Университет ИТМО

Администрирование вычислительных систем
Лабораторная работа №2

Выполнили: Калугина Марина
Саржевский Иван
Группа: P3402

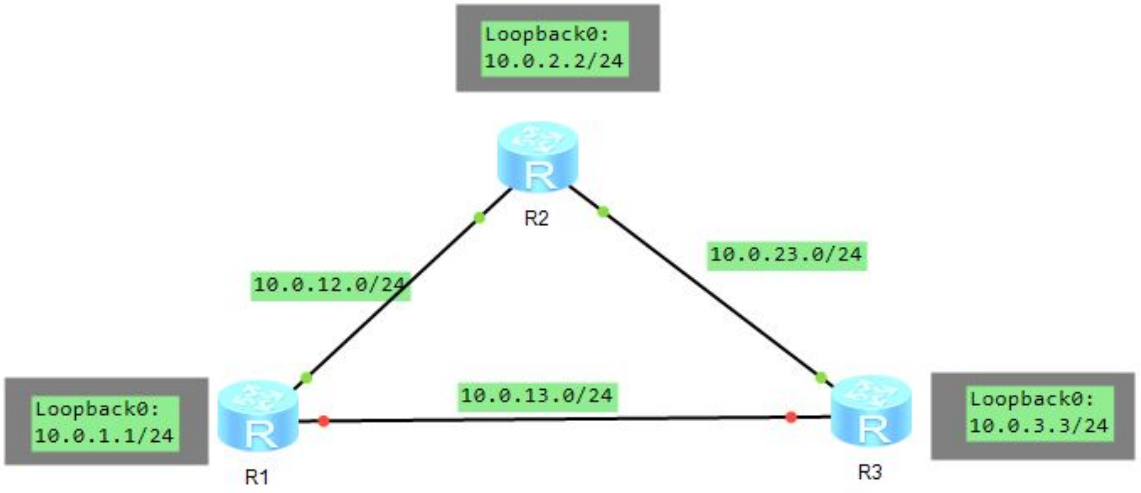
г. Санкт-Петербург
2020 г.

Содержание

Lab 4-1 Configuring Static Routes and Default Routes

Выполнения базовой конфигурации системы и IP-адреса

Топология



R1

Настроим имя устройства и IP-адрес для R1

```
[Huawei]sysname R1
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]ip address 10.0.13.1 24
Oct  6 2020 00:02:25-08:00 R1 %%01IFNET/4/LINK_STATE(l)[2]:The
line protocol IP
on the interface GigabitEthernet0/0/0 has entered the UP state.
[R1-GigabitEthernet0/0/0]quit
[R1]interface GigabitEthernet 0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.12.1 24
Oct  6 2020 00:03:18-08:00 R1 %%01IFNET/4/LINK_STATE(l)[3]:The
line protocol IP
on the interface GigabitEthernet0/0/1 has entered the UP state.
[R1-GigabitEthernet0/0/1]quit
[R1]interface LoopBack 0
```

```
[R1-LoopBack0]ip address 10.0.1.1 24
```

Проверим конфигурацию

```
<R1>display ip interface brief
Interface                   IP Address/Mask      Physical   Protocol
GigabitEthernet0/0/0        10.0.13.1/24         up         up
GigabitEthernet0/0/1        10.0.12.1/24         up         up
GigabitEthernet0/0/2        unassigned           down       down
LoopBack0                   10.0.1.1/24          up         up(s)
```

R2

Настроим имя устройства и IP-адрес для R2

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R2
[R2]interface GigabitEthernet 0/0/1
[R2-GigabitEthernet0/0/1]ip address 10.0.12.2 24
[R2-GigabitEthernet0/0/1]
Oct  6 2020 00:07:16-08:00 R2 %%01IFNET/4/LINK_STATE(l)[0]:The
line protocol IP
on the interface GigabitEthernet0/0/1 has entered the UP state.
[R2-GigabitEthernet0/0/1]quit
[R2]interface GigabitEthernet 0/0/2
[R2-GigabitEthernet0/0/2]ip add
[R2-GigabitEthernet0/0/2]ip address 10.0.23.2 24
Oct  6 2020 00:08:00-08:00 R2 %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol IP
on the interface GigabitEthernet0/0/2 has entered the UP state.
[R2-GigabitEthernet0/0/2]quit
[R2]interface LoopBack0
[R2-LoopBack0]ip address 10.0.2.2 24
```

Проверим конфигурацию

```
[R2]display ip interface brief
Interface                   IP Address/Mask      Physical   Protocol
GigabitEthernet0/0/0        unassigned           down       down
GigabitEthernet0/0/1        10.0.12.2/24         up         up
GigabitEthernet0/0/2        10.0.23.2/24         up         up
LoopBack0                   10.0.2.2/24          up         up(s)
```

R3

Настроим имя устройства и IP-адрес для R3

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R3
[R3]interface GigabitEthernet 0/0/0
```

```
[R3-GigabitEthernet0/0/0]ip address 10.0.13.3 24
Oct  6 2020 00:10:56-08:00 R3 %%01IFNET/4/LINK_STATE(l)[0]:The
line protocol IP
on the interface GigabitEthernet0/0/0 has entered the UP state.
[R3-GigabitEthernet0/0/0]quit
[R3]interface GigabitEthernet 0/0/2
[R3-GigabitEthernet0/0/2]ip address 10.0.23.3 24
Oct  6 2020 00:11:44-08:00 R3 %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol IP
on the interface GigabitEthernet0/0/2 has entered the UP state.
[R3-GigabitEthernet0/0/2]quit
[R3]interface LoopBack 0
[R3-LoopBack0]ip address 10.0.3.3 24
```

Проверим конфигурацию

```
[R3]display ip interface brief
Interface                   IP Address/Mask      Physical   Protocol
GigabitEthernet0/0/0        10.0.13.3/24         up         up
GigabitEthernet0/0/1        unassigned           down       down
GigabitEthernet0/0/2        10.0.23.3/24         up         up
LoopBack0                   10.0.3.3/24          up         up(s)
```

Выполним команду ping для проверки сетевого соединения

```
<R1>ping 10.0.12.2
  PING 10.0.12.2: 56  data bytes, press CTRL_C to break
    Reply from 10.0.12.2: bytes=56 Sequence=1 ttl=255 time=200 ms
    Reply from 10.0.12.2: bytes=56 Sequence=2 ttl=255 time=30 ms
    Reply from 10.0.12.2: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.12.2: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.12.2: bytes=56 Sequence=5 ttl=255 time=60 ms

  --- 10.0.12.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/68/200 ms

<R1>ping 10.0.13.3
  PING 10.0.13.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.13.3: bytes=56 Sequence=1 ttl=255 time=150 ms
    Reply from 10.0.13.3: bytes=56 Sequence=2 ttl=255 time=40 ms
    Reply from 10.0.13.3: bytes=56 Sequence=3 ttl=255 time=20 ms
    Reply from 10.0.13.3: bytes=56 Sequence=4 ttl=255 time=40 ms
    Reply from 10.0.13.3: bytes=56 Sequence=5 ttl=255 time=10 ms

  --- 10.0.13.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/52/150 ms
```

```
<R2>ping 10.0.23.3
  PING 10.0.23.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.23.3: bytes=56 Sequence=1 ttl=255 time=70 ms
    Reply from 10.0.23.3: bytes=56 Sequence=2 ttl=255 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=3 ttl=255 time=10 ms
    Reply from 10.0.23.3: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.23.3: bytes=56 Sequence=5 ttl=255 time=40 ms

  --- 10.0.23.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/34/70 ms
```

