

Лабораторная работа №9

Администрирование локальных сетей

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Информация

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

Откроем проект с названием lab_PT-08.pkt и сохраним под названием lab_PT-09.pkt. После чего откроем его для дальнейшего редактирования

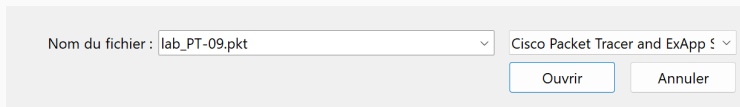
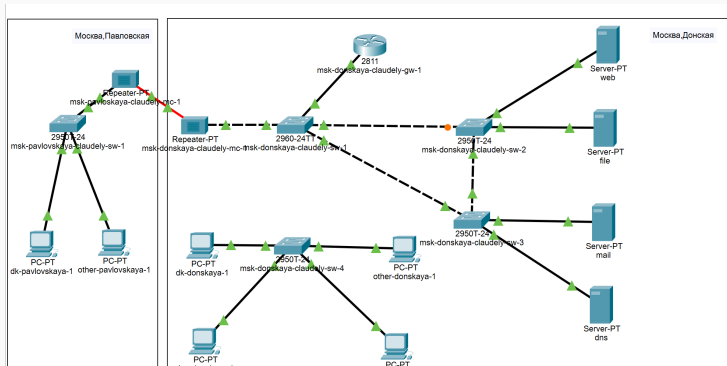


Рис. 1: Открытие проекта lab_PT-09.pkt

Выполнение лабораторной работы

Теперь сформируем резервное соединение между коммутаторами msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-3. Для этого заменим соединение между коммутаторами msk-donskaya-claudely-sw-1 (Gig0/2) и msk-donskaya-claudely-sw-4 (Gig0/1) на соединение между коммутаторами msk-donskaya-claudely-sw-1 (Gig0/2) и msk-donskaya-claudely-sw-3 (Gig0/2)



После чего сделаем порт на интерфейсе Gig0/2 коммутатора msk-donskaya-claudely-sw-3 транковым

```
Password:

msk-donskaya-claudely-sw-3>cisco
Translating "cisco"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

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

msk-donskaya-claudely-sw-3(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to down

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

msk-donskaya-claudely-sw-3(config-if)#
```

Рис. 3: Настройка порта на интерфейсе Gig0/2 коммутатора msk-donskaya-claudely-sw-3 как транкового.

Выполнение лабораторной работы

Теперь соединение между коммутаторами msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-4 сделаем через интерфейсы Fa0/23 (Рис. 1.4), не забыв активировать их в транковом режиме

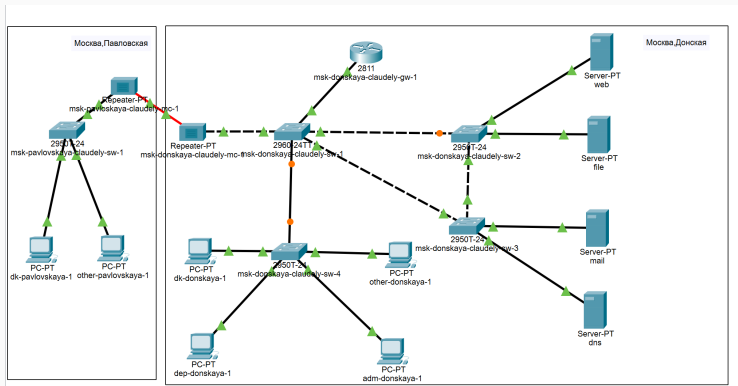


Рис. 4: Соединение между коммутаторами msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-4

