Лабораторная работа № 9

Использование протокола STP. Агрегирование каналов

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Информация

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Цели

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

Задание

1. Сформируйте резервное соединение между коммутаторами msk-donskaya-sw-1 и msk-donskaya-sw-3.
2. Настройте балансировку нагрузки между резервными соединениями.
3. Настройте режим Portfast на тех интерфейсах коммутаторов, к которым подключены серверы.
4. Изучите отказоустойчивость резервного соединения.
5. Сформируйте и настройте 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

Содержание исследования

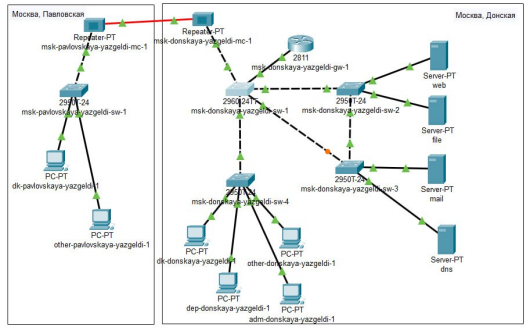


Рис. 1: Логическая схема локальной сети с резервным соединением

```
msk-donskaya-yazgeldi-sw-3>en
Password:
msk-donskaya-yazgeldi-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-3(config)#int g0/2
msk-donskaya-yazgeldi-sw-3(config-if)#switchport mode trunk
```

Рис. 2: Настройка транк-порта на интерфейсе Gig0/2 коммутатора

```
msk-donskaya-yazgeldi-sw-1>en
Password:
msk-donskaya-yazgeldi-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-1(config)#interface f0/23
msk-donskaya-yazgeldi-sw-1(config-if)#switchport mode trunk
msk-donskaya-yazgeldi-sw-1(config-if)#
```

Рис. 3: Настройка транк-порта на интерфейсе Gig0/2 коммутатора

```
msk-donskaya-yazgeldi-sw-4>en
Password:
msk-donskaya-yazgeldi-sw-4#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-4(config)#int f0/23
msk-donskaya-yazgeldi-sw-4(config-if)#switchport mode trunk
```

Рис. 4: Настройка транк-порта на интерфейсе Gig0/2 коммутатора

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

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:\>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
```

Рис. 5: Настройка транк-порта на интерфейсе Gig0/2 коммутатора

Содержание исследования

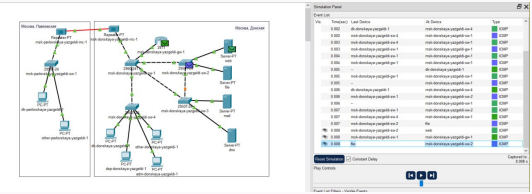


Рис. 6: Движение пакетов ICMP в режиме симуляции

Содержание исследования

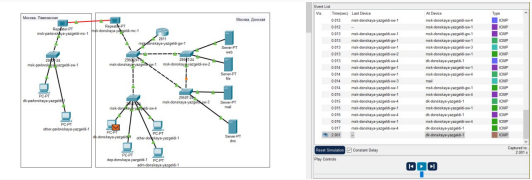


Рис. 7: Движение пакетов ICMP в режиме симуляции

```
msk-donskaya-yazgeldi-sw-2>en
Password:
msk-donskaya-yazgeldi-sw-2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-2(config)#int f0/1
msk-donskaya-yazgeldi-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.
msk-donskaya-yazgeldi-sw-2(config-if)#int f0/2
msk-donskaya-yazgeldi-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.
```

Рис. 8: Настройка режима Portfast

