МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РФ

Федеральное государственное автономное
образовательное учреждение высшего образования
«Национальный исследовательский университет ИТМО»

ФАКУЛЬТЕТ ПРОГРАММНОЙ ИНЖЕНЕРИИ И КОМПЬЮТЕРНОЙ ТЕХНИКИ

ЛАБОРАТОРНАЯ РАБОТА №2

по дисциплине

‘Администрирование систем и сетей’

Выполнил:
Студенты группы P34312
Соболев Иван
Верещагин Егор

Желаемая оценка: 4

Преподаватель:
Афанасьев Дмитрий
Борисович

УНИВЕРСИТЕТ ИТМО

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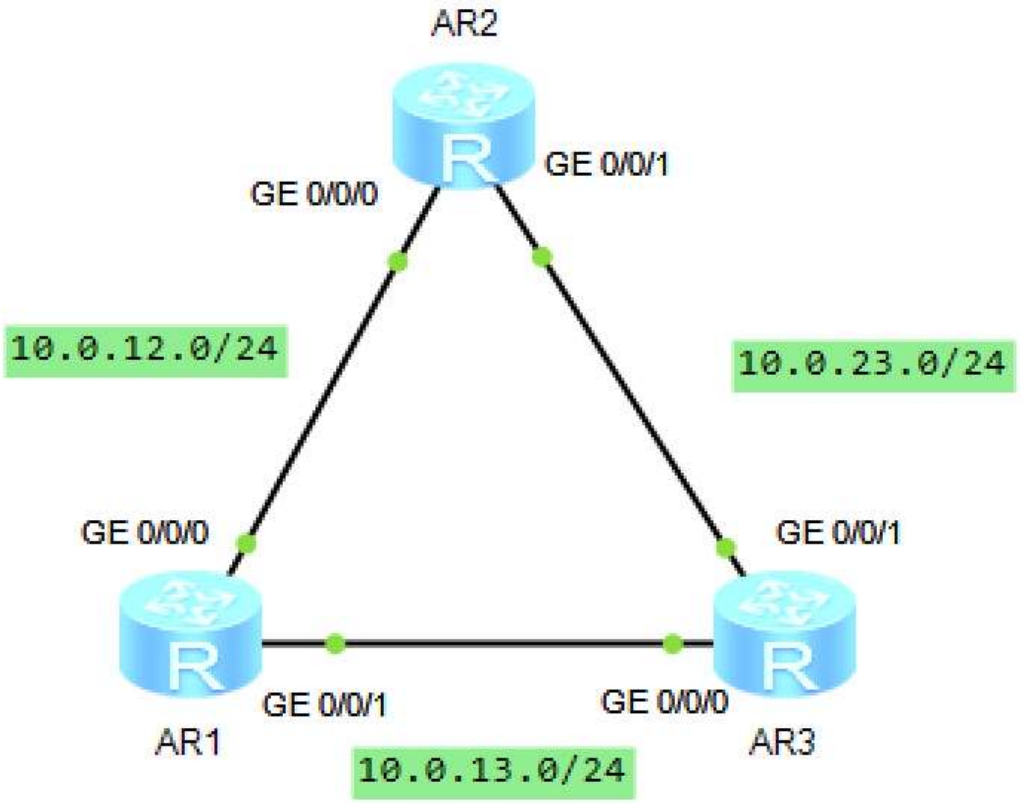
Адресация и маршрутизация IPv4

Адресация и маршрутизация IPv4

Топология



Конфигурация

Настройка адресов для физических интерфейсов

R1:

```
<R1>system-view
Enter system view, return user view with Ctrl+Z.
[R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]ip address 10.0.12.1 24
Sep  7 2024 17:23:00-08:00 Huawei %%01IFNET/4/LINK_STATE(l)[0]:The
line protocol
 IP on the interface GigabitEthernet0/0/0 has entered the UP state.
[R1-GigabitEthernet0/0/0]quit

[R1]interface GigabitEthernet0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.13.1 24
Sep  7 2024 17:26:56-08:00 Huawei %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol
 IP on the interface GigabitEthernet0/0/1 has entered the UP state.
[R1-GigabitEthernet0/0/1]quit
```

```
[R1]display ip interface brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 3
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 3
The number of interface that is DOWN in Protocol is 1

Interface                         IP Address/Mask      Physical
Protocol
GigabitEthernet0/0/0              10.0.12.1/24         up         up
GigabitEthernet0/0/1              10.0.13.1/24         up         up
GigabitEthernet0/0/2              unassigned           down       down
NULL0                             unassigned           up
up(s)
```

