

Администрирование вычислительных систем

Лабораторная работа №3

“Конфигурация интерфейса и канала Ethernet”

“Конфигурация VLAN”

“Маршрутизация VLAN”

“Конфигурирование коммутации уровня 3”

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Содержание

Содержание	2
Конфигурация интерфейса и канала Ethernet	3
Топология	3
Шаг 1. Выполнение основных настроек на коммутаторах Ethernet	3
Шаг 2. Настройка агрегации канала вручную	3
Шаг 3. Конфигурирование агрегации каналов в статическом режиме LACP	4
Конфигурация VLAN	7
Топология	7
Шаг 2 Отключение неиспользуемых интерфейсов и установка магистральной VLAN 7	7
Шаг 3 Конфигурирование VLAN	8
Шаг 4 Настройка IP-адресации для каждой VLAN	9
Шаг 5 Проверка конфигурации путем проверки подключения	10
Шаг 6 Конфигурирование гибридного интерфейса	11
Окончательная конфигурация	12
Маршрутизация VLAN	14
Топология	14
Шаг 1 Подготовка среды	14
Шаг 2 Конфигурирование IP-адресов для R3	15
Шаг 3 Установка двух VLAN	15
Шаг 4 Настройка маршрутизации VLAN через субинтерфейс R2	15
Окончательная конфигурация	17
Конфигурирование коммутации уровня 3	18
Топология	18
Шаг 1 Подготовка среды	18
Шаг 3 Конфигурирование VLAN 3 – VLAN 7 для S1 и S2	19
Шаг 4 Установка соединения Eth-Trunk между S1 и S2 с помощью PVID 5	20
Шаг 5 Настройка адресов шлюза для VLAN на S1 и S2	22
Шаг 6 IP-адресация и маршруты по умолчанию для R1, R3, S3 и S4	22
Шаг 7 Проверка подключения между VLAN 3 и VLAN 4	23
Шаг 8 Включение OSPF на S1 и S2	24
Окончательная конфигурация	25
Вывод	28

Конфигурация интерфейса и канала Ethernet

Топология



Шаг 1. Выполнение основных настроек на коммутаторах Ethernet

Для скорости G 0/0/9 и G 0/0/10 на S1 установлено значение 100 Мбит/с. Перед изменением скорости интерфейса отключено автосогласование.

```
[S1]int g0/0/9
[S1-GigabitEthernet0/0/9]undo negotiation auto
[S1-GigabitEthernet0/0/9]speed 100
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]undo negotiation auto
[S1-GigabitEthernet0/0/10]speed 100
```

Для скорости G 0/0/9 и G 0/0/10 на S2 установлено значение 100 Мбит/с.

```
[S2]int g0/0/9
[S2-GigabitEthernet0/0/9]undo negotiation auto
[S2-GigabitEthernet0/0/9]speed 100
[S2-GigabitEthernet0/0/9]int g0/0/10
[S2-GigabitEthernet0/0/10]undo negotiation auto
[S2-GigabitEthernet0/0/10]speed 100
```

Шаг 2. Настройка агрегации канала вручную

Создано Eth-Trunk 1 на S1 и S2. Удалена конфигурация по умолчанию с G 0/0/9 и G 0/0/10 на S1 и S2, а затем добавлена G 0/0/9 и G 0/0/10 в Eth Trunk 1.

```
[S1]int Eth-Trunk 1
[S1-Eth-Trunk1]q
[S1]int g0/0/9
[S1-GigabitEthernet0/0/9]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...done.
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
```

```
moment...done.
```

```
[S2]int Eth-Trunk 1
[S2-Eth-Trunk1]q
[S2]int g0/0/9
[S2-GigabitEthernet0/0/9]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...done.
[S2-GigabitEthernet0/0/9]int g0/0/10
[S2-GigabitEthernet0/0/10]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...done.
```

Проверка конфигурации Eth-Trunk.

```
[S1]dis eth-trunk 1
Eth-Trunk1's state information is:
WorkingMode: NORMAL          Hash arithmetic: According to
SIP-XOR-DIP
Least Active-linknumber: 1   Max Bandwidth-affected-linknumber: 8

Operate status: up          Number Of Up Port In Trunk: 2
```

```
-----
-
PortName                Status    Weight
GigabitEthernet0/0/9    Up        1
GigabitEthernet0/0/10    Up        1
```

```
[S2]dis eth-trunk 1
Eth-Trunk1's state information is:
WorkingMode: NORMAL          Hash arithmetic: According to
SIP-XOR-DIP
Least Active-linknumber: 1   Max Bandwidth-affected-linknumber: 8

Operate status: up          Number Of Up Port In Trunk: 2
```

```
-----
-
PortName                Status    Weight
GigabitEthernet0/0/9    Up        1
GigabitEthernet0/0/10    Up        1
```

Шаг 3. Конфигурирование агрегации каналов в статическом режиме LACP

Удаление настроек с G 0/0/9 и G 0/0/10 на S 1 и S 2.

```
[S1]int g0/0/9
[S1-GigabitEthernet0/0/9]undo eth-trunk
Info: This operation may take a few seconds. Please wait for a
```

```
moment...done.
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]undo eth-trunk
Info: This operation may take a few seconds. Please wait for a
moment...done.
```

```
[S2]int g0/0/9
[S2-GigabitEthernet0/0/9]undo eth-trunk
Info: This operation may take a few seconds. Please wait for a
moment...done.
[S2-GigabitEthernet0/0/9]int g0/0/10
[S2-GigabitEthernet0/0/10]undo eth-trunk
Info: This operation may take a few seconds. Please wait for a
moment...done.
```

Создание Eth-Trunk 1 и установка режима балансировки нагрузки Eth-Trunk в качестве статического режима LACP

```
[S1]int Eth-Trunk 1
[S1-Eth-Trunk1]mode lacp
[S1-Eth-Trunk1]q
[S1]int g0/0/9
[S1-GigabitEthernet0/0/9]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...done.
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...
```

```
[S2]int Eth-Trunk 1
[S2-Eth-Trunk1]mode lacp
[S2-Eth-Trunk1]int g0/0/9
[S2-GigabitEthernet0/0/9]eth-trunk 1
[S2-GigabitEthernet0/0/9]int g0/0/10
[S2-GigabitEthernet0/0/10]eth-trunk 1
Info: This operation may take a few seconds. Please wait for a
moment...done.
```

