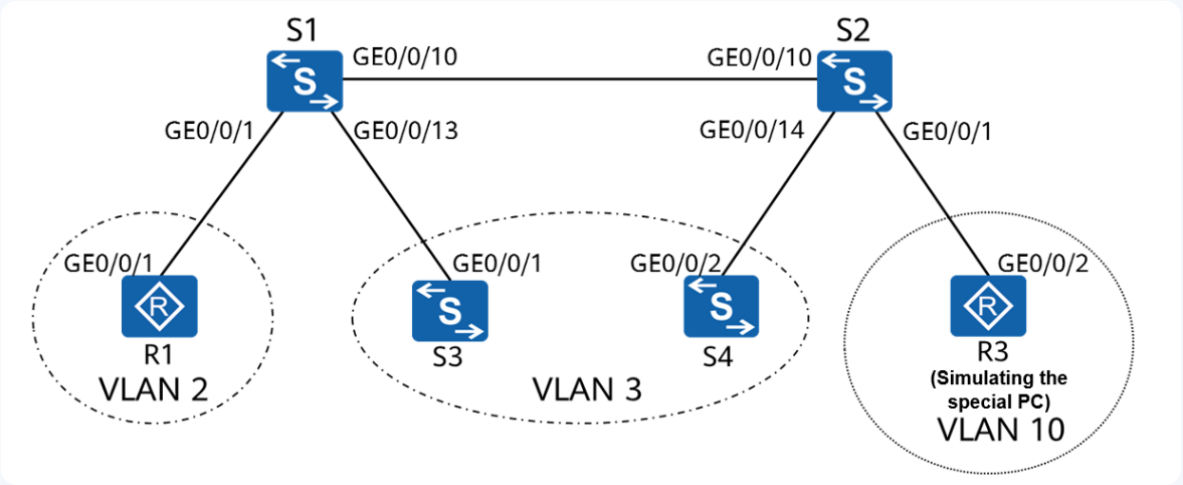
Lab3

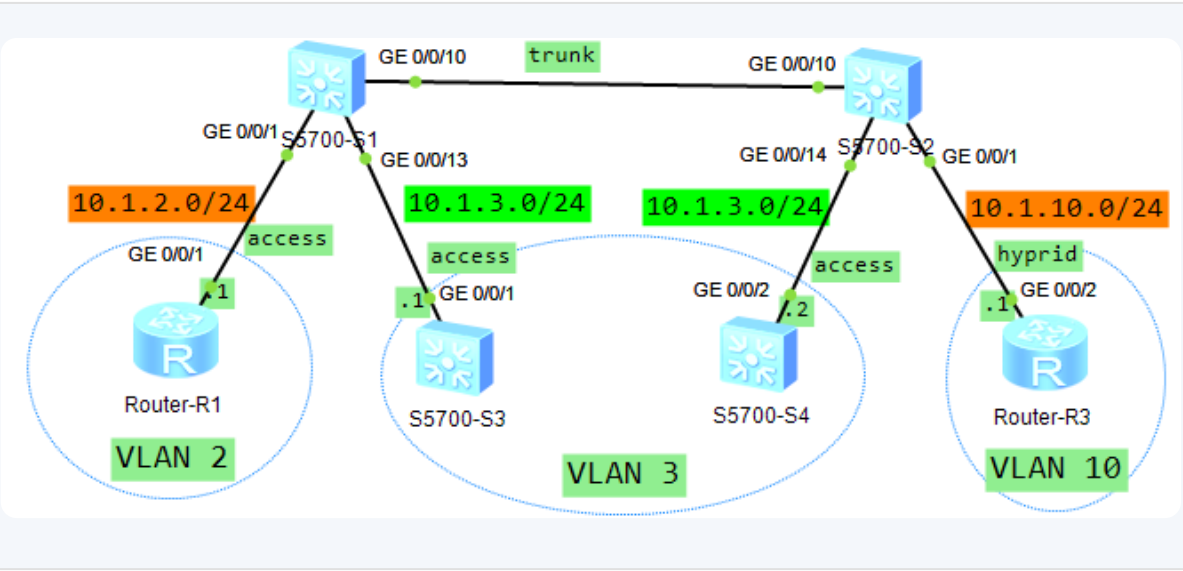
1 Lab3 Part1 Ethernet Basics and VLAN Configuration

1.1 In this lab

- Learn to set up VLANs on Huawei switches.
- Understand how to assign switch ports to VLANs as access, trunk, or hybrid.
- Configure VLAN membership either by port or MAC address.
- Review the MAC address table and VLAN configurations.

1.2 Topology





1.3 Step 1: Interface Shutdown

> Shut down unused interfaces for security purposes(By default all link is shutdown state).

1.4 Step 2: Configure Device IP Addresses

> Assign IP addresses to router and switch interfaces.

Device	Interface	IP Address	Mode
R1	GigabitEthernet0/0/1	10.1.2.1/24	Layer 3

Device	Interface	IP Address	Mode
R3	GigabitEthernet0/0/2	10.1.10.1/24	Layer 3
S3	GigabitEthernet0/0/1	10.1.3.1/24	Layer 3 (if supported)
S4	GigabitEthernet0/0/2	10.1.3.2/24	Layer 3 (if supported)

1.4.1 R1

```
[R1]interface GigabitEthernet0/0/1
[R1-GigabitEthernet0/0/1]ip address 10.1.2.1 24
```

1.4.2 R3

```
[R3]interface GigabitEthernet0/0/2
[R3-GigabitEthernet0/0/2]ip address 10.1.10.1 24
```

1.4.3 S3 & S4

1.4.3.1 For Scenario 1:

If S3 and S4 support Multi layer switching from Layer 2 interfaces to Layer 3:

```
[S3]interface GigabitEthernet0/0/1
[S3-GigabitEthernet0/0/1]undo portswitch
[S3-GigabitEthernet0/0/1]ip address 10.1.3.1
```

> Convert Switching from layer 2 to Layer 3 mode.

> This step for S3 and S4

1.4.3.2 For Scenario 2:

If S3 and S4 do not support Layer 3 mode:

```Markdown
[S3]vlan batch 3
[S3]interface GigabitEthernet0/0/1
[S3-GigabitEthernet0/0/1]port link-type access
[S3-GigabitEthernet0/0/1]port default vlan 3
[S3]interface Vlanif 3
[S3-Vlanif3]ip address 10.1.3.1 24
```

> Create VLAN and assign ports. Since the switch doesn't support l3 mode so ,you should assign ip with virtual interface `vlanif` since the switches in this topology act like end devices

