计网实验1

PB20051061 牟真伟

Linux 下常用网络指令

- 用`ip address`命令查看本机 IP 地址和以太网的硬件地址

```
ustc-mzw@ustcmzw-VirtualBox:~$ ip addr > ip_addr
ustc-mzw@ustcmzw-VirtualBox:~$ cat ip_addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:de:df:45 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.101/24 brd 192.168.56.255 scope global dynamic noprefixrout
e enp0s3
       valid_lft 579sec preferred_lft 579sec
    inet6 240e:459:480:ea3a:e076:5e4c:9d3b:efd7/64 scope global temporary dynam
ic
       valid_lft 1953sec preferred_lft 1953sec
    inet6 240e:459:480:ea3a:ce4e:81d9:c847:2b19/64 scope global dynamic mngtmpa
ddr noprefixroute
       valid_lft 1953sec preferred_lft 1953sec
    inet6 fe80::f605:b83:421b:baf4/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
ustc-mzw@ustcmzw-VirtualBox:~$
```

虚拟机IPv4地址：`192.168.56.101`

网卡MAC地址：`08:00:27:de:df:45`

- 输入`ipconfig`命令并在输出中找到适配器 VMnet8 的 IP 地址

```
C:\Users\Aweary>ipconfig

Windows IP 配置


以太网适配器 VirtualBox Host-Only Network:

   连接特定的 DNS 后缀 . . . . . . . :
   本地链接 IPv6 地址. . . . . . . . : fe80::ac3f:3239:1e89:c6c0%18
   IPv4 地址 . . . . . . . . . . . . : 192.168.56.1
   子网掩码 . . . . . . . . . . . . : 255.255.255.0
   默认网关. . . . . . . . . . . . . :
```

用`ip neigh`命令查看本机的 ARP 缓存表

```
ustc-mzw@ustcmzw-VirtualBox:~$ ip neigh > ip_neigh
ustc-mzw@ustcmzw-VirtualBox:~$ cat ip_neigh
240e:459:480:ea3a:23f8:13d0:73e1:8916 dev enp0s3  INCOMPLETE
```

用`ping -c 4 <IP 地址>`命令向 VMnet8 发送报文（ICMP echo request）

```
ustc-mzw@ustcmzw-VirtualBox:~$ ping -c 4 192.168.56.1
PING 192.168.56.1 (192.168.56.1) 56(84) bytes of data.
64 字节，来自 192.168.56.1: icmp_seq=1 ttl=128 时间=3.94 毫秒
64 字节，来自 192.168.56.1: icmp_seq=2 ttl=128 时间=6.83 毫秒
64 字节，来自 192.168.56.1: icmp_seq=3 ttl=128 时间=1.10 毫秒
64 字节，来自 192.168.56.1: icmp_seq=4 ttl=128 时间=1.33 毫秒

--- 192.168.56.1 ping 统计 ---
已发送 4 个包， 已接收 4 个包，0% 包丢失，耗时 3022 毫秒
rtt min/avg/max/mdev = 1.096/3.300/6.834/2.325 ms
ustc-mzw@ustcmzw-VirtualBox:~$
```

收到响应（ICMP echo reply）后，再次使用`ip neigh`命令查看本机 ARP 缓存表的内容，找到 VMnet8 对应的表项，并记录其 MAC 地址

```
ustc-mzw@ustcmzw-VirtualBox:~$ ip neigh > ip_neigh
ustc-mzw@ustcmzw-VirtualBox:~$ cat ip_neigh
192.168.56.1 dev enp0s3 lladdr 0a:00:27:00:00:12 STALE
240e:459:480:ea3a:23f8:13d0:73e1:8916 dev enp0s3  FAILED
```

- 用`ip route`命令查看本机的 IPv4 路由表，

```
ustc-mzw@ustcmzw-VirtualBox:~$ ip route > ip_route
ustc-mzw@ustcmzw-VirtualBox:~$ cat ip_route
192.168.56.0/24 dev enp0s3 proto kernel scope link src 192.168.56.101 metric 10
0
```

