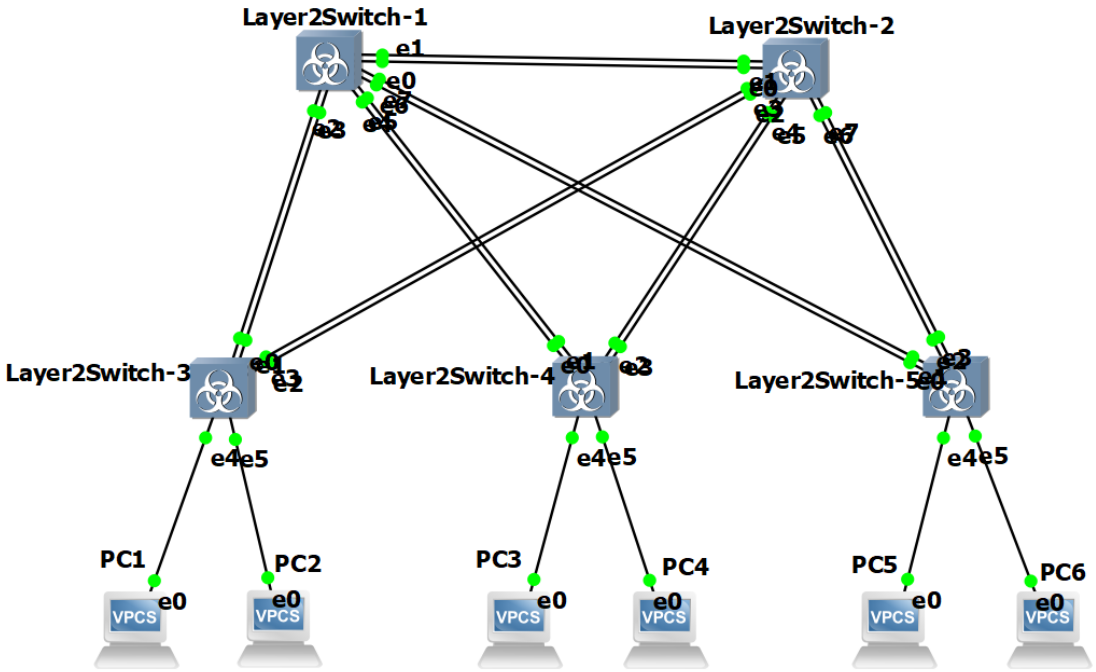
Лабораторная работа №2

Тема: Настройка протокола STP (IEEE 802.1D)

1) Для заданной на схеме schema-lab2 сети, состоящей из управляемых коммутаторов и персональных компьютеров, настроила протокол STP, назначив явно один из коммутаторов корневым настройкой приоритета.

Схема schema-lab2:



Пусть корневым коммутатором будет SW4. Для того, чтобы назначить его корневым, напишем:

enable

configure terminal

spanning-tree vlan 1 priority 0

end

2) Проверила доступность каждого с каждым всех персональных компьютеров (VPCS).

PC1 (192.168.1.1)

```
ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=1.543 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=3.584 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=6.927 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=7.298 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=7.737 ms

PC1> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=12.372 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=7.456 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=7.574 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=5.895 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=8.072 ms

PC1> ping 192.168.1.4

84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=12.963 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=9.239 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=4.369 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=6.974 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=7.937 ms

PC1> ping 192.168.1.5

84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=9.044 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=6.052 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=11.702 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=2.921 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=3.499 ms

PC1> ping 192.168.1.6

84 bytes from 192.168.1.6 icmp_seq=1 ttl=64 time=16.256 ms
84 bytes from 192.168.1.6 icmp_seq=2 ttl=64 time=3.001 ms
84 bytes from 192.168.1.6 icmp_seq=3 ttl=64 time=2.491 ms
84 bytes from 192.168.1.6 icmp_seq=4 ttl=64 time=11.230 ms
84 bytes from 192.168.1.6 icmp_seq=5 ttl=64 time=3.364 ms
```

