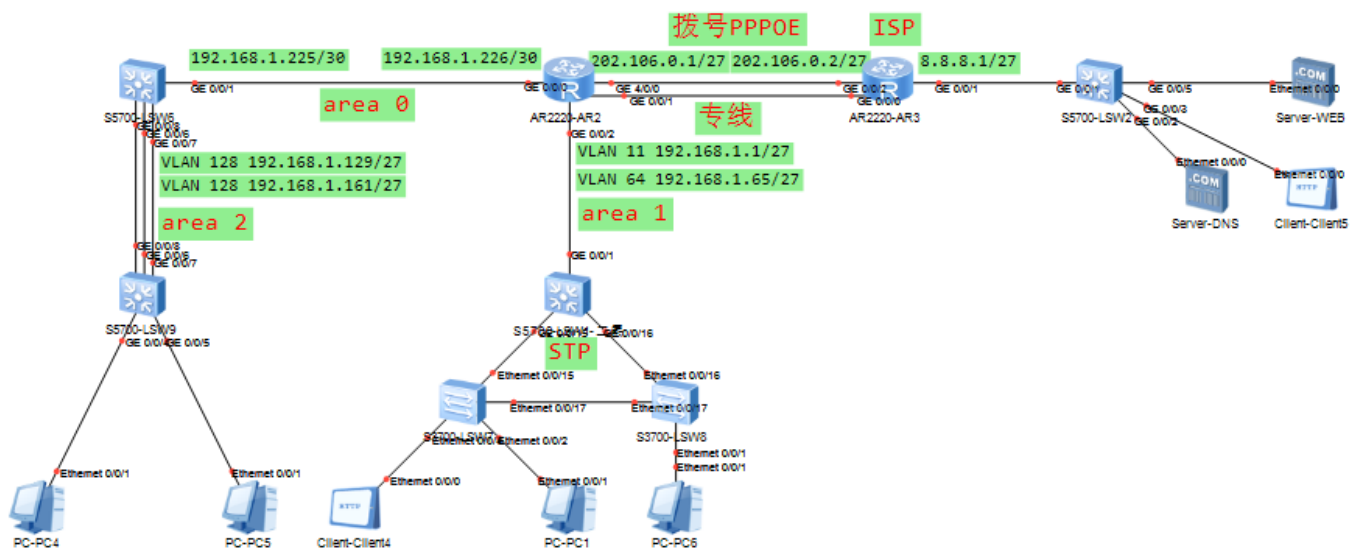


部署某企业小型局域网内网网络环境

一、项目拓扑



二、项目需求:

1、地址规划:

1.1、用 192.168.1.0/24 划分子网为 8 个网段; 使用 4 个网段, 保留 4 个网段;

部门	网络位	广播位	有效主机范围	网关地址
1	192.168.1.0/27	192.168.1.31/27	192.168.1.1-30/27	192.168.1.1/27
2	192.168.1.32/27	192.168.1.63/27	192.168.1.33-62/27	192.168.1.33/27
3	192.168.1.64/27	192.168.1.95/27	192.168.1.65-94/27	192.168.1.65/27
4	192.168.1.96/27	192.168.1.127/27	192.168.1.97-126/27	192.168.1.97/27
5	192.168.1.128/27	192.168.1.159/27	192.168.1.127-158/27	192.168.1.129/27
6	192.168.1.160/27	192.168.1.191/27	192.168.1.159-190/27	192.168.1.161/27
7	192.168.1.192/27	192.168.1.223/27	192.168.1.193-222/27	192.168.1.193/27
8	192.168.1.224/27	192.168.1.255/27	192.168.1.225-254/27	192.168.1.225/27

1.2、在保留 4 个网段中，最后一个，再划分 8 个子网段，用户设备互联使用。

网络	网络位	广播位	有效主机范围	设备名称	接口编号	IP 地址
1	192.168.1.224/30	192.168.1.227/30	192.168.1.225-226/30			
2	192.168.1.228/30	192.168.1.231/30	192.168.1.229-230/30			
3	192.168.1.232/30	192.168.1.235/30	192.168.1.233-234/30			
4	192.168.1.236/30	192.168.1.239/30	192.168.1.237-238/30			
5	192.168.1.240/30	192.168.1.243/30	192.168.1.241-242/30			
6	192.168.1.244/30	192.168.1.247/30	192.168.1.245-246/30			
7	192.168.1.248/30	192.168.1.251/30	192.168.1.249-250/30			
8	192.168.1.252/30	192.168.1.255/27	192.168.1.253-254/30			

