MSTP

Configuration

Contents

1. Configuring MSTP

1.1 Brief Introduction to MSTP

The Spanning Tree Protocol (STP) was established based on the 802.1d standard of IEEE to eliminate physical loops at the data link layer in a local area network (LAN). Devices running this protocol detect loops in the network by exchanging information with one another and eliminate loops by selectively blocking certain ports until the loop structure is pruned into a loop-free network structure. This avoids proliferation and infinite recycling of packets that would occur in a loop network and prevents deterioration of the packet processing capability of network devices caused by duplicate packets received.

The multiple spanning tree protocol (MSTP) overcomes the shortcomings of STP and RSTP. In addition to support for rapid network convergence, it also allows data flows of different VLANs to be forwarded along their own paths, thus providing a better load sharing mechanism for redundant links. For description about VLANs, refer to VLAN.

1.2 BPDU

MSTP uses BPDU algorithm the same as STP, RSTP. Meanwhile, BPDU in MSTP also exist MSTP configuration information in the switch.
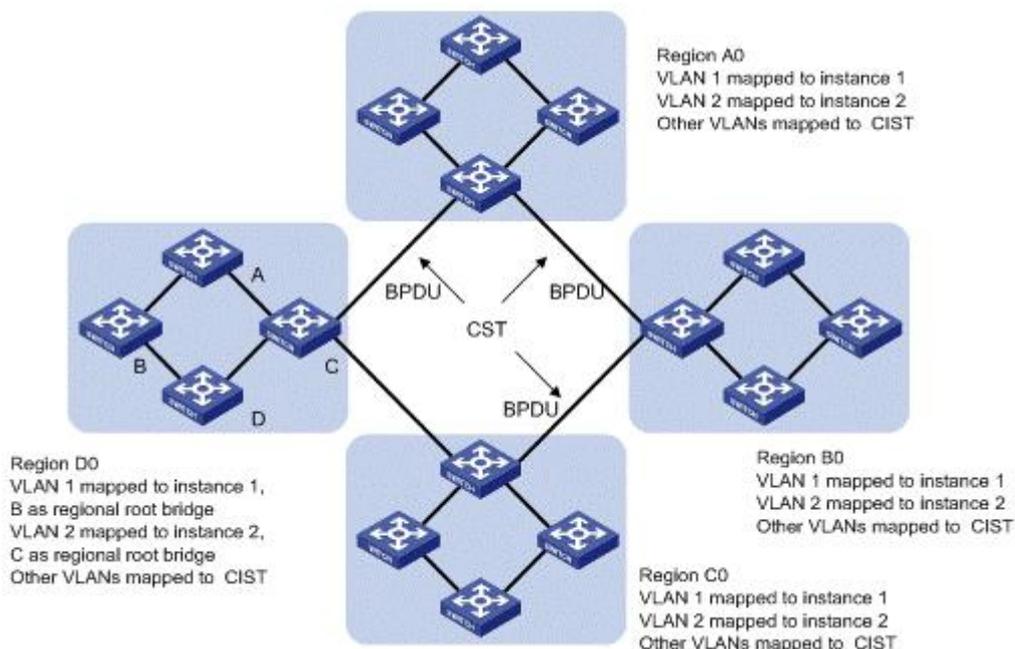
1.2.1 Basic Concepts in MSTP

Figure 1-1 MSTP topology example

As shown in the MSTP network, MSTP is composed of three spanning tree areas and a running 802.1D STP protocol switch.

1. MST region

A multiple spanning tree region (MST region) is composed of multiple devices in a switched network and network segments among them. These devices have the following characteristics:

All are MSTP-enabled,

They have the same region name,

They have the same VLAN-to-instance mapping configuration,

They have the same MSTP revision level configuration, and

They are physically linked with one another.

Multiple MST regions can exist in a switched network. You can use an MSTP command to group multiple devices to the same MST region.

2. CIST

Jointly constituted by ISTs and the CST, the CIST is a single spanning tree that connects all devices in a switched network.

In Figure 1-1, for example, the ISTs in all MST regions plus the inter-region CST constitute the CIST of the entire network.

3. CST

The CST is a single spanning tree that connects all MST regions in a switched network. If you regard each MST region as a "device", the CST is a spanning tree calculated by these devices through STP or RSTP. For example, the red lines in Figure 1-1 describe the CST.

4. IST

Internal spanning tree (IST) is a spanning tree that runs in an MST region.

ISTs in all MST regions and the common spanning tree (CST) jointly constitute the common and internal spanning tree (CIST) of the entire network. An IST is a section of the CIST in the given MST region.

In Figure 1-1, for example, the CIST has a section in each MST region, and this section is the IST in the respective MST region.

5. MSTI

Multiple spanning trees can be generated in an MST region through MSTP, one spanning tree being independent of another. Each spanning tree is referred to as a multiple spanning tree instance (MSTI). In Figure 1-1, for example, multiple spanning tree can exist in each MST region, each spanning tree corresponding to a VLAN. These spanning trees are called MSTIs.

6. CIST root bridge

CIST root, The root bridge of the IST or an MSTI within an MST region is the regional root bridge of the MST or that MSTI. Based on the topology, different spanning trees in an MST region may have different regional roots.

7.   CIST External root path cost

External root path cost refers to the cost of the shortest path for a packet to travel to the common root bridge.

8.   CIST Internal root path cost

CIST Internal root path cost refers to the cost of the shortest path for a packet to travel to the CIST regional root bridge.

9.   CIST designated bridge

CIST designated bridge is the STP appointed bridge

10.   MSTI regional root,

The root bridge of the IST or an MSTI within an MST region is the regional root bridge of the IST or the MSTI. Based on the topology, different spanning trees in an MST region may have different regional roots.

11.   MSTI internal root path cost

MSTI Internal root path cost refers to the cost of the shortest path for a packet to travel to the MSTI regional root bridge.

12.   MSTI Designated bridge

MSTI designated bridge is the STP appointed bridge.

1.2.2 Roles of Ports

In the MSTP calculation process, port roles include root port, designated port, master port, alternate port, backup port, and so on.

