厦門大學

信息学院软件工程系

《计算机网络》实验报告

题　　目 实验五 CISCO IOS 路由器基本配置

班　　级 软件工程 2018 级 2 班

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1 实验目的

1、理解路由协议的分类。

2、掌握路由器的基本配置以及静态路由、动态路由和交换机端口 VLAN 的配置方法。

2 实验环境

Windows 10，Router eSIM v1.0，CCNA Network Visualizer 6.0

3 实验结果

1、使用 Router eSIM v1.0 模拟器模拟路由器的基本配置

```
Router>enable
Router#config terminal
Enter configuration commands, one per line.  End with END.
Router(config)#hostname lab_A
lab_A(config)#banner motd#
                          ^
% Invalid input detected at '^' marker.

lab_A(config)#banner motd #
Enter TEXT message.  End with the character '#'.
Accounting Department
You have entered a secure system.
Authorized access only #
lab_A(config)#
```

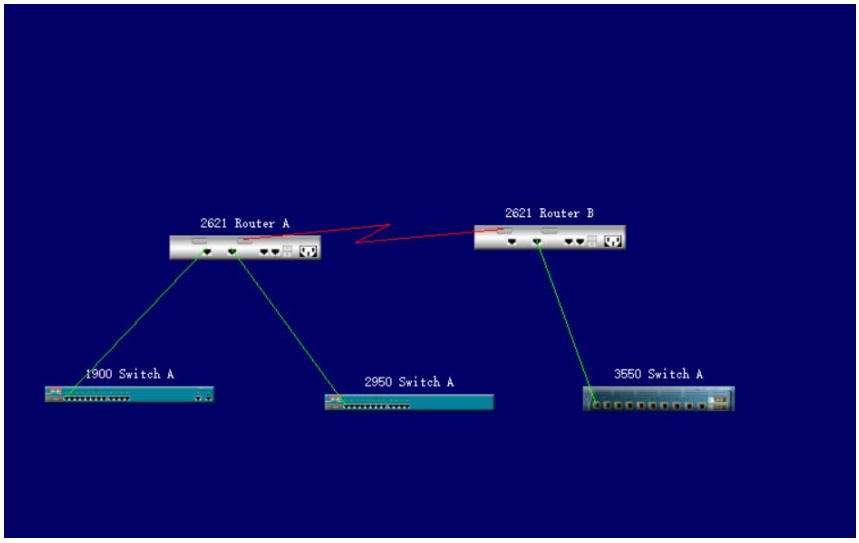
```
lab_A(config)#ip host lab_A 192.5.5.1 205.7.5.1 201.100.11.1
lab_A(config)#ip host lab_B 219.17.100.1 199.6.13.1 201.100.11.2
lab_A(config)#ip host lab_C 223.8.151.1 204.204.7.1 199.6.13.2
lab_A(config)#ip host lab_D 210.93.105.1 204.204.7.2
lab_A(config)#ip host lab_E 210.93.105.2
lab_A(config)#int eth 0
lab_A(config-if)#ip address 192.5.5.1 255.255.255.0
lab_A(config-if)#int eth 1
lab_A(config-if)#ip address 205.7.5.1 255.255.255.0
lab_A(config-if)#int serial 0
lab_A(config-if)#ip address 201.100.11.1 255.255.255.0
lab_A(config-if)#
```

```
lab_A(config-if)#exit
lab_A(config)#interface serial 0
lab_A(config-if)#clock rate 56000
lab_A(config-if)#_
```

```
lab_A#show interface serial 0
Serial0 is administratively down, line protocol is down
   Internet address is 201.100.11.1/24
   Hardware is HD64570
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
   Encapsulation HDLC, loopback not set
   Keepalive set (10 sec)
   Last input never, output never, output hang never
   Last clearing of "show interface" counters never
   Input queue: 0/75/0 (size/max/drops); Total output drops: 0
   Queueing strategy: weighted fair
   Output queue: 0/1000/64/0 (size/max total/threshold/drops)
      Conversations  0/0/256 (active/max active/max total)
      Reserved Conversations 0/0 (allocated/max allocated)
   5 minute input rate 0 bits/sec, 0 packets/sec
   5 minute output rate 0 bits/sec, 0 packets/sec
      0 packets input, 0 bytes, 0 no buffer
      Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
      0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
      0 packets output, 0 bytes, 0 underruns
      0 output errors, 0 collisions, 1 interface resets
      0 output buffer failures, 0 output buffers swapped out
```