> This step for S3 and S4

1.5 Step 3: Create VLANs on Switches S1 and S2

```Markdown
[S1]vlan batch 2 3 10
```

> It will be used in trunk port to allow particular vlan tag to be passed

> This step for S1 and S2

1.6 Step 4: Configure Port-Based VLANs

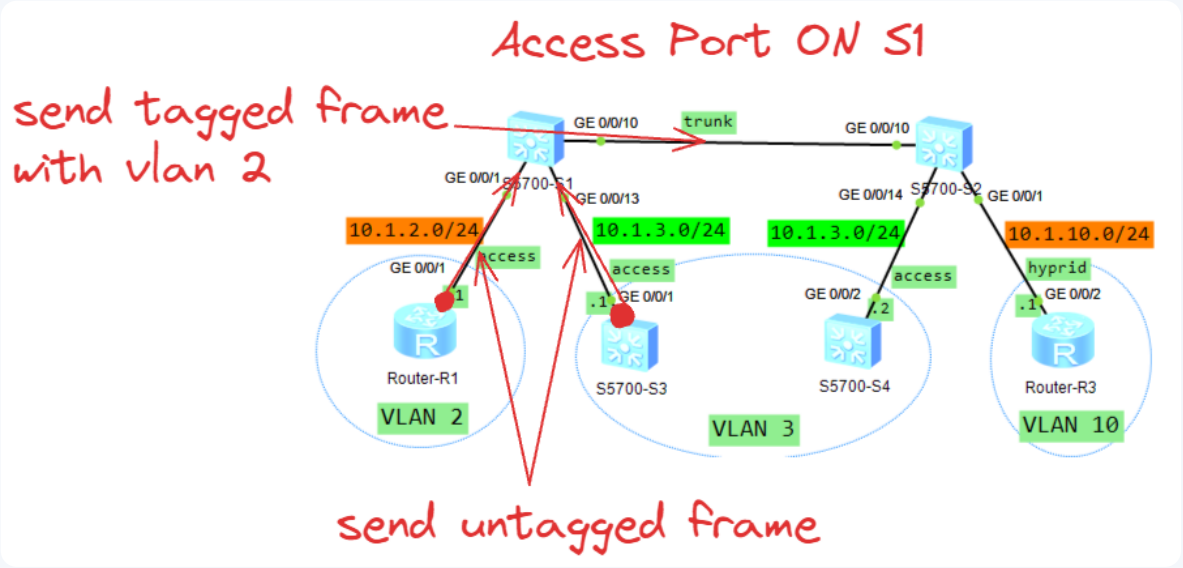
> Access ports are configured for end devices; trunk ports are configured between switches.

1.6.1 Access Ports Configuration:

1.6.1.1 S1

Markdown

```
[S1]interface GigabitEthernet0/0/1
[S1-GigabitEthernet0/0/1]port link-type access
[S1-GigabitEthernet0/0/1]port default vlan 2
[S1-GigabitEthernet0/0/1]int gig0/0/13
[S1-GigabitEthernet0/0/13]port link-type access
[S1-GigabitEthernet0/0/13]port default vlan 3
```



> Access port for end user since end user doesn't know how to read vlan frame so `port default vlan` is responsible to make it frame without vlan and vice visa

1.6.1.2 S2

Markdown

```
[S2]interface GigabitEthernet0/0/14
[S2-GigabitEthernet0/0/14]port link-type access
[S2-GigabitEthernet0/0/14]port default vlan 3
```

> Access port for end user since end user doesn't know how to read vlan frame so `port default vlan` is responsible to make it frame without vlan and vice visa

1.6.1.3 S3

Markdown

```
[S3]interface GigabitEthernet0/0/1
```

```
[S3-GigabitEthernet0/0/1]port link-type access
[S3-GigabitEthernet0/0/1]port default vlan 3
```

> Access port for end user since end user doesn't know how to read vlan frame so `port default vlan` is responsible to make it frame without vlan and vice visa

1.6.1.4 S4

Markdown

```
[S4]interface GigabitEthernet0/0/2
[S4-GigabitEthernet0/0/2]port link-type access
[S4-GigabitEthernet0/0/2]port default vlan 3
```

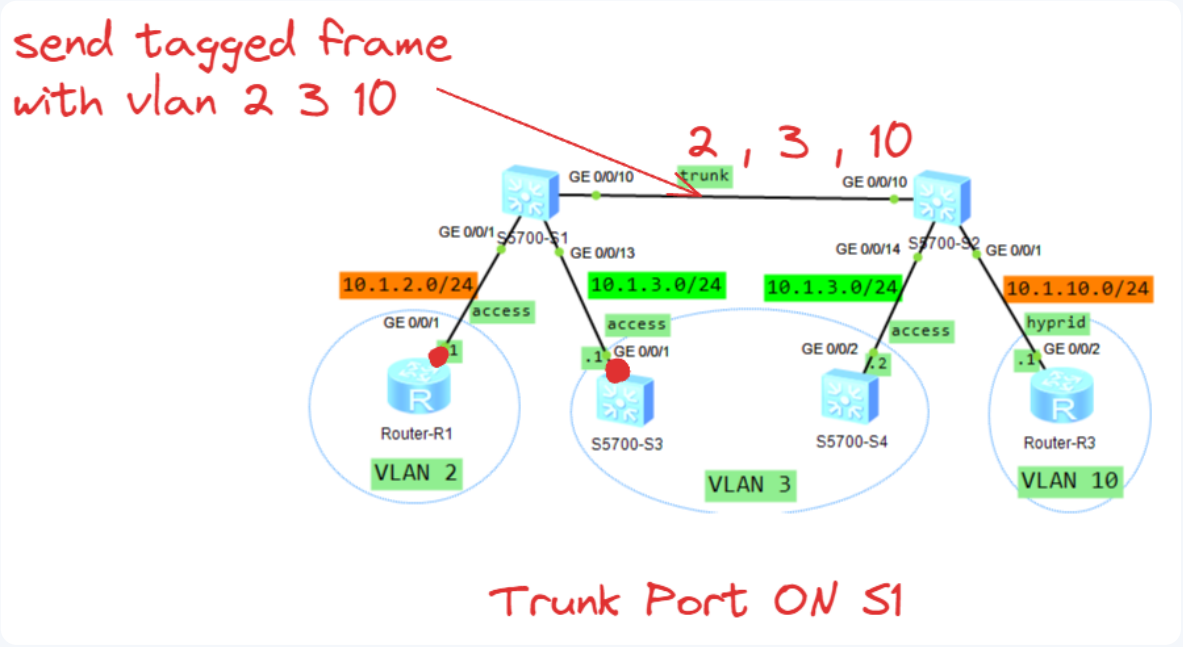
> Access port for end user since end user doesn't know how to read vlan frame so `port default vlan` is responsible to make it frame without vlan and vice visa

1.6.2 Trunk Ports Configuration:

1.6.2.1 S1

Markdown

```
[S1]interface GigabitEthernet0/0/10
[S1-GigabitEthernet0/0/10]port link-type trunk
[S1-GigabitEthernet0/0/10]port trunk allow-pass vlan 2
3 10
[S1-GigabitEthernet0/0/10]undo port trunk allow-pass
vlan 1
```



1.6.2.2 S2

Markdown

```
[S2]interface GigabitEthernet0/0/10
[S2-GigabitEthernet0/0/10]port link-type trunk
[S2-GigabitEthernet0/0/10]port trunk allow-pass vlan 2 3 10
[S2-GigabitEthernet0/0/10]undo port trunk allow-pass vlan 1
```

