

# Лабораторная работы №9

Использование протокола STP. Агрегирование каналов

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## Информация

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## Ход работы

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Рис. 1: Создание нового проекта

# Резервное соединение между коммутаторами msk-donskaya-svkuznecova-sw-1 и msk-donskaya-svkuznecova-sw-3

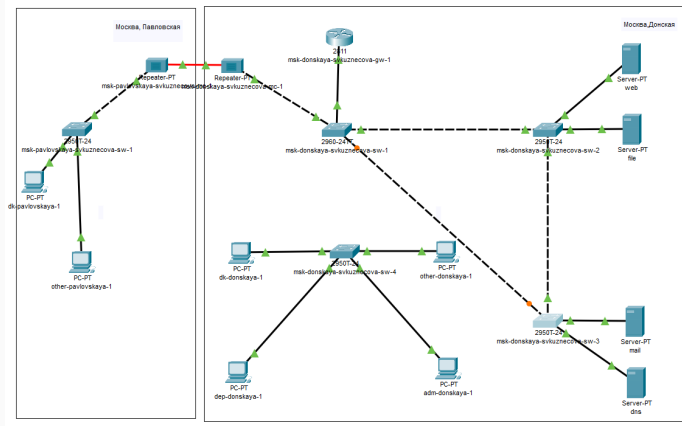
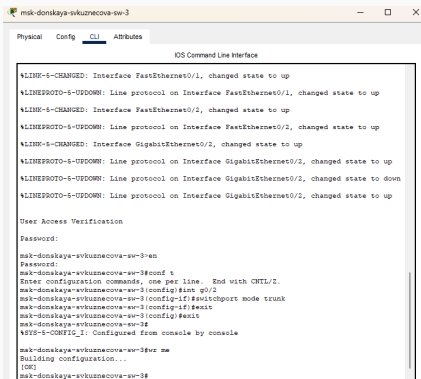


Рис. 2: Резервное соединение

## Порт на интерфейсе Gig0/2



The screenshot shows a network switch CLI window titled "msk-donskaya-svkuznecova-sw-3". The "CLI" tab is selected. The output shows the configuration of GigabitEthernet0/2, including setting the mode to trunk and enabling it. The status of the interface is shown as "up".

```
IOS Command Line Interface

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up

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

msk-donskaya-svkuznecova-sw-3#wr m
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-3#
```

Рис. 3: Транковый порт

Теперь соединение между коммутаторами msk-donskaya-svkuznecova-sw-1 и msk-donskaya-svkuznecova-sw-4 сделаем через интерфейсы Fa0/23

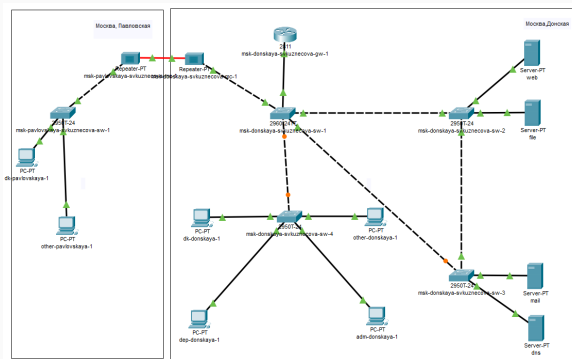
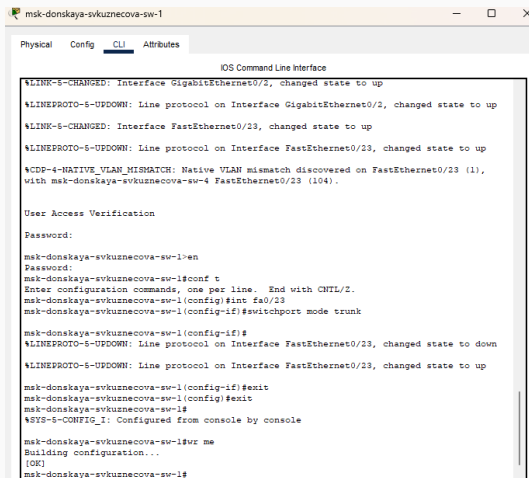