PC2 (192.168.1.2)

```
ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=6.630 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=7.278 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=7.280 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=7.784 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=0.429 ms

PC2> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=15.626 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=13.680 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=8.516 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=14.303 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=8.016 ms

PC2> ping 192.168.1.4

84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=15.016 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=9.995 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=7.841 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=5.503 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=1.537 ms

PC2> ping 192.168.1.5

84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=10.432 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=3.562 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=5.253 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=7.771 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=9.121 ms

PC2> ping 192.168.1.6

84 bytes from 192.168.1.6 icmp_seq=1 ttl=64 time=15.137 ms
84 bytes from 192.168.1.6 icmp_seq=2 ttl=64 time=8.891 ms
84 bytes from 192.168.1.6 icmp_seq=3 ttl=64 time=7.290 ms
84 bytes from 192.168.1.6 icmp_seq=4 ttl=64 time=5.460 ms
84 bytes from 192.168.1.6 icmp_seq=5 ttl=64 time=7.002 ms
```

PC3 (192.168.1.3)

```
ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=8.911 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=7.166 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=9.390 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=13.238 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=8.947 ms

PC3> ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=7.077 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=6.006 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=7.427 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=11.045 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=2.743 ms

PC3> ping 192.168.1.4

84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=0.788 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=6.113 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=7.547 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=0.818 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=0.906 ms

PC3> ping 192.168.1.5

84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=4.634 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=10.190 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=1.909 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=1.601 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=5.843 ms

PC3> ping 192.168.1.6

84 bytes from 192.168.1.6 icmp_seq=1 ttl=64 time=3.616 ms
84 bytes from 192.168.1.6 icmp_seq=2 ttl=64 time=5.991 ms
84 bytes from 192.168.1.6 icmp_seq=3 ttl=64 time=7.377 ms
84 bytes from 192.168.1.6 icmp_seq=4 ttl=64 time=7.193 ms
84 bytes from 192.168.1.6 icmp_seq=5 ttl=64 time=7.975 ms
```

