

## 《信息安全及实践》课程实验报告

学院： 信息学院    专业： 计算机科学与技术    年级： 2019

姓名： 白文强                      学号： 20191060064

姓名： 赵浩杰                      学号： 20191060074

姓名： 李泽昊                      学号： 20191060065

实验时间： 2021 年 12 月 24 日

实验名称： NAT 应用实验

实验成绩：

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# NAT 应用实验

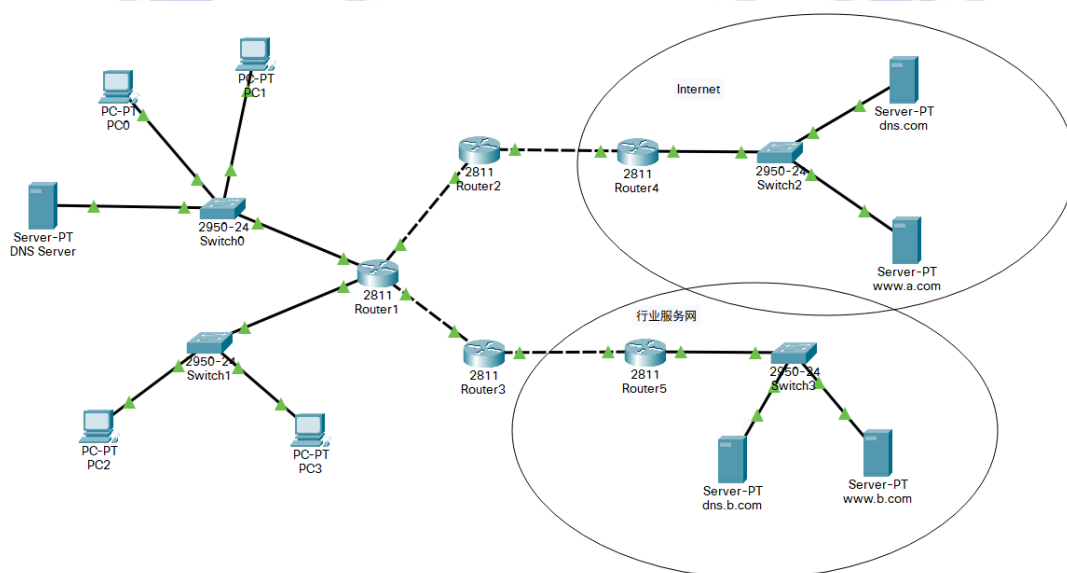
## 一、实验目的

假定某个企业网由两个内部网络组成：一个内部网络连接管理员终端，另一个内部网络连接员工终端。企业网同时连接两个外部网络：一个是 Internet，另一个是行业服务网。Internet 和行业服务网都对该企业网分配了全球 IP 地址，但无论是 Internet 还是行业服务网都只负责到达分配给该企业网的全球 IP 地址的路由功能。

本实验需要实现功能：允许所有人员访问 Internet，但只允许管理员访问行业服务网。

## 二、实验步骤

(1) 根据网络拓扑图放置和连接设备：



(2) 完成所有路由器各个接口的 IP 地址和子网掩码配置过程，完成路由器静态路由项和默认路由项的配置过程。

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
Router>en
Router#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 192.168.3.2 to network 0.0.0.0

C    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
L    192.168.1.0/24 is directly connected, FastEthernet0/0
L    192.168.1.254/32 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.2.0/24 is directly connected, FastEthernet0/1
L    192.168.2.254/32 is directly connected, FastEthernet0/1
C    192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
L    192.168.3.0/24 is directly connected, FastEthernet1/0
L    192.168.3.1/32 is directly connected, FastEthernet1/0
C    192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.4.0/24 is directly connected, FastEthernet1/1
L    192.168.4.1/32 is directly connected, FastEthernet1/1
S    200.1.2.0/24 [1/0] via 192.168.4.2
S*   0.0.0.0/0 [1/0] via 192.168.3.2

