

Лабораторная Работа №15. Динамическая маршрутизация.

Администрирование локальных сетей

Исаев Б.А.

Российский университет дружбы народов им. Патриса Лумумбы, Москва, Россия

- Исаев Булат Абубакарович
- НПИБд-01-22
- Российский университет дружбы народов
- [1132227131@pfur.ru]

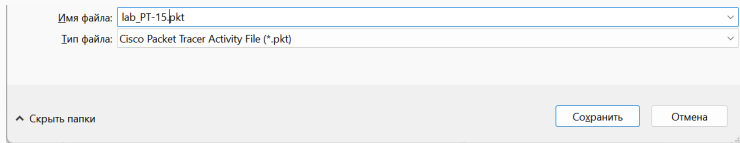
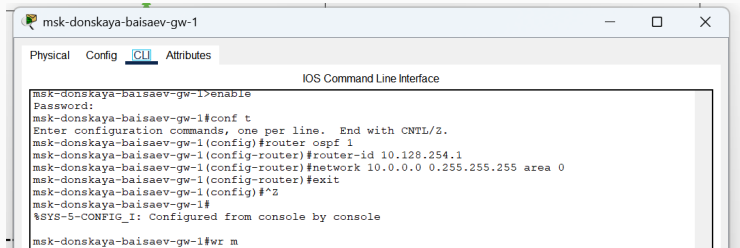


Figure 1: Открытие проекта lab_PT-15.pkt.

Настройка OSPF



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

```
msk-donskaya-baisaev-gw-1>enable
Password:
msk-donskaya-baisaev-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-donskaya-baisaev-gw-1(config)#router ospf 1
msk-donskaya-baisaev-gw-1(config-router)#router-id 10.128.254.1
msk-donskaya-baisaev-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-donskaya-baisaev-gw-1(config-router)#exit
msk-donskaya-baisaev-gw-1(config)#^Z
msk-donskaya-baisaev-gw-1#
%SYS-5-CONFIG_I: Configured from console by console
msk-donskaya-baisaev-gw-1#wr m
```

Figure 2: Настройка OSPF на маршрутизаторе msk-donskaya-baisaev-gw-1 (включение процесса OSPF, назначение областей интерфейсам).

Проверка OSPF

```
msk-donskaya-baisaev-gw-1
Physical Config CLI Attributes
IOS Command Line Interface

msk-donskaya-baisaev-gw-1#sh ip ospf
Routing Process "ospf 1" with ID 10.128.254.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs, Minimum LSA arrival 1 secs
Number of external LSA 0, Checksum Sum 0x000000
Number of opaque AS LSA 0, Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1, 1 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 8
    Area has no authentication
    SPF algorithm executed 1 times
    Area ranges are
    Number of LSA 1, Checksum Sum 0x00312a
    Number of opaque link LSA 0, Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

msk-donskaya-baisaev-gw-1#sh ip ospf neighbor
% Invalid input detected at '^' marker.

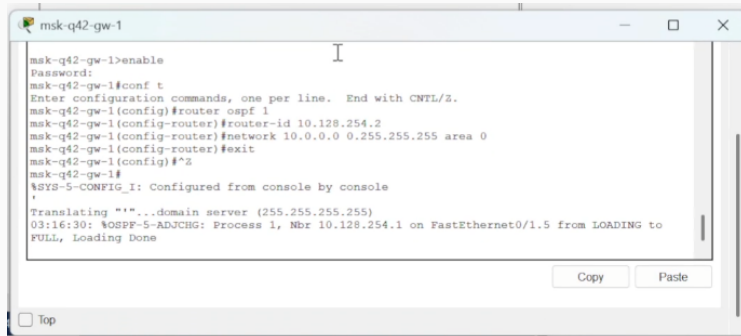
msk-donskaya-baisaev-gw-1#sh ip ospf neighbor
msk-donskaya-baisaev-gw-1#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is 198.51.100.1 to network 0.0.0.0

    10.0.0.0/8 is variably subnetted, 10 subnets, 3 masks
C    10.128.0.0/24 is directly connected, FastEthernet0/0.3
C    10.128.1.0/24 is directly connected, FastEthernet0/0.2
C    10.128.3.0/24 is directly connected, FastEthernet0/0.101
C    10.128.4.0/24 is directly connected, FastEthernet0/0.102
C    10.128.5.0/24 is directly connected, FastEthernet0/0.103
C    10.128.6.0/24 is directly connected, FastEthernet0/0.104
C    10.128.255.0/30 is directly connected, FastEthernet0/1.5
C    10.128.255.4/30 is directly connected, FastEthernet0/1.6
S    10.129.0.0/16 [1/0] via 10.128.255.2
S    10.130.0.0/16 [1/0] via 10.128.255.6
    198.51.100.0/28 is subnetted, 1 subnets
C    198.51.100.0 is directly connected, FastEthernet0/1.4
S*   0.0.0.0/0 [1/0] via 198.51.100.1

msk-donskaya-baisaev-gw-1#
```

