РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

Факультет физико-математических и естественных наук

Кафедра прикладной информатики и теории вероятностей

ОТЧЕТ
ПО ЛАБОРАТОРНОЙ РАБОТЕ № 15

дисциплина: Администрирование локальных сетей

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МОСКВА

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Постановка задачи

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 работы

1. Настройка маршрутизатора msk-donskaya-gw-1

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

msk-donskaya-nabakulin-gw-1#write memory
Building configuration...
[OK]
msk-donskaya-nabakulin-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
```

Рисунок 1

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

```
msk-donskaya-nabakulin-gw-1#sh ip ospf neighbor

msk-donskaya-nabakulin-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 [1/0] via 10.128.255.2
S       10.130.0.0/16 [1/0] via 10.128.255.6
     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
S*   0.0.0.0/0 [1/0] via 198.51.100.1
```

Рисунок 2

3. Настройка маршрутизатора msk-q42-gw-1

```
msk-q42-nabakulin-gw-1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
msk-q42-nabakulin-gw-1(config)#router ospf 1
msk-q42-nabakulin-gw-1(config-router)#router-id 10.128.254.2
msk-q42-nabakulin-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-q42-nabakulin-gw-1(config-router)#exit
```

Рисунок 3

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

```
msk-hostel-nabakulin-gw-1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
msk-hostel-nabakulin-gw-1(config)#router ospf 1
msk-hostel-nabakulin-gw-1(config-router)#router-id 10.128.254.3
msk-hostel-nabakulin-gw-1(config-router)#Reload or use "clear ip ospf process" command, for this to take
effect


msk-hostel-nabakulin-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
msk-hostel-nabakulin-gw-1(config-router)#exit
```

Рисунок 4

5. Настройка маршрутизатора sch-sochi-gw-1

```
sch-sochi-nabakulin-gw-1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
sch-sochi-nabakulin-gw-1(config)#router ospf 1
sch-sochi-nabakulin-gw-1(config-router)#router-id 10.128.254.4
sch-sochi-nabakulin-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
sch-sochi-nabakulin-gw-1(config-router)#exit
```

Рисунок 5

```
msk-donskaya-nabakulin-gw-1#sh ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
10.128.254.4      1   FULL/BDR        00:00:30    10.128.255.6    FastEthernet0/1.6
10.128.254.2      1   FULL/DR         00:00:21    10.128.255.2    FastEthernet0/1.5
msk-donskaya-nabakulin-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, 23 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 [1/0] via 10.128.255.2
O       10.129.0.0/24 [110/2] via 10.128.255.2, 00:03:28, FastEthernet0/1.5
O       10.129.1.0/24 [110/2] via 10.128.255.2, 00:00:58, FastEthernet0/1.5
O       10.129.128.0/24 [110/3] via 10.128.255.2, 00:00:58, FastEthernet0/1.5
S       10.130.0.0/16 [1/0] via 10.128.255.6
O       10.130.0.0/24 [110/2] via 10.128.255.6, 00:13:48, FastEthernet0/1.6
O       10.130.1.0/24 [110/2] via 10.128.255.6, 00:13:48, FastEthernet0/1.6
     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
S*   0.0.0.0/0 [1/0] via 198.51.100.1
```

Рисунок 6

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


Neighbor ID     Pri   State           Dead Time   Address         Interface
10.128.254.1      1   FULL/BDR        00:00:34    10.128.255.1    FastEthernet0/1.5
10.128.254.3      1   FULL/DR         00:00:39    10.129.1.2      FastEthernet1/0.202
msk-q42-nabakulin-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, 17 subnets, 4 masks
O       10.128.0.0/24 [110/2] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.128.1.0/24 [110/2] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.128.3.0/24 [110/2] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.128.4.0/24 [110/2] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.128.5.0/24 [110/2] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.128.6.0/24 [110/2] via 10.128.255.1, 00:04:08, 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, 00:04:08, 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
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       10.129.128.0/24 [110/2] via 10.129.1.2, 00:01:43, FastEthernet1/0.202
O       10.130.0.0/24 [110/3] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
O       10.130.1.0/24 [110/3] via 10.128.255.1, 00:04:08, FastEthernet0/1.5
S*   0.0.0.0/0 [1/0] via 10.128.255.1
```