Router#
```

Ctrl+F6 to exit CLI focus

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Router2

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed
state to up

Router>
Router#en
Router#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 192.1.1.2 to network 0.0.0.0

C    192.1.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.1.1.0/24 is directly connected, FastEthernet0/1
L    192.1.1.1/32 is directly connected, FastEthernet0/1
R    192.168.1.0/24 [120/1] via 192.168.3.1, 00:00:18, FastEthernet0/0
R    192.168.2.0/24 [120/1] via 192.168.3.1, 00:00:18, FastEthernet0/0
C    192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.3.0/24 is directly connected, FastEthernet0/0
L    192.168.3.2/32 is directly connected, FastEthernet0/0
R    192.168.4.0/24 [120/1] via 192.168.3.1, 00:00:18, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 192.1.1.2

Router#
```

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Router3

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed
state to up

Router>
Router#en
Router#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 200.1.1.2 to network 0.0.0.0

R    192.168.1.0/24 [120/1] via 192.168.4.1, 00:00:15, FastEthernet0/0
R    192.168.2.0/24 [120/1] via 192.168.4.1, 00:00:15, FastEthernet0/0
R    192.168.3.0/24 [120/1] via 192.168.4.1, 00:00:15, FastEthernet0/0
C    192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.4.0/24 is directly connected, FastEthernet0/0
L    192.168.4.2/32 is directly connected, FastEthernet0/0
C    200.1.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    200.1.1.0/24 is directly connected, FastEthernet0/1
L    200.1.1.1/32 is directly connected, FastEthernet0/1
S*   0.0.0.0/0 [1/0] via 200.1.1.2

Router#
```

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Router4

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up

Router>en
Router#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

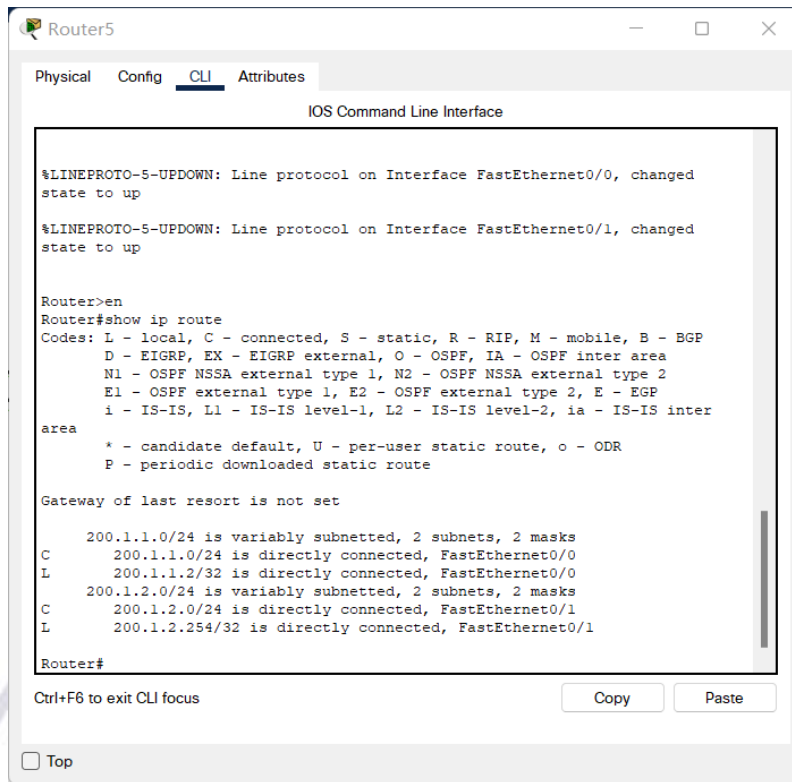
C    192.1.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.1.1.0/24 is directly connected, FastEthernet0/0
L    192.1.1.2/32 is directly connected, FastEthernet0/0
C    192.1.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.1.2.0/24 is directly connected, FastEthernet0/1
L    192.1.2.254/32 is directly connected, FastEthernet0/1

Router#
```

