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«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»

ОТЧЕТ

по лабораторной работе №2

по дисциплине «**Администрирование систем и сетей**»

Вариант на оценку 5

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УНИВЕРСИТЕТ ИТМО

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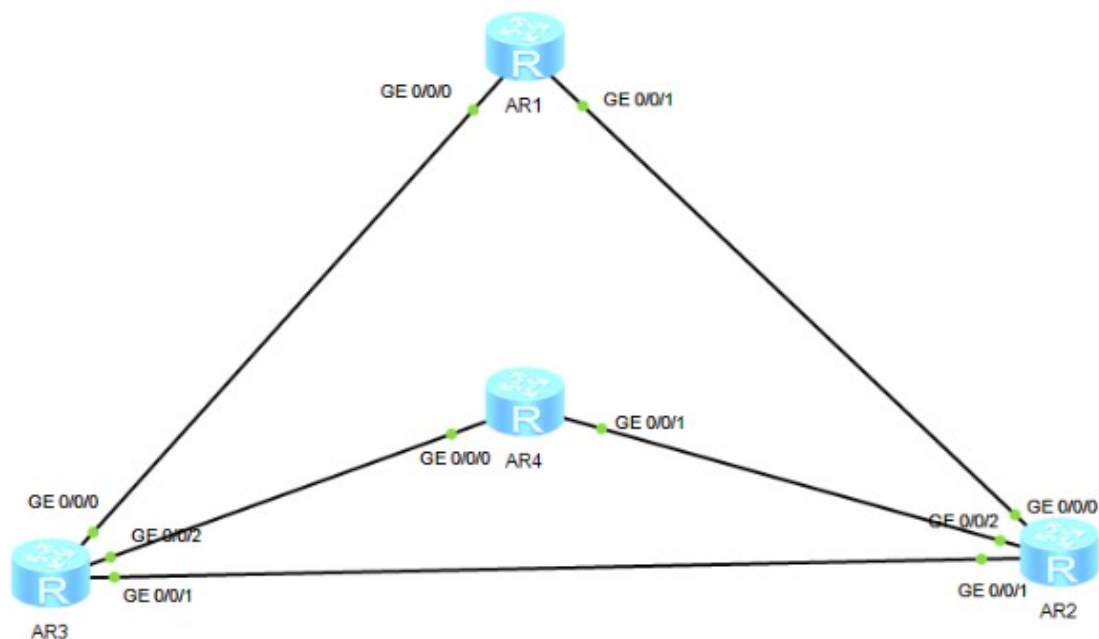
1. Создание взаимосвязанной IP-сети

1.1. Лабораторная работа 1. Адресация и маршрутизация IPv4

1.1.1. Задачи

- Настройка IP-адресов для интерфейсов на маршрутизаторах.
- Настройка статических маршрутов для установления связи между маршрутизаторами.

1.1.2. Топология сети



Настройка IP адресов для физических интерфейсов. Используем IP адреса из диапазона используемые для локального общения внутри приватной сети (10 сеть):

Маршрутизатор	Интерфейс	К:	IP-адрес/маска
---------------	-----------	----	----------------

Router-1	GigabitEthernet 0/0/0	1-3	10.0.13.1/24
	GigabitEthernet 0/0/1	1-2	10.0.14.1/24
Router-2	GigabitEthernet 0/0/0	2-1	10.0.14.2/24
	GigabitEthernet 0/0/1	2-3	10.0.23.1/24
	GigabitEthernet 0/0/2	2-4	10.0.24.1/24
Router-3	GigabitEthernet 0/0/0	3-1	10.0.13.2/24
	GigabitEthernet 0/0/1	3-2	10.0.23.2/24
	GigabitEthernet 0/0/2	3-4	10.0.33.1/24
Router-4	GigabitEthernet 0/0/0	4-3	10.0.33.2/24
	GigabitEthernet 0/0/1	4-2	10.0.24.2/24

1.1.3. Процедура конфигурирования

Задаем имена всем маршрутизаторам:

```
system-view
sysname Router-1
```

Информация об устройстве:

```
[Router-4]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, 5 minutes
```

До настройки:

```
[Router-1]display ip interface brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 4
The number of interface that is DOWN in Physical is 0
The number of interface that is UP in Protocol is 1
The number of interface that is DOWN in Protocol is 3
```

Interface	IP Address/Mask	Physical	Protocol
GigabitEthernet0/0/0	unassigned	up	down
GigabitEthernet0/0/1	unassigned	up	down
GigabitEthernet0/0/2	unassigned	up	down
NULL0			

```
[Router-1]display ip routing-table
```

```
Route Flags: R - relay, D - download to fib
```

```
-----
```

```
Routing Tables: Public
```

```
Destinations : 4          Routes : 4
```

Destination/Mask	Proto	Pre	Cost	Flags	NextHop	Interface
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	InLoopBack

Процедура настройки аналогична для всех маршрутизаторов:

```
[Router-2]interface GigabitEthernet 0/0/2
```

```
[Router-2-GigabitEthernet0/0/2]ip address 10.0.24.1 24
```

```
Sep 14 2023 23:29:15-08:00 Router-2 %01IFNET/4/LINK_STATE(l)[2]:The line protocol IP on the interface GigabitEthernet0/0/2 has entered the UP state.
```

```
[Router-2-GigabitEthernet0/0/2]quit
```

