

1 –

STP

, Spanning Tree Protocol (STP)

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MAC-

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STP

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ZyXEL

STP – 802.1w

RSTP (Rapid STP),

802.1d 2004 .

STP

Hello

( )

MAC- .

BPDU (Bridge Protocol Data Unit) . BPDU

« » . BPDU,

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, BPDU,

, BPDU , BPDU

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BPDU ,

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, ,

BPDU ( — **root**

**port**), ,

( — **designated ports**).

,

RSTP

:

- **Discarding** — ,
- MAC- ;
- **Learning** — BPDU- ;
- **Forward** — .

RSTP : root, designated (

), alternate backup. **alternate**,

BPDU .

**backup**, BPDU,

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STP RSTP —

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STP

$2 * (\text{forward\_delay} + \text{max\_age})$ , RSTP — .

**RSTP** **STP,** .  
 STP (802.1d 2004 ) RSTP (802.1w)  
 :  
 : Disabled, Listening Blocking  
 STP RSTP – Discarding.  
 : **backup** – – ,  
 LAN; **alternate** –  
 – .  
 .  
 , forward.  
 alternate-  
 handshake.  
 : Topology  
 Change (TC) Topology Change Ack (TCA) –  
 proposal/agreement handshake,  
 , .  
 2 ( STP 0).  
**keep-alive.** RSTP  
 keep-alive Hello.  
 . STP,  
 , TCN (Topology  
 change notification) ,  
 ( ), TC  
 .  
 . RSTP  
 ,  
 TC.  
**Discarding Forward.** STP,  
 , Blocking Forward  
 ( ),

. RSTP

forward ,

forward handshake,

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. RSTP


, , Hello,

TC.

, TC, MAC,

, ,

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 Spanning Tree Protocol

Status

Active	<input type="checkbox"/>
Bridge Priority	32768
Hello Time	2 Seconds
Max Age	20 Seconds
Forwarding Delay	15 Seconds

Port	Active	Priority	Path Cost
1	<input type="checkbox"/>	128	4
2	<input type="checkbox"/>	128	4
3	<input 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
9	<input type="checkbox"/>	128	4
10	<input type="checkbox"/>	128	4

2 – STP

. BridgeID

- .

Configuration.

**Bridge Priority** –

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**Hello Time** – Hello BPDU,  
**Max Age** – ,  
 BPDU- ,  
 (designated),  
 BPDU- . **Max Age**  
 BPDU,  
 (root) ,  
 BPDU.

**Forwarding Delay** –

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 , .  
 :

**$2 * (\text{Forward Delay} - 1) \geq \text{Max Age} \geq 2 * (\text{Hello Time} + 1)$**

Forwarding Delay Max Age

STP.


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 (Priority),

,  
 .

**Path Cost** – , BPDU

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 .  
 Path Cost , BPDU. Path

Cost


**Port Setup**

Port	Active	Name	Type	Speed / Duplex	Flow Control	802.1p Priority	BPDU Control
*	<input type="checkbox"/>		-	Auto	<input type="checkbox"/>	0	Peer
1	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
2	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
3	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
4	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
5	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
6	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
7	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
8	<input checked="" type="checkbox"/>		1000M	Auto	<input type="checkbox"/>	0	Peer
9	<input checked="" type="checkbox"/>		10/100/1000M	100M / Full Duplex	<input type="checkbox"/>	0	Peer
10	<input checked="" type="checkbox"/>		10/100/1000M	100M / Half Duplex	<input type="checkbox"/>	0	Peer
11	<input checked="" type="checkbox"/>		10/100/1000M	10M / Full Duplex	<input type="checkbox"/>	0	Peer
12	<input checked="" type="checkbox"/>		10/100/1000M	Auto	<input type="checkbox"/>	0	Peer

Apply
Cancel

4 –

: 10, 100, 1000 / ,

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**Active.** **Flow Control**  
( Pause- , ).

