

实验4：互联网组网与路由器配置

姓名：张刘明 学号：2110049

实验内容及要求：

实体环境下互联网组网与路由器配置

在实体环境下完成互联网组网与路由器配置，要求如下：

1. 在机房实验室环境下，通过将局域网划分为不同子网，用多IP主机作为路由器，组建互联网。
2. 在命令行方式下，按照静态路由方式，配置路由器和主机，测试互联网的连通性。

仿真环境下的互联网组网与路由器配置

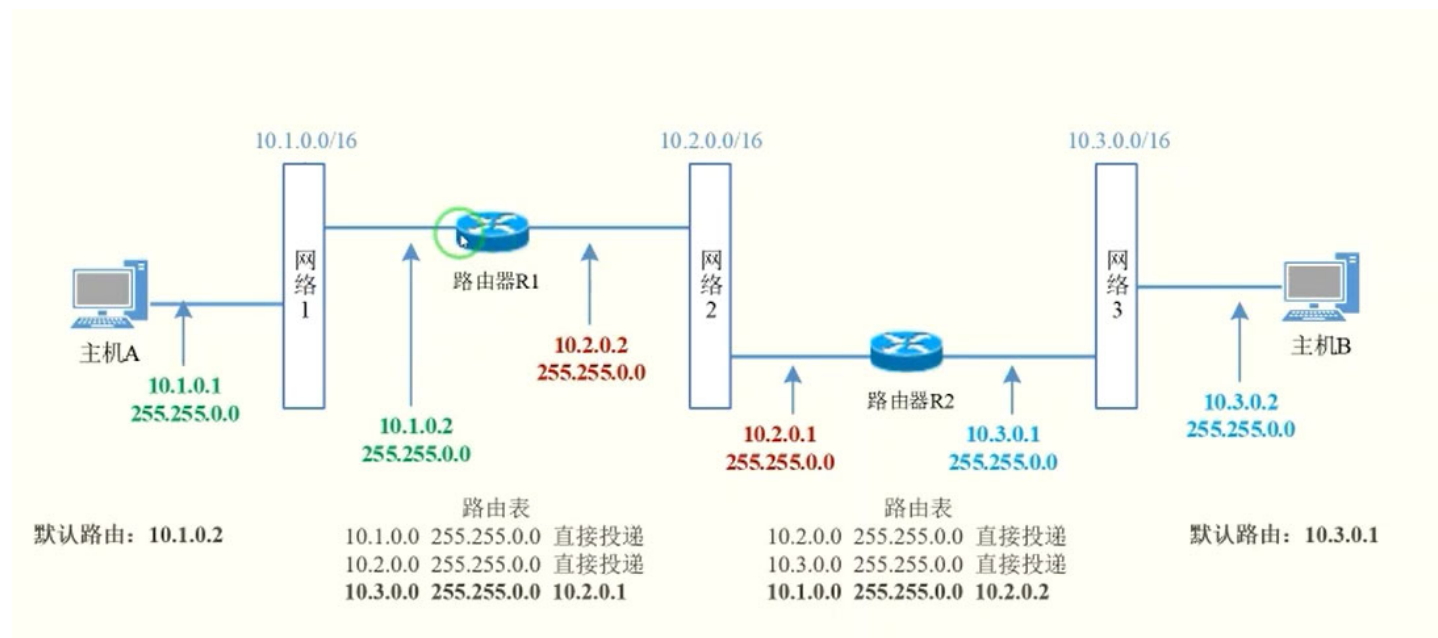
在仿真环境下完成互联网组网与路由器配置，要求如下：

1. 学习路由器的配置方法和配置命令。
2. 参考实体实验，组建由多个路由器组成的互联网。物理网络可以由集线器、交换机构成。
3. 按照静态路由方式配置路由器和主机，测试互联网的连通性。
4. 利用动态路由方式配置路由器和主机，测试互联网的连通性。
5. 在仿真环境的“模拟”方式中观察数据包在互联网中的传递过程，并进行分析。

