федеральное государственное автономное образовательное учреждение
высшего образования

«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»

ОТЧЕТ

по лабораторной работе №3

«Создание коммутируемой сети Ethernet»

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

Вариант на оценку 5

Авторы: Кулаков Н. В.

Факультет: ПИиКТ

Группа: Р34312

Преподаватель: Афанасьев Д.Б.

Санкт-Петербург 2023

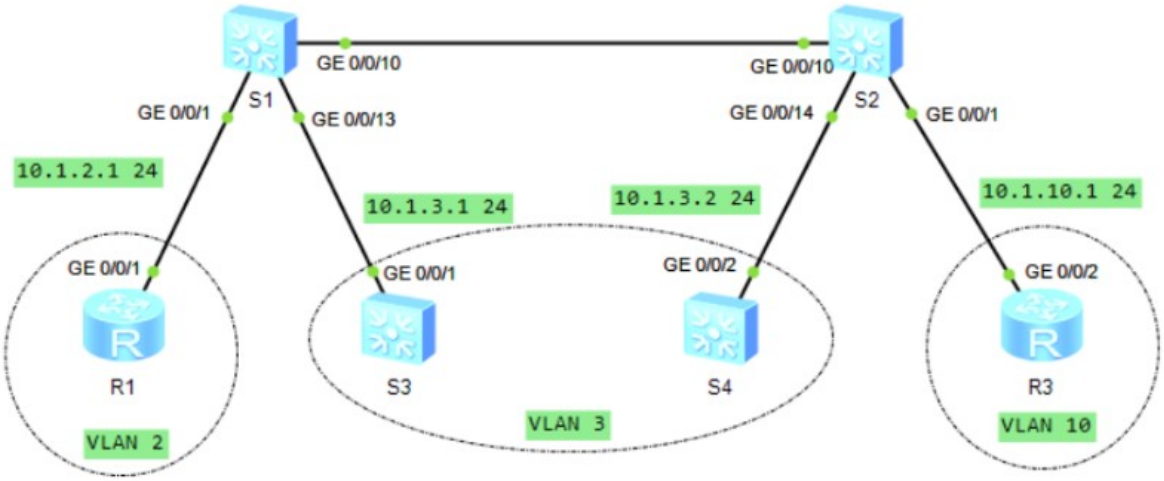
Оглавление

1. Лабораторная работа 1. Основы Ethernet и конфигурирование VLAN

. Задачи

- Создание VLAN.
- Конфигурирование VLAN на основе портов.
- Конфигурирование VLAN на основе MAC-адресов.

. Топология сети



. Настраивание и диагностические команды

Шаг 1.

Отключили порты на S1. Работающие порты на S1:

```
Interface                   PHY    Protocol InUti OutUti   inErrors  outErrors
GigabitEthernet0/0/1        up     up           0%     0%          0          0
GigabitEthernet0/0/2        down   down         0%     0%          0          0
GigabitEthernet0/0/3        down   down         0%     0%          0          0
GigabitEthernet0/0/4        down   down         0%     0%          0          0
GigabitEthernet0/0/5        down   down         0%     0%          0          0
GigabitEthernet0/0/6        down   down         0%     0%          0          0
```

```
GigabitEthernet0/0/7        down  down        0%     0%          0          0
GigabitEthernet0/0/8        down  down        0%     0%          0          0
GigabitEthernet0/0/9        down  down        0%     0%          0          0
GigabitEthernet0/0/10       up    up          0%     0%          0          0
GigabitEthernet0/0/11       *down down        0%     0%          0          0
GigabitEthernet0/0/12       *down down        0%     0%          0          0
GigabitEthernet0/0/13       up    up          0%     0%          0          0
```

Тоже самое на S2:

```
Interface                   PHY   Protocol InUti OutUti   inErrors  outErrors
GigabitEthernet0/0/1        up    up          0%     0%          0          0
GigabitEthernet0/0/2        down  down        0%     0%          0          0
GigabitEthernet0/0/3        down  down        0%     0%          0          0
GigabitEthernet0/0/4        down  down        0%     0%          0          0
GigabitEthernet0/0/5        down  down        0%     0%          0          0
GigabitEthernet0/0/6        down  down        0%     0%          0          0
GigabitEthernet0/0/7        down  down        0%     0%          0          0
GigabitEthernet0/0/8        down  down        0%     0%          0          0
GigabitEthernet0/0/9        down  down        0%     0%          0          0
GigabitEthernet0/0/10       up    up          0%     0%          0          0
GigabitEthernet0/0/11       *down down        0%     0%          0          0
GigabitEthernet0/0/12       *down down        0%     0%          0          0
GigabitEthernet0/0/13       down  down        0%     0%          0          0
GigabitEthernet0/0/14       up    up          0%     0%          0          0
```

Шаг 2.

Вариант 1 настройки (через undo portswitch и задание ip адресов) не работает, так как коммутатор не поддерживает. Поэтому при настройке использовал сценарий 2 с VlanIf.

```
[S3-GigabitEthernet0/0/1]dis this
#
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 3
#
return
[S3-Vlanif3]dis this
#
interface Vlanif3
 ip address 10.1.3.1 255.255.255.0
```

```
#
return
```

Аналогично и на S4.

Шаг 3.

Создаем vlan 2,3,10 на S1, S2:

```
[S1]dis this
#
sysname S1
#
vlan batch 2 to 3 10
#
[S2]dis this
#
sysname S2
#
vlan batch 2 to 3 10
#
```

Шаг 4.

Настроим сеть Vlan на основе портов. S1-G0/0/1 — access vlan 2. S1-G0/0/13, S2-G0/0/14 — access vlan 3. S1-G0/0/10, S2-G0/0/10 — магистральные (trunk), пропускающие vlan 2,3, запрещаем vlan 1.

```
# S1:
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 2
#
#
interface GigabitEthernet0/0/13
 port link-type access
 port default vlan 3
#
return
#
interface GigabitEthernet0/0/10
 port link-type trunk
 undo port trunk allow-pass vlan 1
 port trunk allow-pass vlan 2 to 3
```

```
#
return
```

Аналогично и на S3.

Шаг 5.

Сконфигурируем vlan 10 с фильтром на основе mac-адресов.