802.1p,

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**BPDU control** ( BPDU  
STP),

:

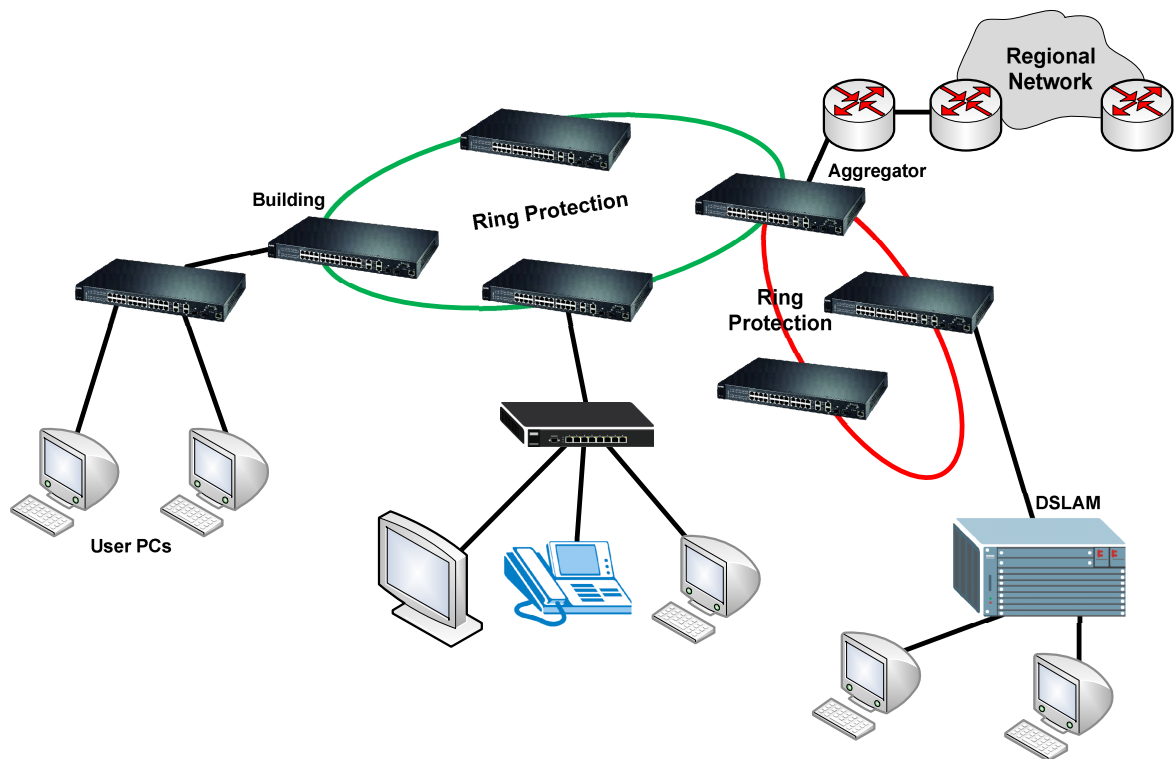
- **Peer** – BPDU- ;
- **Tunnel** – BPDU ;
- **Discard** – BPDU- ;
- **Network** – BPDU- VLAN  
BPDU, VLAN.

BPDU **Bridge Control**

**Protocol Transparency** **Switch Setup.**

## CLI

```
interface port-channel <port-list> inactive
interface port-channel <port-list> name <port-name-string>
interface port-channel <port-list> speed-duplex <auto|10-half|10-full|100-half|
100-full|1000-full>
interface port-channel <port-list> flow-control
interface port-channel <port-list> qos priority <0-7>
interface port-channel <port-list> bpdu-control <peer|tunnel|discard|network>
```



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MRSTP


MRSTP

RSTP,

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**Multiple Rapid Spanning Tree Protocol**
Status

