



湖南大学  
HUNAN UNIVERSITY

## 课程实验报告

课 程 名 称: 计算机网络

实验项目名称:

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## 一、实验题目

理解动态路由协议 RIP 的工作原理；掌握采用动态路由协议 RIP 进行网络设计的基本原则和方法。

## 二、实验内容

1. 华为路由器 IP 地址的配置；
2. 动态路由协议 rip 的配置；
3. 路由规划；
4. 网络测试与排错操作；
5. 静态路由与动态路由的区别。

## 三、实验原理

简要说明 RIP 工作原理和适用范围；设计至少包括 3 个网络由 RIP 协议互连起来；观察并记录 各设备状态变化情况，特别留意路由信息的交换和路由表。解释说明与路由协议、路由表的相关性。可参考图 3.2-1 连线，具体连线情况请自行标注。

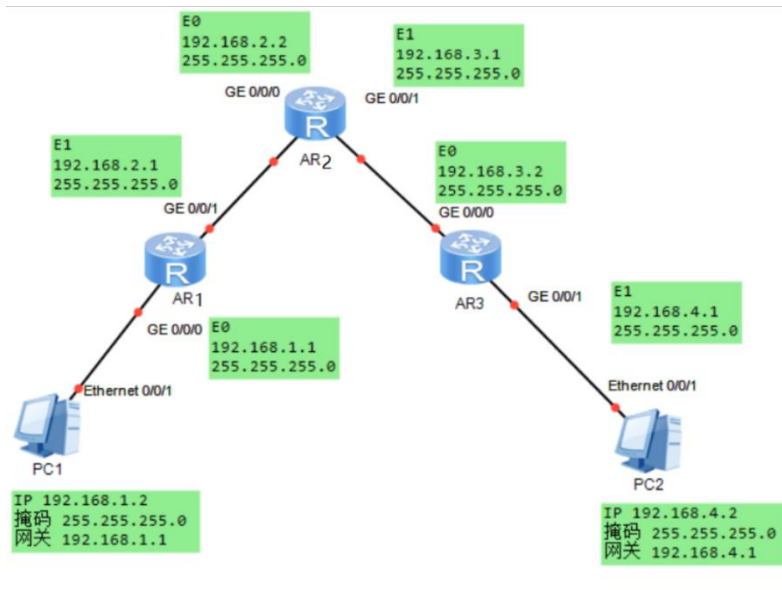


图 3.2-1 实验拓扑图

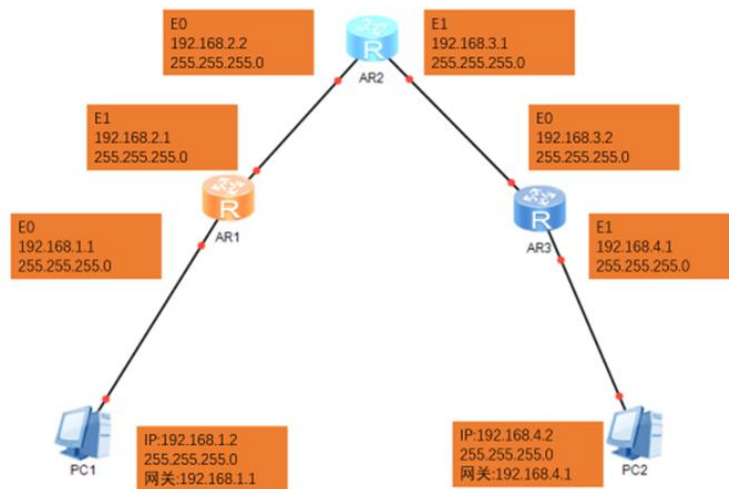
## 四、实验步骤

### STEP1: 软件安装

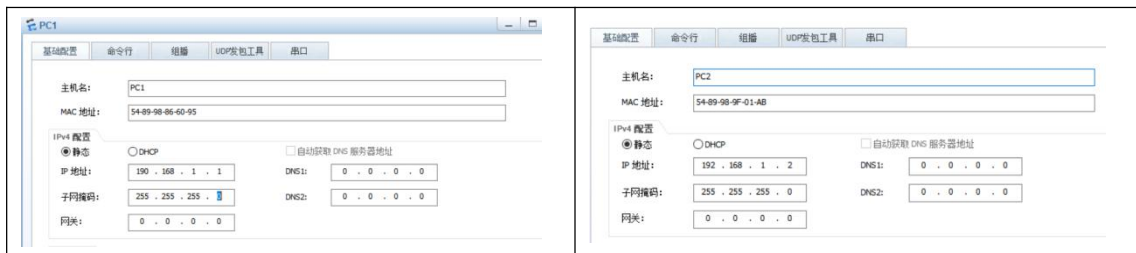
安装 ensp 和 virtualbox 5.2.44

### STEP2: 配置网络结构

建立拓扑结构如下图



配置 PC 的 IP 地址信息，分别配置 IPv4 地址为 192.168.1.1 和 192.168.1.2



然后启动路由器配置路由器名字，R1 的命名如下

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname FanyimingR1
```

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname FanyimingR1
[FanyimingR1]
```

R2 的命名截图:

```
AR2
The device is running!
#####
<Huawei>
Apr 20 2022 18:42:23-08:00 Huawei %%01IFPDT/4/IF_STATE(1)[0]:Interface GigabitEthernet0/0/0 has turned into UP state.
<Huawei>

Please check whether system data has been changed, and save data in time

Configuration console time out, please press any key to log on

<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname FanyimingR2
[FanyimingR2]
```

R3 命名截图：

```
AR3
The device is running!

<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname FanyimingR3
[FanyimingR3]
```

配置路由器的接口：

R1 的 0 接口： `interface GigabitEthernet 0/0/0`  
`ip address 192.168.1.1 255.255.255.0`

```
Enter system view, return user view with Ctrl+Z.
[FanyimingR1]interface GigabitEthernet 0/0/0
[FanyimingR1-GigabitEthernet0/0/0]ip address 192.168.1.1 255.255.255.0
Apr 20 2022 19:01:32-08:00 FanyimingR1 %%01IFNET/4/LINK_STATE(1)[0]:The line protocol IP on the interface GigabitEthernet0/0/0 has entered the UP state.
[FanyimingR1-GigabitEthernet0/0/0]q
[FanyimingR1]
```

在 PC1 上使用 ping 命令： `ping 192.168.1.1`，可以 ping 通。

```
PC Simulator has not been started!

Welcome to use PC Simulator!