[S2-GigabitEthernet0/0/1]dis this

```
#
interface GigabitEthernet0/0/1
 port hybrid untagged vlan 10
 mac-vlan enable
#
return
```

Чтобы получить MAC-адрес:

```
[R3]dis arp
IP ADDRESS      MAC ADDRESS     EXPIRE(M) TYPE        INTERFACE   VPN-INSTANCE
                                          VLAN/CEVLAN PVC
--------------------------------------------------------------------------------
10.1.10.1       00e0-fc00-23d2            I -         GE0/0/2
--------------------------------------------------------------------------------
Total:1         Dynamic:0       Static:0     Interface:1
```

В результате:

```
[S2]dis mac-vlan ?
  mac-address  MAC address
  vlan         Virtual LAN

[S2]dis mac-vlan vlan 10
--------------------------------------------------
MAC Address     MASK            VLAN    Priority
--------------------------------------------------
00e0-fc00-23d2  ffff-ffff-ffff  10      0

Total MAC VLAN address count: 1
```

Также разрешаем vlan 10 на интерфейсах, на которых настроен hybrid vlan.

```
[S1-GigabitEthernet0/0/1]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:GE0/0/2(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)      GE0/0/9(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)

2    common  UT:GE0/0/1(U)
             TG:GE0/0/10(U)
3    common  UT:GE0/0/13(U)
             TG:GE0/0/10(U)

10   common  TG:GE0/0/10(U)


VID  Status  Property      MAC-LRN Statistics Description
------------------------------------------------------------------------------

1    enable  default       enable  disable    VLAN 0001
2    enable  default       enable  disable    VLAN 0002
3    enable  default       enable  disable    VLAN 0003
10   enable  default       enable  disable    VLAN 0010
[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(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)
                GE0/0/9(D)      GE0/0/11(D)     GE0/0/12(D)     GE0/0/13(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)

2    common  TG:GE0/0/10(U)
3    common  UT:GE0/0/14(U)
             TG:GE0/0/10(U)

10   common  UT:GE0/0/1(U)      GE0/0/2(D)      GE0/0/3(D)
             TG:GE0/0/10(U)


VID  Status  Property      MAC-LRN Statistics Description
------------------------------------------------------------------------------
1    enable  default       enable  disable    VLAN 0001
2    enable  default       enable  disable    VLAN 0002
3    enable  default       enable  disable    VLAN 0003
10   enable  default       enable  disable    VLAN 0010
```

Проверка:

```
[R1-GigabitEthernet0/0/1]ping 10.1.10.1
  PING 10.1.10.1: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out

  --- 10.1.10.1 ping statistics ---
    3 packet(s) transmitted
    0 packet(s) received
    100.00% packet loss
[S3-Vlanif3]ping 10.1.3.2
  PING 10.1.3.2: 56  data bytes, press CTRL_C to break
    Reply from 10.1.3.2: bytes=56 Sequence=1 ttl=255 time=140 ms
    Reply from 10.1.3.2: bytes=56 Sequence=2 ttl=255 time=90 ms
    Reply from 10.1.3.2: bytes=56 Sequence=3 ttl=255 time=80 ms
    Reply from 10.1.3.2: bytes=56 Sequence=4 ttl=255 time=90 ms
    Reply from 10.1.3.2: bytes=56 Sequence=5 ttl=255 time=60 ms
[S1]dis mac-address verbose
MAC address table of slot 0:
------------------------------------------------------------------------------
MAC Address    VLAN/       PEVLAN CEVLAN Port            Type      LSP/LSR-ID
               VSI/SI                                              MAC-Tunnel
------------------------------------------------------------------------------
4c1f-ccb2-219b 3           -      -      GE0/0/10        dynamic   0/-
```

```
4c1f-cc2b-087c 3           -      -      GE0/0/13        dynamic   0/-
00e0-fc00-23d2 10          -      -      GE0/0/10        dynamic   0/-
--------------------------------------------------------------------------------
[S2]dis mac-address verbose
MAC address table of slot 0:
--------------------------------------------------------------------------------
MAC Address    VLAN/       PEVLAN CEVLAN Port            Type      LSP/LSR-ID
               VSI/SI                                              MAC-Tunnel
--------------------------------------------------------------------------------
4c1f-cc2b-087c 3           -      -      GE0/0/10        dynamic   0/-
4c1f-ccb2-219b 3           -      -      GE0/0/14        dynamic   0/-
00e0-fc00-23d2 10          -      -      GE0/0/1         dynamic   0/-
--------------------------------------------------------------------------------
Total matching items on slot 0 displayed = 3
```

. Конфигурации

R1:

```
#
interface GigabitEthernet0/0/0
#
interface GigabitEthernet0/0/1
 ip address 10.1.2.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
user-interface con 0
 authentication-mode password
 idle-timeout 0 0
```

S1:

```
#
sysname S1
#
vlan batch 2 to 3 10
#
interface Vlanif1
#
interface GigabitEthernet0/0/1
 port link-type access
```

```
 port default vlan 2
#
interface GigabitEthernet0/0/2
#
interface GigabitEthernet0/0/9
#
interface GigabitEthernet0/0/10
 port link-type trunk
 undo port trunk allow-pass vlan 1
 port trunk allow-pass vlan 2 to 3 10
#
interface GigabitEthernet0/0/11
 shutdown
#
interface GigabitEthernet0/0/12
 shutdown
#
interface GigabitEthernet0/0/13
 port link-type access
 port default vlan 3
#
user-interface con 0
 idle-timeout 0 0
#
```

S2:

```
#
sysname S2
#
vlan batch 2 to 3 10
#
vlan 10
 mac-vlan mac-address 00e0-fc00-23d2 priority 0
#
interface Vlanif1
#
interface GigabitEthernet0/0/1
 port hybrid untagged vlan 10
 mac-vlan enable
#
interface GigabitEthernet0/0/2
 port hybrid untagged vlan 10
 mac-vlan enable
```

```
#
interface GigabitEthernet0/0/3
 port hybrid untagged vlan 10
 mac-vlan enable
#
interface GigabitEthernet0/0/10
 port link-type trunk
 undo port trunk allow-pass vlan 1
 port trunk allow-pass vlan 2 to 3 10
#
interface GigabitEthernet0/0/11
 shutdown
#
interface GigabitEthernet0/0/12
 shutdown
#
interface GigabitEthernet0/0/13
#
interface GigabitEthernet0/0/14
 port link-type access
 port default vlan 3
#
#
user-interface con 0
 idle-timeout 0 0
#
return
```

S3:

```
#
sysname S3
#
vlan batch 3
#
interface Vlanif1
#
interface Vlanif3
 ip address 10.1.3.1 255.255.255.0
#
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 3
#
```

```
user-interface con 0
 idle-timeout 0 0
#
return
```

S4:

```
#
sysname S4
#
vlan batch 3
#
interface Vlanif1
#
interface Vlanif3
 ip address 10.1.3.2 255.255.255.0
#
interface GigabitEthernet0/0/1
#
interface GigabitEthernet0/0/2
 port link-type access
 port default vlan 3
#
user-interface con 0
 idle-timeout 0 0
#
return
```

R3:

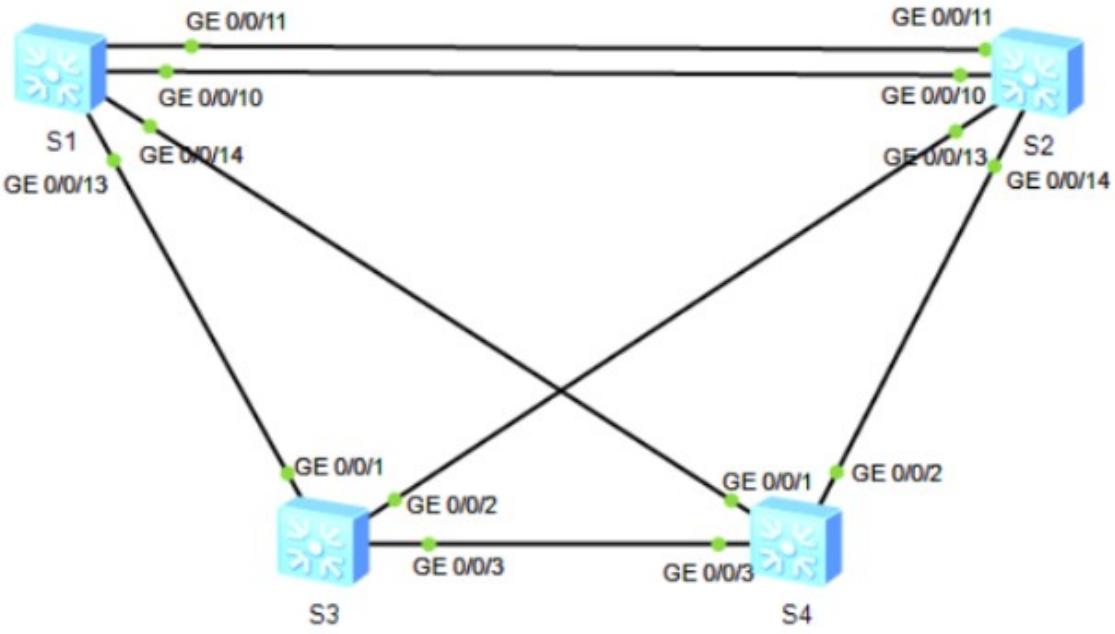
```
#
interface GigabitEthernet0/0/0
#
interface GigabitEthernet0/0/1
#
interface GigabitEthernet0/0/2
 ip address 10.1.10.1 255.255.255.0
#
interface NULL0
#
user-interface con 0
 idle-timeout 0 0
#
return
```

2. Лабораторная работа 2. Протокол связующего дерева (STP)

. Задачи

- Включение STP.
- Изменение приоритетов мостов, чтобы контролировать выбор корневого моста.
- Изменение параметров порта, чтобы определить роль порта.
- Изменение протокола на протокол RSTP.
- Настройка граничных портов

. Топология сети



. Настраивание и диагностические команды

Шаг 1.

Выполнить отключение G0/0/12 для S1 и S2.

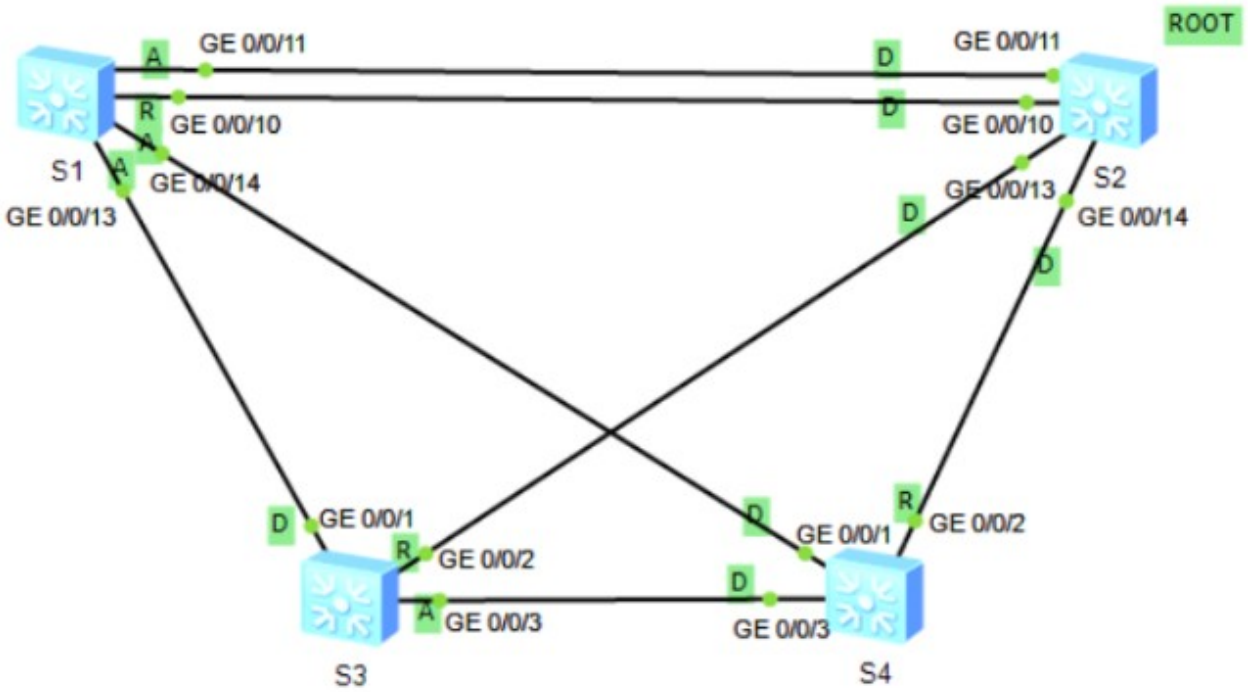
```
[S1]int g0/0/12
[S1-GigabitEthernet0/0/12]shutdown
```

Шаг 2.

Включить STP. Статус связующего дерева:

```
#
sysname S1
#
stp mode stp
#
-------[CIST Global Info][Mode STP]-------
CIST Bridge         :32768.4c1f-cca2-14ca
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :32768.4c1f-cc30-36f6 / 20000
CIST RegRoot/IRPC   :32768.4c1f-cca2-14ca / 0 # CIST regional root (mstp)
CIST RootPortId     :128.10
BPDU-Protection     :Disabled
TC or TCN received  :242
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:5m:43s
Number of TC        :11
Last TC occurred    :GigabitEthernet0/0/10
----[Port10(GigabitEthernet0/0/10)][FORWARDING]----
 Port Protocol       :Enabled
 Port Role           :Root Port
 Port Priority       :128
 Port Cost(Dot1T )   :Config=auto / Active=20000
 Designated Bridge/Port   :32768.4c1f-cc30-36f6 / 128.10
 Port Edged          :Config=default / Active=disabled
 Point-to-point      :Config=auto / Active=true
 Transit Limit       :147 packets/hello-time
 Protection Type     :None
 Port STP Mode       :STP
 Port Protocol Type  :Config=auto / Active=dot1s
 BPDU Encapsulation  :Config=stp / Active=stp
 PortTimes           :Hello 2s MaxAge 20s FwDly 15s RemHop 0
 TC or TCN send      :4
 TC or TCN received  :56
```

```
 BPDU Sent           :7
          TCN: 4, Config: 3, RST: 0, MST: 0
 BPDU Received       :410
          TCN: 0, Config: 410, RST: 0, MST: 0
[S1]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/10       ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/11       ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/13       ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/14       ALTE  DISCARDING      NONE
[S2]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/10       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/11       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/13       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/14       DESI  FORWARDING      NONE
[S3]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/2        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/3        ALTE  DISCARDING      NONE
[S4]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/2        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/3        DESI  FORWARDING      NONE
```



Шаг 3.