Выполнение лабораторной работы

оконечного устройства dk-donskaya-1 пропингуем серверы mail и web (Рис. 1.7). В режиме симуляции проследим движение пакетов ICMP и убедимся, что движение пакетов происходит через коммутатор msk-donskaya-claudely-sw-2

```
Bluetooth Connection:

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

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=16ms 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 = 16ms, Average = 5ms

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

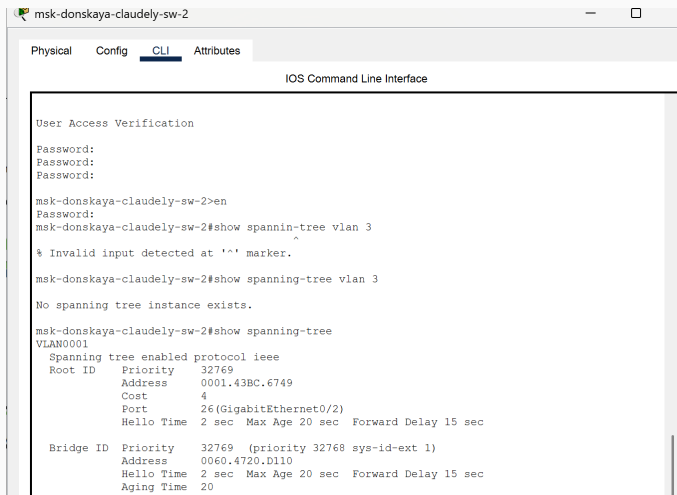
Pinging 10.128.0.4 with 32 bytes of data:

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:
```

Выполнение лабораторной работы

На коммутаторе msk-donskaya-claudely-sw-2 посмотрим состояние протокола STP для vlan 3 (указывается, что данное устройство является корневым (строка This bridge is the root))



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

User Access Verification
Password:
Password:
Password:

msk-donskaya-claudely-sw-2>en
Password:
msk-donskaya-claudely-sw-2#show spannin-tree vlan 3
% Invalid input detected at '^' marker.

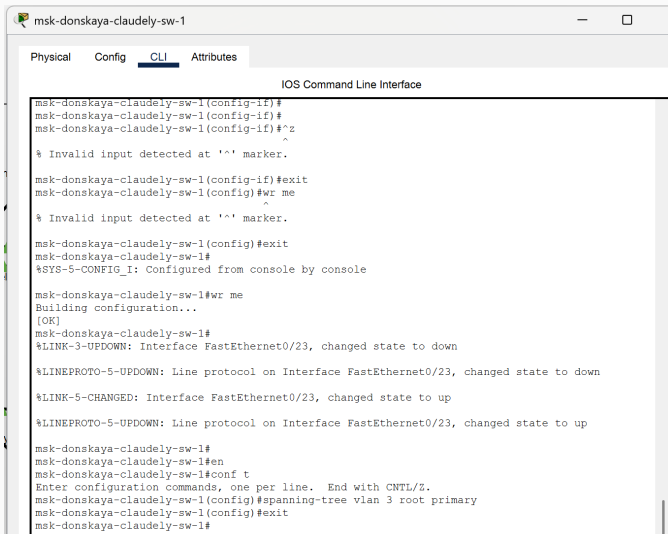
msk-donskaya-claudely-sw-2#show spanning-tree vlan 3
No spanning tree instance exists.

msk-donskaya-claudely-sw-2#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0001.43BC.6749
             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     0060.4720.D110
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20
```

Выполнение лабораторной работы

В качестве корневого коммутатора STP настроим коммутатор msk-donskaya-claudely-sw-1



```
msk-donskaya-claudely-sw-1
Physical Config CLI Attributes
IOS Command Line Interface

msk-donskaya-claudely-sw-1(config-if)#
msk-donskaya-claudely-sw-1(config-if)#
msk-donskaya-claudely-sw-1(config-if)^z
% Invalid input detected at '^' marker.

msk-donskaya-claudely-sw-1(config-if)#exit
msk-donskaya-claudely-sw-1(config)#wr me
% Invalid input detected at '^' marker.