Ping:

```
<Router-1>ping 10.0.14.2
```

```
PING 10.0.14.2: 56 data bytes, press CTRL_C to break
```

```
Reply from 10.0.14.2: bytes=56 Sequence=1 ttl=255 time=230 ms
```

```
Reply from 10.0.14.2: bytes=56 Sequence=2 ttl=255 time=20 ms
```

```
Reply from 10.0.14.2: bytes=56 Sequence=3 ttl=255 time=20 ms
```

```
Reply from 10.0.14.2: bytes=56 Sequence=4 ttl=255 time=20 ms
```

```
Reply from 10.0.14.2: bytes=56 Sequence=5 ttl=255 time=10 ms
```

Ip routing table:

<Router-1>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
10.0.13.0/24	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						
10.0.14.0/24	Direct	0	0	D	10.0.14.1	GigabitEthernet
0/0/1						
10.0.14.1/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
0/0/1						
10.0.14.255/32	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

Loopback-интерфейс:

Маршрутизатор	Интерфейс	IP-адрес/маска
Router-1	LoopBack 0	10.0.1.1/32
Router-2	LoopBack 0	10.0.1.2/32
Router-3	LoopBack 0	10.0.1.3/32
Router-4	LoopBack 0	10.0.1.4/32

[Router-1]interface LoopBack 0

[Router-1-LoopBack0]ip address 10.0.1.1 32

[Router-1-LoopBack0]quit

[Router-1]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
10.0.13.0/24	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						
10.0.14.0/24	Direct	0	0	D	10.0.14.1	GigabitEthernet
0/0/1						
10.0.14.1/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
0/0/1						
10.0.14.255/32	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

[Router-1]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

Настройка статических маршрутов:

[Router-1]ip route-static 10.0.1.3 32 10.0.13.2

...

[Router-1]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

Для маршрутизатора 1 и 4 настрою статические маршруты для loopback циклически через 2 и 3:

[Router-1]ip route-static 10.0.1.4 32 10.0.14.2

```
[Router-4]ip route-static 10.0.1.1 32 10.0.33.1
```

```
[Router-4]ping -a 10.0.1.4 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=254 time=60 ms
```

```
Reply from 10.0.1.1: bytes=56 Sequence=2 ttl=254 time=20 ms
```

```
Reply from 10.0.1.1: bytes=56 Sequence=3 ttl=254 time=20 ms
```

```
Reply from 10.0.1.1: bytes=56 Sequence=4 ttl=254 time=20 ms
```

```
Reply from 10.0.1.1: bytes=56 Sequence=5 ttl=254 time=50 ms
```

Другие статические маршруты для Router-1 и Router-4 я специально не создаю.

Настроим маршрут от Router-1 к Router-2 через Router-3 в качестве резервного:

```
[Router-1]ip route-static 10.0.1.2 32 10.0.13.2 preference 100
```

```
[Router-2]ip route-static 10.0.1.1 32 10.0.23.2 preference 100
```

```
[Router-1]interface GigabitEthernet 0/0/1
```

```
[Router-1-GigabitEthernet0/0/1]shu
```

```
[Router-1-GigabitEthernet0/0/1]shutdown
```

```
Sep 15 2023 02:19:28-08:00 Router-1 %01IFPDT/4/IF_STATE(l)[0]:Interface Gigabit Ethernet0/0/1 has turned into DOWN state.
```

```
[Router-1-GigabitEthernet0/0/1]
```

```
Sep 15 2023 02:19:28-08:00 Router-1 %01IFNET/4/LINK_STATE(l)[1]:The line protocol IP on the interface GigabitEthernet0/0/1 has entered the DOWN state.
```

```
[Router-1-GigabitEthernet0/0/1]display ip rou
```

```
[Router-1-GigabitEthernet0/0/1]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	10.0.13.2	GigabitEthernet0/0/0
10.0.1.3/32	Static	60	0	RD	10.0.13.2	GigabitEthernet0/0/0
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

[Router-1-GigabitEthernet0/0/1]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

Reply from 10.0.1.2: bytes=56 Sequence=2 ttl=254 time=40 ms

Reply from 10.0.1.2: bytes=56 Sequence=3 ttl=254 time=40 ms

Reply from 10.0.1.2: bytes=56 Sequence=4 ttl=254 time=40 ms

Reply from 10.0.1.2: bytes=56 Sequence=5 ttl=254 time=20 ms

--- 10.0.1.2 ping statistics ---

5 packet(s) transmitted

4 packet(s) received

20.00% packet loss

round-trip min/avg/max = 20/35/40 ms

[Router-1-GigabitEthernet0/0/1]tracert -a 10.0.1.1 10.0.1.2

tracert to 10.

0.1.2(10.0.1.2), max hops: 30 ,packet length: 40,press CTRL_C to break

1 10.0.13.2 30 ms 10 ms 30 ms

2 10.0.23.1 40 ms 30 ms 40 ms

Включаем интерфейс, удаляем настроенные маршруты между Router-1 и Router-2:

[Router-1]undo ip route-static 10.0.1.2 32

[Router-1]ip route-static 0.0.0.0 0 10.0.13.2

[Router-1]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=70 ms

Reply from 10.0.1.2: bytes=56 Sequence=2 ttl=255 time=30 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=40 ms

Reply from 10.0.1.2: bytes=56 Sequence=5 ttl=255 time=30 ms