Рис. 4: Соединение между коммутаторов через интерфейсы Fa0/23





The screenshot shows a terminal window titled 'msk-donskaya-svkuznecova-sw-1' with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the 'IOS Command Line Interface'. The output shows the configuration of interface FastEthernet0/23 as a trunk. It includes status messages for link changes and protocol up/down states. The configuration commands entered are 'int fa0/23' and 'switchport mode trunk'. The user then exits configuration mode and returns to the user access verification prompt.

```
msk-donskaya-svkuznecova-sw-1>
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/23, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/23 (1),
with msk-donskaya-svkuznecova-sw-4 FastEthernet0/23 (104).

User Access Verification

Password:

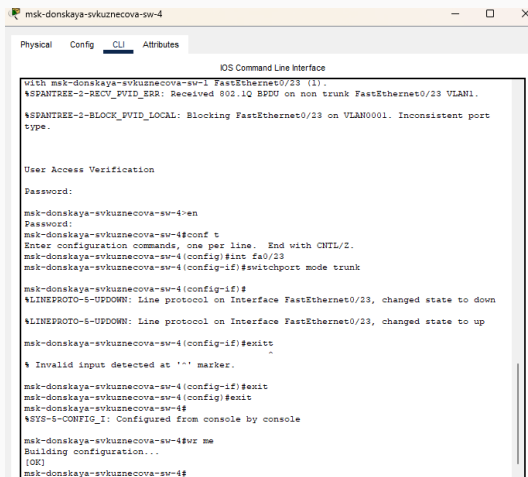
msk-donskaya-svkuznecova-sw-1>en
Password:
msk-donskaya-svkuznecova-sw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-svkuznecova-sw-1(config)#int fa0/23
msk-donskaya-svkuznecova-sw-1(config-if)#switchport mode trunk

msk-donskaya-svkuznecova-sw-1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up

msk-donskaya-svkuznecova-sw-1(config-if)#exit
msk-donskaya-svkuznecova-sw-1(config)#exit
msk-donskaya-svkuznecova-sw-1#
%SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-svkuznecova-sw-1#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-1#
```

Рис. 5: Активация в транковом режиме



The screenshot shows a terminal window titled "msk-donskaya-svkuznecova-sw-4" with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the IOS Command Line Interface. The user enters the command "en" to enter enable mode, followed by "conf t" to enter configuration mode. Then, the user configures interface "fa0/23" as a trunk port using "int fa0/23" and "switchport mode trunk". The interface status changes from "down" to "up". Finally, the user exits the configuration mode with "exit" and returns to the user EXEC mode with "exit".

```
IOS Command Line Interface
with msk-donskaya-svkuznecova-sw-1 FastEthernet0/23 (1).
%SPANTREE-2-RECV_FVID_ERR: Received 802.1Q BPDU on non trunk FastEthernet0/23 VLAN1.
%SPANTREE-2-BLOCK_FVID_LOCAL: Blocking FastEthernet0/23 on VLAN0001. Inconsistent port
type.

User Access Verification
Password:

msk-donskaya-svkuznecova-sw-4>en
Password:
msk-donskaya-svkuznecova-sw-4#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-svkuznecova-sw-4(config)#int fa0/23
msk-donskaya-svkuznecova-sw-4(config-if)#switchport mode trunk

msk-donskaya-svkuznecova-sw-4(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down

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

msk-donskaya-svkuznecova-sw-4(config-if)#exitt
^
% Invalid input detected at '^' marker.

msk-donskaya-svkuznecova-sw-4(config-if)#exit
msk-donskaya-svkuznecova-sw-4(config)#exit
msk-donskaya-svkuznecova-sw-4#
%SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-svkuznecova-sw-4#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-4#
```