На двух каналах включен статический режим LACP

```
[S1]dis eth-trunk
Eth-Trunk1's state information is:
Local:
LAG ID: 1 WorkingMode: STATIC
Preempt Delay: Disabled Hash arithmetic: According to SIP-XOR-DIP
System Priority: 32768 System ID: 4clf-cc12-07a7
Least Active-linknumber: 1 Max Active-linknumber: 8
Operate status: up Number Of Up Port In Trunk: 2
-----
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/9 Selected 1GE 32768 10 305 10111100 1
GigabitEthernet0/0/10 Selected 1GE 32768 11 305 10111100 1

Partner:
-----
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState
```

GigabitEthernet0/0/9	32768	4clf-cc3f-28dd	32768	10	305	10111100
GigabitEthernet0/0/10	32768	4clf-cc3f-28dd	32768	11	305	10111100

Установка приоритета системы на S1 равным 100, чтобы S1 оставался Actor

```
[S1]lacp priority 100
```

Установка приоритета интерфейса и определение активных каналов на S1.

```
[S1]lacp priority 100
[S1]int g0/0/9
[S1-GigabitEthernet0/0/9]lacp priority 100
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]lacp priority 100
```

Проверка конфигурации Eth-Trunk.

```
[S1]dis eth-trunk 1
Eth-Trunk1's state information is:
Local:
LAG ID: 1                      WorkingMode: STATIC
Preempt Delay: Disabled        Hash arithmetic: According to SIP-XOR-DIP
System Priority: 100           System ID: 4clf-cc12-07a7
Least Active-linknumber: 1     Max Active-linknumber: 8
Operate status: up            Number Of Up Port In Trunk: 2
-----
ActorPortName      Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/9 Selected 1GE      100    10    305    10111100 1
GigabitEthernet0/0/10 Selected 1GE      100    11    305    10111100 1

Partner:
-----
ActorPortName      SysPri   SystemID      PortPri PortNo PortKey PortState
GigabitEthernet0/0/9 32768    4clf-cc3f-28dd 32768  10    305    10111100
GigabitEthernet0/0/10 32768    4clf-cc3f-28dd 32768  11    305    10111100

[S2]dis eth-trunk 1
Eth-Trunk1's state information is:
Local:
LAG ID: 1                      WorkingMode: STATIC
Preempt Delay: Disabled        Hash arithmetic: According to SIP-XOR-DIP
System Priority: 32768         System ID: 4clf-cc3f-28dd
Least Active-linknumber: 1     Max Active-linknumber: 8
Operate status: up            Number Of Up Port In Trunk: 2
-----
ActorPortName      Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/9 Selected 1GE      32768  10    305    10111100 1
GigabitEthernet0/0/10 Selected 1GE      32768  11    305    10111100 1

Partner:
-----
ActorPortName      SysPri   SystemID      PortPri PortNo PortKey PortState
GigabitEthernet0/0/9 100      4clf-cc12-07a7 100    10    305    10111100
GigabitEthernet0/0/10 100      4clf-cc12-07a7 100    11    305    10111100
```

Окончательная конфигурация

```
[S1]dis current-configuration
#
```

```
[S2]dis current-configuration
#
```

```

sysname S1
#
lacp priority 100
#
interface Eth-Trunk1
mode lacp-static
#
interface GigabitEthernet0/0/9
undo negotiation auto
speed 100
eth-trunk 1
lacp priority 100
#
interface GigabitEthernet0/0/10
undo negotiation auto
speed 100
eth-trunk 1
lacp priority 100
#
return

```

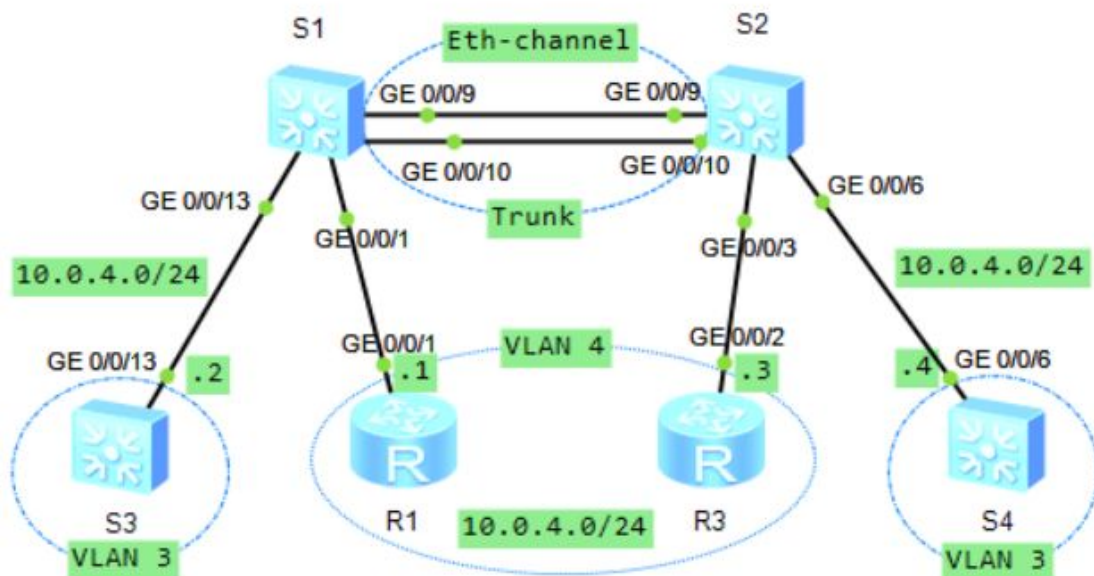
```

sysname S2
#
interface Eth-Trunk1
mode lacp-static
#
interface GigabitEthernet0/0/9
undo negotiation auto
speed 100
eth-trunk 1
#
interface GigabitEthernet0/0/10
undo negotiation auto
speed 100
eth-trunk 1
#
return

```

Конфигурация VLAN

Топология



Шаг 2 Отключение неиспользуемых интерфейсов и установка магистралей VLAN

Отключение неиспользуемых интерфейсов

```
[S3]int g0/0/1
[S3-GigabitEthernet0/0/1]shutdown
[S3-GigabitEthernet0/0/1]q
[S3]int g0/0/7
[S3-GigabitEthernet0/0/7]shutdown
[S3-GigabitEthernet0/0/7]
```

```
[S4]int g0/0/1
[S4-GigabitEthernet0/0/1]shutdown
[S4-GigabitEthernet0/0/1]int g0/0/14
[S4-GigabitEthernet0/0/14]shutdown
```

Настройка port link type для Eth-Trunk 1 в режиме trunk port. Разрешение использования всех VLAN через trunk port

```
[S1]int Eth-Trunk 1
[S1-Eth-Trunk1]port link-type trunk
[S1-Eth-Trunk1]port trunk allow-pass vlan all
```

```
[S2]int Eth-Trunk 1
[S2-Eth-Trunk1]port link-type trunk
[S2-Eth-Trunk1]port trunk allow-pass vlan all
```

Шаг 3 Конфигурирование VLAN

На S1 был связан интерфейс Gigabit Ethernet 0/0/13 с VLAN 3, а интерфейс Gigabit Ethernet 0/0/1 с VLAN 4.