R2:

```
<R2>system-view
Enter system view, return user view with Ctrl+Z.
[R2]interface GigabitEthernet0/0/0
[R2-GigabitEthernet0/0/0]ip address 10.0.12.2 24
Sep  7 2024 17:33:30-08:00 Huawei %%01IFNET/4/LINK_STATE(l)[0]:The
line protocol
 IP on the interface GigabitEthernet0/0/0 has entered the UP state.
[R2-GigabitEthernet0/0/0]quit

[R2]interface GigabitEthernet0/0/1
[R2-GigabitEthernet0/0/1]ip address 10.0.23.2 24
Sep  7 2024 17:35:05-08:00 Huawei %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol
 IP on the interface GigabitEthernet0/0/1 has entered the UP state.
[R2-GigabitEthernet0/0/1]quit
```

```
[R2]display ip interface brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 3
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 3
The number of interface that is DOWN in Protocol is 1

Interface                         IP Address/Mask      Physical
Protocol
GigabitEthernet0/0/0              10.0.12.2/24         up         up
```

```
GigabitEthernet0/0/1                10.0.23.2/24        up          up
GigabitEthernet0/0/2                unassigned          down        down
NULL0                               unassigned          up
up(s)
```

R3:

```
<R3>system-view
Enter system view, return user view with Ctrl+Z.
[R3]interface GigabitEthernet0/0/0
[R3-GigabitEthernet0/0/0]ip address 10.0.13.3 24
Sep  7 2024 17:39:15-08:00 Huawei %%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 GigabitEthernet0/0/1
[R3-GigabitEthernet0/0/1]ip address 10.0.23.1 24
Sep  7 2024 17:40:09-08:00 Huawei %%01IFNET/4/LINK_STATE(l)[1]:The
line protocol
 IP on the interface GigabitEthernet0/0/1 has entered the UP state.
[R3-GigabitEthernet0/0/1]quit
```

```
[R3]display ip interface brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 3
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 3
The number of interface that is DOWN in Protocol is 1

Interface                           IP Address/Mask      Physical
Protocol
GigabitEthernet0/0/0                10.0.13.3/24         up          up
GigabitEthernet0/0/1                10.0.23.1/24         up          up
GigabitEthernet0/0/2                unassigned           down        down
NULL0                               unassigned           up
up(s)
```

Маршрутизатор	Интерфейс	IP-адрес / маска
R1	GigabitEthernet0/0/0	int g0/0/0 ip ad 10.0.12.1 24
	GigabitEthernet0/0/1	int g0/0/2 ip ad 10.0.13.1 24
R2	GigabitEthernet0/0/0	int g0/0/0 ip ad 10.0.12.2 24
	GigabitEthernet0/0/1	int g0/0/1 ip ad 10.0.23.2 24
R3	GigabitEthernet0/0/0	int g0/0/1 ip ad 10.0.13.3 24
	GigabitEthernet0/0/1	int g0/0/2 ip ad 10.0.23.1 24

Проверка связи с помощью ping
R1-R2:

```
<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=110 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=10 ms
    Reply from 10.0.12.2: bytes=56 Sequence=4 ttl=255 time=10 ms
    Reply from 10.0.12.2: bytes=56 Sequence=5 ttl=255 time=30 ms

  --- 10.0.12.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/38/110 ms
```

R1-R3:

```
<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=30 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=20 ms
    Reply from 10.0.13.3: bytes=56 Sequence=4 ttl=255 time=20 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 = 20/24/30 ms
```

R2-R3:

```
<R2>ping 10.0.23.1
 PING 10.0.23.1: 56  data bytes, press CTRL_C to break
   Reply from 10.0.23.1: bytes=56 Sequence=1 ttl=255 time=30 ms
   Reply from 10.0.23.1: bytes=56 Sequence=2 ttl=255 time=40 ms
   Reply from 10.0.23.1: bytes=56 Sequence=3 ttl=255 time=20 ms
   Reply from 10.0.23.1: bytes=56 Sequence=4 ttl=255 time=20 ms
   Reply from 10.0.23.1: bytes=56 Sequence=5 ttl=255 time=20 ms

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

Создание loopback-интерфейсов

R1:

```
[R1]interface LoopBack0
[R1-LoopBack0]ip address 10.0.1.1 32
```

R2:

```
[R2]interface LoopBack0
[R2-LoopBack0]ip address 10.0.1.2 32
```

R3:

```
[R3]interface LoopBack0
[R3-LoopBack0]ip address 10.0.1.3 32
```

Маршрутизатор	Интерфейс	IP-адрес / маска
R1	LoopBack0	`int LoopBack0 ip ad 10.0.1.1 32`
R2	LoopBack0	`int LoopBack0 ip ad 10.0.1.2 32`
R3	LoopBack0	`int LoopBack0 ip ad 10.0.1.3 32`

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

10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet
0/0/0
10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
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
```

Проверка связи между loopback-интерфейсами

```
[R1]ping -a 10.0.1.1 10.0.1.2
  PING 10.0.1.2: 56 data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

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

Настройка статических маршрутов

```
[R1]ip route-static 10.0.1.2 32 10.0.12.2
[R1]ip route-static 10.0.1.3 32 10.0.13.3
```

```
[R2]ip route-static 10.0.1.1 32 10.0.12.1
[R2]ip route-static 10.0.1.3 32 10.0.23.1
```

```
[R3]ip route-static 10.0.1.1 32 10.0.13.1
[R3]ip route-static 10.0.1.2 32 10.0.23.2
```

Таблица маршрутизации R1

```
[R1]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
10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
10.0.1.2/32  Static  60   0           RD  10.0.12.2       GigabitEthernet
0/0/0
10.0.1.3/32  Static  60   0           RD  10.0.13.3       GigabitEthernet
0/0/1
10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet
0/0/0
10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
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
```

Проверка связи между loopback-интерфейсами

```
[R1]ping -a 10.0.1.1 10.0.1.2
  PING 10.0.1.2: 56  data bytes, press CTRL_C to break
    Reply from 10.0.1.2: bytes=56 Sequence=1 ttl=255 time=30 ms
    Reply from 10.0.1.2: bytes=56 Sequence=2 ttl=255 time=10 ms
    Reply from 10.0.1.2: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.1.2: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.1.2: bytes=56 Sequence=5 ttl=255 time=20 ms

  --- 10.0.1.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 10/22/30 ms
[R1]ping -a 10.0.1.1 10.0.1.3
  PING 10.0.1.3: 56  data bytes, press CTRL_C to break
    Reply from 10.0.1.3: bytes=56 Sequence=1 ttl=255 time=30 ms
    Reply from 10.0.1.3: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 10.0.1.3: bytes=56 Sequence=3 ttl=255 time=30 ms
    Reply from 10.0.1.3: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.1.3: bytes=56 Sequence=5 ttl=255 time=30 ms

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

Настройка маршрута от R1 к R2 через R3 в качестве резервного маршрута от LoopBack0 R1 к LoopBack0 R2

Настройка статических маршрутов R1, R2

```
[R1]ip ro 10.0.1.2 32 10.0.13.3 preference 100
[R2]ip ro 10.0.1.1 32 10.0.23.1 preference 100
```

Таблица маршрутизации R1 (до выключения g0/0/0)

```
[R1]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

10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
10.0.1.2/32  Static  60   0          RD   10.0.12.2       GigabitEthernet
0/0/0
10.0.1.3/32  Static  60   0          RD   10.0.13.3       GigabitEthernet
0/0/1
10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet
0/0/0
10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
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
```

Отключение интерфейса GigabitEthernet0/0/0 на маршрутизаторе R1

```
[R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]shutdown
Sep  7 2024 19:06:12-08:00 R1 %%01IFPDT/4/IF_STATE(l)[0]:Interface GigabitEthern
et0/0/0 has turned into DOWN state.
```

Таблица маршрутизации R1 (после выключения g0/0/0)

```
[R1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
         Destinations : 10       Routes : 10

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

        10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.1.2/32  Static  100  0          RD   10.0.13.3       GigabitEthernet
0/0/1
        10.0.1.3/32  Static  60   0          RD   10.0.13.3       GigabitEthernet
0/0/1
      10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
      10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
```

```
0/0/1
    10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
      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
```

Трассировка маршрута, по которому передаются пакеты с данными

```
[R1]tracert -a 10.0.1.1 10.0.1.2

 traceroute to  10.0.1.2(10.0.1.2), max hops: 30 ,packet length: 40,press CTRL_C
 to break

 1 10.0.13.3 40 ms  20 ms  20 ms

 2 10.0.23.2 40 ms  40 ms  10 ms
```

Настройка маршрутов по умолчанию для установления связи между интерфейсом LoopBack0 маршрутизатора R1 и LoopBack0 R2.

