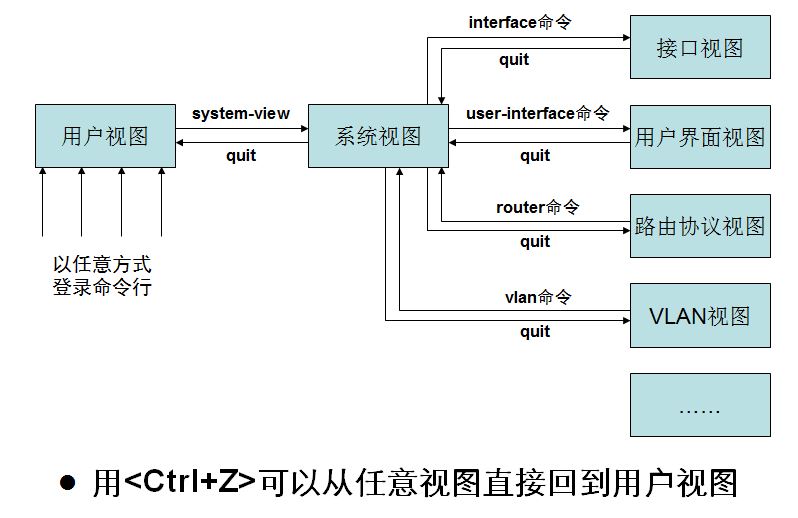
**12 14**

**访问网络设备命令行接口的方法**

* 通过Console口本地访问（最常用模式）
* 通过AUX口远程访问（IP网络中断时，可使用电信网络进行远程配置）
* 使用Telnet终端访问（常用，三种模式，明文信息传递不安全）
* 使用SSH终端访问（类似上一种方式，加密方式传送，有预共享密钥和公钥两种方式）
* 通过异步串口访问（反向Telnet方式）

**命令视图（？和TAB的作用）**

* **用户视图**
  + 设备启动后的缺省视图,可查看启动后基本运行状态和统计信息
* **系统视图**
  + 配置系统全局通用参数的视图
* **路由协议视图**
  + 配置路由协议参数的视图
* **接口视图**
  + 配置接口参数的视图
* **用户界面视图**
  + 配置登陆设备的各个用户属性的视图



**网络设备基本配置**

1. **模拟使用console口配置（使用H3C MSR 36-20）**

<H3C>display version

<H3C>display clock

<H3C>display user-interface

<H3C>display interface（注意使用SPACE ENTER CTRL+C）

<H3C>display history-command

<H3C>display current-configuration

1. **配置设备名称**

<H3C>sys

System View: return to User View with Ctrl+Z.

[H3C]sysname gxy

1. **配置系统时间**

**[gxy]clock protocol ?**

**none Manually set the system time at the CLI**

**ntp Use the Network Time Protocol (NTP)**

<gxy>clock datetime 14:31:30 2015/08/10

1. **显示系统时间**

<gxy>display clock

14:32:17 UTC Mon 08/10/2015

1. **查看版本信息**

[gxy]dis version

1. **查看当前配置**

[gxy]dis current-configuration

1. **显示接口信息**

<gxy>dis interface

1. **显示接口IP状态与配置信息**

<gxy>dis ip interface brief

1. **显示系统运行统计信息**

**<H3C>display diagnostic-information**

**配置TELNET远程登录**

1. **配置交换机的VLAN 1的IP地址**

<gxy>sys

[gxy]interface g0/0

[gxy-GigabitEthernet0/0]ip address 192.168.1.1 24

1. **使能Telnet服务器端功能**

[gxy]telnet server enable

1. **进入VTY用户界面视图，配置用户接入验证方式（注意配置时同时完成所有用户接入配**置）

**配置为密码验证登录方式**

[gxy]user-interface vty 0 63

[gxy-line-vty0-63]authentication-mode password

[gxy-line-vty0-63]set authentication password simple 123（注意与原版本差别较大）

[gxy-line-vty0-63]user-role level-0 //配置接入权限级别为0

[gxy]super password simple 456 //设置super 密码为456

**登录测试：**

在虚拟机上进行登录测试

**保存此过程结果到配置文件telnet.cfg中：**

[gxy]save

The current configuration will be written to the device. Are you sure? [Y/N]:y

Please input the file name(\*.cfg)[flash:/ **telnet.cfg**]

(To leave the existing filename unchanged, press the enter key): **telnet.cfg**

Validating file. Please wait...................

Configuration is saved to device successfully.

**配置为scheme登录方式：（在原来结果上配置，配置后前一种方式自动失效）**

[gxy]user-interface vty 0 63

[gxy-line-vty0-63]authentication-mode scheme

[gxy-ui-vty0-4]quit

[gxy]local-user telnet

New local user added.

[gxy-luser-manage-telnet]password simple test

[gxy-luser-manage-telnet]service-type telnet

[gxy-luser-manage-telnet]authorization-attribute user-role level-15

**验证登录结果：注意此时原有的密码验证方式失效**

login: telnet

Password:

<gxy>

**配置SSH远程登录：**

1. **启动SSH服务器功能**

[gxy]ssh server enable

Info: Enable SSH server.

1. **配置SSH客户端登录时的用户界面**

[gxy]user-interface vty 0 63

[gxy-line-vty0-63]authentication-mode scheme

lo[gxy-ui-vty0-4]protocol inbound ssh //注意三个选项，选择all，telnet和ssh都可登录

1. **配置SSH用户**

[gxy]local-user ssh

New local user added.

[gxy-luser-manage-ssh]password simple ssh

[gxy-luser-manage-ssh]service-type ssh

[gxy-luser-manage-ssh]authorization-attribute user-role level-15

1. **生成RSA密钥，并指定密钥位数**

[gxy]public-key local create rsa

Warning: The local key pair already exist.

Confirm to replace them? [Y/N]:y

The range of public key size is (512 ~ 2048).

NOTES: If the key modulus is greater than 512,

It will take a few minutes.

Press CTRL+C to abort.

Input the bits of the modulus[default = 1024]:1024

Generating Keys...

++++++

++++++

++++++++

++++++++

1. **导出RSA密钥**

[gxy]public-key local export rsa ssh2

---- BEGIN SSH2 PUBLIC KEY ----

Comment: "rsa-key-20150810"

AAAAB3NzaC1yc2EAAAADAQABAAAAgQDAxSlW/0qlXcQWYD0eqho6I7Bg42Er390GLuXpeGWhygWRAHZxCpEbYv5sxarzxpbPqaoWRG+yyh0vf3LGsGcYXy3ZcA4QVZuinwG3GdUbQED8hOIFM5NFt6eBdFA2I+zAz4B1A5s2ULxHT17W6SAMPz12+HutJ173X5RUXoVKLQ==

---- END SSH2 PUBLIC KEY ----

**连接测试：（连接时使用SSH2）**

1. **销毁RSA密钥**

[gxy]public-key local destroy rsa

**网络设备的文件管理**

**网络设备的文件系统**

* 设备以文件的方式对运行所需的数据进行存储
* 网络设备通过文件系统管理这些文件
* 主要文件
  + 应用程序文件
  + 配置文件
  + 日志文件

**文件系统的操作**

1. **目录操作**

<gxy>dir

<gxy>mkdir gxy

Creating directory flash:/gxy... Done.

<gxy>rmdir gxy

Remove directory flash:/gxy and the files in the recycle-bin under this directory will be deleted permanently. Continue? [Y/N]:y

Removing directory flash:/gxy... Done.

**文件操作**

删除文件

<gxy>delete ceshi.cfg

.

Delete flash:/ceshi.cfg?[Y/N]:y

.

%Delete file flash:/ceshi.cfg...Done.

找回删除文件

<gxy>undelete ceshi.cfg

Undelete flash:/ceshi.cfg?[Y/N]:y

....

%Undeleted file flash:/ceshi.cfg.

彻底删除

<gxy>delet /unreserved liu.cfg

The contents cannot be restored!!! Delete flash:/liu.cfg?[Y/N]:

清空回收站，整理磁盘空间

<gxy> reset recycle-bin

Clear flash:/~/a.cfg ?[Y/N]:n

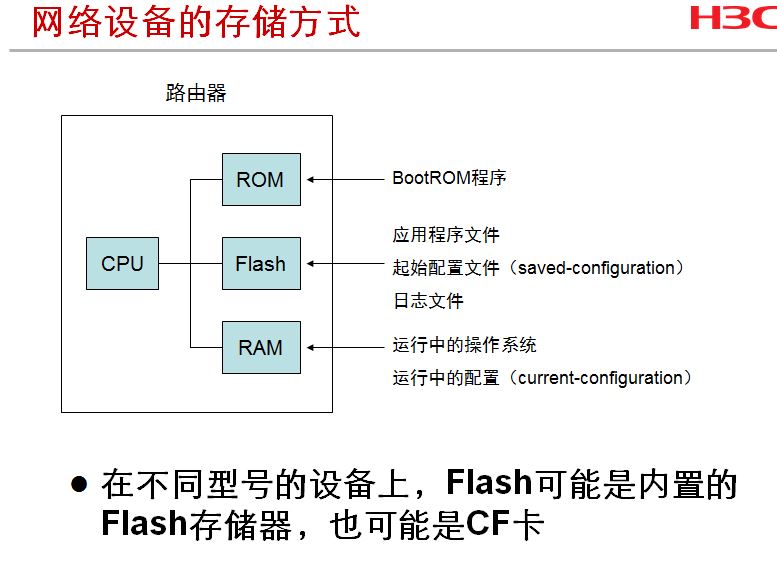
Clear flash:/~/b.cfg ?[Y/N]:y

Clearing files from flash may take a long time. Please wait...

......

%Cleared file flash:/~/b.cfg...

**配置文件的管理和操作**

****

1. **配置的保存（以新文件名保存配置文件）**

<gxy>save

The current configuration will be written to the device. Are you sure? [Y/N]:y

Please input the file name(\*.cfg)[flash:/ceshi.cfg]

(To leave the existing filename unchanged, press the enter key):

Validating file. Please wait.....................

Configuration is saved to device successfully.

1. **擦除配置文件（恢复初始配置）**

<gxy>reset saved-configuration

The saved configuration file will be erased. Are you sure? [Y/N]:y

Configuration file in flash is being cleared.

Please wait ...

..

