

# Лабораторная работа №9

Администрирование локальных сетей

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

1. Сформировать резервное соединение между коммутаторами msk-donskaya-sw-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

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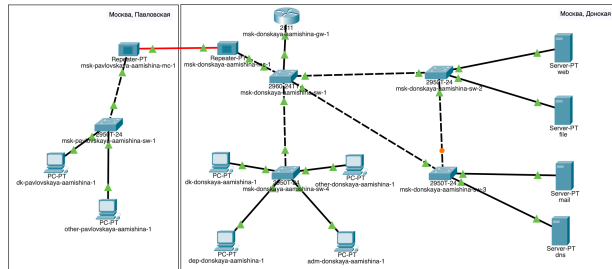


Рис. 1: Логическая схема локальной сети с резервным соединением

```
msk-donskaya-aamishina-sw-3>en
Password:
msk-donskaya-aamishina-sw-3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-aamishina-sw-3(config)#int g0/2
msk-donskaya-aamishina-sw-3(config-if)#switchport mode trunk
msk-donskaya-aamishina-sw-3(config-if)#^Z
msk-donskaya-aamishina-sw-3#
%SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-aamishina-sw-3#
```

Рис. 2: Настройка trunk-порта на интерфейсе Gig0/2 коммутатора msk-donskaya-aamishina-sw-3

```
msk-donskaya-aamishina-sw-1>en
Password:
msk-donskaya-aamishina-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-aamishina-sw-1(config)#interface f0/23
msk-donskaya-aamishina-sw-1(config-if)#swtchport mode trunk
                                     ^
% Invalid input detected at '^' marker.

msk-donskaya-aamishina-sw-1(config-if)#switchport mode trunk
msk-donskaya-aamishina-sw-1(config-if)#
```

Рис. 3: Настройка trunk-порта на интерфейсе Fa0/23 коммутатора msk-donskaya-aamishina-sw-1



```
Password:

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

msk-donskaya-aamishina-sw-4(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2
```

**Рис. 4:** Настройка trunk-порта на интерфейсе Fa0/23 коммутатора msk-donskaya-aamishina-sw-4

```
C:\>
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:

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

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

C:\>
```

Рис. 5: Пингование сервера mail и web

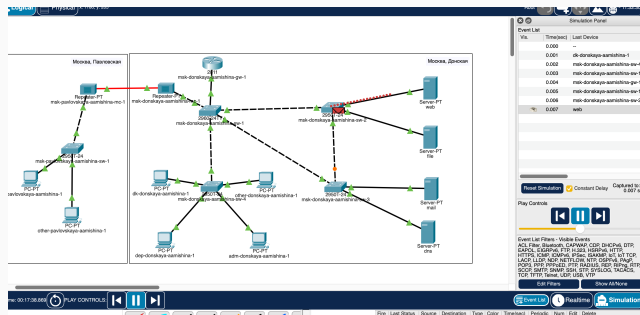


Рис. 6: Режим симуляции движения пакетов ICMP к серверу web

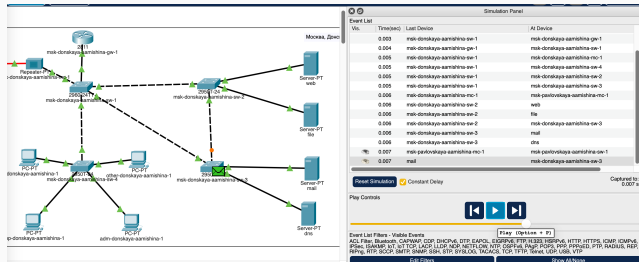


Рис. 7: Режим симуляции движения пакетов ICMP к серверу mail

```

msk-donskaya-aamishina-sw-2#
msk-donskaya-aamishina-sw-2#show spanning-tree vlan 3
VLAN0003
  Spanning tree enabled protocol ieee
  Root ID    Priority    24579
             Address     0090.21CC.DDC4
             This bridge is the root
             Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    24579  (priority 24576 sys-id-ext 3)
             Address     0090.21CC.DDC4
             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                    Desg FWD 4         128.25   P2p
Gi0/2                    Desg FWD 4         128.26   P2p

msk-donskaya-aamishina-sw-2#

