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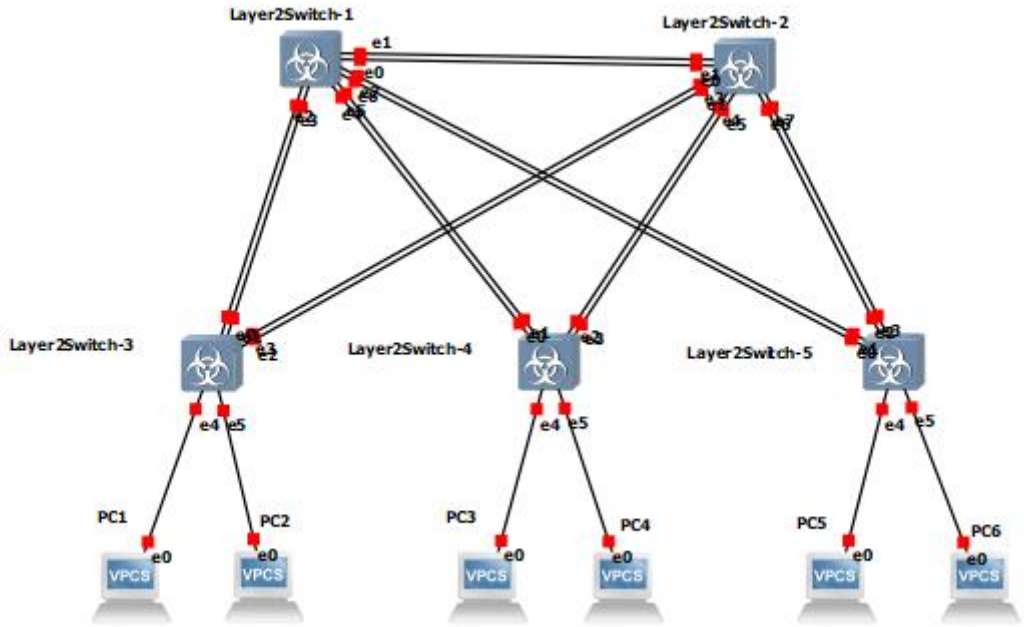
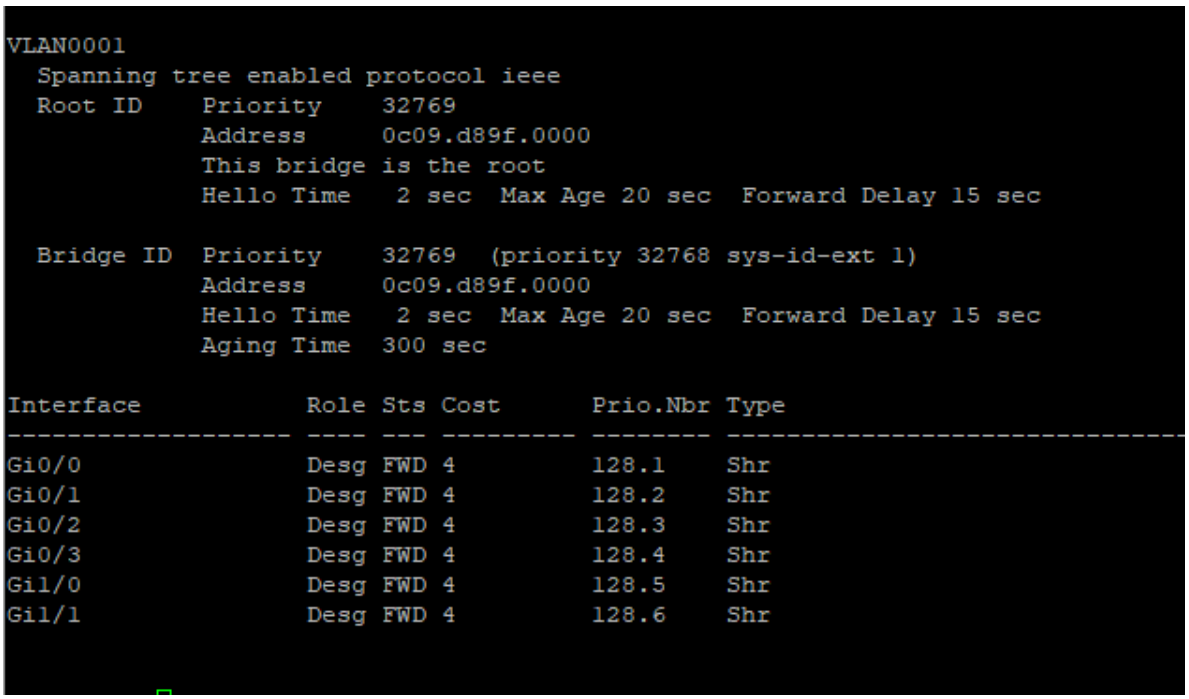
# Настройка протокола STP (IEEE 802.1D)

1) Для заданной на схеме schema-lab2 сети, состоящей из управляемых коммутаторов и персональных компьютеров




настроить протокол STP, назначив явно один из коммутаторов корневым настройкой приоритета

Для начала проверим включен ли протокол STP. Зайдём на коммутатор и введём команду show spanning-tree




Как видим протокол включён. Приоритет по умолчанию 32769. Мы рассматриваем коммутатор Switch3 и он является рутом, промежуток Hello 2 секунды, максимум ждём 20 секунд, если пакеты не поступают и обычная задержка 15 секунд. Данный switch стал рутом, так как его мак-адрес меньше, чем у других свичей, изменим это, присвоив свичу 4 меньший приоритет.

enable

configure

spanning-tree vlan 1 priority 0

exit

write

Снова вызываем show spanning-tree и видим, что адрес рута изменился на мак-адрес свича 4, а также изменился приоритет.

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    1
             Address     0ca5.37fb.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     0ca5.37fb.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
Gi1/0               Desg FWD 4         128.5    Shr
Gi1/1               Desg FWD 4         128.6    Shr
```

2) Проверить доступность каждого с каждым всех персональных компьютеров (VPCS), результаты запротоколировать

Настраиваем IP адреса на компьютерах

PC 1

ip 192.168.100.1 255.255.255.0

save

PC 2

ip 192.168.100.2 255.255.255.0

save

И т.д.

Теперь проверим все пинги.

Пример на PC1

ping 192.168.100.2

ping 192.168.100.3

ping 192.168.100.4

ping 192.168.100.5

ping 192.168.100.6

```
PC1> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=2.550 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=1.668 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=0.783 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=0.798 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=0.693 ms

PC1> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=4.597 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=16.181 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=2.758 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=10.269 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=13.374 ms

PC1> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=16.240 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=8.633 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=7.184 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=7.771 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=6.689 ms

PC1> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=7.351 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=8.788 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=10.136 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=7.725 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=6.163 ms

PC1> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=12.990 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=8.706 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=9.148 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=5.308 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=9.485 ms
```

```
PC2> ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=2.658 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=12.354 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=0.849 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=3.213 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=2.011 ms

PC2> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=5.270 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=5.451 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=3.074 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=3.591 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=7.330 ms

PC2> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=17.169 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=10.992 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=10.186 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=2.528 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=4.966 ms

PC2> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=7.980 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=8.568 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=12.560 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=6.056 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=17.995 ms

PC2> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=9.062 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=12.331 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=10.250 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=13.604 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=6.858 ms
```

```
PC3> ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=6.289 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=10.641 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=10.140 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=3.104 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=6.444 ms

PC3> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=11.391 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=8.075 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=8.018 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=11.062 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=8.671 ms

PC3> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=1.452 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=1.804 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=1.870 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=0.981 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=2.176 ms

PC3> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=14.395 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=12.290 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=14.307 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=13.335 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=5.928 ms

PC3> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=11.161 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=4.465 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=5.207 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=9.447 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=12.527 ms
```

```
PC4> ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=8.011 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=17.366 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=12.186 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=7.557 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=10.774 ms

PC4> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=15.964 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=6.826 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=9.128 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=6.473 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=12.639 ms

PC4> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=2.497 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=0.821 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=5.955 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=2.114 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=0.813 ms

PC4> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=4.396 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=11.422 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=2.198 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=1.896 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=9.124 ms

PC4> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=17.588 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=8.251 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=9.789 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=5.160 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=6.741 ms
```

```
PC5> ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=4.675 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=8.097 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=5.834 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=7.576 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=9.854 ms

PC5> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=8.360 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=4.027 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=3.521 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=19.526 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=4.398 ms

PC5> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=2.390 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=11.571 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=11.323 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=13.199 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=9.590 ms

PC5> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=4.287 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=15.888 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=11.518 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=18.574 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=2.668 ms