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

msk-donskaya-claudely-sw-1#wr me
Building configuration...
[OK]
msk-donskaya-claudely-sw-1#
%LINK-3-UPDOWN: Interface FastEthernet0/23, changed state to down

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

%LINK-5-CHANGED: Interface FastEthernet0/23, changed state to up

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

msk-donskaya-claudely-sw-1#
msk-donskaya-claudely-sw-1#en
msk-donskaya-claudely-sw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-claudely-sw-1(config)#spanning-tree vlan 3 root primary
msk-donskaya-claudely-sw-1(config)#exit
msk-donskaya-claudely-sw-1#
```

Выполнение лабораторной работы

Используя режим симуляции, убедимся, что пакеты ICMP идут от хоста dk-donskaya-1 до mail через коммутаторы msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-3, а от хоста dk-donskaya-1 до web через коммутаторы msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-2

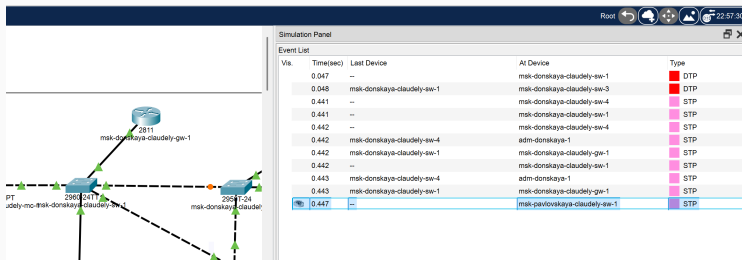
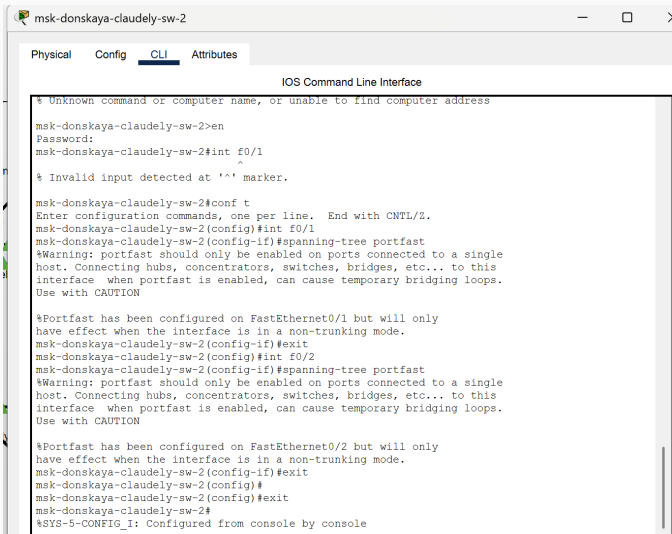


Рис. 8: Путь пакетов ICMP от хоста dk-donskaya-1 до web через коммутаторы msk-donskaya-claudely-sw-1 и msk-donskaya-claudely-sw-2

Настроим режим Portfast на тех интерфейсах коммутаторов, к которым подключены сервера



```
msk-donskaya-claudely-sw-2
Physical  Config  CLI  Attributes

IOS Command Line Interface

% Unknown command or computer name, or unable to find computer address

msk-donskaya-claudely-sw-2>en
Password:
msk-donskaya-claudely-sw-2#int f0/1
^
% Invalid input detected at '^' marker.