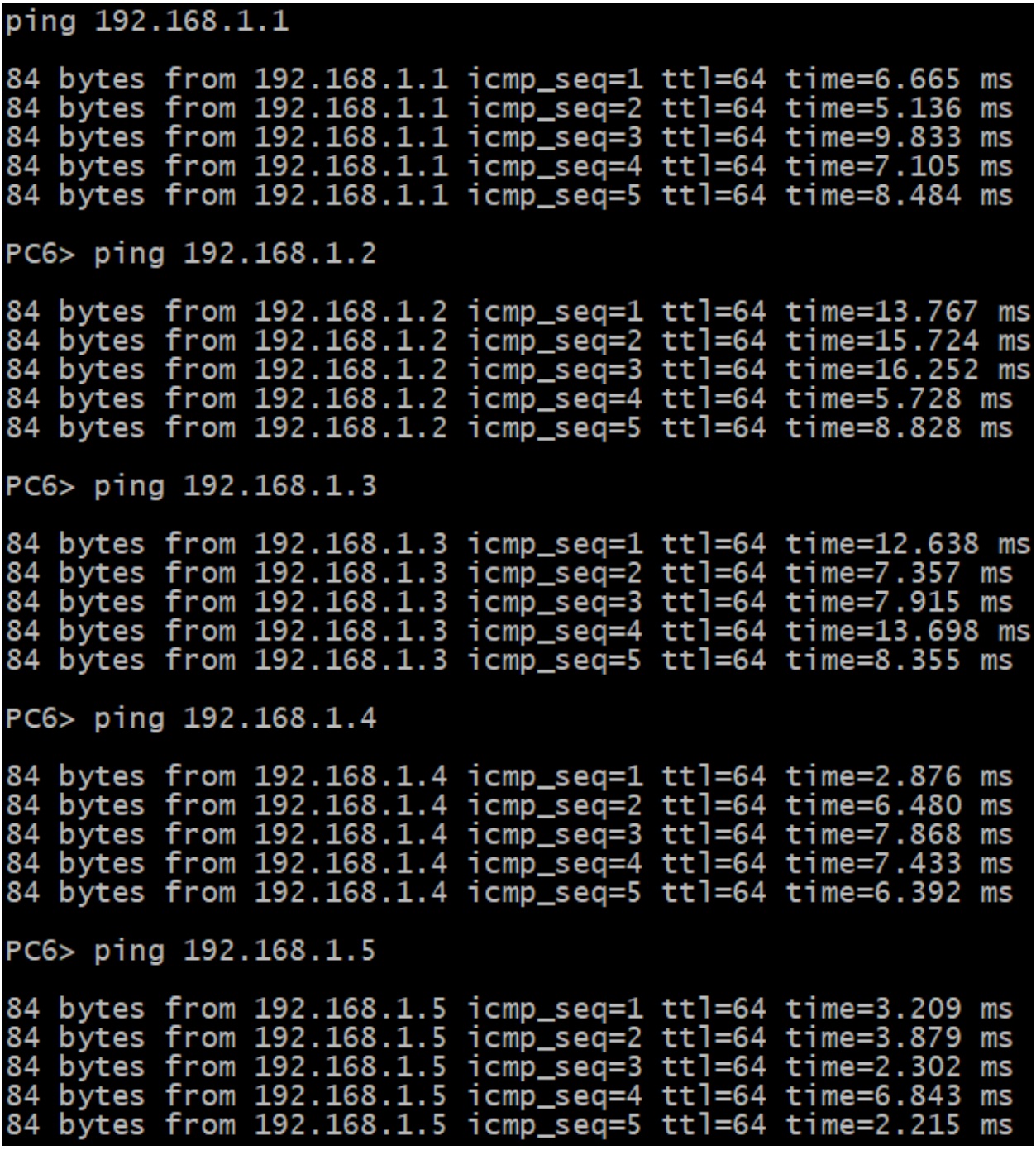
PC4 (192.168.1.4)

```
ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=8.601 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=5.004 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=5.683 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=4.740 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=8.071 ms

PC4> ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=17.890 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=7.514 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=7.238 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=7.206 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=1.698 ms

PC4> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=3.084 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=7.656 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=6.786 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=7.439 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=6.601 ms

PC4> ping 192.168.1.5

84 bytes from 192.168.1.5 icmp_seq=1 ttl=64 time=3.856 ms
84 bytes from 192.168.1.5 icmp_seq=2 ttl=64 time=1.731 ms
84 bytes from 192.168.1.5 icmp_seq=3 ttl=64 time=6.813 ms
84 bytes from 192.168.1.5 icmp_seq=4 ttl=64 time=2.811 ms
84 bytes from 192.168.1.5 icmp_seq=5 ttl=64 time=16.040 ms

PC4> ping 192.168.1.6

84 bytes from 192.168.1.6 icmp_seq=1 ttl=64 time=8.854 ms
84 bytes from 192.168.1.6 icmp_seq=2 ttl=64 time=10.993 ms
84 bytes from 192.168.1.6 icmp_seq=3 ttl=64 time=6.798 ms
84 bytes from 192.168.1.6 icmp_seq=4 ttl=64 time=7.988 ms
84 bytes from 192.168.1.6 icmp_seq=5 ttl=64 time=6.869 ms
```

PC5 (192.168.1.5)

```
ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=6.007 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=9.954 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=7.683 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=6.469 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=6.676 ms

PC5> ping 192.168.1.2

84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=9.950 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=2.513 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=3.625 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=7.521 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=6.231 ms

PC5> ping 192.168.1.3

84 bytes from 192.168.1.3 icmp_seq=1 ttl=64 time=8.310 ms
84 bytes from 192.168.1.3 icmp_seq=2 ttl=64 time=7.966 ms
84 bytes from 192.168.1.3 icmp_seq=3 ttl=64 time=9.884 ms
84 bytes from 192.168.1.3 icmp_seq=4 ttl=64 time=8.734 ms
84 bytes from 192.168.1.3 icmp_seq=5 ttl=64 time=5.514 ms

PC5> ping 192.168.1.4

84 bytes from 192.168.1.4 icmp_seq=1 ttl=64 time=10.018 ms
84 bytes from 192.168.1.4 icmp_seq=2 ttl=64 time=5.340 ms
84 bytes from 192.168.1.4 icmp_seq=3 ttl=64 time=4.570 ms
84 bytes from 192.168.1.4 icmp_seq=4 ttl=64 time=7.530 ms
84 bytes from 192.168.1.4 icmp_seq=5 ttl=64 time=10.543 ms

PC5> ping 192.168.1.6

84 bytes from 192.168.1.6 icmp_seq=1 ttl=64 time=0.829 ms
84 bytes from 192.168.1.6 icmp_seq=2 ttl=64 time=7.696 ms
84 bytes from 192.168.1.6 icmp_seq=3 ttl=64 time=6.912 ms
84 bytes from 192.168.1.6 icmp_seq=4 ttl=64 time=0.696 ms
84 bytes from 192.168.1.6 icmp_seq=5 ttl=64 time=5.903 ms
```

