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Enterprise

HPE FlexFabric 5950 Switch Series

IRF Configuration Guide

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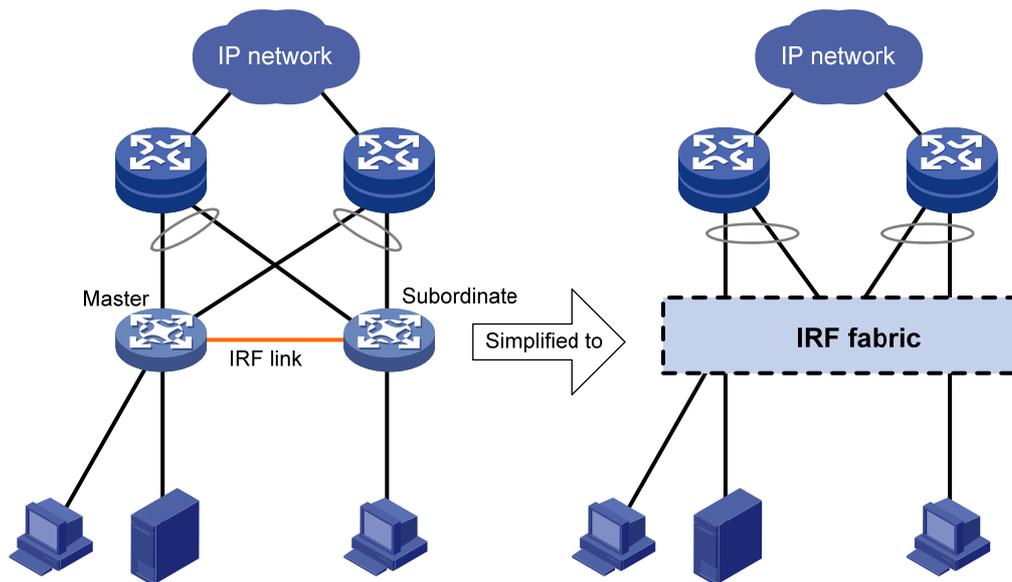
Setting up an IRF fabric

Overview

The Intelligent Resilient Framework (IRF) technology virtualizes multiple physical devices at the same layer into one virtual fabric to provide data center class availability and scalability. IRF virtualization technology offers processing power, interaction, unified management, and uninterrupted maintenance of multiple devices.

Figure 1 shows an IRF fabric that has two devices, which appear as a single node to the upper-layer and lower-layer devices.

Figure 1 IRF application scenario



IRF provides the following benefits:

- **Simplified topology and easy management**—An IRF fabric appears as one node and is accessible at a single IP address on the network. You can use this IP address to log in at any member device to manage all the members of the IRF fabric. In addition, you do not need to run the spanning tree feature among the IRF members.
- **1:N redundancy**—In an IRF fabric, one member acts as the master to manage and control the entire IRF fabric. All the other members process services while backing up the master. When the master fails, all the other member devices elect a new master from among them to take over without interrupting services.
- **IRF link aggregation**—You can assign several physical links between neighboring members to their IRF ports to create a load-balanced aggregate IRF connection with redundancy.
- **Multichassis link aggregation**—You can use the Ethernet link aggregation feature to aggregate the physical links between the IRF fabric and its upstream or downstream devices across the IRF members.
- **Network scalability and resiliency**—Processing capacity of an IRF fabric equals the total processing capacities of all the members. You can increase ports, network bandwidth, and processing capacity of an IRF fabric simply by adding member devices without changing the network topology.

Network topology

An IRF fabric can use a daisy-chain or ring topology. IRF does not support the full mesh topology. For information about connecting IRF member devices, see ["Connecting IRF physical interfaces."](#)

Basic concepts

IRF member roles

IRF uses two member roles: master and standby (called subordinate throughout the documentation).

When devices form an IRF fabric, they elect a master to manage and control the IRF fabric, and all the other devices back up the master. When the master device fails, the other devices automatically elect a new master. For more information about master election, see ["Master election."](#)

IRF member ID

An IRF fabric uses member IDs to uniquely identify and manage its members. This member ID information is included as the first part of interface numbers and file paths to uniquely identify interfaces and files in an IRF fabric. For more information about interface and file path naming, see ["Interface naming conventions"](#) and ["File system naming conventions."](#)

Two devices cannot form an IRF fabric if they use the same member ID. A device cannot join an IRF fabric if its member ID has been used in the fabric.

IRF port

An IRF port is a logical interface that connects IRF member devices. Every IRF-capable device has two IRF ports. The IRF ports are named IRF-port $n/1$ and IRF-port $n/2$, where n is the member ID of the switch. The two IRF ports are referred to as IRF-port 1 and IRF-port 2 in this book.

To use an IRF port, you must bind a minimum of one physical interface to it. The physical interfaces assigned to an IRF port automatically form an aggregate IRF link. An IRF port goes down when all its IRF physical interfaces are down.

IRF physical interface

IRF physical interfaces connect IRF member devices and must be bound to an IRF port. They forward traffic between member devices, including IRF protocol packets and data packets that must travel across IRF member devices.

For more information about physical interfaces that can be used for IRF links, see ["IRF physical interface requirements."](#)

MAD

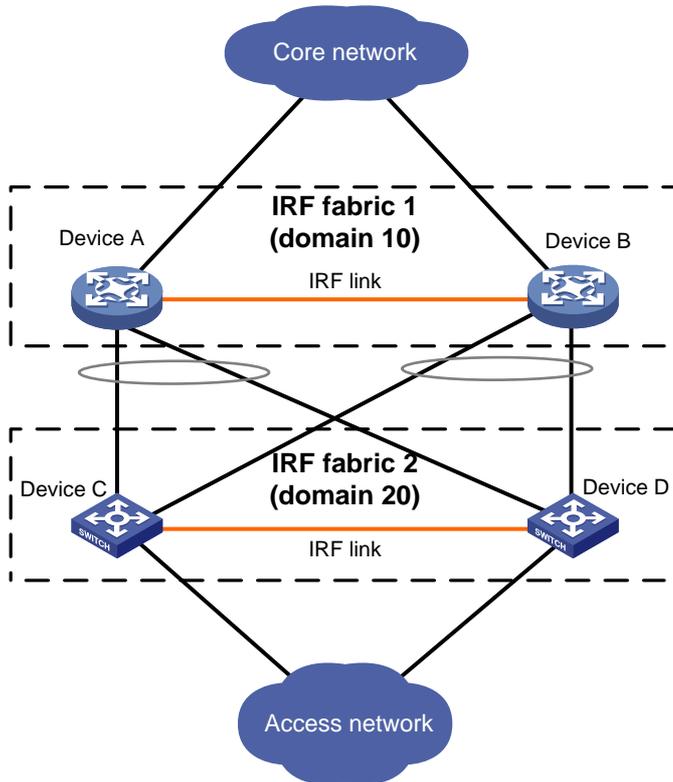
An IRF link failure causes an IRF fabric to split in two IRF fabrics operating with the same Layer 3 settings, including the same IP address. To avoid IP address collision and network problems, IRF uses multi-active detection (MAD) mechanisms to detect the presence of multiple identical IRF fabrics, handle collisions, and recover from faults.

IRF domain ID

One IRF fabric forms one IRF domain. IRF uses IRF domain IDs to uniquely identify IRF fabrics and prevent IRF fabrics from interfering with one another.

As shown in [Figure 2](#), IRF fabric 1 contains Device A and Device B, and IRF fabric 2 contains Device C and Device D. Both fabrics use the LACP aggregate links between them for MAD. When a member device receives an extended LACPDU for MAD, it checks the domain ID to see whether the packet is from the local IRF fabric. Then, the device can handle the packet correctly.

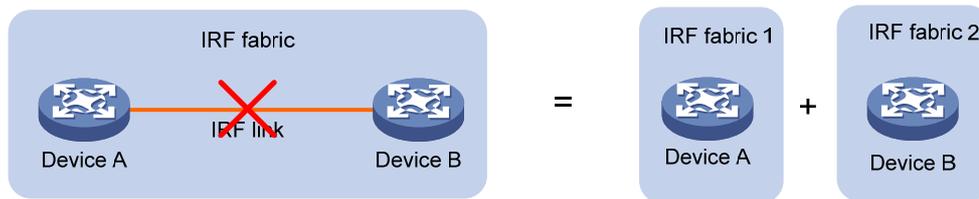
Figure 2 A network that contains two IRF domains



IRF split

IRF split occurs when an IRF fabric breaks up into multiple IRF fabrics because of IRF link failures, as shown in Figure 3. The split IRF fabrics operate with the same IP address. IRF split causes routing and forwarding problems on the network. To quickly detect a multi-active collision, configure a minimum of one MAD mechanism (see "Configuring MAD").

Figure 3 IRF split



IRF merge

IRF merge occurs when two split IRF fabrics reunite or when two independent IRF fabrics are united, as shown in Figure 4.

Figure 4 IRF merge



Member priority

Member priority determines the possibility of a member device to be elected the master. A member with higher priority is more likely to be elected the master.

Interface naming conventions

An interface is named in the *chassis-id/slot-number/port-index* format.

- *chassis-id*—IRF member ID of the device. This argument defaults to 1. The IRF member ID always takes effect, whether or not the device has formed an IRF fabric with other devices. If the device is alone, the device is regarded a one-chassis IRF fabric.
- *slot-number*—Slot number of the front panel. This argument is fixed at 0.
- *port-index*—Index of the port on the device. Port index depends on the number of ports available on the device. To identify the index of a port, examine its port index mark on the chassis.

For example:

- On the single-chassis IRF fabric **Sysname**, HundredGigE 1/0/1 represents the first port on the device. Set its link type to trunk, as follows:

```
<Sysname> system-view
[Sysname] interface hundredgige 1/0/1
[Sysname-HundredGigE1/0/1] port link-type trunk
```

- On the multi-chassis IRF fabric **Master**, HundredGigE 3/0/1 represents the first port on member device 3. Set its link type to trunk, as follows:

```
<Master> system-view
[Master] interface hundredgige 3/0/1
[Master-HundredGigE3/0/1] port link-type trunk
```

File system naming conventions

On a single-chassis fabric, you can use its storage device name to access its file system.

On a multichassis IRF fabric, you can use the storage device name to access the file system of the master. To access the file system of any other member device, use the name in the *slotmember-ID#storage-device-name* format.

For example:

To access the **test** folder under the root directory of the flash memory on the master device:

```
<Master> mkdir test
Creating directory flash:/test... Done.
<Master> dir
Directory of flash:
 0 -rw-   43548660 Jan 01 2011 08:21:29  system.ipe
 1 drw-         - Jan 01 2011 00:00:30  diagfile
 2 -rw-     567 Jan 02 2011 01:41:54  dsakey
 3 -rw-    735 Jan 02 2011 01:42:03  hostkey
 4 -rw-     36 Jan 01 2011 00:07:52  ifindex.dat
 5 -rw-      0 Jan 01 2011 00:53:09  lauth.dat
 6 drw-         - Jan 01 2011 06:33:55  log
 7 drw-         - Jan 02 2000 00:00:07  logfile
 8 -rw-  23724032 Jan 01 2011 00:49:47  switch-cmw710-system.bin
 9 drw-         - Jan 01 2000 00:00:07  seclog
```

```

10 -rw-          591 Jan 02 2011 01:42:03  serverkey
11 -rw-          4609 Jan 01 2011 00:07:53  startup.cfg
12 -rw-          3626 Jan 01 2011 01:51:56  startup.cfg_bak
13 -rw-         78833 Jan 01 2011 00:07:53  startup.mdb
14 drw-           - Jan 01 2011 00:15:48  test
25 drw-           - Jan 01 2011 04:16:53  versionInfo

```

1048576 KB total (889580 KB free)

To create and access the **test** folder under the root directory of the flash memory on member device 3:

```

<Master> mkdir slot3#flash:/test
Creating directory slot3#flash:/test... Done.
<Master> cd slot3#flash:/test
<Master> pwd
slot3#flash:/test

```

Or:

```

<Master> cd slot3#flash:/
<Master> mkdir test
Creating directory slot3#flash:/test... Done.

```

To copy the file **test.ipe** on the master to the root directory of the flash memory on member device 3:

Display the current working path. In this example, the current working path is the root directory of the flash memory on member device 3.

```

<Master> pwd
slot3#flash:

```

Change the current working path to the root directory of the flash memory on the master device.

```

<Master> cd flash:/
<Master> pwd
flash:

```

Copy the file to member device 3.

```

<Master> copy test.ipe slot3#flash:/
Copy flash:/test.ipe to slot3#flash:/test.ipe?[Y/N]:y
Copying file flash:/test.ipe to slot3#flash:/test.ipe... Done.

```

For more information about storage device naming conventions, see *Fundamentals Configuration Guide*.

Configuration synchronization

IRF uses a strict running-configuration synchronization mechanism. In an IRF fabric, all devices obtain and run the running configuration of the master. Configuration changes are automatically propagated from the master to the remaining devices. The configuration files of these devices are retained, but the files do not take effect. The devices use their own startup configuration files only after they are removed from the IRF fabric.

For more information about configuration management, see *Fundamentals Configuration Guide*.

Loop elimination mechanism

Loop control protocols such as the spanning tree feature cannot be configured on IRF physical interfaces. However, IRF has its own mechanism to eliminate loops. Before an IRF member device

forwards a packet, it identifies whether loops exist on the forwarding path based on the source and destination physical interfaces and the IRF topology. If a loop exists, the device discards the packet on the source interface of the looped path. This loop elimination mechanism will drop a large number of broadcast packets on the IRF physical interfaces. When you use SNMP tools, do not monitor packet forwarding on the IRF physical interfaces to reduce SNMP notifications of packet drops.