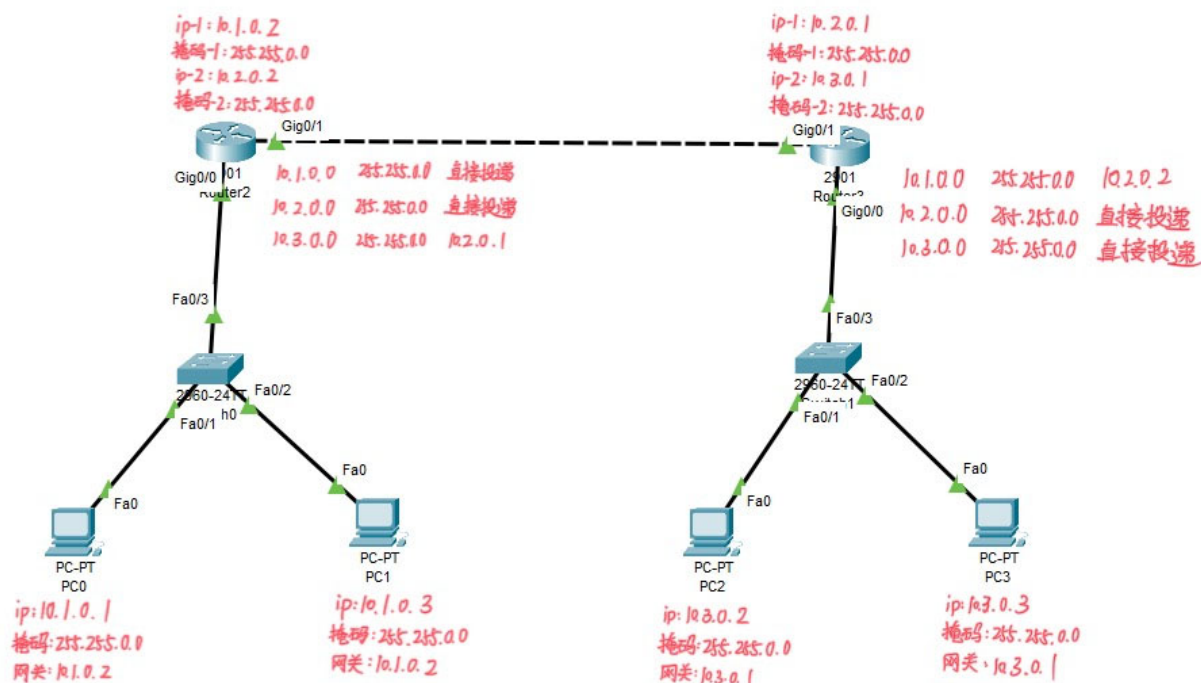
实验过程

仿真环境下的互联网组网与路由配置

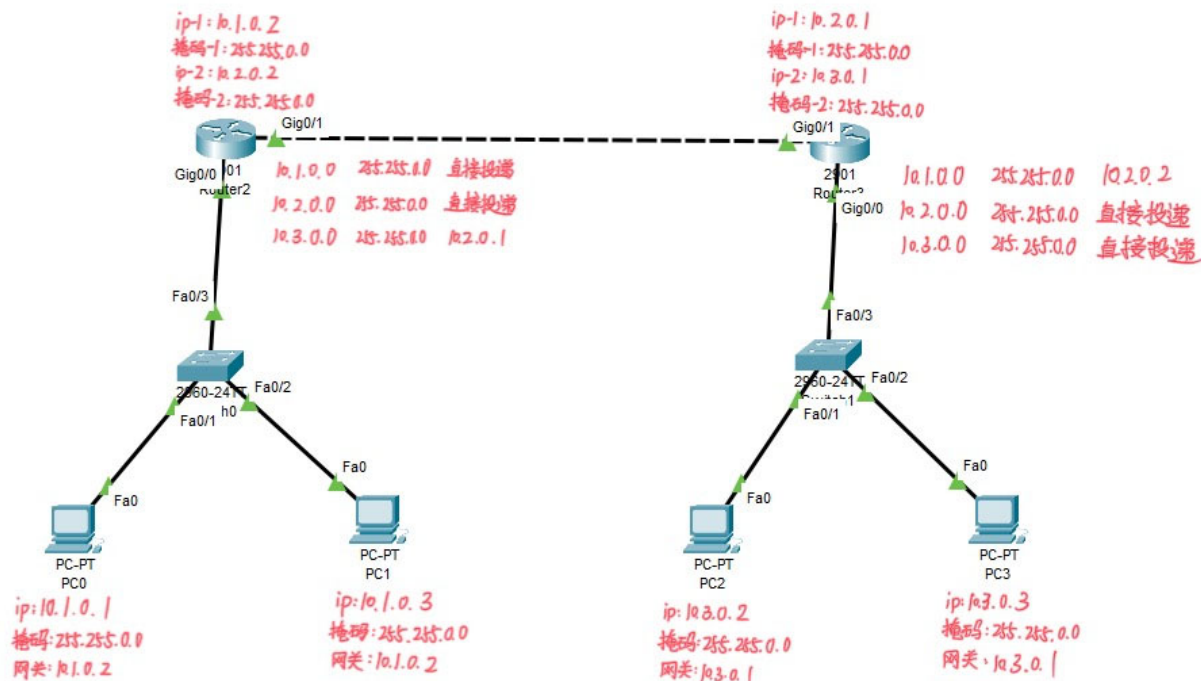
根据要求在Cisco Packet Tracer中建立组网拓扑结构



1. 静态路由拓扑结构配置



2. 动态路由拓扑结构配置



配置过程

静态路由部分

1. 配置路由设备的IP地址

给静态路由Router2和Router3设置IP地址，由于路由设备需要连接2个或2个以上的网络，因此需要设置多个IP地址

- router2:

在CLI中配置如下：

```
Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gig0/0
Router(config-if)#ip address 10.1.0.2 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface gig0/1
Router(config-if)#ip address 10.2.0.2 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

- router3:

在CLI中配置如下：

```

Router>enable
Router#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gig 0/1
Router(config-if)#ip address 10.2.0.1 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface gig 0/0
Router(config-if)#ip address 10.3.0.1 255.255.0.0

```

2. 为路由器添加路由表项

在全局配置模式下使用如下命令给 Router2、Router3 增加路由表项

R2: ip route 10.3.0.0 255.255.0.0 10.2.0.1

R1: ip route 10.1.0.0 255.255.0.0 10.2.0.2

再退回到特权执行模式，用 show ip route 查看路由表，如下，均添加成功

- router2:

```

Router(config)#ip route 10.3.0.0 255.255.0.0 10.2.0.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: L - local, C - connected, S - static, 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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.1.0.0/16 is directly connected, GigabitEthernet0/0
L       10.1.0.2/32 is directly connected, GigabitEthernet0/0
C       10.2.0.0/16 is directly connected, GigabitEthernet0/1
L       10.2.0.2/32 is directly connected, GigabitEthernet0/1
S       10.3.0.0/16 [1/0] via 10.2.0.1

```

- router3:

```

Router(config)#ip route 10.1.0.0 255.255.0.0 10.2.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: L - local, C - connected, S - static, 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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
























Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
S       10.1.0.0/16 [1/0] via 10.2.0.2
C       10.2.0.0/16 is directly connected, GigabitEthernet0/1
L       10.2.0.1/32 is directly connected, GigabitEthernet0/1
C       10.3.0.0/16 is directly connected, GigabitEthernet0/0
L       10.3.0.1/32 is directly connected, GigabitEthernet0/0

```

3. 测试网络连通性

ip为 10.1.0.1 的主机执行指令 ping 10.3.0.3 和指令 tracert 10.3.0.2 如下:

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	 ICMP
	0.001	PC0	Switch0	 ICMP
	0.002	Switch0	Router2	 ICMP
	0.003	Router2	Router3	 ICMP
	0.004	Router3	Switch1	 ICMP
	0.005	Switch1	PC2	 ICMP
	0.006	PC2	Switch1	 ICMP
	0.007	Switch1	Router3	 ICMP
	0.008	Router3	Router2	 ICMP
	0.009	Router2	Switch0	 ICMP
	0.010	Switch0	PC0	 ICMP
	1.011	--	PC0	 ICMP
	1.012	PC0	Switch0	 ICMP
	1.013	Switch0	Router2	 ICMP
	1.014	Router2	Router3	 ICMP
	1.015	Router3	Switch1	 ICMP
	1.016	Switch1	PC2	 ICMP
	1.017	PC2	Switch1	 ICMP
	1.018	Switch1	Router3	 ICMP
	1.019	Router3	Router2	 ICMP
	1.020	Router2	Switch0	 ICMP
	1.021	Switch0	PC0	 ICMP
	1.082	--	Switch1	 STP

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router2	ICMP
	0.002	--	Router2	ICMP
	0.003	Router2	Switch0	ICMP
	0.004	Switch0	PC0	ICMP
	0.107	--	PC0	ICMP
	0.108	PC0	Switch0	ICMP
	0.109	Switch0	Router2	ICMP
	0.109	--	Router2	ICMP
	0.110	Router2	Switch0	ICMP
	0.111	Switch0	PC0	ICMP
	0.212	--	PC0	ICMP
	0.213	PC0	Switch0	ICMP
	0.214	Switch0	Router2	ICMP
	0.214	--	Router2	ICMP
	0.215	Router2	Switch0	ICMP
	0.216	Switch0	PC0	ICMP
	0.318	--	PC0	ICMP
	0.319	PC0	Switch0	ICMP
	0.320	Switch0	Router2	ICMP
	0.321	Router2	Router3	ICMP
	0.321	--	Router3	ICMP
	0.322	Router3	Router2	ICMP
	0.323	Router2	Switch0	ICMP
	0.324	Switch0	PC0	ICMP