PC6 (192.168.1.6)



3) На изображении схемы отметила BID каждого коммутатора и режимы работы портов (RP/DP/blocked) и стоимости маршрутов. Чтобы это сделать, использовала команду ***show spanning-tree***, чтобы посмотреть BID, режимы работы портов и стоимости маршрутов.

1(0c:31:01:59:00 - PuTTY

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c31.0159.0000
              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
Gi1/0               Root FWD 4         128.5    Shr
Gi1/1               Altn BLK 4         128.6    Shr
Gi1/2               Desg FWD 4         128.7    Shr
Gi1/3               Desg FWD 4         128.8    Shr
 --More--
```

2(0c:7a:2d:55:00 - PuTTY

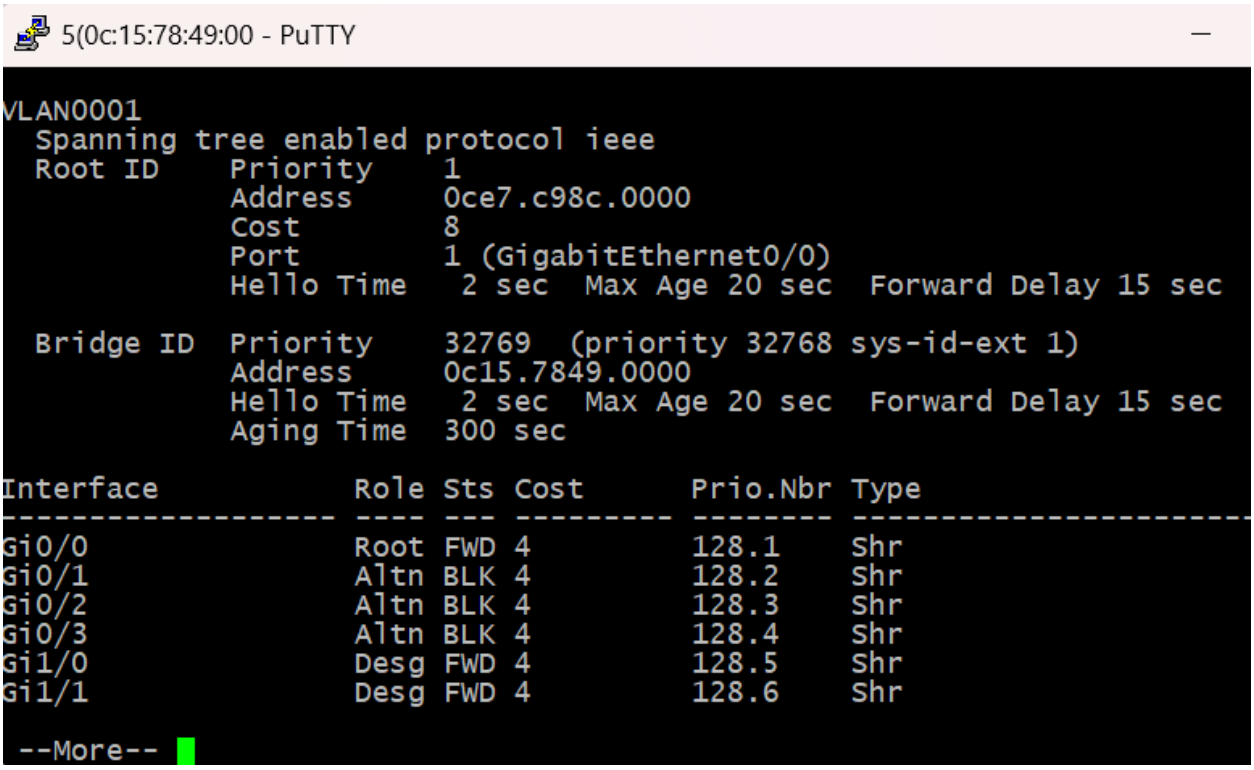
```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c7a.2d55.0000