2、静态/动态路由配置

设备模拟



配置路由器 A 并查看路由表

```
Router(config)#int f0/0
Router(config-if)#ip address 192.5.5.1 255.255.0
                                              ^
% Invalid input detected at '^' marker.
Router(config-if)#ip address 192.5.5.1 255.255.255.0
Router(config-if)#no shutdown
10:08:34 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
10:08:34 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#int f0/1
Router(config-if)#ip addr 205.7.5.1 255.255.255.0
Router(config-if)#no shutdown
10:09:09 %LINK-3-UPDOWN:  Interface FastEthernet0/1, changed state to up
10:09:09 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#int s0/0
Router(config-if)#ip addr 201.100.11.1 255.255.255.0
Router(config-if)#clock rate 56000
Router(config-if)#no shutdown
10:10:06 %LINK-3-UPDOWN:  Interface Serial0/0, changed state to up
10:10:06 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set
C     192.5.5.0/24 is directly connected, FastEthernet0/0
C     205.7.5.0/24 is directly connected, FastEthernet0/1
C     201.100.11.0/24 is directly connected, Serial0/0
```

用同样的方式配置路由器 B

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#hostname RouterB
RouterB(config)#int f0/0
RouterB(config-if)#ip addr 199.6.13.1 255.255.255.0
RouterB(config-if)#no shutdown
10:15:44 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
10:15:44 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, change

RouterB(config-if)#int s0/0
RouterB(config-if)#ip addr 201.100.11.2 255.255.255.0
RouterB(config-if)#no shutdown
10:16:13 %LINK-3-UPDOWN:  Interface Serial0/0, changed state to up
10:16:13 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed stat
```

```
RouterB#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set
C     199.6.13.0/24 is directly connected, FastEthernet0/0
C     201.100.11.0/24 is directly connected, Serial0/0
```

回到路由器 A，检查是否连通

```
Router>ping 199.6.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 199.6.13.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5), round-trip min/avg/max = 0/0/0 ms
Router>
```

配置静态路由，再次检查是否连通

```
RouterA>enable
RouterA#config t
Enter configuration commands, one per line.  End with CNTL/Z
RouterA(config)#ip route 199.6.13.1 255.255.255.0 201.100.11.2
RouterA(config)#exit
RouterA#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set
C     192.5.5.0/24 is directly connected, FastEthernet0/0
C     205.7.5.0/24 is directly connected, FastEthernet0/1
S     199.6.13.1 [1/0] via 201.100.11.2
C     201.100.11.0/24 is directly connected, Serial0/0

RouterA#ping 199.6.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 199.6.13.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
```

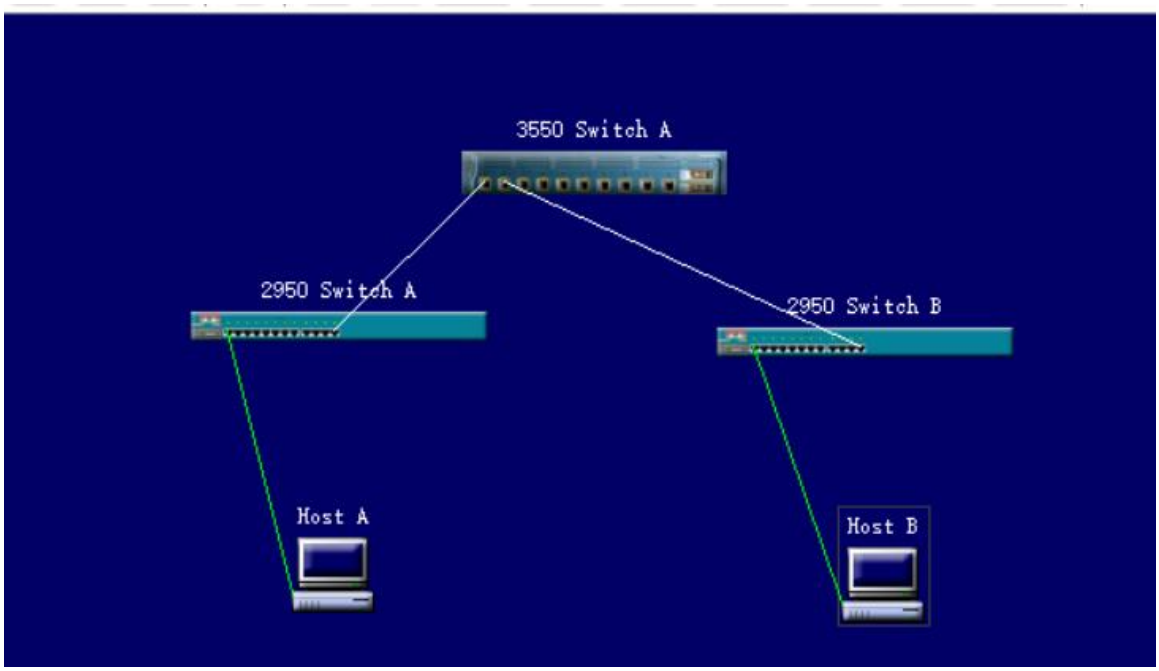
配置 RIP 动态路由协议

