

# Contents

Introduction .....	1
Prerequisites .....	1
Example: Configuring MSTP .....	1
Network configuration .....	1
Analysis .....	1
Applicable hardware and software versions .....	2
Procedures .....	4
Configuring Device A .....	4
Configuring Device B .....	5
Configuring Device C .....	5
Configuring Device D .....	6
Verifying the configuration .....	6
Configuration files .....	9
Example: Configuring PVST .....	12
Network configuration .....	12
Analysis .....	12
Applicable hardware and software versions .....	13
Procedures .....	15
Configuring Device A .....	15
Configuring Device B .....	16
Configuring Device C .....	16
Configuring Device D .....	17
Verifying the configuration .....	17
Configuration files .....	18
Example: Configuring RSTP .....	21
Network configuration .....	21
Analysis .....	22
Applicable hardware and software versions .....	22
Procedures .....	24
Configuring Device A .....	24
Configuring Device B .....	25
Configuring Device C .....	25
Configuring Device D .....	25
Configuring Device E .....	25
Verifying the configuration .....	26
Configuration files .....	29

# Introduction

This document provides spanning tree configuration examples.

## Prerequisites

This document is not restricted to specific software or hardware versions.

The configuration examples in this document were created and verified in a lab environment, and all the devices were started with the factory default configuration. When you are working on a live network, make sure you understand the potential impact of every command on your network.

This document assumes that you have basic knowledge of spanning tree protocols.

## Example: Configuring MSTP

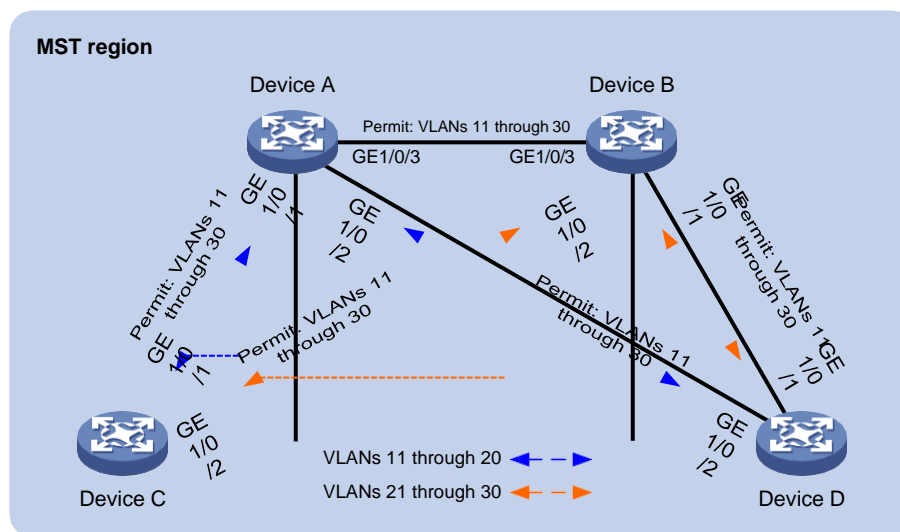
### Network configuration

As shown in [Figure 1](#), Device A and Device B operate at the core layer, and Device C and Device D operate at the distribution layer. The ports on the devices have the same path cost, and they all permit VLANs 11 through 30.

Configure MSTP to meet the following requirements:

- Device A, Device B, Device C, and Device D belong to the same MST region.
- MSTIs are used to share the traffic of VLANs 11 through 20 and of VLANs 21 through 30.

**Figure 1 Network diagram**



## Analysis

To assign the devices to the same MST region, make sure the following MST region parameters are the same on the devices:

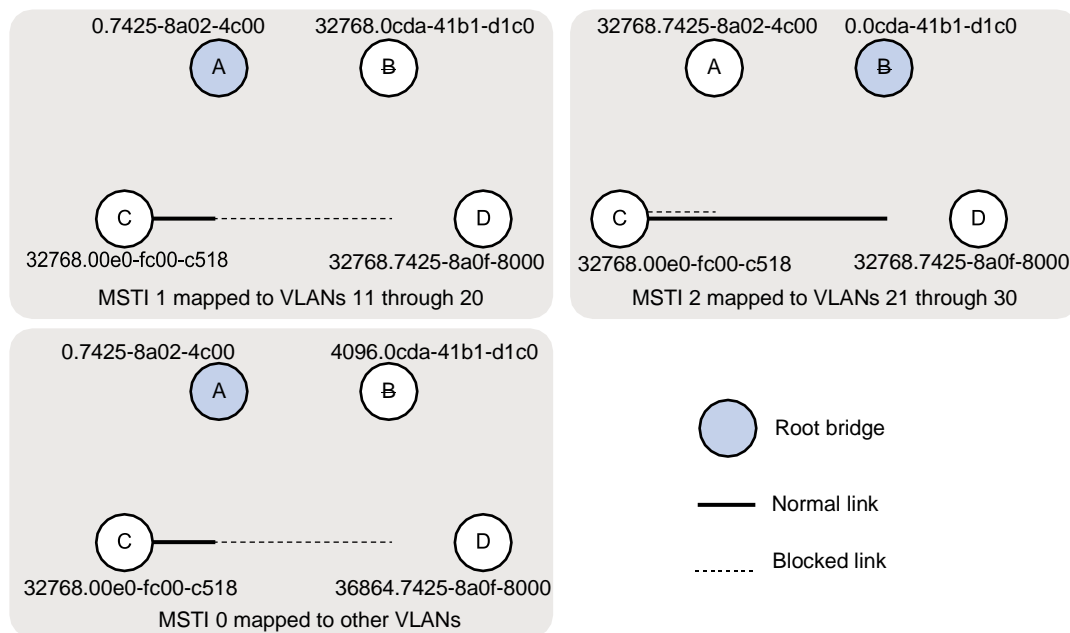
- Spanning tree mode (the default mode MSTP is used).

- Region name (**test** in this example).
- Revision level (the default value 0 is used).
- VLAN-to-instance mappings (VLANs 11 through 20 to MIST 1, and VLANs 21 through 30 to MIST 2).

To use redundant links to share the traffic of different VLANs (as shown in [Figure 2](#)), perform the following tasks:

- Configure Device A as the root bridge of MSTI 1.
- Configure Device B as the root bridge of MSTI 2.
- Assign priorities to Device A, Device B, Device C, and Device D in MSTI 0 in descending order for Device A to be the regional root bridge.

