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Факультет автоматизации и информатики

Кафедра автоматизированных систем управления

ЛАБОРАТОРНАЯ РАБОТА №3

по дисциплине «Компьютерные сети»

Настройка динамической маршрутизации

Вариант 25

Студент

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Цель работы

Изучить протоколы динамической маршрутизации в IP-сетях, получить практические навыки настройки маршрутизаторов с применением динамической маршрутизации RIP и OSPF.

Задание кафедры

Настроить взаимодействие IP-сетей с использованием маршрутизаторов Cisco. Настроить обмен маршрутной информацией по протоколам RIP и OSPF. Проверить работоспособность сети.

Проверить настройку маршрутизации на примере взаимодействия рабочих станций, принадлежащих различным сетям, и взаимодействие рабочих станций с внешней сетью.

Таблица 1 – Диапазон IP-адресов по варианту

№	Диапазон IP-адресов	Network 1	Network 2	Network 3	Network 4	Network 5
5(25)	10.14.0.0/16	70	26	95	51	16

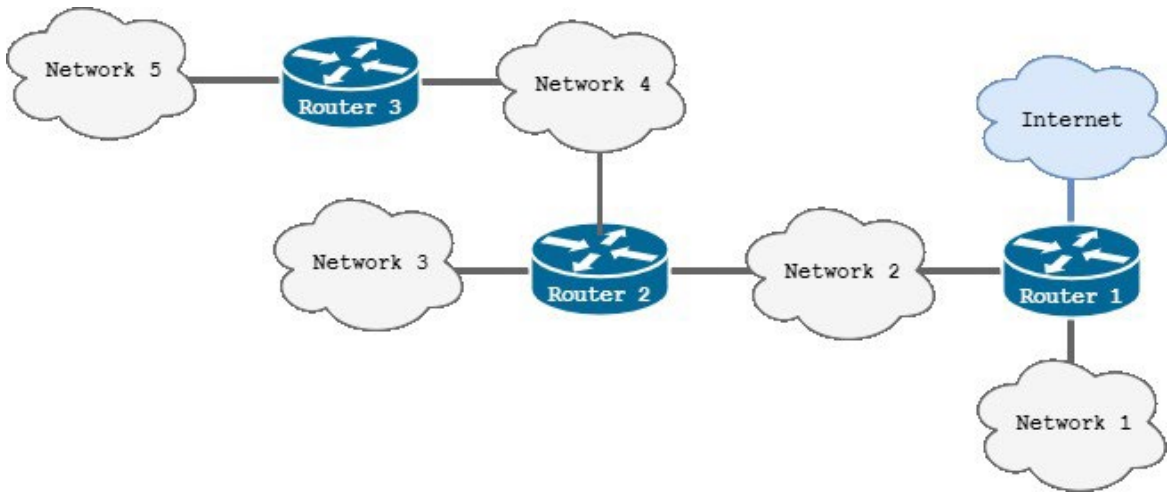

Рисунок 1 – Принципиальная схема сети

Ход работы

Произведем конфигурацию сети в соответствии с рисунком 1. Для этого необходимо назначить IP-адреса интерфейсам в данной сети, полученный результат находится на рисунке 2.