Тестирование соединения

Проверим соединения между R2 и сетями 10.0.13.0/24 и 10.0.3.0/24

```
<R2>ping 10.0.23.3
  PING 10.0.23.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.23.3: bytes=56 Sequence=1 ttl=255 time=70 ms
    Reply from 10.0.23.3: bytes=56 Sequence=2 ttl=255 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=3 ttl=255 time=10 ms
    Reply from 10.0.23.3: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.23.3: bytes=56 Sequence=5 ttl=255 time=40 ms

  --- 10.0.23.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/34/70 ms

<R2>ping 10.0.13.3
  PING 10.0.13.3: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

  --- 10.0.13.3 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
    100.00% packet loss

<R2>ping 10.0.3.3
  PING 10.0.3.3: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
```

```
    Request time out
    Request time out
    Request time out

  --- 10.0.3.3 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
    100.00% packet loss
```

Выведем таблицу маршрутизации R2

```
<R2>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 13       Routes : 13

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
       10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.12.0/24  Direct  0    0           D   10.0.12.2       GigabitEthernet
0/0/1
      10.0.12.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
      10.0.23.0/24  Direct  0    0           D   10.0.23.2       GigabitEthernet
0/0/2
      10.0.23.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/2
    10.0.23.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/2
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Настроим статические маршруты на R2

```
[R2]ip route-static 10.0.13.0 24 10.0.23.3
[R2]ip rou
[R2]ip route-s
[R2]ip route-static 10.0.3.0 24 10.0.23.3
```

```
[R2]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 15       Routes : 15

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
       10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
       10.0.3.0/24  Static  60   0          RD   10.0.23.3       GigabitEthernet
0/0/2
```

```
      10.0.12.0/24  Direct  0    0           D   10.0.12.2       GigabitEthernet
0/0/1
      10.0.12.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
      10.0.13.0/24  Static  60   0          RD   10.0.23.3       GigabitEthernet
0/0/2
      10.0.23.0/24  Direct  0    0           D   10.0.23.2       GigabitEthernet
0/0/2
      10.0.23.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/2
    10.0.23.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/2
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Сконфигурируем резезрвные статические маршруты

```
[R1]ip route-static 10.0.13.0 255.255.255.0 10.0.12.1 preference 80
```

```
[R2]ip route-static 10.0.13.0 255.255.255.0 10.0.12.1 preference 80
[R2]ip route-static 10.0.3.0 24 10.0.12.1 preference 80
```

```
[R3]ip route-static 10.0.12.0 24 10.0.13.1
```

Тестирование статических маршрутов

Таблица маршрутизации R2:

```
<R2>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 15        Routes : 15

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

       10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
       10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
       10.0.3.0/24  Static  60   0          RD   10.0.23.3       GigabitEthernet0/0/2
      10.0.12.0/24  Direct  0    0           D   10.0.12.2       GigabitEthernet0/0/1
      10.0.12.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
      10.0.13.0/24  Static  60   0          RD   10.0.23.3       GigabitEthernet0/0/2
      10.0.23.0/24  Direct  0    0           D   10.0.23.2       GigabitEthernet0/0/2
      10.0.23.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/2
    10.0.23.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/2
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Проверим соединение между R2 и R3

```
<R2>ping 10.0.13.3
  PING 10.0.13.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.13.3: bytes=56 Sequence=1 ttl=255 time=60 ms
    Reply from 10.0.13.3: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 10.0.13.3: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.13.3: bytes=56 Sequence=4 ttl=255 time=10 ms
    Reply from 10.0.13.3: bytes=56 Sequence=5 ttl=255 time=30 ms

  --- 10.0.13.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/30/60 ms

<R2>ping 10.0.3.3
  PING 10.0.3.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.3.3: bytes=56 Sequence=1 ttl=255 time=40 ms
    Reply from 10.0.3.3: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 10.0.3.3: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.3.3: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.3.3: bytes=56 Sequence=5 ttl=255 time=30 ms

  --- 10.0.3.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/28/40 ms
```

```
<R2>tracert 10.0.13.3

 traceroute to  10.0.13.3(10.0.13.3), max hops: 30 ,packet length: 40,press CTRL_C to
break

 1 10.0.23.3 80 ms  30 ms  30 ms
<R2>tracert 10.0.3.3

 traceroute to  10.0.3.3(10.0.3.3), max hops: 30 ,packet length: 40,press CTRL_C
 to break

 1 10.0.23.3 20 ms  60 ms  30 ms
```

Тестирование резервных статических маршрутов

Отключим интерфейс G0/0/2 на маршрутизаторе R2

```
[R2]interface GigabitEthernet 0/0/2
[R2-GigabitEthernet0/0/2]shutdown
Oct  6 2020 00:41:33-08:00 R2
%%01IFPDT/4/IF_STATE(l)[0]:Interface GigabitEthern
et0/0/2 has turned into DOWN state.
[R2-GigabitEthernet0/0/2]
Oct  6 2020 00:41:33-08:00 R2 %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol IP
on the interface GigabitEthernet0/0/2 has entered the DOWN state.
[R2-GigabitEthernet0/0/2]quit
```

Таблица маршрутизации R2

```
<R2>display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 12        Routes : 12

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
        10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.2.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.3.0/24  Static  80   0          RD   10.0.12.1       GigabitEthernet0/0/1
       10.0.12.0/24  Direct  0    0           D   10.0.12.2       GigabitEthernet0/0/1
       10.0.12.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
     10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
       10.0.13.0/24  Static  80   0          RD   10.0.12.1       GigabitEthernet0/0/1
       127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
       127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32   Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32   Direct  0    0           D   127.0.0.1       InLoopBack0
```

Проверим соединения между R2 и адресами 10.0.13.3 и 10.0.3.3

```
<R2>ping 10.0.3.3
  PING 10.0.3.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.3.3: bytes=56 Sequence=1 ttl=254 time=60 ms
    Reply from 10.0.3.3: bytes=56 Sequence=2 ttl=254 time=40 ms
    Reply from 10.0.3.3: bytes=56 Sequence=3 ttl=254 time=40 ms
    Reply from 10.0.3.3: bytes=56 Sequence=4 ttl=254 time=10 ms
    Reply from 10.0.3.3: bytes=56 Sequence=5 ttl=254 time=20 ms

  --- 10.0.3.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/34/60 ms

<R2>ping 10.0.13.3
  PING 10.0.13.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.13.3: bytes=56 Sequence=1 ttl=254 time=30 ms
    Reply from 10.0.13.3: bytes=56 Sequence=2 ttl=254 time=30 ms
    Reply from 10.0.13.3: bytes=56 Sequence=3 ttl=254 time=50 ms
    Reply from 10.0.13.3: bytes=56 Sequence=4 ttl=254 time=30 ms
    Reply from 10.0.13.3: bytes=56 Sequence=5 ttl=254 time=30 ms

  --- 10.0.13.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 30/34/50 ms
```