> On ports connecting switches to carry vlan frame

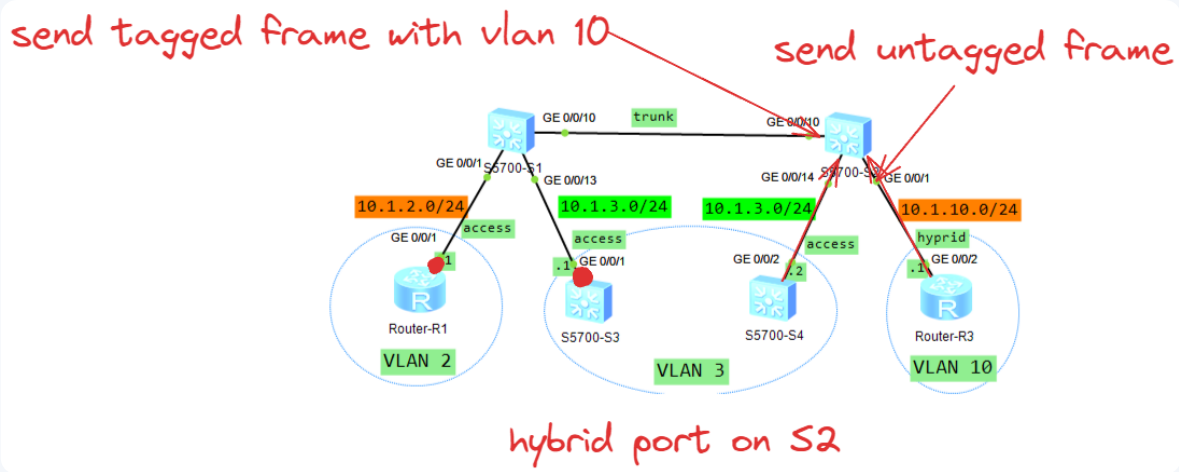
1.7 Step 5: Configure MAC Address-Based VLANs

> Associate specific MAC addresses with a particular VLAN regardless of their access port.

```
[S2] vlan 10
[S2-vlan10] mac-vlan mac-address 5489-9882-6ae2
```

Configure hybrid ports to accept untagged packets from MAC address-based VLANs:

```
[S2]interface GigabitEthernet0/0/1
[S2-GigabitEthernet0/0/1]port link-type hybrid
[S2-GigabitEthernet0/0/1]port hybrid untagged vlan 10
[S2-GigabitEthernet0/0/1]mac-vlan enable
```



1.8 Step 6: Display Configuration Information

1.8.1 Displaying VLAN Information:

```
[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)     GE0/0/9(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]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: GE0/0/1(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)
```

1.8.2 Display the MAC address-based VLAN

```
[S2]display mac-vlan vlan 10
--------------------------------------------------------------------------------
MAC Address       MASK              VLAN       Priority
--------------------------------------------------------------------------------
00e0-fc1c-47a7    ffff-ffff-ffff    10         0

Total MAC VLAN address count: 1
```

1.8.3 Check Connectivity

```
<S3>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=80 ms
    Reply from 10.1.3.2: bytes=56 Sequence=2 ttl=255 time=80 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=70 ms
    Reply from 10.1.3.2: bytes=56 Sequence=5 ttl=255 time=70 ms

  --- 10.1.3.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 70/76/80 ms
```

From S3 to S4 its reachable since they are in same vlans

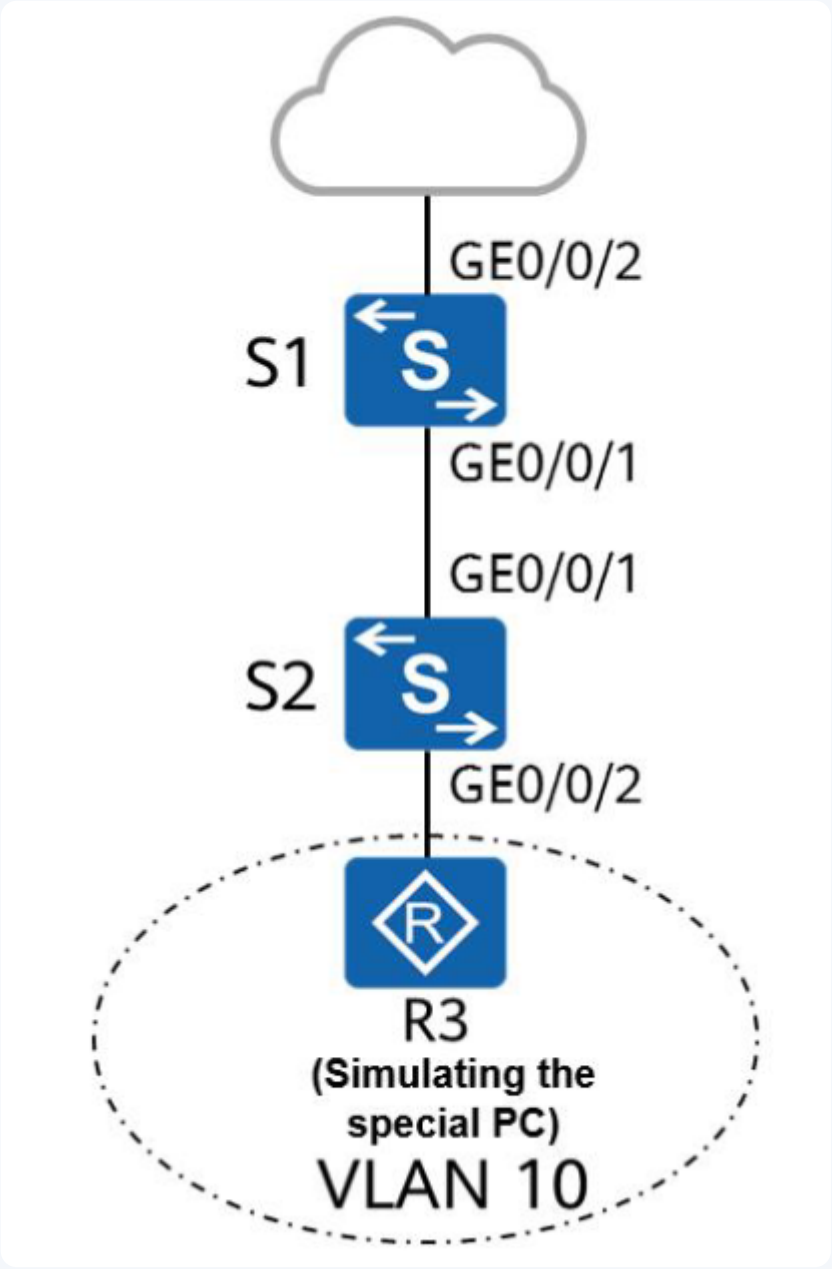
```
<R1>ping 10.1.3.1
  PING 10.1.3.1: 56  data bytes, press CTRL_C to break
    Request time out
    Request time out
    Request time out
    Request time out
    Request time out

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

From R1 to R3 its unreachable since they are in different vlans and there is no inter vlan routing

1.9 Quiz

Question1

As shown in the following figure, to ensure the information security of a special service, only some special PCs can access the network through VLAN How can this requirement be implemented on S1



✓ Answer1

- Create a VLAN for PCs with special needs
- Associate the MAC addresses of the PCs with VLAN
- Assign interfaces to VLANs to implement Layer 2 forwardi

Markdown

