

RSTP

GS1900 series

Support Note

Version 1.00 July 2013



Overview of RSTP

Rapid Spanning Tree Protocol (RSTP) is identified by IEEE as 802.1.w. RSTP enhances the drawbacks of the STP and provides rapid convergence of the STP by assigning port roles and by calculating the active topology.

While STP can take 30 to 50 seconds to respond to a topology change, RSTP is typically able to respond to changes within $3 \times$ Hello times (default: 3 times 2 seconds) or within a few milliseconds of a physical link failure.

General Operation

The switch with the highest priority is selected as root and spanning-tree algorithm uses this information as the source of the spanning-tree topology. Based on the calculation, individual ports are assigned to one of the following port roles.

Port Roles

1. **Root port** – Represents the best path for the traffic toward the root switch.
2. **Designated port** – The lowest cost path when forwarding packets from the LAN to the root switch. A designated switch port on one switch connects to a root port on another switch. The traffic flows from the root port to the designated port, which is closer toward the root switch.
3. **Alternate port** – Provides a backup path for the present root port toward the root switch. Alternate port exists on another switch.
4. **Backup port** – Provides a backup path for the designated port for the traffic flowing from the root switch toward the LAN. The backup port exists on the same switch as the active port. To have a backup port, ports must be connected by a point-to-point link, or a switch must have multiple connections to a shared LAN segment.
5. **Disabled port** – Has no role in the operation of the spanning-tree.

Port Status

Discarding – No user data is sent over the port.

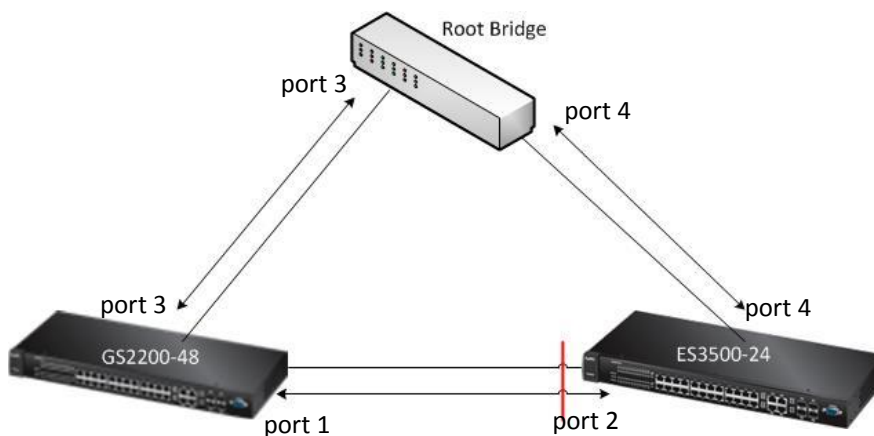
Learning – The port is not forwarding frames yet, but is populating its MAC-address table.

Forwarding – The port is fully operational,

Additional Operation

1. Detection of root switch failure is done in 3 hello times, which is 6 seconds if the default hello times have not been changed.
2. Ports may be configured as edge ports if they are attached to a LAN that has no other bridges attached. These edge ports transition directly to the forwarding state. RSTP still continues to monitor the port for BPDUs in case a bridge is connected. RSTP can also be configured to automatically detect edge ports. As soon as the bridge detects a BPDU coming to an edge port, the port becomes a non-edge port.
3. RSTP will respond to BPDUs sent from the direction of the root bridge. An RSTP bridge will "propose" its spanning tree information to its designated ports. If another RSTP bridge receives this information and determines this is the superior root information, it sets all its other ports to discarding. The bridge may send an "agreement" to the first bridge confirming its superior spanning tree information. Upon receiving the agreement, the bridge will know it can transit that port to the forwarding state rapidly.

Scenario



We would like to setup RSTP for GS1900-8HP, GS2200-48, and ES3500-24.

Here are the requirements:

GS1900-8HP → Root bridge

GS2200-48 → port 1: the designated port
port 3: the root port

ES3500-24 → port 2: the blocked port in this topology
port 4: the root port

GS1900-8HP → port 3: the designated port
port 4: the designated port

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Web GUI configuration

Step 1. Enable RSTP on GS1900-8HP.