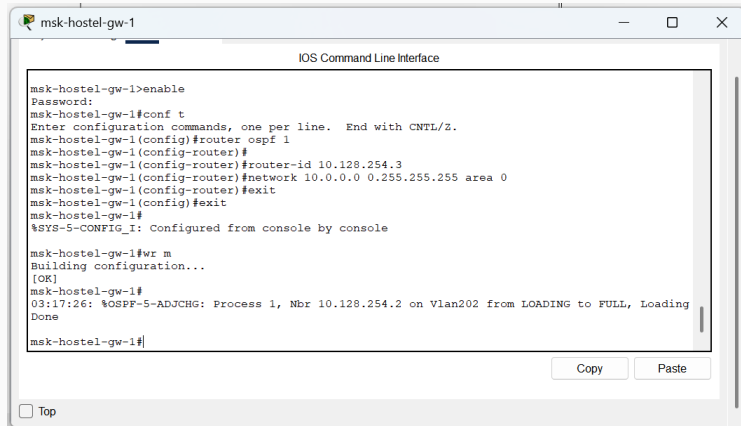
Настройка оборудования



```
msk-q42-gw-1>enable
Password:
msk-q42-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-q42-gw-1(config)#router ospf 1
msk-q42-gw-1(config-router)#router-id 10.128.254.2
msk-q42-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-q42-gw-1(config-router)#exit
msk-q42-gw-1(config)#^Z
msk-q42-gw-1#
%SYS-5-CONFIG_I: Configured from console by console
Translating "...domain server (255.255.255.255)
03:16:30: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.1 on FastEthernet0/1.5 from LOADING to
FULL, Loading Done
```

Figure 4: Настройка маршрутизатора msk-q42-gw-1.

Настройка оборудования



```
msk-hostel-gw-1>enable
Password:
msk-hostel-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-hostel-gw-1(config)#router ospf 1
msk-hostel-gw-1(config-router)#
msk-hostel-gw-1(config-router)#router-id 10.128.254.3
msk-hostel-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-hostel-gw-1(config-router)#exit
msk-hostel-gw-1(config)#exit
msk-hostel-gw-1#
%SYS-5-CONFIG_I: Configured from console by console

msk-hostel-gw-1#wr m
Building configuration...
[OK]
msk-hostel-gw-1#
03:17:26: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.2 on Vlan202 from LOADING to FULL, Loading
Done

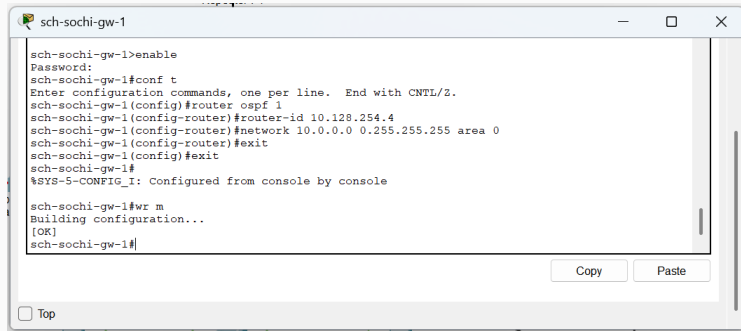
msk-hostel-gw-1#
```

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Figure 5: Настройка маршрутизирующего коммутатора msk-hostel-gw-1.

