HP Networking PVST+/RPVST Configuration on 5800 Switches

Technical Configuration Guide

HP Networking Technical Marketing

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Introduction

Per-VLAN Spanning Tree plus (PVST+) and Rapid Per- VLAN Spanning Tree plus (RPVST+) are Cisco developed protocols that can be configured to provide similar functionality to Multi- instance Spanning Tree Protocol (MSTP). This Technical Configuration Guide (TCG) will provide an example of configuring these protocols in a HP/Cisco environment and point out some limitations. The intended audience is HP Solution Architects, HP Technical Consultants and HP customers.

Background Information

Familiarity with PVST+/RPVST+ and Cisco IOS is highly suggested. For more detailed information, the appropriate documentation from Cisco as well as the latest configuration guide from HP should be downloaded.

Requirements

HP code that has PVST+ functionality should be running on the switch.

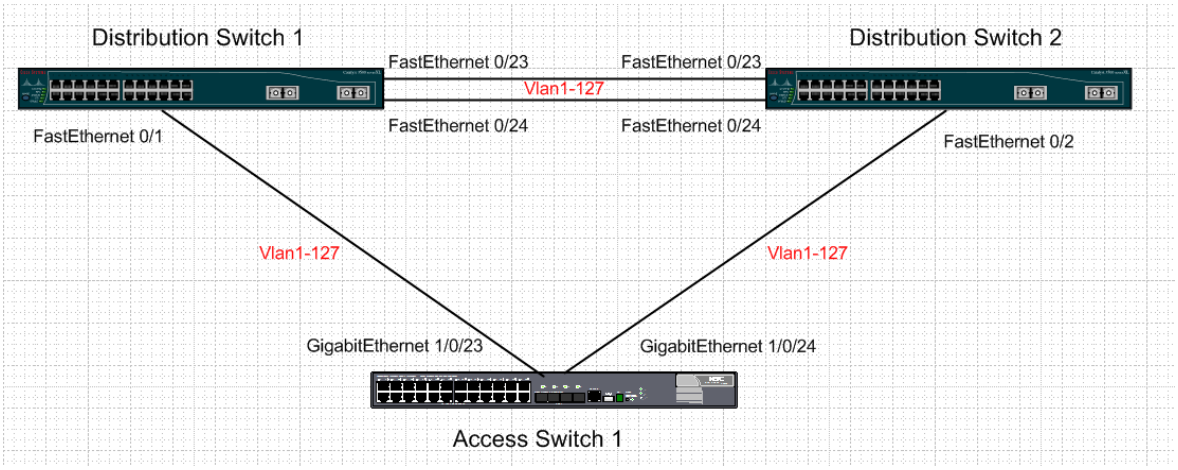
Hardware and Software revisions

The following hardware and software revisions were used to develop this configuration guide.

- HP switch 5800 (JC100A) running S5800_5820X-CMW520-F1305.bin
- Cisco 3550 running 12.2(44)SE6

Network Diagram

The following network diagram shows how the switches are physically connected. The configuration is based on an HP switch being used to connect to a Cisco distribution layer. While the switch roles could be reversed, HP recommends configuring IRF in the distribution layer thus eliminating STP completely.



Distribution Layer Configuration

The configuration for both Cisco switches is below. The configuration was taken from the Cisco configuration paper titled "*Spanning Tree from PVST+ to Rapid-PVST Migration Configuration Example*" and modified for this scenario.
http://www.cisco.com/image/gif/paws/72836/rapidpvst-mig-config.pdf

Disti-01(config)# spanning-tree mode pvst
Disti-01(config)# spanning-tree extend system-id
Disti-01(config)# spanning-tree backbonefast
Disti-01(config)# spanning-tree vlan 1-63 priority 8192
Disti-01(config)# spanning-tree vlan 64-127 priority 16384
Disti-01(config)# interface FastEthernet0/1
Disti-01(config-if)# switchport trunk encapsulation dot1q
Disti-01(config-if)# switchport trunk allowed vlan 1-127
Disti-01(config-if)# switchport mode trunk
Disti-01(config)# interface FastEthernet0/23
Disti-01(config-if)# switchport trunk encapsulation dot1q
Disti-01(config-if)# switchport trunk allowed vlan 1-127
Disti-01(config-if)# switchport mode trunk
Disti-01(config)# interface FastEthernet0/24
Disti-01(config-if)# switchport trunk encapsulation dot1q
Disti-01(config-if)# switchport trunk allowed vlan 1-127
Disti-01(config-if)# switchport mode trunk