Configuration file is cleared.

<gxy>reboot //必须重启后生效

Start to check configuration with next startup configuration file, please wait.........DONE!

This command will reboot the device. Current configuration may be lost in next startup if you continue. Continue? [Y/N]:y

#Aug 10 16:38:47:459 2015 gxy DEV/1/REBOOT:

Reboot device by command.

%Aug 10 16:38:47:460 2015 gxy DEV/4/SYSTEM REBOOT:

System is rebooting now.

%Aug 10 16:38:49:499 2015 gxy IFNET/4/LINK UPDOWN:

Ethernet1/0/2: link status is DOWN

%Aug 10 16:38:49:568 2015 gxy IFNET/4/LINK UPDOWN:

Vlan-interface1: link status is DOWN

%Aug 10 16:38:49:581 2015 gxy IFNET/4/UPDOWN:

Line protocol on the interface Vlan-interface1 is DOWN

Now rebooting, please wait...

1. **设置下次启动的配置文件**

<H3C>startup saved-configuration ceshi.cfg

Please wait ..........

... Done!

<H3C>reboot

1. **使用远端FTP服务器保存并下载配置文件**

**保存文件**

<ftpceshi>ftp 192.168.1.11

Trying 192.168.1.11 ...

Press CTRL+K to abort

Connected to 192.168.1.11.

220 3Com 3CDaemon FTP Server Version 2.0

User(192.168.1.11:(none)):anonymous

331 User name ok, need password

Password:

230-The response '' is not valid.

230-Next time, please use your email address as password.

230 User logged in

[ftp]put ceshi.cfg

227 Entering passive mode (192,168,1,11,229,106)

125 Using existing data connection

226 Closing data connection; File transfer successful.

FTP: 2397 byte(s) sent in 0.213 second(s), 11.00Kbyte(s)/sec.

[ftp]quit

221 Service closing control connection

**下载文件**

<ftpceshi>ftp 192.168.1.11

Trying 192.168.1.11 ...

Press CTRL+K to abort

Connected to 192.168.1.11.

220 3Com 3CDaemon FTP Server Version 2.0

User(192.168.1.11:(none)):anonymous

331 User name ok, need password

Password:

230-The response '' is not valid.

230-Next time, please use your email address as password.

230 User logged in

[ftp]get ceshi.cfg

227 Entering passive mode (192,168,1,11,229,229)

125 Using existing data connection

....226 Closing data connection; File transfer successful.

FTP: 2397 byte(s) received in 4.630 second(s), 517.00 byte(s)/sec.

[ftp]quit

221 Service closing control connection

1. **使用TFTP方式上传并保存配置文件**

上传

<ftpceshi>copy ftpceshi.cfg 192.168.1.11

Copy flash:/ftpceshi.cfg to flash:/192.168.1.11?[Y/N]:y

..

%Copy file flash:/ftpceshi.cfg to flash:/192.168.1.11...Done.

下载

<ftpceshi>copy 192.168.1.11 ftpceshi.cfg

Copy flash:/192.168.1.11 to flash:/ftpceshi.cfg?[Y/N]:y

....

%Copy file flash:/192.168.1.11 to flash:/ftpceshi.cfg...Done.

1. **备份/恢复下次启动配置文件（TFTP方式）**

<ftpceshi>dis startup

Current startup saved-configuration file: flash:/ceshi.cfg

Next startup saved-configuration file: flash:/ftpceshi.cfg

<ftpceshi>backup startup-configuration to 192.168.1.11

Backup next startup-configuration file to 192.168.1.11, please wait...

finished!

<ftpceshi>backup startup-configuration to 192.168.1.11 2015.8.10.cfg

Backup next startup-configuration file to 192.168.1.11, please wait...

finished!

<ftpceshi>restore startup-configuration from 192.168.1.11 2015.8.10.cfg.

Restore next startup-configuration file from 192.168.1.11. Please wait...........

finished!

<ftpceshi>display startup

Current startup saved-configuration file: flash:/ceshi.cfg

Next startup saved-configuration file: flash:/2015.8.10.cfg

1. **查看保存的配置文件信息**

<ftpceshi>dis saved-configuration（注意，显示的是上次启动时的配置文件）

1. **查看系统启动配置文件**

<ftpceshi>dis startup

Current startup saved-configuration file: flash:/ceshi.cfg

Next startup saved-configuration file: flash:/ftpceshi.cfg

1. **查看当前生效的配置文件**

<ftpceshi>dis current-configuration

1. **查看当前视图下生效的配置**
2. **在交换机上设置FTP服务器**

[ftpceshi]ftp server enable

[ftpceshi]local-user limengftp

New local user added.

[ftpceshi-luser-limengftp]password simple limengftp

[ftpceshi-luser-limengftp]service-type ftp

[ftpceshi-luser-limengftp]authorization-attribute level 3

1. **指定下次启动的配置文件**

<ftpceshi>boot-loader file flash:/s3610\_5510-cmw520-r5309p02.bin

1. **显示下次启动加载的应用程序文件（应用程序文件相当于固件）**

<ftpceshi>display boot-loader

The current boot app is: flash:/s3610\_5510-cmw520-r5309p02.bin

The app that will boot upon reboot is: flash:/s3610\_5510-cmw520-r5309p02.bin

1. **重启系统**

<ftpceshi>reboot

Start to check configuration with next startup configuration file, please wait.........DONE!

This command will reboot the device. Current configuration will be lost in next startup if you continue. Continue? [Y/N]:

1. **开启设备定时重启功能，并指定重启的具体时间**

<ftpceshi>schedule reboot at 22:30 2015/08/11

% Reboot delay cannot exceed 720 hours

1. **开启设备定时重启功能，并指定延时时间**

<ftpceshi>schedule reboot delay 24:00

Reboot system at 13:38 04/27/2000(in 24 hour(s) and 0 minute(s)). confirm? [Y/N]:y

<ftpceshi>

%Apr 26 13:38:59:690 2000 ftpceshi CMD/4/REBOOT:

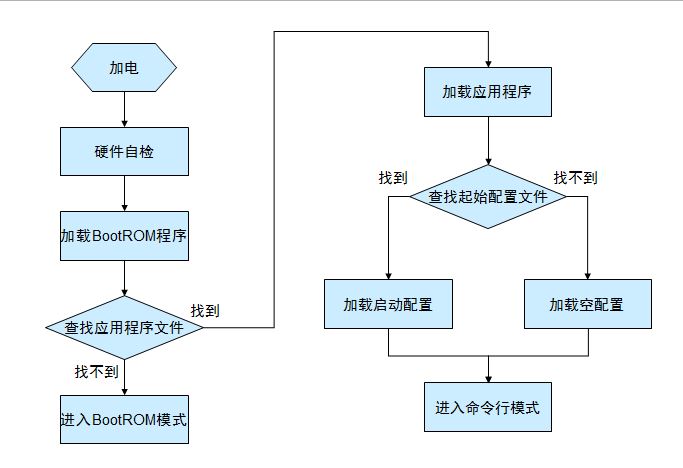
aux0: Set schedule reboot parameters at 13:38:59 04/26/2000, and system will reboot at 13:38 04/27/2000.

1. **显示设备重启时间**

<ftpceshi>display schedule reboot

System will reboot at 13:38 04/27/2000 (in 23 hours and 58 minutes).

**网络设备的一般引导流程**



* 在命令行模式中采用TFTP/FTP上传/下载应用程序及配置文件，实现应用程序升级
* 在BootROM模式中通过以太口采用TFTP/FTP完成应用程序软件升级
* 在BootROM模式中通过Console口采用XModem协议完成BootROM及应用程序的升级

**系统调试的操作**

进行系统调试时要显示详细信息要打开如下功能，但是系统资源占用过多，使用后要及时关闭

1. **开启控制台对系统信息的监视功能**

<ftpceshi>terminal monitor

1. **打开调试信息的屏幕输出开关**

<ftpceshi>terminal debugging

1. **打开模式调试开关**

<ftpceshi>debugging all（注意，这是全部模式，可以具体选择，例如rip bgp等）

1. **显示调试开关**

<ftpceshi>display debugging

使用tracert命令检查路由路径是，路由器上必须启动两项服务，否则无法正常像是跳点地址（安全方面考虑）

<ftpceshi>ip ttl-expires enable

<ftpceshi>ip unreachables enable

**HDLC协议**

* 对于任何一种比特流都可透明传输
* 较高的数据链路传输效率
* 所有的帧都有FCS，传输可靠性高
* 用统一的帧格式来实现传输
* 不支持验证，缺乏足够的安全性
* 协议不支持IP地址协商
* 用于点到点的同步链路

**路由器R1配置:**

<H3C>dis interface //显示联通的端口号

Serial6/0 current state: UP

Line protocol current state: UP

Description: Serial6/0 Interface

The Maximum Transmit Unit is 1500, Hold timer is 10(sec)

Internet protocol processing : disabled

Link layer protocol is PPP //默认点到点协议是PPP

LCP opened

Output queue : (Urgent queuing : Size/Length/Discards) 0/100/0

Output queue : (Protocol queuing : Size/Length/Discards) 0/500/0

Output queue : (FIFO queuing : Size/Length/Discards) 0/75/0

Physical layer is synchronous, Baudrate is 64000 bps

Interface is DCE, Cable type is V35, Clock mode is DCECLK1

Last clearing of counters: Never

Last 300 seconds input rate 0.00 bytes/sec, 0 bits/sec, 0.00 packets/sec

Last 300 seconds output rate 0.00 bytes/sec, 0 bits/sec, 0.00 packets/sec

Input: 6 packets, 80 bytes

0 broadcasts, 0 multicasts

0 errors, 0 runts, 0 giants

0 CRC, 0 align errors, 0 overruns

0 dribbles, 0 aborts, 0 no buffers

0 frame errors

Output:8 packets, 108 bytes

0 errors, 0 underruns, 0 collisions

0 deferred

DCD=UP DTR=UP DSR=UP RTS=UP CTS=UP

<H3C>sys

[H3C]sysname r1

[r1]interface Serial 6/0

[r1-Serial6/0]link-protocol hdlc

[r1-Serial6/0]timer hold 30

[r1-Serial6/0]ip address 192.168.3.11 24

[r1-Serial6/0]display interface Serial 6/0

Serial6/0 current state: UP

Line protocol current state: DOWN

Description: Serial6/0 Interface

The Maximum Transmit Unit is 1500, Hold timer is 30(sec)

Internet Address is 192.168.3.11/24 Primary

Link layer protocol is HDLC

Output queue : (Urgent queuing : Size/Length/Discards) 0/100/0

Output queue : (Protocol queuing : Size/Length/Discards) 0/500/0

Output queue : (FIFO queuing : Size/Length/Discards) 0/75/0

Physical layer is synchronous, Baudrate is 64000 bps

Interface is DCE, Cable type is V35, Clock mode is DCECLK1

Last clearing of counters: Never

Last 300 seconds input rate 2.10 bytes/sec, 16 bits/sec, 0.17 packets/sec

Last 300 seconds output rate 2.20 bytes/sec, 17 bits/sec, 0.18 packets/sec

Input: 97 packets, 1232 bytes

0 broadcasts, 0 multicasts

0 errors, 0 runts, 0 giants

0 CRC, 0 align errors, 0 overruns

0 dribbles, 0 aborts, 0 no buffers

0 frame errors

Output:81 packets, 1094 bytes

0 errors, 0 underruns, 0 collisions

0 deferred

DCD=UP DTR=UP DSR=UP RTS=UP CTS=UP

**路由器R2配置:**

<H3C>system-view

System View: return to User View with Ctrl+Z.