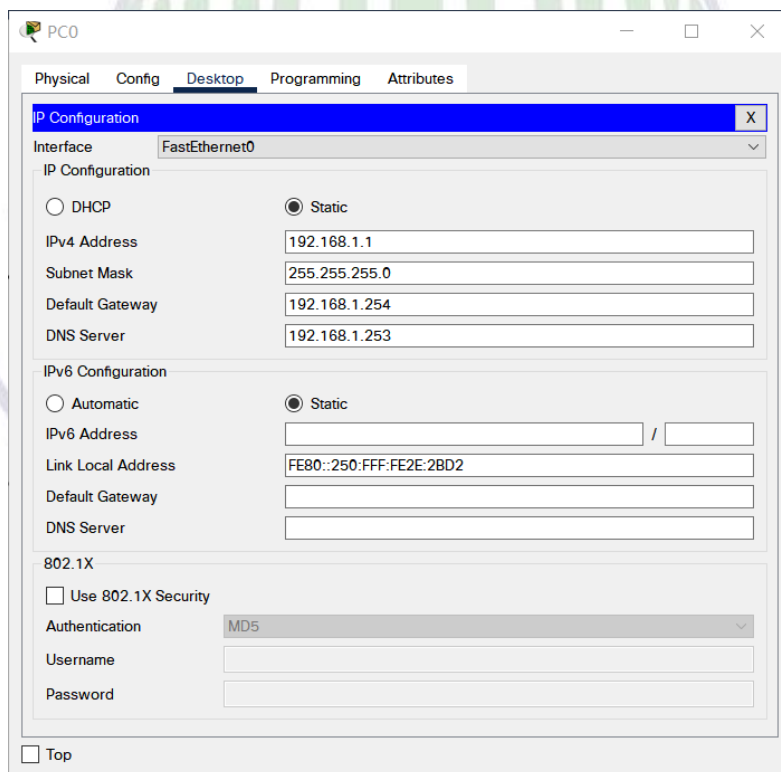
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(3)配置两个网络中设备的信息，查看 PC0 和 PC2