Сделать S1 — primary, S2 — secondary.

```
-------[CIST Global Info][Mode STP]-------
CIST Bridge         :0    .4c1f-cca2-14ca # выставился в 0
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :0    .4c1f-cca2-14ca / 0
CIST RegRoot/IRPC   :0    .4c1f-cca2-14ca / 0
CIST RootPortId     :0.0
BPDU-Protection     :Disabled
CIST Root Type      :Primary root
TC or TCN received  :328
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:0m:11s
Number of TC        :15
Last TC occurred    :GigabitEthernet0/0/14
[S1]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/10       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/11       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/13       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/14       DESI  FORWARDING      NONE
[S2]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/10       ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/11       ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/13       DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/14       DESI  FORWARDING      NONE
[S3]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/2        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/3        ALTE  DISCARDING      NONE
[S4]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/2        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/3        DESI  FORWARDING      NONE
```

Шаг 4.

Назначим порт G0/0/2 S4 корневым портом.

```
[S4]dis stp interface g0/0/2
-------[CIST Global Info][Mode STP]-------
CIST Bridge         :32768.4c1f-cc46-6680
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :0    .4c1f-cca2-14ca / 20000 # стоимость пути от рута
CIST RegRoot/IRPC   :32768.4c1f-cc46-6680 / 0
CIST RootPortId     :128.1
BPDU-Protection     :Disabled
TC or TCN received  :118
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:5m:16s
Number of TC        :18
Last TC occurred    :GigabitEthernet0/0/1
----[Port2(GigabitEthernet0/0/2)][DISCARDING]----
 Port Protocol       :Enabled
 Port Role           :Alternate Port
 Port Priority       :128
 Port Cost(Dot1T )   :Config=auto / Active=20000 # стоимость порта по умолчанию
 Designated Bridge/Port   :4096.4c1f-cc30-36f6 / 128.14
 Port Edged          :Config=default / Active=disabled
 Point-to-point      :Config=auto / Active=true
 Transit Limit       :147 packets/hello-time
 Protection Type     :None
 Port STP Mode       :STP
 Port Protocol Type  :Config=auto / Active=dot1s
 BPDU Encapsulation  :Config=stp / Active=stp
 PortTimes           :Hello 2s MaxAge 20s FwDly 15s RemHop 0
 TC or TCN send      :3
 TC or TCN received  :89
 BPDU Sent           :4
          TCN: 3, Config: 1, RST: 0, MST: 0
 BPDU Received       :904
          TCN: 0, Config: 904, RST: 0, MST: 0
```

Чтобы сделать G0/0/2 можно либо уменьшить его стоимость, либо увеличить стоимость другого интерфейса.

Увеличить стоимость G0/0/1 до 50000, как по заданию:

От S4 отправляется кадр вида:

```
BPDU Type: Topology Change Notification (0x80)
```

Происходит перестроение дерева. Теперь:

```
[S4]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/2        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/3        ALTE  DISCARDING      NONE
[S4]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge         :32768.4c1f-cc46-6680
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :0    .4c1f-cca2-14ca / 40000
CIST RegRoot/IRPC   :32768.4c1f-cc46-6680 / 0
CIST RootPortId     :128.2
BPDU-Protection     :Disabled
TC or TCN received  :185
TC count per hello  :2
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:0m:7s
Number of TC        :21
Last TC occurred    :GigabitEthernet0/0/2
```

Шаг 5.

Изменим режим связующего дерева на RSTP:

```
[S4]dis stp
-------[CIST Global Info][Mode RSTP]-------
CIST Bridge         :32768.4c1f-cc46-6680
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :0    .4c1f-cca2-14ca / 40000
CIST RegRoot/IRPC   :32768.4c1f-cc46-6680 / 0
CIST RootPortId     :128.2
BPDU-Protection     :Disabled
TC or TCN received  :222
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:2m:22s
Number of TC        :22
```

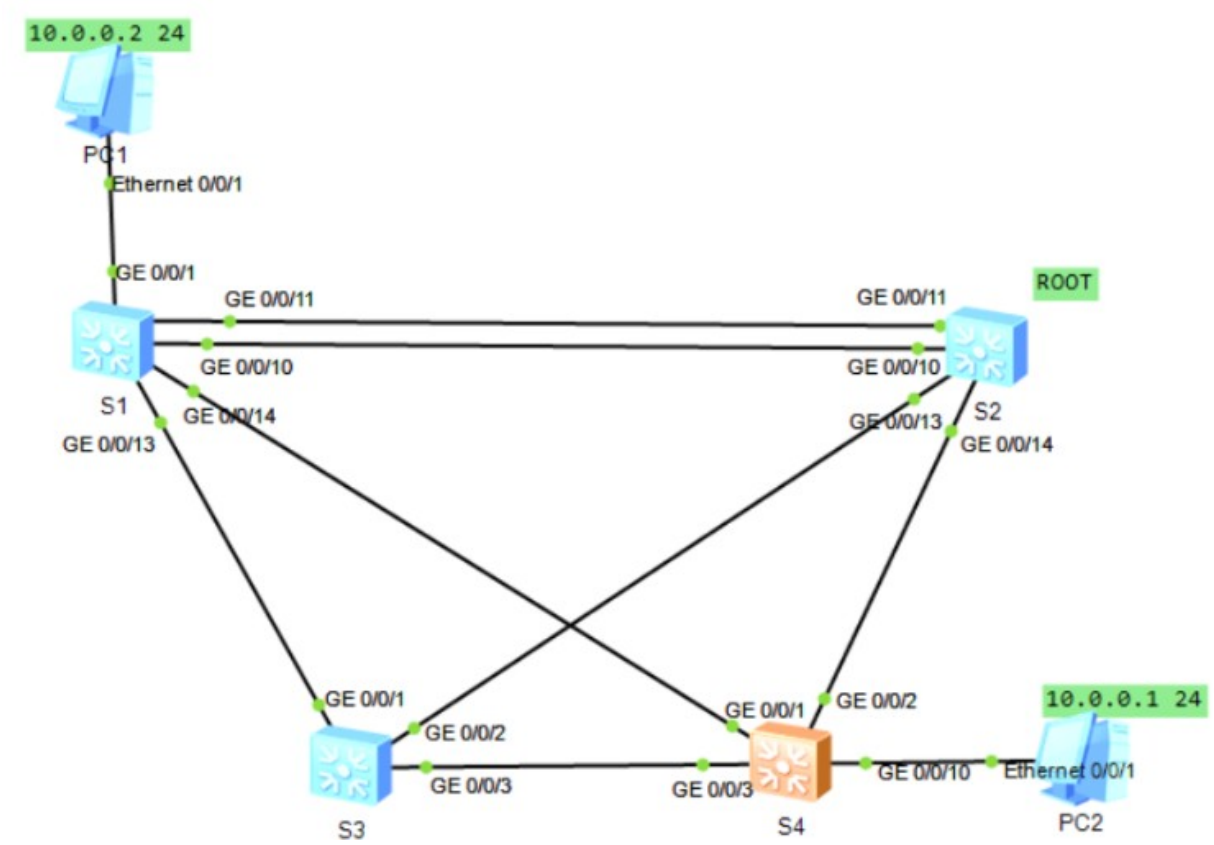
```
Last TC occurred    :GigabitEthernet0/0/2
[S4]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/2        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/3        ALTE  DISCARDING      NONE
```

