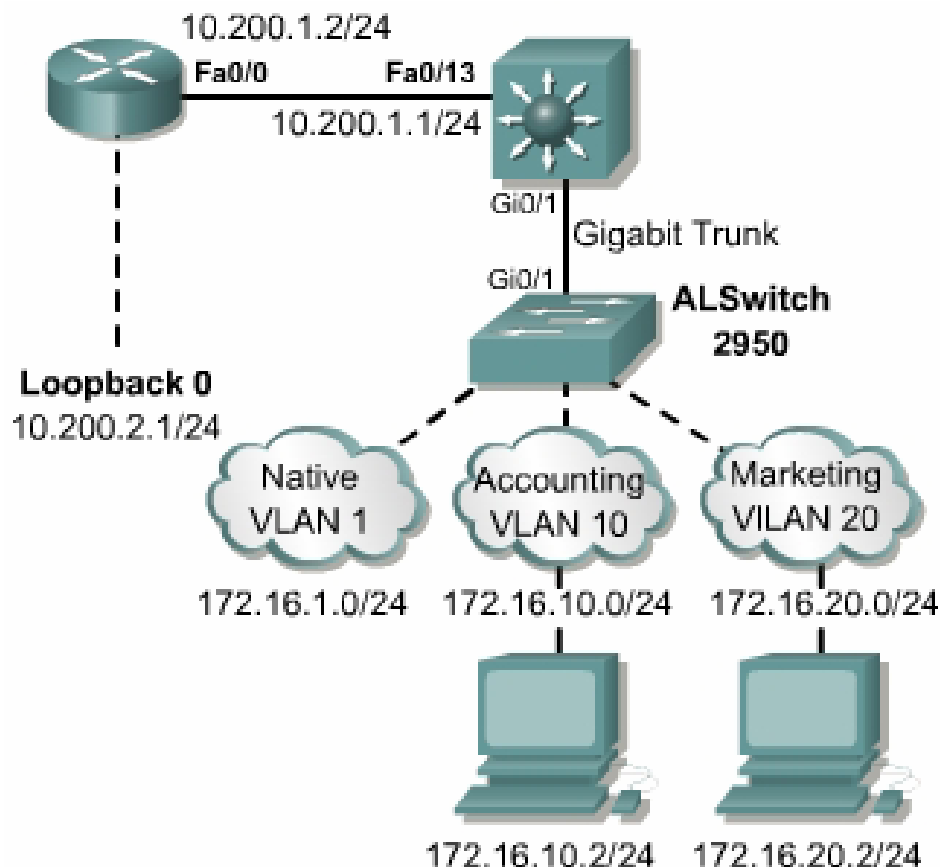


Lab 5.3.4.2 Routing Between an External Router and an Internal Route Processor



Objective

The purpose of this lab is to configure routing between an internal route processor and an external router.

Scenario

The network switching equipment currently includes a 3550 distribution layer switch and a 2950 access layer switch. The network is segmented into three functional VLANs for better network management. The VLANs include Accounting and Marketing for the users and default name is used for the native VLAN 1 network management. The 3550 is used for routing between the VLANs. A separate network with a 2600 router connects to a remote office. The company executive wants the accounting and marketing departments to be able to access the remote office when necessary. To facilitate the new requirement the 2600 will be directly connected to the 3550.

The network design information is as follows:

Switch	VTP Domain	VTP Mode
DLSwitch	CORP	Server
ALSwitch	CORP	Client

The VLAN configuration information is as follows:

VLAN ID	VLAN Name	VLAN Subnet	DLSwitch	ALSwitch Ports
1	Native	172.16.1.0	Gi0/1-2 Fa0/1-4	Gi0/1-2 Fa0/1-4 Fa0/13-24
10	Accounting	172.16.10.0	Fa0/5-13	Fa0/5-8
20	Marketing	172.16.20.0	Fa0/14-24	FA0/9-12
Trunk				802.1Q
Layer 3 Network		10.200.1.0	Fa0/13 (after initial configuration to VLAN 10)	

The internal route processor interface configuration information is as follows:

Interface	IP Address	VLAN
VLAN 1	172.16.1.1	1 Native
VLAN 10	172.16.10.1	10
VLAN 20	172.16.20.1	20
Layer 3 Interface	10.200.1.1	

Step 1

If continuing from Lab 4.3.2 or after loading the saved configurations from the previous lab, proceed to Step 6. Otherwise, start with the instructions below.