```

Рис. 8: Просмотр состояния протокола STP для vlan 3

```
msk-donskaya-aamishina-sw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-aamishina-sw-1(config)#spanning-tree vlan 3 root primary
msk-donskaya-aamishina-sw-1(config)#exit
msk-donskaya-aamishina-sw-1#
%SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-aamishina-sw-1#show spanning-tree vlan 3
VLAN0003
  Spanning tree enabled protocol ieee
  Root ID    Priority    20483
             Address     0003.E4AB.EAE2
             This bridge is the root
             Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    20483 (priority 20480 sys-id-ext 3)
             Address     0003.E4AB.EAE2
             Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

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

msk-donskaya-aamishina-sw-1#
```

Рис. 9: Настройка коммутатора msk-donskaya-aamishina-sw-1 корневым

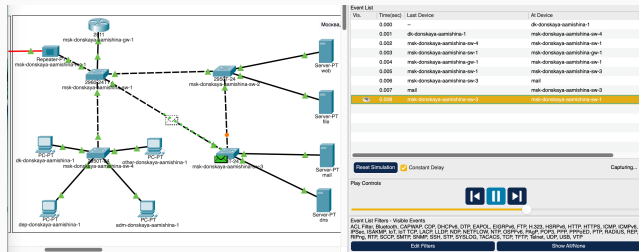


Рис. 10: Режим симуляции движения пакетов ICMP к серверу mail

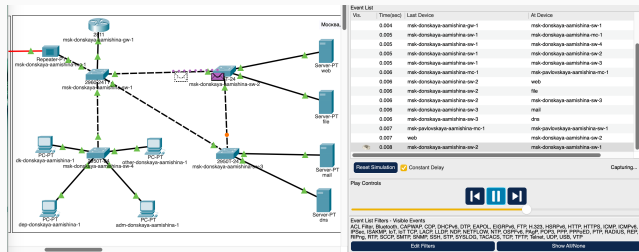


Рис. 11: Режим симуляции движения пакетов ICMP к серверу web



```
msk-donskaya-aamishina-sw-2#  
msk-donskaya-aamishina-sw-2#conf t  
Enter configuration commands, one per line.  End with CNTL/Z.  
msk-donskaya-aamishina-sw-2(config)#interface f0/1  
msk-donskaya-aamishina-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-aamishina-sw-2(config-if)#exit  
msk-donskaya-aamishina-sw-2(config)#interface f0/2  
msk-donskaya-aamishina-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.  
msk-donskaya-aamishina-sw-2(config-if)#
```

Рис. 12: Настройка режима Portfast

```
msk-donskaya-aamishina-sw-3#  
msk-donskaya-aamishina-sw-3#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
msk-donskaya-aamishina-sw-3(config)#interface f0/1  
msk-donskaya-aamishina-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-aamishina-sw-3(config-if)#exit  
msk-donskaya-aamishina-sw-3(config)#interface f0/2  
msk-donskaya-aamishina-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-aamishina-sw-3(config-if)#
```

Рис. 13: Настройка режима Portfast

```
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<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
```

Рис. 14: Пингование mail.donskaya.rudn.ru

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

Рис. 15: 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
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
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
```

Рис. 16: Восстановление соединения

```
msk-donskaya-aamishina-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-aamishina-sw-1(config)#spanning-tree mode rapid-pvst
msk-donskaya-aamishina-sw-1(config)#exit
msk-donskaya-aamishina-sw-1#
%SYS-5-CONFIG_I: Configured from console by console
msk-donskaya-aamishina-sw-1#
```

Рис. 17: Режим работы по протоколу Rapid PVST+

```
msk-donskaya-aamishina-sw-2(config)#  
msk-donskaya-aamishina-sw-2(config)#  
msk-donskaya-aamishina-sw-2(config)#spanning-tree mode rapid-pvst  
msk-donskaya-aamishina-sw-2(config)#exit  
msk-donskaya-aamishina-sw-2#  
%SYS-5-CONFIG_I: Configured from console by console  
  
msk-donskaya-aamishina-sw-2#
```

Рис. 18: Режим работы по протоколу Rapid PVST+

```
msk-donskaya-aamishina-sw-3(config)#  
msk-donskaya-aamishina-sw-3(config)#  
msk-donskaya-aamishina-sw-3(config)#spanning-tree mode rapid-pvst  
msk-donskaya-aamishina-sw-3(config)#exit  
msk-donskaya-aamishina-sw-3#  
%SYS-5-CONFIG_I: Configured from console by console  
  
msk-donskaya-aamishina-sw-3#
```

Рис. 19: Режим работы по протоколу Rapid PVST+



```
Password:
msk-donskaya-aamishina-sw-4#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-aamishina-sw-4(config)#spanning-tree mode rapid-pvst
msk-donskaya-aamishina-sw-4(config)#exit
msk-donskaya-aamishina-sw-4#
%SYS-5-CONFIG_I: Configured from console by console
|
```

Рис. 20: Режим работы по протоколу Rapid PVST+

