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# Chapter 1 VSF

## 1.1 Overview

### 1.1.1 Introduction of VSF

VSF is using the VSF port to connect several servers and build up a virtual logical facility. The user can use this virtual machine to manage all the physical facilities that link up together.

Traditional district and the data center network is using the multiple layer network topology structure design as shown below in the Fig 1-1. The following are the drawbacks of this type of network:

- (1) The network and the server are complicated, thus it will cause the operation efficiency decrease and at higher cost.
- (2) No status internet conk out switch will delay the recover time of application and break out time of operation.
- (3) Low usage of resources will decrease the return of income (ROI) and increase the capital.

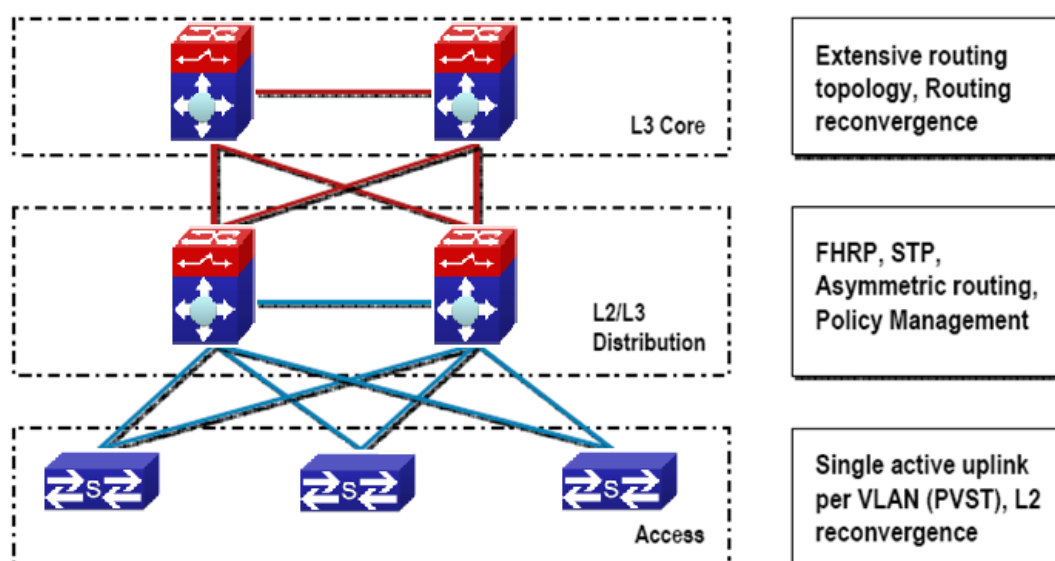


Fig 1-1 Traditional Enterprise Network

In order to solving these problems, VSF comes. Make up more than one device which supports VSF to be the single virtualization switch. In VSF, the data panel of the management engine and the exchange array of both switches can be activated at the same time. Members of VSF can throughout the VSL to connection. The VSL standard among the members of the switches is using million-mega Ethernet for connection (maximum have 4 linkages, to provide redundancy), like Fig 1-2.