Tree	Active	Bridge Priority	Hello Time		MAX Age		Forwarding Delay
1	<input type="checkbox"/>	32768 ▼	2	seconds	20	seconds	15
2	<input type="checkbox"/>	32768 ▼	2	seconds	20	seconds	15
3	<input type="checkbox"/>	32768 ▼	2	seconds	20	seconds	15
4	<input type="checkbox"/>	32768 ▼	2	seconds	20	seconds	15

Port	Active	Priority	Path Cost	Tree
*	<input type="checkbox"/>			1 ▼
1	<input type="checkbox"/>	128	4	1 ▼
2	<input type="checkbox"/>	128	4	1 ▼
3	<input type="checkbox"/>	128	4	1 ▼
4	<input type="checkbox"/>	128	4	1 ▼
■ ■ ■				
12	<input type="checkbox"/>	128	4	1 ▼

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## CLI

spanning-tree mode <RSTP|MRSTP|MSTP>

spanning-tree <cr>

spanning-tree priority <0-61440>

spanning-tree hello-time <1-10> maximum-age <6-40> forward-delay <4-30>

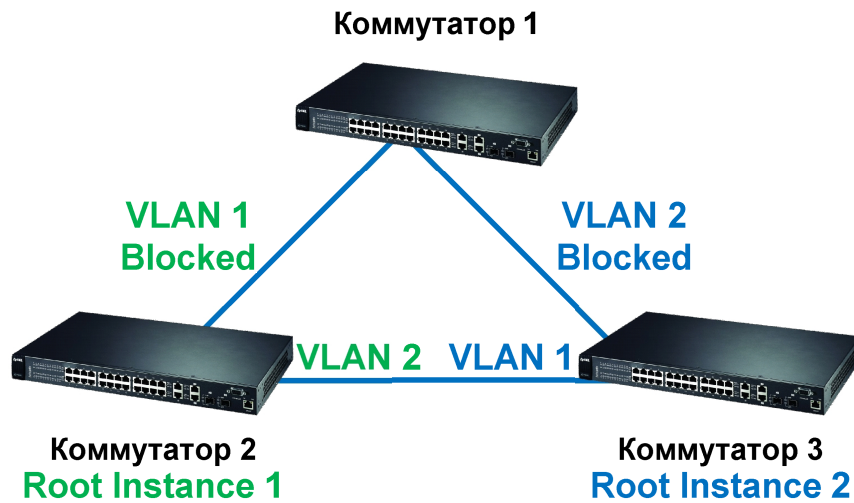
spanning-tree <port-list> <cr>

spanning-tree <port-list> path-cost <1-65535>

spanning-tree <port-ist> priority <0-255>

spanning-tree help





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RSTP

VLAN

802.1s (MSTP)

802.1w (RSTP)

RSTP

VLAN.

**Common and Internal Spanning Tree (CIST) –**

STP/RSTP. CIST

(MST Region)

(CIST Root),

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**MST Region –**

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**CIST Regional**

**Root ( CIST Root ),**

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**CIST Root –**

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**Multiple Spanning Tree Instance (MSTI) –**

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VLAN.

**Instance root –**

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1

: VLAN 1 VLAN 2.

RSTP

2,

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1 3

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1 VID=1

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MSTP:

STP,

2

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VLAN 1.

VLAN 1

1-

3-

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VLAN 2

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,

3

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VLAN 2.

VLAN

2

1-

2-

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VLAN 1

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,

,

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VLAN,

,

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Multiple Spanning Tree Protocol
Status

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**Bridge:**

Active	<input type="checkbox"/>		
Hello Time	2	seconds	
MAX Age	20	seconds	
Forwarding Delay	15	seconds	
Maximum hops	128		
Configuration Name	0013491815bb		
Revision Number	0		

---

**Instance:**

Instance	1		
Bridge Priority	32768		
VLAN Range	Start	End	<input type="button" value="Add"/> <input type="button" value="Remove"/> <input type="button" value="Clear"/>
Enabled VLAN(s)	1-3		