Master election

Master election occurs each time the IRF fabric topology changes in the following situations:

- The IRF fabric is established.
- The master device fails or is removed.
- The IRF fabric splits.
- Independent IRF fabrics merge.

NOTE:

Master election does not occur when two split IRF fabrics merge.

Master election selects a master in descending order:

1. Current master, even if a new member has higher priority.
When an IRF fabric is being formed, all members consider themselves as the master. This rule is skipped.
2. Member with higher priority.
3. Member with the longest system uptime.
Two members are considered to start up at the same time if the difference between their startup times is equal to or less than 10 minutes. For these members, the next tiebreaker applies.
4. Member with the lowest CPU MAC address.

For the setup of a new IRF fabric, the subordinate devices must reboot to complete the setup after the master election.

For an IRF merge, devices must reboot if they are in the IRF fabric that fails the master election.

Multi-active handling procedure

The multi-active handling procedure includes detection, collision handling, and failure recovery.

Detection

MAD identifies each IRF fabric with a domain ID and an active ID (the member ID of the master). If multiple active IDs are detected in a domain, MAD determines that an IRF collision or split has occurred.

For more information about the MAD mechanisms and their application scenarios, see "[MAD mechanisms](#)."

Collision handling

When MAD detects a multi-active collision, it sets all IRF fabrics except one to the Recovery state. The fabric that is not placed in Recovery state can continue to forward traffic. The Recovery-state IRF fabrics are inactive and cannot forward traffic.

LACP MAD and BFD MAD use the following process to handle a multi-active collision:

1. Compare the number of members in each fabric.
2. Set all fabrics to the Recovery state except the one that has the most members.
3. Compare the member IDs of the masters if all IRF fabrics have the same number of members.

4. Set all fabrics to the Recovery state except the one that has the lowest numbered master.
5. Shut down all physical network ports in the Recovery-state fabrics except for the following ports:
 - o IRF physical interfaces.
 - o Ports you have specified with the **mad exclude interface** command.

In contrast, ARP MAD and ND MAD do not compare the number of members in fabrics. These MAD mechanisms use the following process to handle a multi-active collision:

6. Compare the member IDs of the masters in the IRF fabrics.
7. Set all fabrics to the Recovery state except the one that has the lowest numbered master.
8. Take the same action on the network ports in Recovery-state fabrics as LACP MAD and BFD MAD.

Failure recovery

To merge two split IRF fabrics, first repair the failed IRF link and remove the IRF link failure.

- If the IRF fabric in Recovery state fails before the failure is recovered, repair the failed IRF fabric and the failed IRF link.
- If the active IRF fabric fails before the failure is recovered, enable the inactive IRF fabric to take over the active IRF fabric. Then, recover the MAD failure.

MAD mechanisms

IRF provides MAD mechanisms by extending LACP, BFD, ARP, and IPv6 ND. You can configure a minimum of one MAD mechanism on an IRF fabric for prompt IRF split detection.

- Do not configure LACP MAD together with ARP MAD or ND MAD, because they handle collisions differently.
- Do not configure BFD MAD together with ARP MAD or ND MAD. BFD MAD is mutually exclusive with the spanning tree feature, but ARP MAD and ND MAD require the spanning tree feature. At the same time, BFD MAD handles collisions differently than ARP MAD and ND MAD.

Table 1 compares the MAD mechanisms and their application scenarios.

Table 1 Comparison of MAD mechanisms

MAD mechanism	Advantages	Disadvantages	Application scenario
LACP MAD	<ul style="list-style-type: none"> • Detection speed is fast. • Does not require MAD-dedicated physical links or Layer 3 interfaces. 	Requires an intermediate device that supports extended LACP for MAD.	<p>Link aggregation is used between the IRF fabric and its upstream or downstream device.</p> <p>For information about LACP, see <i>Layer 2—LAN Switching Configuration Guide</i>.</p>
BFD MAD	<ul style="list-style-type: none"> • Detection speed is fast. • No intermediate device is required. • Intermediate device, if used, can come from any vendor. 	<ul style="list-style-type: none"> • Requires MAD dedicated physical links and Layer 3 interfaces, which cannot be used for transmitting user traffic. • If no intermediate device is used, any two IRF members must have a BFD MAD link to each other. • If an intermediate 	<ul style="list-style-type: none"> • No special requirements for network scenarios. • If no intermediate device is used, this mechanism is only suitable for IRF fabrics that have a small number of members that are geographically close to one

MAD mechanism	Advantages	Disadvantages	Application scenario
		device is used, every IRF member must have a BFD MAD link to the intermediate device.	another. For information about BFD, see <i>High Availability Configuration Guide</i> .
ARP MAD	<ul style="list-style-type: none"> No intermediate device is required. Intermediate device, if used, can come from any vendor. Does not require MAD dedicated ports. 	<ul style="list-style-type: none"> Detection speed is slower than BFD MAD and LACP MAD. The spanning tree feature must be enabled if common Ethernet ports are used for ARP MAD links. 	<p>If common Ethernet ports are used, this MAD mechanism is applicable only to the spanning tree-enabled non-link aggregation IPv4 network scenario.</p> <p>For information about ARP, see <i>Layer 3—IP Services Configuration Guide</i>.</p>
ND MAD	<ul style="list-style-type: none"> No intermediate device is required. Intermediate device, if used, can come from any vendor. Does not require MAD dedicated ports. 	<ul style="list-style-type: none"> Detection speed is slower than BFD MAD and LACP MAD. The spanning tree feature must be enabled. 	<p>Spanning tree-enabled non-link aggregation IPv6 network scenario.</p> <p>For information about ND, see <i>Layer 3—IP Services Configuration Guide</i>.</p>

LACP MAD

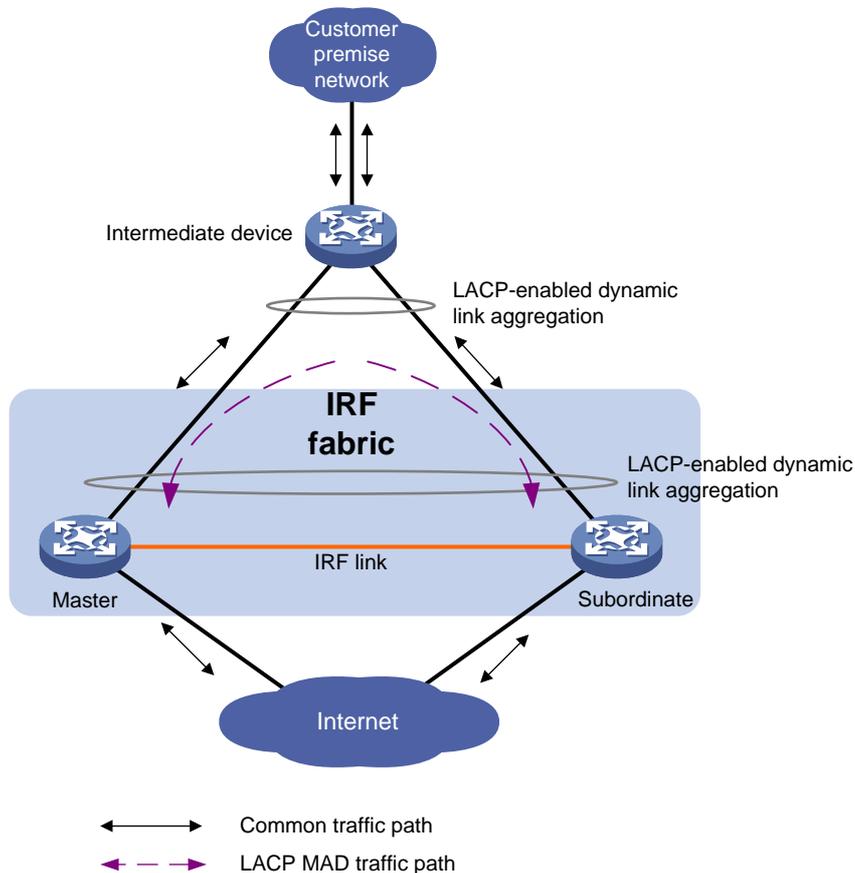
As shown in [Figure 5](#), LACP MAD has the following requirements:

- Every IRF member must have a link with an intermediate device.
- All the links form a dynamic link aggregation group.
- The intermediate device must be a device that supports extended LACP for MAD.

The IRF member devices send extended LACPDUs that convey a domain ID and an active ID. The intermediate device transparently forwards the extended LACPDUs received from one member device to all the other member devices.

- If the domain IDs and active IDs sent by all the member devices are the same, the IRF fabric is integrated.
- If the extended LACPDUs convey the same domain ID but different active IDs, a split has occurred. LACP MAD handles this situation as described in "[Collision handling](#)."

Figure 5 LACP MAD scenario



BFD MAD

You can use common or management Ethernet ports for BFD MAD links.

- If management Ethernet ports are used, BFD MAD must work with an intermediate device. Make sure the following requirements are met:
 - Each IRF member device has a BFD MAD link to an intermediate device.
 - Each member device is assigned a MAD IP address on the master's management Ethernet port.
- If common Ethernet ports are used, BFD MAD has the following requirements:
 - Each member device has a BFD MAD link to an intermediate device, or all member devices have a BFD MAD link to each other.
 - Each member device is assigned a MAD IP address on a VLAN interface.

The BFD MAD links must be dedicated. Do not use BFD MAD links for any other purposes.

NOTE:

- The MAD addresses identify the member devices and must belong to the same subnet.
 - Of all management Ethernet ports on an IRF fabric, only the master's management Ethernet port is accessible.
-

Figure 6 shows a typical BFD MAD scenario that uses an intermediate device. Figure 7 shows a typical BFD MAD scenario that does not use an intermediate device.

With BFD MAD, the master attempts to establish BFD sessions with other member devices by using its MAD IP address as the source IP address.

- If the IRF fabric is integrated, only the MAD IP address of the master takes effect. The master cannot establish a BFD session with any other member. If you execute the **display bfd session** command, the state of the BFD sessions is **Down**.
- When the IRF fabric splits, the IP addresses of the masters in the split IRF fabrics take effect. The masters can establish a BFD session. If you execute the **display bfd session** command, the state of the BFD session between the two devices is **Up**.

Figure 6 BFD MAD scenario with an intermediate device

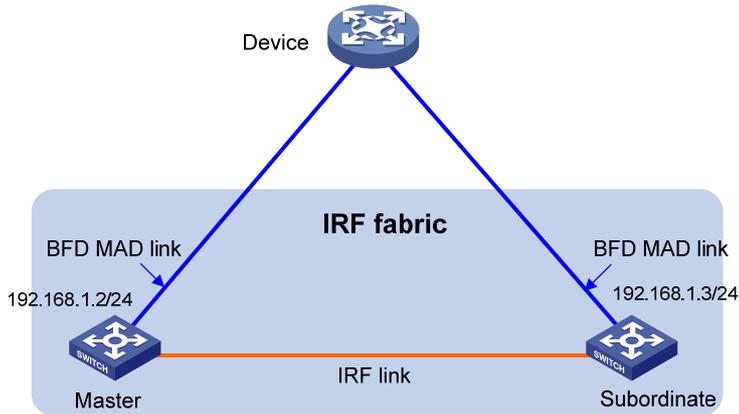
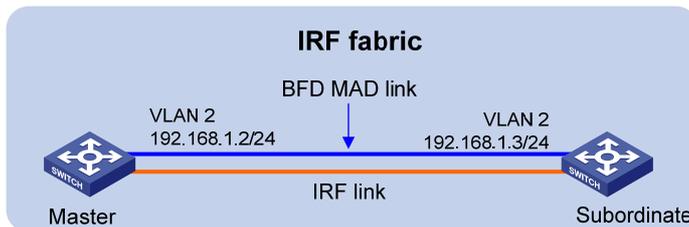


Figure 7 BFD MAD scenario without an intermediate device



ARP MAD

ARP MAD detects multi-active collisions by using extended ARP packets that convey the IRF domain ID and the active ID.

You can use common or management Ethernet ports for ARP MAD.

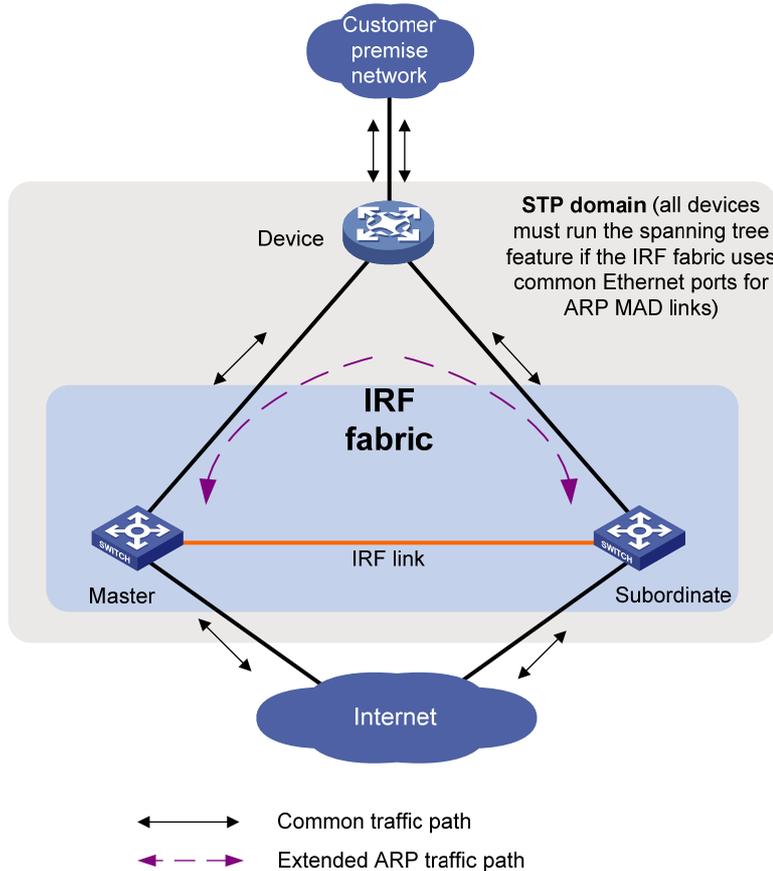
- If management Ethernet ports are used, ARP MAD must work with an intermediate device. Make sure the following requirements are met:
 - Connect the management Ethernet port on each member device to the intermediate device.
 - On the intermediate device, you must assign the ports used for ARP MAD to the same VLAN.
- If common Ethernet ports are used, ARP MAD can work with or without an intermediate device. Make sure the following requirements are met:
 - If an intermediate device is used, connect each IRF member device to the intermediate device. Run the spanning tree feature between the IRF fabric and the intermediate device. In this situation, data links can be used.
 - If an intermediate device is not used, connect each IRF member device to all other member devices. In this situation, IRF links cannot be used for ARP MAD.