              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               Altn BLK 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
Gi1/0               Root FWD 4         128.5    Shr
Gi1/1               Altn BLK 4         128.6    Shr
Gi1/2               Desg FWD 4         128.7    Shr
Gi1/3               Desg FWD 4         128.8    Shr
 --More--
```

3(0c:88:26:75:00 - PuTTY

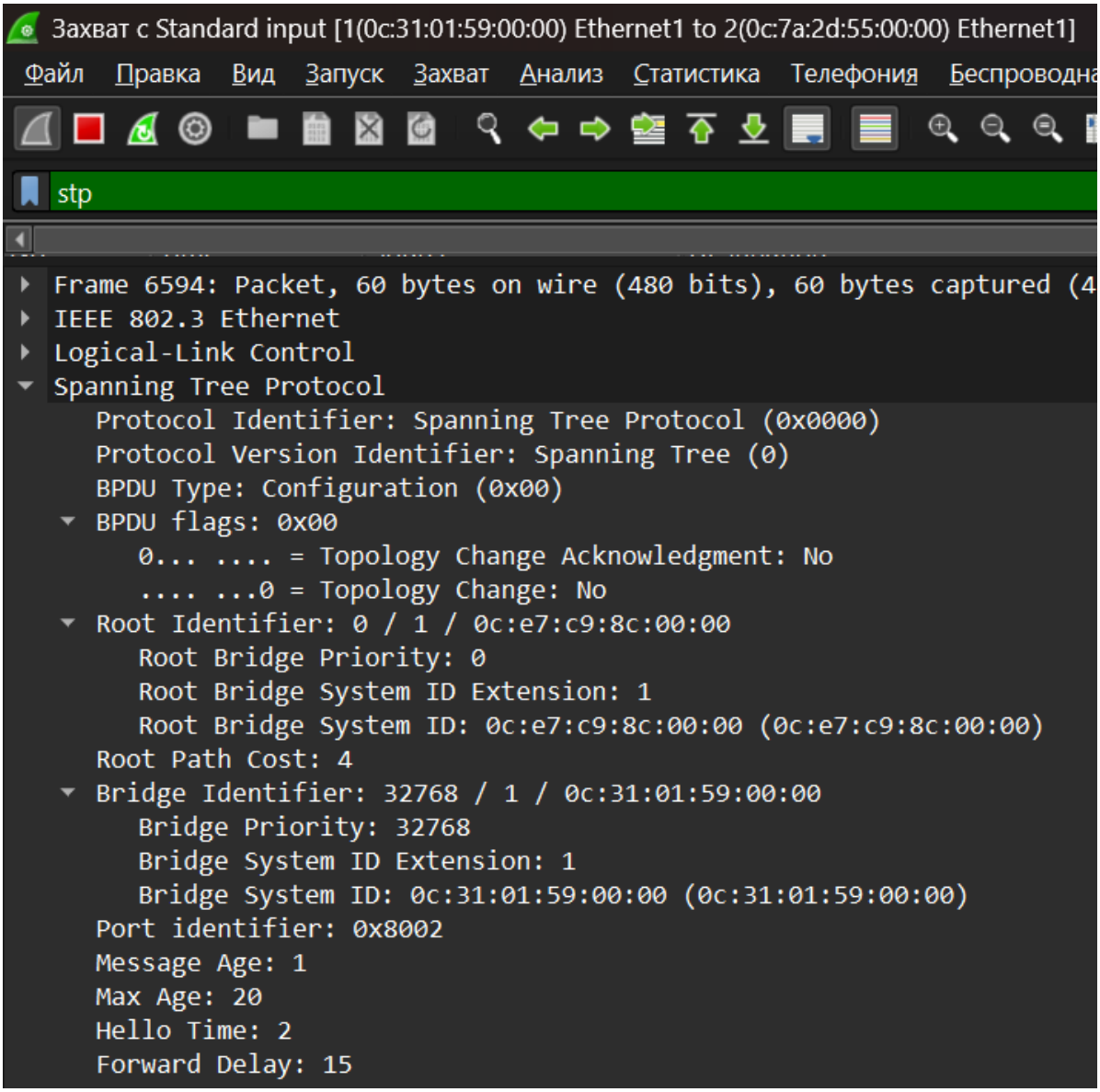
```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        8
              Port        1 (GigabitEthernet0/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c88.2675.0000
              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               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
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr

 --More--
```

4(0c:e7:c9:8c:00 - PuTTY

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    1      (priority 0 sys-id-ext 1)
              Address     0ce7.c98c.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
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr


 --More--
```



4) При помощи wireshark отследила передачу пакетов hello от корневого коммутатора на всех линках. Рассмотрим их подробнее.



В заголовке пакета:

- Название протокола (STP);
- Версия протокола: STP;
- Тип BPDU: в данной случае конфигурационный, пересылающийся корневым коммутатором и ретранслирующийся другими;
- Флаги:
  - Нет подтверждения изменения топологии;
  - Нет индикации изменения топологии.
- Идентификатор корневого коммутатора:
  - Приоритет: 0;

    - Идентификатор корневого коммутатора: 1;
    - MAC-адрес корневого коммутатора: MAC-адрес SW4;
- Стоимость до корневого коммутатора: 4;
- Идентификатора отправителя:
    - Приоритет: 32768;
    - Идентификатор: 1;
    - MAC-адрес идентификатора: SW1;
- Идентификатор порта;
- Message Age: 1 – сколько «переходов» от корневого коммутатора;
- Message Age: 20 – их максимальное количество;
- Hello Time: 2 – показывает, что корневой коммутатор рассылает пакеты каждые 2 секунды.
- Время задержки перед переходм в состояние Forwarding;

Как видим, информация от ***show spanning-tree*** совпала с заголовком пакета.

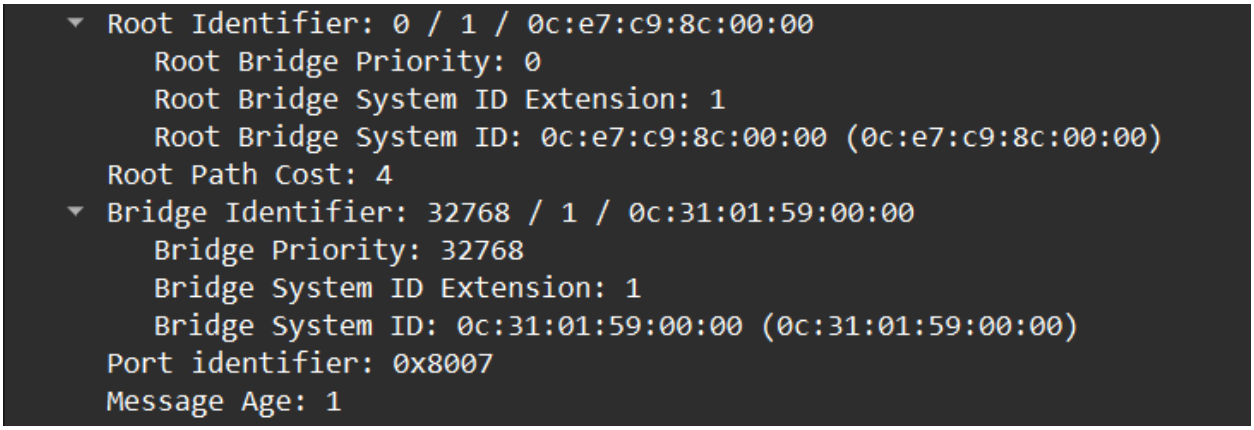
Остальные пакеты имеют такую же структуру, поэтому разберём только самые важные пункты в них.