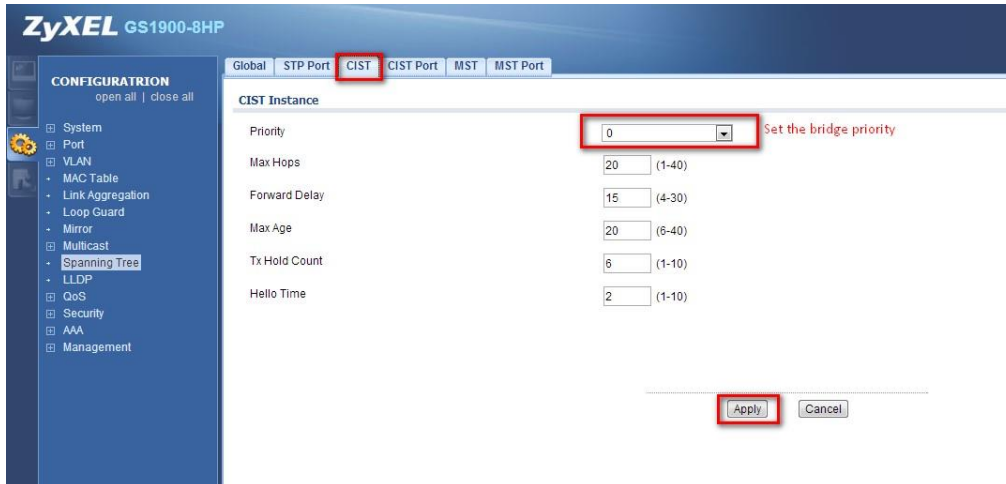
The screenshot shows the ZyXEL GS1900-8HP Web GUI. The left sidebar has a tree view with 'Spanning Tree' highlighted. The main content area shows the 'Global' configuration tab for RSTP. The 'State' is set to 'Enable'. The 'BPDU Forward' is set to 'Flooding'. The 'PathCost Method' is set to 'Short'. The 'Version' is set to 'RSTP'. The 'Configuration Name' is 'RSTP_LAB' and the 'Configuration Revision' is '0'. The 'Apply' button is highlighted.

Step 2. Enable port 3 and port 4 STP status.

The screenshot shows the ZyXEL GS1900-8HP Web GUI with the 'STP Port' configuration tab selected. A table lists the STP status for various ports. Ports 3 and 4 are highlighted with checkboxes checked. The 'Edit' button is also highlighted.

Port	State	External Cost	Edge Port	BPDU Filter	BPDU Guard	P2P MAC
1	Enable	0	Yes	No	No	Yes
2	Enable	0	Yes	No	No	Yes
3	Enable	0	Yes	No	No	Yes
4	Enable	0	Yes	No	No	Yes
5	Enable	0	Yes	No	No	Yes
6	Enable	0	Yes	No	No	Yes
7	Enable	0	Yes	No	No	Yes
8	Enable	0	Yes	No	No	Yes
LAG1	Enable	0	Yes	No	No	Yes
LAG2	Enable	0	Yes	No	No	Yes
LAG3	Enable	0	Yes	No	No	Yes
LAG4	Enable	0	Yes	No	No	Yes
LAG5	Enable	0	Yes	No	No	Yes
LAG6	Enable	0	Yes	No	No	Yes
LAG7	Enable	0	Yes	No	No	Yes
LAG8	Enable	0	Yes	No	No	Yes