Рисунок 7

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


Neighbor ID     Pri   State           Dead Time   Address         Interface
10.128.254.2      1   FULL/BDR        00:00:37    10.129.1.1      Vlan202
msk-hostel-nabakulin-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, 13 subnets, 2 masks
O       10.128.0.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.1.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.3.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.4.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.5.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.6.0/24 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.255.0/30 [110/2] via 10.129.1.1, 00:02:03, Vlan202
O       10.128.255.4/30 [110/3] via 10.129.1.1, 00:02:03, Vlan202
O       10.129.0.0/24 [110/2] via 10.129.1.1, 00:02:03, Vlan202
C       10.129.1.0/24 is directly connected, Vlan202
C       10.129.128.0/24 is directly connected, Vlan301
O       10.130.0.0/24 [110/4] via 10.129.1.1, 00:02:03, Vlan202
O       10.130.1.0/24 [110/4] via 10.129.1.1, 00:02:03, Vlan202
S*   0.0.0.0/0 [1/0] via 10.129.1.1
```

Рисунок 8

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


Neighbor ID     Pri   State           Dead Time   Address         Interface
10.128.254.1      1   FULL/DR         00:00:33    10.128.255.5    FastEthernet0/0.6
sch-sochi-nabakulin-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, 00:15:04, FastEthernet0/0.6
O       10.128.1.0/24 [110/2] via 10.128.255.5, 00:15:04, FastEthernet0/0.6
O       10.128.3.0/24 [110/2] via 10.128.255.5, 00:15:04, FastEthernet0/0.6
O       10.128.4.0/24 [110/2] via 10.128.255.5, 00:15:04, FastEthernet0/0.6
O       10.128.5.0/24 [110/2] via 10.128.255.5, 00:15:04, FastEthernet0/0.6
O       10.128.6.0/24 [110/2] via 10.128.255.5, 00:15:04, FastEthernet0/0.6
O       10.128.255.0/30 [110/2] via 10.128.255.5, 00:04:44, 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, 00:04:44, FastEthernet0/0.6
O       10.129.1.0/24 [110/3] via 10.128.255.5, 00:02:14, FastEthernet0/0.6
O       10.129.128.0/24 [110/4] via 10.128.255.5, 00:02:14, 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
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
```

Рисунок 9

6. Настройка интерфейсов коммутатора provider-sw-1

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

Рисунок 10

7. Настройка маршрутизатора msk-q42-gw-1

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

Рисунок 11

8. Настройка коммутатора sch-sochi-sw-1

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

Рисунок 12

9. Настройка маршрутизатора sch-sochi-gw-1

```
sch-sochi-nabakulin-gw-1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
sch-sochi-nabakulin-gw-1(config)#interface f0/0.7
sch-sochi-nabakulin-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-nabakulin-gw-1(config-subif)#encapsulation dot1Q 7
sch-sochi-nabakulin-gw-1(config-subif)#ip address 10.128.255.10 255.255.255.252
sch-sochi-nabakulin-gw-1(config-subif)#description q42
```

Рисунок 13

Проверка:

```
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    0 ms      1 ms      0 ms      10.128.255.6
  3    0 ms      0 ms      0 ms      10.130.0.200

Trace complete.
```