PC5> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=1.634 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=0.969 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=0.500 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=0.641 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=1.715 ms
```

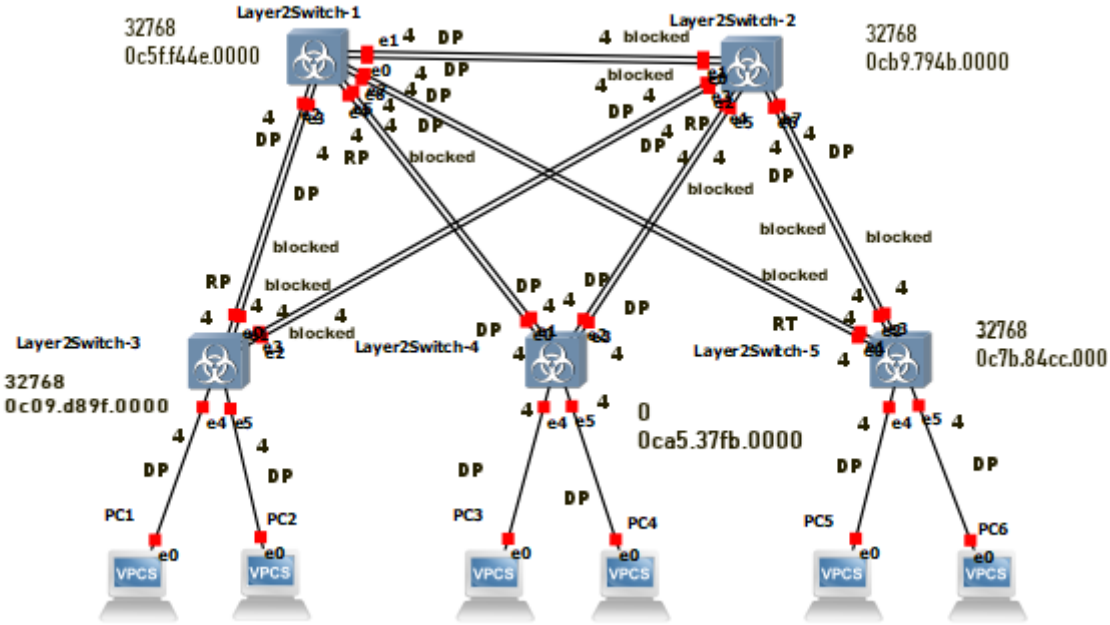
```
PC6> ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=4.878 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=15.298 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=6.945 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=6.197 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=6.812 ms

PC6> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=14.656 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=7.325 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=10.268 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=4.387 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=8.050 ms

PC6> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=13.224 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=5.988 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=9.808 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=10.310 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=2.926 ms

PC6> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=17.065 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=8.662 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=9.088 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=9.245 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=8.194 ms