Figure 8 shows a typical ARP MAD scenario that uses an intermediate device.

Each IRF member compares the domain ID and the active ID in incoming extended ARP packets with its domain ID and active ID.

- If the domain IDs are different, the extended ARP packet is from a different IRF fabric. The device does not continue to process the packet with the MAD mechanism.
- If the domain IDs are the same, the device compares the active IDs.
 - If the active IDs are different, the IRF fabric has split.
 - If the active IDs are the same, the IRF fabric is integrated.

Figure 8 ARP MAD scenario



ND MAD

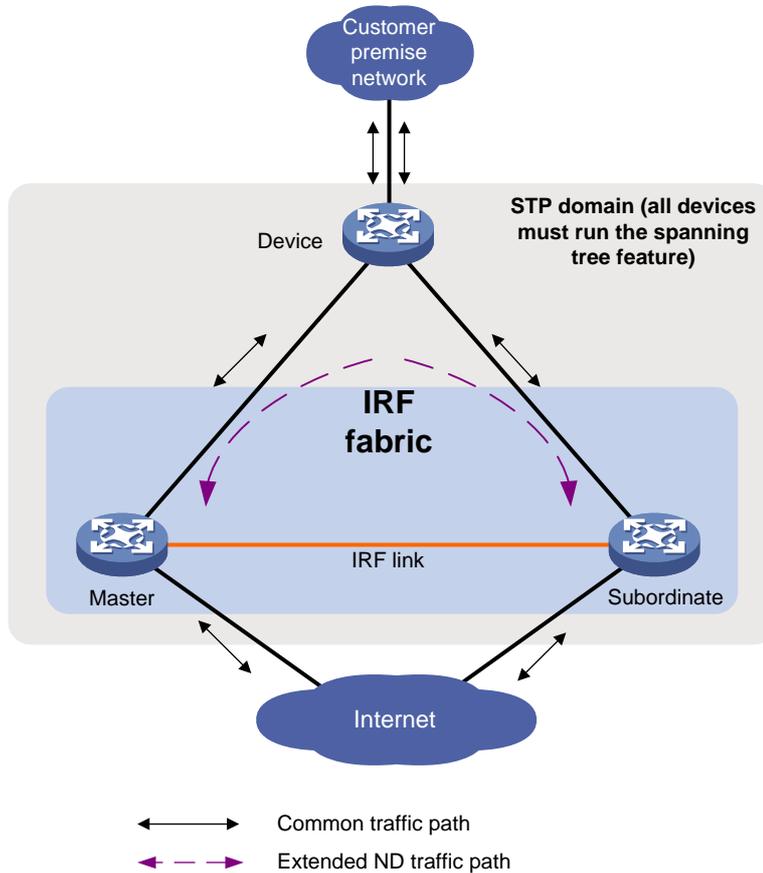
ND MAD detects multi-active collisions by using NS packets to transmit the IRF domain ID and the active ID.

You can set up ND MAD links between neighbor IRF member devices or between each IRF member device and an intermediate device (see [Figure 9](#)). If an intermediate device is used, you must also run the spanning tree protocol between the IRF fabric and the intermediate device.

Each IRF member device compares the domain ID and the active ID in incoming NS packets with its domain ID and active ID.

- If the domain IDs are different, the NS packet is from a different IRF fabric. The device does not continue to process the packet with the MAD mechanism.
- If the domain IDs are the same, the device compares the active IDs.
 - If the active IDs are different, the IRF fabric has split.
 - If the active IDs are the same, the IRF fabric is integrated.

Figure 9 ND MAD scenario



Hardware compatibility

An HPE FlexFabric 5950 switch can form an IRF fabric only with devices in the same series.

General restrictions and configuration guidelines

For a successful IRF setup, follow the restrictions and guidelines in this section and the setup procedure in "[Setup and configuration task list](#)."

Software requirements

All IRF member devices must run the same software image version. Make sure the software auto-update feature is enabled on all member devices.

IRF physical interface requirements

Candidate IRF physical interfaces

Use the SFP+ or QSFP28 ports on the HPE FlexFabric 5950 32QSFP28 Switch (JH321A) or HPE FlexFabric 5950 32QSFP28 TAA-compliant Switch (JH322A) for IRF links.

Selecting physical interface connection media

Use SFP+, QSFP+ to SFP+, QSFP+, or QSFP28 DAC cables for IRF connection.

For more information about the DAC cables, see the switch installation guide and *HPE Comware-Based Devices Transceiver Modules User Guide*.

NOTE:

The DAC cables available for the switch are subject to change over time. For the most up-to-date list of DAC cables, contact your Hewlett Packard Enterprise sales representative.

40-GE and 100-GE port restrictions in QSFP28 port slots

You can use a single 40-GE or 100-GE port for IRF links, or use 10-GE breakout interfaces of a 40-GE or 100-GE port for IRF links. To split a 40-GE or 100-GE port, use the **using tengige** command.

When you use the 10-GE breakout interfaces of a 40-GE or 100-GE port for IRF links, follow these restrictions and guidelines:

- Use all or none of the 10-GE breakout interfaces for IRF links. The breakout interfaces can be bound to different IRF ports.
- Before you bind one 10-GE breakout interface to an IRF port, shut down all the 10-GE breakout interfaces that have not been bound to IRF ports. If any of the unbound breakout interfaces are in up state, the bind action will fail.
- Before you remove one 10-GE breakout interface from an IRF port, you must shut down all the 10-GE breakout interfaces. If any of the breakout interfaces are in up state, the remove action will fail.
- Bring up the breakout interfaces after you complete the bind operation. If any breakout interfaces are not bound to an IRF port, these unbound breakout interfaces cannot be brought up.

Connecting IRF ports

When you connect two neighboring IRF members, connect the physical interfaces of IRF-port 1 on one member to the physical interfaces of IRF-port 2 on the other.

Feature compatibility and configuration restrictions

Make sure the feature settings in [Table 2](#) are the same across member devices.

Table 2 IRF and feature compatibility

Feature	Command	Remarks
Enhanced ECMP mode	ecmp mode enhanced	See <i>Layer 3—IP Routing Configuration Guide</i> .
Maximum number of ECMP routes	max-ecmp-num	See <i>Layer 3—IP Routing Configuration Guide</i> .
Table capacity mode	switch-mode	See <i>Fundamentals Configuration Guide</i> .
Support for the IPv6 routes with prefixes longer than 64 bits	switch-routing-mode ipv6-128	See <i>Layer 3—IP Routing Configuration Guide</i> .
System operating mode	system-working-mode	See <i>Fundamentals Configuration Guide</i> .

Configuration backup

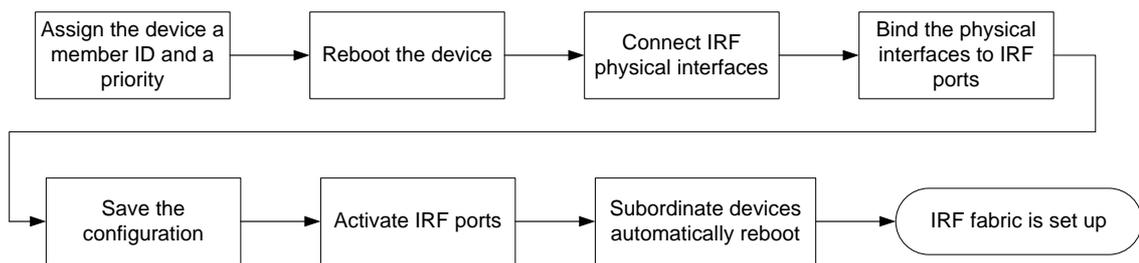
As a best practice, back up the next-startup configuration file on a device before adding the device to an IRF fabric as a subordinate.

A subordinate device's next-startup configuration file might be overwritten if the master and the subordinate use the same file name for their next-startup configuration files. You can use the backup file to restore the original configuration after removing the subordinate from the IRF fabric.

Setup and configuration task list

As a best practice, use the basic IRF setup procedure in [Figure 10](#). Perform the tasks in this figure on each member device.

Figure 10 Basic IRF setup flow chart



To set up an IRF fabric:

Tasks at a glance	Remarks
1. (Required.) Planning the IRF fabric setup	N/A
2. (Required.) Assigning a member ID to each IRF member device	Perform this task on each member device.
3. (Optional.) Specifying a priority for each member device	Perform this task on one or multiple member devices to affect the master election result.
4. (Required.) Connecting IRF physical interfaces	N/A
5. (Required.) Binding physical interfaces to IRF ports	Perform this task on each member device. When you complete IRF port binding and activation on all IRF member devices, the IRF fabric is formed.
6. (Required.) Accessing the IRF fabric	When you log in to the IRF fabric, you are placed at the master's CLI, where you complete subsequent IRF settings and configure other features for the member devices as if they were one device.
7. (Optional.) Bulk-configuring basic IRF settings for a member device	Perform this task to bulk-configure the member ID, domain ID, priority, and IRF port bindings for a device.
8. (Optional.) Configuring a member device description	N/A

Tasks at a glance	Remarks
9. (Optional.) Configuring IRF link load sharing mode: <ul style="list-style-type: none"> ○ Configuring the global load sharing mode ○ Configuring a port-specific load sharing mode 	N/A
10. (Optional.) Configuring IRF bridge MAC persistence	N/A
11. (Optional.) Enabling software auto-update for software image synchronization	As a best practice, enable software auto-update to ensure system software image synchronization.
12. (Optional.) Setting the IRF link down report delay	N/A
13. (Required.) Configuring MAD: <ul style="list-style-type: none"> ○ Configuring LACP MAD ○ Configuring BFD MAD ○ Configuring ARP MAD ○ Configuring ND MAD ○ Excluding a port from the shutdown action upon detection of multi-active collision 	MAD mechanisms are independent of one another. You can configure multiple MAD mechanisms for an IRF fabric.
14. (Optional.) Recovering an IRF fabric	N/A

Planning the IRF fabric setup

Consider the following items when you plan an IRF fabric:

- Hardware compatibility and restrictions.
- IRF fabric size.
- Master device.
- IRF physical interfaces.
- Member ID and priority assignment scheme.
- Fabric topology and cabling scheme.

For more information about hardware and cabling, see the device installation guide.

Assigning a member ID to each IRF member device

CAUTION:

In an IRF fabric, changing IRF member IDs might cause undesirable configuration changes and data loss. Before you do that, back up the configuration, and make sure you fully understand the impact on your network. For example, all member switches in an IRF fabric are the same model. If you swapped the IDs of any two members, their interface settings would also be swapped.

To create an IRF fabric, you must assign a unique IRF member ID to each member device.

To prevent any undesirable configuration change or data loss, avoid changing member IDs after the IRF fabric is formed.

The new member ID takes effect at a reboot. After the device reboots, the settings on all member ID-related physical resources (including common physical network ports) are removed, regardless of whether you have saved the configuration.

To assign a member ID to a device:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Assign a member ID to a member device.	irf member <i>member-id</i> renumber <i>new-member-id</i>	The default IRF member ID is 1.
3. (Optional.) Save the configuration.	save	If you have bound physical interfaces to IRF ports or assigned member priority, you must perform this step for these settings to take effect after the reboot.
4. Reboot the device.	reboot [slot <i>slot-number</i>] [force]	N/A

Specifying a priority for each member device

IRF member priority represents the possibility for a device to be elected the master in an IRF fabric. A larger priority value indicates a higher priority.

A change to member priority affects the election result at the next master election, but it does not cause an immediate master re-election.

To specify a priority for a member device:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Specify a priority for the device.	irf member <i>member-id</i> priority <i>priority</i>	The default IRF member priority is 1.

Connecting IRF physical interfaces

When you connect two neighboring IRF members, connect the physical interfaces of IRF-port 1 on one member to the physical interfaces of IRF-port 2 on the other (see [Figure 11](#)).

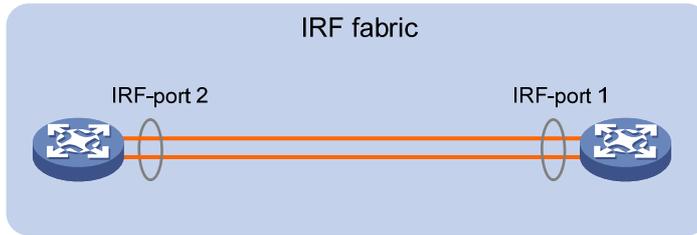
For example, you have four chassis: A, B, C, and D. IRF-port 1 and IRF-port 2 are represented by A1 and A2 on chassis A, represented by B1 and B2 on chassis B, and so on. To connect the four chassis into a ring topology of A-B-C-D(A), the IRF link cabling scheme must be one of the following:

- A1-B2, B1-C2, C1-D2, and D1-A2.
- A2-B1, B2-C1, C2-D1, and D2-A1.