```
<R2>tracert 10.0.13.3

 traceroute to  10.0.13.3(10.0.13.3), max hops: 30 ,packet length: 40,press CTRL_C to
break

 1 10.0.12.1 30 ms  30 ms  30 ms
```

```
 2 10.0.13.3 30 ms  50 ms  30 ms
<R2>tracert 10.0.3.3

 traceroute to  10.0.3.3(10.0.3.3), max hops: 30 ,packet length: 40,press CTRL_C to
break

 1 10.0.12.1 30 ms  20 ms  10 ms

 2 10.0.13.3 80 ms  20 ms  50 ms
```

Включим ранее отключенный интерфейс на R2

```
[R2-GigabitEthernet0/0/2]undo shutdown
[R2-GigabitEthernet0/0/2]
Oct  6 2020 00:48:20-08:00 R2
%%01IFPDT/4/IF_STATE(l)[2]:Interface GigabitEthern
et0/0/2 has turned into UP state.
[R2-GigabitEthernet0/0/2]
Oct  6 2020 00:48:20-08:00 R2 %%01IFNET/4/LINK_STATE(l)[3]:The
line protocol IP
on the interface GigabitEthernet0/0/2 has entered the UP state.
```

Проверим доступность сети 10.0.23.0 из R1

```
[R1]ping 10.0.23.3
  PING 10.0.23.3: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

  --- 10.0.23.3 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
    100.00% packet loss
```

Таблица маршрутизации R1

```
[R1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 14        Routes : 14

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.1.0/24  Direct  0    0           D   10.0.1.1        LoopBack0
        10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.1.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.3.0/24  Static  60   0          RD   10.0.13.3       GigabitEthernet0/0/0
       10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet0/0/1
       10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
     10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
       10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet0/0/0
       10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/0
     10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/0
       127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
```

```
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Настроим маршрут по умолчанию для R1 через следующий переход 10.0.13.3

```
[R1]ip route-static 0.0.0.0 0.0.0.0 10.0.13.3
```

Проверим связь между R1 и 10.0.23.3

```
[R1]ping 10.0.23.3
  PING 10.0.23.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.23.3: bytes=56 Sequence=1 ttl=255 time=70 ms
    Reply from 10.0.23.3: bytes=56 Sequence=2 ttl=255 time=100 ms
    Reply from 10.0.23.3: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=4 ttl=255 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=5 ttl=255 time=130 ms

  --- 10.0.23.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 30/72/130 ms
```

Конфигурирование резервного маршрута по умолчанию

Сконфигурируем резервные маршруты по умолчанию на R1 и R3

```
[R1]ip route-static 0.0.0.0 0.0.0.0 10.0.12.2 preference 80
```

```
[R3]ip route-static 10.0.12.0 24 10.0.23.2 preference 80
```

Таблица маршрутизации R1

```
[R1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 15        Routes : 15

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   Static  60   0           RD   10.0.13.3       GigabitEthernet0/0/0
       10.0.1.0/24  Direct  0    0           D    10.0.1.1        LoopBack0
       10.0.1.1/32  Direct  0    0           D    127.0.0.1       LoopBack0
     10.0.1.255/32  Direct  0    0           D    127.0.0.1       LoopBack0
       10.0.3.0/24  Static  60   0           RD   10.0.13.3       GigabitEthernet0/0/0
      10.0.12.0/24  Direct  0    0           D    10.0.12.1       GigabitEthernet0/0/1
      10.0.12.1/32  Direct  0    0           D    127.0.0.1       GigabitEthernet0/0/1
    10.0.12.255/32  Direct  0    0           D    127.0.0.1       GigabitEthernet0/0/1
      10.0.13.0/24  Direct  0    0           D    10.0.13.1       GigabitEthernet0/0/0
      10.0.13.1/32  Direct  0    0           D    127.0.0.1       GigabitEthernet0/0/0
    10.0.13.255/32  Direct  0    0           D    127.0.0.1       GigabitEthernet0/0/0
```

```
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Отключим G0/0/0 на R1 и G0/0/0 на R3, таким образом симитируем сбой канала

```
[R1]interface GigabitEthernet 0/0/0
[R1-GigabitEthernet0/0/0]sh
[R1-GigabitEthernet0/0/0]shutdown
Oct  6 2020 00:57:29-08:00 R1
%%01IFPDT/4/IF_STATE(l)[0]:Interface GigabitEthern
et0/0/0 has turned into DOWN state.
[R1-GigabitEthernet0/0/0]
[R1-GigabitEthernet0/0/0]
Oct  6 2020 00:57:29-08:00 R1 %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol IP
on the interface GigabitEthernet0/0/0 has entered the DOWN state.
[R1-GigabitEthernet0/0/0]
Oct  6 2020 00:57:29-08:00 R1
%%01RM/4/IPV4_DEFT_RT_CHG(l)[2]:IPV4 default Route
 is changed. (ChangeType=Delete, InstanceId=0, Protocol=Static,
ExitIf=Unknown,
Nexthop=10.0.13.3, Neighbour=0.0.0.0, Preference=1006632960,
Label=NULL, Metric=
0)
```

```
[R3]interface GigabitEthernet 0/0/0
[R3-GigabitEthernet0/0/0]sh
[R3-GigabitEthernet0/0/0]shutdown
Oct  6 2020 00:57:48-08:00 R3
%%01IFPDT/4/IF_STATE(l)[2]:Interface GigabitEthern
et0/0/0 has turned into DOWN state.
[R3-GigabitEthernet0/0/0]
[R3-GigabitEthernet0/0/0]quit
```

Таблица маршрутизации R1

```
[R1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 11       Routes : 11

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   Static  80   0           RD   10.0.12.2       GigabitEthernet0/0/1
       10.0.1.0/24  Direct  0    0           D   10.0.1.1        LoopBack0
       10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.1.255/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet0/0/1
      10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
    10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
      127.0.0.0/8   Direct  0    0           D   127.0.0.1       InLoopBack0
```

```
      127.0.0.1/32  Direct  0    0           D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0    0           D   127.0.0.1       InLoopBack0
```

Проверим сетевое соединение на R1

```
<R1>ping 10.0.23.3
  PING 10.0.23.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.23.3: bytes=56 Sequence=1 ttl=254 time=70 ms
    Reply from 10.0.23.3: bytes=56 Sequence=2 ttl=254 time=20 ms
    Reply from 10.0.23.3: bytes=56 Sequence=3 ttl=254 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=4 ttl=254 time=30 ms
    Reply from 10.0.23.3: bytes=56 Sequence=5 ttl=254 time=40 ms

