Introduction
The purpose and scope of this white paper is to discuss spanning tree interoperability between Arista and Cisco switches. It is written in a manner that assumes the reader has at least a moderate working knowledge of spanning tree protocol configuration and operation. Detailed explanations of the basic functionality of each spanning tree protocol is outside the scope of this document.

If you are already familiar with the content of this white paper, you may skip to Appendix A - Interoperability Matrix to quickly review the key points.

List of Acronyms
BPDU - Bridge Protocol Data Unit  
CIST - Common and Internal Spanning Tree  
CST - Common Spanning Tree  
IEEE - Institute of Electrical and Electronics Engineers  
ISL - Inter-Switch Link  
IST - Internal Spanning Tree  
MAC - Media Access Control  
MST - Multiple Spanning Tree  
MSTI - Multiple Spanning Tree Instance. Ex: MST0 - Multiple Spanning Tree Instance 0 MSTP - Multiple Spanning Tree Protocol (802.1s)  
PVRST+ - Per-VLAN Rapid Spanning Tree Plus  
PVST+ - Per-VLAN Spanning Tree Plus  
RSTP - Rapid Spanning Tree Protocol (802.1w)  
SSTP - Shared Spanning Tree Protocol or Secure Socket Tunneling Protocol  
STP - Spanning Tree Protocol  
VLAN - Virtual Local Area Network

Supported Spanning Tree Protocols
Arista switches use Multiple Spanning Tree Protocol (MSTP/802.1s) by default. However, they also support Rapid Spanning Tree Protocol (RSTP/802.1w), as well as Rapid Per-VLAN Spanning Tree (Rapid-PVST) for vendor interoperability.

By nature of the Rapid-PVST protocol being based on RSTP, this also means that Arista switches are backward-compatible with Cisco switches utilizing their proprietary Per-VLAN Spanning Tree Plus (PVST+) protocol.

What Makes PVST+ Proprietary
Legacy STP called for a single spanning tree instance which the IEEE referred to as the Common Spanning Tree (CST). Rather than sticking to the standard, Cisco developed PVST which supported a single spanning tree instance per VLAN, but required Cisco Inter-switch Link (ISL) be used on trunks - it didn’t support 802.1Q.

The "plus" part of PVST+ can be thought of as Cisco’s compliance with the IEEE standard while still implementing a spanning tree instance per VLAN. This is achieved by treating VLAN 1 as a CST. To interact properly with the CST, IEEE BPDUs are sent untagged to the reserved multicast MAC address of 0180.C200.0000. For non-native VLANs, BPDU traffic is sent tagged with a special multicast MAC address of 0100.0CCC.CCCD utilizing a separate and proprietary Shared Spanning Tree Protocol1 (SSTP) BPDU.
To aid in understanding, viewing the behavior in a packet capture can be helpful. This packet capture was taken from a VLAN trunk on a Cisco switch where the native VLAN is VLAN 1 (the default), and VLAN 5 is active on it as well. The switch is utilizing PVRST+, but the same behavior applies to PVST+ in regards to utilization of SSTP.

Three different BPDU’s are of interest. The first is a standard IEEE BPDU designed to interoperate with the CST. It is untagged and sent to the reserved multicast MAC address of 0180.C200.0000.

The second BPDU is a SSTP BPDU. It is tagged as VLAN 5 and sent to the special multicast MAC address of 0100.0CCC.CCCD.

In the third BPDU we see an additional SSTP BPDU for VLAN 1, untagged, and sent to the same

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1 This has also been referred to as Secure Socket Tunneling Protocol.
2 Packet capture provided by PacketLife.net - http://www.packetlife.net
special multicast MAC address as the second. This represents the native VLAN to other Cisco switches running PVRST+ or PVST+

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**Frame 7:** 64 bytes on wire (512 bits), 64 bytes captured (512 bits)

- **IEEE 802.3 Ethernet**
  - **Destination:** PVST+ (01:00:0c:cc:cc:cd)
  - **Source:** Cisco_96:ec:04 (00:1f:6d:96:ec:04)
  - **Length:** 50

**Logical-Link Control**

**Spanning Tree Protocol**

- **Protocol Identifier:** Spanning Tree Protocol (0x0000)
- **Protocol Version Identifier:** Rapid Spanning Tree (2)
- **BPDU Type:** Rapid/Multiple Spanning Tree (0x02)
- **BPDU flags:** 0x0e (Port Role: Designated, Proposal)
- **Root Identifier:** 32768 / 1 / 00:1f:6d:96:ec:00
- **Root Path Cost:** 0
- **Bridge Identifier:** 32768 / 1 / 00:1f:6d:96:ec:00
- **Port identifier:** 0x8004
- **Message Age:** 0
- **Max Age:** 20
- **Hello Time:** 2

What this accomplishes is a tunneling effect through, for example, an Arista switch environment running MSTP. These SSTP BPDUs would not be understood by the Arista switches, so they would then be flooded as a regular multicast. This allows PVST+ BPDUs to cross through a MST region and be received by another Cisco PVST+ switch on the other side while still maintaining the ability to interact with the CST of a MST environment via IEEE standard BPDUs.

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**What Makes MSTP Proprietary For Cisco**

Cisco switches running MSTP do so without being fully compliant with the 802.1s standard when interacting with non-MST domains by utilizing a proprietary feature called PVST Simulation. PVST Simulation was designed for Cisco switches running MST connected to non-MST domains and is automatically enabled on a per-port basis when non-MST BPDUs are received. BPDUs received on VLAN 1 are received and processed normally within MST. BPDUs received on VLANs other than VLAN 1 go through a PVST Simulation check.
This check enforces two rules:

- If the root bridge for CIST is within a non-MST region (a region where MST isn't running), the spanning-tree priority of VLANs 2 and above within that domain must be better (lesser) than that of VLAN 1.
- If the root bridge for CIST is within a MST region, VLANs 2 and above defined in the non-MST domains must have their spanning-tree priorities worse (greater) than that of the CIST root.

A violation of these rules will place the port on the Cisco switch port into a non-forwarding state until the “inconsistency” that triggered the violation is resolved.

PVST Simulation is also responsible for the interoperability mechanism that MSTP cannot provide alone when working with Cisco's PVST+ or PVRST+ implementations. MSTP by itself cannot affect root bridge election outside of the CIST. This can be a problem for attached Cisco switches running their per-VLAN spanning tree implementations because SSTP BPDUs would tunnel through a Cisco MSTP environment as described in the “What makes PVST+ Proprietary” section if it didn't have this added functionality of PVST Simulation.

PVST Simulation addresses this by taking the bridge information received from a boundary port and sends a BPDU for every active VLAN on that link. This allows Cisco switches running MST to affect root bridge election on all VLANs when interacting with switches running per-VLAN spanning tree implementations. This is why Cisco recommends starting MST migration from the Enterprise distribution layer down in a typical 3-tier model with a routed core, and ensuring that the distribution switch is configured to be the root bridge of the CIST in the example provided in their PVST+ to MST migration document - because it conforms with the second rule of the PVST Simulation check.

Arista switches implement MSTP per the 802.1s standard without any additional interoperability mechanisms.

