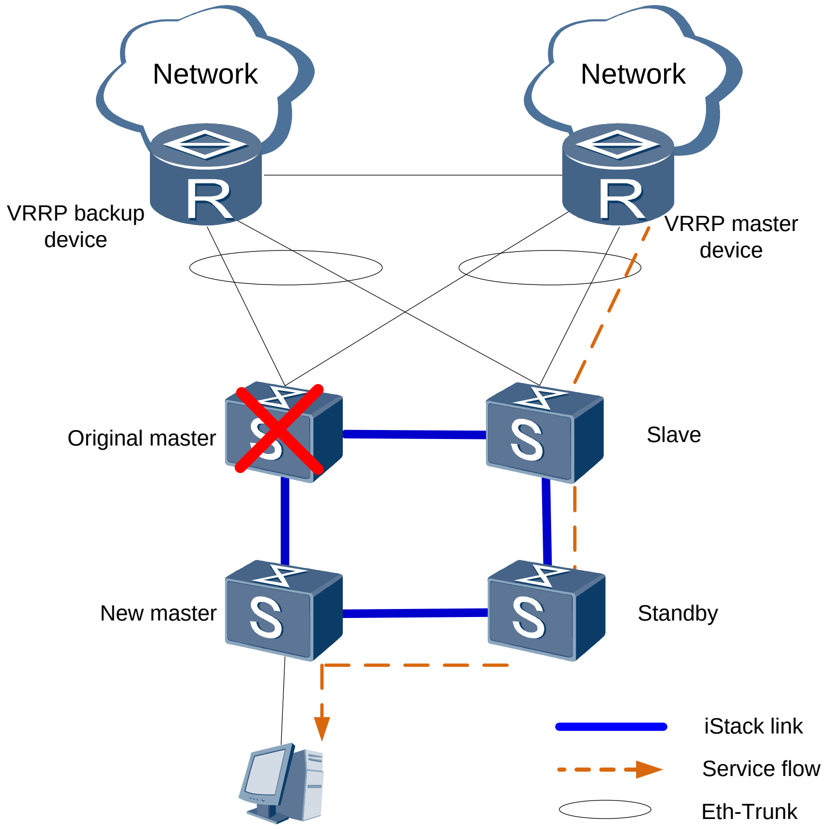


Figure 1-4 Data forwarding after the master switch fails



1.3.3 Uplink and Downlink Redundancy

iStack can implement redundancy of uplinks and downlinks through inter-device link aggregation. Traditional link aggregation technology combines multiple physical Ethernet ports (member ports) into one logical port to provide backup when a link fails. However, this technology cannot provide backup when a device fails.

iStack supports inter-device link aggregation, which allows you to aggregate physical Ethernet ports on multiple member switches of a stack into one logical port. When a device of some member ports fails, the other member switches can manage and maintain the remaining member ports so that services are not interrupted. Inter-device link aggregation is important to the core switching system and networks requiring high QoS. It prevents service interruption caused by single-point failures and greatly improves network availability.

As shown in Figure 1-5 and Figure 1-6, traffic sent to core devices of the network is evenly distributed to multiple links in a link aggregation group. When a link fails, traffic on this link is evenly distributed to the other links. This link redundancy mechanism improves network reliability.

Figure 1-5 Data forwarding before a link fails

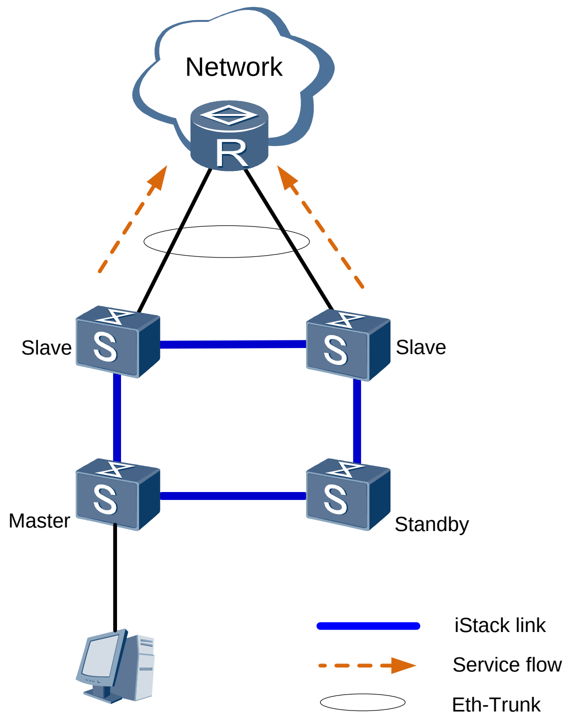
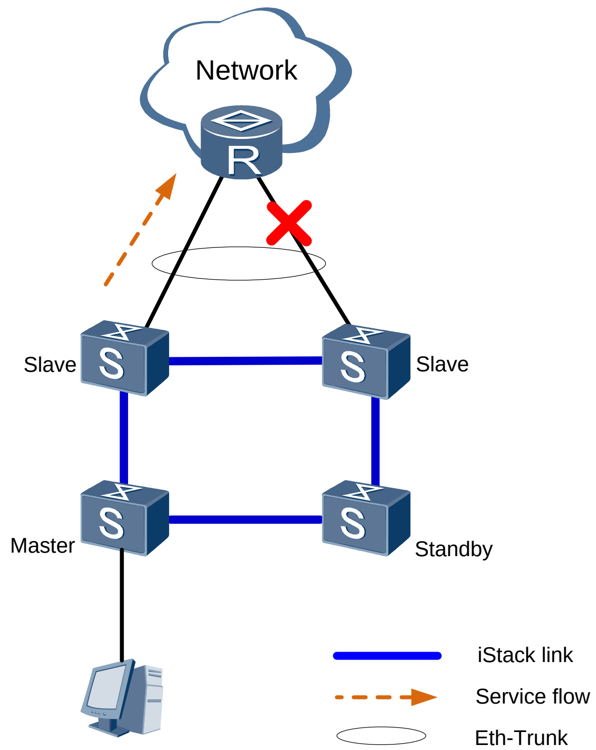


Figure 1-6 Data forwarding after a link fails



1.3.4 Redundancy of Stack Links and Stack Ports

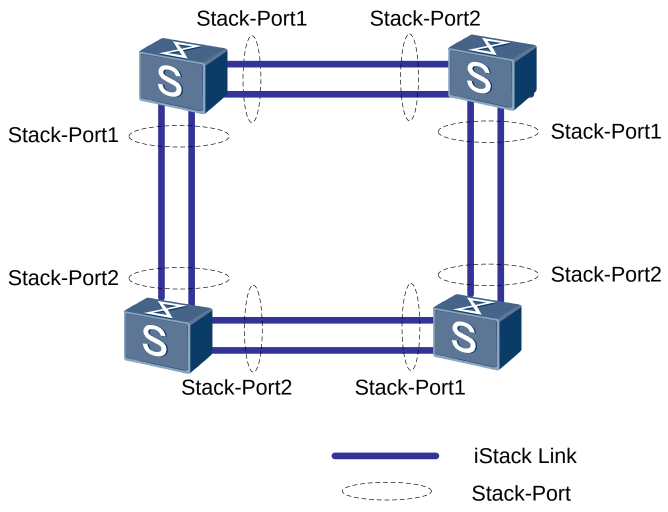
Redundancy of Stack Links in a Ring Topology

iStack can implement redundancy of stack links in a ring topology. When a link fails, the ring topology changes into a chain topology so that services in the stack are not affected.

Redundancy of Stack Ports

As shown in Figure 1-7, iStack uses link aggregation to implement redundancy of stack ports. Multiple physical links on stack ports can be aggregated to load balance traffic, improving bandwidth and system performance. Additionally, the physical links back up each other so that the failure of one link does not affect services in the stack. This improves device reliability.

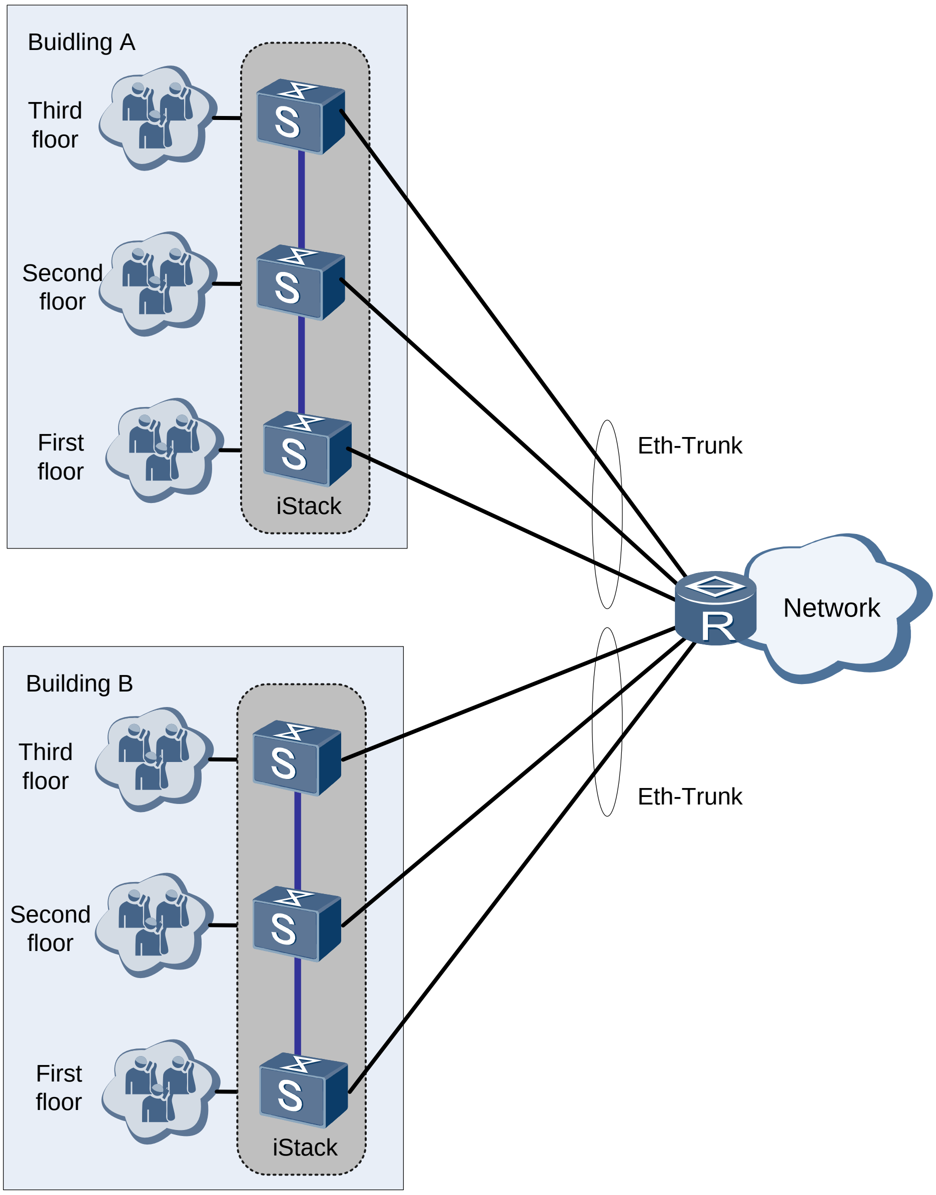
Figure 1-7 Redundancy of stack ports



1.3.5 Long-Distance Stacking

iStack allows remote devices to form a stack. As shown in Figure 1-8, users at each floor connect to the external network through switches deployed at the corridors. These switches are connected to form a stack, as if there is only one access switch in each building. This implementation simplifies network structure. Each building has multiple links to the core network, improving network robustness and reliability. The configurations of multiple switches at the corridors are simplified into the configuration of a stack, reducing management and maintenance costs.

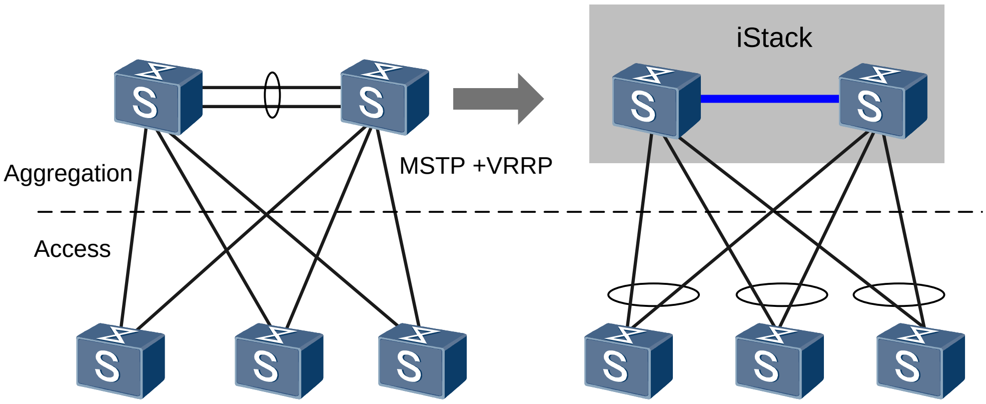
Figure 1-8 Long-distance stacking



1.3.6 Simplified Networking

As shown in Figure 1-9, multiple devices at the aggregation layer are virtualized into a logical device through iStack technology. This simplified network does not require MSTP or VRRP, so network configuration is much simpler. Inter-device link aggregation also speeds up network convergence and improves network reliability.

Figure 1-9 Simplified networking



2 Technology Description

2.1 Stack Physical Connection

As shown in Figure 2-1, switches in a stack can be connected in a chain or ring topology. Table 2-1 compares the two topologies.

A stack usually uses a ring topology. In the ring topology, member switches are connected to each other through stack cables. iStack blocks a stack link to prevent looping of data packets on stack links.

Figure 2-1 Stack connection topologies

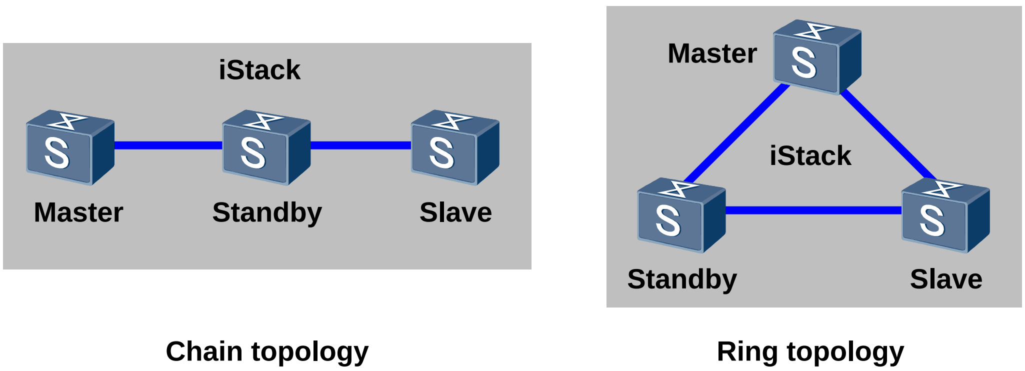


Table 2-1 Comparisons between two stack topologies

	Ring Topology	Chain Topology
Advantages	Provides high reliability. When a stack link in a ring topology fails, the ring topology becomes a chain topology. Data can be forwarded along the shortest path, improving bandwidth usage of stack links.	Applies to long-distance stacking because the first and last devices do not need to be physically connected.

	Ring Topology	Chain Topology
Disadvantages	Does not apply to long-distance stacking because the member devices need to be physically connected to each other.	Provides low reliability. When a stack link fails, the stack cannot work properly and some devices cannot work. The entire stack has only one path, reducing the stack link bandwidth usage.
Recommended scenarios	To ensure reliability, the ring topology is recommended in scenarios where the distance between member devices is short.	The chain topology is recommended in scenarios where the distance between member devices is long because the ring topology is difficult to deploy.

2.2 Stack Packets

The stack packet format varies slightly according to the version. The following uses the stack packet format in V200R003 as an example.

2.2.1 Stack Packet Header

Table 2-2 Stack packet header

<table>
<tr><th>0 1 2 3 4 5 6 7</th><th>0 1 2 3 4 5 6 7</th><th>0 1 2 3 4 5 6 7</th><th>0 1 2 3 4 5 6 7</th></tr>
<tr><td colspan="4">Dst MAC [4]</td></tr>
<tr><td colspan="2">Dst MAC [2]</td><td colspan="2">Src MAC [2]</td></tr>
<tr><td colspan="4">Src MAC [4]</td></tr>
<tr><td colspan="4">VLAN Tag</td></tr>
<tr><td colspan="2">EthType 0x5100</td><td colspan="2">Version</td></tr>
<tr><td colspan="2">ProtoType</td><td colspan="2">Resv</td></tr>
<tr><td colspan="4">SrcFPort</td></tr>
<tr><td colspan="4">SrcStackId</td></tr>
<tr><td colspan="4">DesStackId</td></tr>
<tr><td colspan="2">Length</td><td colspan="2">Resv</td></tr>
<tr><td colspan="4">Packet Data</td></tr>
</table>

Fields in the stack packet header are described as follows:

- Dst Mac: destination MAC address.
- SrcMac: source MAC address.
- VLAN Tag: VLAN tag, which identifies the VLAN used in a stack. By default, a stack uses VLAN 4093.
- EthType: is fixed as 0x5100.
- Version: is fixed as 1.
- ProtoType: protocol type.
- SrcFPort: source HIGIG port number.
- SrcStackId: source stack ID.
- DesStackId: destination stack ID.
- Length: message length.
- Resv: reservation state.
- Packet Data: data packet.

