

# Лабораторная работа №15

## Динамическая маршрутизация

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## Информация

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## Ход работы

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Рис. 1: Создание нового проекта

## Настройка OSPF на маршрутизаторе msk-donskaya-svkuznecova-gw-1

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

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

Рис. 2: Настройка OSPF на маршрутизаторе msk-donskaya-svkuznecova-gw-1

# Проверка состояния протокола OSPF на маршрутизаторе msk-donskaya-svkuznecova-gw-1

```
msk-donskaya-svkuznecova-gw-1#sh ip ospf
Routing Process "ospf 1" with ID 10.128.256.1
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 0x00012a
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-svkuznecova-gw-1#sh ip ospf neighbor

msk-donskaya-svkuznecova-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 198.51.100.1 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 18 subnets, 4 masks
C 10.128.0.0/24 is directly connected, FastEthernet0/0.3
L 10.128.0.1/32 is directly connected, FastEthernet0/0.3
C 10.128.1.0/24 is directly connected, FastEthernet0/0.2
L 10.128.1.1/32 is directly connected, FastEthernet0/0.2
C 10.128.3.0/24 is directly connected, FastEthernet0/0.101
L 10.128.3.1/32 is directly connected, FastEthernet0/0.101
C 10.128.4.0/24 is directly connected, FastEthernet0/0.102
L 10.128.4.1/32 is directly connected, FastEthernet0/0.102
C 10.128.5.0/24 is directly connected, FastEthernet0/0.103
L 10.128.5.1/32 is directly connected, FastEthernet0/0.103
C 10.128.6.0/24 is directly connected, FastEthernet0/0.104
L 10.128.6.1/32 is directly connected, FastEthernet0/0.104
C 10.128.255.0/30 is directly connected, FastEthernet0/1.5
L 10.128.255.1/32 is directly connected, FastEthernet0/1.5
C 10.128.255.4/30 is directly connected, FastEthernet0/1.6
L 10.128.255.5/32 is directly connected, FastEthernet0/1.6
S 10.129.0.0/16 11/01 via 10.128.256.2
S 10.130.0.0/16 11/01 via 10.128.256.6
198.51.100.0/24 is variably subnetted, 2 subnets, 2 masks
C 198.51.100.0/28 is directly connected, FastEthernet0/1.4
L 198.51.100.2/32 is directly connected, FastEthernet0/1.4
```

Рис. 3: Проверка состояния протокола OSPF на маршрутизаторе msk-donskaya-svkuznecova-gw-1

Далее приступим к настройке: маршрутизатора msk-q42-svkuznecova-gw-1, маршрутизирующего коммутатора msk-hostel-svkuznecova-gw-1, маршрутизатора sch-sochi-svkuznecova-gw-1.

```
msk-q42-svkuznecova-gw-1>en
Password:
msk-q42-svkuznecova-gw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-q42-svkuznecova-gw-1(config)#router ospf 1
msk-q42-svkuznecova-gw-1(config-router)#router-id 10.128.254.2
msk-q42-svkuznecova-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-q42-svkuznecova-gw-1(config-router)#exit
msk-q42-svkuznecova-gw-1(config)#exit
msk-q42-svkuznecova-gw-1#
%SYS-5-CONFIG_I: Configured from console by console

msk-q42-svkuznecova-gw-1#wr me
Building configuration...
[OK]
msk-q42-svkuznecova-gw-1#
```

Рис. 4: Маршрутизатор msk-q42-svkuznecova-gw-1



Далее приступим к настройке: маршрутизатора msk-q42-svkuznecova-gw-1, маршрутизирующего коммутатора msk-hostel-svkuznecova-gw-1, маршрутизатора sch-sochi-svkuznecova-gw-1.