```
Router(config)#hostname RouterA
RouterA(config)#router rip
RouterA(config-router)#network 199.6.13.1

RouterA#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 12 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface             Send  Recv  Triggered RIP  Key-chain
    Serial0/0             1     1 2
    FastEthernet0/1       1     1 2
    FastEthernet0/0       1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for networks:
    199.6.13.0
  Routing information sources:
    Gateway         Distance      Last Update
  Distance: <default is 120>
```

3、VLAN 的配置

实例一：



设置 VTP 域

```
switch>enable
switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 3550A
3550A(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
3550A(config)#exit
3550A#sh vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Server
VTP Domain Name                 : Cisco
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 0.0.0.0 at 11-29-93 20:39:24
Local updater ID is 0.0.0.0 on interface Vl1 (lowest numbered VLAN interface
found)


switch>en
switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 2950A
2950A(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950A(config)#vtp mode ?
  client       Set the device to client mode.
  server       Set the device to server mode.
  transparent  Set the device to transparent mode.


2950A(config)#vtp mode client
Setting device to VTP CLIENT mode.
2950A(config)#exit
2950A#sh vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Client
VTP Domain Name                 : Cisco
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 2950 SwitchA at 11-29-93 20:39:24
Local updater ID is 2950 SwitchA on interface Vl1 (lowest numbered VLAN interf
found)
```

```
switch>en
switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 2950B
2950B(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950B(config)#vtp mode client
Setting device to VTP CLIENT mode.
2950B(config)#exit
2950B#_
```

配置 Trunk

```
3550A#config t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#interface fa0/1
3550A(config-if)#switchport trunk encapsulation ?
  dotlq      Interface uses only 802.1q trunking encapsulation when trunking
  isl        Interface uses only ISL trunking encapsulation when trunking
  negotiate  Device will negotiate trunking encapsulation with peer on
             interface

3550A(config-if)#switchport trunk encapsulation dotlq
12:35:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, cha
to down
12:35:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, cha
3550A(config-if)#switchport mode trunk
3550A(config-if)#interface fa0/2
3550A(config-if)#switchport trunk encapsulation dotlq
12:36:31: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, cha
to down
12:36:31: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, cha
3550A(config-if)#switchport mode trunk

2950A(config)#interface fa0/12
2950A(config-if)#switchport mode trunk

2950B(config)#interface fa0/12
2950B(config-if)#switchport mode trunk
```

创建 VLAN

创建两个 VLAN，10 和 20

```
3550A>en
3550A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#vlan 10
3550A(config-vlan)#vlan 20
3550A(config-vlan)#exit
3550A(config)#exit
3550A#sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
10   VLAN0010                         active
20   VLAN0020                         active
```

分配交换机端口加入 VLAN

```
2950A>en
2950A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#interface fa0/1
2950A(config-if)#switchport access vlan 10
```

```
2950B>en
2950B#conf t
Enter configuration commands, one per line.  End with CNTL/Z
2950B(config)#interface fa0/1
2950B(config-if)#switchport access vlan 20
```

配置三层交换机

```
3550A>en
3550A#config t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#int vlan 10
3550A(config-if)#ip address 10.10.10.1 255.255.255.0
3550A(config-if)#int vlan 20
3550A(config-if)#ip address 20.20.20.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#exit
3550A(config)#ip routing
3550A(config)#int vlan 1
3550A(config-if)#ip address 192.168.10.1 255.255.255.0
3550A(config-if)#no shut
```