2.2.2 Stack Packet Types

Table 2-3 Stack packet types

ProtoType	Packet Type	Description
0x1	Hello	Member switches send Hello packets to maintain the neighbor status.
0x2	SPDU	The master switch sends SPDUs (carrying the stack topology and stack reserved VLAN) to all the other member switches. SPUDs also function as the heartbeat packets through which slave switches detect the existence of the master switch.
0x3	Topo Report	A slave switch sends a Topo Report packet to the master switch to report its basic information and position in the stack.
0x4	Assign	The master switch sends an Assign packet to a slave switch to deliver the stack ID assigned to the slave switch. After receiving the Assign packet, the slave switch replies with a response packet.
0x5	Register	It is used in earlier versions.
0x6	NBR	Neighbor change packet, including neighbor loss and neighbor discovery.
0x7	HIGIG Info	The packet carries forwarding entries and the blocking point generated by the master switch according to the Topology Report packets sent from all slave switches. The master switch sends a HIGIG Info packet to a slave switch. After the slave switch receives this packet, it downloads the forwarding table and blocking point to the local LSW chip.

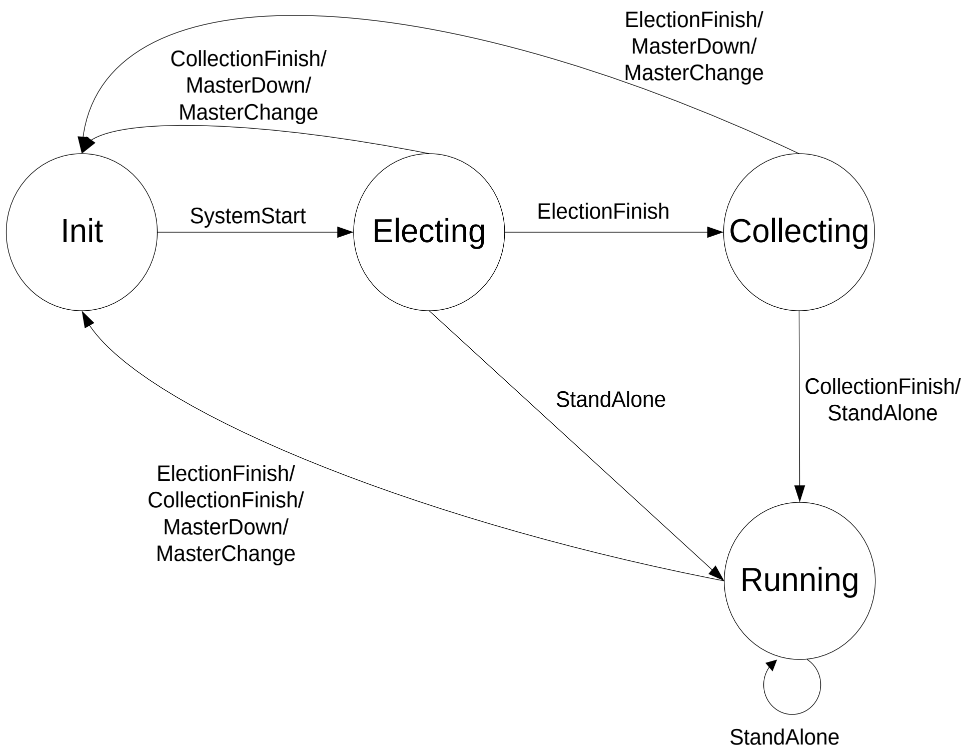
ProtoType	Packet Type	Description
0x8	HeHuan Info	It is not in use currently.
0x9	Modify Config	Modifies the configuration.
0xa	Load	Loads the system software.
0xb	Reset	Resets a slave switch.

2.3 Stack State Machine

Stacked devices run in one of the following states: Init, Electing, Collecting, and Running, as shown in Figure 2-2.

- Init: After a stacked device starts, it enters the Init state. After local data is initialized, it enters the Electing state.
- Electing: In this state, stacked devices compete to determine the master and slave roles.
- Collecting: The master device collects stack topology information and assigns stack IDs to other devices.
- Running: The stack is running stably. Stacked devices may still be starting or have completed configuration restoration.

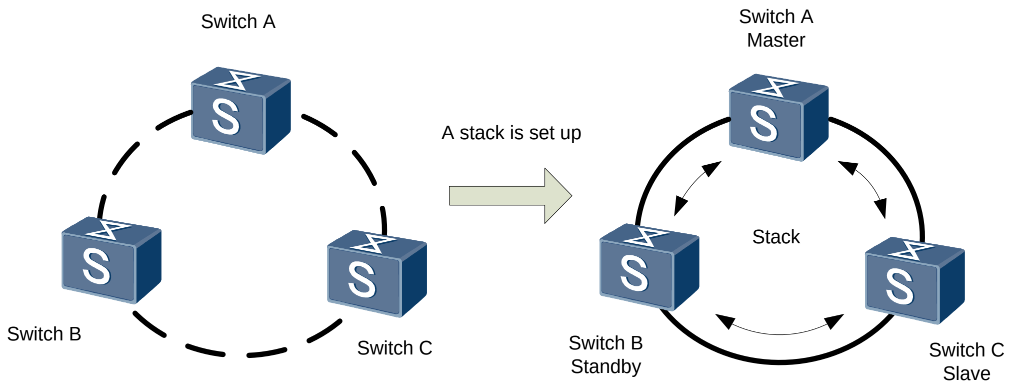
Figure 2-2 Stack state machine



2.4 Stack Setup

Before a stack is set up, each switch is an independent entity with its own IP address and needs to be managed separately. In addition, link aggregation between switches is not supported. After a stack is setup, multiple switches are virtualized into one logical switch. Figure 2-3 shows the stack setup process.

Figure 2-3 Stack setup



Multiple iStack-capable switches are connected through stack cables to form a stack in a ring or chain topology. Each member switch in the stack has a role. After a stack is set up, member switches send stack competition packets to each other to elect the master switch and standby switch, and the remaining switches function as slave switches. When the master switch fails, the standby switch becomes the master switch to manage the stack. All the switches perform Layer 2 and Layer 3 unicast and multicast distributed forwarding.

Rules for electing the master switch are as follows:

1. The switch that starts first becomes the master switch.
2. When multiple switches complete the startup at the same time, the switch with the highest stack priority becomes the master switch.
3. If multiple switches complete the startup at the same time and have the same stack priority, the switch with the smallest MAC address becomes the master switch.

Rules for electing the standby switch are as follows:

1. The switch that starts second becomes the slave switch.
2. If all the devices excluding the master switch complete the startup at the same time, the switch with the highest stack priority becomes the standby switch.
3. If all the devices excluding the master switch complete the startup at the same time and have the same stack priority, the switch with the smallest MAC address becomes the standby switch.

NOTE

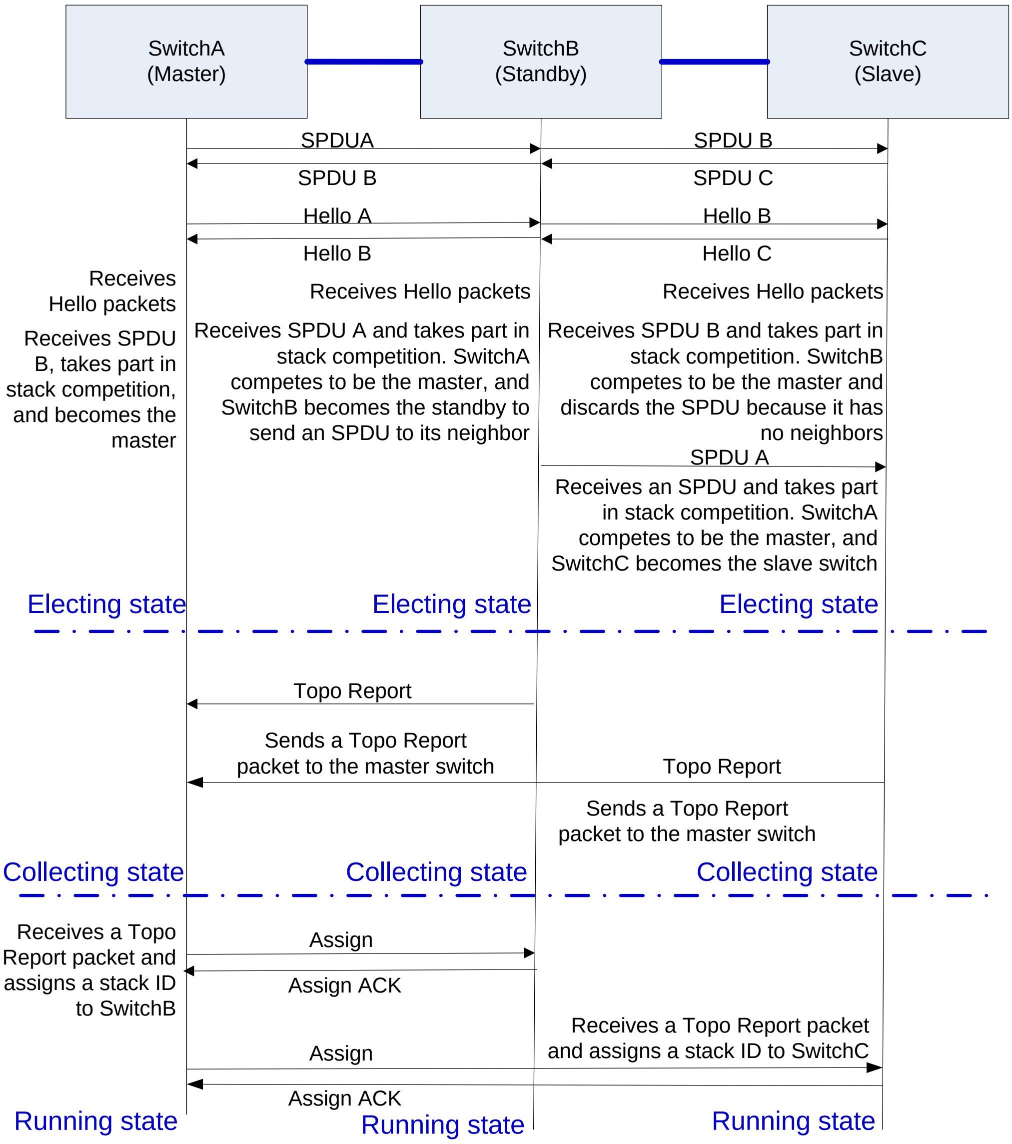
From V200R001, you can specify any device as the standby switch. In earlier versions, the standby switch must be directly connected to the master switch.

During the setup of a stack, the master switch of the stack must be elected. The master switch then collects topology information about all member switches, assigns stack IDs to other member switches, and determines the standby and slave switches. Finally, the master switch synchronizes the collected topology information, its own system software and configuration file to other member switches and runs stably.

NOTE

If the master and slave switches run different software versions, the slave switches synchronize the software version with the master switch after a stack is set up.

Figure 2-4 Packet exchange during a stack setup

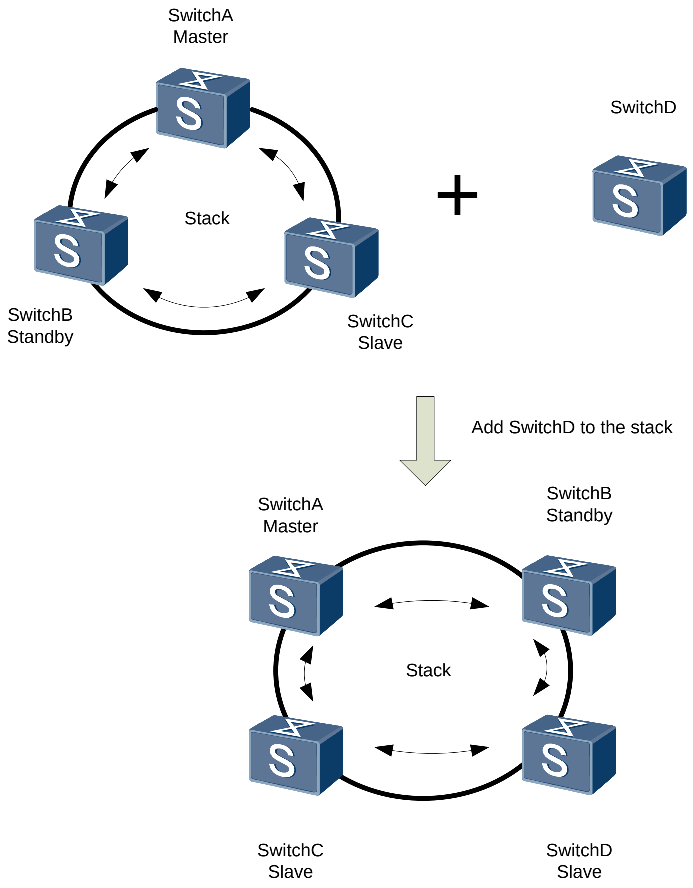


2.5 Member Switch Addition

You can add a switch a stably running stack, as shown in Figure 2-5.

A switch can be added to a stack after being powered off or with power on. In Figure 2-5, the new member switch is powered off before being added to the stack.

Figure 2-5 Adding a member switch

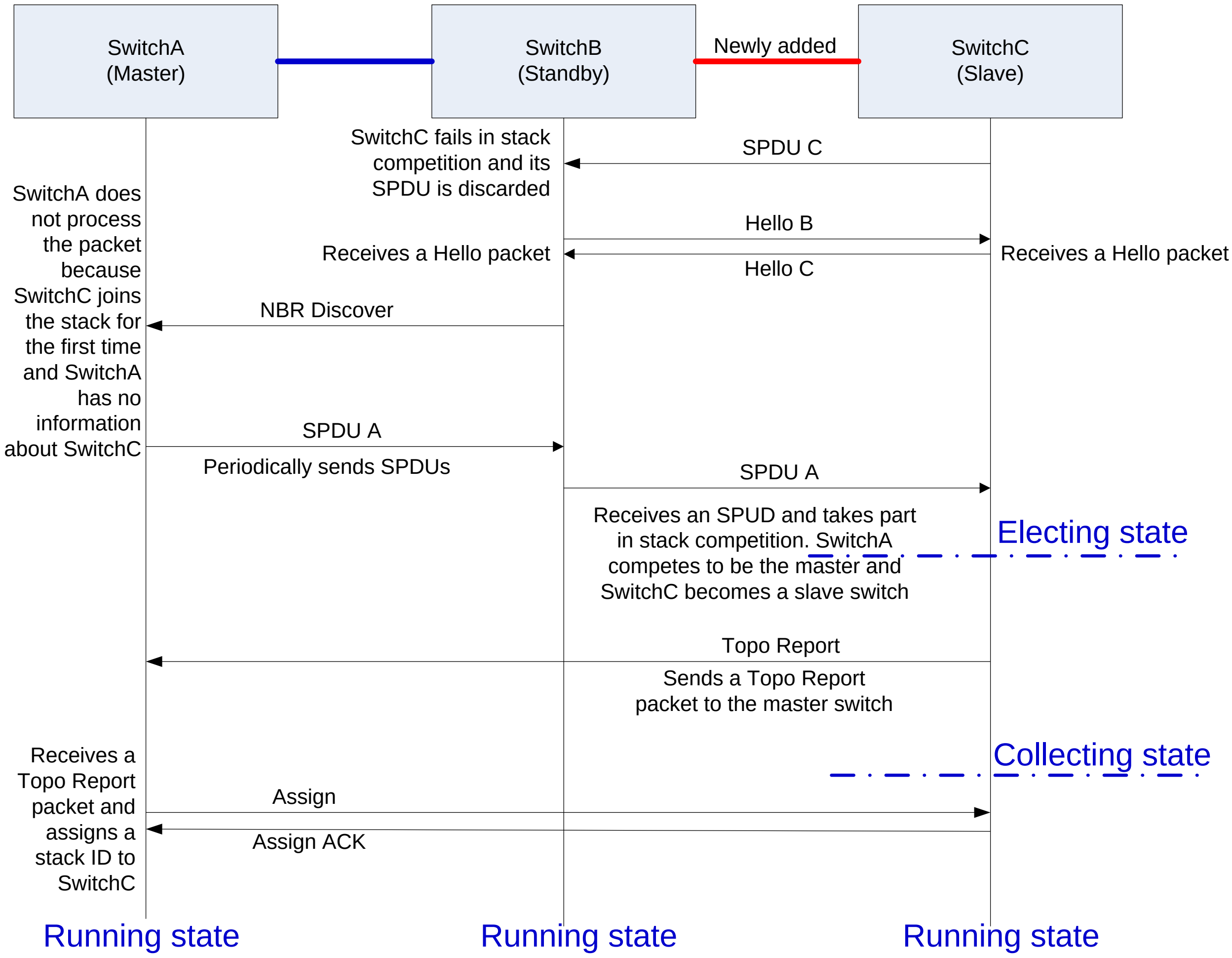


The process of adding a member switch is as follows:

- The new switch is powered off, connected to the member switches of the stack through stack cables, and restarted.
- The new switch is elected as a slave switch after it starts, and roles of other member switches in the stack remain unchanged.
- After the election is complete, the master switch updates the topology information, synchronizes the topology information to other switches, and assigns a stack ID to the new member switch.
- The new member switch updates its stack ID, registers with the master switch, synchronizes the configuration with the master switch, and then enters the Running state.

Figure 2-6 shows how member switches exchange stack packets when a new member switch is added to the stack.

Figure 2-6 Packet exchange during the addition of a member switch



2.6 Member Switch Removal

You can remove a member switch from a stack. The stack is affected in the following ways after a member switch is removed:

- If the master switch is removed, the neighbor switch notifies other member switches of the topology change and updates local neighbor information. The standby switch becomes the new master switch. It recalculates the topology information, synchronizes the information to other members, and selects the new standby switch. Then the stack enters running state.
- When the standby switch is removed, the master switch specifies a new standby switch, and then recalculates the stack topology and synchronizes the information to other member switches.
- When a slave switch is removed, the master switch recalculates the stack topology information and synchronizes the information to other member switches.

