

# 计网综合实验

## 1.小组成员

组长：李一洲

组员：刘子仰、林心鹏、李炫晔、韩明浩

## 2.实验目的

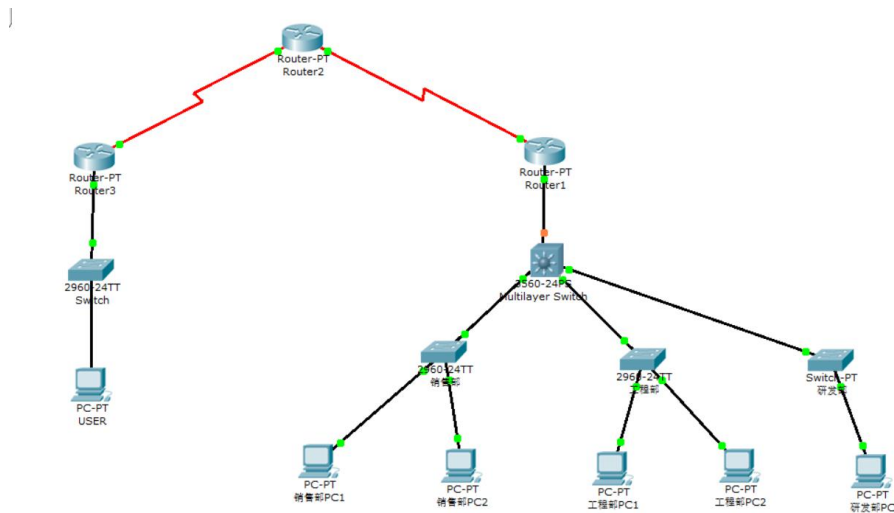
- 1). 拓扑需使用动态路由协议。
- 2). 拓扑中需包含 VLAN 及 trunk 技术。
- 3). 拓扑至少需包含设备：2 台交换机、4 台路由器（路由器之间串线链接）、4 台 PC。
- 4). 拓扑中包含两项较为复杂的网络技术（如 ACL，NAT 等）。

## 3.实验步骤

### 1.1 实验设备：

PC 6 台、Router-PT 3 台、Switch-PT 4 台、3560-24PS 1 台

### 1.2 拓扑：



### 实验拓扑介绍：

本次实验拓扑我们组想要模拟一个简易的公司网络拓扑,公司以内网划分 VLAN 并通过 NAT 与外网的用户连通。公司分为研发部、销售部和工程部三个部门，具体实现要求如下。

### 网络拓扑要求：

1. 研发部、销售部、工程部分别划分在不同 VLAN 下。
2. 公司内网通过边界路由与外网连接，销售部和工程部分别以静态和动态 NAT 实现
3. 研发部通过 ACL 防止与外网通讯
4. 网络拓扑使用动态路由协议

### 配置 vlan：

1. 给销售部、工程部、研发部交换机分别配置 VLAN10、20、30，并将其与 PC 连接的端

口改为对应的 VLAN Access，与三层交换机连接的端口改为 trunk，以销售部为例：

```
Switch(config)#vlan 10
Switch(config)#interface FastEthernet0/1
Switch(config-if)#switchport access vlan 10
Switch(config)#interface FastEthernet0/3
Switch(config-if)#switchport mode trunk
```

## 2. 为三层交换机配置 vlan：

```
Switch(config)#vlan 10
Switch(config-vlan)#vlan 20
Switch(config-vlan)#vlan 30
Switch(config-vlan)#exit
Switch(config)#interface vlan 10
Switch(config-if)#ip address 192.168.10.1
Switch(config-if)#interface vlan 20
Switch(config-if)#ip address 192.168.20.1
Switch(config-if)#interface vlan 30
Switch(config-if)#ip address 192.168.30.1
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/2
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
Switch(config)#interface FastEthernet0/4
Switch(config-if)#switchport mode trunk
```

为每台 PC 配置默认网关及 ip 地址:

销售部 PC：192.168.10.2 (IP)，192.168.10.1 (默认网关)  
销售部 PC：192.168.10.3 (IP)，192.168.10.1 (默认网关)  
工程部 PC：192.168.20.2 (IP)，192.168.20.1 (默认网关)  
工程部 PC：192.168.20.3 (IP)，192.168.20.1 (默认网关)  
研发部 PC：192.168.30.2 (IP)，192.168.30.1 (默认网关)  
USERPC：192.168.5.2 (IP)，192.168.5.1 (默认网关)