Рисунок 14

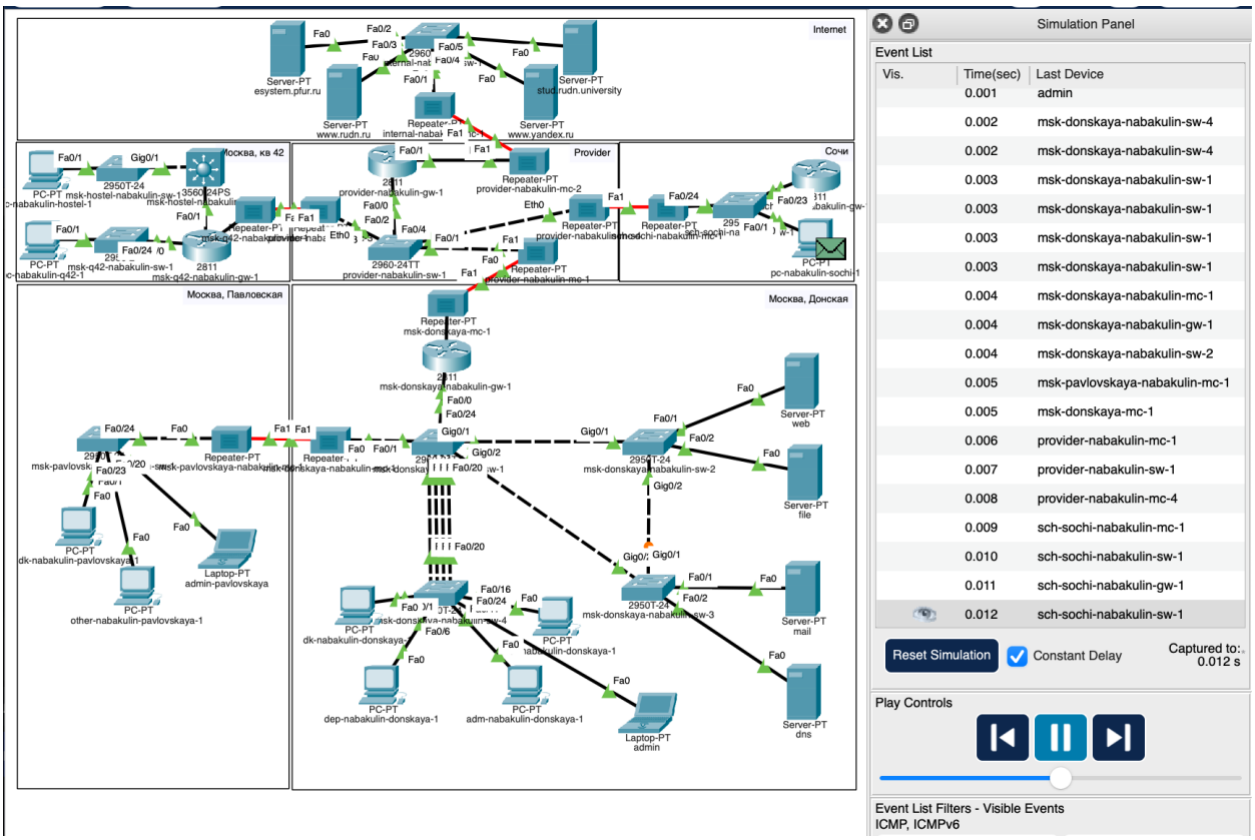

Рисунок 15

```
provider-nabakulin-sw-1(config-vlan)#no vlan 6
provider-nabakulin-sw-1(config)#
%LINK-3-UPDOWN: Interface Vlan6, changed state to down

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

Рисунок 16

```
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    0 ms      1 ms      0 ms      10.128.255.2
  3    1 ms      0 ms      0 ms      10.128.255.10
  4    0 ms      10 ms     2 ms      10.130.0.200

Trace complete.
```

Рисунок 17

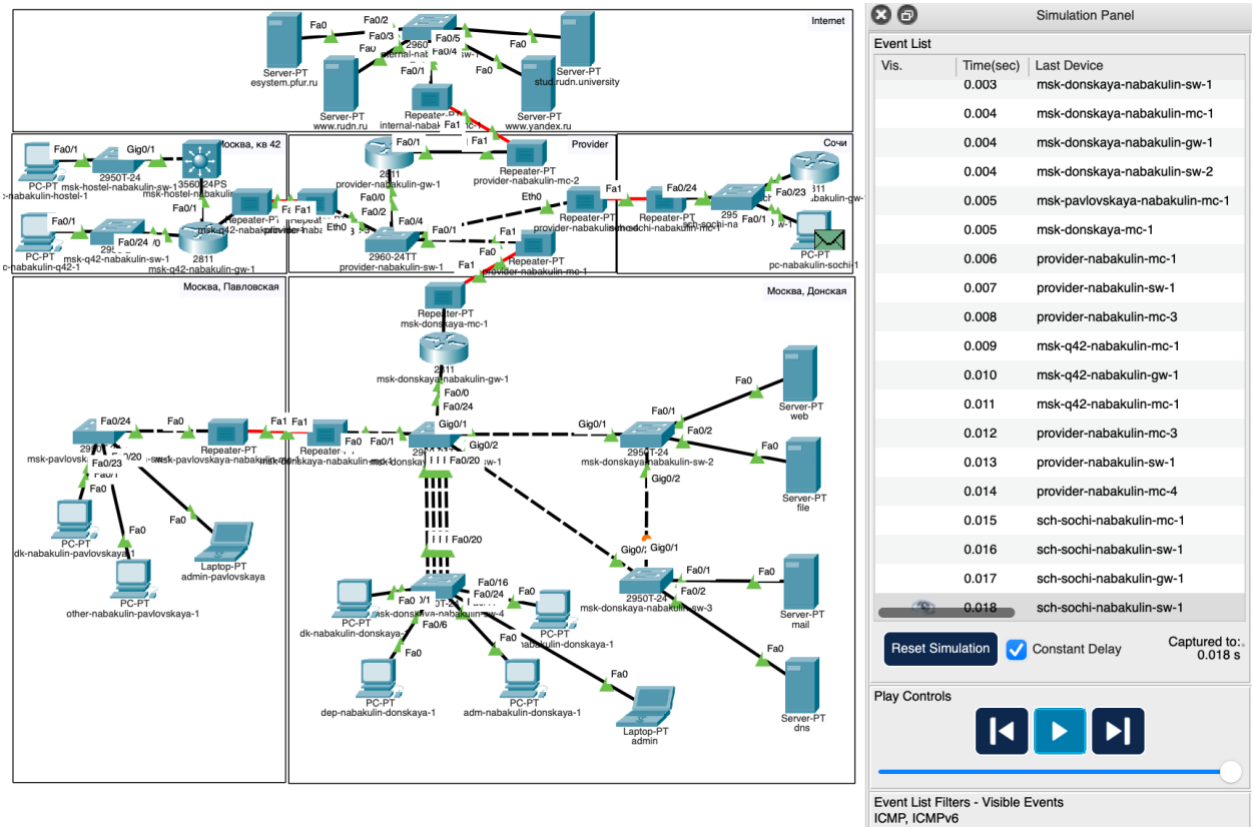

Рисунок 18