  --- 10.0.23.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/38/70 ms
```

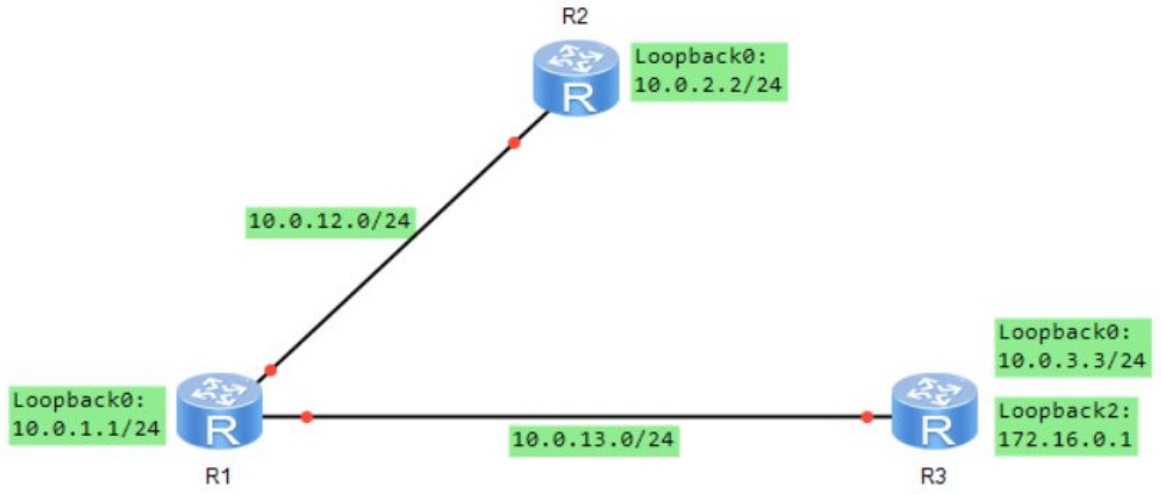
```
<R1>tracert 10.0.23.3

 traceroute to  10.0.23.3(10.0.23.3), max hops: 30 ,packet length: 40,press CTRL_C to
break

 1 10.0.12.2 30 ms  40 ms  30 ms

 2 10.0.23.3 30 ms  40 ms  20 ms
```

Lab 4-2 OSPF Single-Area Configuration



Настройка OSPF для одной области

R1

```
[R1]ospf 1 router-id 10.0.1.1
[R1-ospf-1]area 0
[R1-ospf-1-area-0.0.0.0]network 10.0.1.0 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.13.0 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.12.0 0.0.0.255
```

R2

```
[R2]ospf 1 router-id 10.0.2.2
[R2-ospf-1]area 0
[R2-ospf-1-area-0.0.0.0]network 10.0.2.0 0.0.0.255
[R2-ospf-1-area-0.0.0.0]network 10.0.12.0 0.0.0.255
Oct  8 2020 01:32:56-08:00 R2
%%01OSPF/4/NBR_CHANGE_E(l)[5]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.12.0.10, Neighbor
Event=LoadingDone, NeighborPreviousState=Loading,
NeighborCurrentState=Full)
```

R3

```
[R3]ospf 1 router-id 10.0.3.3
[R3-ospf-1]area 0
[R3-ospf-1-area-0.0.0.0]network 10.0.3.0 0.0.0.255
[R3-ospf-1-area-0.0.0.0]network 10.0.13.0 0.0.0.255
```

Проверка конфигурации OSPF

R1

```
[R1-ospf-1-area-0.0.0.0]dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 15        Routes : 15

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.1.0/24  Direct  0    0           D   10.0.1.1        LoopBack0
        10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.1.255/32  Direct  0    0         D   127.0.0.1       LoopBack0
        10.0.2.2/32  OSPF    10   1           D   10.0.12.2       GigabitEthernet0/0/1
        10.0.3.3/32  OSPF    10   1           D   10.0.13.3       GigabitEthernet0/0/0
        10.0.12.0/24  Direct  0    0          D   10.0.12.1       GigabitEthernet
0/0/1
        10.0.12.1/32  Direct  0    0          D   127.0.0.1       GigabitEthernet
0/0/1
        10.0.12.255/32  Direct  0    0        D   127.0.0.1       GigabitEthernet
0/0/1
        10.0.13.0/24  Direct  0    0          D   10.0.13.1       GigabitEthernet
0/0/0
        10.0.13.1/32  Direct  0    0          D   127.0.0.1       GigabitEthernet
0/0/0
        10.0.13.255/32  Direct  0    0        D   127.0.0.1       GigabitEthernet
0/0/0
        127.0.0.0/8   Direct  0    0          D   127.0.0.1       InLoopBack0
        127.0.0.1/32  Direct  0    0          D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
```

R2

```
<R2>dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 13        Routes : 13

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.1.1/32  OSPF    10   1           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.2.0/24  Direct  0    0           D   10.0.2.2        LoopBack0
        10.0.2.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.2.255/32  Direct  0    0        D   127.0.0.1       LoopBack0
        10.0.3.3/32  OSPF    10   2           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.12.0/24  Direct  0    0         D   10.0.12.2       GigabitEthernet0/0/1
        10.0.12.2/32  Direct  0    0         D   127.0.0.1       GigabitEthernet0/0/1
        10.0.12.255/32  Direct  0    0       D   127.0.0.1       GigabitEthernet0/0/1
        10.0.13.0/24  OSPF    10   2           D   10.0.12.1       GigabitEthernet0/0/1
        127.0.0.0/8   Direct  0    0          D   127.0.0.1       InLoopBack0
        127.0.0.1/32  Direct  0    0          D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
255.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
```

R3

```
<R3>dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 16        Routes : 16

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.1.1/32  OSPF    10   1           D   10.0.13.1       GigabitEthernet0/0/0
        10.0.2.2/32  OSPF    10   2           D   10.0.13.1       GigabitEthernet0/0/0
        10.0.3.0/24  Direct  0    0           D   10.0.3.3        LoopBack0
        10.0.3.3/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.3.255/32  Direct  0    0        D   127.0.0.1       LoopBack0
```

```
      10.0.12.0/24  OSPF    10   2           D   10.0.13.1       GigabitEthernet0/0/0
      10.0.13.0/24  Direct  0      0         D   10.0.13.3       GigabitEthernet0/0/0
      10.0.13.3/32  Direct  0      0         D   127.0.0.1       GigabitEthernet0/0/0
      10.0.13.255/32  Direct  0    0         D   127.0.0.1       GigabitEthernet0/0/0
      127.0.0.0/8   Direct  0      0         D   127.0.0.1       InLoopBack0
      127.0.0.1/32  Direct  0      0         D   127.0.0.1       InLoopBack0
127.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
      172.16.0.0/24  Direct  0     0         D   172.16.0.1      LoopBack2
      172.16.0.1/32  Direct  0     0         D   127.0.0.1       LoopBack2
   172.16.0.255/32  Direct  0 0             D   127.0.0.1       LoopBack2
255.255.255.255/32  Direct  0 0             D   127.0.0.1       InLoopBack0
```

Проверка сетевого соединения между R2 и R1

```
<R2>ping 10.0.1.1
  PING 10.0.1.1: 56  data bytes, press CTRL_C to break
    Reply from 10.0.1.1: bytes=56 Sequence=1 ttl=255 time=20 ms
    Reply from 10.0.1.1: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 10.0.1.1: bytes=56 Sequence=3 ttl=255 time=20 ms
    Reply from 10.0.1.1: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.1.1: bytes=56 Sequence=5 ttl=255 time=20 ms

  --- 10.0.1.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/20/20 ms
```

Проверка сетевого соединения между R2 и R3