Включение интерфейсов и удаление настроенных маршрутов

```
[R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]
[R1-GigabitEthernet0/0/0]undo shutdown
[R1-GigabitEthernet0/0/0]
Sep  7 2024 19:36:48-08:00 R1 %%01IFPDT/4/IF_STATE(l)[0]:Interface
GigabitEthern
et0/0/0 has turned into UP state.
[R1-GigabitEthernet0/0/0]
Sep  7 2024 19:36:48-08:00 R1 %%01IFNET/4/LINK_STATE(l)[1]:The line
protocol IP
on the interface GigabitEthernet0/0/0 has entered the UP state


[R1]undo ip ro 10.0.1.2 32 10.0.12.2
[R1]undo ip ro 10.0.1.2 32 10.0.13.3
```

Таблица маршрутизации R1

```
[R1]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

        10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
        10.0.1.3/32  Static  60   0          RD   10.0.13.3       GigabitEthernet
0/0/1
       10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet
0/0/0
       10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
     10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
       10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
       10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
     10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
       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
```

Настройка маршрута по умолчанию на R1

```
[R1]ip ro 0.0.0.0 0 10.0.12.2
```

Таблица маршрутизации R1

```
[R1]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

        0.0.0.0/0   Static  60   0           RD   10.0.12.2
GigabitEthernet
0/0/0
       10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
       10.0.1.3/32  Static  60   0          RD   10.0.13.3
GigabitEthernet
0/0/1
      10.0.12.0/24  Direct  0    0           D   10.0.12.1
GigabitEthernet
0/0/0
```

```
      10.0.12.1/32  Direct  0    0           D   127.0.0.1
GigabitEthernet
0/0/0
    10.0.12.255/32  Direct  0    0           D   127.0.0.1
GigabitEthernet
0/0/0
      10.0.13.0/24  Direct  0    0           D   10.0.13.1
GigabitEthernet
0/0/1
      10.0.13.1/32  Direct  0    0           D   127.0.0.1
GigabitEthernet
0/0/1
    10.0.13.255/32  Direct  0    0           D   127.0.0.1
GigabitEthernet
0/0/1
      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
```

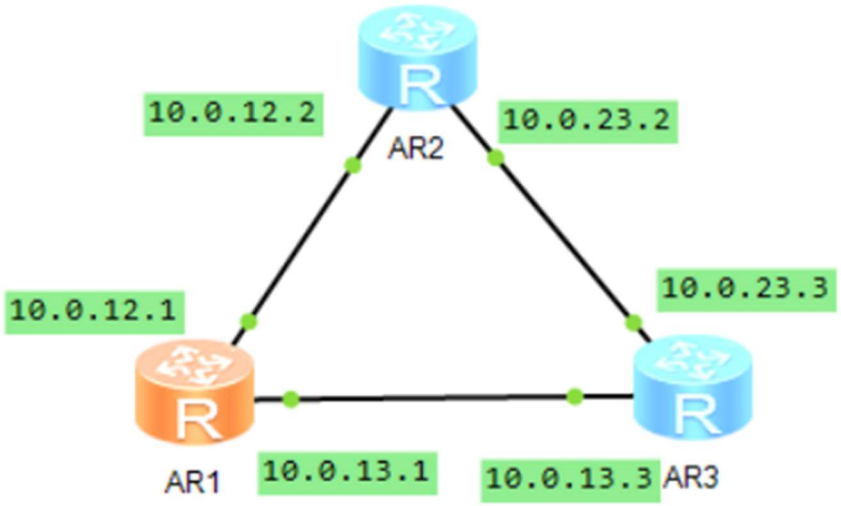
Проверка наличия связи между LoopBack0 маршрутизатора R1 и LoopBack0 маршрутизатора R2

```
[R1]ping -a 10.0.1.1 10.0.1.2
  PING 10.0.1.2: 56  data bytes, press CTRL_C to break
    Reply from 10.0.1.2: bytes=56 Sequence=1 ttl=255 time=60 ms
    Reply from 10.0.1.2: bytes=56 Sequence=2 ttl=255 time=20 ms
    Reply from 10.0.1.2: bytes=56 Sequence=3 ttl=255 time=20 ms
    Reply from 10.0.1.2: bytes=56 Sequence=4 ttl=255 time=20 ms
    Reply from 10.0.1.2: bytes=56 Sequence=5 ttl=255 time=20 ms

  --- 10.0.1.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
                  round-trip min/avg/max = 20/28/60 ms
```