```
Password:
msk-pavlovskaya-aamishina-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-pavlovskaya-aamishina-sw-1(config)#spanning-tree mode rapid-pvst
msk-pavlovskaya-aamishina-sw-1(config)#exit
msk-pavlovskaya-aamishina-sw-1#
%SYS-5-CONFIG_I: Configured from console by console
|
```

Рис. 21: Режим работы по протоколу Rapid PVST+

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping -n 1000 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
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
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=13ms TTL=127
Reply from 10.128.0.4: bytes=32 time=1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=14ms 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.
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
Reply from 10.128.0.4: bytes=32 time=26ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
```

Рис. 22: Пингование mail.donskaya.rudn.ru

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

msk-donskaya-aamishina-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

msk-donskaya-aamishina-sw-3(config-if)#no shutdown

msk-donskaya-aamishina-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

msk-donskaya-aamishina-sw-3(config-if)#|
```

Рис. 23: Разрыв соединения

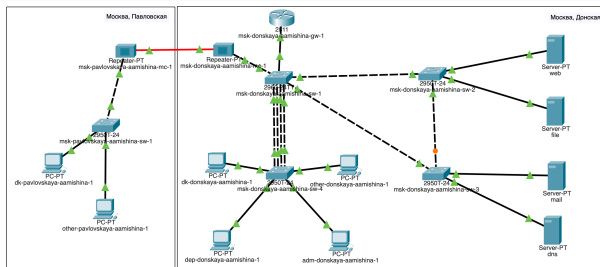


Рис. 24: Логическая схема локальной сети с агрегированным соединением

```
msk-donskaya-aamishina-sw-1(config)#interface range f0/20-23
msk-donskaya-aamishina-sw-1(config-if-range)#channel-group 1 mode on
msk-donskaya-aamishina-sw-1(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, Fa0/20 is off)
%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/21 and will be suspended (dtp mode of Fa0/23 is on, Fa0/21 is off)
%EC-5-CANNOT_BUNDLE2: Fa0/23 is not compatible with Fa0/22 and will be suspended (dtp mode of Fa0/23 is on, Fa0/22 is off)

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

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with msk-donskaya-aamishina-sw-4 FastEthernet0/22 (104).

msk-donskaya-aamishina-sw-1(config-if-range)#exit
msk-donskaya-aamishina-sw-1(config)#interface port-channel 1
msk-donskaya-aamishina-sw-1(config-if)#switchport mode trunk

msk-donskaya-aamishina-sw-1(config-if)#exit
msk-donskaya-aamishina-sw-1(config)#
```

Рис. 25: Настройка агрегирования каналов на msk-donskaya-aamishina-sw-1

```
msk-donskaya-aamishina-sw-4>en
Password:
msk-donskaya-aamishina-sw-4#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-aamishina-sw-4(config)#int range f0/20-23
msk-donskaya-aamishina-sw-4(config-if-range)#no switchport access vlan 104
msk-donskaya-aamishina-sw-4(config-if-range)#exit
msk-donskaya-aamishina-sw-4(config)#interface range f0/20-23
msk-donskaya-aamishina-sw-4(config-if-range)#channel-group 1 mode on
msk-donskaya-aamishina-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
%SPANTREE-2-RECV_FVID_ERR: Received 802.1Q BPDU on non trunk Port-channel1 VLAN1.

%SPANTREE-2-BLOCK_FVID_LOCAL: Blocking Port-channel1 on VLAN0001. Inconsistent port type.

msk-donskaya-aamishina-sw-4(config-if-range)#exit
msk-donskaya-aamishina-sw-4(config)#interface port-channel 1
msk-donskaya-aamishina-sw-4(config-if)#switchport mode trunk
```

Рис. 26: Настройка агрегирования каналов на msk-donskaya-aamishina-sw-4

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