На S2: интерфейс Gigabit Ethernet 0/0/3 - с VLAN 4, интерфейс Gigabit Ethernet 0/0/6 - с VLAN 2.

```
[S1]int g0/0/13
[S1-GigabitEthernet0/0/13]port link-type access
[S1-GigabitEthernet0/0/13]int g0/0/1
[S1-GigabitEthernet0/0/1]port link-type access
[S1-GigabitEthernet0/0/1]q
[S1]vlan 2
[S1-vlan2]vlan 3
[S1-vlan3]port g0/0/13
[S1-vlan3]vlan 4
[S1-vlan4]port g0/0/1
```

```
[S2]vlan batch 2 to 4
Info: This operation may take a few seconds. Please wait for a
```



```

moment...done.
[S2]int g0/0/3
[S2-GigabitEthernet0/0/3]port link-type access
[S2-GigabitEthernet0/0/3]port default vlan 4
[S2-GigabitEthernet0/0/3]int g0/0/6
[S2-GigabitEthernet0/0/6]port link-type access
[S2-GigabitEthernet0/0/6]port default vlan 2

```

VLAN правильно применена к S1 и S2.

```

<S1>display vlan
The total number of vlans is : 4
-----
U: Up;          D: Down;      TG: Tagged;      UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----

VID   Type      Ports
-----
1      common    UT:GE0/0/2 (D)      GE0/0/3 (D)      GE0/0/4 (D)      GE0/0/5 (D)
                        GE0/0/6 (D)      GE0/0/7 (D)      GE0/0/8 (D)      GE0/0/11 (D)
                        GE0/0/12 (D)     GE0/0/14 (D)     GE0/0/15 (D)     GE0/0/16 (D)
                        GE0/0/17 (D)     GE0/0/18 (D)     GE0/0/19 (D)     GE0/0/20 (D)
                        GE0/0/21 (D)     GE0/0/22 (D)     GE0/0/23 (D)     GE0/0/24 (D)
                        Eth-Trunk1 (U)

2      common    TG:Eth-Trunk1 (U)

3      common    UT:GE0/0/13 (U)
                        TG:Eth-Trunk1 (U)

4      common    UT:GE0/0/1 (U)
                        TG:Eth-Trunk1 (U)
... omitted ...

```

```

<S2>dis vlan
The total number of vlans is : 4
-----
U: Up;          D: Down;      TG: Tagged;      UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----

VID   Type      Ports
-----
1      common    UT:GE0/0/1 (D)      GE0/0/2 (D)      GE0/0/4 (D)      GE0/0/5 (D)
                        GE0/0/7 (D)      GE0/0/8 (D)      GE0/0/11 (D)     GE0/0/12 (D)
                        GE0/0/13 (D)     GE0/0/14 (D)     GE0/0/15 (D)     GE0/0/16 (D)
                        GE0/0/17 (D)     GE0/0/18 (D)     GE0/0/19 (D)     GE0/0/20 (D)
                        GE0/0/21 (D)     GE0/0/22 (D)     GE0/0/23 (D)     GE0/0/24 (D)
                        Eth-Trunk1 (U)

2      common    UT:GE0/0/6 (U)
                        TG:Eth-Trunk1 (U)

3      common    TG:Eth-Trunk1 (U)

4      common    UT:GE0/0/3 (U)
                        TG:Eth-Trunk1 (U)

```

```
... omitted ...
```

Шаг 4 Настройка IP-адресации для каждой VLAN

Настройка IP адресов на хостах, R1, S3, R3 и S4 как частей соответствующих VLAN .
Настройка собственного интерфейса управления Vlanif1 с IP адресом для коммутатора.

```
<Huawei>sys
[Huawei]sysname R1
[R1]int g0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.4.1 24
```

```
[S3]int vlanif 1
[S3-Vlanif1]ip address 10.0.4.2 24
```

```
<Huawei>sys
[Huawei]sysname R3
[R3]int g0/0/2
[R3-GigabitEthernet0/0/2]ip address 10.0.4.3 24
```

```
[S4]int Vlanif 1
[S4-Vlanif1]ip address 10.0.4.4 24
```

Шаг 5 Проверка конфигурации путем проверки подключения

```
[R1]ping 10.0.4.3
  PING 10.0.4.3: 56 data bytes, press CTRL_C to break
    Reply from 10.0.4.3: bytes=56 Sequence=1 ttl=255 time=170
ms
    Reply from 10.0.4.3: bytes=56 Sequence=2 ttl=255 time=80 ms
    Reply from 10.0.4.3: bytes=56 Sequence=3 ttl=255 time=60 ms
    Reply from 10.0.4.3: bytes=56 Sequence=4 ttl=255 time=50 ms
    Reply from 10.0.4.3: bytes=56 Sequence=5 ttl=255 time=60 ms
```

```
--- 10.0.4.3 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 50/84/170 ms
```

```
[R1]ping 10.0.4.4
  PING 10.0.4.4: 56 data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out
```

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

Шаг 6 Конфигурирование гибридного интерфейса

Установка типа соединения порта Gigabit Ethernet 0/0/1 порта S 1 и интерфейсы Gigabit Ethernet 0/0/3 и 0/0/6 S2 в качестве гибридных портов.