ⓘ IMPORTANT:

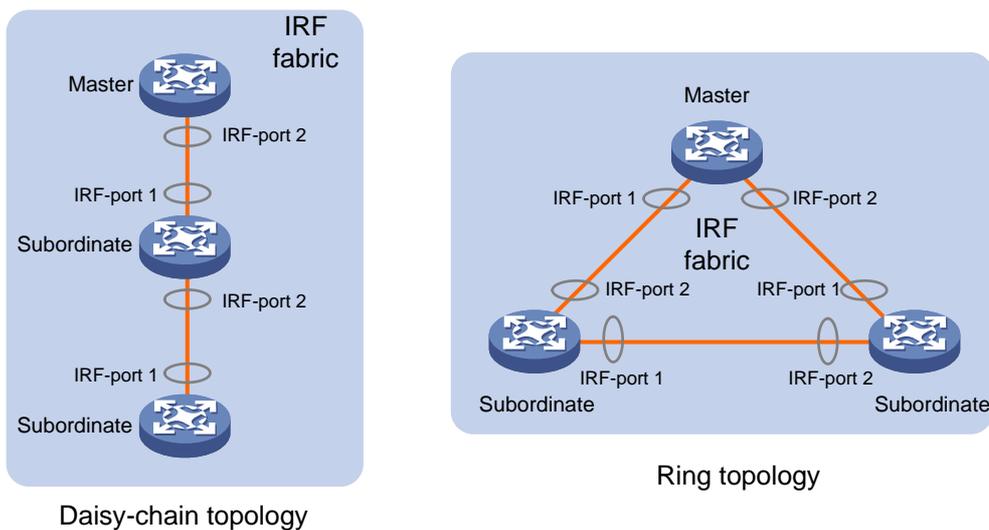
No intermediate devices are allowed between neighboring members.

Figure 11 Connecting IRF physical interfaces



Connect the devices into a daisy-chain topology or a ring topology. A ring topology is more reliable (see [Figure 12](#)). In ring topology, the failure of one IRF link does not cause the IRF fabric to split as in daisy-chain topology. Rather, the IRF fabric changes to a daisy-chain topology without interrupting network services.

Figure 12 Daisy-chain topology vs. ring topology



Binding physical interfaces to IRF ports

When you bind physical interfaces to IRF ports, follow the restrictions in "[IRF physical interface requirements](#)."

On a physical interface bound to an IRF port, you can execute only the following commands:

- Interface commands:
 - **description.**
 - **flow-interval.**
 - **shutdown.**
- LLDP commands:
 - **lldp admin-status.**
 - **lldp check-change-interval.**
 - **lldp enable.**
 - **lldp encapsulation snap.**
 - **lldp notification remote-change enable.**
 - **lldp tlv-enable.**

For more information about these commands, see *Layer 2—LAN Switching Command Reference*.

To bind physical interfaces to IRF ports:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Enter interface view or interface range view.	<ul style="list-style-type: none"> • Enter interface range view: <ul style="list-style-type: none"> ○ Method 1: interface range { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24> ○ Method 2: interface range name name [interface { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24>] • Enter interface view: interface <i>interface-type</i> <i>interface-number</i> 	<p>To shut down a range of IRF physical interfaces, enter interface range view.</p> <p>To shut down one IRF physical interface, enter its interface view.</p>
3. Shut down the physical interfaces.	shutdown	By default, all physical interfaces are up.
4. Return to system view.	quit	N/A
5. Enter IRF port view.	irf-port <i>member-id/irf-port-number</i>	N/A
6. Bind each physical interface to the IRF port.	port group interface <i>interface-type</i> <i>interface-number</i>	<p>By default, no physical interfaces are bound to an IRF port.</p> <p>Repeat this step to assign multiple physical interfaces to the IRF port.</p> <p>You can bind a maximum of eight physical interfaces to an IRF port.</p>
7. Return to system view.	quit	N/A
8. Enter interface view or interface range view.	<ul style="list-style-type: none"> • Enter interface range view: <ul style="list-style-type: none"> ○ Method 1: interface range { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24> ○ Method 2: interface range name name [interface { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24>] • Enter interface view: interface <i>interface-type</i> <i>interface-number</i> 	N/A
9. Bring up the physical interfaces.	undo shutdown	N/A

Step	Command	Remarks
10. Return to system view.	quit	N/A
11. Save the configuration.	save	Activating IRF port configurations causes IRF merge and reboot. To avoid data loss, save the running configuration to the startup configuration file before you perform the operation.
12. Activate the IRF port settings.	irf-port-configuration active	After this step is performed, the state of the IRF port changes to UP, the member devices elect a master automatically, and the subordinate device reboots automatically. After the IRF fabric is formed, you can add additional physical interfaces to an IRF port (in UP state) without repeating this step.

Accessing the IRF fabric

The IRF fabric appears as one device after it is formed. You configure and manage all IRF members at the CLI of the master. All settings you have made are propagated to the IRF members automatically.

The following methods are available for accessing an IRF fabric:

- **Local login**—Log in through the console port of any member device.
- **Remote login**—Log in at a Layer 3 interface on any member device by using methods including Telnet and SNMP.

When you log in to an IRF fabric, you are placed at the CLI of the master, regardless of at which member device you are logged in.

For more information, see login configuration in *Fundamentals Configuration Guide*.

Bulk-configuring basic IRF settings for a member device

ⓘ **IMPORTANT:**

The member device reboots immediately after you specify a new member ID for it. Make sure you are aware of the impact on the network.

Use the easy IRF feature to bulk-configure basic IRF settings for a member device, including the member ID, domain ID, priority, and IRF port bindings.

The easy IRF feature provides the following configuration methods:

- **Interactive method**—Enter the **easy-irf** command without parameters. The system will guide you to set the parameters step by step.
- **Non-interactive method**—Enter the **easy-irf** command with parameters.

As a best practice, use the interactive method if you are new to IRF.

When you specify IRF physical interfaces for an IRF port, you must follow the IRF port binding restrictions in "IRF physical interface requirements."

If you specify IRF physical interfaces by using the interactive method, you must also follow these restrictions and guidelines:

- Do not enter spaces between the interface type and interface number.
- Use a comma (,) to separate two physical interfaces. No spaces are allowed between interfaces.

To bulk-configure basic IRF settings for a device:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Bulk-configure basic IRF settings for the device.	easy-irf [member <i>member-id</i> [renumber <i>new-member-id</i>] domain <i>domain-id</i> [priority <i>priority</i>] [irf-port1 <i>interface-list1</i>] [irf-port2 <i>interface-list2</i>]]	<p>Make sure the new member ID is unique in the IRF fabric to which the device will be added.</p> <p>If you execute this command multiple times, the following settings take effect:</p> <ul style="list-style-type: none"> • The most recent settings for the member ID, domain ID, and priority. • IRF port bindings added through executions of the command. You can bind a maximum of eight physical interfaces to an IRF port. <p>To remove an IRF physical interface from an IRF port, you must use the undo port group interface command in IRF port view.</p>

Configuring a member device description

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Configure a description for a member device.	irf member <i>member-id</i> description <i>text</i>	By default, no member device description is configured.

Configuring IRF link load sharing mode

On an IRF port, traffic is balanced across its physical links.

You can configure the IRF port to distribute traffic based on any combination of the following criteria:

- Source IP addresses.
- Destination IP addresses.
- Source MAC addresses.
- Destination MAC addresses.

The criteria can also be packet types, such as Layer 2, IPv4, and IPv6. If the device does not support a criterion combination, the system displays an error message.

Configure the IRF link load sharing mode for IRF links in system view or IRF port view:

- In system view, the configuration is global and takes effect on all IRF ports.
- In IRF port view, the configuration is port specific and takes effect only on the specified IRF port.

An IRF port preferentially uses the port-specific load sharing mode. If no port-specific load sharing mode is available, the IRF port uses the global load sharing mode.

The IRF link load sharing mode takes effect on all types of packets, including unicast, multicast, and broadcast.

Configuring the global load sharing mode

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Configure the global IRF link load sharing mode.	irf-port global load-sharing mode { destination-ip destination-mac source-ip source-mac } *	By default, packets are distributed automatically across IRF member links based on packet types. If you execute this command multiple times, the most recent configuration takes effect.

Configuring a port-specific load sharing mode

Before you configure a port-specific load sharing mode, make sure you have bound a minimum of one physical interface to the IRF port.

To configure a port-specific load sharing mode for an IRF port:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Enter IRF port view.	irf-port <i>member-id/irf-port-number</i>	N/A
3. Configure the port-specific load sharing mode.	irf-port load-sharing mode { destination-ip destination-mac source-ip source-mac } *	By default, the global IRF link load sharing mode is used. If you execute this command multiple times, the most recent configuration takes effect.

Configuring IRF bridge MAC persistence

By default, an IRF fabric uses the bridge MAC address of the master device as its bridge MAC address. Layer 2 protocols, such as LACP, use this bridge MAC address to identify the IRF fabric. On a switched LAN, the bridge MAC address must be unique.

To avoid duplicate bridge MAC addresses, an IRF fabric can change its bridge MAC address automatically after the address owner leaves. However, the change causes temporary traffic disruption.

Depending on the network condition, enable the IRF fabric to retain or change its bridge MAC address after the address owner leaves. Available options include:

- **irf mac-address persistent timer**—Bridge MAC address of the IRF fabric is retained for 6 minutes after the address owner leaves. If the address owner does not return before the timer expires, the IRF fabric uses the bridge MAC address of the current master as its bridge MAC address. This option avoids unnecessary bridge MAC address changes caused by device reboot, transient link failure, or purposeful link disconnection.

- **irf mac-address persistent always**—Bridge MAC address of the IRF fabric does not change after the address owner leaves.
- **undo irf mac-address persistent**—Bridge MAC address of the current master replaces the original IRF bridge MAC address as soon as the owner of the original address leaves.

When IRF fabrics merge, IRF ignores the IRF bridge MAC address and only checks the bridge MAC address of each member device in the IRF fabrics. IRF merge fails if any of the member devices have the same bridge MAC address.

When you configure IRF bridge MAC persistence, follow these restrictions and guidelines:

- If ARP MAD or ND MAD is used, configure the **undo irf mac-address persistent** command to enable immediate bridge MAC address change after the address owner leaves.
- If the IRF fabric uses a daisy-chain topology and has aggregate links with upstream or downstream devices, do not configure the **undo irf mac-address persistent** command. The command setting prevents transmission delay or packet loss after the address owner leaves or reboots.
- If the IRF fabric has cross-member aggregate links, do not use the **undo irf mac-address persistent** command to avoid unnecessary traffic disruption.

To configure the IRF bridge MAC persistence setting:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Configure IRF bridge MAC persistence.	<ul style="list-style-type: none"> • Retain the bridge MAC address even if the address owner has left the fabric: irf mac-address persistent always • Retain the bridge MAC address for 6 minutes after the address owner leaves the fabric: irf mac-address persistent timer • Change the bridge MAC address as soon as the address owner leaves the fabric: undo irf mac-address persistent 	By default, the IRF bridge MAC address remains unchanged for 6 minutes after the address owner leaves the fabric.

Enabling software auto-update for software image synchronization

ⓘ IMPORTANT:

To ensure a successful software auto-update in a multi-user environment, prevent anyone from rebooting member devices during the auto-update process. To inform administrators of the auto-update status, configure the information center to output the status messages to configuration terminals (see *Network Management and Monitoring Configuration Guide*).

The software auto-update feature automatically synchronizes the current software images of the master to devices that are attempting to join the IRF fabric.

To join an IRF fabric, a device must use the same software images as the master in the fabric.

When you add a device to the IRF fabric, software auto-update compares the startup software images of the device with the current software images of the IRF master. If the two sets of images are different, the device automatically performs the following operations:

1. Downloads the current software images of the master.
2. Sets the downloaded images as its main startup software images.
3. Reboots with the new software images to rejoin the IRF fabric.

You must manually update the new device with the software images running on the IRF fabric if software auto-update is disabled.

Configuration prerequisites

Make sure the device you are adding to the IRF fabric has sufficient storage space for the new software images.

If sufficient storage space is not available, the device automatically deletes the current software images. If the reclaimed space is still insufficient, the device cannot complete the auto-update. You must reboot the device, and then access the Boot menus to delete files.

Configuration procedure

To enable automatic software synchronization with the master:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Enable software auto-update.	irf auto-update enable	By default, software auto-update is enabled.

Setting the IRF link down report delay

To prevent frequent IRF splits and merges during link flapping, configure the IRF ports to delay reporting link down events.

An IRF port does not report a link down event to the IRF fabric immediately after its link changes from up to down. If the IRF link state is still down when the delay is reached, the port reports the change to the IRF fabric.

An IRF port does not delay a link up event. It reports the link up event immediately after the IRF link comes up. However, for fiber IRF physical interfaces, the IRF port does not report the link up event immediately to the IRF fabric if the link up event occurs in the following conditions:

1. The IRF link was down because the physical interfaces were shut down by using the **shutdown** command or were disconnected.
2. The IRF link is recovered after you execute the **undo shutdown** command or reconnect the IRF physical interfaces.

In the above conditions, the IRF port reports the link up event to the IRF fabric after the delay time expires.

When you configure the IRF link down report delay, follow these restrictions and guidelines:

- Make sure the IRF link down report delay is shorter than the heartbeat or hello timeout settings of upper-layer protocols (for example, CFD, VRRP, and OSPF). If the report delay is longer than the timeout setting of a protocol, unnecessary recalculations might occur.
- Set the delay to 0 seconds in the following situations:
 - The IRF fabric requires a fast master/subordinate or IRF link switchover.

- The BFD or GR feature is used.
- You want to shut down an IRF physical interface or reboot an IRF member device. (After you complete the operation, reconfigure the delay depending on the network condition.)

To set the IRF link down report delay:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Set the IRF link down report delay.	irf link-delay <i>interval</i>	The default IRF link down report delay is 4 seconds.