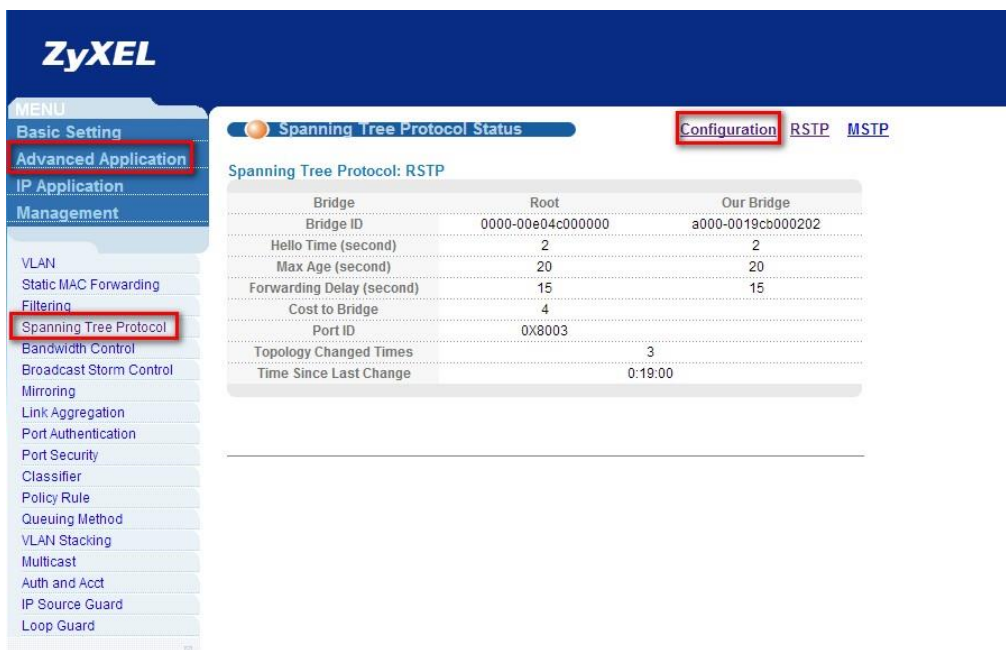
Step 3. Set the CIST priority.



The screenshot shows the ZyXEL GS1900-8HP configuration interface. The 'CIST' tab is selected in the top navigation bar. The 'CIST Instance' section is visible, showing various parameters for the CIST. The 'Priority' field is set to 0, which is highlighted with a red box and a red arrow pointing to it. A red text label 'Set the bridge priority' is next to the Priority field. Other parameters include Max Hops (20), Forward Delay (15), Max Age (20), Tx Hold Count (6), and Hello Time (2). The 'Apply' button is highlighted with a red box at the bottom right of the configuration area.

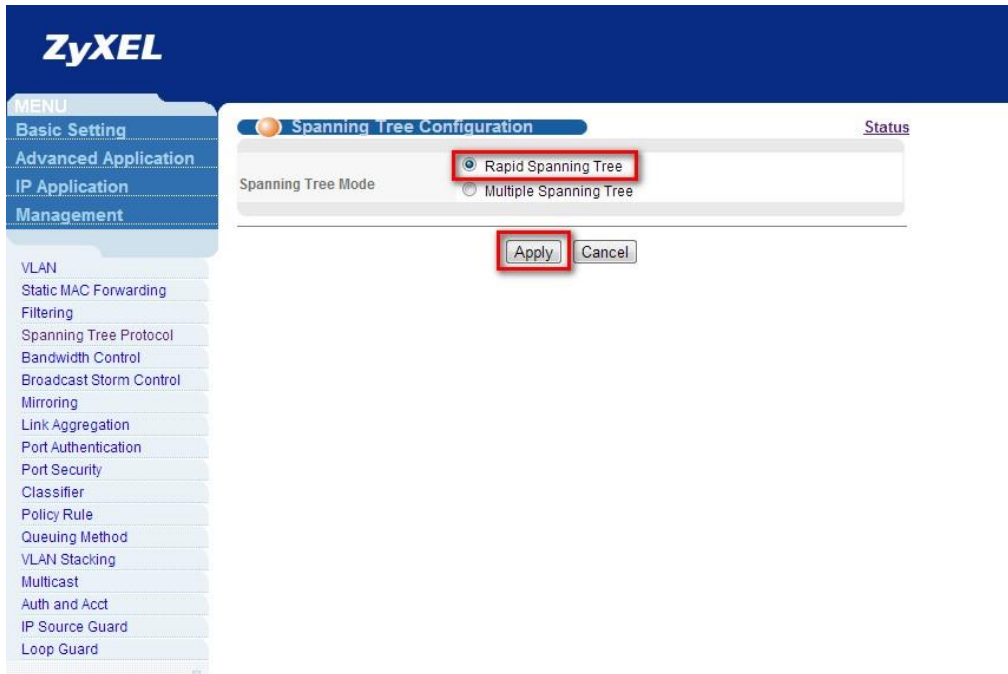
Step 4. Enable RSTP on GS2200-48 and ES3500-24.

