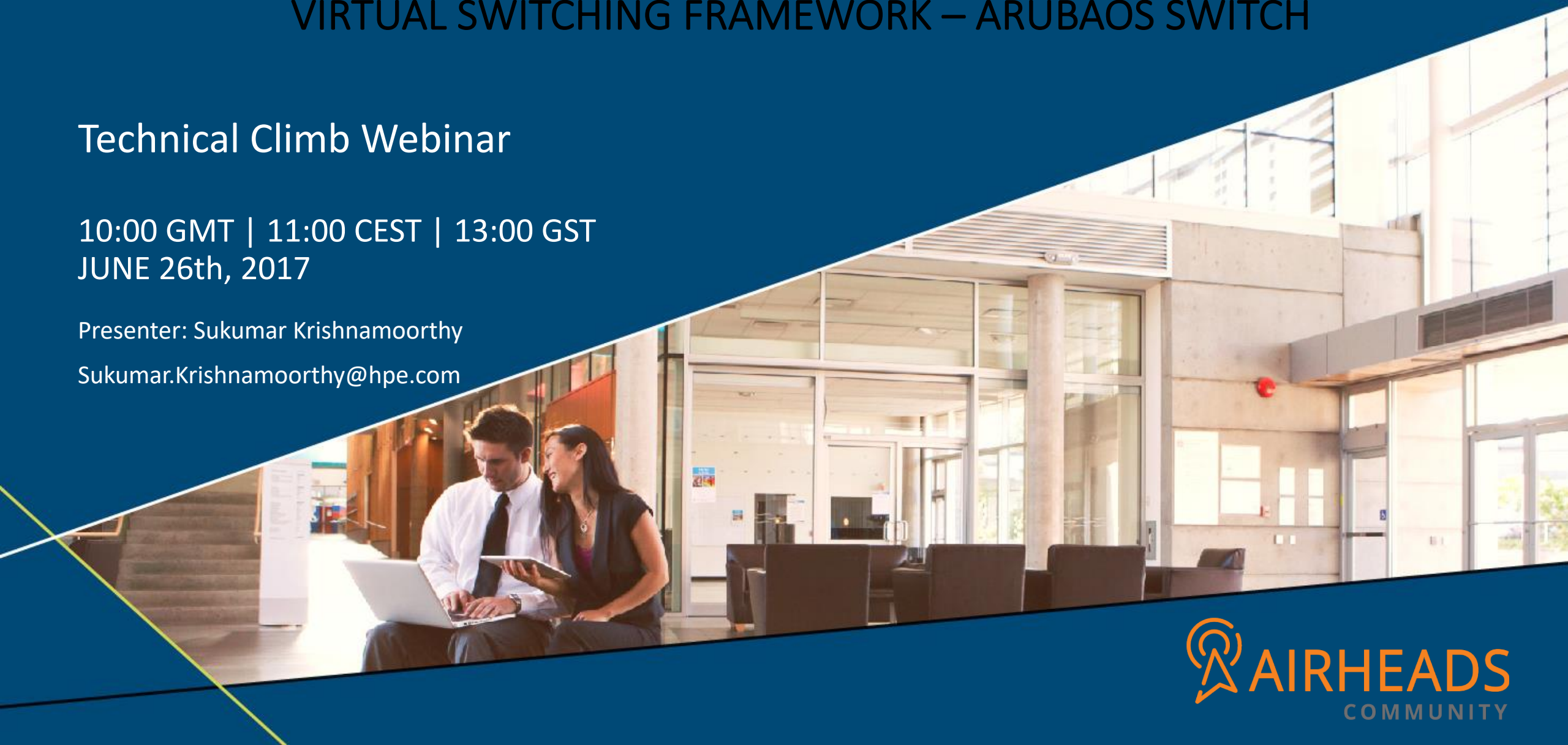


# VIRTUAL SWITCHING FRAMEWORK – ARUBAOS SWITCH

## Technical Climb Webinar

10:00 GMT | 11:00 CEST | 13:00 GST  
JUNE 26th, 2017

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# Agenda

- **Introduction: Virtual switching framework (VSF)**
- **VSF Architecture**
- **VSF Configuration Methods**
- **VSF Stack split – MAD**
- **Troubleshooting**

# Frontplane stacking: VSF

- **What?**

- ✓ **VSF: Virtual Switching Framework**
- ✓ **Stacking technology**
- ✓ **Stack interconnect using Ethernet interfaces**
  - ✓ Copper / Fiber / DAC
  - ✓ 1G, 10G or 40 G

- **Supported on**

- ✓ **Aruba 2930F Switch Series**

- ✓ VSF up to 4 units
    - ✓ VSF-ports: 1GbE or 10GbE port aggregation
    - ✓ 2 units: chain topology only
    - ✓ 3 or 4 units: ring topology



- ✓ **Aruba 5400R Switch Series**

- ✓ V3 modules only
    - ✓ Chain topology: up to 2 chassis
    - ✓ Up to 8 physical links per VSF link
    - ✓ VSF-ports: 10GbE or 40GbE port aggregations



# Design Requirements for VSF

- **Supported on 5400R (5406R, 5412R) & 2930F**
- **5400R with v3 modules, operating in v3-only mode**
- **Currently limited to 2 members on 5400R (SW version 16.x.x or greater)**
- **Currently limited to 4 members on 2930F**
- **Only same model switches can join a VSF system**
- **VSF links supported on 10G and 40G Ethernet interfaces only– 5400R**
- **VSF links supported on 1G and 10G Ethernet interfaces only– 2930F**
- **Each switch supports only 1 logical VSF link**
- **Logical VSF links can support up to 8 physical ports**
- **Physical ports can reside on different modules**
- **VSF is disabled on the switch by default**