OSPF Routing

Топология



Конфигурация

Просмотр информации о устройстве

```
<Huawei>display version
Huawei Versatile Routing Platform Software
VRP (R) software, Version 5.130 (AR2200 V200R003C00)
Copyright (C) 2011-2012 HUAWEI TECH CO., LTD
Huawei AR2220 Router uptime is 0 week, 0 day, 0 hour, 0 minute
BKP 0 version information:
1. PCB      Version  : AR01BAK2A VER.NC
2. If Supporting PoE : No
3. Board    Type     : AR2220
4. MPU Slot Quantity : 1
5. LPU Slot Quantity : 6

MPU 0(Master) : uptime is 0 week, 0 day, 0 hour, 0 minute
MPU version information :
1. PCB      Version  : AR01SRU2A VER.A
2. MAB      Version  : 0
3. Board    Type     : AR2220
                       4. BootROM  Version  : 0
```

Меняем имя и настраиваем IP адреса

```
[R1]interface GigabitEthernet0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.13.1 24
Sep  7 2024 20:22:05-08:00 R1 %%01IFNET/4/LINK_STATE(l)[0]:The line protocol IP
on the interface GigabitEthernet0/0/1 has entered the UP state.
[R1-GigabitEthernet0/0/1]quit
 [R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]ip address 10.0.12.1 24
Sep  7 2024 20:27:40-08:00 R1 %%01IFNET/4/LINK_STATE(l)[1]:The line protocol IP
on the interface GigabitEthernet0/0/0 has entered the UP state.
[R1-GigabitEthernet0/0/0]quit


[Huawei]sysname AR3
[AR3]interface GigabitEthernet 0/0/0
[AR3-GigabitEthernet0/0/0]ip address 10.0.13.3 24
Sep  7 2024 20:31:07-08:00 AR3 %%01IFNET/4/LINK_STATE(l)[0]:The line protocol IP
 on the interface GigabitEthernet0/0/0 has entered the UP state.
[AR3-GigabitEthernet0/0/0]quit
[AR3]interface GigabitEthernet 0/0/1
[AR3-GigabitEthernet0/0/1]ip address 10.0.23.3 24
Sep  7 2024 20:31:27-08:00 AR3 %%01IFNET/4/LINK_STATE(l)[1]:The line protocol IP
 on the interface GigabitEthernet0/0/1 has entered the UP state.
[AR3-GigabitEthernet0/0/1]quit



<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname AR2
[AR2]interface GigabitEthernet 0/0/0
 [AR2-GigabitEthernet0/0/0]ip address 10.0.12.2 24
Sep  7 2024 20:32:53-08:00 AR2 %%01IFNET/4/LINK_STATE(l)[0]:The line protocol IP
 on the interface GigabitEthernet0/0/0 has entered the UP state.
[AR2-GigabitEthernet0/0/0]quit
[AR2]interface GigabitEthernet 0/0/1
[AR2-GigabitEthernet0/0/1]ip address 10.0.23.2 24
Sep  7 2024 20:33:21-08:00 AR2 %%01IFNET/4/LINK_STATE(l)[1]:The line protocol IP
 on the interface GigabitEthernet0/0/1 has entered the UP state.
[AR2-GigabitEthernet0/0/1]quit
[AR2]

[R1]interface LoopBack0
[R1-LoopBack0]ip address 10.0.1.1 32
[R2]interface LoopBack0
[R2-LoopBack0]ip address 10.0.1.2 32
[R3]interface LoopBack0
[R3-LoopBack0]ip address 10.0.1.3 32
```