[H3C]sysname r2

[r2]display interface

Serial6/0 current state: UP

Line protocol current state: DOWN

Description: Serial6/0 Interface

The Maximum Transmit Unit is 1500, Hold timer is 10(sec)

Internet protocol processing : disabled

Link layer protocol is PPP

LCP reqsent

Output queue : (Urgent queuing : Size/Length/Discards) 0/100/0

Output queue : (Protocol queuing : Size/Length/Discards) 0/500/0

Output queue : (FIFO queuing : Size/Length/Discards) 0/75/0

Physical layer is synchronous, Virtual baudrate is 64000 bps

Interface is DTE, Cable type is V35, Clock mode is DTECLK1

Last clearing of counters: Never

Last 300 seconds input rate 1.36 bytes/sec, 10 bits/sec, 0.08 packets/sec

Last 300 seconds output rate 2.14 bytes/sec, 17 bits/sec, 0.15 packets/sec

Input: 84 packets, 1176 bytes

0 broadcasts, 0 multicasts

0 errors, 0 runts, 0 giants

0 CRC, 0 align errors, 0 overruns

0 dribbles, 0 aborts, 0 no buffers

0 frame errors

Output:116 packets, 1574 bytes

0 errors, 0 underruns, 0 collisions

0 deferred

DCD=UP DTR=UP DSR=UP RTS=UP CTS=UP

[r2]interface Serial 6/0

[r2-Serial6/0]link-protocol hdlc

%Aug 11 12:49:13:240 2015 r2 IFNET/4/LINK UPDOWN:

Serial6/0: link status is DOWN

[r2-Serial6/0]

%Aug 11 12:49:15:510 2015 r2 IFNET/4/LINK UPDOWN:

Serial6/0: link status is UP

[r2-Serial6/0]timer hold 30

[r2-Serial6/0]ip address 192.168.3.12 24

[r2-Serial6/0]dis interface Serial 6/0

Serial6/0 current state: UP

Line protocol current state: UP

Description: Serial6/0 Interface

The Maximum Transmit Unit is 1500, Hold timer is 30(sec)

Internet Address is 192.168.3.12/24 Primary

Link layer protocol is HDLC

Output queue : (Urgent queuing : Size/Length/Discards) 0/100/0

Output queue : (Protocol queuing : Size/Length/Discards) 0/500/0

Output queue : (FIFO queuing : Size/Length/Discards) 0/75/0

Physical layer is synchronous, Virtual baudrate is 64000 bps

Interface is DTE, Cable type is V35, Clock mode is DTECLK1

Last clearing of counters: Never

Last 300 seconds input rate 1.36 bytes/sec, 10 bits/sec, 0.08 packets/sec

Last 300 seconds output rate 2.14 bytes/sec, 17 bits/sec, 0.15 packets/sec

Input: 89 packets, 1286 bytes

0 broadcasts, 0 multicasts

0 errors, 0 runts, 0 giants

0 CRC, 0 align errors, 0 overruns

0 dribbles, 0 aborts, 0 no buffers

0 frame errors

Output:126 packets, 1766 bytes

0 errors, 0 underruns, 0 collisions

0 deferred

DCD=UP DTR=UP DSR=UP RTS=UP CTS=UP

[r2-Serial6/0]ping 192.168.3.11 //测试

PING 192.168.3.11: 56 data bytes, press CTRL\_C to break

Reply from 192.168.3.11: bytes=56 Sequence=1 ttl=255 time=26 ms

Reply from 192.168.3.11: bytes=56 Sequence=2 ttl=255 time=25 ms

Reply from 192.168.3.11: bytes=56 Sequence=3 ttl=255 time=26 ms

Reply from 192.168.3.11: bytes=56 Sequence=4 ttl=255 time=26 ms

Reply from 192.168.3.11: bytes=56 Sequence=5 ttl=255 time=25 ms

--- 192.168.3.11 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

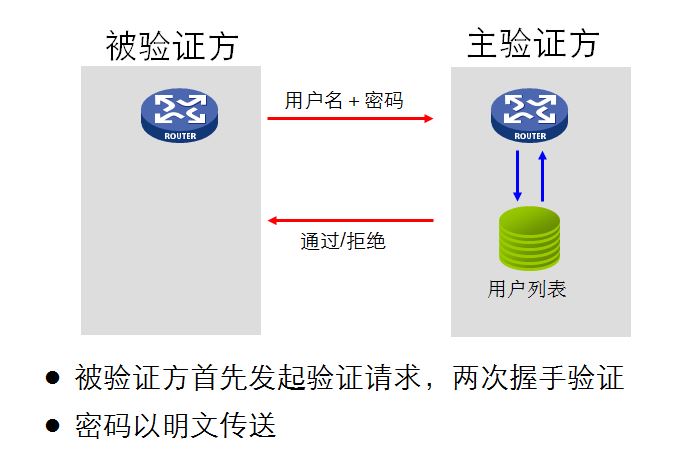
round-trip min/avg/max = 25/25/26 ms

**PPP协议特点**

* 可以工作在同异步方式下
* 能够控制数据链路的建立
* 支持验证，更加安全
* 可同时支持多种网络层协议
* 可以对网络层地址进行协商，能够远程分配IP地址
* 无重传机制，网络开销小

注意：HDLC协议配置方式简单，只需选择链路协议为HDLC，并约定检测时间即可；PPP协议时一个协议族，除了建立连接，还需建立认证（PAP和CHAP两种方式），最后约定IP地址（PPP协议支持IP地址获取）

1. **使用PAP方式进行验证**



**路由器R1作为主验证方：**

[r1]interface Serial 6/0

[r1-Serial6/0]link-protocol ppp

[r1-Serial6/0]

%Oct 23 05:41:45:433 2008 r1 IFNET/3/LINK\_UPDOWN: Serial6/0 link status is DOWN.

%Oct 23 05:41:45:434 2008 r1 IFNET/5/LINEPROTO\_UPDOWN: Line protocol on the interface Serial6/0 is DOWN.

%Oct 23 05:41:46:297 2008 r1 IFNET/3/LINK\_UPDOWN: Serial6/0 link status is UP.

[r1-Serial6/0]ppp authentication-mode pap

[r1]local-user pap

New local user added.

[r1-luser-hdlcpap]password simple pap

[r1-luser-hdlcpap]service-type ppp

**路由器R2作为被验证方：**

[r2]interface Serial 6/0

[r2-Serial6/0]link-protocol ppp

[r2-Serial6/0]ppp pap local-user pap password simple pap

[r2-Serial6/0]display interface Serial 6/0

Serial6/0 current state: UP

Line protocol current state: UP

Description: Serial6/0 Interface

The Maximum Transmit Unit is 1500, Hold timer is 30(sec)

Internet Address is 192.168.3.12/24 Primary

Link layer protocol is PPP

LCP opened, IPCP opened

Output queue : (Urgent queuing : Size/Length/Discards) 0/100/0

Output queue : (Protocol queuing : Size/Length/Discards) 0/500/0

Output queue : (FIFO queuing : Size/Length/Discards) 0/75/0

Physical layer is synchronous, Virtual baudrate is 64000 bps

Interface is DTE, Cable type is V35, Clock mode is DTECLK1

Last clearing of counters: Never

Last 300 seconds input rate 2.00 bytes/sec, 16 bits/sec, 0.11 packets/sec

Last 300 seconds output rate 0.66 bytes/sec, 5 bits/sec, 0.03 packets/sec

Input: 70 packets, 1200 bytes

0 broadcasts, 0 multicasts

0 errors, 0 runts, 0 giants

0 CRC, 0 align errors, 0 overruns

0 dribbles, 0 aborts, 0 no buffers

0 frame errors

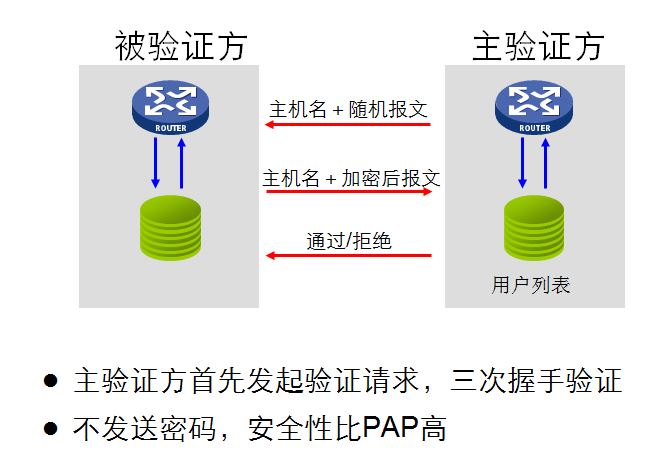
Output:33 packets, 564 bytes

0 errors, 0 underruns, 0 collisions

0 deferred

DCD=UP DTR=UP DSR=UP RTS=UP CTS=UP

1. **使用CHAP方式进行验证**

****

**注意：CHAP方式可实现单向和双向认证，实例中使用单向认证**

**路由器R1作为主验证方：**

<r1>sys

System View: return to User View with Ctrl+Z.

