

Лабораторная работа 15

Динамическая маршрутизация

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Информация

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Настроить динамическую маршрутизацию между территориями организации.

1. Настроить динамическую маршрутизацию по протоколу OSPF на маршрутизаторах msk-donskaya-gw-1, msk-q42-gw-1, msk-hostel-gw-1, sch-sochi-gw-1.
2. Настроить связь сети квартала 42 в Москве с сетью филиала в г. Сочи напрямую.
3. В режиме симуляции отследить движение пакета ICMP с ноутбука администратора сети на Донской в Москве (Laptop-PT admin) до компьютера пользователя в филиале в г. Сочи pc-sochi-1.

4. На коммутаторе провайдера отключить временно vlan 6 и в режиме симуляции убедиться в изменении маршрута прохождения пакета ICMP с ноутбука администратора сети на Донской в Москве (Laptop-PT admin) до компьютера пользователя в филиале в г. Сочи pc-sochi-1.
5. На коммутаторе провайдера восстановить vlan 6 и в режиме симуляции убедиться в изменении маршрута прохождения пакета ICMP с ноутбука администратора сети на Донской в Москве (Laptop-PT admin) до компьютера пользователя в филиале в г. Сочи pc-sochi-1.

Выполнение лабораторной работы

```
msk-donskaya-yalantsova-gw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-donskaya-yalantsova-gw-1(config)#router ospf 1
msk-donskaya-yalantsova-gw-1(config-router)#router id 10.128.254.1
                                     ^
% Invalid input detected at '^' marker.

msk-donskaya-yalantsova-gw-1(config-router)#router-id 10.128.254.1
msk-donskaya-yalantsova-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-donskaya-yalantsova-gw-1(config-router)#exit
```

Рис. 1: Настройка маршрутизатора msk-donskaya-gw-1

Выполнение лабораторной работы

```
msk-donskaya-valantsova-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 DChitless 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 DChitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0

msk-donskaya-valantsova-gw-1#sh ip ospf neighbor

msk-donskaya-valantsova-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
--More--|
```

Рис. 2: Проверка состояния протокола OSPF на маршрутизаторе msk-donskaya-gw-1

```
msk-q42-yalantsova-gw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
msk-q42-yalantsova-gw-1(config)#router ospf 1
msk-q42-yalantsova-gw-1(config-router)#router-id 10.128.254.2
msk-q42-yalantsova-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-q42-yalantsova-gw-1(config-router)#exit
msk-q42-yalantsova-gw-1(config)#
01:04:01: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.1 on FastEthernet0/1.5 from LOADING to FULL,
Loading Done
```

Рис. 3: Настройка маршрутизатора msk-q42-gw-1

Выполнение лабораторной работы

```
msk-hostel-yalantsova-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msk-hostel-yalantsova-gw-1(config)#router ospf 1
msk-hostel-yalantsova-gw-1(config-router)#router-id 10.128.254.3
msk-hostel-yalantsova-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-hostel-yalantsova-gw-1(config-router)#exit
msk-hostel-yalantsova-gw-1(config)#exit
```

Рис. 4: Настройка маршрутизирующего коммутатора msk-hostel-gw-1

Выполнение лабораторной работы

```
sch-sochi-yalantsova-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sch-sochi-yalantsova-gw-1(config)#router ospf 1
sch-sochi-yalantsova-gw-1(config-router)#router id 10.128.254.4
^
% Invalid input detected at '^' marker.

sch-sochi-yalantsova-gw-1(config-router)#router-id 10.128.254.4
sch-sochi-yalantsova-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
sch-sochi-yalantsova-gw-1(config-router)#
01:19:18: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.1 on FastEthernet0/0.6 from LOADING to FULL,
Loading Done
```

Рис. 5: Настройка маршрутизатора sch-sochi-gw-1

Выполнение лабораторной работы

```
msk-hostel-yalantsova-gw-1#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 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 2
Area has no authentication
SPF algorithm executed 2 times
Area ranges are
Number of LSA 5, Checksum Sum 0x000000
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

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

Neighbor ID      Pri   State           Dead Time   Address      Interface
10.129.254.2      1    FULL/DR         00:00:30    10.129.1.1   Vlan202

msk-hostel-yalantsova-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, s - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 10.129.1.1 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 11 subnets, 2 masks
O       10.129.0.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.1.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.3.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.4.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.5.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.6.0/24 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.255.0/30 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.255.4/30 [110/3] via 10.129.1.1, 00:00:20, Vlan202
O       10.129.0.0/24 [110/2] via 10.129.1.1, 00:00:20, Vlan202
C       10.129.1.0/24 is directly connected, Vlan202
```

Рис. 6: Проверка состояния протокола OSPF на маршрутизаторе msk-hostel-gw-1

Выполнение лабораторной работы

```
sch-sochi-yalantsova-gw-1#sh ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
10.128.254.1      1    FULL/DR         00:00:38    10.128.255.5    FastEthernet0/0.6

sch-sochi-yalantsova-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 1 times
    Area ranges are
    Number of LSA 7. Checksum Sum 0x04bcdc
    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-yalantsova-gw-1#
sch-sochi-yalantsova-gw-1#
sch-sochi-yalantsova-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, 16 subnets, 3 masks
O   10.128.0.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.1.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.3.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.4.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.5.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.6.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
O   10.128.7.0/24 [110/2] via 10.128.255.5, 00:01:18, FastEthernet0/0.6
```