1.   Root port: a port responsible for forwarding data to the root bridge.
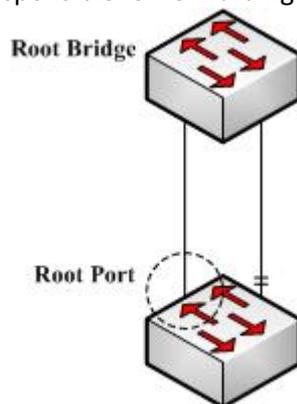
Figure 1-2 Root port

2.   Designated port: a port responsible for forwarding data to the downstream network segment or device.
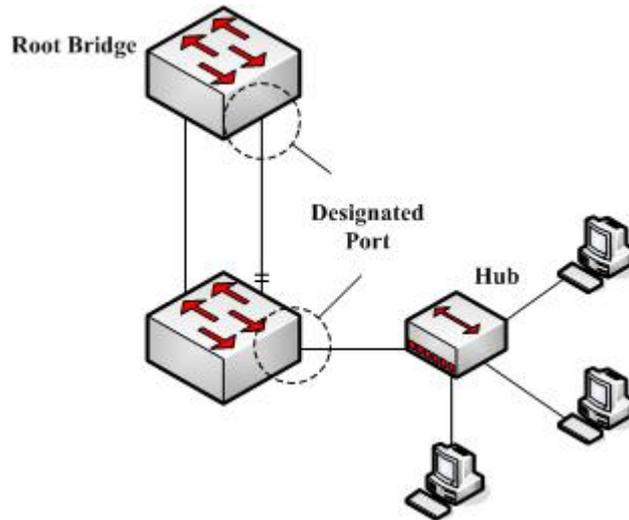
Figure 1- 3 Designated port

3.   Alternate port: The standby port for the root port or master port. When the root port or master port is blocked, the alternate port becomes the new root port or master port.
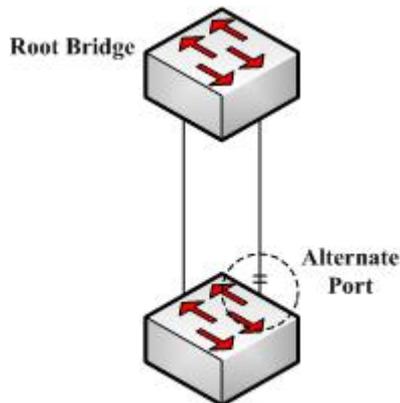
Figure 1-4 Alternate port

4.   Backup port: The backup port of designated ports. When a designated port is blocked, the backup port becomes a new designated port and starts forwarding data without delay. When a loop occurs while two ports of the same MSTP device are interconnected, the device will block either of the two ports, and the backup port is that port to be blocked.
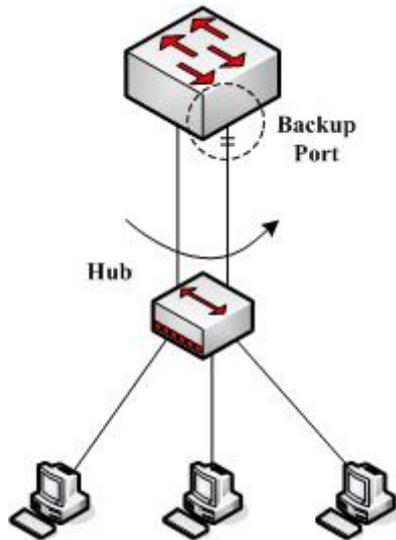
Figure 1-5 Backup port

5.   A master port connects an MST region to the common root. The path from the master port to the common root is the shortest path between the MST region and the common root. In the CST, the master port is the root port of the region, which is considered as a node. The master port is a special boundary port. It is a root port in the IST/CIST while a master port in the other MSTIs
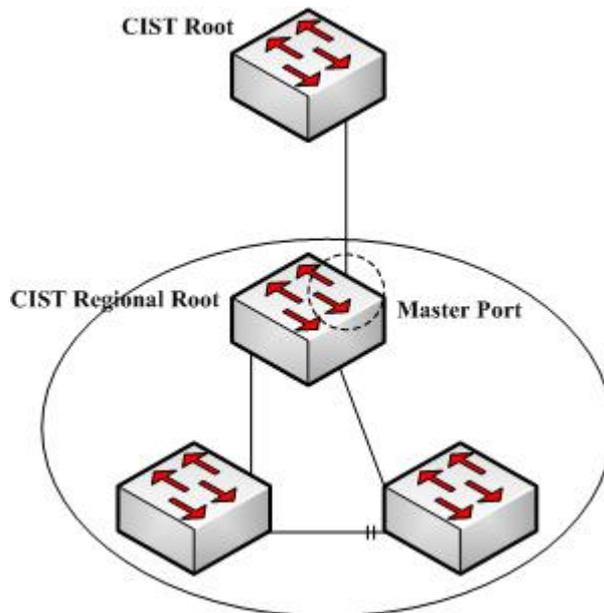
Figure 1-6 master port

6.   Boundary Port

A boundary port is a port that connects an MST region to another MST configuration, or to a single spanning-tree region running STP, or to a single spanning-tree region running RSTP.

During MSTP calculation, a boundary port assumes the same role on the CIST and on MST instances. Namely, if a boundary port is the master port on the CIST, it is also the master port on all MST instances within this region.