DNS Server

Physical Config Services Desktop Programming Attributes

IP Configuration X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.253

Subnet Mask 255.255.255.0

Default Gateway 192.168.1.254

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::2D0:58FF:FE31:2708

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

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#### (4) DNS Server 配置

DNS Server

Physical Config Services Desktop Programming Attributes

SERVICES

HTTP

DHCP

DHCPv6

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

IoT

VM Management

Radius EAP

DNS

DNS Service ☒ On ☐ Off

Resource Records

Name Type A Record

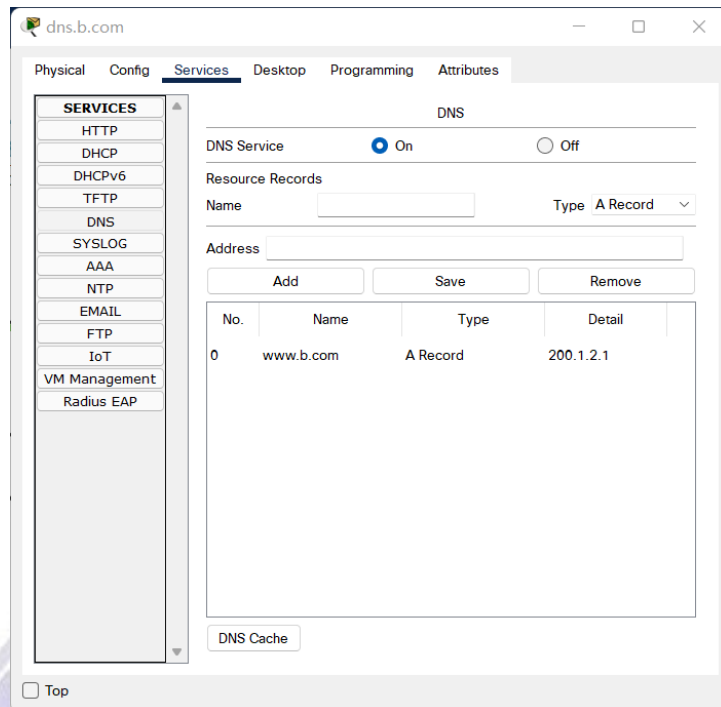
Address

Add Save Remove

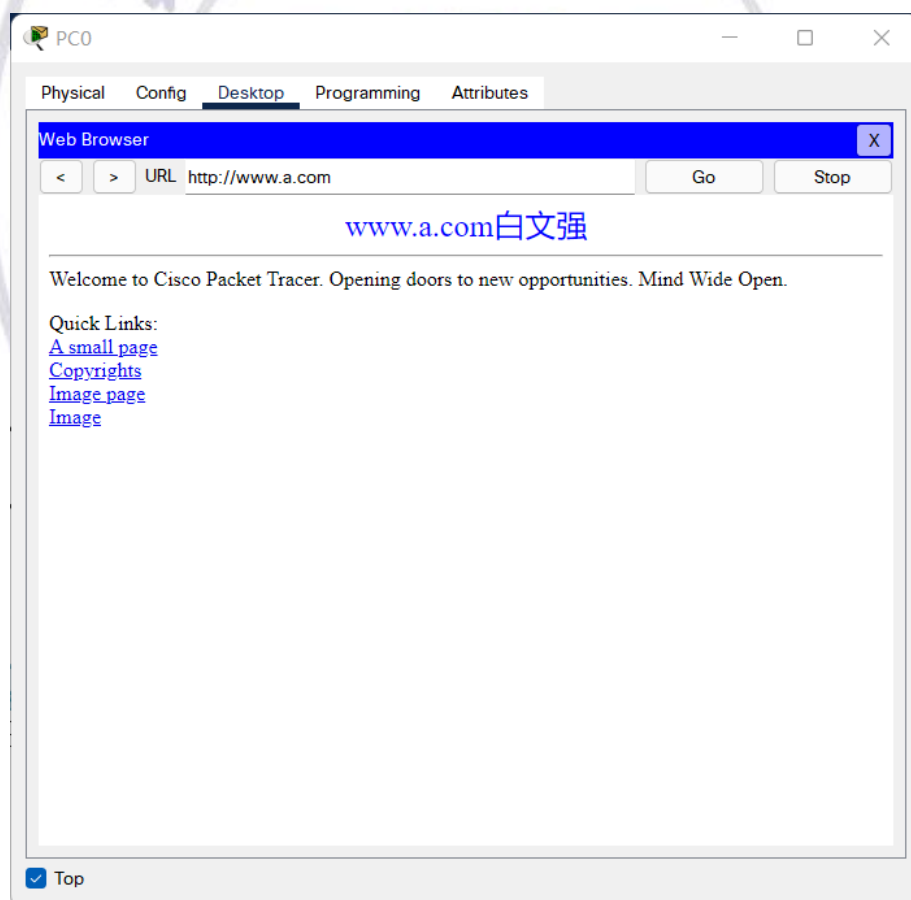
| No. | Name      | Type     | Detail      |
|-----|-----------|----------|-------------|
| 0   | b.com     | NS       | dns.b.com   |
| 1   | com       | NS       | dns.com     |
| 2   | dns.b.com | A Record | 200.1.2.253 |
| 3   | dns.com   | A Record | 192.1.2.253 |
| 4   | edu       | NS       | dns.com     |