Включаем OSPF

```
[R1]ospf 1
[R1-ospf-1]area 0
[R1-ospf-1-area-0.0.0.0]network 10.0.12.1 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.13.1 0.0.0.255
[R1-ospf-1-area-0.0.0.0]network 10.0.1.1 0.0.0.0

[AR2]ospf
[AR2-ospf-1]area 0
[AR2-ospf-1-area-0.0.0.0]network 10.0.12.2 0.0.0.0
[AR2-ospf-1-area-0.0.0.0]network 10.0.23.2 0.0.0.0
[AR2-ospf-1-area-0.0.0.0]network 10.0.1.2 0.0.0.0

[AR3]ospf
[AR3-ospf-1]area 0
[AR3-ospf-1-area-0.0.0.0]network 10.0.13.3 0.0.0.0
[AR3-ospf-1-area-0.0.0.0]network 10.0.23.3 0.0.0.0
[AR3-ospf-1-area-0.0.0.0]network 10.0.1.3 0.0.0.0
```

статус

```
<R1>display ospf peer

          OSPF Process 1 with Router ID 10.0.13.1
                  Neighbors

 Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/1)'s neighbors
 Router ID: 10.0.13.3       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 32  sec
   Retrans timer interval: 5
   Neighbor is up for 00:00:33
   Authentication Sequence: [ 0 ]

                  Neighbors

 Area 0.0.0.0 interface 10.0.12.1(GigabitEthernet0/0/0)'s neighbors
 Router ID: 10.0.12.2       Address: 10.0.12.2
   State: Full  Mode:Nbr is  Slave  Priority: 1
   DR: 10.0.12.1  BDR: 10.0.12.2  MTU: 0
   Dead timer due in 36  sec
   Retrans timer interval: 5
   Neighbor is up for 00:07:50
   Authentication Sequence: [ 0 ]


<R1>display ip routing-table protocol ospf
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Public routing table : OSPF
       Destinations : 3        Routes : 4

OSPF routing table status : <Active>
```

```
      Destinations : 3       Routes : 4

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

     10.0.1.2/32  OSPF    10   1         D   10.0.12.2       GigabitEthernet
0/0/0
     10.0.1.3/32  OSPF    10   1         D   10.0.13.3       GigabitEthernet
0/0/1
    10.0.23.0/24  OSPF    10   2         D   10.0.12.2       GigabitEthernet
0/0/0
             OSPF    10   2         D   10.0.13.3       GigabitEthernet
0/0/1

OSPF routing table status : <Inactive>
      Destinations : 0       Routes : 0
```

Configure authentication

```
[R1]interface GigabitEthernet0/0/1
[R1-GigabitEthernet0/0/1]ospf authentication-mode md5 1 cipher HCIA-Datacom
 [R1-GigabitEthernet0/0/1]quit
 [R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]ospf authentication-mode md5 1 cipher HCIA-Datacom
[R1-GigabitEthernet0/0/0]display this
[V200R003C00]
#
interface GigabitEthernet0/0/0
 ip address 10.0.12.1 255.255.255.0
 ospf authentication-mode md5 1 cipher %$%$|N{)>,.nO@m;xW!r$(T:5cw1%$%$
#
Return


[R1]display ospf peer brief

          OSPF Process 1 with Router ID 10.0.13.1
                    Peer Statistic Information
 ----------------------------------------------------------------------------
 Area Id        Interface                     Neighbor id     State
 ----------------------------------------------------------------------------
```

Настраиваем аутентификацию на других роутерах

```
[R2]interface GigabitEthernet0/0/1
[R2-GigabitEthernet0/0/1]ospf authentication-mode md5 1 cipher HCIA-Datacom
 [R2-GigabitEthernet0/0/1]quit
 [R2]interface GigabitEthernet0/0/0
[R2-GigabitEthernet0/0/0]ospf authentication-mode md5 1 cipher HCIA-Datacom


[AR2-GigabitEthernet0/0/1]display ospf peer brief

          OSPF Process 1 with Router ID 10.0.12.2
                    Peer Statistic Information
 ----------------------------------------------------------------------------
```

```
 Area Id        Interface                  Neighbor id     State
 0.0.0.0        GigabitEthernet0/0/0           10.0.13.1       Full
 ------------------------------------------------------------------------------

[AR3]ospf
[AR3-ospf-1]area 0
[AR3-ospf-1-area-0.0.0.0]network 10.0.13.3 0.0.0.0
[AR3-ospf-1-area-0.0.0.0]network 10.0.23.3 0.0.0.0


[AR3-ospf-1-area-0.0.0.0]display ospf peer brief

           OSPF Process 1 with Router ID 10.0.13.3
                    Peer Statistic Information
 ------------------------------------------------------------------------------
 Area Id        Interface                  Neighbor id     State
 0.0.0.0        GigabitEthernet0/0/0           10.0.13.1       Full
 0.0.0.0        GigabitEthernet0/0/1           10.0.12.2       Full
 ------------------------------------------------------------------------------
```