PC6> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=15.237 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=3.099 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=4.739 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=6.190 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=2.284 ms
```

Оформим таблицу

| | PC1 | PC2 | PC3 | PC4 | PC5 | PC6 |
|---|---|---|---|---|---|---|
| PC1 | - | 5/5 | 5/5 | 5/5 | 5/5 | 5/5 |
| PC2 | 5/5 | - | 5/5 | 5/5 | 5/5 | 5/5 |
| PC3 | 5/5 | 5/5 | - | 5/5 | 5/5 | 5/5 |
| PC4 | 5/5 | 5/5 | 5/5 | - | 5/5 | 5/5 |
| PC5 | 5/5 | 5/5 | 5/5 | 5/5 | - | 5/5 |
| PC6 | 5/5 | 5/5 | 5/5 | 5/5 | 5/5 | - |

3) На изображении схемы отметить BID каждого коммутатора и режимы работы портов (RP/DP/blocked) и стоимости маршрутов, результат сохранить в файл.

Вновь пользуемся show spanning-tree и переносим всю информацию на изображение.




У рута как видим все линки служат для передачи (для рассылки пакетов hello). В некоторых свичах линки работают для передачи, но для свича-получателя этот линк заблокирован для отправки пакетов. Это нужно для передачи пакетов hello, на случай если линк к руту окажется не доступен и заблокированный порт перейдёт в статус активного.

4) При помощи wireshark отследить передачу пакетов hello от корневого коммутатора на всех линках (nb!), результаты включить в отчет

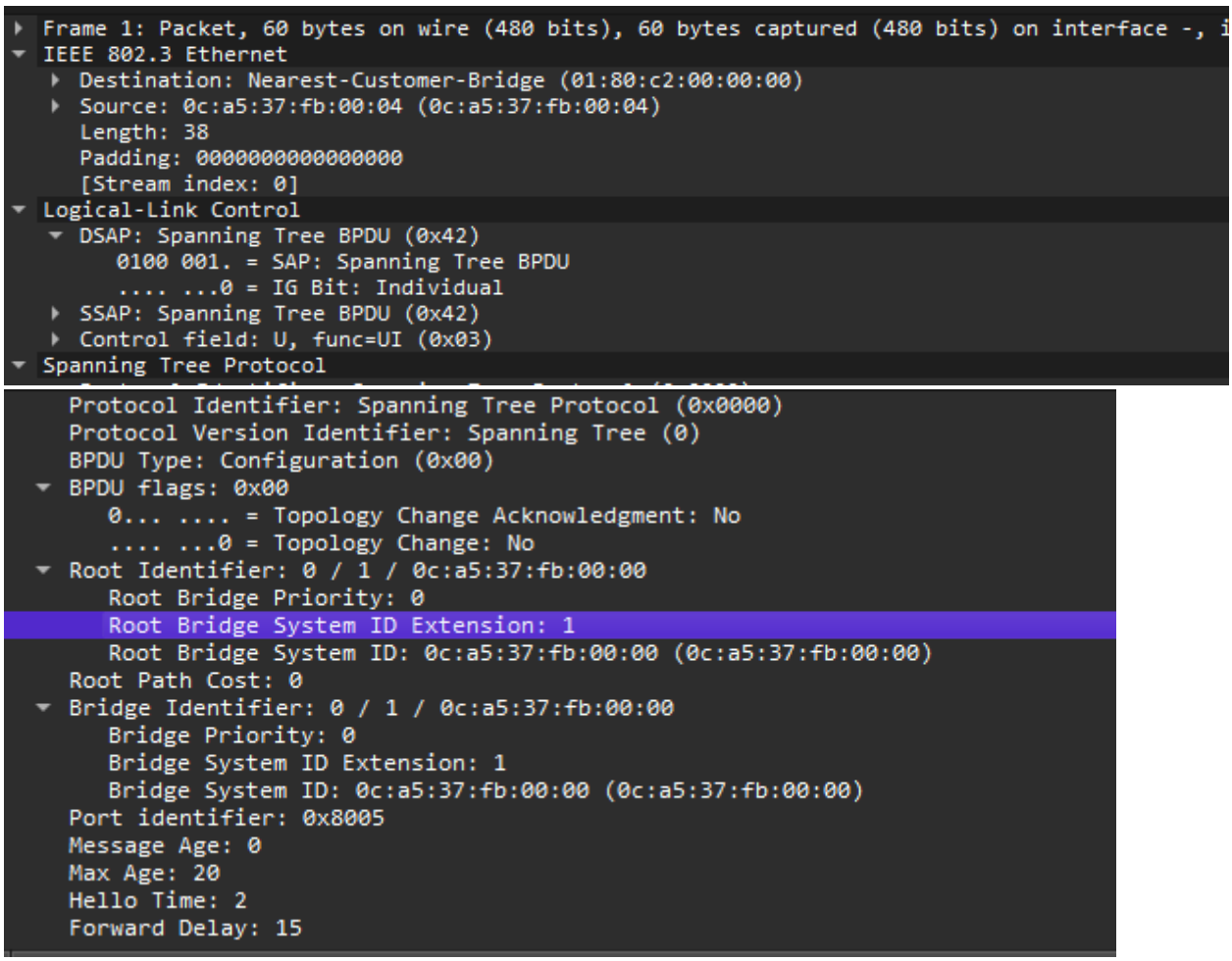
Начнём с корневого коммутатора.

На PC3

stp

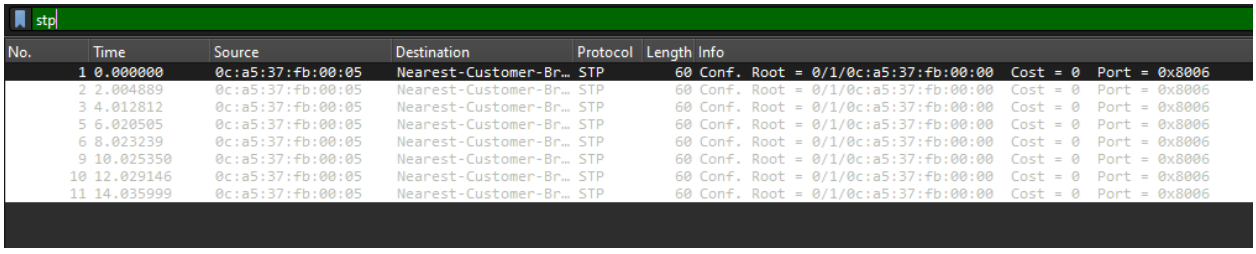
| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 1 | 0.000000 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 2 | 2.003347 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 4 | 4.010943 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 5 | 6.022631 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 6 | 8.028339 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 7 | 10.036121 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 8 | 12.040224 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 10 | 14.048303 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 11 | 16.060374 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 14 | 18.067871 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 15 | 20.073509 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 16 | 22.080193 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 18 | 24.089006 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 19 | 26.093614 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 20 | 28.103255 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 21 | 30.107308 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 22 | 32.110762 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 24 | 34.116644 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |
| 25 | 36.127033 | 0c:a5:37:fb:00:04 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8005 |

Как видим, BDPU приходят каждые 2 секунды. Рассмотрим сам пакет

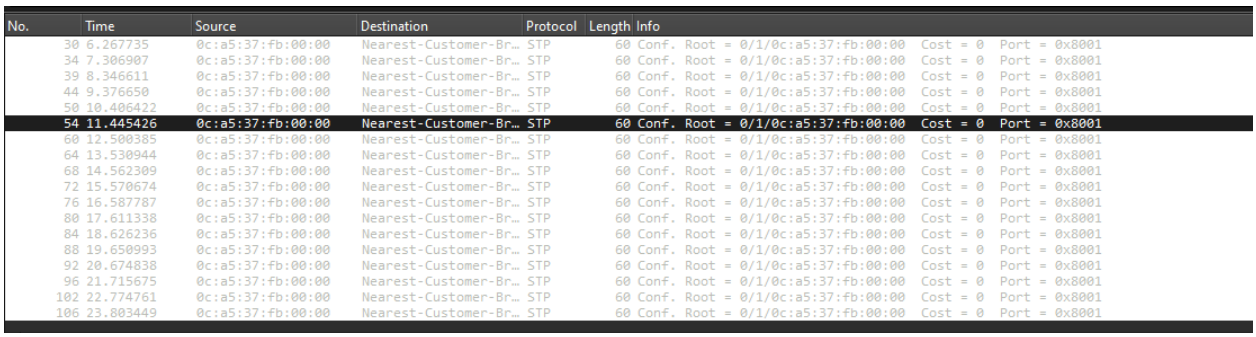



Передача 60 байт по канальному уровню с коммутатора на PC3. Длина (полезная нагрузка) 38, для минимального размера были добавлены нулевые байты. Протокол STP, идентификатор рута – приоритет 0б в системе ID 1 и MAC рута. Стоимость пути до рута - 0. Идентификатор моста совпадает с идентификатором рута, так как рут напрямую связан с PC3. Указан идентификатор порта, время жизни сообщения, максимальное время жизни сообщения, период hello и задержка. В дальнейшем пакеты для будут практически идентичны.

На PC4

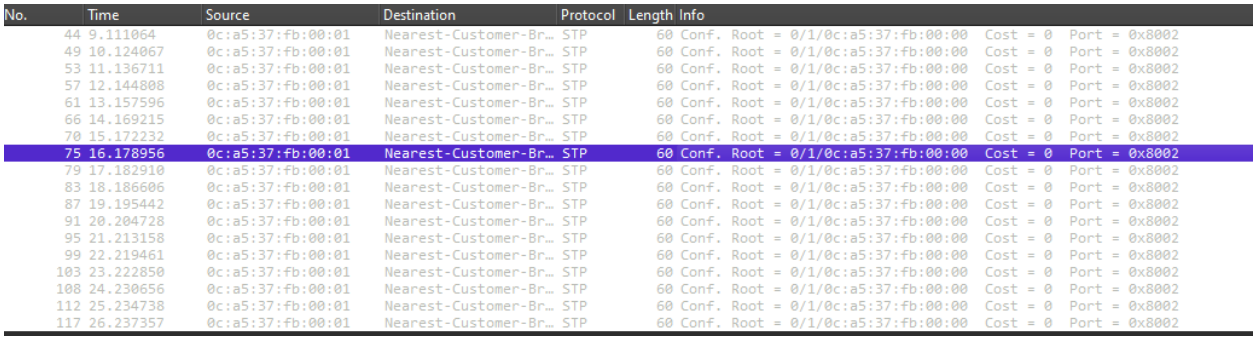



На Switch 1 e0



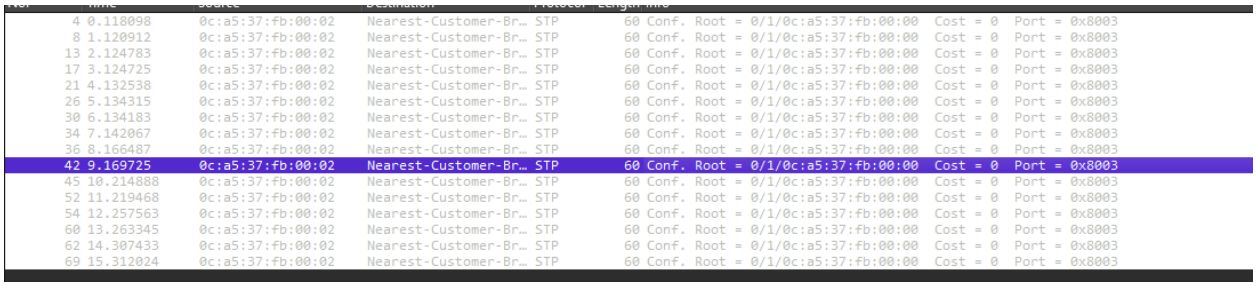
| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 30 | 6.267735 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 34 | 7.306907 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 39 | 8.346611 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 44 | 9.376650 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 50 | 10.406422 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 54 | 11.445426 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 60 | 12.500385 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 64 | 13.530944 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 68 | 14.562309 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 72 | 15.570674 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 76 | 16.587787 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 80 | 17.611338 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 84 | 18.626236 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 88 | 19.650993 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 92 | 20.674838 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 96 | 21.715675 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 102 | 22.774761 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |
| 106 | 23.803449 | 0c:a5:37:fb:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8001 |

E1



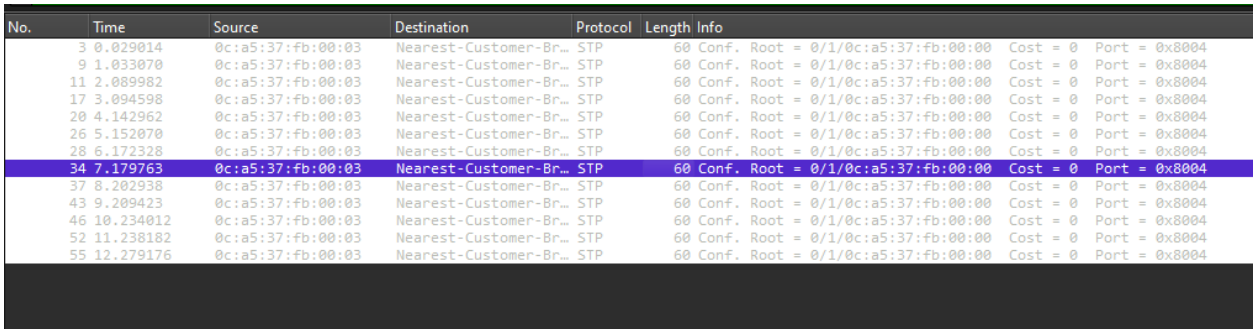
| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 44 | 9.111064 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 49 | 10.124067 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 53 | 11.136711 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 57 | 12.144808 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 61 | 13.157596 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 66 | 14.169215 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 70 | 15.172232 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 75 | 16.178956 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 79 | 17.182910 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 83 | 18.186606 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 87 | 19.195442 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 91 | 20.204728 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 95 | 21.213158 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 99 | 22.219461 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 103 | 23.222850 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 108 | 24.230656 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 112 | 25.234738 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |
| 117 | 26.237357 | 0c:a5:37:fb:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8002 |

e2



| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 0.118098 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 8 | 1.120912 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 13 | 2.124783 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 17 | 3.124725 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 21 | 4.132538 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 26 | 5.134315 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 30 | 6.134183 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 34 | 7.142067 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 36 | 8.166487 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 42 | 9.169725 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 45 | 10.214888 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 52 | 11.219468 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 54 | 12.257563 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 60 | 13.263345 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 62 | 14.307433 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |
| 69 | 15.312024 | 0c:a5:37:fb:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8003 |

E3

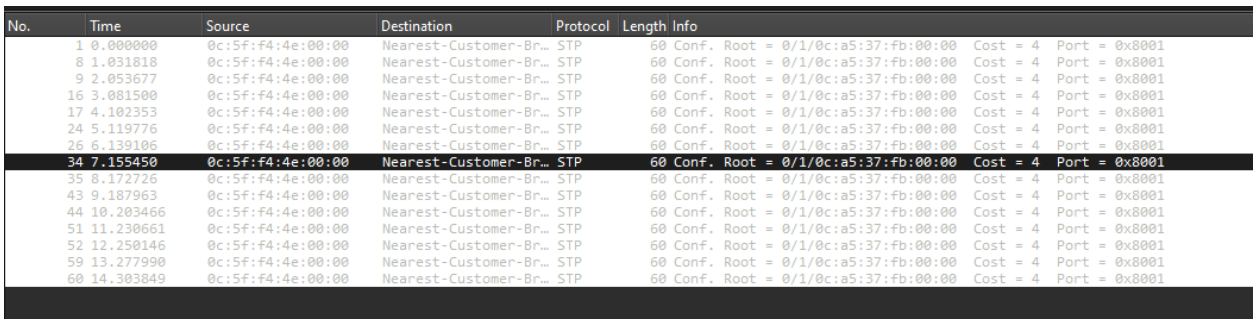


| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 3 | 0.029014 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 9 | 1.033070 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 11 | 2.089982 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 17 | 3.094598 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 20 | 4.142962 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 26 | 5.152070 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 28 | 6.172328 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 34 | 7.179763 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 37 | 8.202938 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 43 | 9.209423 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 46 | 10.234012 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 52 | 11.238182 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |
| 55 | 12.279176 | 0c:a5:37:fb:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 0 Port = 0x8004 |

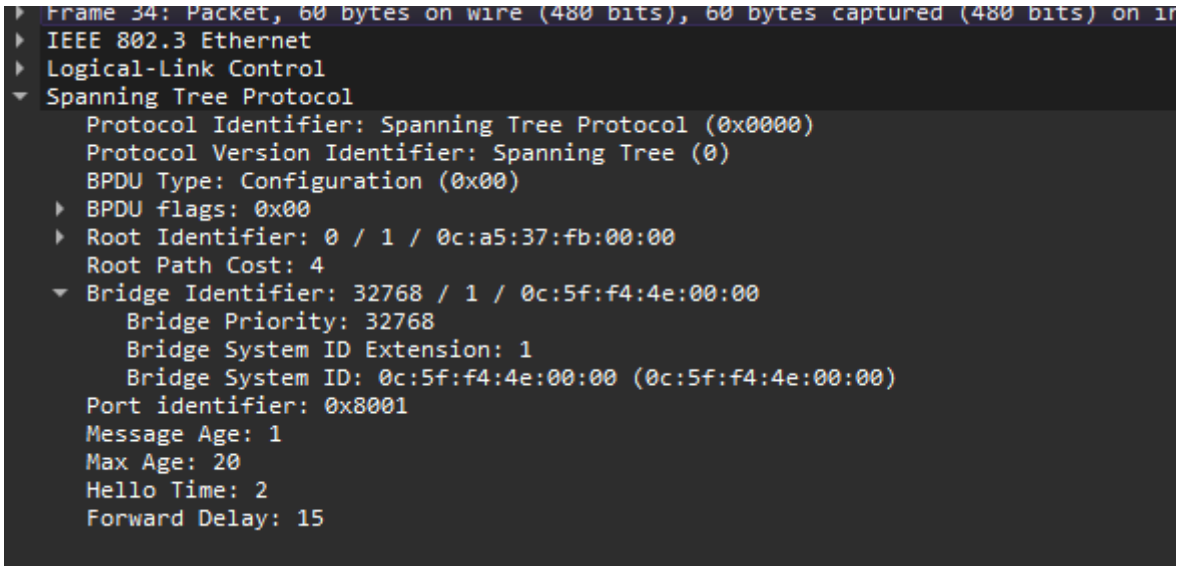
Так как все эти линки соединены с портом на прямую стоимость всегда 0.

Рассмотрим Switch2

E0



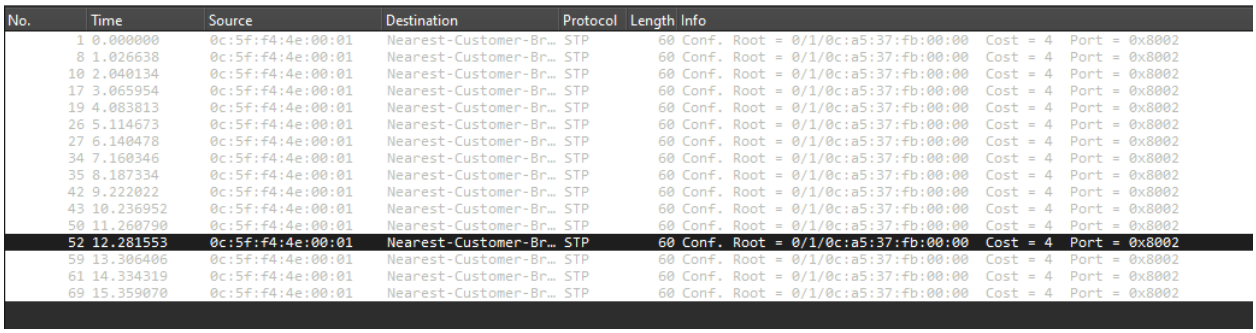
| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 1 | 0.000000 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 8 | 1.031818 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 9 | 2.053677 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 16 | 3.081500 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 17 | 4.102353 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 24 | 5.119776 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 26 | 6.139106 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 34 | 7.155450 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 35 | 8.172726 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 43 | 9.187963 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 44 | 10.203466 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 51 | 11.230661 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 52 | 12.250146 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 59 | 13.277990 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |
| 60 | 14.303849 | 0c:5f:f4:4e:00:00 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8001 |