PC>ping 192.168.1.1

Ping 192.168.1.1: 32 data bytes, Press Ctrl_C to break
From 192.168.1.1: bytes=32 seq=1 ttl=255 time<1 ms
From 192.168.1.1: bytes=32 seq=2 ttl=255 time=16 ms
From 192.168.1.1: bytes=32 seq=3 ttl=255 time=16 ms
From 192.168.1.1: bytes=32 seq=4 ttl=255 time=15 ms
From 192.168.1.1: bytes=32 seq=5 ttl=255 time=16 ms

--- 192.168.1.1 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 0/12/16 ms
```

为路由器 R1 的 GE1 接口配置 IP 地址。ip address 192.168.2.1 255.255.255.0

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]interface GigabitEthernet 0/0/1
[Huawei-GigabitEthernet0/0/1]ip address 192.168.2.1 255.255.255.0
Apr 20 2022 19:15:34-08:00 Huawei %01IFNET/4/LINK_STATE(1)[0]:The line protocol
IP on the interface GigabitEthernet0/0/1 has entered the UP state.
[Huawei-GigabitEthernet0/0/1]
```

然后是为 R2 的两个端口配置 IP 地址, 其中 GE0 端口: 192.168.2.2, GE1 端口: 192.168.3.1

```
[Huawei-GigabitEthernet0/0/1]
Apr 20 2022 19:18:42-08:00 Huawei %01IFNET/4/LINK_STATE(1)[1]:The line protocol
IP on the interface GigabitEthernet0/0/1 has entered the UP state.
[Huawei-GigabitEthernet0/0/1]interface GigabitEthernet 0/0/0
[Huawei-GigabitEthernet0/0/0]ip address 192.168.2.2 255.255.255.0
[Huawei-GigabitEthernet0/0/0]interface GigabitEthernet 0/0/1
[Huawei-GigabitEthernet0/0/1]ip address 192.168.3.1 255.255.255.0
Error: The address already exists.
[Huawei-GigabitEthernet0/0/1]ip address 192.168.3.1 255.255.255.0
```

R1 与 R2 相互 Ping 命令, 可以 ping 通

R1->R2

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]ping 192.168.2.2
PING 192.168.2.2: 56 data bytes, press CTRL_C to break
  Reply from 192.168.2.2: bytes=56 Sequence=1 ttl=255 time=70 ms
  Reply from 192.168.2.2: bytes=56 Sequence=2 ttl=255 time=20 ms
  Reply from 192.168.2.2: bytes=56 Sequence=3 ttl=255 time=20 ms
  Reply from 192.168.2.2: bytes=56 Sequence=4 ttl=255 time=20 ms
  Reply from 192.168.2.2: bytes=56 Sequence=5 ttl=255 time=30 ms

--- 192.168.2.2 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 20/32/70 ms
[Huawei]
```