GS2200-48



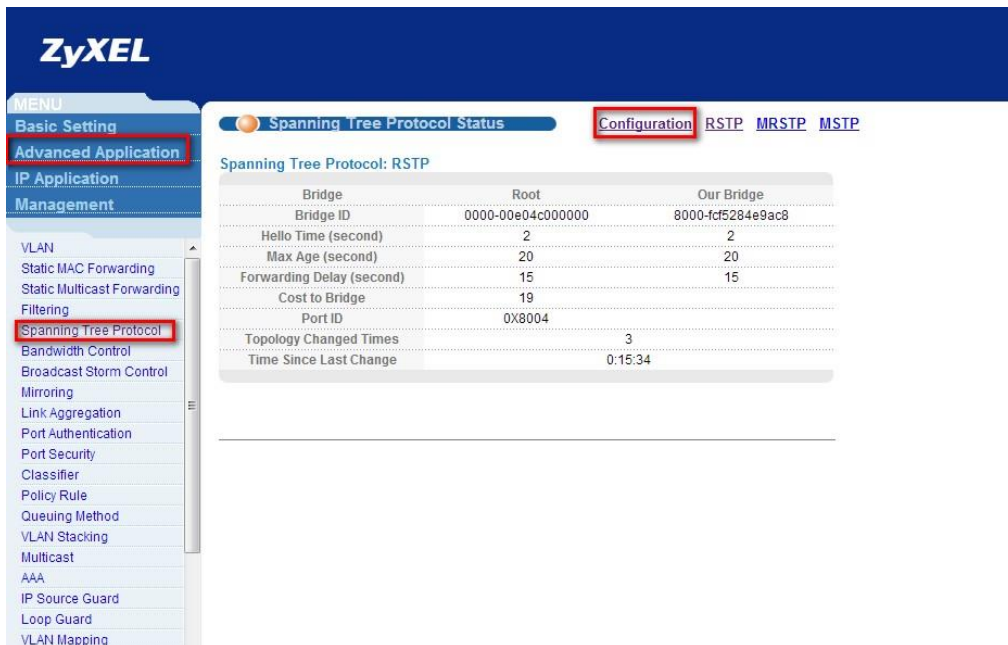
The screenshot shows the ZyXEL GS2200-48 configuration interface. The 'Spanning Tree Protocol Status' page is displayed, with the 'Configuration' tab selected. The 'Spanning Tree Protocol: RSTP' section is visible, showing a table with parameters for the Bridge, Root, and Our Bridge. The 'Configuration' tab is highlighted with a red box. The table shows the following data:

Bridge	Root	Our Bridge
Bridge ID	0000-00e04c000000	a000-0019cb000202
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	4	
Port ID	0x8003	
Topology Changed Times		3
Time Since Last Change		0:19:00