Топология не изменилась.

Шаг 6.

Настроить для S3 гарничные порты G0/0/10-G0/0/14 (range не работает):

```
interface GigabitEthernet0/0/10
 stp edged-port enable
#
interface GigabitEthernet0/0/11
 stp edged-port enable
#
interface GigabitEthernet0/0/12
 stp edged-port enable
#
interface GigabitEthernet0/0/13
 stp edged-port enable
#
interface GigabitEthernet0/0/14
 stp edged-port enable
#
```



Проверка что произойдет при отключении порта. До отключения (PC2-PC1):

```
PC>ping 10.0.0.2

Ping 10.0.0.2: 32 data bytes, Press Ctrl_C to break
From 10.0.0.2: bytes=32 seq=1 ttl=128 time=109 ms
From 10.0.0.2: bytes=32 seq=2 ttl=128 time=78 ms
From 10.0.0.2: bytes=32 seq=3 ttl=128 time=78 ms
From 10.0.0.2: bytes=32 seq=4 ttl=128 time=78 ms
From 10.0.0.2: bytes=32 seq=5 ttl=128 time=79 ms
+ stutdown
[S4-GigabitEthernet0/0/2]dis stp brief
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/3        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/10       DESI  FORWARDING      NONE

PC>ping 10.0.0.2

Ping 10.0.0.2: 32 data bytes, Press Ctrl_C to break
From 10.0.0.2: bytes=32 seq=1 ttl=128 time=93 ms
From 10.0.0.2: bytes=32 seq=2 ttl=128 time=94 ms
From 10.0.0.2: bytes=32 seq=3 ttl=128 time=94 ms
From 10.0.0.2: bytes=32 seq=4 ttl=128 time=78 ms
```

```
From 10.0.0.2: bytes=32 seq=5 ttl=128 time=94 ms

--- 10.0.0.2 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 78/90/94 ms
```

. Конфигурации

```
sysname S1
#
stp mode rstp
stp instance 0 root primary
#
interface GigabitEthernet0/0/12
 shutdown
#
user-interface con 0
 idle-timeout 0 0
#
return
#

sysname S2
#
stp mode rstp
stp instance 0 root secondary
#
interface GigabitEthernet0/0/12
 shutdown
#

sysname S3
#
stp mode rstp
#

sysname S4
#
stp mode rstp
#
interface GigabitEthernet0/0/1
```

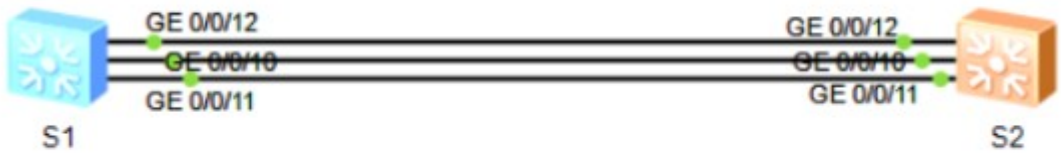
```
 stp instance 0 cost 50000
#
interface GigabitEthernet0/0/2
 shutdown
#
interface GigabitEthernet0/0/10
 stp edged-port enable
#
interface GigabitEthernet0/0/11
 stp edged-port enable
#
interface GigabitEthernet0/0/12
 stp edged-port enable
#
interface GigabitEthernet0/0/13
 stp edged-port enable
#
interface GigabitEthernet0/0/14
 stp edged-port enable
#
```

3. Лабораторная работа 3. Агрегирование каналов Ethernet

. Задачи

- Настройка агрегирования каналов вручную.
- Настройка агрегирования каналов в режиме LACP.
- Изменение параметров для определения активных каналов.
- Изменение режима балансировки нагрузки.

. Топология сети



. Настраивание и диагностические команды

Шаг 1.

Выполнить ручную настройку Eth-Trunk. Шаги совпадают с методичкой, демонстрация:

```
[S1-GigabitEthernet0/0/12]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: 3
--------------------------------------------------------------------------------
PortName                      Status      Weight
GigabitEthernet0/0/10         Up          1
GigabitEthernet0/0/11         Up          1
GigabitEthernet0/0/12         Up          1
[S2-Eth-Trunk1]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: 3
--------------------------------------------------------------------------------
PortName                      Status      Weight
GigabitEthernet0/0/10         Up          1
GigabitEthernet0/0/11         Up          1
GigabitEthernet0/0/12         Up          1
```

Шаг 2.

Настроить в режиме LACP:

```
[S1-Eth-Trunk1]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: 4c1f-cc19-2f8c
Least Active-linknumber: 1  Max Active-linknumber: 8
Operate status: up          Number Of Up Port In Trunk: 3
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight

GigabitEthernet0/0/10  Selected 1GE      32768   11     305     10111100  1
GigabitEthernet0/0/11  Selected 1GE      32768   12     305     10111100  1
GigabitEthernet0/0/12  Selected 1GE      32768   13     305     10111100  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc27-2d26  32768   11     305     10111100
GigabitEthernet0/0/11  32768    4c1f-cc27-2d26  32768   12     305     10111100
GigabitEthernet0/0/12  32768    4c1f-cc27-2d26  32768   13     305     10111100
[S2-Eth-Trunk1]dis eth-t 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: 4c1f-cc27-2d26
Least Active-linknumber: 1  Max Active-linknumber: 8
Operate status: up          Number Of Up Port In Trunk: 3
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/10  Selected 1GE      32768   11     305     10111100  1
GigabitEthernet0/0/11  Selected 1GE      32768   12     305     10111100  1
GigabitEthernet0/0/12  Selected 1GE      32768   13     305     10111100  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc19-2f8c  32768   11     305     10111100
GigabitEthernet0/0/11  32768    4c1f-cc19-2f8c  32768   12     305     10111100
GigabitEthernet0/0/12  32768    4c1f-cc19-2f8c  32768   13     305     10111100
```

Шаг 3.