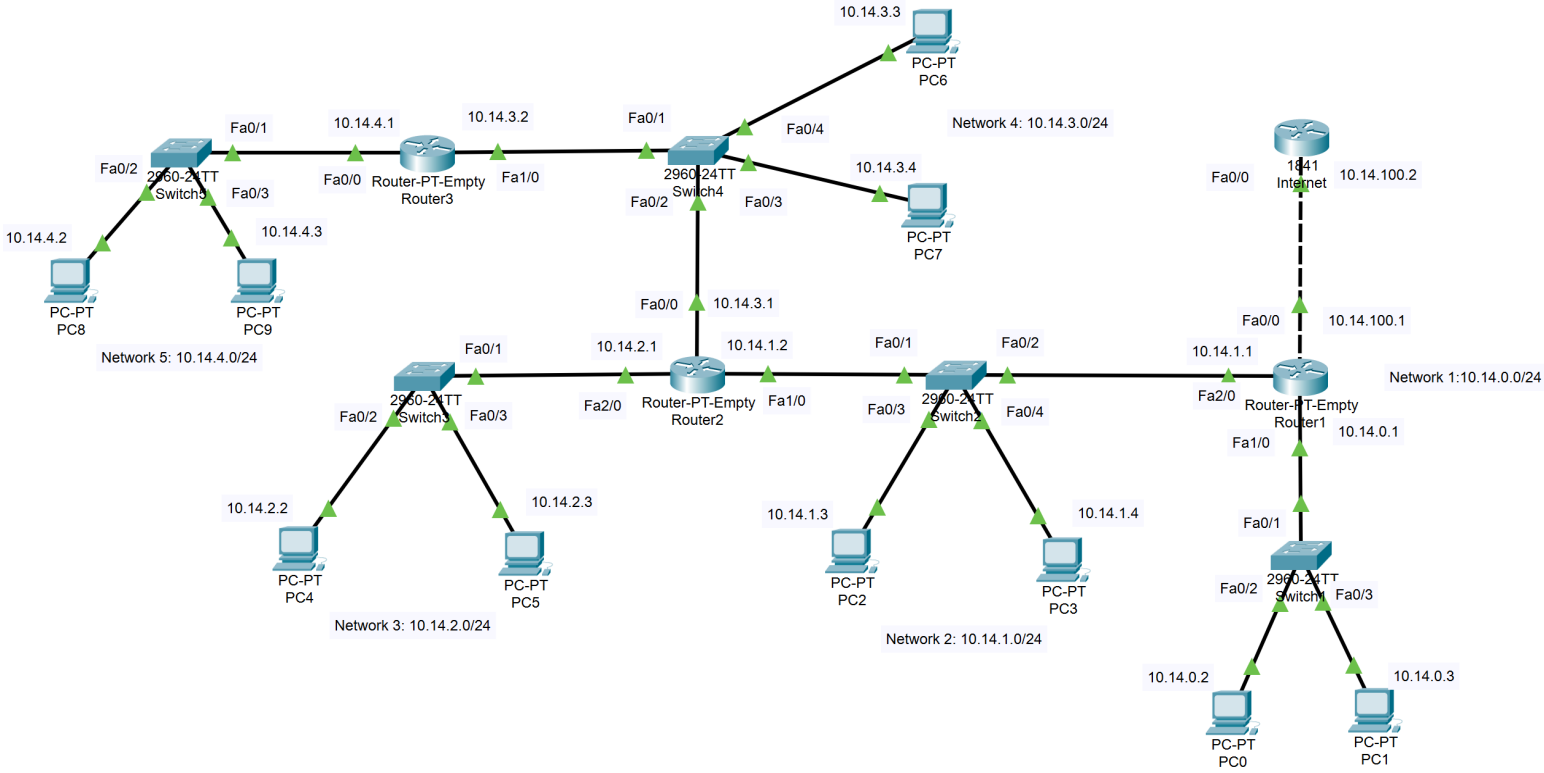

Рисунок 2 – Собранная начальная схема

1 Протокол RIP

1.1 Схема с ЛВС

Настроим протокол динамической маршрутизации RIP. Составленная схема сети для данного протокола представлена на рисунке 3.