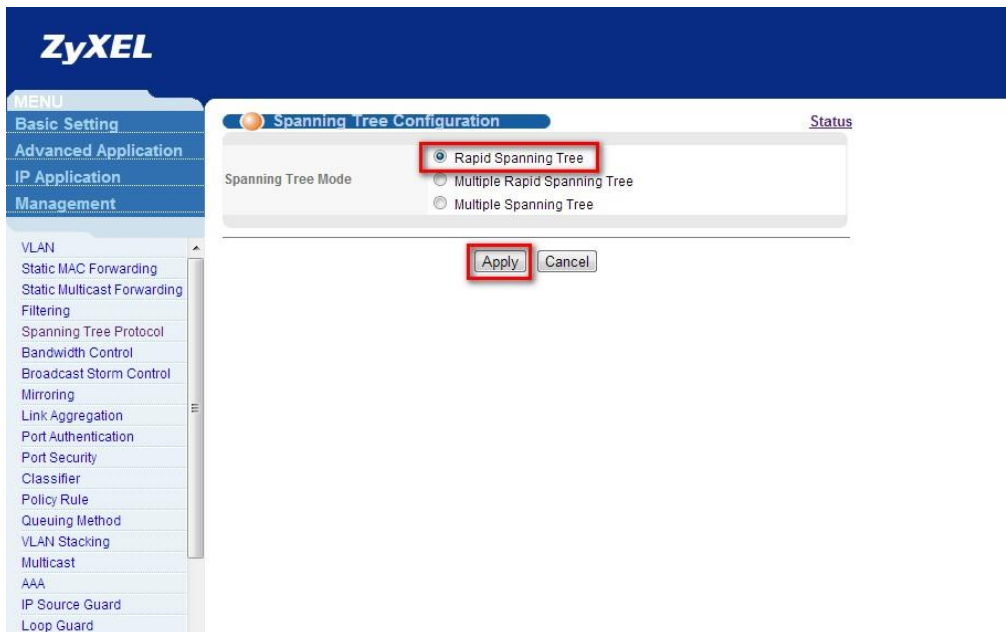
The image shows the ZyXEL web interface for Spanning Tree Configuration. The left sidebar contains a menu with options: Basic Setting, Advanced Application, IP Application, and Management. Under Management, there is a list of features including VLAN, Static MAC Forwarding, Filtering, Spanning Tree Protocol, Bandwidth Control, Broadcast Storm Control, Mirroring, Link Aggregation, Port Authentication, Port Security, Classifier, Policy Rule, Queuing Method, VLAN Stacking, Multicast, Auth and Acct, IP Source Guard, and Loop Guard. The main content area is titled 'Spanning Tree Configuration' and has a 'Status' link. It displays the 'Spanning Tree Mode' with two radio buttons: 'Rapid Spanning Tree' (selected) and 'Multiple Spanning Tree'. Below the mode selection are 'Apply' and 'Cancel' buttons.

ES3500-24



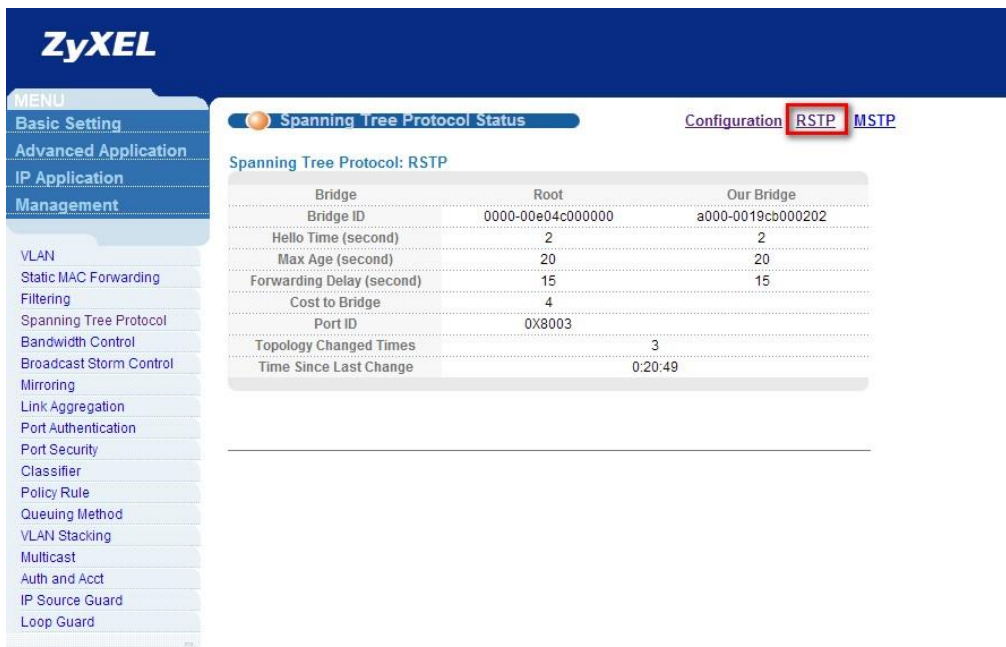
The image shows the ZyXEL web interface for Spanning Tree Protocol Status. The left sidebar is the same as the previous image, but 'Spanning Tree Protocol' is highlighted in the menu. The main content area is titled 'Spanning Tree Protocol Status' and has tabs for 'Configuration', 'RSTP', 'MRSTP', and 'MSTP'. The 'Configuration' tab is selected. Below the tabs, it says 'Spanning Tree Protocol: RSTP'. A table displays the following information:

	Bridge	Root	Our Bridge
Bridge ID	0000-00e04c000000		8000-fcf5284e9ac8
Hello Time (second)	2		2
Max Age (second)	20		20
Forwarding Delay (second)	15		15
Cost to Bridge	19		
Port ID	0x8004		
Topology Changed Times		3	
Time Since Last Change		0:15:34	



Step 5. Set the bridge priority and the ports which join the RSTP for GS2200-48 and ES3500-24.

GS2200-48



ZyXEL

MENU

- Basic Setting
- Advanced Application
- IP Application
- Management

VLAN

- Static MAC Forwarding
- Filtering
- Spanning Tree Protocol
- Bandwidth Control
- Broadcast Storm Control
- Mirroring
- Link Aggregation
- Port Authentication
- Port Security
- Classifier
- Policy Rule
- Queuing Method
- VLAN Stacking
- Multicast
- Auth and Acct
- IP Source Guard
- Loop Guard

Rapid Spanning Tree Protocol

Status

Active	<input checked="" type="checkbox"/>
Bridge Priority	40960
Hello Time	2 Seconds
MAX Age	20 Seconds
Forwarding Delay	15 Seconds

Port	Active	Priority	Path Cost
*	<input type="checkbox"/>		
1	<input checked="" type="checkbox"/>	128	4
2	<input type="checkbox"/>	128	4
3	<input checked="" type="checkbox"/>	128	4
4	<input type="checkbox"/>	128	4
5	<input type="checkbox"/>	128	4
6	<input type="checkbox"/>	128	4
7	<input type="checkbox"/>	128	4
8	<input type="checkbox"/>	128	4

And then click "Apply"

ES3500-24

ZyXEL

MENU

- Basic Setting
- Advanced Application
- IP Application
- Management

VLAN

- Static MAC Forwarding
- Static Multicast Forwarding
- Filtering
- Spanning Tree Protocol
- Bandwidth Control
- Broadcast Storm Control
- Mirroring
- Link Aggregation
- Port Authentication
- Port Security
- Classifier
- Policy Rule
- Queuing Method
- VLAN Stacking
- Multicast
- AAA
- IP Source Guard

Spanning Tree Protocol Status

[Configuration](#)
RSTP
[MRSTP](#)
[MSTP](#)

Spanning Tree Protocol: RSTP

Bridge	Root	Our Bridge
Bridge ID	0000-00e04c000000	8000-fcf5284e9ac8
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	19	
Port ID	0X8004	
Topology Changed Times		3
Time Since Last Change		0:16:48

Rapid Spanning Tree Protocol

Active ☒

Bridge Priority

Hello Time Seconds

MAX Age Seconds

Forwarding Delay Seconds

Port	Active	Edge	Priority	Path Cost
*	<input type="checkbox"/>	<input type="checkbox"/>		
1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19
8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	128	19

And then click "Apply".

Verification:

Connect all ports and check the RSTP status on GS1900-8HP, GS2200-48, and ES3500-24.