msk-donskaya-claudely-sw-2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-claudely-sw-2(config)#int f0/1
msk-donskaya-claudely-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-claudely-sw-2(config-if)#exit
msk-donskaya-claudely-sw-2(config)#int f0/2
msk-donskaya-claudely-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-claudely-sw-2(config-if)#exit
msk-donskaya-claudely-sw-2(config)#
msk-donskaya-claudely-sw-2(config)#exit
msk-donskaya-claudely-sw-2#
%SYS-5-CONFIG_I: Configured from console by console
```

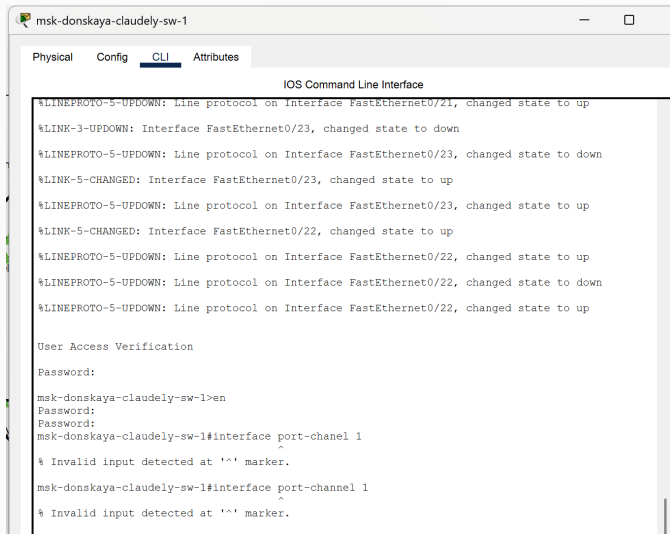
Теперь изучим отказоустойчивость протокола STP и время восстановления соединения при переключении на резервное соединение. Для этого используем команду `ping -n 1000 mail.donskaya.rudn.ru` на хосте `dk-donskaya-1`, а разрыв соединения обеспечим переводом соответствующего интерфейса коммутатора в состояние `shutdown`

```
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
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
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
Reply from 10.128.0.4: bytes=32 time=15ms 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=2ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
```

Изучение отказоустойчивости протокола STP и времени восстановления соединения при переключении на резервное соединение.

Выполнение лабораторной работы

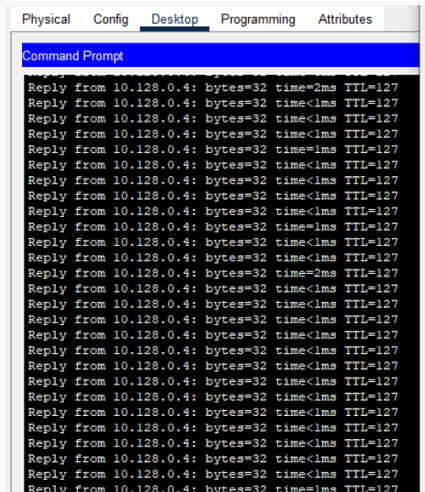
Далее переключим коммутаторы в режим работы по протоколу Rapid PVST+



```
msk-donskaya-claudely-sw-1
Physical Config CLI Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/21, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0/23, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to down
%LINK-5-CHANGED: Interface FastEthernet0/23, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/23, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/22, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up
User Access Verification
Password:
msk-donskaya-claudely-sw-1>en
Password:
msk-donskaya-claudely-sw-1#interface port-channel 1
^
% Invalid input detected at '^' marker.
msk-donskaya-claudely-sw-1#interface port-channel 1
^
% Invalid input detected at '^' marker.
```

Выполнение лабораторной работы

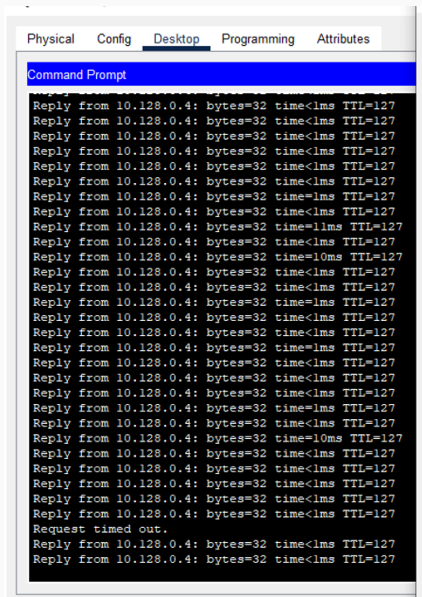
Изучим отказоустойчивость протокола Rapid PVST+ и время восстановления соединения при переключении на резервное соединение



The screenshot shows a network configuration interface with tabs for Physical, Config, Desktop, Programming, and Attributes. The Desktop tab is active, displaying a Command Prompt window. The window shows a series of 25 ping replies from 10.128.0.4. The replies are as follows:

```
Reply from 10.128.0.4: bytes=32 time=2ms 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<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=2ms 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<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

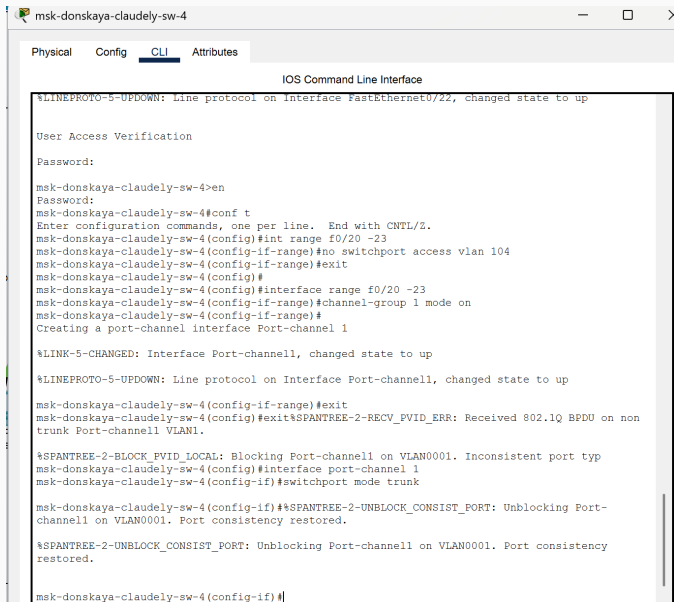


The screenshot shows a network utility window with tabs for Physical, Config, Desktop, Programming, and Attributes. The 'Desktop' tab is active, displaying a 'Command Prompt' window. The Command Prompt shows the output of a series of ping commands to the IP address 10.128.0.4. The results indicate successful replies with 32 bytes, times less than 1ms, and a TTL of 127. There is one instance of 'Request timed out.' followed by a successful reply.

```
Physical Config Desktop Programming Attributes
Command Prompt
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
Reply from 10.128.0.4: bytes=32 time=11ms TTL=127
Reply from 10.128.0.4: bytes=32 time<1ms TTL=127
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=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
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=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<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<1ms TTL=127
```

Сформируем агрегированное соединение интерфейсов Fa0/20 – Fa0/23 между коммутаторами msk-donskaya-claudely-sw-1 и msk-claudely-donskaya-sw-4

Выполнение лабораторной работы



```
msk-donskaya-claudely-sw-4
Physical Config CLI Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/22, changed state to up

User Access Verification

Password:

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

msk-donskaya-claudely-sw-4(config-if-range)#exit
msk-donskaya-claudely-sw-4(config)#exit%SPANTREE-2-RECV_PVID_ERR: Received 802.1Q BPDU on non
trunk Port-channel1 VLAN1.

%SPANTREE-2-BLOCK_PVID_LOCAL: Blocking Port-channel1 on VLAN0001. Inconsistent port typ
msk-donskaya-claudely-sw-4(config)#interface port-channel 1
msk-donskaya-claudely-sw-4(config-if)#switchport mode trunk

msk-donskaya-claudely-sw-4(config-if)##SPANTREE-2-UNBLOCK_CONSIST_PORT: Unblocking Port-
channel1 on VLAN0001. Port consistency restored.

%SPANTREE-2-UNBLOCK_CONSIST_PORT: Unblocking Port-channel1 on VLAN0001. Port consistency
restored.

msk-donskaya-claudely-sw-4(config-if)#
```

Выводы

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