- 用`sysctl net.ipv4.ip_forward`命令查看本机`net.ipv4.ip_forward`的配置值

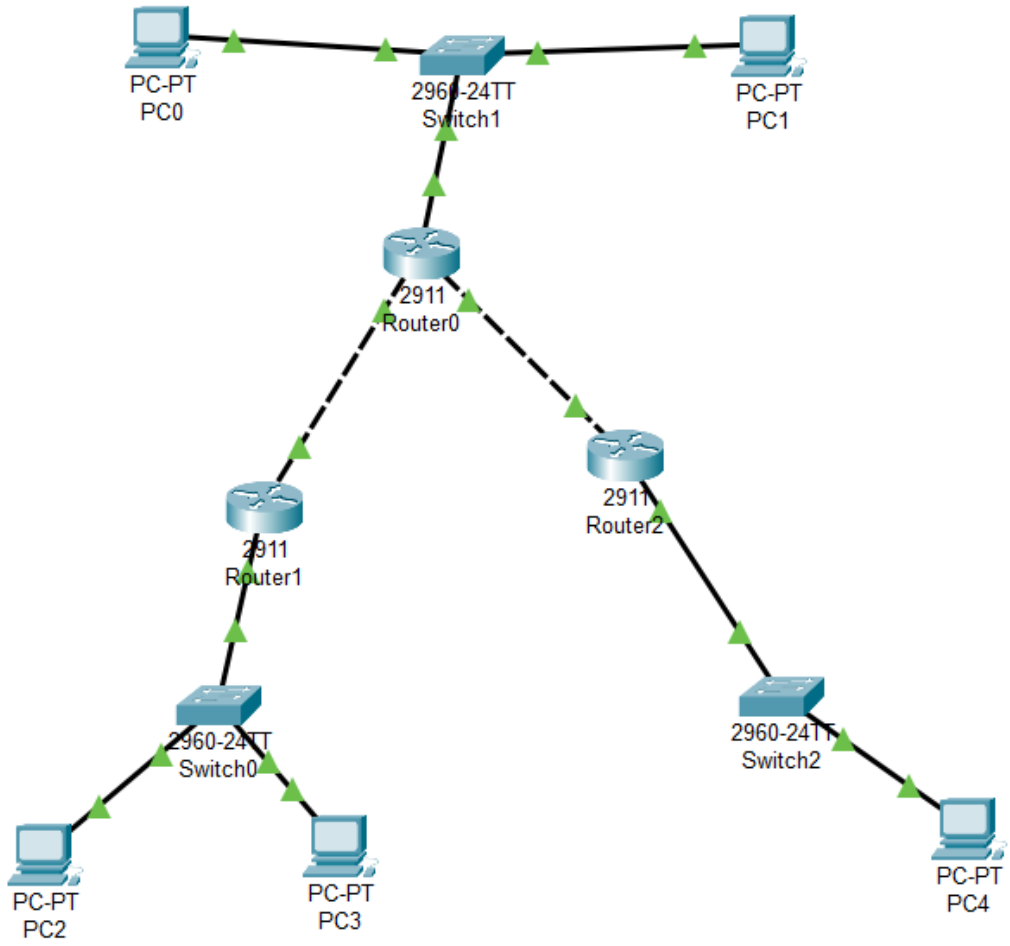
```
ustc-mzw@ustcmzw-VirtualBox:~$ sysctl net.ipv4.ip_forward > net.ipv4.ip_forward
ustc-mzw@ustcmzw-VirtualBox:~$ cat net.ipv4.ip_forward
net.ipv4.ip_forward = 0
```