# VSF Terminologies

- **VSF member ID** – unique ID assigned by VSF; configurable <1-2>
- **VSF Domain ID** – uniquely identifies VSF system and prevents interfering with other VSF systems; must match with other member to form VSF; configurable <1-4294967295>
- **VSF Split** – when a VSF link becomes disconnected, resulting in two independent VSF systems
- **VSF Merge** – when a member joins to form a VSF
- **VSF link** – logical port dedicated to the internal connection of the VSF device
- **VSF port** – physical port which is assigned to the logical VSF link; limited configuration options
- **VSF member priority** – default value is 128; configurable; Member priority determines the possibility of a member device to be elected the Commander. A member with higher priority is more likely to be elected the Commander.
- **Multiple Active Detection (MAD)** – mechanism to detect and mitigate VSF split conditions

# Switch Roles: VSF

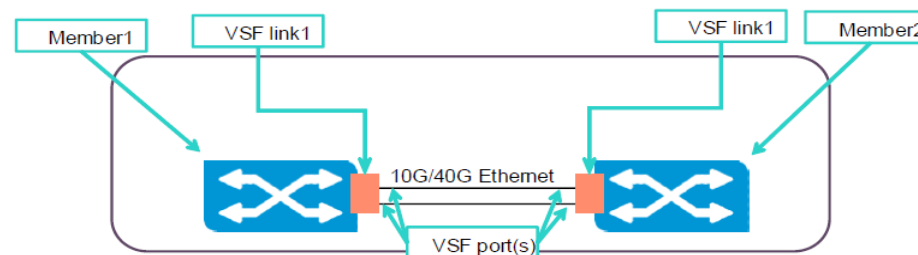
- **Commander**
  - Runs network control and management protocols (STP, LACP, RIP, OSPF, Telnet, SNMP...)
  - Syncs protocol states to the “Standby” for hitless failover.
  - Manages the ASIC (forwarding) tables of \*all\* switches in the stack
- **Standby**
  - Provides commander-level HA
  - Receives configuration and protocol state information from Commander.
  - Runs protocols in passive mode where their runtime states are updated based on sync from Commander.
  - Is ready to take over as Commander of the Stack should the Commander fail
- **Member**
  - Remaining switches (if any) are “Member” switches
  - Only have a copy of the configuration but no knowledge of protocol state
  - Will be upgraded to Standby if commander/standby fails

# VSF Port Restrictions

- **VSF ports should be in default configuration**
- **VSF ports cannot be part of a trunk, mesh, Distributed Trunk, ISC link**
- **A VSF link can only comprise ports with the same speed; either all 10G or all 40G**
- **Different port media types are supported, but must be the same speed**
- **Maximum of 8 physical ports in on logical VSF link**
- **A VSF port can only be enabled or disabled. No other port configuration is supported**

# VSF Deployment Methods

- **Auto-join/plug-and-play** – configure one switch with VSF and a second, factory default switch that is connected will join and form a VSF automatically
- **Manual configuration** – configure both VSF members manually
  - Assign VSF ports to VSF link
  - Enable VSF domain ID and reboot
- **VSF provisioning** – configure one switch with VSF, and manually provision a second switch with:
  - Chassis type; called loose provision
  - Chassis type and mac-address; called strict provisioning
  - Connect a second member matching the provisioning





# Auto-Join config

```
HP-VSF-Switch(config)# vsf member 1 link 1 b1
```

*All configuration on this port has been removed and port is placed in VSF mode.*

```
HP-VSF-Switch(config)# vsf enable domain 2
```

*To enable VSF, the REST interface will be disabled.*

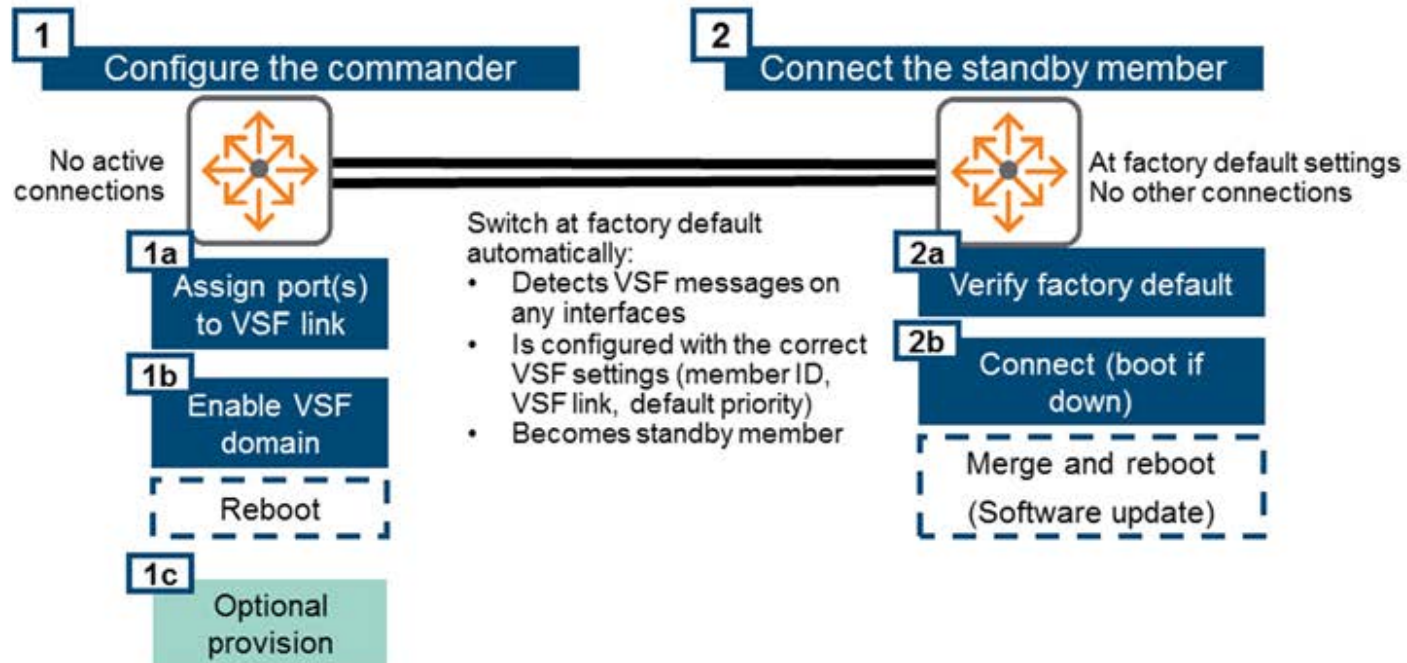
*This will save the current configuration and reboot the switch.*