**Default Spanning Tree Path Costs**
Arista switches use default port path costs as defined in IEEE 802.1D-2004:

<table>
<thead>
<tr>
<th>Link Speed</th>
<th>Recommended value</th>
<th>Recommended range</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=100 Kb/s</td>
<td>20 000 000</td>
<td>20 000 000–200 000 000</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>1 Mb/s</td>
<td>20 000 000</td>
<td>2 000 000–20 000 000</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>10 Mb/s</td>
<td>2 000 000</td>
<td>200 000–20 000 000</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>100 Mb/s</td>
<td>200 000</td>
<td>20 000–2 000 000</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>1 Gb/s</td>
<td>2 000</td>
<td>200–2 000</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>10 Gb/s</td>
<td>200</td>
<td>20–200</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>100 Gb/s</td>
<td>20</td>
<td>2–200</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>1 Tb/s</td>
<td>2</td>
<td>1–20</td>
<td>1–200 000 000</td>
</tr>
<tr>
<td>10 Tb/s</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Bridges conformant to IEEE Std 802.1D, 1998 Edition, i.e., that support only 16-bit values for Path Cost, should use 65 535 as the Path Cost for these link speeds when used in conjunction with Bridges that support 32-bit Path Cost values.*
ARISTA.21:27:12#sh span

VL1
   Spanning tree enabled protocol rapid-pvst
   Root ID  Priority  4097
   Address  001c.730c.25f0
   This bridge is the root

   Bridge ID Priority 4097 (priority 4096 sys-id-ext 1)
   Address  001c.730c.25f0
   Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

   Interface   Role        State       Cost    Prio.Nbr    Type
   ----------- ----------  ----------  ------  ----------  -----------------
   Et1        designated forwarding  20000  128.1   P2p Boundary(STP)
   Et2        designated forwarding  20000  128.2   P2p Boundary(STP)
   Et4        designated forwarding  20000  128.4   P2p Boundary(STP)
   Et6        designated forwarding  20000  128.4   P2p Boundary(STP)

Cisco switches utilizing PVST+ or PVRST+ use port path costs defined in the older IEEE 802.1D-1998 standard by default, which does not provide enough granularity for modern networks utilizing 40Gb and 100Gb:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Link Speed</th>
<th>Recommended value</th>
<th>Recommended range</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path Cost</td>
<td>4 Mb/s</td>
<td>250</td>
<td>100-1000</td>
<td>1-65355</td>
</tr>
<tr>
<td>Path Cost</td>
<td>10 Mb/s</td>
<td>100</td>
<td>50-600</td>
<td>1-65355</td>
</tr>
<tr>
<td>Path Cost</td>
<td>16 Mb/s</td>
<td>62</td>
<td>40-400</td>
<td>1-65355</td>
</tr>
<tr>
<td>Path Cost</td>
<td>100 Mb/s</td>
<td>19</td>
<td>10-60</td>
<td>1-65355</td>
</tr>
<tr>
<td>Path Cost</td>
<td>1 Gb/s</td>
<td>4</td>
<td>3-10</td>
<td>1-65355</td>
</tr>
<tr>
<td>Path Cost</td>
<td>10 Gb/s</td>
<td>2</td>
<td>1-5</td>
<td>1-65355</td>
</tr>
</tbody>
</table>

CISCO#sh span

VLAN0001
   Spanning tree enabled protocol rstp
   Root ID  Priority  4097
   Address  001c.730c.25f0
   This bridge is the root
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

   Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
   Address  001d.a143.f900
   Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
   Aging Time 300

   Interface   Role  State Cost  Prio.Nbr    Type
   ----------- ----  ----- ----  ----------  -----------------
   Gi0/1       Root  FWD   4    128.1   P2p
   Gi0/2       Altn  BLK   4    128.2   P2p
   Gi0/3       Altn  BLK   4    128.3   P2p
   Gi0/4       Altn  BLK   4    128.4   P2p
This is important to know as it can have effects on path choice in spanning tree environments. For example, in the following scenario, the upstream Cisco switch influences path choice due to its lower advertised cost to reach the root bridge:

This can cause suboptimal traffic forwarding in situations where path speeds are not the same, such as in the following two scenarios. In both cases, the upstream Cisco switch influences path selection through a less desirable path: either at the Leaf or Spine layer as appropriate.
This issue can be addressed by utilizing the `spanning-tree pathcost method long` global configuration mode command on a Cisco switch running PVST+ or PVRST+.

```
CISCO(config)#spanning-tree pathcost method long
```

!The Gigabit interfaces on this Cisco switch now have costs that are more in line with IEEE 802.1D-2004

```
CISCO#sh span
VLAN0001
Spanning tree enabled protocol rstp
  Root ID  Priority  4097
  Address  001c.730c.25f0
  Cost 20000
  Port 1 (GigabitEthernet0/1)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

  Bridge ID  Priority  32769 (priority 32768 sys-id-ext 1)
  Address  001d.a143.f900
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 300

Interface  Role  Sts  Cost  Prio.Nbr  Type
----------  ----  ---  ------  ---------  ----
  Gi0/1  Root  FWD  20000  128.1  P2p
  Gi0/2  Altn  BLK  20000  128.2  P2p
  Gi0/3  Altn  BLK  20000  128.3  P2p
  Gi0/4  Altn  BLK  20000  128.4  P2p
```

Lastly, this is not an issue for Cisco switches running MSTP, as the more granular STP path costs are used by default.
Port Channel Behavior

Two LAGs are configured between the Arista and Cisco switches. Only VLAN 1 is present. Rapid-PVST is utilized on the Arista switch with PVRST+ being utilized on the Cisco switch. The Arista switch is configured with a lower priority to become the root bridge.

! Note current spanning tree topology
ARISTA.10:04:48(config)#sh span
VL1
Spanning tree enabled protocol rapid-pvst
  Root ID    Priority    4097
  Address     001c.730c.25f0
  This bridge is the root
  Bridge ID  Priority    4097 (priority 4096 sys-id-ext 1)
  Address     001c.730c.25f0
  Hello Time 2.000 sec Max Age 20 secForward Delay 15 sec
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Interface Role       State      Cost  Prio.Nbr Type
--------- ---------- ---------- ----  -------- -----
  Po1       designated forwarding 19999 128.100  P2p
  Po2       designated forwarding 19999 128.101  P2p

! One item of interest is how the spanning tree port costs are presented differently. On the Arista switch, the cost of Po1 and Po2 was 19,999. On the Cisco switch, it is 3
CISCO(config)#do sh span
VLAN0001
  Spanning tree enabled protocol rstp
  Root ID    Priority    4097
  Address     001c.730c.25f0
  Cost 3
  Port 56 (Port-channel1)
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 300
  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
  Address     001d.a143.f900
  Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time 300
Interface Role       Sts  Cost Prio.Nbr Type
--------- ------ ---- ---  -------- ----
  Po1       Root   FWD  3   128.56   P2p
  Po2       Altn   BLK  3   128.64   P2p

! Now interface Et1 which is a member of Po1 on the Arista switch will be shut down.