Do not cable the lab until all switch configurations and vlan.dat files have been erased.

Delete the vlan database if it exists on any switches and clear the configuration.

```
Switch#delete flash:vlan.dat
Delete filename [vlan.dat]?
Delete flash:vlan.dat? [confirm]
Switch#
Switch#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
Switch#reload
```

```
System configuration has been modified. Save? [yes/no]:n
Proceed with reload? [confirm]
```

Cable the lab according to the diagram.

Configure the hostname, passwords, and Telnet access on the switches.

Step 2

Configure the VLANs on DLSwitch.

Create the VLANs on DLSwitch. The 3550 will default to vtp server mode. Therefore, it does not need to be configured. If it is in client mode, use the **vtp server** command.

```
DLSwitch#vlan database
DLSwitch(vlan)#vtp domain CORP
DLSwitch(vlan)#vlan 10 name Accounting
DLSwitch(vlan)#vlan 20 name Marketing
DLSwitch(vlan)#exit
```

Verify the VTP and VLAN configuration with the **show vlan** and **show vtp status** commands.

```
DLSwitch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gi0/1, Gi0/2
10	Accounting	active	
20	Marketing	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1003	tr	101003	1500	-	-	-	-	srbb	0	0
1004	fdnet	101004	1500	-	-	-	-	ieee	0	0
1005	trnet	101005	1500	-	-	-	-	ibm	0	0

```
Remote SPAN VLANs
```

Primary	Secondary	Type	Ports
---------	-----------	------	-------

```

DLSwitch#show vtp status
VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
VTP Operating Mode          : Server
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0x31 0x31 0xF4 0x65 0x66 0x67 0x37 0x63
Configuration last modified by 0.0.0.0 at 3-1-93 00:01:18
Local updater ID is 0.0.0.0 (no valid interface found)

```

Place the ports into the proper VLAN. The **interface range** command can be used to configure several interfaces at the same time. By default all ports are in vlan 1. For this lab, move the ports that belong to VLAN 10 and 20.

```

DLSwitch(config)#interface range fastethernet 0/5 - 13
DLSwitch(config-if-range)#switchport mode access
DLSwitch(config-if-range)#switchport access vlan 10
DLSwitch(config)#interface range fastethernet 0/14 - 24
DLSwitch(config-if-range)#switchport mode access
DLSwitch(config-if-range)#switchport access vlan 20

```

Verify the port configuration with the **show vlan** command.

```
DLSwitch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Gi0/1, Gi0/2
10	Accounting	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13
20	Marketing	active	Fa0/14, Fa0/15, Fa0/16, Fa0/17 Fa0/18, Fa0/19, Fa0/20, Fa0/21 Fa0/22, Fa0/23, Fa0/24
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports

Step 3

Configure the VLANs on the ALSwitch.

```
ALSwitch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gi0/2
10	Accounting	active	
20	Marketing	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	-	-	ieee	0	0
1005	trnet	101005	1500	-	-	-	-	ibm	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
-----	-----	-----	-----

The ALSwitch is the VTP client. The ALSwitch must join the domain in client mode.