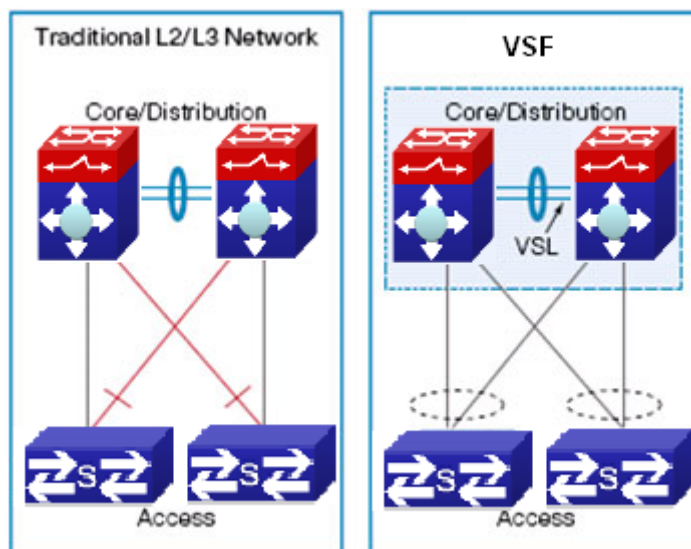


Fig 1-2 VSF

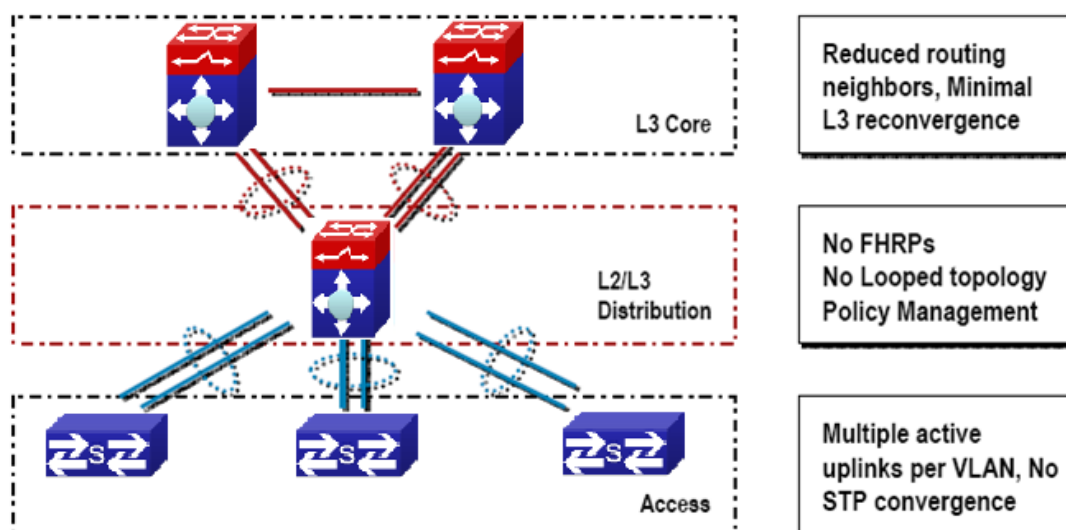


Fig 1-3 Enterprise that adopting virtual technology

Compare with the tradition L2/L3network design, VSF provides with multiple markedness advantages. All in all, we can conclude with 3 main advantages:

1. VSF can increase the efficiency of operation

Only one management point, including configuration documents and gateway IP address (dispense with HSRP/ VRRP/GLBP)

One logical device which is made up by multiple physical devices creates the simple topology without loop and without the spanning tree protocol (STP).

Bottom physical switches connect together by using standard million-mega Ethernet port; it provides a flexible deploy option for the location.

2. VSF can optimize the uninterrupted communication

Switches status conk out switching will not interrupt the applications which are using the internet status information. With the help of VSF, if one of the virtual switch members is out of order, no need to continuous the reconstringency of L2/L3 can restart the virtual switch recover in short time. The active mode must be used for port group.

3. VSF can expand the system bandwidth capacity

In the vsf switch can activate all the L2 bandwidth, can carry on the equilibrium of load on the multiple members of VSF when expanding the bandwidth.

### 1.1.2 Basic Concept

(1) Role

Each of the facilities in the VSF is called member facility. According to the function of each member facility, will divide into 2 different roles:

**Master:** Responds for manage entire VSF

**Standby Master:** Is the standby member of VSF, as the Master backup facility for operation. When the Master is out of order, the systems will handover to Standby Master automatically to perform the original job of Master.

**Slave:** The member facilities that are other than Master and Standby Master in VSF.

Master, Standby Master and Slave are produced by election. For entire VSF, it can only have one Master, one Standby Master, other members should be Slave.

(2) VSF port

It is a logic port which is particular use for VSF. It divides into vsf-port1 and vsf-port2, need to colligate with the VSF physical port and then become effictive.

(3) VSF physical port

It is the facility that is used for physical connection port for VSF. VSF physical port can be VSF specific port, Ethernet port or light port (different equipment and the model will using different port, please equipt it according to the virtual situtation). Usually, Ethernet port and light port respond for transmitting operation message. After they colligate with the VSF port, they will become the VSF physical port. They will use for transmitting the message within the members. The message including VSF related negotiation message and the operation message that needs to cross over different members.

(4) Merge

Two different VSF operation separately, throughout the physical connection and configuration, it will become one VSF. This process is called merge.



Fig 1-4 Merging of VSF

## (5) Split

One VSF is formed. Due to the VSF link is out of order, it will cause the facilities that are border upon cannot connect together physically. Therefore, one stracking will divide into two stracking. This process is called split.