```
▸ Frame 34: Packet, 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on in
▸ IEEE 802.3 Ethernet
▸ Logical-Link Control
▾ Spanning Tree Protocol
    Protocol Identifier: Spanning Tree Protocol (0x0000)
    Protocol Version Identifier: Spanning Tree (0)
    BPDU Type: Configuration (0x00)
  ▸ BPDU flags: 0x00
  ▸ Root Identifier: 0 / 1 / 0c:a5:37:fb:00:00
    Root Path Cost: 4
  ▾ Bridge Identifier: 32768 / 1 / 0c:5f:f4:4e:00:00
      Bridge Priority: 32768
      Bridge System ID Extension: 1
      Bridge System ID: 0c:5f:f4:4e:00:00 (0c:5f:f4:4e:00:00)
    Port identifier: 0x8001
    Message Age: 1
    Max Age: 20
    Hello Time: 2
    Forward Delay: 15
```

Стоимость поменялась, а также поменялось время жизни сообщения и идентификатор моста. Источником остался рут, но так как пакет был прислал по линку с другого моста, то в BID записана информация о свиче с которого пришло сообщение switch1.

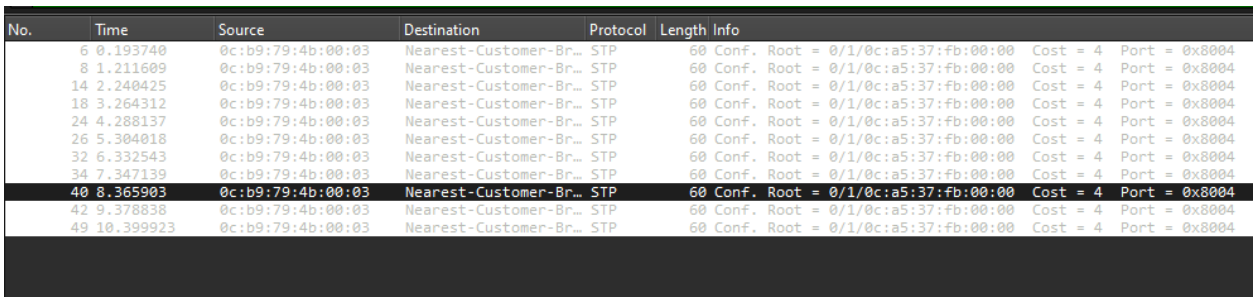
E1



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 1 | 0.000000 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 8 | 1.026638 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 10 | 2.040134 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 17 | 3.065954 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 19 | 4.083813 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 26 | 5.114673 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 27 | 6.140478 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 34 | 7.160346 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 35 | 8.187334 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 42 | 9.222022 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 43 | 10.236952 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 50 | 11.260790 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 52 | 12.281553 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 59 | 13.306406 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 61 | 14.334319 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |
| 69 | 15.359070 | 0c:5f:f4:4e:00:01 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8002 |

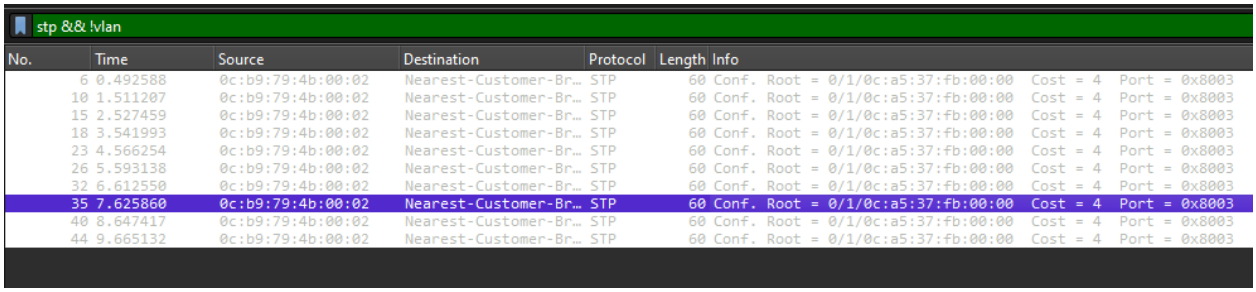
Так как e0, e1 – blocked мы видим только отправку со switch 1, но switch по линкам ничего не отправляет.

E2



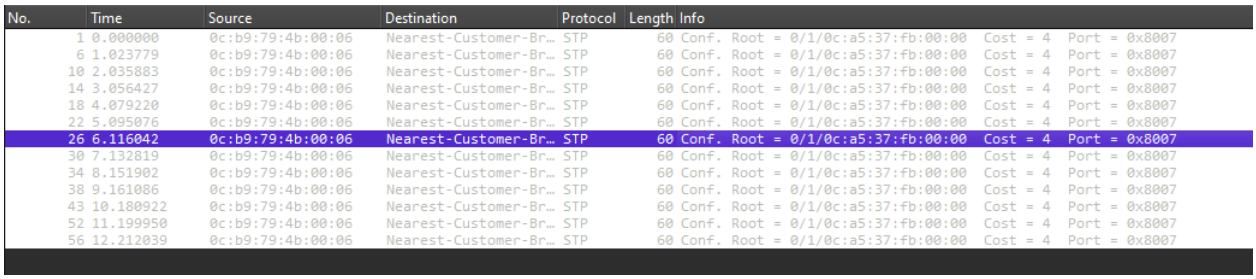
| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 6 | 0.193740 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 8 | 1.211609 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 14 | 2.240425 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 18 | 3.264312 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 24 | 4.288137 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 26 | 5.304018 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 32 | 6.332543 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 34 | 7.347139 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 40 | 8.365903 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 42 | 9.378838 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |
| 49 | 10.399923 | 0c:b9:79:4b:00:03 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8004 |

e3



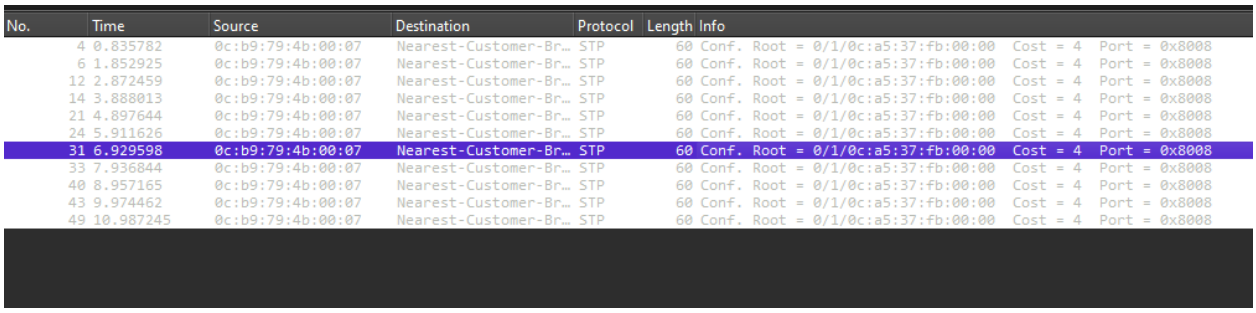

| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 6 | 0.492588 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 10 | 1.511207 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 15 | 2.527459 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 18 | 3.541993 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 23 | 4.566254 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 26 | 5.593138 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 32 | 6.612550 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 35 | 7.625860 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 40 | 8.647417 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |
| 44 | 9.665132 | 0c:b9:79:4b:00:02 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8003 |

E6



| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 1 | 0.000000 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 6 | 1.023779 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 10 | 2.035883 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 14 | 3.056427 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 18 | 4.079220 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 22 | 5.095076 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 26 | 6.116042 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 30 | 7.132819 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 34 | 8.151902 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 38 | 9.161086 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 43 | 10.180922 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 52 | 11.199950 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |
| 56 | 12.212039 | 0c:b9:79:4b:00:06 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8007 |

E7

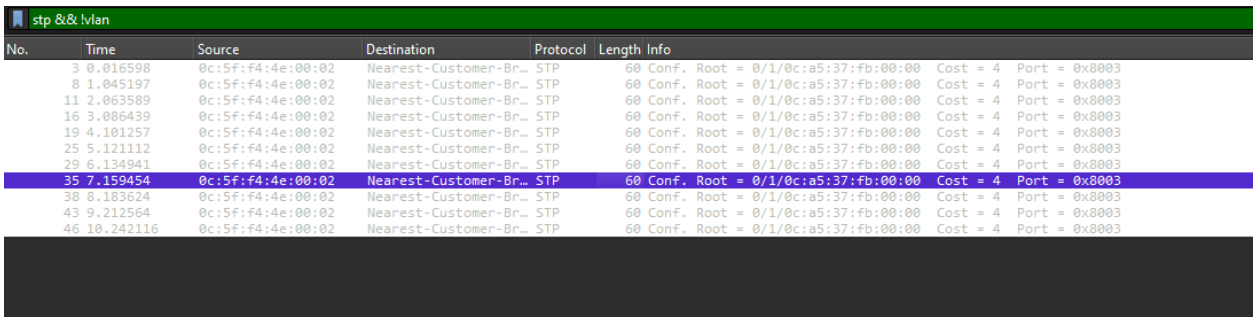


| No. | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 4 | 0.835782 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 6 | 1.852925 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 12 | 2.872459 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 14 | 3.888013 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 21 | 4.897644 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 24 | 5.911626 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 31 | 6.929598 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 33 | 7.936844 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 40 | 8.957165 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 43 | 9.974462 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |
| 49 | 10.987245 | 0c:b9:79:4b:00:07 | Nearest-Customer-Br… | STP | 60 | Conf. Root = 0/1/0c:a5:37:fb:00:00 Cost = 4 Port = 0x8008 |

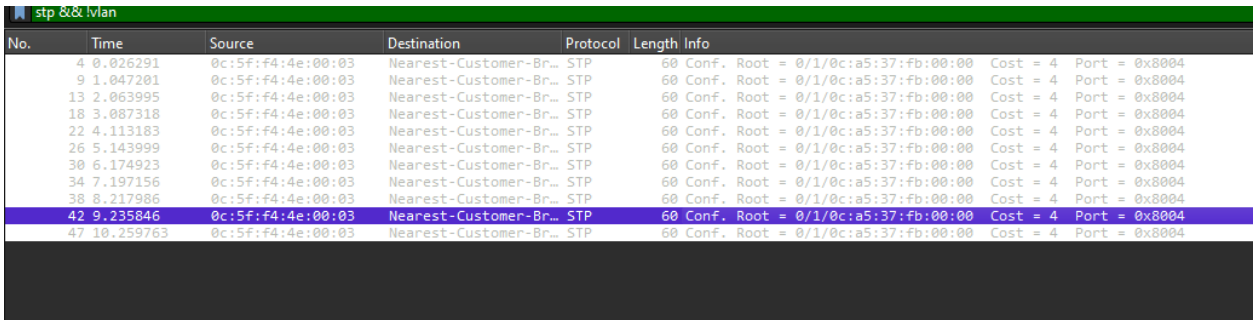
На этих линках ситуация аналогична, но теперь DPDU рассылает только switch2, ведь у других коммутаторов порты blocked.

Рассмотрим switch1

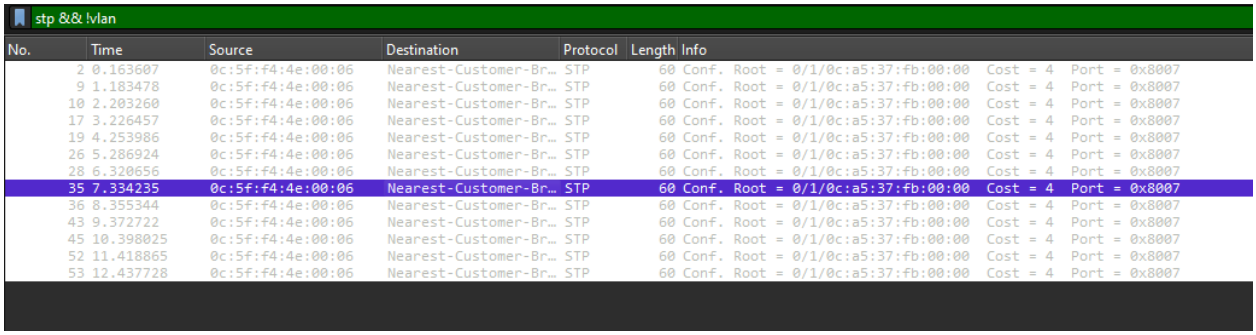
E2



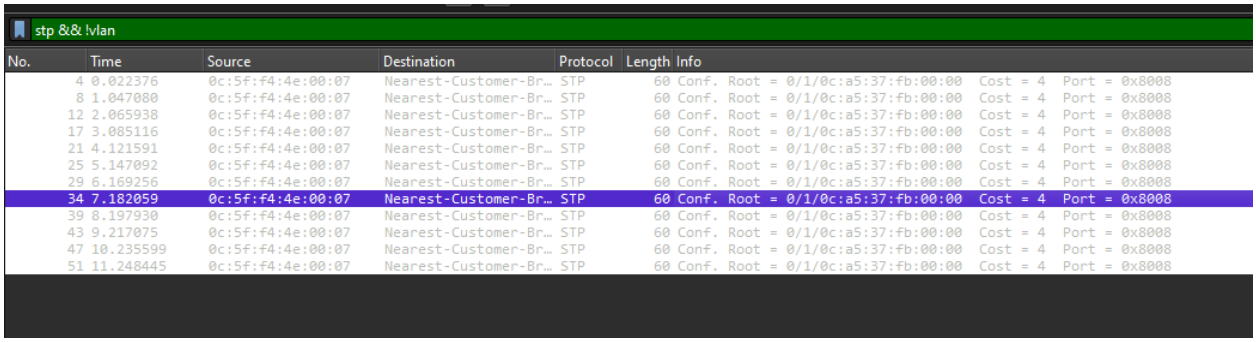

E3




E6



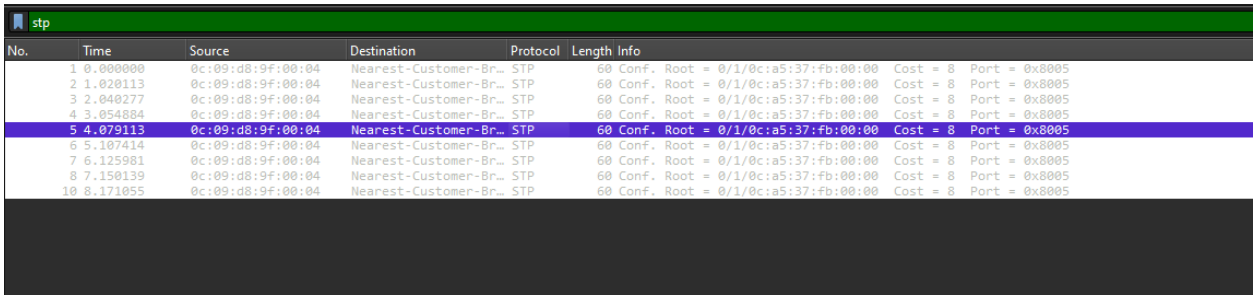

E7




Отправляет BPDU только коммутатор 1, а другие порты на линках или blocked или root, но рассылать пакет root не имеет смысла, так как он является отправителем.

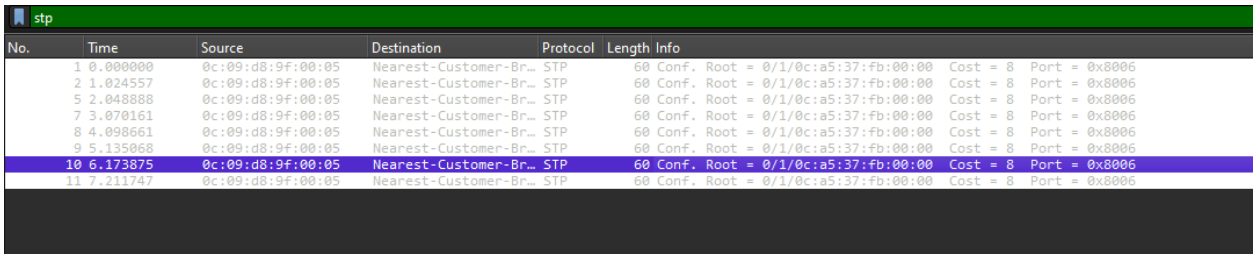
Рассмотрим switch 3

PC1



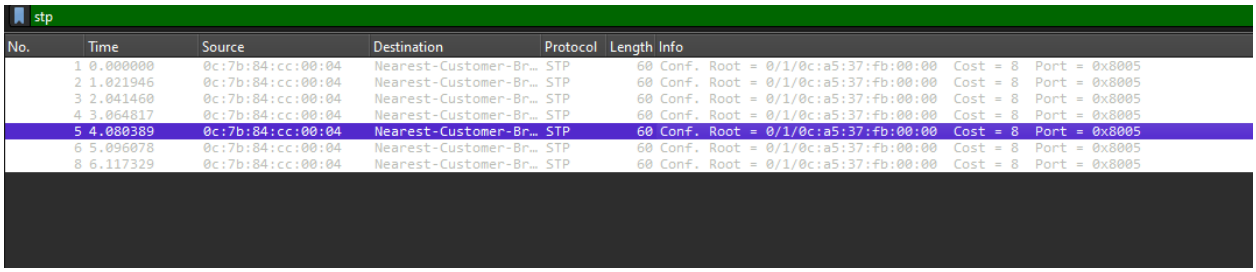

Со свича 3 передаём сообщение на PC, стоимость вновь увеличилась

PC2

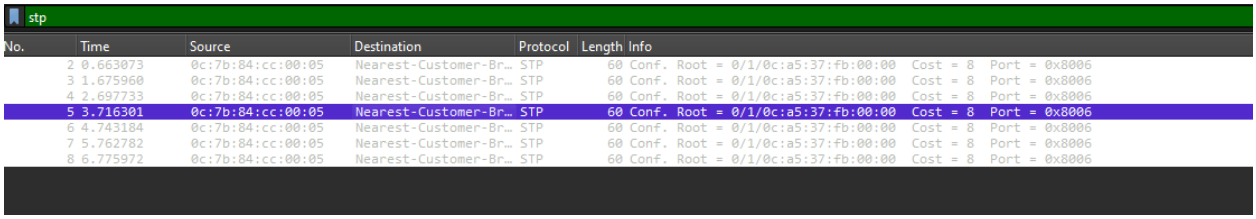



Рассмотрим switch 5

PC5




PC6




5) Изменить стоимость маршрута для порта RP произвольного назначенного (designated) коммутатора, повторить действия из п.3, результат сохранить в отдельный файл

Будем редактировать маршрут на коммутаторе Switch1. Посмотрим на какой интерфейсе подключён маршрут до рута – (Gi1/0)

show spanning-tree