**Figure 2 MSTIs mapped to different VLANs**



## Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

# Procedures

## Configuring Device A

**# Create VLANs 11 through 30.**

```
<DeviceA> system-view  
[DeviceA] vlan 11 to 30
```

**# Configure GigabitEthernet 1/0/1, GigabitEthernet 1/0/2, and GigabitEthernet 1/0/3 to trunk VLANs 11 through 30.**

```
[DeviceA] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/3  
[DeviceA-if-range] port link-type trunk  
[DeviceA-if-range] port trunk permit vlan 11 to 30  
[DeviceA-if-range] quit
```

**# Configure the MST region name as **test**.**

```
[DeviceA] stp region-configuration  
[DeviceA-mst-region] region-name test
```

**# Map VLANs 11 through 20 to MSTI 1, and map VLANs 21 through 30 to MSTI 2.**

```
[DeviceA-mst-region] instance 1 vlan 11 to 20
```

```
[DeviceA-mst-region] instance 2 vlan 21 to 30

# Activate the MST region configuration.
[DeviceA-mst-region] active region-configuration
[DeviceA-mst-region] quit

# Configure Device A as the root bridge of MSTI 0 and MSTI 1.
[DeviceA] stp instance 0 to 1 root primary

# Enable the spanning tree feature globally.
[DeviceA] stp global enable
```

## Configuring Device B

```
# Create VLANs 11 through 30.
<DeviceB> system-view
[DeviceB] vlan 11 to 30

# Configure GigabitEthernet 1/0/1, GigabitEthernet 1/0/2, and GigabitEthernet 1/0/3 to trunk
VLANs 11 through 30.
[DeviceB] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/3
[DeviceB-if-range] port link-type trunk
[DeviceB-if-range] port trunk permit vlan 11 to 30
[DeviceB-if-range] quit

# Configure the MST region name as test.
[DeviceB] stp region-configuration
[DeviceB-mst-region] region-name test

# Map VLANs 11 through 20 to MSTI 1, and map VLANs 21 through 30 to MSTI 2.
[DeviceB-mst-region] instance 1 vlan 11 to 20
[DeviceB-mst-region] instance 2 vlan 21 to 30

# Activate the MST region configuration.
[DeviceB-mst-region] active region-configuration
[DeviceB-mst-region] quit

# Configure Device B as the root bridge of MSTI 2 and a secondary root bridge of MSTI 0.
[DeviceB] stp instance 2 root primary
[DeviceB] stp instance 0 root secondary

# Enable the spanning tree feature globally.
[DeviceB] stp global enable
```

## Configuring Device C

```
# Create VLANs 11 through 30.
<DeviceC> system-view
[DeviceC] vlan 11 to 30

# Configure GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2 to trunk VLANs 11 through 30.
[DeviceC] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2
[DeviceC-if-range] port link-type trunk
[DeviceC-if-range] port trunk permit vlan 11 to 30
[DeviceC-if-range] quit

# Configure the MST region name as test.
```

```
[DeviceC] stp region-configuration
[DeviceC-mst-region] region-name test

# Map VLANs 11 through 20 through MSTI 1, and map VLANs 21 through 30 to MSTI 2.
[DeviceC-mst-region] instance 1 vlan 11 to 20
[DeviceC-mst-region] instance 2 vlan 21 to 30

# Activate the MST region configuration.
[DeviceC-mst-region] active region-configuration
[DeviceC-mst-region] quit

# Enable the spanning tree feature globally.
[DeviceC] stp global enable
```

## Configuring Device D

```
# Create VLANs 11 through 30.
<DeviceD> system-view
[DeviceD] vlan 11 to 30

# Configure GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2 to trunk VLANs 11 through 30.
[DeviceD] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2
[DeviceD-if-range] port link-type trunk
[DeviceD-if-range] port trunk permit vlan 11 to 30
[DeviceD-if-range] quit

# Configure the MST region name as test.
[DeviceD] stp region-configuration
[DeviceD-mst-region] region-name test

# Map VLANs 11 through 20 to MSTI 1, and map VLANs 21 through 30 to MSTI 2.
[DeviceD-mst-region] instance 1 vlan 11 to 20
[DeviceD-mst-region] instance 2 vlan 21 to 30

# Activate the MST region configuration.
[DeviceD-mst-region] active region-configuration
[DeviceD-mst-region] quit

# Set the device priority to 36864 in MSTI 0, which is lower than the default priority 32768 of
Device C.
[DeviceD] stp instance 0 priority 36864

# Enable the spanning tree feature globally.
[DeviceD] stp global enable
```

## Verifying the configuration

1. Verify that Layer 2 loops have been eliminated in each MSTI:  
Use the **display stp brief** command to display brief spanning tree information on each device.