Маршрут по умолчанию в R1

```
[R1]
[R1]ospf
[R1-ospf-1]default-route-advertise always
[R1-ospf-1]

[AR2-GigabitEthernet0/0/1]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
       Destinations : 15       Routes : 16

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

      0.0.0.0/0   O_ASE   150  1           D   10.0.12.1       GigabitEthernet
0/0/0
     10.0.1.1/32  OSPF    10   1           D   10.0.12.1       GigabitEthernet
0/0/0
     10.0.1.2/32  Direct  0    0           D   127.0.0.1       LoopBack0
     10.0.1.3/32  OSPF    10   1           D   10.0.23.3       GigabitEthernet
0/0/1
    10.0.12.0/24  Direct  0    0           D   10.0.12.2       GigabitEthernet
0/0/0
    10.0.12.2/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
  10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
    10.0.13.0/24  OSPF    10   2           D   10.0.12.1       GigabitEthernet
0/0/0
                  OSPF    10   2           D   10.0.23.3       GigabitEthernet
0/0/1
```

```
    10.0.23.0/24  Direct  0    0         D   10.0.23.2       GigabitEthernet
0/0/1
    10.0.23.2/32  Direct  0    0         D   127.0.0.1       GigabitEthernet
0/0/1
   10.0.23.255/32  Direct  0    0         D   127.0.0.1       GigabitEthernet
0/0/1
    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


[AR3-ospf-1-area-0.0.0.0]display ip routing-table
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Routing Tables: Public
       Destinations : 15       Routes : 16

Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface

      0.0.0.0/0   O_ASE   150  1         D   10.0.13.1       GigabitEthernet
0/0/0
     10.0.1.1/32  OSPF    10   1         D   10.0.13.1       GigabitEthernet
0/0/0
     10.0.1.2/32  OSPF    10   1         D   10.0.23.2       GigabitEthernet
0/0/1
     10.0.1.3/32  Direct  0    0         D   127.0.0.1       LoopBack0
    10.0.12.0/24  OSPF    10   2         D   10.0.23.2       GigabitEthernet
0/0/1
            OSPF    10   2         D   10.0.13.1       GigabitEthernet
0/0/0
    10.0.13.0/24  Direct  0    0         D   10.0.13.3       GigabitEthernet
0/0/0
    10.0.13.3/32  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
    10.0.23.0/24  Direct  0    0         D   10.0.23.3       GigabitEthernet
0/0/1
    10.0.23.3/32  Direct  0    0         D   127.0.0.1       GigabitEthernet
0/0/1
   10.0.23.255/32  Direct  0    0         D   127.0.0.1       GigabitEthernet
0/0/1
    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
```

Меняем веса так, чтобы LoobBack0 R1 ходил в R2 через R3

```
[R1]interface GigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]ospf cost 10
[R1-GigabitEthernet0/0/0]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

      10.0.1.1/32  Direct  0    0           D   127.0.0.1       LoopBack0
      10.0.1.2/32  OSPF    10   2           D   10.0.13.3       GigabitEthernet
0/0/1
      10.0.1.3/32  OSPF    10   1           D   10.0.13.3       GigabitEthernet
0/0/1
     10.0.12.0/24  Direct  0    0           D   10.0.12.1       GigabitEthernet
0/0/0
     10.0.12.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
   10.0.12.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/0
     10.0.13.0/24  Direct  0    0           D   10.0.13.1       GigabitEthernet
0/0/1
     10.0.13.1/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
   10.0.13.255/32  Direct  0    0           D   127.0.0.1       GigabitEthernet
0/0/1
     10.0.23.0/24  OSPF    10   2           D   10.0.13.3       GigabitEthernet
0/0/1
     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


[R1]tracert -a 10.0.1.1 10.0.1.2

 traceroute to  10.0.1.2(10.0.1.2), max hops: 30 ,packet length: 40,press CTRL_C
 to break

 1 10.0.13.3 30 ms  10 ms  10 ms

 2 10.0.23.2 40 ms  30 ms  10 ms
```

Вывод

В ходе выполнения лабораторной работы мы познакомились со средой eNSP и её настройкой, создали первую топологию, назначил адреса и статические маршруты и настроили OSPF.