1.3、查看 2 台设备 LSW6 和 AR2 地址配置，display ip interface brief

LSW6

LSW6

```
[YMSW6]dis ip int b
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 5
The number of interface that is DOWN in Physical is 1
The number of interface that is UP in Protocol is 4
The number of interface that is DOWN in Protocol is 2

Interface                IP Address/Mask      Physical  Protocol
MEth0/0/1                unassigned           down      down
NULL0                    unassigned           up        up(s)
Vlanif1                  unassigned           up        down
Vlanif10                 192.168.1.225/30     up        up
Vlanif128                192.168.1.129/27    up        up
Vlanif160                192.168.1.161/27    up        up
```

```
AR2
LSW6  AR2
[YMMAR2]dis ip int b
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 8
The number of interface that is DOWN in Physical is 0
The number of interface that is UP in Protocol is 6
The number of interface that is DOWN in Protocol is 2

Interface                IP Address/Mask      Physical  Protocol
Dialer1                  202.106.1.254/32     up        up(s)
GigabitEthernet0/0/0     192.168.1.226/30     up        up
GigabitEthernet0/0/1     202.106.0.1/27       up        up
GigabitEthernet0/0/2     unassigned           up        down
GigabitEthernet0/0/2.11  192.168.1.1/27       up        up
GigabitEthernet0/0/2.64  192.168.1.65/27      up        up
GigabitEthernet4/0/0     unassigned           up        down
```

2、STP 和单臂实现 VLAN 间通

2.1、AR2 使用单臂路由，为 VLAN 11 和 VLAN 64 创建子接口；g0/0/2.11 和 G0/0/2.64 子接口。

```
AR2
LSW6  LSW9  AR2
[YMMAR2-GigabitEthernet0/0/2.64]q
[YMMAR2]display ip interface brief
*down: administratively down
^down: standby
(l): loopback
(s): spoofing
The number of interface that is UP in Physical is 7
The number of interface that is DOWN in Physical is 0
The number of interface that is UP in Protocol is 6
The number of interface that is DOWN in Protocol is 1

Interface                IP Address/Mask      Physical  Protocol
GigabitEthernet0/0/0     192.168.1.34/27      up        up
GigabitEthernet0/0/1     202.106.0.1/27       up        up
GigabitEthernet0/0/2     192.168.1.97/27      up        up
GigabitEthernet0/0/2.11  192.168.1.1/27       up        up
GigabitEthernet0/0/2.64  192.168.1.65/27      up        up
GigabitEthernet4/0/0     unassigned           up        down
NULL0                   unassigned           up        up(s)
[YMMAR2]
```

2.2、生成树 LSW1、LSW7、LSW8 使用 STP 增加备份链接；查验 LSW8 的 E0/0/17 接口堵塞。

```
LSW8
LSW6 LSW9 AR2 LSW1-二层 LSW7 LSW8
pathcost-standard priority
process
[YMMLSW8]undo stp p
[YMMLSW8]undo stp process
[YMMLSW8]undo stp priority
[YMMLSW8]int e
Apr 10 2023 22:45:14-08:00 YMMLSW8 DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.20
5.25.191.3.1 configurations have been changed. The current change number is 1
the change loop count is 0, and the maximum number of records is 4095./0
[YMMLSW8]int e/0/0/17
^
Error: Wrong parameter found at '^' position.
[YMMLSW8]int e0/0/17
[YMMLSW8-Ethernet0/0/17]dis stp b
MSTID Port Role STP State Protection
0 Ethernet0/0/1 DESI FORWARDING NONE
0 Ethernet0/0/16 ROOT FORWARDING NONE
0 Ethernet0/0/17 ALTE DISCARDING NONE
[YMMLSW8-Ethernet0/0/17]
[YMMLSW8-Ethernet0/0/17]
```

3、VLANIF 和链路聚合结合实现 VLAN 间通信：

3.1、LSW9 到 LSW6 增加链路带宽和可靠性 G6-8 接口使用链接聚合，同时活跃 2 个接口；查验任何一台交换机，G0/0/6 和 G0/0/7 为活动接口，G0/0/8 非活动接口。

```
LSW6
LSW6 LSW9 AR2 LSW1-二层 LSW7 LSW8
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-cc26-239a
Least Active-linknumber: 1 Max Active-linknumber: 2
Operate status: up Number Of Up Port In Trunk: 2
-----
ActorPortName Status PortType PortPri PortNo PortKey PortState Weight
GigabitEthernet0/0/6 Selected 1GE 32768 7 305 10111100 1
GigabitEthernet0/0/7 Unselect 1GE 32768 8 305 10100000 1
GigabitEthernet0/0/8 Selected 1GE 32768 9 305 10111100 1
Partner:
-----
ActorPortName SysPri SystemID PortPri PortNo PortKey PortState
GigabitEthernet0/0/6 32768 4c1f-cc29-413d 32768 7 305 10111100
GigabitEthernet0/0/7 32768 4c1f-cc29-413d 32768 8 305 10100000
GigabitEthernet0/0/8 32768 4c1f-cc29-413d 32768 9 305 10111100
[YMMLSW6]
```

3.2、配置 Access 和 Trunk 接口保障，单臂路由 VLAN 通信；PC1、PC4、PC5、PC6 动态自动获得地址，PC1 ping 通 PC6；PC4 ping 通 PC5。

PC1 Vlan11

基础配置

命令行

组播

UDP发包工具

串口

Welcome to use PC Simulator!