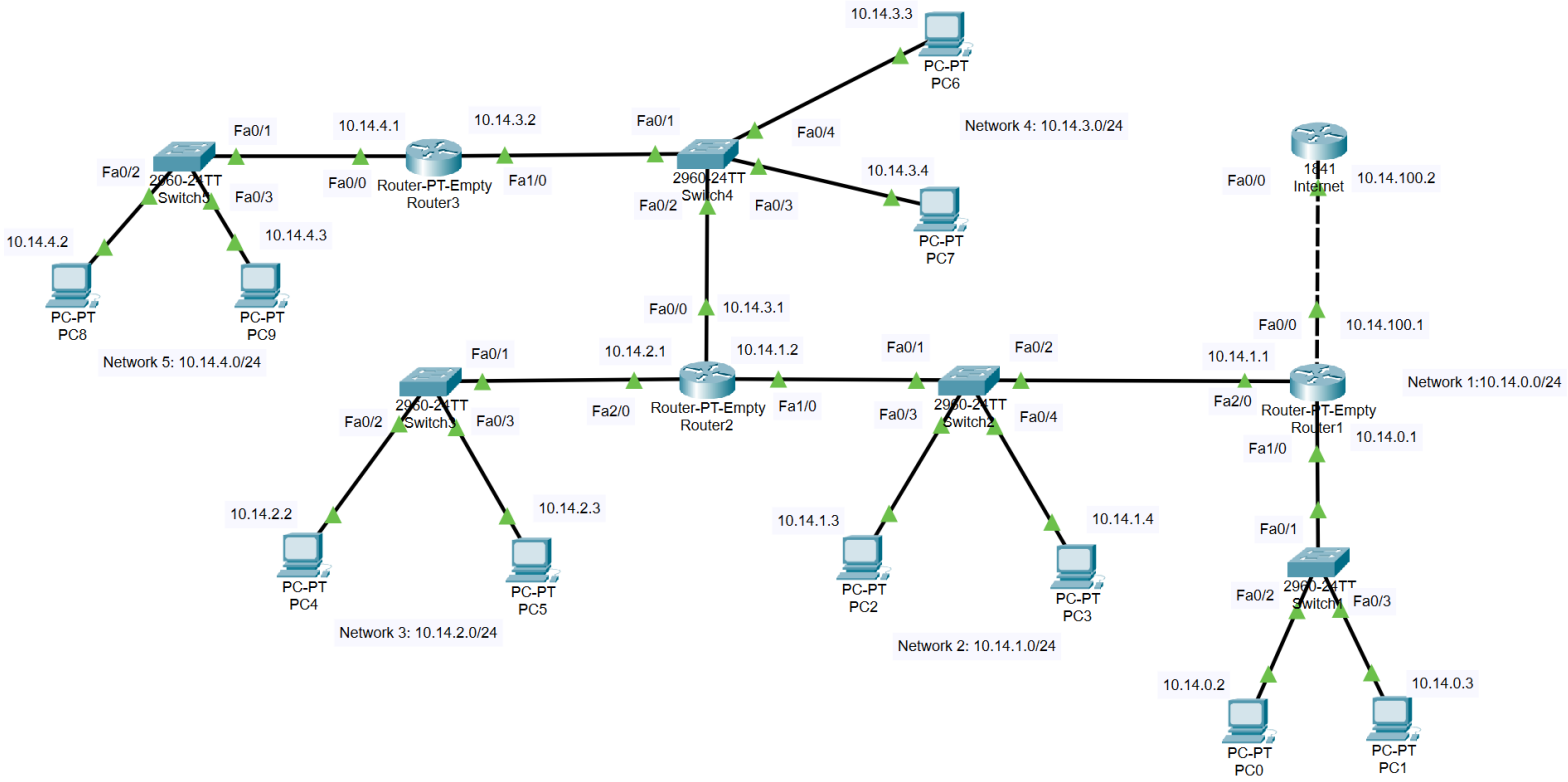

Рисунок 3 – Схема с протоколом RIP

1.2 Конфигурация устройств

Конфигурация настройки роутера Internet находится в приложении А. Конфигурация роутеров Router1, Router2 и Router 3 для протокола RIP находится в приложении Б, В, Г соответственно.

1.3 Информация о портах маршрутизаторов (команда show ip interface brief)

Информация о портах маршрутизаторов представлена на рисунках 4-7.

```
Internet#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.100.2     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  up                    down
Vlan1                  unassigned      YES unset  administratively down down
```

Рисунок 4 – Информация о портах маршрутизатора Internet

```
Router1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.100.1     YES manual up                    up
FastEthernet1/0        10.14.0.1       YES manual up                    up
FastEthernet2/0        10.14.1.1       YES manual up                    up
```

Рисунок 5 – Информация о портах маршрутизатора Router1

```
Router2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.3.1       YES manual up                    up
FastEthernet1/0        10.14.1.2       YES manual up                    up
FastEthernet2/0        10.14.2.1       YES manual up                    up
```

Рисунок 6 – Информация о портах маршрутизатора Router2

```
Router3#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.4.1       YES manual up                    up
FastEthernet1/0        10.14.3.2       YES manual up                    up
```

Рисунок 7 – Информация о портах маршрутизатора Router3

1.4 Таблицы маршрутизации (команда show ip route)

Таблицы маршрутизации Internet, Router1, Router2 и Router3 соответственно представлены на рисунках 8-11.

```
Internet#show 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 10.14.100.1 to network 0.0.0.0

     10.0.0.0/24 is subnetted, 1 subnets
C       10.14.100.0 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.14.100.1
```

Рисунок 8 – Таблица маршрутизации Internet

```
Router1#show 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 10.14.100.2 to network 0.0.0.0

     10.0.0.0/24 is subnetted, 6 subnets
C       10.14.0.0 is directly connected, FastEthernet1/0
C       10.14.1.0 is directly connected, FastEthernet2/0
R       10.14.2.0 [120/1] via 10.14.1.2, 00:00:08, FastEthernet2/0
R       10.14.3.0 [120/1] via 10.14.1.2, 00:00:08, FastEthernet2/0
R       10.14.4.0 [120/2] via 10.14.1.2, 00:00:08, FastEthernet2/0
C       10.14.100.0 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.14.100.2
```

Рисунок 9 – Таблица маршрутизации Router1

```
Router2#show 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 not set

     10.0.0.0/24 is subnetted, 6 subnets
R       10.14.0.0 [120/1] via 10.14.1.1, 00:00:16, FastEthernet1/0
C       10.14.1.0 is directly connected, FastEthernet1/0
C       10.14.2.0 is directly connected, FastEthernet2/0
C       10.14.3.0 is directly connected, FastEthernet0/0
R       10.14.4.0 [120/1] via 10.14.3.2, 00:00:29, FastEthernet0/0
R       10.14.100.0 [120/1] via 10.14.1.1, 00:00:16, FastEthernet1/0
```

Рисунок 10 – Таблица маршрутизации Router2

```
Router3#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.4.1       YES manual up                    up
FastEthernet1/0        10.14.3.2       YES manual up                    up
Router3#show 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 not set

     10.0.0.0/24 is subnetted, 6 subnets
R       10.14.0.0 [120/2] via 10.14.3.1, 00:00:24, FastEthernet1/0
R       10.14.1.0 [120/1] via 10.14.3.1, 00:00:24, FastEthernet1/0
R       10.14.2.0 [120/1] via 10.14.3.1, 00:00:24, FastEthernet1/0
C       10.14.3.0 is directly connected, FastEthernet1/0
C       10.14.4.0 is directly connected, FastEthernet0/0
R       10.14.100.0 [120/2] via 10.14.3.1, 00:00:24, FastEthernet1/0
```

Рисунок 11 – Таблица маршрутизации Router3

1.5 Параметры, статистика протоколов маршрутизации, запущенных на маршрутизаторах (команда show ip protocols)

Параметры, статистика протоколов маршрутизации, запущенных на маршрутизаторах Internet, Router1, Router2 и Router3 соответственно представлены на рисунках 12-15.

```
Internet#show ip protocols
Internet#
```

Рисунок 12 – Internet

```
Router1#show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 11 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface             Send  Recv  Triggered RIP  Key-chain
  FastEthernet1/0       12 1
  FastEthernet0/0       12 1
  FastEthernet2/0       12 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
          10.0.0.0
Passive Interface(s):
Routing Information Sources:
          Gateway         Distance      Last Update
          10.14.1.2            120      00:00:02
Distance: (default is 120)
```