```

--- 10.0.1.2 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 30/40/70 ms

```

```
[Router-1]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
0.0.0.0/0	Static	60	0	RD	10.0.13.2	GigabitEthernet
10.0.1.1/32	Direct	0	0	D	127.0.0.1	LoopBack0
10.0.1.3/32	Static	60	0	RD	10.0.13.2	GigabitEthernet
10.0.1.4/32	Static	60	0	RD	10.0.14.2	GigabitEthernet
10.0.13.0/24	Direct	0	0	D	10.0.13.1	GigabitEthernet
10.0.13.1/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
10.0.13.255/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
10.0.14.0/24	Direct	0	0	D	10.0.14.1	GigabitEthernet
10.0.14.1/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
10.0.14.255/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
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

Также добавил шлюз по умолчанию для Router-4:

```
[Router-4]ip route-static 0.0.0.0 0 10.0.33.1
```

```
[Router-4]ping -a 10.0.1.4 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=254 time=40 ms
  Reply from 10.0.1.1: bytes=56 Sequence=2 ttl=254 time=50 ms
  Reply from 10.0.1.1: bytes=56 Sequence=3 ttl=254 time=30 ms
  Reply from 10.0.1.1: bytes=56 Sequence=4 ttl=254 time=40 ms
  Reply from 10.0.1.1: bytes=56 Sequence=5 ttl=254 time=30 ms

--- 10.0.1.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 30/38/50 ms
```

1.1.4. Справочные конфигурации

```
[V200R003C00]
#
 sysname Router-1
#
...
interface GigabitEthernet0/0/0
 ip address 10.0.13.1 255.255.255.0
#
interface GigabitEthernet0/0/1
 ip address 10.0.14.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
interface LoopBack0
 ip address 10.0.1.1 255.255.255.255
#
ip route-static 0.0.0.0 0.0.0.0 10.0.13.2
ip route-static 10.0.1.3 255.255.255.255 10.0.13.2
ip route-static 10.0.1.4 255.255.255.255 10.0.14.2
#

[V200R003C00]
#
 sysname Router-2
#
```

```
...
interface GigabitEthernet0/0/0
  ip address 10.0.14.2 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.23.1 255.255.255.0
#
interface GigabitEthernet0/0/2
  ip address 10.0.24.1 255.255.255.0
#
interface NULL0
#
interface LoopBack0
  ip address 10.0.1.2 255.255.255.255
#
ip route-static 10.0.1.1 255.255.255.255 10.0.14.1
ip route-static 10.0.1.1 255.255.255.255 10.0.23.2 preference 100
ip route-static 10.0.1.3 255.255.255.255 10.0.23.2
ip route-static 10.0.1.4 255.255.255.255 10.0.24.2
#

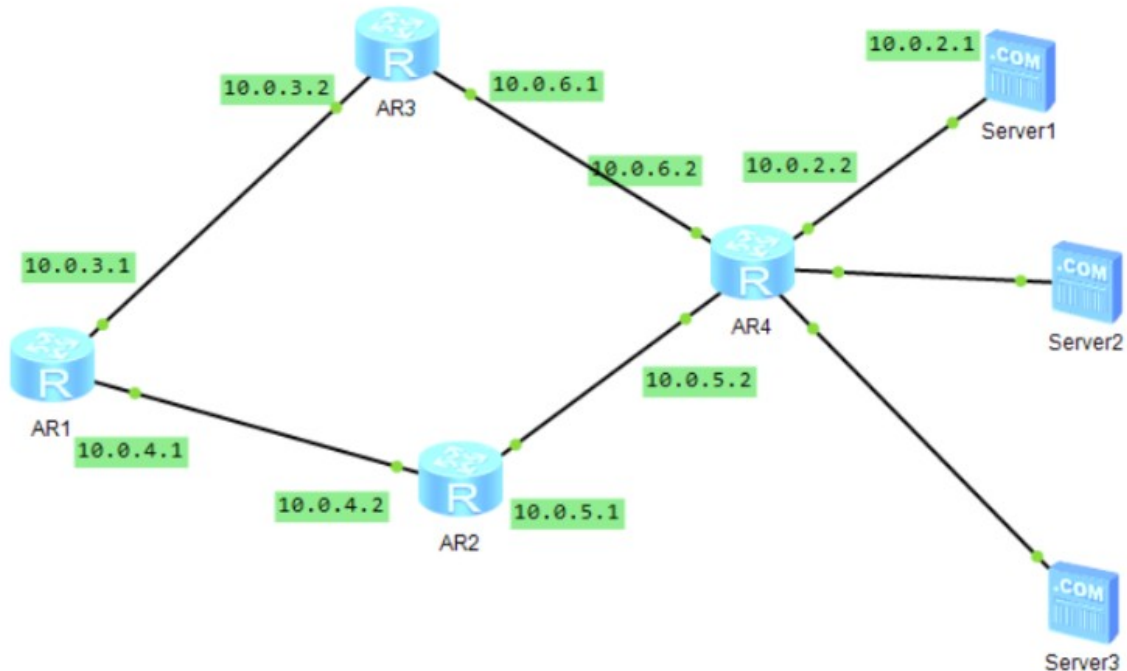
[V200R003C00]
#
  sysname Router-3
#
...
interface GigabitEthernet0/0/0
  ip address 10.0.13.2 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.23.2 255.255.255.0
#
interface GigabitEthernet0/0/2
  ip address 10.0.33.1 255.255.255.0
#
interface NULL0
#
interface LoopBack0
  ip address 10.0.1.3 255.255.255.255
#
ip route-static 10.0.1.1 255.255.255.255 10.0.13.1
ip route-static 10.0.1.2 255.255.255.255 10.0.23.1
ip route-static 10.0.1.4 255.255.255.255 10.0.33.2
```

```
#

[V200R003C00]
#
 sysname Router-4
#
...
interface GigabitEthernet0/0/0
 ip address 10.0.33.2 255.255.255.0
#
interface GigabitEthernet0/0/1
 ip address 10.0.24.2 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
interface LoopBack0
 ip address 10.0.1.4 255.255.255.255
#
ip route-static 0.0.0.0 0.0.0.0 10.0.33.1
ip route-static 10.0.1.2 255.255.255.255 10.0.24.1
ip route-static 10.0.1.3 255.255.255.255 10.0.33.1
#
```