Рис. 6: Активация в транковом режиме

# Пинг серверов mail и web



```
di-dondays-1
Physical Config Desktop Programming Attributes

Command Prompt

Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig

FastEthernet0 Connection: (default port)

Connection-specific DNS Suffix...:
Link-local IPv6 Address . . . . . : FE80::293:FFF:FE68:1696
IPv4 Address. . . . . : 10.118.3.30
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 10.118.3.1

Bluetooth Connection:

Connection-specific DNS Suffix...:
Link-local IPv6 Address . . . . . :
IPv4 Address. . . . . : 0.0.0.0
Subnet Mask . . . . . : 0.0.0.0
Default Gateway . . . . . : 0.0.0.0

C:\>ping mail.dondays.ru.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 10.118.0.4: 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

C:\>ping www.dondays.ru.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 = 10ms, Average = 1ms

C:\>ping 10.128.0.8

Pinging 10.128.0.8 with 32 bytes of data:

Reply from 10.128.0.8: bytes=32 time=1ms TTL=127
Reply from 10.128.0.8: bytes=32 time=1ms TTL=127
Reply from 10.128.0.8: bytes=32 time=1ms TTL=127
Reply from 10.128.0.8: bytes=32 time=1ms TTL=127

Ping statistics for 10.128.0.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

Рис. 7: Пинг

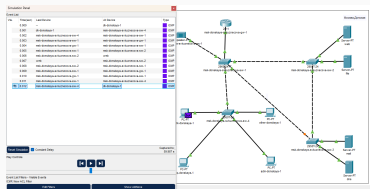


Рис. 8: Режим симуляции

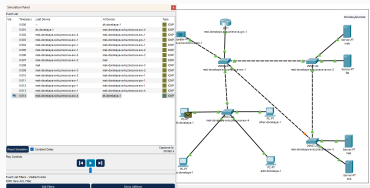
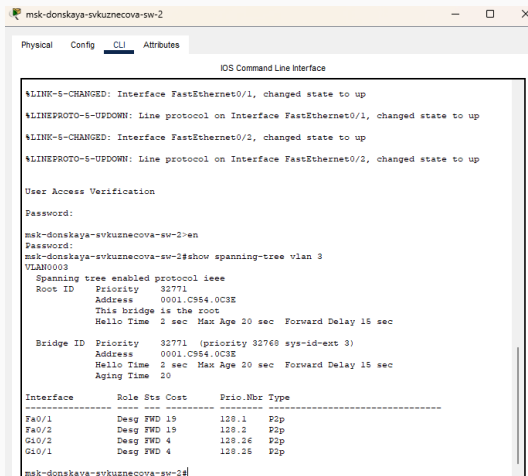


Рис. 9: Режим симуляции



The screenshot shows a terminal window titled 'msk-donskaya-svkuznecova-sw-2' with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the 'IOS Command Line Interface'. The output shows interface status changes for Fa0/1 and Fa0/2, followed by a password prompt and a command to show the spanning tree for VLAN 3. The output includes details for the root bridge (0001.C954.0C3E) and the local bridge (0001.C954.0C3E), and a table of interface roles and costs.

```
msk-donskaya-svkuznecova-sw-2#
Physical Config CLI Attributes
IOS Command Line Interface

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

User Access Verification
Password:
msk-donskaya-svkuznecova-sw-2>en
Password:
msk-donskaya-svkuznecova-sw-2#show spanning-tree vlan 3
VLAN0003
  Spanning tree enabled protocol ieee
  Root ID    Priority    32771
             Address     0001.C954.0C3E
             This bridge is the root
             Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec

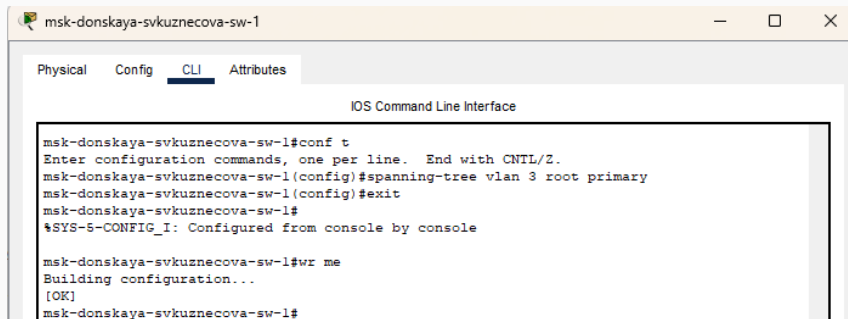
  Bridge ID  Priority    32771 (priority 32768 sys-id-ext 3)
             Address     0001.C954.0C3E
             Hello Time 2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