Рисунок 13 – Router1

```
Router2#show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 18 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface             Send  Recv  Triggered RIP  Key-chain
  FastEthernet1/0       12 1
  FastEthernet2/0       12 1
  FastEthernet0/0       12 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
          10.0.0.0
Passive Interface(s):
Routing Information Sources:
          Gateway         Distance      Last Update
          10.14.1.1            120      00:00:23
          10.14.3.2            120      00:00:10
Distance: (default is 120)
```

Рисунок 14 – Router2

```
Router3#show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 13 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 1, receive any version
  Interface             Send  Recv  Triggered RIP  Key-chain
  FastEthernet1/0       12 1
  FastEthernet0/0       12 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
           10.0.0.0
Passive Interface(s):
Routing Information Sources:
           Gateway         Distance      Last Update
           10.14.3.1            120      00:00:13
Distance: (default is 120)
```

Рисунок 15 – Router3

1.6 База данных RIP (команда show ip rip database)

База данных RIP Internet, Router1, Router2 и Router3 соответственно представлена на рисунках 16-19.

```
Internet#show ip rip database
Internet#
```

Рисунок 16 – Internet

```
Router1#show ip rip database
10.14.0.0/24    auto-summary
10.14.0.0/24    directly connected, FastEthernet1/0
10.14.1.0/24    auto-summary
10.14.1.0/24    directly connected, FastEthernet2/0
10.14.2.0/24    auto-summary
10.14.2.0/24
    [1] via 10.14.1.2, 00:00:20, FastEthernet2/0
10.14.3.0/24    auto-summary
10.14.3.0/24
    [1] via 10.14.1.2, 00:00:20, FastEthernet2/0
10.14.4.0/24    auto-summary
10.14.4.0/24
    [2] via 10.14.1.2, 00:00:20, FastEthernet2/0
10.14.100.0/24    auto-summary
10.14.100.0/24    directly connected, FastEthernet0/0
```

Рисунок 17 – Router1

```
Router2#show ip rip database
10.14.0.0/24    auto-summary
10.14.0.0/24
    [1] via 10.14.1.1, 00:00:06, FastEthernet1/0
10.14.1.0/24    auto-summary
10.14.1.0/24    directly connected, FastEthernet1/0
10.14.2.0/24    auto-summary
10.14.2.0/24    directly connected, FastEthernet2/0
10.14.3.0/24    auto-summary
10.14.3.0/24    directly connected, FastEthernet0/0
10.14.4.0/24    auto-summary
10.14.4.0/24
    [1] via 10.14.3.2, 00:00:05, FastEthernet0/0
10.14.100.0/24    auto-summary
10.14.100.0/24
    [1] via 10.14.1.1, 00:00:06, FastEthernet1/0
```

Рисунок 18 – Router2

```
Router3#show ip rip database
10.14.0.0/24    auto-summary
10.14.0.0/24
    [2] via 10.14.3.1, 00:00:02, FastEthernet1/0
10.14.1.0/24    auto-summary
10.14.1.0/24
    [1] via 10.14.3.1, 00:00:02, FastEthernet1/0
10.14.2.0/24    auto-summary
10.14.2.0/24
    [1] via 10.14.3.1, 00:00:02, FastEthernet1/0
10.14.3.0/24    auto-summary
10.14.3.0/24    directly connected, FastEthernet1/0
10.14.4.0/24    auto-summary
10.14.4.0/24    directly connected, FastEthernet0/0
10.14.100.0/24    auto-summary
10.14.100.0/24
    [2] via 10.14.3.1, 00:00:02, FastEthernet1/0
```

Рисунок 19 – Router3

1.7 Результат проверки

Результат проверки динамической маршрутизации по протоколу RIP представлен на рисунке 20.

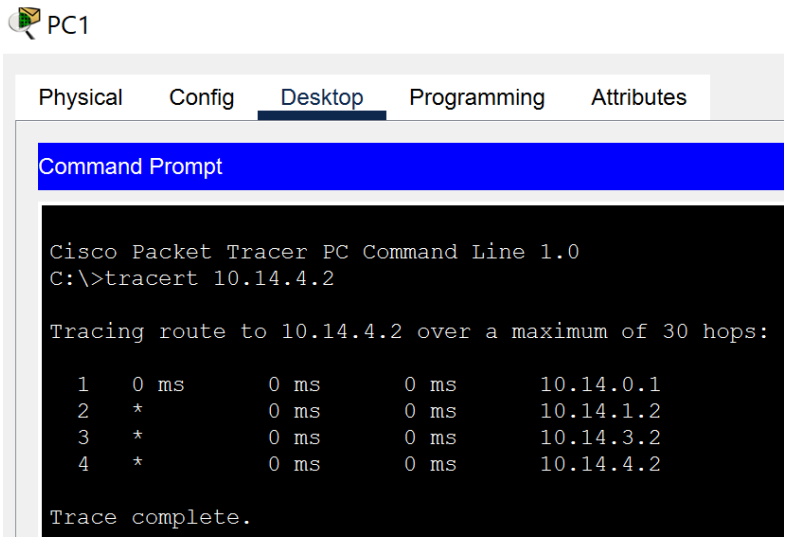

Рисунок 20 – Результат проверки

2 Протокол OSPF

2.1 Схема ЛВС с указанием выделенных областей

Следующим этапом перейдём к настройке протокола OSPF. После этого получим схему, которую можно наблюдать на рисунке 21.