```
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
 --More--
```

Изменим стоимость маршрута.

enable

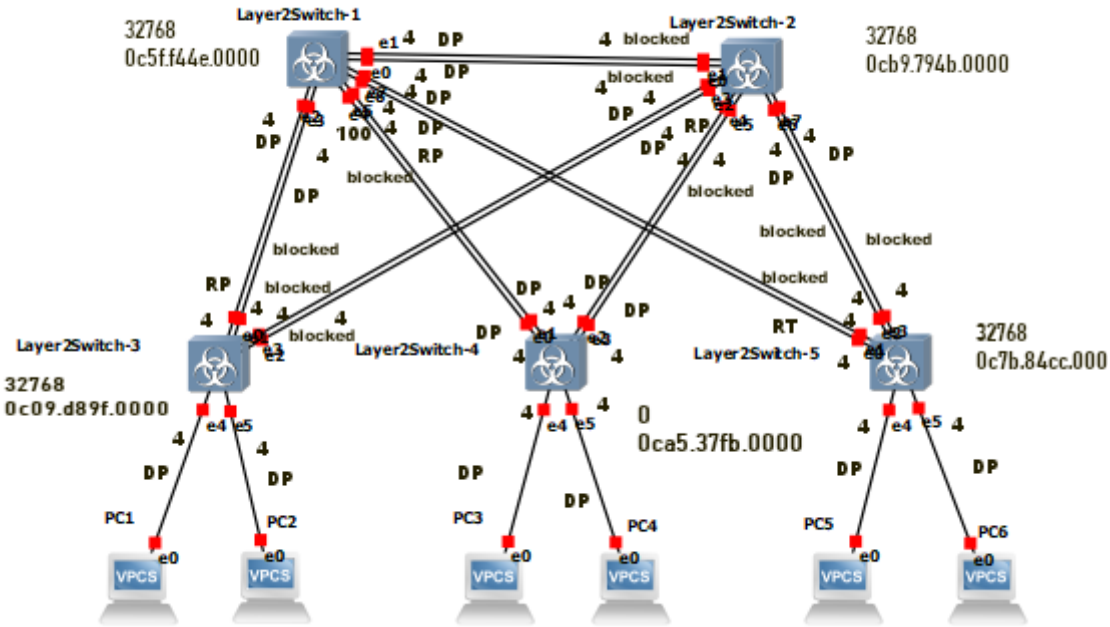
configure terminal

interface Gi1/0

spanning-tree cost 100

exit

write memory




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

Сохраняем конфигурацию для каждого коммутатора.
enable

show running-config

7*) Опциональное задание: заменить STP на RSTP (IEEE 802.1w), повторить 1-6, отметить резервные порты в п.3 и п.5,

отличие работы протокола RSTP от протокола STP в п.4

Включим протокол RSTP на каждом коммутаторе

enable

configure terminal

spanning-tree mode rapid-pvst

exit

Теперь вновь сделаем Switch4 корневым.

enable

configure terminal

spanning-tree vlan 1 priority 0

exit

write memory

Проверим результат на switch4, введя show spanning-tree