Настройка оборудования



```
sch-sochi-gw-1>enable
Password:
sch-sochi-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sch-sochi-gw-1(config)#router ospf 1
sch-sochi-gw-1(config-router)#router-id 10.128.254.4
sch-sochi-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
sch-sochi-gw-1(config-router)#exit
sch-sochi-gw-1(config)#exit
sch-sochi-gw-1#
%SYS-5-CONFIG_I: Configured from console by console

sch-sochi-gw-1#wr m
Building configuration...
[OK]
sch-sochi-gw-1#
```

Figure 6: Настройка маршрутизатора sch-sochi-gw-1.

Проверка OSPF

```
msk-q42-gw-1
Physical Config CLI Attributes
IOS Command Line Interface
msk-q42-gw-1#sh ip ospf
Routing Process "ospf 1" with ID 10.128.254.2
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs, Minimum LSA arrival 1 secs
Number of external LSA 0, Checksum Sum 0x00000000
Number of opaque AS LSA 0, Checksum Sum 0x00000000
Number of DoNotAge external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 4
Area has no authentication
SPF algorithm executed 4 times
Area ranges are
Number of LSA 6, Checksum Sum 0x03a120
Number of opaque link LSA 0, Checksum Sum 0x00000000
Number of DoNotAge LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
msk-q42-gw-1#sh ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
10.128.254.1 1 FULL/DR 00:00:38 10.128.255.1 FastEthernet0/1.5
10.128.254.4 1 FULL/DR 00:00:38 10.128.255.10 FastEthernet0/1.7
msk-q42-gw-1#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, O - per-user static route, o - ODR
p - periodic downloaded static route
Gateway of last resort is 10.128.255.1 to network 0.0.0.0
0.0.0.0/8 is variably subnetted, 18 subnets, 4 masks
O 10.128.0.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
O 10.128.1.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
O 10.128.3.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
O 10.128.4.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
O 10.128.5.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
O 10.128.6.0/24 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
C 10.128.255.0/30 is directly connected, FastEthernet0/1.5
L 10.128.255.2/32 is directly connected, FastEthernet0/1.5
O 10.128.255.4/30 [110/2] via 10.128.255.1, 00:02:16, FastEthernet0/1.5
L 10.128.255.8/30 is directly connected, FastEthernet0/1.7
C 10.128.255.8/32 is directly connected, FastEthernet0/1.7
C 10.129.0.0/24 is directly connected, FastEthernet0/0.201
L 10.129.0.1/32 is directly connected, FastEthernet0/0.201
C 10.129.1.0/24 is directly connected, FastEthernet1/0.202
L 10.129.1.1/32 is directly connected, FastEthernet1/0.202
S 10.129.128.0/17 [1/0] via 10.129.1.2
O 10.130.0.0/24 [110/2] via 10.128.255.10, 00:02:16, FastEthernet0/1.7
O 10.130.1.0/24 [110/2] via 10.128.255.10, 00:02:16, FastEthernet0/1.7
S* 0.0.0.0/0 [1/0] via 10.128.255.1
```

Проверка OSPF

```
msk-hostel-gw-1
Physical Config CLI Attributes
IOS Command Line Interface

msk-hostel-gw-1#enable
Password:
msk-hostel-gw-1#sh ip ospf
Routing Process "ospf 1" with ID 10.128.254.3
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 2
    Area has no authentication
    SPF algorithm executed 3 times
    Area ranges are
    Number of LSA 5. Checksum Sum 0x0297fc
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

msk-hostel-gw-1#sh ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address      Interface
10.128.254.2      1    FULL/DR         00:00:32    10.129.1.1   Vlan202

msk-hostel-gw-1#sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 10.129.1.1 to network 0.0.0.0

    10.0.0.0/8 is variably subnetted, 12 subnets, 2 masks
O       10.128.0.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.1.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.3.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.4.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.5.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.6.0/24 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.255.0/30 [110/2] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.255.4/30 [110/3] via 10.129.1.1, 00:13:43, Vlan202
O       10.128.255.8/30 [110/2] via 10.129.1.1, 00:10:55, Vlan202
O       10.129.0.0/24 [110/2] via 10.129.1.1, 00:13:43, Vlan202
C       10.129.1.0/24 is directly connected, Vlan202
--More--
```