SW1 (Ethernet 7) → SW5 (Ethernet 1)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:31:01:59:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:31:01:59:00:00 (0c:31:01:59:00:00)
  Port identifier: 0x8008
  Message Age: 1
```

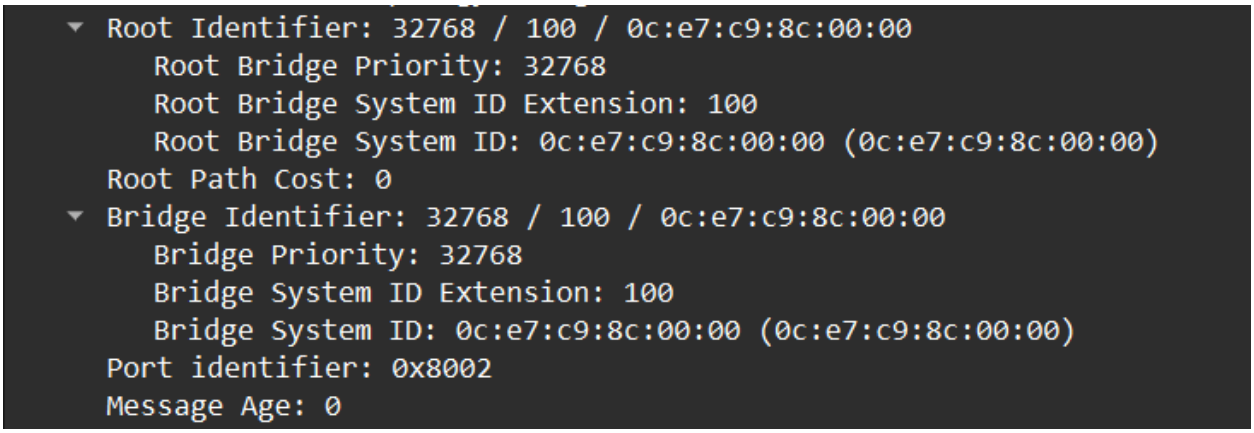
- Root Identifier: MAC-адрес SW4 – корневой коммутатор;
- Root Path Cost: 4 – стоимость;
- Bridge Identifier: MAC-адрес SW1 – коммутатор, от которого пришло сообщение;
- Message Age: 1 – сколько «переходов» от корневого коммутатора;

SW1 (Ethernet 6) → SW5 (Ethernet 0)



Аналогично выше, только порт другой.

SW1 (Ethernet 5) → SW4 (Ethernet 1)



- Root Identifier: MAC-адрес SW4 – корневой коммутатор;
- Root Path Cost: 0 – так как от корневого;
- Bridge Identifier: MAC-адрес SW4 – коммутатор, от которого пришло сообщение;
- Message Age: 0 – так как сообщение от корневого, до которого можно добраться «по прямой», а не через какой-либо ещё коммутатор, то равно 0;

SW1 (Ethernet 4) → SW4 (Ethernet 0)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 0
▾ Bridge Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Bridge Priority: 0
    Bridge System ID Extension: 1
    Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Port identifier: 0x8001
  Message Age: 0
```

Аналогично выше, только порт другой.

SW 1 (Ethernet 3) → SW3 (Ethernet 1)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:31:01:59:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:31:01:59:00:00 (0c:31:01:59:00:00)
  Port identifier: 0x8004
  Message Age: 1
```

Аналогично выше, но порт другой.

SW 1 (Ethernet 2) → SW3 (Ethernet 0)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:31:01:59:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:31:01:59:00:00 (0c:31:01:59:00:00)
  Port identifier: 0x8003
  Message Age: 1
```

Аналогично выше, но порт другой.