Port	Active	Priority	Path Cost
*	<input type="checkbox"/>		
1	<input type="checkbox"/>	128	4

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## CLI

spanning-tree mode <rstp | mrstp | mstp>

mstp <cr>

mstp configuration-name <name>

mstp revision <0-65535>

mstp hello-time <1-10> maximum-age <6-40> forward-delay <4-30>

mstp max-hop <1-255>

mstp instance <0-16>

mstp instance <0-16> vlan <vlan-list>

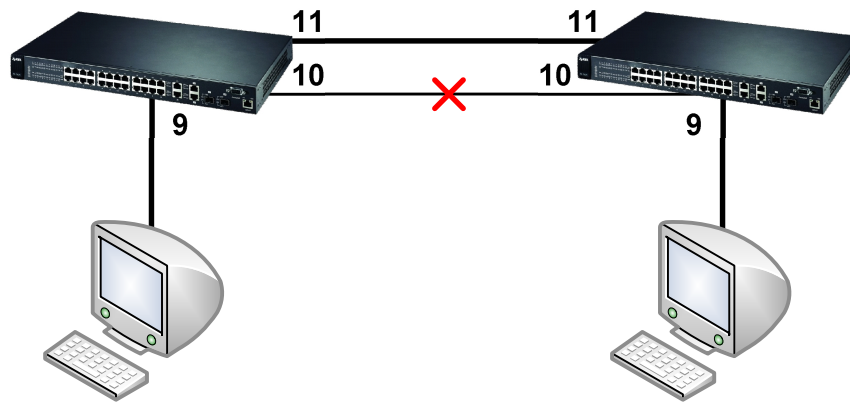
mstp instance <0-16> priority <0-61440>

mstp instance <0-16> interface port-channel <port-list> <cr>

mstp instance <0-16> interface port-channel <port-list> path-cost <1-65535>

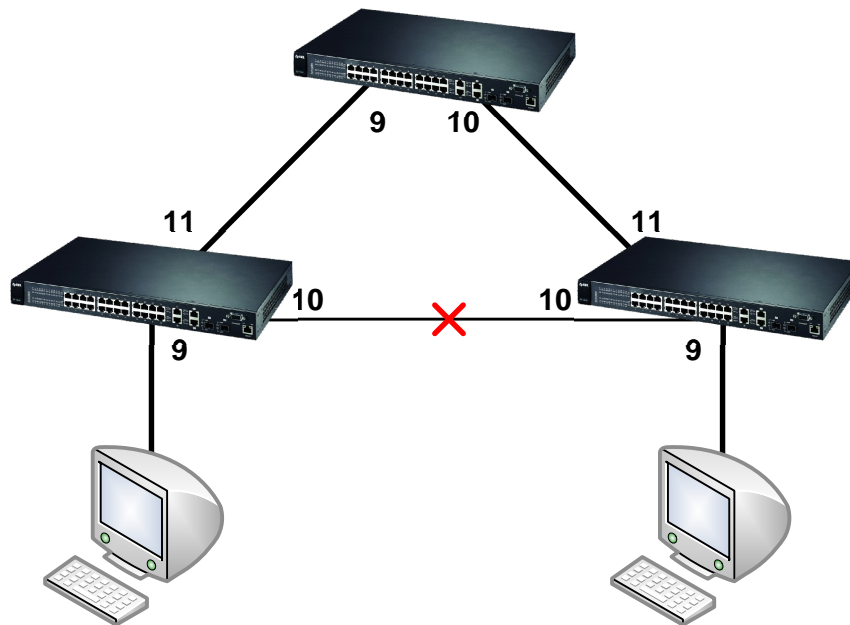
mstp instance <0-16> interface port-channel <port-list> priority <0-255>

RSTP ( )



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RSTP



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RSTP

1. , , .
2. Advanced Application > Spanning Tree Protocol > Configuration.
3. STP, , .
4. Apply.
5. , ,  
PC1 PC2 .