7. Edge Port

In RSTP and MSTP protocols, edge port means that connect to host port in the network, these ports can be in a forwarding status and not be a loopback without waiting.
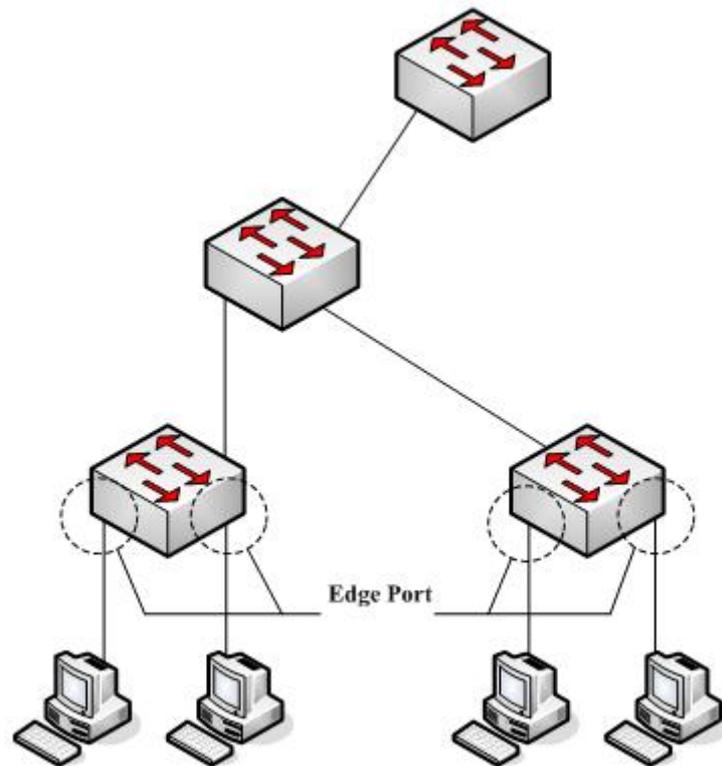
Figure 1-7 Edge Port

1.3 Algorithm Implementation

1.3.1 MSTP Protocol

MST BPDU packet format as below:

■It is the similar of Green region and red region of the message format and SST;

■Version 3 Length indicates the length of the blue area;

■Version 3 Length indicates the length of the blue area;

■RSTP is defined with the Flags field is similar to but MSTI Flags of the highest bit is the main port identification, while the highest is the CIST Flags TCA logo.

	Octet
Protocol Identifier	1–2
Protocol Version Identifier	3
BPDU Type	4
CIST Flags	5
CIST Root Identifier	6–13
CIST External Path Cost	14–17
CIST Regional Root Identifier	18–25
CIST Port Identifier	26–27
Message Age	28–29
Max Age	30–31
Hello Time	32–33
Forward Delay	34–35
Version 1 Length = 0	36
Version 3 Length	37–38
MST Configuration Identifier	39–89
CIST Internal Root Path Cost	90–93
CIST Bridge Identifier	94–101
CIST Remaining Hops	102
MSTI Configuration Messages (may be absent)	103–39 + Version 3 Length

|	Octet
MSTI Flags	1
MSTI Regional Root Identifier	2–9
MSTI Internal Root Path Cost	10–13
MSTI Bridge Priority	14
MSTI Port Priority	15
MSTI Remaining Hops	16

Flags: | TCA/Master | Agreement | Forwarding | Learning | Port Role | Proposal | TC |

Figure 1-8 MSTP PDU protocol packet

Protocol Identifier: is 0x0000, identifies the Spanning Tree Protocol (2 bytes).

Protocol Version Identifier: as the 0x03, identifies the protocol version (1 byte).

BPDU Type: for the 0x02, that RST BPDU (1 byte).

● CIST Flags: identify the CIST topology change confirmation, consent, forwarding, learning, port role, suggested that the topology change state (1 byte).

● CIST Root Identifier: CIST root bridge's unique identifier, by the CIST root bridge of the CIST root bridge priority and MAC address (eight bytes).

● CIST External Root Path Cost: CIST external root path cost, when only cross-domain change in the propagation constant region (4 bytes).

● CIST Regional Root Identifier: CIST regional root bridge's unique identifier, the CIST regional root bridge priority and the CIST regional root bridge MAC address, when only cross-domain change in the spread within a fixed time (8 bytes).

● CIST Port Identifier: MST BPDU packets to send the port identified by the port priority and port ID component (2 bytes).

● Message Age: CIST root bridge is from this MST BPDU packets generated since the time when the only cross-domain change in the propagation constant region (2 bytes).

● Max Age: MST BPDU message valid time, this parameter is set by the CIST root bridge (2 bytes).

● Hello Time: CIST root bridge generates MST BPDU packet interval, this parameter is set by the CIST root bridge (2 bytes).

● Forward Delay: forwarding delay, this parameter is set by the CIST root bridge (2 bytes).Its role is twofold:

To be as a port state transition (from Discarding to Learning, from Learning to Forwarding) protocol timer time; in the network topology changes, be as the dynamic filtering database entry aging time.

● Version 1 Length: additional information, is fixed at 0 (1 byte).

● Version 3 Length: instructions from the MST BPDU configuration identification to the end of length of the packet (2 bytes);

● MST Configuration Identifier: MST configuration identification, configuration selected by the device, the configuration name, revision level and configuration summary form only when the cross-domain changes in the propagation constant region (51 bytes).

● CIST Internal Root Path Cost: CIST internal root path cost, effective only in the Ministry of MST region (4 bytes).

● CIST Bridge Identifier: sending MST BPDU packet bridge identified by the bridge priority and MAC address of the bridge (8 bytes).

● CIST Remaining Hops: MST BPDU packets remaining in the CIST in the number of hops (1 byte).

● MSTI Flags: identification of MSTI's main port, agreed to, forward, learning, port role, suggested that the topology change state (1 byte).

● MSTI Regional Root Identifier: MSTI regional root bridge's unique identifier, the MSTI regional root bridge priority, MSTID and MSTI regional root bridge MAC address, its domain for different MSTI root bridge may be different (8 bytes).

● MSTI Internal Root Path Cost: MSTI internal root path cost, effective only in the Ministry of MST region (4 bytes).

● MSTI Bridge Priority: MSTI bridge priority, and the CIST Bridge Identifier of the MAC address of the MSTI configuration information with the composition of the sending bridge (1 byte).

● MSTI Port Priority: MSTI port priority, and the CIST Port Identifier of the port ID with the composition of MSTI send port configuration information (1 byte).

● MSTI Remaining Hops: MST BPDU packets remaining in the MSTI in hops (1 byte).

1.3.2 Determining CIST Priority Vectors

The MSTP role of each bridge is calculated based on the information carried in BPDUs. The most important information carried in BPDUs is the spanning tree priority vector. The following part introduces how to calculate the CIST priority vectors and MSTI priority vectors.

The CIST priority vector consists of common root bridge, external root path cost, regional root, internal root path cost, designated bridge ID, designated port ID, and the BPDU-receiving port ID.