为三层交换机及路由器配置 IP:

```
Router1(config)# int f0/0
Router1(config-if)# ip address 192.168.3.1 255.255.255.0
Router1(config-if)# int s2/0
Router1(config-if)# ip address 192.168.2.2 255.255.255.0
Router2(config)# int s2/0
```

```
Router2(config-if)# ip address 192.168.1.2 255.255.255.0
Router2(config-if)# int s3/0
Router2(config-if)# ip address 192.168.2.1 255.255.255.0
Router3(config)# int f0/0
Router3(config-if)# ip address 192.168.5.1 255.255.255.0
Router3(config-if)# int s2/0
Router2(config-if)# ip address 192.168.1.1 255.255.255.0
Multilayer Switch(config)# int f0/3
Multilayer Switch(config-if)# no switchport
Multilayer Switch(config-if)# ip address 192.168.3.2 255.255.255.0
Multilayer Switch(config-if)# no shutdown
```

为三层交换机及路由器配置 rip:

```
Router1(config)#router rip
Router1(config-if)#version 2
Router1(config-if)#no auto-summary
Router1(config-if)#network 192.168.2.0
Router1(config-if)#network 192.168.3.0
Multilayer Switch(config)#router rip
Multilayer Switch(config-if)#version 2
Multilayer Switch(config-if)#no auto-summary
Multilayer Switch(config-if)#network 192.168.3.0
Multilayer Switch(config-if)#network 192.168.10.0
Multilayer Switch(config-if)#network 192.168.20.0
Multilayer Switch(config-if)#network 192.168.30.0
Router2(config)#router rip
Router2(config-if)#version 2
Router2(config-if)#no auto-summary
Router2(config-if)#network 192.168.1.0
Router2(config-if)#network 192.168.2.0
Router3(config)#router rip
Router3(config-if)#version 2
Router3(config-if)#no auto-summary
Router3(config-if)#network 192.168.1.0
Router3(config-if)#network 192.168.5.0
```

配置 NAT:

1).配置 Router1 静态 NAT

```
Router1(config)#int f0/0
Router1(config-if)#ip nat inside
Router1(config-if)#int s2/0
Router1(config-if)#ip nat outside
Router1(config)#ip nat inside source static 192.168.10.1 192.168.2.3
Router1(config)#ip nat inside source static 192.168.10.2 192.168.2.4
```

```
Router1(config)#ip nat inside source static 192.168.30.2 192.168.2.20
```

2).配置 Router1 动态 NAT

```
Router1(config)#ip nat pool nju 192.168.2.5 192.168.2.8 netmask 255.255.255.0
```

```
Router1(config)#access-list 2 permit 192.168.20.0 0.0.0.255
```

```
Router1(config)#access-list 4 permit 192.168.3.0 0.0.0.255
```

3).配置 Router3 静态 NAT

```
Router3(config)#int f0/0
```

```
Router3(config-if)#ip nat inside
```

```
Router3(config-if)#int s2/0
```

```
Router3(config-if)#ip nat outside
```

```
Router3(config)#ip nat inside source static 192.168.5.2 192.168.1.3
```

Router1 配置 ACL:

```
Router1(config)#access-list 10 deny host 192.168.2.20
```

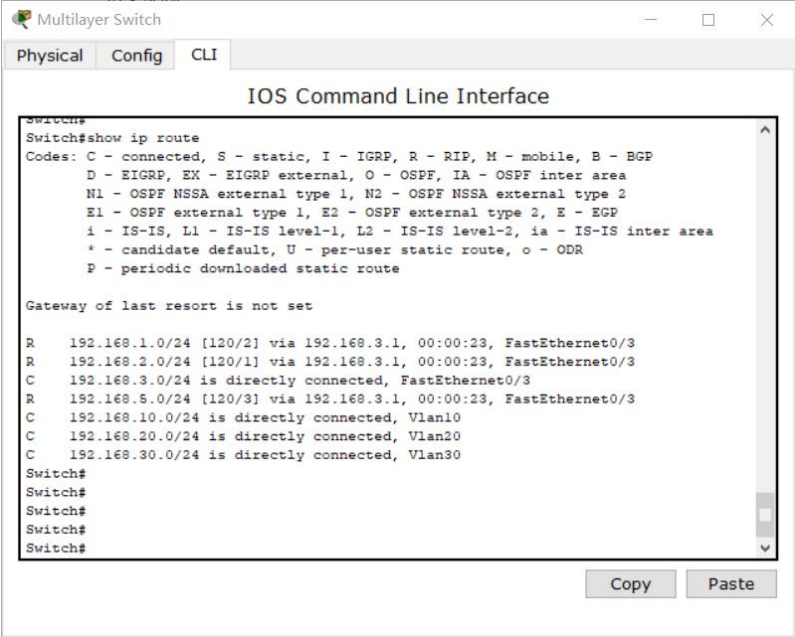
```
Router1(config)#access-list 10 permit any
```

```
Router1(config)#int f0/0
```

```
Router1(config-if)#ip access-group 10 out
```