```
[S1]vlan 10
[S1-vlan10]mac-vlan mac-address 00e0-fc1c-47a7
[S1-vlan10]interface gigabitethernet 0/0/1
[S1-GigabitEthernet0/0/1]mac-vlan enable
```

```
[S1-GigabitEthernet0/0/1]interface gigabitethernet 0/0/1
[S1-GigabitEthernet0/0/1]port link-type hybrid
[S1-GigabitEthernet0/0/1]port hybrid untagged vlan 10
[S1-GigabitEthernet0/0/1]interface gigabitethernet 0/0/2
[S1-GigabitEthernet0/0/2]port link-type trunk
[S1-GigabitEthernet0/0/2]port trunk allow-pass vlan 10
```

- Create VLANs.
- Associate the MAC address of the PC with VLAN 10
- Enable MAC address-based VLAN assignmen
- Configure GE0/0/1 connected to S2 as a hybrid port to allow data frames of the corresponding VLAN to pass through in untagged mode.
- Configure GE0/0/2 connected to the enterprise network to transparently transmit packets from the VLANs associated with MAC address.

2 Lab3 Part2 Spanning Tree

2.1 Spanning Tree Protocol (STP) Overview

STP is a network protocol that ensures a loop-free topology for Ethernet networks. The protocol allows redundant links in a network to prevent complete network failure if an active link fails, without the danger of bridge loops.

Upon completing this task, you will know how to:

- Toggle STP/RSTP on and off
- Switch between STP modes on a switch

- Set bridge priorities for root bridge selection
- Adjust port priorities to influence root and designated port choices
- Modify port costs affecting root and designated port selection
- Configure ports as edge ports
- Enable or disable RSTP specifically

A company aims to enhance network reliability by adding redundant links in its Layer 2 network while using STP to avoid loops that lead to broadcast storms and MAC address instability.

2.2 Lab Steps

2.2.1 Step 1: enable stp and set it to stp

Markdown

```
[S1]stp enable
[S1]stp mode stp
```

> Enable stp and set the mode to stp. Default is MSTP

> Re-enter same commands for S2 & S3 & S4

2.2.1.1 Display stp

```
[S1]display stp
-------[CIST Global Info][Mode STP]-------
CIST Bridge          :32768.4c1f-cc33-7359                //Bridge ID of the device.
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-cc10-5913 / 20000        //ID and path cost of the current root
bridge.
```

[S1]display 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	ROOT	FORWARDING	NONE

[S2]display stp brief

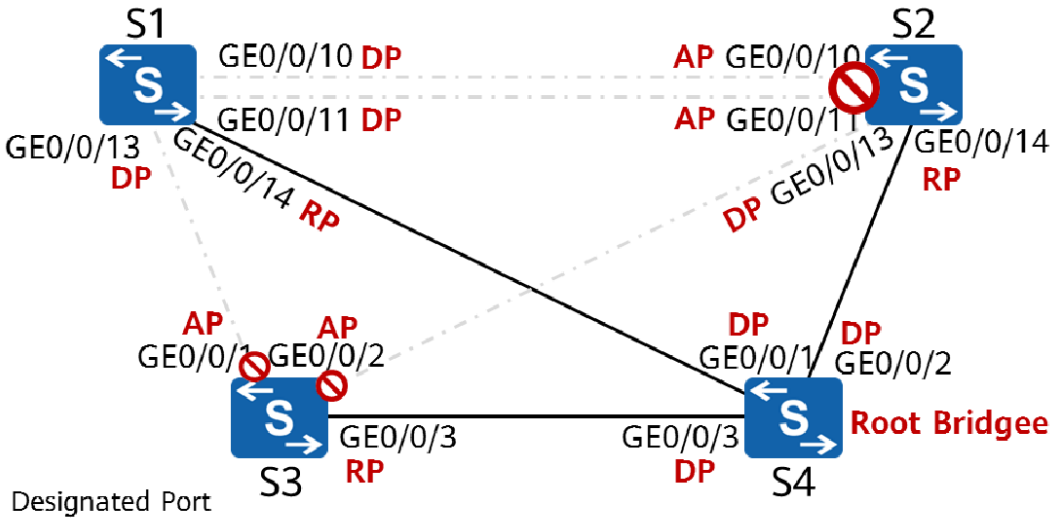
MSTID	Port	Role	STP State	Protection
0	GigabitEthernet0/0/10	ALTE	DISCARDING	NONE
0	GigabitEthernet0/0/11	ALTE	DISCARDING	NONE
0	GigabitEthernet0/0/13	DESI	FORWARDING	NONE
0	GigabitEthernet0/0/14	ROOT	FORWARDING	NONE

[S3]display stp brief

MSTID	Port	Role	STP State	Protection
0	GigabitEthernet0/0/1	ALTE	DISCARDING	NONE
0	GigabitEthernet0/0/2	ALTE	DISCARDING	NONE
0	GigabitEthernet0/0/3	ROOT	FORWARDING	NONE

[S4]display stp brief

MSTID	Port	Role	STP State	Protection
0	GigabitEthernet0/0/1	DESI	FORWARDING	NONE
0	GigabitEthernet0/0/2	DESI	FORWARDING	NONE
0	GigabitEthernet0/0/3	DESI	FORWARDING	NONE



2.2.2 Step 2: Configuring Root Bridges

Change bridge priorities on S1 and S2 to make S1 the primary root bridge and S2 the secondary root bridge:

```Markdown
[S1] stp root primary
[S2] stp root secondary
```

> Make S1 the primary root bridge with highest priority (0)

> Make S2 secondary with second-highest priority (4096)

2.2.3 Step 3: Modifying Root Ports

To modify a specific interface's cost:

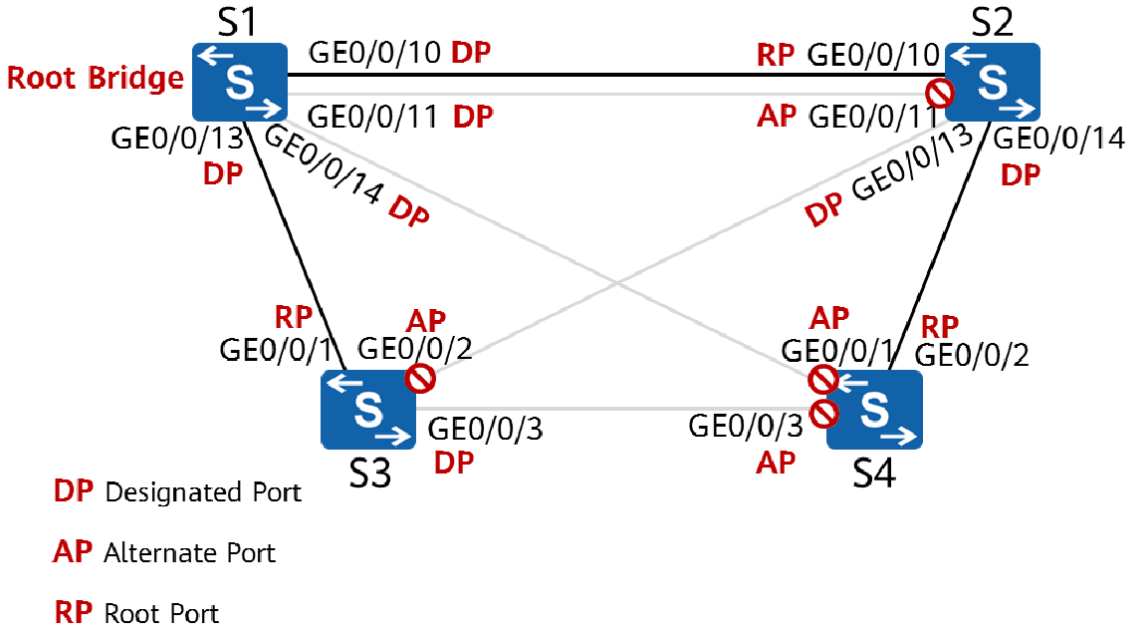
```Markdown
[S4]interface GigabitEthernet0/0/1
[S4-GigabitEthernet0/0/1]stp cost 50000
```

> Modify STP path cost; higher cost will change role to ALTE/DISCARDING state

[S4]display 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

Was Previous the Gig0/0/1 Root and the Cost is 20000 and then we change it to 50000 so other port is cost 20000+20000 =40000 so the election for root port is elect gig0/0/2



2.2.4 Step 4: Switching to RSTP Mode

Change all devices from STP to RSTP mode:

Markdown

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

Apply it for S2 & S3 S4

```
[S1]display stp
-------[CIST Global Info][Mode RSTP]-------
CIST Bridge             :0      .4c1f-cc33-7359
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-cc33-7359 / 0
CIST RegRoot/IRPC       :0      .4c1f-cc33-7359 / 0
CIST RootPortId         :0.0
BPDU-Protection         :Disabled
CIST Root Type          :Primary root
TC or TCN received      :89
TC count per hello      :0
```

2.2.5 Step 5: Configuring Edge Ports

Configure interfaces connected only to terminals as edge ports:

```Markdown
[S3]port-group group-member gigabitethernet 0/0/10 to gigabitethernet 0/0/20
[S3-port-group]stp edged-port enable
```

> Select multiple interfaces in range on S3

2.2.6 Configure loop protection

```Markdown
[S3]interface gigabitethernet0/0/1
[S3]stp loop-protection
```

> prevent Layer 2 forwarding loops and broadcast radiation in a network by blocking redundant paths that could cause a loop if a port incorrectly transitions into forwarding state.

2.2.7 bpdu-protection

Markdown

```
[S3]stp bpdu-protection
```

> BPDU protection enhances network stability by disabling ports that receive unexpected Bridge Protocol Data Units (BPDUs), preventing potential malicious or accidental topology changes.

2.3 Verification Tasks

- Verify which switch is designated as the root bridge and roles of ports after convergence.
- Test redundancy by disabling an active link and checking traffic rerouting through backup links.

```
<S4>dis stp bri
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/1        ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/3        ROOT  FORWARDING      NONE
```

> After Shutdown interface gig0/0/2 the interface gig0/0/3 goes up

2.4 Quiz Questions

Consider these questions based on lab activities:

Question1

In step 3, if the cost of GigabitEthernet 0/0/14 on S1 is changed to 50000, can the desired result be achieved? Why?

Answer1

it will not change anything since the S1 is bridge and all port is designated

Quesion2

In the current topology, modify the configuration to make GigabitEthernet0/0/11 of S2 the root port.

Markdown

```
[S3]interface gig0/0/10
[S3-GigabitEthernet0/0/10]stp cost 60000
[S3-GigabitEthernet0/0/10]interface gig0/0/13
[S3-GigabitEthernet0/0/13]stp cost 60000
```

Answer2

> Change the cost of other interface and make it bigger to make interface gig0/0/11 more preferer over other interfaces

```
[S2-GigabitEthernet0/0/13]dis stp bri
 MSTID  Port                        Role  STP State     Protection
   0    GigabitEthernet0/0/10       ALTE  DISCARDING      NONE
   0    GigabitEthernet0/0/11       ROOT  FORWARDING      NONE
   0    GigabitEthernet0/0/13       DESI  FORWARDING      NONE
```

Question3

Can the two links between S1 and S2 be in the forwarding state at the same time? Why?

Answer3

Not possible since the broadcast between S1 and S2 if all port is enable it will cause loop storm so at least it should one port is disable

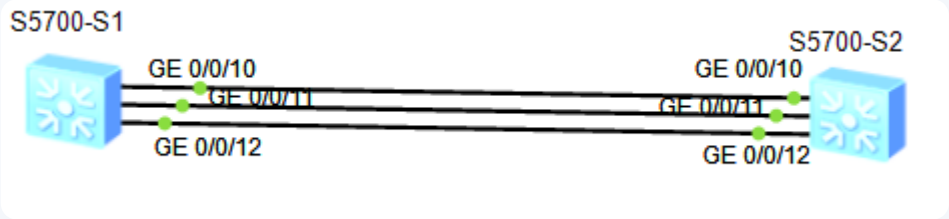
3 Lab3 Part3 Ethernet Link Aggregation

3.1 Overview of Link Aggregation

Link aggregation allows multiple network connections to be combined to increase throughput beyond what a single connection could sustain, or to provide redundancy in case one link fails.

3.2 Configuration Roadmap

1. **Manual Link Aggregation**
2. **LACP Mode Configuration**
3. **Active Link Determination**
4. **Load Balancing Mode Change**



3.3 Manual Link Aggregation

Step 1: Create an Eth-Trunk and set the mode to manual load balancing.

Markdown

```
[S1]interface Eth-Trunk 1
[S1-Eth-Trunk1]mode manual load-balance
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/10
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/11
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/12
```

This configuration for S1 and S2

Create Eth-Trunk 1

Set mode to manual (optional here because it's default)

Add ports to Eth-Trunk

3.3.1 Display Eth-trunk status

```
[S1]display 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: 32
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
```

3.3.2 Important Points for Manual Aggregation

- Max of 8 member ports per Eth-Trunk.
- Cannot add an Eth-Trunk into another.
- Each Ethernet port can only belong to one Eth-Trunk.
- Match number of physical ports, port rate, and duplex mode on both ends.

> All links are active and forward data.

3.4 LACP Mode Configuration

> **Step 2:** Configure link aggregation using the LACP protocol.

Markdown

```
[S1]interface eth-trunk 1
[S1-Eth-Trunk1]undo trunkport gigabitethernet 0/0/10
[S1-Eth-Trunk1]undo trunkport gigabitethernet 0/0/11
[S1-Eth-Trunk1]undo trunkport gigabitethernet 0/0/12
[S1-Eth-Trunk1]mode lacp-static
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/10
```

```
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/11
[S1-Eth-Trunk1]trunkport gigabitethernet 0/0/12
```

> Remove member ports from the current trunk (if any) since you cant change mode if there is member ports

> Change working mode to LACP

> Re-add the ports under LACP mode

3.4.1 Display Eth-trunk status

```
[S1]display 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-cc33-7359
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-ccc1-4a02  32768   11     305     10111100
GigabitEthernet0/0/11   32768     4c1f-ccc1-4a02  32768   12     305     10111100
GigabitEthernet0/0/12   32768     4c1f-ccc1-4a02  32768   13     305     10111100
```

3.4.2 Actor Selection in LACP

Priority is given based on system priority (lower is better) or by MAC address if there's a tie.

3.5 Active Link Determination

> **Step 3:** Modify parameters such as priority and thresholds for active links.