PC>ipconfig

```
Link local IPv6 address.....: fe80::5689:98ff:fe66:385a
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.30
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.1.1
Physical address.....: 54-89-98-66-38-5A
DNS server.....: 8.8.8.8
```

PC4 V 128

基础配置

命令行

组播

UDP发包工具

串口

PC>ipconfig

```
Link local IPv6 address.....: fe80::5689:98ff:fec5:67c
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.158
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.1.129
Physical address.....: 54-89-98-C5-06-7C
DNS server.....: 8.8.8.8
```

PC5 vlan 160

基础配置

命令行

组播

UDP发包工具

串口

Welcome to use PC Simulator!

PC>ipconfig

```
Link local IPv6 address.....: fe80::5689:98ff:fe4f:10a1
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.190
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.1.161
Physical address.....: 54-89-98-4F-10-A1
DNS server.....: 8.8.8.8
```

PC6 Vlan 64

基础配置

命令行

组播

UDP发包工具

串口

Welcome to use PC Simulator!

PC>ipconfig

```
Link local IPv6 address.....: fe80::5689:98ff:fe46:211d
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.94
Subnet mask.....: 255.255.255.224
Gateway.....: 192.168.1.65
Physical address.....: 54-89-98-46-21-1D
DNS server.....: 8.8.8.8
```

PC4 V 128

基础配置

命令行

组播

UDP发包工具

串口

DNS server.....: 8.8.8.8

PC>ping 192.168.1.190

Ping 192.168.1.190: 32 data bytes, Press Ctrl_C to break
Request timeout!

```
From 192.168.1.190: bytes=32 seq=2 ttl=127 time=78 ms
From 192.168.1.190: bytes=32 seq=3 ttl=127 time=93 ms
From 192.168.1.190: bytes=32 seq=4 ttl=127 time=79 ms
From 192.168.1.190: bytes=32 seq=5 ttl=127 time=78 ms
```