Проверка OSPF

```
sch-sochi-gw-1
Physical Config CLI Attributes
IOS Command Line Interface

sch-sochi-baisaev-gw-1#sh ip ospf
Routing Process "ospf 1" with ID 10.128.254.4
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs, Minimum LSA arrival 1 secs
Number of external LSA 0, Checksum Sum 0x000000
Number of opaque AS LSA 0, Checksum Sum 0x000000
Number of DoNotAge external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1, 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 4
Area has no authentication
SPF algorithm executed 6 times
Area ranges are
Number of LSA 6, Checksum Sum 0x047824
Number of opaque link LSA 0, Checksum Sum 0x000000
Number of DoNotAge LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0

sch-sochi-baisaev-gw-1#sh ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
10.128.254.1      1    FULL/BDR        00:00:31    10.128.255.5   FastEthernet0/0.6
10.128.254.2      1    FULL/BDR        00:00:31    10.128.255.9   FastEthernet0/0.7

sch-sochi-baisaev-gw-1#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 10.128.255.5 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 17 subnets, 3 masks
O    10.128.0.0/24 [110/2] via 10.128.255.5, 00:05:32, FastEthernet0/0.6
O    10.128.1.0/24 [110/2] via 10.128.255.5, 00:12:32, FastEthernet0/0.6
O    10.128.3.0/24 [110/2] via 10.128.255.5, 00:05:32, FastEthernet0/0.6
O    10.128.4.0/24 [110/2] via 10.128.255.5, 00:05:32, FastEthernet0/0.6
O    10.128.5.0/24 [110/2] via 10.128.255.5, 00:05:32, FastEthernet0/0.6
O    10.128.6.0/24 [110/2] via 10.128.255.5, 00:05:32, FastEthernet0/0.6
O    10.128.255.0/30 [110/2] via 10.128.255.5, 00:12:22, FastEthernet0/0.6
O    10.128.255.0/30 [110/2] via 10.128.255.9, 00:12:22, FastEthernet0/0.7
C    10.128.255.4/30 is directly connected, FastEthernet0/0.6
L    10.128.255.4/32 is directly connected, FastEthernet0/0.6
C    10.128.255.0/30 is directly connected, FastEthernet0/0.7
L    10.128.255.10/32 is directly connected, FastEthernet0/0.7
O    10.129.0.0/24 [110/2] via 10.128.255.9, 00:12:22, FastEthernet0/0.7
O    10.129.1.0/24 [110/2] via 10.128.255.9, 00:12:22, FastEthernet0/0.7
C    10.130.0.0/24 is directly connected, FastEthernet0/0.401
L    10.130.0.1/32 is directly connected, FastEthernet0/0.401
C    10.130.1.0/24 is directly connected, FastEthernet0/0.402
L    10.130.1.1/32 is directly connected, FastEthernet0/0.402
S*   0.0.0.0/0 [1/0] via 10.128.255.5

sch-sochi-baisaev-gw-1#
sch-sochi-baisaev-gw-1#
```

Настройка интерфейсов

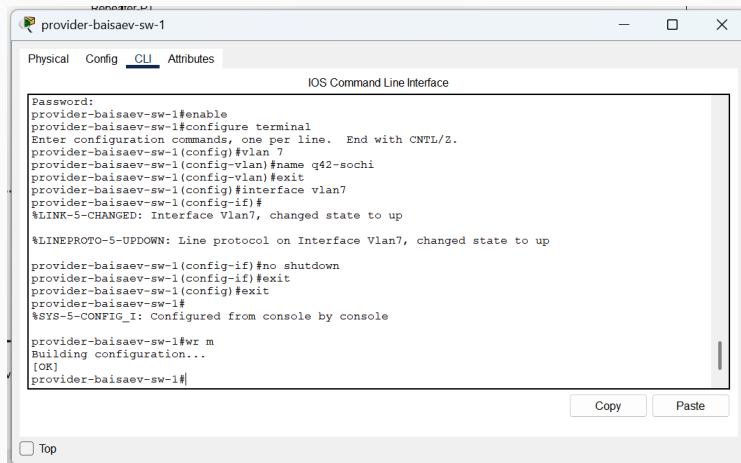


Figure 10: Настройка интерфейсов коммутатора provider-baisaev-sw-1.

Настройка оборудования

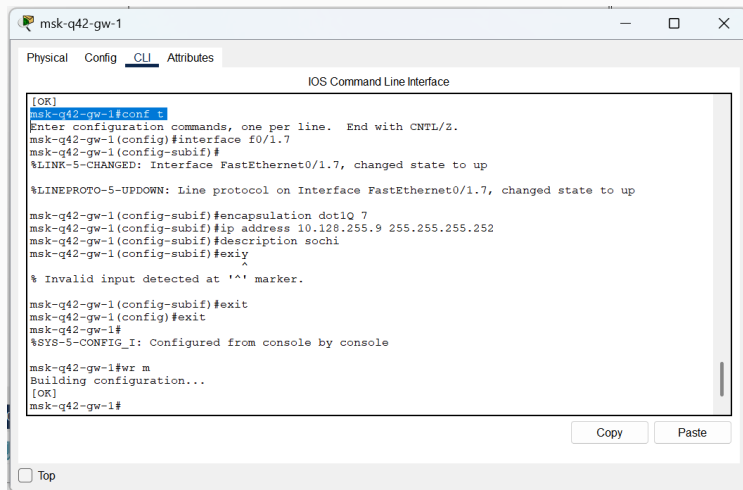
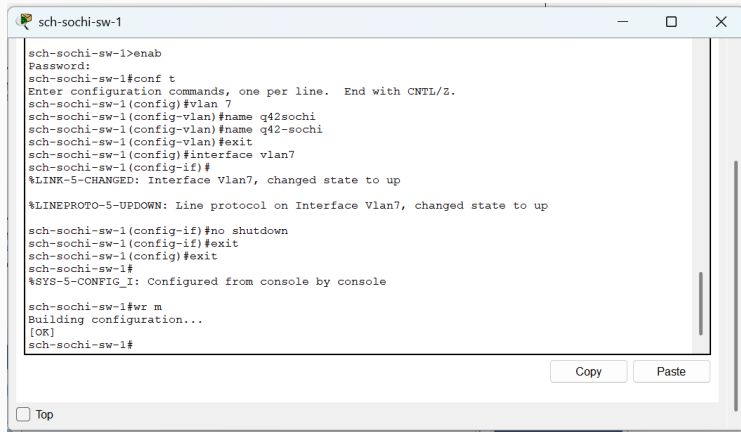


Figure 11: Настройка маршрутизатора msk-q42-gw-1.

Настройка оборудования



```
sch-sochi-sw-1>enab
Password:
sch-sochi-sw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sch-sochi-sw-1(config)#vlan 7
sch-sochi-sw-1(config-vlan)#name q42sochi
sch-sochi-sw-1(config-vlan)#name q42-sochi
sch-sochi-sw-1(config-vlan)#exit
sch-sochi-sw-1(config)#interface vlan7
sch-sochi-sw-1(config-if)#
%LINK-5-CHANGED: Interface Vlan7, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan7, changed state to up

sch-sochi-sw-1(config-if)#no shutdown
sch-sochi-sw-1(config-if)#exit
sch-sochi-sw-1(config)#exit
sch-sochi-sw-1#
%SYS-5-CONFIG_I: Configured from console by console

sch-sochi-sw-1#wr m
Building configuration...
[OK]
sch-sochi-sw-1#
```

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Figure 12: Настройка коммутатора sch-sochi-sw-1..

Настройка оборудования

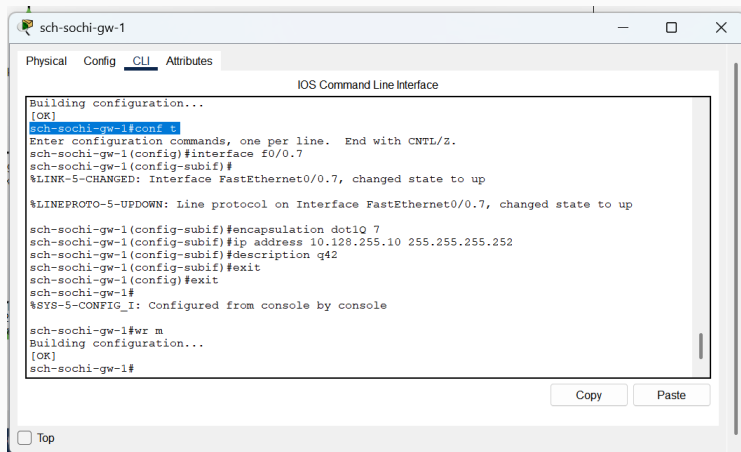
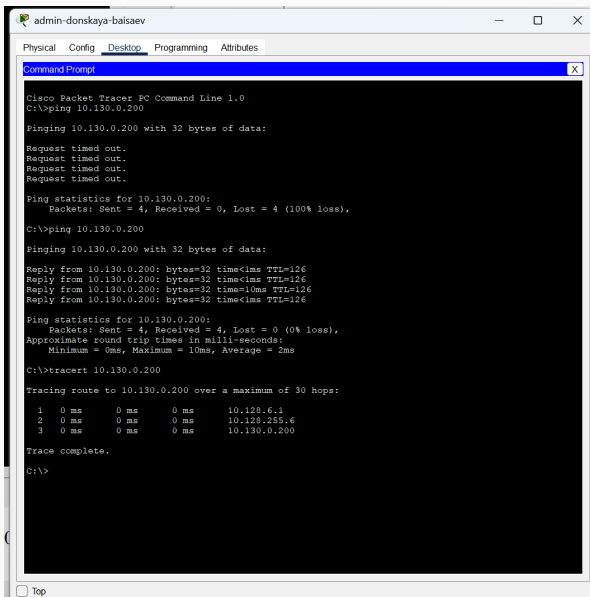


Figure 13: Настройка маршрутизатора sch-sochi-gw-1.

Ping



The screenshot shows a Cisco Packet Tracer PC Command Line window for a device named 'admin-donskaya-baisaev'. The window has tabs for 'Physical', 'Config', 'Desktop', 'Programming', and 'Attributes', with 'Desktop' selected. The Command Prompt shows the following sequence of commands and outputs:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.130.0.200

Pinging 10.130.0.200 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.130.0.200:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 10.130.0.200

Pinging 10.130.0.200 with 32 bytes of data:

Reply from 10.130.0.200: bytes=32 time<1ms TTL=126
Reply from 10.130.0.200: bytes=32 time<1ms TTL=126
Reply from 10.130.0.200: bytes=32 time=10ms TTL=126
Reply from 10.130.0.200: bytes=32 time<1ms TTL=126

Ping statistics for 10.130.0.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 2ms

C:\>tracert 10.130.0.200

Tracing route to 10.130.0.200 over a maximum of 30 hops:

  0  0 ms    0 ms    0 ms    10.128.6.1
  1  0 ms    0 ms    0 ms    10.128.255.6
  2  0 ms    0 ms    0 ms    10.130.0.200

Trace complete.

C:\>
```

At the bottom left of the window, there is a 'Top' button.

Отслеживание пакета

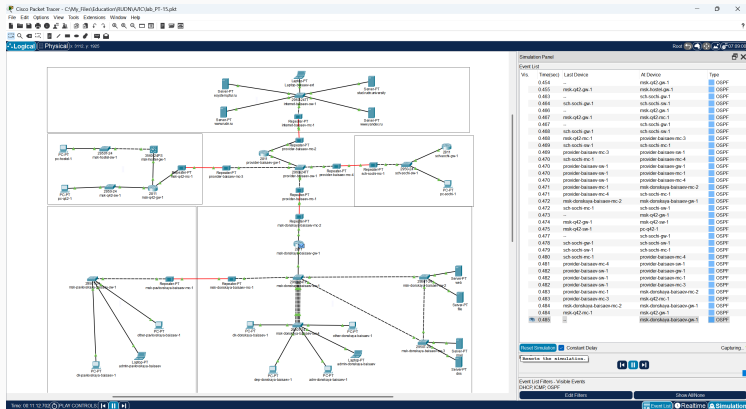
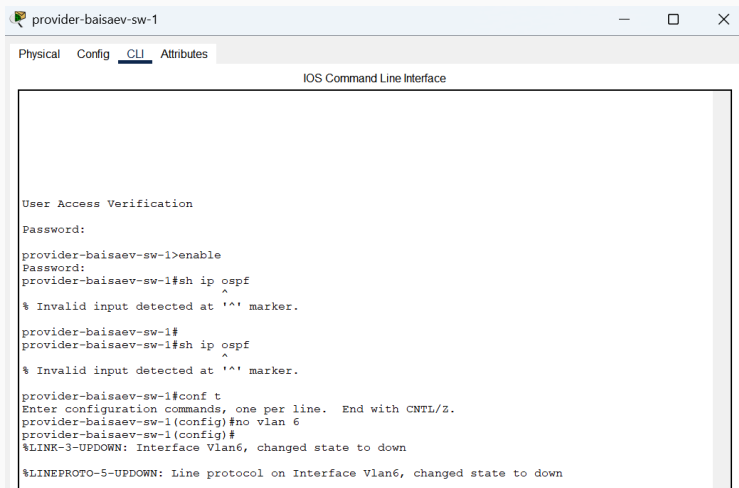


Figure 15: Отслеживание в режиме симуляции движения пакета ICMP (OSPF) с ноутбука администратора сети на Донской в Москве до компьютера пользователя в филиале в г. Сочи.

Отключение vlan 6



The screenshot shows a web-based CLI interface for a device named 'provider-baisaev-sw-1'. The 'CLI' tab is selected. The interface displays the following commands and system messages:

```
provider-baisaev-sw-1>enable
Password:
provider-baisaev-sw-1#sh ip ospf
      ^
% Invalid input detected at '^' marker.

provider-baisaev-sw-1#
provider-baisaev-sw-1#sh ip ospf
      ^
% Invalid input detected at '^' marker.

provider-baisaev-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
provider-baisaev-sw-1(config)#no vlan 6
provider-baisaev-sw-1(config)#
%LINK-3-UPDOWN: Interface Vlan6, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan6, changed state to down
```

Figure 16: Временное отключение на коммутаторе провайдера vlan 6.

Отслеживание пакета

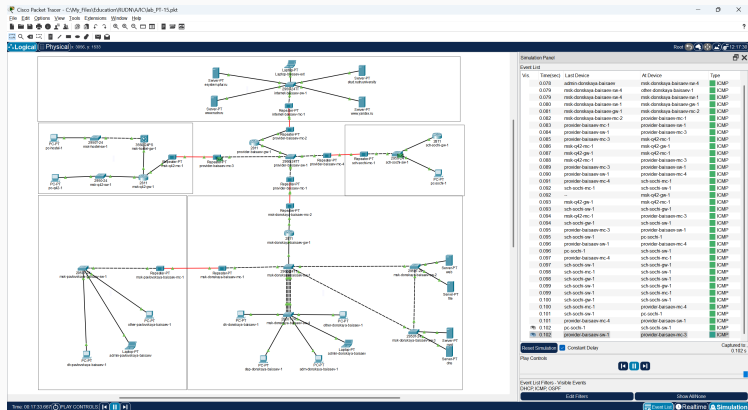


Figure 17: Проверка изменения маршрута прохождения пакета ICMP в режиме симуляции с ноутбука администратора сети на Донской в Москве до компьютера пользователя в филиале в г. Сочи.

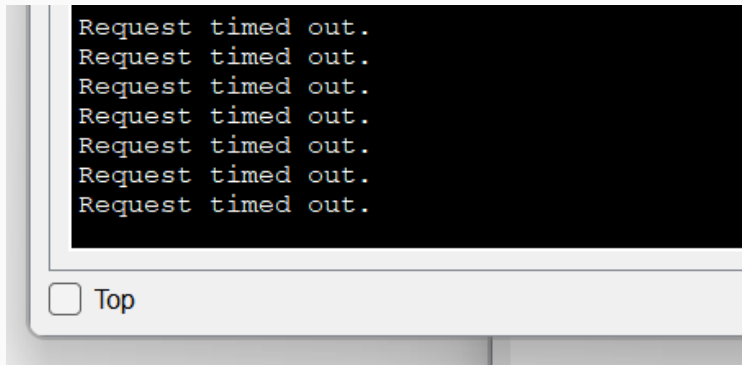
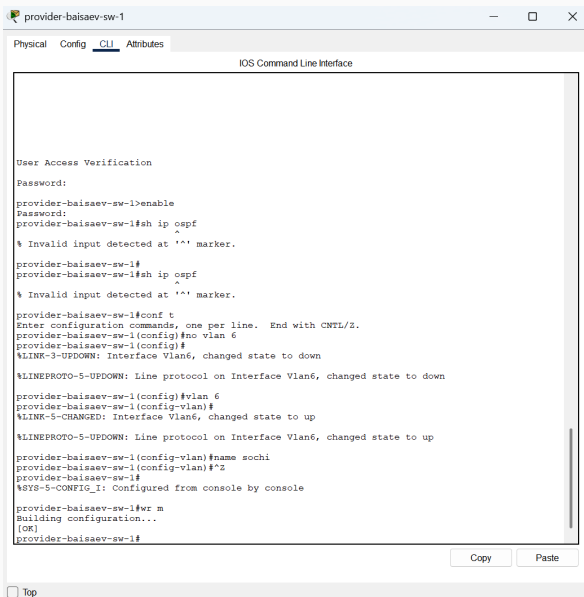


Figure 18: Потеря пакетов.

Восстановление vlan 6



```
provider-baisaev-sw-1
Physical Config CLI Attributes
IOS Command Line Interface

User Access Verification
Password:
provider-baisaev-sw-1>enable
Password:
provider-baisaev-sw-1#sh ip ospf
      ^
% Invalid input detected at '^' marker.

provider-baisaev-sw-1#
provider-baisaev-sw-1#sh ip ospf
      ^
% Invalid input detected at '^' marker.

provider-baisaev-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
provider-baisaev-sw-1(config)#no vlan 6
provider-baisaev-sw-1(config)#
%LINK-3-UPDOWN: Interface Vlan6, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan6, changed state to down

provider-baisaev-sw-1(config)#vlan 6
provider-baisaev-sw-1(config-vlan)#
%LINK-5-CHANGED: Interface Vlan6, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan6, changed state to up

provider-baisaev-sw-1(config-vlan)#name sochi
provider-baisaev-sw-1(config-vlan)#^Z
provider-baisaev-sw-1#
%SYS-5-CONFIG_I: Configured from console by console

provider-baisaev-sw-1#wr m
Building configuration...
[OK]
provider-baisaev-sw-1#
```

Copy Paste

Top

Отслеживание пакета

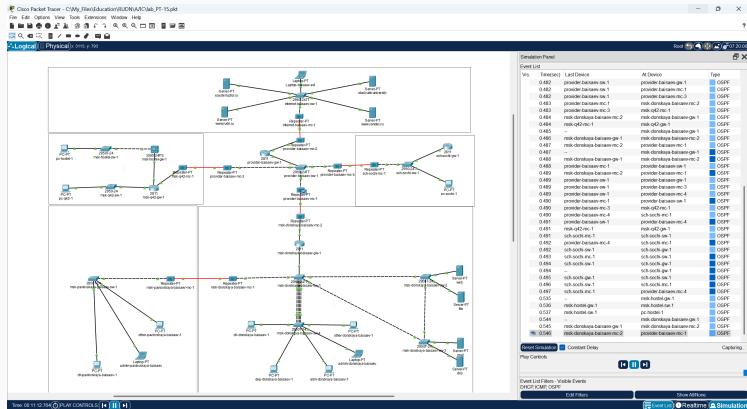


Figure 20: Проверка изменения маршрута прохождения пакета ICMP в режиме симуляции с ноутбука администратора сети на Донской в Москве до компьютера пользователя в филиале в г. Сочи.

В ходе выполнения лабораторной работы мы настроили динамическую маршрутизацию между территориями организации.