1.2. Лабораторная работа 1. Усложненная топология

1.2.1. Топология сети



1.2.2. Процедура конфигурирование

Шаги выполняются аналогично предыдущей реализации. В данном контексте рассматривается реализация, однако затрагивается вопрос, что произойдет в случае, когда интерфейс недоступен.

Первый вариант: 10.0.3.0/24 лежит. Тогда, если узлом отправителем является AR1, то как и раньше будет выбран путь другой путь.

```
<R1>ping 10.0.2.1
```

```
PING 10.0.2.1: 56 data bytes, press CTRL_C to break
```

```
Reply from 10.0.2.1: bytes=56 Sequence=1 ttl=253 time=40 ms
```

```
Reply from 10.0.2.1: bytes=56 Sequence=2 ttl=253 time=30 ms
```

```
Reply from 10.0.2.1: bytes=56 Sequence=3 ttl=253 time=40 ms
```

```
Reply from 10.0.2.1: bytes=56 Sequence=4 ttl=253 time=50 ms
```

```
Reply from 10.0.2.1: bytes=56 Sequence=5 ttl=253 time=30 ms
```

Если тот же отправитель попытается отправить данные, но при этом 10.0.6.0/24 лежит, то данные не достигнут получателя, если не переконфигурировать

маршруты, так как для AR1 все интерфейсы up, и он будет отправлять пакеты тем же маршрутом. Но дойдя до маршрутизатора, где интерфейс down, тот не сможет передать далее данные, а только в обратную сторону. Тогда данные дойдут до изначально маршрутизатора, а тот, потому что у него в таблице маршрутов указан destination соответствующий, снова отправит данные по тому же пути. В общем, это не будет работать. Необходим протокол динамической маршрутизации.

1.2.3. Справочная конфигурация

R1:

```
interface GigabitEthernet0/0/0
  ip address 10.0.4.1 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.3.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 10.0.2.0 255.255.255.0 10.0.3.2
ip route-static 10.0.2.0 255.255.255.0 10.0.4.2 preference 100
#
```

R2:

```
interface GigabitEthernet0/0/0
  ip address 10.0.4.2 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.5.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 10.0.2.0 255.255.255.0 10.0.5.2
```

R3:

```
interface GigabitEthernet0/0/0
  ip address 10.0.3.2 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.6.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 10.0.2.0 255.255.255.0 10.0.4.2
ip route-static 10.0.2.0 255.255.255.0 10.0.6.2
ip route-static 10.0.2.0 255.255.255.0 10.0.3.1 preference 100
ip route-static 10.0.3.0 255.255.255.0 10.0.4.2 preference 100
#
```

R4:

```
interface Ethernet4/0/0
#
interface Ethernet4/0/1
#
interface Ethernet4/0/2
#
interface Ethernet4/0/3
#
interface Ethernet4/0/4
#
interface Ethernet4/0/5
#
interface Ethernet4/0/6
#
interface Ethernet4/0/7
#
interface GigabitEthernet0/0/0
  ip address 10.0.6.2 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.5.2 255.255.255.0
#
interface GigabitEthernet0/0/2
  ip address 10.0.2.2 255.255.255.0
#
interface GigabitEthernet4/0/0
```