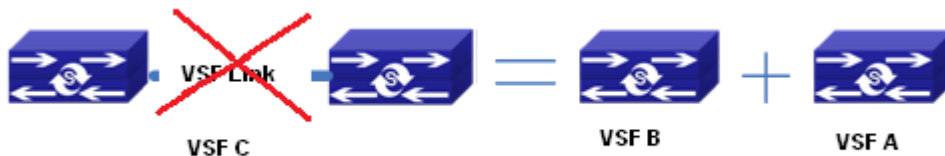


Fig 1-5 Splitting of tacking

## (6) Priority of member

Priority of member is the member facilities attribute, mainly use for the role selection for confirming the role of each members. If the facility has higher the priority, it will have higher chance to become the Master. The default setting of the facilities is 1. If the user want to pre-set particular facility become the Master, he can increase the priority value of that facility manually before build up the VSF.

### 1.1.3 Glossary

**VSF** is the short form of the Virtual Switching Framework.

**VSF Port:** VSF port, is a mode on port-channel

**VSF AM:** the master card of the VSF activities

**VSF SM:** the backup master card of the VSF activities

**VSF Slave:** the slave card of VSF, to operate the VSF agreement ,during the switching it means Chassis AM, the not selecte one is VSF AM or VSF SM

**VSF Member:** the member facilities of VSF

**VSF Master Member:** the master member facility of VSF

**VSF Standby Master Member:** the standby master member facility of VSF

**VSF Slave Member:** the slave member facilities of VSF

**HA:** High Availability

**AM:** Active Master, activities controller. It is the switch whose working mode is Master is and it is in the operation status, each of the cassette vsf group can only has a AM at each time.

**SM:** Standby Master, the working mode in the cassette vsf group is Master and it locates in the standby status.

**SSO:** Stateful Switchove, the data of in-phase agreement layer will occur the switchover, the backup master agreement apply function which can connect to corresponding function fleetly. The data of this function will not be lose, but the router agreement data is not in-phase

**NSF:** None Stop Forwarding. Using the independent management characteristics of data layer control, data layer can still transmit data normally as the control layer is out of order

**NSF/SSO:** Nonstop Forwarding with Stateful Switchover means that undergo the SSO “master-backup interchange”, the data transmit is not affected

**Syn process:** HA synchronization processes responsible for activities control and backup agreement function collection or distribution and data synchronization communication.

**GR:** Graceful restart. In order to transmitting uninterruptedly, require the router confer to extend to support the GR ability.

**MAD:** Multi-Active Detection

### 1.1.4 VSF Typical Application

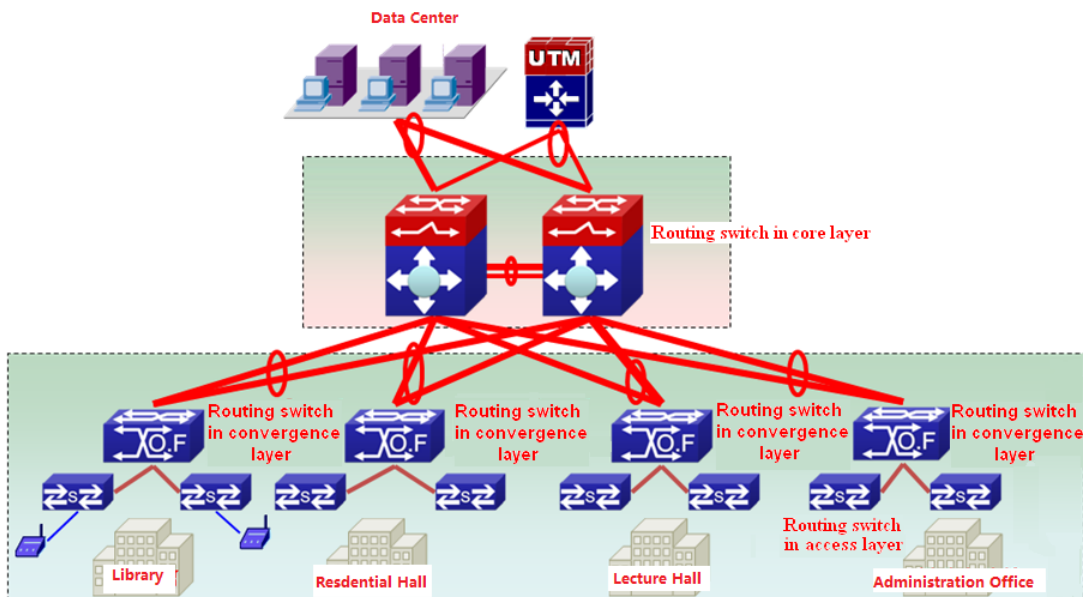


Fig 1-6 application of VSF in the campus data center

Fig 1-6 is the application of VSF in the campus internet. After using the VSF, it groups several facilities together to become the single logic facility and connect to the virtual facility. After the predigestion, the network do not need to use MSTP, VRRP protocol, it simplifies the network configuration. At the same time, it relies on the cross facilities to aggregate the link (The active mode must be used for port group). When some of the members are out of order, it will not rely on MSTP, VRRP protocol etc constringency, thus in increase the reliability.