Figure 2-7, Figure 2-8, and Figure 2-9 illustrate stack packet exchange during the removal of the master switch, standby switch, and slave switch respectively.

Figure 2-7 Removing the master switch

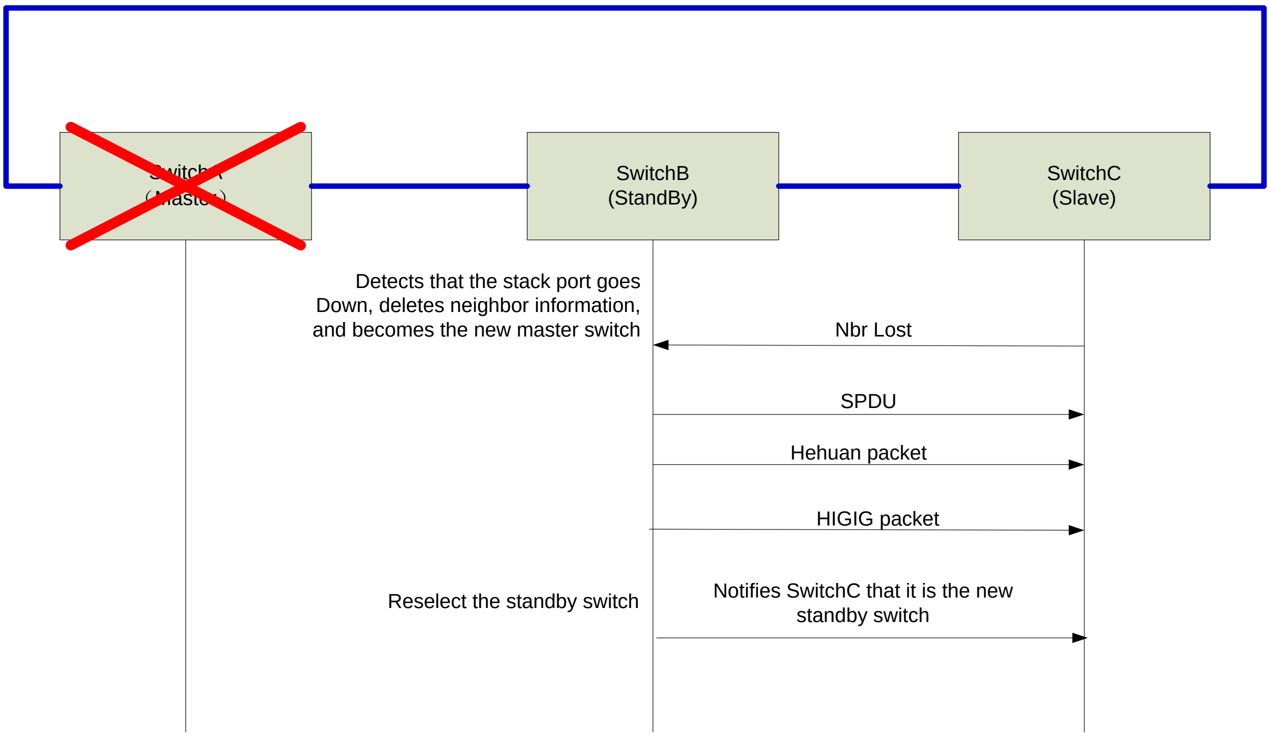


Figure 2-8 Removing the standby switch

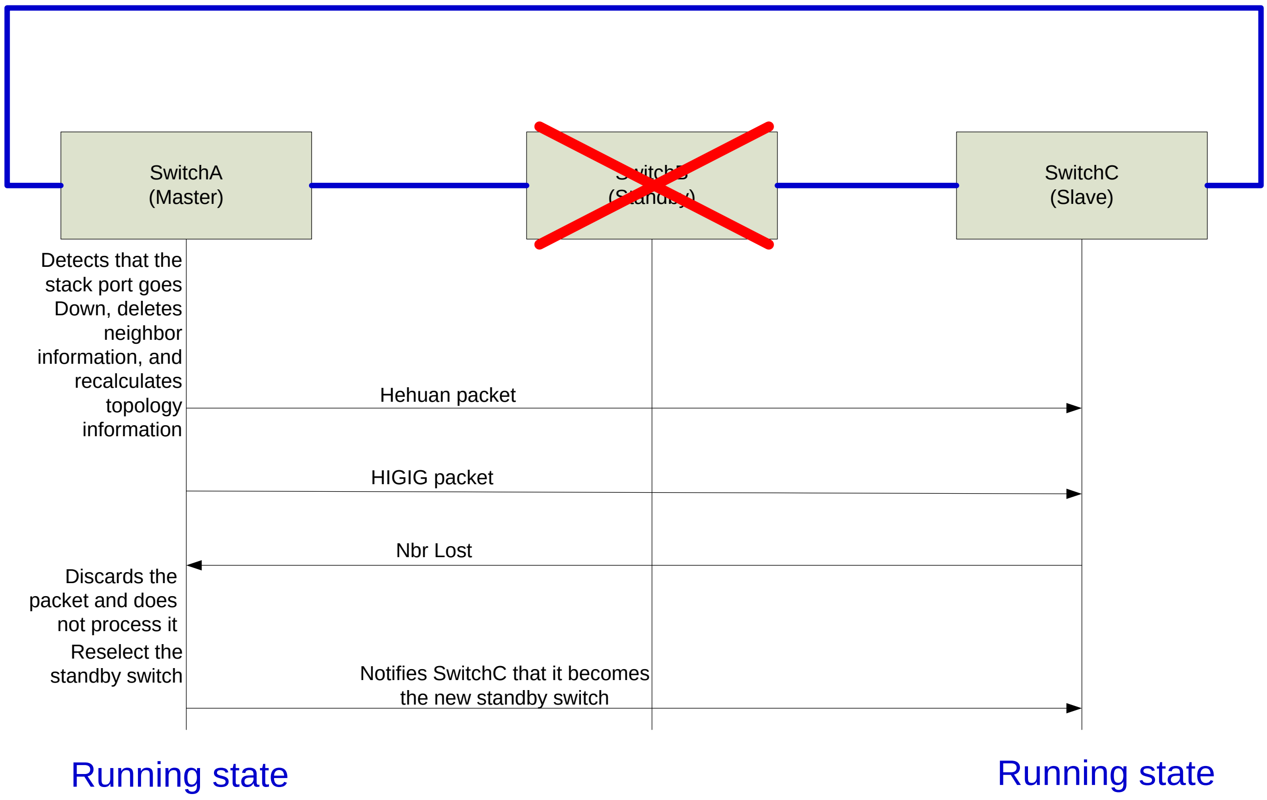
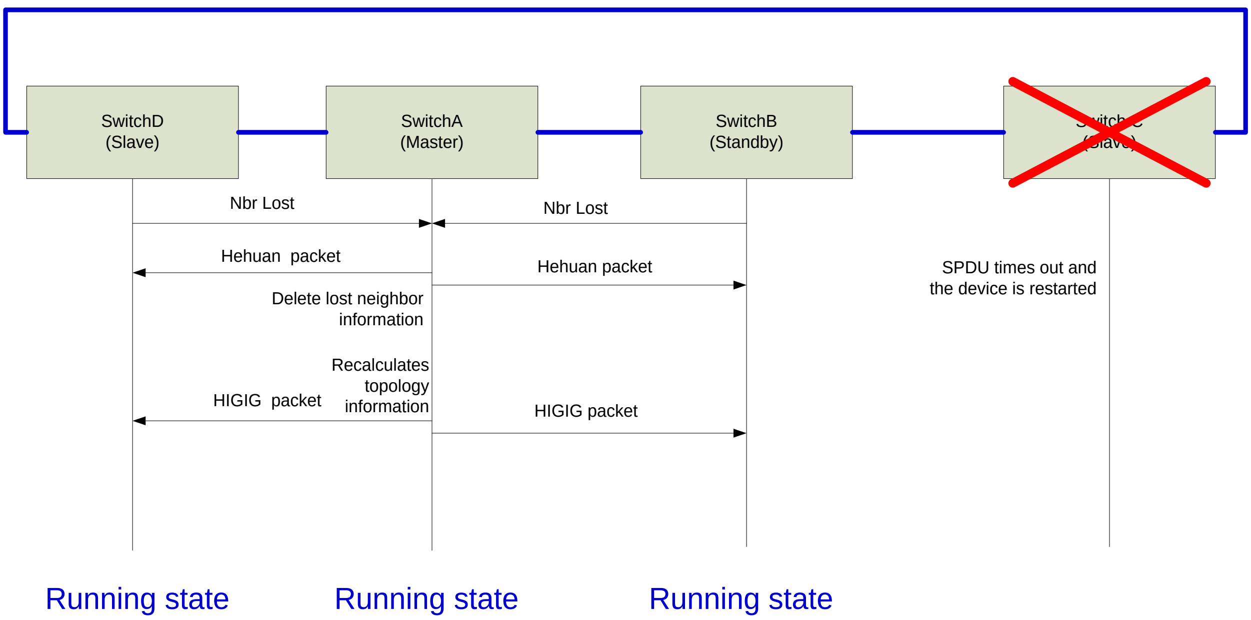


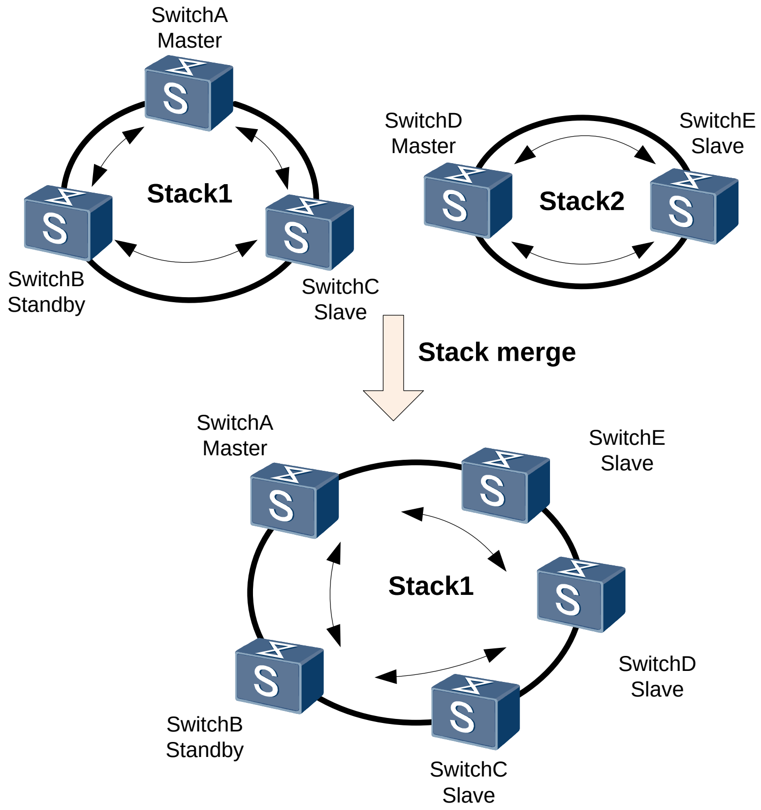
Figure 2-9 Removing a slave switch



2.7 Stack Merge

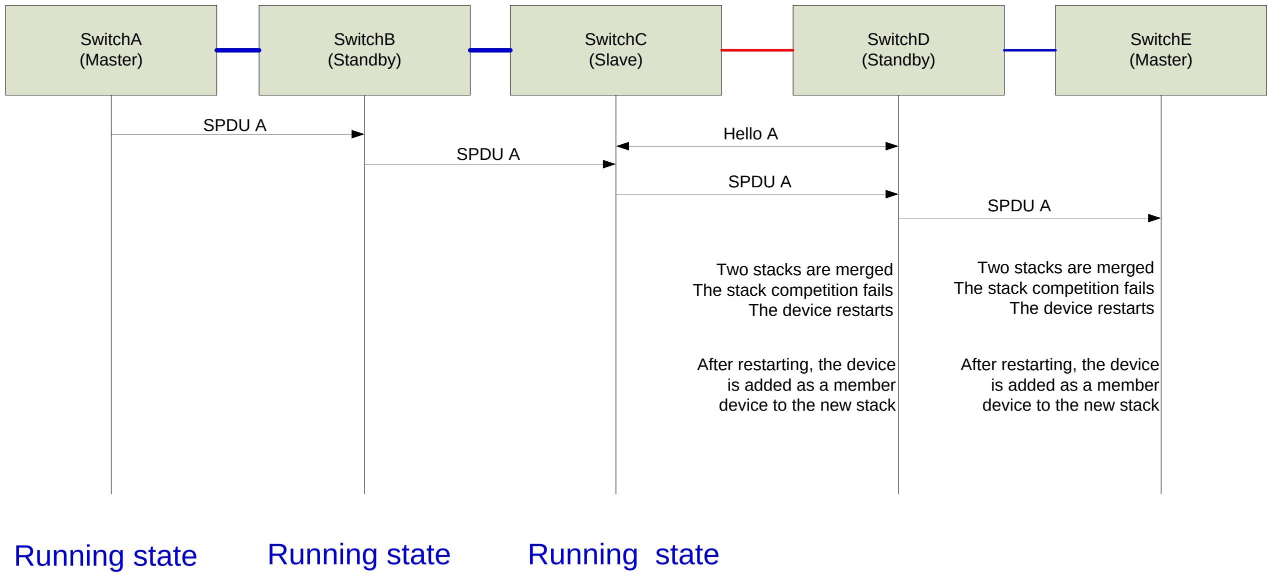
As shown in Figure 2-10, two stable stacks are merged into one stack. The superior switch between the master switches of the two stacks is selected as the master switch of the new stack. The original stack containing the new master remains the original device roles and configurations, and services in this stack are not affected. Switches in the other stack restart and join the new stack as slave switches. Then the master switch assigns new stack IDs to the restarted switches and synchronizes configurations to the switches. Services on these switches are interrupted in this period.

Figure 2-10 Stack merge



The process of merging two stacks is similar to the process of adding a member switch as shown in Figure 2-11. The master switches of the original two stacks compete the master of the new stack. Member switches in the stack whose master switch fails the master competition join the new stack. For details, see the process of adding a member switch.

Figure 2-11 Packet exchange during a stack merge



2.8 Stack Split

Removing member switches with power on from a stable stack will cause the split of the stack. Member switches act differently after the stack splits.

2.8.1 The Original Master and Standby Switches Are in the Same Stack After the Original Stack Splits

As shown in Figure 2-12, after a stack splits into two new stacks, the original master and standby switches in the stack belong to the same stack. The master switch recalculates the stack topology and deletes the removed switches from the topology. The removed switches restart after detecting that stack packets time out, and then select a new master switch.

After the original stack splits, the original master switch processes the NBR Lost packet of SwitchD and deletes member switches (SwitchD and SwitchE). SwitchD and SwitchE restart and then set up a new stack. Figure 2-13 shows the packet exchange process.

Figure 2-12 Original master and standby switches are in the same stack after the original stack splits

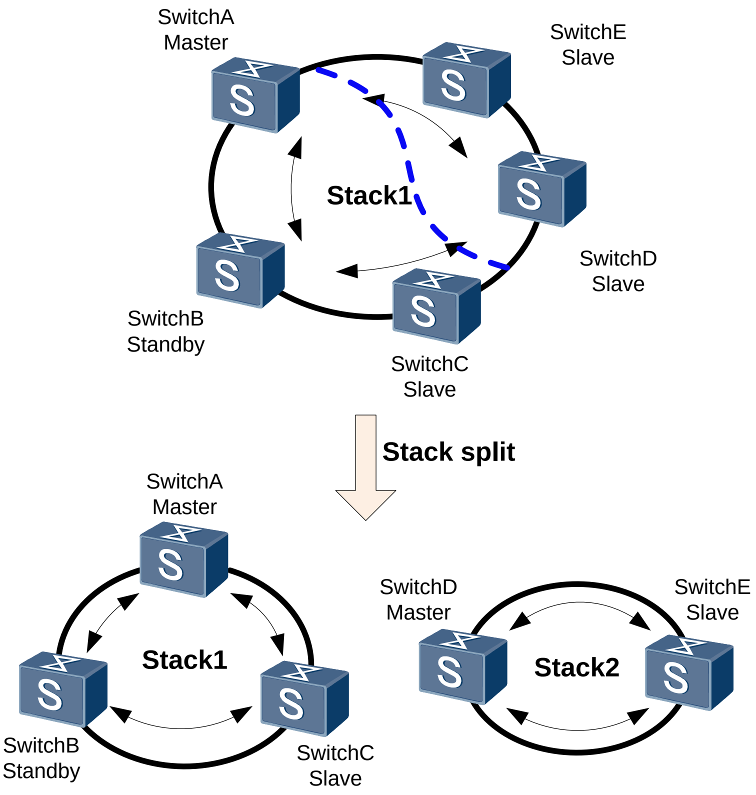
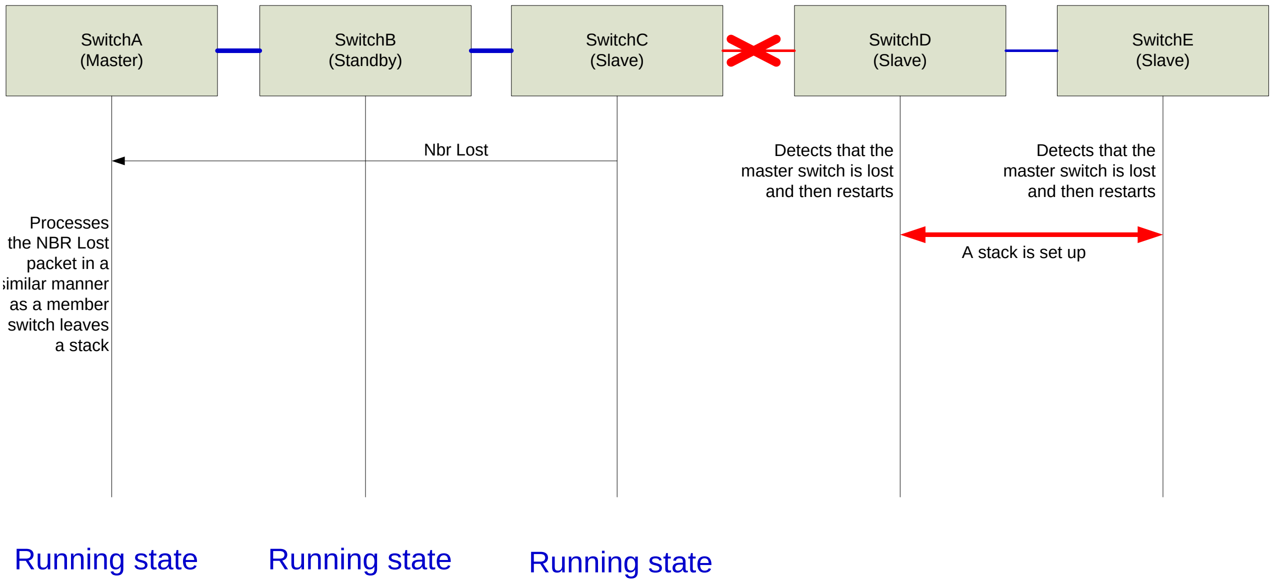


Figure 2-13 Packet exchange during a stack split



2.8.2 The Original Master and Standby Switches Are in Different Stacks After the Original Stack Splits

As shown in Figure 2-14, after a stack splits into two new stacks, the original master and standby switches in the stack belong to two different stacks. The master switch specifies a new standby switch, recalculates the stack topology information, and synchronizes the information to other member switches as shown in Figure 2-8. The original standby switch becomes the master switch of the other stack, recalculates the stack topology information, and synchronizes the information to other member switches as shown in Figure 2-7. Figure 2-15 shows the packet exchange process.

