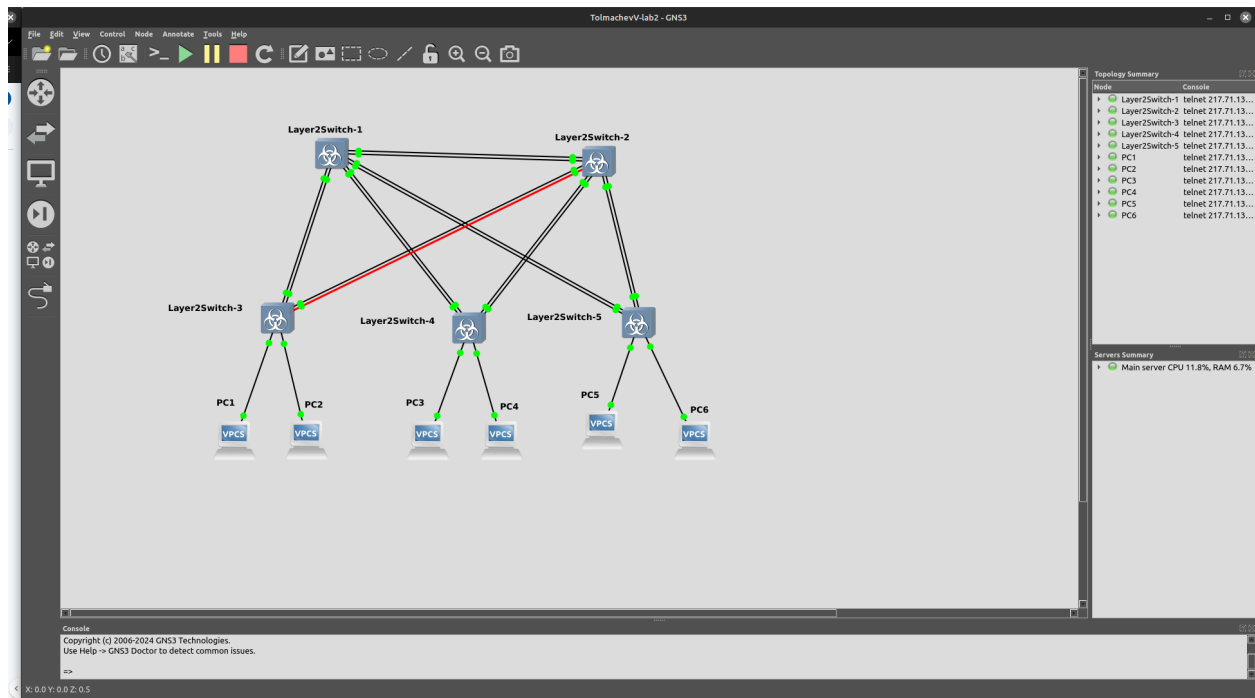


Копирование проекта



Изначальная конфигурация протокола STP.

The screenshot displays a network simulation environment with five Layer2 switches and six PCs. The switches are configured with STP (Spanning Tree Protocol) for VLAN0001. The PCs are configured with IP addresses in the 10.10.10.x/24 range.

Layer2Switch-1 Configuration:

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID: Priority 32769
  Address: 0c2b.8195.0000
  Cost: 4
  Port: 1 (GigabitEthernet0/0)
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Bridge ID: Priority 32769 (priority 32768 sys-id-ext 1)
  Address: 0c2b.8195.0000
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time: 15 sec
  Interface Role Sts Cost Prio.Nbr Type
  Gi0/0 Desg FWD 4 128.1 Shr
  Gi0/1 Desg FWD 4 128.2 Shr
  Gi0/2 Desg FWD 4 128.3 Shr
  Gi0/3 Desg FWD 4 128.4 Shr
  Gi0/4 Desg FWD 4 128.5 Shr
  Gi1/1 Desg FWD 4 128.6 Shr
  
```

Layer2Switch-2 Configuration:

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID: Priority 32769
  Address: 0c2b.8195.0000
  Cost: 4
  Port: 1 (GigabitEthernet0/0)
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Bridge ID: Priority 32769 (priority 32768 sys-id-ext 1)
  Address: 0c2b.8195.0000
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time: 15 sec
  Interface Role Sts Cost Prio.Nbr Type
  Gi0/0 Root FWD 4 128.1 Shr
  Gi0/1 Altn BLK 4 128.2 Shr
  Gi0/2 Altn BLK 4 128.3 Shr
  Gi0/3 Altn BLK 4 128.4 Shr
  Gi0/4 Altn BLK 4 128.5 Shr
  Gi1/1 Altn BLK 4 128.6 Shr
  