```
msk-donskaya-yazgeldi-sw-3>en
Password:
msk-donskaya-yazgeldi-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-3(config)#int f0/1
msk-donskaya-yazgeldi-sw-3(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.
msk-donskaya-yazgeldi-sw-3(config-if)#int f0/2
msk-donskaya-yazgeldi-sw-3(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.
msk-donskaya-yazgeldi-sw-3(config-if)#^Z
msk-donskaya-yazgeldi-sw-3#wr mem
Building configuration...
[OK]
```

Рис. 9: Настройка режима Portfast

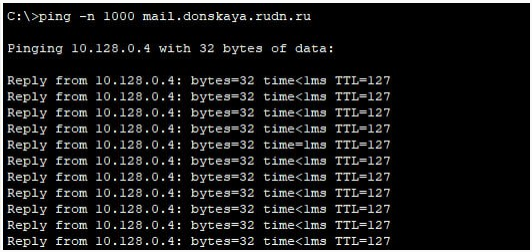


Рис. 10: Пингование mail.donskaya.rudn.ru

```
msk-donskaya-yazgeldi-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-3(config)#int g0/2
msk-donskaya-yazgeldi-sw-3(config-if)#shutdown

msk-donskaya-yazgeldi-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
```

Рис. 11: Разрыв соединения

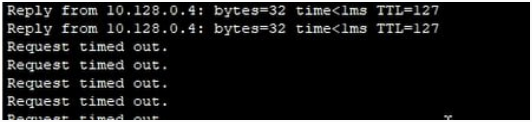


Рис. 12: Восстановление соединения

```
msk-donskaya-yazgeldi-sw-2(config-if)#spanning-tree mode rapid-pvst
msk-donskaya-yazgeldi-sw-2(config)#
msk-donskaya-yazgeldi-sw-2(config)#^Z
msk-donskaya-yazgeldi-sw-2#
%SYS-5-CONFIG_I: Configured from console by console
wr me
Building configuration...
[OK]
```

Рис. 13: Переключение режима работы коммутатора по протоколу Rapid PVST+

```
msk-donskaya-yazgeldi-sw-1(config-if)#spanning-tree mode rapid-pvst
msk-donskaya-yazgeldi-sw-1(config)#^Z
msk-donskaya-yazgeldi-sw-1#
%SYS-5-CONFIG_I: Configured from console by console
wr mem
Building configuration...
[OK]
```

Рис. 14: Переключение режима работы коммутатора по протоколу Rapid PVST+

```
msk-pavlovskaya-yazgeldi-sw-1>en
Password:
msk-pavlovskaya-yazgeldi-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-pavlovskaya-yazgeldi-sw-1(config)#spanning-tree mode rapid-pvst
msk-pavlovskaya-yazgeldi-sw-1(config)#^Z
msk-pavlovskaya-yazgeldi-sw-1#
%SYS-5-CONFIG_I: Configured from console by console
wr m
Building configuration...
[OK]
```

Рис. 15: Переключение режима работы коммутатора по протоколу Rapid PVST+

```
msk-donskaya-yazgeldi-sw-4>en
Password:
msk-donskaya-yazgeldi-sw-4#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-4(config)#spanning-tree mode rapid-pvst
msk-donskaya-yazgeldi-sw-4(config)#
```

Рис. 16: Переключение режима работы коммутатора по протоколу Rapid PVST+

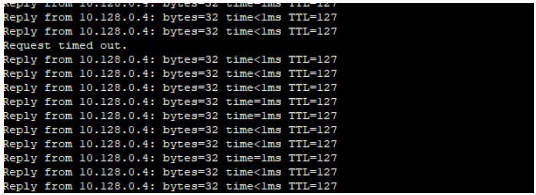


Рис. 17: Пингование mail.donskaya.rudn.ru

```
msk-donskaya-yazgeldi-sw-3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-3(config)#int g0/2
msk-donskaya-yazgeldi-sw-3(config-if)#shutdown
msk-donskaya-yazgeldi-sw-3(config-if)#
msk-donskaya-yazgeldi-sw-3(config-if)#no shutdown

msk-donskaya-yazgeldi-sw-3(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up