Настроить LACP, задав System Priority для S1, изменив приоритет порта, установив минимальное и максимальное число портов.

```
[S1-Eth-Trunk1]
Oct 11 2023 08:18:36-08:00 S1 DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.5.25.
191.3.1 configurations have been changed. The current change number is 16, the c
hange loop count is 0, and the maximum number of records is 4095.
[S1-Eth-Trunk1]dis eth-t
[S1-Eth-Trunk1]dis eth-trunk 1
Eth-Trunk1's state information is:
Local:
LAG ID: 1                   WorkingMode: STATIC
Preempt Delay Time: 30      Hash arithmetic: According to SIP-XOR-DIP
System Priority: 100        System ID: 4c1f-cc19-2f8c
Least Active-linknumber: 2  Max Active-linknumber: 2
Operate status: up          Number Of Up Port In Trunk: 2
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/10  Unselect 1GE      40000   11     305     10100000  1
GigabitEthernet0/0/11  Selected 1GE      32768   12     305     10111100  1
GigabitEthernet0/0/12  Selected 1GE      32768   13     305     10111100  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc27-2d26  32768   11     305     10110000
GigabitEthernet0/0/11  32768    4c1f-cc27-2d26  32768   12     305     10111100
GigabitEthernet0/0/12  32768    4c1f-cc27-2d26  32768   13     305     10111100
```

После отключения G0/0/12:

```
[S1-GigabitEthernet0/0/12]dis eth-trunk 1
Eth-Trunk1's state information is:
Local:
LAG ID: 1                   WorkingMode: STATIC
Preempt Delay Time: 30      Hash arithmetic: According to SIP-XOR-DIP
System Priority: 100        System ID: 4c1f-cc19-2f8c
Least Active-linknumber: 2  Max Active-linknumber: 2
Operate status: up          Number Of Up Port In Trunk: 2
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/10  Selected 1GE      40000   11     305     10111100  1
GigabitEthernet0/0/11  Selected 1GE      32768   12     305     10111100  1
```

```
GigabitEthernet0/0/12  Unselect 1GE      32768   13     305     10100010  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc27-2d26  32768   11     305     10111100
GigabitEthernet0/0/11  32768    4c1f-cc27-2d26  32768   12     305     10111100
GigabitEthernet0/0/12  0        0000-0000-0000  0       0      0       10100011
```

После отключения G0/0/11 Eth-Trunk отключается, так как кол-во активных портов меньше, чем least:

```
Eth-Trunk1's state information is:
Local:
LAG ID: 1                   WorkingMode: STATIC
Preempt Delay Time: 30      Hash arithmetic: According to SIP-XOR-DIP
System Priority: 100        System ID: 4c1f-cc19-2f8c
Least Active-linknumber: 2  Max Active-linknumber: 2
Operate status: down        Number Of Up Port In Trunk: 0
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/10  Unselect 1GE      40000   11     305     10100000  1
GigabitEthernet0/0/11  Unselect 1GE      32768   12     305     10100010  1
GigabitEthernet0/0/12  Unselect 1GE      32768   13     305     10100010  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc27-2d26  32768   11     305     10110000
GigabitEthernet0/0/11  0        0000-0000-0000  0       0      0       10100011
GigabitEthernet0/0/12  0        0000-0000-0000  0       0      0       10100011
```

Шаг 4.

Изменить режим балансировки нагрузки на с использованием IP. Вернуть интерфейсы во включенное состояние:

```
[S1-Eth-Trunk1]dis eth-trunk 1
Eth-Trunk1's state information is:
Local:
LAG ID: 1                   WorkingMode: STATIC
Preempt Delay Time: 30      Hash arithmetic: According to DIP
System Priority: 100        System ID: 4c1f-cc19-2f8c
```

```
Least Active-linknumber: 2  Max Active-linknumber: 2
Operate status: up          Number Of Up Port In Trunk: 2
--------------------------------------------------------------------------------
ActorPortName          Status   PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/10  Unselect 1GE      40000   11     305     10100000  1
GigabitEthernet0/0/11  Selected 1GE      32768   12     305     10111100  1
GigabitEthernet0/0/12  Selected 1GE      32768   13     305     10111100  1

Partner:
--------------------------------------------------------------------------------
ActorPortName          SysPri   SystemID        PortPri PortNo PortKey PortState
GigabitEthernet0/0/10  32768    4c1f-cc27-2d26  32768   11     305     10110000
GigabitEthernet0/0/11  32768    4c1f-cc27-2d26  32768   12     305     10111100
GigabitEthernet0/0/12  32768    4c1f-cc27-2d26  32768   13     305     10111100
```

. Конфигурации

```
#
sysname S1
#
lacp priority 100
#
interface Eth-Trunk1
 mode lacp-static
 least active-linknumber 2
 load-balance dst-ip
 lacp preempt enable
 max active-linknumber 2
#
interface GigabitEthernet0/0/10
 eth-trunk 1
 lacp priority 40000
#
interface GigabitEthernet0/0/11
 eth-trunk 1
#
interface GigabitEthernet0/0/12
 eth-trunk 1
#
user-interface con 0
 idle-timeout 0 0
#
return
```

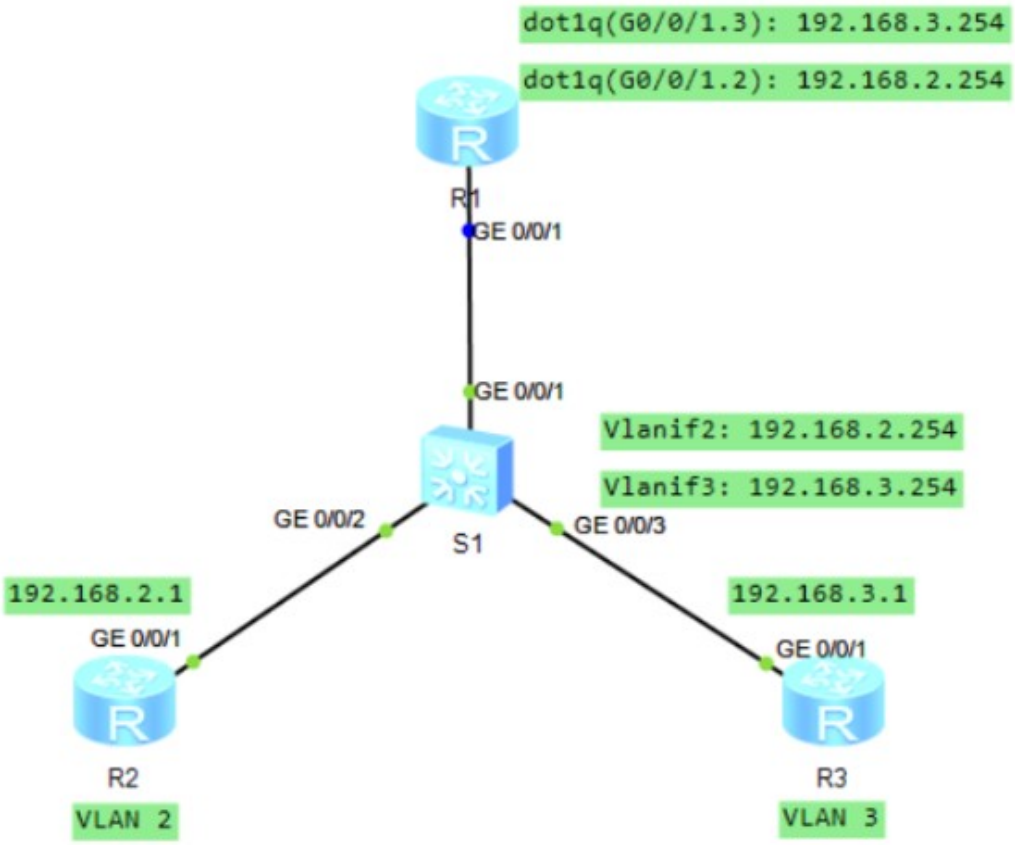
```
#
sysname S2
#
interface Eth-Trunk1
 mode lacp-static
#
interface GigabitEthernet0/0/10
 eth-trunk 1
#
interface GigabitEthernet0/0/11
 eth-trunk 1
#
interface GigabitEthernet0/0/12
 eth-trunk 1
#
user-interface con 0
 idle-timeout 0 0
#
return
```