```

Layer2Switch-3 Configuration:

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID: Priority 32769
  Address: 0c2b.8195.0000
  Cost: 4
  Port: 1 (GigabitEthernet0/0)
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Bridge ID: Priority 32769 (priority 32768 sys-id-ext 1)
  Address: 0c2b.8195.0000
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time: 15 sec
  Interface Role Sts Cost Prio.Nbr Type
  Gi0/0 Root FWD 4 128.1 Shr
  Gi0/1 Altn BLK 4 128.2 Shr
  Gi0/2 Desg FWD 4 128.3 Shr
  Gi0/3 Desg FWD 4 128.4 Shr
  Gi0/4 Desg FWD 4 128.5 Shr
  Gi1/1 Desg FWD 4 128.6 Shr
  
```

Layer2Switch-4 Configuration:

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID: Priority 32769
  Address: 0c2b.8195.0000
  Cost: 4
  Port: 1 (GigabitEthernet0/0)
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Bridge ID: Priority 32769 (priority 32768 sys-id-ext 1)
  Address: 0c2b.8195.0000
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time: 15 sec
  Interface Role Sts Cost Prio.Nbr Type
  Gi0/0 Root FWD 4 128.1 Shr
  Gi0/1 Altn BLK 4 128.2 Shr
  Gi0/2 Desg FWD 4 128.3 Shr
  Gi0/3 Desg FWD 4 128.4 Shr
  Gi0/4 Desg FWD 4 128.5 Shr
  Gi1/1 Desg FWD 4 128.6 Shr
  
```

Layer2Switch-5 Configuration:

```

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID: Priority 32769
  Address: 0c2b.8195.0000
  Cost: 4
  Port: 1 (GigabitEthernet0/0)
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Bridge ID: Priority 32769 (priority 32768 sys-id-ext 1)
  Address: 0c2b.8195.0000
  Hello Time: 2 sec Max Age 20 sec Forward Delay 15 sec
  Aging Time: 15 sec
  Interface Role Sts Cost Prio.Nbr Type
  Gi0/0 Root FWD 4 128.1 Shr
  Gi0/1 Altn BLK 4 128.2 Shr
  Gi0/2 Desg FWD 4 128.3 Shr
  Gi0/3 Desg FWD 4 128.4 Shr
  Gi0/4 Desg FWD 4 128.5 Shr
  Gi1/1 Desg FWD 4 128.6 Shr
  
```

PC Configuration:

```

PC1: IP: 10.10.10.1/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:00, LPORT: 20098, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
PC2: IP: 10.10.10.2/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:01, LPORT: 20099, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
PC3: IP: 10.10.10.3/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:02, LPORT: 20100, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
PC4: IP: 10.10.10.4/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:03, LPORT: 20101, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
PC5: IP: 10.10.10.5/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:04, LPORT: 20102, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
PC6: IP: 10.10.10.6/24, Gateway: 0.0.0.0, MAC: 00:50:79:66:88:05, LPORT: 20103, RHOST:PORT: 127.0.0.1:20097, MTU: 1500
  
```

Далее были назначены ip адреса для VPCS командой `ip 10.10.10.1x/24` где x - число от 0 до 5 в зависимости от номера устройства

```
Layer2Switch-1
vIOS-L2-01>spanning-tree de
^
% Invalid input detected at '^' marker.
vIOS-L2-01>show sp
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
            Address     0c2b.8195.0000
            This bridge is the root
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
            Address     0c2b.8195.0000
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  300 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi0/0          Desg FWD 4        128.1 Shr
Gi0/1          Desg FWD 4        128.2 Shr
Gi0/2          Desg FWD 4        128.3 Shr
Gi0/3          Desg FWD 4        128.4 Shr
```

Можно заметить что корневой коммутатор - LayerSwitch1 по строке This bridge is root.

Назначим корневым коммутатором второй коммутатор:

En

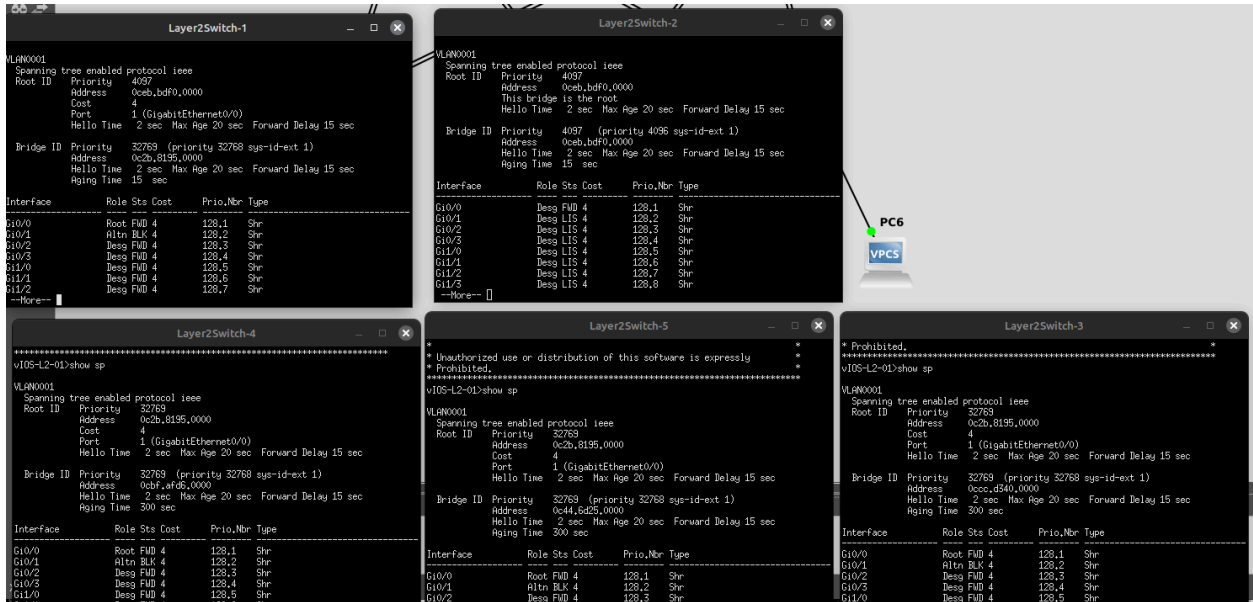
conf

spanning-tree vlan 1 priority 4096

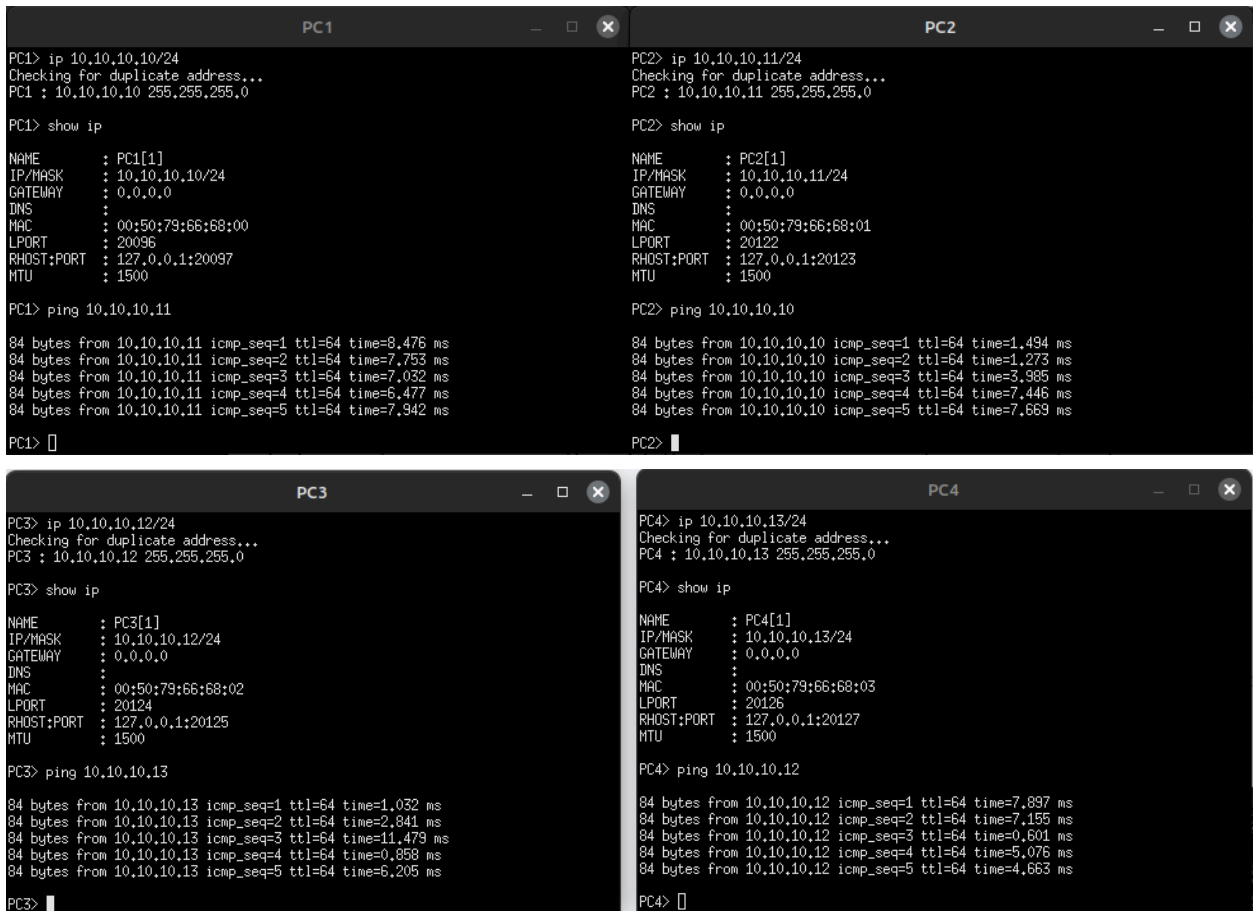
```
Layer2Switch-2
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
            Address     0ceb.bdf0.0000
            This bridge is the root
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    4097 (priority 4096 sys-id-ext 1)
            Address     0ceb.bdf0.0000
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  15 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi0/0          Desg FWD 4        128.1 Shr
Gi0/1          Desg LIS 4        128.2 Shr
Gi0/2          Desg LIS 4        128.3 Shr
Gi0/3          Desg LIS 4        128.4 Shr
Gi1/0          Desg LIS 4        128.5 Shr
Gi1/1          Desg LIS 4        128.6 Shr
Gi1/2          Desg LIS 4        128.7 Shr
Gi1/3          Desg LIS 4        128.8 Shr
--More--
```



