Университет ИТМО

Администрирование вычислительных систем

Лабораторная работа №1

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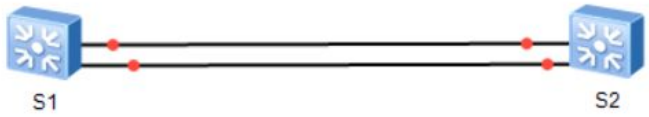
Топология сети STP



На рисунке изображена топология сети STP.

Были использованы два коммутатора S5700 - S1 и S2
И созданы 2 сети G 0/0/9 и G 0/0/10

Настройка

1. Отключение нерелевантных интерфейсов

   S1:

```
<Huawei>system-view
[Huawei]sysname S1
[S1]interface GigabitEthernet 0/0/1
[S1-GigabitEthernet0/0/1]shutdown
[S1-GigabitEthernet0/0/1]quit
[S1]interface GigabitEthernet 0/0/2
[S1-GigabitEthernet0/0/2]shutdown
[S1]interface GigabitEthernet 0/0/3
[S1-GigabitEthernet0/0/3]shutdown
[S1-GigabitEthernet0/0/3]quit
[S1]interface GigabitEthernet 0/0/13
[S1-GigabitEthernet0/0/13]shutdown
[S1]interface GigabitEthernet 0/0/14
[S1-GigabitEthernet0/0/14]shutdown
```

   S2:

```
<Huawei>system-view
[Huawei]sysname S2
[S2]interface GigabitEthernet 0/0/1
```

```
[S2-GigabitEthernet0/0/1]shutdown
[S2-GigabitEthernet0/0/1]quit
[S2]interface GigabitEthernet 0/0/2
[S2-GigabitEthernet0/0/2]shutdown
[S2-GigabitEthernet0/0/2]quit
[S2]interface GigabitEthernet 0/0/3
[S2-GigabitEthernet0/0/3]shutdown
[S2]interface GigabitEthernet 0/0/6
[S2-GigabitEthernet0/0/6]shutdown
[S2-GigabitEthernet0/0/6]quit
[S2]interface GigabitEthernet 0/0/7
[S2-GigabitEthernet0/0/7]shutdown
[S2-GigabitEthernet0/0/7]quit
```

2. Выключение stp

S1:

```
[S1]stp enable
[S1]stp mode stp
[S1]stp root primary
```

S2:

```
[S2]stp enable
[S2]stp mode stp
[S2]stp root secondary
```

Краткая информация об stp:

S1:

```
[S1]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/9        DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/10       DESI  FORWARDING      NONE
```

S2:

```
[S2]display stp brief
 MSTID  Port                        Role  STP State
```

```
Protection
   0     GigabitEthernet0/0/9         ROOT   FORWARDING       NONE
   0     GigabitEthernet0/0/10        ALTE   DISCARDING       NONE
```

Здесь нам интересно то, что у s2 порт GigabitEthernet0/0/10 отбрасывается.

Проверка статуса stp-порта:

S1:

```
[S1]display stp interface GigabitEthernet 0/0/10
<...>
----[Port10(GigabitEthernet0/0/10)][FORWARDING]----
 Port Protocol         :Enabled
 Port Role             :Designated Port
Port Priority         :128
 Port Cost(Dot1T )     :Config=auto / Active=20000
 Designated Bridge/Port    :0.4c1f-cc03-2c9f / 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 20
 TC or TCN send        :35
 TC or TCN received    :0
 <...>
```

S2:

```
 [S2]display stp interface GigabitEthernet 0/0/10
 <...>
 ----[Port10(GigabitEthernet0/0/10)][DISCARDING]----
 Port Protocol         :Enabled
 Port Role             :Alternate Port
 Port Priority         :128
 Port Cost(Dot1T )     :Config=auto / Active=20000
 Designated Bridge/Port    :0.4c1f-cc03-2c9f / 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        :0
```

```
 TC or TCN received  :30
<...>
```

Как можно заметить у S1 для интерфейса GigabitEthernet 0/0/10 указан как назначенный порт, а у S2 как альтернативный.