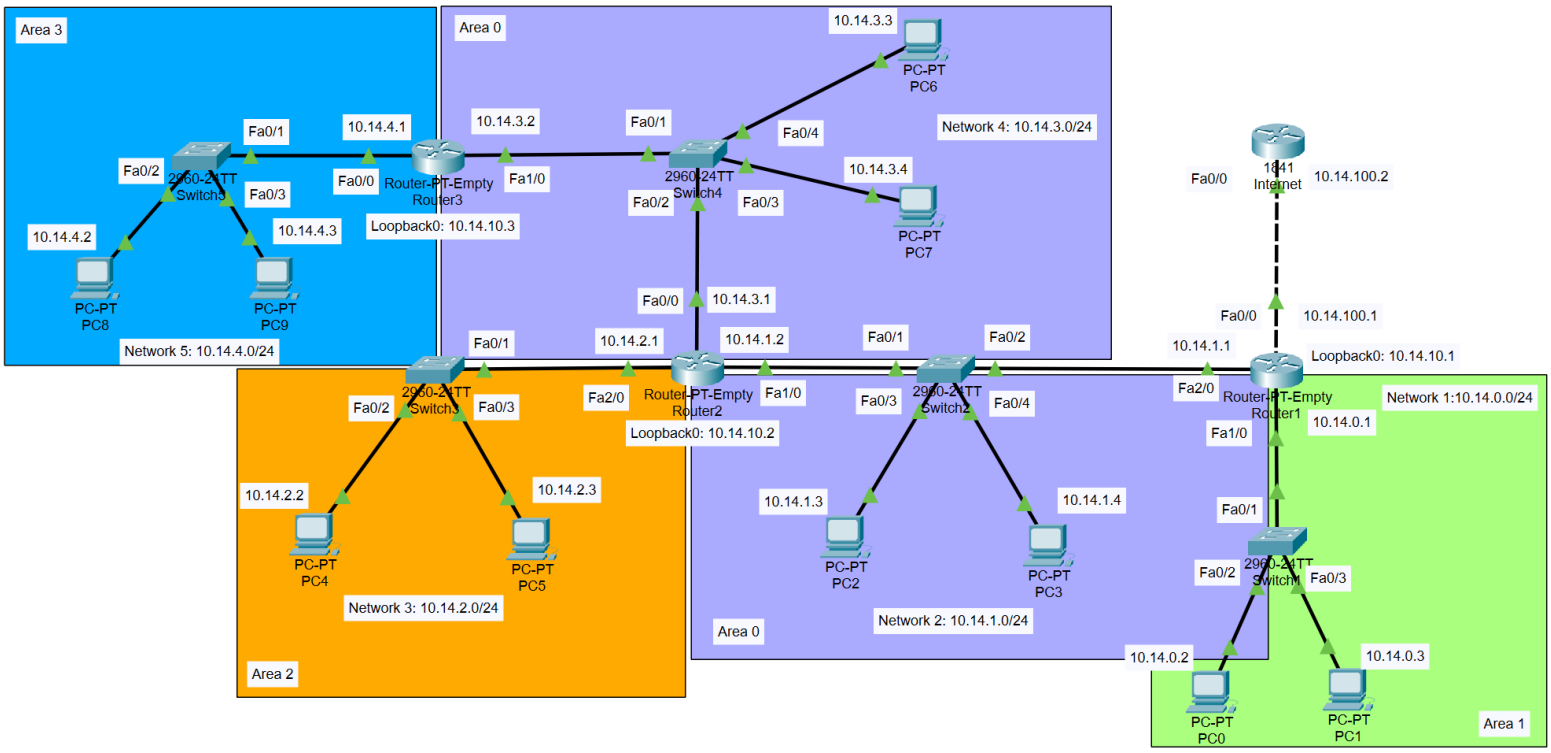

Рисунок 21 – Схема с протоколом OSPF

2.2 Содержание файлов конфигурации устройств

Конфигурация настройки роутера Internet находится, аналогично примеру с RIP, в приложении А. Конфигурация роутеров Router1, Router2 и Router 3 для протокола OSPF находится в приложении Д, Е, Ж соответственно.

2.3 Информация о портах маршрутизаторов (команда show ip interface brief)

Информация о портах маршрутизаторов Internet, Router1, Router2 и Router3 соответственно представлена на рисунках 22-25.

```
Internet#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.100.2     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  up                    down
Vlan1                  unassigned      YES unset  administratively down down
```

Рисунок 22 – Internet

```
show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.100.1     YES manual up                    up
FastEthernet1/0        10.14.0.1       YES manual up                    up
FastEthernet2/0        10.14.1.1       YES manual up                    up
Loopback0              10.14.10.1      YES manual up                    up
Router1#
```

Рисунок 23 – Router1

```
Router2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.3.1       YES manual up                    up
FastEthernet1/0        10.14.1.2       YES manual up                    up
FastEthernet2/0        10.14.2.1       YES manual up                    up
Loopback0              10.14.10.2      YES manual up                    up
```