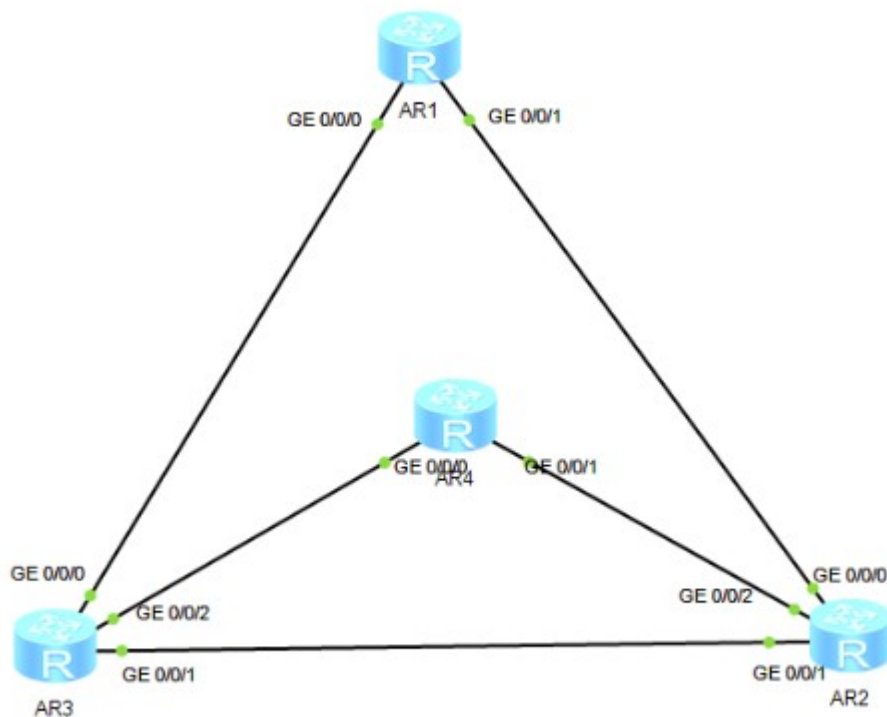
```
#
interface NULL0
#
ip route-static 10.0.3.0 255.255.255.0 10.0.6.1
ip route-static 10.0.4.0 255.255.255.0 10.0.5.1
#
```

1.3. Лабораторная работа 2. Маршрутизация OSPF

1.3.1. Задачи

- Создание процессов OSPF на устройствах и включение OSPF на интерфейсах.
- Настройка аутентификации OSPF.
- Настройка OSPF для анонсирования маршрутов по умолчанию.
- Управление выбором маршрутов OSPF на основании их стоимости.

1.3.2. Топология сети



Настройка IP адресов для физических интерфейсов. Используем IP адреса из диапазона используемые для локального общения внутри приватной сети (10 сеть):

Маршрутизатор	Интерфейс	К:	IP-адрес/маска
Router-1	GigabitEthernet 0/0/0	1-3	10.0.13.1/24
	GigabitEthernet 0/0/1	1-2	10.0.14.1/24
Router-2	GigabitEthernet 0/0/0	2-1	10.0.14.2/24
	GigabitEthernet 0/0/1	2-3	10.0.23.1/24
	GigabitEthernet 0/0/2	2-4	10.0.24.1/24
Router-3	GigabitEthernet 0/0/0	3-1	10.0.13.2/24
	GigabitEthernet 0/0/1	3-2	10.0.23.2/24
	GigabitEthernet 0/0/2	3-4	10.0.33.1/24
Router-4	GigabitEthernet 0/0/0	4-3	10.0.33.2/24
	GigabitEthernet 0/0/1	4-2	10.0.24.2/24

Loopback-интерфейс:

Маршрутизатор	Интерфейс	IP-адрес/маска
Router-1	LoopBack 0	10.0.1.1/32
Router-2	LoopBack 0	10.0.1.2/32
Router-3	LoopBack 0	10.0.1.3/32
Router-4	LoopBack 0	10.0.1.4/32

1.3.3. Процедура конфигурирования

Необходимо удалить статические маршруты, настроенные в ЛР 1. В результате, таблица маршрутизации Router-1:

```
<Router-1>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
10.0.13.0/24	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						
10.0.14.0/24	Direct	0	0	D	10.0.14.1	GigabitEthernet
0/0/1						
10.0.14.1/32	Direct	0	0	D	127.0.0.1	GigabitEthernet
0/0/1						
10.0.14.255/32	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

Конфигурирование ospf, магистральной area:

```
[Router-1]ospf 1
[Router-1-ospf-1]area 0
[Router-1-ospf-1-area-0.0.0.0]network 10.0.13.1 0.0.0.255
[Router-1-ospf-1-area-0.0.0.0]network 10.0.14.1 0.0.0.255
[Router-1-ospf-1-area-0.0.0.0]network 10.0.1.1 0.0.0.0
```