```
<R2>ping 10.0.3.3
  PING 10.0.3.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.3.3: bytes=56 Sequence=1 ttl=254 time=30 ms
    Reply from 10.0.3.3: bytes=56 Sequence=2 ttl=254 time=40 ms
    Reply from 10.0.3.3: bytes=56 Sequence=3 ttl=254 time=20 ms
    Reply from 10.0.3.3: bytes=56 Sequence=4 ttl=254 time=20 ms
    Reply from 10.0.3.3: bytes=56 Sequence=5 ttl=254 time=20 ms

  --- 10.0.3.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/26/40 ms
```

Вывод подробной информации:

```
<R1>dis ospf peer

     OSPF Process 1 with Router ID 10.0.1.1
       Neighbors

 Area 0.0.0.0 interface 10.0.12.1(GigabitEthernet0/0/1)'s
neighbors
 Router ID: 10.0.2.2        Address: 10.0.12.2
```

```
   State: Full  Mode:Nbr is  Master  Priority: 1
   DR: 10.0.12.1  BDR: 10.0.12.2  MTU: 0
   Dead timer due in 32  sec
   Retrans timer interval: 5
   Neighbor is up for 00:09:25
   Authentication Sequence: [ 0 ]

       Neighbors

 Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s
neighbors
 Router ID: 10.0.3.3       Address: 10.0.13.3
   State: Full  Mode:Nbr is  Master  Priority: 1
   DR: 10.0.13.1  BDR: 10.0.13.3  MTU: 0
   Dead timer due in 36  sec
   Retrans timer interval: 5
   Neighbor is up for 00:06:11
   Authentication Sequence: [ 0 ]
```

```
<R1>dis ospf peer brief

     OSPF Process 1 with Router ID 10.0.1.1
         Peer Statistic Information

----------------------------------------------------------------
-
 Area Id         Interface                       Neighbor id
State
 0.0.0.0         GigabitEthernet0/0/1            10.0.2.2
Full
 0.0.0.0         GigabitEthernet0/0/0            10.0.3.3
Full

----------------------------------------------------------------
-
```

```
<R2>dis ospf peer brief

     OSPF Process 1 with Router ID 10.0.2.2
         Peer Statistic Information

----------------------------------------------------------------
-
 Area Id         Interface                       Neighbor id
State
 0.0.0.0         GigabitEthernet0/0/1            10.0.1.1
Full

----------------------------------------------------------------
-
```

```
<R2>dis ospf peer brief

     OSPF Process 1 with Router ID 10.0.2.2
```

```
         Peer Statistic Information

--------------------------------------------------------------------------
 Area Id         Interface                       Neighbor id
State
 0.0.0.0         GigabitEthernet0/0/1            10.0.1.1
Full

--------------------------------------------------------------------------
```

Изменение интервала Hello и интервала Dead

Просмотр интервала Hello и интервала Dead

```
<R1>dis ospf int G0/0/0

     OSPF Process 1 with Router ID 10.0.1.1
        Interfaces


 Interface: 10.0.13.1 (GigabitEthernet0/0/0)
 Cost: 1         State: DR       Type: Broadcast MTU: 1500
 Priority: 1
 Designated Router: 10.0.13.1
 Backup Designated Router: 10.0.13.3
 Timers: Hello 10 , Dead 40 , Poll  120 , Retransmit 5 , Transmit
Delay 1
```

Изменение интервалов Hello и Dead на R1

```
[R1]int G0/0/0
[R1-GigabitEthernet0/0/0]ospf timer hello 15
[R1-GigabitEthernet0/0/0]ospf timer dead 60
Oct  8 2020 02:26:48-08:00 R1
%%01OSPF/3/NBR_CHG_DOWN(l)[14]:Neighbor event:neig
hbor state changed to Down. (ProcessId=256,
NeighborAddress=3.3.0.10, NeighborEv
ent=InactivityTimer, NeighborPreviousState=Full,
NeighborCurrentState=Down)
[R1-GigabitEthernet0/0/0]
Oct  8 2020 02:26:48-08:00 R1
%%01OSPF/3/NBR_DOWN_REASON(l)[15]:Neighbor state l
eaves full or changed to Down. (ProcessId=256,
NeighborRouterId=3.3.0.10, Neighb
orAreaId=0,
NeighborInterface=GigabitEthernet0/0/0,NeighborDownImmediate
reason=
```

```
Neighbor Down Due to Inactivity,
NeighborDownPrimeReason=Interface Parameter Mis
match, NeighborChangeTime=2020-10-08 02:26:48-08:00)
[R1-GigabitEthernet0/0/0]dis ospf int G0/0/0

     OSPF Process 1 with Router ID 10.0.1.1
        Interfaces


 Interface: 10.0.13.1 (GigabitEthernet0/0/0)
 Cost: 1         State: DR       Type: Broadcast MTU: 1500
 Priority: 1
 Designated Router: 10.0.13.1
 Backup Designated Router: 0.0.0.0
 Timers: Hello 15 , Dead 60 , Poll  120 , Retransmit 5 , Transmit
Delay 1
```

Проверка состояния соседей OSPF на R1

```
<R1>dis ospf peer brief

     OSPF Process 1 with Router ID 10.0.1.1
         Peer Statistic Information

----------------------------------------------------------------------
-
 Area Id         Interface                       Neighbor id
State
 0.0.0.0         GigabitEthernet0/0/1            10.0.2.2
Full

----------------------------------------------------------------------
-
```

Изменение интервалов Hello и Dead на R3

```
[R3]int G0/0/0
[R3-GigabitEthernet0/0/0]ospf timer hello 15
[R3-GigabitEthernet0/0/0]ospf timer dead 60
Oct  8 2020 02:32:45-08:00 R3
%%01OSPF/4/NBR_CHANGE_E(l)[0]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.13.0.10, Neighbor
Event=HelloReceived, NeighborPreviousState=Down,
NeighborCurrentState=Init)
Oct  8 2020 02:32:50-08:00 R3
%%01OSPF/4/NBR_CHANGE_E(l)[1]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.13.0.10, Neighbor
Event=2WayReceived, NeighborPreviousState=Init,
NeighborCurrentState=ExStart)
[R3-GigabitEthernet0/0/0]
Oct  8 2020 02:32:50-08:00 R3
```

```
%%01OSPF/4/NBR_CHANGE_E(l)[2]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.13.0.10, Neighbor
Event=NegotiationDone, NeighborPreviousState=ExStart,
NeighborCurrentState=Excha
nge)
[R3-GigabitEthernet0/0/0]
Oct  8 2020 02:32:50-08:00 R3
%%01OSPF/4/NBR_CHANGE_E(l)[3]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.13.0.10, Neighbor
Event=ExchangeDone, NeighborPreviousState=Exchange,
NeighborCurrentState=Loading
)
[R3-GigabitEthernet0/0/0]
Oct  8 2020 02:32:50-08:00 R3
%%01OSPF/4/NBR_CHANGE_E(l)[4]:Neighbor changes eve
nt: neighbor status changed. (ProcessId=256,
NeighborAddress=1.13.0.10, Neighbor
Event=LoadingDone, NeighborPreviousState=Loading,
NeighborCurrentState=Full)
```

```
<R3>dis ospf int G0/0/0

     OSPF Process 1 with Router ID 10.0.3.3
       Interfaces


 Interface: 10.0.13.3 (GigabitEthernet0/0/0)
 Cost: 1        State: DR       Type: Broadcast MTU: 1500
 Priority: 1
 Designated Router: 10.0.13.3
 Backup Designated Router: 10.0.13.1
 Timers: Hello 15 , Dead 60 , Poll  120 , Retransmit 5 , Transmit
Delay 1
```

Повторная проверка OSPF соседей на R1

```
<R1>dis ospf peer brief

     OSPF Process 1 with Router ID 10.0.1.1
         Peer Statistic Information

----------------------------------------------------------------
-----------
 Area Id        Interface                       Neighbor id
State
 0.0.0.0        GigabitEthernet0/0/1            10.0.2.2
Full
 0.0.0.0        GigabitEthernet0/0/0            10.0.3.3
Full

----------------------------------------------------------------
-----------
```

Объявление маршрутов по умолчанию OSPF.