```
2950A>en
2950A#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#int vlan 1
2950A(config-if)#ip address 192.168.10.2 255.255.255.0
2950A(config-if)#no shutdown
```

```
2950B>en
2950B#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950B(config)#int vlan 1
2950B(config-if)#ip address 192.168.10.3 255.255.255.0
2950B(config-if)#no shut down
                        ^
% Invalid input detected at '^' marker.
2950B(config-if)#no shutdown
```

配置主机并测试

Host A IP ： 10.10.10.2/24 default gateway：10.10.10.1

Host B：IP ： 20.20.20.2/24 default gateway：20.20.20.1

```
3550A>en
3550A#ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
3550A#ping 192.168.10.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
```

HostA ping HostB

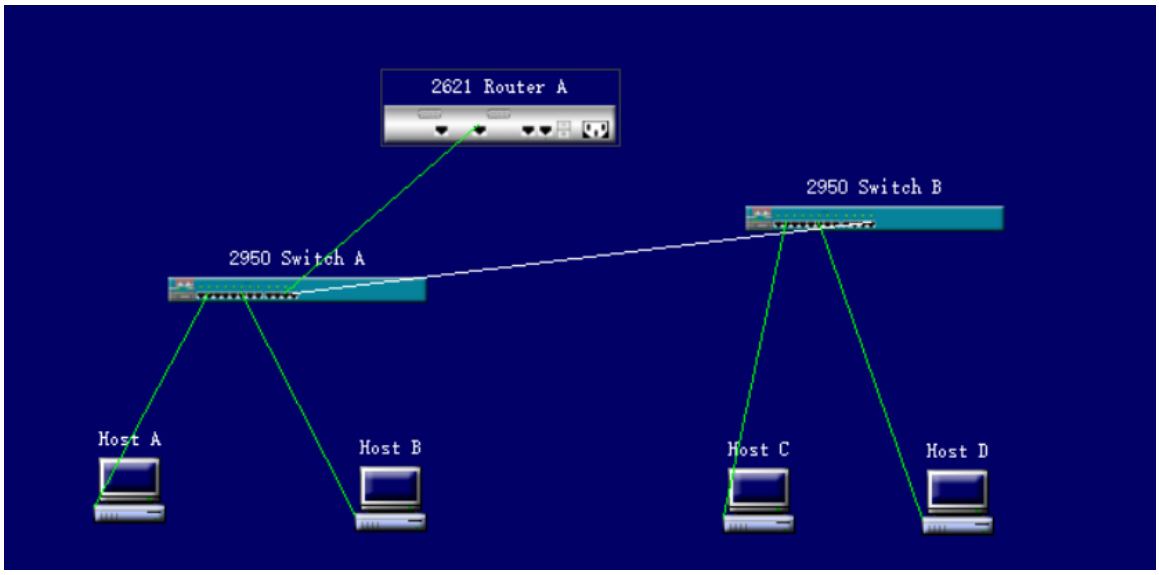
```
C:\>ping 20.20.20.2

Pinging 20.20.20.2 with 32 bytes of data:

Reply from 20.20.20.2 ;bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 ;bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 ;bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 ;bytes=32 time=22ms TTL=254

Ping Statistics for 20.20.20.2:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 22ms, Maximum = 23ms, Average = 22ms
```

实例二：



配置 VTP

```
switch(config)#hostname 2950A
2950A(config)#vtp domain Test
Changing VTP domain name from NULL to Test
2950A(config)#vtp mode ?
  client       Set the device to client mode.
  server       Set the device to server mode.
  transparent  Set the device to transparent mode.

2950A(config)#vtp mode server
Device mode already VTP SERVER.
2950A(config)#exit
2950A#show vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Server
VTP Domain Name                 : Test
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 0.0.0.0 at 11-29-93 20:39:24
Local updater ID is 0.0.0.0 on interface Vl1 (lowest numbered VLAN interface
found)
```

启动 Trunk

```
2950A>en
2950A#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#interface fa0/12
2950A(config-if)#switchport mode ?
  access   Set trunking mode to ACCESS unconditionally
  dynamic  Set trunking mode to dynamically negotiate access or trunk mode
  trunk    Set trunking mode to TRUNK unconditionally

2950A(config-if)#switchport mode trunk
2950A(config-if)#interface fa0/11
2950A(config-if)#switchport mode trunk
2950A(config-if)#exit
2950A(config)#
```