```
[Router-1]display ospf peer 10.0.1.1
```

```
OSPF Process 1 with Router ID 10.0.13.1
```

```
[Router-1]display ospf peer
```

```
OSPF Process 1 with Router ID 10.0.13.1
```

```
Neighbors
```

```
Area 0.0.0.0 interface 10.0.13.1(GigabitEthernet0/0/0)'s neighbors
```

```
Router ID: 10.0.13.2      Address: 10.0.13.2
```

```
State: Full  Mode:Nbr is Master  Priority: 1
```

```
DR: 10.0.13.1  BDR: 10.0.13.2  MTU: 0
```

```
Dead timer due in 37 sec
```

```
Retrans timer interval: 5
```

Neighbor is up for 00:05:15
Authentication Sequence: [0]

Neighbors

Area 0.0.0.0 interface 10.0.14.1(GigabitEthernet0/0/1)'s neighbors

Router ID: 10.0.14.2 Address: 10.0.14.2
State: Full Mode:Nbr is Master Priority: 1
DR: 10.0.14.1 BDR: 10.0.14.2 MTU: 0
Dead timer due in 33 sec
Retrans timer interval: 5
Neighbor is up for 00:06:56
Authentication Sequence: [0]

[Router-1]display ip routing-table protocol ospf

Route Flags: R - relay, D - download to fib

Public routing table : OSPF

Destinations : 6 Routes : 7

OSPF routing table status : <Active>

Destinations : 6 Routes : 7

Destination/Mask	Proto	Pre	Cost	Flags	NextHop	Interface
10.0.1.2/32	OSPF	10	1	D	10.0.14.2	GigabitEthernet
0/0/1						
10.0.1.3/32	OSPF	10	1	D	10.0.13.2	GigabitEthernet
0/0/0						
10.0.1.4/32	OSPF	10	2	D	10.0.14.2	GigabitEthernet
0/0/1						
10.0.23.0/24	OSPF	10	2	D	10.0.14.2	GigabitEthernet
0/0/1						
	OSPF	10	2	D	10.0.13.2	GigabitEthernet
0/0/0						
10.0.24.0/24	OSPF	10	2	D	10.0.14.2	GigabitEthernet
0/0/1						
10.0.33.0/24	OSPF	10	3	D	10.0.14.2	GigabitEthernet
0/0/1						

OSPF routing table status : <Inactive>

Destinations : 0 Routes : 0

Настройка аутентификации:

```
[Router-1-GigabitEthernet0/0/0]ospf authentication-mode md5 1 cipher lab22
[Router-1-GigabitEthernet0/0/0]dis
[Router-1-GigabitEthernet0/0/0]display this
[V200R003C00]
#
interface GigabitEthernet0/0/0
 ip address 10.0.13.1 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$jeS)073DuDJ2{b@hY/j2[sBW%$$$
#
return
```

После настройки:

```
[Router-2]display ospf peer brief
```

```
OSPF Process 1 with Router ID 10.0.14.2
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 10.0.13.2          Full
0.0.0.0           GigabitEthernet0/0/2 10.0.33.2          Full
-----
```

Сделаем R1 граничным маршрутизатором, тогда он анонсирует свой маршрут, как маршрут по умолчанию.

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

Маршрутизаторы 2,3,4 получили маршрут по умолчанию:

```
[Router-2]display ip routing-table
```

```
Route Flags: R - relay, D - download to fib
```

```
-----
Routing Tables: Public
```

```
Destinations : 20          Routes : 21
```

Destination/Mask	Proto	Pre	Cost	Flags	NextHop	Interface
0.0.0.0/0	O_ASE	150	1	D	10.0.14.1	GigabitEthernet
0/0/0						
10.0.1.1/32	OSPF	10	1	D	10.0.14.1	GigabitEthernet

...

Изменим значения стоимости интерфейсов на Router-1, чтобы Router-2 достигался через Router-3:

```
[Router-1]interface GigabitEthernet 0/0/1
[Router-1-GigabitEthernet0/0/1]ospf cost 10
[Router-1-GigabitEthernet0/0/1]quit
[Router-1]display 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
10.0.1.1/32	Direct	0	0	D	127.0.0.1	LoopBack0
10.0.1.2/32	OSPF	10	2	D	10.0.13.2	GigabitEthernet
0/0/0						
10.0.1.3/32	OSPF	10	1	D	10.0.13.2	GigabitEthernet

Проверка:

```
[Router-1]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 10.0.13.2 50 ms 30 ms 30 ms
```

```
2 10.0.23.1 40 ms 40 ms 30 ms
```

Отключим какой-то интерфейс, проверим работоспособность:

```
[Router-1-GigabitEthernet0/0/0]shutdown
[Router-1]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 10.0.14.2 50 ms 20 ms 30 ms
```

То есть используется маршрут с большей стоимостью.

1.3.4. Справочные конфигурации

```
[V200R003C00]
#
 sysname Router-1
#
interface GigabitEthernet0/0/0
 ip address 10.0.13.1 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$jeS)073DuDJ2{b@hY/j2[sBW%$$$
#
interface GigabitEthernet0/0/1
 ip address 10.0.14.1 255.255.255.0
 ospf cost 10
 ospf authentication-mode md5 1 cipher %$$Dr^&ORih00X0G%-f>i{<[tk=%$$$
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
interface LoopBack0
 ip address 10.0.1.1 255.255.255.255
#
ospf 1
 default-route-advertise always
 area 0.0.0.0
  network 10.0.1.1 0.0.0.0
  network 10.0.13.0 0.0.0.255
  network 10.0.14.0 0.0.0.255
#

[V200R003C00]
#
 sysname Router-2
#
interface GigabitEthernet0/0/0
 ip address 10.0.14.2 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$LRn0:6B#2!)KU6PHr$VD[w"R%$$$
#
interface GigabitEthernet0/0/1
 ip address 10.0.23.1 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$L$n&7]H*pX\Y0=AK8F>~[wX~%$$$
#
interface GigabitEthernet0/0/2
```

```

ip address 10.0.24.1 255.255.255.0
ospf authentication-mode md5 1 cipher %$$WD-1Nqvre1MR-WQ3XPr@[w0*%$$$
#
interface NULL0
#
interface LoopBack0
ip address 10.0.1.2 255.255.255.255
#
ospf 1
area 0.0.0.0
network 10.0.1.2 0.0.0.0
network 10.0.14.2 0.0.0.0
network 10.0.23.1 0.0.0.0
network 10.0.24.1 0.0.0.0
#

[V200R003C00]
#
sysname Router-3
#
interface GigabitEthernet0/0/0
ip address 10.0.13.2 255.255.255.0
ospf authentication-mode md5 1 cipher %$$o1]-QiVZo7-s-5S+RDrM[y7.%$$$
#
interface GigabitEthernet0/0/1
ip address 10.0.23.2 255.255.255.0
ospf authentication-mode md5 1 cipher %$$rL_h:s/&g:xNH;XjPTtQ[zE\%$$$
#
interface GigabitEthernet0/0/2
ip address 10.0.33.1 255.255.255.0
ospf authentication-mode md5 1 cipher %$$BMfB++I.Q5@|/FHW/2_>[z&4%$$$
#
interface NULL0
#
interface LoopBack0
ip address 10.0.1.3 255.255.255.255
#
ospf 1
area 0.0.0.0
network 10.0.1.3 0.0.0.0
network 10.0.13.2 0.0.0.0
network 10.0.23.2 0.0.0.0
network 10.0.31.1 0.0.0.0