# Display brief spanning tree information on Device A.

```
[DeviceA] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/2	DESI	FORWARDING	NONE

0	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE

#### # Display brief spanning tree information on Device B.

[DeviceB] display stp brief

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
2	GigabitEthernet1/0/3	DESI	FORWARDING	NONE

#### # Display brief spanning tree information on Device C.

[DeviceC] display stp brief

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
0	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
1	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
2	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
2	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE

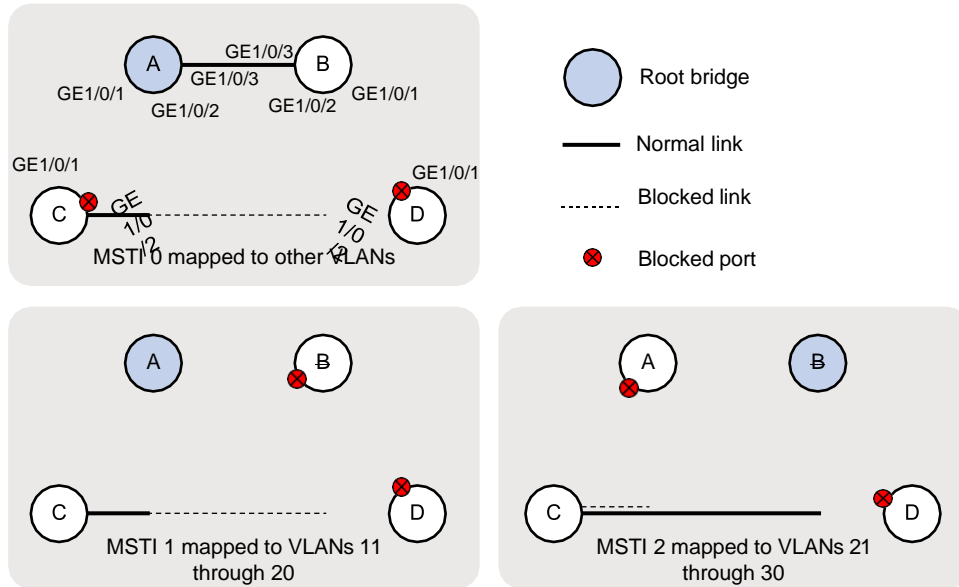
#### # Display brief spanning tree information on Device D.

[DeviceD] display stp brief

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
0	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
1	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE

Based on the output, the topology for each MSTI is shown in [Figure 3](#).

**Figure 3 MSTI topologies**



2. Verify that the network can accommodate topology changes:
  - # Shut down GigabitEthernet 1/0/1 on Device C. (Details not shown.)
  - # Display brief spanning tree information on all devices.

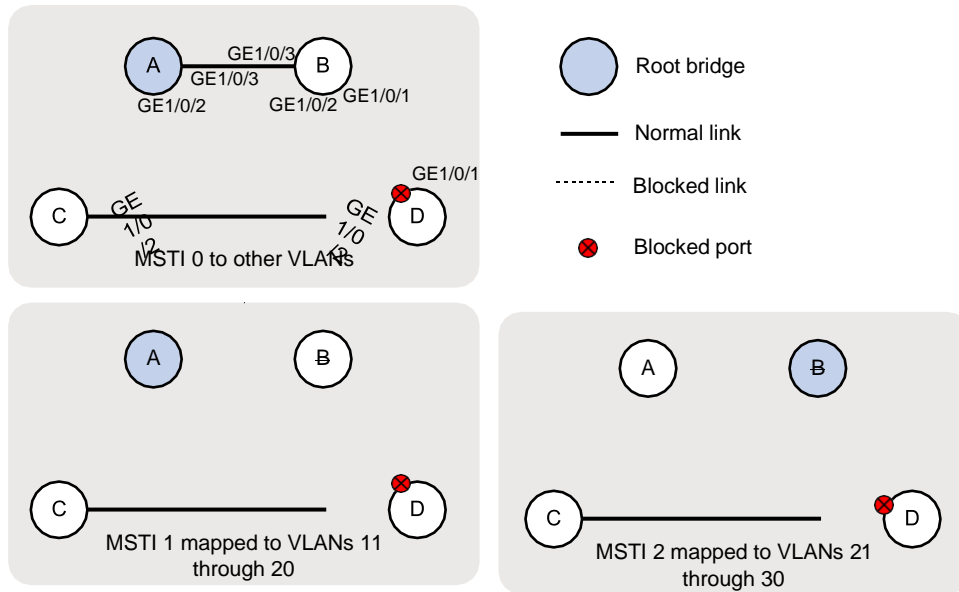
```
[DeviceA] display stp brief
```



0	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
1	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
2	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE

Based on the output, the topology for each MSTI is shown in [Figure 4](#).

**Figure 4 MSTI topologies**



## Configuration files

### ⚠ IMPORTANT:

Support for the `port link-mode bridge` command depends on the device model.

- Device A:

```
#
vlan 1
#
vlan 11 to 30
#
stp region-configuration
  region-name test
  instance 1 vlan 11 to 20
  instance 2 vlan 21 to 30
  active region-configuration
#
stp instance 0 to 1 root primary
stp global enable
#
interface GigabitEthernet1/0/1
  port link-mode bridge
```

```

port link-type trunk
port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/2
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/3
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 11 to 30
#

```

- **Device B:**

```

#
vlan 1
#
vlan 11 to 30
#
stp region-configuration
region-name test
instance 1 vlan 11 to 20
instance 2 vlan 21 to 30
active region-configuration
#
stp instance 0 root secondary
stp instance 2 root primary
stp global enable
#
interface GigabitEthernet1/0/1
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/2
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/3
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 11 to 30
#

```

- **Device C:**

```

#
vlan 1
#

```

```

vlan 11 to 30
#
stp region-configuration
    region-name test
    instance 1 vlan 11 to 20
    instance 2 vlan 21 to 30
    active region-configuration
#
    stp global enable
#
interface GigabitEthernet1/0/1
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/2
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 11 to 30
#

```

- **Device D:**