R2->R1

```
[Huawei]ping 192.168.2.1
PING 192.168.2.1: 56 data bytes, press CTRL_C to break
  Reply from 192.168.2.1: bytes=56 Sequence=1 ttl=255 time=20 ms
  Reply from 192.168.2.1: bytes=56 Sequence=2 ttl=255 time=20 ms
  Reply from 192.168.2.1: bytes=56 Sequence=3 ttl=255 time=20 ms
  Reply from 192.168.2.1: bytes=56 Sequence=4 ttl=255 time=30 ms
  Reply from 192.168.2.1: bytes=56 Sequence=5 ttl=255 time=20 ms

--- 192.168.2.1 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 20/22/30 ms
```

配置 R3 的 IP, 其中 GE0 端口: 192.168.3.2, GE1 端口: 192.168.4.1

```
AR3
The device is running!

<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]interface GigabitEthernet 0/0/0
[Huawei-GigabitEthernet0/0/0]ip address 192.168.3.2 255.255.255.0
Apr 20 2022 19:24:32-08:00 Huawei %01IFNET/4/LINK_STATE(1)[0]:The line protocol
IP on the interface GigabitEthernet0/0/0 has entered the UP state.
[Huawei-GigabitEthernet0/0/0]q
[Huawei]interface GigabitEthernet 0/0/1
[Huawei-GigabitEthernet0/0/1]ip address 192.168.4.1 255.255.255.0
[Huawei-GigabitEthernet0/0/1]
```

用 PC2 ping R3 的端口, 可以 ping 通过。



```

PC>ping 192.168.4.1

Ping 192.168.4.1: 32 data bytes, Press Ctrl_C to break
From 192.168.4.1: bytes=32 seq=1 ttl=128 time<1 ms
From 192.168.4.1: bytes=32 seq=2 ttl=128 time<1 ms
From 192.168.4.1: bytes=32 seq=3 ttl=128 time<1 ms
From 192.168.4.1: bytes=32 seq=4 ttl=128 time<1 ms
From 192.168.4.1: bytes=32 seq=5 ttl=128 time<1 ms

--- 192.168.4.1 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 0/0/0 ms

PC>

```

### STEP3: 配置动态 RIP

#### R1 配置信息

```

[Huawei]rip
[Huawei-rip-1]network
192.168.1.0
[Huawei-rip-1]network
192.168.2.0
[Huawei-rip-1]q

```

#### R2 配置

```

[Huawei]rip
[Huawei-rip-1]network
192.168.2.0
[Huawei-rip-1]network
192.168.3.0
[Huawei-rip-1]

```

#### R3 配置信息

```

[Huawei]rip
[Huawei-rip-1]network
192.168.3.0
[Huawei-rip-1]network
192.168.4.0
[Huawei-rip-1]

```

路由表输出:disp ip routing-table

#### R1

```

[Huawei]disp ip routing-table
Route Flags: R - relay, D - download to fib
-----
Routing Tables: Public
  Destinations : 12      Routes : 12

Destination/Mask    Proto    Pre  Cost    Flags NextHop         Interface
-----
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
127.255.255.255/32  Direct   0    0        D    127.0.0.1           InLoopBack0
192.168.1.0/24      Direct   0    0        D    192.168.1.1         GigabitEthernet0/0/0
192.168.1.1/32      Direct   0    0        D    127.0.0.1           GigabitEthernet0/0/0
192.168.1.255/32    Direct   0    0        D    127.0.0.1           GigabitEthernet0/0/0
192.168.2.0/24      Direct   0    0        D    192.168.2.1         GigabitEthernet0/0/1
192.168.2.1/32      Direct   0    0        D    127.0.0.1           GigabitEthernet0/0/1
192.168.2.255/32    Direct   0    0        D    127.0.0.1           GigabitEthernet0/0/1
192.168.3.0/24      RIP      100  1        D    192.168.2.2         GigabitEthernet0/0/1