*Continue (y/n)? y*

**Connect Member 2** – connect a factory default switch to the VSF port configured on Member 1.

- After a few brief moments, the VSF will detect the new device, reboot the new switch and join the VSF.

# Auto-Join config



# Manual Config

- **Configure Member 1** – configure member 1 with VSF and reboot

```
HP-VSF-Switch(config)# vsf member 1 link 1 b1
```

*All configuration on this port has been removed and port is placed in VSF mode.*

```
HP-VSF-Switch(config)# vsf enable domain 2
```

*To enable VSF, the REST interface will be disabled.*

- **Configure Member 2** – configure member 2 with VSF and reboot

```
HP-VSF-Switch(config)# vsf member 2 link 1 b1
```

*All configuration on this port has been removed and port is placed in VSF mode.*

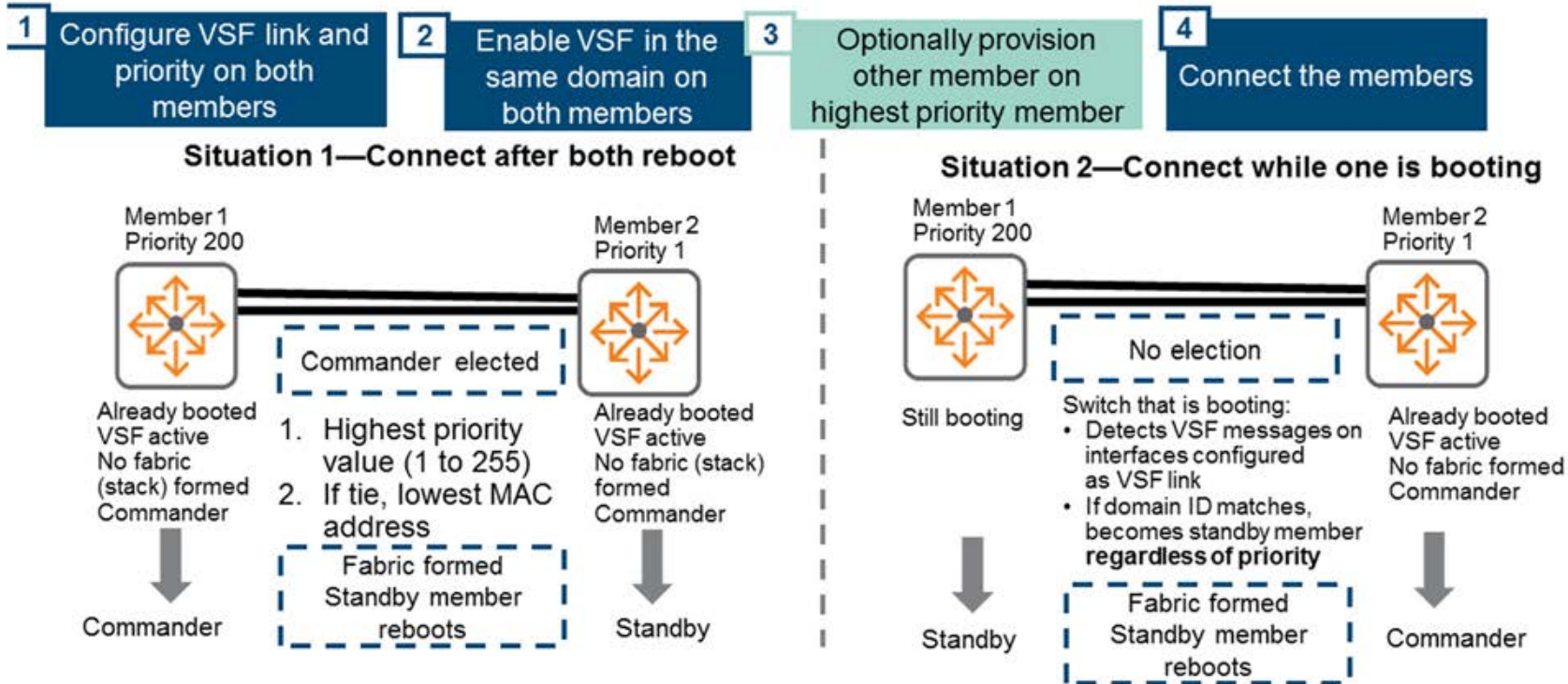
```
HP-VSF-Switch(config)# vsf enable domain 2
```

*To enable VSF, the REST interface will be disabled.*

*This will save the current configuration and reboot the switch.*

*Continue (y/n)? y*

# Manual Config



# VSF Provisioning

- **Configuring Member 1** – configure one switch with VSF and reboot

```
HP-VSF-Switch(config)# vsf member 1 link 1 b1
```

*All configuration on this port has been removed and port is placed in VSF mode.*

```
HP-VSF-Switch(config)# vsf enable domain 2
```