4. Лабораторная работа 4. Связь между VLAN

. Задачи

- Настройка подинтерфейсов терминирования dot1q для реализации связи между VLAN.
- Настройка интерфейсов VLANIF для реализации связи между VLAN.

. Топология сети



. Настраивание и диагностические команды

Шаг 1.

Настроить основные параметры устройств:

```
sysname R2
ip route-static 0.0.0.0 0.0.0.0 192.168.2.254

sysname R3
ip route-static 0.0.0.0 0.0.0.0 192.168.3.254

S1
VID  Status  Property      MAC-LRN Statistics Description
--------------------------------------------------------------------------------

1    enable  default       enable  disable    VLAN 0001
```

```
2    enable  default       enable  disable    VLAN 0002
3    enable  default       enable  disable    VLAN 0003
interface GigabitEthernet0/0/2
 port link-type access
 port default vlan 2
#
interface GigabitEthernet0/0/3
 port link-type access
 port default vlan 3
```

Шаг 2.

Настроить подинтерфейсы терминирования dot1q для реализации связи между VLAN:

```
[S1-GigabitEthernet0/0/1]dis this
#
interface GigabitEthernet0/0/1
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
return
```

```
[R1]dis dot1q information termination interface g0/0/1
  GigabitEthernet0/0/1.2
    Total QinQ Num: 1
      dot1q termination vid 2
    Total vlan-group Num: 0
  GigabitEthernet0/0/1.3
    Total QinQ Num: 1
      dot1q termination vid 3
    Total vlan-group Num: 0
```

Таким образом, при приеме например кадра с vlan 2, в данной конфигурации он отправляется на подинтерфейс 2 через g0/0/1, а затем, так как dest ip 192.168.3.1, дальнейшая обработка идет к подинтерфейсу 3 по таблице маршрутизации. После этого, кадр с уже тегом 3 отправляется на коммутатор.

```
[R2]ping 192.168.3.1
  PING 192.168.3.1: 56  data bytes, press CTRL_C to break
    Reply from 192.168.3.1: bytes=56 Sequence=1 ttl=254 time=90 ms
    Reply from 192.168.3.1: bytes=56 Sequence=2 ttl=254 time=130 ms
    Reply from 192.168.3.1: bytes=56 Sequence=3 ttl=254 time=100 ms
```

```
    Reply from 192.168.3.1: bytes=56 Sequence=4 ttl=254 time=100 ms
    Reply from 192.168.3.1: bytes=56 Sequence=5 ttl=254 time=80 ms
```

Шаг 3.

Настроить интерфейсы VLANIF, удалив предыдущую конфигурацию.

```
[R2]ping 192.168.3.1
  PING 192.168.3.1: 56  data bytes, press CTRL_C to break
    Reply from 192.168.3.1: bytes=56 Sequence=1 ttl=254 time=160 ms
    Reply from 192.168.3.1: bytes=56 Sequence=2 ttl=254 time=70 ms
    Reply from 192.168.3.1: bytes=56 Sequence=3 ttl=254 time=50 ms
    Reply from 192.168.3.1: bytes=56 Sequence=4 ttl=254 time=50 ms
    Reply from 192.168.3.1: bytes=56 Sequence=5 ttl=254 time=60 ms

  --- 192.168.3.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 50/78/160 ms

[R2]tracert 192.168.3.1

 traceroute to  192.168.3.1(192.168.3.1), max hops: 30 ,packet length: 40,press
CTRL_C to break

 1 192.168.2.254 20 ms  70 ms  10 ms

 2 192.168.3.1 50 ms  70 ms  40 ms
```

. Конфигурации

```
sysname R2
#
interface GigabitEthernet0/0/0
#
interface GigabitEthernet0/0/1
 ip address 192.168.2.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 0.0.0.0 0.0.0.0 192.168.2.254
```