Рисунок 24 – Router2

```
Router3#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.14.4.1       YES manual up                    up
FastEthernet1/0        10.14.3.2       YES manual up                    up
Loopback0              10.14.10.3      YES manual up                    up
```

Рисунок 25 – Router3

2.4 Таблица маршрутизации (команда show ip route)

Таблицы маршрутизации маршрутизаторов Internet, Router1, Router2 и Router3 соответственно представлены на рисунках 26-29.

```
Internet#show 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 10.14.100.1 to network 0.0.0.0

     10.0.0.0/24 is subnetted, 1 subnets
C       10.14.100.0 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.14.100.1
```

Рисунок 26 – Internet

```
Router1#show 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 10.14.100.2 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
C       10.14.0.0/24 is directly connected, FastEthernet1/0
C       10.14.1.0/24 is directly connected, FastEthernet2/0
O IA    10.14.2.0/24 [110/2] via 10.14.1.2, 00:04:56, FastEthernet2/0
O       10.14.3.0/24 [110/2] via 10.14.1.2, 00:04:46, FastEthernet2/0
O IA    10.14.4.0/24 [110/3] via 10.14.1.2, 00:04:46, FastEthernet2/0
C       10.14.10.1/32 is directly connected, Loopback0
C       10.14.100.0/24 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.14.100.2
```

Рисунок 27 – Router1

```
Router2#show 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 10.14.1.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
O IA    10.14.0.0/24 [110/2] via 10.14.1.1, 00:05:21, FastEthernet1/0
C       10.14.1.0/24 is directly connected, FastEthernet1/0
C       10.14.2.0/24 is directly connected, FastEthernet2/0
C       10.14.3.0/24 is directly connected, FastEthernet0/0
O IA    10.14.4.0/24 [110/2] via 10.14.3.2, 00:05:21, FastEthernet0/0
C       10.14.10.2/32 is directly connected, Loopback0
O*E2 0.0.0.0/0 [110/1] via 10.14.1.1, 00:05:21, FastEthernet1/0
```

Рисунок 28 – Router2

```
Router3#show 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 10.14.3.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
O IA    10.14.0.0/24 [110/3] via 10.14.3.1, 00:05:08, FastEthernet1/0
O       10.14.1.0/24 [110/2] via 10.14.3.1, 00:05:08, FastEthernet1/0
O IA    10.14.2.0/24 [110/2] via 10.14.3.1, 00:05:08, FastEthernet1/0
C       10.14.3.0/24 is directly connected, FastEthernet1/0
C       10.14.4.0/24 is directly connected, FastEthernet0/0
C       10.14.10.3/32 is directly connected, Loopback0
O*E2 0.0.0.0/0 [110/1] via 10.14.3.1, 00:05:08, FastEthernet1/0
```

Рисунок 29 – Router3

2.5 Параметры, статистика протоколов маршрутизации запущенных на маршрутизаторах (команда show ip protocols)

Параметры, статистика протоколов маршрутизации, запущенных на маршрутизаторах, Internet, Router1, Router2 и Router3 соответственно представлены на рисунках 30-33.

```
Internet#show ip protocols
Internet#
```

Рисунок 30 – Internet

```
Router1#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 10.14.10.1
  It is an autonomous system boundary router
  Redistributing External Routes from,
  Number of areas in this router is 2. 2 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.14.0.0 0.0.0.255 area 1
    10.14.1.0 0.0.0.255 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.14.10.1           110      00:06:59
    10.14.10.2           110      00:06:55
    10.14.10.3           110      00:06:55
  Distance: (default is 110)
```

Рисунок 31 – Router1

```
Router2#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 10.14.10.2
  Number of areas in this router is 2. 2 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.14.1.0 0.0.0.255 area 0
    10.14.3.0 0.0.0.255 area 0
    10.14.2.0 0.0.0.255 area 2
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.14.10.1           110      00:06:56
    10.14.10.2           110      00:07:37
    10.14.10.3           110      00:06:56
  Distance: (default is 110)
```

Рисунок 32 – Router2

```
Router3#show ip protocols

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 10.14.10.3
  Number of areas in this router is 2. 2 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.14.3.0 0.0.0.255 area 0
    10.14.4.0 0.0.0.255 area 3
  Routing Information Sources:
    Gateway         Distance      Last Update
    10.14.10.1           110      00:06:49
    10.14.10.2           110      00:06:49
    10.14.10.3           110      00:07:34
  Distance: (default is 110)
```

Рисунок 33 – Router3

2.6 Информация о настройках OSPF на интерфейсах (команда show ip ospf interface)

Информация о настройках OSPF на интерфейсах Internet, Router1, Router2 и Router3 соответственно представлены на рисунках 34-37.

```
Internet#show ip ospf interface

Internet#
```

Рисунок 34 – Internet

```
Router1#show ip ospf interface

FastEthernet2/0 is up, line protocol is up
  Internet address is 10.14.1.1/24, Area 0
  Process ID 1, Router ID 10.14.10.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.14.10.2, Interface address 10.14.1.2
  Backup Designated Router (ID) 10.14.10.1, Interface address 10.14.1.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.14.10.2  (Designated Router)
  Suppress hello for 0 neighbor(s)
FastEthernet1/0 is up, line protocol is up
  Internet address is 10.14.0.1/24, Area 1
  Process ID 1, Router ID 10.14.10.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.14.10.1, Interface address 10.14.0.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Рисунок 35 – Router1