### 1.1.5 LACP MAD

lacp mad is the dynamic aggregation method based on lacp. Each member device of vsf has one port connecting to the middle device at least.

Notice: The middle device must be the device which supports the extended function of lacp.

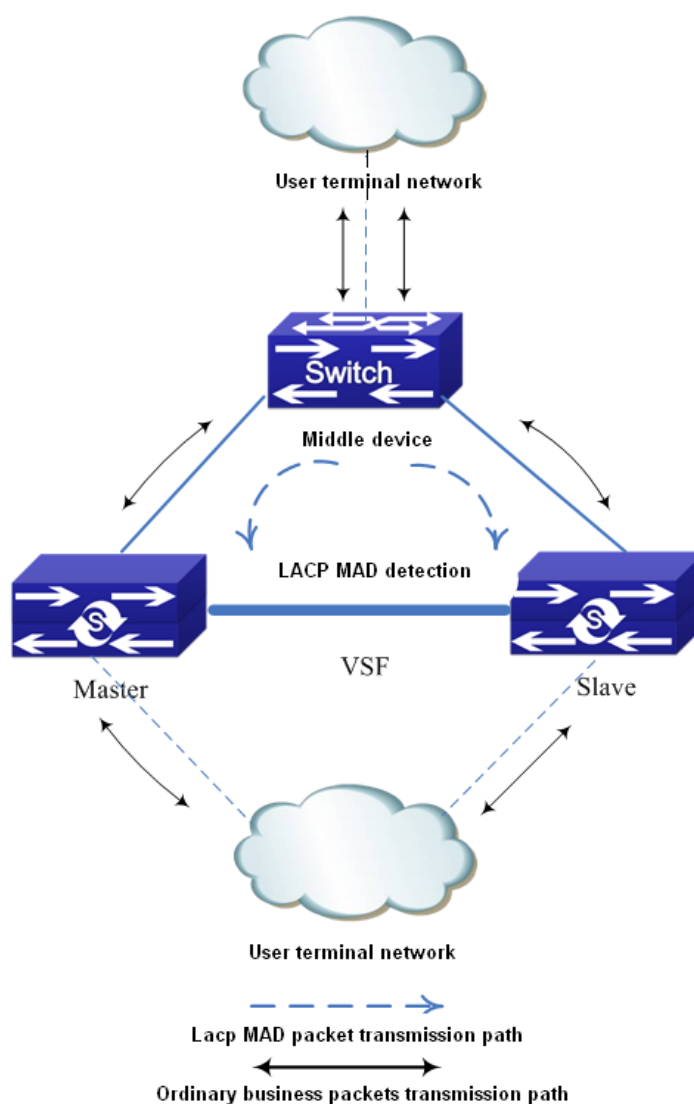


Fig 1-7 LACP MAD detection

LACP MAD detection is achieved through the extended LACP protocol packets content. It defines a new TLV (Type Length Value) in the extended field of LACP protocol packets and this TLV is used for the ActiveID of the interaction VSF. For VSF system, ActiveID value is unique, and it is expressed by the member number of the master device in VSF. After enabling LACP MAD detection, the member device interact the ActiveID information with other member devices through the LACP protocol packets.

When VSF is running normally, the ActiveID values of the LACP protocol packets sent by all member devices are the same, there is no Active conflict.

When the VSF is split into two vsf, the ActiveID values of the LACP protocol packets sent by different VSF member devices are the different and multiple Active conflict will be detected.

### 1.1.6 BFD MAD

The topology of Bfd mad detection is simpler than lacp. But, one vlan is selected for bfd mad detection once, this vlan and the ports in it will be as the specific vlan and ports of bfd mad and they cannot be configured other functions.

Construction method: select one port on member1 and select one port on member2. Connect them with a line.