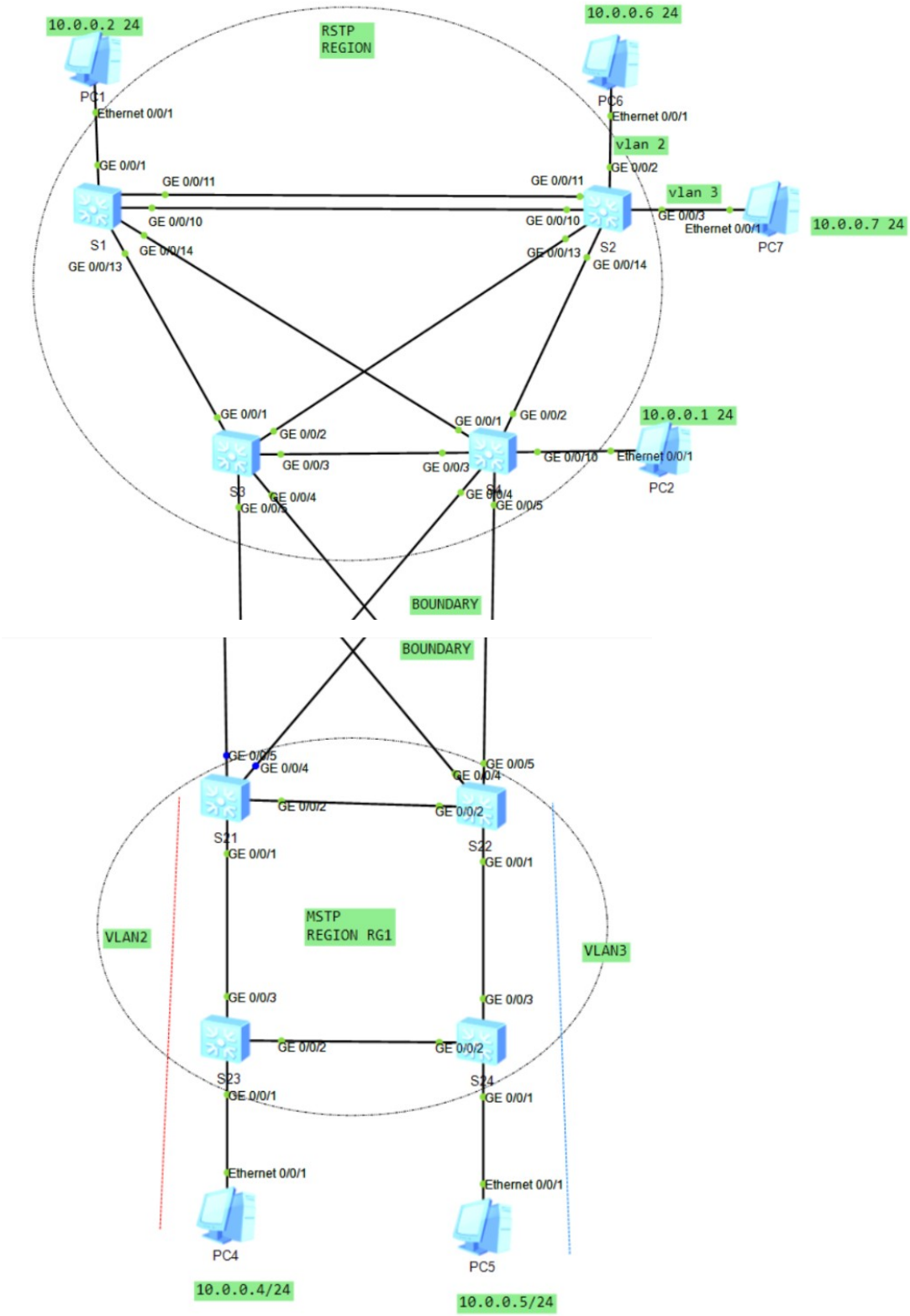
```
#

sysname R3
#
interface GigabitEthernet0/0/0
#
interface GigabitEthernet0/0/1
 ip address 192.168.3.1 255.255.255.0
#
interface GigabitEthernet0/0/2
#
interface NULL0
#
ip route-static 0.0.0.0 0.0.0.0 192.168.3.254
#

sysname S1
#
interface Vlanif1
#
interface Vlanif2
 ip address 192.168.2.254 255.255.255.0
#
interface Vlanif3
 ip address 192.168.3.254 255.255.255.0
#
interface MEth0/0/1
#
interface GigabitEthernet0/0/1
#
interface GigabitEthernet0/0/2
 port link-type access
 port default vlan 2
#
interface GigabitEthernet0/0/3
 port link-type access
 port default vlan 3
#
```

5. Усложненная топология. Объединение региона SMTP и STP, добавление VLAN

. Топология сети



. Конфигурации

```
#
sysname S21
#
vlan batch 2 to 3
#
stp pathcost-standard legacy
#
stp instance 1 root primary
stp instance 2 root secondary
stp pathcost-standard legacy
#
stp region-configuration
 region-name RG1
 instance 1 vlan 2
 instance 2 vlan 3
 active region-configuration
#
drop-profile default
#
interface Vlanif1
#
interface MEth0/0/1
#
interface GigabitEthernet0/0/1
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/2
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/3
#
interface GigabitEthernet0/0/4
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/5
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
```

```
#
sysname S22
#
vlan batch 2 to 3
#
stp pathcost-standard legacy
#
stp instance 1 root secondary
stp instance 2 root primary
stp pathcost-standard legacy
#
stp region-configuration
 region-name RG1
 instance 1 vlan 2
 instance 2 vlan 3
 active region-configuration
#
interface GigabitEthernet0/0/1
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/2
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/3
#
interface GigabitEthernet0/0/4
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#
interface GigabitEthernet0/0/5
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#

#
sysname S23
#
vlan batch 2 to 3
#
stp pathcost-standard legacy
```

```
#
stp region-configuration
 region-name RG1
 instance 1 vlan 2
 instance 2 vlan 3
 active region-configuration
#
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 2
 stp edged-port enable
#
interface GigabitEthernet0/0/2
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
 stp instance 2 cost 200
#
interface GigabitEthernet0/0/3
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#

#
sysname S24
#
vlan batch 2 to 3
#
stp pathcost-standard legacy
#
stp region-configuration
 region-name RG1
 instance 1 vlan 2
 instance 2 vlan 3
 active region-configuration
#
interface GigabitEthernet0/0/1
 port link-type access
 port default vlan 3
 stp edged-port enable
#
interface GigabitEthernet0/0/2
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
```

```
 stp instance 1 cost 200
#
interface GigabitEthernet0/0/3
 port link-type trunk
 port trunk allow-pass vlan 2 to 3
#

#
sysname S1
#
vlan batch 2 to 3
#
stp mode rstp
stp instance 0 root primary
#
interface GigabitEthernet0/0/10
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/11
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/12
 shutdown
#
interface GigabitEthernet0/0/13
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/14
 port hybrid tagged vlan 2 to 3
#

#
sysname S2
#
vlan batch 2 to 3
#
stp mode rstp
stp instance 0 root secondary
#
interface GigabitEthernet0/0/2
 port link-type access
 port default vlan 2
#
```

```
interface GigabitEthernet0/0/3
 port link-type access
 port default vlan 3
#
interface GigabitEthernet0/0/10
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/11
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/12
 shutdown
#
interface GigabitEthernet0/0/13
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/14
 port hybrid tagged vlan 2 to 3
#

#
sysname S3
#
vlan batch 2 to 3
#
stp mode rstp
#
interface GigabitEthernet0/0/1
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/2
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/3
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/4
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/5
 port hybrid tagged vlan 2 to 3
#
```

```
#
sysname S4
#
vlan batch 2 to 3
#
stp mode rstp
#
interface GigabitEthernet0/0/1
 port hybrid tagged vlan 2 to 3
 stp instance 0 cost 50000
#
interface GigabitEthernet0/0/2
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/3
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/4
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/5
 port hybrid tagged vlan 2 to 3
#
interface GigabitEthernet0/0/10
 stp edged-port enable
#
interface GigabitEthernet0/0/11
 stp edged-port enable
#
interface GigabitEthernet0/0/12
 stp edged-port enable
#
interface GigabitEthernet0/0/13
 stp edged-port enable
#
interface GigabitEthernet0/0/14
 stp edged-port enable
#
```