[r1]local-user r1chap

New local user added.

[r1-luser-r1chap]password simple test

[r1-luser-r1chap]service-type ppp

[r1]interface Serial 6/0

[r1-Serial6/0]link-protocol ppp

[r1-Serial6/0]ppp authentication-mode chap

[r1-Serial6/0]ppp chap user r2chap

**路由器R2作为主验证方：**

[r2]local-user r2chap

New local user added.

[r2-luser-r2chap]password simple test

[r2-luser-r2chap]service-type ppp

[r2]interface Serial 6/0

[r1-Serial6/0]link-protocol ppp

[r2-Serial6/0]ppp authentication-mode chap //此条启动双向认证

[r2-Serial6/0]ppp chap user r1chap

**PPP MP简介**

* MP（Multilink PPP）将多个PPP链路捆绑后当作一条链路使用
* MP可以实现增加带宽、负载分担、链路备份以及降低报文时延的目的
* 一种是通过配置虚拟模板接口（Virtual-Template，VT）来实现MP
  + - 可利用用户名确定捆绑
    - 一个VT接口可派生多个捆绑
* 一种是利用MP-Group接口实现MP
* Mp-Group是MP专用接口，一个MP-group只能对应一个绑定

注：经常应用的是mp-gourp方式，Mp-Group组设置中设置三层信息，二层内容仍由物理接口完成，PPP的认证属于二层内容，同一个组中如果有2个接口，这两个接口可以使用不同的二层协议和不同的认证方式。

**路由器R1设置：**

[r1-Serial6/0]undo ip address //取消原有物理接口的IP地址

[r1]interface Mp-group 1

[r1-Mp-group1]ip address 192.168.3.11 24

[r1-Mp-group1]interface s6/0

[r1-Serial6/0]ppp mp Mp-group 1

[r1-Serial6/0]interface s6/1

[r1-Serial6/1]ppp mp Mp-group 1

注：6/0接口配置中根据上步实验是有认证方式的，6/1口默认配置为PPP，未启用认证，可混合使用

**路由器R2配置：**

[r2]inter s 6/0

[r2-Serial6/0]undo ip address

[r2]interface Mp-group 1

[r2-Mp-group1]ip address 192.168.3.12 24

[r2-Mp-group1]inter s6/0

[r2-Serial6/0]ppp mp Mp-group 1

[r2-Serial6/0]inter s6/1

[r2-Serial6/1]ppp mp Mp-group 1

**测试和监测：**

[r2]ping 192.168.3.11

PING 192.168.3.11: 56 data bytes, press CTRL\_C to break

Reply from 192.168.3.11: bytes=56 Sequence=1 ttl=255 time=27 ms

Reply from 192.168.3.11: bytes=56 Sequence=2 ttl=255 time=28 ms

Reply from 192.168.3.11: bytes=56 Sequence=3 ttl=255 time=27 ms

Reply from 192.168.3.11: bytes=56 Sequence=4 ttl=255 time=27 ms

Reply from 192.168.3.11: bytes=56 Sequence=5 ttl=255 time=27 ms

--- 192.168.3.11 ping statistics ---

5 packet(s) transmitted

5 packet(s) received

0.00% packet loss

round-trip min/avg/max = 27/27/28 ms

**[r2]display ppp mp**

Mp-group is Mp-group1

max-bind: 16, min-fragment: 128

Bundle Multilink, 2 members, Master link is Mp-group1

Peer's endPoint descriptor: Mp-group1

Sequence format: long/long rcv/sent

Bundle Up Time: 2015/08/11 14:33:13:634

0 lost fragments, 5 reordered, 0 unassigned, 0 interleaved

Sequence: 4/5 rcvd/sent

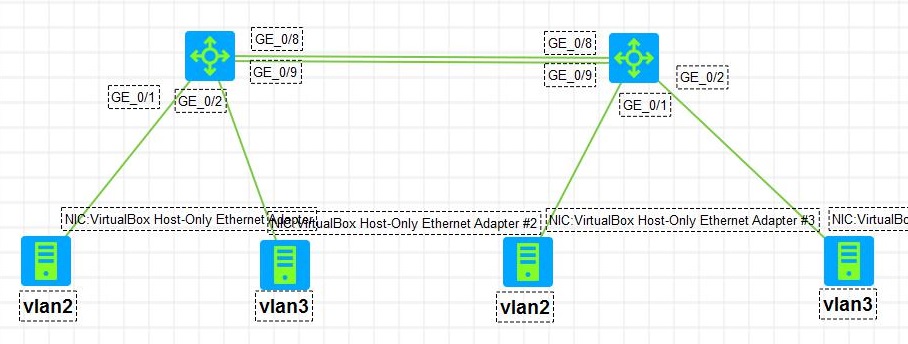
The member channels bundled are:

Serial6/0 Up-Time:2015/08/11 14:33:13:634

Serial6/1 Up-Time:2015/08/11 14:33:28:615

**VLAN和链路聚合**

图示如下：



主机1:192.168.2.11

主机2:192.168.2.12

主机3:192.168.2.13

主机4:192.168.2.14

**左侧路由器配置：**

[s1]vlan 2

[s1-vlan2]port GigabitEthernet 1/0/1

[s1-vlan2]vlan 3

[s1-vlan3]port GigabitEthernet 1/0/2

[s1]interface Bridge-Aggregation 1

[s1]interface GigabitEthernet 1/0/8

[s1-GigabitEthernet1/0/8]port link-aggregation group 1

[s1]interface GigabitEthernet 1/0/9

[s1-GigabitEthernet1/0/9]port link-aggregation group 1

[s1]interface Bridge-Aggregation 1

[s1-Bridge-Aggregation1]port link-type trunk

[s1-Bridge-Aggregation1]port trunk permit vlan all

**右侧路由器配置：**

[s2]vlan 2

[s2-vlan2]port GigabitEthernet 1/0/1

[s2-vlan2]vlan 3

[s2-vlan3]port GigabitEthernet 1/0/2

[s2]interface Bridge-Aggregation 1

[s2]interface GigabitEthernet 1/0/8

[s2-GigabitEthernet1/0/8]port link-aggregation group 1

[s2]interface GigabitEthernet 1/0/9

[s2-GigabitEthernet1/0/9]port link-aggregation group 1

[s2]interface Bridge-Aggregation 1

[s2-Bridge-Aggregation1]port link-type trunk

[s2-Bridge-Aggregation1]port trunk permit vlan all

[s2]display vlan all

VLAN ID: 2

VLAN type: Static

Route interface: Not configured

Description: VLAN 0002

Name: VLAN 0002

Tagged ports: None

Untagged ports:

GigabitEthernet1/0/1

VLAN ID: 3

VLAN type: Static

Route interface: Not configured

Description: VLAN 0003

Name: VLAN 0003

Tagged ports: None

Untagged ports:

GigabitEthernet1/0/2

**[s2]display link-aggregation summary**

Aggregation Interface Type:

BAGG -- Bridge-Aggregation, BLAGG -- Blade-Aggregation, RAGG -- Route-Aggregation

Aggregation Mode: S -- Static, D -- Dynamic

Loadsharing Type: Shar -- Loadsharing, NonS -- Non-Loadsharing

Actor System ID: 0x8000, 46bc-8970-0200

AGG AGG Partner ID Selected Unselected Individual Share

Interface Mode Ports Ports Ports Type

--------------------------------------------------------------------------------

BAGG1 S None 2 0 0 Shar

**[s2]display interface Bridge-Aggregation brief**

Brief information on interface(s) under bridge mode:

Link: ADM - administratively down; Stby - standby

Speed or Duplex: (a)/A - auto; H - half; F - full

Type: A - access; T - trunk; H - hybrid

Interface Link Speed Duplex Type PVID Description

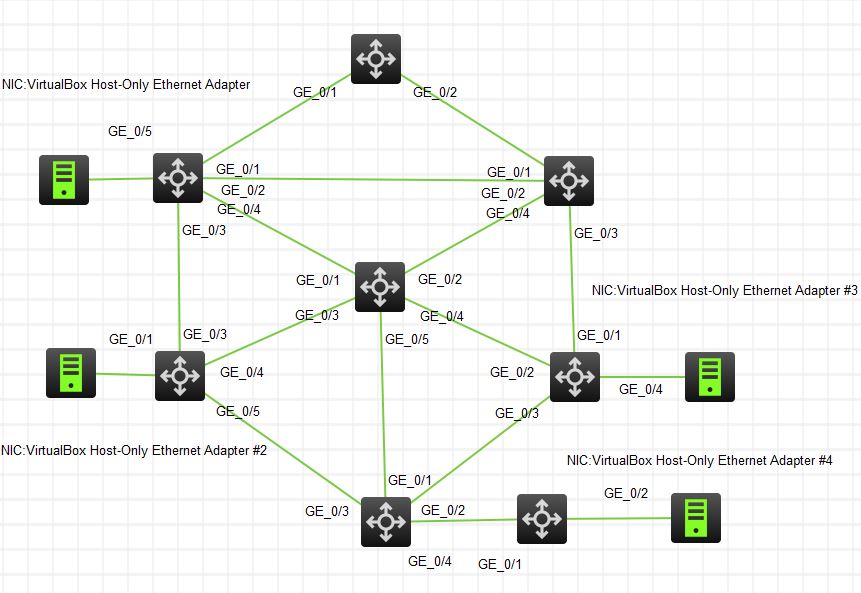
BAGG1 UP 2G(a) F(a) T 1

**连通测试：**

****

**STP生成树练习**

**图示：**

****

**顶路由：**

**[H3C]stp mode stp**

**[H3C]stp global enable**

**[H3C]stp priority 0**

**左上路由：**

**[H3C]stp priority 4096**

**[H3C]stp mode stp**

**[H3C]stp global enable**

**[H3C]interface GigabitEthernet 1/0/5**

**[H3C-GigabitEthernet1/0/5]undo stp enable**

**[H3C]dis stp**

**-------[CIST Global Info][Mode STP]-------**

**Bridge ID : 4096.4641-2c75-0200**

**Bridge times : Hello 2s MaxAge 20s FwdDelay 15s MaxHops 20**

**Root ID/ERPC : 0.4641-220f-0100, 20**

**RegRoot ID/IRPC : 4096.4641-2c75-0200, 0**

**RootPort ID : 128.2**

**BPDU-Protection : Disabled**

**Bridge Config-**

**Digest-Snooping : Disabled**

**TC or TCN received : 27**

**Time since last TC : 0 days 0h:9m:29s**

**----[Port6(GigabitEthernet1/0/5)][DISABLED]----**

**Port protocol : Disabled**

**下端路由：**

**[H3C]stp mode stp**

**[H3C]stp global enable**

**[H3C-GigabitEthernet1/0/4]stp edged-port**

**Edge port should only be connected to terminal. It will cause temporary loops if port GigabitEthernet1/0/4 is connected to bridges. Please use it carefully.**