```

C:\>ping 10.3.0.3

Pinging 10.3.0.3 with 32 bytes of data:

Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126

Ping statistics for 10.3.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 10ms, Average = 10ms

C:\>tracert 10.3.0.2

Tracing route to 10.3.0.2 over a maximum of 30 hops:

  0  4 ms    4 ms    4 ms    10.1.0.2
  1  6 ms    6 ms    6 ms    10.2.0.1
  2 10 ms   10 ms   10 ms    10.3.0.2

Trace complete.

C:\>

```

结果显示网络联通。

动态路由部分

动态路由可以通过自身的学习，自动修改和刷新路由表。

在互联网中RIP是一个经常使用的动态路由选择协议，适合在中小型互联网上使用。

1. 配置路由器接口的IP地址

单击需要配置的路由器，在弹出的配置界面选择CLI。使用enable命令进入路由器的特权执行模式，然后使用config terminal 进入全局配置模式，通过interface进入特定接口的配置模式。配置路由器的IP地址的命令 ip address IP 地址 掩码，利用命令 no shutdown 保证使用的接口处于激活状态。具体配置命令如下图所示：

- router2:

```
Router(config)#interface gig0/0
Router(config-if)#ip address 10.1.0.2 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface gig0/1
Router(config-if)#ip address 10.2.0.2 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

- router3:

```
Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface gig0/0
Router(config-if)#ip address 10.3.0.1
% Incomplete command.
Router(config-if)#ip address 10.3.0.1 255.255.0.0
Router(config-if)#exit
Router(config)#interface gig0/1
Router(config-if)#ip address 10.2.0.1 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
```

2. RIP的配置

RIP的配置需要在全局配置模式下进行。在全局配置模式下运行router rip 命令进入RIP配置模式，利用version2命令通知系统使用的RIP版本为可以处理子网编址的Version2版本。使用network命令说明路由器直接相连的网络，最后使用show ip route命令查看路由器是否获得了正确的路由。

- router2:

```
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.1.0.0
Router(config-router)#network 10.2.0.0
Router(config-router)#exit
Router(config)#
```



```

Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: L - local, C - connected, S - static, 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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

```

Gateway of last resort is not set

```

      10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       10.1.0.0/16 is directly connected, GigabitEthernet0/0
L       10.1.0.2/32 is directly connected, GigabitEthernet0/0
C       10.2.0.0/16 is directly connected, GigabitEthernet0/1
L       10.2.0.2/32 is directly connected, GigabitEthernet0/1
S       10.3.0.0/16 [1/0] via 10.2.0.1

```

Router#

- router3:

```

Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 10.2.0.0
Router(config-router)#network 10.3.0.0
Router(config-router)#exit
Router(config)#

```

```

Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: L - local, C - connected, S - static, 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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

```

Gateway of last resort is not set

```

      10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
S       10.1.0.0/16 [1/0] via 10.2.0.2
C       10.2.0.0/16 is directly connected, GigabitEthernet0/1
L       10.2.0.1/32 is directly connected, GigabitEthernet0/1
C       10.3.0.0/16 is directly connected, GigabitEthernet0/0
L       10.3.0.1/32 is directly connected, GigabitEthernet0/0

```

Router#

3. 测试网络连通性

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router2	ICMP
	0.003	Router2	Router3	ICMP
	0.004	Router3	Switch1	ICMP
	0.005	Switch1	PC2	ICMP
	0.006	PC2	Switch1	ICMP
	0.007	Switch1	Router3	ICMP
	0.008	Router3	Router2	ICMP
	0.009	Router2	Switch0	ICMP
	0.010	Switch0	PC0	ICMP
	1.012	--	PC0	ICMP
	1.013	PC0	Switch0	ICMP
	1.014	Switch0	Router2	ICMP
	1.015	Router2	Router3	ICMP
	1.016	Router3	Switch1	ICMP
	1.017	Switch1	PC2	ICMP
	1.018	PC2	Switch1	ICMP
	1.019	Switch1	Router3	ICMP
	1.020	Router3	Router2	ICMP
	1.021	Router2	Switch0	ICMP
	1.022	Switch0	PC0	ICMP
	1.539	--	Switch0	STP