```
Router2#show ip ospf interface

FastEthernet1/0 is up, line protocol is up
  Internet address is 10.14.1.2/24, Area 0
  Process ID 1, Router ID 10.14.10.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.14.10.2, Interface address 10.14.1.2
  Backup Designated Router (ID) 10.14.10.1, Interface address 10.14.1.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.14.10.1  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
FastEthernet0/0 is up, line protocol is up
  Internet address is 10.14.3.1/24, Area 0
  Process ID 1, Router ID 10.14.10.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.14.10.3, Interface address 10.14.3.2
  Backup Designated Router (ID) 10.14.10.2, Interface address 10.14.3.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.14.10.3  (Designated Router)
  Suppress hello for 0 neighbor(s)
FastEthernet2/0 is up, line protocol is up
  Internet address is 10.14.2.1/24, Area 2
  Process ID 1, Router ID 10.14.10.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.14.10.2, Interface address 10.14.2.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:00
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Рисунок 36 – Router2

```
Router3#show ip ospf interface

FastEthernet1/0 is up, line protocol is up
  Internet address is 10.14.3.2/24, Area 0
  Process ID 1, Router ID 10.14.10.3, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.14.10.3, Interface address 10.14.3.2
  Backup Designated Router (ID) 10.14.10.2, Interface address 10.14.3.1
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.14.10.2  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
FastEthernet0/0 is up, line protocol is up
  Internet address is 10.14.4.1/24, Area 3
  Process ID 1, Router ID 10.14.10.3, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 10.14.10.3, Interface address 10.14.4.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
```

Рисунок 37 – Router3

2.7 База данных состояния каналов (команда show ip ospf database)

База данных состояния каналов Internet, Router1, Router2 и Router3 соответственно представлена на рисунках 38-41.

```
Internet#show ip ospf database
Internet#
```

Рисунок 38 – Internet

```
Router1#show ip ospf database
            OSPF Router with ID (10.14.10.1) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.1      10.14.10.1      490         0x80000003 0x003c98 1
10.14.10.2      10.14.10.2      486         0x80000006 0x008106 2
10.14.10.3      10.14.10.3      486         0x80000003 0x00507d 1

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.1.2       10.14.10.2      490         0x80000001 0x0087d5
10.14.3.2       10.14.10.3      490         0x80000001 0x00f3fc

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.0.0       10.14.10.1      528         0x80000001 0x0051d1
10.14.2.0       10.14.10.2      522         0x80000001 0x0035ea
10.14.4.0       10.14.10.3      527         0x80000001 0x001904

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.1      10.14.10.1      534         0x80000003 0x00fbf4 1

                Summary Net Link States (Area 1)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.1.0       10.14.10.1      525         0x80000001 0x0046db
10.14.3.0       10.14.10.1      485         0x80000002 0x0038e5
10.14.2.0       10.14.10.1      485         0x80000003 0x0041dc
10.14.4.0       10.14.10.1      475         0x80000004 0x0033e6

                Type-5 AS External Link States
Link ID         ADV Router      Age         Seq#       Checksum Tag
0.0.0.0         10.14.10.1      532         0x80000001 0x0006a9 1
```

Рисунок 39 – Router1

```
Router2#show ip ospf database
            OSPF Router with ID (10.14.10.2) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.2      10.14.10.2      493         0x80000006 0x008106 2
10.14.10.1      10.14.10.1      493         0x80000003 0x003c98 1
10.14.10.3      10.14.10.3      493         0x80000003 0x00507d 1

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.1.2       10.14.10.2      493         0x80000001 0x0087d5
10.14.3.2       10.14.10.3      493         0x80000001 0x00f3fc

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.2.0       10.14.10.2      525         0x80000001 0x0035ea
10.14.0.0       10.14.10.1      531         0x80000001 0x0051d1
10.14.4.0       10.14.10.3      530         0x80000001 0x001904

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.2      10.14.10.2      534         0x80000001 0x00fbf4 1

                Summary Net Link States (Area 2)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.1.0       10.14.10.2      530         0x80000001 0x0040e0
10.14.3.0       10.14.10.2      530         0x80000002 0x0028f5
10.14.0.0       10.14.10.2      488         0x80000004 0x004fce
10.14.4.0       10.14.10.2      488         0x80000005 0x0021f7

                Summary ASB Link States (Area 2)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.10.1      10.14.10.2      488         0x80000003 0x00c053

                Type-5 AS External Link States
Link ID         ADV Router      Age         Seq#       Checksum Tag
0.0.0.0         10.14.10.1      535         0x80000001 0x0006a9 1
```