```
VLAN0001
  Spanning tree enabled protocol rstp
  Root ID    Priority    1
             Address     0cfa.2ef4.0000
             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     0cfa.2ef4.0000
             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
```

Как видим используемый протокол – rstp, приоритет изменился и данный коммутатор является рутом.

Однако если будем смотреть свитч с подключением к PC можем обнаружить что порты к PC заблокированы. Нужно указать, что на пути к эти портам не может быть петли и блокировать их не нужно.

enable

configure terminal

interface Gi1/0

spanning-tree portfast

no shutdown

exit

write memory

Также некоторые порты могут войти в err-disabled. Нужно снова их включить

enable

configure terminal

interface Gi0/2

shutdown

no shutdown

exit

interface Gi0/3

shutdown

no shutdown

exit

write memory

Пример настройки на switch3

```
VLAN0001
  Spanning tree enabled protocol rstp
  Root ID     Priority    1
              Address     0cfa.2ef4.0000
              Cost        8
              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     0cb4.ae2f.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               Root FWD 4         128.3    Shr
Gi0/3               Altn BLK 4         128.4    Shr
Gi1/0               Desg FWD 4         128.5    Shr Edge
Gi1/1               Desg FWD 4         128.6    Shr Edge
```

Точно также настраиваем IP как в п.2 и пингуем.

На PC1

ip 192.168.100.1/24

save

```
PC1> ping 192.168.100.2

84 bytes from 192.168.100.2 icmp_seq=1 ttl=64 time=8.014 ms
84 bytes from 192.168.100.2 icmp_seq=2 ttl=64 time=0.738 ms
84 bytes from 192.168.100.2 icmp_seq=3 ttl=64 time=1.169 ms
84 bytes from 192.168.100.2 icmp_seq=4 ttl=64 time=4.190 ms
84 bytes from 192.168.100.2 icmp_seq=5 ttl=64 time=1.087 ms

PC1> ping 192.168.100.3

host (192.168.100.3) not reachable

PC1> ping 192.168.100.4

host (192.168.100.4) not reachable

PC1> ping 192.168.100.5

host (192.168.100.5) not reachable

PC1> ping 192.168.100.6

host (192.168.100.6) not reachable
```

На PC2

```
ping 192.168.100.1

84 bytes from 192.168.100.1 icmp_seq=1 ttl=64 time=8.891 ms
84 bytes from 192.168.100.1 icmp_seq=2 ttl=64 time=5.974 ms
84 bytes from 192.168.100.1 icmp_seq=3 ttl=64 time=1.323 ms
84 bytes from 192.168.100.1 icmp_seq=4 ttl=64 time=6.988 ms
84 bytes from 192.168.100.1 icmp_seq=5 ttl=64 time=6.226 ms

PC2> ping 192.168.100.3

host (192.168.100.3) not reachable

PC2> ping 192.168.100.4

host (192.168.100.4) not reachable

PC2> ping 192.168.100.5

host (192.168.100.5) not reachable

PC2> ping 192.168.100.6

host (192.168.100.6) not reachable
```

На PC3

```
PC3> ping 192.168.100.1

host (192.168.100.1) not reachable

PC3> ping 192.168.100.2

host (192.168.100.2) not reachable

PC3> ping 192.168.100.4

84 bytes from 192.168.100.4 icmp_seq=1 ttl=64 time=1.893 ms
84 bytes from 192.168.100.4 icmp_seq=2 ttl=64 time=17.328 ms
84 bytes from 192.168.100.4 icmp_seq=3 ttl=64 time=1.311 ms
84 bytes from 192.168.100.4 icmp_seq=4 ttl=64 time=5.547 ms
84 bytes from 192.168.100.4 icmp_seq=5 ttl=64 time=5.887 ms

PC3> ping 192.168.100.5

host (192.168.100.5) not reachable

PC3> ping 192.168.100.6

host (192.168.100.6) not reachable
```

На PC4

```
PC4> ping 192.168.100.1

host (192.168.100.1) not reachable

PC4> ping 192.168.100.2

host (192.168.100.2) not reachable

PC4> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=3.667 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=18.102 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=3.536 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=1.806 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=6.748 ms