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

msk-hostel-svkuznecova-gw-1#wr me
Building configuration...
[OK]
msk-hostel-svkuznecova-gw-1#
```

Рис. 5: Маршрутизирующий коммутатор msk-hostel-svkuznecova-gw-1

Далее приступим к настройке: маршрутизатора msk-q42-svkuznecova-gw-1, маршрутизирующего коммутатора msk-hostel-svkuznecova-gw-1, маршрутизатора sch-sochi-svkuznecova-gw-1.

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

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

Рис. 6: Маршрутизатор sch-sochi-svkuznecova-gw-1

## Теперь проверим состояние OSPF на всех вышеперечисленных устройствах.

```
msk-q42-svkuznecova-gw-ls#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 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 3
  Area has no authentication
  SPF algorithm executed 3 times
  Area ranges are
    Number of LSA 5, Checksum Sum 0x036018
    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-q42-svkuznecova-gw-ls#sh ip ospf neighbor

Neighbor ID      Pri  State           Dead Time   Address      Interface
10.128.254.1      1   FULL/DR         00:00:31    10.128.255.1 FastEthernet0/1.5

msk-q42-svkuznecova-gw-ls#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, s - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 10.128.255.1 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 16 subnets, 4 masks
O       10.128.0.0/24 [110/2] via 10.128.255.1, 00:02:56, FastEthernet0/1.5
O       10.128.1.0/24 [110/2] via 10.128.255.1, 00:02:56, FastEthernet0/1.5
O       10.128.3.0/24 [110/2] via 10.128.255.1, 00:02:56, FastEthernet0/1.5
O       10.128.4.0/24 [110/2] via 10.128.255.1, 00:02:56, FastEthernet0/1.5
O       10.128.5.0/24 [110/2] via 10.128.255.1, 00:02:56, FastEthernet0/1.5
O       10.128.6.0/24 [110/2] via 10.128.255.1, 00:02:56, 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, 00:00:41, FastEthernet0/1.5
C       10.129.0.0/24 is directly connected, FastEthernet0/0.201
L       10.129.0.1/32 is directly connected, FastEthernet0/0.201
O       10.129.1.0/24 is directly connected, FastEthernet0/1.202
L       10.129.1.1/32 is directly connected, FastEthernet0/1.202
O       10.129.128.0/17 [1/0] via 10.129.1.2
S       10.130.0.0/24 [110/3] via 10.128.255.1, 00:00:41, FastEthernet0/1.5
```

Рис. 7: Маршрутизатор msk-q42-svkuznecova-gw-1

## Теперь проверим состояние OSPF на всех вышеперечисленных устройствах.

```
msk-hostel-svkuznecova-gw-l#sh ip ospf
Routing Process "ospf 1" with ID 10.129.254.3
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 1 times
Area ranges are
Number of LSA 1, Checksum Sum 0x00444c
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-svkuznecova-gw-l#sh ip ospf neighbor

msk-hostel-svkuznecova-gw-l#sh ip route
Codes: C - connected, S - static, I - IGMP, 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

10.0.0.0/24 is subnetted, 2 subnets
C    10.129.1.0 is directly connected, Vlan202
C    10.129.129.0 is directly connected, Vlan304
S*   0.0.0.0/0 [1/0] via 10.129.1.1
```

Рис. 8: Маршрутизатор msk-hostel-svkuznecova-gw-1

## Теперь проверим состояние OSPF на всех вышеперечисленных устройствах.

```
sch-sochi-svkuznecova-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 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 3
    Area has no authentication
    SPF algorithm executed 2 times
    Area ranges are
    Number of LSA 5, Checksum Sum 0x036018
    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

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

Neighbor ID      Pri   State           Dead Time   Address        Interface
10.128.254.1      1    FULL/DR         00:00:30    10.128.255.5   FastEthernet0/0.6
sch-sochi-svkuznecova-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
NI - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, S - SGP
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, 15 subnets, 3 masks
O   10.128.0.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.1.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.2.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.4.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.5.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.6.0/24 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.128.255.0/30 [110/2] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
C   10.128.255.4/30 is directly connected, FastEthernet0/0.6
L   10.128.255.6/32 is directly connected, FastEthernet0/0.6
O   10.129.0.0/24 [110/3] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
O   10.129.1.0/24 [110/3] via 10.128.255.5, 00:02:27, FastEthernet0/0.6
C   10.130.0.0/24 is directly connected, FastEthernet0/0.401
L   10.130.0.1/32 is directly connected, FastEthernet0/0.401
L   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
```

Рис. 9: Маршрутизатор sch-sochi-svkuznecova-gw-1

## Перейдём к настройке линка 42-й квартал–Сочи.