Figure 2-14 Original master and standby switches are in different stacks after the original stack splits

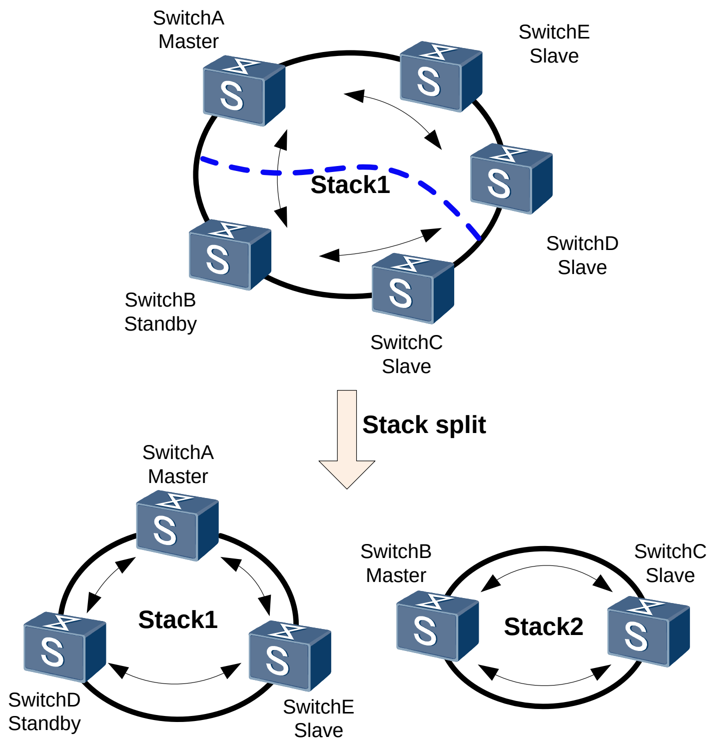
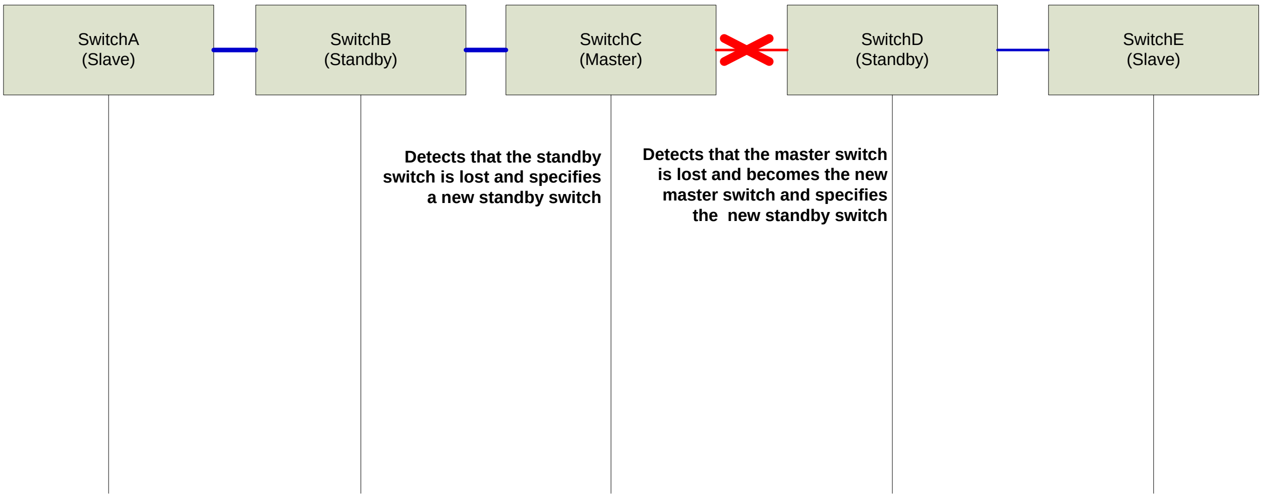


Figure 2-15 Packet exchange during a stack split



2.9 Address Conflict Detection After a Stack Split

All the member switches in a stack use the same IP address and MAC address. A stack split during network operation can result in multiple stacks using the same IP address and MAC address. In this case, IP address and MAC address conflict occurs. Therefore, after a stack splits, IP address and MAC address conflict detection must be performed.

Multi-active detection (MAD) is a protocol that can detect stack split and multiple-master situations and take recovery actions to minimize impact of a stack split on services.

2.9.1 MAD Modes

MAD can be implemented in direct or relay mode. The direct and relay modes cannot be configured simultaneously in a stack.

Direct Mode

In direct mode, MAD is performed through dedicated direct links between member switches and an intermediate device or between fully meshed member switches. In this mode, member switches do not send MAD packets when the stack is running properly. When the stack splits, member switches send MAD packets at an interval of 1s over MAD links.

NOTE

- After configuring MAD in direct mode on an interface, do not configure other services on the interface.
- To ensure reliability, configure a maximum of eight direct MAD links on a single member switch.
- MAD packets are BPDUs. If MAD is performed through dedicated direct links between member switches and an intermediate device, configure interface-based Layer 2 protocol transparent transmission on the intermediate device.

As shown in Figure 2-16, when MAD is performed through dedicated direct links between member switches and an intermediate device, each member switch in the stack has at least one link connected to the intermediate device to improve network reliability. In this topology, at least N dedicated direct links are required for MAD (N is the number of member switches).

As shown in Figure 2-17, member switches in the stack are fully meshed to improve reliability. No intermediate device is deployed in this topology so that MAD will not be affected by failures of the intermediate device. The full-mesh topology requires at least ½N(N-1) dedicated direct links for MAD (N is the number of member switches).

Figure 2-16 MAD through direct links to an intermediate device

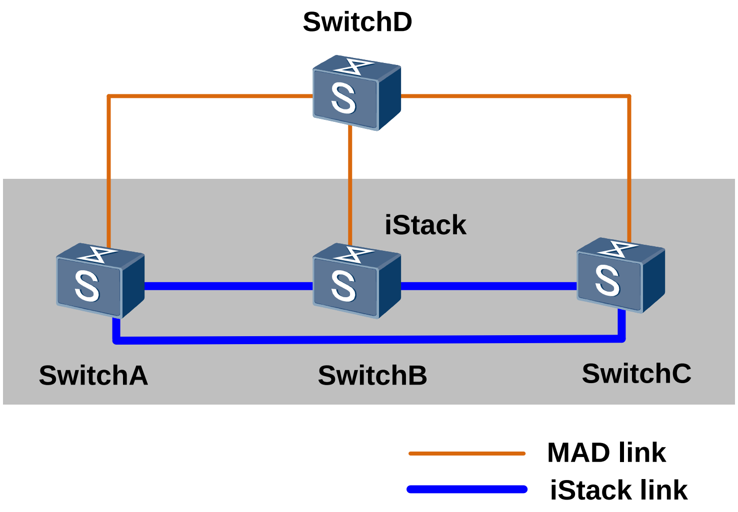
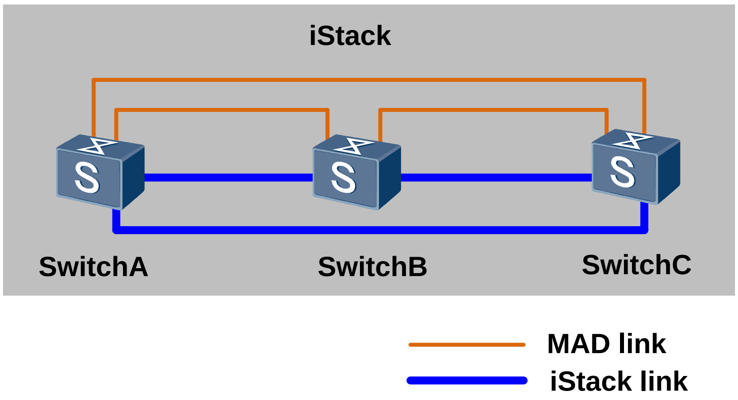


Figure 2-17 MAD through direct links between fully meshed member switches



Relay Mode

In relay mode, MAD relay detection is configured on inter-device Eth-Trunk interfaces, and the MAD relay function is enabled on an agent. This MAD mode requires that all the member switches in the stack have links to the MAD relay agent and these links be added to the same Eth-Trunk. The relay mode does not require additional interfaces because Eth-Trunk interfaces can perform MAD relay detection and run other services simultaneously.

In relay mode, member switches send MAD packets at an interval of 30s over MAD links when the stack is running properly. When the stack is running properly, member switches do not process received MAD packets. After the stack splits, member switches send MAD packets over MAD links at an interval of 1s.

The relay mode can be implemented in two ways: single switch as the MAD relay agent and two stacks as MAD relay agents of each other.

NOTE

The MAD relay agent is a switch that supports the MAD relay function. Currently, S2750&S5700&S6700 series switches support this function.

Two stacks can function as a proxy of each other to implement MAD. The two stacks must be configured with different MAD domain IDs.

Figure 2-18 Single switch as the MAD relay agent

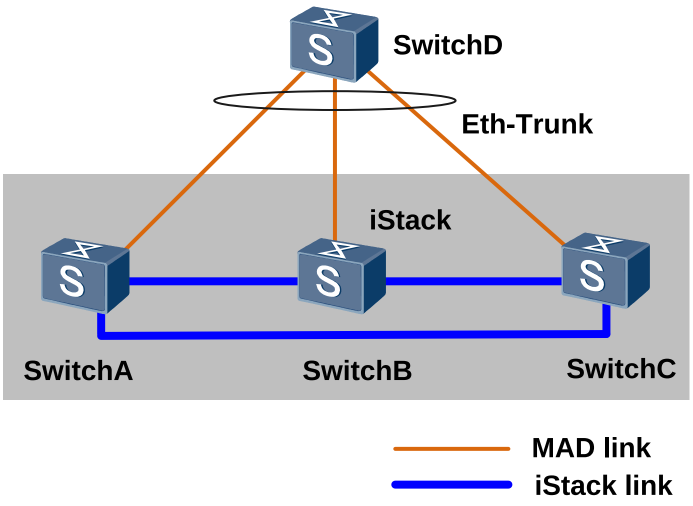
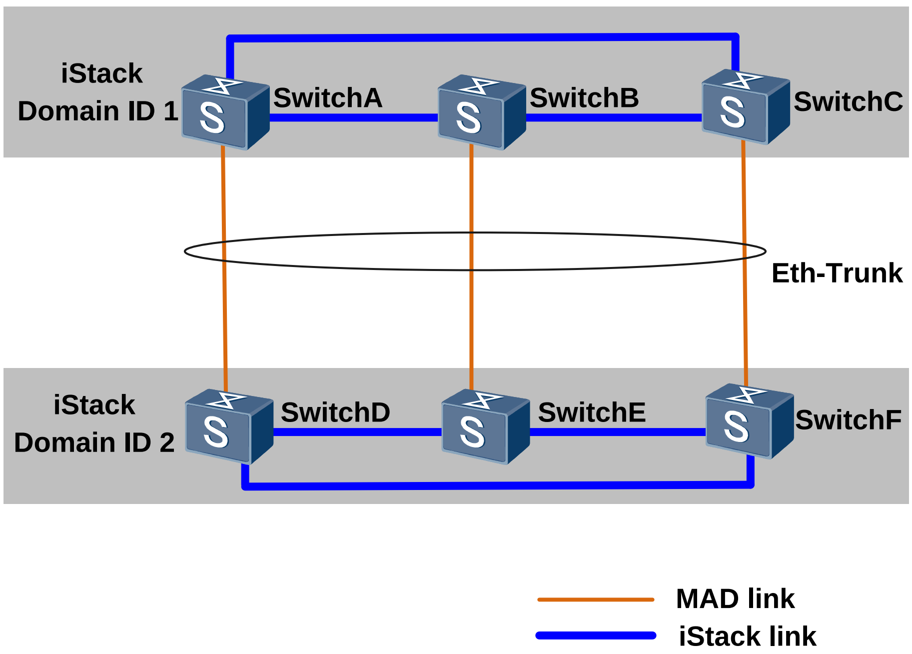
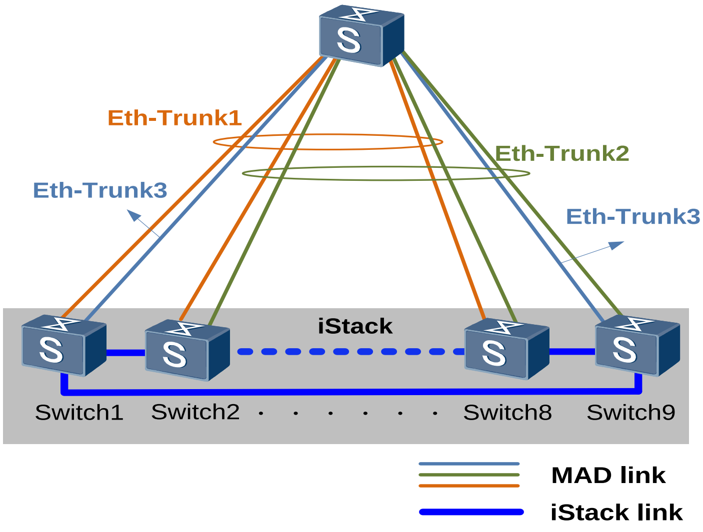


Figure 2-19 Two stacks as MAD relay agents of each other



To ensure reliability, configure the relay mode on a maximum of four Eth-Trunks in a stack. Each Eth-Trunk can have a maximum eight member interfaces. Therefore, when a stack contains nine member switches, one Eth-Trunk cannot provide detection links for all the member switches. In this case, multiple Eth-Trunks need to be configured to ensure that a detection link is available between any two member switches. As shown in Figure 2-20, Eth-Trunk1 provides detection links for Switch1 to Switch8, Eth-Trunk2 provides detection links for Switch2 to Switch9, and Eth-Trunk3 provides detection links for Switch1 and Switch9.

Figure 2-20 MAD relay detection on multiple Eth-Trunks



2.9.2 MAD Collision Handling

After a stack splits, the MAD split detection mechanism detects multiple stacks in Active state (indicating that the stacks are working normally). Then the MAD collision handling mechanism retains the stack with the original master switch in Active state and turns the other stacks into Recovery state (stacks do not work in this state). Member switches in the stacks in Recovery state shut down all their physical ports (generally service ports) except reserved ports, so that these stacks do not forward service packets. By default, only physical member ports of stack ports are reserved ports. You can run a command to specify other ports, such as the port used for remote login, as reserved ports.

2.9.3 MAD Fault Recovery

After a fault link recovers, the MAD fault recovery mechanism merges the stacks into one. Stacks can merge in either of the following ways:

- After the fault link recovers, the stacks in Recovery state restart and merge with the stack in Active state, and restore the shutdown service ports to Up state. Then the entire stack recovers.
- If the stack in Active state is also faulty before the faulty link recovers, remove the stack in Active state first, and use a command to start the stacks in Recovery state, enabling the stacks to take over services on the original stack in Active state. After the original stack in Active state and the faulty link recover, the stacks can merge.

2.10 Automatic Software Upgrade of Member Switches

iStack has automatic system software load function. A new member switch can join a stack if its software version is compatible with that of the stack. When you add the new member switch to the stack, the new member switch compares its software version with that of the stack. If the software versions are inconsistent, the new member switch downloads the system startup file from the master switch, restarts using the new startup file, and joins the stack. If the new member switch has a software version that is incompatible with that of the stack, ensure that the new member switch has the same software version as the existing member switches. Then the new member switch can join the stack.