Disti-02(config)# spanning-tree mode pvst
Disti-02(config)# spanning-tree extend system-id
Disti-02(config)# spanning-tree backbonefast
Disti-02(config)# spanning-tree vlan 1-63 priority 8192
Disti-02(config)# spanning-tree vlan 64-127 priority 16384
Disti-02(config)# interface FastEthernet0/1
Disti-02(config-if)# switchport trunk encapsulation dot1q
Disti-02(config-if)# switchport trunk allowed vlan 1-127
Disti-02(config-if)# switchport mode trunk
Disti-02(config)# interface FastEthernet0/23
Disti-02(config-if)# switchport trunk encapsulation dot1q
Disti-02(config-if)# switchport trunk allowed vlan 1-127
Disti-02(config-if)# switchport mode trunk
Disti-02(config)# interface FastEthernet0/24

```
Disti-02(config-if)# switchport trunk encapsulation dot1q
Disti-02(config-if)# switchport trunk allowed vlan 1-127
Disti-02(config-if)# switchport mode trunk
```

The above configuration shows PVST+ being configured on the distribution switches. If RPVST+ is the protocol being used the following command should be used on the Cisco devices.

```
Cisco(config)# spanning-tree mode rapid-pvst
```

To load share VLAN traffic across both links, the spanning tree VLAN priority should be mirrored. Notice in the following example how on switch Disti-01 the "spanning-tree vlan 1-63 cost 8192" and "spanning-tree vlan 64-127 cost 16384". Commands are flipped in switch Disti-02 to be "spanning-tree vlan 1-63 cost 16384" and "spanning-tree vlan 64-127 cost 8192".

```
Disti-01(config)# spanning-tree mode pvst
Disti-01(config)# spanning-tree extend system-id
Disti-01(config)# spanning-tree backbonefast
Disti-01(config)# spanning-tree vlan 1-63 priority 8192
Disti-01(config)# spanning-tree vlan 64-127 priority 16384
```

```
Disti-02(config)# spanning-tree mode pvst
Disti-02(config)# spanning-tree extend system-id
Disti-02(config)# spanning-tree backbonefast
Disti-02(config)# spanning-tree vlan 1-63 priority 16384
Disti-02(config)# spanning-tree vlan 64-127 priority 8192
```

Access switch Configuration

This is a short summary of the commands necessary to have an HP access switch participate in a PVST+ environment.

```
<HP>system-view
[HP]stp enable
[HP]stp mode pvst
[HP]vlan 1-127
[HP]interface GigabitEthernet1/0/23
[HP-GigabitEthernet1/0/23]port link-type trunk
[HP-GigabitEthernet1/0/23]port trunk permit vlan 1-127
[HP]interface GigabitEthernet1/0/24
[HP-GigabitEthernet1/0/24]port link-type trunk
[HP-GigabitEthernet1/0/24]port trunk permit vlan 1-127
```

A cost can be assigned to the uplink port(s) for a particular VLAN (s) to load share across both links. As mentioned above, we are already doing this at the distribution layer which shows that the HP switch can correctly recognize PVST priorities that Cisco devices are assigning.

By modifying the cost on an uplink port, in this case GigabitEthenet 1/0/24, we can load share traffic for certain VLAN's across both links. This example shows that traffic from VLANs 1-63 will forward on port 1/0/23 and block on port 1/0/24 while VLANs 1-63 will be blocked on port 1/0/24 and VLANs 64-127 will be forwarding on port 1/0/24.

```
<HP>system-view
[HP]interface GigabitEthernet1/0/24
[HP-GigabitEthernet1/0/24]stp vlan 64-127 cost 16
```

Testing Fail-over

Below is what the STP tree looks like before any failover testing:

```
[HP]display stp
------[VLAN 1 Global Info]------ Protocol Status
                    :enabled
Bridge ID           :32768.0023-898e-7606
Bridge Times        :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC       :32768.0023-898e-7606 / 0
RootPortId          :0.0
BPDU-Protection     :disabled
TC or TCN received  :0
Time since last TC  :0 days 0h:17m:36s

-------[VLAN 10 Global Info]-------
Protocol Status     :enabled
Bridge ID           :32768.0023-898e-7606
Bridge Times        :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC       :8192.000d-ede4-d400 / 200
RootPortId          :128.23
BPDU-Protection     :disabled
TC or TCN received  :115
Time since last TC  :0 days 0h:0m:0s

 ----[Port23(GigabitEthernet1/0/23)][FORWARDING]----
 Port Protocol      :enabled
 Port Role          :Root Port
  --- More ---              Port Priority      :128
 Port Cost(Legacy)  :Config=auto / Active=200
 Desg. Bridge/Port  :8192.000d-ede4-d400 / 128.1
 Port Edged         :Config=disabled / Active=disabled
 Point-to-point     :Config=auto / Active=true Transmit Limit
                    :10 packets/hello-time Protection Type
                     :None
 PortTimes          :Hello 2s MaxAge 20s FwDly 15s MsgAge 0s

 ----[Port24(GigabitEthernet1/0/24)][DISCARDING]----
 Port Protocol      :enabled
 Port Role          :Alternate Port
 Port Priority      :128
 Port Cost(Legacy)  :Config=auto / Active=200
 Desg. Bridge/Port  :28672.000d-edf0-3280 / 128.2
 Port Edged         :Config=disabled / Active=disabled
 Point-to-point     :Config=auto / Active=true Transmit Limit
                    :10 packets/hello-time Protection Type
                     :None
 PortTimes          :Hello 2s MaxAge 20s FwDly 15s MsgAge 1s
```