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

msk-donskaya-svkuznecova-sw-2#
```

Рис. 10: Состояние протокола STP для vlan 3

## Корневой коммутатор STP



The screenshot shows a web-based configuration interface for a network device named 'msk-donskaya-svkuznecova-sw-1'. The 'CLI' tab is selected, displaying the 'IOS Command Line Interface'. The terminal output shows the following commands and responses:

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

msk-donskaya-svkuznecova-sw-1#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-1#
```

Рис. 11: Корневой коммутатор

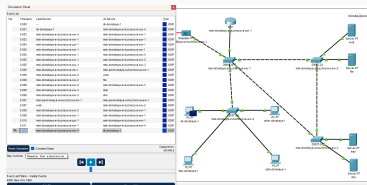


Рис. 12: Режим симуляции

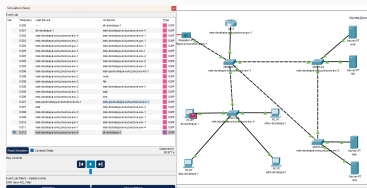
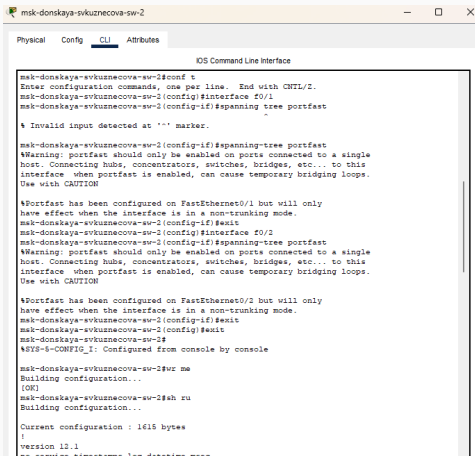


Рис. 13: Режим симуляции



```
msk-donskaya-svkuznecova-sw-2
Physical Config CLI Attributes
IOS Command Line Interface
msk-donskaya-svkuznecova-sw-2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-svkuznecova-sw-2(config)#interface f0/1
msk-donskaya-svkuznecova-sw-2(config-if)#spanning tree portfast
^
% Invalid input detected at '^' marker.

msk-donskaya-svkuznecova-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-svkuznecova-sw-2(config-if)#exit
msk-donskaya-svkuznecova-sw-2(config)#interface f0/2
msk-donskaya-svkuznecova-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

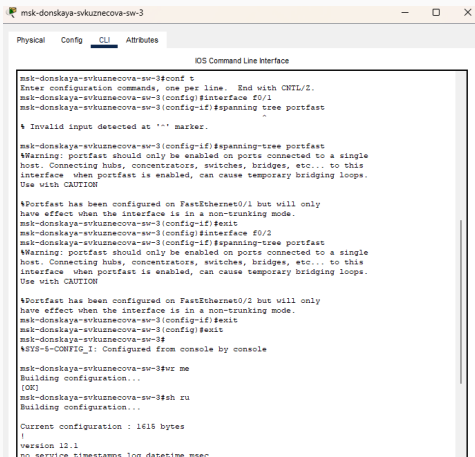
%Portfast has been configured on FastEthernet0/2 but will only
have effect when the interface is in a non-trunking mode.
msk-donskaya-svkuznecova-sw-2(config-if)#exit
msk-donskaya-svkuznecova-sw-2(config)#exit
msk-donskaya-svkuznecova-sw-2#
%SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-svkuznecova-sw-2#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-2#sh ru
Building configuration...

Current configuration : 1615 bytes
!
version 13.1
no service timestamps log datetime msec
```