```

#
vlan 1
#
vlan 11 to 30
#
stp region-configuration
    region-name test
    instance 1 vlan 11 to 20
    instance 2 vlan 21 to 30
    active region-configuration
#
    stp instance 0 priority 36864
    stp global enable
#
interface GigabitEthernet1/0/1
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 11 to 30
#
interface GigabitEthernet1/0/2
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 11 to 30
#

```

# Example: Configuring PVST

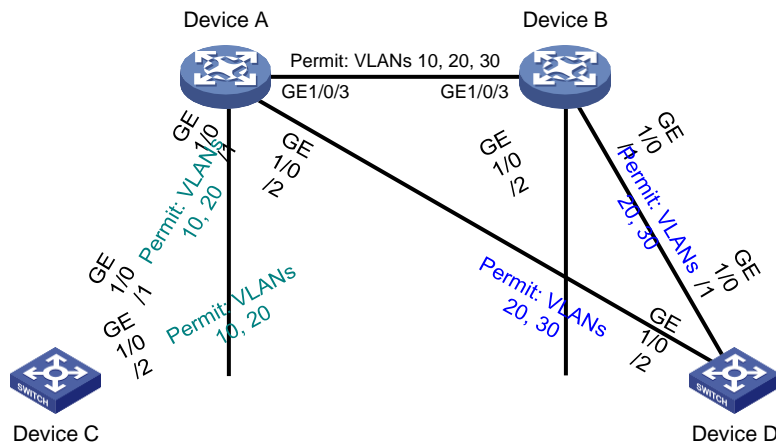
## Network configuration

As shown in [Figure 5](#), Device A and Device B operate at the distribution layer, and Device C and Device D operate at the access layer. The ports on the devices have the same path cost.

Configure PVST to meet the following requirements:

- Redundant links are used for load sharing.
- Packets of each VLAN are forwarded along its spanning tree.

**Figure 5 Network diagram**

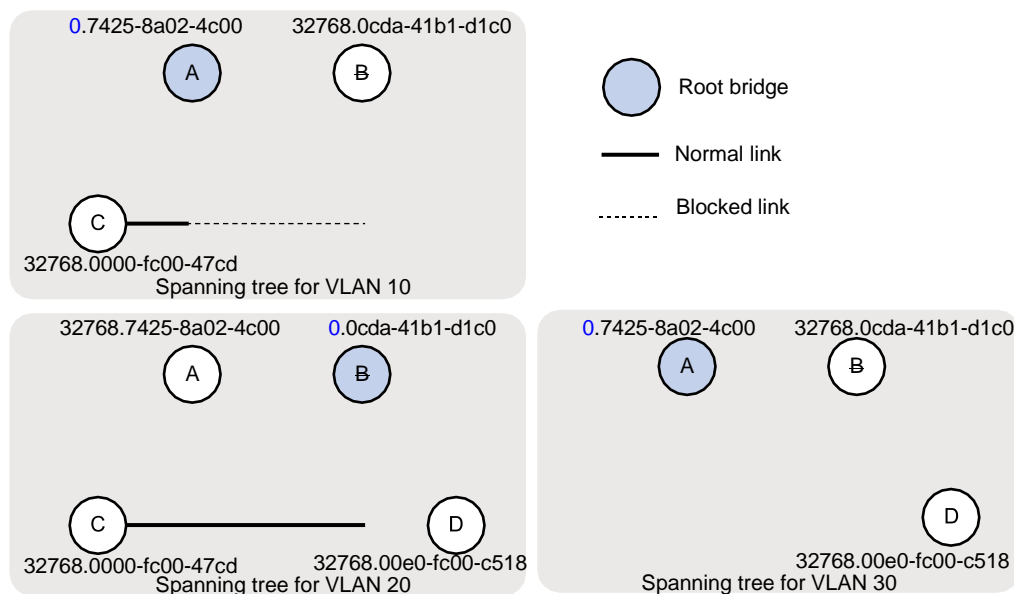


## Analysis

For traffic of different VLANs to be shared along the spanning trees in [Figure 6](#), perform the following tasks:

- Configure Device A as the root bridge of the spanning trees for VLAN 10 and VLAN30.
- Configure Device B as the root bridge of the spanning tree for VLAN 20.

**Figure 6 VLAN spanning tree topologies**



## Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

## Procedures

### Configuring Device A

# Create VLAN 10, VLAN 20, and VLAN 30.

```
<DeviceA> system-view
[DeviceA] vlan 10
[DeviceA-vlan10] vlan 20
[DeviceA-vlan20] vlan 30
[DeviceA-vlan30] quit
```

# Configure GigabitEthernet 1/0/1 to trunk VLAN 10 and VLAN 20.

```
[DeviceA] interface gigabitethernet 1/0/1
[DeviceA-GigabitEthernet1/0/1] port link-type trunk
[DeviceA-GigabitEthernet1/0/1] port trunk permit vlan 10 20
```

```
[DeviceA-GigabitEthernet1/0/1] quit
# Configure GigabitEthernet 1/0/2 to trunk VLAN 20 and VLAN 30.
[DeviceA] interface gigabitethernet 1/0/2
[DeviceA-GigabitEthernet1/0/2] port link-type trunk
[DeviceA-GigabitEthernet1/0/2] port trunk permit vlan 20 30
[DeviceA-GigabitEthernet1/0/2] quit
# Configure GigabitEthernet 1/0/3 to trunk VLAN 10, VLAN 20, and VLAN 30.
[DeviceA] interface gigabitethernet 1/0/3
[DeviceA-GigabitEthernet1/0/3] port link-type trunk
[DeviceA-GigabitEthernet1/0/3] port trunk permit vlan 10 20 30
[DeviceA-GigabitEthernet1/0/3] quit
# Set the spanning tree mode to PVST.
[DeviceA] stp mode pvst
# Configure Device A as the root bridge of VLAN 10 and VLAN 30.
```

```
[DeviceA] stp vlan 10 30 root primary
# Enable the spanning tree feature globally.
[DeviceA] stp global enable
```

## Configuring Device B

```
# Create VLAN 10, VLAN 20, and VLAN 30.
<DeviceB> system-view
[DeviceB] vlan 10
[DeviceB-vlan10] vlan 20
[DeviceB-vlan20] vlan 30
[DeviceB-vlan30] quit

# Configure GigabitEthernet 1/0/1 to trunk VLAN 20 and VLAN 30.
[DeviceB] interface gigabitethernet 1/0/1
[DeviceB-GigabitEthernet1/0/1] port link-type trunk
[DeviceB-GigabitEthernet1/0/1] port trunk permit vlan 20 30
[DeviceB-GigabitEthernet1/0/1] quit

# Configure GigabitEthernet 1/0/2 to trunk VLAN 10 and VLAN 20.
[DeviceB] interface gigabitethernet 1/0/2
[DeviceB-GigabitEthernet1/0/2] port link-type trunk
[DeviceB-GigabitEthernet1/0/2] port trunk permit vlan 10 20
[DeviceB-GigabitEthernet1/0/2] quit

# Configure GigabitEthernet 1/0/3 to trunk VLAN 10, VLAN 20, and VLAN 30.
[DeviceB] interface gigabitethernet 1/0/3
[DeviceB-GigabitEthernet1/0/3] port link-type trunk
[DeviceB-GigabitEthernet1/0/3] port trunk permit vlan 10 20 30
[DeviceB-GigabitEthernet1/0/3] quit

# Set the spanning tree mode to PVST.
[DeviceB] stp mode pvst

# Configure Device B as the root bridge of VLAN 20.
[DeviceB] stp vlan 20 root primary

# Enable the spanning tree feature globally.
[DeviceB] stp global enable
```

## Configuring Device C

```
# Create VLAN 10 and VLAN 20.
<DeviceC> system-view
[DeviceC] vlan 10
[DeviceC-vlan10] vlan 20
[DeviceC-vlan20] quit