For brevity not all VLANs forwarding on port 1/0/23 are shown.

```
-------[VLAN 127 Global Info]-------
Protocol Status     :enabled
Bridge ID           :32768.0023-898e-7606
```

```
Bridge Times       :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC      :16384.000d-ede4-d400 / 35
RootPortId         :128.24
BPDU-Protection    :disabled
TC or TCN received  :142
Time since last TC  :0 days 0h:0m:17s


 ----[Port23(GigabitEthernet1/0/23)][DISCARDING]----
 Port Protocol      :enabled
 Port Role          :Alternate Port
 Port Priority      :128

 Port Cost(Legacy)   :Config=auto / Active=200
 Desg. Bridge/Port   :16384.000d-ede4-d400 / 128.1
 Port Edged          :Config=disabled / Active=disabled
 Point-to-point      :Config=auto / Active=true
 Transmit Limit      :10 packets/hello-time
 Protection Type     :None
 PortTimes           :Hello 2s MaxAge 20s FwDly 15s MsgAge 0s

 ----[Port24(GigabitEthernet1/0/24)][FORWARDING]----
 Port  Protocol            :enabled  Port  Role
 :Root Port Port Priority      :128
 Port Cost(Legacy)   :Config=16 / Active=16
 Desg. Bridge/Port   :24576.000d-edf0-3280 / 128.2
 Port Edged          :Config=disabled / Active=disabled
 Point-to-point      :Config=auto / Active=true Transmit Limit
                     :10 packets/hello-time Protection Type
                      :None
 PortTimes           :Hello 2s MaxAge 20s FwDly 15s MsgAge 1s
```

When the link on port GigabitEthernet 1/0/23 is pulled you will see the recalculation and port GigabitEthernet 1/0/23 shows as down.

```
#Apr 26 14:21:27:847 2000 HP MSTP/1/PFWD:
 Trap 1.3.6.1.4.1.25506.8.35.14.0.1<hh3cPortMstiStateForwarding>: Instance 2's Port 2.9437207 has been set to
forwarding state!
#Apr 26 14:21:28:057 2000 HP MSTP/1/PFWD:
 Trap 1.3.6.1.4.1.25506.8.35.14.0.1<hh3cPortMstiStateForwarding>: Instance 3's Port 3.9437207 has been set to forwarding state!
%Apr 26 14:21:28:278 2000 HP MSTP/6/MSTP_FORWARDING: VLAN 1's port GigabitEthernet1/0/24 has been set to forwarding state.
%Apr 26 14:21:28:428 2000 HP MSTP/6/MSTP_FORWARDING: VLAN 2's port GigabitEthernet1/0/24 has been set to
forwarding state.
%Apr 26 14:21:28:579 2000 HP IFNET/3/LINK_UPDOWN: GigabitEthernet1/0/23 link status is DOWN.
```

For Brevity VLANs 3-63 messages have been omitted.

Using either the display stp or display stp vlan X command we can now see that VLAN 10 traffic is using uplink 1/0/24.

```
[HP]display stp vlan 10
-------[VLAN 10 Global Info]-------
Protocol Status     :enabled
Bridge ID           :32768.0023-898e-7606
Bridge Times        :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC       :8192.000d-ede4-d400 / 219
RootPortId          :128.24
BPDU-Protection     :disabled
TC or TCN received  :126
Time since last TC  :0 days 0h:0m:1s
```

----[Port24(GigabitEthernet1/0/24)][FORWARDING]----
Port Protocol :enabled Port Role
:Root Port Port Priority :128
Port Cost(Legacy) :Config=auto / Active=200
Desg. Bridge/Port :28672.000d-edf0-3280 / 128.2
Port Edged :Config=disabled / Active=disabled
Point-to-point :Config=auto / Active=true Transmit Limit

:10 packets/hello-time Protection Type
:None
PortTimes :Hello 2s MaxAge 20s FwDly 15s MsgAge 1s

When the link on port GigabitEthernet 1/0/23 is established, you will see the following in the CLI.