На гибридных портах произведена отмена тегирования всех кадров, связанных с VLAN 2 и VLAN 4.

```
[S1]int g0/0/1
[S1-GigabitEthernet0/0/1]undo port default vlan
[S1-GigabitEthernet0/0/1]port link-type hybrid
[S1-GigabitEthernet0/0/1]port hybrid untagged vlan 2 4
[S1-GigabitEthernet0/0/1]port hybrid pvid vlan 4
```

```
[S2]int g0/0/3
[S2-GigabitEthernet0/0/3]undo port default vlan
[S2-GigabitEthernet0/0/3]port link-type hybrid
[S2-GigabitEthernet0/0/3]port hybrid untagged vlan 2 4
[S2-GigabitEthernet0/0/3]port hybrid pvid vlan 4
[S2-GigabitEthernet0/0/3]int g0/0/6
[S2-GigabitEthernet0/0/6]undo port default vlan
[S2-GigabitEthernet0/0/6]port link-type hybrid
[S2-GigabitEthernet0/0/6]port hybrid untagged vlan 2 4
[S2-GigabitEthernet0/0/6]port hybrid pvid vlan 2
```

С помощью команды ping убедимся, что R 3 в VLAN 4 все еще доступен.

```
<R1>ping 10.0.4.3
PING 10.0.4.3: 56 data bytes, press CTRL_C to break
  Reply from 10.0.4.3: bytes=56 Sequence=1 ttl=255 time=70 ms
  Reply from 10.0.4.3: bytes=56 Sequence=2 ttl=255 time=60 ms
  Reply from 10.0.4.3: bytes=56 Sequence=3 ttl=255 time=60 ms
  Reply from 10.0.4.3: bytes=56 Sequence=4 ttl=255 time=60 ms
  Reply from 10.0.4.3: bytes=56 Sequence=5 ttl=255 time=80 ms

--- 10.0.4.3 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
round-trip min/avg/max = 60/66/80 ms
```

Используя команду ping, проверим, что доступен S4 в VLAN 2 из R1 в VLAN 4.

```
<R1>ping 10.0.4.4
PING 10.0.4.4: 56 data bytes, press CTRL_C to break
  Reply from 10.0.4.4: bytes=56 Sequence=1 ttl=255 time=110
```

```
ms
    Reply from 10.0.4.4: bytes=56 Sequence=2 ttl=255 time=60 ms
    Reply from 10.0.4.4: bytes=56 Sequence=3 ttl=255 time=70 ms
    Reply from 10.0.4.4: bytes=56 Sequence=4 ttl=255 time=70 ms
    Reply from 10.0.4.4: bytes=56 Sequence=5 ttl=255 time=60 ms

--- 10.0.4.4 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 60/74/110 ms
```

Окончательная конфигурация

```
[S1]dis current-configuration
#
sysname S1
#
vlan batch 2 to 4
#
interface Eth-Trunk1
    port link-type trunk
    port trunk allow-pass vlan 2 to 4094
    mode lacp-static
#
interface GigabitEthernet0/0/1
    port hybrid pvid vlan 4
    port hybrid untagged vlan 2 4
#
interface GigabitEthernet0/0/9
    eth-trunk 1
#
interface GigabitEthernet0/0/10
    eth-trunk 1
#
interface GigabitEthernet0/0/13
    port link-type access
    port default vlan 3
#
return
```

```
[S2]dis current-configuration
#
sysname S2
#
vlan batch 2 to 4
#
interface Vlanif1
#
interface MEth0/0/1
#
interface Eth-Trunk1
```

```
port link-type trunk
port trunk allow-pass vlan 2 to 4094
mode lacp-static
#
interface GigabitEthernet0/0/3
port hybrid pvid vlan 4
port hybrid untagged vlan 2 4
#
interface GigabitEthernet0/0/6
port hybrid pvid vlan 2
port hybrid untagged vlan 2 4
#
interface GigabitEthernet0/0/9
eth-trunk 1
#
interface GigabitEthernet0/0/10
eth-trunk 1
#
return
```

```
[S3]dis current-configuration
#
sysname S3
#
interface Vlanif1
ip address 10.0.4.2 255.255.255.0
#
interface GigabitEthernet0/0/1
shutdown
#
interface GigabitEthernet0/0/7
shutdown
#
return
```

```
[S4]dis current-configuration#
sysname S4
#
interface Vlanif1
ip address 10.0.4.4 255.255.255.0
#
interface GigabitEthernet0/0/1
shutdown
#
interface GigabitEthernet0/0/14
shutdown
#
return
```

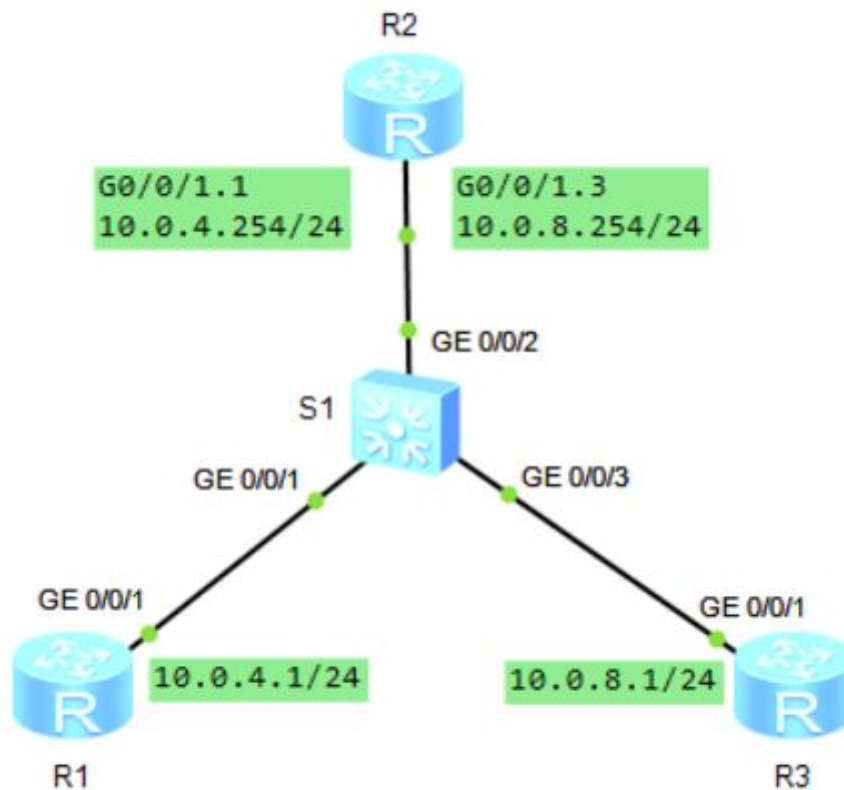
```
[R1]dis current-configuration
[V200R003C00]
#
sysname R1
#
interface GigabitEthernet0/0/1
```

```
ip address 10.0.4.1 255.255.255.0
#
return
```

```
[R3]dis current-configuration
[V200R003C00]
#
sysname R3
#
interface GigabitEthernet0/0/2
ip address 10.0.4.3 255.255.255.0
#
return
```

Маршрутизация VLAN

Топология



Шаг 1 Подготовка среды

```
<Huawei>sys
[Huawei]sysname R1
[R1]int g0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.4.1 24
```

```
<Huawei>sys
[Huawei]sysname R3
```

```
<Huawei>sys
[Huawei]sysname S1
```