Рисунок 40 – Router2

```
Router3#show ip ospf database
            OSPF Router with ID (10.14.10.3) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.3      10.14.10.3      497         0x80000003 0x00507d 1
10.14.10.2      10.14.10.2      493         0x80000006 0x008106 2
10.14.10.1      10.14.10.1      493         0x80000003 0x003c98 1

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.3.2       10.14.10.3      497         0x80000001 0x00f3fc
10.14.1.2       10.14.10.2      497         0x80000001 0x0087d5

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.4.0       10.14.10.3      534         0x80000001 0x001904
10.14.2.0       10.14.10.2      529         0x80000001 0x0035ea
10.14.0.0       10.14.10.1      535         0x80000001 0x0051d1

                Router Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.14.10.3      10.14.10.3      538         0x80000001 0x00fdee 1

                Summary Net Link States (Area 3)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.3.0       10.14.10.3      529         0x80000001 0x0024f9
10.14.1.0       10.14.10.3      483         0x80000002 0x0042db
10.14.2.0       10.14.10.3      483         0x80000004 0x0033e7
10.14.0.0       10.14.10.3      483         0x80000005 0x0051c9

                Summary ASB Link States (Area 3)
Link ID         ADV Router      Age         Seq#       Checksum
10.14.10.1      10.14.10.3      483         0x80000003 0x00c44d

                Type-5 AS External Link States
Link ID         ADV Router      Age         Seq#       Checksum Tag
0.0.0.0         10.14.10.1      539         0x80000001 0x0006a9 1
```

Рисунок 41 – Router3

Вывод

В ходе выполнения данной лабораторной работы нами были изучены протоколы динамической маршрутизации в IP-сетях, получены практические навыки настройки маршрутизаторов с применением динамической маршрутизации RIP и OSPF.

ПРИЛОЖЕНИЕ А

Настройки роутера Internet

```
!
version 12.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Internet
!
!
!
ip cef
no ipv6 cef
!
!
!
spanning-tree mode pvst
!
!
!
interface FastEthernet0/0
 ip address 10.14.100.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 duplex auto
 speed auto
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.14.100.1
!
ip flow-export version 9
!
!
!
no cdp run
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
end
```

ПРИЛОЖЕНИЕ Б

Настройки роутера Router1 для RIP

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router1
!
!
!
no ip cef
no ipv6 cef
!
!
!
no ip domain-lookup
!
!
!
interface FastEthernet0/0
 ip address 10.14.100.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet2/0
 ip address 10.14.1.1 255.255.255.0
 duplex auto
 speed auto
!
router rip
 network 10.0.0.0
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.14.100.2
!
ip flow-export version 9
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
end
```

ПРИЛОЖЕНИЕ В

Настройки роутера Router2 для RIP

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router2
!
!
!
no ip cef
no ipv6 cef

!
!
!
no ip domain-lookup
!
!
!
interface FastEthernet0/0
 ip address 10.14.3.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.1.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet2/0
 ip address 10.14.2.1 255.255.255.0
 duplex auto
 speed auto
!
router rip
 network 10.0.0.0
!
ip classless
!
ip flow-export version 9
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
end
```

ПРИЛОЖЕНИЕ Г

Настройки роутера Router3 для RIP

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router3
!
!
!
no ip cef
no ipv6 cef
!
!
!
no ip domain-lookup
!
!
!
interface FastEthernet0/0
 ip address 10.14.4.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.3.2 255.255.255.0
 duplex auto
 speed auto
!
router rip
 network 10.0.0.0
!
ip classless
!
ip flow-export version 9
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
end
```

ПРИЛОЖЕНИЕ Д

Настройки роутера Router1 для OSPF

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router1
!
!
!
no ip cef
no ipv6 cef
!
!
no ip domain-lookup
!
!
!
interface Loopback0
 ip address 10.14.10.1 255.255.255.255
!
interface FastEthernet0/0
 ip address 10.14.100.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet2/0
 ip address 10.14.1.1 255.255.255.0
 duplex auto
 speed auto
!
router ospf 1
 log-adjacency-changes
 network 10.14.0.0 0.0.0.255 area 1
 network 10.14.1.0 0.0.0.255 area 0
 default-information originate
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.14.100.2
!
ip flow-export version 9
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
end
```

ПРИЛОЖЕНИЕ Е

Настройки роутера Router2 для OSPF

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router2
!
!
!
no ip cef
no ipv6 cef
!
!
!
no ip domain-lookup
!
!
!
interface Loopback0
 ip address 10.14.10.2 255.255.255.255
!
interface FastEthernet0/0
 ip address 10.14.3.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.1.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet2/0
 ip address 10.14.2.1 255.255.255.0
 duplex auto
 speed auto
!
router ospf 1
 log-adjacency-changes
 network 10.14.1.0 0.0.0.255 area 0
 network 10.14.3.0 0.0.0.255 area 0
 network 10.14.2.0 0.0.0.255 area 2
!
ip classless
!
ip flow-export version 9
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
end
```

ПРИЛОЖЕНИЕ Ж

Настройки роутера Router3 для OSPF

```
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router3
!
!
!
no ip cef
no ipv6 cef
!
!
!
no ip domain-lookup
!
!
!
interface Loopback0
 ip address 10.14.10.3 255.255.255.255
!
interface FastEthernet0/0
 ip address 10.14.4.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 10.14.3.2 255.255.255.0
 duplex auto
 speed auto
!
router ospf 1
 log-adjacency-changes
 network 10.14.3.0 0.0.0.255 area 0
 network 10.14.4.0 0.0.0.255 area 3
!
ip classless
!
ip flow-export version 9
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
!
!
end
```