```
switch>en
switch#config t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 2950B
2950B(config)#interface fa0/12
2950B(config-if)#switchport mode trunk
2950B(config-if)#exit
2950B(config)#
```

创建 VLAN

```
2950A>en
2950A#vlan database
2950A(vlan)#vlan 2 name vlan2
VLAN 2 added:
    Name: vlan2
2950A(vlan)#vlan 3 name vlan3
VLAN 3 added:
    Name: vlan3
2950A(vlan)#exit
APPLY completed.
Exiting....
2950A#
```

分配端口到 VLAN

```
2950A>en
2950A#vlan database
2950A(vlan)#vlan 2 name vlan2
VLAN 2 added:
    Name: vlan2
2950A(vlan)#vlan 3 name vlan3
VLAN 3 added:
    Name: vlan3
2950A(vlan)#exit
APPLY completed.
Exiting....
2950A#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#interface f0/2
2950A(config-if)#switchport access vlan 2
2950A(config-if)#switchport mode access
2950A(config-if)#interface f0/6
2950A(config-if)#switchport access vlan 3
2950A(config-if)#switchport mode access
2950A(config-if)#exit
2950A(config)#show vlan
               ^
% Invalid input detected at '^' marker.
2950A(config)#exit
2950A#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/3, Fa0/4, Fa0/5
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12
2    vlan2                            active    Fa0/2
3    vlan3                            active    Fa0/6
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
2    enet  100002     1500  -      -      -        -    -        0      0
3    enet  100003     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0
--More--
```

```
2950B>en
2950B#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950B(config)#vtp domain Test
Changing VTP domain name from NULL to Test
2950B(config)#vtp mode client
Setting device to VTP CLIENT mode.
2950B(config)#interface f0/2
2950B(config-if)#switchport access vlan 2
2950B(config-if)#switchport moade access
                                ^
% Invalid input detected at '^' marker.
2950B(config-if)#switch mode access
2950B(config-if)#interface f0/6
2950B(config-if)#switchport access vlan 3
2950B(config-if)#switchport mode access
2950B(config-if)#exit
2950B(config)#
```

配置 VLAN 之间的路由

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#hostname R2600
R2600(config)#interface f0/0
R2600(config-if)#no ip address
R2600(config-if)#no shutdown
04:24:24 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
04:24:24 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

R2600(config-if)#interface f0/0.1
R2600(config-subif)#encapsulation dotlq 1
R2600(config-subif)#ip address 172.16.10.1 255.255.255.0
R2600(config-subif)#interface f0/0.2
R2600(config-subif)#encapsulation dotlq 2
R2600(config-subif)#ip address 172.16.20.1 255.255.255.0
R2600(config-subif)#interface f0/0.3
R2600(config-subif)#encapsulation dotlq 3
R2600(config-subif)#ip address 172.16.30.1 255.255.255.0
R2600(config-subif)#exit
R2600(config)#
```

配置主机并验证连通性

Host A, IP Address ： 172.16.20.3/24，default gateway ： 172.16.20.1.

Host B, IP Address ： 172.16.30.3/24，default gateway ： 172.16.30.1.

Host a, IP Address ： 172.16.20.5/24，default gateway ： 172.16.20.1.

Host b, IP Address ： 172.16.30.5/24，default gateway ： 172.16.30.1.

```
C:\>ping 172.16.20.1

Pinging 172.16.20.1 with 32 bytes of data:

Reply from 172.16.20.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.20.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.20.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.20.1 ;bytes=32 time=22ms TTL=254

Ping Statistics for 172.16.20.1:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 22ms, Maximum = 23ms, Average = 22ms
```

```
C:\>ping 172.16.30.1

Pinging 172.16.30.1 with 32 bytes of data:

Reply from 172.16.30.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.1 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.1 ;bytes=32 time=22ms TTL=254

Ping Statistics for 172.16.30.1:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 22ms, Maximum = 23ms, Average = 22ms
```

```
C:\>ping 172.16.30.3

Pinging 172.16.30.3 with 32 bytes of data:

Reply from 172.16.30.3 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.3 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.3 ;bytes=32 time=22ms TTL=254
Reply from 172.16.30.3 ;bytes=32 time=22ms TTL=254

Ping Statistics for 172.16.30.3:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 22ms, Maximum = 23ms, Average = 22ms
```

4 实验总结

本次实验主要了解到一些路由协议相关的内容，以及掌握了静态路由、动态路由和交换机端口 VLAN 的配置方法