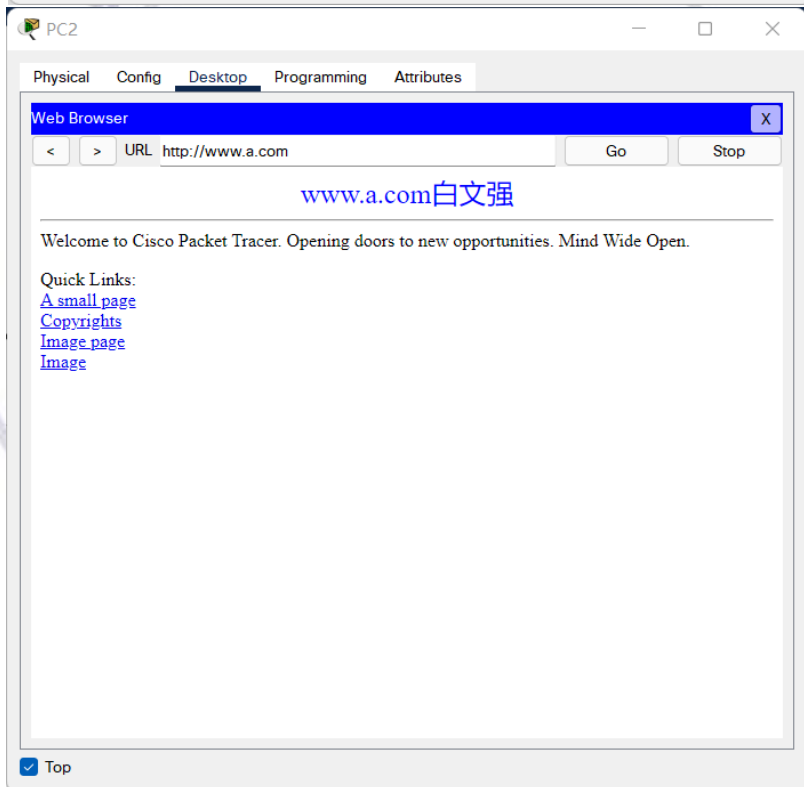
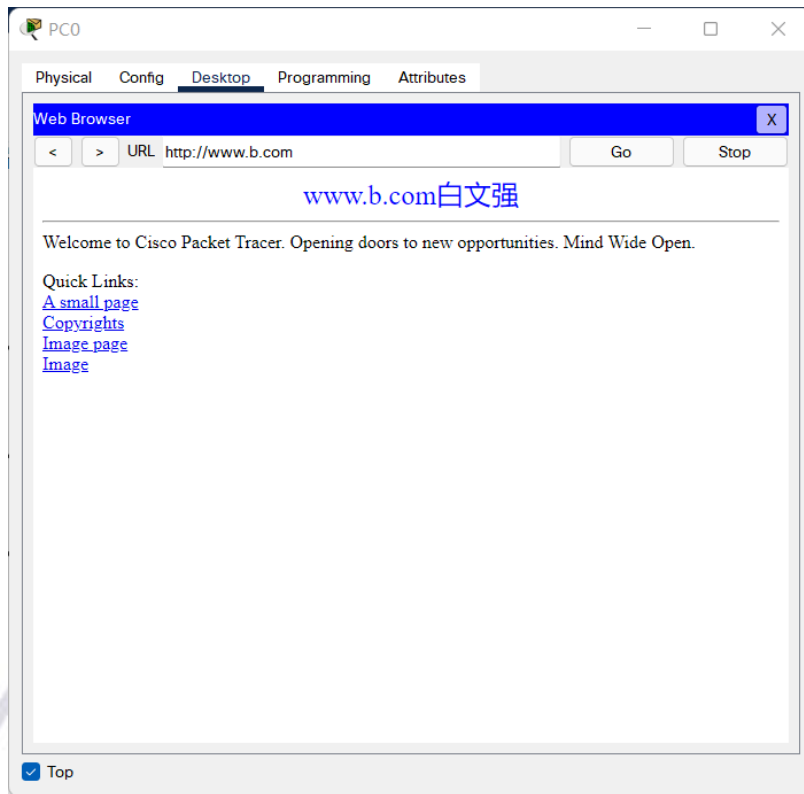
DNS Cache

