

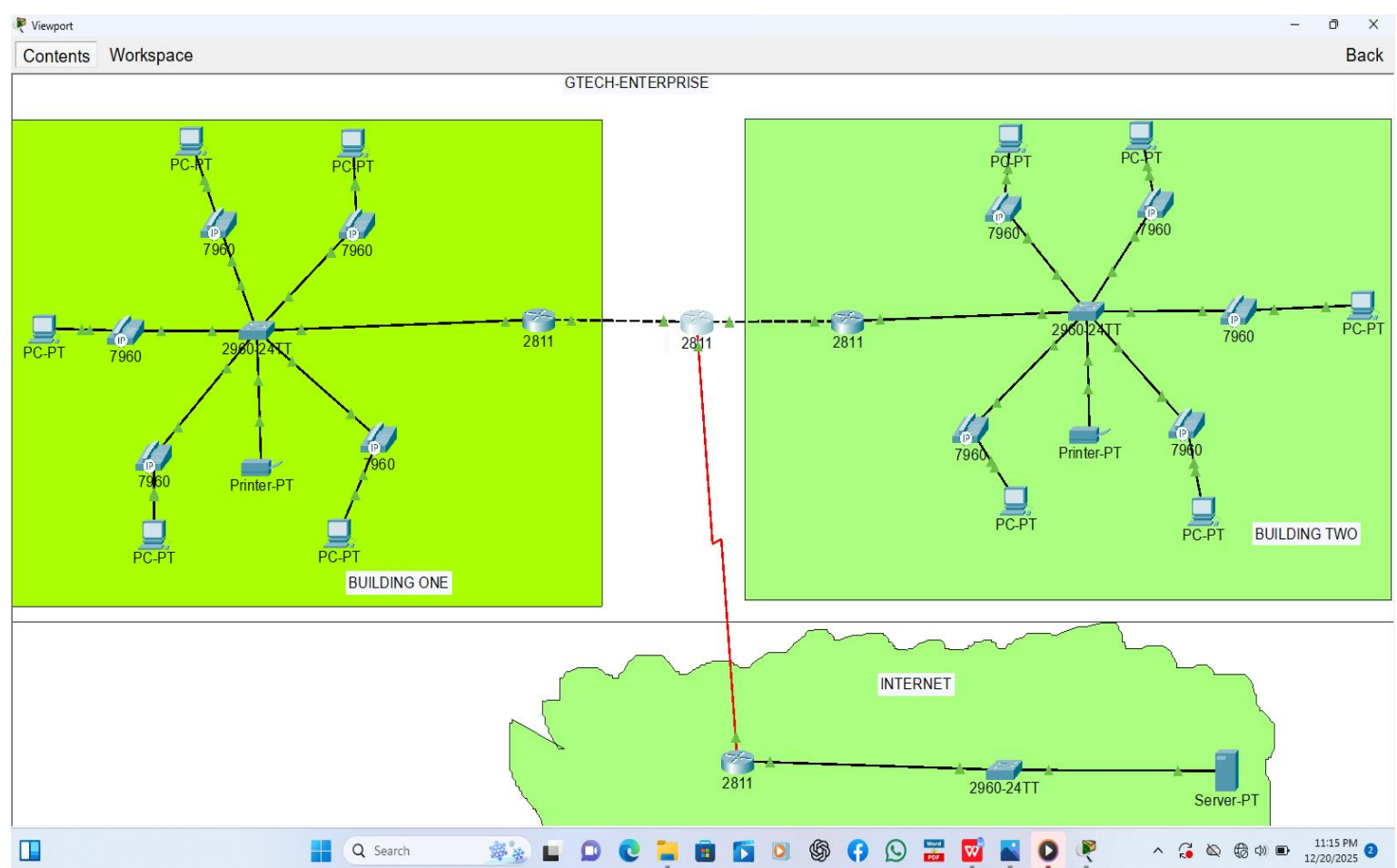
## IP PHONES CONFIGURATIONS

### ACTIVITY

You are the network engineer for Gtech enterprise, they just brought you some ip phones , they are moving away from analog,they have two buildings building one has two departments Sales and Human Resource and building two has Finance and ICT, they doesn't have enough layer 2 switches they only have two which should accommodate the said departments per building.The network address is 192.168.0.0. You are required to;

1. Subnet the network address use slash 28.
2. Create vlans for the departments( data vlan and voice vlan for ip phones).
3. DHCP on the routers LANs (Building 1 and 2).
4. Telephony-service
5. Dial-peer
6. Routing protocol RIP.
7. Access List Control.
8. Network Address Translation (NAT).

## NETWORK TOPOLOGY



## LAYER 2 CONFIGURATIONS

### BUILDING ONE

Hostname BUILDING-1-MAIN-SW

Enable secret Admin2

Username Admin password Admin123

Line console 0

Login local

Line vty 0 15

Login local

Service password-encryption

Banner motd #ADMINS ONLY#

Vlan 10

Name DATA1

Vlan 15

Name VOICE1

Vlan 20

Name DATA2

Vlan 25

Name VOICE2

Int range fa0/2-4

```
Switchport mode access
Switchport access vlan 10
Switchport voice vlan 15
Exit
Int range fa0/5-7
Switchport mode access
Switchport access vlan 20
Switchport voice vlan 25
Int fa0/1
Switchport mode trunk
Do wr
BUILDING TWO
Hostname BUILDING-2-MAIN-SW
Enable secret Admin2
Username Admin password Admin123
Line console 0
Login local
Line vty 0 15
Login local
Service password-encryption
Banner motd #ADMINS ONLY#
Vlan 30
Name DATA3
Vlan 35
Name VOICE3
Vlan 40
Name DATA4
Vlan 45
Name VOICE4
Int range fa0/2-4
Switchport mode access
Switchport access vlan 30
Switchport voice vlan 35
Exit
Int range fa0/5-7
Switchport mode access
Switchport access vlan 40
Switchport voice vlan 45
Int fa0/1
Switchport mode trunk
Do wr
```

## SUBNETTING

Vlan	Mask	Network	Usable Addresses	Broadcast
10	/28	192.168.0.0	192.168.0.1-192.168.0.14	192.168.0.15
15	/28	192.168.0.16	192.168.0.17-192.168.0.30	192.168.0.31
20	/28	192.168.0.32	192.168.0.33-192.168.0.46	192.168.0.47
25	/28	192.168.0.48	192.168.0.49-192.168.0.62	192.168.0.63
30	/28	192.168.0.64	192.168.0.65-192.168.0.78	192.168.0.79
35	/28	192.168.0.80	192.168.0.81-192.168.0.94	192.168.0.95
40	/28	192.168.0.96	192.168.0.97-192.168.0.110	192.168.0.111
45	/28	192.168.0.112	192.168.0.113-192.168.0.126	192.168.0.127

## LAYER 3 CONFIGURATIONS

### BUILDING ONE

Hostname BUILDING-1-MAIN-ROUTER

Enable secret Admin1

Username Admin password Admin123

Line console 0

Login local

Line vty 0 15

Login local

Service password-encryption

Banner motd #ADMINS ONLY#

Int range fa0/0

No shut

Description link to BUILDING1

Ex

### SUB-INTERFACES

Int fa0/0.10

Encap dot1q 10

Ip add 192.168.0.1 255.255.255.240

Int fa0/0.15

Encap dot1q 15

Ip add 192.168.0.17 255.255.255.240

Int fa0/0.20

Encap dot1q 20

Ip add 192.168.0.33 255.255.255.240

Int fa0/0.25

Encap dot1q 25

Ip add 192.168.0.49 255.255.255.240

Ex

Do wr

## **DYNAMIC HOST CONFIGURATION**

### **BUILDING ONE**

#### **DATA**

Ip dhcp excluded-address 192.168.0.1 192.168.0.5  
Ip dhcp pool VLAN10  
Network 192.168.0.0 255.255.255.240  
Default-router 192.168.0.1  
Dns-server 8.8.8.8  
Ex  
Ip dhcp excluded-address 192.168.0.33 192.168.0.38  
Ip dhcp pool VLAN20  
Network 192.168.0.32 255.255.255.240  
Default-router 192.168.0.33  
Dns-server 8.8.8.8  
Ex

#### **VOICE**

Ip dhcp excluded-address 192.168.0.17 192.168.0.22  
Ip dhcp pool VLAN15  
Network 192.168.0.16 255.255.255.240  
Default-router 192.168.0.17  
Option 150 ip 192.168.0.17  
Ex  
Ip dhcp excluded-address 192.168.0.49 192.168.0.54  
Ip dhcp pool VLAN25  
Network 192.168.0.48 255.255.255.240  
Default-router 192.168.0.49  
Option 150 ip 192.168.0.49  
Ex  
Do wr

#### **!TELEPHONY-SERVICE**

Telephony-service  
Max-dn 5  
Max-ephones 5  
Auto assign 1 to 5  
Ip source-address 192.168.0.17 port 2000  
Ex  
Do wr  
Ephone-dn 1  
Number 1001  
Ephone-dn 2  
Number 1002  
Ephone-dn 3  
Number 1003  
Ephone-dn 4  
Number 1004  
Ephone-dn 5  
Number 1005  
Ex  
Ephone 1  
Type 7960  
Button 1:1  
Ephone 2  
Type 7960  
Button 1:2  
Ephone 3  
Type 7960