Контроль выбора корневого моста

Просмотр информации о корневом мосте:

S1:

```
[S1]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :0     .4c1f-cc03-2c9f
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-cc03-2c9f / 0
CIST RegRoot/IRPC    :0     .4c1f-cc03-2c9f / 0
CIST RootPortId      :0.0
BPDU-Protection      :Disabled
CIST Root Type       :Primary root
TC or TCN received   :3
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:8m:27s
Number of TC         :7
Last TC occurred     :GigabitEthernet0/0/10
```

Здесь видно, что текущий мост (S1) является корневым.

S2:

```
[S2]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :4096 .4c1f-cc18-2885
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-cc03-2c9f / 20000
CIST RegRoot/IRPC    :4096 .4c1f-cc18-2885 / 0
CIST RootPortId      :128.9
BPDU-Protection      :Disabled
CIST Root Type       :Secondary root
TC or TCN received   :109
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:14m:33s
Number of TC         :7
```

```
Last TC occurred    :GigabitEthernet0/0/9
```

А мост S2 не является корневым.
Настройка S2 в качестве корневого моста и S1 в качестве резервного корневого моста:

Для этого изменим приоритет S1 на 8192, а S2 на 4096

S1:

```
[S1]undo stp root
[S1]stp priority 8192
```

S2:

```
[S2]undo stp root
[S2]stp priority 4096
```

Просмотр информации о новом корневом мосте:

S1:

```
[S1]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :8192 .4c1f-cc03-2c9f
Config Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC       :4096 .4c1f-cc18-2885 / 20000
CIST RegRoot/IRPC    :8192 .4c1f-cc03-2c9f / 0
CIST RootPortId      :128.9
BPDU-Protection      :Disabled
TC or TCN received   :60
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:1m:33s
Number of TC         :10
Last TC occurred     :GigabitEthernet0/0/9
```

Здесь видно, что у S1 новый приоритет -- 8192 и он больше не является корневым мостом

S2:

```
[S2]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :4096 .4c1f-cc18-2885
Config Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC       :4096 .4c1f-cc18-2885 / 0
CIST RegRoot/IRPC    :4096 .4c1f-cc18-2885 / 0
```

```
CIST RootPortId     :0.0
BPDU-Protection     :Disabled
TC or TCN received  :109
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:1m:2s
Number of TC        :9
Last TC occurred    :GigabitEthernet0/0/10
```

На S2 также виден новый приоритет и то, что он стал новым корневым мостом.

Отключим интерфейсы GigabitEthernet 0/0/9 и GigabitEthernet 0/0/10 *зачеркнуто* отрежем првода для изоляции S2 и для того, чтобы убедиться, что при отказе S2, S1 становится новым корневым мостом:

S2:

```
[S2]interface GigabitEthernet 0/0/9
[S2-GigabitEthernet0/0/9]shutdown
[S2]interface GigabitEthernet 0/0/10
[S2-GigabitEthernet0/0/10]shutdown
```

Проверим состояние stp:
S1:

```
[S1]display stp
-------[CIST Global Info][Mode STP]-------
-------[CIST Global Info][Mode STP]-------
CIST Bridge         :8192 .4c1f-cc03-2c9f
Config Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times        :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC      :4096 .4c1f-cc18-2885 / 20000
CIST RegRoot/IRPC   :8192 .4c1f-cc03-2c9f / 0
CIST RootPortId     :128.9
BPDU-Protection     :Disabled
TC or TCN received  :0
TC count per hello  :0
STP Converge Mode   :Normal
Time since last TC  :0 days 0h:0m:0s
Number of TC        :0
```

Повторно включаем интерфейсы GigabitEthernet 0/0/9 и GigabitEthernet 0/0/10:

S2:

```
[S2]interface GigabitEthernet 0/0/9
[S2-GigabitEthernet0/0/9]undo shutdown
[S2]interface GigabitEthernet 0/0/10
[S2-GigabitEthernet0/0/10]undo shutdown
```

Проверим состояние:

```
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :8192 .4c1f-cc03-2c9f
Config Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC       :4096 .4c1f-cc18-2885 / 20000
CIST RegRoot/IRPC    :8192 .4c1f-cc03-2c9f / 0
CIST RootPortId      :128.9
BPDU-Protection      :Disabled
TC or TCN received   :120
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:0m:55s
Number of TC         :13
Last TC occurred     :GigabitEthernet0/0/9
```

S1 не является рутом.