Observe the resulting spanning tree topology
ARISTA.10:05:48(config)#int et1
ARISTA.10:38:11(config-if-Et1)#shut

! No change is seen on the Arista switch
ARISTA.10:39:15(config)#sh span
VL1

Spanning tree enabled protocol rapid-pvst
Root ID    Priority   4097
  Address    001c.730c.25f0
This bridge is the root

Bridge ID Priority   4097 (priority 4096 sys-id-ext 1)
  Address    001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Interface Role       State      Cost  Prio.Nbr Type
--------- ----       ---------- ----- -------- ---------
Po1       designated forwarding 19999 128.100  P2p
Po2       designated forwarding 19999 128.101  P2p
!
! The Cisco switch on the other hand updates the cost of Po1 to 4. This in turn causes
a change in the spanning tree topology as Po1 is moved into an alternate role, blocking
state. Po2 is moved into a root role, forwarding state
CISCO(config)#do sh span

VLAN0001

Spanning tree enabled protocol rstp
Root ID    Priority   4097
  Address    001c.730c.25f0
Cost    3
Port    64 (Port-channel2)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority   32769 (priority 32768 sys-id-ext 1)
  Address    001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300
Interface Role Sts  Cost Prio.Nbr Type
--------- ---- ---- ---  -------- --------
Po1       Altn BLK  4    128.56   P2p
Po2       Root FWD  3    128.64   P2p

It is important to note that Arista switches only update the STP cost for a port channel upon its creation to favor the port channel
over a single link that has the same speed as one of the port channel’s members. For example, the STP cost for a 1Gb link on an Arista
switch is 20,000. A port channel on the same switch made up of 1Gb links has a STP cost of 19,999 making it more desirable over a
single 1Gb link.

Arista switches do not update the STP cost as of a port channel in the case of a member link failure. This is done to improve stability
by avoiding STP reconvergence events per the IEEE 802.1D-2004 standard:

“Where intermediate link speeds are created as a result of the aggregation of two or more links of the same speed (see IEEE Std
802.3-2002), it can be appropriate to modify the recommended values shown in Table 17-3 to reflect the change in link speed.
However, as the primary purpose of the Path Cost is to establish the active topology of the network, it can be inappropriate for the
Path Cost to track the effective speed of such links too closely, as the resultant active topology could differ from that intended by
the network administrator. For example, if the network administrator had chosen an active topology that makes use of aggregated links
for resilience (rather than for increased data rate), it would be inappropriate to cause a Spanning Tree topology change as a result of
one of the physical links in an aggregation failing. Similarly, with links that can autonegotiate their data rate, reflecting such changes
of data rate in changes to Path Cost is not necessarily appropriate, depending upon the intent of the network administrator. As a
default, dynamic changes of data rate shall not automatically cause changes in Port Path Cost.”
In the following scenario, we see how a change in port channel membership due to a faulty link causes an STP reconvergence event:

1. Traffic is flowing normally through CISCO1 toward the root bridge.
2. A 1Gb member link from the port channel between CISCO1 and the root bridge goes down.
3. CISCO1 updates the STP cost to 4, making that path less desirable than through CISCO2.
4. The switch at the bottom of the diagram begins receiving superior BPDUs on Port 2 due to a lower cost to reach the root bridge. It transitions Port 1 to a blocking state while transitioning Port 2 to a forwarding state. This is a STP reconvergence event.
5. Traffic is now forwarded through CISCO2 and will remain that way until the member link issue is resolved, which will cause another STP reconvergence event as the topology returns back to as it was in Step 1.

This is a standard behavior with all spanning tree protocols on IOS-based Cisco switches. NX-OS-based platforms do not follow this model and instead base the STP cost of a port channel on its configured members - not their operational status (like Arista switches).

Applying the same scenario with Arista switches, it can be observed that the switch at the bottom of the diagram doesn't see a change. This avoids a STP reconvergence event and maintains a stable topology. This also allows the faulty member link to be repaired without causing further STP reconvergence events.
To address this issue on an IOS-based Cisco switch, you may configure the spanning tree cost manually on the port channel with the spanning-tree cost interface command. This will make the STP cost of the port channel static regardless of the state of a member link:

CISCO(config-if)#int po1
CISCO(config-if)#spanning-tree cost 19999
!
! The STP cost of Po1 is now 19,999
CISCO(config-if)#do sho span int po1

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN0001</td>
<td>Root</td>
<td>FWD</td>
<td>19999</td>
<td>128.56</td>
<td>P2p</td>
</tr>
</tbody>
</table>
!
! One of Po1’s member links is shut down
CISCO(config-if)#int gi0/1
CISCO(config-if)#shut
!
! The STP cost of Po1 is unchanged
CISCO(config-if)#do sh span int po1

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN0001</td>
<td>Root</td>
<td>FWD</td>
<td>19999</td>
<td>128.56</td>
<td>P2p</td>
</tr>
</tbody>
</table>

The downside of this is that you will need to ensure you utilize the correct port cost depending on the situation.

Another difference in port channel behavior is the initially-assigned STP cost. On an Arista switch, a port channel made up of two 1Gb interfaces or four 1Gb interfaces has the same cost. For Cisco switches, the cost is a function of the aggregated bandwidth of that particular port channel’s configured member links. So in most cases, the port channel on a Cisco switch will have better cost
all things being equal. Take the following scenario for example where the Cisco switch has been configured with the spanning-tree pathcost method long command and initially only one 1Gb link is in the port channel:

![Diagram of Cisco and Arista switches](image)

<table>
<thead>
<tr>
<th>Instance</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL1</td>
<td>designated</td>
<td>forwarding</td>
<td>19999</td>
<td>128.100</td>
<td>P2p</td>
</tr>
</tbody>
</table>

! The Cisco switch shows a cost of 20,000 for Po1

CISCO#sh span int po1

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN0001</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.56</td>
<td>P2p</td>
</tr>
</tbody>
</table>

! Now the second interface will be added to Po1 on both sides

ARISTA.10:16:29(config)#int et2

ARISTA.10:19:38(config-if-Et2)#channel-group 1 mode active

! CISCO(config)#int gi0/2

CISCO(config-if)#channel-group 1 mode active

! The Arista switch still shows a cost of 19,999 for Po1

ARISTA.10:19:42(config-if-Et2)#sh span int po1

<table>
<thead>
<tr>
<th>Instance</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL1</td>
<td>designated</td>
<td>forwarding</td>
<td>19999</td>
<td>128.100</td>
<td>P2p</td>
</tr>
</tbody>
</table>

! The Cisco switch however now shows a cost of 10,000

CISCO(config-if)#do sh span int po1

<table>
<thead>
<tr>
<th>Vlan</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN0001</td>
<td>Root</td>
<td>FWD</td>
<td>10000</td>
<td>128.56</td>
<td>P2p</td>
</tr>
</tbody>
</table>

This could also be worked around with the spanning-tree cost interface command on Po1 of the Cisco switch - with the same caveats.

**Use Case - Arista MSTP**

In these scenarios, an Arista DCS-7048T-4S-F on 4.13.0 is connected to a Cisco C2960 on 12.2(35) SE5, LAN Base via four links configured as trunks initially allowing all VLANs between the two switches. VLANs 1, 10, and 20 are active on both switches. Initially, all configurations are default.
Interoperability With Cisco PVST+

Arista switches only send MST0 BPDUs on the default VLAN (VLAN 1 by default). When interoperating with PVST+, it is important to keep this in mind when it comes to root bridge election. For example, consider the following scenario:

- Arista switch is configured with MST, all VLANs are in MST0, and priority is configured for 4,096. VLAN 1, 10, and 20 are active.
- Cisco switch is attached, configured for PVST+, and default priority (32,768). VLAN 1, 10, and 20 are active.
- The links connecting these two switches are configured as trunks and allow all VLANs.