PC4> ping 192.168.100.5

host (192.168.100.5) not reachable

PC4> ping 192.168.100.6

host (192.168.100.6) not reachable
```

Ha PC5

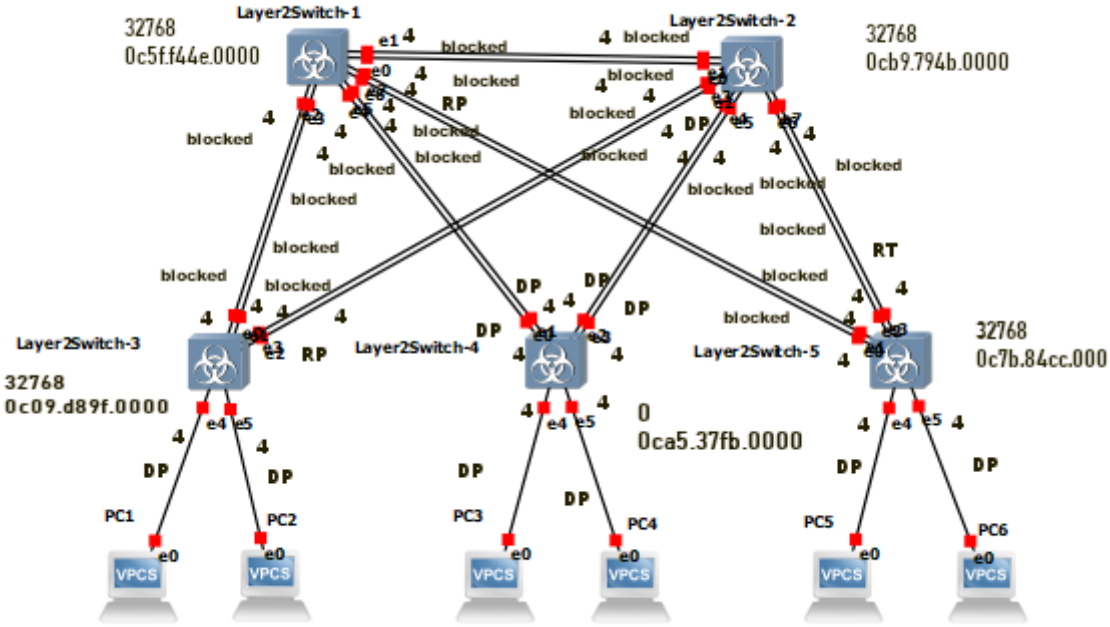
```
PC5> ping 192.168.100.6

84 bytes from 192.168.100.6 icmp_seq=1 ttl=64 time=1.001 ms
84 bytes from 192.168.100.6 icmp_seq=2 ttl=64 time=6.087 ms
84 bytes from 192.168.100.6 icmp_seq=3 ttl=64 time=4.035 ms
84 bytes from 192.168.100.6 icmp_seq=4 ttl=64 time=17.263 ms
84 bytes from 192.168.100.6 icmp_seq=5 ttl=64 time=5.814 ms