%Apr 26 14:21:55:217 2000 HP IFNET/3/LINK_UPDOWN: GigabitEthernet1/0/23 link status is UP.
#Apr 26 14:21:58:302 2000 HP MSTP/1/PDISC:
Trap 1.3.6.1.4.1.25506.8.35.14.0.2<hh3cPortMstiStateDiscarding>: Instance 2's Port 2.9437207 has been set to discarding state!
#Apr 26 14:21:58:514 2000 HP MSTP/1/PFWD:
Trap 1.3.6.1.4.1.25506.8.35.14.0.1<hh3cPortMstiStateForwarding>: Instance 2's Port 2.9437206 has been set to forwarding state!
#Apr 26 14:21:58:724 2000 HP MSTP/1/PDISC:
Trap 1.3.6.1.4.1.25506.8.35.14.0.2<hh3cPortMstiStateDiscarding>: Instance 3's Port 3.9437207 has been set to discarding state!
#Apr 26 14:21:58:935 2000 HP MSTP/1/PFWD:
Trap 1.3.6.1.4.1.25506.8.35.14.0.1<hh3cPortMstiStateForwarding>: Instance 3's Port 3.9437206 has been set to forwarding state!
%Apr 26 14:21:59:152 2000 HP MSTP/6/MSTP_DISCARDING: VLAN 10's port GigabitEthernet1/0/24 has been set to discarding state.
%Apr 26 14:21:59:308 2000 HP MSTP/6/MSTP_FORWARDING: VLAN 10's port GigabitEthernet1/0/23 has been set to forwarding state.
%Apr 26 14:21:59:469 2000 HP MSTP/6/MSTP_DISCARDING: VLAN 20's port GigabitEthernet1/0/24 has been set to discarding state.
%Apr 26 14:21:59:619 2000 HP MSTP/6/MSTP_FORWARDING: VLAN 20's port GigabitEthernet1/0/23 has been set to forwarding state.

Using the previous command, we can verify that traffic for VLAN 10 is now using GigabitEthernet 1/0/23 again.

[HP]display stp vlan 10
------[VLAN 1 Global Info]------ Protocol Status
:enabled
Bridge ID :32768.0023-898e-7606
Bridge Times :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC :32768.0023-898e-7606 / 0
RootPortId :0.0
BPDU-Protection :disabled
TC or TCN received :0
Time since last TC :0 days 0h:18m:34s

-------[VLAN 10 Global Info]-------
Protocol Status :enabled
Bridge ID :32768.0023-898e-7606
Bridge Times :Hello 2s MaxAge 20s FwDly 15s
Root ID / RPC :8192.000d-ede4-d400 / 200
RootPortId :128.23
BPDU-Protection :disabled
TC or TCN received :151
Time since last TC :0 days 0h:0m:0s

```
----[Port23(GigabitEthernet1/0/23)][FORWARDING]----
Port  Protocol            :enabled  Port  Role
:Root Port Port Priority       :128
Port Cost(Legacy)   :Config=auto / Active=200
Desg. Bridge/Port   :8192.000d-ede4-d400 / 128.1
Port Edged          :Config=disabled / Active=disabled
Point-to-point      :Config=auto / Active=true Transmit Limit
                    :10 packets/hello-time Protection Type
                     :None
PortTimes           :Hello 2s MaxAge 20s FwDly 15s MsgAge 0s

----[Port24(GigabitEthernet1/0/24)][DISCARDING]----
Port Protocol       :enabled
Port Role           :Alternate Port
Port Priority       :128

Port Cost(Legacy)   :Config=auto / Active=200
Desg. Bridge/Port   :28672.000d-edf0-3280 / 128.2
Port Edged          :Config=disabled / Active=disabled
Point-to-point      :Config=auto / Active=true
Transmit Limit      :10 packets/hello-time
Protection Type     :None
PortTimes           :Hello 2s MaxAge 20s FwDly 15s MsgAge 1s
```

PVST+ Observations

- HP switches that support PVST/PVST+ functionality can correctly identify PVST priorities when the native VLAN on Cisco devices is configured for either VLAN 1 or another VLAN.
- When configured as the distribution layer, HP switches that support PVST/PVST+ functionality, can assign PVST priorities and Cisco devices can correctly interpret these priorities including the selection of root and designated ports as well as forwarding and blocking interface states.
- HP switches detect and react to inconsistencies with native VLAN configurations.
- PVST+ can only accommodate 128 VLAN's which limits the scalability in which this protocol can be used. If more than 128 VLAN's are configured, the switch will only use the first 128 and remove the remaining VLAN's from the PVST+ configuration.

For more information

To read more about <product> solutions, go to
http://h17007.www1.hp.com/us/en/products/index.aspx

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