Detailed as below:

1. CIST root id

2. CIST external root path cost

3. CIST regional root id

4. CIST internal root path cost

5. CIST designated bridge id

6. CIST designated port id

7. CIST receiving port id

These parameters exist prior, the superior the more precedence.

1.3.3 Determining the MSTI priority vectors

The MSTI priority vector consists of common root bridge, external root path cost, regional root, internal root path cost, designated bridge ID, designated port ID, and the BPDU-receiving port ID.

Detailed as below:

1. MSTI regional root id

2. MSTI internal root path cost

3. MSTI designated bridge

4. MSTI designated port

5. MSTI receiving port

These parameters exist prior, the superior the more precedence.

1.3.4 Determining MSTP

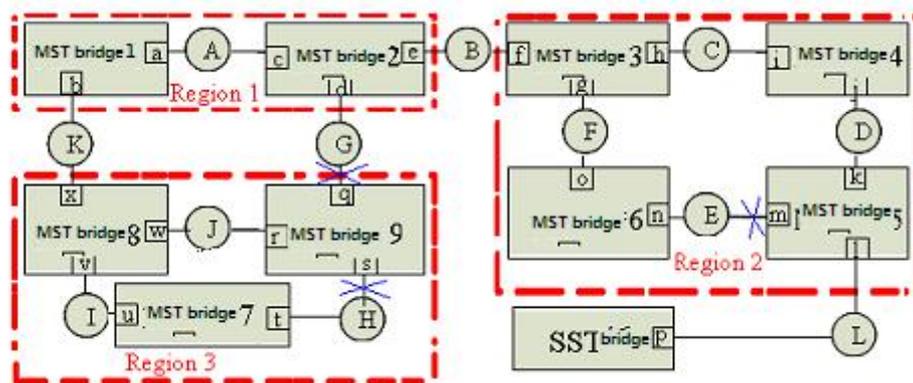Determining MSTP divide into two parts, first starts CIST priority vectors, then MSTI priority vectors.

Figure 1-9

As figure1-9,suppose all the cost of the ports in the whole bridge is equal, "MST brige-1"—"MST brige-9"the identify increase by step, "SST bridge" is the most one.

1.3.4.1 Determining CIST Priority Vectors

1. The election of CIST root bridge, CIST root port

Throughout the bridged LAN, MST bridge 1 bridge priority of the highest identity, was selected as the CIST root bridge. Assuming Region 2, Region 3 to the CIST root bridge of the external root path cost is 1. Therefore, the bridge 8 MST CIST bridge priority vector update (MST bridge 1,1, MST Bridge 8,0, MST Bridge 8), MST bridge 8 port x is the CIST root port; MST CIST bridge priority bridge 9 level vector update (MST bridge 1,1, MST Bridge 9,0, MST Bridge 9). Similarly, MST bridge port 3 f is the CIST root port.

2. The election of each domain CIST regional root bridge (IST root bridge), CIST root port CIST

CIST root bridge was elected, they begin to select the various regions of the CIST regional root bridge. To Region 3 as an example:

MST Bridge 7 Port u receive MST CIST bridge 8 priority vector (MST Bridge 1,1, MST Bridge 8,0, MST bridge 8, v), with its own port u (MST Bridge 7,0, MST Bridge 7 , 0, MST bridge 7, u) compared to that of MST Bridge 8 better, so the information is updated to the port u (MST bridge 1,1, MST Bridge 8,0, MST bridge 8, v); Similarly, t update the port information (MST bridge 1,1, MST Bridge 9,0, MST Bridge 9, s), then the port 7 MST bridge then u and t CIST priority vector, we found that the port u better information , so the election for the Region 3 8 MST bridge the CIST regional root bridge, MST bridge 7, u is the CIST root port the port. Assuming MST Bridge 7 CIST internal root path cost is 1, then the information will update t port (MST bridge 1,1, MST Bridge 8,1, MST bridge 7, t).

Bridge 8 port w MST received the CIST bridge priority vector 9 (MST Bridge 1,1, MST Bridge 9,0, MST Bridge 9, r), with its own port w (MST Bridge 1,1, MST Bridge 8 , 0, MST bridge 8, w) compared to find themselves better, do not update the port information of w; Similarly, port v of the information received MST bridge over the CIST priority vector 7 (MST Bridge 7,0, MST Bridge 7,0, MST bridge 7, u) better, do not update the port v information. Then MST bridge 8 port w and v for CIST priority vector comparison, the election for the Region 3 MST bridge 8 the CIST regional root bridge.

MST Bridge Port 9 r received MST CIST bridge 8 priority vector (MST Bridge 1,1, MST Bridge 8,0, MST bridge 8, w), r with the port itself (MST Bridge 1,1, MST Bridge 9 , 0, MST Bridge 9, r) compared to that of MST Bridge 8 better, it will update the port information of r (MST bridge 1,1, MST Bridge 8,0, MST bridge 8, w); port s information than the MST received the CIST bridge priority vector 7 (MST Bridge 7,0, MST Bridge 7,0, MST bridge 7, u) better, do not update the port s of information. Then MST Bridge 9 r and s, with CIST port priority vector comparison, the election for the Region 3 MST bridge 8 the CIST regional root bridge, MST Bridge 9 port r is the CIST root port. Assuming MST Bridge 9 CIST internal root path cost is 1, then the information will be updated to the port s (MST bridge 1,1, MST Bridge 8,1, MST Bridge 9, s).

Similarly, MST bridge 3 was selected as the CIST regional root Region 2 bridge, MST bridge 4 port i is the CIST root port, MST Bridge 5 port k is the CIST root port, MST Bridge 6 o is the CIST root port the port. As the MST CIST root bridge 1 bridge, so bridge a MST Region 1 is the CIST regional root bridge, MST bridge port 2 c is the CIST root port.

3. All elections within the specified bridge IST, CIST specified port

CIST regional root bridge elected after the Region 3, for example: MST CIST regional root bridge 8 for the bridge, the port w and v are specified port port is the LAN I, J of the designated bridge.