```
ALSwitch(vlan)#vtp client
ALSwitch(vlan)#vtp domain CORP
ALSwitch(vlan)#exit
```

Verify the VLAN configuration with the **show vlan** command.

1. Are VLAN 10 and VLAN 20 displayed?
2. Why or why not?

Step 4

Create a trunk link between DLSwitch and ALSwitch.

Set the port to trunking with 802.1Q encapsulation on the DLSwitch.

Note	The encapsulation in some IOS versions may be set to auto, which will not allow the user to set the switchport mode to trunking. If this is the case, the encapsulation will need to be configured first.
-------------	---

```

DLSwitch(config)#interface gigabitethernet 0/1
DLSwitch(config-if)#switchport mode trunk
DLSwitch(config-if)#switchport trunk encapsulation dot1q
DLSwitch(config-if)#exit

```

The 2950 switches do not need the encapsulation configured. These switches default to 802.1Q. In some IOS versions there are no other options. Console into ALSwitch and configure trunking.

```

ALSwitch(config)#interface gigabitethernet 0/1
ALSwitch(config-if)#switchport mode trunk
ALSwitch(config-if)#exit

```

Verify the VLAN configuration with the **show vlan** command.

```
ALSwitch(config)#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Gi0/2
10	Accounting	active	
20	Marketing	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srbr	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Move the ports into the appropriate VLANs.

```

ALSwitch(config)#interface range fastethernet 0/5-8
ALSwitch(config-if-range)#switchport access vlan 10
ALSwitch(config-if-range)#exit

ALSwitch(config)#interface range fastethernet 0/9-12
ALSwitch(config-if-range)#switchport access vlan 20
ALSwitch(config-if-range)#exit

```

Verify the port configuration with **show vlan** command.

```
ALSwitch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Gi0/2
10	Accounting	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8
20	Marketing	active	Fa0/9, Fa0/10, Fa0/11, Fa0/12
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	

```

1005 trnet-default          active

VLAN Type  SAID      MTU    Parent RingNo BridgeNo  Stp  BrdgMode Trans1 Trans2
----
1    enet    100001  1500   -      -      -      -    -        0      0
10   enet    100010  1500   -      -      -      -    -        0      0
20   enet    100020  1500   -      -      -      -    -        0      0
1002 fddi    101002  1500   -      -      -      -    -        0      0
1003 tr     101003  1500   -      -      -      -    srb       0      0
1004 fdnet  101004  1500   -      -      -      ieee -        0      0
1005 trnet  101005  1500   -      -      -      ibm  -        0      0

Remote SPAN VLANs
-----

Primary Secondary Type          Ports
-----

```

The **show vtp status** and **show vtp counters** commands can also be used to verify and troubleshoot trunking.

```

ALSwitch#show vtp status
VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 250
Number of existing VLANs    : 7
VTP Operating Mode          : Client
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0xB4 0x57 0x1A 0x95 0x99 0x85 0x6D 0x49
Configuration last modified by 0.0.0.0 at 3-1-93 00:13:27

ALSwitch#show vtp counters
VTP statistics:
Summary advertisements received : 4
Subset advertisements received  : 1
Request advertisements received  : 0
Summary advertisements transmitted : 5
Subset advertisements transmitted : 1
Request advertisements transmitted : 2
Number of config revision errors  : 0
Number of config digest errors    : 0
Number of V1 summary errors       : 0

VTP pruning statistics:

Trunk      Join Transmitted Join Received  Summary advts received from
non-pruning-capable device
-----
Gi0/1      0                0                0

```

Verify the VLAN trunking at Layer 3.

Connect one workstation to VLAN 10 on ALSwitch. Connect a second workstation to VLAN 10 on ALSwitch. Test connectivity with the **ping** command.

Note Remember to change the workstation IP address when connecting to different VLANs.

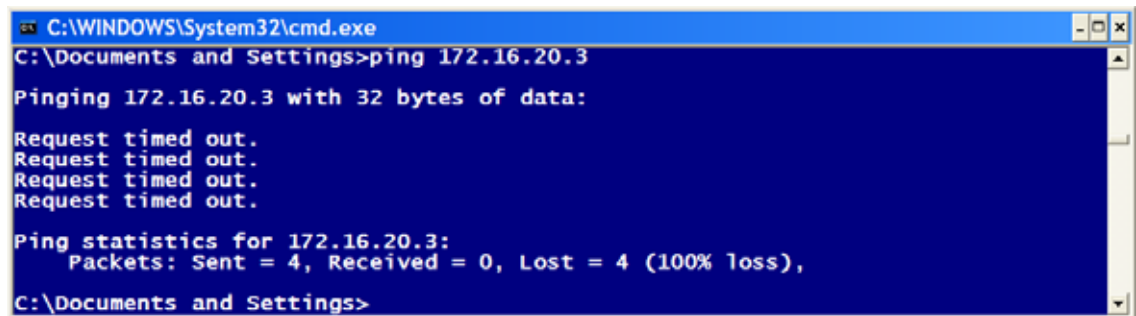
1. Did the **ping** work?

Now move both workstations to VLAN 20 on ALSwitch. Wait until the ports are in forwarding mode (green light). Use the **ping** command to test the connection.

2. Did the **ping** work?

The last step is to test the connections between VLANs. Connect one workstation to VLAN 10 and the other to VLAN 20. Wait until the ports are in forwarding mode (green light). Use the **ping** command to test the connection.

3. Did the **ping** work?



```
C:\WINDOWS\System32\cmd.exe
C:\Documents and Settings>ping 172.16.20.3

Pinging 172.16.20.3 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 172.16.20.3:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Documents and Settings>
```

Step 5

Configure the DLSwitch for ip routing and create the Layer 3 VLAN interfaces with the **interface vlan *vlan-id*** command to route between VLANs.

The 3550 IOS consists of a single image, instead of a CatOS image for the switching engine and an IOS image for the route processor. Inter-VLAN routing is configured from a single command-line interface. Internal trunks or internal EtherChannels do not need to be configured since there are no internal Layer 2 ports and internal Layer 3 interfaces that connect through the switch backplane.

```
DLSwitch(config)#ip routing

DLSwitch(config)#interface vlan 1
DLSwitch(config-if)#ip address 172.16.1.1 255.255.255.0
DLSwitch(config-if)#no shutdown

DLSwitch(config-if)#interface vlan 10
DLSwitch(config-if)#ip address 172.16.10.1 255.255.255.0

DLSwitch(config-if)#interface vlan 20
DLSwitch(config-if)#ip address 172.16.20.1 255.255.255.0
DLSwitch(config-if)#^Z
```

Verify the interfaces with the **show ip interface brief** command.

```
DLSwitch#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
Vlan1	172.16.1.1	YES	manual	up	up
Vlan10	172.16.10.1	YES	manual	up	up
Vlan20	172.16.20.1	YES	manual	up	up

FastEthernet0/1	unassigned	YES	unset	administratively down	down
FastEthernet0/2	unassigned	YES	unset	administratively down	down

<Output omitted>

Step 6

Verify routing between the VLANs.

Connect a workstation to VLAN 10 and another to VLAN 20. Use the **ping** command to test connectivity. Remember to change the workstation IP address and gateway to match the subnet.

Note	No routing will occur until the ip routing command is entered on the DLSwitch.
-------------	---

4. Did the **ping** work?

Step 7

Connect the 2600 FastEthernet 0/0 router port to the Catalyst 3500 FastEthernet 0/13 port. Configure FastEthernet 0/0 on the 2600.

```
Router(config)#hostname 2600
2600(config)#interface fastethernet 0/0
2600(config-if)#ip address 10.200.1.2 255.255.255.0
2600(config-if)#no shutdown
2600((config-if)#exit
```

Configure the loopback interface that will be used to test external connectivity.

```
2600(config)#interface loopback 0
2600(config-if)#ip address 10.200.2.1 255.255.255.0
2600(config-if)#exit
```

Configure EIGRP as the routing protocol. A routing protocol must be configured so that the routers can learn about external networks.

```
2600(config)#router eigrp 100
2600(config-router)#no auto-summary
2600(config-router)#network 10.200.1.0
2600(config-router)#network 10.200.2.0
2600(config-router)#^Z
```

Step 8

Configure the Layer 3 interface on the 3550.