# Configure GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2 to trunk VLAN 10 and VLAN 20.
[DeviceC] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2
[DeviceC-if-range] port link-type trunk
[DeviceC-if-range] port trunk permit vlan 10 20
[DeviceC-if-range] quit
```

```
# Set the spanning tree mode to PVST.
[DeviceC] stp mode pvst

# Enable the spanning tree feature globally.
[DeviceC] stp global enable
```

## Configuring Device D

```
# Create VLAN 20 and VLAN 30.
<DeviceD> system-view
[DeviceD] vlan 20
[DeviceD-vlan20] vlan 30
[DeviceD-vlan30] quit

# Configure GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2 to trunk VLAN 20 and VLAN 30.
[DeviceD] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2
[DeviceD-if-range] port link-type trunk
[DeviceD-if-range] port trunk permit vlan 20 30
[DeviceD-if-range] quit

# Set the spanning tree mode to PVST.
[DeviceD] stp mode pvst

# Enable the spanning tree feature globally.
[DeviceD] stp global enable
```

## Verifying the configuration

Use the **display stp brief** command to display brief spanning tree information on each device.

# Display brief spanning tree information on Device A.

```
[DeviceA] display stp brief
```

VLAN ID	Port	Role	STP State	Protection
1	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/3	ALTE	DISCARDING	NONE
10	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
10	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
20	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
20	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
20	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE
30	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
30	GigabitEthernet1/0/3	DESI	FORWARDING	NONE

# Display brief spanning tree information on Device B.

```
[DeviceB] display stp brief
```

VLAN ID	Port	Role	STP State	Protection
1	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
10	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
10	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE



20	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
20	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
20	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
30	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
30	GigabitEthernet1/0/3	ROOT	FORWARDING	NONE

# Display brief spanning tree information on Device C.

```
[DeviceC] display stp brief
```

VLAN ID	Port	Role	STP State	Protection
1	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
1	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
10	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
10	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
20	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
20	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE

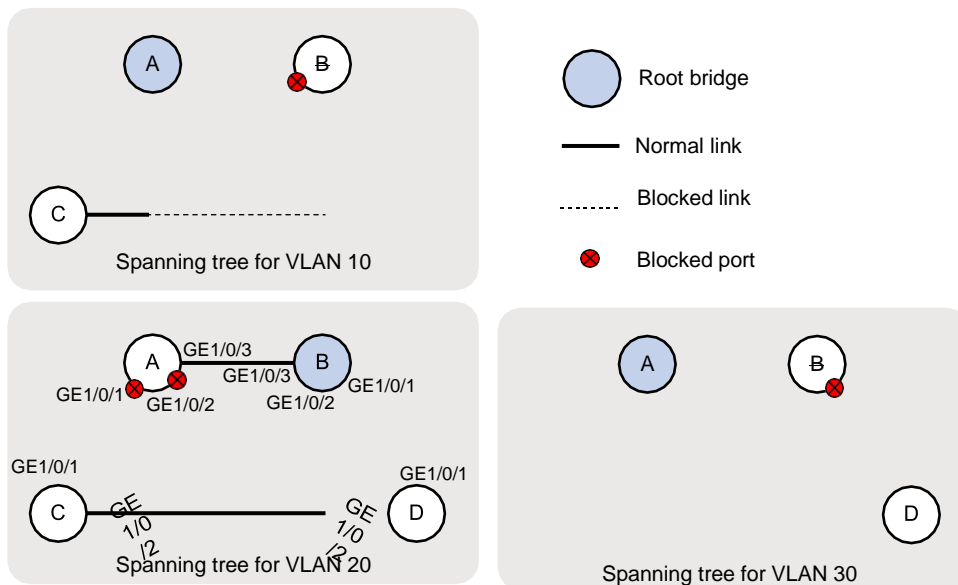
# Display brief spanning tree information on Device D.

```
[DeviceD] display stp brief
```

VLAN ID	Port	Role	STP State	Protection
1	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
1	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
20	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
20	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
30	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
30	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE

Based on the output, the topology for each VLAN is shown in [Figure 7](#).

**Figure 7 VLAN spanning tree topologies**



## Configuration files

! **IMPORTANT:**

---

Support for the `port link-mode bridge` command depends on the device model.

---

- **Device A:**

```
#
vlan 1
#
vlan 10
#
vlan 20
#
vlan 30
#
    stp vlan 10 30 root primary
    stp mode pvst
    stp global enable
#
interface GigabitEthernet1/0/1
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 10 20
#
interface GigabitEthernet1/0/2
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 20 30
#
interface GigabitEthernet1/0/3
    port link-mode bridge
    port link-type trunk
    port trunk permit vlan 1 10 20 30
#
```

- **Device B:**

```
#
vlan 1
#
vlan 10
#
vlan 20
#
vlan 30
#
    stp vlan 20 root primary
    stp mode pvst
    stp global enable
#
interface GigabitEthernet1/0/1
    port link-mode bridge
    port link-type trunk
```

```

port trunk permit vlan 1 20 30
#
interface GigabitEthernet1/0/2
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 10 20
#
interface GigabitEthernet1/0/3
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 10 20 30
#

```

- **Device C:**

```

#
vlan 1
#
vlan 10
#
vlan 20
#
stp mode pvst
stp global enable
#
interface GigabitEthernet1/0/1
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 10 20
#
interface GigabitEthernet1/0/2
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 10 20
#

```

- **Device D:**

```

#
vlan 1
#
vlan 20
#
vlan 30
#
stp mode pvst
stp global enable
#
interface GigabitEthernet1/0/1
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 20 30

```