Configuring MAD

When you configure MAD, follow these restrictions and guidelines:

- You can configure a minimum of one MAD mechanism on an IRF fabric for prompt IRF split detection.
 - Do not configure LACP MAD together with ARP MAD or ND MAD, because they handle collisions differently.
 - Do not configure BFD MAD together with ARP MAD or ND MAD. BFD MAD is mutually exclusive with the spanning tree feature, but ARP MAD and ND MAD require the spanning tree feature. At the same time, BFD MAD handles collisions differently than ARP MAD and ND MAD.
- If LACP MAD, ARP MAD, or ND MAD runs between two IRF fabrics, assign each fabric a unique IRF domain ID. (For BFD MAD, this task is optional.)
- An IRF fabric has only one IRF domain ID. You can change the IRF domain ID by using the following commands: **irf domain**, **mad enable**, **mad arp enable**, or **mad nd enable**. The IRF domain IDs configured by using these commands overwrite each other.
- To prevent a port from being shut down when the IRF fabric transits to the Recovery state, use the **mad exclude interface** command. To bring up ports in a Recovery-state IRF fabric, use the **mad restore** command instead of the **undo shutdown** command. The **mad restore** command activates the Recovery-state IRF fabric.

Configuring LACP MAD

When you use LACP MAD, follow these guidelines:

- The intermediate device must be a device that supports extended LACP for MAD.
- If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection.
- Use dynamic link aggregation mode. MAD is LACP dependent. Even though LACP MAD can be configured on both static and dynamic aggregate interfaces, it takes effect only on dynamic aggregate interfaces.
- Configure link aggregation settings on the intermediate device.

To configure LACP MAD:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	The default IRF domain ID is 0.
3. Create an aggregate	<ul style="list-style-type: none"> ● Enter Layer 2 aggregate 	Perform this step also on the

Step	Command	Remarks
interface and enter aggregate interface view.	interface view: interface bridge-aggregation <i>interface-number</i> • Enter Layer 3 aggregate interface view: interface route-aggregation <i>interface-number</i>	intermediate device.
4. Configure the aggregation group to operate in dynamic aggregation mode.	link-aggregation mode dynamic	By default, an aggregation group operates in static aggregation mode. Perform this step also on the intermediate device.
5. Enable LACP MAD.	mad enable	By default, LACP MAD is disabled.
6. Return to system view.	quit	N/A
7. Enter Ethernet interface view or interface range view.	<ul style="list-style-type: none"> • Enter interface range view: <ul style="list-style-type: none"> ○ Method 1: interface range { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24> ○ Method 2: interface range name <i>name</i> [interface { <i>interface-type</i> <i>interface-number</i> [to <i>interface-type</i> <i>interface-number</i>] } &<1-24>] • Enter Ethernet interface view: interface <i>interface-type</i> <i>interface-number</i> 	To assign a range of ports to the aggregation group, enter interface range view. To assign one port to the aggregation group, enter Ethernet interface view.
8. Assign the Ethernet port or the range of Ethernet ports to the specified aggregation group.	port link-aggregation group <i>group-id</i>	Multichassis link aggregation is allowed. Also perform this step on the intermediate device.

Configuring BFD MAD

Before you configure BFD MAD, choose a BFD MAD link scheme as described in "[BFD MAD](#)."

As a best practice, connect the BFD MAD links after you finish the BFD MAD configuration.

Configuring BFD MAD that uses common Ethernet ports

Configure BFD MAD on a VLAN interface if you use common Ethernet ports for BFD MAD.

When you configure BFD MAD settings, follow these restrictions and guidelines:

Category	Restrictions and guidelines
BFD MAD VLAN	<ul style="list-style-type: none"> • Do not enable BFD MAD on VLAN-interface 1. • If you are using an intermediate device, perform the following tasks on both the IRF fabric and the intermediate device:

Category	Restrictions and guidelines
	<ul style="list-style-type: none"> ○ Create a VLAN and VLAN interface for BFD MAD. ○ Assign the ports of BFD MAD links to the BFD MAD VLAN. • Make sure the IRF fabrics on the network use different BFD MAD VLANs. • Make sure the BFD MAD VLAN contains only ports on the BFD MAD links. Exclude a port from the BFD MAD VLAN if the port is not on the BFD MAD link. For example, if you have assigned the port to all VLANs by using the port trunk permit vlan all command, use the undo port trunk permit command to exclude the port from the BFD MAD VLAN.
BFD MAD VLAN and feature compatibility	<p>Do not use the BFD MAD VLAN for any purpose other than configuring BFD MAD.</p> <ul style="list-style-type: none"> • Configure only the mad bfd enable and mad ip address commands on the VLAN interface used for BFD MAD. If you configure other features, both BFD MAD and other features on the interface might run incorrectly. • Disable the spanning tree feature on all Layer 2 Ethernet ports in the BFD MAD VLAN. The MAD feature is mutually exclusive with the spanning tree feature. • Do not bind a BFD MAD-enabled VLAN interface to a VPN instance. The MAD feature is mutually exclusive with VPN.
MAD IP address	<ul style="list-style-type: none"> • Use the mad ip address command instead of the ip address command to configure MAD IP addresses on the BFD MAD-enabled VLAN interface. • Make sure all the MAD IP addresses are on the same subnet.

To configure BFD MAD that uses common Ethernet ports:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. (Optional.) Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	By default, the domain ID of an IRF fabric is 0.
3. Create a VLAN dedicated to BFD MAD.	vlan <i>vlan-id</i>	By default, only VLAN 1 exists.
4. Return to system view.	quit	N/A
5. Enter interface view or interface range view.	<ul style="list-style-type: none"> • Enter interface range view: interface range { <i>interface-type interface-number</i> [to <i>interface-type interface-number</i>] } <1-24> • Enter interface view: interface <i>interface-type interface-number</i> 	<p>To assign a range of ports to the BFD MAD VLAN, enter interface range view.</p> <p>To assign one port to the BFD MAD VLAN, enter Ethernet interface view.</p>
6. Assign the port or the range of ports to the BFD MAD VLAN.	<ul style="list-style-type: none"> • Assign the port to the VLAN as an access port: port access vlan <i>vlan-id</i> • Assign the port to the VLAN as a trunk port: port trunk permit vlan <i>vlan-id</i> • Assign the port to the VLAN as a hybrid port: port hybrid vlan <i>vlan-id</i> { tagged untagged } 	<p>The link type of BFD MAD ports can be access, trunk, or hybrid.</p> <p>The default link type of a port is access.</p>
7. Return to system view.	quit	N/A
8. Create the VLAN interface and enter VLAN interface	interface <i>vlan-interface</i> <i>vlan-interface-id</i>	N/A

Step	Command	Remarks
view.		
9. Enable BFD MAD.	mad bfd enable	By default, BFD MAD is disabled.
10. Assign a MAD IP address to a member device on the VLAN interface.	mad ip address <i>ip-address</i> { <i>mask</i> <i>mask-length</i> } member <i>member-id</i>	By default, no MAD IP addresses are configured on any VLAN interfaces. Repeat this step to assign a MAD IP address to each member device on the VLAN interface.

Configuring BFD MAD that uses management Ethernet ports

When you configure BFD MAD that uses management Ethernet ports, follow these restrictions and guidelines:

Category	Restrictions and guidelines
Ports on the intermediate device for BFD MAD	Use common Ethernet ports on the intermediate device to connect the management Ethernet ports on the IRF fabric.
BFD MAD VLAN	<ul style="list-style-type: none"> On the intermediate device, create a VLAN for BFD MAD, and assign the ports used for BFD MAD to the VLAN. On the IRF fabric, you do not need to assign the management Ethernet ports to the VLAN. Make sure the IRF fabrics on the network use different BFD MAD VLANs. Make sure the BFD MAD VLAN on the intermediate device contains only ports on the BFD MAD links.
BFD MAD-enabled management Ethernet port and feature compatibility	Do not bind a BFD MAD-enabled management Ethernet port to a VPN instance. The MAD feature is mutually exclusive with VPN.
MAD IP address	<ul style="list-style-type: none"> Use the mad ip address command instead of the ip address command to configure MAD IP addresses on the BFD MAD-enabled management Ethernet ports. Make sure all the MAD IP addresses are on the same subnet.

To configure BFD MAD that uses management Ethernet ports:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. (Optional.) Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	By default, the domain ID of an IRF fabric is 0.
3. Enter management Ethernet interface view.	interface M-GigabitEthernet <i>interface-number</i>	Of all management Ethernet ports on an IRF fabric, only the master's management Ethernet port is accessible.
4. Enable BFD MAD.	mad bfd enable	By default, BFD MAD is disabled.
5. Assign a MAD IP address to each member device.	mad ip address <i>ip-address</i> { <i>mask</i> <i>mask-length</i> } member <i>member-id</i>	By default, no MAD IP addresses are configured.

Configuring ARP MAD

Before you configure ARP MAD, choose an ARP MAD link scheme as described in "[ARP MAD](#)."

As a best practice, connect the ARP MAD links after you finish the ARP MAD configuration if you are not using existing data links as ARP MAD links.

Configuring ARP MAD that uses common Ethernet ports

Configure ARP MAD on a VLAN interface if you use common Ethernet ports for ARP MAD.

When you configure ARP MAD that uses common Ethernet ports, follow these restrictions and guidelines:

Category	Restrictions and guidelines
ARP MAD VLAN	<ul style="list-style-type: none"> Do not enable ARP MAD on VLAN-interface 1. If you are using an intermediate device, perform the following tasks on both the IRF fabric and the intermediate device: <ul style="list-style-type: none"> Create a VLAN and VLAN interface for ARP MAD. Assign the ports of ARP MAD links to the ARP MAD VLAN. Do not use the ARP MAD VLAN for any other purposes.
ARP MAD and feature configuration	<p>If an intermediate device is used, make sure the following requirements are met:</p> <ul style="list-style-type: none"> Run the spanning tree feature between the IRF fabric and the intermediate device to ensure that there is only one ARP MAD link in forwarding state. For more information about the spanning tree feature and its configuration, see Layer 2—LAN Switching Configuration Guide. Enable the IRF fabric to change its bridge MAC address as soon as the address owner leaves. If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection.

To configure ARP MAD that uses common Ethernet ports:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	The default IRF domain ID is 0.
3. Configure the IRF bridge MAC address to change as soon as the address owner leaves.	undo irf mac-address persistent	By default, the IRF bridge MAC address remains unchanged for 6 minutes after the address owner leaves.
4. Create a VLAN dedicated to ARP MAD.	vlan <i>vlan-id</i>	By default, only VLAN 1 exists.
5. Return to system view.	quit	N/A
6. Enter Ethernet interface view.	interface <i>interface-type</i> <i>interface-number</i>	N/A
7. Assign the port to the ARP MAD VLAN.	<ul style="list-style-type: none"> Assign the port to the VLAN as an access port: port access vlan <i>vlan-id</i> Assign the port to the VLAN as a trunk port: port trunk permit vlan <i>vlan-id</i> Assign the port to the VLAN as a hybrid port: port hybrid vlan <i>vlan-id</i> 	<p>The link type of ARP MAD ports can be access, trunk, or hybrid.</p> <p>The default link type of a port is access.</p>

Step	Command	Remarks
	{ tagged untagged }	
8. Return to system view.	quit	N/A
9. Enter VLAN interface view.	interface vlan-interface <i>vlan-interface-id</i>	N/A
10. Assign the interface an IP address.	ip address <i>ip-address</i> { <i>mask</i> <i>mask-length</i> }	By default, no IP addresses are assigned to a VLAN interface.
11. Enable ARP MAD.	mad arp enable	By default, ARP MAD is disabled.

Configuring ARP MAD that uses management Ethernet ports

When you configure ARP MAD that uses management Ethernet ports, follow these restrictions and guidelines:

Category	Restrictions and guidelines
Ports on the intermediate device for ARP MAD	Use common Ethernet ports on the intermediate device to connect the management Ethernet ports on the IRF fabric.
ARP MAD VLAN	On the intermediate device, create a VLAN for ARP MAD, and assign the ports used for ARP MAD to the VLAN. On the IRF fabric, you do not need to assign the management Ethernet ports to the VLAN.
ARP MAD and feature configuration	<ul style="list-style-type: none"> Enable the IRF fabric to change its bridge MAC address as soon as the address owner leaves. If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection.

To configure ARP MAD that uses management Ethernet ports:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	By default, the domain ID of an IRF fabric is 0.
3. Configure the IRF bridge MAC address to change as soon as the address owner leaves.	undo irf mac-address persistent	By default, the IRF bridge MAC address remains unchanged for 6 minutes after the address owner leaves.
4. Enter management Ethernet interface view.	interface M-GigabitEthernet <i>interface-number</i>	Of all management Ethernet ports on an IRF fabric, only the master's management Ethernet port is accessible.
5. Assign an IP address to the management Ethernet ports.	ip address <i>ip-address</i> { <i>mask</i> <i>mask-length</i> }	By default, no IP addresses are configured.
6. Enable ARP MAD.	mad arp enable	By default, ARP MAD is disabled.

Configuring ND MAD

When you use ND MAD, follow these guidelines:

- Do not configure ND MAD on VLAN-interface 1.

- Do not use the VLAN configured for ND MAD for any other purposes.
- If an intermediate device is used, you can use common data links as ND MAD links. If no intermediate device is used, set up dedicated ND MAD links between IRF member devices.
- If an intermediate device is used, make sure the following requirements are met:
 - Run the spanning tree feature between the IRF fabric and the intermediate device. Make sure there is only one ND MAD link in forwarding state. For more information about the spanning tree feature and its configuration, see *Layer 2—LAN Switching Configuration Guide*.
 - Enable the IRF fabric to change its bridge MAC address as soon as the address owner leaves.
 - Create an ND MAD VLAN and assign the ports on the ND MAD links to the VLAN.
 - If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection.

