Лабораторная работа №9

Использование протокола STP. Агрегирование каналов.

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Информация

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Цель работы

Изучить возможности протокола STP и его модификаций по обеспечению отказоустойчивости сети, агрегированию интерфейсов и перераспределению нагрузки между ними.

Задание

1. Сформировать резервное соединение между коммутаторами msk-donskayasw-1 и msk-donskaya-sw-3.
2. Настроить балансировку нагрузки между резервными соединениями.
3. Настроить режим Portfast на тех интерфейсах коммутаторов, к которым подключены серверы.
4. Изучить отказоустойчивость резервного соединения.
5. Сформировать и настроить агрегированное соединение интерфейсов Fa0/20 – Fa0/23 между коммутаторами msk-donskaya-sw-1 и msk-donskaya-sw-4.
6. При выполнении работы необходимо учитывать соглашение об именовании.

Выполнение лабораторной работы

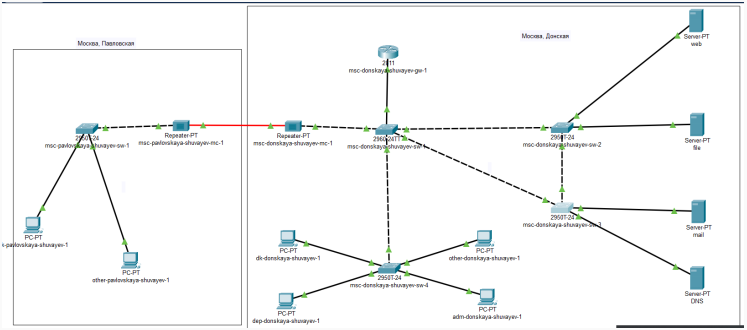

Figure 1: Логическая схема локальной сети с резервным соединением

```
User Access Verification

Password:

msc-donskaya-shuvayev-sw-3>en
Password:
msc-donskaya-shuvayev-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msc-donskaya-shuvayev-sw-3(config)#int g0/2
msc-donskaya-shuvayev-sw-3(config-if)#switchport mode trunk
msc-donskaya-shuvayev-sw-3(config-if)#exit
msc-donskaya-shuvayev-sw-3(config)#exit
msc-donskaya-shuvayev-sw-3#
%SYS-5-CONFIG_I: Configured from console by console
write m
Building configuration...
[OK]
msc-donskaya-shuvayev-sw-3#
```

Figure 2: Настройка trunk-порта на интерфейсе Gig0/2 коммутатора msk-donskaya-sw-3

Выполнение лабораторной работы

```
Pinging 10.128.0.2 with 32 bytes of data:

Request timed out.
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127

Ping statistics for 10.128.0.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>www.donskaya.rudn.ru
Invalid Command.

C:\>ping www.donskaya.rudn.ru

Pinging 10.128.0.2 with 32 bytes of data:

Reply from 10.128.0.2: bytes=32 time<1ms TTL=127
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127
Reply from 10.128.0.2: bytes=32 time<1ms TTL=127

Ping statistics for 10.128.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping mail.donskaya.rudn.ru

Pinging 10.128.0.4 with 32 bytes of data:

Request timed out.
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127

Ping statistics for 10.128.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Выполнение лабораторной работы

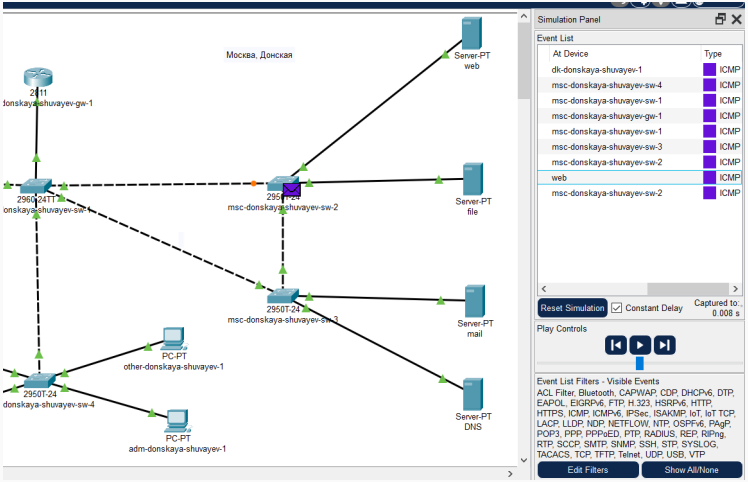

Figure 4: Режим симуляции движения пакетов ICMP

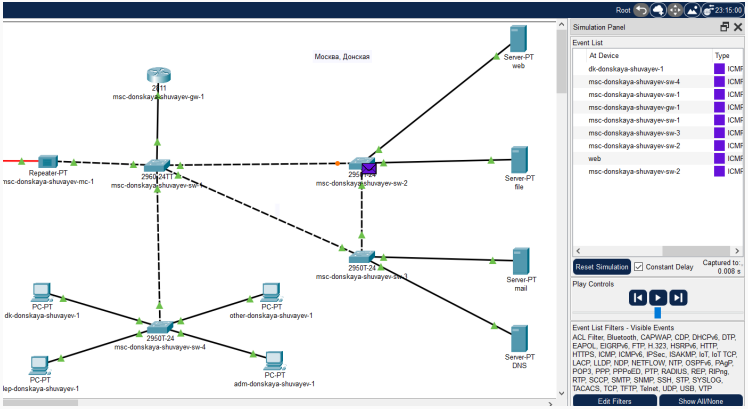

Figure 5: Режим симуляции движения пакетов ICMP