```

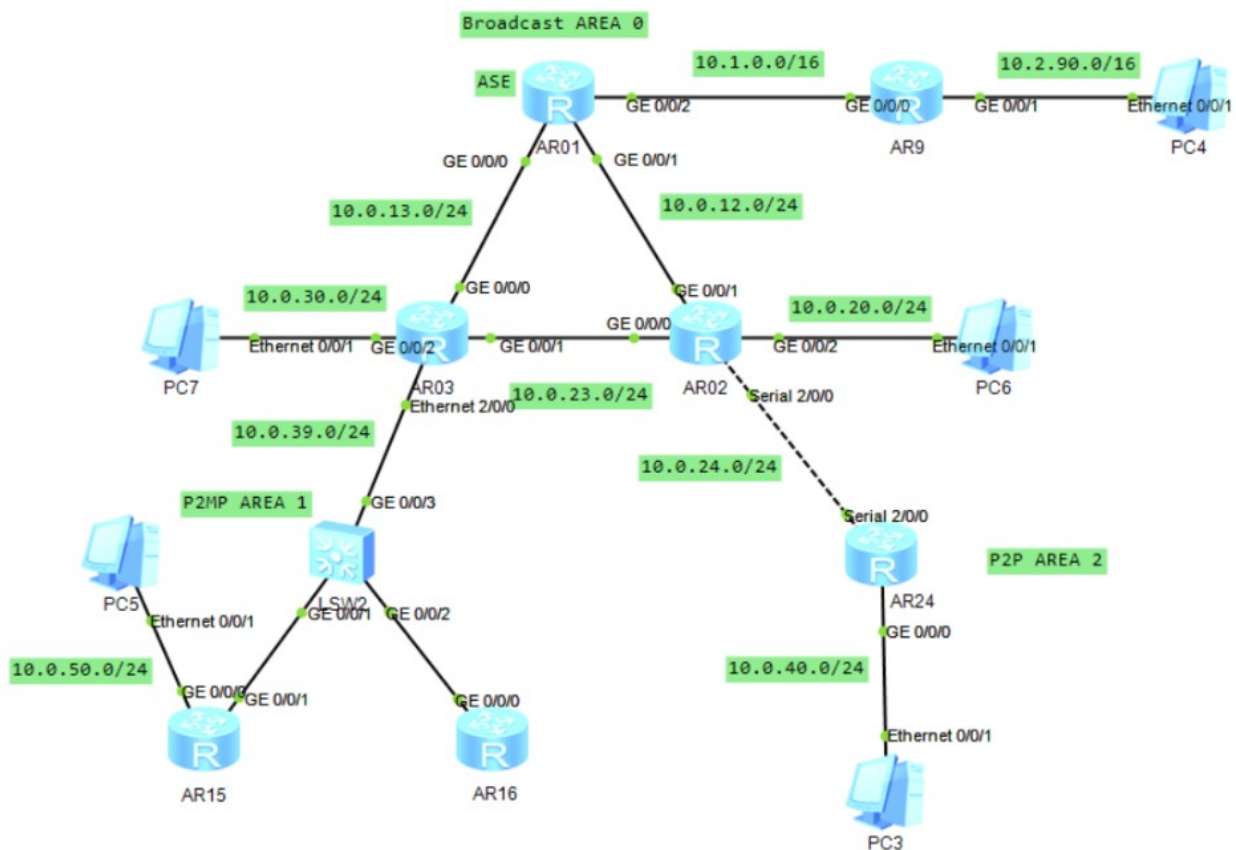


```
#

[V200R003C00]
#
 sysname Router-4
#
interface GigabitEthernet0/0/0
 ip address 10.0.33.2 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$YDM%Xxm5iQY.]BDWP^94[zeL%$$$
#
interface GigabitEthernet0/0/1
 ip address 10.0.24.2 255.255.255.0
 ospf authentication-mode md5 1 cipher %$$Pq]BBmMGy6cd{&Il&{##[{CT%$$$
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
interface LoopBack0
 ip address 10.0.1.4 255.255.255.255
#
ospf 1
 area 0.0.0.0
  network 10.0.1.4 0.0.0.0
  network 10.0.24.2 0.0.0.0
  network 10.0.33.2 0.0.0.0
#
```