To configure ND MAD:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Assign a domain ID to the IRF fabric.	irf domain <i>domain-id</i>	The default IRF domain ID is 0.
3. Configure the IRF bridge MAC address to change as soon as the address owner leaves.	undo irf mac-address persistent	By default, the IRF bridge MAC address remains unchanged for 6 minutes after the address owner leaves.
4. Create a VLAN dedicated to ND MAD.	vlan <i>vlan-id</i>	By default, only VLAN 1 exists.
5. Return to system view.	quit	N/A
6. Enter Ethernet interface view.	interface <i>interface-type</i> <i>interface-number</i>	N/A
7. Assign the port to the ND MAD VLAN.	<ul style="list-style-type: none"> • Assign the port to the VLAN as an access port: port access vlan <i>vlan-id</i> • Assign the port to the VLAN as a trunk port: port trunk permit vlan <i>vlan-id</i> • Assign the port to the VLAN as a hybrid port: port hybrid vlan <i>vlan-id</i> { tagged untagged } 	The link type of ND MAD ports can be access, trunk, or hybrid. The default link type of a port is access.
8. Return to system view.	quit	N/A
9. Enter VLAN interface view.	interface vlan-interface <i>vlan-interface-id</i>	N/A
10. Assign the interface an IP address.	ipv6 address { <i>ipv6-address/prefix-length</i> <i>ipv6-address prefix-length</i> }	By default, no IPv6 addresses are assigned to a VLAN interfaces.
11. Enable ND MAD.	mad nd enable	By default, ND MAD is disabled.

Excluding a port from the shutdown action upon detection of multi-active collision

⚠ CAUTION:

Do not exclude a VLAN interface and its Layer 2 ports from the shutdown action if the Layer 2 ports are distributed on multiple member devices. The exclusion introduces IP collision risks because the VLAN interface might be up on both active and inactive IRF fabrics.

By default, all ports except the console and IRF physical interfaces shut down automatically when the IRF fabric transits to the Recovery state.

You can exclude a network port from the shutdown action for management or other special purposes. For example:

- Exclude a port from the shutdown action so you can Telnet to the port for managing the device.
- Exclude a VLAN interface and its Layer 2 ports from the shutdown action so you can log in through the VLAN interface.

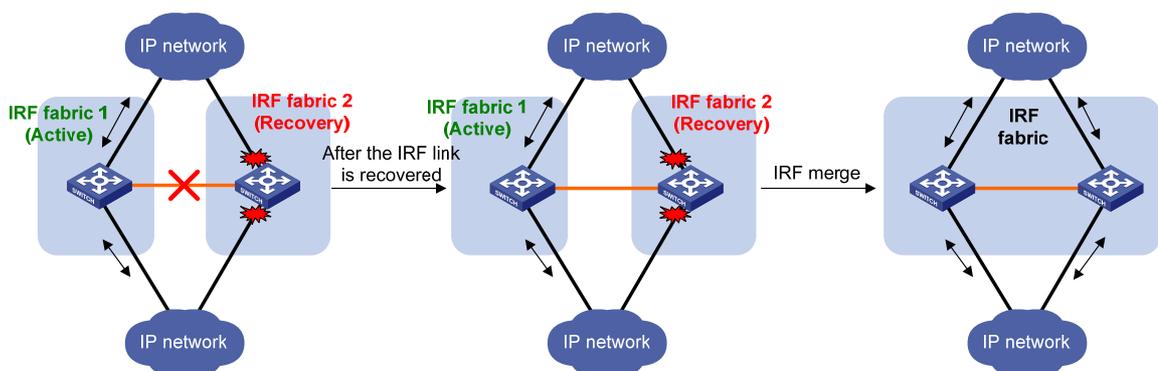
To configure a port to not shut down when the IRF fabric transits to the Recovery state:

Step	Command	Remarks
1. Enter system view.	system-view	N/A
2. Configure a network port to not shut down when the IRF fabric transits to the Recovery state.	mad exclude interface <i>interface-type interface-number</i>	By default, all network ports on a Recovery-state IRF fabric are shut down, except for the IRF physical interfaces and console port.

Recovering an IRF fabric

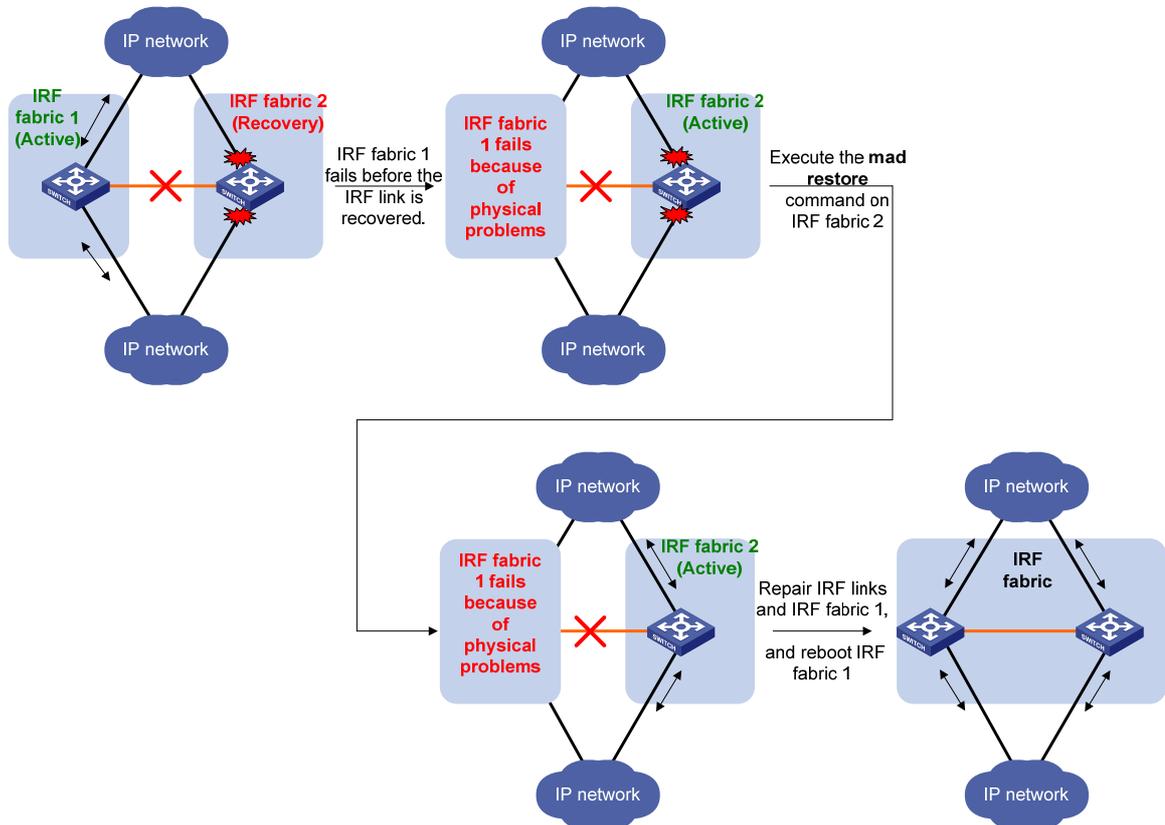
When the failed IRF link between two split IRF fabrics is recovered, all member devices in the inactive IRF fabric automatically join the active IRF fabric as subordinate members. The network ports that have been shut down by MAD automatically restore their original physical state, as shown in Figure 13.

Figure 13 Recovering the IRF fabric



If the active IRF fabric fails before the IRF link is recovered (see Figure 14), use the **mad restore** command on the inactive IRF fabric to recover the inactive IRF fabric. This command also brings up all physical interfaces that were shut down by MAD. After you repair the IRF link, the two parts merge into a unified IRF fabric.

Figure 14 Active IRF fabric fails before the IRF link is recovered



To manually recover an inactive IRF fabric:

Step	Command
1. Enter system view.	system-view
2. Recover the inactive IRF fabric.	mad restore

After the IRF fabric is recovered, all ports that have been shut down by MAD come up automatically.

Displaying and maintaining an IRF fabric

Execute **display** commands in any view.

Task	Command
Display information about all IRF members.	display irf
Display the IRF fabric topology.	display irf topology
Display IRF link information.	display irf link
Display IRF configuration.	display irf configuration
Display the load sharing mode for IRF links.	display irf-port load-sharing mode [irf-port [member-id/irf-port-number]]
Display MAD configuration.	display mad [verbose]

Configuration examples

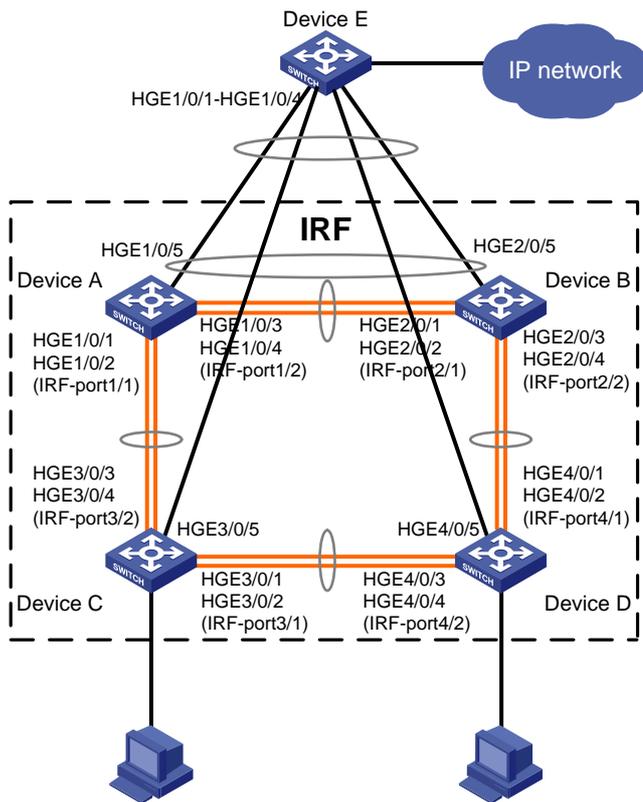
This section provides IRF configuration examples for IRF fabrics that use different MAD mechanisms.

LACP MAD-enabled IRF configuration example

Network requirements

As shown in [Figure 15](#), set up a four-chassis IRF fabric at the access layer of the enterprise network. Configure LACP MAD on the multichassis aggregation to Device E, an HPE device that supports extended LACP.

Figure 15 Network diagram



Configuration procedure

1. Configure Device A:

Shut down the physical interfaces used for IRF links. In this example, the physical interfaces are shut down in batch. For more information, see *Layer 2—LAN Switching Configuration Guide*.

```
<Sysname> system-view
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 1/0/1 and HundredGigE 1/0/2 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/1
```

```
[Sysname-irf-port1/1] port group interface hundredgige 1/0/2
[Sysname-irf-port1/1] quit
# Bind HundredGigE 1/0/3 and HundredGigE 1/0/4 to IRF-port 1/2.
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface hundredgige 1/0/3
[Sysname-irf-port1/2] port group interface hundredgige 1/0/4
[Sysname-irf-port1/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
```

2. Configure Device B:

Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device B to Device A as shown in [Figure 15](#), and log in to Device B. (Details not shown.)

Shut down the physical interfaces for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 2/0/1 and HundredGigE 2/0/2 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/2
[Sysname-irf-port2/1] quit
```

Bind HundredGigE 2/0/3 and HundredGigE 2/0/4 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface hundredgige 2/0/3
[Sysname-irf-port2/2] port group interface hundredgige 2/0/4
[Sysname-irf-port2/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

3. Configure Device C:

Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device C to Device A as shown in [Figure 15](#), and log in to Device C. (Details not shown.)

Shut down the physical interfaces for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 3/0/1 and HundredGigE 3/0/2 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/2
[Sysname-irf-port3/1] quit
```

Bind HundredGigE 3/0/3 and HundredGigE 3/0/4 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
[Sysname-irf-port3/2] port group interface hundredgige 3/0/3
[Sysname-irf-port3/2] port group interface hundredgige 3/0/4
[Sysname-irf-port3/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

4. Configure Device D:

Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device D to Device B and Device C as shown in [Figure 15](#), and log in to Device D. (Details not shown.)

Shut down the physical interfaces.

```
<Sysname> system-view
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 4/0/1 and HundredGigE 4/0/2 to IRF-port 4/1.

```

[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/2
[Sysname-irf-port4/1] quit
# Bind HundredGigE 4/0/3 and HundredGigE 4/0/4 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface hundredgige 4/0/3
[Sysname-irf-port4/2] port group interface hundredgige 4/0/4
[Sysname-irf-port4/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active

```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

5. Configure LACP MAD on the IRF fabric:

Set the domain ID of the IRF fabric to 1.

```

<Sysname> system-view
[Sysname] irf domain 1

```

Create a dynamic aggregate interface and enable LACP MAD.

```

[Sysname] interface bridge-aggregation 2
[Sysname-Bridge-Aggregation2] link-aggregation mode dynamic
[Sysname-Bridge-Aggregation2] mad enable

```

You need to assign a domain ID (range: 0-4294967295)

```

[Current domain is: 1]:
The assigned domain ID is: 1
Info: MAD LACP only enable on dynamic aggregation interface.
[Sysname-Bridge-Aggregation2] quit

```

Assign HundredGigE 1/0/5, HundredGigE 2/0/5, HundredGigE 3/0/5, and HundredGigE 4/0/5 to the aggregate interface.

```

[Sysname] interface range hundredgige 1/0/5 hundredgige 2/0/5 hundredgige 3/0/5
hundredgige 4/0/5
[Sysname-if-range] port link-aggregation group 2
[Sysname-if-range] quit

```

6. Configure Device E as the intermediate device:

CAUTION:

If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection. False detection causes IRF split.

Create a dynamic aggregate interface.