```
#
interface GigabitEthernet1/0/2
port link-mode bridge
port link-type trunk
port trunk permit vlan 1 20 30
#
```

# Example: Configuring RSTP

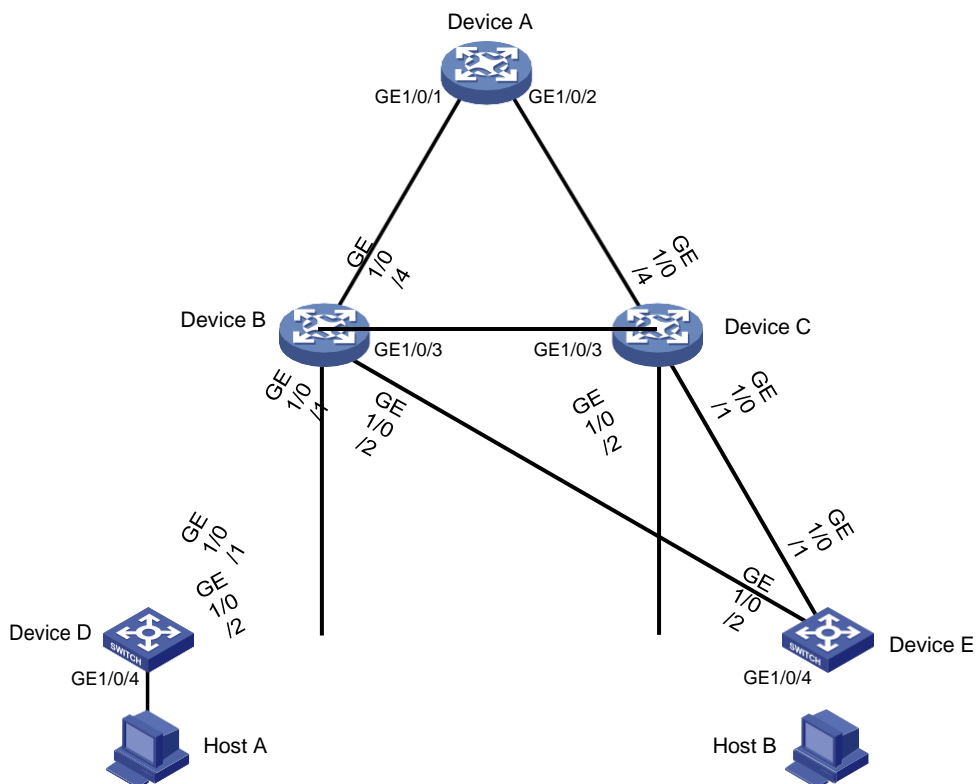
## Network configuration

As shown in [Figure 8](#), Device A operates at the core layer, Device B and Device C operate at the distribution layer, and Device D and Device E operate at the access layer. The ports on the devices have the same path cost.

Configure RSTP as follows:

- Configure Device A as the root bridge, and enable root guard to retain its root bridge role when configuration errors or malicious attacks occur.
- Configure Device C as a backup of Device B. When Device B fails, traffic is forwarded through Device C.
- Configure GigabitEthernet 1/0/4 on Device D and GigabitEthernet 1/0/4 on Device E as edge ports, and enable BPDU guard on the ports.

**Figure 8 Network diagram**



# Analysis

For Device C to be a backup of Device B, make sure Device C's priority is lower than Device B's priority. In this example, configure the priorities of Device B and Device C as 4096 and 8192.

For Device A to be the root bridge, make sure Device A has the lowest bridge ID (containing the device's priority and MAC address) in the network. In this example, because Device A already has the lowest MAC address, configure the priority as 4096 for Device A to hold the lowest bridge ID.

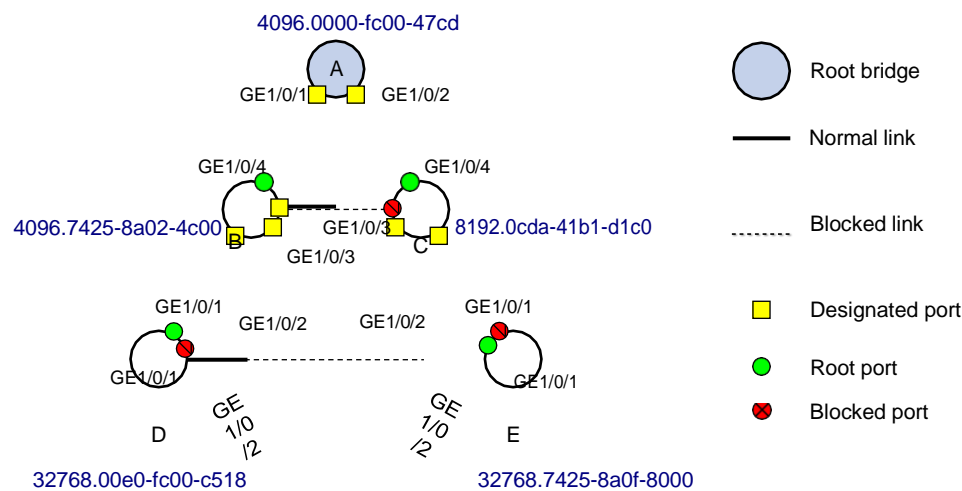
## NOTE:

To configure a device as the root bridge, you also can use the `stp root primary` or `stp priority 0` command to set the device's priority to 0.

To retain Device A's root bridge role, enable root guard on the designated ports of Device A, Device B, and Device C. To identify the designated ports, use either of the following methods:

- Use the `display stp brief` command to display the brief spanning tree information. The role is **DES** for a designated port.
- Identify the designated ports in the RSTP topology that is calculated based on the device configuration, as shown in Figure 9.

**Figure 9 RSTP topology**



# Applicable hardware and software versions

The following matrix shows the hardware and software versions to which this configuration example is applicable:

Hardware	Software version
SC 3570 switch series	Release 11xx
SC 5525 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 5520 switch series	Release 63xx, Release 65xx, Release 6615Pxx, Release 6628Pxx
SC 3170 switch series	Release 11xx
SC 3130 switch series	Release 63xx

# Procedures

## Configuring Device A

**# Set the spanning tree mode to RSTP.**

```
<DeviceA> system-view  
[DeviceA] stp mode rstp
```

**# Configure the priority as 4096 for Device A.**

```
[DeviceA] stp priority 4096
```

**# Enable the spanning tree feature globally.**

```
[DeviceA] stp global enable
```

**# Enable root guard on designated ports GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2.**

```
[DeviceA] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2  
[DeviceA-if-range] stp root-protection  
[DeviceA-if-range] quit
```

## Configuring Device B

**# Set the spanning tree mode to RSTP.**

```
<DeviceB> system-view
[DeviceB] stp mode rstp
```

**# Configure the priority as 4096 for Device B.**