SW 3 (Ethernet 3) → SW2 (Ethernet 3)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:7a:2d:55:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:7a:2d:55:00:00 (0c:7a:2d:55:00:00)
  Port identifier: 0x8004
  Message Age: 1
```

- Root Identifier: MAC-адрес SW4 – корневой коммутатор;
- Root Path Cost: 4 – стоимость;
- Bridge Identifier: MAC-адрес SW2 – коммутатор, от которого пришло сообщение;
- Message Age: 1 – сколько «переходов» от корневого коммутатора;

SW 3 (Ethernet 2) → SW2 (Ethernet 2)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:7a:2d:55:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:7a:2d:55:00:00 (0c:7a:2d:55:00:00)
  Port identifier: 0x8003
  Message Age: 1
```

Аналогично выше, но порт другой.

SW 2 (Ethernet 4) → SW4 (Ethernet 2)

```
▾ Root Identifier: 32768 / 200 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 32768
    Root Bridge System ID Extension: 200
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 0
▾ Bridge Identifier: 32768 / 200 / 0c:e7:c9:8c:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 200
    Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Port identifier: 0x8003
  Message Age: 0
  Max Age: 20
```

Аналогично выше, только порт другой.

SW 2 (Ethernet 5) → SW4 (Ethernet 3)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 0
▾ Bridge Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Bridge Priority: 0
    Bridge System ID Extension: 1
    Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Port identifier: 0x8004
  Message Age: 0
```

Аналогично выше, только порт другой.

SW 2 (Ethernet 6) → SW5 (Ethernet 2)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:7a:2d:55:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:7a:2d:55:00:00 (0c:7a:2d:55:00:00)
  Port identifier: 0x8007
  Message Age: 1
```

Аналогично выше, только порт другой.

SW 2 (Ethernet 7) → SW5 (Ethernet 3)

```
▾ Root Identifier: 0 / 1 / 0c:e7:c9:8c:00:00
    Root Bridge Priority: 0
    Root Bridge System ID Extension: 1
    Root Bridge System ID: 0c:e7:c9:8c:00:00 (0c:e7:c9:8c:00:00)
  Root Path Cost: 4
▾ Bridge Identifier: 32768 / 1 / 0c:7a:2d:55:00:00
    Bridge Priority: 32768
    Bridge System ID Extension: 1
    Bridge System ID: 0c:7a:2d:55:00:00 (0c:7a:2d:55:00:00)
  Port identifier: 0x8008
  Message Age: 1
```

Аналогично выше, только порт другой.

5) Изменила стоимость маршрута для порта RP SW5 с помощью команд:

enable

configure terminal

interface gigabitEthernet 0/0

spanning-tree cost 12

end

Изменения в SW5:

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        8
              Port        2 (GigabitEthernet0/1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c15.7849.0000
              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 12        128.1    Shr
Gi0/1               Root LIS 4         128.2    Shr
Gi0/2               Altn BLK 4         128.3    Shr
Gi0/3               Altn BLK 4         128.4    Shr
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr
```

Остальные коммутаторы:

SW1

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c31.0159.0000
              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
Gi1/0               Root FWD 4         128.5    Shr
Gi1/1               Altn BLK 4         128.6    Shr
Gi1/2               Desg FWD 4         128.7    Shr
Gi1/3               Desg FWD 4         128.8    Shr
```

SW2

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        4
              Port        5 (GigabitEthernet1/0)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32769  (priority 32768 sys-id-ext 1)
              Address     0c7a.2d55.0000
              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               Altn BLK 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
Gi1/0               Root FWD 4         128.5    Shr
Gi1/1               Altn BLK 4         128.6    Shr
Gi1/2               Desg FWD 4         128.7    Shr
Gi1/3               Desg FWD 4         128.8    Shr
```

SW3

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              Cost        8
              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     0c88.2675.0000
              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               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
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr
```

SW4

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID     Priority    1
              Address     0ce7.c98c.0000
              This bridge is the root
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    1      (priority 0 sys-id-ext 1)
              Address     0ce7.c98c.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
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr
```

6) Сохранила файлы конфигураций устройств в виде набора файлов с именами, соответствующими именам устройств.