Button 1:3

Ephone 4

Type 7960

Button 1:4

Ephone 5

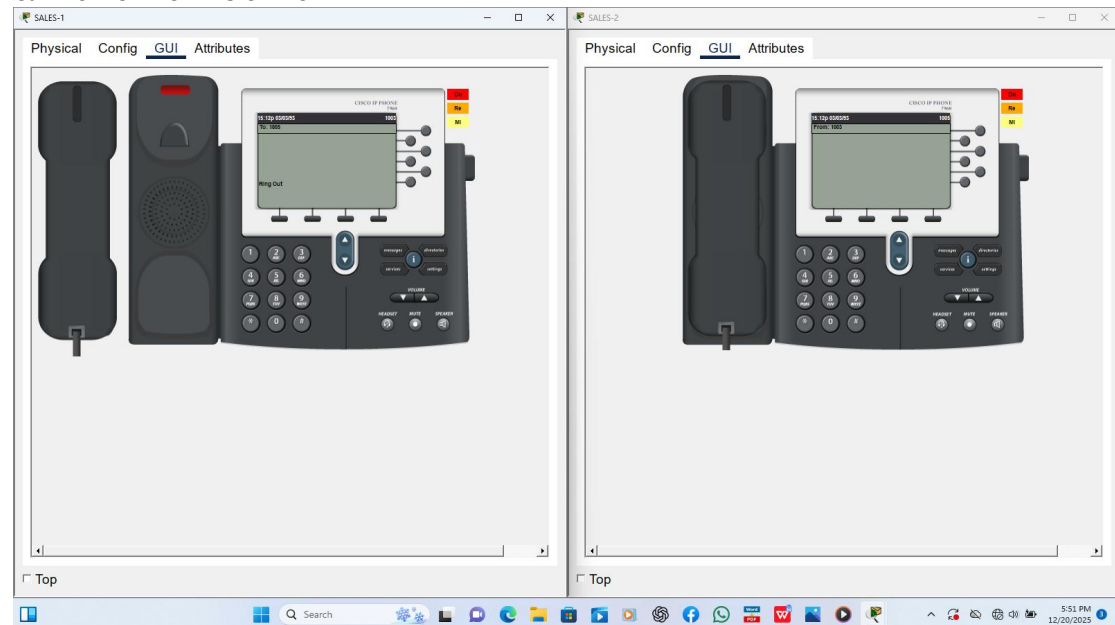
Type 7960

Button 1:5

Do wr

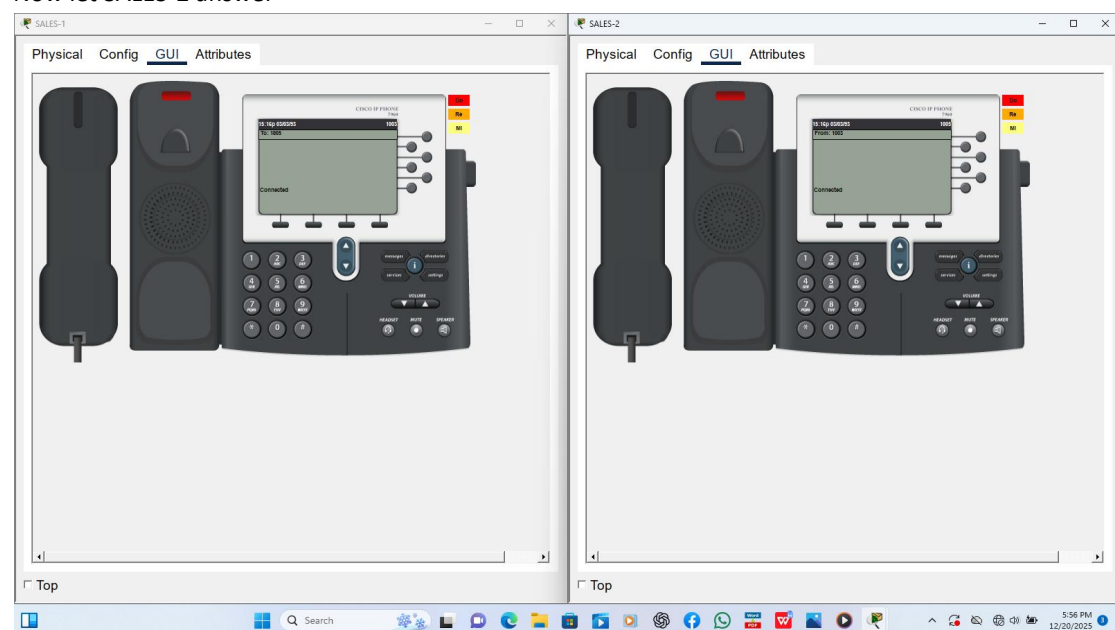
Before we go to building two let us try the calls between our phones, we will just do one

Call from SALES-1 TO SALES 2

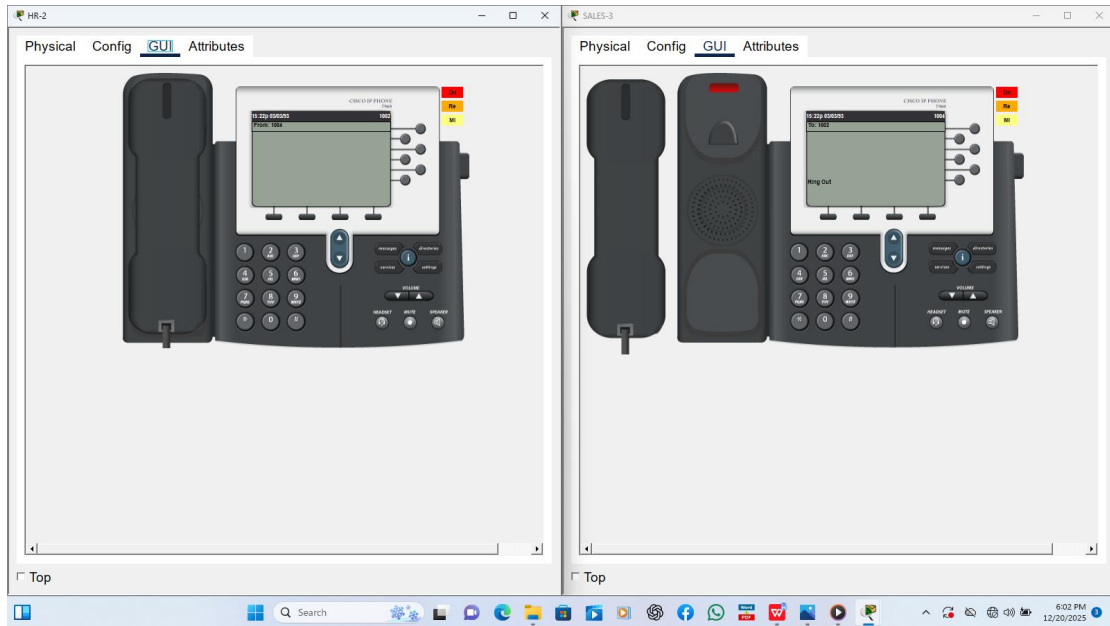


From the above picture we can see the phone ringing

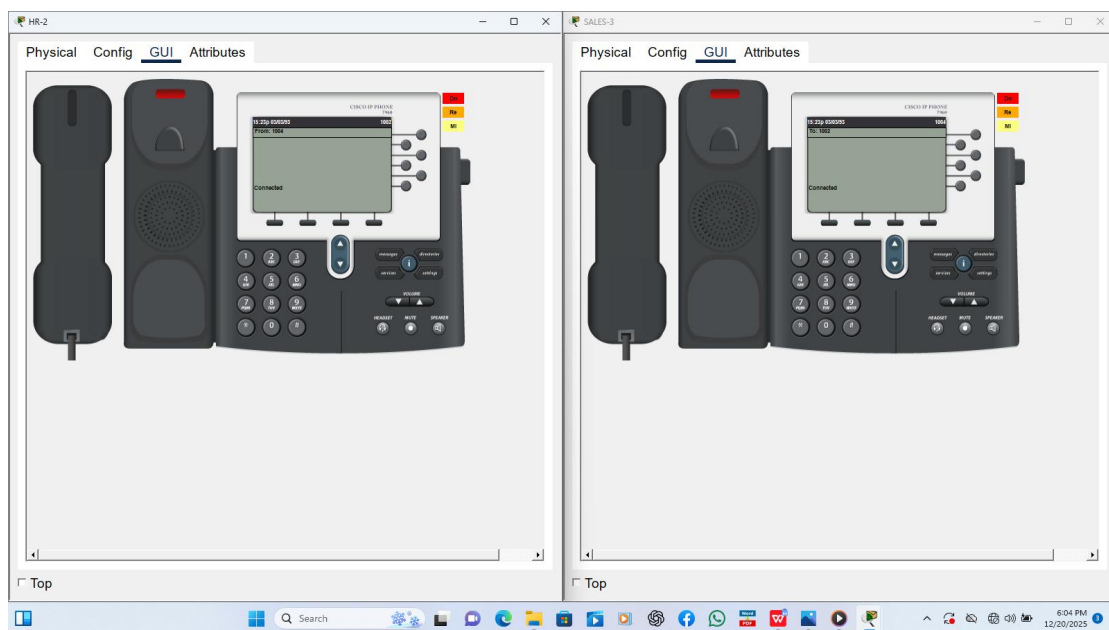
Now let SALES-2 answer



let us try calling HR, thus from SALES to HR (VLAN 15 TO VLAN 25)