```
[R3]ip route-static 0.0.0.0 0.0.0.0 LoopBack 2
[R3]ospf 1
[R3-ospf-1]default-route-advertise
```

Таблицы маршрутизации R1, R2 и R3

```
<R1>dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 16        Routes : 16

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   O_ASE   150  1           D   10.0.13.3       GigabitEthernet0/0/0
        10.0.1.0/24 Direct  0    0             D   10.0.1.1        LoopBack0
        10.0.1.1/32 Direct  0    0             D   127.0.0.1       LoopBack0
        10.0.1.255/32 Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.2.2/32 OSPF    10   1           D   10.0.12.2       GigabitEthernet0/0/1
        10.0.3.3/32 OSPF    10   1           D   10.0.13.3       GigabitEthernet0/0/0
        10.0.12.0/24 Direct  0    0           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.12.1/32 Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
        10.0.12.255/32 Direct  0    0         D   127.0.0.1       GigabitEthernet0/0/1
        10.0.13.0/24 Direct  0    0           D   10.0.13.1       GigabitEthernet0/0/0
        10.0.13.1/32 Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/0
        10.0.13.255/32 Direct  0    0         D   127.0.0.1       GigabitEthernet0/0/0
        127.0.0.0/8 Direct  0    0           D   127.0.0.1       InLoopBack0
        127.0.0.1/32 Direct  0    0          D   127.0.0.1       InLoopBack0
127.255.255.255/32 Direct  0 0              D   127.0.0.1       InLoopBack0
255.255.255.255/32 Direct  0 0              D   127.0.0.1       InLoopBack0
```

```
<R2>dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 14        Routes : 14

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   O_ASE   150  1           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.1.1/32 OSPF    10   1           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.2.0/24 Direct  0    0             D   10.0.2.2        LoopBack0
        10.0.2.2/32 Direct  0    0             D   127.0.0.1       LoopBack0
        10.0.2.255/32 Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.3.3/32 OSPF    10   2           D   10.0.12.1       GigabitEthernet0/0/1
        10.0.12.0/24 Direct  0    0           D   10.0.12.2       GigabitEthernet0/0/1
        10.0.12.2/32 Direct  0    0           D   127.0.0.1       GigabitEthernet0/0/1
        10.0.12.255/32 Direct  0    0         D   127.0.0.1       GigabitEthernet0/0/1
        10.0.13.0/24 OSPF    10   2           D   10.0.12.1       GigabitEthernet0/0/1
        127.0.0.0/8 Direct  0    0           D   127.0.0.1       InLoopBack0
        127.0.0.1/32 Direct  0    0          D   127.0.0.1       InLoopBack0
127.255.255.255/32 Direct  0 0              D   127.0.0.1       InLoopBack0
255.255.255.255/32 Direct  0 0              D   127.0.0.1       InLoopBack0
```

```
<R3>dis ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 17        Routes : 17

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        0.0.0.0/0   Static  60   0           D   172.16.0.1      LoopBack2
```

```
       10.0.1.1/32  OSPF     10   1         D   10.0.13.1         GigabitEthernet0/0/0
       10.0.2.2/32  OSPF     10   2         D   10.0.13.1         GigabitEthernet0/0/0
       10.0.3.0/24  Direct  0       0             D   10.0.3.3          LoopBack0
       10.0.3.3/32  Direct  0       0             D   127.0.0.1         LoopBack0
       10.0.3.255/32  Direct  0     0        D   127.0.0.1         LoopBack0
       10.0.12.0/24  OSPF    10   2         D   10.0.13.1         GigabitEthernet0/0/0
       10.0.13.0/24  Direct  0       0        D   10.0.13.3         GigabitEthernet0/0/0
       10.0.13.3/32  Direct  0       0        D   127.0.0.1         GigabitEthernet0/0/0
       10.0.13.255/32  Direct  0     0        D   127.0.0.1         GigabitEthernet0/0/0
       127.0.0.0/8   Direct  0       0        D   127.0.0.1         InLoopBack0
       127.0.0.1/32  Direct  0       0        D   127.0.0.1         InLoopBack0
127.255.255.255/32  Direct  00             D   127.0.0.1         InLoopBack0
       172.16.0.0/24  Direct  0       0        D   172.16.0.1        LoopBack2
       172.16.0.1/32  Direct  0       0        D   127.0.0.1         LoopBack2
   172.16.0.255/32  Direct  00             D   127.0.0.1         LoopBack2
255.255.255.255/32  Direct  00             D   127.0.0.1         InLoopBack0
```

Проверка связи между R2 и Loopback2

```
<R2>ping 172.16.0.1
  PING 172.16.0.1: 56  data bytes, press CTRL_C to break
    Reply from 172.16.0.1: bytes=56 Sequence=1 ttl=254 time=20
ms
    Reply from 172.16.0.1: bytes=56 Sequence=2 ttl=254 time=20
ms
    Reply from 172.16.0.1: bytes=56 Sequence=3 ttl=254 time=30
ms
    Reply from 172.16.0.1: bytes=56 Sequence=4 ttl=254 time=30
ms
    Reply from 172.16.0.1: bytes=56 Sequence=5 ttl=254 time=30
ms

  --- 172.16.0.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 20/26/30 ms
```

Управление выборами DR или BDR OSPF

Проверка DR и BDR R1 и R3

```
<R1>dis ospf peer 10.0.3.3

     OSPF Process 1 with Router ID 10.0.1.1
       Neighbors

 Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s
neighbors
 Router ID: 10.0.3.3       Address: 10.0.13.3
   State: Full  Mode:Nbr is  Master  Priority: 1
   DR: 10.0.13.3  BDR: 10.0.13.1  MTU: 0
   Dead timer due in 58  sec
   Retrans timer interval: 0
   Neighbor is up for 00:07:38
   Authentication Sequence: [ 0 ]
```

Изменение приоритетов DR R1 и R3

```
[R1]int G0/0/0
[R1-GigabitEthernet0/0/0]ospf dr-p
[R1-GigabitEthernet0/0/0]ospf dr-priority 200
```

```
[R3]int G0/0/0
[R3-GigabitEthernet0/0/0]ospf dr-pr
[R3-GigabitEthernet0/0/0]ospf dr-priority 100
```

Сброс отношений соседства