```

<Sysname> system-view
[Sysname] interface bridge-aggregation 2
[Sysname-Bridge-Aggregation2] link-aggregation mode dynamic
[Sysname-Bridge-Aggregation2] quit

```

```
# Assign HundredGigE 1/0/1, HundredGigE 1/0/2, HundredGigE 1/0/3, and HundredGigE 1/0/4
to the aggregate interface.
```

```
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] port link-aggregation group 2
[Sysname-if-range] quit
```

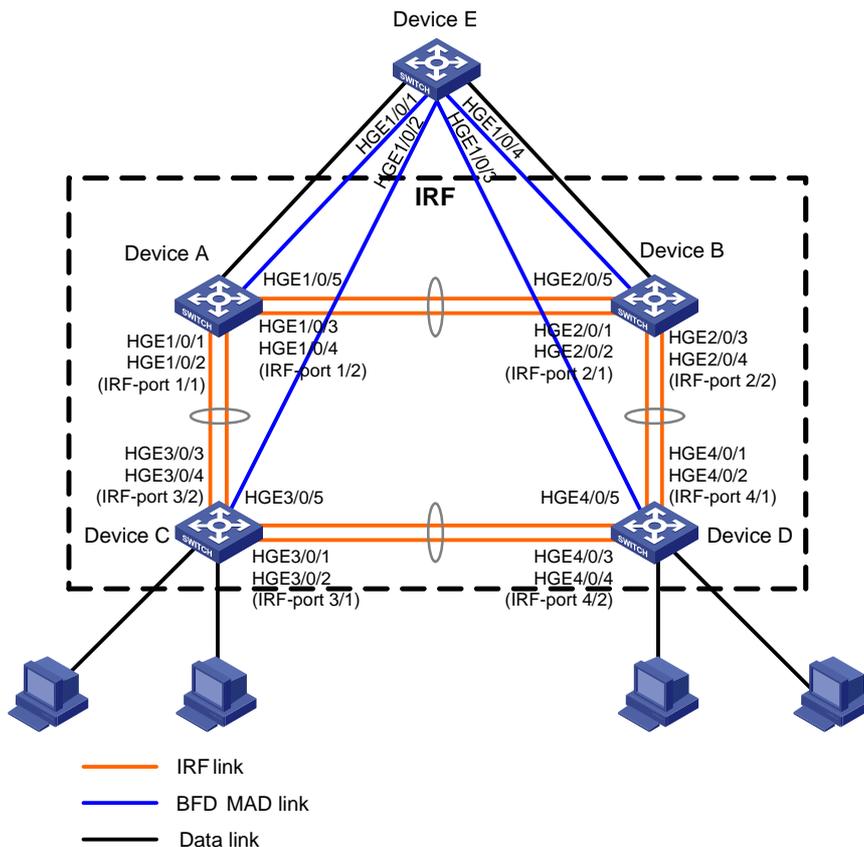
BFD MAD-enabled IRF configuration example

Network requirements

As shown in Figure 16, set up a four-chassis IRF fabric at the distribution layer of the enterprise network.

- Configure BFD MAD on the IRF fabric and set up BFD MAD links between each member device and the intermediate device.
- Disable the spanning tree feature on the ports used for BFD MAD, because the two features conflict with each other.

Figure 16 Network diagram



Configuration procedure

1. Configure Device A:

```
# Shut down the physical interfaces used for IRF links.
```

```
<Sysname> system-view
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 1/0/1 and HundredGigE 1/0/2 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/2
[Sysname-irf-port1/1] quit
```

Bind HundredGigE 1/0/3 and HundredGigE 1/0/4 to IRF-port 1/2.

```
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface hundredgige 1/0/3
[Sysname-irf-port1/2] port group interface hundredgige 1/0/4
[Sysname-irf-port1/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

2. Configure Device B:

Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device B to Device A as shown in [Figure 16](#), and log in to Device B. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 2/0/1 and HundredGigE 2/0/2 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/2
[Sysname-irf-port2/1] quit
```

Bind HundredGigE 2/0/3 and HundredGigE 2/0/4 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface hundredgige 2/0/3
[Sysname-irf-port2/2] port group interface hundredgige 2/0/4
[Sysname-irf-port2/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

3. Configure Device C:

Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
```

```
[Sysname] irf member 1 renumber 3
```

Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y

```
[Sysname] quit
```

```
<Sysname> reboot
```

Connect Device C to Device A as shown in [Figure 16](#), and log in to Device C. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
```

```
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
```

```
[Sysname-if-range] shutdown
```

```
[Sysname-if-range] quit
```

Bind HundredGigE 3/0/1 and HundredGigE 3/0/2 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
```

```
[Sysname-irf-port3/1] port group interface hundredgige 3/0/1
```

```
[Sysname-irf-port3/1] port group interface hundredgige 3/0/2
```

```
[Sysname-irf-port3/1] quit
```

Bind HundredGigE 3/0/3 and HundredGigE 3/0/4 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
```

```
[Sysname-irf-port3/2] port group interface hundredgige 3/0/3
```

```
[Sysname-irf-port3/2] port group interface hundredgige 3/0/4
```

```
[Sysname-irf-port3/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
```

```
[Sysname-if-range] undo shutdown
```

```
[Sysname-if-range] quit
```

```
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

4. Configure Device D:

Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
```

```
[Sysname] irf member 1 renumber 4
```

Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y

```
[Sysname] quit
```

```
<Sysname> reboot
```

Connect Device D to Device B and Device C as shown in [Figure 16](#), and log in to Device D. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
```

```
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
```

```

[Sysname-if-range] shutdown
[Sysname-if-range] quit
# Bind HundredGigE 4/0/1 and HundredGigE 4/0/2 to IRF-port 4/1.
[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/2
[Sysname-irf-port4/1] quit
# Bind HundredGigE 4/0/3 and HundredGigE 4/0/4 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface hundredgige 4/0/3
[Sysname-irf-port4/2] port group interface hundredgige 4/0/4
[Sysname-irf-port4/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

```

5. Configure BFD MAD on the IRF fabric:

Create VLAN 3, and add HundredGigE 1/0/5, HundredGigE 2/0/5, HundredGigE 3/0/5, and HundredGigE 4/0/5 to VLAN 3.

```

[Sysname] vlan 3
[Sysname-vlan3] port hundredgige 1/0/5 hundredgige 2/0/5 hundredgige 3/0/5
hundredgige 4/0/5
[Sysname-vlan3] quit

```

Create VLAN-interface 3, and configure a MAD IP address for each member device on the VLAN interface.

```

[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] mad bfd enable
[Sysname-Vlan-interface3] mad ip address 192.168.2.1 24 member 1
[Sysname-Vlan-interface3] mad ip address 192.168.2.2 24 member 2
[Sysname-Vlan-interface3] mad ip address 192.168.2.3 24 member 3
[Sysname-Vlan-interface3] mad ip address 192.168.2.4 24 member 4
[Sysname-Vlan-interface3] quit

```

Disable the spanning tree feature on HundredGigE 1/0/5, HundredGigE 2/0/5, HundredGigE 3/0/5, and HundredGigE 4/0/5.

```

[Sysname] interface range hundredgige 1/0/5 hundredgige 2/0/5 hundredgige 3/0/5
hundredgige 4/0/5
[Sysname-if-range] undo stp enable
[Sysname-if-range] quit

```

6. Configure Device E as the intermediate device:

⚠ CAUTION:

If the intermediate device is also an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection. False detection causes IRF split.

```
# Create VLAN 3, and assign HundredGigE 1/0/1, HundredGigE 1/0/2, HundredGigE 1/0/3,
and HundredGigE 1/0/4 to VLAN 3 for forwarding BFD MAD packets.
```

```
<DeviceE> system-view
[DeviceE] vlan 3
[DeviceE-vlan3] port hundredgige 1/0/1 to hundredgige 1/0/4
[DeviceE-vlan3] quit
```

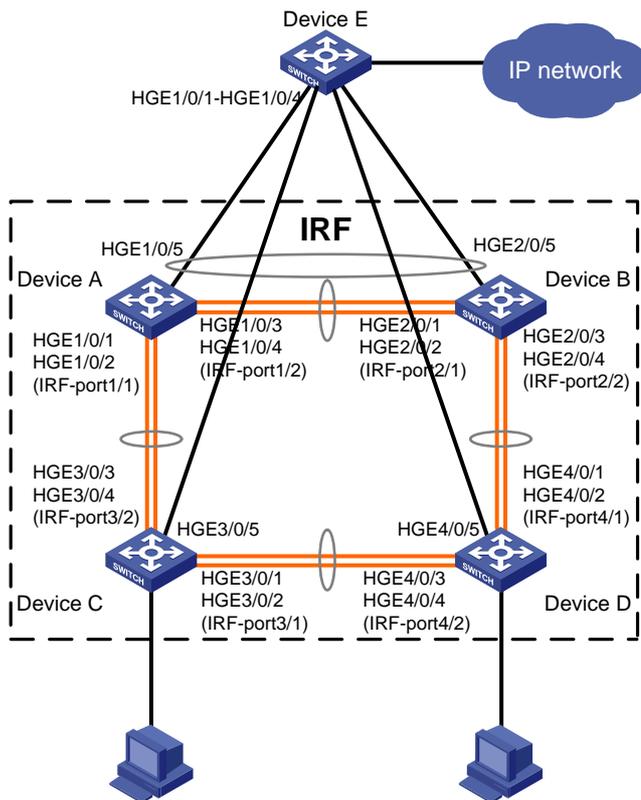
ARP MAD-enabled IRF configuration example

Network requirements

As shown in [Figure 17](#), set up a four-chassis IRF fabric in the enterprise network.

- Configure ARP MAD on the IRF fabric and use the links connected to Device E for transmitting ARP MAD packets.
- To prevent loops, run the spanning tree feature between Device E and the IRF fabric.

Figure 17 Network diagram



Configuration procedure

1. Configure Device A:

```
# Shut down the physical interfaces used for IRF links.
```

```
<Sysname> system-view
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

```
# Bind HundredGigE 1/0/1 and HundredGigE 1/0/2 to IRF-port 1/1.
```

```
[Sysname] irf-port 1/1
```

```

[Sysname-irf-port1/1] port group interface hundredgige 1/0/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/2
[Sysname-irf-port1/1] quit
# Bind HundredGigE 1/0/3 and HundredGigE 1/0/4 to IRF-port 1/2.
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface hundredgige 1/0/3
[Sysname-irf-port1/2] port group interface hundredgige 1/0/4
[Sysname-irf-port1/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active

```

2. Configure Device B:

```

# Change the member ID of Device B to 2 and reboot the device to validate the change.
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
# Connect Device B to Device A as shown in Figure 17, and log in to Device B. (Details not shown.)
# Shut down the physical interfaces used for IRF links.
<Sysname> system-view
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
# Bind HundredGigE 2/0/1 and HundredGigE 2/0/2 to IRF-port 2/1.
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/2
[Sysname-irf-port2/1] quit
# Bind HundredGigE 2/0/3 and HundredGigE 2/0/4 to IRF-port 2/2.
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface hundredgige 2/0/3
[Sysname-irf-port2/2] port group interface hundredgige 2/0/4
[Sysname-irf-port2/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active

```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

3. Configure Device C:

Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device C to Device A as shown in [Figure 17](#), and log in to Device C. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 3/0/1 and HundredGigE 3/0/2 to IRF-port 3/1.

```
[Sysname] irf-port 3/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/2
[Sysname-irf-port3/1] quit
```

Bind HundredGigE 3/0/3 and HundredGigE 3/0/4 to IRF-port 3/2.

```
[Sysname] irf-port 3/2
[Sysname-irf-port3/2] port group interface hundredgige 3/0/3
[Sysname-irf-port3/2] port group interface hundredgige 3/0/4
[Sysname-irf-port3/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device C reboots to join the IRF fabric.

4. Configure Device D:

Change the member ID of Device D to 4 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device D to Device B and Device C as shown in [Figure 17](#), and log in to Device D. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 4/0/1 and HundredGigE 4/0/2 to IRF-port 4/1.

```

[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/2
[Sysname-irf-port4/1] quit
# Bind HundredGigE 4/0/3 and HundredGigE 4/0/4 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface hundredgige 4/0/3
[Sysname-irf-port4/2] port group interface hundredgige 4/0/4
[Sysname-irf-port4/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save

```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

5. Configure ARP MAD on the IRF fabric:

Enable the spanning tree feature globally. Map the ARP MAD VLAN to MSTI 1 in the MST region.

```

<Sysname> system-view
[Sysname] stp global enable
[Sysname] stp region-configuration
[Sysname-mst-region] region-name arpmad
[Sysname-mst-region] instance 1 vlan 3
[Sysname-mst-region] active region-configuration
[Sysname-mst-region] quit

```

Configure the IRF fabric to change its bridge MAC address as soon as the address owner leaves.

```
[Sysname] undo irf mac-address persistent
```

Set the domain ID of the IRF fabric to 1.

```
[Sysname] irf domain 1
```

Create VLAN 3, and assign HundredGigE 1/0/5, HundredGigE 2/0/5, HundredGigE 3/0/5, and HundredGigE 4/0/5 to VLAN 3.

```

[Sysname] vlan 3
[Sysname-vlan3] port hundredgige 1/0/5 hundredgige 2/0/5 hundredgige 3/0/5
hundredgige 4/0/5
[Sysname-vlan3] quit

```

Create VLAN-interface 3, assign it an IP address, and enable ARP MAD on the interface.

```

[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] ip address 192.168.2.1 24
[Sysname-Vlan-interface3] mad arp enable
You need to assign a domain ID (range: 0-4294967295)
[Current domain is: 1]:
The assigned domain ID is: 1

```

6. Configure Device E as the intermediate device:

⚠ CAUTION:

If the intermediate device is also in an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection. False detection causes IRF split.