```Markdown
[S1]lacp priority 100
[S1]interface gigabitethernet0/0/10
[S1-gigabitethernet0/0/10]lacp priority 40000
```

> Set system LACP priority (lower is higher priority) to act like the Actor to initiate the election for LACP

> Port priority lower value mean more preferable so elect for port as active

3.5.1 preemption

```Markdown
[S1-Eth-Trunk1]lacp preempt enable
```

> In LACP mode, the system replaces a failed active link with the highest-priority backup link and, if preemption is enabled a recovered higher-priority link can regain active status; preemption is disabled by default.

3.5.2 Thresholds for Active Ports

Specify lower and upper threshold for active links:

```
[S1-Eth-Trunk1]least active-linknumber 2
[S1-Eth-Trunk1]max active-linknumber 2
```

> The threshold is at least 2 and maximum is 2 if there is 1 port then the eth-trunk will go off and if there is 3 port one of the port will act as backup based of port priority

3.5.2.1 Display Eth-trunk status

```
[S1]display 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-cc33-7359
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
```

> In this case the GigabitEthernet0/0/10 is unselected since the eth-trunk is set to max active port is 2 and eth-trunk elect them based on their priority port low mean preferable so eth-trunk elect GigabitEthernet0/0/11 & GigabitEthernet0/0/12 since their priority is blow than GigabitEthernet0/0/10

Shut down GigabitEthernet0/0/12 to simulate a link

```
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-cc33-7359
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-ccc1-4a02  32768   11      305       10111100
GigabitEthernet0/0/11   32768      4c1f-ccc1-4a02  32768   12      305       10111100
GigabitEthernet0/0/12   0          0000-0000-0000  0       0       0         10100011
GigabitEthernet 0/0/10 has become active.
```

In this case after GigabitEthernet0/0/12 go down the GigabitEthernet0/0/10 will go up since its act as backup

Shut down GigabitEthernet 0/0/11 & 0/0/12 to simulate a link

```
[S1]display 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-cc33-7359
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:
--------------------------------------------------------------------------------
```

Since the least port is set to 2 and in this case is only one port is working so the eth-trunk will go off

3.6 Load Balancing Mode Change

> **Step 4:** Adjust how traffic is distributed across the aggregated links based on criteria like source or destination IP addresses.

Markdown

```
[S1-Eth-Trunk1]load-balance dst-ip
```

> Set load balancing mode based on destination IP

3.6.1 Load Balancing Considerations

Load balancing affects only outgoing traffic; modes can differ between endpoints.

3.7 Quiz Question

Question1

What are the requirements for setting `least active-linknumber` and `max active-linknumber` values?

Answer1

Answer: Both values define thresholds that control the minimum and maximum number of active links allowed before an Eth-Trunks state changes. Setting these helps ensure stability and bandwidth requirements are met according to network design considerations.

4 Lab3 Part4 Inter-VLAN Communication

4.1 Introduction

VLANs are used to segment network traffic at Layer 2, creating separate broadcast domains. To enable communication between VLANs, Huawei routers can employ two primary technologies:

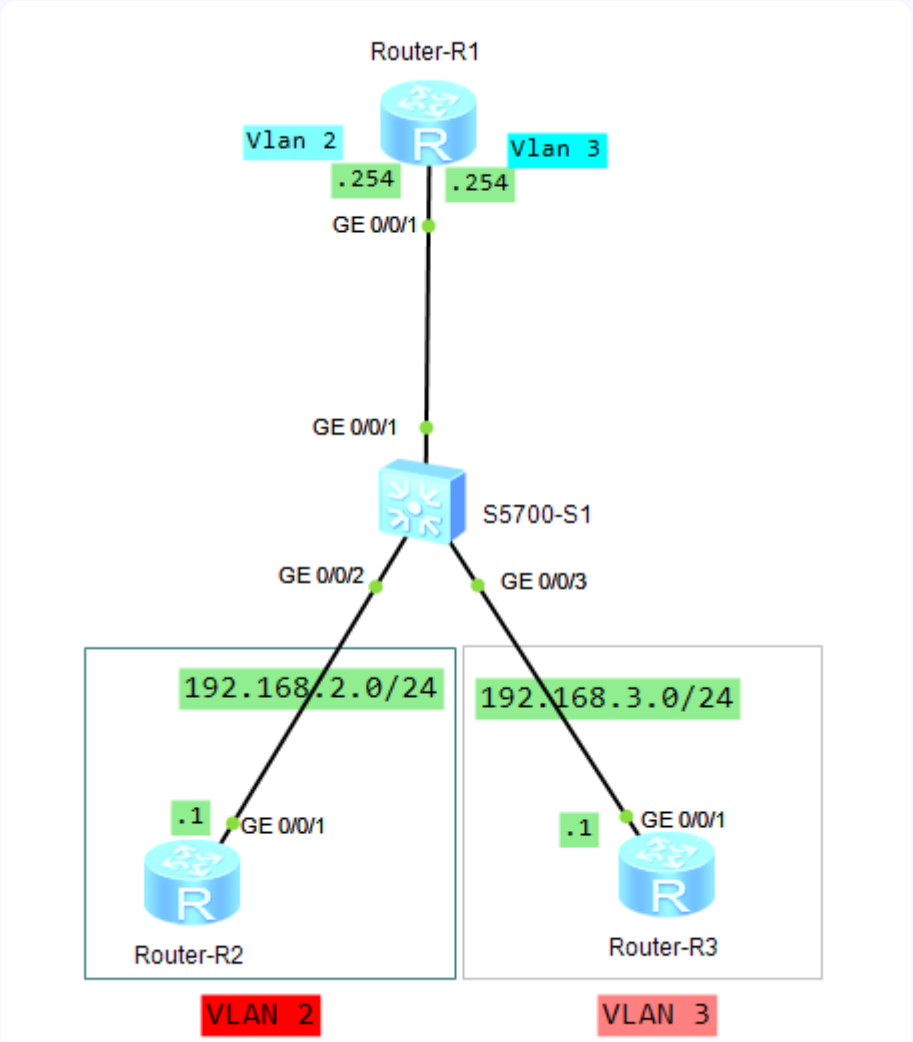
1. **Dot1q Termination Subinterfaces**
    - Layer 3 logical interfaces that allow a single physical interface to route traffic for multiple VLANs.
2. **VLANIF Interfaces**
    - Also Layer 3 logical interfaces, these are associated with specific VLANs and route traffic accordingly.

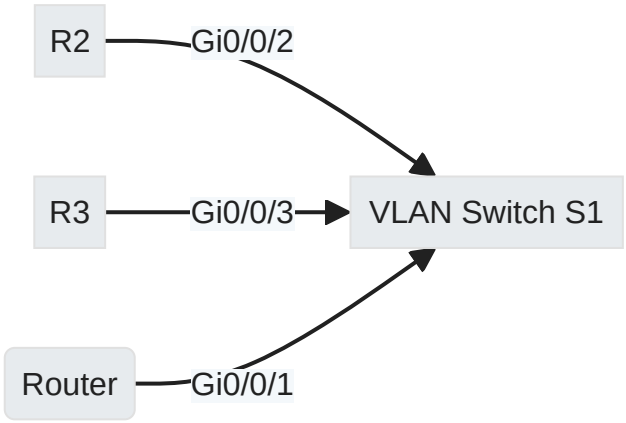
4.2 Objectives

- Understand how to configure both Dot1q termination subinterfaces and VLANIF interfaces for inter-VLAN communication.
- Grasp the forwarding process that enables devices in different VLANs to communicate.

4.3 Networking Topology

- Devices R2 and R3 are in separate VLANs and need to communicate through a router or switch using the aforementioned technologies.





Device	Interface	Description	IP Address
S1	Vlanif2	Gateway for VLAN 2	`192.168.2.254`
S1	Vlanif3	Gateway for VLAN 3	`192.168.3.254`
R2	G0/0/1	Device in VLAN 2	`192.168.2.1`
R3	G0/0/1	Device in VLAN 3	`192.168.3.1`
R1	G0/0/1	Sub interface Gateway for	`192.168.2.254`

Device	Interface	Description	IP Address
		VLAN 2	
R1	G0/0/1	Sub interface Gateway for VLAN 3	`192.168.3.254`

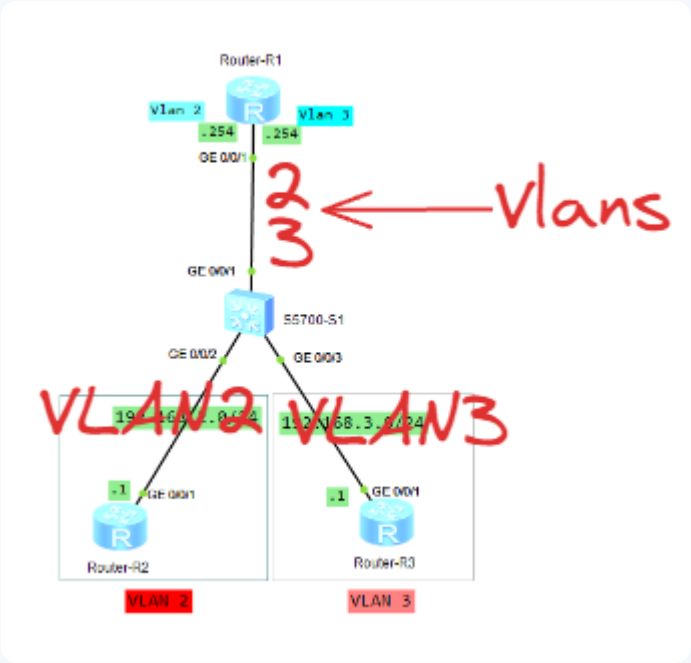
4.4 Configuration Steps

4.4.1 Basic Configuration

> Assign devices to appropriate VLANs on switch S1.

Markdown