- 用`sudo traceroute --icmp 202.38.64.1`观察从本机到`202.38.64.1`一共经过多少路由器

```
ustc-mzw@ustcmzw-VirtualBox:~$ sudo traceroute --icmp 202.38.64.1 > traceroute
ustc-mzw@ustcmzw-VirtualBox:~$ cat traceroute
traceroute to 202.38.64.1 (202.38.64.1), 30 hops max, 60 byte packets
 1  _gateway (10.0.2.2)  7.207 ms  5.701 ms  5.493 ms
 2  192.168.43.1 (192.168.43.1)  6.830 ms  6.050 ms  8.719 ms
 3  192.168.25.254 (192.168.25.254)  29.120 ms  31.170 ms  31.730 ms
 4  10.3.1.17 (10.3.1.17)  28.520 ms  28.328 ms  31.109 ms
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  ns.ustc.edu.cn (202.38.64.1)  42.681 ms  45.204 ms  47.851 ms
ustc-mzw@ustcmzw-VirtualBox:~$
```

Cisco 路由器 IP 组网模拟

网络拓扑为：

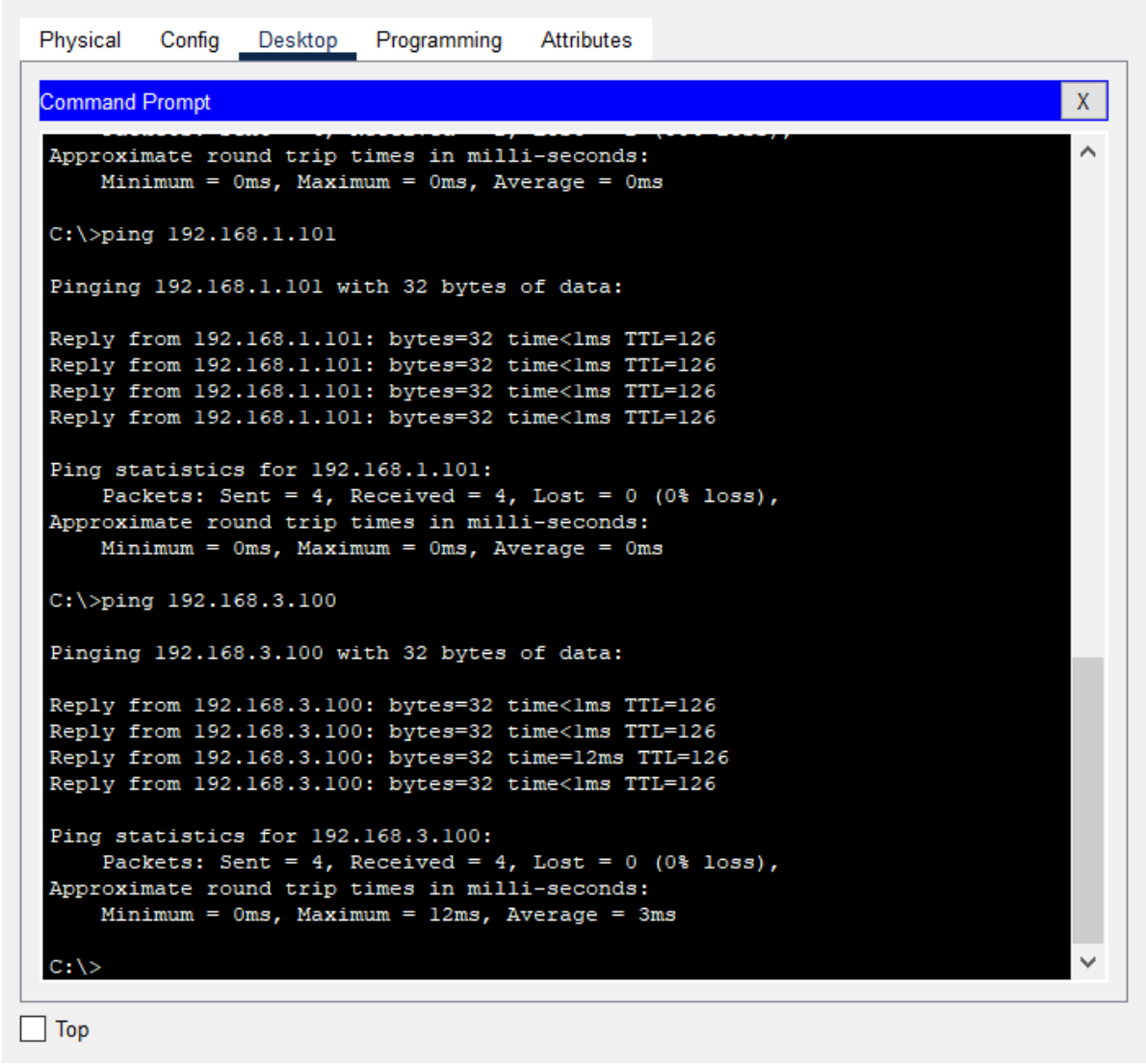


静态路由

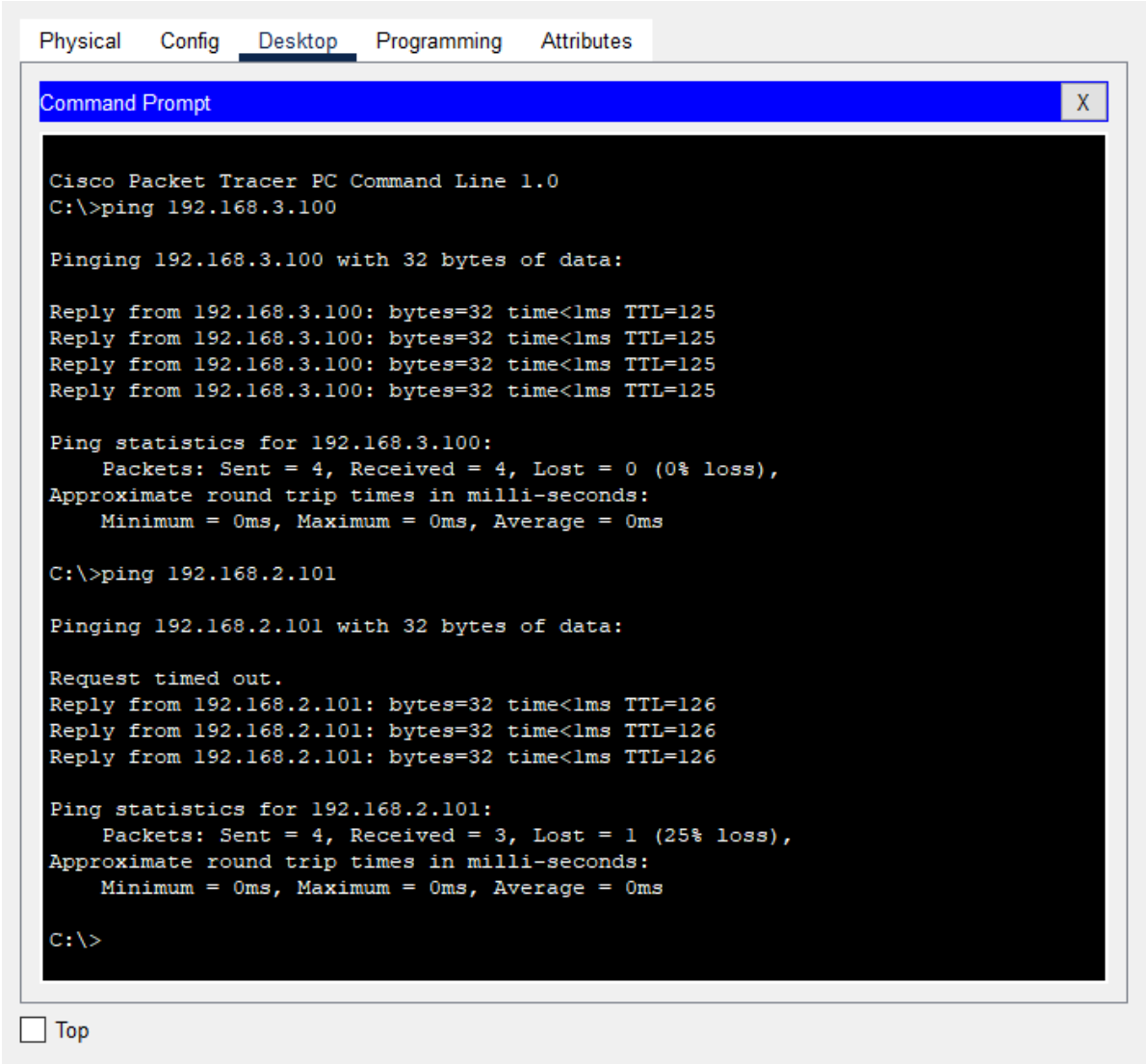
Router0的路由表：

```
Router>
Router>en
Router#show ip rou
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

S     192.168.1.0/24 [1/0] via 192.168.10.1
      192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.2.0/24 is directly connected, GigabitEthernet0/1
L        192.168.2.1/32 is directly connected, GigabitEthernet0/1
S     192.168.3.0/24 [1/0] via 192.168.11.1
      192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.10.0/24 is directly connected, GigabitEthernet0/0
L        192.168.10.2/32 is directly connected, GigabitEthernet0/0
      192.168.11.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.11.0/24 is directly connected, GigabitEthernet0/2
L        192.168.11.2/32 is directly connected, GigabitEthernet0/2

Router#
```