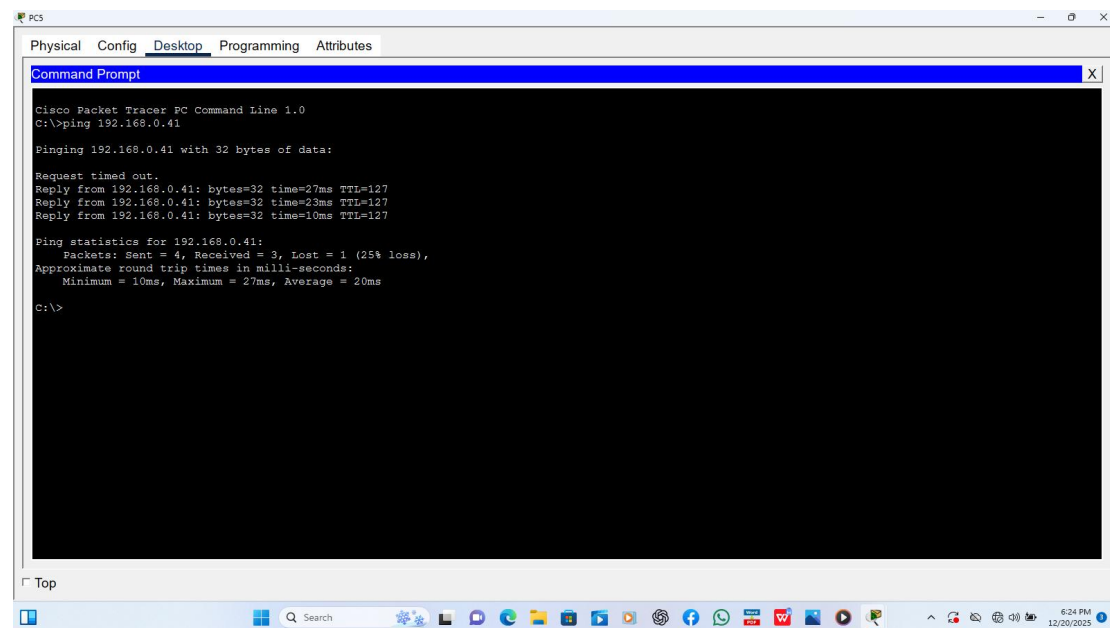


HR can answer the call



Let us try to ping from vlan 10 to vlan 20  
Ping 192.168.0.41

## OUTPUT



```
Physical  Config  Desktop  Programming  Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.41

Pinging 192.168.0.41 with 32 bytes of data:

Request timed out.
Reply from 192.168.0.41: bytes=32 time=27ms TTL=127
Reply from 192.168.0.41: bytes=32 time=23ms TTL=127
Reply from 192.168.0.41: bytes=32 time=10ms TTL=127

Ping statistics for 192.168.0.41:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 27ms, Average = 20ms

C:\>
```

Ping was successful. On building one everything is working well let us go to building two

### BUILDING TWO

Hostname BUILDING2-MAIN-ROUTER

Enable secret Admin1

Username Admin password Admin123

Line console 0

Login local

Line vty 0 15

Login local

Service password-encryption

Banner motd #ADMINS ONLY#

Int range fa0/0-1

No shut

Description link to BUILDING2

Ex

### SUB-INTERFACES

Int fa0/0.30

Encap dot1q 30

Ip add 192.168.0.65 255.255.255.240

Int fa0/0.35

Encap dot1q 35

Ip add 192.168.0.81 255.255.255.240

Int fa0/0.40

Encap dot1q 40

Ip add 192.168.0.97 255.255.255.240

Int fa0/0.45

Encap dot1q 45

Ip add 192.168.0.113 255.255.255.240

Ex

Do wr



## DYNAMIC HOST CONFIGURATION

### !DATA

Ip dhcp excluded-address 192.168.0.65 192.168.0.70

Ip dhcp pool VLAN30

Network 192.168.0.64 255.255.255.240

Default-router 192.168.0.65

Dns-server 8.8.8.8

Ex

Ip dhcp excluded-address 192.168.0.97 192.168.0.102

Ip dhcp pool VLAN40

Network 192.168.0.96 255.255.255.240

Default-router 192.168.0.97

Dns-server 8.8.8.8

Ex

### !VOICE

Ip dhcp excluded-address 192.168.0.81 192.168.0.86

Ip dhcp pool VLAN35

Network 192.168.0.80 255.255.255.240

Default-router 192.168.0.81

Option 150 ip 192.168.0.81

Ex

Ip dhcp excluded-address 192.168.0.113 192.168.0.118

Ip dhcp pool VLAN45

Network 192.168.0.112 255.255.255.240

Default-router 192.168.0.113

Option 150 ip 192.168.0.113

Ex

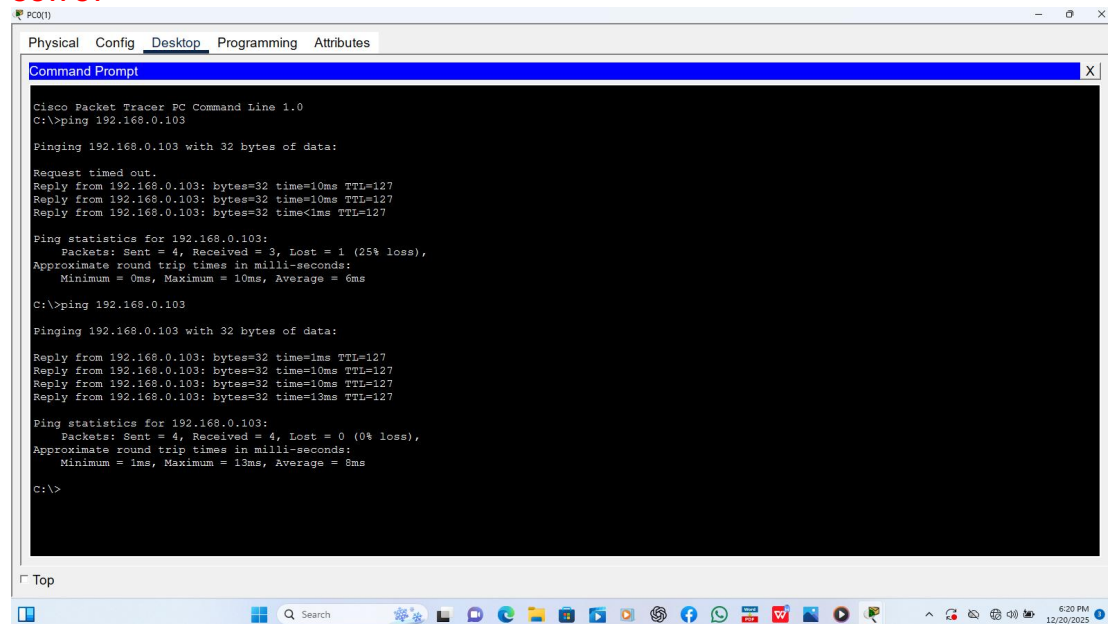
Do wr

After configuring the dhcp we can try to ping between the PCs.

We will ping from Vlan 30 to vlan 40

Ping 192.168.0.103

### OUTPUT



```
PC0(1)
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.103

Pinging 192.168.0.103 with 32 bytes of data:

Request timed out.
Reply from 192.168.0.103: bytes=32 time=10ms TTL=127
Reply from 192.168.0.103: bytes=32 time=10ms TTL=127
Reply from 192.168.0.103: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.0.103:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 6ms

C:\>ping 192.168.0.103

Pinging 192.168.0.103 with 32 bytes of data:

Reply from 192.168.0.103: bytes=32 time=1ms TTL=127
Reply from 192.168.0.103: bytes=32 time=10ms TTL=127
Reply from 192.168.0.103: bytes=32 time=10ms TTL=127
Reply from 192.168.0.103: bytes=32 time=13ms TTL=127

Ping statistics for 192.168.0.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 13ms, Average = 8ms

C:\>
```