In this case, the Arista switch will be the root bridge for VLAN 1, but the Cisco switch will consider itself the root bridge for VLANs 10 and 20 since it will only receive BPDUs from the Arista switch for VLAN 1. Again, an Arista switch configured for MST will only send BPDUs on the default VLAN.

For the following use case, all VLANs on the Arista switch running MST are mapped to MST0. Note spanning tree topology.
The Arista switch claims itself to be root of MST0, and places all of its ports into a designated role, forwarding state. Also note that the connected ports between these two switches are seen as boundary ports because the Cisco switch is not running MST.

**MST0**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p Boundary(STP)</td>
</tr>
</tbody>
</table>

The Cisco switch agrees that the Arista switch is the root bridge for VLAN 1 because the Arista switch has a superior bridge priority of 32768. However, it claims itself to be the root bridge for VLANs 10 and 20. Also note that port Gi0/1 is in a Root port role for VLAN 1, but in a Designated port role for VLANs 10 and 20.

**VLAN0001**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>128.1</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>128.2</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Altn</td>
<td>BLK</td>
<td>128.3</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>128.4</td>
<td>P2p</td>
<td></td>
</tr>
</tbody>
</table>

**VLAN0010**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>128.1</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>128.2</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Altn</td>
<td>BLK</td>
<td>128.3</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>128.4</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>Role</td>
<td>Sts</td>
<td>Cost</td>
<td>Prio.Nbr</td>
<td>Type</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>-----</td>
<td>------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>FWD</td>
<td>4</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.2</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.3</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.4</td>
<td>P2p</td>
</tr>
</tbody>
</table>

Spanning tree enabled protocol ieee

Root ID  Priority  32788
Address  001d.a143.f900
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority  32788 (priority 32768 sys-id-ext 20)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>FWD</td>
<td>4</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.2</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.3</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Back</td>
<td>BLK</td>
<td>4</td>
<td>128.4</td>
<td>P2p</td>
</tr>
</tbody>
</table>

This reflects the per-VLAN behavior of PVST+ versus the fact that Arista switches running MST only send BPDUs on the default VLAN (VLAN 1 by default) and that MSTP by itself is not VLAN aware. Even if the Arista switch were to be configured with a priority of 4096 for MST0 (to which VLANs 1, 10, and 20 are mapped), it would have no effect outside of VLAN 1 in the Cisco switch’s view.

ARISTA.15:49:35(config)#spanning-tree mst 0 priority 4096

! Note the updated bridge priority for VLAN 1, but no changes to VLAN 10 or 20

CISCO#sh span

VLAN0001

Spanning tree enabled protocol ieee

Root ID  Priority  4096
Address  001c.730c.25f0
Cost  4
Port  1 (GigabitEthernet0/1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID Priority  32769 (priority 32768 sys-id-ext 1)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>4</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.2</td>
<td>P2p</td>
</tr>
<tr>
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<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.3</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.4</td>
<td>P2p</td>
</tr>
</tbody>
</table>
VLAN0010

Spanning tree enabled protocol iee
Root ID  Priority  32778
Address  001d.a143.f900
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  32778 (priority 32768 sys-id-ext 10)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 15

Interface Role Sts Cost  Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Gi0/1 Desg FWD 4  128.1  P2p
Gi0/2 Back BLK 4  128.2  P2p
Gi0/3 Back BLK 4  128.3  P2p
Gi0/4 Back BLK 4  128.4  P2p

VLAN0020

Spanning tree enabled protocol iee
Root ID  Priority  32788
Address  001d.a143.f900
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  32788 (priority 32768 sys-id-ext 20)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 15

Interface Role Sts Cost  Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Gi0/1 Desg FWD 4  128.1  P2p
Gi0/2 Back BLK 4  128.2  P2p
Gi0/3 Back BLK 4  128.3  P2p
Gi0/4 Back BLK 4  128.4  P2p

! Now the Arista switch will be returned to default configuration and the Cisco switch will be configured for a priority of 4096 for all VLANs. Note the resulting spanning tree topology
ARISTA.15:49:40(config)#no spanning-tree mst 0 priority 4096
!
CISCO(config)#spanning-tree vlan 1,10,20 priority 4096
!
! The results are as expected. The Cisco switch sees itself as the root bridge for all VLANs
CISCO#sh span
VLAN0001

Spanning tree enabled protocol iee
Root ID  Priority  4097
Address  001d.a143.f900
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  4097 (priority 4096 sys-id-ext 1)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300
### VLAN0010

Spanning tree enabled protocol ieee

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.1</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.2</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.3</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.4</td>
<td>P2p</td>
<td></td>
</tr>
</tbody>
</table>

### VLAN0020

Spanning tree enabled protocol ieee

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>Sts</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.1</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.2</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.3</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Desg</td>
<td>FWD 4</td>
<td>128.4</td>
<td>P2p</td>
<td></td>
</tr>
</tbody>
</table>

The Arista switch sees the Cisco switch as the root bridge for MST0

ARISTA.16:11:50#sh span

MST0

Spanning tree enabled protocol mstp

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>root</td>
<td>forwarding 20000</td>
<td>128.1</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et2</td>
<td>alternate</td>
<td>discarding 20000</td>
<td>128.2</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et4</td>
<td>alternate</td>
<td>discarding 20000</td>
<td>128.4</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et6</td>
<td>alternate</td>
<td>discarding 20000</td>
<td>128.6</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
</tbody>
</table>
Interoperability With Cisco MSTP

All VLANs on the Arista and Cisco switches are mapped to MST0. Note spanning tree topology. The Arista switch sees itself as the root bridge for MST0.

```
ARISTA.10:20:19#sh span
MST0
        Spanning tree enabled protocol mstp
    Root ID    Priority 32768
             Address 001c.730c.25f0
             This bridge is the root
    Bridge ID Priority 32768 (priority 32768 sys-id-ext 0)
             Address 001c.730c.25f0
        Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
    Interface        Role       State      Cost      Prio.Nbr Type
        ------------ ---------- ---------- --------- -------- -------------------
        Et1          designated forwarding 20000     128.1    P2p
        Et2          designated forwarding 20000     128.2    P2p
        Et4          designated forwarding 20000     128.4    P2p
        Et6          designated forwarding 20000     128.6    P2p
```

As expected, the Cisco switch agrees that the Arista switch is the root bridge for MST0, due to the Arista switch having a lower MAC address.

```
CISCO#sh spanning-tree
MST0
        Spanning tree enabled protocol mstp
    Root ID    Priority 32768
             Address 001c.730c.25f0
             Cost 0
             Port 1 (GigabitEthernet0/1)
        Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
    Bridge ID Priority 32768 (priority 32768 sys-id-ext 0)
             Address 001d.a143.f900
        Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
    Interface        Role       State      Cost      Prio.Nbr Type
        ------------ ---------- ---------- --------- -------- -------------------
        Gi0/1        Root       FWD        20000     128.1    P2p
        Gi0/2        Altn       BLK        20000     128.2    P2p
        Gi0/3        Altn       BLK        20000     128.3    P2p
        Gi0/4        Altn       BLK        20000     128.4    P2p
```