```
[R1]vlan batch 2 3
[R1]interface GigabitEthernet0/0/2
[R1-GigabitEthernet0/0/2]port link-type access
[R1-GigabitEthernet0/0/2]port default vlan 2
[R1-GigabitEthernet0/0/2]interface GigabitEthernet0/0/3
[R1-GigabitEthernet0/0/3]port link-type access
[R1-GigabitEthernet0/0/3]port default vlan 3
[R1-GigabitEthernet0/0/3]interface GigabitEthernet0/0/1
[R1-GigabitEthernet0/0/1]port link-type trunk
[R1-GigabitEthernet0/0/1]port trunk allow-pass vlan 2 3
[R1-GigabitEthernet0/0/1]undo port trunk allow-pass
vlan 1
```



Create Vlan

Assign port for interfaces (Acess and Trunk) access for end device and trunk for carry vlan frames

4.4.1.1 Assign Ip address

4.4.1.1.1 R2

Markdown

```
[R2]interface GigabitEthernet0/0/1
[R2-GigabitEthernet0/0/1]ip address 192.168.2.1 24
```

In this topology R2 is act as end deive

4.4.1.1.2 R3

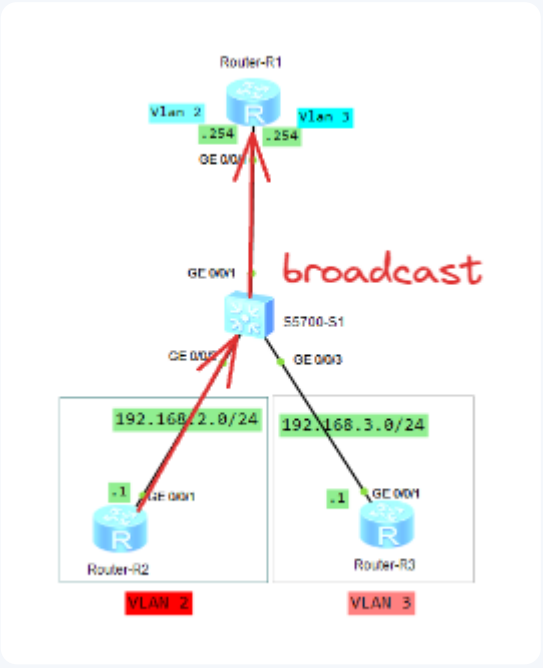
```
[R3]interface GigabitEthernet0/0/1
[R3-GigabitEthernet0/0/1]ip address 192.168.3.1 24
```

In this topology R3 is act as end deive

4.4.1.2 Configure Default Static Route

4.4.1.2.1 R2

```
[R2]ip route-static 0.0.0.0 0 192.168.2.254
```



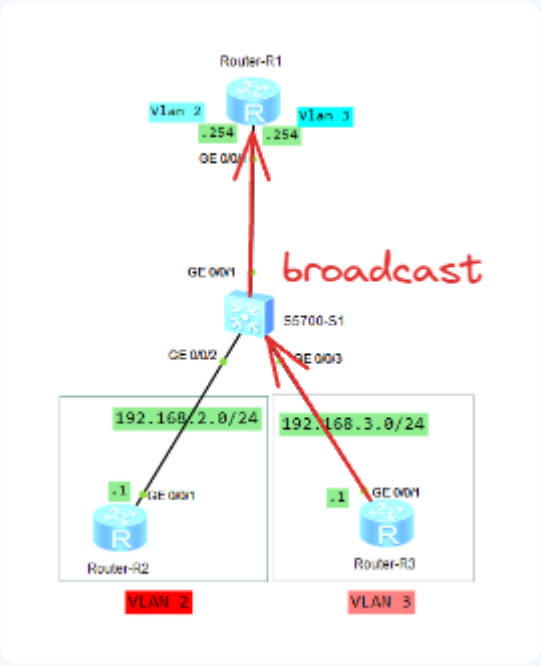
Configure a default route (equivalent to a gateway) for the device since the router is acted as end device

This default static route used for connectivity between different range of ip if like R2 ping R3 (pinging `192.168.2.1` to `192.168.3.1`) so its required router to know the route for `192.168.3.1` so the default router will forward it to its gateway and if its in same broadcast domain like pinging `192.168.2.1` to `192.168.2.254` it will not required for routing since its in same ip domain so the router have routing table with direct route

4.4.1.2.2 R3

Markdown

```
[R3]ip route-static 0.0.0.0 0 192.168.3.254
```



Configure a default route (equivalent to a gateway) for the device since the router is acted as end device

This default static route used for connectivity between different range of ip if like R2 ping R3 (pinging `192.168.2.1` to `192.168.3.1`) so its required router to know the route for `192.168.3.1` so the default router

> will forward it to its gateway and if its in same broadcast domain like pinging `192.168.2.1` to `192.168.2.254` it will not required for routing since its in same ip domain so the router have routing table with direct route

4.4.2 Dot1q Termination Subinterfaces

> Configure subinterfaces on the router for each VLAN.

Markdown

```
[R1]interface GigabitEthernet0/0/1.2
[R1-GigabitEthernet0/0/1.2]dot1q termination vid 2
[R1-GigabitEthernet0/0/1.2]ip add 192.168.2.254 24
[R1-GigabitEthernet0/0/1.2]arp broadcast enable
[R1-GigabitEthernet0/0/1.2]int gig0/0/1.3
[R1-GigabitEthernet0/0/1.3]dot1q termination vid 3
[R1-GigabitEthernet0/0/1.3]ip add 192.168.3.254 24
[R1-GigabitEthernet0/0/1.3]arp broadcast enable
```

> Create subinterface for vlans

> It is recommended that the subinterface number be the same as the VLAN for simplicity for configuration and management

> The idea of `dot1q termination vid` is for receive tagged frame and remove the tag header to process it for routing process then before forward it to next destination re tagged with same `vid` to receive it and forward it for end device

> Subinterfaces for VLAN tag termination cannot forward broadcast packets

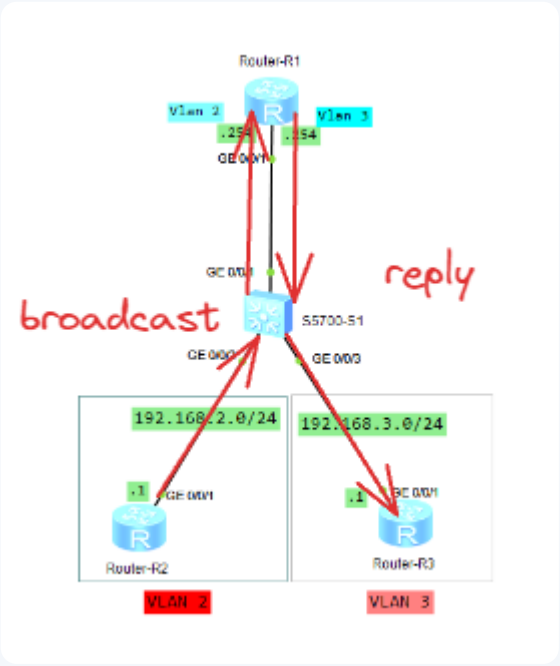
and automatically discard them upon receiving

By default, this function is enabled on some devices

4.4.2.1 Display connectivity Between Vlans

```
<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=60 ms
    Reply from 192.168.3.1: bytes=56 Sequence=2 ttl=254 time=40 ms
    Reply from 192.168.3.1: bytes=56 Sequence=3 ttl=254 time=110 ms
    Reply from 192.168.3.1: bytes=56 Sequence=4 ttl=254 time=70 ms
    Reply from 192.168.3.1: bytes=56 Sequence=5 ttl=254 time=100 ms

  --- 192.168.3.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 40/76/110 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 30 ms  50 ms  50 ms

 2 192.168.3.1 70 ms  60 ms  60 ms
VLAN 2 and VLAN 3 can communicate with each other.
```

Tracert:



Test the connectivity between VLANS (2,3)

4.4.3 VLANIF Interface Configuration

For undo the configuration for port links undo `trunk` and `access`

4.4.3.1 Access

Markdown

```
[S]interface gigabitethernet0/0/1
[S1-GigabitEthernet0/0/1]undo port default vlan
```

4.4.3.2 Trunk

```
[S1]interface gigabitethernet0/0/1
[S1-GigabitEthernet0/0/1]undo port trunk pvid vlan
[S1-GigabitEthernet0/0/1]undo port trunk allow-pass vlan all
[S1-GigabitEthernet0/0/1]port trunk allow-pass vlan 1
```

4.4.3.3 Hybrid

```
[S1]interface gigabitethernet0/0/1
[S1-GigabitEthernet0/0/1]undo port hybrid pvid vlan
[S1-GigabitEthernet0/0/1]undo port hybrid vlan all
[S1-GigabitEthernet0/0/1]port hybrid untagged vlan 1
```

> Instead of subinterfaces, configure a single interface on the switch for each VLAN.

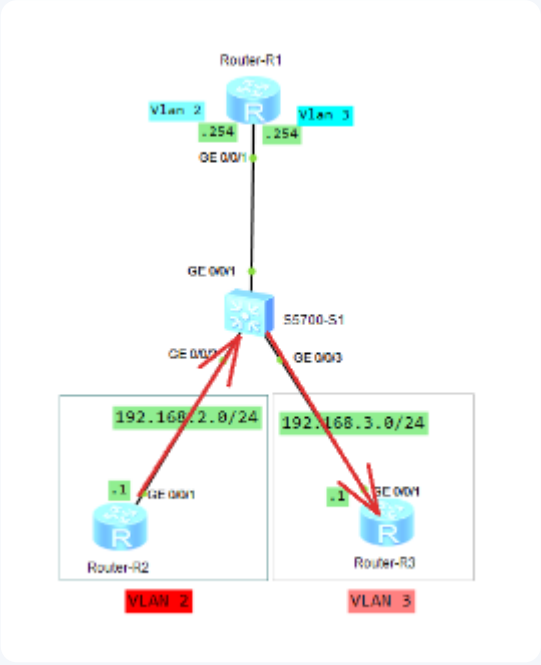
```
[S1]interface vlanif 2
[S1-Vlanif2]ip address 192.168.2.254 24
[S1-Vlanif2]int vlanif 3
[S1-Vlanif3]ip address 192.168.3.254 24
```

4.4.3.4 Display connectivity Between Vlans

```
<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=100 ms
    Reply from 192.168.3.1: bytes=56 Sequence=2 ttl=254 time=50 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=60 ms
    Reply from 192.168.3.1: bytes=56 Sequence=5 ttl=254 time=70 ms
  --- 192.168.3.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 50/66/100 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 40 ms  30 ms  20 ms

 2 192.168.3.1 40 ms  30 ms  40 ms
```

VLAN 2 and VLAN 3 can communicate with each other.

Tracert:



Test the connectivity between VLANS (2,3)

4.5 Quiz Questions

Question1

If R2 needs to access the network connected to R1, what configuration needs to be performed on S1?

Answer1

Configure the appropriate inter-VLAN routing method (either Dot1Q termination or a VLANIF interface) with correct addressing and routing rules so that packets from R2 can be forwarded to the correct destination through R1.

Question2

As a Layer 3 interface, when will a VLANIF interface go up?

Answer2

A VLANIF interface will go up when it has been assigned an IP address and is associated with an existing active (up/up) physical port that is a member of the corresponding VLAN.