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

Рис. 18: Разрыв соединения

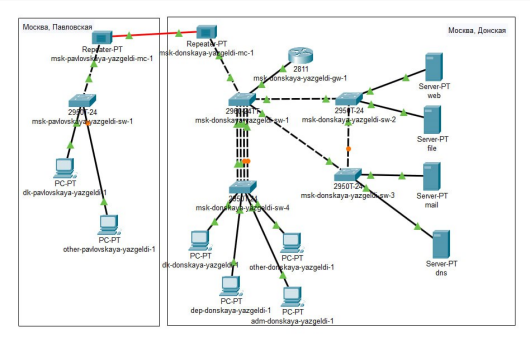
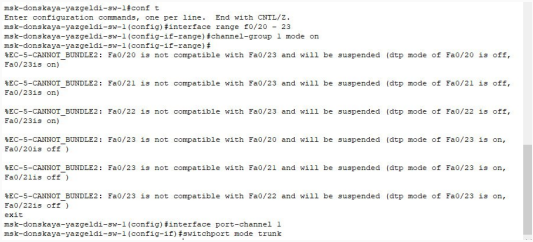


Рис. 19: Логическая схема локальной сети с агрегированным соединением

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

Рис. 20: Настройка агрегирования каналов на коммутаторе



```
msk-donskaya-yazgeldi-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-1(config)#interface range f0/20 - 23
msk-donskaya-yazgeldi-sw-1(config-if-range)#channel-group 1 mode on
msk-donskaya-yazgeldi-sw-1(config-if-range)#
%EC-5-CANNOT_BUNDLE2: Fa0/20 is not compatible with Fa0/23 and will be suspended (dtp mode of Fa0/20 is off,
Fa0/23is on)

%EC-5-CANNOT_BUNDLE2: Fa0/21 is not compatible with Fa0/23 and will be suspended (dtp mode of Fa0/21 is off,
Fa0/23is on)

%EC-5-CANNOT_BUNDLE2: Fa0/22 is not compatible with Fa0/23 and will be suspended (dtp mode of Fa0/22 is off,
Fa0/23is on)

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/20 and will be suspended (dtp mode of Fa0/23 is on,
Fa0/20is off )

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/21 and will be suspended (dtp mode of Fa0/23 is on,
Fa0/21is off )

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/22 and will be suspended (dtp mode of Fa0/23 is on,
Fa0/22is off )
exit
msk-donskaya-yazgeldi-sw-1(config)#interface port-channel 1
msk-donskaya-yazgeldi-sw-1(config-if)#switchport mode trunk
```

Рис. 21: Настройка агрегирования каналов на коммутаторе

```
msk-donskaya-yazgeldi-sw-4>en
Password:
msk-donskaya-yazgeldi-sw-4#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yazgeldi-sw-4(config)#int range f0/20 - 23
msk-donskaya-yazgeldi-sw-4(config-if-range)#no switchport access vlan 104
msk-donskaya-yazgeldi-sw-4(config-if-range)#exit
msk-donskaya-yazgeldi-sw-4(config)#interface range f0/20 - 23
msk-donskaya-yazgeldi-sw-4(config-if-range)#channel-group 1 mode on
msk-donskaya-yazgeldi-sw-4(config-if-range)#
Creating a port-channel interface Port-channel 1

%LINK-5-CHANGED: Interface Port-channel1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel1, changed state to up

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/20 and will be suspended (dtp mode of
Fa0/23 is on, Fa0/20is off )

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/21 and will be suspended (dtp mode of
Fa0/23 is on, Fa0/21is off )

%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/22 and will be suspended (dtp mode of
Fa0/23 is on, Fa0/22is off )

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2, changed state to down
exit
msk-donskaya-yazgeldi-sw-4(config)#interface port-channel 1
msk-donskaya-yazgeldi-sw-4(config-if)#switchport mode trunk
```

Рис. 22: Настройка агрегирования каналов на коммутаторе

Результаты

В ходе лабораторной работы изучили возможностей протокола STP и его модификаций по обеспечению отказоустойчивости сети, агрегированию интерфейсов и перераспределению нагрузки между ними.