RSTP status on GS1900-8HP

ZyXEL GS1900-8HP

MONITOR

open all | close all

- System
- Port
- VLAN
 - MAC Table
 - Link Aggregation
 - Loop Guard
- Multicast
- Spanning Tree**
- LLDP
- Security
- Management

CIST | CIST Port | MST | MST Port | STP Statistics

CIST Instance

State	Enable
Bridge Identifier	0/00:E0:4C:00:00:00
Designated Root Bridge	0/00:E0:4C:00:00:00
External Root Path Cost	0
Regional Root Bridge	0/00:E0:4C:00:00:00
Internal Root Path Cost	0
Designated Bridge	0/00:E0:4C:00:00:00
Root Port	0/0
Remaining Hops	20
Last Topology Change	2053

ZyXEL GS1900-8HP

Welcome: admin | [Logout](#) | [Stats](#) | [About](#) | [Help](#)

MONITOR
open all | close all

- System
- Port
- VLAN
- MAC Table
- Link Aggregation
- Loop Guard
- Multicast
- Spanning Tree**
 - RSTP**
- Security
- Management

CIST **CIST Port** **RST** **MST Port** **STP Statistics**

CIST Port

Port	Identifier (Priority / Port ID)	External Path Cost	Internal Path Cost	Designated Root Bridge	External Root Cost	Regional Root Bridge	Internal Root Cost	Designated Bridge	Edge Port Operation	P2P MAC Operation	Port Role	Port State
1	128 / 1	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
2	128 / 2	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
3	128 / 3	20000	20000	0 / 00:E0:4C:00:00:00	0	0 / 00:E0:4C:00:00:00	0	0 / 00:E0:4C:00:00:00	No	Yes	Designated Forwarding	Designated Forwarding
4	128 / 4	200000	200000	0 / 00:E0:4C:00:00:00	0	0 / 00:E0:4C:00:00:00	0	0 / 00:E0:4C:00:00:00	No	Yes	Designated Forwarding	Designated Forwarding
5	128 / 5	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
6	128 / 6	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
7	128 / 7	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
8	128 / 8	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG1	128 / 9	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG2	128 / 10	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG3	128 / 11	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG4	128 / 12	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG5	128 / 13	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG6	128 / 14	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG7	128 / 15	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable
LAG8	128 / 16	20000	20000	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	0	0 / 00:00:00:00:00:00	Yes	No	Disable	Disable

RSTP status on GS2200-48

ZyXEL

MENU

- Basic Setting
- Advanced Application
- IP Application
- Management

Spanning Tree Protocol Status [Configuration](#) [RSTP](#) [MSTP](#)

Spanning Tree Protocol: RSTP

Bridge	Root	Our Bridge
Bridge ID	0000-00e04c000000	a000-0019cb000202
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	4	
Port ID	0x8003	
Topology Changed Times		3
Time Since Last Change		0:19:00

```
GS2200# sh spanning-tree config
Bridge Info:
(a)BridgeID:          a000-0019cb000202
(b)TimeSinceTopoChange: 9904
(c)TopoChangeCount:    3
(d)TopoChange:         0
(e)DesignatedRoot:     0000-00e04c000000
(f)RootPathCost:       4
(g)RootPort:           0x8003
(h)MaxAge:              20      (seconds)
(i)HelloTime:           2       (seconds)
(j)ForwardDelay:        15      (seconds)
(k)BridgeMaxAge:         20      (seconds)
(l)BridgeHelloTime:      2       (seconds)
(m)BridgeForwardDelay:   15      (seconds)
(n)TransmissionLimit:   3
(o)ForceVersion:         2
```

```
Port [01] Info:
(a)Uptime:             9905      (seconds)
(b)State:               FORWARDING
(c)PortID:              0x8001
(d)PathCost:            4
(e)DesignatedRoot:      0000-00e04c000000
(f)DesignatedCost:      4
(g)DesignatedBridge:    a000-0019cb000202
(h)DesignatedPort:      0x8001
(i)TopoChangeAck:       False
(j)adminEdgePort:       True
(k)operEdgePort:        False
(m)MAC_Operational:     True
(n)adminPointToPointMAC: AUTO
(o)operPointToPointMAC: True
rx_cfg_bpdu[ 0]      rx_tcn_bpdu[ 0]      rx_rstp_bpdu[ 1]
```

```
Port [03] Info:
(a)Uptime:             9960      (seconds)
(b)State:               FORWARDING
(c)PortID:              0x8003
(d)PathCost:            4
(e)DesignatedRoot:      0000-00e04c000000
(f)DesignatedCost:      0
(g)DesignatedBridge:    0000-00e04c000000
(h)DesignatedPort:      0x8003
(i)TopoChangeAck:       False
(j)adminEdgePort:       True
(k)operEdgePort:        False
(m)MAC_Operational:     True
(n)adminPointToPointMAC: AUTO
(o)operPointToPointMAC: True
rx_cfg_bpdu[ 0]      rx_tcn_bpdu[ 0]      rx_rstp_bpdu[4984]
```