Now the Arista switch will be configured to have VLAN 20 in MST1. Note resulting spanning tree topology.

```
ARISTA.10:36:47(config)#spanning-tree mst configuration
ARISTA.10:36:57(config-mst)#instance 1 vlans 20
```

The Arista switch sees itself as the root bridge for both MST0 and MST1. Also note the boundary ports due to mismatched MST configuration between the two switches which has resulted in two discrete MST regions being created.

```
ARISTA.10:37:39#sh span
MST0
        Spanning tree enabled protocol mstp
    Root ID    Priority 32768
             Address 001c.730c.25f0
             This bridge is the root
```
Bridge ID  Priority  32768 (priority 32768 sys-id-ext 0)
Address    001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.1</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.2</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.4</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.6</td>
<td>P2p Boundary</td>
</tr>
</tbody>
</table>

MST1

Spanning tree enabled protocol mstp
Root ID  Priority  32769
Address    001c.730c.25f0
This bridge is the root

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.1</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.2</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.4</td>
<td>P2p Boundary</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding 20000</td>
<td>128.6</td>
<td>P2p Boundary</td>
</tr>
</tbody>
</table>

The Cisco switch agrees that the Arista switch is the root bridge for MST0. Again, we see boundary ports due to mismatched MST configuration.

CISCO#sh span

MST0

Spanning tree enabled protocol mstp
Root ID  Priority  32768
Address    001c.730c.25f0
Cost 20000
Port 1 (GigabitEthernet0/1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>20000</td>
<td>128.1 P2p Bound(RSTP)</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.2 P2p Bound(RSTP)</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.3 P2p Bound(RSTP)</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.4 P2p Bound(RSTP)</td>
</tr>
</tbody>
</table>

Now the Cisco switch will be configured to have VLAN 20 in MST1, matching the MST config of the Arista switch. Note resulting spanning tree topology.

CISCO(config)#spanning-tree mst configuration
CISCO(config-mst)#instance 1 vlan 20

As expected, the Arista switch sees itself as the root bridge, and no boundary ports exist due to both switches having matching MST configuration - thus, both switches believe themselves to be within the same MST region.

ARISTA.14:52:31#sh span
MST0

Spanning tree enabled protocol mstp

Root ID    Priority    32768
Address     001c.730c.25f0
This bridge is the root

Bridge ID Priority    32768 (priority 32768 sys-id-ext 0)
Address     001c.730c.25f0
Hello Time  2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p</td>
</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p</td>
</tr>
</tbody>
</table>

MST1

Spanning tree enabled protocol mstp

Root ID    Priority    32769
Address     001c.730c.25f0
This bridge is the root

Bridge ID Priority    32769 (priority 32768 sys-id-ext 1)
Address     001c.730c.25f0
Hello Time  2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.2</td>
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</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p</td>
</tr>
</tbody>
</table>

Interoperability With Cisco PVRST+

The same interoperability behavior exhibited in the use case with Cisco PVST+ will apply in this situation as well.

Use Case - Arista Rapid-PVST

In these scenarios, an Arista DCS-7048T-4S-F on 4.13.0 is configured with Rapid-PVST and is connected to a Cisco C2960 on 12.2(35) SE5, LAN Base via four links configured as trunks initially allowing all VLANs between the two switches. VLANs 1, 10, and 20 are active on both switches. At the start, all configurations are default.
Interoperability With Cisco PVST+

! Note current spanning tree topology with default settings. The Arista switch considers itself the root bridge for all VLANs due to having a lower MAC address since there is a tie on bridge priority

ARISTA.23:39:56#sh span

VL1

Spanning tree enabled protocol rapid-pvst

Root ID    Priority    Address
32769       001c.730c.25f0
This bridge is the root

Bridge ID Priority Address
32769 (priority 32768 sys-id-ext 1) 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Priority Nbr Type
------------- ------- -------- ------- -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)

VL10

Spanning tree enabled protocol rapid-pvst

Root ID    Priority    Address
32778       001c.730c.25f0
This bridge is the root

Bridge ID Priority Address
32778 (priority 32768 sys-id-ext 10) 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Priority Nbr Type
------------- ------- -------- ------- -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)

VL20

Spanning tree enabled protocol rapid-pvst

Root ID    Priority    Address
32788       001c.730c.25f0
This bridge is the root

Bridge ID Priority Address
32788 (priority 32768 sys-id-ext 20) 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Priority Nbr Type
------------- ------- -------- ------- -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)

! The Cisco switch agrees that the Arista switch is the root bridge for all VLANs

CISCO#sh span
VLAN0001

Spanning tree enabled protocol ieee
Root ID  Priority  32769
Address  001c.730c.25f0
Cost     4
Port     1 (GigabitEthernet0/1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  32769 (priority 32768 sys-id-ext 1)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface | Role | State | Cost | Prio.Nbr | Type
---------|------|-------|------|----------|--------
        |      |       |      |          |        |
Gi0/1   | Root | FWD   | 4    | 128.1    | P2p    |
Gi0/2   | Altn | BLK   | 4    | 128.2    | P2p    |
Gi0/3   | Altn | BLK   | 4    | 128.3    | P2p    |
Gi0/4   | Altn | BLK   | 4    | 128.4    | P2p    |

VLAN0010

Spanning tree enabled protocol ieee
Root ID  Priority  32778
Address  001c.730c.25f0
Cost     4
Port     1 (GigabitEthernet0/1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  32778 (priority 32768 sys-id-ext 10)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface | Role | State | Cost | Prio.Nbr | Type
---------|------|-------|------|----------|--------
        |      |       |      |          |        |
Gi0/1   | Root | FWD   | 4    | 128.1    | P2p    |
Gi0/2   | Altn | BLK   | 4    | 128.2    | P2p    |
Gi0/3   | Altn | BLK   | 4    | 128.3    | P2p    |
Gi0/4   | Altn | BLK   | 4    | 128.4    | P2p    |

VLAN0020

Spanning tree enabled protocol ieee
Root ID  Priority  32788
Address  001c.730c.25f0
Cost     4
Port     1 (GigabitEthernet0/1)
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority  32788 (priority 32768 sys-id-ext 20)
Address  001d.a143.f900
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300

Interface | Role | State | Cost | Prio.Nbr | Type
---------|------|-------|------|----------|--------
        |      |       |      |          |        |
Gi0/1   | Root | FWD   | 4    | 128.1    | P2p    |
Gi0/2   | Altn | BLK   | 4    | 128.2    | P2p    |
Gi0/3   | Altn | BLK   | 4    | 128.3    | P2p    |
Gi0/4   | Altn | BLK   | 4    | 128.4    | P2p    |
Now the Arista switch will be configured to be the root bridge for VLANs 1 and 10, and
the Cisco switch to be the root bridge for VLAN 20. Note resulting spanning tree topology

ARISTA.23:47:46(config)#spanning-tree vlan 1,10 priority 4096

CISCO(config)#spanning-tree vlan 20 priority 4096

Results were as expected for both the Arista and Cisco switches. They both agree that
the Arista switch is the root bridge for VLANs 1 and 10, and that the Cisco switch is the
root bridge for VLAN 20.