MST Bridge 9 s in the port receiving the message priority vector (MST Bridge 1,1, MST Bridge 8,1, MST bridge 7, t) 9 own bridge than the MST port priority vector (MST Bridge 1,1, MST Bridge 8,1, MST Bridge 9, s) excellent, that is to receive the CIST root bridge, CIST external root path cost, CIST regional root bridge and the CIST internal root path costs are equal, but CIST logo smaller than their designated bridge, so choose MST bridges to LAN 7 H, CIST designated bridge, MST bridge 7 of the CIST port t becomes the designated port, MST Bridge 9 port s port on the replacement, is set to the Discarding state. Similarly, MST Bridge 2 port d to specify the port, MST Bridge 2 is the designated bridge of G LAN, MST Bridge Port 9 q is replaced by the port, is set to the Discarding state.

Similarly, in Region 2 in, MST bridge 4 port j for the CIST port specified, MST bridge 4 on the designated bridge for LAN D; MST Bridge 6, n is the CIST port specify a port, MST bridge on the LAN E, 6 designated bridge. In Region 1 in, MST CIST regional root bridge 1 bridge, so the port a and port b is the designated port is the LAN A designated bridge; MST Bridge 2 port e to the specified port, MST bridge B is designated for the LAN 2 bridge.

1.3.4.4 Determining MSTI Priority Vectors

MSTI elections and the electoral process similar to the single spanning tree, MSTI priority vector is used to compare the election.
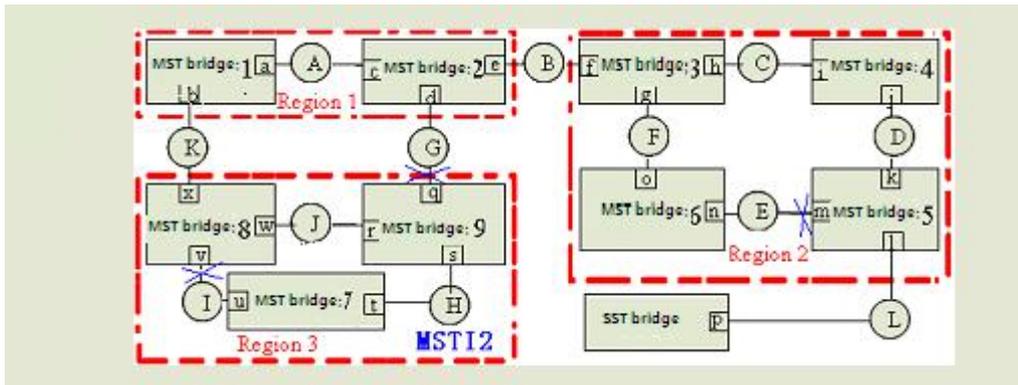
Figure 1-10

To Region 3 as an example MSTI1 formation, as shown in Figure 10:

Assuming the bridge priority: MST bridge 9< MST bridge 8< MST bridge 7, The path cost of all ports is 1.

1.   MSTP domain root bridge election
MST Bridge 7 Bridge highest priority, was selected MSTI regional root bridge.
2.   Election of the non-root bridge MSTI root port
MST Bridge 8: Select the port v is the MSTI root port, MSTI internal root path cost is 1.
MST Bridge 9: Select the port s is the MSTI root port, MSTI internal root path cost is 1.
3.   Election of the designated bridge of the MSTI port
MST Bridge 7: H was selected as the designated regional networks and bridges, ports, u and t as specified MSTI port.

MST Bridge 8: J was selected as the designated bridge the LAN port w is specified MSTI port; port x is Region 3 and the upstream communications port, and is designated as the main port MSTI1 of MSTI.

MST Bridge 9: port s, r is replaced by MSTI port; port q is replaced Region 3 of the CIST port while designated as MSTI1 replace the MSTI port.

LAN J Select MSTI port designated bridge and designated MSTI process: MST Bridge 9 r in the port receiving the message priority vector (MST Bridge 7,1, MST bridge 8, w) 9 own bridge than the MST port priority vector (MST Bridge 7,1, MST Bridge 9, r) excellent, that is to receive the MSTI regional root bridge and MSTI internal root path costs are equal, but MSTI logo smaller than their designated bridge, so choose the LAN MST Bridge J, MSTI 8 designated bridge, LAN port w J, MSTI has become the designated port, the port was set to r Discarding state.
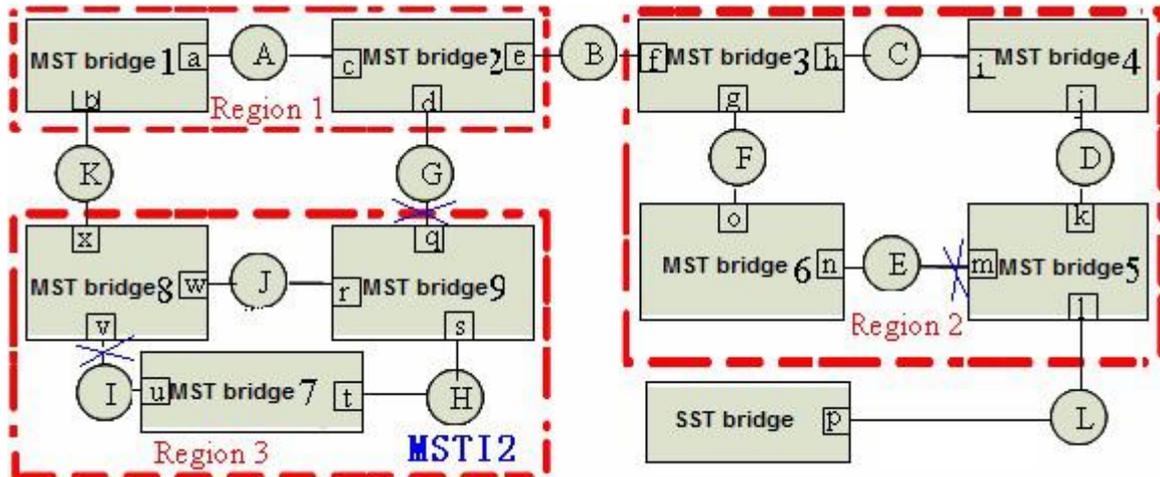
Figure 1-11

To Region 3 as an example MSTI2 formation, as shown in Figure 11:

Assuming the bridge priority: MST bridge 8 < MST bridge 7< MST bridge 9, The path cost of all ports is 1.