*To enable VSF, the REST interface will be disabled.*

*This will save the current configuration and reboot the switch.*

*Continue (y/n)? y*

- **On Member 1, provision Member 2** – after Member 1 reboots, provision Member 2 for either:
  - Loose provision – This scenario will allow ANY device with matching J# to join the VSF domain for this you will need to get the device J# (you can find it when you execute show running-config)

```
HP-VSF-Switch(config)# vsf member 2 type j9850a
```

- Strict provision- This scenario will only devices with matching J# + MAC to join the VSF domain for this you will need to get the device J# and MAC address (you can find them when you executing show running-config, and show system)

```
HP-VSF-Switch(config)# vsf member 2 type j9850a 3ca82a-3f583f
```

# Validate VSF status

- ***show VSF*** – shows the list of VSF virtual chassis members that are provisioned
- ***show vsf detail*** - shows detailed information related to the current state of the VSF virtual chassis.
- ***show vsf link*** - shows the state of the VSF links for each VSF member.
- ***show vsf link detail*** - shows detail for the VSF links for each VSF member.
- ***show vsf member <x>*** - shows the specified VSF virtual chassis members provisioned.
- ***show vsf lldp-mad status*** - displays the VSF LLDP MAD (Multi-Active Detection) information.
- ***show vsf lldp-mad parameters*** - displays the VSF LLDP MAD (Multi-Active Detection) information.
- ***show vsf trunk-designated-forwarder*** - shows the designated forwarders for each trunk.

# Assign additional ports to a VSF link

- VSF allows multiple ports assigned to a logical VSF link:
- Assign VSF ports on Member 1 to VSF link
  - *HP-VSF-Switch(config)# vsf member 1 link 1 1/b2*
  - *HP-VSF-Switch(config)# vsf member 1 link 1 1/b3*
  - *HP-VSF-Switch(config)# vsf member 1 link 1 1/b4*
- Assign VSF ports on Member 2 to VSF link
  - *HP-VSF-Switch(config)# vsf member 2 link 1 2/b2*
  - *HP-VSF-Switch(config)# vsf member 2 link 1 2/b3*
  - *HP-VSF-Switch(config)# vsf member 2 link 1 2/b4*

## Validate status

*HP-VSF-Switch(config)# show vsf link detail*

*VSF Member: 1    Link: 1*

*Vsf-Port Port-State*

```
-----  
1/B1    Up: Connected to port 2/B1  
1/B2    Up: Connected to port 2/B2  
1/B3    Up: Connected to port 2/B3  
1/B4    Up: Connected to port 2/B4
```

*VSF Member: 2    Link: 1*

*Vsf-Port Port-State*

```
-----  
2/B1    Up: Connected to port 1/B1  
2/B2    Up: Connected to port 1/B2  
2/B3    Up: Connected to port 1/B3  
2/B4    Up: Connected to port 1/B4
```



# Removing and shutting down a VSF member

## Removing a member

```
#Vsf member <x> remove
HP-VSF-Switch(config)# vsf member 2 remove
The specified VSF virtual chassis standby member will be removed and
its configuration will be erased. The resulting configuration
will be saved. The VSF standby member will be shutdown. Continue (y/n)? y
```

## Shutting down a member

```
Vsf member <x> shutdown
HP-VSF-Switch(config)# vsf member 2 shutdown
```

```
HP-VSF-Switch(config)# show vsf
VSF Domain ID : 2
MAC Address : 3ca82a-3f913f
VSF Topology : No Stack Formed
VSF Status : Active
Uptime : 0d 4h 2m
VSF Oobm-MAD : Disabled
Software Version : KB.16.01.0000x
Mbr
ID Mac Address Model Pri Status
-----
1 3ca82a-3f8100 HP J9850A Switch 5406Rzl2 128 Commander
```



# Changing VSF ports in a VSF link

- **Remove VSF Standby switch via sw**
- **Physically disconnect all VSF ports**
- **If a different port speed, remove VSF ports from VSF link on commander**
- **Assign new port to VSF link**
- **Connect factory default or provisioned switch and reboot**
- **Show vsf link detail**

# Replacing a member

- **Physically disconnect all VSF links**
  - Example: VSF configured on 1/b5 and 2/b5
- **From the Commander, remove VSF related port/link configuration for the old member in the stack**
  - Example: no vsf member 2 link 1 2/b5
- **From the Commander, remove the module (via software) that the VSF link was configured for the old member**
  - Example: no module 2/b
- **From the Commander, loose (or strict, adding mac-address) provision the new member in the stack**
  - Example: vsf member 2 type J9850A <optional mac-address>
- **Connect the new, factory default member, to the port where previous old member was connected**
  - Example; connect any 10G port of the new member to port 1/b5 of the Commander
- **New VSF member will reboot and join the VSF stack through plug-n-play**
- **Validate VSF formed with show vsf command**