RSTP status on ES3500-24

The screenshot shows the ZyXEL web interface for the ES3500-24 switch. The left sidebar contains a 'MENU' with options: Basic Setting, Advanced Application, IP Application, and Management. Under 'Management', there is a list of features including VLAN, Static MAC Forwarding, Static Multicast Forwarding, Filtering, Spanning Tree Protocol (which is selected), Bandwidth Control, Broadcast Storm Control, Mirroring, Link Aggregation, Port Authentication, Port Security, Classifier, Policy Rule, Queuing Method, VLAN Stacking, Multicast, AAA, IP Source Guard, and Loop Guard.

The main content area is titled 'Spanning Tree Protocol Status' and includes tabs for Configuration, RSTP (selected), MRSTP, and MSTP. Below the tabs, the text 'Spanning Tree Protocol: RSTP' is displayed. A table shows the RSTP status for the bridge and the root.

Bridge	Root	Our Bridge
Bridge ID	0000-00e04c000000	8000-fcf5284e9ac8
Hello Time (second)	2	2
Max Age (second)	20	20
Forwarding Delay (second)	15	15
Cost to Bridge	19	
Port ID	0x8004	
Topology Changed Times		3
Time Since Last Change		0:13:21

```
ES3500# sh spanning-tree config
Bridge Info:
(a)BridgeID: 8000-fcf5284e9ac8
(b)TimeSinceTopoChange: 37
(c)TopoChangeCount: 3
(d)TopoChange: 0
(e)DesignatedRoot: 0000-00e04c000000
(f)RootPathCost: 19
(g)RootPort: 0x8004
(h)MaxAge: 20 (seconds)
(i)HelloTime: 2 (seconds)
(j)ForwardDelay: 15 (seconds)
(k)BridgeMaxAge: 20 (seconds)
(l)BridgeHelloTime: 2 (seconds)
(m)BridgeForwardDelay: 15 (seconds)
(n)TransmissionLimit: 3
(o)ForceVersion: 2
```

```
Port [02] Info:
(a)Uptime:          38      (seconds)
(b)State:           DISCARDING
(c)PortID:          0x8002
(d)PathCost:        19
(e)DesignatedRoot:  0000-00e04c000000
(f)DesignatedCost:  4
(g)DesignatedBridge: a000-0019cb000202
(h)DesignatedPort:  0x8001
(i)TopoChangeAck:   False
(j)adminEdgePort:   True
(k)operEdgePort:    False
(m)MAC_Operational: True
(n)adminPointToPointMAC: AUTO
(o)operPointToPointMAC: True
rx_cfg_bpdu[ 0]    rx_tcn_bpdu[ 0]    rx_rstp_bpdu[ 19]

Port [04] Info:
(a)Uptime:          73      (seconds)
(b)State:           FORWARDING
(c)PortID:          0x8004
(d)PathCost:        19
(e)DesignatedRoot:  0000-00e04c000000
(f)DesignatedCost:  0
(g)DesignatedBridge: 0000-00e04c000000
(h)DesignatedPort:  0x8004
(i)TopoChangeAck:   False
(j)adminEdgePort:   True
(k)operEdgePort:    False
(m)MAC_Operational: True
(n)adminPointToPointMAC: AUTO
(o)operPointToPointMAC: True
rx_cfg_bpdu[ 0]    rx_tcn_bpdu[ 0]    rx_rstp_bpdu[ 39]
```