S2:

```
[S2]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :4096 .4c1f-cc18-2885
Config Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
Active Times         :Hello 2s MaxAge 20s FwDly 15s MaxHop 20
CIST Root/ERPC       :4096 .4c1f-cc18-2885 / 0
CIST RegRoot/IRPC    :4096 .4c1f-cc18-2885 / 0
CIST RootPortId      :0.0
BPDU-Protection      :Disabled
TC or TCN received   :111
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:1m:15s
Number of TC         :13
Last TC occurred     :GigabitEthernet0/0/10
```

S2 является рутом.

Контроль выбора корневого порта

Просмотр роли интерфейсов:

S1:

```
<S1>display stp brief
 MSTID  Port                        Role  STP State
```

```
Protection
   0     GigabitEthernet0/0/9         ROOT   FORWARDING       NONE
   0     GigabitEthernet0/0/10        ALTE   DISCARDING       NONE
```

GigabitEthernet0/0/9 - корневой порт
GigabitEthernet0/0/10 - альтернативный порт

Изменим приоритеты портов, чтобы GigabitEthernet0/0/10 стал корневым портом, а GigabitEthernet0/0/9 - альтернативным. Установим GigabitEthernet0/0/9 приоритет 32, а GigabitEthernet0/0/10 - 16.

S2:

```
[S2]interface GigabitEthernet 0/0/9
[S2-GigabitEthernet0/0/9]stp port priority 32
[S2]interface GigabitEthernet 0/0/10
[S2-GigabitEthernet0/0/10]stp port priority 16
```

Проверим состояние GigabitEthernet 0/0/9:

```
[S2]display stp interface GigabitEthernet 0/0/9
<...>
----[Port9(GigabitEthernet0/0/9)][FORWARDING]----
 Port Protocol       :Enabled
 Port Role           :Designated Port
 Port Priority       :32
 Port Cost(Dot1T )   :Config=auto / Active=20000
 Designated Bridge/Port   :4096.4c1f-cc18-2885 / 32.9
 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 20
 TC or TCN send      :52
 TC or TCN received  :1
 BPDU Sent           :580
          TCN: 0, Config: 580, RST: 0, MST: 0
 BPDU Received       :1
          TCN: 1, Config: 0, RST: 0, MST: 0
```

Проверим состояние GigabitEthernet 0/0/10:

```
[S2]display stp interface GigabitEthernet 0/0/10
<...>
 ----[Port10(GigabitEthernet0/0/10)][FORWARDING]----
 Port Protocol       :Enabled
```

```
 Port Role            :Designated Port
 Port Priority        :16
 Port Cost(Dot1T )    :Config=auto / Active=20000
 Designated Bridge/Port   :4096.4c1f-cc18-2885 / 16.10
 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 20
 TC or TCN send       :36
 TC or TCN received   :1
 BPDU Sent            :582
          TCN: 0, Config: 582, RST: 0, MST: 0
 BPDU Received        :1
          TCN: 1, Config: 0, RST: 0, MST: 0
```

Просмотр роли интерфейсов на S1:

```
<S1>display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/9        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/10       ROOT  FORWARDING      NONE
```

Теперь GigabitEthernet0/0/9 стал альтернативным портом, а GigabitEthernet0/0/10 - корневым.

