Федеральное государственное автономное образовательное учреждение высшего образования

Университет ИТМО

Дисциплина: Администрирование систем и сетей **Лабораторная работа №2**

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# **Цель работы:**

Получить практические в следующих темах:

• Процедура настройки IPv4-адреса на интерфейсе

• Функции и значение loopback-интерфейсов

• Принципы генерирования прямых маршрутов

• Процедура настройки статических маршрутов и условия, при которых используются статические маршруты

• Процедура проверки возможности установления соединения сетевого уровня с помощью инструмента ping

• Процедура настройки статических маршрутов и сценарии их применения

# **Топология сети:**

# 

# **План работы:**

1. Настроить IP-адресов для интерфейсов на маршрутизаторах

2. Настройка статических маршрутов для установления связи между маршрутизаторами

# **Конфигурация оборудования:**

## Вывод IP-адреса текущего интерфейса и таблицы маршрутизации:

<R1>display ip interface 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 2

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 down down

GigabitEthernet0/0/2 unassigned down down

NULL0 unassigned up up(s)

## Вывод таблицы маршрутизации на маршрутизаторе R1:

<R1>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 InLoopBack0

## Настройка IP-адресов для физических интерфейсов:

| Маршрутизатор | Интерфейс | P-адрес/маска |
| --- | --- | --- |
| R1 | GigabitEthernet0/0/1 | 10.0.13.1/24 |
| GigabitEthernet0/0/0 | 10.0.12.1/24 |
| R2 | GigabitEthernet0/0/0 | 10.0.12.2/24 |
| GigabitEthernet0/0/2 | 10.0.23.2/24 |
| R3 | GigabitEthernet0/0/1 | 10.0.13.3/24 |
| GigabitEthernet0/0/2 | 10.0.23.3/24 |

### Процесс конфигурации оборудования:

<R1>system-view

[R1]interface GigabitEthernet0/0/1

[R1-GigabitEthernet0/0/1]ip address 10.0.13.1 24

[R1-GigabitEthernet0/0/1]quit

[R1]interface GigabitEthernet0/0/0

[R1-GigabitEthernet0/0/0]ip address 10.0.12.1 24

[R1i-GigabitEthernet0/0/0] quit

<R2>system-view

[R2]interface GigabitEthernet0/0/0

[R2-GigabitEthernet0/0/2]ip address 10.0.12.2 24

[R2-GigabitEthernet0/0/2]quit

[R2]interface GigabitEthernet0/0/2

[R2-GigabitEthernet0/0/2]ip address 10.0.23.2 24

[R2-GigabitEthernet0/0/2]quit

<R3>system-view

[R3]interface GigabitEthernet0/0/1

[R3-GigabitEthernet0/0/1]ip address 10.0.13.3 24

[R3i-GigabitEthernet0/0/1]quit

[R3]interface GigabitEthernet0/0/2

[R3-GigabitEthernet0/0/2]ip address 10.0.23.3 24

[R3-GigabitEthernet0/0/2]quit

### Проверка наличия связи:

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=80 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=20 ms

Reply from 10.0.12.2: bytes=56 Sequence=4 ttl=255 time=30 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 = 20/38/80 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=80 ms

Reply from 10.0.13.3: bytes=56 Sequence=2 ttl=255 time=30 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=30 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 = 20/38/80 ms

### Таблица маршрутизации:

<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

10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

## Создание Loopback-интерфейсов:

| Маршрутизатор | Интерфейс | IP-адрес/маска |
| --- | --- | --- |
| R1 | LoopBack0 | 10.0.1.1/32 |
| R2 | LoopBack0 | 10.0.1.2/32 |
| R3 | LoopBack0 | 10.0.1.3/32 |

<R1>system-view

[R1]interface LoopBack0

[R1-LoopBack0]ip address 10.0.1.1 32

[R1-LoopBack0]quit

<R2>system-view

[R2]interface LoopBack0

[R2-LoopBack0]ip address 10.0.1.2 32

[R2-LoopBack0]quit

<R3>system-view

[R3]interface LoopBack0

[R3-LoopBack0]ip address 10.0.1.3 32

[R3-LoopBack0]quit

### Таблица маршрутизации для 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 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