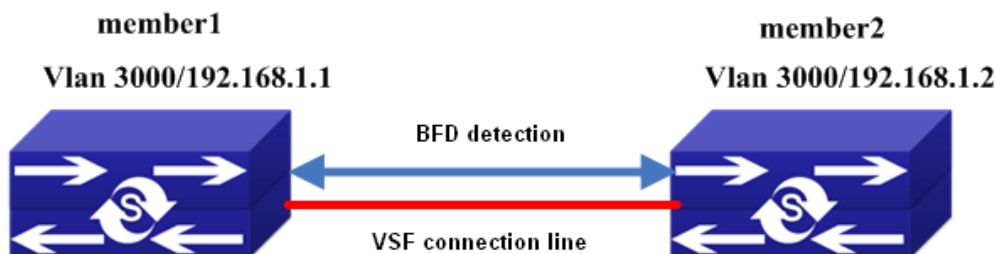


Fig 1-8 BFD MAD detection

BFD MAD detection is achieved through BFD protocol. For BFD MAD detection function running normally, enable BFD MAD detection function under the layer3 interface and configure MAD IP address on this interface. The difference between MAD IP address and the ordinary IP address is that MAD IP address is bond to the member device, each member device in VSF should configured it and they must belong to the same network segment.

When VSF is running normally, only the MAD IP address configured on master is effective, the MAD IP associated with the slave device is not effective, BFD session is under the status of down.

When the VSF is split into two vsf, the mad ip address associated with the member on the new vsf becomes effective. Through the connection line of bfd mad detection, the bfd session will be created between the two vsf to detect the multiple Active conflict.

## 1.2 Relevant VSF Configuration

### 1.2.1 VSF Configuration

#### VSF configuration task list:

1. Configure the number of VSF members (necessary)
2. Configure the priority of VSF members (optional)
3. Configure the VSF domain (optional)
4. Configure the logic VSF port
  - (1) Configure the logic VSF port
  - (2) Bind the physical port to the logic port
5. Transform the device from independent operation mode to VSF operation mode
6. Configure the VSF to merge automatically (optional)
7. Describe the VSF members (optional)
8. Configure the down delaying reporting function of the VSF link (optional)
9. Configure the keeping time of MAC address of VSF group after VSF split (optional)



10. Transform the device from VSF operation mode to the independent operation mode
11. Detect the VSF link status' change quickly

### 1. Configure the number of VSF members (necessary)

Command	Explanation
Global Mode	
<b>vsf member &lt;member-id&gt;</b> <b>no vsf member &lt;member-id&gt;</b>	Configure/delete the number of VSF members.

### 2. Configure the priority and domain of VSF members (optional)

Command	Explanation
Global Mode	
<b>vsf priority &lt;priority&gt;</b> <b>no vsf priority</b>	Configure/delete the priority of VSF members.
<b>vsf domain &lt;domain-id&gt;</b> <b>no vsf domain</b>	Configure/delete the VSF domain, the no command recovers to be default of 1.

### 3. Configure the logic VSF port and Bind the physical port to the logic port

Command	Explanation
Global Mode	
<b>vsf port-group &lt;port-number&gt;</b> <b>no vsf port-group &lt;port-number&gt;</b>	Configure/delete the logic VSF port.
VSF Port Configuration Mode	
<b>vsf port-group interface Ethernet &lt;interface-list&gt;</b> <b>no vsf port-group interface Ethernet &lt;interface-list&gt;</b>	Bind the physical port to the logic VSF port or delete the binding.

### 4. Transform the operation modes of the device

Command	Explanation
Global Mode	
<b>switch convert mode ( stand-alone   vsf )</b>	Transform the device from independent operation mode to VSF operation mode or transform the device from VSF operation mode to the independent operation mode

### 5. Other configurations

Command	Explanation
Global Mode	
<b>vsf auto-merge enable</b> <b>no vsf auto-merge enable</b>	Enable the automatic merger function of VSF, the no command disables this function.

<b>vsf member &lt;member-id&gt;</b> <b>description &lt;text&gt;</b> <b>no vsf member &lt;member-id&gt;</b> <b>description</b>	Describe the VSF members. This information will be only written in the VSF master configuration file. The <b>no</b> command deletes this information.
<b>vsf link delay&lt;interval&gt;</b> <b>no vsf link delay</b>	Configure the down delaying reporting function of the VSF link, using for avoid link to split and merge due to changing in short period of time. The <b>no</b> command will set the time for delay report to default value.
<b>vsf mac-address persistent &lt;timer   always&gt;</b> <b>no vsf mac-address persistent</b>	Configure VSF split group MAC address retention time. <b>No</b> command deletes the MAC address retention time.
<b>vsf non-wait port-inactive</b> <b>no vsf non-wait port-inactive</b>	Detect the VSF link status' change quickly for discovering the vsf splitting. The <b>no</b> command recovers to be the default method.