1. MST Bridge 9 Bridge highest priority, was selected MSTI regional root bridge.
2. MST bridge 7 and 8 of the MSTI internal root path cost is 1, port t and w are MSTI root port.
3. MST was selected as the LAN Bridge 9 J and H, designated bridges, ports r and s is the specified MSTI port; MST Bridge 7 was selected as the designated bridge LAN I, u is the MSTI port specified port; MST Bridge Port v 8 was selected as the MSTI port w replace port
4. Port x is Region 3 and the upstream communications port, and is designated as the primary port MSTI2 the MSTI; port q is replaced Region 3 of the CIST port while designated as MSTI2 replace the MSTI port.

It can be seen from: MSTI in a Region border port in the CIST role is limited, role for the CIST port if the CIST root port (IST root bridge root port), it is the main port of all MSTI; if the CIST Port Role replace the main port of the CIST port, it is the replacement of all MSTI port. The same port for different MSTI, the port state may be different (such as port v in MSTI1 for forwarding state, and in MSTI2 for discarding state).

In addition, the bridge priority and port priority and port path cost settings for different MSTI unrelated (such as MSTI1 and MSTI2 can configure their parameter values, respectively).

1.3.5 Active Topology

According running MSTP switch receives a BPDU perform calculations and comparison, and ultimately allows the network to reach steady state as follows:

(1) CIST Root :A switch was selected as the CIST root the entire network;

(2) Each switch will determine the LAN segment and to the CIST root of the path with minimum cost, to ensure the integrity of the connection and prevent loops;

(3) Within each region will elect a switch as the CIST regional root (CIST Regional Root), the CIST root switch has reached the minimum cost path;

(4)   Each MSTI will be an independent choice of a switch as the MSTI regional root;

(5)   Each switch within the region and will determine the LAN segment where the MSTI root to reach the path of least cost;

(6)   CIST Root Port provided through the CIST regional root (if not the CIST regional root switch) to reach the CIST root (if not the CIST root switch) with minimum cost path;

(7)   Alternate and Backup ports in the switch, port or LAN connection fails or is removed to provide;

(8) MSTI root port (Root Port) providing reach the MSTI regional root of the minimum cost path (if the switch is not MSTI regional root bridge);

(9)   A main port (Master Port) to provide regional and regional CIST root bridge outside the connections. Within the region, CIST regional root bridge of the CIST root port as the area of all MSTI master ports.

1.3.6 A Topology Change

MSTP and RSTP topology change in a similar spread.

In MSTP, only one is considered a topology change occurs, that is, when a port changes from an inactive port to port activities that occur when the topology changes, the role of the port is replaced by the port or backup port to switch to the root port , specify the port or the main port.

In addition, MSTP and RSTP is also supported as a "proposal / consent" mechanism and point to point link type, used to quickly convert the port state to Forwarding state.

1.3.7 MST and SST Compatibility

MSTP protocol and the MSTP-enabled switch does not support the MSTP switch is divided into different regions, respectively, called the MST region and SST fields, the Ministry of the MST region to run multiple instances of spanning tree, the edge in an MST region to run RSTP compatible protocol.
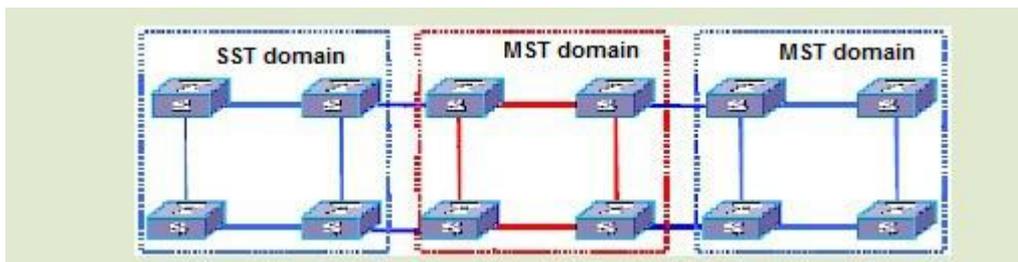
Diagram below shows MSTP works:

Figure 1-12

The middle of the red MST region use MSTP BPDU exchange between the switch topology information, the blue region of the switch use the SST STP / RSTP BPDU exchange topology information.

MST region and SST fields between the edge of the port on the MSTP processing is slightly more complicated:

When the edge of the other switch port receives STP BPDU sent by the time the port will enter the STP-compliant state, sending STP BPDU;

When the edge of the port when the received RSTP BPDU, the port will enter the RSTP-compatible state, but still send MSTP BPDU. Because RSTP to consider when designing the expansion, so the equipment side of the RSTP MSTP packets can be understood as the right RSTP packets.

1.4 Configuring MSTP

1.4.1 Configuring MSTP Task

Table1-1 Configuring MSTP task

Configuring MSTP task		Remark	Detailed configuration
MSTP basic configuration	Choose STP mode	required	1.3.2
	Enable STP	required	1.3.2
Adjust and optimize the MSTP configuration	Configure bridge forward delay	optional	1.3.3
	Configure bridge hello time	optional	1.3.3
	Configure bridge max aging time	optional	1.3.3
	Configure bridge max hops	optional	1.3.3
	Configure MSTP identifier	optional	1.3.4
	Configure MSTP identifier revision	optional	1.3.4
	Configure MSTP instance configuration and VLAN identifier mapping	optional	1.3.4
	Configure MSTP bridge priority	optional	1.3.5
	Configure the boundary port status	optional	1.3.6
	Configure the port link type	optional	1.3.7
	Configure port internal path cost	optional	1.3.8
	Configure port external path cost	optional	1.3.8
	Configure port priority	optional	1.3.9
	Configure port protection	optional	1.3.10
	Configure port digest Snooping	optional	1.3.11
	Configure port mCheck	optional	1.3.12
	Configure MSTP instance is enabled	optional	1.3.13
Display and maintain MSTP		optional	1.3.14

1.4.2 Enabling MSTP

After the tree starts to give birth to a global default for all ports will participate in the spanning tree topology is calculated, if an administrator wants some of the port does not

participate in the calculation of the production tree, or go to the specified port configuration mode, use the no spanning-tree to disable the port Spanning Tree function.