<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>system-view

[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

[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 GigabitEthernet0/0/0

10.0.1.3/32 Static 60 0 RD 10.0.13.3 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

<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

[R2]ip route-static 10.0.1.1 32 10.0.12.1

[R2]ip route-static 10.0.1.3 32 10.0.23.3

<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=20 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=10 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=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 = 10/20/30 ms

[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

<R2>ping -a 10.0.1.2 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=20 ms

Reply from 10.0.1.3: bytes=56 Sequence=2 ttl=255 time=30 ms

Reply from 10.0.1.3: bytes=56 Sequence=3 ttl=255 time=20 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=20 ms

--- 10.0.1.3 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 20/22/30 ms

<R3>ping -a 10.0.1.3 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=20 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 = 10/20/30 ms

## Создание резервных маршрутов:

[R1]ip route-static 10.0.1.2 32 10.0.13.3 preference 100

[R2]ip route-static 10.0.1.1 32 10.0.23.3 preference 100

[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 GigabitEthernet0/0/0

10.0.1.3/32 Static 60 0 RD 10.0.13.3 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

[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

10.0.1.1/32 Static 60 0 RD 10.0.12.1 GigabitEthernet0/0/0

10.0.1.2/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.1.3/32 Static 60 0 RD 10.0.23.3 GigabitEthernet0/0/2

10.0.12.0/24 Direct 0 0 D 10.0.12.2 GigabitEthernet0/0/0

10.0.12.2/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

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

### Выключение интерфейса для активации резервного маршрута:

[R1]interface GigabitEthernet 0/0/0

[R1-GigabitEthernet0/0/0]shutdown

[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 GigabitEthernet0/0/1

10.0.1.3/32 Static 60 0 RD 10.0.13.3 GigabitEthernet0/0/1

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

<R2>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 Static 100 0 RD 10.0.23.3 GigabitEthernet0/0/2

10.0.1.2/32 Direct 0 0 D 127.0.0.1 LoopBack0

10.0.1.3/32 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

<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=254 time=20 ms

Reply from 10.0.1.2: bytes=56 Sequence=2 ttl=254 time=30 ms

Reply from 10.0.1.2: bytes=56 Sequence=3 ttl=254 time=20 ms

Reply from 10.0.1.2: bytes=56 Sequence=4 ttl=254 time=30 ms

Reply from 10.0.1.2: bytes=56 Sequence=5 ttl=254 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 = 20/26/30 ms

<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 20 ms

2 10.0.23.2 30 ms 40 ms 20 ms

## Включение интерфейсов и удаление настроенных маршрутов:

<R1>system-view

Enter system view, return user view with Ctrl+Z.

[R1]interface GigabitEthernet0/0/0

[R1-GigabitEthernet0/0/0]undo shutdown

[R1-GigabitEthernet0/0/0]quit

[R1]undo ip route-static 10.0.1.2 255.255.255.255 10.0.13.3 preference 100

[R1]undo ip route-static 10.0.1.2 255.255.255.255 10.0.12.2

[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 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

## Настройка маршрута по-умолчанию:

[R1]ip route-static 0.0.0.0 0 10.0.12.2

[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 GigabitEthernet0/0/0

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 GigabitEthernet0/0/1

10.0.12.0/24 Direct 0 0 D 10.0.12.1 GigabitEthernet0/0/0

10.0.12.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.12.255/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/0

10.0.13.0/24 Direct 0 0 D 10.0.13.1 GigabitEthernet0/0/1

10.0.13.1/32 Direct 0 0 D 127.0.0.1 GigabitEthernet0/0/1

10.0.13.255/32 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

### Проверка связи:

<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=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 = 20/22/30 ms

# 

# Вывод:

Во время выполнения лабораторной работы мы:

* познакомились с работой в eNSP
* настроили IPv4 адреса на интерфейсах, loopback адреса, статические маршруты и резервные маршруты.