Let us configure telephony-service

## !TELEPHONY-SERVICE

Telephony-service

Max-dn 5

Max-ephones 5

Auto assign 1 to 5

Ip source-address 192.168.0.113 port 2000

Ex

Do wr

Ephone-dn 1

Number 2001

Ephone-dn 2

Number 2002

Ephone-dn 3

Number 2003

Ephone-dn 4

Number 2004

Ephone-dn 5

Number 2005

Ex

Ephone 1

Type 7960

Button 1:1

Ephone 2

Type 7960

Button 1:2

Ephone 3

Type 7960

Button 1:3

Ephone 4

Type 7960

Button 1:4

Ephone 5

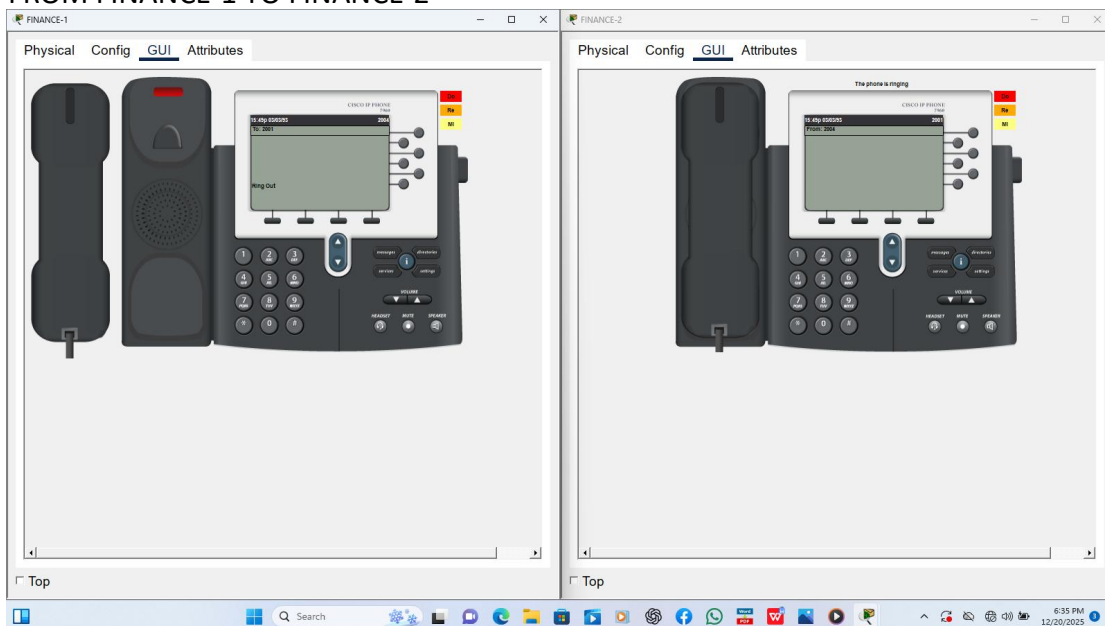
Type 7960

Button 1:5

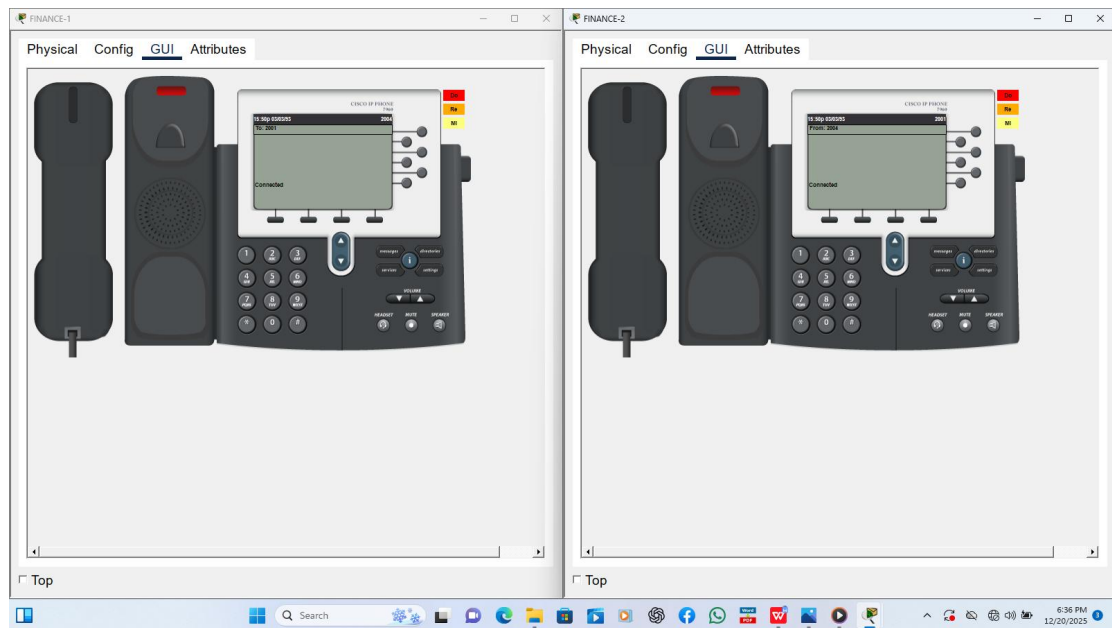
Do wr

We are done with telephony service configurations, let us now do the testing, we will first do with Vlans then we will try between Vlans

FROM FINANCE-1 TO FINANCE-2

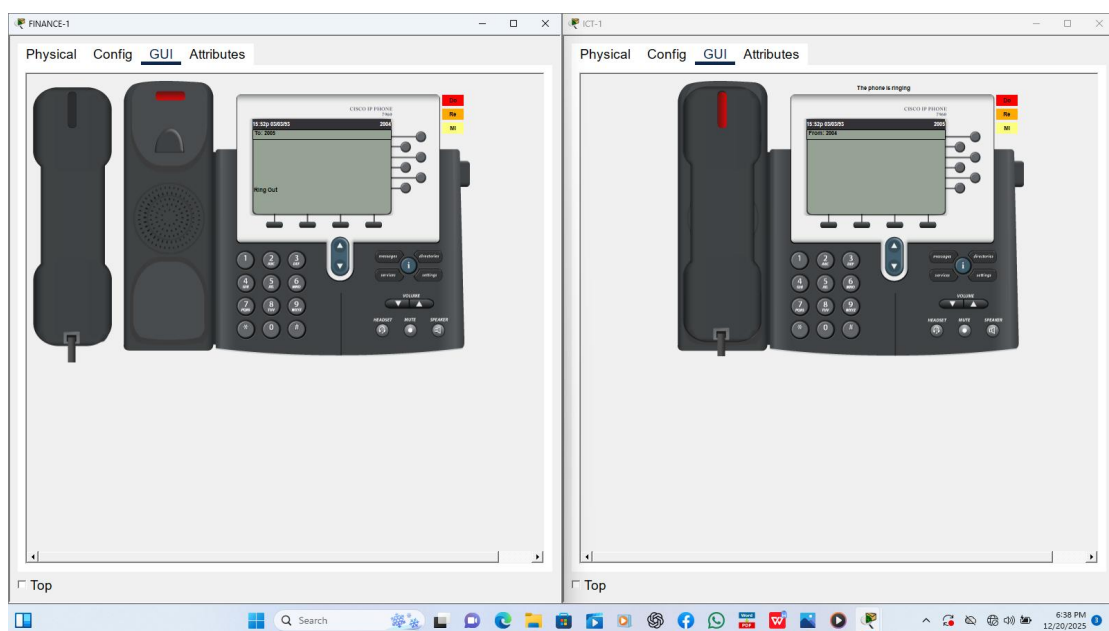


Let us answer,

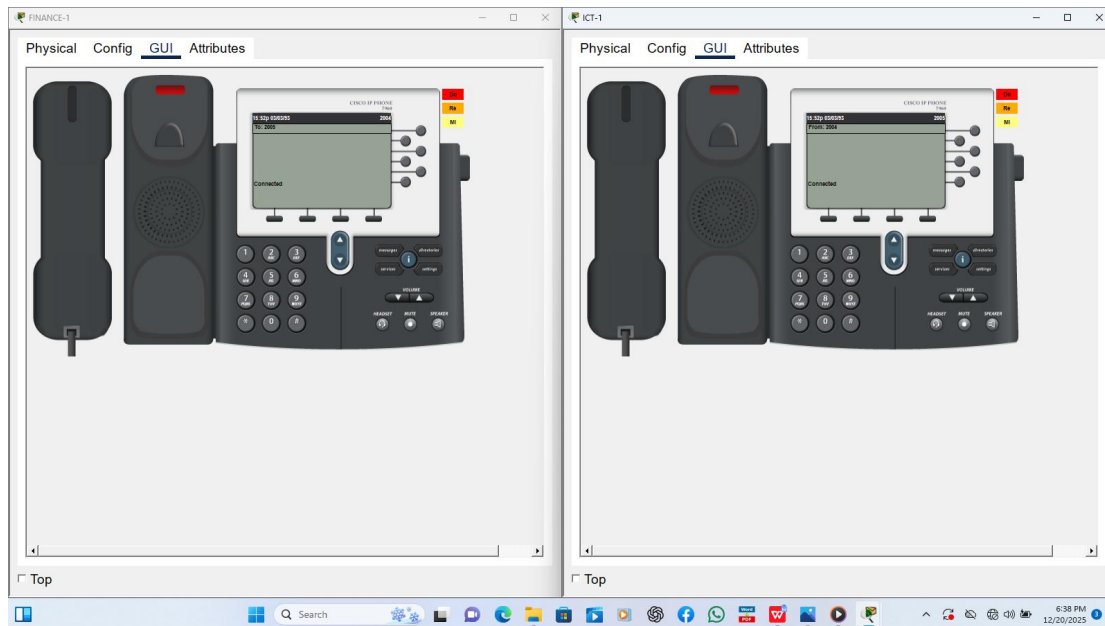


It is working.