Выключим интерфейс GigabitEthernet0/0/10 для того, чтобы убедиться, что GigabitEthernet0/0/9 станет корневым при отказе GigabitEthernet0/0/10.

```
[S1]interface GigabitEthernet 0/0/10
[S1-GigabitEthernet0/0/10]shutdown
```

Проверим роли интерфейсов:

```
[S1]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/9        ROOT  DISCARDING      NONE
```

Порт GigabitEthernet0/0/9 стал корневым.

Возобновим приоритеты по умолчанию:

```
[S2]interface GigabitEthernet 0/0/9
[S2-GigabitEthernet0/0/9]undo stp port priority
```

```
[S2]interface GigabitEthernet 0/0/10
[S2-GigabitEthernet0/0/10]undo stp port priority
```

И включим отключенный интерфейс:

```
[S1]interface GigabitEthernet 0/0/10
[S1-GigabitEthernet0/0/10]undo shutdown
```

Проверим роли интерфейсов:

```
[S1-GigabitEthernet0/0/10]display stp brief
MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/9        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/10       ALTE  DISCARDING      NONE
```

```
[S1]display stp interface GigabitEthernet 0/0/9
----[Port9(GigabitEthernet0/0/9)][FORWARDING]----
 Port Protocol       :Enabled
 Port Role           :Root Port
 Port Priority       :128
 Port Cost(Dot1T )   :Config=auto / Active=20000
 Designated Bridge/Port   :4096.4c1f-cc18-2885 / 128.9
 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  :106
 BPDU Sent           :4
          TCN: 3, Config: 1, RST: 0, MST: 0
 BPDU Received       :1020
          TCN: 0, Config: 1020, RST: 0, MST: 0
```

```
[S1]display stp interface GigabitEthernet 0/0/10
 Port Protocol       :Enabled
 Port Role           :Alternate Port
 Port Priority       :128
 Port Cost(Dot1T )   :Config=auto / Active=20000
 Designated Bridge/Port   :4096.4c1f-cc18-2885 / 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       :0
 TC or TCN received   :17
 BPDU Sent            :1
          TCN: 0, Config: 1, RST: 0, MST: 0
 BPDU Received        :124
          TCN: 0, Config: 124, RST: 0, MST: 0
```

Текущая стоимость - стоимость по умолчанию.

Изменим стоимость G0/0/9 на 200000:

```
[S1]interface GigabitEthernet 0/0/9
[S1-GigabitEthernet0/0/9]stp cost 200000
```

Проверим:

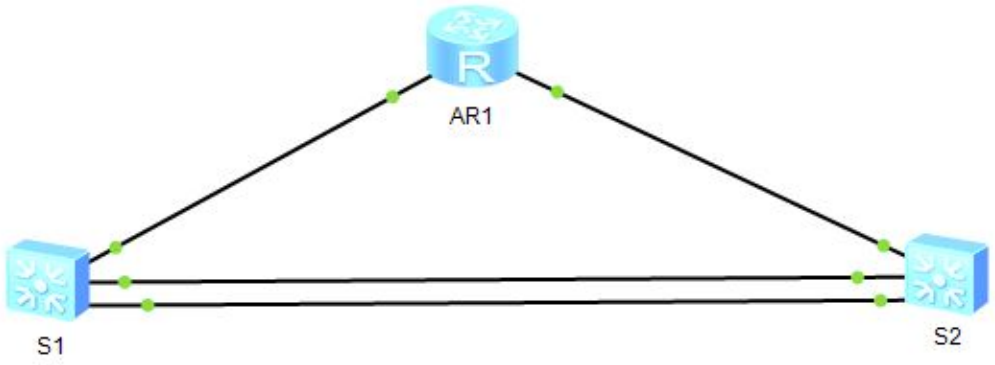
```
[S1]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/9        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/10       ROOT  FORWARDING      NONE
```

```
[S1]display stp interface GigabitEthernet 0/0/9
<...>
----[Port9(GigabitEthernet0/0/9)][DISCARDING]----
 Port Protocol        :Enabled
 Port Role            :Alternate Port
 Port Priority        :128
 Port Cost(Dot1T )    :Config=200000 / Active=200000
 Designated Bridge/Port   :4096.4c1f-cc18-2885 / 128.9
 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
```