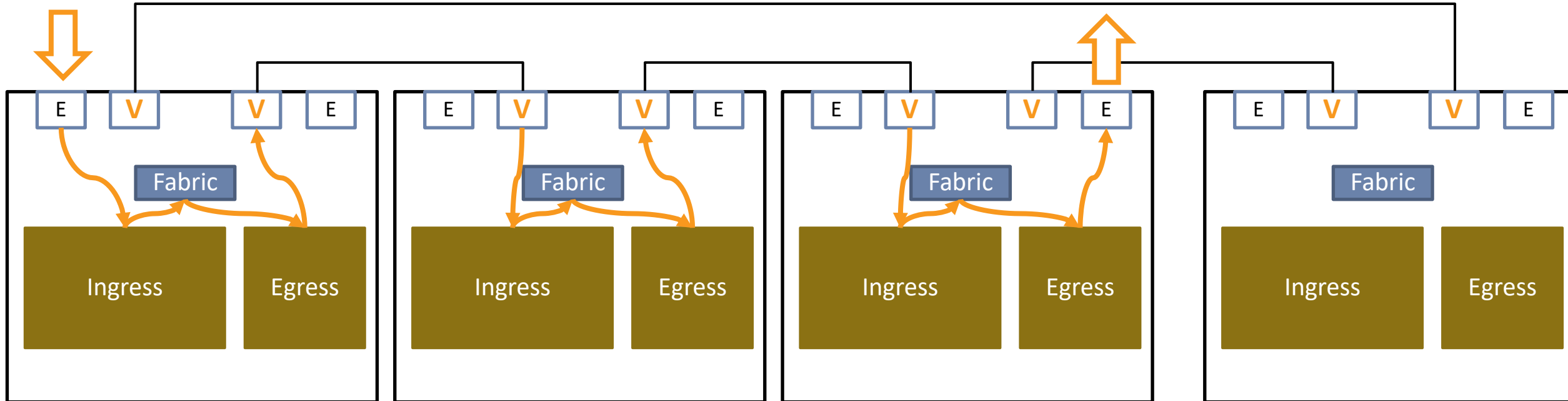
# Firmware upgrade

- **Updating firmware in a VSF is the same as if upgrading a stand-alone switch. The commander will send the firmware to the VSF member switch and both devices will reboot (as requested).**

# Unicast packet flow: VSF

Ethernet ports (E)    VSF ports (V)

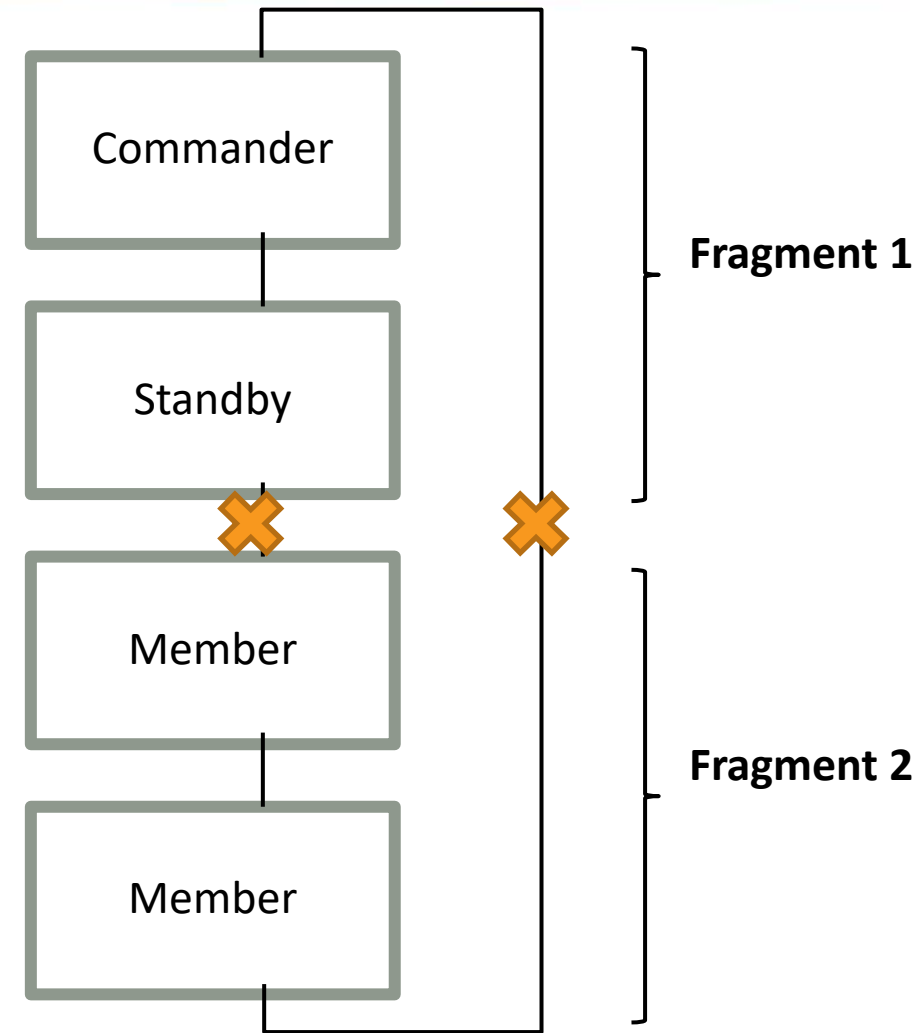
Ring topology



Ethernet Frame

# VSF Stack split and MAD (Multi-active detection)

- **If the VSF stack splits**
  - Low probability
  - Cause: Link of device failure
- **Two fragments are created**
- **Problem: two stacks with the same IP address (and if layer 3 forwarding, same router ID)**
- **Fragment 2 in this case**
  - Does not contain the Commander
  - Needs to determine if the commander is still running and connected to the network
  - If yes: shuts down all non-VSF ports
  - If no: elects own commander and continues forwarding