验证 rip:

三层交换机:



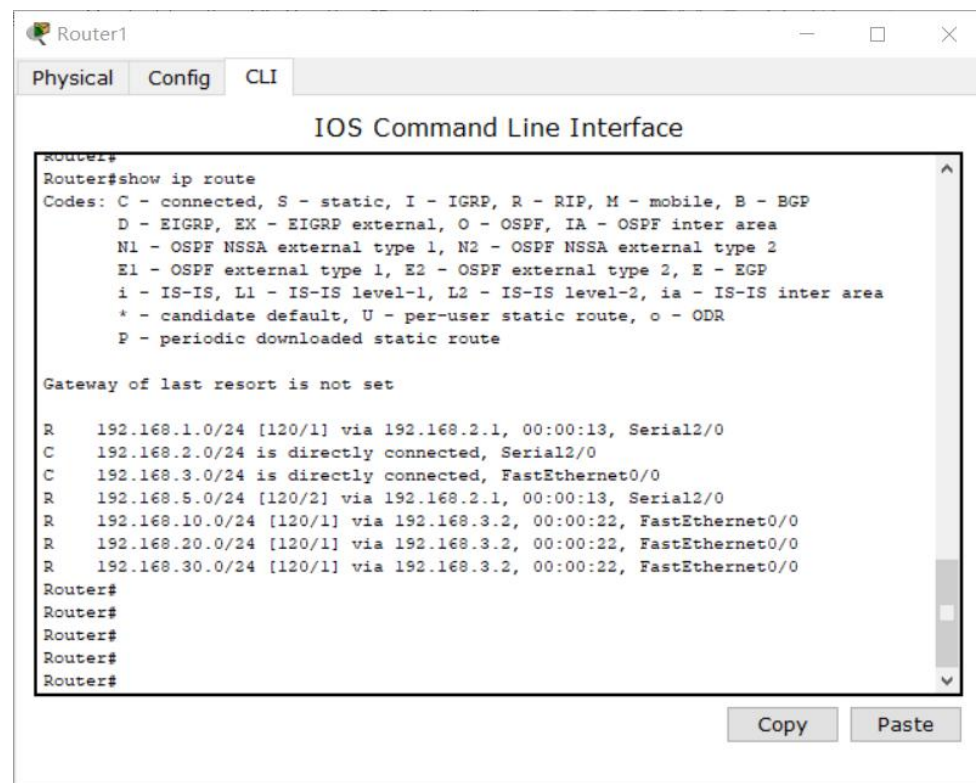
```
Multilayer Switch
Physical Config CLI
IOS Command Line Interface

Switch#
Switch#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, 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

R    192.168.1.0/24 [120/2] via 192.168.3.1, 00:00:23, FastEthernet0/3
R    192.168.2.0/24 [120/1] via 192.168.3.1, 00:00:23, FastEthernet0/3
C    192.168.3.0/24 is directly connected, FastEthernet0/3
R    192.168.5.0/24 [120/3] via 192.168.3.1, 00:00:23, FastEthernet0/3
C    192.168.10.0/24 is directly connected, Vlan10
C    192.168.20.0/24 is directly connected, Vlan20
C    192.168.30.0/24 is directly connected, Vlan30
Switch#
Switch#
Switch#
Switch#
Switch#
```

Router1:



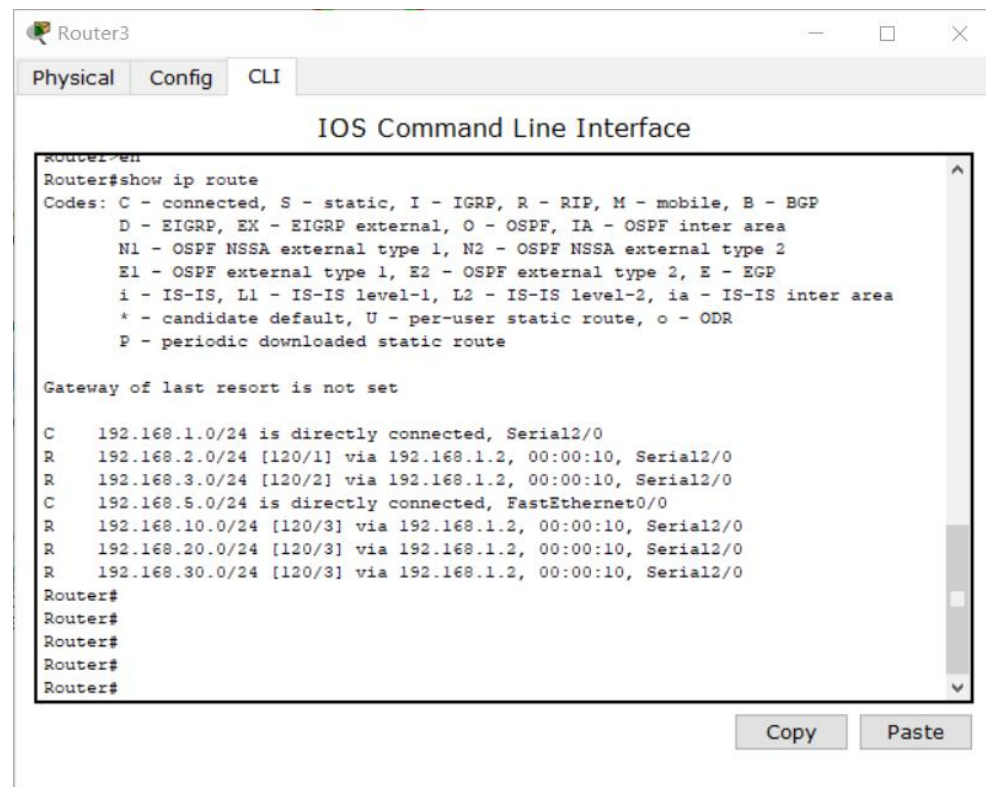
The screenshot shows the Router1 CLI interface with the 'CLI' tab selected. The title bar reads 'Router1'. The main window title is 'IOS Command Line Interface'. The command prompt is 'Router#'. The output of the 'show ip route' command is displayed, showing a list of routes and their status. The routes are: 192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:13, Serial2/0; 192.168.2.0/24 is directly connected, Serial2/0; 192.168.3.0/24 is directly connected, FastEthernet0/0; 192.168.5.0/24 [120/2] via 192.168.2.1, 00:00:13, Serial2/0; 192.168.10.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0; 192.168.20.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0; 192.168.30.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0. The output also includes a legend for route codes and a message 'Gateway of last resort is not set'.

```
Router#
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, 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

R    192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:13, Serial2/0
C    192.168.2.0/24 is directly connected, Serial2/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
R    192.168.5.0/24 [120/2] via 192.168.2.1, 00:00:13, Serial2/0
R    192.168.10.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0
R    192.168.20.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0
R    192.168.30.0/24 [120/1] via 192.168.3.2, 00:00:22, FastEthernet0/0
Router#
Router#
Router#
Router#
Router#
```

Router3:



The screenshot shows the Router3 CLI interface with the 'CLI' tab selected. The title bar reads 'Router3'. The main window title is 'IOS Command Line Interface'. The command prompt is 'Router#'. The output of the 'show ip route' command is displayed, showing a list of routes and their status. The routes are: 192.168.1.0/24 is directly connected, Serial2/0; 192.168.2.0/24 [120/1] via 192.168.1.2, 00:00:10, Serial2/0; 192.168.3.0/24 [120/2] via 192.168.1.2, 00:00:10, Serial2/0; 192.168.5.0/24 is directly connected, FastEthernet0/0; 192.168.10.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0; 192.168.20.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0; 192.168.30.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0. The output also includes a legend for route codes and a message 'Gateway of last resort is not set'.

```
Router#
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, 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

C    192.168.1.0/24 is directly connected, Serial2/0
R    192.168.2.0/24 [120/1] via 192.168.1.2, 00:00:10, Serial2/0
R    192.168.3.0/24 [120/2] via 192.168.1.2, 00:00:10, Serial2/0
C    192.168.5.0/24 is directly connected, FastEthernet0/0
R    192.168.10.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0
R    192.168.20.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0
R    192.168.30.0/24 [120/3] via 192.168.1.2, 00:00:10, Serial2/0
Router#
Router#
Router#
Router#
Router#
```