## 1.2.2 LACP MAD Configuration

### LACP MAD configuration task list:

1. Create the aggregation groups
2. Add the port into the aggregation group, and one is with the active method at least
3. Configure the quick detection (optional)
4. Enable LACP MAD

#### 1. Create the aggregation groups

Command	Explanation
Global Mode	
<b>port-group &lt;port-group id&gt;</b> <b>no Port-group &lt;port-group id&gt;</b>	Create/delete the port-group.

#### 2. Add the port into the aggregation group

Command	Explanation
Global Mode	
<b>interface ethernet &lt;port-num&gt;</b>	Enter into the port mode.
Port Mode	
<b>port-group &lt;port-group id&gt; mode &lt;active   passive&gt;</b> <b>no port-group &lt;port-group id&gt;</b>	Add the port into the aggregation group or let it quit.

#### 3. Configure the quick detection

Command	Explanation
Port Mode	

<b>lACP timeout &lt;long   short&gt;</b> <b>no lACP timeout</b>	Configure/delete the quick detection.
--	---------------------------------------

#### 4. Enable LACP MAD

Command	Explanation
Aggregation Port Mode	
<b>vsf mad lACP &lt;enable   disable&gt;</b>	Enable/disable LACP MAD on port-group.

## 1.2.3 BFD MAD Configuration

### BFD MAD configuration task list:

1. Create the vlan used for BFD MAD
2. Add the port used for BFD MAD into the corresponding vlan
3. Configure IP address for BFD MAD layer3 interface
4. Enable BFD MAD function

#### 1. Create the vlan used for BFD MAD

Command	Explanation
Global Mode	
<b>vlan &lt;vlan-id&gt;</b> <b>no vlan &lt;vlan-id&gt;</b>	Configure/delete vlan.

#### 2. Add the port used for BFD MAD into the corresponding vlan

Command	Explanation
VLAN Configuration Mode	
<b>switchport interface ethernet &lt;port-num&gt;</b> <b>no switchport interface ethernet &lt;port-num&gt;</b>	Add the port into vlan or let it out.

#### 3. Configure IP address for BFD MAD layer3 interface

Command	Explanation
Global Mode	
<b>Interface vlan &lt;vlan-id&gt;</b>	Enter into the vlan interface configuration mode.
Interface Configuration Mode	
<b>vsf mad ip address &lt;ip-addr&gt; &lt;ip-mask&gt; member &lt;member-id&gt;</b> <b>no vsf mad ip address &lt;ip-addr&gt; &lt;ip-mask&gt; member &lt;member-id&gt;</b>	Configure/delete the IP address used for BFD MAD on the layer3 interface.

#### 4. Enable BFD MAD function

Command	Explanation
Interface Configuration Mode	
<b>vsf mad bfd &lt;enable   disable&gt;</b>	Enable/disable BFD MAD.

## 1.3 Typical VSF Example

### Case 1:

Configure under the independent operation mode, let two switches create VSF. The member number of these two facilities is 1 and 2. In order to let vsf member2 as the vsf master, configure the priority of member 2 as 32, and build up two vsf port-group between both facilities. Each of the vsf port-group will colligate one of the million mega port.

#### switch1 VSF configuration as following:

```
switch1#config
switch1(config)#vsf member 1
switch1(config)#vsf port-group 1
switch1(config-vsf-port1)#vsf port-group interface ethernet 1/1
switch1(config)#vsf port-group 2
switch1(config-vsf-port1)#vsf port-group interface ethernet 1/2
switch1(config)#exit
switch1(config)#switch convert mode vsf
```

#### switch2 VSF configuration as following:

```
switch2#config
switch1(config)#vsf member 2
switch1(config)#vsf priority 32
switch1(config)#vsf port-group 1
switch1(config-vsf-port1)#vsf port-group interface ethernet 2/1
switch1(config)#vsf port-group 2
switch1(config-vsf-port1)#vsf port-group interface ethernet 2/2
switch1(config)#exit
switch1(config)#switch convert mode vsf
```

### Case 2:

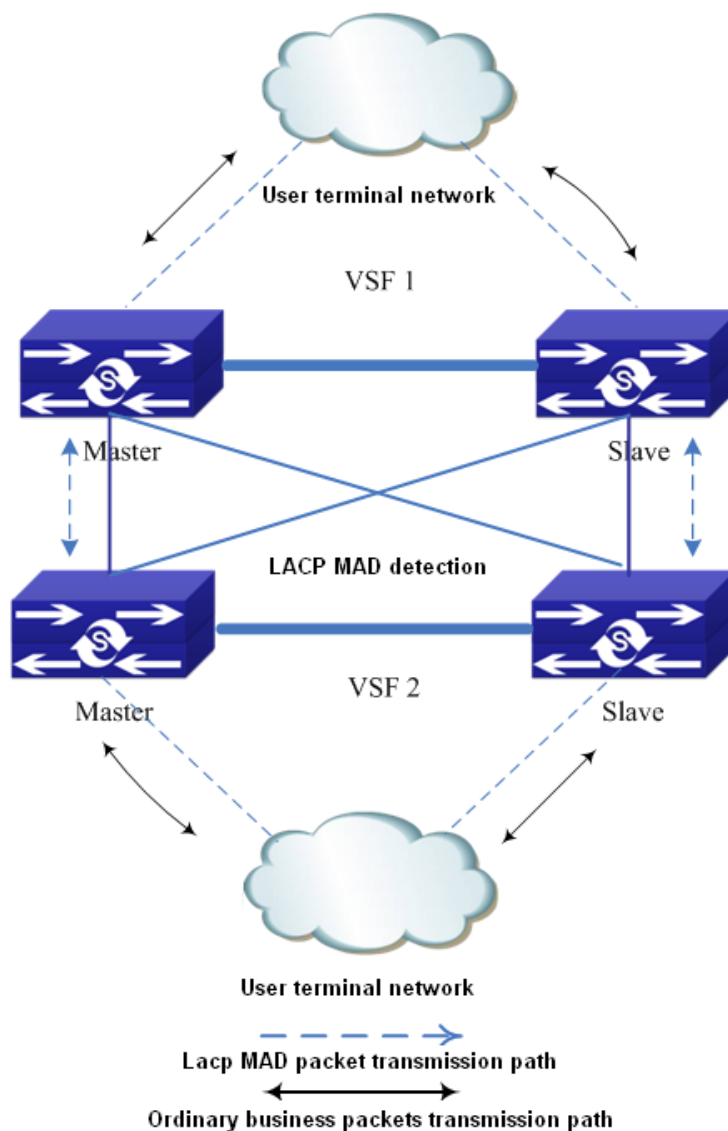


Fig 1-9 lacp mad detection topology

As shown in the above picture, use the lacp mad detection function between two vsf. Vsf1 and vsf2 are the devices which are detected and they are also the middle devices. The configuration is same with above. Proposal: uses create the overlapping connection among the devices to avoid that the vsf1 cannot be the middle device to detect vsf2 after it is split.

Assume that vsf1 and vsf2 use the lacp ports of ethernet1/1/1, ethernet 1/1/2, ethernet 2/1/1 and ethernet 2/1/2.

#### vsf1 configuration:

```
Switch(config)#vsf domain 1
```

Configure vsf domain number, it can be configured as other value but it cannot be the same as vsf2.

```
Switch(config)#port-group 1
```

```
Switch(config)#interface ethernet 1/1/1
```

```
Switch(config-if-ethernet1/1/1)#port-group 1 mode active
```

```
Switch(config)#interface ethernet 1/1/2
```

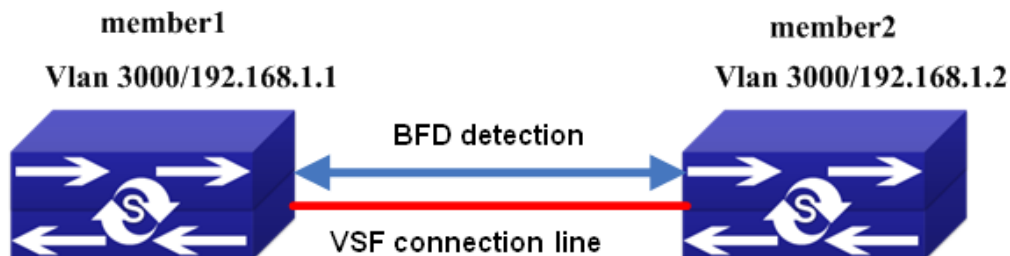
```
Switch(config-if-ethernet1/1/2)#port-group 1 mode active
Switch(config)#interface ethernet 2/1/1
Switch(config-if-ethernet2/1/1)#port-group 1 mode active
Switch(config)#interface ethernet 2/1/2
Switch(config-if-ethernet2/1/2)#port-group 1 mode active
Switch(config-if-ethernet2/1/2)#interface port-channel 1
Switch(config-if-port-channel1)#vsf mad lacp enable
```

**vsf2 configuration:**

```
Switch(config)#vsf domain 2
```

Configure vsf domain number, it can be configured as other value but it cannot be the same as vsf1.

Other configuration is same as the configuration on vsf1.

**Case 3:**

As show in the above picture, assume the ports used for bfd mad detection are ethernet1/1/1 and ethernet2/1/1, and the vlan is 3000. The configuration of mad ip address is the network segment of 192.168.1.1 for example.

**BFD MAD configuration of switch:**

```
Switch(config)#vlan 3000
Switch(config-vlan3000)#interface ethernet 1/1/1
Switch(config-if-ethernet1/1/1)#switchport access vlan 3000
Switch(config-if-ethernet1/1/1)#interface ethernet 2/1/1
Switch(config-if-ethernet2/1/1)#switchport access vlan 3000
Switch(config-if-ethernet2/1/1)#interface vlan 3000
Switch(config-if-vlan3000)#vsf mad bfd enable
Switch(config-if-vlan3000)#vsf mad ip add 192.168.1.1 255.255.255.0 member 2
Switch(config-if-vlan3000)#vsf mad ip add 192.168.1.2 255.255.255.0 member 1
```

Notice: In this time, the whole vsf is a device, so BFD MAD configuration is equivalent to conduct on one device.

## 1.4 VSF Troubleshooting

For VSF, under the configuration and usage, the command may not be workable, please pay attention to the following items:

- ⇒ Whether it is at the operation mode, because some of the commands can only be configured at VSF operation mode, but some of them can operation at both VSF and independent operation mode.

Under the failure of VSF during the VSF processes, or appear any abnormality, please pay attention to the following thing:

- ⇒ First, need to check whether physical connection is correct. Right now, the group VSF machine can only support million-mega port or logic port colligate. Please check whether the colligate port is the million-mega port.
- ⇒ Whether the Vsf member id is clash, if the member ids are clashing, the facilities cannot form vsf.
- ⇒ Whether the Vsf domain numbers are same. Only the vsf domain numbers are identical, the facilities can form the vsf.
- ⇒ To see whether the logical port has any physical connection, for example, double speed, bandwidth restriction, safety authentication, ACL etc configuration.

Under the VSF operation mode to undergo configuration, please pay attention to the following things:

- ⇒ During the VSF operation mode, VSF related configuration can be done on the each member separately. However, the configuration done on the members cannot be saved independently. It cans still excute the write function on the vsf master. All the membes' personal configuration that is related to vsf will be save in the main computer's vsf.cfg.
- ⇒ Under the VSF operation mode, some of the commands such as VSF domain number, priority of member, member id etc can still be configured or amended. After the configuration, the show run displays as the latest value, it can only be effective as you restart the computer after saving.
- ⇒ Under the VSF operation mode, the active mode must be used for port group for ensuring the fault convergence time.

**For LACP MAD, under the configuration and usage, if there are problems, please pay attention to the following items:**

- ⇒ When creating the aggregation group, the aggregation of the device which is detected and the middle device must be identical.
- ⇒ The ports of the device which is detected and the middle device cannot be added into the aggregation with on mode for LACP MAD, one should be active method at least.
- ⇒ When the device which is detected and the middle device are both vsf, the domain id (vsf domain number) of the two vsf cannot be the same.

**For BFD MAD, under the configuration and usage, if there are problems, please pay attention to the following items:**

- ⇒ bfd mad function cannot be enabled under interface vlan 1.
- ⇒ bfd mad function and the anti-ring function are mutually exclusive (such as stp, mstp, etc). if this vsf is configured anti-ring function, the ports used for bfd mad

detection should be disabled the anti-ring function, otherwise, the detection may fail.

- ⇒ If there is port configured as trunk port on this vsf (include port-channel port), please ensure whether the vlan used for bfd mad detection is in this trunk (trunk port belongs to all vlan as default). If it is in, the vlan used for bfd mad detection must be filtered under this port, otherwise, the loop may appears.
- ⇒ If there is port configured as hybrid port on this vsf, please ensure that this hybrid port does not belong the vlan used for bfd mad detection, otherwise, the loop may appears.
- ⇒ The vlan interface and all the ports in this vlan used for bfd mad detection cannot be configured other configuration except bfd mad detection.
- ⇒ If the bfd mad function will not be used any more, clear the configuration and the connection line used for bfd mad should be removed.
- ⇒ If bfd mad configuration has been already completed, and other ports, vlan or the command under the global mode should be modified, please ensure whether it conforms the above items.
- ⇒ Suggestion: user should select a vlan which is not used in business on the whole as the specific vlan for bfd mad detection.