# LLDP MAD

- **MAD assist device**

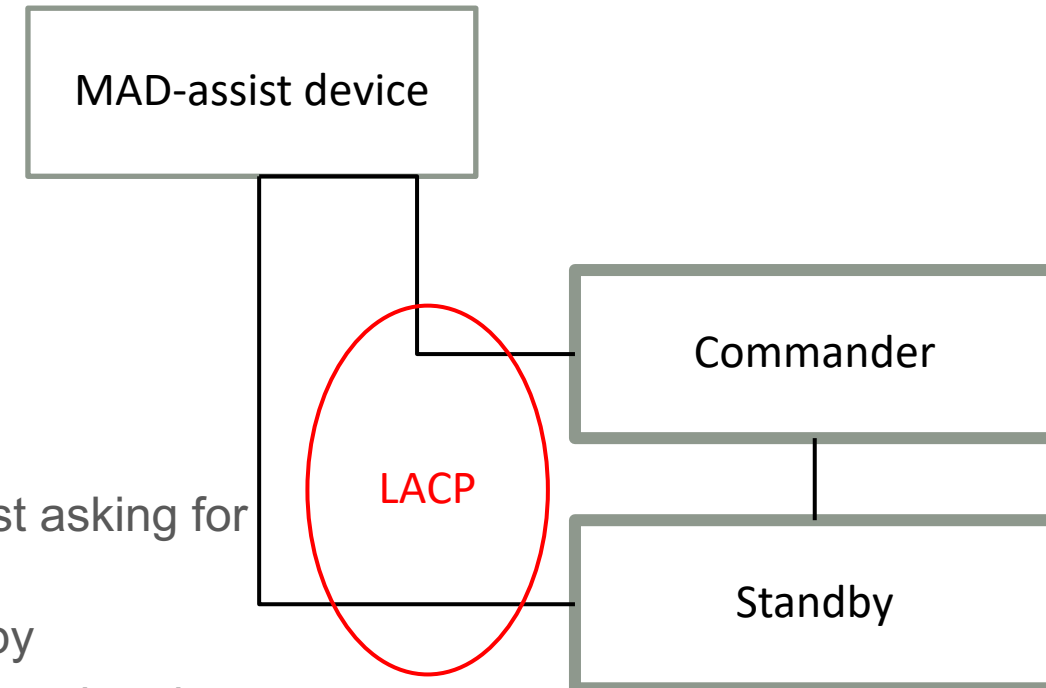
- Normal upstream or downstream switch

- **Requirements**

- SNMP v2
- LLDP
- ARP

- **Mechanism**

- Standby sends an SNMP GET Request to the MAD-assist asking for the state of the ports on the LACP LAG
- The MAD-assist send an SNMP GET Reply to the standby
  - If the standby receives confirmation that all ports are up, then it shuts down its non-VSF ports
  - If it receives confirmation that the ports to the commander are down, it becomes the commander and continues forwarding
  - If it does not receive a GET Reply, it retries (up to 3 times) and decides that the commander must be up, and turns off its own ports



# Configuring LLDP MAD

- Configuring MAD device for LACP trunk – configure Switch 2920

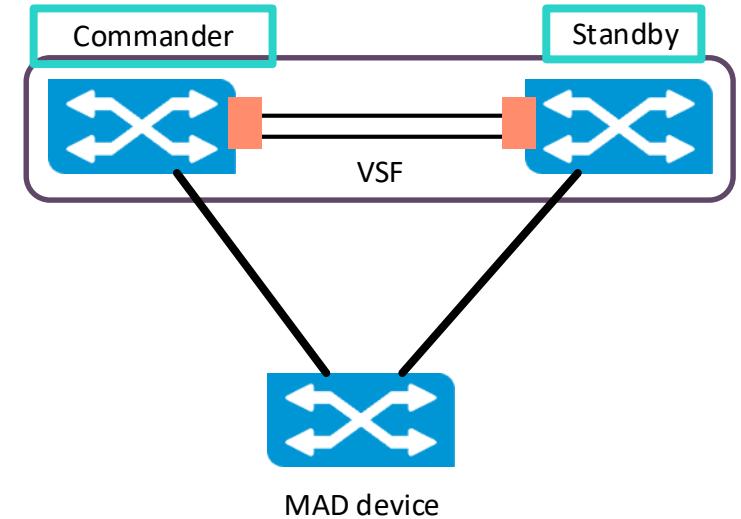
```
HP-2920-48G-POEP(config)# vlan 1110
HP-2920-48G-POEP(vlan-1110)# ip address 10.111.120.33/24
HP-2920-48G-POEP(vlan-1110)# exit
HP-2920-48G-POEP(config)# trunk 2,4 trk1 lacp
HP-2920-48G-POEP(config)# vlan 1110
HP-2920-48G-POEP(vlan-1110)# tag trk1
HP-2920-48G-POEP(vlan-1110)# wr me
```

- Configure LACP Trunk on the VSF

```
HP-VSF-Switch(config)# vlan 1110
HP-VSF-Switch(vlan-1110)# ip address 10.111.120.31/24
HP-VSF-Switch(vlan-1110)# exit
HP-VSF-Switch(config)# trunk 1/c1,2/c1 trk2 lacp
HP-VSF-Switch(config)# vlan 1110
HP-VSF-Switch(vlan-1110)# tag trk2
HP-VSF-Switch(vlan-1110)# wr me
HP-VSF-Switch(vlan-1110)# exit
```