PC1 Vlan11

基础配置

命令行

组播

UDP发包工具

串口

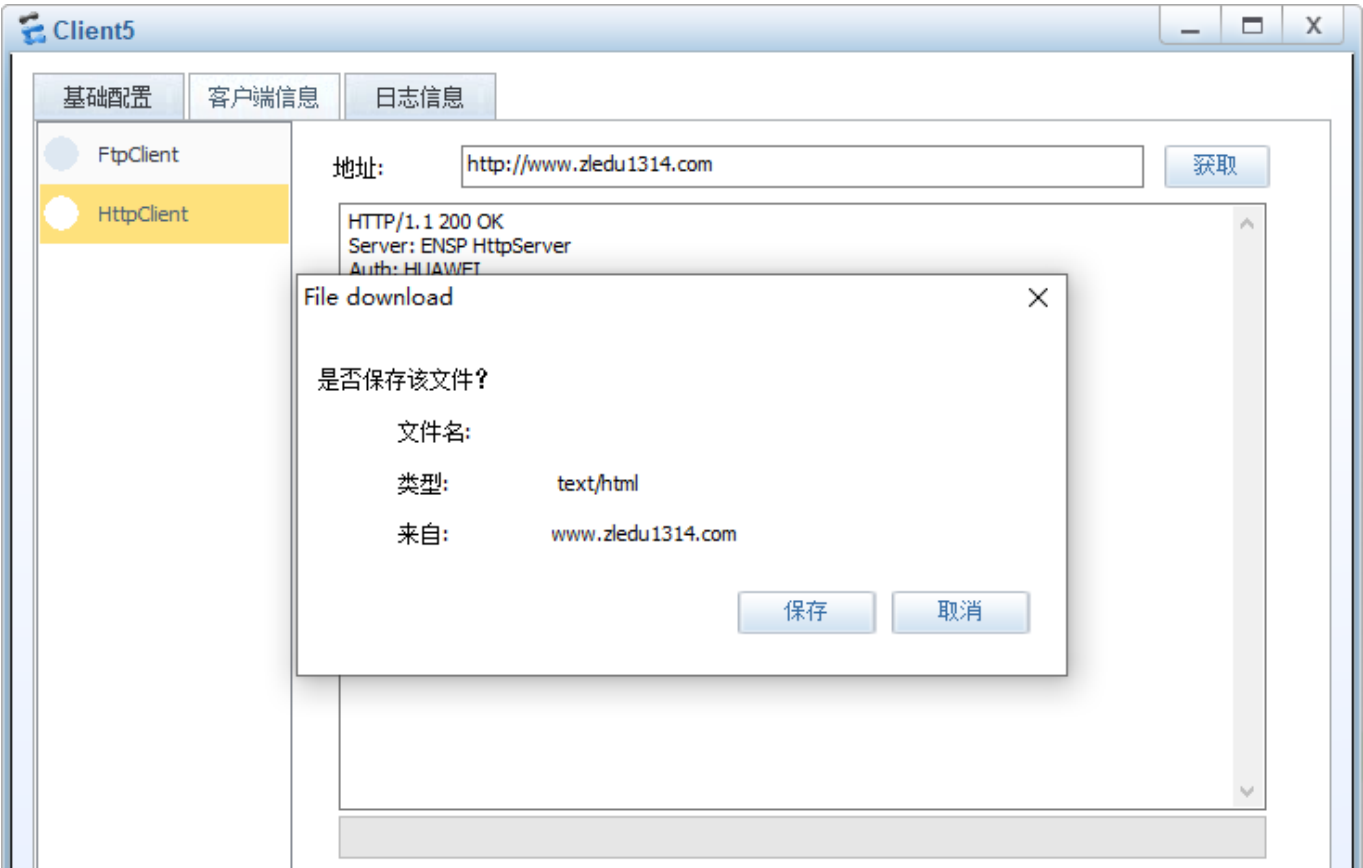
PC>ping 192.168.1.94

Ping 192.168.1.94: 32 data bytes, Press Ctrl_C to break
Request timeout!

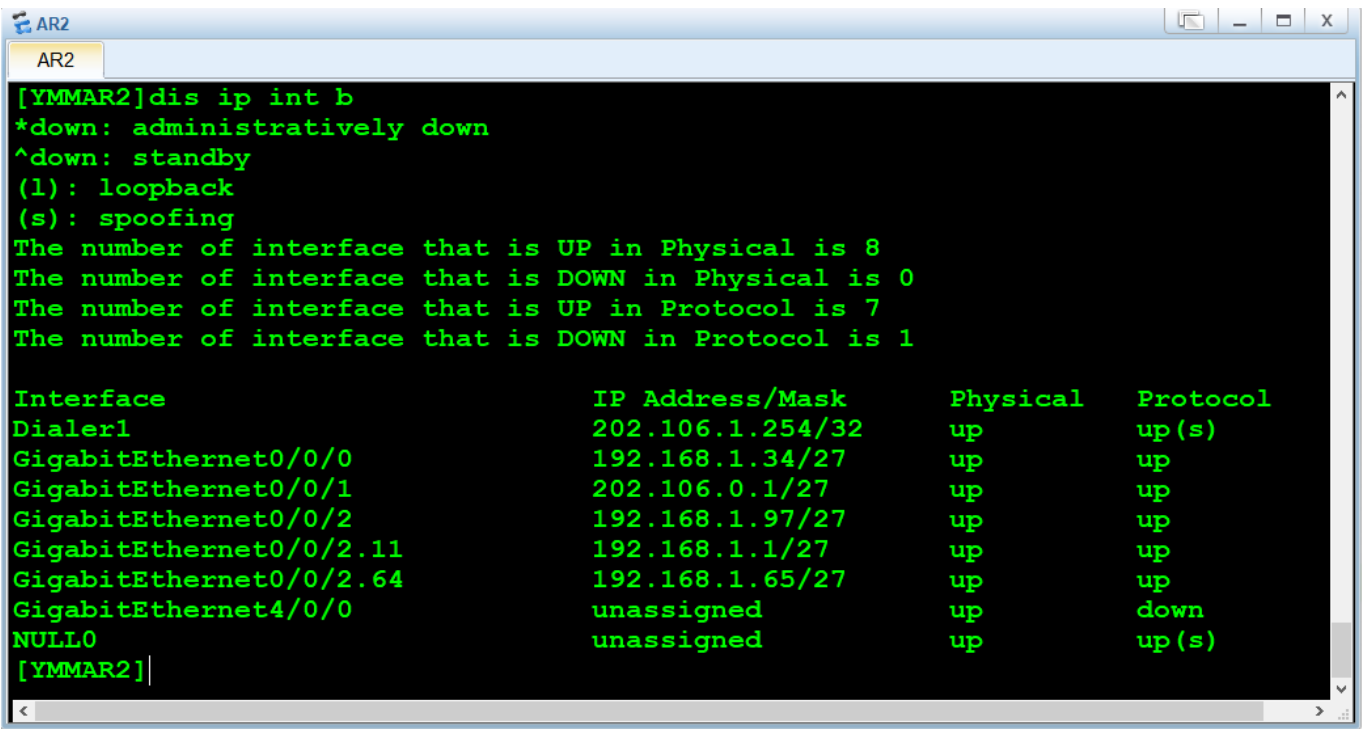
```
From 192.168.1.94: bytes=32 seq=2 ttl=127 time=109 ms
From 192.168.1.94: bytes=32 seq=3 ttl=127 time=109 ms
From 192.168.1.94: bytes=32 seq=4 ttl=127 time=141 ms
From 192.168.1.94: bytes=32 seq=5 ttl=127 time=125 ms
```