Let us do between vlans,thus from FINANCE to ICT

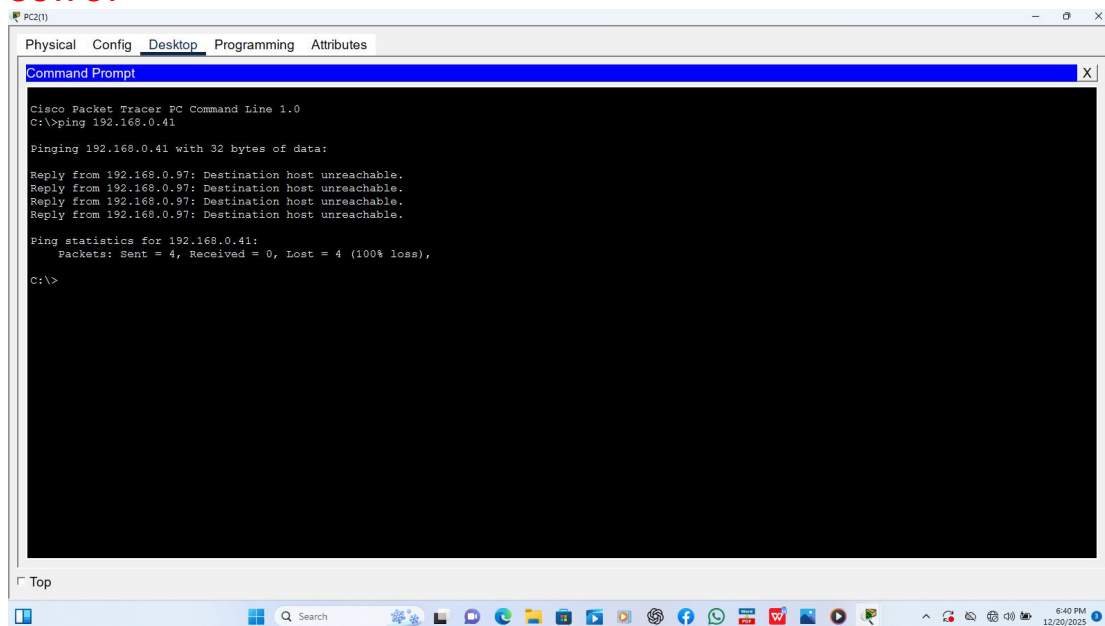


We can pick



We are done, let us try pinging from building two to building one

## OUTPUT



Ping has failed, this is because of two reasons, one being that the data/packet is being blocked by the router or the router doesn't know how to reach the destination address. Given that we have not configured the ACLs on either router we can conclude that the reason is that the router doesn't know how to reach the destination address, we have ensured that the routers all have the IP addresses connecting each other, thereafter we configure the routing protocol.

We could use the same network address but for this project I will consider getting another address which is 10.0.0.0 for point-to-point, I will subnet that.

## POINT TO POINT LINK

S/N	MASK	NETWORK	USABLE ADDRESSES
R1-R2	/30	10.0.0.0	10.0.0.1-10.0.0.2
R2-R3	/30	10.0.1.0	10.0.0.1-10.0.0.2

!ROUTER1(BUILDING1) TO EDGE ROUTER

Int fa0/1

Ip add 10.0.0.1 255.255.255.252

```

Ex
Do wr
!EDGE ROUTER
Int fa0/0
Ip add 10.0.0.2 255.255.255.252
Ex
Int fa0/1
Ip add 10.0.1.1 255.255.255.252
Ex
Int se0/3/0
Ip add 203.0.113.2 255.255.255.192
Do wr
!ROUTER2(BUILDING2 FROM EDGE ROUTER)
Int fa0/1
Ip add 10.0.0.2 255.255.255.252
Ex
Do wr

```

## ROUTING PROTOCOL

For the routing protocol we are using Routing Information Protocol (RIP) because the network is small .

## RIP CONFIGURATIONS

### BUILDING ONE

```

!BUILDING-1-MAIN-ROUTER
Ip route 0.0.0.0 0.0.0.0 10.0.0.1
Router rip
Version 2
No auto-summary
Network 192.168.0.0
Network 192.168.0.16
Network 192.168.0.32
Network 192.168.0.48
Network 10.0.0.0
Do wr
Ex
!EDGE ROUTER
Router rip
Version 2
No auto-summary
Network 10.0.1.0
Network 10.0.0.0
Network 203.0.113.0
Do wr
Ex

```

### BUILDING TWO

```

!BUILDING21-MAIN-ROUTER
Ip route 0.0.0.0 0.0.0.0 10.0.1.1
Router rip
Version 2
No auto-summary
Network 192.168.0.64
Network 192.168.0.80
Network 192.168.0.97
Network 192.168.0.112
Network 10.0.1.0
Do wr

```

We are done, now let us try to verify the configuration to see if the routers do know how reach each other.

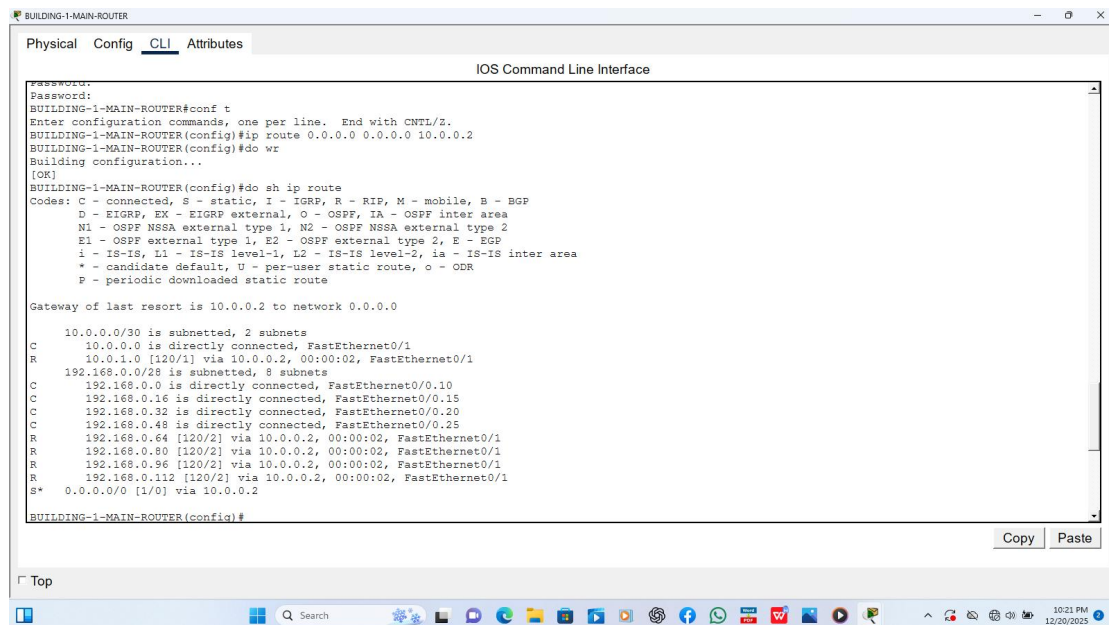
I added a static route on building 1 router and building two router this is going to be used as gateway of last resort