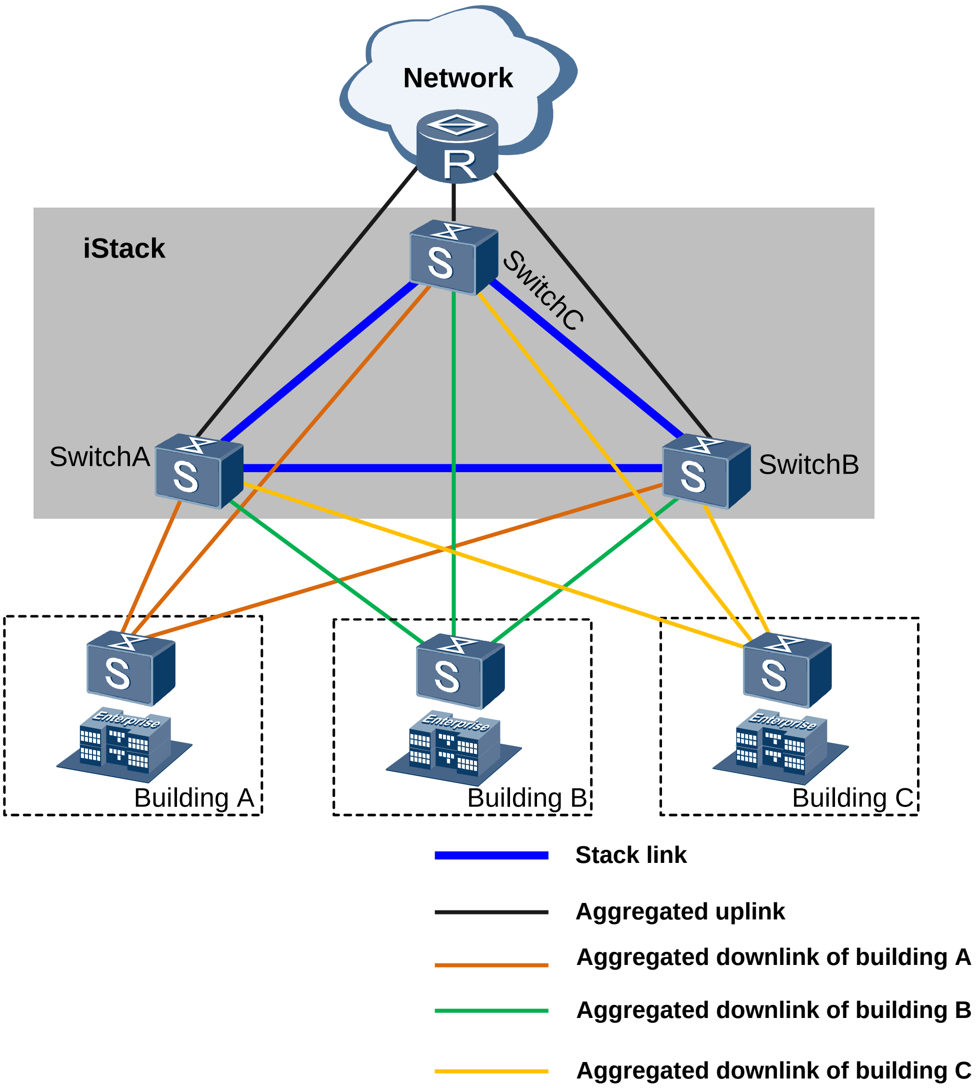
NOTE

When multiple member switches are added to a stack simultaneously, the software versions of these switches are automatically upgraded one by one.

2.11 Smooth Upgrade

A stack is usually upgraded by specifying the startup system software and restarting the stack. However, this upgrade method causes service interruption in a long time. If uplinks and downlinks of a stack work in redundancy mode, as shown in Figure 2-21, you can perform a smooth upgrade in the stack to shorten the upgrade time and reduce impact of the upgrade on running services.

Figure 2-21 Networking for smooth upgrade of a stack



A reliable stack can be divided into an active area and a backup area that back up each other. After an upgrade starts, the two areas are upgraded in turn. When one area is upgrading, traffic is transmitted in the other area.

A smooth upgrade undergoes three phases:

1. A command is executed in the stack to trigger a smooth upgrade. Members in the backup area then restart with the new system software.
2. Members in the backup area set up an independent stack running the new system software and notify members in the active area. The master switch in the backup area starts to control the stack, and traffic is transmitted in the backup area. The active area then starts the upgrade.
3. Members in the active area restart with the new system software and join the stack set up by the members in the backup area. The master switch in the backup area displays the upgrade result depending on the stack setup result.

If errors occur during a smooth upgrade, member switches in the stack can automatically roll back to the original system version and set up a stack again.

2.12 iStack Packet Forwarding

2.12.1 Unicast Packet Forwarding

Unicast stack packets are forwarded in the following situations:

- Unicast stack packets are forwarded within the local device without being forwarded over stack links, as shown in Figure 2-22.
- Unicast stack packets need to be forwarded from the slave switch to the standby switch. Because there is no direct link between the two switches, the packets need to be forwarded by the master switch, as shown in Figure 2-23. This forwarding mode occupies bandwidth between the master and slave switches and between the master and standby switches.
- In the ring topology shown in Figure 2-24, unicast stack packets from the slave switch to the standby switch are forwarded according to the shortest path. This forwarding mode does not occupy bandwidth between the master and slave switches and between the master and standby switches.

Figure 2-22 Intra-device unicast packet forwarding

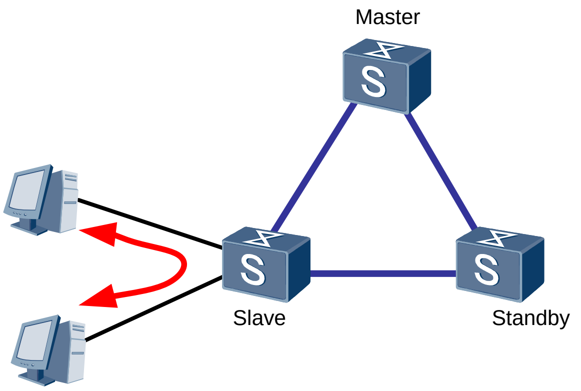


Figure 2-23 Inter-device unicast packet forwarding in a chain topology

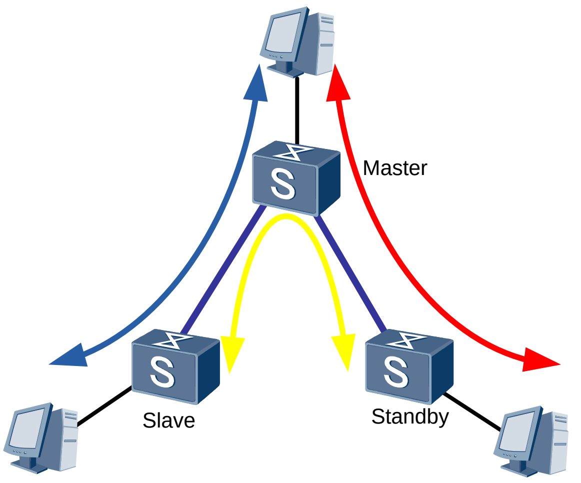
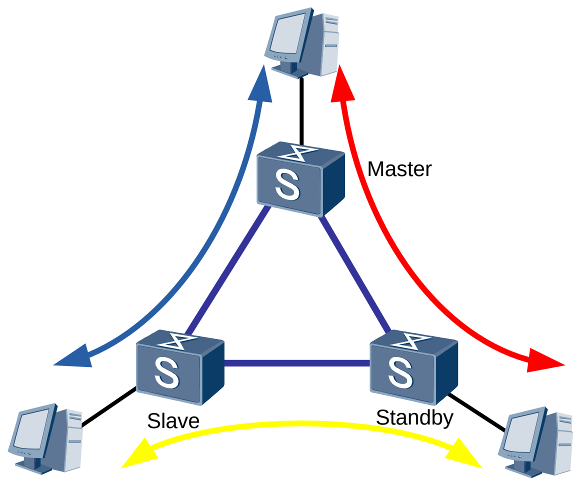


Figure 2-24 Inter-device unicast packet forwarding in a ring topology



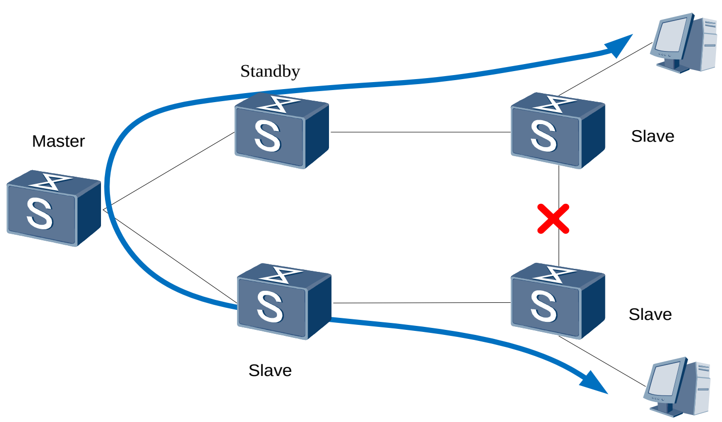
2.12.2 Unknown Unicast and Broadcast Packet Forwarding

In a ring topology, broadcast packets will not be looped within a stack because the stack has only one path. In a ring topology, loop prevention needs to be performed to prevent broadcast packets from being looped between devices. The following describes how to prevent loops when an even or odd number of member devices are deployed in a ring topology.

Loop Prevention in the Case of an Odd Number of Member Switches

In versions earlier than V200R001, the link farthest from the master switch is blocked to prevent loops, as shown in Figure 2-25.

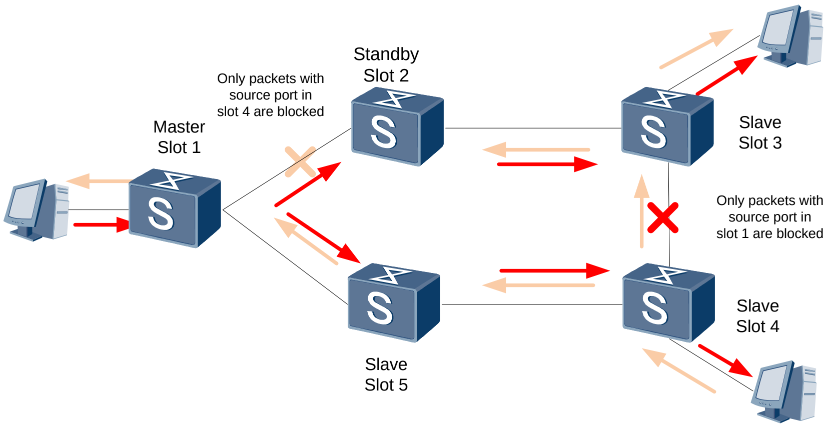
Figure 2-25 Broadcast packet forwarding in V100R006 and earlier versions



In versions earlier than V200R001, two users farther from the master need to communicate and their data needs to be forwarded through stack cables of five member switches, as shown in Figure 2-25. This forwarding mode wastes bandwidth of intermediate stack links.

From V200R001, the forwarding mode is optimized. That is, broadcast packets are blocked according to the stack ID of the member switch that sends the packets to ensure stack link use efficiency and prevent broadcast loops. As shown in Figure 2-26, when users between Slave3 and Slave4 need to communicate, their data only needs to be forwarded over the stack link between Slave3 and Slave4. Calculating the blocking point of each member switch according to the topology can improve bandwidth use efficiency of stack links.

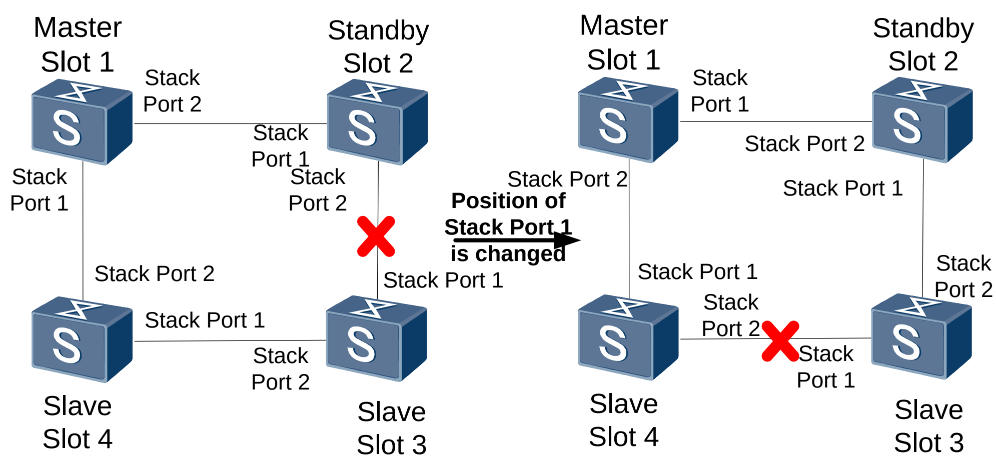
Figure 2-26 Broadcast packet forwarding along the shortest path



Loop Prevention in the Case of an Even Number of Member Switches

The blocking point in the case of an even number of member switches depends on the position of Stack Port 1 on the master switch. As shown in Figure 2-27, the blocking point is between Slot2 and Slot 3 in the stack at the left side, and the blocking point is between Slot3 and Slot 4 in the stack at the right side.

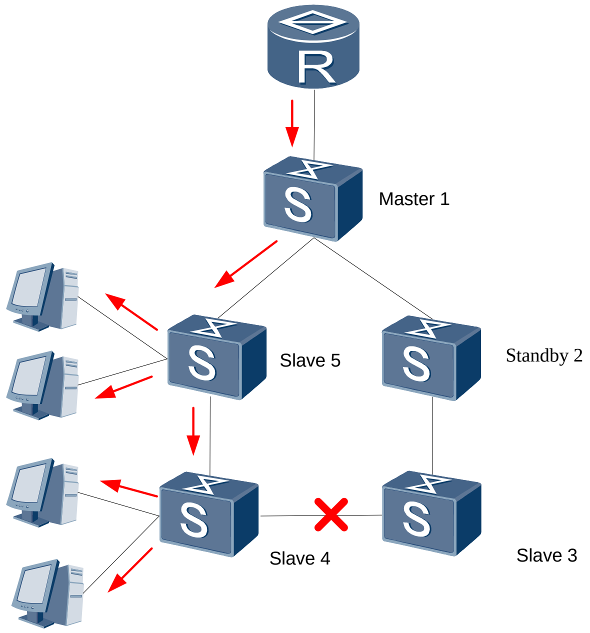
Figure 2-27 Loop prevention in the case of an even number of member switches



2.12.3 Multicast Packet Forwarding

Similar to broadcast packet forwarding, multicast packet forwarding within a stack requires loop prevention based on the calculated topology on each device, as shown in Figure 2-28. Multicast packets are forwarded as broadcast packets.

Figure 2-28 Multicast packet forwarding

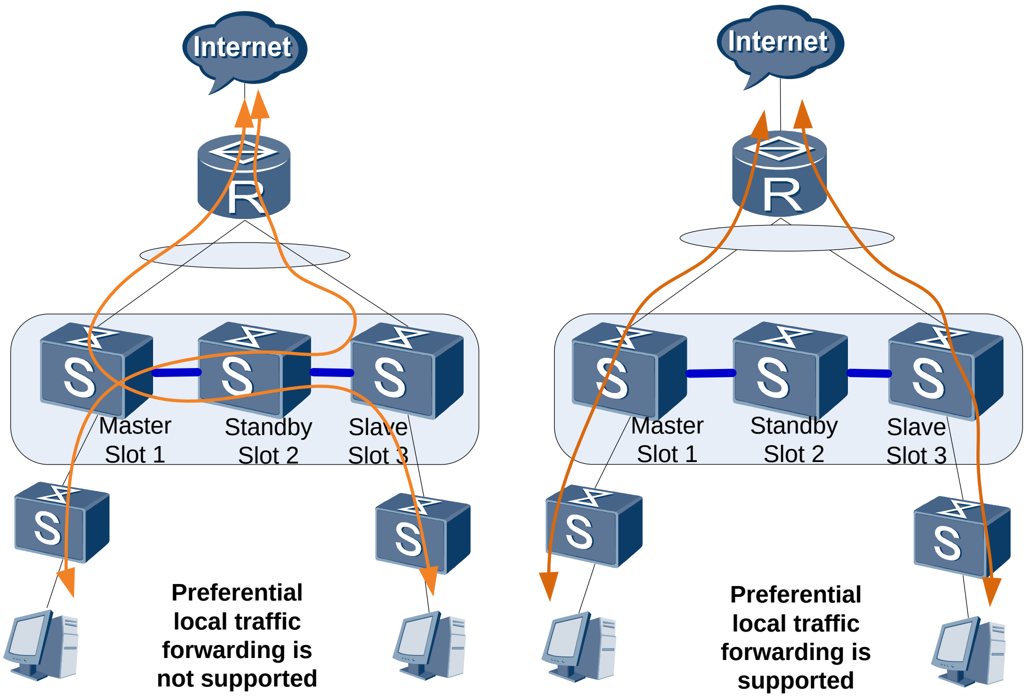


2.12.4 Eth-Trunk Preferentially Forwarding Local Traffic

The stack cable bandwidth is limited. To improve forwarding efficiency and reduce inter-device forwarded traffic, you need to configure an Eth-Trunk to preferentially forward local traffic. Then traffic received by the local device is first forwarded from the interface of the local device. If the interface becomes faulty or the traffic reaches the line rate of the interface, the traffic is forwarded from the interface of another member device.

As shown in Figure 2-29, three devices form a stack, and their uplink interfaces are added to an Eth-Trunk. If preferential local traffic forwarding is not configured, traffic received by a member switch is forwarded from the physical interface of another member switch through the cluster cable. However, the limited stack cable bandwidth restricts traffic forwarding performance. After preferential forwarding of local traffic is configured, traffic received by a member switch is first forwarded from the interface of the local device without passing through the stack cable.