**[H3C-GigabitEthernet1/0/4]display stp brief**

**MST ID Port Role STP State Protection**

**0 GigabitEthernet1/0/1 ALTE DISCARDING NONE**

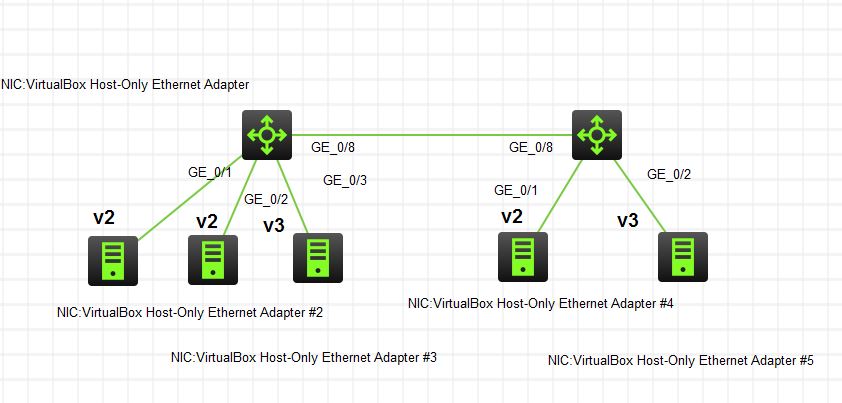
**0 GigabitEthernet1/0/2 ALTE DISCARDING NONE**

**0 GigabitEthernet1/0/3 ROOT FORWARDING NONE**

**0 GigabitEthernet1/0/4 DESI FORWARDING NONE**

**VLAN练习 hybrid**

**图示：**

****

**左侧交换设置：**

**[H3C]vlan 2**

**[H3C-vlan2]vlan 3**

**[H3C-vlan3]quit**

**[H3C]interface GigabitEthernet 1/0/1**

**[H3C-GigabitEthernet1/0/2]port hybrid pvid vlan 2**

**[H3C-GigabitEthernet1/0/1]port link-type hybrid**

**[H3C-GigabitEthernet1/0/1]port hybrid vlan 2 untagged**

**[H3C-GigabitEthernet1/0/1]port hybrid vlan 3 untagged**

**[H3C-GigabitEthernet1/0/1]dis inter g1/0/1**

**GigabitEthernet1/0/1**

**PVID: 2**

**Mdi type: automdix**

**Port link-type: hybrid**

**Tagged Vlan: none**

**UnTagged Vlan: 1(default vlan), 2-3**

**[H3C]interface GigabitEthernet 1/0/2**

**[H3C-GigabitEthernet1/0/2]port link-type hybrid**

**[H3C-GigabitEthernet1/0/2]port hybrid pvid vlan 2**

**[H3C-GigabitEthernet1/0/2]port hybrid vlan 2 untagged**

**[H3C-GigabitEthernet1/0/2]dis inter g1/0/2**

**GigabitEthernet1/0/2**

**PVID: 2**

**Mdi type: automdix**

**Port link-type: hybrid**

**Tagged Vlan: none**

**UnTagged Vlan: 1(default vlan), 2**

**[H3C]interface GigabitEthernet 1/0/3**

**[H3C-GigabitEthernet1/0/3]port link-type hybrid**

**[H3C-GigabitEthernet1/0/3]port hybrid pvid vlan 3**

**[H3C-GigabitEthernet1/0/3]port hybrid vlan 3 untagged**

**[H3C-GigabitEthernet1/0/3]port hybrid vlan 2 untagged**

**[H3C-GigabitEthernet1/0/3]dis inter g1/0/3**

**GigabitEthernet1/0/2**

**PVID: 2**

**Mdi type: automdix**

**Port link-type: hybrid**

**Tagged Vlan: none**

**UnTagged Vlan: 1(default vlan), 2-3**

**[H3C]interface GigabitEthernet 1/0/8**

**[H3C-GigabitEthernet1/0/8]port link-type hybrid**

**[H3C-GigabitEthernet1/0/8]port hybrid vlan 2 tagged**

**[H3C-GigabitEthernet1/0/8]port hybrid vlan 3 tagged**

**右侧交换机设置：**

**[H3C]vlan 2**

**[H3C-vlan2]vlan 3**

**[H3C]interface GigabitEthernet 1/0/1**

**[H3C-GigabitEthernet1/0/1]port link-type hybrid**

**[H3C-GigabitEthernet1/0/1]port hybrid pvid vlan 2**

**[H3C-GigabitEthernet1/0/1]port hybrid vlan 2 untagged**

**[H3C-GigabitEthernet1/0/1]interface GigabitEthernet 1/0/2**

**[H3C-GigabitEthernet1/0/2]port link-type hybrid**

**[H3C-GigabitEthernet1/0/2]port hybrid pvid vlan 3**

**[H3C-GigabitEthernet1/0/2]port hybrid vlan 3 untagged**

**[H3C]interface GigabitEthernet 1/0/8**

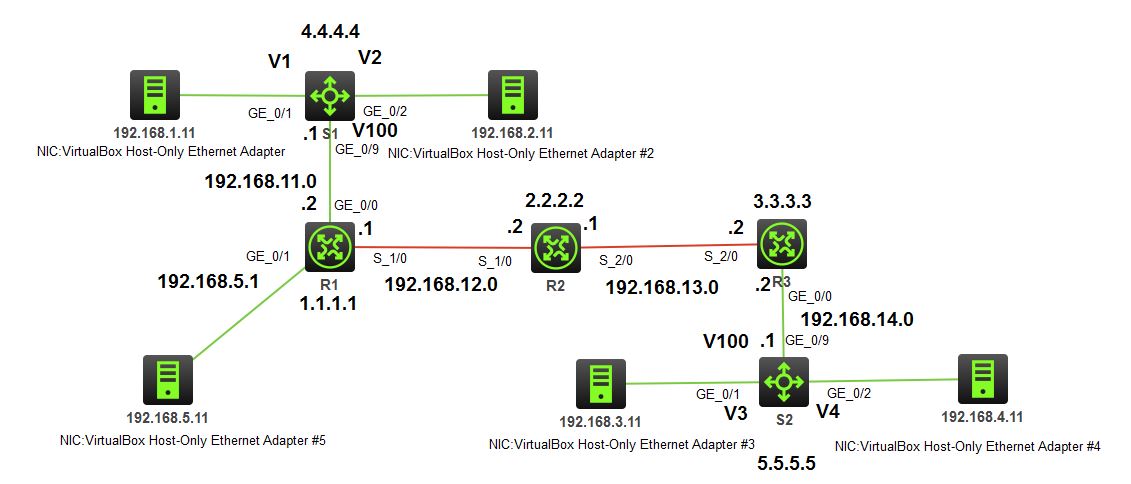
**[H3C-GigabitEthernet1/0/8]port link-type hybrid**