```
[R3-GigabitEthernet0/0/0]shutdown
[R3-GigabitEthernet0/0/0]undo shutdown
```

```
[R1-GigabitEthernet0/0/0]shutdown
[R1-GigabitEthernet0/0/0]undo shutdown
```

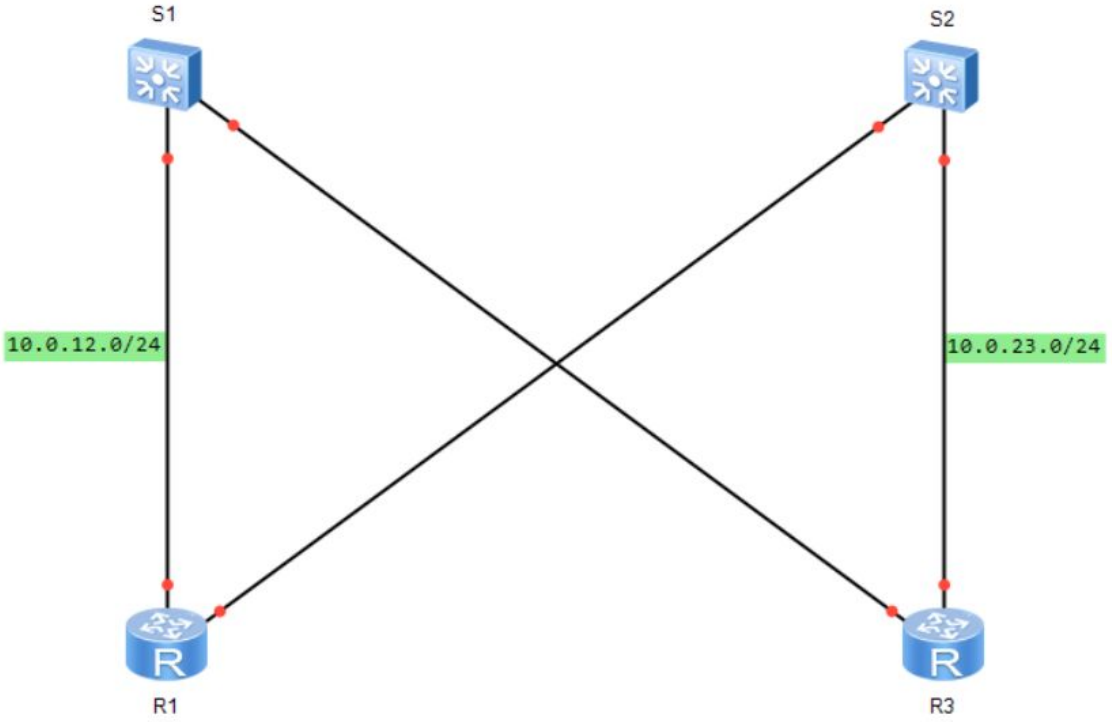
Просмотр DR и BDR R1 и R3

```
[R1]dis ospf peer 10.0.3.3

     OSPF Process 1 with Router ID 10.0.1.1
       Neighbors

 Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s
neighbors
 Router ID: 10.0.3.3       Address: 10.0.13.3
   State: Full  Mode:Nbr is  Master  Priority: 100
   DR: 10.0.13.1  BDR: 10.0.13.3  MTU: 0
   Dead timer due in 56  sec
   Retrans timer interval: 5
   Neighbor is up for 00:00:04
   Authentication Sequence: [ 0 ]
```

Lab 5-2 Implementing DHCP



Внедрение DHCP

Включение DHSP

```
[R1]dhcp enable
```

```
[R3]dhcp enable
```

Создание глобального пула IP-адресов

```
[R1]ip pool pool1
Info: It's successful to create an IP address pool.
[R1-ip-pool-pool1]net 10.0.12.0 mask 24
[R1-ip-pool-pool1]gateway-list 10.0.12.1
[R1-ip-pool-pool1]lease day 1 hour 12
[R1-ip-pool-pool1]int G0/0/1
[R1-GigabitEthernet0/0/1]dhcp select global
```

```
[R3]ip pool pool2
Info: It's successful to create an IP address pool.
[R3-ip-pool-pool2]net 10.0.23.0 mask 24
[R3-ip-pool-pool2]gateway-list 10.0.23.3
[R3-ip-pool-pool2]lease day 1 hour 12
[R3-ip-pool-pool2]int G0/0/2
[R3-GigabitEthernet0/0/2]dhcp select global
```

Просмотр конфигурации назначенного пула адресов

```
<R1>dis ip pool name pool1
  Pool-name      : pool1
  Pool-No        : 0
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : -
  NBNS-server0    : -
  Netbios-type    : -
  Position       : Local         Status          : Unlocked
  Gateway-0      : 10.0.12.1
  Mask           : 255.255.255.0
  VPN instance    : --

-------------------------------------------------------------------------
-
Start    End    Total  Used  Idle(Expired)  Conflict  Disable

-------------------------------------------------------------------------
-
     10.0.12.1  10.0.12.254   253     0     253(0)          0     0

-------------------------------------------------------------------------
-
```

Настройка интерфейса управления по умолчанию для S1 для запроса IP адреса с сервера DHCP

```
[S1]dhcp enable
Info: The operation may take a few seconds. Please wait for a
moment.done.
[S1]int Vlanif 1
Oct  7 2020 22:04:09-08:00 S1 DS/4/DATASYNC_CFGCHANGE:OID
1.3.6.1.4.1.2011.5.25.
191.3.1 configurations have been changed. The current change
number is 5, the ch
ange loop count is 0, and the maximum number of records is 4095.
[S1-Vlanif1]ip addr dhcp-alloc
[S1-Vlanif1]
Oct  7 2020 22:04:27-08:00 S1 %%01IFNET/4/LINK_STATE(l)[4]:The
line protocol IP
on the interface Vlanif1 has entered the UP state.
Oct  7 2020 22:04:30-08:00 S1 DS/4/DATASYNC_CFGCHANGE:OID
1.3.6.1.4.1.2011.5.25.
191.3.1 configurations have been changed. The current change
number is 7, the ch
ange loop count is 0, and the maximum number of records is 4095.
[S1-Vlanif1]
<S1>dis ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 2
```

```
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 2
The number of interface that is DOWN in Protocol is 1

Interface                         IP Address/Mask      Physical
Protocol
MEth0/0/1                         unassigned           down
down
NULL0                             unassigned           up
up(s)
Vlanif1                           10.0.12.254/24       up
up
```

```
[S2]dhcp enable
[S2]int Vlanif1
[S2-Vlanif1]ip addr dhcp-alloc
[S2-Vlanif1]
Oct  7 2020 22:07:54-08:00 S2 %%01IFNET/4/LINK_STATE(l)[3]:The
line protocol IP
on the interface Vlanif1 has entered the UP state.
Oct  7 2020 22:08:00-08:00 S2 DS/4/DATASYNC_CFGCHANGE:OID
1.3.6.1.4.1.2011.5.25.
191.3.1 configurations have been changed. The current change
number is 7, the ch
ange loop count is 0, and the maximum number of records is 4095.
[S2-Vlanif1]dis ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 2
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 2
The number of interface that is DOWN in Protocol is 1

Interface                         IP Address/Mask      Physical
Protocol
MEth0/0/1                         unassigned           down
down
NULL0                             unassigned           up
up(s)
Vlanif1                           10.0.23.254/24       up
up
```

Проверка, что адрес взят из пула DHCP с именем pool1 на R1, а на S2 - pool2