Шаг 2 Конфигурирование IP-адресов для R3

```
[R3]int g0/0/1
[R3-GigabitEthernet0/0/1]ip address 10.0.8.1 24
```

Шаг 3 Установка двух VLAN

Создание VLAN 4 и VLAN 8 на S1, настройка интерфейса Gigabit Ethernet 0/0/1 для подключения к VLAN 4, а интерфейса Gigabit Ethernet 0/0/3 для подключения к VLAN 8.

```
[S1]vlan batch 4 8
Info: This operation may take a few seconds. Please wait for a moment...done.
[S1]int g0/0/1
[S1-GigabitEthernet0/0/1]port link-type access
[S1-GigabitEthernet0/0/1]port default vlan 4
[S1-GigabitEthernet0/0/1]int g0/0/3
[S1-GigabitEthernet0/0/3]port link-type access
[S1-GigabitEthernet0/0/3]port default vlan 8
```

Настройка интерфейса Gigabit Ethernet 0/0/2 в качестве магистрального канала для VLAN 4 и VLAN 8.

```
[S1]int g0/0/2
[S1-GigabitEthernet0/0/2]port link-type trunk
[S1-GigabitEthernet0/0/2]port trunk allow-pass vlan 4 8
```

Шаг 4 Настройка маршрутизации VLAN через субинтерфейс R2

Конфигурирование субинтерфейсов GigabitEthernet 0/0/1.1 и GigabitEthernet 0/0/1.3 для работы в качестве шлюза VLAN 4, а также в качестве шлюза VLAN 8.

```
[R2]int g0/0/1.1
```

```
[R2-GigabitEthernet0/0/1.1]ip address 10.0.4.254 24
[R2-GigabitEthernet0/0/1.1]dot1q termination vid 4
[R2-GigabitEthernet0/0/1.1]arp broadcast enable
[R2-GigabitEthernet0/0/1.1]int g0/0/1.3
[R2-GigabitEthernet0/0/1.3]ip address 10.0.8.254 24
[R2-GigabitEthernet0/0/1.3]dot1q termination vid 8
[R2-GigabitEthernet0/0/1.3]arp broadcast enable
```

Проверка связи между R1 и R3.

```
<R1>ping 10.0.8.1
  PING 10.0.8.1: 56 data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

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

Настройка маршрута по умолчанию на R1 и R3.

```
ip route-static 0.0.0.0 0.0.0.0 10.0.4.254
```

```
ip route-static 0.0.0.0 0.0.0.0 10.0.8.254
```

Проверка связи между R1 и R3.

```
<R1>ping 10.0.8.1
  PING 10.0.8.1: 56 data bytes, press CTRL_C to break
    Request time out
    Reply from 10.0.8.1: bytes=56 Sequence=2 ttl=254 time=100
ms
    Reply from 10.0.8.1: bytes=56 Sequence=3 ttl=254 time=70 ms
    Reply from 10.0.8.1: bytes=56 Sequence=4 ttl=254 time=80 ms
    Reply from 10.0.8.1: bytes=56 Sequence=5 ttl=254 time=90 ms

  --- 10.0.8.1 ping statistics ---
    5 packet(s) transmitted
    4 packet(s) received
    20.00% packet loss
    round-trip min/avg/max = 70/85/100 ms
```

```
[R2]dis 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
10.0.4.0/24 Direct  0      0           D      10.0.4.254
10.0.4.254/32 Direct  0      0           D      127.0.0.1         GigabitEthernet0/0/1.1
```


10.0.4.255/32	Direct	0	0	D	127.0.0.1	GigabitEthernet0/0/1.1
10.0.8.0/24	Direct	0	0	D	10.0.8.254	
GigabitEthernet0/0/1.3						
10.0.8.254/32	Direct	0	0	D	127.0.0.1	GigabitEthernet0/0/1.3
10.0.8.255/32	Direct	0	0	D	127.0.0.1	GigabitEthernet0/0/1.3
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
255.255.255.255/32	Direct	00		D	127.0.0.1	InLoopBack0

Окончательная конфигурация

```
[R1]dis current-configuration
[V200R003C00]
#
 sysname R1
#
interface GigabitEthernet0/0/1
 ip address 10.0.4.1 255.255.255.0
#
ip route-static 0.0.0.0 0.0.0.0 10.0.4.254
#
return
```

```
[R2]dis current-configuration
[V200R003C00]
#
 sysname R2
#
interface GigabitEthernet0/0/1.1
 dot1q termination vid 4
 ip address 10.0.4.254 255.255.255.0
 arp broadcast enable
#
interface GigabitEthernet0/0/1.3
 dot1q termination vid 8
 ip address 10.0.8.254 255.255.255.0
 arp broadcast enable
#
return
```

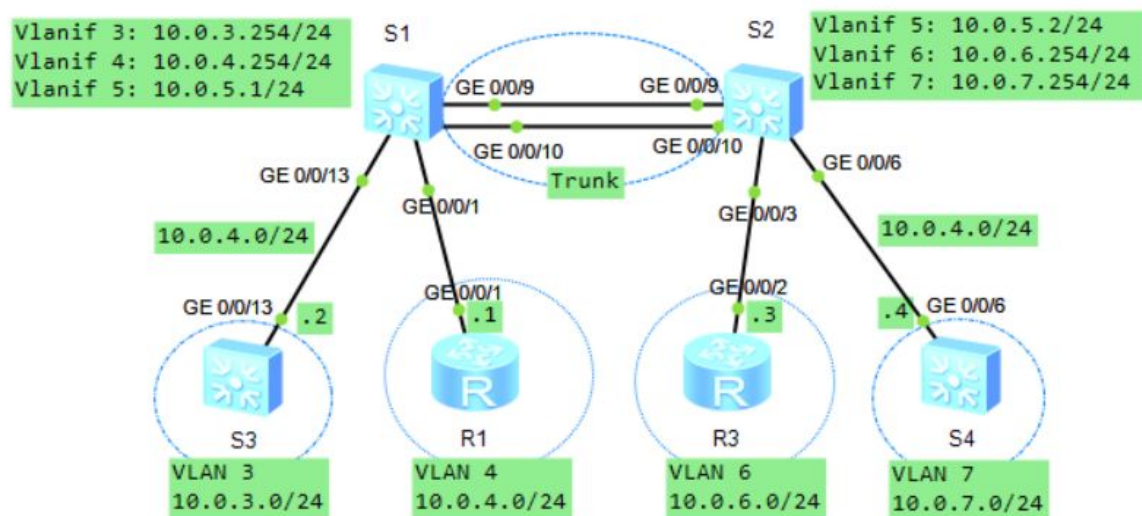
```
[R3]dis current-configuration
[V200R003C00]
#
 sysname R3
#
interface GigabitEthernet0/0/1
 ip address 10.0.8.1 255.255.255.0
#
ip route-static 0.0.0.0 0.0.0.0 10.0.8.254
#
return
```