**[H3C-GigabitEthernet1/0/8]port hybrid vlan 2 tagged**

**[H3C-GigabitEthernet1/0/8]port hybrid vlan 3 tagged**

**静态路由实验**

1. **静态路由接口和指向IP的区别**
2. **默认路由的作用和产生环路的可能**
3. **黑洞路由的作用消除环路**

****

1. **配置各设备接口IP地址及还回地址：**

**S1配置：**

**<H3C>sys**

**[H3C]hostname S1**

**[S1]interface LoopBack 0**

**[S1-LoopBack0]ip address 4.4.4.4 255.255.255.255**

**[S1]vlan 2**

**[S1-vlan2]vlan 100**

**[S1]interface Vlan-interface 1**

**[S1-Vlan-interface1]ip address 192.168.1.1 24**

**[S1]interface Vlan-interface 2**

**[S1-Vlan-interface2]ip address 192.168.2.1 24**

**[S1]inter Vlan-interface 100**

**[S1-Vlan-interface100]ip address 192.168.11.1 24**

**[S1]vlan 2**

**[S1-vlan2]port GigabitEthernet 1/0/2**

**[S1-vlan2]vlan 100**

**[S1-vlan100]port GigabitEthernet 1/0/9**

**从192.168.1.11 使用ping –S 192.168.1.11 192.168.1.1/2.1/4.4.4.4进行测试**

**S2配置：**

**<H3C>sys**

**[H3C]hostname S2**

**[S2]vlan 3**

**[S2-vlan3]vlan 4**

**[S2-vlan4]vlan 100**

**[S2]interface LoopBack 0**

**[S2-LoopBack0]ip address 5.5.5.5 32**

**[S2]inter Vlan-interface 3**

**[S2-Vlan-interface3]ip address 192.168.3.1 24**

**[S2]inter Vlan-interface 4**

**[S2-Vlan-interface4]ip address 192.168.4.1 24**

**[S2]inter Vlan-interface 100**

**[S2-Vlan-interface100]ip address 192.168.14.1 24**

**[S2-Vlan-interface100]vlan 3**

**[S2-vlan3]port GigabitEthernet 1/0/1**

**[S2-vlan3]vlan 4**

**[S2-vlan4]port GigabitEthernet 1/0/2**

**[S2-vlan4]vlan 100**

**[S2-vlan100]port GigabitEthernet 1/0/9**

**R1配置：**

**<H3C>sys**

**[H3C]hostname R1**

**[R1] interface LoopBack 0**

**[R1-LoopBack0]ip address 1.1.1.1 32**

**[R1]interface GigabitEthernet 0/0**

**[R1-GigabitEthernet0/0]ip address 192.168.11.2 24**

**[R1-GigabitEthernet0/0]interface g0/1**

**[R1-GigabitEthernet0/1]ip address 192.168.5.1 24**

**[R1-GigabitEthernet0/1]interface s1/0**

**[R1-Serial1/0]ip address 192.168.12.1 24**

**R2配置：**

**<H3C>sys**

**[H3C]hostname R2**

**[R2] interface LoopBack 0**

**[R2-LoopBack0]ip address 2.2.2.2 32**

**[R2-GigabitEthernet0/1]interface s1/0**

**[R2-Serial1/0]ip address 192.168.12.2 24**

**[R2-GigabitEthernet0/1]interface s2/0**

**[R2-Serial1/0]ip address 192.168.13.1 24**

**R3配置：**

**<H3C>sys**

**[H3C]hostname R3**

**[R3]interface g 0/0**

**[R3-GigabitEthernet0/0]ip address 192.168.14.2 24**

**[R3-GigabitEthernet0/0]interface s2/0**

**[R3-Serial2/0]ip address 192.168.13.2 24**

**[R3]inter LoopBack 0**

**[R3-LoopBack0]ip address 3.3.3.3 32**

1. **配置静态路由**

**[S1]ip route-static 0.0.0.0 0 192.168.11.2 //终端路由器，现在除了直连路由只有一个出口，配置默认路由实现**

**[S2]ip route-static 0.0.0.0 0 192.168.14.2**

**[R1]ip route-static 192.168.1.0 24 192.168.11.1**

**[R1]ip route-static 192.168.2.0 24 192.168.11.1**

**[R1]ip route-static 0.0.0.0 0 192.168.12.2**

**[R1]ip route-static 4.4.4.4 32 192.168.11.1**

**[R2]ip route-static 192.168.1.0 24 s1/0 //点到点链路，可以使用端口号**

**[R2]ip route-static 192.168.2.0 24 s1/0**

**[R2]ip route-static 192.168.5.0 24 s1/0**

**[R2]ip route-static 192.168.11.0 24 s1/0**

**[R2]ip route-static 4.4.4.4 32 192.168.12.1**

**[R2]ip route-static 1.1.1.1 32 192.168.12.1**

**[R2]ip route-static 0.0.0.0 0 s2/0**

**[R3]ip route-static 192.168.3.0 24 192.168.14.1**

**[R3]ip route-static 192.168.4.0 24 192.168.14.1**

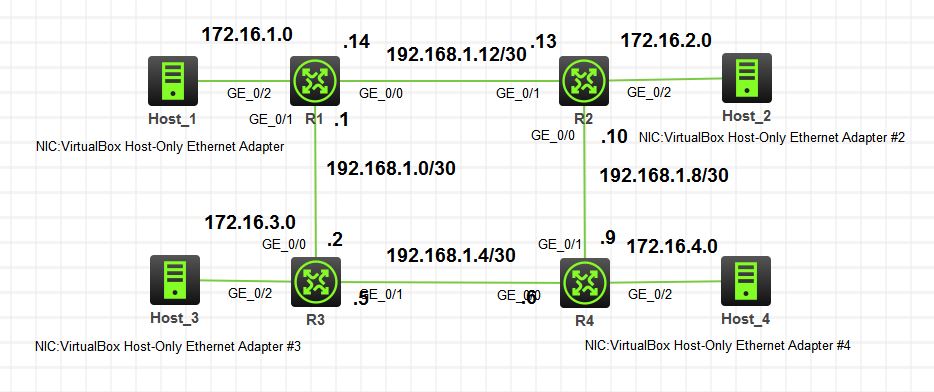
**[R3]ip route-static 5.5.5.5 32 192.168.14.1**

**[R3]ip route-static 0.0.0.0 0 s2/0**

**注意默认路由情况下为何要采用黑洞路由，路由备份和负载分担的应用场景**

**累加查询的意义？**

**RIP路由协议**



1. 接口配置

[R1]interface g0/0

[R1-GigabitEthernet0/0]ip address 192.168.1.14 30

[R1-GigabitEthernet0/0]interface g0/1

[R1-GigabitEthernet0/1]ip address 192.168.1.1 30

[R1-GigabitEthernet0/1]interface g0/2

[R1-GigabitEthernet0/2]ip address 172.16.1.1 24

<H3C>sys

[H3C]hostname R2

[R2]inter g0/1

[R2-GigabitEthernet0/1]ip address 192.168.1.13 30

[R2-GigabitEthernet0/1]inter g0/0

[R2-GigabitEthernet0/0]ip address 192.168.1.10 30

[R2-GigabitEthernet0/0]inter g0/2

[R2-GigabitEthernet0/2]ip address 172.16.2.1 24

[H3C]hostname R3

[R3]inter g0/0

[R3-GigabitEthernet0/0]ip address 192.168.1.2 30

[R3-GigabitEthernet0/0]inter g0/1

[R3-GigabitEthernet0/1]ip address 192.168.1.5 30

[R3-GigabitEthernet0/1]inter g0/2

[R3-GigabitEthernet0/2]ip address 172.16.3.1 24

[H3C]sysname R4

[R4]inter g0/0

[R4-GigabitEthernet0/0]ip address 192.168.1.6 30

[R4-GigabitEthernet0/0]inte g0/1

[R4-GigabitEthernet0/1]ip address 192.168.1.9 30

[R4-GigabitEthernet0/1]inter g0/2

[R4-GigabitEthernet0/2]ip address 172.16.4.1 24

1. 路由配置

<R1>sys

System View: return to User View with Ctrl+Z.

[R1]rip 1

[R1-rip-1]version 2

[R1-rip-1]undo summary

[R1-rip-1]network 192.168.1.0

[R1-rip-1]network 172.16.1.0

[R1-rip-1]silent-interface GigabitEthernet 0/2

[R1-GigabitEthernet0/0]rip authentication-mode md5 rfc2082 plain abcdef 50

<R2>sys

System View: return to User View with Ctrl+Z.

[R2]rip 1

[R2-rip-1]version 2

[R2-rip-1]undo summary

[R2-rip-1]network 192.168.1.0

[R2-rip-1]network 172.16.2.0

[R2-rip-1]silent-interface GigabitEthernet 0/2

[R2-rip-1]inter g0/1

[R2-GigabitEthernet0/1]rip authentication-mode md5 rfc2082 plai abcdef 50

<R3>sys

System View: return to User View with Ctrl+Z.

[R3]rip 1

[R3-rip-1]version 2

[R3-rip-1]undo summary

[R3-rip-1]network 192.168.1.0

[R3-rip-1]network 172.16.3.0

[R3-rip-1]silent-interface GigabitEthernet 0/2

<R4>sys

System View: return to User View with Ctrl+Z.

[R4]rip 1

[R4-rip-1]version 2

[R4-rip-1]undo summary

[R4-rip-1]network 192.168.1.0

[R4-rip-1]network 172.16.4.0

[R4-rip-1]silent-interface GigabitEthernet 0/2

**查看及演示：**

[R4-rip-1]dis rip 1 rout

Route Flags: R - RIP, T - TRIP

P - Permanent, A - Aging, S - Suppressed, G - Garbage-collect

D - Direct, O - Optimal, F - Flush to RIB

----------------------------------------------------------------------------

Peer 192.168.1.5 on GigabitEthernet0/0

Destination/Mask Nexthop Cost Tag Flags Sec

172.16.1.0/24 192.168.1.5 2 0 RAOF 13

172.16.3.0/24 192.168.1.5 1 0 RAOF 13

192.168.1.0/30 192.168.1.5 1 0 RAOF 13

Peer 192.168.1.10 on GigabitEthernet0/1

Destination/Mask Nexthop Cost Tag Flags Sec

172.16.1.0/24 192.168.1.10 2 0 RAOF 21

172.16.2.0/24 192.168.1.10 1 0 RAOF 21

192.168.1.12/30 192.168.1.10 1 0 RAOF 21

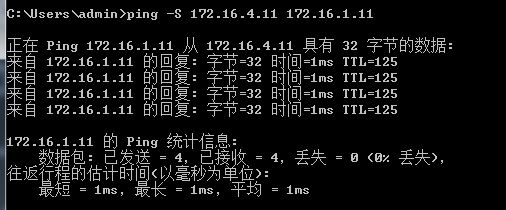
Local route

Destination/Mask Nexthop Cost Tag Flags Sec

172.16.4.0/24 0.0.0.0 0 0 RDOF -

192.168.1.4/30 0.0.0.0 0 0 RDOF -

192.168.1.8/30 0.0.0.0 0 0 RDOF

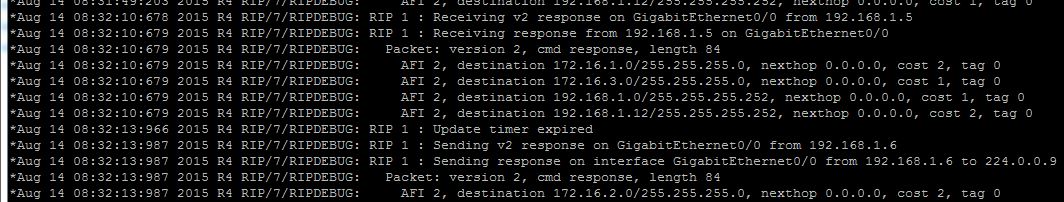


**显示RIP交流信息：**

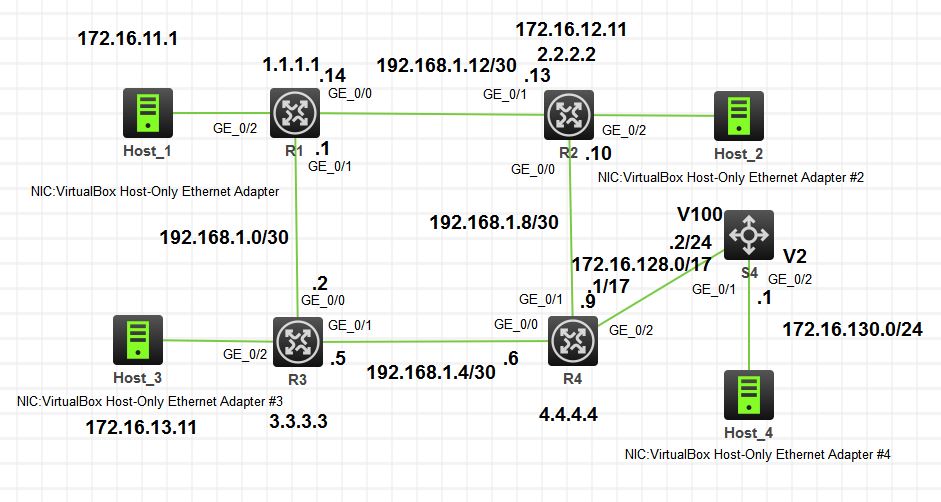
<R4>terminal monitor

<R4>terminal debugging

<R4>terminal debugging



**OSPF实验**



1. S4配置：

<H3C>sys

System View: return to User View with Ctrl+Z.

[H3C]sysname S4

[S4]vlan 2

[S4-vlan2]port GigabitEthernet 1/0/2

[S4-vlan2]vlan 100

[S4-vlan100]port GigabitEthernet 1/0/1

[S4]inter Vlan-interface 100

[S4-Vlan-interface100]ip address 172.16.128.2 24

[S4-Vlan-interface100]inter vlan-inter 2

[S4-Vlan-interface2]ip address 172.16.130.1 24

[S4]vlan 3

[S4]inter Vlan-interface 3

[S4-Vlan-interface3]ip address 172.16.131.1 24

[S4]ip route-static 0.0.0.0 0 172.16.128.1

1. 路由器接口配置

[H3C]sys

[H3C]sysname R1

[R1]inter g0/0

[R1-GigabitEthernet0/0]ip address 192.168.1.14 30

[R1-GigabitEthernet0/0]inter g0/1

[R1-GigabitEthernet0/1]ip address 192.168.1.1 30

[R1-GigabitEthernet0/1]inter g0/2

[R1-GigabitEthernet0/2]ip address 172.16.11.1 24

[R1]interface LoopBack 0

[R1-LoopBack0]ip address 1.1.1.1 32

<H3C>sys

[H3C]hostname R2

[R2]inter LoopBack 0

[R2-LoopBack0]ip address 2.2.2.2 32

[R2-LoopBack0]inter g0/0

[R2-GigabitEthernet0/0]ip address 192.168.1.10 30

[R2-GigabitEthernet0/0]inter g0/1

[R2-GigabitEthernet0/1]ip address 192.168.1.13 30

[R2-GigabitEthernet0/1]inter g0/2

[R2-GigabitEthernet0/2]ip address 172.168.12.1 24

<H3C>sys

[H3C]hostname R3

[R3]interface LoopBack 0

[R3-LoopBack0]ip address 3.3.3.3 32

[R3-LoopBack0]inter g0/0

[R3-GigabitEthernet0/0]ip address 192.168.1.2 30

[R3-GigabitEthernet0/0]inter g0/1

[R3-GigabitEthernet0/1]ip address 192.168.1.5 30

[R3-GigabitEthernet0/1]inter g0/2

[R3-GigabitEthernet0/2]ip address 172.16.13.1 24

<H3C>sys

[H3C]sysname

[H3C]sysname R4

[R4]interface g0/2

[R4-GigabitEthernet0/2]ip address 172.16.128.1 17

[R4]inter g0/0

[R4-GigabitEthernet0/0]ip address 192.168.1.6 30

[R4]interface g0/1

[R4-GigabitEthernet0/1]ip address 192.168.1.9 30

[R4]inter LoopBack 0

[R4-LoopBack0]IP address 4.4.4.4 32

1. OSPF设置

[R1]router id 1.1.1.1

[R1]ospf 1

[R1-ospf-1]area 0

[R1-ospf-1-area-0.0.0.0]network 1.1.1.1 0.0.0.0

[R1-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255

[R1-ospf-1-area-0.0.0.0]network 172.16.11.0 0.0.0.255

[R1-ospf-1-area-0.0.0.0]inter g0/0

[R1-GigabitEthernet0/0]ospf dr-priority 10

[R1-GigabitEthernet0/0]ospf cost ?

[R1-GigabitEthernet0/0]ospf cost 1000

[R2]router id 2.2.2.2

[R2]ospf 1

[R2-ospf-1]area 0

[R2-ospf-1-area-0.0.0.0]network 2.2.2.2 0.0.0.0

[R2-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255

[R2-ospf-1-area-0.0.0.0]network 172.16.12.0 0.0.0.255

[R2-ospf-1-area-0.0.0.0]inter g0/0

[R2-GigabitEthernet0/0]ospf dr-priority 10

[R2-GigabitEthernet0/0]ospf cost 500

[R3]router id 3.3.3.3

[R3]ospf 1

[R3-ospf-1]area 0

[R3-ospf-1-area-0.0.0.0]network 3.3.3.3 0.0.0.0

[R3-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255

[R3-ospf-1-area-0.0.0.0]network 172.16.13.0 0.0.0.255

[R3-ospf-1-area-0.0.0.0]inter g0/0

[R3-GigabitEthernet0/0]ospf dr-priority 10

[R3-GigabitEthernet0/0]ospf cost 10000

[R4]router id 4.4.4.4

[R4]ospf 1

[R4-ospf-1]area 0

[R4-ospf-1-area-0.0.0.0]network 4.4.4.4 0.0.0.0

[R4-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255

[R4-ospf-1-area-0.0.0.0]network 172.16.0.0 0.0.255.255

[R4-ospf-1-area-0.0.0.0]inter g0/0

[R4-GigabitEthernet0/0]ospf dr-priority 10

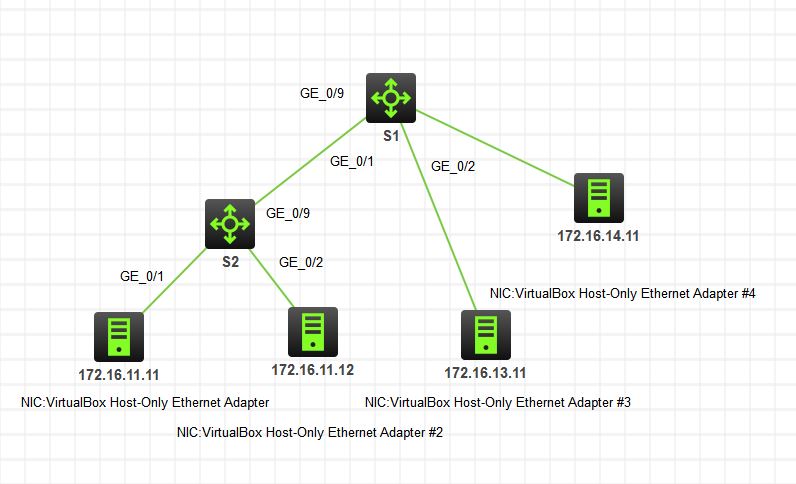
[R4-GigabitEthernet0/0]ospf cost 1000

注意此时R4路由器G0/2内部网络和外部不通，除非开启S4的arp代理功能

[S4-Vlan-interface100]proxy-arp enable

[S4-Vlan-interface100]undo arp authorized enable

**交换机安全设置实验**



**1、基本配置**

<H3C>SYS

[H3C]SYSNAME S1

[S1]vlan 11

[S1-vlan11]vlan 12

[S1-vlan12]vlan 13

[S1-vlan13]vlan 14

[S1-vlan14]interface vlan 11

[S1-Vlan-interface11]ip address 172.16.11.1 24

[S1-Vlan-interface11]interface vlan 12

[S1-Vlan-interface12]ip address 172.16.12.1 24

[S1-Vlan-interface12]interface vlan 13

[S1-Vlan-interface13]ip address 172.16.13.1 24

[S1]interface vlan 14

[S1-Vlan-interface14]ip address 172.16.14.1 24

[S1-Vlan-interface14]interface g1/0/9

[S1-GigabitEthernet1/0/9]port link-type trunk

[S1-GigabitEthernet1/0/9]port trunk permit vlan all

[S1-vlan13]port g1/0/1

[S1-vlan13]vlan 14

[S1-vlan14]port g1/0/2

<H3C>sys

[H3C]sysname S2

[S2]vlan 11

[S2-vlan11]port g1/0/1

[S2-vlan11]port g1/0/2

[S2-vlan11]inter g1/0/9

[S2-GigabitEthernet1/0/9]port link-type trunk

[S2-GigabitEthernet1/0/9]port trunk permit vlan all

各网段连通实验

2、端口隔离实验

隔离172.16.11.11 和 172.16.11.12

等待进一步测试

3、802.1x实验

[S1]dot1x

[S1]local-user 802.1x class network //v7命令特有

[S1-luser-network-802.1x]password simple test

[S1-luser-network-802.1x]service-type lan-access

[S1]interface g1/0/2

[S1-GigabitEthernet1/0/2]dot1x

[S1-GigabitEthernet1/0/2]dot1x port-method portbased //只有基于端口模式方可审核guest

Auth 模式两种均可

[S1-GigabitEthernet1/0/2]dot1x guest-vlan 13

[S1-GigabitEthernet1/0/2]dot1x auth-fail vlan 12

[S1-GigabitEthernet1/0/2]dot1x port-method portbased

[S1]dhcp enable

[S1]dhcp server ip-pool v12

[S1-dhcp-pool-v12]network 172.16.12.0 mask 255.255.255.0

[S1-dhcp-pool-v12]gateway-list 172.16.12.1

[S1]dhcp server ip-pool v13

[S1-dhcp-pool-v13]network 172.16.13.0 mask 255.255.255.0

[S1-dhcp-pool-v13]gateway-list 172.16.13.1

[S1]dhcp server ip-pool v14

[S1-dhcp-pool-v14]network 172.16.14.0 mask 255.255.255.0

[S1-dhcp-pool-v14]gateway-list 172.16.14.1

[S1-Vlan-interface12]dhcp server apply ip-pool v12

[S1-Vlan-interface13]dhcp server apply ip-pool v13

[S1]dhcp server forbidden-ip 172.16.13.1 172.16.13.100

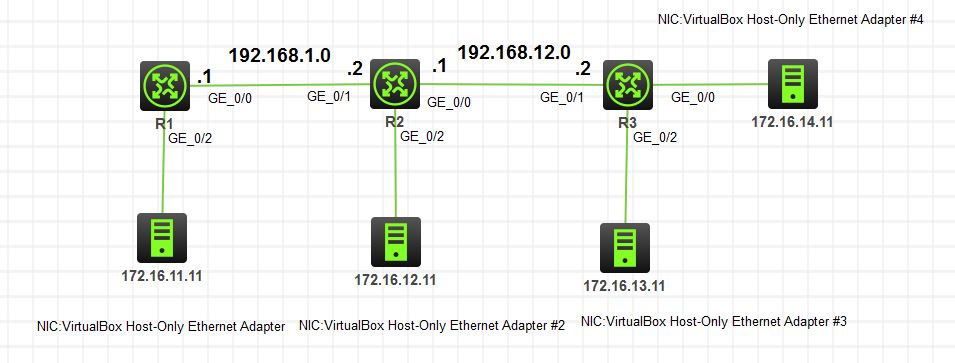
[S1]dhcp server forbidden-ip 172.16.12.1 172.16.12.100