```
msc-donskaya-shuvayev-sw-2>en
Password:
msc-donskaya-shuvayev-sw-2#show spanning-tree vlan 3
VLAN0003
  Spanning tree enabled protocol ieee
  Root ID     Priority    32771
              Address     0009.7CA4.DC61
              Cost        4
              Port        26(GigabitEthernet0/2)
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32771  (priority 32768 sys-id-ext 3)
              Address     00D0.975E.5EB7
              Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/2            Desg FWD 19        128.2    P2p
Gi0/1            Altn BLK 4         128.25   P2p
Gi0/2            Root FWD 4         128.26   P2p

msc-donskaya-shuvayev-sw-2#
```

Figure 6: Просмотр состояния протокола STP для vlan 3

Выполнение лабораторной работы

```
msc-donskaya-shuvayev-sw-1#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0009.7CA4.DC61
             Cost        4
             Port        26(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     000B.BE67.5772
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/24           Desg FWD 19        128.24   P2p
Fa0/23           Desg FWD 19        128.23   P2p
Gi0/1            Desg FWD 4         128.25   P2p
Gi0/2            Root FWD 4         128.26   P2p
Fa0/1            Desg FWD 19        128.1    Shr

VLAN0002
  Spanning tree enabled protocol ieee
  Root ID    Priority    32770
             Address     0009.7CA4.DC61
             Cost        4
             Port        26(GigabitEthernet0/2)
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32770  (priority 32768 sys-id-ext 2)
 --More--
```

Выполнение лабораторной работы

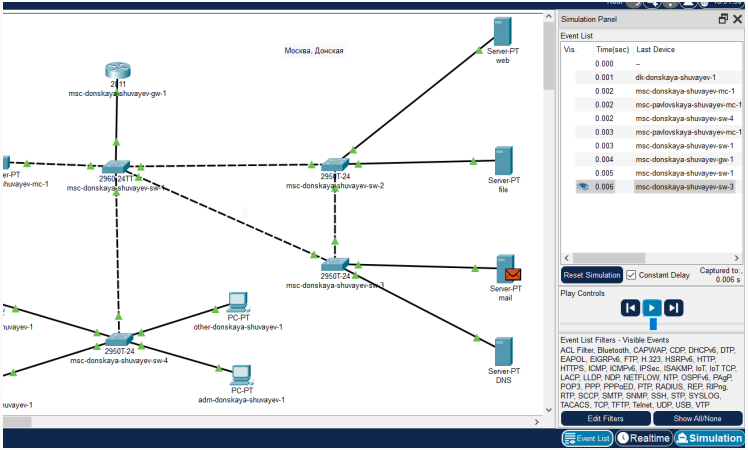

Figure 8: Режим симуляции движения пакетов ICMP к серверу web

Выполнение лабораторной работы

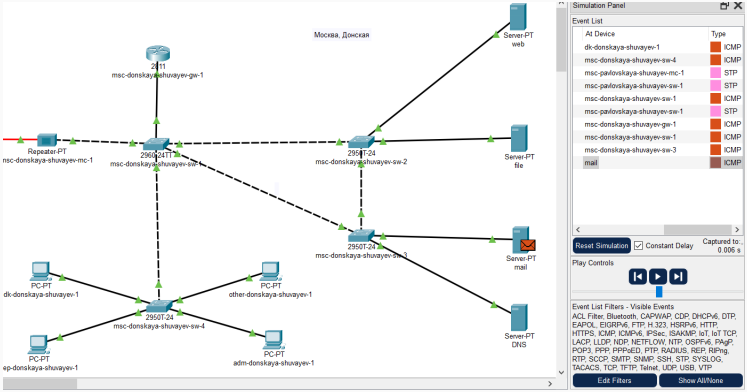

Figure 9: Режим симуляции движения пакетов ICMP к серверу mail

Выполнение лабораторной работы

```
User Access Verification

Password:

msc-donskaya-shuvayev-sw-2>en
Password:
msc-donskaya-shuvayev-sw-2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msc-donskaya-shuvayev-sw-2(config)#int f0/1
msc-donskaya-shuvayev-sw-2(config-if)#spanning-tree portfast
%Warning: portfast should only be enabled on ports connected to a single
host. Connecting hubs, concentrators, switches, bridges, etc... to this
interface  when portfast is enabled, can cause temporary bridging loops.
Use with CAUTION