4、广域网：专线和增加广域网带宽使用 PPPOE 拨号线路和专线同时传输数据；

4.1、ISP 运营商测试环境配置：AR3 PPPOE 服务器和 WEB、DNS 服务搭建，CClient5 成功访问。



4.2、企业边界 AR2 申请千兆专线，同时增加 PPPOE 拨号千兆线路；节约成本提高广域网带宽；dialer 1 接口获得地址；用 dialer 接口地址和 202.106.0.1 ping 8.8.8.8。



```
AR2
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 30/44/70 ms

[YMMAR2]ping -a 202.106.0.1 8.8.8.8
PING 8.8.8.8: 56 data bytes, press CTRL_C to break
Reply from 8.8.8.8: bytes=56 Sequence=1 ttl=254 time=30 ms
Reply from 8.8.8.8: bytes=56 Sequence=2 ttl=254 time=30 ms
Reply from 8.8.8.8: bytes=56 Sequence=3 ttl=254 time=30 ms
Reply from 8.8.8.8: bytes=56 Sequence=4 ttl=254 time=30 ms
Reply from 8.8.8.8: bytes=56 Sequence=5 ttl=254 time=50 ms

--- 8.8.8.8 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 30/34/50 ms

[YMMAR2]
```

4.3、企业内部路由：IGP 网络配置 OSPF 路由保障通讯，LSW6 和 AR2 配置 OSPF 进程 1 和英特网路由设置；LSW6 ping 8.8.8.8。

```
LSW6
LSW6 AR2
[YMMSW6]ping 8.8.8.8
PING 8.8.8.8: 56 data bytes, press CTRL_C to break
Request time out
Reply from 8.8.8.8: bytes=56 Sequence=2 ttl=253 time=60 ms
Reply from 8.8.8.8: bytes=56 Sequence=3 ttl=253 time=50 ms
Reply from 8.8.8.8: bytes=56 Sequence=4 ttl=253 time=70 ms
Reply from 8.8.8.8: bytes=56 Sequence=5 ttl=253 time=90 ms

--- 8.8.8.8 ping statistics ---
5 packet(s) transmitted
4 packet(s) received
20.00% packet loss
round-trip min/avg/max = 50/67/90 ms

[YMMSW6]dis ip rou
[YMMSW6]dis ip routing-table
Route Flags: R - relay, D - download to fib
-----
Routing Tables: Public
Destinations : 11 Routes : 11

Destination/Mask Proto Pre Cost Flags NextHop Interface
0.0.0.0/0 O_ASE 150 1 D 192.168.1.226 Vlanif10
127.0.0.0/8 Direct 0 0 D 127.0.0.1 InLoopBack0
127.0.0.1/32 Direct 0 0 D 127.0.0.1 InLoopBack0
192.168.1.0/27 OSPF 10 2 D 192.168.1.226 Vlanif10
192.168.1.64/27 OSPF 10 2 D 192.168.1.226 Vlanif10
192.168.1.128/27 Direct 0 0 D 192.168.1.129 Vlanif128
192.168.1.129/32 Direct 0 0 D 127.0.0.1 Vlanif128
192.168.1.160/27 Direct 0 0 D 192.168.1.161 Vlanif160
```


5、开启服务和包过滤:

5.1、企业内部向英特网开放服务: LSW6 能远程登陆 用 AAA 增加安全性, 并使用伪端口 7788; AR3 成功登陆 LSW6。

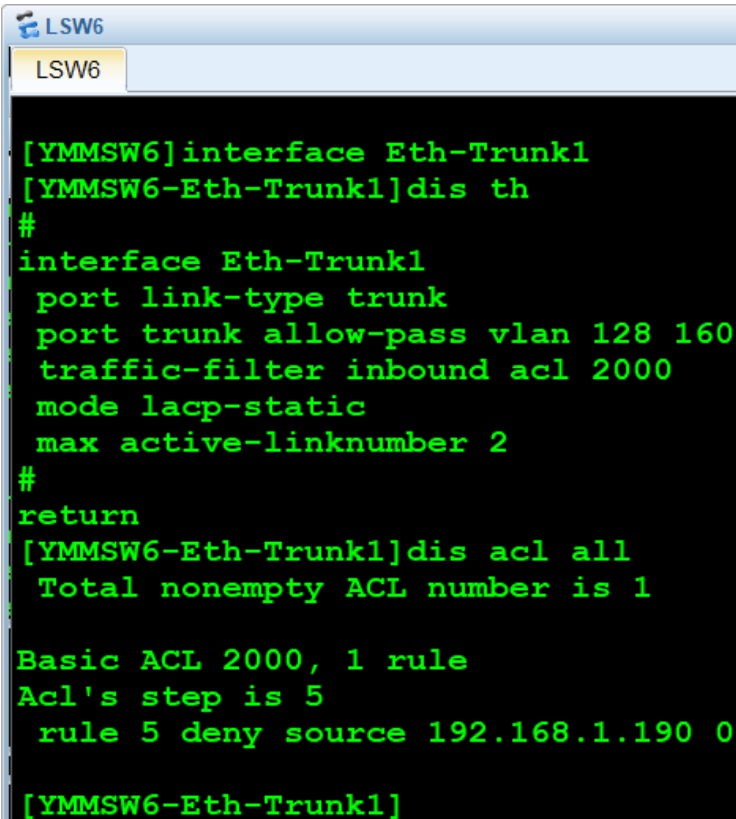
```
<YMMISP>telnet 202.106.0.3 7788
Press CTRL_] to quit telnet mode
Trying 202.106.0.3 ...
Connected to 202.106.0.3 ...

Login authentication

Username:zl
Password:
Info: The max number of VTY users is 5, and the number
      of current VTY users on line is 1.
      The current login time is 2023-04-11 03:44:23.
<YMSW6>
```

5.2、安全设置:

5.2.1、PC5 不能访问英特网; Client4 不能访问 www.zledu1314.com;



```
LSW6
LSW6
[YMMSW6]interface Eth-Trunk1
[YMMSW6-Eth-Trunk1]dis th
#
interface Eth-Trunk1
port link-type trunk
port trunk allow-pass vlan 128 160
traffic-filter inbound acl 2000
mode lacp-static
max active-linknumber 2
#
return
[YMMSW6-Eth-Trunk1]dis acl all
Total nonempty ACL number is 1

Basic ACL 2000, 1 rule
Acl's step is 5
rule 5 deny source 192.168.1.190 0

[YMMSW6-Eth-Trunk1]
```

AR2

```
[YMMAR2]dis acl all
Total quantity of nonempty ACL number is 2

Basic ACL 2000, 1 rule
Acl's step is 5
  rule 5 permit source 192.168.1.0 0.0.0.255

Advanced ACL 3001, 1 rule
Acl's step is 5
  rule 5 deny tcp source 192.168.1.2 0 destination-port eq www (5 matches)
```

PC5 vlan 160

基础配置 命令行 组播 UDP发包工具 串口

```
PC>ping 8.8.8.8

Ping 8.8.8.8: 32 data bytes, Press Ctrl_C to
break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!

--- 8.8.8.8 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
```