ARISTA.23:50:33(config)#sh span

VLAN 1
Spanning tree enabled protocol rapid-pvst
   Root ID  Priority    4097
         Address  001c.730c.25f0
   This bridge is the root
   Bridge ID  Priority    4097 (priority 4096 sys-id-ext 1)
         Address  001c.730c.25f0
   Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

   Interface        Role       State      Cost      Prio.Nbr Type
   ---------------- ---------- ---------- --------- -------- --------------------
   Et1              designated forwarding 20000     128.1    P2p Boundary(STP)
   Et2              designated forwarding 20000     128.2    P2p Boundary(STP)
   Et4              designated forwarding 20000     128.4    P2p Boundary(STP)
   Et6              designated forwarding 20000     128.6    P2p Boundary(STP)

VLAN 10
Spanning tree enabled protocol rapid-pvst
   Root ID  Priority    4106
         Address  001c.730c.25f0
   This bridge is the root
   Bridge ID  Priority    4106 (priority 4096 sys-id-ext 10)
         Address  001c.730c.25f0
   Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

   Interface        Role       State      Cost      Prio.Nbr Type
   ---------------- ---------- ---------- --------- -------- --------------------
   Et1              designated forwarding 20000     128.1    P2p Boundary(STP)
   Et2              designated forwarding 20000     128.2    P2p Boundary(STP)
   Et4              designated forwarding 20000     128.4    P2p Boundary(STP)
   Et6              designated forwarding 20000     128.6    P2p Boundary(STP)

VLAN 20
Spanning tree enabled protocol rapid-pvst
   Root ID  Priority    4116
         Address  001d.a143.f900
   Cost        20000 (Ext) 0 (Int)
   Port        1 (Ethernet1)
   Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
   Bridge ID  Priority    32788 (priority 32768 sys-id-ext 20)
         Address  001c.730c.25f0
   Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

   Interface        Role       State      Cost      Prio.Nbr Type
   ---------------- ---------- ---------- --------- -------- --------------------
   Et1              designated forwarding 20000     128.1    P2p Boundary(STP)
   Et2              designated forwarding 20000     128.2    P2p Boundary(STP)
   Et4              designated forwarding 20000     128.4    P2p Boundary(STP)
   Et6              designated forwarding 20000     128.6    P2p Boundary(STP)
<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>4</td>
<td>128.1</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.2</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.3</td>
<td>P2p</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>4</td>
<td>128.4</td>
<td>P2p</td>
</tr>
<tr>
<td>VLAN0010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLAN0020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interoperability With Cisco MSTP

! Note current spanning tree topology with default settings. The Arista switch sees the Cisco switch as the root bridge for all VLANs due to superior bridge priority. If you didn’t already notice, this is different behavior than what was seen in the use case where the Arista switch was utilizing MST and the Cisco switch was using PVRST+. This output reflects the fact that a Cisco switch running MST sends a BPDU for every VLAN via PVST Simulation

ARISTA.14:57:59#sh span

VL1
Spanning tree enabled protocol rapid-pvst
Root ID  Priority 32768
Address 001d.a143.f900
Cost 20000 (Ext) 0 (Int)
Port 1 (Ethernet1)
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Prio.Nbr Type
----------------- ------ ----- ------ -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)

VL10
Spanning tree enabled protocol rapid-pvst
Root ID  Priority 32768
Address 001d.a143.f900
Cost 20000 (Ext) 0 (Int)
Port 1 (Ethernet1)
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32778 (priority 32768 sys-id-ext 10)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Prio.Nbr Type
----------------- ------ ----- ------ -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)

VL20
Spanning tree enabled protocol rapid-pvst
Root ID  Priority 32768
Address 001d.a143.f900
Cost 20000 (Ext) 0 (Int)
Port 1 (Ethernet1)
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32788 (priority 32768 sys-id-ext 20)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

Interface Role State Cost Prio.Nbr Type
----------------- ------ ----- ------ -------------------
Et1 designated forwarding 20000 128.1 P2p Boundary(STP)
Et2 designated forwarding 20000 128.2 P2p Boundary(STP)
Et4 designated forwarding 20000 128.4 P2p Boundary(STP)
Et6 designated forwarding 20000 128.6 P2p Boundary(STP)
The Cisco switch sees itself as the root bridge for MST0, as expected

CISCO#sh span

<table>
<thead>
<tr>
<th>MST0</th>
<th>Priority</th>
<th>Address</th>
<th>Hello Time</th>
<th>Max Age</th>
<th>Forward Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanning tree enabled</td>
<td></td>
<td>Protocol mstp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root ID</td>
<td>32768</td>
<td>001d.a143.f900</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>This bridge is the root</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge ID</td>
<td>32768</td>
<td>001d.a143.f900</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Interface</td>
<td>Role</td>
<td>State</td>
<td>Cost</td>
<td>Prio.Nbr</td>
<td>Type</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Gi0/1</td>
<td>Root</td>
<td>FWD</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Bound(PVST)</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Bound(PVST)</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.3</td>
<td>P2p Bound(PVST)</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Altn</td>
<td>BLK</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Bound(PVST)</td>
</tr>
</tbody>
</table>

Now the Arista switch will be configured to be the root bridge for VLAN 10. Note resulting spanning tree topology

ARISTA.15:26:20(config)#spanning-tree vlan 10 priority 4096

The Arista switch sees itself as the root bridge for VLAN 10, as expected

ARISTA.15:27:25#sh span

<table>
<thead>
<tr>
<th>VL1</th>
<th>Priority</th>
<th>Address</th>
<th>Hello Time</th>
<th>Max Age</th>
<th>Forward Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanning tree enabled</td>
<td></td>
<td>Protocol rapid-pvst</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root ID</td>
<td>32768</td>
<td>001d.a143.f900</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Port</td>
<td>1 (Ethernet1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge ID</td>
<td>32769</td>
<td>001c.730c.25f0</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Interface</td>
<td>Role</td>
<td>State</td>
<td>Cost</td>
<td>Prio.Nbr</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Et1</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et2</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et4</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et6</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
</tbody>
</table>

VL10

<table>
<thead>
<tr>
<th>VL10</th>
<th>Priority</th>
<th>Address</th>
<th>Hello Time</th>
<th>Max Age</th>
<th>Forward Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanning tree enabled</td>
<td></td>
<td>Protocol rapid-pvst</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root ID</td>
<td>4106</td>
<td>001c.730c.25f0</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Bridge ID</td>
<td>4106</td>
<td>001c.730c.25f0</td>
<td>2 sec</td>
<td>20 sec</td>
<td>15 sec</td>
</tr>
<tr>
<td>Interface</td>
<td>Role</td>
<td>State</td>
<td>Cost</td>
<td>Prio.Nbr</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Et1</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et2</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et4</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
<tr>
<td>Et6</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p Boundary(STP)</td>
<td></td>
</tr>
</tbody>
</table>
### VL20

Spanning tree enabled protocol rapid-pvst

<table>
<thead>
<tr>
<th>Root ID</th>
<th>Priority</th>
<th>32768</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>001d.a143.f900</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>20000 (Ext) 0 (Int)</td>
<td></td>
</tr>
<tr>
<td>Port</td>
<td>1 (Ethernet1)</td>
<td></td>
</tr>
</tbody>
</table>

Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Bridge ID</th>
<th>Priority</th>
<th>32788 (priority 32768 sys-id-ext 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>001c.730c.25f0</td>
<td></td>
</tr>
</tbody>
</table>

Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et2</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et4</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et6</td>
<td>designated</td>
<td>forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p Boundary(STP)</td>
</tr>
</tbody>
</table>

! The Cisco switch sees itself as the root bridge for MST0 as before, but also reports an inconsistency caused by the receipt of a superior BPDU on VLAN 10 across all its the links and triggers a PVST Simulation check failure.

```
CISCO# 3w3d: %SPANTREE-2-PVSTSIM_FAIL: Blocking designated port Gi0/3: Inconsistent superior PVST BPDU received on VLAN 10 across all its the links and triggers a PVST Simulation check failure.
```

This bridge is the root

Spanning tree enabled protocol mstp

<table>
<thead>
<tr>
<th>Root ID</th>
<th>Priority</th>
<th>32768</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>001d.a143.f900</td>
<td></td>
</tr>
</tbody>
</table>

Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Bridge ID</th>
<th>Priority</th>
<th>32768 (priority 32768 sys-id-ext 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>001d.a143.f900</td>
<td></td>
</tr>
</tbody>
</table>

Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

In this case, the CIST root bridge (the root bridge on VLAN 1) is the Cisco switch, which is running MST, and therefore is within a MST region. The BPDU received on VLAN 10 came from a non-MST region, and was superior, thus violating the second rule of the PVST Simulation check which again states:

"If the root bridge for CIST is within a MST region, VLANs 2 and above defined in the non-MST domains must have their spanning-tree priorities worse (greater) than that of the CIST root."

The end result is all connected links transporting these superior BPDUs from the non-MST region (boundary ports) on VLAN 10 are placed into a BKN* status, which do not forward traffic. Once the “inconsistency” is cleared, the port will be returned back to an operational state.

```
CISCO# sh span
```

MST0
### Interface Role State Cost Prio.Nbr Type

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.3</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
</tbody>
</table>

CISCO#sh spanning-tree mst 0
##### MST0 vlans mapped: 1-4094
Bridge address 001d.a143.f900 priority 32768 (32768 sysid 0)
Root this switch for the CIST
Operational hello time 2, forward delay 15, max age 20, txholdcount 6
Configured hello time 2, forward delay 15, max age 20, max hops 20

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/1</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/2</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/3</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.3</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
<tr>
<td>Gi0/4</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Bound(PVST) *PVST_Inc</td>
</tr>
</tbody>
</table>

! Now the Arista switch will be configured as the CIST root bridge by assigning VLAN 1 a priority of 4096. Note resulting spanning tree topology
ARISTA.17:07:22(config)#spanning-tree vlan 1 priority 4096

! The Arista switch sees itself as root bridge for VLAN 1 and 10, as expected. Also note that it believes itself to be the root for VLAN 20 as well despite no change in priority. The reason for this may not be clear right now, but it will be in a moment
ARISTA.17:08:55(config)#sh span
VL1
Spanning tree enabled protocol rapid-pvst
Root ID Priority 4097
Address 001c.730c.25f0
This bridge is the root
Bridge ID Priority 4097 (priority 4096 sys-id-ext 1)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Bound(STP)</td>
<td></td>
</tr>
<tr>
<td>Et2</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Et4</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p</td>
<td></td>
</tr>
<tr>
<td>Et6</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p</td>
<td></td>
</tr>
</tbody>
</table>

VL10
Spanning tree enabled protocol rapid-pvst
Root ID Priority 4106
Address 001c.730c.25f0
This bridge is the root
Bridge ID Priority 4106 (priority 4096 sys-id-ext 10)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
### Spanning tree enabled protocol rapid-pvst

**Root ID**  
Priority: 32788  
Address: 001c.730c.25f0  
This bridge is the root

**Bridge ID**  
Priority: 32788 (priority 32768 sys-id-ext 20)  
Address: 001c.730c.25f0  
Hello Time: 2.000 sec  
Max Age: 20 sec  
Forward Delay: 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Et1</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.1</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et2</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et4</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p Boundary(STP)</td>
</tr>
<tr>
<td>Et6</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p Boundary(STP)</td>
</tr>
</tbody>
</table>

### Spanning tree enabled protocol mstp

**Root ID**  
Priority: 4097  
Address: 001c.730c.25f0  
Cost: 20000  
Port: 1 (GigabitEthernet0/1)  
Hello Time: 2 sec  
Max Age: 20 sec  
Forward Delay: 15 sec

**Bridge ID**  
Priority: 32768 (priority 32768 sys-id-ext 0)  
Address: 001d.a143.f900  
Hello Time: 2 sec  
Max Age: 20 sec  
Forward Delay: 15 sec

<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>G10/1</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.1</td>
</tr>
<tr>
<td>G10/2</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.2</td>
</tr>
<tr>
<td>G10/3</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.3</td>
</tr>
<tr>
<td>G10/4</td>
<td>Desg</td>
<td>BKN</td>
<td>20000</td>
<td>128.4</td>
</tr>
</tbody>
</table>

The only port that could have forwarded BPDUs is in a BKN* state because in this circumstance the first rule of the PVST Simulation check is being violated, which again states:

"If the root bridge for CIST is within a non-MST region, the spanning-tree priority of VLANs 2 and above within that domain must be better (lesser) than that of VLAN 1."

This rule applies because the Arista switch is not running MST, and is therefore within a non-MST region, and is now the CIST root due to the priority for VLAN 1 being configured at 4096, which is the same or less (better) than the configured priority for VLAN 10, and of course the unmodified priority of VLAN 20.
In order to clear this “inconsistency”, VLAN 1 will be configured with a priority of 8192, and VLAN 20 will be configured with a priority of 4096. Note the resulting spanning tree topology:

```
ARISTA.17:25:08(config)#spanning-tree vlan 1 priority 8192
ARISTA.17:25:08(config)#spanning-tree vlan 20 priority 4096
```

The spanning tree output from the Arista switch is as expected:

```
ARISTA.17:25:31(config)#sh span
VL1
Spanning tree enabled protocol rapid-pvst
Root ID  Priority     8193
Address  001c.730c.25f0
This bridge is the root
Bridge ID Priority     8193 (priority 8192 sys-id-ext 1)
Address  001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Interface Role       State      Cost      Prio.Nbr Type
----------------- --------- ---------- --------- -------- -------------------
Et1              designated forwarding 20000     128.1    P2p
Et2              designated forwarding 20000     128.2    P2p
Et4              designated forwarding 20000     128.4    P2p
Et6              designated forwarding 20000     128.6    P2p

VL10
Spanning tree enabled protocol rapid-pvst
Root ID  Priority     4106
Address  001c.730c.25f0
This bridge is the root
Bridge ID Priority     4106 (priority 4096 sys-id-ext 10)
Address  001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Interface Role       State      Cost      Prio.Nbr Type
----------------- --------- ---------- --------- -------- -------------------
Et1              designated forwarding 20000     128.1    P2p Boundary(STP)
Et2              designated forwarding 20000     128.2    P2p Boundary(STP)
Et4              designated forwarding 20000     128.4    P2p Boundary(STP)
Et6              designated forwarding 20000     128.6    P2p Boundary(STP)

VL20
Spanning tree enabled protocol rapid-pvst
Root ID  Priority     4116
Address  001c.730c.25f0
This bridge is the root
Bridge ID Priority     4116 (priority 4096 sys-id-ext 20)
Address  001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
Interface Role       State      Cost      Prio.Nbr Type
----------------- --------- ---------- --------- -------- -------------------
Et1              designated forwarding 20000     128.1    P2p Boundary(STP)
Et2              designated forwarding 20000     128.2    P2p Boundary(STP)
Et4              designated forwarding 20000     128.4    P2p Boundary(STP)
Et6              designated forwarding 20000     128.6    P2p Boundary(STP)
```