```
[DeviceB] stp priority 4096
```

**# Enable the spanning tree feature globally.**

```
[DeviceB] stp global enable
```

**# Enable root guard on designated ports GigabitEthernet 1/0/1, GigabitEthernet 1/0/2, and GigabitEthernet 1/0/3.**

```
[DeviceB] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/3
[DeviceB-if-range] stp root-protection
[DeviceB-if-range] quit
```

## Configuring Device C

**# Set the spanning tree mode to RSTP.**

```
<DeviceC> system-view
[DeviceC] stp mode rstp
```

**# Configure the priority as 8192 for Device C.**

```
[DeviceC] stp priority 8192
```

**# Enable the spanning tree feature globally.**

```
[DeviceC] stp global enable
```

**# Enable root guard on designated ports GigabitEthernet 1/0/1 and GigabitEthernet 1/0/2.**

```
[DeviceC] interface range gigabitethernet 1/0/1 to gigabitethernet 1/0/2
[DeviceC-if-range] stp root-protection
[DeviceC-if-range] quit
```

## Configuring Device D

**# Set the spanning tree mode to RSTP.**

```
<DeviceD> system-view
[DeviceD] stp mode rstp
```

**# Enable the spanning tree feature globally.**

```
[DeviceD] stp global enable
```

**# Configure GigabitEthernet 1/0/4 as an edge port, and enable BPDU guard.**

```
[DeviceD] interface gigabitethernet 1/0/4
[DeviceD-GigabitEthernet1/0/4] stp edged-port
[DeviceD-GigabitEthernet1/0/4] quit
[DeviceD] stp bpdu-protection
```

## Configuring Device E

**# Configure Device E in the same way you configure Device D. (Details not shown.)**

# Verifying the configuration

1. Verify that Layer 2 loops have been eliminated in the network:

Use the **display stp brief** command to display brief spanning tree information on each device.

# Display the brief spanning tree information on Device A.

```
[DeviceA] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/2	DESI	FORWARDING	NONE

# Display the brief spanning tree information on Device B.

```
[DeviceB] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/3	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/4	ROOT	FORWARDING	NONE

# Display the brief spanning tree information on Device C.

```
[DeviceC] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/2	DESI	FORWARDING	NONE
0	GigabitEthernet1/0/3	ALTE	DISCARDING	NONE
0	GigabitEthernet1/0/4	ROOT	FORWARDING	NONE

# Display the brief spanning tree information on Device D.

```
[DeviceD] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	ROOT	FORWARDING	NONE
0	GigabitEthernet1/0/2	ALTE	DISCARDING	NONE
0	GigabitEthernet1/0/4	DESI	FORWARDING	BPDU

# Display the brief spanning tree information on Device E.

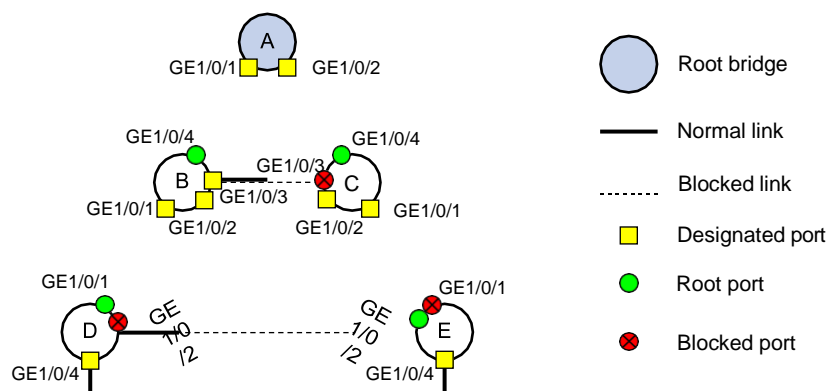
```
[DeviceE] display stp brief
```

MST ID	Port	Role	STP State	Protection
0	GigabitEthernet1/0/1	ALTE	DISCARDING	NONE
0	GigabitEthernet1/0/2	ROOT	FORWARDING	NONE
0	GigabitEthernet1/0/4	DESI	FORWARDING	BPDU

Based on the output, the topology for the network is shown in [Figure 10](#).



**Figure 10 Network topology**



**2. Verify that root guard can retain Device A's root bridge role:**

# Verify that Device A is the root bridge in the network.

```
[DeviceD] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID           : 32768.00e0-fc00-c518
Bridge times        : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC        : 4096.0000-fc00-47cd, 40
RegRoot ID/IRPC     : 32768.00e0-fc00-c518, 0
...
```

# Set the priority to 0 for Device D. Because the priority is higher than the priority of Device A, Device D considers itself as the root bridge and sends BPDUs that contain its bridge ID 0.00e0-fc00-c518.

```
[DeviceD] stp priority 0
[DeviceD] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID           : 0.00e0-fc00-c518
Bridge times        : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC        : 0.00e0-fc00-c518, 0
RegRoot ID/IRPC     : 0.00e0-fc00-c518, 0
...
```

# Set the priority to 0 for Device E. Because the priority is higher than the priority of Device A, Device E considers itself as the root bridge and sends BPDUs that contain its bridge ID 0.7425-8a0f-8000.

```
[DeviceE] stp priority 0
[DeviceE] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID           : 0.7425-8a0f-8000
Bridge times        : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC        : 0.7425-8a0f-8000, 0
RegRoot ID/IRPC     : 0.7425-8a0f-8000, 0
...
```

# Verify that Device A is still the root bridge in the network. The ports connected Device B and Device C to Device D and Device E transit to the discarding state.