BUILDING 1

Command

Show ip route

OUTPUT



```
Building-1-MAIN-ROUTER
Physical Config CLI Attributes
IOS Command Line Interface

Password:
BUILDING-1-MAIN-ROUTER#conf t
Enter configuration commands, one per line. End with CNTL/Z.
BUILDING-1-MAIN-ROUTER(config)#ip route 0.0.0.0 0.0.0.0 10.0.0.2
BUILDING-1-MAIN-ROUTER(config)#do wr
Building configuration...
[OK]
BUILDING-1-MAIN-ROUTER(config)#do sh 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 10.0.0.2 to network 0.0.0.0

  10.0.0.0/30 is subnetted, 2 subnets
    C      10.0.0.0 is directly connected, FastEthernet0/1
    R      10.0.1.0 [120/1] via 10.0.0.2, 00:00:02, FastEthernet0/1
  192.168.0.0/28 is subnetted, 8 subnets
    C      192.168.0.0 is directly connected, FastEthernet0/0.10
    C      192.168.0.16 is directly connected, FastEthernet0/0.15
    C      192.168.0.32 is directly connected, FastEthernet0/0.20
    C      192.168.0.48 is directly connected, FastEthernet0/0.25
    R      192.168.0.64 [120/2] via 10.0.0.2, 00:00:02, FastEthernet0/1
    R      192.168.0.80 [120/2] via 10.0.0.2, 00:00:02, FastEthernet0/1
    R      192.168.0.96 [120/2] via 10.0.0.2, 00:00:02, FastEthernet0/1
    R      192.168.0.112 [120/2] via 10.0.0.2, 00:00:02, FastEthernet0/1
    S*     0.0.0.0/0 [1/0] via 10.0.0.2

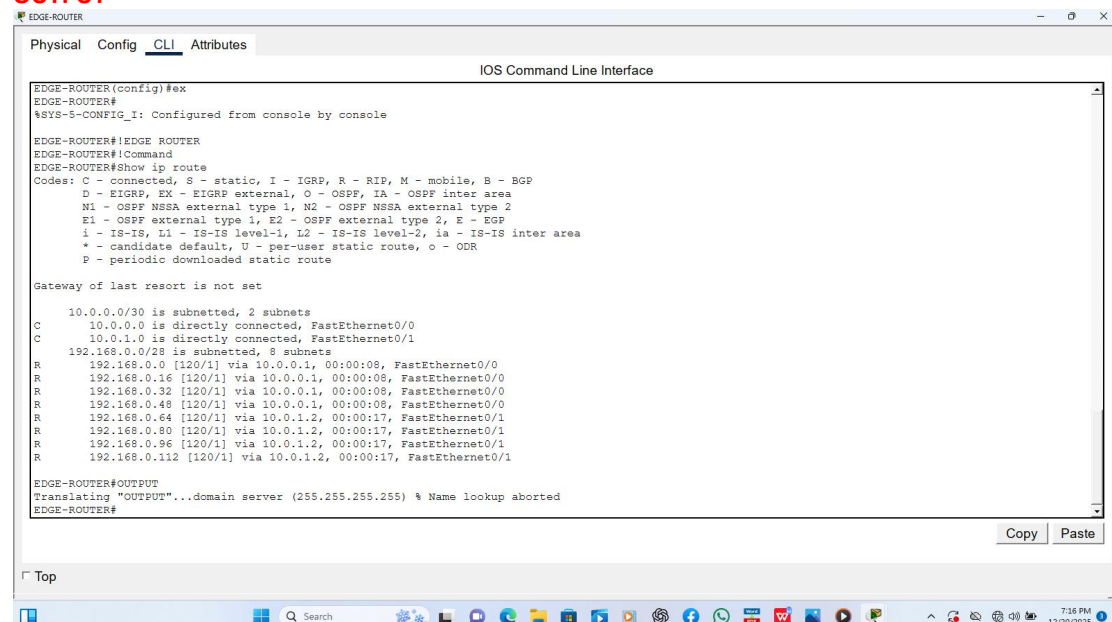
BUILDING-1-MAIN-ROUTER(config)#
```

EDGE ROUTER

Command

Show ip route

OUTPUT



```
EDGE-ROUTER
Physical Config CLI Attributes
IOS Command Line Interface

EDGE-ROUTER(config)#ex
EDGE-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console

EDGE-ROUTER#EDGE ROUTER
EDGE-ROUTER#Command
EDGE-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

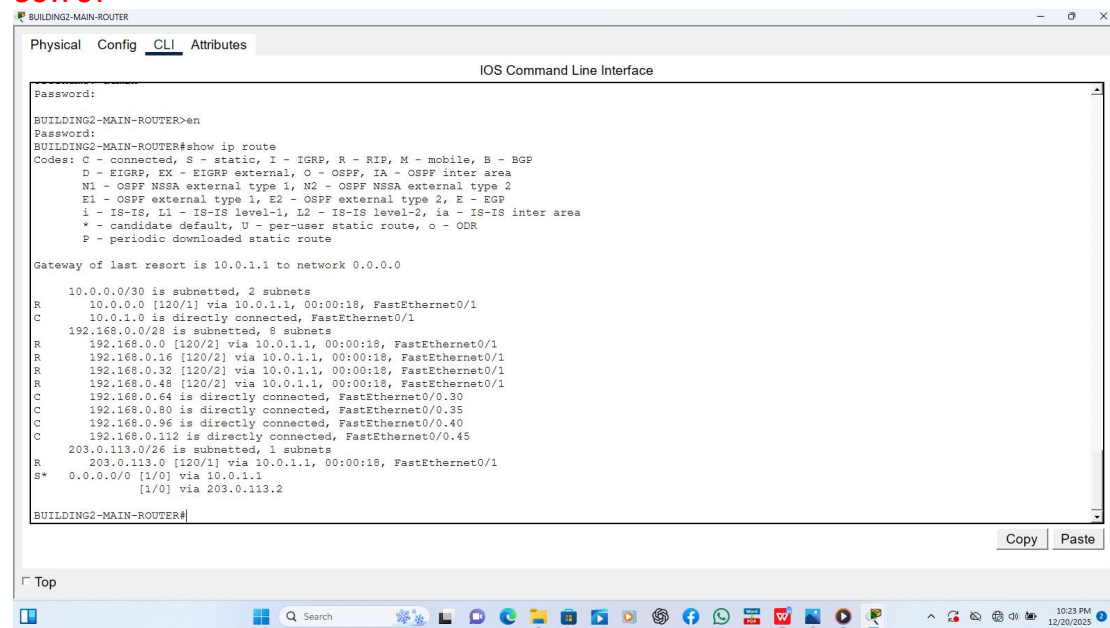
Gateway of last resort is not set

  10.0.0.0/30 is subnetted, 2 subnets
    C      10.0.0.0 is directly connected, FastEthernet0/0
    C      10.0.1.0 is directly connected, FastEthernet0/1
  192.168.0.0/28 is subnetted, 8 subnets
    R      192.168.0.0 [120/1] via 10.0.0.1, 00:00:08, FastEthernet0/0
    R      192.168.0.16 [120/1] via 10.0.0.1, 00:00:08, FastEthernet0/0
    R      192.168.0.32 [120/1] via 10.0.0.1, 00:00:08, FastEthernet0/0
    R      192.168.0.48 [120/1] via 10.0.0.1, 00:00:08, FastEthernet0/0
    R      192.168.0.64 [120/1] via 10.0.1.2, 00:00:17, FastEthernet0/1
    R      192.168.0.80 [120/1] via 10.0.1.2, 00:00:17, FastEthernet0/1
    R      192.168.0.96 [120/1] via 10.0.1.2, 00:00:17, FastEthernet0/1
    R      192.168.0.112 [120/1] via 10.0.1.2, 00:00:17, FastEthernet0/1

EDGE-ROUTER#OUTPUT
Translating "OUTPUT"...domain server (255.255.255.255) % Name lookup aborted
EDGE-ROUTER#
```

## Show ip route

### OUTPUT



```
Building2-MAIN-ROUTER
Physical Config CLI Attributes
IOS Command Line Interface

Password:
BUILDING2-MAIN-ROUTER>en
Password:
BUILDING2-MAIN-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

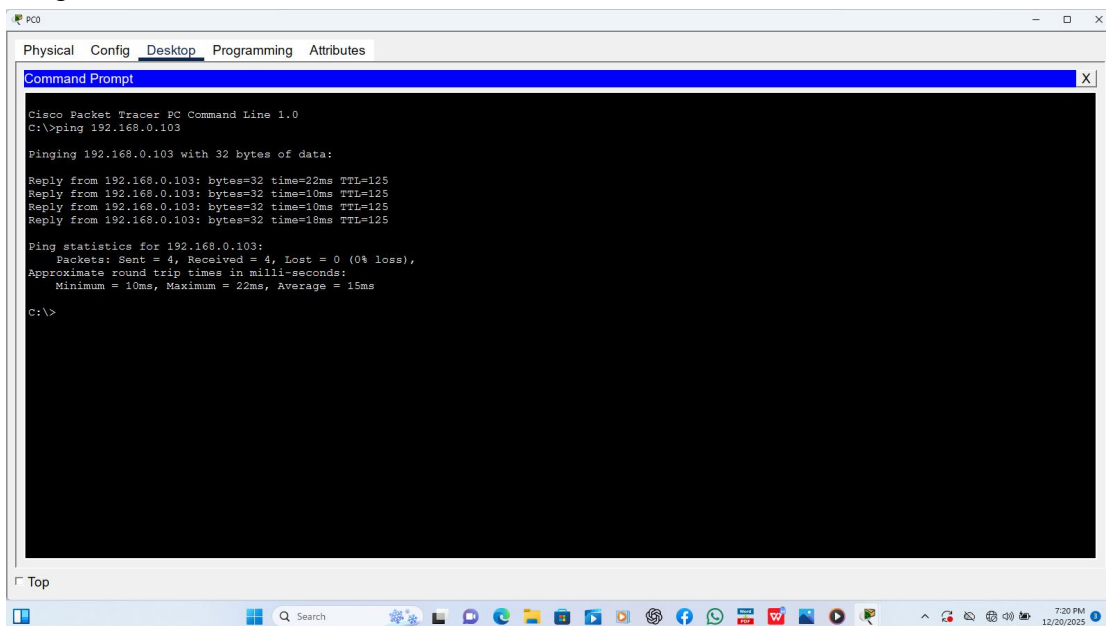
Gateway of last resort is 10.0.1.1 to network 0.0.0.0

R    10.0.0.0/30 is subnetted, 2 subnets
R      10.0.0.0 [120/1] via 10.0.1.1, 00:00:18, FastEthernet0/1
C      10.0.1.0 is directly connected, FastEthernet0/1
R    192.168.0.0/28 is subnetted, 8 subnets
R      192.168.0.0 [120/2] via 10.0.1.1, 00:00:18, FastEthernet0/1
R      192.168.0.16 [120/2] via 10.0.1.1, 00:00:18, FastEthernet0/1
R      192.168.0.32 [120/2] via 10.0.1.1, 00:00:18, FastEthernet0/1
R      192.168.0.48 [120/2] via 10.0.1.1, 00:00:18, FastEthernet0/1
C      192.168.0.64 is directly connected, FastEthernet0/0.30
C      192.168.0.80 is directly connected, FastEthernet0/0.35
C      192.168.0.96 is directly connected, FastEthernet0/0.40
C      192.168.0.112 is directly connected, FastEthernet0/0.45
R    203.0.113.0/26 is subnetted, 1 subnets
R      203.0.113.0 [120/1] via 10.0.1.1, 00:00:18, FastEthernet0/1
S*    0.0.0.0/0 [1/0] via 10.0.1.1
       [1/0] via 203.0.113.2

BUILDING2-MAIN-ROUTER#
```