Client4

基础配置 客户端信息 日志信息

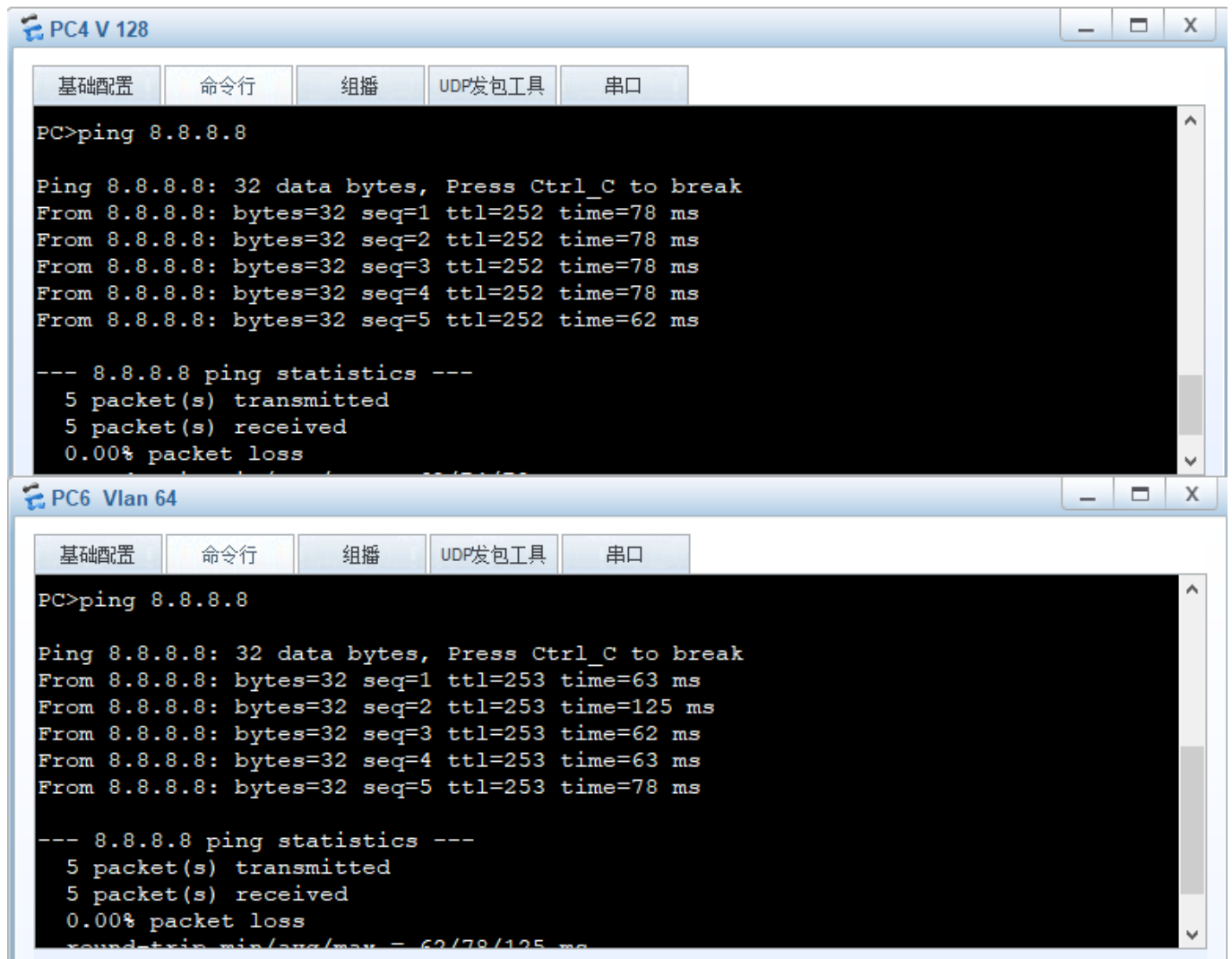
☐ FtpClient

☒ HttpClient

地址:

Parse URL failure.

5.2.2、PC4 和 PC6 成功访问英特网；



The image displays two screenshots of a network simulation interface. The top window, titled 'PC4 V 128', shows a terminal window with the following output:

```
PC>ping 8.8.8.8

Ping 8.8.8.8: 32 data bytes, Press Ctrl_C to break
From 8.8.8.8: bytes=32 seq=1 ttl=252 time=78 ms
From 8.8.8.8: bytes=32 seq=2 ttl=252 time=78 ms
From 8.8.8.8: bytes=32 seq=3 ttl=252 time=78 ms
From 8.8.8.8: bytes=32 seq=4 ttl=252 time=78 ms
From 8.8.8.8: bytes=32 seq=5 ttl=252 time=62 ms

--- 8.8.8.8 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
```

The bottom window, titled 'PC6 Vlan 64', shows a similar terminal window with the following output:

```
PC>ping 8.8.8.8

Ping 8.8.8.8: 32 data bytes, Press Ctrl_C to break
From 8.8.8.8: bytes=32 seq=1 ttl=253 time=63 ms
From 8.8.8.8: bytes=32 seq=2 ttl=253 time=125 ms
From 8.8.8.8: bytes=32 seq=3 ttl=253 time=62 ms
From 8.8.8.8: bytes=32 seq=4 ttl=253 time=63 ms
From 8.8.8.8: bytes=32 seq=5 ttl=253 time=78 ms

--- 8.8.8.8 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
```