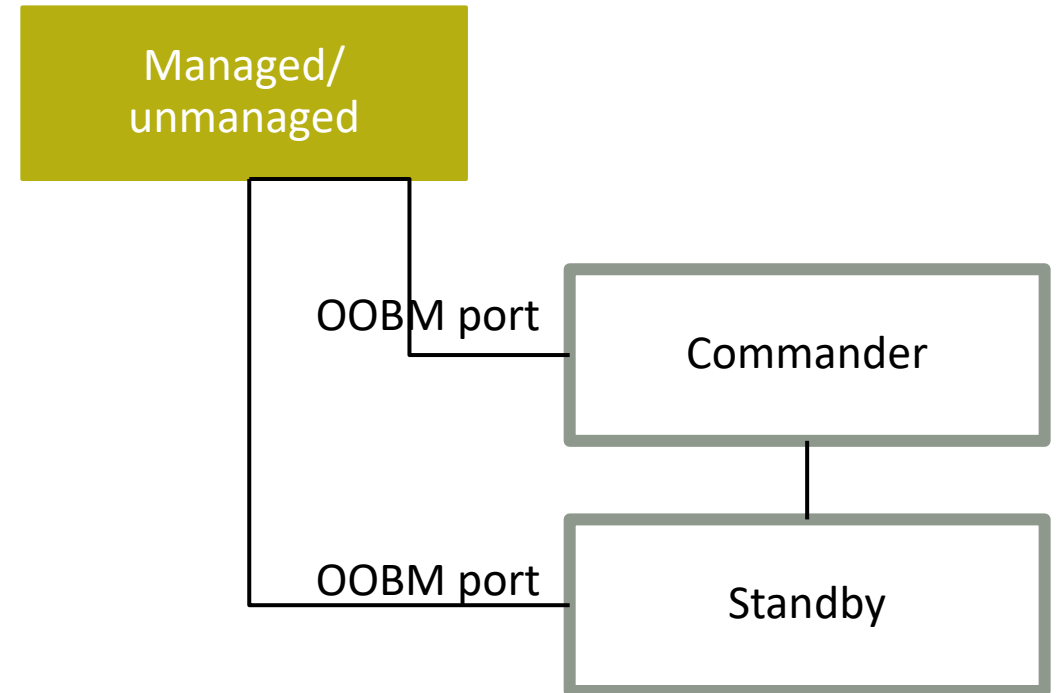
- Configure MAD on the VSF

```
HP-VSF-Switch(config)# vsf lldp-mad ipv4 10.111.120.33 v2c public
```



# OOBM MAD: 5400R switch series

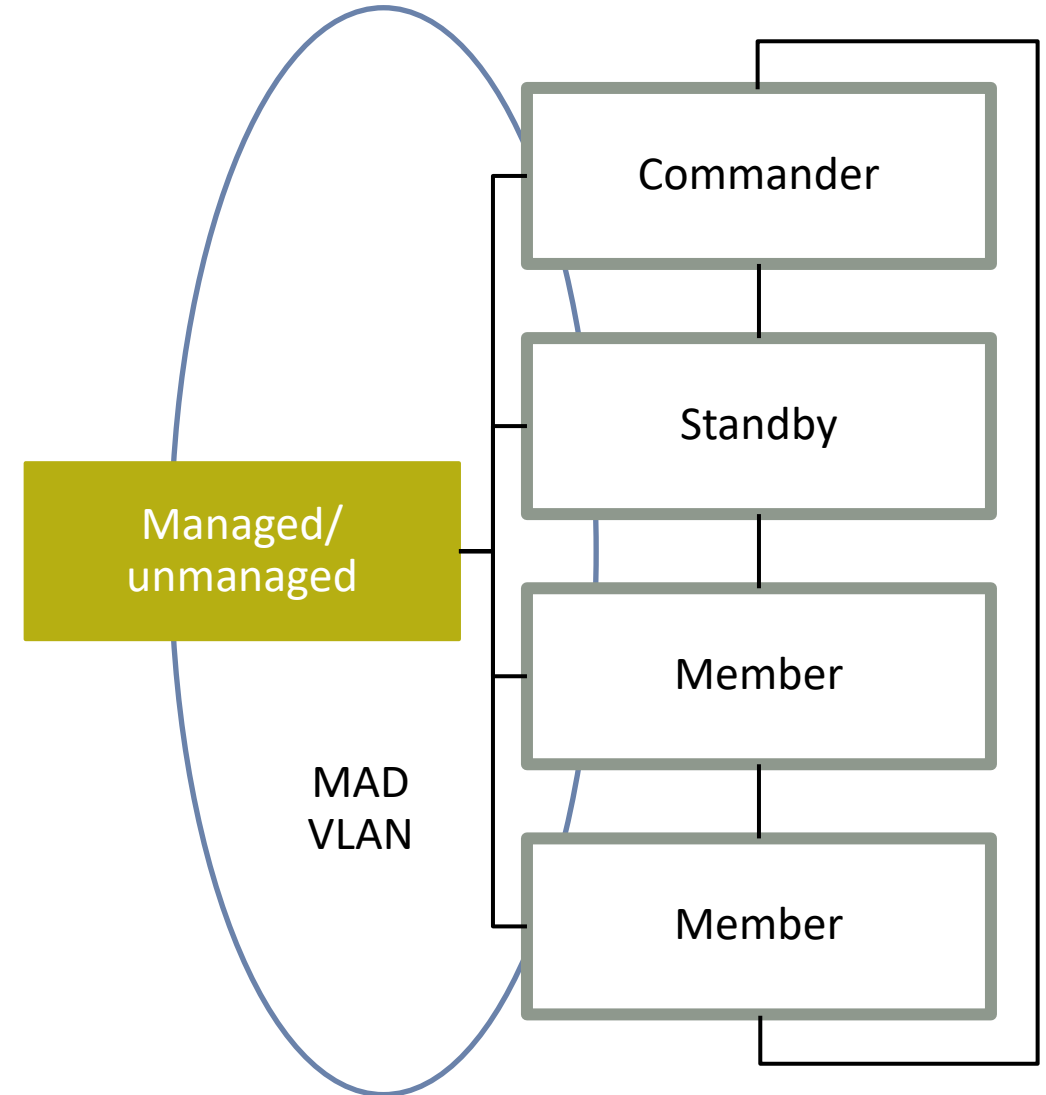
- **5400R management modules talk directly via OOBM ports for MAD**
- **OOB switch requirements**
  - No specific requirements
  - Just needs to provide connectivity to and between OOBM ports





# VLAN MAD: 2930F switch series

- Similar to OOBM MAD for switches that do not have OOBM ports, for example 2930F
- One VLAN is created and configured as MAD VLAN
- One port on each VSF member is assigned to the MAD VLAN and connected to a third device that is dedicated to this purpose
- Besides MAD, these connections can be used for “virtual” out-of-band management