```
provider-nabakulin-sw-1(config)#vlan 6
provider-nabakulin-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
```

Рисунок 19

```
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    0 ms      0 ms      0 ms      10.128.255.6
  3    1 ms      0 ms      10 ms     10.130.0.200
```

Рисунок 20

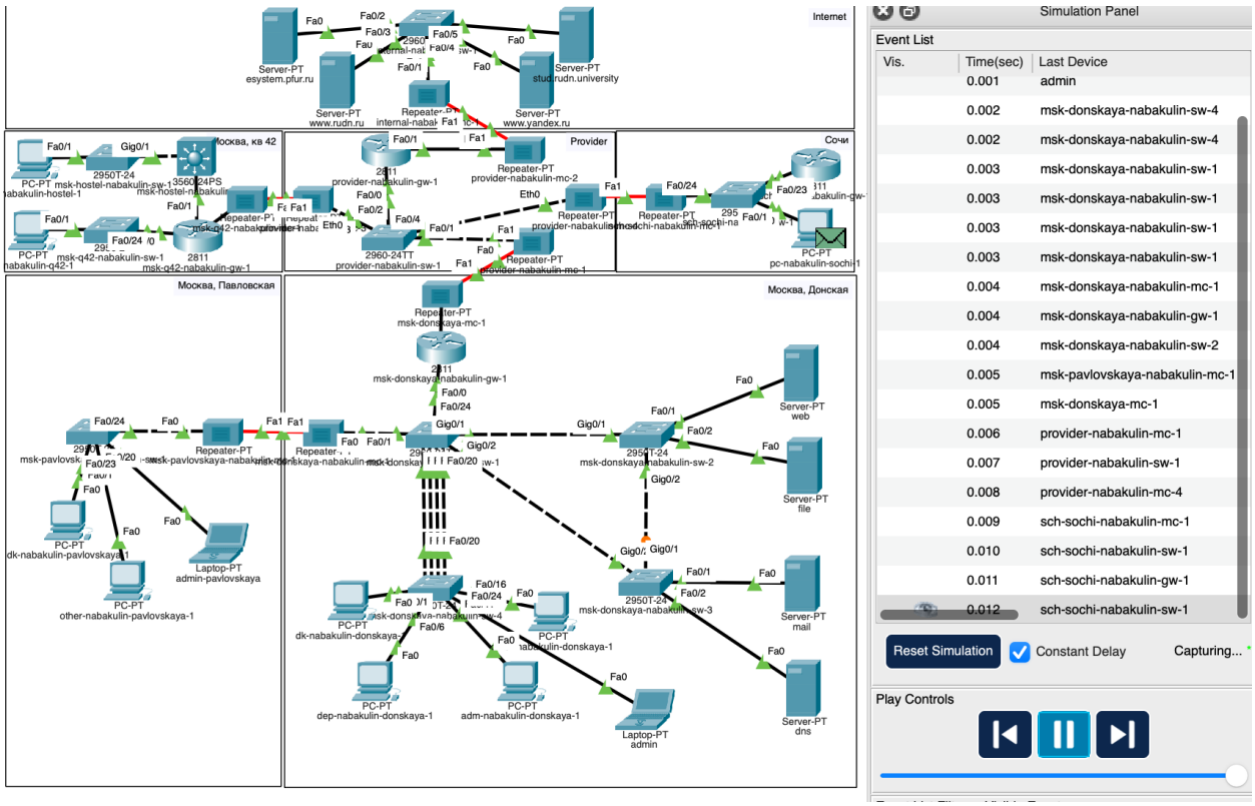

Рисунок 21

Вывод

Мы настроили динамическую маршрутизацию между территориями организации.

Контрольные вопросы

1. Какие протоколы относятся к протоколам динамической маршрутизации?
   OSPF, RIP, EIGRP
2. Охарактеризуйте принципы работы протоколов динамической маршрутизации.
   Маршрутизаторы делятся своими таблицами маршрутизации с остальными, корректируют свою на основе остальных
3. Опишите процесс обращения устройства из одной подсети к устройству из другой подсети по протоколу динамической маршрутизации.
   При обращении в случае проблемы маршрутизаторы перестраивают свои таблицы и отправляют пакеты по актуальным маршрутам
4. Опишите выводимую информацию при просмотре таблицы маршрутизации.
   Протокол / тип маршрута / адрес сети / следующий маршрутизатор / время обновления / интерфейс