[S1-Vlan-interface12]dhcp server apply ip-pool v12

[S1-Vlan-interface13]dhcp server apply ip-pool v13

[S1-Vlan-interface14]dhcp server apply ip-pool v14

**ACL及NAT练习**



1. 基本接口配置

<R1>sys

[R1]interface g0/0

[R1-GigabitEthernet0/0]ip address 192.168.1.1 24

[R1-GigabitEthernet0/0]inter g0/2

[R1-GigabitEthernet0/2]ip address 172.16.11.1 24

<H3C>sys

[H3C]sysname R2

[R2-GigabitEthernet0/0]inter g0/1

[R2-GigabitEthernet0/1]ip address 192.168.1.2 24

[R2-GigabitEthernet0/1]inter g0/2

[R2-GigabitEthernet0/2]ip address 172.16.12.1 24

[R2-GigabitEthernet0/2]inter g0/0

[R2-GigabitEthernet0/0]ip address 192.168.2.1 24

<H3C>sys

[H3C]sysname R3

[R3]inter g0/0

[R3-GigabitEthernet0/0]ip address 172.16.14.1 24

[R3-GigabitEthernet0/0]inter g0/1

[R3-GigabitEthernet0/1]ip address 192.168.2.2 24

[R3-GigabitEthernet0/1]inter g0/2

[R3-GigabitEthernet0/2]ip address 172.16.13.1 24

1. 使用OSPF路由实现互通

[R1]router id 1.1.1.1

[R1]ospf 1

[R1-ospf-1]area 0

[R1-ospf-1-area-0.0.0.0]network 192.168.1.0 0.0.0.255

[R1-ospf-1-area-0.0.0.0]network 172.16.0.0 0.0.255.255

<R2>sys

[R2]router id 2.2.2.2

[R2]ospf 1

[R2-ospf-1]area 0

[R2-ospf-1-area-0.0.0.0]network 192.168.0.0 0.0.255.255

[R2-ospf-1-area-0.0.0.0]network 172.16.0.0 0.0.255.255

<R3>sys

[R3]router id 3.3.3.3

[R3]ospf 1

[R3-ospf-1]area 0

[R3-ospf-1-area-0.0.0.0]network 192.168.0.0 0.0.255.255

[R3-ospf-1-area-0.0.0.0]network 172.16.0.0 0.0.255.255

1. 使用基本ACL，限制172.16.11.0网段访问172.16.14.0网段//ACL应用中只有包防火墙功能默认all，permit

[R3]acl basic 2000

[R3-acl-ipv4-basic-2000]rule 10 deny source 172.16.11.0 0.0.0.255

[R3-GigabitEthernet0/0]packet-filter 2000 outbound

增加命令，允许172.16.11.0网段中的172.16.11.11访问172.16.14.0网段

[R3-acl-ipv4-basic-2000]rule 5 permit source 172.16.11.11 0.0.0.0

1. 使用高级ACL，限制172.16.11.0网段访问172.16.13.11

[R1]acl advanced 3000

[R1-acl-ipv4-adv-3000]rule 5 deny ip source 172.16.11.0 0.0.0.255 destination 17

2.16.13.11 0.0.0.0

[R1-acl-ipv4-adv-3000]inter g0/2

[R1-GigabitEthernet0/2]packet-filter 3000 inbound

1. NAT实验

**R2上添加NAT，使得172.16.11.0网段访问外网使用地址池192.168.3.20-30**

<R2>sys

[R2]acl basic 2000

[R2-acl-ipv4-basic-2000]rule 5 permit source 172.16.11.0 0.0.0.255

[R2]nat address-group 1

[R2-address-group-1]address 192.168.3.20 192.168.3.30

[R2-GigabitEthernet0/0]nat outbound 2000 address-group 1

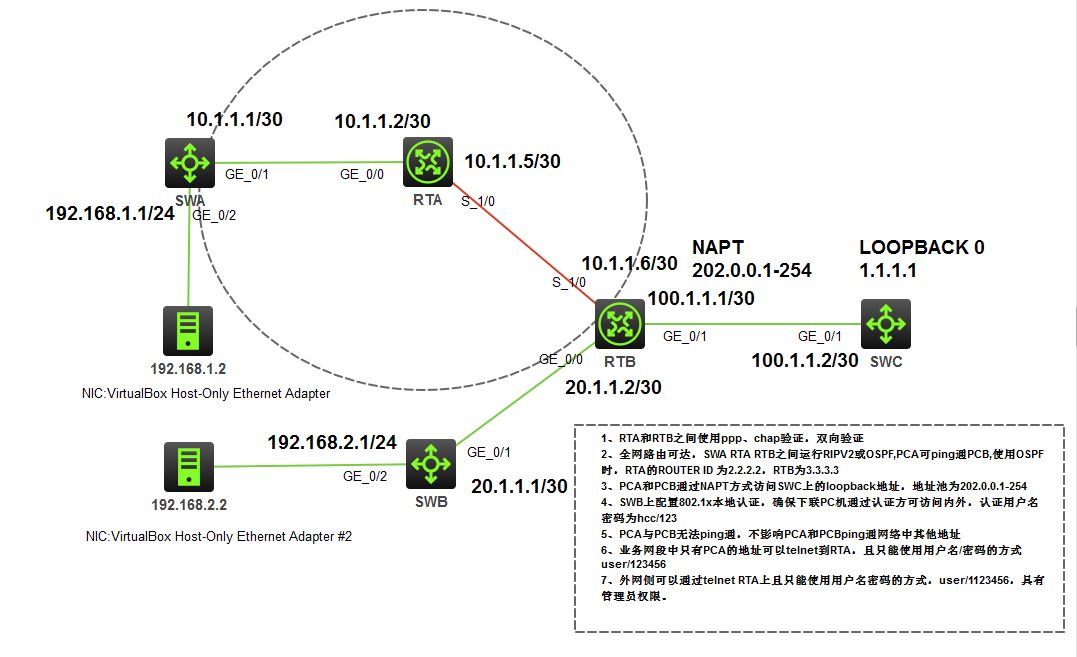
**R3上添加静态路由：**

[R3]ip route-static 192.168.3.0 24 192.168.2.1

**NAT SERVER实验：注意，如果进行此步骤实验，需要更改R2和R3间设置，使R3到R2内部不通，但R2上要添加至R3的默认路由（模拟真实网络边界情况）**

**特别注意：ACL策略配置时，只有包过滤防火墙使用中，策略可以不配置permit all，其他情况使用，如果需要都需要手动添加。**

**综合练习**

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1. **根据图示完成设备各接口配置并完成链路间连通测试**

**SWA:**

**<H3C>SYS**

**[H3C]sysname SWA**

**[SWA]vlan 2**

**[SWA]vlan 3**

**[SWA-Vlan-interface2]ip address 10.1.1.1 30**

**[SWA-Vlan-interface3]ip address 192.168.1.1 24**

**[SWB]vlan 2**

**[SWB-vlan2]port g1/0/1**

**[SWB-vlan2]vlan 3**

**[SWB-vlan3]port g1/0/2**

**SWB:**

**<H3C>sys**

**[H3C]sysname SWB**

**[SWB]vlan 2**

**[SWB-vlan2]vlan 3**

**[SWB]interface Vlan-interface 2**

**[SWB-Vlan-interface2]ip address 20.1.1.1 30**

**[SWB]inter Vlan-interface 3**

**[SWB-Vlan-interface3]ip address 192.168.2.1 24**

**[SWB]vlan 2**

**[SWB-vlan2]port g1/0/1**

**[SWB-vlan2]vlan 3**

**[SWB-vlan3]port g1/0/2**

**SWC:**

**<H3C>sys**

**[H3C]sysname SWC**

**[SWC]VLAN 2**

**[SWC-vlan2]PORT G1/0/1**

**[SWC-Vlan-interface2]ip address 100.1.1.2 30**

**[SWC]inter LoopBack 0**

**[SWC-LoopBack0]ip address 1.1.1.1 255.255.255.255**

**RTA:**

**<H3C>sys**

**[H3C]sysname RTA**

**[RTA-GigabitEthernet0/0]ip address 10.1.1.2 30**

**[RTA-Serial1/0]ip address 10.1.1.5 30**

**RTB:**

**<H3C>sys**

**[H3C]SYSNAME RTB**

**[RTB]inter g0/1**

**[RTB-GigabitEthernet0/1]ip address 100.1.1.1 30**

**[RTB-GigabitEthernet0/1]inter g0/0**

**[RTB-GigabitEthernet0/0]ip address 20.1.1.2 30**

**[RTB-GigabitEthernet0/0]inter s1/0**

**[RTB-Serial1/0]ip address 10.1.1.6 30**

**注意：完成接口设置后完成链路间PING测试，确保物理连接和接口IP配置无误**

1. **RTA和RTB间CHAP设置**

**RTA:**

**[RTA]local-user ppp class network**

**[RTA-luser-network-ppp]service-type ppp**

**[RTA-luser-network-ppp]password simple ppp**

**[RTA]inter s1/0**

**[RTA-Serial1/0]link-protocol ppp**

**[RTA-Serial1/0]ppp authentication-mode chap**

**[RTA-Serial1/0]ppp chap user ppp**

**RTB:**

**[RTB]local-user PPP class network**

**[RTB-luser-network-PPP]service-type ppp**

**[RTB-luser-network-PPP]password simple ppp**

**[RTB-luser-network-PPP]inter s1/0**

**[RTB-Serial1/0]link-protocol ppp**

**[RTB-Serial1/0]ppp authentication-mode chap**

**[RTB-Serial1/0]ppp chap user ppp**