Figure 2-29 Preferential local traffic forwarding



3 Product Capability

NOTE

The product capabilities in this section are subject to change without notice because of version upgrades. For details about product capabilities, see the specifications lists of products.

3.1 Stack Cables

SFP Cable

Table 3-1 SFP cable

Attribute	Description
Cable model	SFP high-speed cable-indoor-(SFP 20M)-(SFP 20M)-SFP-(CC2P0.32 black)-1.5m
Connector X1/X2	SFP, 20-pin, male
Color	Black
Length	1.5 m
Bend radius	40 mm

SFP+ Cable

Table 3-2 SFP+ 1 m passive cable

Attribute	Description
Cable model	SFP+ high-speed cable-1m-(SFP+20M)-(CC2P0.254 black)-(SFP+20M)-indoor low-fume, halogenless and flame-retardant cable
Connector X1/X2	SFP, 20-pin, male
Color	Black

Attribute	Description
Length	1 m
Bend radius	25 mm

Table 3-3 SFP+ 3 m passive cable

Attribute	Description
Cable model	Outsourcing cable-SFP+ high-speed cable-3m-SFP+20M-CC2P0.254 black-SFP+20M-indoor low-fume, halogenless and flame-retardant cable
Connector X1/X2	SFP, 20-pin, male
Color	Black
Length	3 m
Bend radius	25 mm

Table 3-4 SFP+ 10 m passive cable

Attribute	Description
Cable model	Outsourcing cable-SFP+ high-speed cable-10m-SFP+20M-CC2P0.5 black-SFP+20M-indoor low-fume, halogenless and flame-retardant cable
Connector X1/X2	SFP, 20-pin, male
Color	Black
Length	10 m
Bend radius	30 mm

Table 3-5 SFP+ 10 m active cable

Attribute	Description
Cable model	Outsourcing cable-SFP+ active high-speed cable-10m-(SFP+20M)-(CC2P0.32 black)-(SFP+20M)-indoor low-fume, halogenless and flame-retardant cable
Connector X1/X2	SFP, 20-pin, male
Color	Black
Length	10 m

Attribute	Description
Bend radius	25 mm

PCIE Cable

Table 3-6 PCIE cable

Attribute	Description
Cable model	100 cm PCI-E cable
Connector X1/X2	PCIE
Color	Black
Length	1 m
Bend radius	75 mm

3.2 Stack Parameters of S Series Switches

Table 3-7 Stack parameters of S2750-EI series switches

Stack Parameter	S2750-EI
Stack connection mode	Service port connection
Stack port	Two SFP ports (not combo ports)
Stack cable	• 1 m passive SFP+ copper cable • 3 m passive SFP+ copper cable • 10 m active SFP+ copper cable • 3 m, 10 m AOC cables • 6GE stack optical module (SFP-6GE-LR) and optical fiber
Maximum stack bandwidth (unidirectional)	2.5 Gbit/s
Remarks	Any models of the S2750-EI series can set up a stack.

Table 3-8 Stack parameters of S5700-P-LI series switches

Stack Parameter	S5700-P-LI (with GE Uplink Ports)
Stack connection mode	Service port connection

Stack Parameter	S5700-P-LI (with GE Uplink Ports)
Stack port	• V200R001: last two SFP ports • V200R002 and later versions: last four SFP ports
Stack cable	• 1 m passive SFP+ copper cable • 10 m active SFP+ copper cable • 3 m, 10 m AOC cables (applicable in V200R003C00 and later versions)
Maximum stack bandwidth (unidirectional)	• Using a 1 m passive SFP+ copper cable: 2.5 Gbit/s • Using a 10 m active SFP+ copper cable: 5 Gbit/s • Using a 3 m or 10 m AOC cable: 2.5 Gbit/s
Remarks	V200R001: A switch supports at most two logical stack ports, and each logical stack port can have only one physical member port. Each switch can use a maximum of two service ports as physical member ports. V200R002 and later versions: A switch supports at most two logical stack ports, and each logical stack port can have at most two physical member ports. Each switch can use a maximum of four service ports as physical member ports. Any models of the S5700-P-LI series can set up a stack, but S5700-P-LI models cannot set up a stack with S5700-X-LI models. **NOTE** The S5700-10P-LI-AC and S5700-10P-PWR-LI-AC do not support the stacking function.

Table 3-9 Stack parameters of S5700-X-LI series switches

Stack Parameter	S5700-X-LI (with GE Uplink Ports)
Stack connection mode	Service port connection
Stack port	Last four SFP+ ports
Stack cable	• 1 m passive SFP+ copper cable • 3 m passive SFP+ copper cable • 10 m active SFP+ copper cable • 3 m, 10 m AOC cables (applicable in V200R003C00 and later versions) • 10GE SFP+ optical module and optical fiber
Maximum stack bandwidth (unidirectional)	10 Gbit/s

Stack Parameter	S5700-X-LI (with GE Uplink Ports)
Remarks	A switch supports at most two logical stack ports, and each logical stack port can have at most two physical member ports. Each switch can use a maximum of four service ports as physical member ports. Any models of the S5700-X-LI series can set up a stack, but S5700-P-LI models cannot set up a stack with S5700-X-LI models.

Table 3-10 Stack parameters of S5700-SI series switches

Stack Parameter	S5700-SI
Stack connection mode	Stack card connection
Stack port	Two ports on a stack card
Stack cable	• 1 m PCIe cable • 3 m PCIe cable
Maximum stack bandwidth (unidirectional)	12 Gbit/s
Remarks	Any models of the S5700-SI series can set up a stack. NOTE The S5700-26X-SI-12S-AC does not support the stacking function.

Table 3-11 Stack parameters of S5700-EI series switches

Stack Parameter	S5700-EI
Stack connection mode	Stack card connection
Stack port	Two ports on a stack card
Stack cable	• 1 m PCIe cable • 3 m PCIe cable (only supported by S5700-52C-EI and S5700-28C-EI-24S in V200R002 and supported on all the S5700-EI series in V200R003)
Maximum stack bandwidth (unidirectional)	12 Gbit/s
Remarks	Any models of the S5700-EI series can set up a stack.

Table 3-12 Stack parameters of S5710-EI series switches

Stack Parameter	S5710-EI
Stack connection mode	Service port connection
Stack port	Any 10GE ports, including the four fixed 10GE SFP+ optical ports on the front panel and ports on the ES5D21X02S00 rear card (A switch supports a maximum of two rear cards, and each card provides two 10GE SFP+ optical ports.) NOTE Each logical stack port can have a maximum of four physical member ports. Ports on different rear cards can be added to the same logical stack port, but ports on a rear card and fixed ports on the front panel cannot be added to the same logical stack port.
Stack cable	• 1 m passive SFP+ copper cable • 3 m passive SFP+ copper cable • 10 m active SFP+ copper cable • 3 m, 10 m AOC cables (applicable in V200R003C00 and later versions) • 10GE SFP+ optical module and optical fiber
Maximum stack bandwidth (unidirectional)	10 Gbit/s
Remarks	V200R001: A switch supports at most two logical stack ports, and each logical stack port can have at most three physical member ports. Each switch can use a maximum of four service ports as physical member ports. All physical member ports must be located on the front panel or rear subcards. V200R002 and later versions: A switch supports at most two logical stack ports, and each logical stack port can have at most four physical member ports. Each switch can use a maximum of eight service ports as physical member ports. Any models of the S5710-EI series can set up a stack.

Table 3-13 Stack parameters of S5700-HI series switches

Stack Parameter	S5700-HI
Stack connection mode	Service port connection
Stack port	10GE ports on front cards: The S5700-HI supports ES5D00X2SA00 and ES5D00X4SA00 front cards, which support two and four 10GE SFP+ optical ports respectively. NOTE After a front card is replaced, the stack configurations become invalid and need to be reconfigured.

Stack Parameter	S5700-HI
Stack cable	• 1 m passive SFP+ copper cable • 3 m passive SFP+ copper cable • 10 m active SFP+ copper cable • 3 m, 10 m AOC cables • 10GE SFP+ optical module and optical fiber
Maximum stack bandwidth (unidirectional)	10 Gbit/s
Remarks	Any models of the S5700-HI series can set up a stack. NOTE The S5700-HI series does not support the stacking function in versions earlier than V200R003C00.

Table 3-14 Stack parameters of S6700-EI series switches

Stack Parameter	S6700-EI
Stack connection mode	Service port connection
Stack port	Any 10GE ports NOTE The S6700-EI series supports a maximum of eight service ports as physical member ports.
Stack cable	• 1 m passive SFP+ copper cable • 3 m passive SFP+ copper cable • 10 m passive SFP+ copper cable • 10 m active SFP+ copper cable (applicable in V200R001C00 and later versions) • 3 m, 10 m AOC cables (applicable in V200R003C00 and later versions) • 10GE SFP+ optical module and optical fiber
Maximum stack bandwidth (unidirectional)	10 Gbit/s
Remarks	Any models of the S6700-EI series can set up a stack. The 10GE ports cannot be used as stack ports when they work as GE ports.

3.3 Switches That Do Not Support Stacking

S5706, S5700S-LI, and S5710-HI do not support the stacking function.

4 Application Scenarios

4.1 Configuring a Stack with a Ring Topology

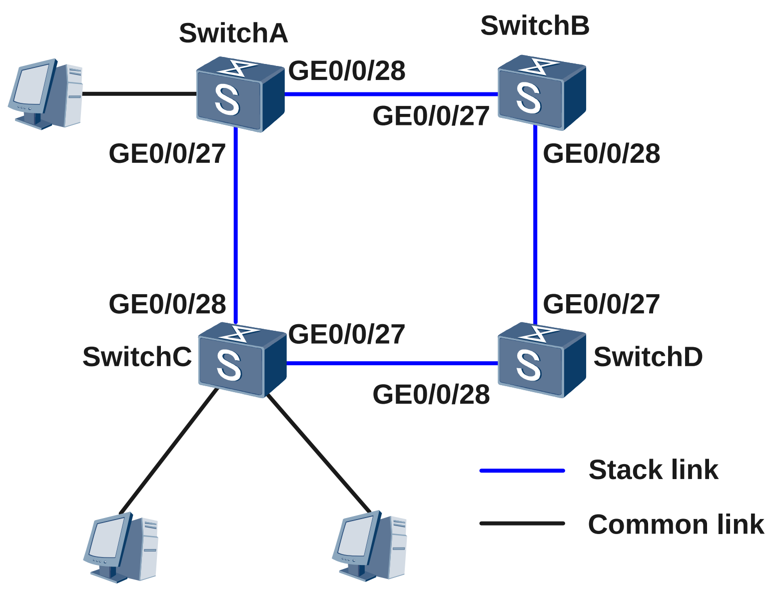
Networking Requirements

As shown in Figure 4-1, SwitchA, SwitchB, SwitchC, and SwitchD need to set up a stack with a ring topology.

As the network scale rapidly increases, the number of interfaces provided by an access switch cannot meet server access requirements. To meet these requirements, the number of access interfaces needs to be increased without increasing the existing investment, and the network must be easy to manage and maintain.

The following uses the S5700-LI as an example to describe how to configure a stack in service port connection mode with a ring topology.

Figure 4-1 Diagram of configuring a stack with a ring topology



Configuration Roadmap

1. Configure physical member interfaces and add them to stack interfaces to ensure that member switches can forward data packets. Physical member interfaces on both ends of a stack link must be added to different stack interfaces.
2. Connect interfaces using SFP+ cables as shown in Figure 4-1.

Configuration Procedure

Step 1 Configure stack interfaces.

On SwitchA, configure GigabitEthernet0/0/27 and GigabitEthernet0/0/28 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchA
[SwitchA] interface stack-port 0/1
[SwitchA-stack-port0/1] port interface gigabitethernet 0/0/27 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchA-stack-port0/1] quit
[SwitchA] interface stack-port 0/2
[SwitchA-stack-port0/2] port interface gigabitethernet 0/0/28 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchA-stack-port0/2] quit
```

On SwitchB, configure GigabitEthernet0/0/27 and GigabitEthernet0/0/28 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchB
[SwitchB] interface stack-port 0/1
[SwitchB-stack-port0/1] port interface gigabitethernet 0/0/27 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchB-stack-port0/1] quit
[SwitchB] interface stack-port 0/2
[SwitchB-stack-port0/2] port interface gigabitethernet 0/0/28 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchB-stack-port0/2] quit
```

On SwitchC, configure GigabitEthernet0/0/27 and GigabitEthernet0/0/28 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchC
[SwitchC] interface stack-port 0/1
[SwitchC-stack-port0/1] port interface gigabitethernet 0/0/27 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchC-stack-port0/1] quit
[SwitchC] interface stack-port 0/2
[SwitchC-stack-port0/2] port interface gigabitethernet 0/0/28 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
```

```
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchC-stack-port0/2] quit
```

On SwitchD, configure GigabitEthernet0/0/27 and GigabitEthernet0/0/28 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchD
[SwitchD] interface stack-port 0/1
[SwitchD-stack-port0/1] port interface gigabitethernet 0/0/27 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchD-stack-port0/1] quit
[SwitchD] interface stack-port 0/2
[SwitchD-stack-port0/2] port interface gigabitethernet 0/0/28 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
[SwitchD-stack-port0/2] quit
```

Step 2 Configure stack IDs and stack priorities.

Set the stack priority of SwitchA to 200.

```
[SwitchA] stack slot 0 priority 200
Warning:Please do not frequently modify Priority, it will make the stack split!
continue?[Y/N]:y
```

Set the stack ID of SwitchB to 1.

```
[SwitchB] stack slot 0 renumber 1
Warning: All the configurations related to the slot ID will be lost after the slot ID
is modified.
Please do not frequently modify slot ID, it will make the stack split. Continue?[Y/N]:y
Info: Stack configuration has been changed, need reboot to take effect.
```

Set the stack ID of SwitchC to 2.

```
[SwitchC] stack slot 0 renumber 2
Warning: All the configurations related to the slot ID will be lost after the slot ID
is modified.
Please do not frequently modify slot ID, it will make the stack split. Continue?[Y/N]:y
Info: Stack configuration has been changed, need reboot to take effect.
```

Set the stack ID of SwitchD to 3.

```
[SwitchD] stack slot 0 renumber 3
Warning: All the configurations related to the slot ID will be lost after the slot ID
is modified.
Please do not frequently modify slot ID, it will make the stack split. Continue?[Y/N]:y
Info: Stack configuration has been changed, need reboot to take effect.
```

Step 3 Power off and then power on the switches and connect the switches using stack cables.

NOTE

Stack port 0/1 of the local device must be connected to stack port 0/2 of the remote device. Otherwise, the two devices cannot set up a stack.

To specify a member switch as the master switch, power on the switch first. For example, to specify SwitchA as the master switch, SwitchB as the standby switch, SwitchC and SwitchD as slave switches, perform the following operations:

1. Power off SwitchA, SwitchB, SwitchC, and SwitchD.

2. Connect SwitchA and SwitchB using a stack cable.

3. Power on SwitchA first. After SwitchA starts, power on SwitchB. Then run a display command to check whether SwitchA and SwitchB set up a stack.

4. Connect SwitchC and SwitchB using a stack cable and power on SwitchC first. Connect SwitchD to SwitchC and SwitchA using stack cables and then power on SwitchD.

Step 4 Verify the configuration.

Check basic stack information.

```
<SwitchA> display stack
Stack topology type : Ring
Stack system MAC: 0018-82d2-2e85
MAC switch delay time: 10 min
Stack reserve vlan : 4093
Slot of the active management port: --
slot    Role       Mac address     Priority   Device type
-------------------------------------------------------------
   0    Master     0018-82d2-2e85   200       S5700-28P-LI-AC
   1    Slave      0018-82c6-1f44   100       S5700-28P-LI-AC
   2    Standby    0018-82c6-1f4c   100       S5700-28P-LI-AC
   3    Slave      0018-82b1-6eb8   100       S5700-28P-LI-AC
```

----End

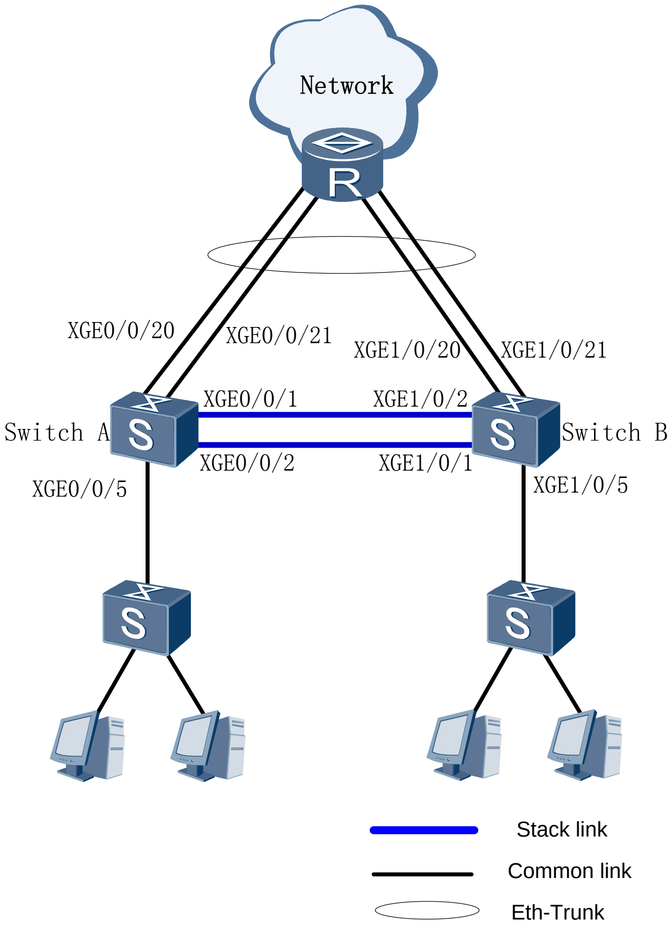
4.2 Configuring a Stack for Bandwidth Expansion

Networking Requirements

As the network scale increases, switches on the network cannot provide sufficient uplink bandwidth. You can add new switches to configure them to set up a stack with existing switches and configure multiple physical links of member switches in the stack as a link aggregation group to increase the uplink bandwidth of the switches.