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch0	ICMP
	0.002	Switch0	Router2	ICMP
	0.002	--	Router2	ICMP
	0.003	Router2	Switch0	ICMP
	0.004	Switch0	PC0	ICMP
	0.105	--	PC0	ICMP
	0.106	PC0	Switch0	ICMP
	0.107	Switch0	Router2	ICMP
	0.107	--	Router2	ICMP
	0.108	Router2	Switch0	ICMP
	0.109	Switch0	PC0	ICMP
	0.209	--	PC0	ICMP
	0.210	PC0	Switch0	ICMP
	0.211	Switch0	Router2	ICMP
	0.211	--	Router2	ICMP
	0.212	Router2	Switch0	ICMP
	0.213	Switch0	PC0	ICMP
	0.316	--	PC0	ICMP
	0.317	PC0	Switch0	ICMP
	0.318	Switch0	Router2	ICMP
	0.319	Router2	Router3	ICMP
	0.319	--	Router3	ICMP
	0.320	Router3	Router2	ICMP
	0.321	Router2	Switch0	ICMP
	0.322	Switch0	PC0	ICMP

```
C:\>ping 10.3.0.3

Pinging 10.3.0.3 with 32 bytes of data:

Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126
Reply from 10.3.0.3: bytes=32 time=10ms TTL=126

Ping statistics for 10.3.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 10ms, Average = 10ms

C:\>tracert 10.3.0.2

Tracing route to 10.3.0.2 over a maximum of 30 hops:

  0  4 ms    4 ms    4 ms    10.1.0.2
  1  6 ms    6 ms    6 ms    10.2.0.1
  2  *        10 ms   10 ms   10.3.0.2

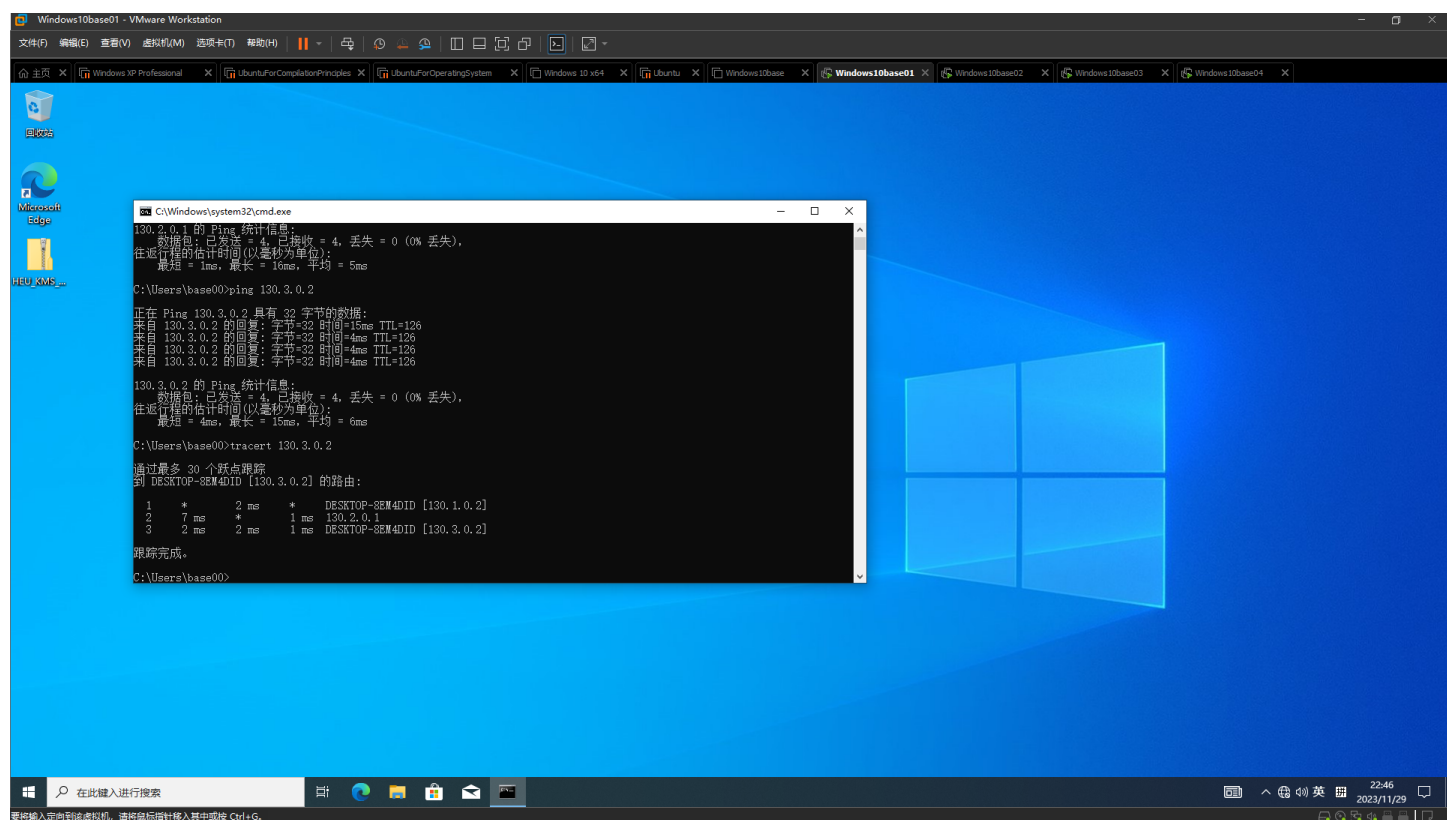
Trace complete.

C:\>|
```