```

#### R2

```
AR2
[Huawei]disp ip routing-table
Route Flags: R - relay, D - download to fib
-----
Routing Tables: Public
Destinations : 12      Routes : 12

Destination/Mask    Proto  Pre  Cost    Flags NextHop         Interface
-----
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
127.255.255.255/32   Direct  0    0        D  127.0.0.1           InLoopBack0
192.168.1.0/24       RIP     100  1        D  192.168.2.1         GigabitEthernet
0/0/0
192.168.2.0/24       Direct  0    0        D  192.168.2.2         GigabitEthernet
0/0/0
192.168.2.2/32       Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/0
192.168.2.255/32     Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/0
192.168.3.0/24       Direct  0    0        D  192.168.3.1         GigabitEthernet
0/0/1
192.168.3.1/32       Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/1
192.168.3.255/32     Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/1
192.168.4.0/24       RIP     100  1        D  192.168.3.2         GigabitEthernet
```

R3

```
AR3
Error: The specified network already exists in the process.
[Huawei-rip-1]disp ip routing-table
Route Flags: R - relay, D - download to fib
-----
Routing Tables: Public
Destinations : 12      Routes : 12

Destination/Mask    Proto  Pre  Cost    Flags NextHop         Interface
-----
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
127.255.255.255/32   Direct  0    0        D  127.0.0.1           InLoopBack0
192.168.1.0/24       RIP     100  2        D  192.168.3.1         GigabitEthernet
0/0/0
192.168.2.0/24       RIP     100  1        D  192.168.3.1         GigabitEthernet
0/0/0
192.168.3.0/24       Direct  0    0        D  192.168.3.2         GigabitEthernet
0/0/0
192.168.3.2/32       Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/0
192.168.3.255/32     Direct  0    0        D  127.0.0.1           GigabitEthernet
0/0/0
192.168.4.0/24       Direct  0    0        D  192.168.4.1         GigabitEthernet
0/0/1
```

等待一分钟后，这些 Rip 协议仍然存在。

PC1 和 PC2 相互 ping

PC1pingPC2 如下图，最开始有一些组超时，但是之后再 ping'就没有超时数据了

```
PC1
基础配置  命令行  组播  UDP发包工具  串口
Request timeout!
From 192.168.4.1: bytes=32 seq=4 ttl=253 time=31 ms
From 192.168.4.1: bytes=32 seq=5 ttl=253 time=31 ms

--- 192.168.4.1 ping statistics ---
5 packet(s) transmitted
2 packet(s) received
60.00% packet loss
round-trip min/avg/max = 0/31/31 ms

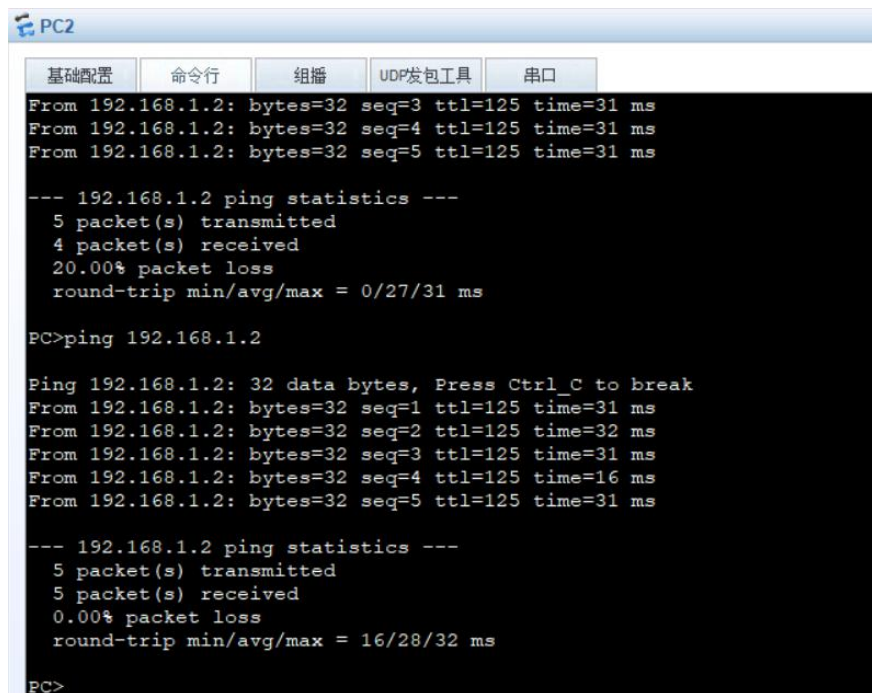
PC>ping 192.168.4.2

Ping 192.168.4.2: 32 data bytes, Press Ctrl_C to break
Request timeout!
From 192.168.4.2: bytes=32 seq=2 ttl=125 time=31 ms
From 192.168.4.2: bytes=32 seq=3 ttl=125 time=31 ms
From 192.168.4.2: bytes=32 seq=4 ttl=125 time=16 ms
From 192.168.4.2: bytes=32 seq=5 ttl=125 time=31 ms

--- 192.168.4.2 ping statistics ---
5 packet(s) transmitted
4 packet(s) received
20.00% packet loss
round-trip min/avg/max = 0/27/31 ms

PC>
```