PC5> ping 192.168.100.1

host (192.168.100.1) not reachable

PC5> ping 192.168.100.2

host (192.168.100.2) not reachable

PC5> ping 192.168.100.3

host (192.168.100.3) not reachable

PC5> ping 192.168.100.4

host (192.168.100.4) not reachable
```

Ha PC6

```
PC6> ping 192.168.100.1

host (192.168.100.1) not reachable

PC6> ping 192.168.100.2

host (192.168.100.2) not reachable

PC6> ping 192.168.100.3

host (192.168.100.3) not reachable

PC6> ping 192.168.100.4

host (192.168.100.4) not reachable

PC6> ping 192.168.100.5

84 bytes from 192.168.100.5 icmp_seq=1 ttl=64 time=6.080 ms
84 bytes from 192.168.100.5 icmp_seq=2 ttl=64 time=7.835 ms
84 bytes from 192.168.100.5 icmp_seq=3 ttl=64 time=2.188 ms
84 bytes from 192.168.100.5 icmp_seq=4 ttl=64 time=6.919 ms
84 bytes from 192.168.100.5 icmp_seq=5 ttl=64 time=4.388 ms
```

Так как RSTP устанавливает более жёсткие правила для блокировки портов, то пинг проходит только для PC в одном сегменте сети, так как порты, ведущие к другим коммутаторам, оказались blocked.

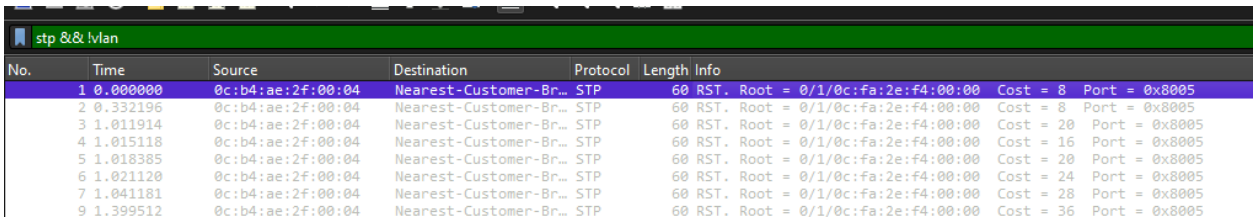
В итоге связь в сети выглядит следующим образом:



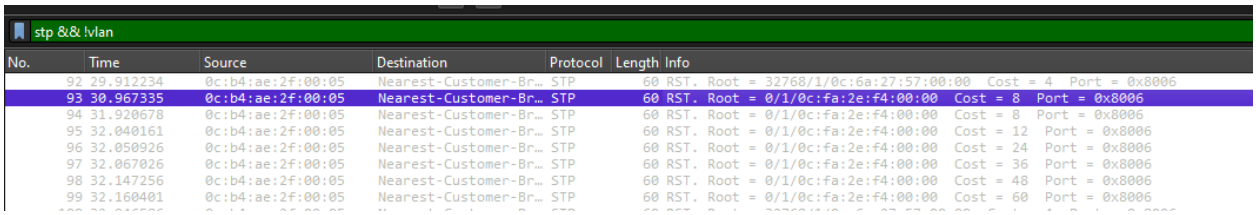

Посмотрим передачу пакетов hello на всех линках.

Начнём с switch3

Switch3-PC1

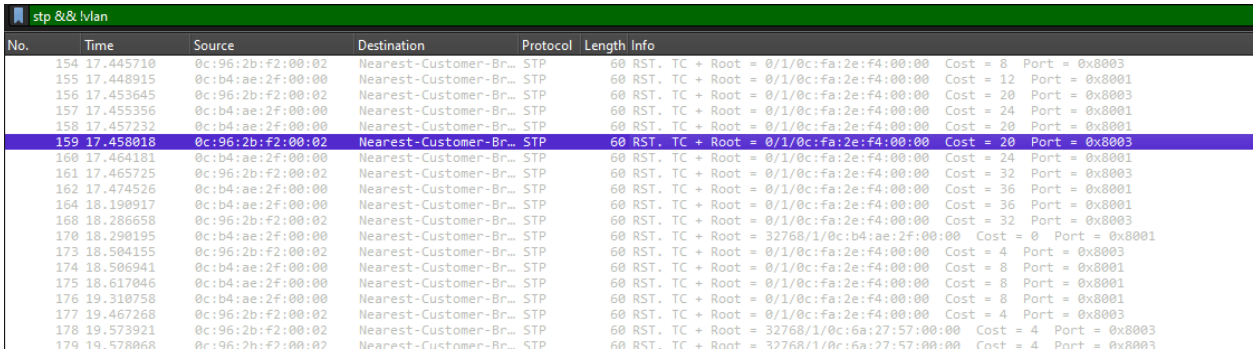



Switch3-PC2

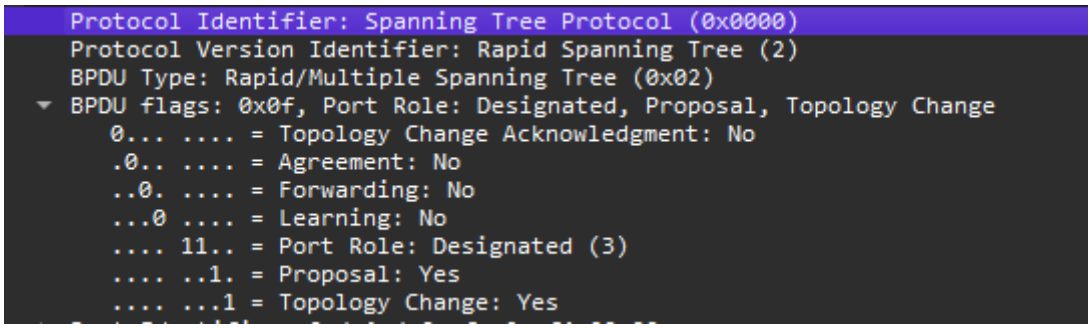



До PC доходит BDPU пакеты, доставляемых по разным маршрутам.

Switch3-Switch1 (e0)

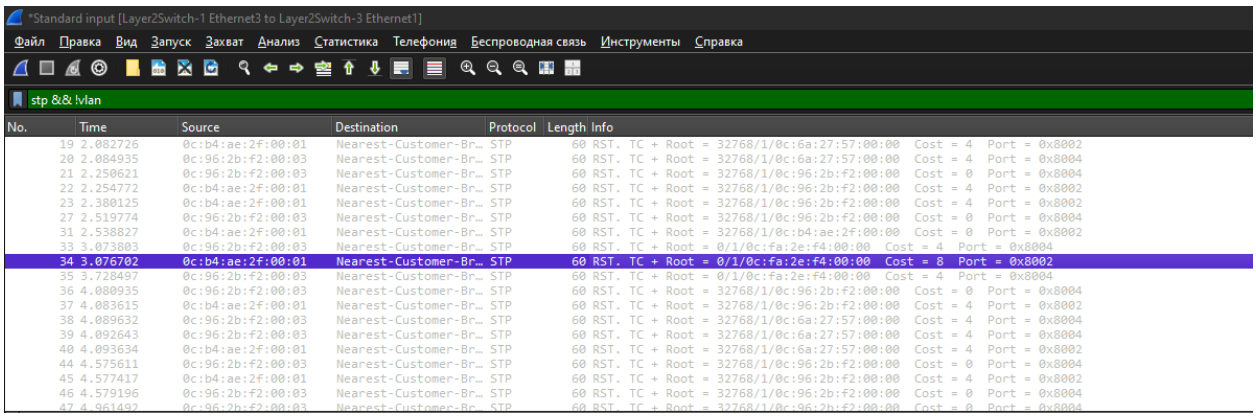


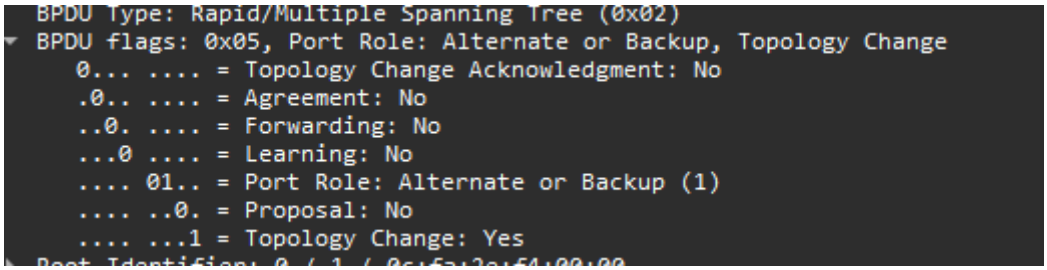

Рассмотрим изменения в пакете




Используется протокол RSTP. Порт является Designated, RSTP недавно изменяло топологию.

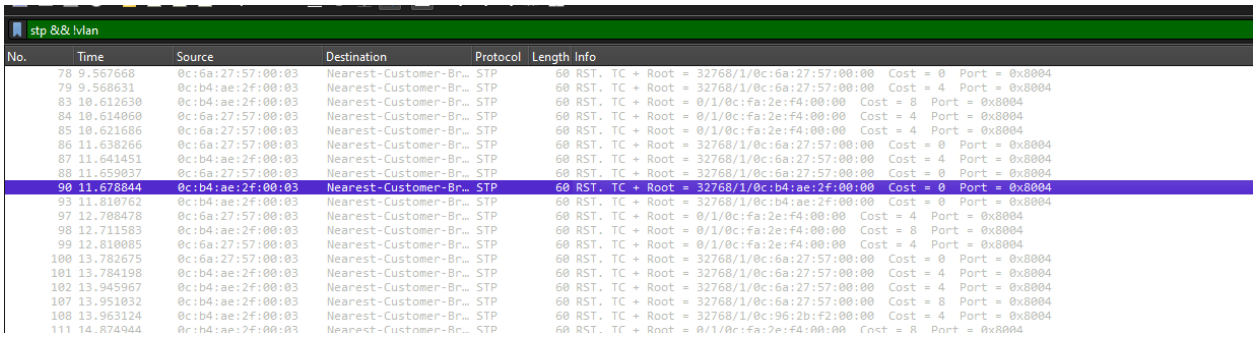
Switch3-Switch1 (e1)



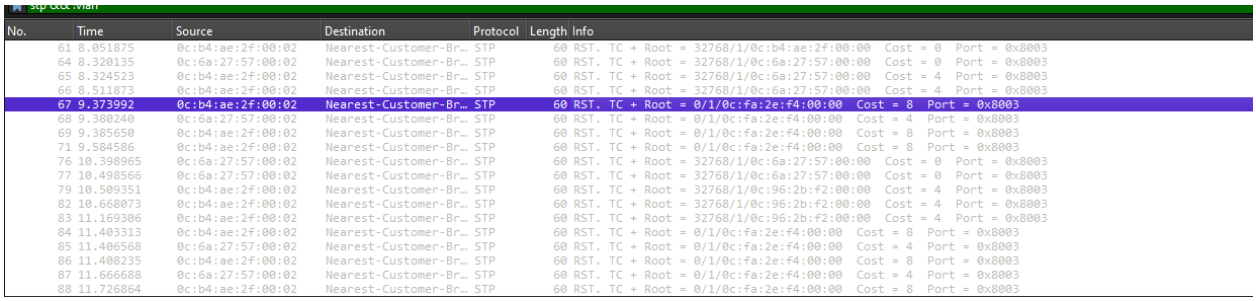




В этом случае порт, с которого пришёл пакет является запасным.

Switch3-Switch2 (e3)

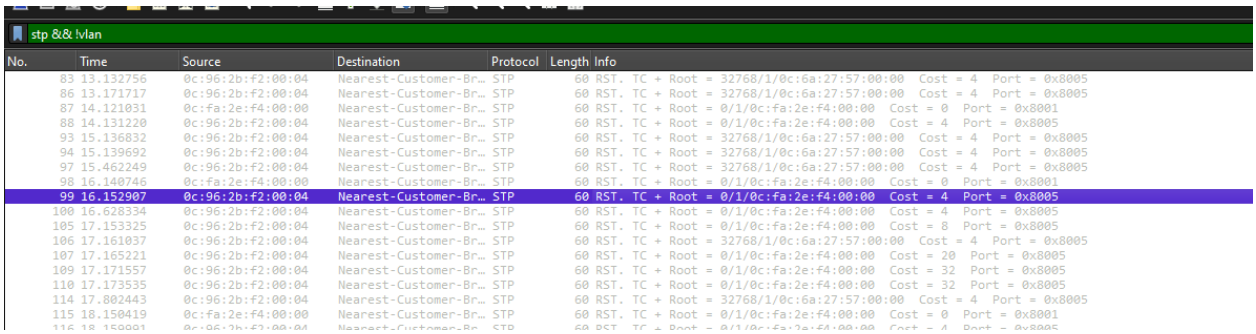



Switch3-Switch2 (e2)




В протоколе RSTP BPDU-пакеты рассылают все порты, независимо от статуса, поэтому мы видим на линках множество пакетов от разных отправителей, с разной стоимостью.

Посмотрим связь на руте switch4-switch1




Руту тоже приходят пакеты с других портов, которые просто сообщают ему о стоимости маршрута.

В остальном на всех оставшихся линках картина одинакова.

Изменим cost на swicth1

enable

configure terminal

interface Gi0/2

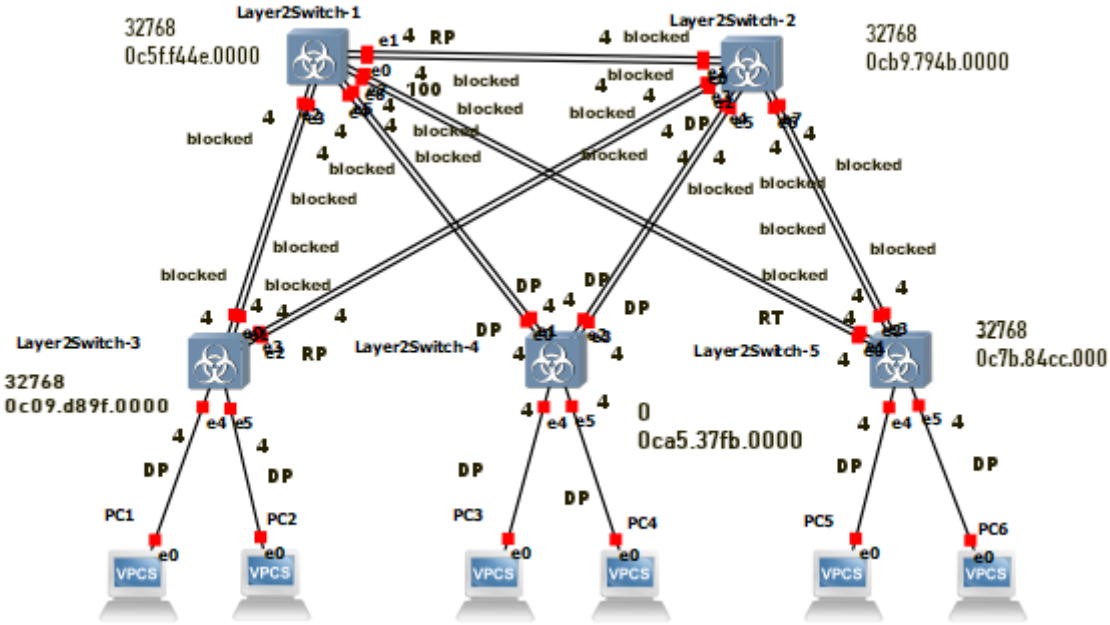
spanning-tree cost 100

exit

write memory

show spanning-tree

```
VLAN0001
  Spanning tree enabled protocol rstp
  Root ID     Priority    1
              Address     0cfa.2ef4.0000
              Cost        40
              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     0c96.2bf2.0000
              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 BLK 4         128.1    P2p
Gi0/1               Root FWD 4         128.2    P2p
Gi0/2               Desg BLK 100       128.3    P2p
Gi0/3               Desg BLK 4         128.4    P2p
Gi1/0               Desg BLK 4         128.5    P2p
Gi1/1               Desg BLK 4         128.6    P2p
Gi1/2               Desg BLK 4         128.7    Shr
```




В отличие от STP произошло не просто переключение на альтернативный порт – дерево перестроилось, изменились активные порты как на switch1, так и связанным с ним switch5.

Сохраним конфигурации.

enable

show running-config