As shown in Figure 4-2, SwitchA and SwitchB are two S6700-E1s and need to set up a stack with a ring topology. Assume that SwitchA functions as the master switch and SwitchB functions as the standby switch. To facilitate device management, set the stack ID of SwitchA to 0 and the stack ID of SwitchB to 1. Connect XGigabitEthernet 0/0/5 and XGigabitEthernet 1/0/5 to access switches, and add XGigabitEthernet 0/0/20, XGigabitEthernet 0/0/21, XGigabitEthernet 1/0/20, and XGigabitEthernet 1/0/21 to an Eth-Trunk to increase uplink bandwidth.

Figure 4-2 Diagram of configuring a stack for bandwidth expansion



Configuration Roadmap

1. Configure a stack, including configuring stack IDs, stack interfaces, and connecting switches using stack cables.
2. Configure an Eth-Trunk to increase uplink bandwidth.

Configuration Procedure

Step 1 Configure stack IDs for switches.

Set the stack ID of SwitchB to 1.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchB
[SwitchB] stack slot 0 renumber 1
```

NOTE

After the stack ID is configured for a device, the configuration takes effect only after the device is restarted.

Before a stack is set up, the default stack ID of a device is 0. You can run the **display stack** or **display stack peers** command to view the stack ID of a device.

Step 2 Configure stack interfaces.

On SwitchA, configure XGigabitEthernet0/0/1 and GigabitEthernet0/0/2 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchA
[SwitchA] interface stack-port 0/1
[SwitchA-stack-port0/1] port interface XGigabitEthernet 0/0/1 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
Info: Ports XGigabitEthernet0/0/1 to XGigabitEthernet0/0/4 have been configured as
physical stack-port.
[SwitchA-stack-port0/1] quit
[SwitchA] interface stack-port 0/2
[SwitchA-stack-port0/2] port interface XGigabitEthernet 0/0/2 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
Info: Ports XGigabitEthernet0/0/1 to XGigabitEthernet0/0/4 have been configured as
physical stack-port.
[SwitchA-stack-port0/2] quit
```

On SwitchB, configure XGigabitEthernet0/0/1 and GigabitEthernet0/0/2 as physical member interfaces and add them to stack port 0/1 and stack port 0/2 respectively.

```
<SwitchB> system-view
[SwitchB] interface stack-port 0/1
[SwitchB-stack-port0/1] port interface XGigabitEthernet 0/0/1 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
Info: Ports XGigabitEthernet0/0/1 to XGigabitEthernet0/0/4 have been configured as
physical stack-port.
[SwitchB-stack-port0/1] quit
[SwitchB] interface stack-port 0/2
[SwitchB-stack-port0/2] port interface XGigabitEthernet 0/0/2 enable
Warning: Enabling stack port cause configuration loss on the interface, continue?[Y/N]:y
Info: This operation may take a few seconds. Please wait for a moment.......
Info: Ports XGigabitEthernet0/0/1 to XGigabitEthernet0/0/4 have been configured as
physical stack-port.
[SwitchB-stack-port0/2] quit
```

Step 3 Power cycle the switches and connect the switches through stack cables.

NOTE

Power off SwitchA and SwitchB, connect the two switches through stack cables, and then power on SwitchA and SwitchB in sequence.

Stack port 0/1 of the local device must be connected to stack port 0/2 of the remote device. Otherwise, the two devices cannot set up a stack.

Step 4 View the stack configuration.

```
<SwitchA> display stack
Stack topology type: Ring
Stack system MAC: 80fb-06af-7570
MAC switch delay time: 10 min
Stack reserve vlan : 4093
Slot of the active management port: --
slot    Role       Mac address     Priority   Device type
```

```
-------------------------------------------------------------
0    Master     80fb-06af-7570   100       S6700-48-EI
1    Standby    80fb-06af-7ed0   100       S6700-48-EI
```

Step 5 Configure a user VLAN and add the interfaces that connect access switches to the VLAN.

```
<SwitchA> system-view
[SwitchA] vlan 100
[SwitchA] vlan 100
[SwitchA-vlan100] quit
[SwitchA] interface XGigabitEthernet 0/0/5
[SwitchA-XGigabitEthernet 0/0/5] port link-type trunk
[SwitchA-XGigabitEthernet 0/0/5] port trunk allow-pass vlan 100
[SwitchA-XGigabitEthernet 0/0/5] quit
[SwitchA] interface XGigabitEthernet 1/0/5
[SwitchA-XGigabitEthernet 1/0/5] port link-type trunk
[SwitchA-XGigabitEthernet 1/0/5] port trunk allow-pass vlan 100
[SwitchA-XGigabitEthernet 1/0/5] quit
```

Step 6 Configure an Eth-Trunk and add uplink interfaces to the Eth-Trunk.

```
<SwitchA> system-view
[SwitchA] interface Eth-Trunk 10
[SwitchA-Eth-Trunk10] port link-type trunk
[SwitchA-Eth-Trunk10] port trunk allow-pass vlan 100
[SwitchA-Eth-Trunk10] trunkport XGigabitEthernet 0/0/20 to 0/0/21
[SwitchA-Eth-Trunk10] trunkport XGigabitEthernet 1/0/20 to 1/0/21
[SwitchA-Eth-Trunk10] quit
```

----End

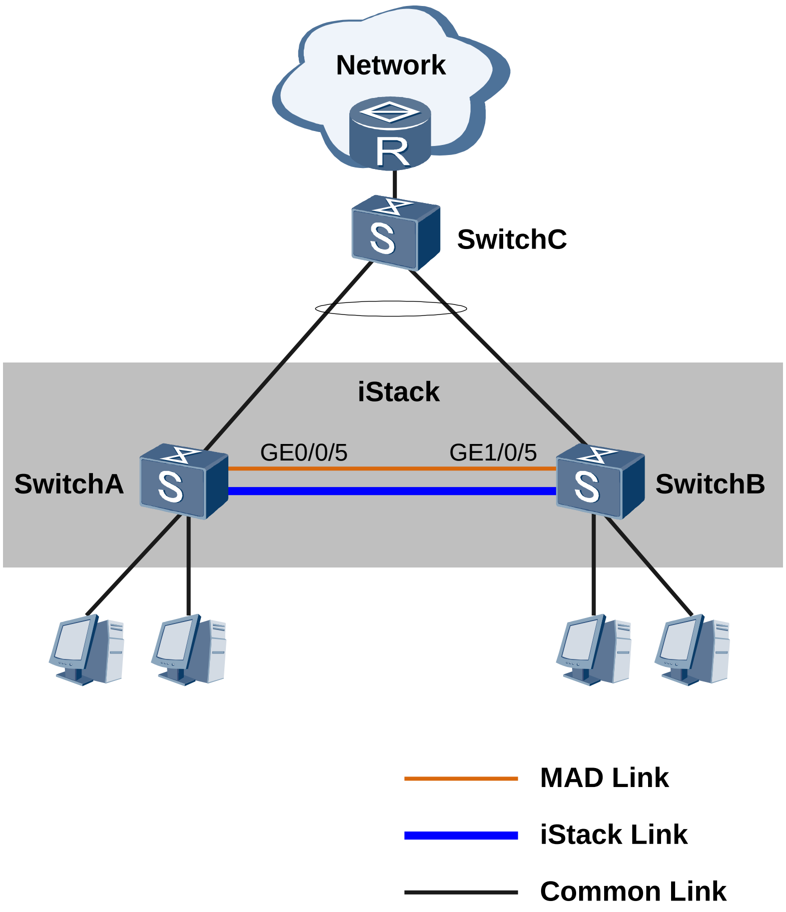
4.3 Example for Configuring MAD in Direct Mode

Networking Requirements

As shown in Figure 4-3, SwitchA and SwitchB form a stack. The stack IDs of SwitchA and SwitchB are 0 and 1 respectively.

To ensure stack reliability, MAD in direct mode needs to be configured on GigabitEthernet0/0/5 and GigabitEthernet1/0/5. When the stack splits because of a stack link fault and there are two devices with the same configuration on the network, you can use MAD to reduce the impact of a stack split on the network.

Figure 4-3 Networking diagram of MAD in direct mode



Configuration Roadmap

The configuration roadmap is as follows:

- Configure MAD in direct mode on specified interfaces.

Configuration Procedure

Step 1 Configure MAD on interfaces.

Configure MAD in direct mode on GigabitEthernet0/0/5.

```
<HUAWEI> system-view
[HUAWEI] interface gigabitethernet 0/0/5
[HUAWEI-GigabitEthernet0/0/5] mad detect mode direct
Warning: This command will block the port, and no other configuration running on
 this port is recommended. Continue?[Y/N]:y
```

Configure MAD in direct mode on GigabitEthernet1/0/5.

```
<HUAWEI> system-view
[HUAWEI] interface gigabitethernet 1/0/5
[HUAWEI-GigabitEthernet1/0/5] mad detect mode direct
```

```
Warning: This command will block the port, and no other configuration running on
 this port is recommended. Continue?[Y/N]:y
```

Step 2 Verify the configuration.

Check detailed MAD configuration of the stack.

```
<HUAWEI> display mad verbose
Current MAD domain: 0
Current MAD status: Detect
Mad direct detect interfaces configured:
 GigabitEthernet0/0/5
 GigabitEthernet1/0/5
Mad relay detect interfaces configured:
Excluded ports(configurable):
Excluded ports(cannot be configured):
 GigabitEthernet0/0/27
 GigabitEthernet1/0/27
```

----End

Configuration File

- Configuration file of the stack

```
#
interface GigabitEthernet0/0/5
 mad detect mode direct
#
interface GigabitEthernet1/0/5
 mad detect mode direct
#
return
```

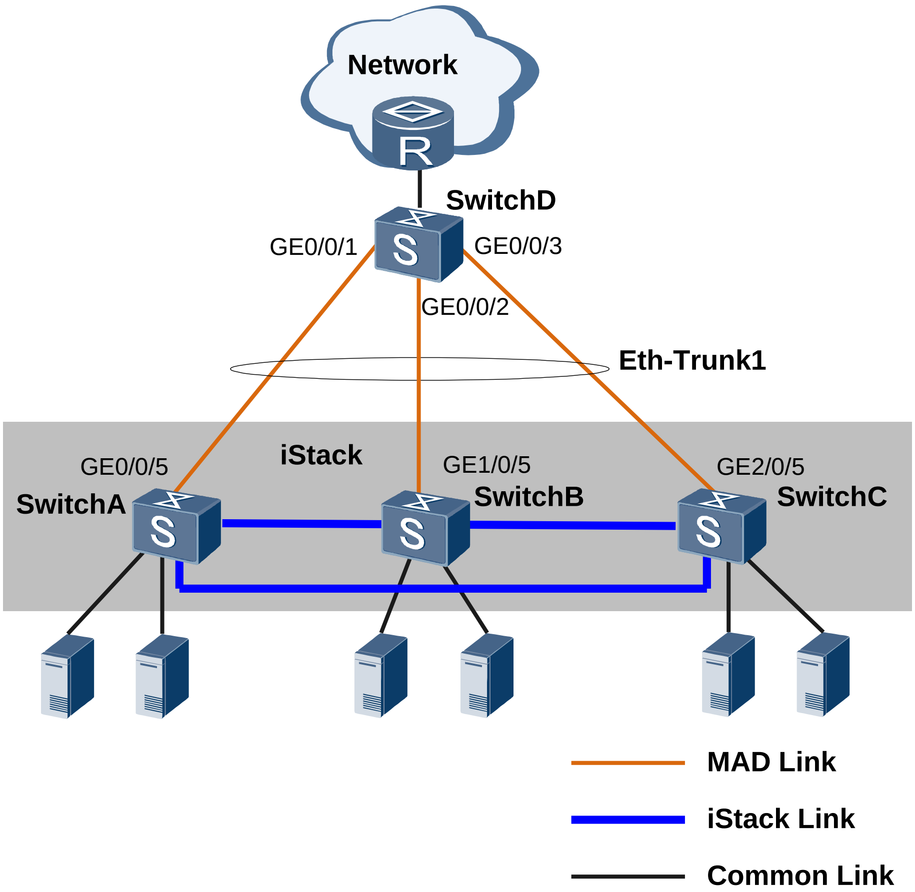
4.4 Example for Configuring MAD in Relay Mode

Network Requirements

As shown in Figure 4-4, SwitchA, SwitchB and SwitchC form a stack. SwitchA, SwitchB and SwitchC connect to SwitchD using Eth-Trunk1.

When the stack splits because of a stack link fault and there are two devices with the same configuration on the network, you can use MAD to reduce the impact of a stack split on the network.

Figure 4-4 Networking diagram of MAD in relay mode



Configuration Roadmap

The configuration roadmap is as follows:

- Configure MAD in relay mode on a specified Eth-Trunk interface.
- Configure the relay function on the proxy device to allow the proxy device to forward MAD protocol packets.

Configuration Procedure

Step 1 Configure MAD.

Configure MAD in relay mode.

```
<HUAWEI> system-view
[HUAWEI] interface eth-trunk 1
[HUAWEI-Eth-Trunk1] mad detect mode relay
[HUAWEI-Eth-Trunk1] quit
[HUAWEI] interface gigabitethernet 0/0/5
[HUAWEI-GigabitEthernet0/0/5] eth-trunk 1
[HUAWEI-GigabitEthernet0/0/5] quit
[HUAWEI] interface gigabitethernet 1/0/5
[HUAWEI-GigabitEthernet1/0/5] eth-trunk 1
```

```
[HUAWEI-GigabitEthernet1/0/5] quit
[HUAWEI] interface gigabitethernet 2/0/5
[HUAWEI-GigabitEthernet2/0/5] eth-trunk 1
[HUAWEI-GigabitEthernet2/0/5] quit
```

Step 2 Configure the relay function.

Configure the relay function on proxy device SwitchD.

```
<HUAWEI> system-view
[HUAWEI] sysname SwitchD
[SwitchD] interface eth-trunk 1
[SwitchD-Eth-Trunk1] mad relay
[SwitchD-Eth-Trunk1] quit
[SwitchD] interface gigabitethernet 0/0/1
[SwitchD-GigabitEthernet0/0/1] eth-trunk 1
[SwitchD-GigabitEthernet0/0/1] quit
[SwitchD] interface gigabitethernet 0/0/2
[SwitchD-GigabitEthernet0/0/2] eth-trunk 1
[SwitchD-GigabitEthernet0/0/2] quit
[SwitchD] interface gigabitethernet 0/0/3
[SwitchD-GigabitEthernet0/0/3] eth-trunk 1
[SwitchC-GigabitEthernet0/0/3] quit
```

Step 3 Verify the configuration.

Check detailed MAD configuration of the stack.

```
<HUAWEI> display mad verbose
Current MAD domain: 0
Current MAD status: Detect
Mad direct detect interfaces configured:
Mad relay detect interfaces configured:
 Eth-Trunk1
Excluded ports(configurable):
Excluded ports(cannot be configured):
 GigabitEthernet0/0/26
 GigabitEthernet0/0/27
 GigabitEthernet1/0/26
 GigabitEthernet1/0/27
 GigabitEthernet2/0/26
 GigabitEthernet2/0/27
```

Check information about the proxy device SwitchD.

```
<SwitchD> display mad proxy
Mad relay interfaces configured:
 Eth-Trunk1
```

----End

Configuration File

- Configuration file of the stack

```
#
interface Eth-Trunk1
 mad detect mode relay
#
interface GigabitEthernet0/0/5
 eth-trunk 1
#
interface GigabitEthernet1/0/5
 eth-trunk 1
#
interface GigabitEthernet2/0/5
 eth-trunk 1
#
return
```

- Configuration file of SwitchD

```
#
sysname SwitchD
#
interface Eth-Trunk1
 mad relay
#
interface GigabitEthernet0/0/1
 eth-trunk 1
#
interface GigabitEthernet0/0/2
 eth-trunk 1
#
interface GigabitEthernet0/0/3
 eth-trunk 1
#
return
```

4.5 Adding a Member Switch to a Stack

In some scenarios, one or multiple new switches need to be added to a running stack to work with existing member switches. This process involves the following steps:

Step 1 Collect the stack topology and prevent loops of stack links.

Before adding a new switch to a stack, analyze the physical connections of the stack.

If the stack has a chain topology, add the new switch to either end of the chain topology to minimize the impact on existing services. Adding the new switch to the middle of the chain topology will cause the split of the stack. Therefore, analyze the impact of adding a new switch to a stack on existing services.

If the stack has a ring topology, change the ring topology into a chain topology and then add the new switch on either end of the chain topology. In versions earlier than V200R001, you need to select where to break the ring. It is not recommended to break the ring on the link between the master and standby switches. Breaking the ring on the link between the master and standby switches will cause the reelection of the standby switch and result in the role changes of member switches.

Step 2 Perform the stack configuration.

Configure stack interfaces on the existing edge switches of the stack. This configuration is required only for a stack with a chain topology but not for a stack with a ring topology. For details, see section 4.1 "Configuring a Stack with a Ring Topology."

Configure stack interfaces on the new switch.

To facilitate device management, configure a stack ID for the new switch. If no stack ID is configured for the new switch, the stack assigns a stack ID to the new switch. For details, see section 4.1 "Configuring a Stack with a Ring Topology."

Step 3 Connect the new switch using stack cables to add it to the stack.