The 3550 supports Layer 2 interfaces and Layer 3 physical interfaces. If a port on the switch is connected to an independent network without VLANs, it should be converted to a Layer 3 interface. The **no switchport** command is used for this purpose.

```
DLSwitch(config)#interface fastethernet 0/13
DLSwitch(Config-if)#no switchport
DLSwitch(Config-if)#ip address 10.200.1.1 255.255.255.0
DLSwitch(config-if)#exit
```

A routing protocol is needed to pass network information between the 2600 router and Catalyst 3550. Configure EIGRP as the DLSwitch routing protocol. Configure EIGRP as the routing protocol.

```

DLSwitch(config)#router eigrp 100
DLSwitch(config-router)#no auto-summary
DLSwitch(config-router)#network 10.200.1.0
DLSwitch(config-router)#network 172.16.1.0
DLSwitch(config-router)#network 172.16.10.0
DLSwitch(config-router)#network 172.16.20.0
DLSwitch(config-router)#^Z

```

Step 9

Verify proper routing between networks.

Use the **show ip route** command on the DLSwitch to verify routing.

```

DLSwitch#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

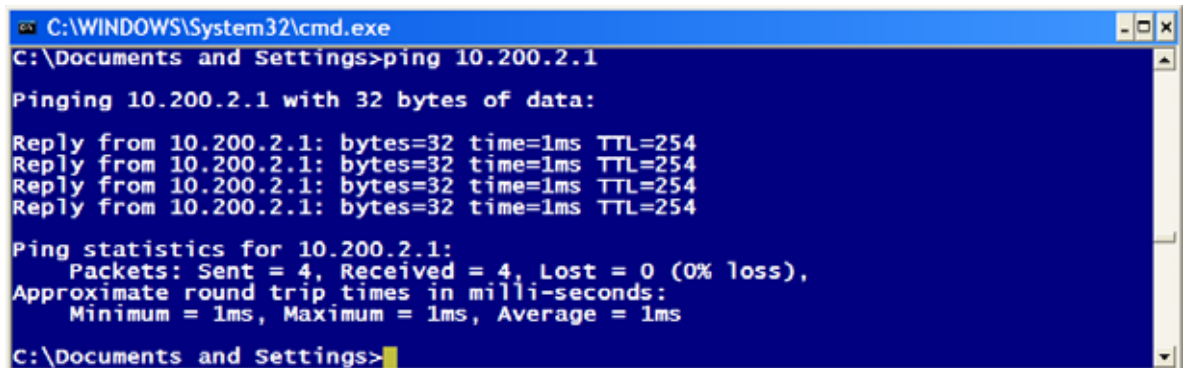
Gateway of last resort is not
01:22:19: %SYS-5-CONFIG_I: Configured from console by consoleset

      172.16.0.0/24 is subnetted, 3 subnets
C      172.16.20.0 is directly connected, Vlan20
C      172.16.10.0 is directly connected, Vlan10
C      172.16.1.0 is directly connected, Vlan1
      10.0.0.0/24 is subnetted, 2 subnets
D      10.200.2.0 [90/156160] via 10.200.1.2, 00:00:12, FastEthernet0/13
C      10.200.1.0 is directly connected, FastEthernet0/13
DLSwitch#

```

5. Which network is learned through EIGRP on DLSwitch?

Use the **ping** command to test connectivity between the workstation to the loopback address (10.200.2.1).



```

C:\WINDOWS\System32\cmd.exe
C:\Documents and Settings>ping 10.200.2.1

Pinging 10.200.2.1 with 32 bytes of data:

Reply from 10.200.2.1: bytes=32 time=1ms TTL=254
Reply from 10.200.2.1: bytes=32 time=1ms TTL=254
Reply from 10.200.2.1: bytes=32 time=1ms TTL=254
Reply from 10.200.2.1: bytes=32 time=1ms TTL=254

Ping statistics for 10.200.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Documents and Settings>

```