```
[S1]dis current-configuration
#
sysname S1
```

```
#
vlan batch 4 8
#
interface GigabitEthernet0/0/1
port link-type access
port default vlan 4
#
interface GigabitEthernet0/0/2
port link-type trunk
port trunk allow-pass vlan 4 8
#
interface GigabitEthernet0/0/3
port link-type access
port default vlan 8
#
return
```

Конфигурирование коммутации уровня 3

Топология



Шаг 1 Подготовка среды

Настройте IP-адрес 10.0.4.1/24 для R1 на интерфейсе Gigabit Ethernet 0/0/1.
Установите соединение по каналу

```
<Huawei>sys
[Huawei]sysname R1
[R1]int g0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.0.4.1 24
```

```
<Huawei>sys
```

```
[Huawei]sysname R3
```

```
<Huawei>sys
[Huawei]sysname S1
[S1]int Eth-Trunk 1
[S1-Eth-Trunk1]mode lacp
[S1-Eth-Trunk1]port link-type trunk
[S1-Eth-Trunk1]port trunk allow-pass vlan all
[S1-Eth-Trunk1]int g0/0/9
[S1-GigabitEthernet0/0/9]eth-trunk 1
[S1-GigabitEthernet0/0/9]int g0/0/10
[S1-GigabitEthernet0/0/10]eth-trunk 1
```

```
<Huawei>sys
[Huawei]sysname S2
[S2]int Eth-Trunk 1
[S2-Eth-Trunk1]mode lacp
[S2-Eth-Trunk1]port link-type trunk
[S2-Eth-Trunk1]port trunk allow-pass vlan all
[S2-Eth-Trunk1]int g0/0/9
[S2-GigabitEthernet0/0/9]eth-trunk 1
s turned into UP state.int g0/0/10
[S2-GigabitEthernet0/0/10]eth-trunk 1
```

```
<Huawei>sys
[Huawei]sysname S3
[S3]int g0/0/7
[S3-GigabitEthernet0/0/7]shutdown
```

```
<Huawei>sys
[Huawei]sysname S4
[S4]int g0/0/14
[S4-GigabitEthernet0/0/14]shutdown
```

Шаг 3 Конфигурирование VLAN 3 – VLAN 7 для S1 и S2

```
[S1]vlan batch 3 to 7
```

```
[S2]vlan batch 3 to 7
```

Проверка, что VLAN созданы.

```
[S1]dis vlan
The total number of vlans is : 6
-----
-
U: Up;           D: Down;           TG: Tagged;       UT:
Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----
-
VID  Type  Ports
```

-				
1	common	UT:GE0/0/1 (U)	GE0/0/2 (D)	GE0/0/3 (D)
GE0/0/4 (D)		GE0/0/5 (D)	GE0/0/6 (D)	GE0/0/7 (D)
GE0/0/8 (D)		GE0/0/11 (D)	GE0/0/12 (D)	GE0/0/13 (U)
GE0/0/14 (D)		GE0/0/15 (D)	GE0/0/16 (D)	GE0/0/17 (D)
GE0/0/18 (D)		GE0/0/19 (D)	GE0/0/20 (D)	GE0/0/21 (D)
GE0/0/22 (D)		GE0/0/23 (D)	GE0/0/24 (D)	Eth-Trunk1 (U)
3	common	TG:Eth-Trunk1 (U)		
4	common	TG:Eth-Trunk1 (U)		
5	common	TG:Eth-Trunk1 (U)		
6	common	TG:Eth-Trunk1 (U)		
7	common	TG:Eth-Trunk1 (U)		

[S2]dis vlan				
The total number of vlans is : 6				

U: Up; D: Down; TG: Tagged; UT:				
Untagged;				
MP: Vlan-mapping;				
ST: Vlan-stacking;				
#: ProtocolTransparent-vlan; *: Management-vlan;				

VID Type Ports				

1	common	UT:GE0/0/1 (D)	GE0/0/2 (D)	GE0/0/3 (U)
GE0/0/4 (D)		GE0/0/5 (D)	GE0/0/6 (U)	GE0/0/7 (D)
GE0/0/8 (D)		GE0/0/11 (D)	GE0/0/12 (D)	GE0/0/13 (D)
GE0/0/14 (D)		GE0/0/15 (D)	GE0/0/16 (D)	GE0/0/17 (D)
GE0/0/18 (D)		GE0/0/19 (D)	GE0/0/20 (D)	GE0/0/21 (D)
GE0/0/22 (D)		GE0/0/23 (D)	GE0/0/24 (D)	Eth-Trunk1 (U)
3	common	TG:Eth-Trunk1 (U)		
4	common	TG:Eth-Trunk1 (U)		
5	common	TG:Eth-Trunk1 (U)		
6	common	TG:Eth-Trunk1 (U)		
7	common	TG:Eth-Trunk1 (U)		

Шаг 4 Установка соединения Eth-Trunk между S1 и S2 с помощью PVID 5

Добавление интерфейсов GigabitEthernet 0/0/1 и 0/0/13 S1 к VLAN 4 и VLAN 3 соответственно. Для S2 добавление интерфейсов GigabitEthernet 0/0/3 и G 0/0/6 к VLAN 6 и VLAN 7 соответственно.