Рис. 14: msk-donskaya-svkuznecova-sw-2





```
msk-donskaya-svkuznecova-sw-3
Physical Config CLI Attributes
IOS Command Line Interface

msk-donskaya-svkuznecova-sw-3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-svkuznecova-sw-3(config)#interface f0/1
msk-donskaya-svkuznecova-sw-3(config-if)#spanning tree portfast
^
% Invalid input detected at '^' marker.

msk-donskaya-svkuznecova-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-svkuznecova-sw-3(config-if)#exit
msk-donskaya-svkuznecova-sw-3(config)#interface f0/2
msk-donskaya-svkuznecova-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-svkuznecova-sw-3(config-if)#exit
msk-donskaya-svkuznecova-sw-3(config)#exit
msk-donskaya-svkuznecova-sw-3#
!SYS-5-CONFIG_I: Configured from console by console

msk-donskaya-svkuznecova-sw-3#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-3#sh ru
Building configuration...

Current configuration : 1615 bytes
!
version 12.1
no service timestamps log datetime msec
```

Рис. 15: msk-donskaya-svkuznecova-sw-3

# Отказоустойчивость протокола STP

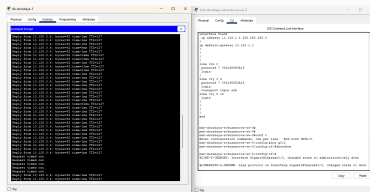


Рис. 16: Отказоустойчивость

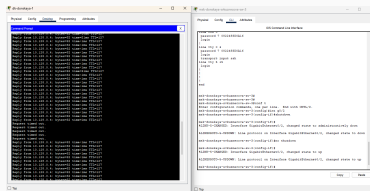
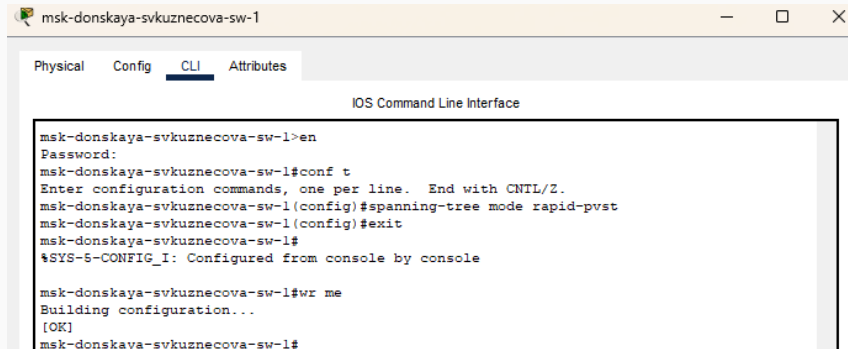


Рис. 17: Отказоустойчивость

## Режим работы по протоколу Rapid PVST+



The screenshot shows a web-based configuration interface for a network device named 'msk-donskaya-svkuznecova-sw-1'. The 'CLI' tab is selected, displaying the 'IOS Command Line Interface'. The terminal output shows the following sequence of commands and responses:

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

msk-donskaya-svkuznecova-sw-1#wr me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-1#
```

Рис. 18: Протокол Rapid PVST+

# Отказоустойчивость протокола Rapid PVST+

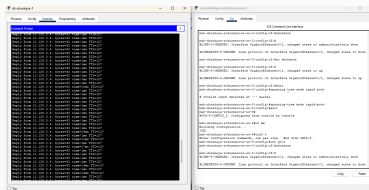


Рис. 19: Отказоустойчивость

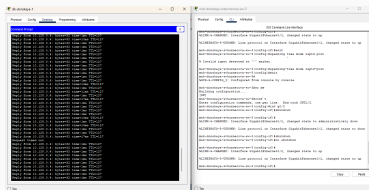


Рис. 20: Отказоустойчивость

# Агрегированное соединение интерфейсов

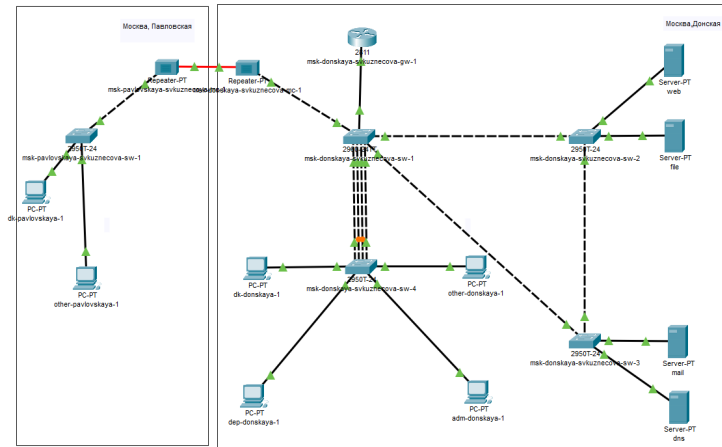


Рис. 21: Агрегированное соединение интерфейсов

## Агрегированное соединение интерфейсов