Let us try to ping across from building one to building two

Ping 192.168.0.103



```
PC0
Physical Config Desktop Programming Attributes
Command Prompt

Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.103

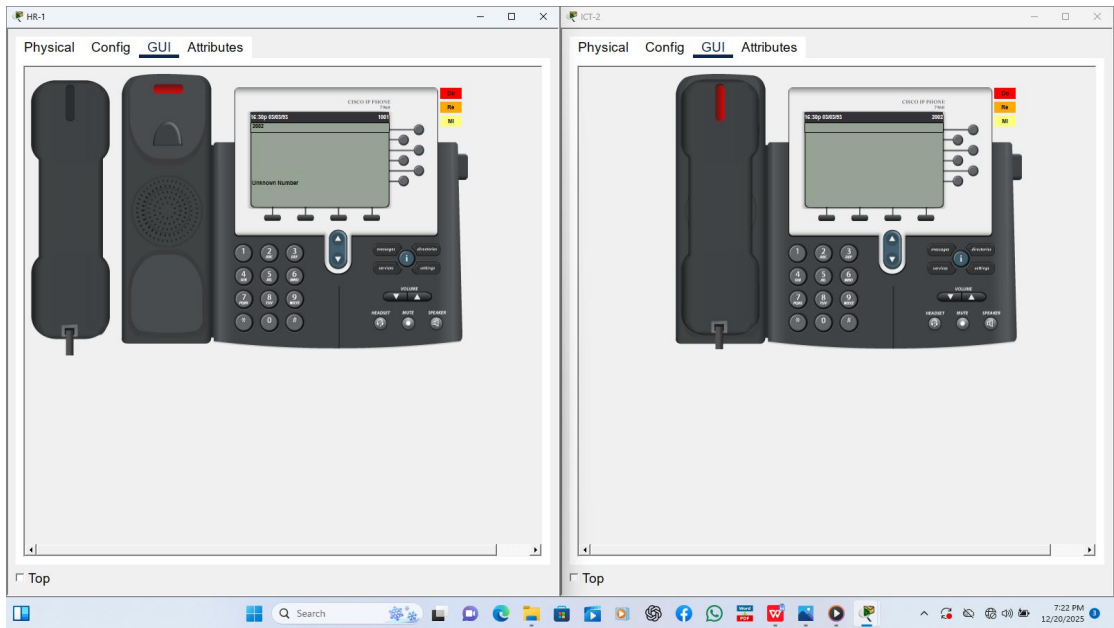
Pinging 192.168.0.103 with 32 bytes of data:

Reply from 192.168.0.103: bytes=32 time=22ms TTL=125
Reply from 192.168.0.103: bytes=32 time=10ms TTL=125
Reply from 192.168.0.103: bytes=32 time=10ms TTL=125
Reply from 192.168.0.103: bytes=32 time=18ms TTL=125

Ping statistics for 192.168.0.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 22ms, Average = 15ms

C:\>
```

For the data vlans we are good, how about voice vlans, let us try to call from either building one or two



Unknown number.

Why unknown number? We did configured the routing protocol and from the vlans output we can see the routing protocol is working but why with the voice vlan failing?

Well the case is different, we have to configure the dial-peer on the routers

!BUILDING ONE

Dial-peer voice 100 voip

Destination-pattern 2...

Session target ipv4:192.168.0.113

Do wr

!BUILDING TWO

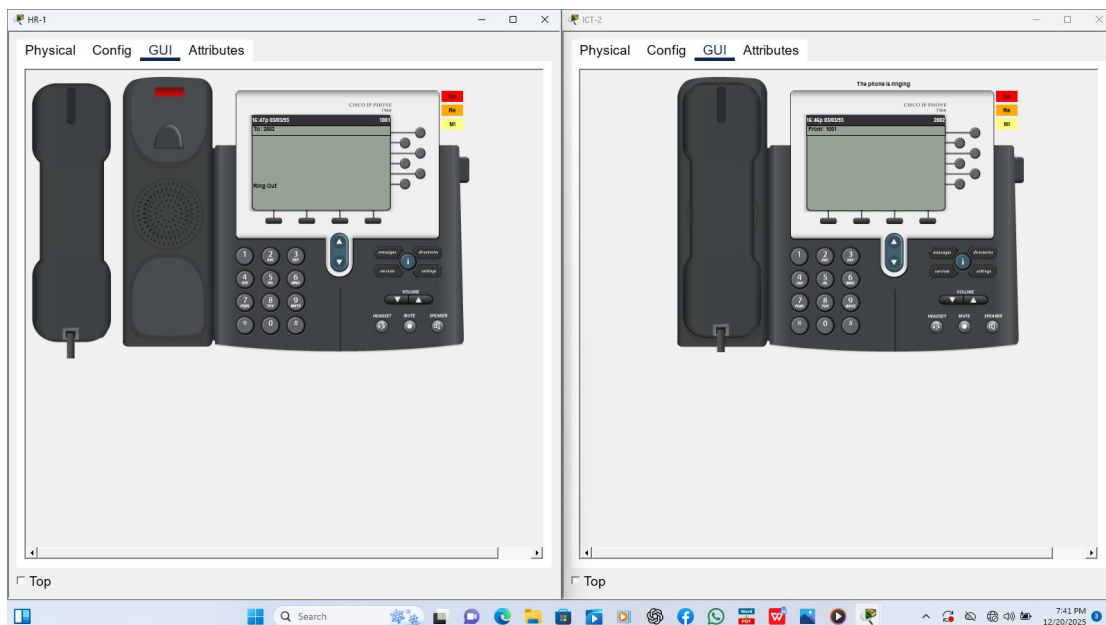
Dial-peer voice 200 voip

Destination-pattern 1...

Session target ipv4:192.168.0.17

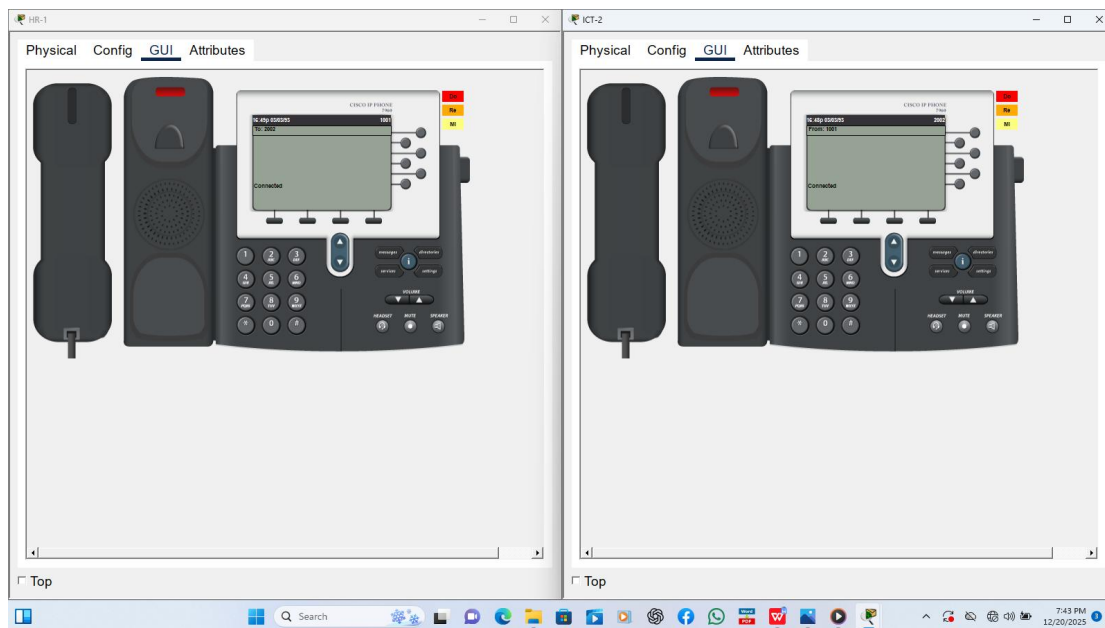
Do wr

Let us try again calling from HR-1 to ICT-2





It is now ringing, we can pick up the phone now



So far so good we are progressing well, the last thing now is to configure NAT (Network Address Translation)

Given that we have the edge router, it means that our NAT is going to be done there.