```
[S1]int Eth-Trunk 1
[S1-Eth-Trunk1]port trunk pvid vlan 5
[S1-Eth-Trunk1]int g0/0/1
[S1-GigabitEthernet0/0/1]port link-type access
[S1-GigabitEthernet0/0/1]port default vlan 4
[S1-GigabitEthernet0/0/1]int g0/0/13
[S1-GigabitEthernet0/0/13]port link-type access
[S1-GigabitEthernet0/0/13]port default vlan 3
```

```
[S2]INT Eth-Trunk 1
[S2-Eth-Trunk1]port trunk pvid vlan 5
[S2-Eth-Trunk1]int g0/0/3
[S2-GigabitEthernet0/0/3]port link-type access
[S2-GigabitEthernet0/0/3]port default vlan 6
[S2-GigabitEthernet0/0/3]int g0/0/6
[S2-GigabitEthernet0/0/6]port link-type access
[S2-GigabitEthernet0/0/6]port default vlan 7
```

Просмотр конфигурации

The total number of vlans is : 6

U: Up; D: Down; TG: Tagged; UT:
Untagged;
MP: Vlan-mapping; ST: Vlan-stacking;
#: ProtocolTransparent-vlan; *: Management-vlan;

VID Type Ports

1 common UT:GE0/0/2 (D) GE0/0/3 (D) GE0/0/4 (D)
GE0/0/5 (D) GE0/0/6 (D) GE0/0/7 (D) GE0/0/8 (D)
GE0/0/11 (D) GE0/0/12 (D) GE0/0/14 (D) GE0/0/15 (D)
GE0/0/16 (D) GE0/0/17 (D) GE0/0/18 (D) GE0/0/19 (D)
GE0/0/20 (D) GE0/0/21 (D) GE0/0/22 (D) GE0/0/23 (D)
GE0/0/24 (D) TG:Eth-Trunk1 (U)
3 common UT:GE0/0/13 (U)
 TG:Eth-Trunk1 (U)
4 common UT:GE0/0/1 (U)

		TG:Eth-Trunk1 (U)		
5	common	UT:Eth-Trunk1 (U)		
6	common	TG:Eth-Trunk1 (U)		
7	common	TG:Eth-Trunk1 (U)		
<p><S2>dis vlan</p> <p>The total number of vlans is : 6</p> <p>-----</p> <p>-----</p> <p>U: Up; D: Down; TG: Tagged; UT: Untagged;</p> <p>MP: Vlan-mapping; ST: Vlan-stacking;</p> <p>#: ProtocolTransparent-vlan; *: Management-vlan;</p> <p>-----</p> <p>-----</p> <p>VID Type Ports</p> <p>-----</p> <p>-----</p> <p>1 common UT:GE0/0/1 (D) GE0/0/2 (D) GE0/0/4 (D)</p> <p>GE0/0/5 (D) GE0/0/7 (D) GE0/0/8 (D) GE0/0/11 (D)</p> <p>GE0/0/12 (D) GE0/0/13 (D) GE0/0/14 (D) GE0/0/15 (D)</p> <p>GE0/0/16 (D) GE0/0/17 (D) GE0/0/18 (D) GE0/0/19 (D)</p> <p>GE0/0/20 (D) GE0/0/21 (D) GE0/0/22 (D) GE0/0/23 (D)</p> <p>GE0/0/24 (D)</p> <p> TG:Eth-Trunk1 (U)</p> <p>3 common TG:Eth-Trunk1 (U)</p> <p>4 common TG:Eth-Trunk1 (U)</p> <p>5 common UT:Eth-Trunk1 (U)</p> <p>6 common UT:GE0/0/3 (U)</p> <p> TG:Eth-Trunk1 (U)</p> <p>7 common UT:GE0/0/6 (U)</p> <p> TG:Eth-Trunk1 (U)</p>				

Шаг 5 Настройка адресов шлюза для VLAN на S1 и S2

<pre>[S1]int vlanif 3 [S1-Vlanif3]ip address 10.0.3.254 24 [S1-Vlanif3]int vlanif 4 [S1-Vlanif4]ip address 10.0.4.254 24 [S1-Vlanif4]int vlanif 5 [S1-Vlanif5]ip address 10.0.5.1 24</pre>
<pre>[S2]int vlanif 5</pre>

```
[S2-Vlanif5]ip address 10.0.5.2 24
[S2-Vlanif5]int vlanif 6
[S2-Vlanif6]ip address 10.0.6.254 24
[S2-Vlanif6]int vlanif 7
[S2-Vlanif7]ip address 10.0.7.254 24
```

Шаг 6 IP-адресация и маршруты по умолчанию для R1, R3, S3 и S4

```
[R1]ip route-static 0.0.0.0 0 10.0.4.254

[S3]int vlanif 1
[S3-Vlanif1]ip address 10.0.3.3 24
[S3-Vlanif1]q
[S3]ip route-static 0.0.0.0 0 10.0.3.254

[R3]interface GigabitEthernet 0/0/2
[R3-GigabitEthernet0/0/2]ip address 10.0.6.3 24
[R3-GigabitEthernet0/0/2]q
[R3]ip route-static 0.0.0.0 0.0.0.0 10.0.6.254

[S4]interface Vlanif 1
[S4-Vlanif1]ip address 10.0.7.4 24
[S4-Vlanif1]q
[S4]ip route-static 0.0.0.0 0 10.0.7.254
```

Шаг 7 Проверка подключения между VLAN 3 и VLAN 4

Проверка связи между S3 и R1.

```
<R1>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=100
ms
    Reply from 10.0.3.3: bytes=56 Sequence=2 ttl=254 time=30 ms
    Reply from 10.0.3.3: bytes=56 Sequence=3 ttl=254 time=50 ms
    Reply from 10.0.3.3: bytes=56 Sequence=4 ttl=254 time=30 ms
    Reply from 10.0.3.3: bytes=56 Sequence=5 ttl=254 time=40 ms

  --- 10.0.3.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 30/50/100 ms
```

Проверка связи между R3 и R1.

```
<R1>ping 10.0.6.3
  PING 10.0.6.3: 56 data bytes, press CTRL_C to break
    Request time out
    Request time out
```

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

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

Устранение сбоя при помощи tracer

```
[R1]tracert 10.0.6.3

  traceroute to 10.0.6.3(10.0.6.3), max hops: 30 ,packet length:
40,press CTRL_C
  to break

 1 10.0.4.254 20 ms  20 ms  20 ms
 2 10.0.4.254 20 ms  !N 20 ms  !N 30 ms  !N
```

Проверка, доступности сеть на шлюзе (S1).