```

Physical Config CLI Attributes
IDC Command Line Interface
#enable
#show ip address: state protocol on interface port-channel0, changed state to up
%EC-6-CANNOT_REMOVE: Fa0/23 is not compatible with Fa0/20 and will be suspended (dtp mode of Fa0/23 is on, Fa0/20is off)
%EC-6-CANNOT_REMOVE: Fa0/23 is not compatible with Fa0/21 and will be suspended (dtp mode of Fa0/23 is on, Fa0/21is off)
%EC-6-CANNOT_REMOVE: Fa0/23 is not compatible with Fa0/22 and will be suspended (dtp mode of Fa0/23 is on, Fa0/22is off)
%LINEPROTO-3-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
mak-donskaya-svkunecova-sw-1(config-if-range)#exit
mak-donskaya-svkunecova-sw-1(config)#interface port-channel
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/20 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/21 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/20 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/21 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/22 (104).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/22 (1), with mak-donskaya-svkunecova-sw-4 FastEthernet0/22 (104).
%
mak-donskaya-svkunecova-sw-1(config-if)#switchport mode trunk
mak-donskaya-svkunecova-sw-1(config-if)#exit
mak-donskaya-svkunecova-sw-1(config)#exit
mak-donskaya-svkunecova-sw-1#
%SYS-5-CONFIG_1: Configured from console by console
Current configuration : 1779 bytes
!
version 16.0

```

Рис. 22: msk-donskaya-svkuznecova-sw-1

# Агрегированное соединение интерфейсов



```
msk-donskaya-svkuznecova-sw-4
Physical  Config  CLI  Attributes
IOS Command Line Interface

msk-donskaya-svkuznecova-sw-4(config)#interface range 20/20 - 23
msk-donskaya-svkuznecova-sw-4(config-if-range)#channel group 1 mode on
% Ambiguous command: "channel group 1 mode on"
msk-donskaya-svkuznecova-sw-4(config-if-range)#channel-group 1 mode on
msk-donskaya-svkuznecova-sw-4(config-if-range)#
Creating a port-channel interface Port-channel 1

%LINK-6-CHANGED: Interface Port-channel1, changed state to up
%LINEPROTO-6-UPDOWN: Line protocol on Interface Port-channel1, changed state to up
%EC-6-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-6-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-6-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-6-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
%SPANTREE-2-RECV_PVID_ERR: Received 802.1Q BPDU on non trunk Port-channel VLAN1.
%SPANTREE-2-BLOCK_PVID_LOCAL: Blocking Port-channel on VLAN0001. Inconsistent port type.

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

msk-donskaya-svkuznecova-sw-4(config-if)#%SPANTREE-2-UNLOCK_CONSIST_PORT: Unblocking
Port-channel on VLAN0001. Port consistency restored.
%SPANTREE-2-UNLOCK_CONSIST_PORT: Unblocking Port-channel on VLAN0001. Port consistency
restored.

exit
msk-donskaya-svkuznecova-sw-4(config)#exit
msk-donskaya-svkuznecova-sw-4#
MSX-6-CFG19_T: Configured from console by console

msk-donskaya-svkuznecova-sw-4#ur me
Building configuration...
[OK]
msk-donskaya-svkuznecova-sw-4#sh ru
Building configuration...

Current configuration : 2731 bytes
!
version 12.1
no service timestamps log datetime msec
```

Рис. 23: msk-donskaya-svkuznecova-sw-4

## Выводы

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

Спасибо за внимание!