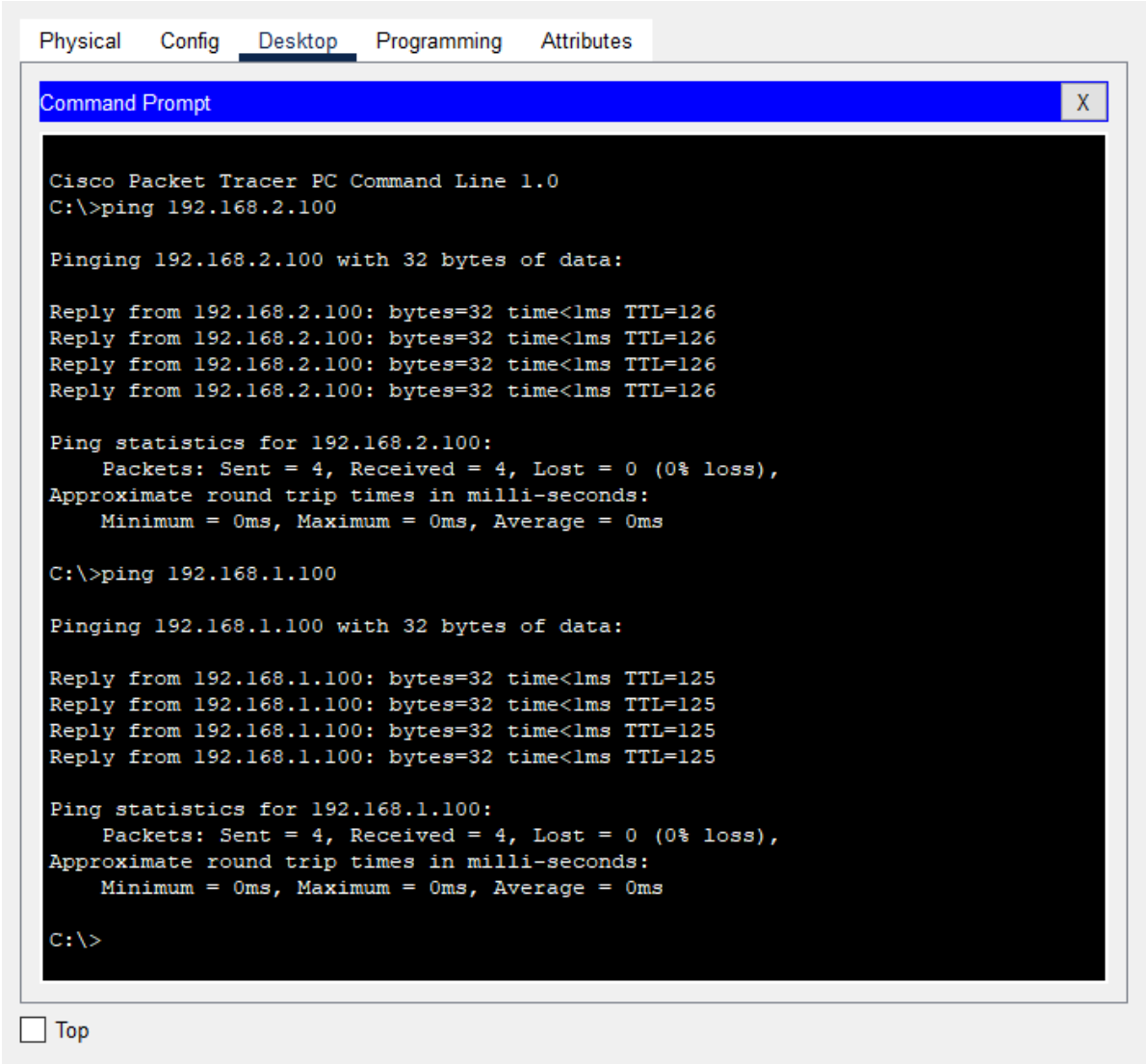
PC0 ping PC3和PC4:



PC2 ping PC4和PC1



PC4 Ping PC0和PC2:



RIP动态路由

Router0的路由表：

```
Router>en
Router#sho
Router#show ip
Router#show ip rou
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

R    192.168.1.0/24 [120/1] via 192.168.10.1, 00:00:21, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/1
L       192.168.2.1/32 is directly connected, GigabitEthernet0/1
R    192.168.3.0/24 [120/1] via 192.168.11.1, 00:00:07, GigabitEthernet0/2
     192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, GigabitEthernet0/0
L       192.168.10.2/32 is directly connected, GigabitEthernet0/0
     192.168.11.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.11.0/24 is directly connected, GigabitEthernet0/2
L       192.168.11.2/32 is directly connected, GigabitEthernet0/2

Router#
```

PC0 ping PC2和PC4:

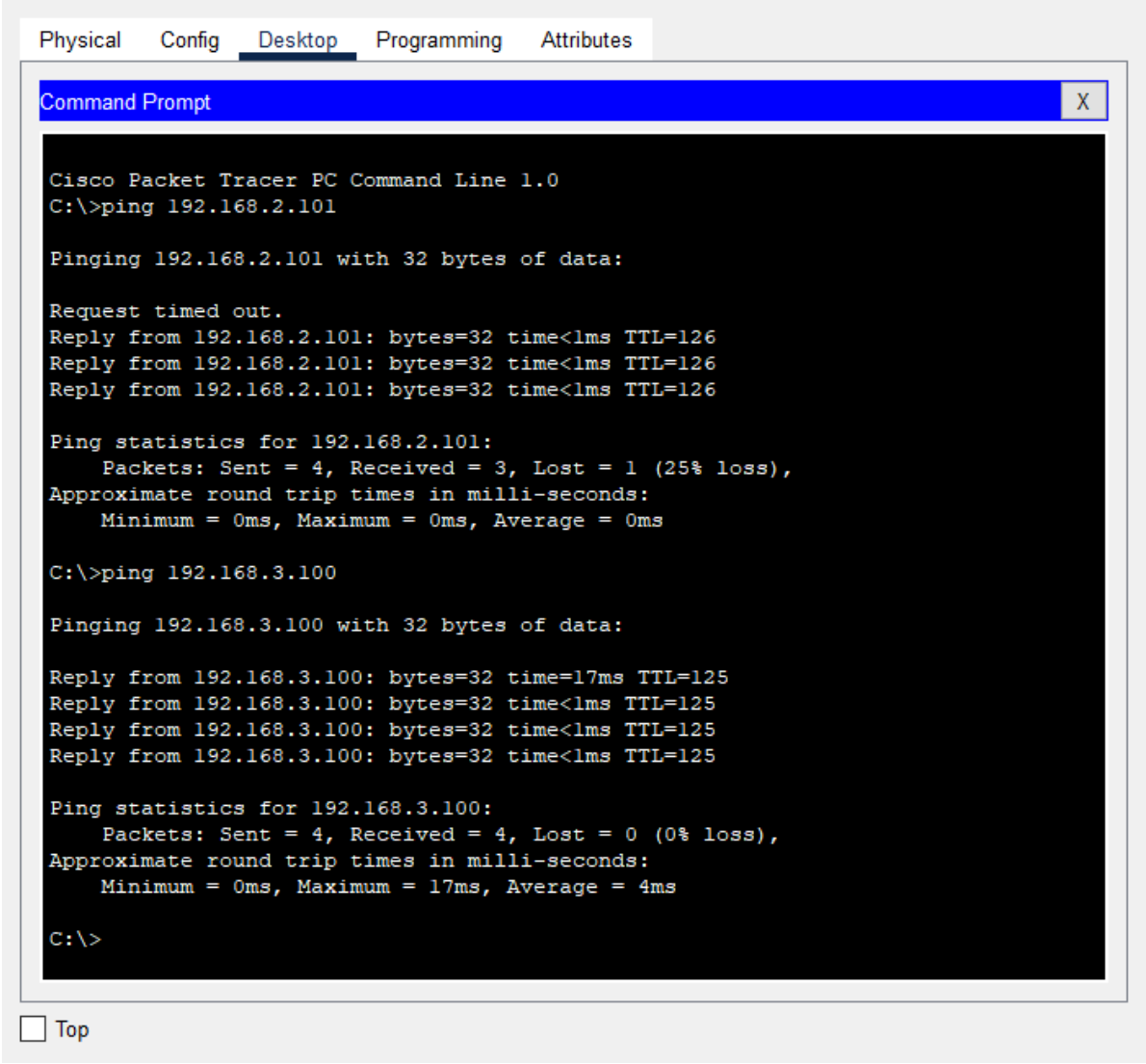
Physical Config Desktop Programming Attributes