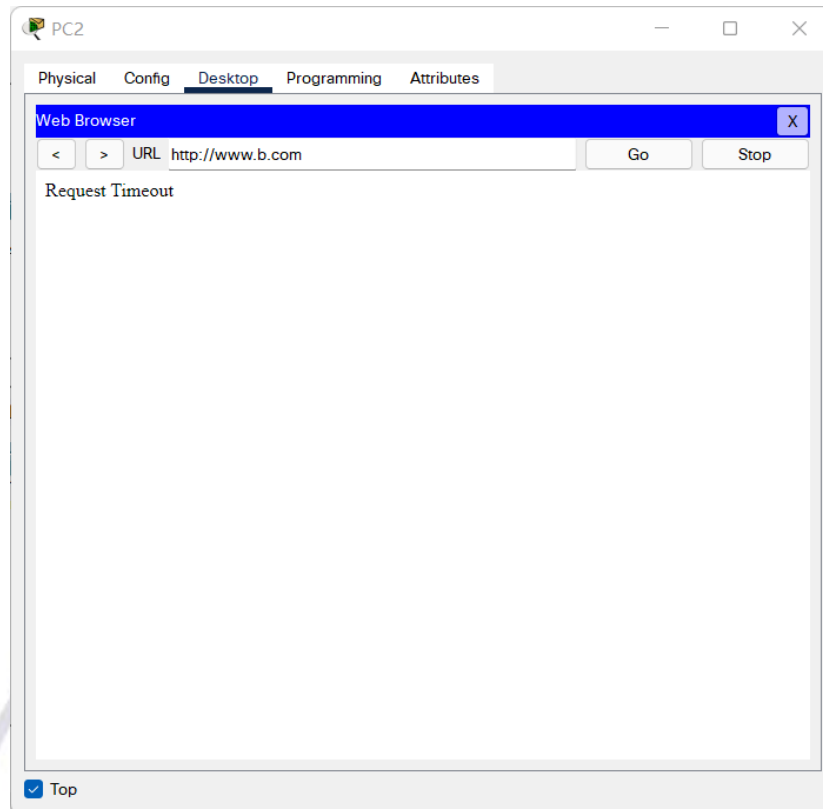
☐ Top



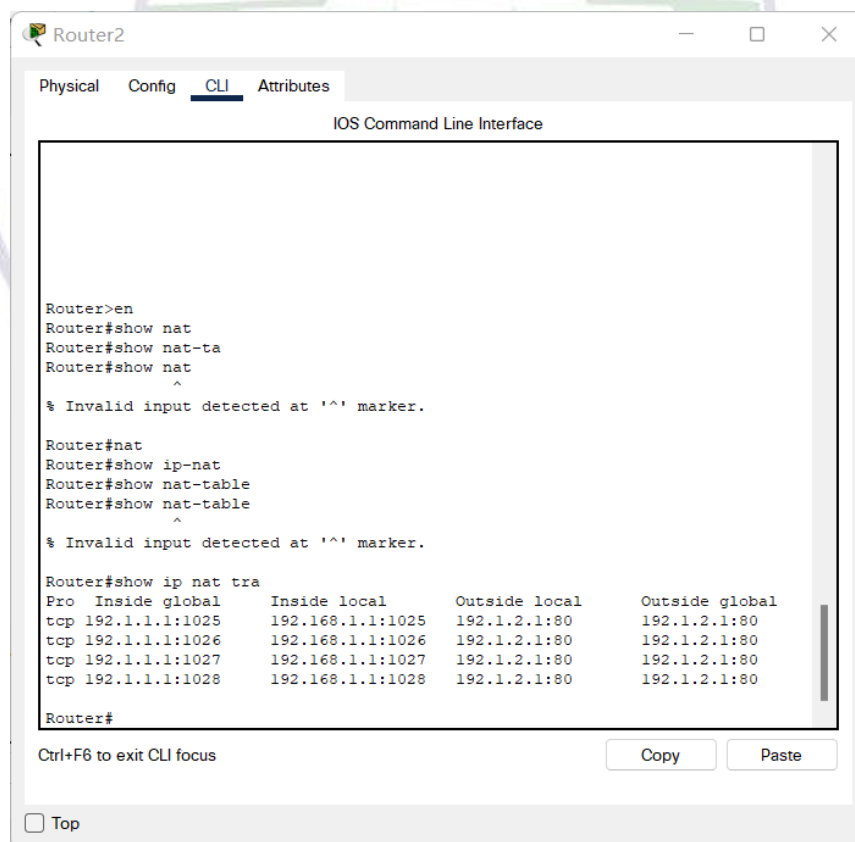
(5) PC0 访问完全合格的域名为 www. a. com 的 Web 服务器和域名为 www. b. com 的行业服务网，PC2 只能访问 www. a. com，不能访问 www. b. com:



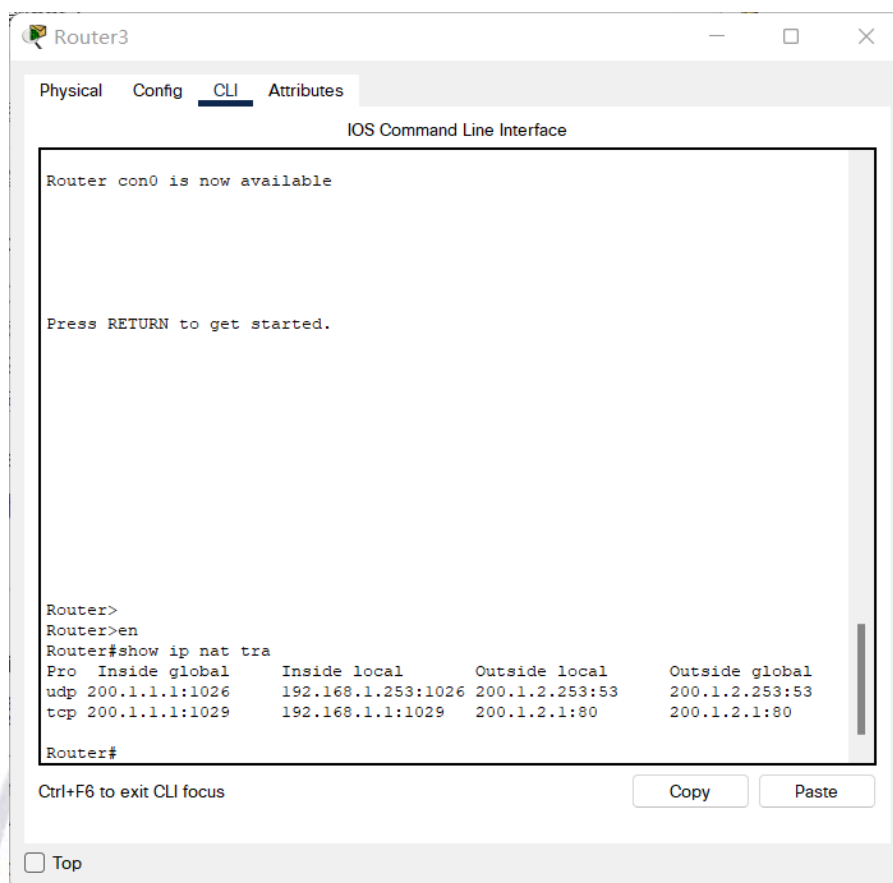




(6) 查看路由器的 NAT 表







### 三、实验结果及分析

实验结果显示：PC0 正常访问 www. a. com 和 www. b. com， PC2 可以访问 www. a. com 但无法访问 www. b. com。

实验结果说明网络地址为 192. 168. 1. 0/24 的子网中的设备即**管理员**设备可以访问 Internet 和行业服务网，网络地址为 192. 168. 2. 0/24 的子网中的设备即**普通员工**的设备只能访问 Internet 无法访问行业服务网。

完成了实验的设计目的，允许所有人员访问 Internet，但只允许管理员访问行业服务网。

### 四、实验总结及体会

NAT 是用来解决 IPV4 地址不够用而出现的**技术**，既可以解决 IP 地址短缺的问题，还可以隐藏内网的 IP，让外网用户无法查看到内网的 IP，有效保护内网安全。在实际中，企业网中的设备通过路由器自动获取网络信息，需要启动企业网中的交换机的防 DHCP 欺骗功能以禁止设备连接其他 DHCP 服务器，保护企业网不受攻击。