1.4. Лабораторная работа 2. Усложненная топология

1.4.1. Топология сети



1.4.2. Файлы конфигурации

```
[V200R003C00]
#
sysname R15
#
interface GigabitEthernet0/0/0
ip address 10.0.50.5 255.255.255.0
#
interface GigabitEthernet0/0/1
ip address 10.0.39.5 255.255.255.0
ospf network-type p2mp
#
interface GigabitEthernet0/0/2
#
interface NULL0
```

```
#
ospf 1
  silent-interface GigabitEthernet0/0/0
  area 0.0.0.1
    network 10.0.39.5 0.0.0.0
    network 10.0.50.5 0.0.0.0
#
user-interface con 0
  authentication-mode password
  idle-timeout 0 0
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```

[V200R003C00]

```
#
  sysname R24
#
interface Serial2/0/0
  link-protocol ppp
  ip address 10.0.24.4 255.255.255.0
#
interface Serial2/0/1
  link-protocol ppp
#
interface GigabitEthernet0/0/0
  ip address 10.0.40.4 255.255.255.0
  ospf network-type p2p
#
interface GigabitEthernet0/0/1
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ospf 1 router-id 4.4.4.4
  silent-interface GigabitEthernet0/0/0
  area 0.0.0.2
    network 10.0.24.0 0.0.0.255
```

```
network 10.0.40.4 0.0.0.0
#
user-interface con 0
authentication-mode password
idle-timeout 0 0
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```

```
[V200R003C00]
#
sysname R01
#
interface GigabitEthernet0/0/0
ip address 10.0.13.1 255.255.255.0
#
interface GigabitEthernet0/0/1
ip address 10.0.12.1 255.255.255.0
#
interface GigabitEthernet0/0/2
ip address 10.1.0.1 255.255.0.0
#
interface NULL0
#
ospf 1 router-id 1.1.1.1
default-route-advertise always
silent-interface GigabitEthernet0/0/2
area 0.0.0.0
network 10.0.12.1 0.0.0.0
network 10.0.13.1 0.0.0.0
network 10.1.0.0 0.0.255.255
#
ip route-static 10.1.0.0 255.255.0.0 10.1.0.9
ip route-static 10.2.0.0 255.255.0.0 10.1.0.9
#
user-interface con 0
authentication-mode password
idle-timeout 0 0
user-interface vty 0 4
```

```
user-interface vty 16 20
#
wlan ac
#
return
```

```
[V200R003C00]
#
 sysname R9
#
interface GigabitEthernet0/0/0
 ip address 10.1.0.9 255.255.0.0
#
interface GigabitEthernet0/0/1
 ip address 10.2.90.9 255.255.0.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 10.0.0.0 255.255.0.0 10.1.0.1
#
user-interface con 0
 authentication-mode password
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```

```
[V200R003C00]
#
 sysname R02
#
interface Serial2/0/0
 link-protocol ppp
 ip address 10.0.24.2 255.255.255.0
#
interface Serial2/0/1
 link-protocol ppp
```

```
#
interface GigabitEthernet0/0/0
 ip address 10.0.23.2 255.255.255.0
 ospf enable 1 area 0.0.0.0
#
interface GigabitEthernet0/0/1
 ip address 10.0.12.2 255.255.255.0
 ospf enable 1 area 0.0.0.0
#
interface GigabitEthernet0/0/2
 ip address 10.0.20.2 255.255.255.0
#
interface NULL0
#
ospf 1 router-id 2.2.2.2
 silent-interface GigabitEthernet0/0/2
 area 0.0.0.0
  network 10.0.20.0 0.0.0.255
 area 0.0.0.2
  network 10.0.24.0 0.0.0.255
#
user-interface con 0
 authentication-mode password
 idle-timeout 0 0
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```

[V200R003C00]

```
#
sysname R16
#
interface GigabitEthernet0/0/0
 ip address 10.0.39.6 255.255.255.0
 ospf network-type p2mp
#
interface GigabitEthernet0/0/1
#
interface GigabitEthernet0/0/2
```

```
#
interface NULL0
#
ospf 1
  area 0.0.0.1
    network 10.0.39.6 0.0.0.0
#
user-interface con 0
  authentication-mode password
  idle-timeout 0 0
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```

[V200R003C00]

```
#
  sysname R03
#
interface Ethernet2/0/0
  ip address 10.0.39.3 255.255.255.0
  ospf network-type p2mp
#
interface Ethernet2/0/1
#
interface GigabitEthernet0/0/0
  ip address 10.0.13.3 255.255.255.0
#
interface GigabitEthernet0/0/1
  ip address 10.0.23.3 255.255.255.0
#
interface GigabitEthernet0/0/2
  ip address 10.0.30.3 255.255.255.0
#
interface NULL0
#
ospf 1 router-id 3.3.3.3
  silent-interface GigabitEthernet0/0/2
  area 0.0.0.0
    network 10.0.13.3 0.0.0.0
```

```
network 10.0.23.3 0.0.0.0
network 10.0.30.3 0.0.0.0
area 0.0.0.1
network 10.0.39.3 0.0.0.0
#
user-interface con 0
authentication-mode password
idle-timeout 0 0
user-interface vty 0 4
user-interface vty 16 20
#
wlan ac
#
return
```