验证 nat:

Router1:

静态 nat

```
Router#
Router#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
---  192.168.2.3         192.168.10.2     ---               ---
---  192.168.2.4         192.168.10.3     ---               ---
---  192.168.2.20        192.168.30.2     ---               ---
```

动态 nat

```
Pro  Inside global      Inside local      Outside local      Outside global
icmp 192.168.2.5:1     192.168.20.2:1   192.168.1.3:1     192.168.1.3:1
icmp 192.168.2.5:2     192.168.20.2:2   192.168.1.3:2     192.168.1.3:2
icmp 192.168.2.5:3     192.168.20.2:3   192.168.1.3:3     192.168.1.3:3
icmp 192.168.2.5:4     192.168.20.2:4   192.168.1.3:4     192.168.1.3:4
icmp 192.168.2.6:1     192.168.20.3:1   192.168.1.3:1     192.168.1.3:1
icmp 192.168.2.6:2     192.168.20.3:2   192.168.1.3:2     192.168.1.3:2
icmp 192.168.2.6:3     192.168.20.3:3   192.168.1.3:3     192.168.1.3:3
icmp 192.168.2.6:4     192.168.20.3:4   192.168.1.3:4     192.168.1.3:4
```

Router3:

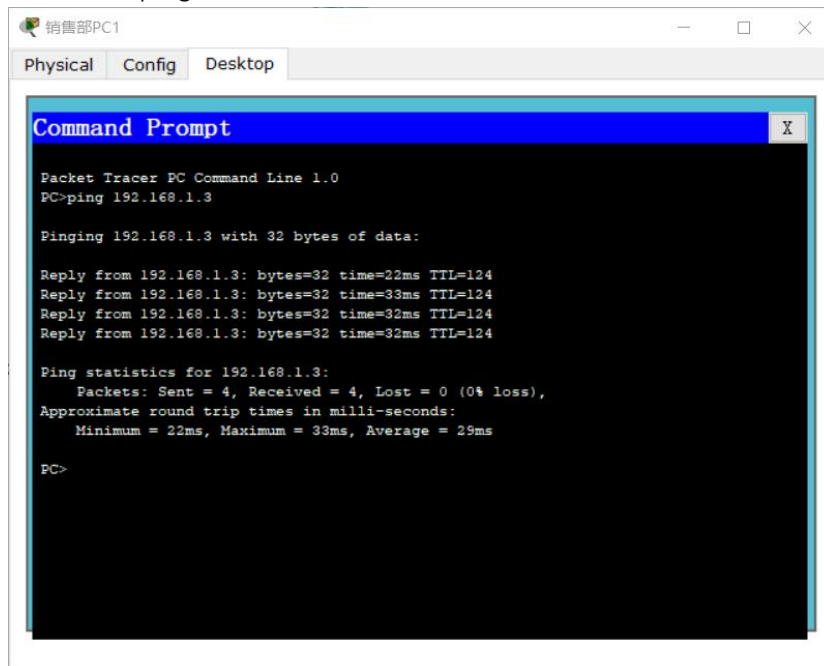
静态 nat:

```
Router#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
---  192.168.1.3         192.168.5.2     ---               ---
Router#
```