三、相关配置：

```
AR2
sy
sysname AR2
int g0/0/0
ip address 192.168.1.226 27
int g0/0/1
ip address 202.106.0.1 27
int g0/0/2
ip address 192.168.1.1 27
ip route-s 0.0.0.0 0 202.106.0.2
dhcp enable
ip pool ymm
network 192.168.1.0 mask 27
gateway-list 192.168.1.1
excluded-ip-address 202.106.0.1 202.106.0.2
dns-list 8.8.8.8
int g0/0/2
dhcp select global
```

```
aaa
local-user ymm password cipher ymm123
local-user ymm privilege level 3
local-user ymm service-type telnet
q
user-interface vty 0 4
authentication-mode aaa
q
ospf router-id 2.2.2.2
area 0
network 192.168.1.226 0.0.0.0
default-route-advertise always
AR2创建子接口
int g0/0/2.11
dot1q termination vid 11
ip address 192.168.1.1 27
traffic-filter inbound acl 3001
arp broadcast enable
dhcp select global
int g0/0/2.64
dot1q termination vid 64
ip address 192.168.1.65 27
arp broadcast enable
ospf 1
area 1
network 192.168.1.65 0.0.0.0
AR2网络边界设备使用Easy NAT接入英特网;
acl number 2000
rule permit source 192.168.1.0 0.0.0.255
int g0/0/1
nat outbound 2000
nat server protocol tcp global 202.106.0.3 7788 inside 192.168.1.33 telnet
PC1>ping 8.8.8.1通
访问202.106.0.3的7788端口调转到192.168.1.33的23端口成功登录AR1设备
AR3telnet 202.106.0.3 7788成功登陆到AR1
PC1不能访问英特网络离目的近在AR2配置
acl n 2001
rule deny source 192.168.1.5 0
int g0/0/0
traffic-filter inbound acl 2001
PC1>ping 8.8.8.8不通PC3>ping 8.8.8.8通
AR1 离源近配置
acl number 3000
rule deny tcp source 192.168.1.4 0 destination any destination-port eq 80
interface GigabitEthernet0/0/1
traffic-filter inbound acl 3000
rule deny udp source 192.168.1.4 0 destination any destination-port eq 80
interface GigabitEthernet0/0/1
```

traffic-filter inbound acl 3000

Client3不能访问Client1可以访问

LSW6

sy

sysname LSW6

vlan batch 225 128 160

interface Vlanif225

ip address 192.168.1.98 27

interface Vlanif128

ip address 192.168.1.129 27

interface Vlanif160

ip address 192.168.1.161 27

int g0/0/1

port link-type access

port default vlan 225

int g0/0/4

port link-type access

port default vlan 128

int g0/0/5

port link-type access

port default vlan 160

ospf 1

area 2

network 0.0.0.0 0.0.0.0

q

链路聚合：

interface eth-trunk 1

mode lacp-static

max active-linknumber 2

trunkport gigabitethernet 0/0/6 to 0/0/8

port link-type trunk

port trunk allow-pass vlan 128 160

q

dis eth-trunk 1

LSW9

sy

sysname LSW9

vlan batch 128 160

int g0/0/4

p l a

p d v 128

int g0/0/5

p l a

p d v 160

interface eth-trunk 1

mode lacp-static

max active-linknumber 2

trunkport gigabitethernet 0/0/6 to 0/0/8

```
port link-type trunk
port trunk allow-pass vlan 128 160
q
LSW1-二层
sy
sysname LSW1-2
vlan batch 11 64
int g0/0/1
port link-type trunk
port trunk allow-pass vlan 11 64
int g0/0/15
port link-type trunk
port trunk allow-pass vlan 11 64
int g0/0/16
port link-type trunk
port trunk allow-pass vlan 11 64
q
stp mode stp
stp priority 4096
LSW7
vlan batch 11 64
int e0/0/15
port link-type trunk
port trunk allow-pass vlan 11 64
int e0/0/17
port link-type trunk
port trunk allow-pass vlan 11 64
vlan batch 11 64
int e0/0/1
port link-type access
port default vlan 11
int e0/0/2
port link-type access
port default vlan 11
q
stp mode stp
stp priority 8192
LSW8
sy
vlan batch 11 64
int e0/0/16
port link-type trunk
port trunk allow-pass vlan 11 64
int e0/0/17
port link-type trunk
port trunk allow-pass vlan 11 64
int e0/0/1
port link-type access
```

```
port default vlan 64
q
stp mode stp
AR2 拨号PPPOE
acl number 2000
rule permit
int dialer 1
ppp chap user zl
ppp chap password cipher ZL123
ip address ppp-negotiate
dialer user zl
dialer bundle 1
dialer-group 1
nat outbound 2000
int g4/0/0
pppoe-client dial-bundle-number 1
dialer-rule
dialer-rule 1 ip permit
ip route-static 0.0.0.0 0.0.0.0 dialer 1
ISP 配置测试
sy
sysn ISP
int g0/0/0
ip address 202.106.0.2 27
int g/0/1
ip address 8.8.8.1 27
ISP PPPOE服务配置
ip pool zl202
network 202.106.1.0 mask 24
dns-list 8.8.8.8 114.114.114.114
aaa
local-user zl password cipher ZL123
local-user zl service-type ppp
interface Virtual-Template1
ppp authentication-mode chap
remote address pool zl202
ip address 202.106.1.1 24
int g0/0/2
pppoe-server bind Virtual-Template 1
```