Table1-2 Enable MSTP

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Choice STP mode	**spanning-tree mode mstp**	required
Enable STP	**spanning-tree**	required
Enter port configuration mode	**interface ethernet** *interface-num*	-
Enable(disable) port STP	**(no)spanning-tree**	optional

1.4.3 Configuring MSTP Timer Parameter Values

MSTP timers include: forwarding delay, contracting cycle hello time, maximum aging time, and the maximum hops. Users can configure these three parameters on the switch for MSTP spanning tree.

Table1-3 Configure MSTP timer parameter values

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Configure bridge forward delay	**spanning-tree mst forward-time** *forward-time*	optional
Configure bridge hello time	**spanning-tree mst hello-time** *hello-time*	optional
Configure bridge max aging time	**spanning-tree mst max-age** *max-age*	optional
Configure bridge max hops	**spanning-tree mst max-hops** *max-hops*	optional

Notes:

● The Hello Time value is too long will lead to packet loss due to leaving the bridge that links the link failure, began to re-calculate the spanning tree; too short can cause the bridge Hello Time value configured to send messages frequently to increase the network and CPU burden. Hello Time value range is 1 to 10 seconds, recommended default value of 2 seconds. Hello Time must be less than equal to the Forward Delay 2.

● If the Forward Delay configuration is too small, may introduce temporary redundant paths; if the Forward Delay configuration is too large, the network may not be a long time to restore connectivity. Forward Delay value range is 4 to 30 seconds, it is recommended to use the default value of 15 seconds. Forward Delay time must be greater than equal to the Hello Time + 2.

● Max Age is used to set the MSTP protocol packet aging longest interval, if the timeout, it discards the packet. If this value is too small, spanning tree will be more frequent, there may be network congestion mistaken link failure; If this value is too large, is not conducive to timely detection of link failures. Max Age of the range is 6 to 40 seconds. Max Age time

value and the exchange of the network diameter. Recommended default value of 20 seconds. Max Age time must be greater than equal to 2 * (Hello Time + 1), less than or equal 2 * (Forward Delay-1).

1.4.4 Configuring MSTP Identifier

MSTP configuration identifiers include: MSTP configuration name, MSTP revision level, and the MSTP instance and VLAN mapping, MSTP will have the same configuration identifier and the bridge connected to each other logically be treated as a virtual bridge.

Table1-4 Configure MSTP identifier

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Configure MSTP identifier name	**spanning-tree mst name** *name*	optional
Configure MSTP identifiers revision	**spanning-tree mst revision** *revision-level*	optional
Configure MSTP instance configuration and VLAN identifier mapping	**spanning-tree mst instance** *instance-num* **vlan** *vlan-list*	optional

1.4.5 Configuring MSTP Bridge Priority

In MSTP, the bridge priority is based on the parameters of MSTI, the bridge priority together with port priority and port path cost determines the topology of each spanning tree instance, constitute the basis for link load balancing.

Switch bridge priority determines the size of this switch is able to be selected as the spanning tree root bridge. By configuring the bridge priority of the smaller, you can specify a switch to become the spanning tree root bridge purposes.

By default, the switch bridge priority is 32768.

Table1-5 Configure MSTP bridge priority

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Configure MSTP instance priority	**spanning-tree mst instance** *instance-num* **priority** *priority*	optional

1.4.6 Configuring Port Boundary Port Status

Border and port means connected to the host ports that can linkup within a very short time after entering the forwarding state, but once these ports receive spanning tree packets will automatically switch to non-border ports.

Table1-6 Configure the port boundary port status

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-

Enter port configuration mode	**Interface** **ethernet** *interface-num*	-
Configure the port boundary port status	**spanning-tree mst portfast**	optional

1.4.7 Configuring Port Link Type

Port link type is divided into two kinds: First, the type of shared media links (links through the hub, etc.), another type of point to point link. Link type is mainly used in the rapid conversion of the proposed port state - agreed mechanism, only the port link type as point to point only to allow the port state of rapid transformation.

In MSTP, the port state requires quick access to the port forwarding to point to point link, not a shared media link, you can manually specify the port link type, then can determine the port by the bridge current link type.

Table1-7 Configure the port link type

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	*interface* **ethernet** *interface-num*	-
Configure the switch automatically detects whether the port is point to point link	**spanning-tree mst link-type point-to-point auto**	Optional
Configure the port connected to the link point to point link	**spanning-tree mst link-type point-to-point forcetrue**	Optional
Configure the port connected to link non-point link	**spanning-tree mst link-type point-to-point forcefalse**	Optional

1.4.8 Configuring Path Cost

Port path cost is divided into internal and external costs to spend, the former is based on the configuration parameters for each instance of MSTP, each MSTP region to determine the topology of different instances, which is unrelated to an instance of the parameters used to determine each region of the topology composed of CST.

Cost path through the configuration port, you can make the port more likely to be the root port or designated port.

Port path cost and the link rate on the port, the larger the link rate, the smaller should be the parameter configuration. MSTP protocol can automatically detect the current port link rate, and converted into the corresponding path cost.

Configuring the Ethernet port will cause the spanning tree path cost to recalculate. Port path cost in the range 1 to 65535.Recommended default values, so that their MSTP protocol to calculate the path of the current port cost. By default, the port was based on the rate to determine the path cost.

Port path cost default value is determined according to the port speed, port speed 10M when the default value is 200,000 2,000,000,100 M, while the 1000M is, when 20,000 default. When the time is less than the port speed, path cost default value 200,000.

Table1-8 Configure the path cost

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	*interface* **ethernet** *interface-num*	Optional
Configure internal port path cost	*spanning-tree* **mst** *instance* *instance-num* **cost** **cost**	Optional
Configure the port cost of the external path	**spanning-tree mst external cost** *cost-value*	Optional

1.4.9 Configuring Port Priority

In MSTP port priority is based on the parameters of each spanning tree instance, by configuring the priority of the port, a port can make it easier to become the root port.

The smaller the priority value that the higher the priority. Change the priority of Ethernet port can cause spanning tree recalculation. Spanning tree port priority values range from 0 to 240, the value must be a multiple of 16. By default, spanning tree port priority is 128.