```
<R1>dis ip pool name pool1
  Pool-name      : pool1
  Pool-No        : 0
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : -
  NBNS-server0   : -
  Netbios-type   : -
```

```
  Position       : Local          Status           : Unlocked
  Gateway-0      : 10.0.12.1
  Mask           : 255.255.255.0
  VPN instance    : --

-------------------------------------------------------------------------
-
Start   End      Total  Used  Idle(Expired)  Conflict  Disable
-------------------------------------------------------------------------
-
      10.0.12.1  10.0.12.254   253     1     252(0)           0     0

-------------------------------------------------------------------------
-
```

```
<R3>dis ip pool name pool2
  Pool-name      : pool2
  Pool-No        : 0
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : -
  NBNS-server0    : -
  Netbios-type    : -
  Position       : Local          Status           : Unlocked
  Gateway-0      : 10.0.23.3
  Mask           : 255.255.255.0
  VPN instance    : --

-------------------------------------------------------------------------
-
Start  End      Total  Used  Idle(Expired)  Conflict  Disable

-------------------------------------------------------------------------
-
      10.0.23.1  10.0.23.254   253     1     252(0)           0     0

-------------------------------------------------------------------------
-
```

Создание пула IP адресов на основе интерфейса

```
[R1]int g0/0/1
[R1-GigabitEthernet0/0/1]shutdown
```

```
[R3]int g0/0/2
[R3-GigabitEthernet0/0/2]shutdown
```

Настройка пула адресов интерфейса

```
[R1-GigabitEthernet0/0/2]dhcp select int
[R1-GigabitEthernet0/0/2]dhcp server dns-list 10.0.23.254
[R1-GigabitEthernet0/0/2]dhcp server excluded-ip-address
10.0.23.254
[R1-GigabitEthernet0/0/2]dhcp server lease day 1 hour 12
```

```
[R3-GigabitEthernet0/0/1]dhcp select int
[R3-GigabitEthernet0/0/1]dhcp server dns-list 10.0.12.254
[R3-GigabitEthernet0/0/1]dhcp server excluded-ip-address
10.0.12.254
[R3-GigabitEthernet0/0/1]dhcp server lease day 1 hour 12
```

Просмотр настроек пула адресов интерфейса

```
<R1>dis ip pool int GigabitEthernet0/0/2
  Pool-name      : GigabitEthernet0/0/2
  Pool-No        : 1
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : 10.0.23.254
  NBNS-server0   : -
  Netbios-type   : -
  Position       : Interface     Status          : Unlocked
  Gateway-0      : 10.0.23.1
  Mask           : 255.255.255.0
  VPN instance   : --

------------------------------------------------------------------------
-
     Start           End   Total  Used  Idle(Expired)  Conflict
Disable

------------------------------------------------------------------------
-
     10.0.23.1  10.0.23.254   253     0     252(0)           0     1

------------------------------------------------------------------------
-
```

```
<R3>dis ip pool int GigabitEthernet0/0/1
  Pool-name      : GigabitEthernet0/0/1
  Pool-No        : 1
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : 10.0.12.254
  NBNS-server0   : -
  Netbios-type   : -
  Position       : Interface     Status          : Unlocked
  Gateway-0      : 10.0.12.3
  Mask           : 255.255.255.0
  VPN instance   : --

------------------------------------------------------------------------
-
Start   End     Total  Used  Idle(Expired)  Conflict  Disable

------------------------------------------------------------------------
-
     10.0.12.1  10.0.12.254   253     0     252(0)           0     1
```

```
----------------------------------------------------------------------
-
```

Очистить существующий Vlanif1 для динамического выделения нового адреса

```
[S2-Vlanif1]shut
[S2-Vlanif1]shutdown
[S2-Vlanif1]undo sh
[S2-Vlanif1]undo shutdown
```

Включение G0/0/2 и проверка того, что он выделен из пула

```
[R1]int g0/0/2
[R1-GigabitEthernet0/0/2]undo shutdown
<R1>dis ip pool int GigabitEthernet0/0/2
  Pool-name      : GigabitEthernet0/0/2
  Pool-No        : 1
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : 10.0.23.254
  NBNS-server0   : -
  Netbios-type   : -
  Position       : Interface     Status          : Unlocked
  Gateway-0      : 10.0.23.1
  Mask           : 255.255.255.0
  VPN instance   : --

----------------------------------------------------------------------
-
     Start           End   Total  Used  Idle(Expired)  Conflict
Disable

----------------------------------------------------------------------
-
     10.0.23.1  10.0.23.254   253     1     251(0)          0     1

----------------------------------------------------------------------
-
```

Интерфейсу Vlanif1 был выделен адрес из пула адресов G0/0/2

```
<S2>dis ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 2
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 2
The number of interface that is DOWN in Protocol is 1

Interface                IP Address/Mask   Physical   Protocol
MEth0/0/1                    unassigned        down       down
NULL0                        unassigned        up         up(s)
```

```
Vlanif1                         10.0.23.253/24      up          up
```

Очистить существующий адрес Vlanif1 для динамического выделения из пула адресов

```
[S1]int Vlanif 1
[S1-Vlanif1]shutdown
[S1-Vlanif1]undo shutdown
```

Включение G0/0/1

```
[R3]int g0/0/1
[R3-GigabitEthernet0/0/1]undo sh
[R3-GigabitEthernet0/0/1]undo shutdown
```

Проверка, что новый IP-адрес выделен из пула интерфейса

```
<R3>dis ip pool int GigabitEthernet0/0/1
  Pool-name      : GigabitEthernet0/0/1
  Pool-No        : 1
  Lease          : 1 Days 12 Hours 0 Minutes
  Domain-name    : -
  DNS-server0    : 10.0.12.254
  NBNS-server0   : -
  Netbios-type   : -
  Position       : Interface     Status          : Unlocked
  Gateway-0      : 10.0.12.3
  Mask           : 255.255.255.0
  VPN instance   : --

-----------------------------------------------------------------------
-
Start    End    Total  Used  Idle(Expired)  Conflict  Disable

-----------------------------------------------------------------------
-
     10.0.12.1  10.0.12.254   253    1    251(0)           0     1

-----------------------------------------------------------------------
-
```

```
<S1>dis ip int brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 2
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 2
The number of interface that is DOWN in Protocol is 1

Interface                IP Address/Mask   Physical   Protocol
```

```
MEth0/0/1                  unassigned      down       down
NULL0                      unassigned      up         up(s)
Vlanif1                    10.0.12.253/24  up         up
```

Вывод

В ходе выполнения лабораторной работы был сконфигурирован статический маршрут с использованием интерфейса и IP-адреса в качестве следующего перехода и сконфигурирован маршрут по умолчанию для реализации взаимодействия между локальной и внешней сетью. Был сконфигурирован резервный статический маршрут на маршрутизаторе.
Был настроен OSPF для одной области на определенном интерфейсе или сети, объявлены маршруты по умолчанию, изменены интервалы Hello и Dead и изменение приоритета маршрута.
И сконфигурирован глобальный и интерфейсный пул DHCP, включение обнаружения DHCP и распределения IP-адресов для интерфейсов коммутаторов, и последующая настройка глобального пула и пула адресов интерфейса.