PC2PingPC1: 可以 ping 通过



The screenshot shows a terminal window titled 'PC2' with tabs for '基础配置', '命令行', '组播', 'UDP发包工具', and '串口'. The '命令行' tab is active, displaying the following output:

```
From 192.168.1.2: bytes=32 seq=3 ttl=125 time=31 ms
From 192.168.1.2: bytes=32 seq=4 ttl=125 time=31 ms
From 192.168.1.2: bytes=32 seq=5 ttl=125 time=31 ms

--- 192.168.1.2 ping statistics ---
 5 packet(s) transmitted
 4 packet(s) received
20.00% packet loss
round-trip min/avg/max = 0/27/31 ms

PC>ping 192.168.1.2

Ping 192.168.1.2: 32 data bytes, Press Ctrl_C to break
From 192.168.1.2: bytes=32 seq=1 ttl=125 time=31 ms
From 192.168.1.2: bytes=32 seq=2 ttl=125 time=32 ms
From 192.168.1.2: bytes=32 seq=3 ttl=125 time=31 ms
From 192.168.1.2: bytes=32 seq=4 ttl=125 time=16 ms
From 192.168.1.2: bytes=32 seq=5 ttl=125 time=31 ms

--- 192.168.1.2 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
round-trip min/avg/max = 16/28/32 ms

PC>
```

## 五、实验心得与不足

### 思考题

1. 在完成动态路由配置后，最远两端能够 ping 通，请问网络中间的任意两点间也能 ping 通吗？为什么？

可以，因为最远两端可以 ping 通的话，则网络中间任意两点是最远两端路线的子集（一部分），因此也一定能 ping 通。

2. 静态路由和动态路由协议的区别是什么？

静态路由指的是有一些路由器使用者或是一些网络管理人员手工进行配置的一些路由信息。当网络的拓扑结构或链路的状态发生变化时，网络管理员需要手工去修改路由表中相关的静态路由信息。

动态路由是指路由器能够自动地建立自己的路由表，并且能够根据实际实际情况的变化适时地进行调整。动态路由机制的运作依赖路由器的两个基本功能：对路由表的维护；路由器之间适时的路由信息交换。

简单来说：动态路由是自动分配 IP，能够适应各种设备加入和离开，静态路由是手工配置 IP，一般是管理员手工配置好网络结构。

### 遇到的问题：

1. 遇到 AR 无法启动的问题，发现需要关闭 hype-v 功能，并重启计算机。注意其他软件的要求，版本错误会导致 ensp 无法正确运行，



表 B-1 华为 eNSP 需安装软件及对应版本号

软件类别	版本号
WinPcap	4.1.3
Wireshark	2.6.6
VirtualBox	4.2.X-5.2.X

2. 做到半发现拓扑图的顺序与指导书不一致，左下是 1 中间是 2 右边是 3，要细心顺序问题。
3. 大坑：在 ensp 的路由器配置之后，一定要记得保存，不然上次配置的全会失效

```
[FanyimingR1-rfp-1]q
[FanyimingR1]q
<FanyimingR1>save
  The current configuration will be written to the device.
  Are you sure to continue? (y/n)[n]:y
  It will take several minutes to save configuration file, please wait.....
  Configuration file had been saved successfully
  Note: The configuration file will take effect after being activated
<FanyimingR1>
```