Проверка доступности устройств командой ping



Захват пакетов hello при помощи Wireshark

The image displays six screenshots of the Wireshark network protocol analyzer, arranged in a 3x2 grid. Each screenshot shows a different capture session for Spanning Tree Protocol (STP) Hello packets. The top pane of each window shows a list of captured packets with columns for No., Time, Source, Destination, Protocol, Length, and Info. The bottom pane shows the packet details and the raw packet data in hexadecimal and ASCII.

- Top Left:** Capture on interface 1 of Layer2Switch-1. Shows a single STP Hello packet (No. 1) from source 0c:eb:bd:f0:00:01 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.
- Top Middle:** Capture on interface 0 of Layer2Switch-1. Shows a list of STP Hello packets (Nos. 1072, 1073, 1074, 1075, 1076, 1077) from source 0c:eb:bd:f0:00:00 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.
- Top Right:** Capture on interface 0 of Layer2Switch-3. Shows a list of STP Hello packets (Nos. 1828, 1830, 1831, 1832, 1833, 1834) from source 0c:eb:bd:f0:00:03 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.
- Bottom Left:** Capture on interface 0 of Layer2Switch-2. Shows a list of STP Hello packets (Nos. 991, 992, 993, 994, 995, 996) from source 0c:eb:bd:f0:00:04 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.
- Bottom Middle:** Capture on interface 0 of Layer2Switch-4. Shows a list of STP Hello packets (Nos. 965, 966, 967, 968, 969, 970) from source 0c:eb:bd:f0:00:05 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.
- Bottom Right:** Capture on interface 0 of Layer2Switch-5. Shows a list of STP Hello packets (Nos. 939, 940, 941, 942, 943) from source 0c:eb:bd:f0:00:06 to destination Spanning-tree (for...) STP. The packet length is 60 bytes.

Each screenshot also includes a packet details pane showing the structure of the STP Hello packet, including the IEEE 802.3 Ethernet header, Logical-Link Control, and Spanning Tree Protocol fields. The raw packet data is displayed in hexadecimal and ASCII format.

Смена стоимости маршрута для порта R на 4 коммутаторе

Layer2Switch4

en

conf

interface Gi0/3

spanning-tree cost 10

```
Layer2Switch-4
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
             Address    0ceb.bdf0.0000
             Cost        4
             Port        3 (GigabitEthernet0/2)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
             Address    0cbf.afd6.0000
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  15 sec

Interface      Role Sts Cost      Prio.Nbr Type
-----
Gi0/0          Altn BLK 4         128.1   Shr
Gi0/1          Altn BLK 4         128.2   Shr
Gi0/2          Root LRN 4         128.3   Shr
Gi0/3          Altn BLK 10        128.4   Shr
Gi1/0          Desg FWD 4         128.5   Shr
Gi1/1          Desg FWD 4         128.6   Shr

--More--
```

Дополненная схема