Table 1-9 Configure port priority

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	*interface* **ethernet** *interface-num*	-
Configure port priority	*spanning-tree* **mst** **instance** *instance-num* **port-priority** *priority-value*	Optional

1.4.10 Configuring Root Port Protection

As the maintenance of configuration errors or malicious network attacks, network valid root bridge may receive a higher priority configuration information, so the root bridge will lose the current status of the root bridge, causing changes in network topology errors .Assuming the original traffic is forwarded through the high-speed links, this is not legally change will lead to the original high-speed links are to low-speed traffic links, resulting in network congestion. Root protection function to prevent this from happening.

Root-protection function of the port, the port can only be kept for a specified port. Once this port received a high priority on the configuration information, status of the ports will be set to the Discarding state, not forwarding packets (equivalent to the link connected to this port is disconnected).When a long enough period of time does not receive better configuration message, the port will revert to the original state.

In MSTP, this function works for all instances.

Table 1-10 Configure the root port protection

Operation	Command	Remarks
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	***interface* ethernet** *interface-num*	-
Configure **the root port protection**	**spanning-tree mst root-guard**	Optional

1.4.11 Configuring Digest Snooping Port

When a switch port uses a proprietary spanning tree with Cisco and other switch is connected, these manufacturers' switches configured with the proprietary spanning tree protocol, even if the same MST region configuration, the switch can't be achieved between the MSTP domain interoperability. Digest snooping feature such a situation. With the use of proprietary spanning tree protocol of the manufacturer's switches connected to the port on the digest snooping feature, when receiving the manufacturer's switches over to send a BPDU, the switch that is from the same packet in an MST region, while the configuration summary record; when BPDU packets sent to these manufacturer's switches, the switch configuration summary to supplement it. This switch is realized and the manufacturer's switches in the MSTP region exchange.

Table 1-11 Configure digest snooping port

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	**interface ethernet** *interface-num*	-
Configure digest snooping port	**spanning-tree mst config-digest-snooping**	Optional

1.4.12 Configuring Port mCheck Function

In order to flexibly control MSTP, you can open the DISABLE INSTANCE features, disable instance STP mode operating results with the implementation of no spanning-tree similar to the instance of the VLAN mapping of all connections on port forwarding state.

Table 1-12 Configuration port mcheck function

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Enter port configuration mode	***interface* ethernet** *interface-num*	-
Configuration port mcheck function	**spanning-tree mst mcheck**	Optional

Note: mcheck function is a prerequisite for the port must send BPDU packets, so only works on the specified port.

1.4.13 Configuring MSTP Instance Is disabled

In order to flexibly control MSTP, you can open the DISABLE INSTANCE features, disable instance STP mode operating results with the implementation of no spanning-tree similar to the instance of the VLAN mapping of all connections on port forwarding state.

Table 1-13 Configuring MSTP instance is enabled

Operation	Command	Remark
Enter global configuration mode	**configure terminal**	-
Does not enable MSTP instance	**spanning-tree mst disable instance** *instance-number*	Optional
Enable MSTP instances	**no** *spanning-tree* **mst disable instance** *instance-number*	Optional

1.4.14 Configure Loop-guard Function

The loop-guard function: prevent a blocked port because of abnormal link from becoming a forwarding state after not receiving the BPDU configuration information. When the port is configured with this option, the port remains blocked even if BPDU configuration BPDU are not received.

- Configure loop-guard function

operation	command	remark
Enter the global configuration mode	**configure terminal**	-
Enter the port configuration mode	**interface ethernet** *interface-num*	
Enable the loop-guard function	**spanning-tree mst loop-guard**	Don't share with root-guard
disenable the loop-guard function	**no spanning-tree loop-guard**	

1.4.15 Configure BPDU Guard Function

For an access layer device, the access port usually directly connects to the user terminal or the file server. In this case, the access ports are set as edge ports to enable rapid transition of these ports. When these ports receive BPDU message, the system automatically sets these ports as non-edge ports and recalculates the spanning trees, and causes network topology changes. These ports should normally not receive BPDU message. If someone forges BPDU to attack the device, the network will become unstable.

The device provides the BPDU guard function to prevent these attacks: After the BPDU guard function is enabled on a device, if a port configured with edge port attributes receives BPDU

message, the device will SHUTDOWN the port and prompt the user with the syslog information.

Configure bpdu-guard function

operation	command	remark
Enter the global configuration mode	**configure terminal**	-
Enable the bpdu guard function globally	(no) **spanning-tree mst bpdu-guard**	In global mode, this command is enabled on all ports
Disable the bpdu guard function	**no spanning-tree mst bpdu-guard**	
Enter the port configuration mode	**interface ethernet** *interface-num*	
Enable the bpdu guard function	**spanning-tree mst bpdu-guard**	Take effect on the specified port
Disable the bpdu guard function	**no spanning-tree mst bpdu-guard**	

Note: The BPDU guard function of a port takes effect only on the port configured with the edge port attribute. If the edge port attribute is configured, but because it receives the BPDU message from other port and re-becomes non-edge port. In this case, the BPDU guard function is enabled. The port can take effect only when it is restarted as an edge port.

1.4.16 Configure Bpdu-filter Function

If the BPDU is set on the edge port, the device will discard the received BPDU message and the port will not send BPDU message.

- Configure bpdu-filter function

operation	command	remark
Enter the global configuration mode	**configure terminal**	-
Enable bpdu-filter function	**spanning-tree mst bpdu-filter**	In global mode, this command is enabled on all ports
Disable bpdu-filter function	**no spanning-tree mst bpdu-filter**	
Enter the port configuration mode	**interface ethernet interface-num**	
Enable bpdu-filter function	**spanning-tree mst**	Take effect on the

	bpdu-filter	specified port
Disable bpdu-filter function	**no spanning-tree mst bpdu-filter**	

1.4.17 Displaying and Maintain MSTP

After completing the above configuration, can use the following command to view configuration. RSTP

Table 1-14Display MSTP and maintain

Operation	Command	Remarks
MSTP configuration information display identifier	**show spanning-tree mst config-id**	Performs either of the commands
Show spanning tree instance and port configuration information	**show spanning-tree mst instance** [br]**[brief [ethernet** *interface-list* **]**	