```
[DeviceB] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID           : 4096.7425-8a02-4c00
```

```

Bridge times      : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC     : 4096.0000-fc00-47cd, 20
RegRoot ID/IRPC  : 4096.7425-8a02-4c00, 0
...
[DeviceC] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID        : 8192.0cda-41b1-d1c0
Bridge times     : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC     : 4096.0000-fc00-47cd, 20
RegRoot ID/IRPC  : 8192.0cda-41b1-d1c0, 0
...
[DeviceB] display stp brief
MST ID  Port                                Role  STP State  Protection
0       Ten-GigabitEthernet1/0/1          DESI  DISCARDING  NONE
0       Ten-GigabitEthernet1/0/2          DESI  DISCARDING  NONE
0       Ten-GigabitEthernet1/0/3          DESI  FORWARDING  NONE
0       Ten-GigabitEthernet1/0/4          ROOT  FORWARDING  NONE
[DeviceC] display stp brief
MST ID  Port                                Role  STP State  Protection
0       Ten-GigabitEthernet1/0/1          DESI  DISCARDING  NONE
0       Ten-GigabitEthernet1/0/2          DESI  DISCARDING  NONE
0       Ten-GigabitEthernet1/0/3          ALTE  DISCARDING  NONE
0       Ten-GigabitEthernet1/0/4          ROOT  FORWARDING  NONE

```

**# Verify that Device A cannot retain its root bridge role when root guard is disabled on a designated port on Device B (for example, GigabitEthernet 1/0/2).**

```

[DeviceB] interface gigabitethernet 1/0/2
[DeviceB-GigabitEthernet1/0/2] undo stp root-protection
[DeviceB-GigabitEthernet1/0/2] display stp
-----[CIST Global Info] [Mode RSTP] -----
Bridge ID        : 4096.7425-8a02-4c00
Bridge times     : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20
Root ID/ERPC     : 0.7425-8a0f-8000, 20
...
[DeviceB-GigabitEthernet1/0/2] display stp brief
MST ID  Port                                Role  STP State  Protection
0       GigabitEthernet1/0/1              DESI  DISCARDING  ROOT
0       GigabitEthernet1/0/2              ROOT  FORWARDING  NONE
0       GigabitEthernet1/0/3              DESI  FORWARDING  NONE
0       GigabitEthernet1/0/4              DESI  FORWARDING  NONE

```

### 3. Verify that traffic is forwarded through Device C when Device B fails:

**# Reboot Device B. (Details not shown.)**

**# Display the brief spanning tree information on Device A, Device C, Device D, and Device E before Device B completes the reboot.**

```

[DeviceA] dis stp brief
MST ID  Port                                Role  STP State  Protection
0       GigabitEthernet1/0/2              DESI  FORWARDING  ROOT
[DeviceC] dis stp brief
MST ID  Port                                Role  STP State  Protection

```

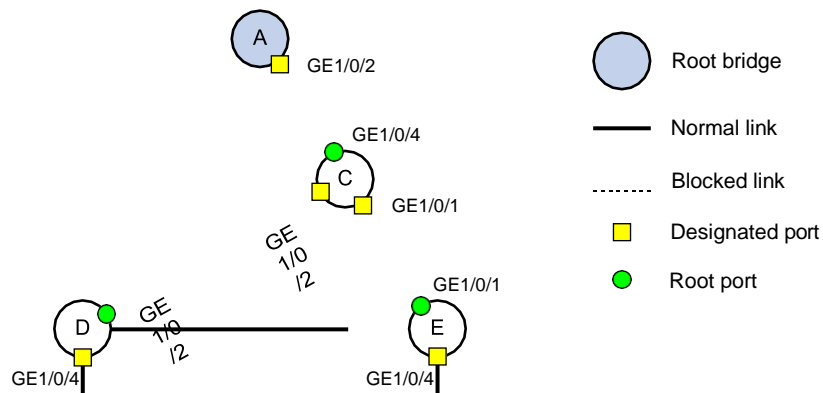
```

0      GigabitEthernet1/0/1      DESI  FORWARDING  ROOT
0      GigabitEthernet1/0/2      DESI  FORWARDING  ROOT
0      GigabitEthernet1/0/4      ROOT   FORWARDING  NONE
[DeviceD] dis stp brief
MST ID  Port                      Role  STP State  Protection
0       GigabitEthernet1/0/2      ROOT  FORWARDING  NONE
0       GigabitEthernet1/0/4      DESI  FORWARDING  BPDU
[DeviceE] dis stp brief
MST ID  Port                      Role  STP State  Protection
0       GigabitEthernet1/0/1      ROOT  FORWARDING  NONE
0       GigabitEthernet1/0/4      DESI  FORWARDING  BPDU

```

Based on the network topology, the topology for the network is shown in Figure 11.

**Figure 11 Network topology**



#### 4. Verify that BPDU guard can protect edge ports from attacks:

# Verify that the edge port GigabitEthernet 1/0/4 on Device D goes down when the port receives configuration BPDUs.

```

[DeviceD] display stp down-port
Down Port                      Reason
GigabitEthernet1/0/4          BPDU-Protected

```

# Verify that GigabitEthernet 1/0/4 goes up when it does not receive any configuration BPDUs from the peer end.

```

[DeviceD] display interface brief | include UP
InLoop0      UP    UP(s)    --
M-E0/0/0     UP    UP       192.168.2.125
NULL0        UP    UP(s)    --
GE1/0/1      UP    1G(a)    F(a)    T    1
GE1/0/2      UP    1G(a)    F(a)    T    1
GE1/0/4      UP    1G(a)    F(a)    A    1

```

## Configuration files

### ! IMPORTANT:

Support for the `port link-mode bridge` command depends on the device model.

- Device A:

```
#
```

```

vlan 1
#
  stp instance 0 priority 4096
  stp mode rstp
  stp global enable
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  stp root-protection
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  stp root-protection
#

```

- **Device B:**

```

#
vlan 1
#
  stp instance 0 priority 4096
  stp mode rstp
  stp global enable
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  stp root-protection
#
interface GigabitEthernet1/0/2
  port link-mode bridge
  stp root-protection
#
interface GigabitEthernet1/0/3
  port link-mode bridge
  stp root-protection
#

```

- **Device C:**

```

#
vlan 1
#
  stp instance 0 priority 8192
  stp mode rstp
  stp global enable
#
interface GigabitEthernet1/0/1
  port link-mode bridge
  stp root-protection
#
interface GigabitEthernet1/0/2
  port link-mode bridge

```

- ```
    stp root-protection
#
```
- **Device D:**

```
#
vlan 1
#
    stp mode rstp
    stp bpdu-protection
    stp global enable
#
interface GigabitEthernet1/0/4
    port link-mode bridge
    stp edged-port
#
```
  - **Device E:**

```
#
vlan 1
#
    stp mode rstp
    stp bpdu-protection
    stp global enable
#
interface GigabitEthernet1/0/4
    port link-mode bridge
    stp edged-port
#
```