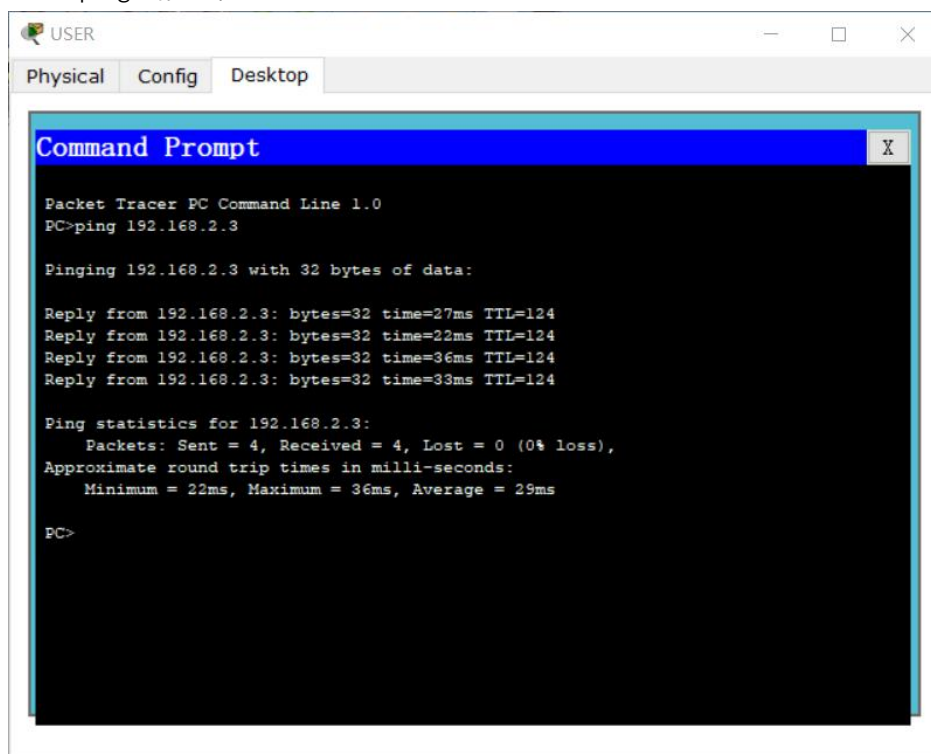
验证 ACL :

```
Router#show ip access-lists
Standard IP access list 2
    permit 192.168.20.0 0.0.0.255 (16 match(es))
Standard IP access list 3
    permit 192.168.3.0 0.0.0.255
Standard IP access list 10
    deny host 192.168.2.20
    permit any (15 match(es))
-
```

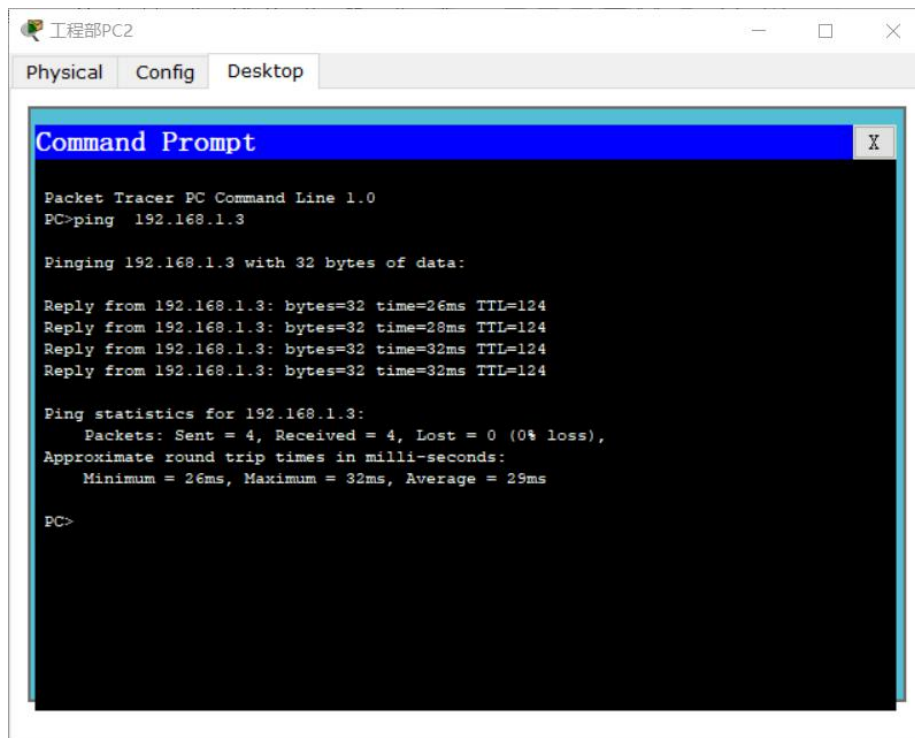
销售部 PC ping USER:



USER ping 销售部 PC:



工程部 PC ping USER:



研发部 PC ping USER:

