

FSOS

Stack Configuration

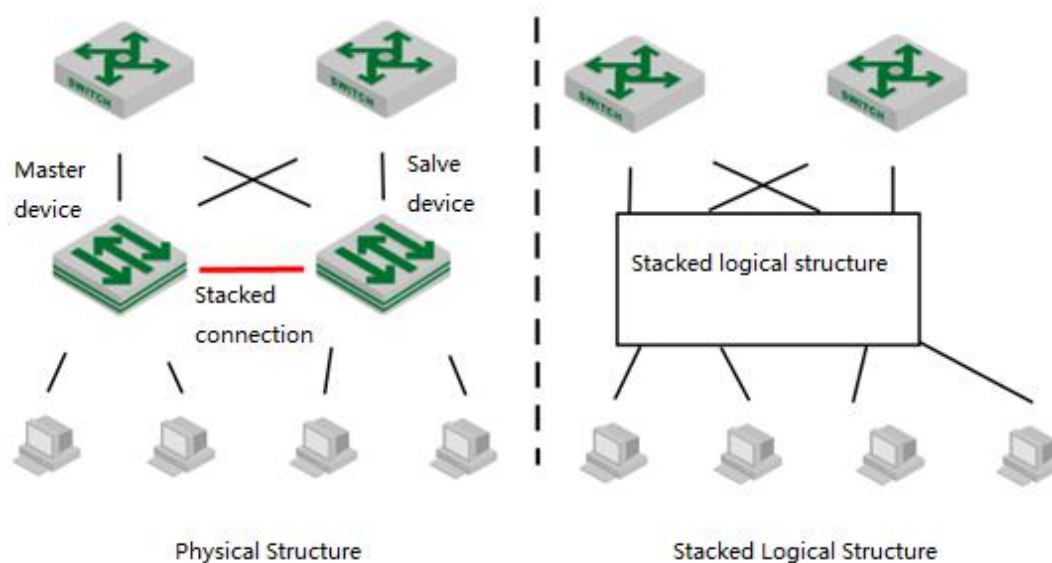
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1. Stack Configuration

1.1 Stack Overview

Stack means multiple devices are connected via stack port to form a fictitious logic device, and users perform the management via performing the management on fictitious logic device.



schematic diagram of stack networking applications

(1) Technical advantages of stack

Stack possesses the following advantages:

- **Network scalability.** At the early stage of the network construction, it uses less devices to build the network and it will expand the port number and bandwidth via adding the stack devices in middle and later periods of the network construction.
- **Reliability.** Stack system is made up by a master device and multiple slave devices. Master device takes the responsibility to finish the administration and maintenance of the stack system whereas slave devices take part in service data processing. If there is something wrong with master device, system will select a new master device to perform the backup job. In addition, physical ports between devices support aggregation function to help to finish the port backup job.
- **Available management.** Any port of any device in stack system can be able to login stack system to perform management configuration, and there is no need to perform separate management configuration on each member device.
- **Low cost on operations and maintenance.** Network upgrading needn't to replace existing devices, just add the new devices will be OK. Multiple devices form a logic device can effectively reduce maintenance cost

(2) Stack basic conception

- master-slave devices

There are two types devices in stack system:

Master device is the management device of the stack system.

Slave device. The backup device of the master device and it will be selected as the master device if there is something wrong with the master device.

Master-slave equipment is produced automatically by the system. There is only one master device and multiple slave devices in a stack system.

- Device ID

Each device in the system must be manually specified a non-repeatable to uniquely identify the ID number of this equipment, and the device port is shown as “device ID/ slot number/ port number”, for example, “0/0/1” means that device ID is “0”, and its slot number is 0 and port number is 1.

All devices in one stack system should not exist the same ID.

The smaller the device ID is, the higher priority it will be.

- Stack port

Devices connect with each other via stack port in stack system. Stack port can use dedicated stack interface or normal device port to perform devices connection.

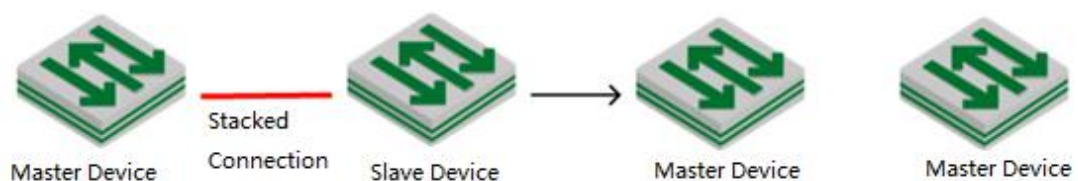
All device stack port in one stack system should be the same or it cannot form the stack. For example, if SW1 uses port{1,2,3,4} as stack port, SW2 must use port{1,2,3,4} as stack port as a consequence. Or these two DUT cannot form stack.

- service port

Other ports are called as service port except stack port.

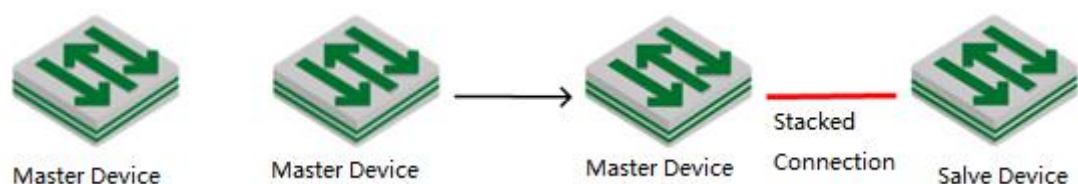
- Split and merge

In stack system, it will split two independent stack systems if the device port lose connection.



schematic diagram of stack split

In reverse, two independent stack systems will be merged in one stack system because of the adding connection of the stack ports.



Stack merge

(3) Stack Topology

Currently, stack can only use the devices with the same capacities to help to form loop topology structure and rectilinear topology structure.

“same capacities” refers to the same software version number and the same hardware type.

(4) left-right virtual port

For example, stack is just like few people hand in hand to form a loop or rectilinear figure.

Left-right port is geared to virtual port, forming by one or multiple physical stack port or no physical stack port.

In stack system, stack port must be left-right virtual port connection, that is, the virtual port left-left virtual port connection and right-right virtual port connection are not allowed.

(5) Master-Slave Selection

In stack system, there will be a master device of automatic select according to stack protocol, and the other devices will act as slave devices.

To understand the master-slave selection mechanism, you need to understand different stack scenarios:

- Power on the devices at the same time: devices connect with each other via stack port before start up, and then power on at the same time;
- Add the devices which are booting to existing stack system: devices connect to an existing stack system through the stack port, then starts to power on.
- Add the devices which have finished booting to existing stack system: it is geared to stack merge. Devices have finished booting and formed its own stack, and then this stack system will connect with the other system via stack port. Stack merger occurs at this time.
- Re-select slave device: if there is something wrong with the master device or the stack splitting, device needs to re-select a master device.

Selection mechanism is as following:

- Running priority. This rule applies to the situation when the stack is added during boot process. If the device discovers the existing master device during boot process, it will add the existing master device to the stack system as a slave device.
- Number of members. This rule applies to the stack merging situation. In the process of stack merging, the master devices with large number of members will stay to be master device while the master devices with fewer number of members will turn into slave devices.
- Device ID. The device with small device ID will be selected to be master device in the following situation: multiple devices establish stack system at the same time;

master device re-selection situation because of master device losing; members of the same number when stack merging.

(6) Device mode

stack equipment can work in two different working modes:

- Standalone Mode. It is the same as ordinary switch, that is, it does not offer stack function.
- Stack Profile. This mode can enable stack function as well as to form a stack system with other device.

(7)MAD Multi-Active Detection

If there is something wrong with a certain stack link, it will disconnect with Master device while it can still connect with multiple Slave devices and select one of them to be the new Master device. So there will be two or multiple master devices with the same configuration in stack system, and it is the so called Multi-Active.

As to the networking devices in the external stack system, logical devices corresponding to stack system are divided into two or multiple logical devices with the same configuration. Therefore, it will appear network configuration conflict and then lead to transmission confusion between uplink and downlink. For this reason, multi-active arises at the historic moment. Multi-Active can be able to detect stack line fault in the shortest time and then perform duly handle.

Therefore, it asks to ensure the following networking function when stack system splitting:

A. Multi-Active Detection


It judges whether there exists multiple logical devices from one stack system and they are now in **active** state via LACP and BFD.

B. Conflict resolution

After stack system splitting, it will be detected that there are multiple logical devices are in active state via multi-active detection mechanism. Conflict resolution will make the logical device with the highest ActivePriority continue the regular work (remain *Active* state)while the other logical devices will be moved to *Recovery* state (Disable state) via a certain election algorithm. When the logical devices are in the *Recovery* state, it will perform Recovery Action: disabled VLAN interface (except the saving-port) and all service port which are in the Recovery state to ensure the logical devices completely disconnected with the network.

C. Failure recovery

Stack system reminder user to restore the stack link by log record. After restoring the stack link, conflicting equipment will reboot and then restore the stack system. At the same time, the closed port will also restore the service transmission.

 Note:

In MAD, use device-id as activePriority; save the small id number as active state, and the other as recovery state.

1.2 Stack

1.2.1 Stand-Alone Mode Configuration

Stand-Alone Mode Configuration

Operation	Command	Remarks
Enter global configuration mode	configure terminal	-
Configure stack	[no] stack	required
Configure device ID	stack device-id <i>value</i>	required
Configure stack port	[no] stack { left-port right-port } <i>port-num</i>	required
Configure device priority	[no] stack priority <i>value</i>	optional
Display stack information	show stack	optional

 Note:

- Stack function will go into effect after rebooting. Except for debug configuration, all stack configuration will be written into Flash and will not be shown in show running;
 - Stack configuration cannot be deleted via the command of *clear startup-config*, and it should be use the command of *no command* to delete one by one.
-

1.2.2 Stack Mode Configuration

Stack Mode Configuration

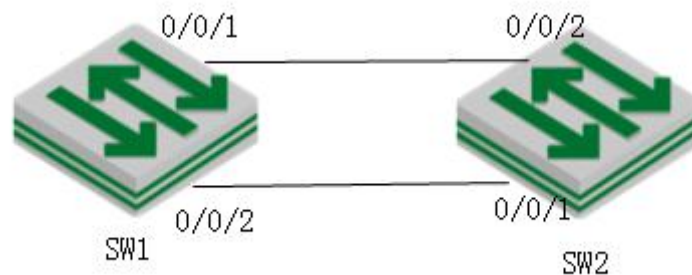
Operation	Command	Remarks
Enter global configuration mode	configure terminal	-
Configure device ID	stack device-id <i>value</i>	optional
Configure stack port	[no] stack { left-port right-port } <i>port-num</i>	optional
Configure device priority	[no] stack priority <i>value</i>	optional
Display stack information	show stack	optional
Configure stack debug function	[no] stack debug { all default error event packet packet-detail smd smd-msg state }	optional
Display stack debug function configuration	show stack debug	optional
Display stack member information	show stack members	optional
Display stack neighbor information	show stack neighbors	optional

Display statistical information of stack packet	show stack statistic	optional
Configure keeping active time	[no] stack hello-timeout <i>value</i>	optional
Configure detection delay	[no] stack linkdown-delay	optional
Enter privileged mode	exit	required
Reboot and designate member	reboot <i>device-id</i>	optional

1.2.3 Stack Configuration Examples

1. Network requirements

It is shown as following. SW1 acts as Master, and SW2 acts as Slave.



sketch map of stack networking

2. Configuration procedure

#SW1 configuration:

enable stack

SW1(config)#stack

configure device-id, 0 by default, SW1 is optional to modify;

SW1(config)#stack device-id 0

configure SW1 left-port

SW1(config)#stack left-port 0/0/1

SW1(config)#stack left-port 0/0/2

configure the priority of SW1

SW1(config)#stack priority 200

reboot. Reboot to bring stack into effect

SW1(config)#ex

SW1#reboot

#SW2 configuration


```

SW2(config)#stack
SW2(config)#stack device-id 1
SW2(config)#stack right-port 0/0/1
SW2(config)#stack right-port 0/0/2
SW2(config)#stack priority 100
SW2(config)#exit
SW2#reboot
  
```

3. Verification result

After two switches rebooting, perform the connect operation according to network construction. SW2 will be selected as Slave and it will be reboot. After rebooting, the stack light of Master device will keep coruscating whereas the stack light of Slave device will keep bum steady. All configurations can only be performed in Master device.

(1)stack system port information after finishing the stack:

```
SW1(config)#show interface brief
```

Port	Desc	Link	shutdn	Speed	Pri	PVID	Mode	TagVlan	UtVlan
e0/0/3		down	false	auto	0	1	hyb		1
e0/0/4		down	false	auto	0	1	hyb		1
e0/0/5		down	false	auto	0	1	hyb		1
e0/0/6		down	false	auto	0	1	hyb		1
e0/0/7		down	false	auto	0	1	hyb		1
.....									
e1/0/1		down	false	auto	0	1	hyb		1
e1/0/2		down	false	auto	0	1	hyb		1
e1/0/3		down	false	auto	0	1	hyb		1
e1/0/4		down	false	auto	0	1	hyb		1
e1/0/5		down	false	auto	0	1	hyb		1

(2) Display all stack members' information

```
SW1(config)#show stack members
```

Informations of stack devices:

```
switch 1 <local>
```

```
  macaddress 00:01:7a:fd:ef:2d device id 0 priority 200
```

```
  master device left hops 0 right hops 0
```

```
  stack identity fdef2d003e4a
```

```
  it's master device 00:01:7a:fd:ef:2d device id 0
```

```
switch 2
```

```
  macaddress 00:01:7a:fd:ee:d2 device id 1 priority 100
```

```
  slave device left hops 1 right hops infinite
```

```
  stack identity fdef2d003e4a
```

```
  it's master device 00:01:7a:fd:ef:2d device id 0
```

Total entries: 2

(3) Display all neighbors' information

```
SW1(config)#show stack neighbors
```

Informations of neighbor devices:

```
switch 1 <local>
```

```
  macaddress 00:01:7a:fd:ef:2d device id 0 priority 200
```

```
  master device left hops 0 right hops 0
```

```
  stack identity fdef2d003e4a
```

```
  it's master device 00:01:7a:fd:ef:2d device id 0
```

```
switch 2
```

```
  macaddress 00:01:7a:fd:ee:d2 device id 1 priority 100
```

```
  slave device left hops 1 right hops infinite
```

```
  stack identity fdef2d003e4a
```

```
  it's master device 00:01:7a:fd:ef:2d device id 0
```

Total entries: 2

(4) establish vlan, and then add members:

```
SW1(config)#vlan 100
```

```
SW1(config-if-vlan)#sw e 0/0/3 e 1/0/3
```

```
SW1(config-if-vlan)#show vlan 100
```

```
show VLAN information
```

```
VLAN ID          : 100
```

```
VLAN status      : static
```

```
VLAN member      : e0/0/3,e1/0/3.
```

```
Static tagged ports :
```

```
  Static untagged Ports : e0/0/3,e1/0/3.
```

```
  Dynamic tagged ports  :
```

Total entries: 1 vlan.

5) upgrade stack system:

```
SW1#load application tftp inet 192.168.1.99 host.arj
```

```
Downloading application via TFTP...
```

```
  Master device 0 operation complete, successful.
```

```
  Slave device 1 operation complete, successful.
```

```
Download application via TFTP successfully.
```

1.2.4 LACP MAD

LACP MAD stack system

operation	command	remark
Enter global configuration mode	configure terminal	-
Enable lacp mad	[no] channel-group <i>value</i> lacp mad	required
Configure lacp mad domain	[no] lacp mad domain <i>value</i>	optional
Display lacp mad information	show lacp mad	optional

LACP MAD relay device configuration

Operation	Command	Remarks
Enter global configuration mode	configure terminal	-
Configure LACP expansion field	channel-group <i>group-id</i> extend-info-relay	required
Display LACP expansion field	show lacp extend-info-relay	optional

Configure MAD to save the port

Operation	Command	Remarks
Enter port configuration mode	interface ethernet <i>port-num</i>	-
Configure mad to save the port	[no] stack mad exclude	required
Display port configuration	show stack mad exclude interface [ethernet <i>port-num</i>]	optional

Note:

LACP MAD only supports dynamic lacp;

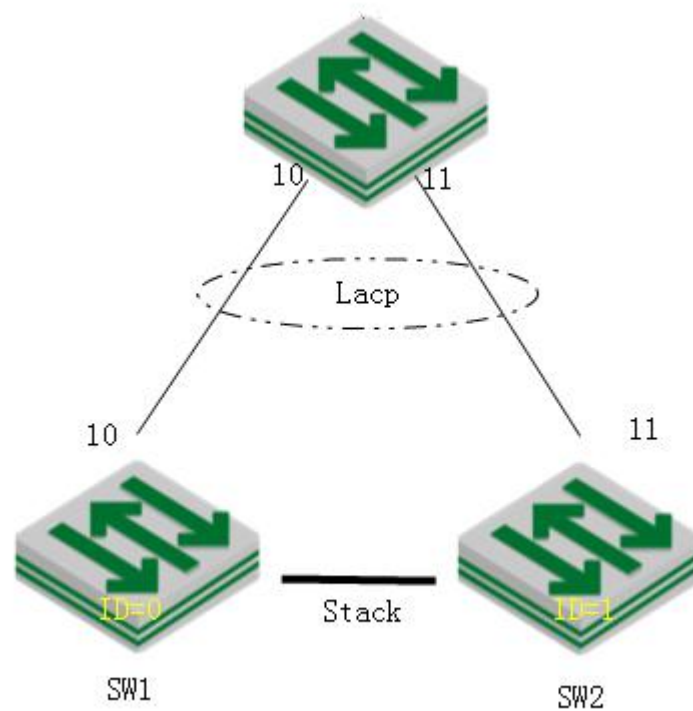
LACP MAD relay device should be able to support LACP expansion field, or it can not take effect;

LACP MAD configuration will not be written in Flash directly;

1.2.5 Configuration Examples for LACP MAD

1. Network requirements

Shown as follow. Two SW form stack system, construct network with the other SW via LACP.



LACP MAD schematic diagram

2. Configuration steps

stack configuration (please refer to stack configuration content for more details)

configure dynamic LACP

```
SW1(config)# interface range ethernet 0/0/10 ethernet 1/0/10
```

```
SW1(config-if-ethernet-0/0/10)#channel-group 1 mode active
```

configure LACP MAD in stack system

enable lacp mad

```
SW1(config)#channel-group 1 lacp mad
```

configure mad domain (optional configuration, 255 by default)

```
SW1(config)#lacp mad domain 200
```

configure the port (optional)

```
SW1(config)#in e 0/0/12
```

```
SW1(config-if-ethernet-0/0/10)#stack mad exclude
```

configure LACP extension field in relay device configuration

```
MilddleDUT#configure terminal
```

```
MilddleDUT (config)# interface ethernet 0/0/10
```

```
MilddleDUT (config-if-ethernet-0/0/10)#channel-group 1 mode active
```

```
MilddleDUT (config-if-ethernet-0/0/10)#ex
```

```
MilddleDUT(config)#channel-group 1 extend-info-relay
```

3. verification result:

```

SW1(config)# logging monitor 0
SW1(config)#debug link_aggregation
SW1(config)#debug stack
    # manually disconnect all the stack line;
00:26:06: SW1: %stack-5-state: stack port 1/0/1 link down
00:26:08: SW1: %stack-5-state: stack port 0/0/1 link down
00:26:08: SW1: %stack-5-state: isf_devinfo_timeout_hello:device 1 leave stack mac
00:01:7a:fd:ee:d2
    # the MAD which has been detected ;
00:26:08: SW1: %LINK_AGGREGATION-7-isfMad: A multi-active conflict detected on channel
group 1(local ActiveId = 0, peer ActiveId = 1).
    # only save and linkup port and lacp mad port, shutdown the other ports
SW1(config)#show interface brief

```

Port	Desc	Link	shutdn	Speed	Pri	PVID	Mode	TagVlan	UtVlan
e0/0/3		down	false	auto	0	1	hyb		1
e0/0/4		down	false	auto	0	1	hyb		1
e0/0/5		down	false	auto	0	1	hyb		1
e0/0/6		down	false	auto	0	1	hyb		1
e0/0/7		down	false	auto	0	1	hyb		1
e0/0/8		down	false	auto	0	1	hyb		1
e0/0/9		down	false	auto	0	1	hyb		1
e0/0/10		up	false	auto-f1000	0	1	hyb		1
e0/0/11		down	false	auto	0	1	hyb		1
e0/0/12		up	false	auto-f1000	0	1	hyb		1
e0/0/13		down	false	auto	0	1	hyb		1
e0/0/14		down	false	auto	0	1	hyb		1
.....									
e0/0/21		down	false	auto	0	1	hyb		1
e0/0/22		down	false	auto	0	1	hyb		1
e0/0/23		down	false	auto	0	1	hyb		1

Total entries: 50 .

 📖 Note:

All the above are just to demonstrate the effect, the actual use don't need to open the debug.

1.2.6 BFD MAD

Configure BFD MAD—L3 devices

Operation	Command	Remarks
Enter global configuration mode	configure terminal	-
Enable/disable bfd	bfd { enable disable }	required
Disable STP	no spanning-tree	required
Create a Layer 3 interface	interface vlan-interface <i>vlan-id</i>	optional
Configure member ip of mad detection	[no] mad device-id ip address <i>A.B.C.D mask</i>	required
Enable/disable mad bfd	mad bfd {enable disable}	required
Display mad bfd information	show mad bfd	optional
Display bfd session information	show bfd session	optional

Configure the MAD reserved port

Operation	Command	Remarks
Enter port configuration mode	interface ethernet <i>port-num</i>	-
Configure mad to save the port	[no] stack mad exclude	required
Display port configuration	show stack mad exclude interface [ethernet <i>port-num</i>]	optional

Note:

1. BFD MAD port asks to disable the spanning tree to avoid detection failure on account of the port in Blocking state and then discard the BFD packet.

2. It asks to use BFD VLAN to isolate MAD port and the other ports so as to avoid the storm.

3. BFD MAD has no requirement on VLAN type of detection port (Access/Trunk/Hybrid) while it requires to ensure the VLAN connectivity.

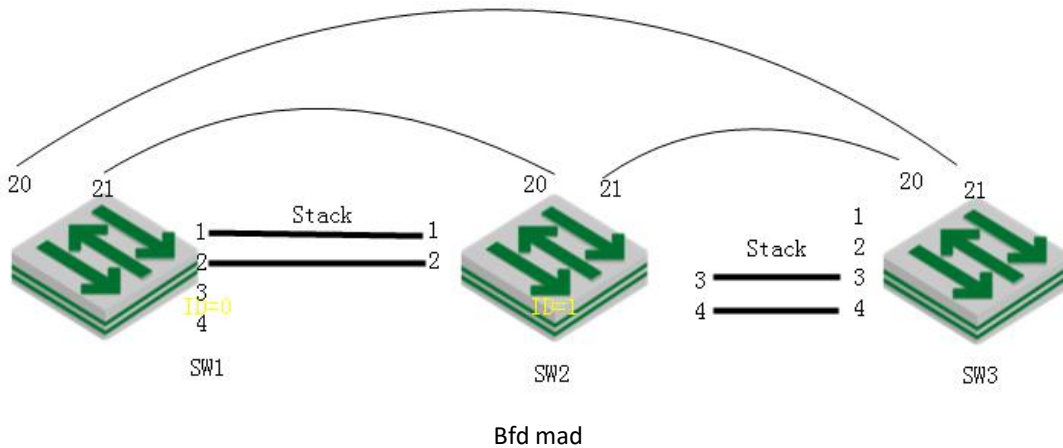
4. It asks to use the command of *mad member member-id ip address* to configure MAD IP address. Remember do not configure other IP addresses (for example, use the command of ip address to configure normal IP address, interface IP address, VRRP vlan IP address, etc) for fear that it will affect MAD function.

5. It asks to ensure the mesh connection of all stack members when BFD MAD do not use relay device to construct networking; it asks to ensure each member has connected with relay device when using relay device to construct networking.

1.2.7 Configuration Examples for BFD MAD (L3 Devices)

1. Network requirements

Network requirements:



2. Configuration steps

stack configuration:

```
SW1(config)#stack
```

```
SW1(config)#stack priority 200
```

```
SW1(config)#stack device-id 0
```

```
SW1(config)#stack left-port 0/0/3
```

```
SW1(config)#stack left-port 0/0/4
```

```
SW1(config)#stack right-port 0/0/1
```

```
SW1(config)#stack right-port 0/0/2
```

```
SW2(config)#stack
```

```
SW2(config)#stack priority 190
```

```
SW2(config)#stack device-id 1
```

```
SW2(config)#stack left-port 0/0/1
```

```
SW2(config)#stack left-port 0/0/2
```

```
SW2(config)#stack right-port 0/0/3
```

```
SW2(config)#stack right-port 0/0/4
```

```
SW3(config)#stack
```

```
SW3(config)#stack priority 170
```

```
SW3(config)#stack device-id 2
```

```
SW3(config)#stack left-port 0/0/3
```

```
SW3(config)#stack left-port 0/0/4
```

```
SW3(config)#stack right-port 0/0/1
```

```
SW3(config)#stack right-port 0/0/2
```

MAD BFD port configuration: using vlan100 interface to perform the MAD detect with each SW 20 and SW 21 port, and then save the BFD port;

```
SW1(config)#vlan 100
SW1(config-if-vlan)#switchport ethernet 0/0/20 to ethernet 0/0/21
SW1(config-if-vlan)#switchport ethernet 1/0/20 to ethernet 1/0/21
SW1(config-if-vlan)#switchport ethernet 2/0/20 to ethernet 2/0/21
SW1(config-if-vlan)#interface range ethernet 0/0/20 ethernet 0/0/21
SW1(config-if-range)#switchport default vlan 100
SW1(config-if-range)#no spanning-tree
SW1(config-if-range)#stack mad exclude
SW1(config-if-range)#interface range ethernet 1/0/20 ethernet 1/0/21
SW1(config-if-range)#switchport default vlan 100
SW1(config-if-range)#no spanning-tree
SW1(config-if-range)#stack mad exclude
SW1(config-if-range)#interface range ethernet 2/0/20 ethernet 2/0/21
SW1(config-if-range)#switchport default vlan 100
SW1(config-if-range)#no spanning-tree
SW1(config-if-range)#stack mad exclude
```

#MAD BFD configuration

```
SW1(config)#interface vlan-interface 100
SW1(config-if-vlanInterface-100)#mad bfd enable
SW1(config-if-vlanInterface-100)#mad device-id 0 ip address 20.20.20.20 255.255.255.0
SW1(config-if-vlanInterface-100)#mad device-id 1 ip address 20.20.20.21 255.255.255.0
SW1(config-if-vlanInterface-100)#mad device-id 2 ip address 20.20.20.22 255.255.255.0
```

3.Result validation

(1) when under normal circumstances, BFD session state will be as following:

```
SW1(config)#show bfd session
Total Session Num: 2
Init Mode: Active
Session Working Under Asynch Mode
LD          SourceAddr      DestAddr      State      Holdtime Interface
0x0add68e8 20.20.20.20      20.20.20.21  DOWN      0ms      Vlan100
Init Mode: Active
Session Working Under Asynch Mode
LD          SourceAddr      DestAddr      State      Holdtime Interface
0x0add699c 20.20.20.20      20.20.20.22  DOWN      0ms      Vlan100
```

(2) manually disconnect all the STACK line between SW2 and SW3, the conflict that BFD MAD has detected will be shown as following:

```
SW1(config)#s bfd session
Total Session Num: 2
```


Init Mode: Active

Session Working Under Asynch Mode

LD	SourceAddr	DestAddr	State	Holdtime	Interface
0x0add68e8	20.20.20.20	20.20.20.21	DOWN	0ms	Vlan100

Init Mode: Active

Session Working Under Asynch Mode

LD	SourceAddr	DestAddr	State	Holdtime	Interface
0x0add699c	20.20.20.20	20.20.20.22	UP	1890ms	Vlan100

(3) Enter SW3, you can see the Stack processing recovery state:

SW1(config)#show stack

Config in flash:

enable stack, device id is 2, priority is 200

left port 2/0/3 2/0/4

right port 2/0/1 2/0/2

Config in running:

enable stack, device id is 2, priority is 170

left port 2/0/3 2/0/4

right port 2/0/1 2/0/2

Local device is master devcie, state is STATE_MASTER

Linkdown-delay is FALSE, hello-timeout is 30

Mad status: recovery

Left-port load-sharing mode: source port

Right-port load-sharing mode: source port

Infomation of stack port:

stack port 2/0/1 is link down speed is unknown

stack port 2/0/2 is link down speed is unknown

stack port 2/0/3 is link down speed is unknown

stack port 2/0/4 is link down speed is unknown