%Portfast has been configured on FastEthernet0/1 but will only
have effect when the interface is in a non-trunking mode.
msc-donskaya-shuvayev-sw-2(config-if)#int f0/2
msc-donskaya-shuvayev-sw-2(config-if)#spanning-tree portfast
%Warning: portfast should only be enabled on ports connected to a single
host. Connecting hubs, concentrators, switches, bridges, etc... to this
interface  when portfast is enabled, can cause temporary bridging loops.
Use with CAUTION

%Portfast has been configured on FastEthernet0/2 but will only
have effect when the interface is in a non-trunking mode.
msc-donskaya-shuvayev-sw-2(config-if)#exit
msc-donskaya-shuvayev-sw-2(config)#exit
msc-donskaya-shuvayev-sw-2#
%SYS-5-CONFIG_I: Configured from console by console
write m
Building configuration...
[OK]
msc-donskaya-shuvayev-sw-2#
```

Выполнение лабораторной работы

```
C:\>ping -n 1000 mail.donskaya.rudn.ru

Pinging 10.128.0.4 with 32 bytes of data:

Reply from 10.128.0.4: bytes=32 time=10ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=17ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=12ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=15ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=12ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
```

Выполнение лабораторной работы

```
[OK]
msc-donskaya-shuvayev-sw-3#en
msc-donskaya-shuvayev-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msc-donskaya-shuvayev-sw-3(config)#int g0/2
msc-donskaya-shuvayev-sw-3(config-if)#shutdown

msc-donskaya-shuvayev-sw-3(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to administratively down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to down
```

Figure 12: Разрыв соединения

```
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
```

```
msc-donskaya-shuvayev-sw-1(config)#spanning-tree mode rapid-pvst
msc-donskaya-shuvayev-sw-1(config)#
```

Figure 14: Режим работы по протоколу Rapid PVST+

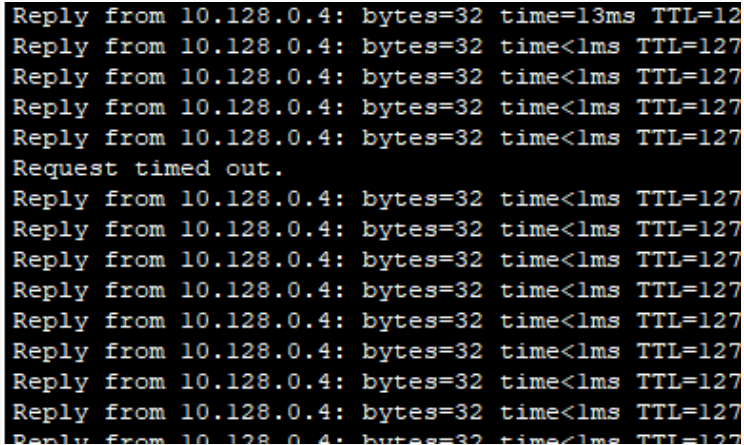

Figure 15: Пингование mail.donskaya.rudn.ru

```
msc-donskaya-shuvayev-sw-3>en
Password:
msc-donskaya-shuvayev-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msc-donskaya-shuvayev-sw-3(config)#int g0/2
msc-donskaya-shuvayev-sw-3(config-if)#shutdown
msc-donskaya-shuvayev-sw-3(config-if)#no shutdown
```

Figure 16: Разрыв соединения

```
msc-donskaya-shuvayev-sw-3(config-if)#no shutdown

msc-donskaya-shuvayev-sw-3(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthe
```

Figure 17: Время восстановления соединения

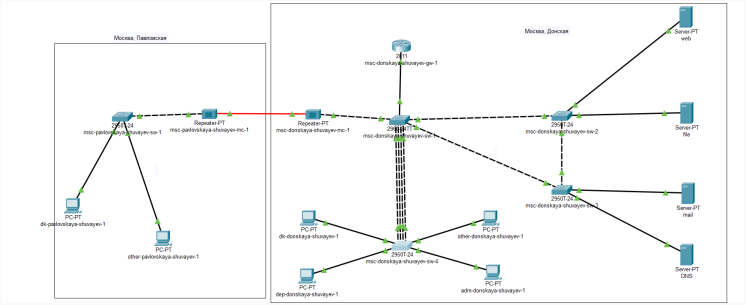

Figure 18: Логическая схема локальной сети с агрегированным соединением

```
msc-donskaya-shuvayev-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msc-donskaya-shuvayev-sw-1(config)#int f0/23
msc-donskaya-shuvayev-sw-1(config-if)#no switchport mode trunk
```

Figure 19: Настройка агрегирования каналов на msc-donskaya-shuvayev-sw-1

Figure 20: Настройка агрегирования каналов на msc-donskaya-shuvayev-sw-1

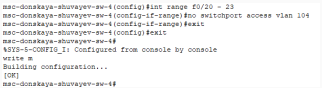

Figure 21: Настройка агрегирования каналов на msc-donskaya-shuvayev-sw-4

Выводы

В результате выполнения лабораторной работы я изучил возможности протокола STP и его модификаций по обеспечению отказоустойчивости сети, агрегированию интерфейсов и перераспределению нагрузки между ними.