```
provider-svkuznecova-sw-1>en
Password:
provider-svkuznecova-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
provider-svkuznecova-sw-1(config)#vlan 7
provider-svkuznecova-sw-1(config-vlan)#name q42-sochi
provider-svkuznecova-sw-1(config-vlan)#exit
provider-svkuznecova-sw-1(config)#interface vlan7
provider-svkuznecova-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

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

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

Рис. 10: Настройка интерфейсов коммутатора provider-svkuznecova-sw-1

## Перейдём к настройке линка 42-й квартал–Сочи.

```
msk-q42-svkuznecova-gw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-q42-svkuznecova-gw-1(config)#interface f0/1.7
msk-q42-svkuznecova-gw-1(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/1.7, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1.7, changed state to up

msk-q42-svkuznecova-gw-1(config-subif)#encapsulation dot1Q 7
msk-q42-svkuznecova-gw-1(config-subif)#ip address 10.128.255.9 255.255.255.252
msk-q42-svkuznecova-gw-1(config-subif)#description sochi
msk-q42-svkuznecova-gw-1(config-subif)#exit
msk-q42-svkuznecova-gw-1(config)#exit
msk-q42-svkuznecova-gw-1#
%SYS-5-CONFIG_I: Configured from console by console

msk-q42-svkuznecova-gw-1#wr me
Building configuration...
[OK]
msk-q42-svkuznecova-gw-1#
```

Рис. 11: Настройка маршрутизатора msk-q42-svkuznecova-gw-1

## Перейдём к настройке линка 42-й квартал–Сочи.

```
sch-sochi-svkuznecova-sw-1>en
Password:
sch-sochi-svkuznecova-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
sch-sochi-svkuznecova-sw-1(config)#vlan 7
sch-sochi-svkuznecova-sw-1(config-vlan)#name q42sochi
sch-sochi-svkuznecova-sw-1(config-vlan)#name q42-sochi
sch-sochi-svkuznecova-sw-1(config-vlan)#exit
sch-sochi-svkuznecova-sw-1(config)#interface vlan7
sch-sochi-svkuznecova-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-svkuznecova-sw-1(config-if)#no shutdown
sch-sochi-svkuznecova-sw-1(config-if)#exit
sch-sochi-svkuznecova-sw-1(config)#exit
sch-sochi-svkuznecova-sw-1#
%SYS-5-CONFIG_I: Configured from console by console

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

Рис. 12: Настройка коммутатора sch-sochi-svkuznecova-sw-1



## Перейдём к настройке линка 42-й квартал–Сочи.

```
sch-sochi-svkuznecova-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sch-sochi-svkuznecova-gw-1(config)#interface f0/0.7
sch-sochi-svkuznecova-gw-1(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.7, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.7, changed state to up

sch-sochi-svkuznecova-gw-1(config-subif)#encapsulation dot1Q 7
sch-sochi-svkuznecova-gw-1(config-subif)#ip address 10.128.255.10 255.255.255.252
sch-sochi-svkuznecova-gw-1(config-subif)#description q42
sch-sochi-svkuznecova-gw-1(config-subif)#e
00:23:40: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.2 on FastEthernet0/0.7 from LOADING
to FULL, Loading Done
sch-sochi-svkuznecova-gw-1(config-subif)#exit
sch-sochi-svkuznecova-gw-1(config)#exit
sch-sochi-svkuznecova-gw-1#
%SYS-5-CONFIG_I: Configured from console by console

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

Рис. 13: Настройка маршрутизатора sch-sochi-vkuznecova-gw-1

## Выводы

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

Спасибо за внимание!