The Cisco switch clears the PVST Simulation inconsistency and restores the port to normal operation. The switchport is now forwarding and the Cisco switch agrees that the Arista switch is the CIST root bridge.
When taking this behavior into account, it is understandable that migrations from a per-VLAN spanning tree implementation to MST can be challenging - especially in mixed-vendor environments with Cisco and its PVST Simulation feature.

**Interoperability With Cisco PVRST+**

The same interoperability behavior exhibited in the use case with Cisco PVST+ will apply in this situation as well.

### APPENDIX A - INTEROPERABILITY MATRIX

<table>
<thead>
<tr>
<th>Arista / Cisco Spanning Tree Mode</th>
<th>Arista MST</th>
<th>Arista Rapid-PVST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco MST</strong></td>
<td>No issues.**</td>
<td>Be aware of the implications of Cisco's proprietary PVST Simulation feature.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the Arista switch is to be the CIST root bridge, VLANS 2 and above on the Arista switch must be configured with a lower (better) priority than VLAN 1. This adheres to the first rule of the PVST Simulation check.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the Arista switch is NOT to be the CIST root bridge, ALL VLANs on the Arista switch must be configured with a higher (worse) priority than the CIST root bridge in order to adhere to the second rule of the PVST Simulation check (and not to overtake the role of the CIST root bridge).**</td>
</tr>
<tr>
<td><strong>Cisco PVRST+</strong></td>
<td>Be aware of the implications of the tunneling effect of Cisco's proprietary SSTP feature.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the Arista switch is to be root bridge of the CIST, determine which Cisco switches should be the root bridge for their respective VLANs outside of the CIST and utilize spanning tree priority in order to maintain a stable, predictable topology.**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Configure the Cisco switch with the spanningtree pathcost method long command.**</td>
</tr>
<tr>
<td><strong>Cisco PVST+</strong></td>
<td>Same as with Cisco PVRST+.**</td>
<td>Configure the Cisco switch with the spanningtree pathcost method long command.**</td>
</tr>
</tbody>
</table>
** With all spanning tree protocols on IOS-based Cisco switches, consider utilizing the spanning-tree cost interface command on appropriate port channels to prevent the STP cost being updated on a port channel when a member link is added or removed, and to address situations where you need to equalize port path costs between Arista and Cisco switches. Be wary of the caveats described in the “Port Channel Behavior” section.

Appendix B - Other Concerns

Multiple MSTIs

In a situation where multiple Multiple Spanning Tree Instances (MSTIs) are being leveraged, this has no added effect on interoperability. MSTP does not send a BPDU for every spanning tree instance. MSTIs are communicated via MRecord fields (one for every instance) within the BPDU sent through the Internal Spanning Tree (IST) of a single MST region.

```
ARISTA.14:45:12(config)#spanning-tree mst configuration
ARISTA.14:46:00(config-mst)#instance 1 vlan 10
ARISTA.14:46:14(config-mst)#instance 2 vlan 20
```

This is a function within MSTP itself and is separate from PVST Simulation functionality. It does not change interoperability. To verify this, the Arista switch will be configured to have three MSTIs. VLAN 1 will be mapped to MST0 (by default), VLAN 10 will be mapped to MST1, and VLAN 20 will be mapped to MST2.

```
! The Arista switch will also have a priority of 4096 configured for MST0, with default priorities for MST1 and MST2
ARISTA.14:45:12(config)#spanning-tree mst 0 priority 4096
```

! The Cisco switch will be configured to have a priority of 4096 for VLAN 20, with default priorities for VLANs 1 and 10. Note the resulting spanning tree topology
```
CISCO(config)# spanning-tree vlan 20 priority 4096
```

! The Arista switch claims itself to be root for all MSTIs, including MST2 to which VLAN 20 is mapped, despite the Cisco switch being configured with a lower (better) priority for that VLAN. This is again because MSTP by itself is not VLAN aware
```
ARISTA.14:57:16#sh span
```

---

<table>
<thead>
<tr>
<th>Interface</th>
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<th>Type</th>
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<tbody>
<tr>
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<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et2</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.2</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et4</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.4</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
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<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
</tbody>
</table>

MST1
Spanning tree enabled protocol mstp
Root ID Priority 32769
Address 001c.730c.25f0
This bridge is the root
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
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<th>Type</th>
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<td>designated forwarding</td>
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<td>Boundary(STP)</td>
</tr>
<tr>
<td>Et6</td>
<td>designated forwarding</td>
<td>20000</td>
<td>128.6</td>
<td>P2p</td>
<td>Boundary(STP)</td>
</tr>
</tbody>
</table>

MST2
Spanning tree enabled protocol mstp
Root ID Priority 32770
Address 001c.730c.25f0
This bridge is the root
Bridge ID Priority 32770 (priority 32768 sys-id-ext 2)
Address 001c.730c.25f0
Hello Time 2.000 sec Max Age 20 sec Forward Delay 15 sec
<table>
<thead>
<tr>
<th>Interface</th>
<th>Role</th>
<th>State</th>
<th>Cost</th>
<th>Prio.Nbr</th>
<th>Type</th>
</tr>
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<tbody>
<tr>
<td>Et1</td>
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<td>P2p</td>
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</tr>
</tbody>
</table>

While this looks more complicated, in reality it is the same interoperability behavior described in the “Interoperability with Cisco PVST+” section of the use case with Arista MSTP.
Changing The VLAN-To-Instance Mapping

While removing or adding VLANs to MST instances certainly has effects on the spanning tree topology behavior that are outside the scope of this interoperability white paper, it does not change the actual interoperability behavior described within the various use cases. For example, an Arista switch leveraging MSTP will still have no effect outside of VLAN 1 on a Cisco switch running PVST+. Inversely, a Cisco switch running MSTP will still have an effect on every VLAN on a connected Arista switch running Rapid-PVST due to Cisco’s PVST Simulation feature.

Cisco Bug CSCta

While removing or adding VLANs to MST instances certainly has effects on the spanning tree topology behavior that are outside the scope of this interoperability white paper, it does not change the actual interoperability behavior described within the various use cases. For example, an Arista switch leveraging MSTP will still have no effect outside of VLAN 1 on a Cisco switch running PVST+. Inversely, a Cisco switch running MSTP will still have an effect on every VLAN on a connected Arista switch running Rapid-PVST due to Cisco’s PVST Simulation feature.

5“Tagging the Native VLAN” - Network World.
http://www.networkworld.com/community/node/38732