Рис. 7: Проверка состояния протокола OSPF на маршрутизаторе sch-sochi-gw-1

Выполнение лабораторной работы

```
msk-q42-ylantsova-gw-1#sh ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
10.128.254.4      1   FULL/DR         00:00:31    10.128.255.10  FastEthernet0/1.7
10.128.254.1      1   INIT/DROTHER    00:00:22    10.128.255.1   FastEthernet0/1.5
10.128.254.3      1   FULL/DR         00:00:32    10.129.1.2     FastEthernet1/0.202
msk-q42-ylantsova-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 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 2 times
Area ranges are
Number of LSA 4, Checksum Sum 0x025a0d
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

msk-q42-ylantsova-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 10.128.255.1 to network 0.0.0.0

10.0.0.0/8 is variably subnetted, 10 subnets, 4 masks
C    10.128.255.0/30 is directly connected, FastEthernet0/1.5
L    10.128.255.2/32 is directly connected, FastEthernet0/1.5
C    10.128.255.8/30 is directly connected, FastEthernet0/1.7
L    10.128.255.9/32 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
```

Рис. 8: Проверка состояния протокола OSPF на маршрутизаторе msk-q42-gw-1

Выполнение лабораторной работы

```
provider-yalantsova-sw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
provider-yalantsova-sw-1(config)#vlan 7
provider-yalantsova-sw-1(config-vlan)#name q42-sochi
provider-yalantsova-sw-1(config-vlan)#exit
provider-yalantsova-sw-1(config)#interface vlan7
provider-yalantsova-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-yalantsova-sw-1(config-if)#no shutdown
provider-yalantsova-sw-1(config-if)#exit
```

Рис. 9: Настройка интерфейсов коммутатора provider-sw-1


```
sch-sochi-yalantsova-sw-1(config)#vlan 7
sch-sochi-yalantsova-sw-1(config-vlan)#name q42-sochi
sch-sochi-yalantsova-sw-1(config-vlan)#exit
sch-sochi-yalantsova-sw-1(config)#interface vlan7
sch-sochi-yalantsova-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-yalantsova-sw-1(config-if)#no shutdown
sch-sochi-yalantsova-sw-1(config-if)#exit
```

Рис. 10: Настройка коммутатора sch-sochi-sw-1

```
msk-q42-yalantsova-gw-1(config)#interface f0/1.7
msk-q42-yalantsova-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-yalantsova-gw-1(config-subif)#encapsulation dot1Q 7
msk-q42-yalantsova-gw-1(config-subif)#ip address 10.128.255.9 255.255.255.252
msk-q42-yalantsova-gw-1(config-subif)#description sochi
msk-q42-yalantsova-gw-1(config-subif)#exit
```

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

Выполнение лабораторной работы

```
sch-sochi-yalantsova-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
sch-sochi-yalantsova-gw-1(config)#interface f0/0.7
sch-sochi-yalantsova-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-yalantsova-gw-1(config-subif)#encapsulation dot1Q 7
sch-sochi-yalantsova-gw-1(config-subif)#ip address 10.128.255.10 255.255.255.252
sch-sochi-yalantsova-gw-1(config-subif)#description qd2
sch-sochi-yalantsova-gw-1(config-subif)#exit
```

Рис. 12: Настройка маршрутизатора sch-sochi-gw-1

Выполнение лабораторной работы

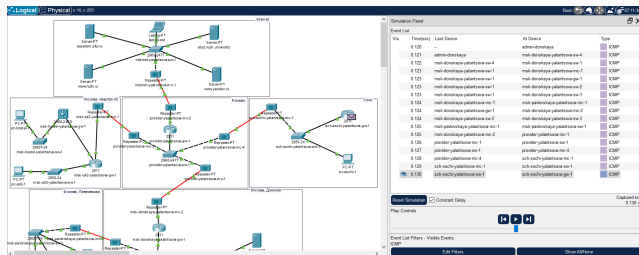
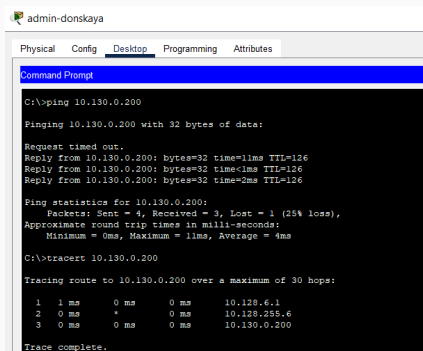


Рис. 13: Движение пакета ICMP при пересылке с администратора на ПК в Сочи в режиме симуляции

Выполнение лабораторной работы



The screenshot shows a Windows Command Prompt window titled "admin-donskaya". The window has tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes", with "Desktop" currently selected. The Command Prompt displays the results of a ping and a traceroute command.

```
C:\>ping 10.130.0.200

Pinging 10.130.0.200 with 32 bytes of data:

Request timed out.
Reply from 10.130.0.200: bytes=32 time=11ms TTL=126
Reply from 10.130.0.200: bytes=32 time<1ms TTL=126
Reply from 10.130.0.200: bytes=32 time=2ms TTL=126

Ping statistics for 10.130.0.200:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 4ms

C:\>tracert 10.130.0.200

Tracing route to 10.130.0.200 over a maximum of 30 hops:

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

Trace complete.
```

Рис. 14: Движение пакета ICMP при пересылке с администратора на ПК в Сочи в терминале

```
C:\>tracert 10.130.0.200

Tracing route to 10.130.0.200 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.128.6.1
  2  1 ms      0 ms      32 ms     10.128.255.2
  3  0 ms      0 ms      0 ms      10.128.255.10
  4  34 ms     *          10 ms     10.130.0.200

Trace complete.
```

Рис. 15: Движение пакета ICMP при пересылке с администратора на ПК в Сочи в режиме симуляции после отключения vlan 6

Выводы

В результате выполнения лабораторной были приобретены практические навыки по настройке динамической маршрутизации между территориями организации.