Command Prompt X

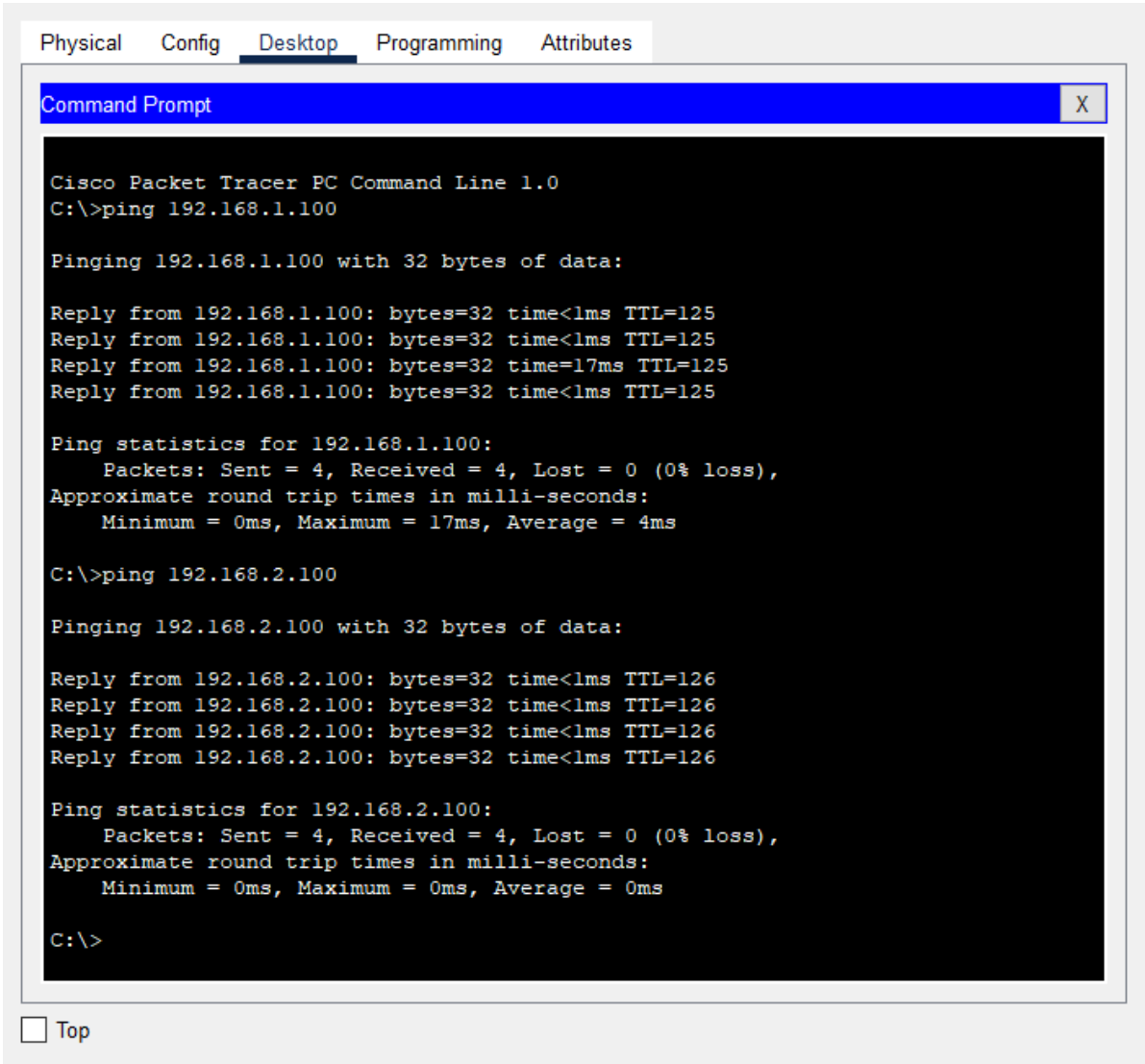
```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.3.100

Pinging 192.168.3.100 with 32 bytes of data:

Request timed out.
Reply from 192.168.3.100: bytes=32 time<1ms TTL=126
Reply from 192.168.3.100: bytes=32 time<1ms TTL=126
Reply from 192.168.3.100: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.3.100:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.1.100

Pinging 192.168.1.100 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.100: bytes=32 time<1ms TTL=126
Reply from 192.168.1.100: bytes=32 time<1ms TTL=126
Reply from 192.168.1.100: bytes=32 time<1ms TTL=126

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Top

PC3 ping PC4和PC1：



PC4 ping PC0和PC2:


Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.100
Pinging 192.168.1.100 with 32 bytes of data:
Reply from 192.168.1.100: bytes=32 time<1ms TTL=125
Reply from 192.168.1.100: bytes=32 time<1ms TTL=125
Reply from 192.168.1.100: bytes=32 time=17ms TTL=125
Reply from 192.168.1.100: bytes=32 time<1ms TTL=125
Ping statistics for 192.168.1.100:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 17ms, Average = 4ms
C:\>ping 192.168.2.100
Pinging 192.168.2.100 with 32 bytes of data:
Reply from 192.168.2.100: bytes=32 time<1ms TTL=126
Reply from 192.168.2.100: bytes=32 time<1ms TTL=126
Reply from 192.168.2.100: bytes=32 time<1ms TTL=126
Reply from 192.168.2.100: bytes=32 time<1ms TTL=126
Ping statistics for 192.168.2.100:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
Top