Цена для G0/0/9 изменилась и G0/0/10 стал новым корневым портом

RSTP

Топология сети



Удаление предыдущих конфигураций

```
[S1]undo stp priority
[S1]interface GigabitEthernet 0/0/9
[S1-GigabitEthernet0/0/9]undo stp cost
```

```
[S2]undo stp priority
```

Настройка RSTP и проверка конфигурации RSTP

```
[S1]stp mode rstp
```

```
[S2]stp mode rstp
```

Просмотр краткой информации о RSTP
Можно увидеть что текущий режим на самом деле является RSTP, а также информацию о дефолтных конфигурационных периодах

```
[S1]display stp
-------[CIST Global Info][Mode RSTP]-------
CIST Bridge          :32768.4c1f-cc03-2c9f
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-cc03-2c9f / 0
CIST RegRoot/IRPC    :32768.4c1f-cc03-2c9f / 0
CIST RootPortId      :0.0
BPDU-Protection      :Disabled
TC or TCN received   :163
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:4m:48s
Number of TC         :13
Last TC occurred     :GigabitEthernet0/0/9
<...>
```

```
[S2]display stp
-------[CIST Global Info][Mode RSTP]-------
CIST Bridge          :32768.4c1f-cc18-2885
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-cc03-2c9f / 20000
CIST RegRoot/IRPC    :32768.4c1f-cc18-2885 / 0
CIST RootPortId      :32.9
BPDU-Protection      :Disabled
TC or TCN received   :41
TC count per hello   :0
STP Converge Mode    :Normal
Time since last TC   :0 days 0h:6m:21s
Number of TC         :12
Last TC occurred     :GigabitEthernet0/0/9
<...>
```

Конфигурирование граничного порта

```
[S1]interface GigabitEthernet 0/0/1
[S1-GigabitEthernet0/0/1]undo shutdown
[S1-GigabitEthernet0/0/1]stp edged-port enable
```

```
[S2]interface GigabitEthernet 0/0/1
[S2-GigabitEthernet0/0/1]undo shutdown
[S2-GigabitEthernet0/0/1]stp edged-port enable
```

Настройка защиты BPDU

```
[S1]stp bpdu-protection
```

```
[S2]stp bpdu-protection
```

После настройки портов G0/0/1 на S1 и S2 показывает поддержку защиты BPDU

```
[S1]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      BPDU
   0    GigabitEthernet0/0/9        DESI  FORWARDING      NONE
   0    GigabitEthernet0/0/10       DESI  FORWARDING      NONE
```

```
[S2]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      BPDU
   0    GigabitEthernet0/0/9        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/10       ALTE  FORWARDING      NONE
```

Конфигурация защиты от петель

В данный момент интерфейсы G0/0/9 и G0/0/10 на коммутаторе S2 являются корневым и альтернативным соответственно. Настроим защиту от петель на обоих

```
[S2]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      BPDU
   0    GigabitEthernet0/0/9        ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/10       ALTE  FORWARDING      NONE
```

Настройка защиты от петель:

```
[S2]interface GigabitEthernet 0/0/9
```

```
[S2-GigabitEthernet0/0/9]stp loop-protection
[S2-GigabitEthernet0/0/9]quit
[S2]interface GigabitEthernet 0/0/10
[S2-GigabitEthernet0/0/10]stp loop-protection
```

```
[S2]display stp brief
 MSTID  Port                        Role  STP State
Protection
   0    GigabitEthernet0/0/1        DESI  FORWARDING      BPDU
   0    GigabitEthernet0/0/9        ROOT  FORWARDING      LOOP
   0    GigabitEthernet0/0/10       ALTE  DISCARDING      LOOP
```

Вывод

В ходе выполнения лабораторной работы были осознаны принципы протоколов stp и rstp, в их числе: принципы выбора корневого моста, блокирования избыточных каналов, типы состояния портов и их роли и основные отличия stp и rstp.