Enable the spanning tree feature globally. Map the ARP MAD VLAN to MSTI 1 in the MST region.

```
<DeviceE> system-view
[DeviceE] stp global enable
[DeviceE] stp region-configuration
[DeviceE-mst-region] region-name arpmad
[DeviceE-mst-region] instance 1 vlan 3
[DeviceE-mst-region] active region-configuration
[DeviceE-mst-region] quit
```

Create VLAN 3, and assign HundredGigE 1/0/1, HundredGigE 1/0/2, HundredGigE 1/0/3, and HundredGigE 1/0/4 to VLAN 3 for forwarding ARP MAD packets.

```
[DeviceE] vlan 3
[DeviceE-vlan3] port hundredgige 1/0/1 to hundredgige 1/0/4
[DeviceE-vlan3] quit
```

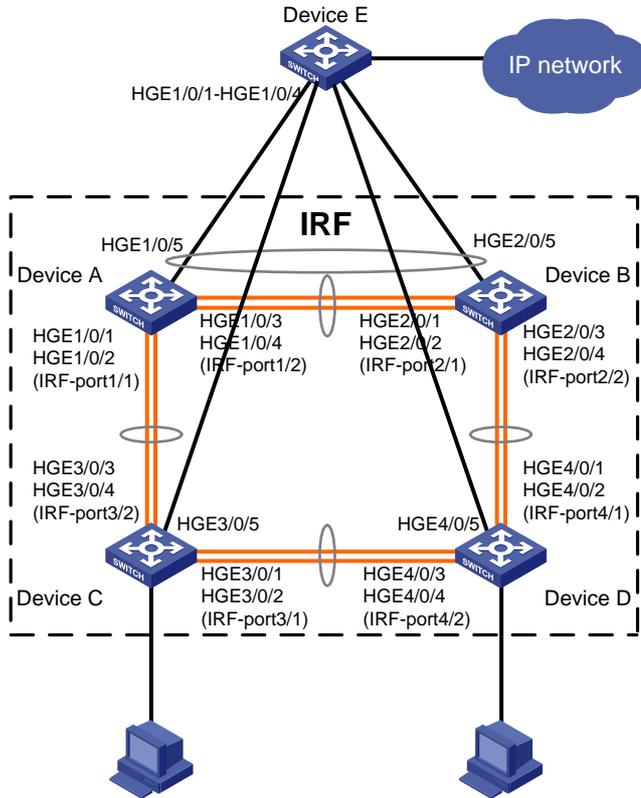
ND MAD-enabled IRF configuration example

Network requirements

As shown in [Figure 18](#), set up a four-chassis IRF fabric in the IPv6 enterprise network.

- Configure ND MAD on the IRF fabric and use the links connected to Device E for transmitting ND MAD packets.
- To prevent loops, run the spanning tree feature between Device E and the IRF fabric.

Figure 18 Network diagram



Configuration procedure

1. Configure Device A:

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 1/0/1 and HundredGigE 1/0/2 to IRF-port 1/1.

```
[Sysname] irf-port 1/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/1
[Sysname-irf-port1/1] port group interface hundredgige 1/0/2
[Sysname-irf-port1/1] quit
```

Bind HundredGigE 1/0/3 and HundredGigE 1/0/4 to IRF-port 1/2.

```
[Sysname] irf-port 1/2
[Sysname-irf-port1/2] port group interface hundredgige 1/0/3
[Sysname-irf-port1/2] port group interface hundredgige 1/0/4
[Sysname-irf-port1/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 1/0/1 to hundredgige 1/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

2. Configure Device B:

Change the member ID of Device B to 2 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 2
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device B to Device A as shown in [Figure 18](#), and log in to Device B. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 2/0/1 and HundredGigE 2/0/2 to IRF-port 2/1.

```
[Sysname] irf-port 2/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/1
[Sysname-irf-port2/1] port group interface hundredgige 2/0/2
[Sysname-irf-port2/1] quit
```

Bind HundredGigE 2/0/3 and HundredGigE 2/0/4 to IRF-port 2/2.

```
[Sysname] irf-port 2/2
[Sysname-irf-port2/2] port group interface hundredgige 2/0/3
[Sysname-irf-port2/2] port group interface hundredgige 2/0/4
[Sysname-irf-port2/2] quit
```

Bring up the physical interfaces and save the configuration.

```
[Sysname] interface range hundredgige 2/0/1 to hundredgige 2/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
```

Activate the IRF port configuration.

```
[Sysname] irf-port-configuration active
```

The two devices perform master election, and the one that has lost the election reboots to form an IRF fabric with the master.

3. Configure Device C:

Change the member ID of Device C to 3 and reboot the device to validate the change.

```
<Sysname> system-view
[Sysname] irf member 1 renumber 3
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
```

Connect Device C to Device A as shown in [Figure 18](#), and log in to Device C. (Details not shown.)

Shut down the physical interfaces used for IRF links.

```
<Sysname> system-view
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
```

Bind HundredGigE 3/0/1 and HundredGigE 3/0/2 to IRF-port 3/1.

```

[Sysname] irf-port 3/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/1
[Sysname-irf-port3/1] port group interface hundredgige 3/0/2
[Sysname-irf-port3/1] quit
# Bind HundredGigE 3/0/3 and HundredGigE 3/0/4 to IRF-port 3/2.
[Sysname] irf-port 3/2
[Sysname-irf-port3/2] port group interface hundredgige 3/0/3
[Sysname-irf-port3/2] port group interface hundredgige 3/0/4
[Sysname-irf-port3/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 3/0/1 to hundredgige 3/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.
[Sysname] irf-port-configuration active
Device C reboots to join the IRF fabric.

```

4. Configure Device D:

```

# Change the member ID of Device D to 4 and reboot the device to validate the change.
<Sysname> system-view
[Sysname] irf member 1 renumber 4
Renumbering the member ID may result in configuration change or loss. Continue? [Y/N]:y
[Sysname] quit
<Sysname> reboot
# Connect Device D to Device B and Device C as shown in Figure 18, and log in to Device D.
(Details not shown.)
# Shut down the physical interfaces used for IRF links.
<Sysname> system-view
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] shutdown
[Sysname-if-range] quit
# Bind HundredGigE 4/0/1 and HundredGigE 4/0/2 to IRF-port 4/1.
[Sysname] irf-port 4/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/1
[Sysname-irf-port4/1] port group interface hundredgige 4/0/2
[Sysname-irf-port4/1] quit
# Bind HundredGigE 4/0/3 and HundredGigE 4/0/4 to IRF-port 4/2.
[Sysname] irf-port 4/2
[Sysname-irf-port4/2] port group interface hundredgige 4/0/3
[Sysname-irf-port4/2] port group interface hundredgige 4/0/4
[Sysname-irf-port4/2] quit
# Bring up the physical interfaces and save the configuration.
[Sysname] interface range hundredgige 4/0/1 to hundredgige 4/0/4
[Sysname-if-range] undo shutdown
[Sysname-if-range] quit
[Sysname] save
# Activate the IRF port configuration.

```

```
[Sysname] irf-port-configuration active
```

Device D reboots to join the IRF fabric. A four-chassis IRF fabric is formed.

5. Configure ND MAD on the IRF fabric:

Enable the spanning tree feature globally. Map the ND MAD VLAN to MSTI 1 in the MST region.

```
<Sysname> system-view
[Sysname] stp global enable
[Sysname] stp region-configuration
[Sysname-mst-region] region-name ndmad
[Sysname-mst-region] instance 1 vlan 3
[Sysname-mst-region] active region-configuration
[Sysname-mst-region] quit
```

Configure the IRF fabric to change its bridge MAC address as soon as the address owner leaves.

```
[Sysname] undo irf mac-address persistent
```

Set the domain ID of the IRF fabric to 1.

```
[Sysname] irf domain 1
```

Create VLAN 3, and add HundredGigE 1/0/5, HundredGigE 2/0/5, HundredGigE 3/0/5, and HundredGigE 4/0/5 to VLAN 3.

```
[Sysname] vlan 3
[Sysname-vlan3] port hundredgige 1/0/5 hundredgige 2/0/5 hundredgige 3/0/5
hundredgige 4/0/5
[Sysname-vlan3] quit
```

Create VLAN-interface 3, assign it an IPv6 address, and enable ND MAD on the interface.

```
[Sysname] interface vlan-interface 3
[Sysname-Vlan-interface3] ipv6 address 2001::1 64
[Sysname-Vlan-interface3] mad nd enable
You need to assign a domain ID (range: 0-4294967295)
[Current domain is: 1]:
The assigned domain ID is: 1
```

6. Configure Device E as the intermediate device:

CAUTION:

If the intermediate device is also in an IRF fabric, assign the two IRF fabrics different domain IDs for correct split detection. False detection causes IRF split.

Enable the spanning tree feature globally. Map the ND MAD VLAN to MSTI 1 in the MST region.

```
<DeviceE> system-view
[DeviceE] stp global enable
[DeviceC] stp region-configuration
[DeviceC-mst-region] region-name ndmad
[DeviceC-mst-region] instance 1 vlan 3
[DeviceC-mst-region] active region-configuration
[DeviceC-mst-region] quit
```

Create VLAN 3, and add HundredGigE 1/0/1, HundredGigE 1/0/2, HundredGigE 1/0/3, and HundredGigE 1/0/4 to VLAN 3 for forwarding ND MAD packets.

```
[DeviceE] vlan 3
[DeviceE-vlan3] port hundredgige 1/0/1 to hundredgige 1/0/4
```

```
[DeviceE-vlan3] quit
```

Document conventions and icons

Conventions

This section describes the conventions used in the documentation.

Port numbering in examples

The port numbers in this document are for illustration only and might be unavailable on your device.

Command conventions

Convention	Description
Boldface	Bold text represents commands and keywords that you enter literally as shown.
<i>Italic</i>	<i>Italic</i> text represents arguments that you replace with actual values.
[]	Square brackets enclose syntax choices (keywords or arguments) that are optional.
{ x y ... }	Braces enclose a set of required syntax choices separated by vertical bars, from which you select one.
[x y ...]	Square brackets enclose a set of optional syntax choices separated by vertical bars, from which you select one or none.
{ x y ... }*	Asterisk marked braces enclose a set of required syntax choices separated by vertical bars, from which you select at least one.
[x y ...]*	Asterisk marked square brackets enclose optional syntax choices separated by vertical bars, from which you select one choice, multiple choices, or none.
&<1-n>	The argument or keyword and argument combination before the ampersand (&) sign can be entered 1 to n times.
#	A line that starts with a pound (#) sign is comments.

GUI conventions

Convention	Description
Boldface	Window names, button names, field names, and menu items are in Boldface. For example, the New User window appears; click OK .
>	Multi-level menus are separated by angle brackets. For example, File > Create > Folder .

Symbols

Convention	Description
 WARNING!	An alert that calls attention to important information that if not understood or followed can result in personal injury.
 CAUTION:	An alert that calls attention to important information that if not understood or followed can result in data loss, data corruption, or damage to hardware or software.
 IMPORTANT:	An alert that calls attention to essential information.
NOTE:	An alert that contains additional or supplementary information.
 TIP:	An alert that provides helpful information.

Network topology icons

Convention	Description
	Represents a generic network device, such as a router, switch, or firewall.
	Represents a routing-capable device, such as a router or Layer 3 switch.
	Represents a generic switch, such as a Layer 2 or Layer 3 switch, or a router that supports Layer 2 forwarding and other Layer 2 features.
	Represents an access controller, a unified wired-WLAN module, or the access controller engine on a unified wired-WLAN switch.
	Represents an access point.
	Represents a wireless terminator unit.
	Represents a wireless terminator.
	Represents a mesh access point.
	Represents omnidirectional signals.
	Represents directional signals.
	Represents a security product, such as a firewall, UTM, multiservice security gateway, or load balancing device.
	Represents a security card, such as a firewall, load balancing, NetStream, SSL VPN, IPS, or ACG card.

Support and other resources

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:
www.hpe.com/assistance
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:
www.hpe.com/support/hpesc

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates, go to either of the following:
 - Hewlett Packard Enterprise Support Center **Get connected with updates** page:
www.hpe.com/support/e-updates
 - Software Depot website:
www.hpe.com/support/softwaredepot
- To view and update your entitlements, and to link your contracts, Care Packs, and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:
www.hpe.com/support/AccessToSupportMaterials

ⓘ **IMPORTANT:**

Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HP Passport set up with relevant entitlements.

Websites

Website	Link
Networking websites	
Hewlett Packard Enterprise Information Library for Networking	www.hpe.com/networking/resourcefinder
Hewlett Packard Enterprise Networking website	www.hpe.com/info/networking
Hewlett Packard Enterprise My Networking website	www.hpe.com/networking/support
Hewlett Packard Enterprise My Networking Portal	www.hpe.com/networking/mynetworking
Hewlett Packard Enterprise Networking Warranty	www.hpe.com/networking/warranty
General websites	
Hewlett Packard Enterprise Information Library	www.hpe.com/info/enterprise/docs
Hewlett Packard Enterprise Support Center	www.hpe.com/support/hpesc
Hewlett Packard Enterprise Support Services Central	ssc.hpe.com/portal/site/ssc/
Contact Hewlett Packard Enterprise Worldwide	www.hpe.com/assistance
Subscription Service/Support Alerts	www.hpe.com/support/e-updates
Software Depot	www.hpe.com/support/softwaredepot
Customer Self Repair (not applicable to all devices)	www.hpe.com/support/selfrepair
Insight Remote Support (not applicable to all devices)	www.hpe.com/info/insightremotesupport/docs

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

www.hpe.com/support/selfrepair

Remote support

Remote support is available with supported devices as part of your warranty, Care Pack Service, or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

For more information and device support details, go to the following website:

www.hpe.com/info/insightremotesupport/docs

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