```
[S1]dis ip routing-table
Route Flags: R - relay, D - download to fib
-----
---
Routing Tables: Public
  Destinations : 8           Routes : 8

Destination/Mask    Proto   Pre  Cost           Flags NextHop         Interface
-----
10.0.3.0/24        Direct  0    0                D    10.0.3.254        Vlanif3
10.0.3.254/32      Direct  0    0                D    127.0.0.1          Vlanif3
10.0.4.0/24        Direct  0    0                D    10.0.4.254        Vlanif4
10.0.4.254/32      Direct  0    0                D    127.0.0.1          Vlanif4
10.0.5.0/24        Direct  0    0                D    10.0.5.1           Vlanif5
10.0.5.1/32        Direct  0    0                D    127.0.0.1          Vlanif5
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
```

Шаг 8 Включение OSPF на S1 и S2

```
[S1]ospf
[S1-ospf-1]area 0
[S1-ospf-1-area-0.0.0.0]network 10.0.0.0 0.255.255.255
```

```
[S2]ospf
[S2-ospf-1]area 0
[S2-ospf-1-area-0.0.0.0]network 10.0.0.0 0.255.255.255
```

Просмотр итоговой таблицы маршрутизации

```
[S1]dis 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
10.0.3.0/24	Direct	0	0	D	10.0.3.254	Vlanif3
10.0.3.254/32	Direct	0	0	D	127.0.0.1	Vlanif3
10.0.4.0/24	Direct	0	0	D	10.0.4.254	Vlanif4
10.0.4.254/32	Direct	0	0	D	127.0.0.1	Vlanif4
10.0.5.0/24	Direct	0	0	D	10.0.5.1	Vlanif5
10.0.5.1/32	Direct	0	0	D	127.0.0.1	Vlanif5
10.0.6.0/24	OSPF	10	2	D	10.0.5.2	Vlanif5
10.0.7.0/24	OSPF	10	2	D	10.0.5.2	Vlanif5
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

Проверка связи между R1 и R3

```
<R1>ping 10.0.6.3
  PING 10.0.6.3: 56 data bytes, press CTRL_C to break
    Reply from 10.0.6.3: bytes=56 Sequence=1 ttl=253 time=130
ms
    Reply from 10.0.6.3: bytes=56 Sequence=2 ttl=253 time=70 ms
    Reply from 10.0.6.3: bytes=56 Sequence=3 ttl=253 time=60 ms
    Reply from 10.0.6.3: bytes=56 Sequence=4 ttl=253 time=70 ms
    Reply from 10.0.6.3: bytes=56 Sequence=5 ttl=253 time=60 ms

  --- 10.0.6.3 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 60/78/130 ms
<R1>ping 10.0.7.4
  PING 10.0.7.4: 56 data bytes, press CTRL_C to break
    Reply from 10.0.7.4: bytes=56 Sequence=1 ttl=253 time=80 ms
    Reply from 10.0.7.4: bytes=56 Sequence=2 ttl=253 time=90 ms
    Reply from 10.0.7.4: bytes=56 Sequence=3 ttl=253 time=60 ms
    Reply from 10.0.7.4: bytes=56 Sequence=4 ttl=253 time=90 ms
    Reply from 10.0.7.4: bytes=56 Sequence=5 ttl=253 time=70 ms

  --- 10.0.7.4 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 60/78/90 ms
```

Окончательная конфигурация

```
[R1]dis current-configuration
[V200R003C00]
#
```

```
sysname R1
#
interface GigabitEthernet0/0/1
 ip address 10.0.4.1 255.255.255.0
#
ip route-static 0.0.0.0 0.0.0.0 10.0.4.254
#
return
```

```
[S1]dis current-configuration
#
sysname S1
#
vlan batch 3 to 7
#
interface Vlanif1
#
interface Vlanif3
 ip address 10.0.3.254 255.255.255.0
#
interface Vlanif4
 ip address 10.0.4.254 255.255.255.0
#
interface Vlanif5
 ip address 10.0.5.1 255.255.255.0
#
interface Eth-Trunk1
 port link-type trunk
 port trunk pvid vlan 5
 port trunk allow-pass vlan 2 to 4094
 mode lacp-static
#
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 4
#
interface GigabitEthernet0/0/9
 eth-trunk 1
#
interface GigabitEthernet0/0/10
 eth-trunk 1
#
interface GigabitEthernet0/0/13
 port link-type access
 port default vlan 3
#
ospf 1
 area 0.0.0.0
 network 10.0.0.0 0.255.255.255
#
return
```

```
[S2]dis current-configuration
#
sysname S2
```

```
#
vlan batch 3 to 7
#
interface Vlanif1
#
interface Vlanif5
ip address 10.0.5.2 255.255.255.0
#
interface Vlanif6
ip address 10.0.6.254 255.255.255.0
#
interface Vlanif7
ip address 10.0.7.254 255.255.255.0
#interface Eth-Trunk1
port link-type trunk
port trunk pvid vlan 5
port trunk allow-pass vlan 2 to 4094
mode lacp-static
#interface GigabitEthernet0/0/3
port link-type access
port default vlan 6
#
interface GigabitEthernet0/0/6
port link-type access
port default vlan 7
#
interface GigabitEthernet0/0/9
eth-trunk 1
#
interface GigabitEthernet0/0/10
eth-trunk 1
#
ospf 1
area 0.0.0.0
network 10.0.0.0 0.255.255.255
##
return
```

```
[S3]dis current-configuration
#
sysname S3
#
interface Vlanif1
ip address 10.0.3.3 255.255.255.0
#
interface GigabitEthernet0/0/7
shutdown
#
ip route-static 0.0.0.0 0.0.0.0 10.0.3.254
#
return
```

```
[S4]dis current-configuration
#
sysname S4
```

```
#
interface Vlanif1
 ip address 10.0.7.4 255.255.255.0
#
interface GigabitEthernet0/0/14
 shutdown
#
ip route-static 0.0.0.0 0.0.0.0 10.0.7.254
#
return

[R3]dis current-configuration
[V200R003C00]
#
 sysname R3
#
interface GigabitEthernet0/0/2
 ip address 10.0.6.3 255.255.255.0
#
ip route-static 0.0.0.0 0.0.0.0 10.0.6.254
#
return
```

Вывод

В ходе выполнения лабораторной работы было выполнено:

1. проведена конфигурация интерфейса и канала ethernet, в ходе чего была настроены скорости линии на интерфейсе, была произведена настройка каналов в ручном и статическом LACP режиме, было произведено управление приоритетом интерфейсов в статическом режиме LACP.
2. был сконфигурирован VLAN: назначение интерфейсов портов в качестве портов доступа и магистральных портов, создание VLAN, настройка тегирования VLAN для портов с использованием типа связи гибридного порта, настройка VLAN по умолчанию для интерфейса с помощью идентификатора VLAN порта.
3. была настроена маршрутизация VLAN: создание магистрального интерфейса для маршрутизации VLAN, конфигурирование субинтерфейсов на одном физическом интерфейсе, включение сообщений ARP для трансляции между VLAN
4. была сконфигурирована коммутация уровня L3: конфигурация интерфейсов VLAN, настройка маршрутизации VLAN на одном коммутаторе, реализация маршрутизации VLAN по каналу Ethernet Trunk, выполнение динамической маршрутизации между интерфейсами VLAN с помощью OSPF.