Connect the new switch using stack cables. The switch joins the stack after being powered on.

CAUTION

Stack port n/1 of a device must be connected to stack port n/2 of the neighboring device. Otherwise, the two devices cannot set up a stack. **n** indicates the stack ID of a member switch.

Step 4 Configure services on the new switch.

After the new switch joins the stack, you can configure services on the new switch.

Step 5 Repeat steps 1 to 4 to add multiple new switches to the stack.

----End

4.6 Removing a Member Switch from a Stack

In some scenarios, one or multiple member switches need to be removed from a running stack. This process involves the following steps:

Step 1 Determine which member switches need to be removed.

The impact of removing member switches from a stack on existing services varies according to the roles of the switches:

- Removing the standby or slave switch from a stack results in short-term packet loss on the switch but does not affect other devices.
- You can remove the master switch from a stack in either of the following ways:
  - Perform an active/standby switchover manually to change the master switch as a slave switch and then remove it from the stack.
  - Remove the master switch from the stack directly.

To minimize the impact of removing the master switch on existing services, perform an active/standby switchover manually to change the master switch as a slave switch before removing the master switch. Additionally, to ensure service reliability, configure GR on upstream and downstream devices of member switches if the member switches function as Layer 3 devices. Currently, the impact of removing the master switch from a stack on existing services is the same regardless of which way the master switch is removed.

Step 2 Remove the member switches.

Disconnect stack cables to remove the member switches.

- In a stack with a ring topology, connect the two stack interfaces that connect the removed member switch using stack cables to ensure network reliability. Connect stack port 0/1 of the member switch to stack port 0/2 of the neighboring member switch. Otherwise, the stack may fail to run properly.
- In a stack with a chain topology, removing an intermediate device may cause the split of the stack. Therefore, analyze services before removing member switches from the stack to minimize the impact on services.

Step 3 Add the removed member switches as standalone devices to the network again.

A removed device was a member switch, so it uses the stack MAC address within the stack MAC address switching delay to inherit the configuration of the member switch. After the stack MAC address switching delay expires, the removed device uses its own system MAC address.

----End

5 Troubleshooting

5.1 Switches Cannot Set Up a Stack

A stacking failure refers to one of the following situations:

- Switches cannot set up a stack.
- A switch fails to join a stack.
- A stack cannot be set up again after it splits.

This fault is commonly caused by one of the following:

- The stacking function is disabled on the switches.
- The stack reserved VLAN is occupied.
- The switch models are different. For example, an EI model is connected to an SI model.
- Some switches do not support the stacking function.
- A switch does not have any electronic label or has an incorrect electronic label.
- A stack card has no electronic label or an incorrect electronic label.
- Stack cables are incorrectly connected.
- Some stack cables or stack cards are faulty.

When multiple switches cannot set up a stack, perform the following operations to rectify the fault.

Troubleshooting Procedure

NOTE

Saving the results of each troubleshooting step is recommended. If your troubleshooting fails to correct the fault, you will have a record of your actions to provide Huawei technical support personnel.

CAUTION

Before replacing a switch, inserting a stack card or stack cable, or replacing a stack card, power off the switch.

Perform the following steps on each switch where a stacking failure occurs.

Step 1 Check whether the stacking function is enabled on the switches.

Log in to the switches and run the **display stack** command to check the stack status.

- If running the **display stack** command fails, the stacking function is disabled.

NOTE

On a switch in a stack set up in stack port connection mode, running the **display stack** command will fail if the stack card is not properly installed on the switch. When this occurs, check whether the stack card and stack cables are installed properly.

Check whether the stack card and stack cables are installed properly. If the stack card or a stack cable is loose, reconnect it. Switches can form a ring stack or chain stack. The ring stack is recommended because it is more stable and reliable.

Run the **stack enable** command in the system view to enable the stacking function, and then restart the switch.

If the following information is displayed, the stacking function is enabled. Go to step 2.

```
<HUAWEI> display stack
Stack topology type: Link
Stack system MAC: 0200-0001-0000
MAC switch delay time: never
Stack reserved vlanid : 4093
Slot of the active management port: --
Slot    role       Mac address     Priority   Device type
------   ----       --------------   ------    -------
   1    Master     0200-0001-0000   100       S5700-48TP-PWR-SI
```

Step 2 Check whether the stack reserved VLAN is occupied.

Run the **display vlan 4093** command in the user view to check whether the stack reserved VLAN is occupied. By default, a stack uses VLAN 4093 as the reserved VLAN.

If the reserved VLAN is occupied, run the **undo vlan 4093** command in the system view to delete the reserved VLAN.

Step 3 Check the switch model.

Run the **display elabel** command to view the electronic label. The Description field in the command output indicates the device model.

```
<HUAWEI> display elabel
/$[System Integration Version]
/$SystemIntegrationVersion=3.0


[Slot_0]
/$[Board Integration Version]
/$BoardIntegrationVersion=3.0


[Main_Board]


/$[ArchivesInfo Version]
/$ArchivesInfoVersion=3.0


[Board Properties]
```

```
BoardType=CX22EMGEB
BarCode=21023518320123456789
Item=02351832
Description=Quidway S5700-48TP-PWR-SI,LS5ZC48CM,S5700-48TP-PWR-SI Mainframe
Manufactured=2009-02-05
VendorName=Huawei
IssueNumber=
CLEICode=
BOM=
```

- If the switch is not of a different model from other switches, replace the switch.
- If the switches have the same model, go to step 4.

Step 4 Check that the correct electronic label has been loaded to the switch.

Run the **display elabel** command to view the electronic label.

- If all fields under [Board Properties] are empty, no electronic label is loaded to the switch. Replace the switch.

```
<HUAWEI> display elabel
/$[System Integration Version]
/$SystemIntegrationVersion=3.0


[Slot_0]
/$[Board Integration Version]
/$BoardIntegrationVersion=3.0


[Main_Board]


/$[ArchivesInfo Version]
/$ArchivesInfoVersion=3.0


[Board Properties]
BoardType=
BarCode=
Item=
Description=
Manufactured=
VendorName=
IssueNumber=
CLEICode=
BOM=
```

- If fields under [Board Properties] are not empty, the electronic label has been loaded to the switch. Go to step 5.

```
<HUAWEI> display elabel
/$[System Integration Version]
/$SystemIntegrationVersion=3.0


[Slot_0]
```

```
/$[Board Integration Version]
/$BoardIntegrationVersion=3.0


[Main_Board]


/$[ArchivesInfo Version]
/$ArchivesInfoVersion=3.0


[Board Properties]
BoardType=CX22EMGEB
BarCode=21023518320123456789
Item=02351832
Description=Quidway S5700-48TP-PWR-SI,LS5ZC48CM,S5700-48TP-PWR-SI Mainframe
Manufactured=2009-02-05
VendorName=Huawei
IssueNumber=
CLEICode=
BOM=
```

Step 5 Check the electronic label of the stack card.

NOTE

Perform this step only on switches that set up a stack using stack cards.

Run the **display elabel slot** *slot-number sub-card-number* command to check the electronic label of the stack card.

In the command, **slot** *slot-number* specifies the stack ID, which can be obtained from the **display stack** command output. The subcard-number value is always 2 for a stack card. For example, to view the stack card electronic label on a switch with stack ID 0, run the **display elabel slot 0 2** command.

- If all fields under [Board Properties] are empty, the stack card does not function properly. Replace the stack card.

```
<HUAWEI> display elabel slot 0  2
/$[System Integration Version]
/$SystemIntegrationVersion=3.0


[Slot_0]
/$[Board Integration Version]
/$BoardIntegrationVersion=3.0


[Main_Board]


/$[ArchivesInfo Version]
/$ArchivesInfoVersion=3.0


[Board Properties]
```

```
BoardType=
BarCode=
Item=
Description=
Manufactured=
VendorName=
IssueNumber=
CLEICode=
BOM=
```

- If fields under [Board Properties] are not empty, go to step 6.

```
<HUAWEI> display elabel slot 0  2
/$[System Integration Version]
/$SystemIntegrationVersion=3.0


[Slot_0]
/$[Board Integration Version]
/$BoardIntegrationVersion=3.0


[Main_Board]


/$[ArchivesInfo Version]
/$ArchivesInfoVersion=3.0


[Board Properties]
BoardType=CX22ETPC
BarCode=210235000c0120081008
Item=0235000c
Description=CX22ETPC for S5700 HindCard
Manufactured=2008-11-14
VendorName=Huawei
IssueNumber=
CLEICode=
BOM=
```

Step 6 Check that stack cables are correctly connected.

NOTE

Perform this step only on switches that set up a stack using service interfaces.

If the switch uses service ports and stack ports, check the configuration of the stack ports.

Run the **display stack port** [**configuration**] [**slot** *slot-id*] command to check the configuration of stack ports.

Compare the ports displayed in the command output with the ports used for stack connection.

```
<HUAWEI> display stack port
*down : administratively down
Logic Port        Phy Port                  Online      Status
----------------------------------------------------------------------------
```

```
stack-port0/1     XGigabitEthernet0/0/1      present     up
stack-port0/2     XGigabitEthernet0/0/3      present     *down
stack-port3/1     XGigabitEthernet3/0/1      present     down
                  XGigabitEthernet3/0/2      present     down
stack-port3/2     XGigabitEthernet3/0/3      present     up
stack-port4/1     XGigabitEthernet4/0/1      present     up
stack-port4/2     XGigabitEthernet4/0/3      present     up
stack-port8/1     XGigabitEthernet8/0/1      present     up
stack-port8/2     XGigabitEthernet8/0/3      present     up
```

- If the ports displayed in the command output are different from the ports used for stack connection, reconnect ports.
- If the ports displayed in the command output are the same as the ports used for stack connection, go to step 7.

Step 7 Check that the stack cards and stack cables are functioning properly.

- Check the status of physical member interfaces in the **display stack port** command output. If all the member ports are Up, go to step 8.
- If a member port is Down, check whether the switch connected to the port has been powered off or is restarting. If so, check the port status after the remote switch restarts. If not, replace the stack card on the local switch or the stack cable on this port.

If the fault persists, go to step 8.

Step 8 Collect the following information and contact Huawei technical support personnel.

- Results of the preceding troubleshooting procedure
- Configuration file, logs, and alarms of the device

----End

Relevant Alarms

- A stack port goes Up: FSP_1.3.6.1.4.1.2011.5.25.183.1.22.1 hwStackLinkUp
- A stack port goes Down: FSP_1.3.6.1.4.1.2011.5.25.183.1.22.2 hwStackLinkDown
- A switch has joined a stack: FSP_1.3.6.1.4.1.2011.5.25.183.1.22.6 hwStackStackMemberAdd
- A switch has left a stack: FSP_1.3.6.1.4.1.2011.5.25.183.1.22.7 hwStackStackMemberLeave
- Logical ports with the same ID on two switches are connected: ECM_1.3.6.1.4.1.2011.5.25.183.1.22.9 hwStackLogicStackPortLinkErr
- Physical ports of the same logical port are connected differently: ECM_1.3.6.1.4.1.2011.5.25.183.1.22.10 hwStackPhyStackPortLinkErr

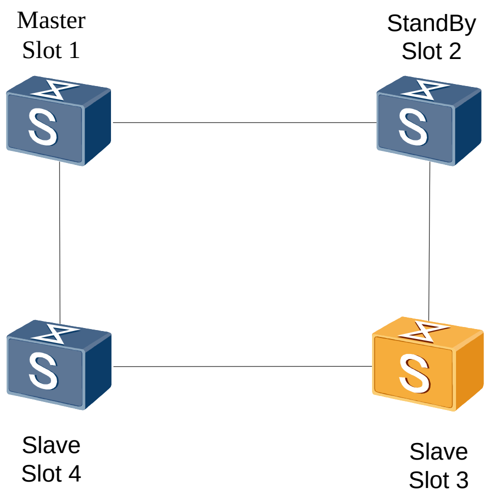
5.2 A Stack Cannot Run Properly Because One Member Switch Becomes Faulty

When faults often occur on a member switch of a stack, the stack cannot run properly. To ensure the reliability of other running member switches, you need to isolate the member switch from the stack. This isolation mode applies only to service port connection but not to stack card connection because the number of stack port limitations of stack cards.

Step 1 Determine the role of the member switch to be isolated.

If the member switch is a slave switch, go to step 2. If the member switch is the master switch, change the member switch into a slave switch as shown in Figure 5-1.

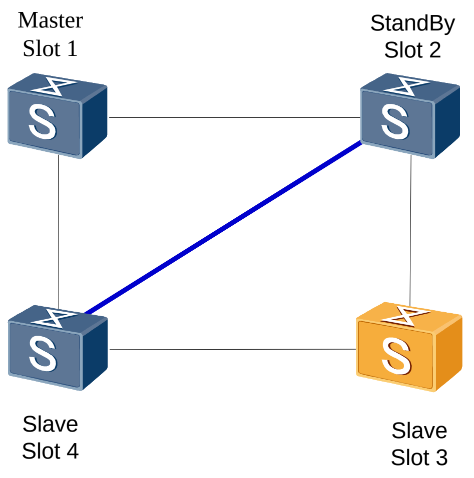
Figure 5-1 Networking before the isolation of a slave switch



Step 2 Connect member switches using a stack cable.

Configure interfaces in slot 2 and slot 4 as stack interfaces and connect the stack interfaces using a new stack cable as shown in Figure 5-2. Interfaces on both ends of the new stack cable are in Down state and the stack cable does not work.

Figure 5-2 Networking after stack interfaces in slot 2 and slot 4 are connected using a stack cable



Step 3 Remove stack cables.

As shown in Figure 5-3, remove the stack cable between the standby switch 2 and slave switch 3. Then the master switch 1, standby switch 2, and slave switches 3 and 4 form a stack with a chain topology. The new stack cable between the standby switch 2 and slave switch 4 is still Down.

Remove the stack cable between slave switches 3 and 4. Then the new stack cable becomes Up, and the master switch 1, standby switch 2, and slave switch 3 form a stack with a ring topology, as shown in Figure 5-4.

Figure 5-3 Removing the stack cable between standby switch 2 and slave switch 3

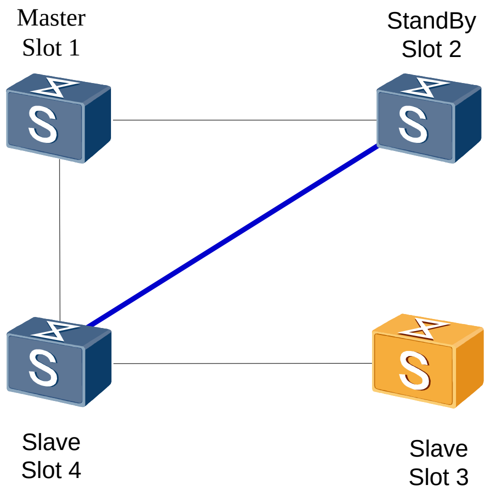
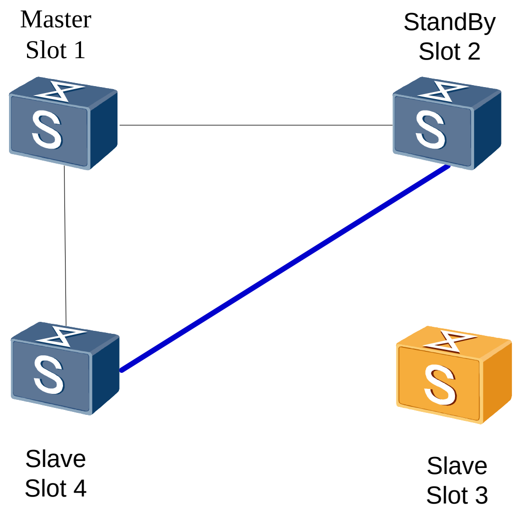


Figure 5-4 Networking after the isolation of a slave switch



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6 FAQ

6.1 Can I Log In to a Standby or Slave Switch from Its Console Port or Management Interface?

You can log in to a stack from the console port or management interface of any member switch to manage the stack.

6.2 How Can I Determine Which Member Switch Is the Master of a Stack Without Logging In to the Stack?

A device has a mode switching button, which can set the device mode. Press this button on the device to set the device mode to stack. If the Stack indicator on the device blinks, this device is the master of the stack.

6.3 How Can I Check the Stack ID of a Box Switch Through Indicators?

Press the mode switching button on the front panel of the switch. When the mode switching button turns red, the port indicator on the front panel indicates the stack ID of the switch.

When checking the stack ID of a box switch, note the following:

- Non-master switch:
  - Switch with the stack ID ranging from 1 to 8: The sequence number of the port indicator that is steady on indicates the stack ID of the switch. For example, if the first port indicator is steady on, the stack ID is 1. If the second port indicator is steady on, the stack ID is 2.
  - Switch with stack ID 0: The number of port indicators that are steady on indicates the number of member devices supported by the product. For example, if the first nine port indicators are steady on, the product supports nine member switches in a stack, and the stack ID of the local switch is 0.
- Master switch: The stack ID indicator is blinking. The method to check the stack ID on the master switch is the same as that used on non-master switches.

6.4 What Is the Bandwidth Limitation on the S5700-SI&S5700-EI?

The S5700-SI&S5700-EI subcards in the front slot and rear slot use the same chip that provides 4x10 Gbit/s bandwidth.

A stack card can be used with a 2x10G subcard. Two stack interfaces on the stack card occupy 20 Gbit/s bandwidth, and the 2x10G subcard occupies 20 Gbit/s. A stack card cannot be used with a 4x10GE subcard. The 10GE interfaces on the 4x10GE subcard are actually 10GE interfaces with their rates limited, so the actual bandwidth of the subcard is 4x10 Gbit/s. This subcard occupies all the 4x10 Gbit/s bandwidth of the chip, so there is no available bandwidth for the stack card.