成功。

实体环境下互联网组网与路由器配置

在四台win10虚拟机镜像下跑出的结果如下：

The screenshot shows a Windows 10 desktop with a blue background and the Windows logo. A command prompt window is open, displaying the results of a ping and traceroute command. The window title is "C:\Windows\system32\cmd.exe". The output shows a successful ping to 130.3.0.2 and a traceroute that identifies the path through 130.2.0.1 and 130.2.0.2. The desktop has several icons on the left: "回收站", "Microsoft Edge", and "HEU_KMS...". The taskbar at the bottom shows the Start button, a search bar, and several application icons. The system tray in the bottom right corner shows the date and time as 22:46 on 2023/11/29.

```
Windows10base01 - VMware Workstation
文件(F) 编辑(E) 查看(V) 虚拟机(M) 选项卡(T) 帮助(H)
主页 文件(F) 编辑(E) 查看(V) 虚拟机(M) 选项卡(T) 帮助(H)
Windows XP Professional X UbuntuForCompilationPrinciples X UbuntuForOperatingSystem X Windows 10 x64 X Ubuntu X Windows 10base X Windows10base01 X Windows 10base02 X Windows 10base03 X Windows 10base04 X

回收站
Microsoft Edge
HEU_KMS...

C:\Windows\system32\cmd.exe
130.2.0.1 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
    往返行程的估计时间(以毫秒为单位):
        最短 = 1ms, 最长 = 16ms, 平均 = 5ms

C:\Users\base00>ping 130.3.0.2

正在 Ping 130.3.0.2 具有 32 字节的数据:
来自 130.3.0.2 的回复: 字节=32 时间=15ms TTL=126
来自 130.3.0.2 的回复: 字节=32 时间=4ms TTL=126
来自 130.3.0.2 的回复: 字节=32 时间=4ms TTL=126
来自 130.3.0.2 的回复: 字节=32 时间=4ms TTL=126

130.3.0.2 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
    往返行程的估计时间(以毫秒为单位):
        最短 = 4ms, 最长 = 15ms, 平均 = 6ms

C:\Users\base00>tracert 130.3.0.2

通过最多 30 个跃点跟踪
到 DESKTOP-8EM4DID [130.3.0.2] 的路由:

  0  *         2 ms    *         DESKTOP-8EM4DID [130.1.0.2]
  1  7 ms     *         1 ms    130.2.0.1
  2  2 ms     2 ms     1 ms    DESKTOP-8EM4DID [130.3.0.2]

跟踪完成。

C:\Users\base00>
```

使用虚拟机组网过程中与实机组网的不同：

1. 用实机实验开启 Routing and Remote Access 服务后不重启也可以，但是虚拟机镜像必须重启才能启动服务；

2. 用实机做实验时为路由添加规则的指令不需要进入管理员模式即可，但虚拟机必须进入管理员模式才行；