# TROUBLESHOOTING

# VSF Troubleshooting tools

- **VSF specific**
  - For VSF support case, capture the output of the “**show tech vsf**” CLI command.  
Note: the output of the command contains a lot of information and may take an extended amount of time to complete.
  - VSF specific event log messages of a typical VSF formation of a member joining a VSF as a result of the “show log VSF” CLI command:

# VSF Commands

- Use the “show vsf” CLI command output to view the status of the VSF

```
HP-VSF-Switch(config)# show vsf
```

```
VSF Domain ID      : 5
MAC Address        : 3ca82a-3f583f
VSF Topology       : Chain
VSF Status         : Active
Uptime             : 16d 0h 7m
VSF Oobm-MAD       : Disabled
Software Version   : KB.16.01.0000x
```

Mbr			Pri	Status
ID	Mac Address	Model		
1	3ca82a-3f8100	HP J9850A Switch 5406Rz12	128	Commander
2	3ca82a-3f4800	HP J9850A Switch 5406Rz12	128	Standby

- Use the “show vsf link detail” CLI command output to verify VSF link peer connectivity.

```
HP-VSF-Switch(config)# show vsf link detail
```

```
VSF Member: 1      Link: 1
```

```
Vsf-Port  Port-State
```

1/B1	Up: Connected to port 2/B1
1/B2	Up: Connected to port 2/B2
1/B3	Up: Connected to port 2/B3
1/B4	Up: Connected to port 2/B4

```
VSF Member: 2      Link: 1
```

```
Vsf-Port  Port-State
```

2/B1	Up: Connected to port 1/B1
2/B2	Up: Connected to port 1/B2
2/B3	Up: Connected to port 1/B3
2/B4	Up: Connected to port 1/B4

```
HP-VSF-Switch(config)#
```

# VSF Commands

- Use the “show vsf detail” CLI command output to view status, priority and CPU Utilization information. Higher than normal CPU Utilization could indicate a misconfiguration or network loop.

```
HP-VSF-Switch(config)# show vsf detail

VSF Domain ID       : 5
MAC Address         : 3ca82a-3f583f
VSF Topology        : Chain
VSF Status          : Active
Uptime              : 15d 23h 52m
VSF Oobm-M&D        : Disabled
Software Version    : KB.16.01.0000x

Name                : HP-VSF-Switch
Contact             :
Location            :

Member ID           : 1
Mac Address         : 3ca82a-3f8100
Type                : J9850A
Model               : HP J9850A Switch 5406Rz12
Priority             : 128
Status              : Commander
ROM Version         : KB.16.01.0005
Serial Number       : SG54G492F0
Uptime              : 14d 4h 30m
CPU Utilization     : 2%
Memory - Total      : 709,365,760 bytes
Free                : 534,365,296 bytes
VSF Links -
#1 : Active, Peer member 2

Member ID           : 2
Mac Address         : 3ca82a-3f4800
Type                : J9850A
Model               : HP J9850A Switch 5406Rz12
Priority             : 128
Status              : Standby
ROM Version         : KB.16.01.0005
Serial Number       : SG54G492F1
Uptime              : 0d 0h 19m
CPU Utilization     : 0%
Memory - Total      : 709,365,760 bytes
Free                : 547,383,992 bytes
VSF Links -
#1 : Active, Peer member 1

HP-VSF-Switch(config)#
```

# VSF Commands

- Use the “show vsf lldp-mad status”

CLI command output to view the status of a VSF split.

```
HP-VSF-Switch(config)# show vsf lldp-mad status

MAD device IP           : 10.111.120.66
MAD-probe portset       : 1/C1,2/C1,

VSF split                : No
MAD probe originator     : No
Number of probe requests sent : 0
Number of probe responses received : 0
MAD Active Fragment      : Yes
```

- Use the “show vsf lldp-mad parameters” CLI command output to view MAD readiness status and LAG connectivity.

```
HP-VSF-Switch(config)# show vsf lldp-mad parameters

MAD device IP           : 10.111.120.66
MAD readiness status     : Success
MAD device MAC           : 082e5f-253bfc
Reachable via Vlan       : 1110
Local LAG interface      : Trk29
MAD-probe portset        : 1/C1,2/C1,

LAG connectivity         : Full
HP-VSF-Switch(config)#
```

# VSF member states

- **Commander** – The member-switch which is the commander of the VSF virtual chassis.
- **Standby** – The member-switch which is the standby of the VSF virtual chassis
- **Not Joined** – Standby provisioned but not yet connected
- **Missing** – A VSF chassis member-switch is marked as missing when it becomes non-responsive. A lack of response from the switch means that either the virtual chassis link or the virtual chassis member has crashed. Note that it is possible to remove a missing member from the virtual chassis. Once removed, the missing member's configuration will be deleted from the virtual chassis configuration file.
- **Standby Booting** – standby switch booting up to join the VSF
- **Shutdown**- The member-switch is in the shutdown state
- **Provisioned** - A member switch that is not physically present but whose configuration is provisioned
- **Communication Failure** - The member-switch cannot be reached.
- **Incompatible OS** - The member-switch is running with a different Operating System.
- **Unknown State** - The state of the member-switch cannot be determined.

# Summary

- **Frontplane stacking (VFS – virtual switching framework)**
  - Uses GbE, 1GbE or 10GbE or 40GbE ports for stack interconnection
  - Provides a low cost stacking solution
  - Provides high availability
  - Easy deployment via Plug and play setup
  - Stack of up to 2 5400R chassis or 4 2930F switches
  - MAD is used to detect and protect against split brains.



# QUESTIONS?

THANK YOU!