First we have to define our inside interfaces, we have interface fa0/0 going to building 1 and interface fa0/1 going to building 2

Let us get started

## NAT CONFIGURATION

EDGE ROUTER

Int fa0/0

Ip nat inside

Ex

Int fa0/1

Ip nat inside

Int se0/3/0

Ip nat outside

!We have defined our inside interfaces and outside interface

!Next we create access lists to tell the edge router which network to permit and translate

Access-list 1 permit 192.168.0.0 0.0.0.15

Access-list 1 permit 192.168.0.16 0.0.0.15

Access-list 1 permit 192.168.0.32 0.0.0.15

Access-list 1 permit 192.168.0.48 0.0.0.15

Access-list 1 permit 192.168.0.64 0.0.0.15

Access-list 1 permit 192.168.0.80 0.0.0.15

Access-list 1 permit 192.168.0.96 0.0.0.15

Access-list 1 permit 192.168.0.112 0.0.0.15

!We now link our inside nat to our access list

Ip nat inside source list 1 interface se0/3/0 overload

!next is to configure ip route for unknown addresses

Ip route 0.0.0.0 0.0.0.0 203.0.113.1

Do wr

Let us ping the internet router and see if our nat is working

From building 1 pc

Ping 203.0.113.2

## OUTPUT

```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>
C:\>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=1ms TTL=255
Reply from 10.0.0.1: bytes=32 time<1ms TTL=255
Reply from 10.0.0.1: bytes=32 time=1ms TTL=255
Reply from 10.0.0.1: bytes=32 time=1ms TTL=255

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 3ms

C:\>
C:\>Ping 203.0.113.2

Pinging 203.0.113.2 with 32 bytes of data:

Reply from 203.0.113.2: bytes=32 time=1ms TTL=254
Reply from 203.0.113.2: bytes=32 time=17ms TTL=254
Reply from 203.0.113.2: bytes=32 time=18ms TTL=254
Reply from 203.0.113.2: bytes=32 time=15ms TTL=254

Ping statistics for 203.0.113.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 18ms, Average = 12ms

C:\>|
```

We can aswell ping the gateway of external server

Ping 203.0.113.65

## OUTPUT

```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 3ms

C:\>
C:\>Ping 203.0.113.2

Pinging 203.0.113.2 with 32 bytes of data:

Reply from 203.0.113.2: bytes=32 time=1ms TTL=254
Reply from 203.0.113.2: bytes=32 time=17ms TTL=254
Reply from 203.0.113.2: bytes=32 time=18ms TTL=254
Reply from 203.0.113.2: bytes=32 time=15ms TTL=254

Ping statistics for 203.0.113.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 18ms, Average = 12ms

C:\>Ping 203.0.113.65

Pinging 203.0.113.65 with 32 bytes of data:

Request timed out.
Reply from 203.0.113.65: bytes=32 time=25ms TTL=253
Reply from 203.0.113.65: bytes=32 time=18ms TTL=253
Reply from 203.0.113.65: bytes=32 time=10ms TTL=253

Ping statistics for 203.0.113.65:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 25ms, Average = 17ms

C:\>
```

Ping 203.0.113.70

## OUTPUT

```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 203.0.113.2: bytes=32 time=18ms TTL=254

Ping statistics for 203.0.113.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 18ms, Average = 12ms

C:\>Ping 203.0.113.65

Pinging 203.0.113.65 with 32 bytes of data:

Request timed out.
Reply from 203.0.113.65: bytes=32 time=25ms TTL=253
Reply from 203.0.113.65: bytes=32 time=18ms TTL=253
Reply from 203.0.113.65: bytes=32 time=10ms TTL=253

Ping statistics for 203.0.113.65:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 25ms, Average = 17ms

C:\>Ping 203.0.113.70

Pinging 203.0.113.70 with 32 bytes of data:

Reply from 203.0.113.70: bytes=32 time=11ms TTL=125
Reply from 203.0.113.70: bytes=32 time=16ms TTL=125
Reply from 203.0.113.70: bytes=32 time=12ms TTL=125
Reply from 203.0.113.70: bytes=32 time=11ms TTL=125

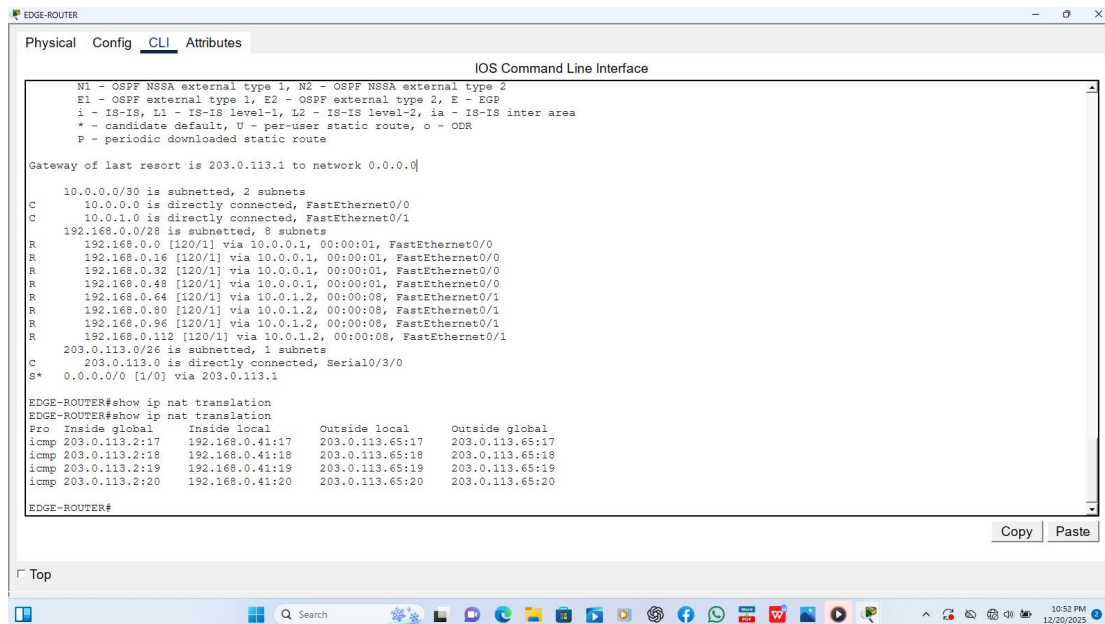
Ping statistics for 203.0.113.70:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 16ms, Average = 12ms

C:\>
```

Now from any building let us ping 203.0.113.65

After that we can issue the show ip nat translation command to verify our NAT configurations.

### OUTPUT



```
EDGE-ROUTER
Physical Config CLI Attributes
IOS Command Line Interface

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 203.0.113.1 to network 0.0.0.0

10.0.0.0/30 is subnetted, 2 subnets
C 10.0.0.0 is directly connected, FastEthernet0/0
C 10.0.1.0 is directly connected, FastEthernet0/1
192.168.0.0/28 is subnetted, 8 subnets
R 192.168.0.0 [120/1] via 10.0.0.1, 00:00:01, FastEthernet0/0
R 192.168.0.16 [120/1] via 10.0.0.1, 00:00:01, FastEthernet0/0
R 192.168.0.32 [120/1] via 10.0.0.1, 00:00:01, FastEthernet0/0
R 192.168.0.48 [120/1] via 10.0.0.1, 00:00:01, FastEthernet0/0
R 192.168.0.64 [120/1] via 10.0.1.2, 00:00:08, FastEthernet0/1
R 192.168.0.80 [120/1] via 10.0.1.2, 00:00:08, FastEthernet0/1
R 192.168.0.96 [120/1] via 10.0.1.2, 00:00:08, FastEthernet0/1
R 192.168.0.112 [120/1] via 10.0.1.2, 00:00:08, FastEthernet0/1
203.0.113.0/26 is subnetted, 1 subnets
C 203.0.113.0 is directly connected, Serial0/3/0
S* 0.0.0.0/0 [1/0] via 203.0.113.1

EDGE-ROUTER#show ip nat translation
EDGE-ROUTER#show ip nat translation
Pro Inside global Inside local Outside local Outside global
icmp 203.0.113.2:17 192.168.0.41:17 203.0.113.65:17 203.0.113.65:17
icmp 203.0.113.2:18 192.168.0.41:18 203.0.113.65:18 203.0.113.65:18
icmp 203.0.113.2:19 192.168.0.41:19 203.0.113.65:19 203.0.113.65:19
icmp 203.0.113.2:20 192.168.0.41:20 203.0.113.65:20 203.0.113.65:20

EDGE-ROUTER#
```

There is our nat output, there are some terms in the output we can see inside global, inside local, outside local and outside global

**INSIDE GLOBAL: The nat'd address as it appears from the outside**

**INSIDE LOCAL: The actual address of the inside host**

**OUTSIDE LOCAL: The address of the external device as seen by the inside host**

**OUTSIDE GLOBAL: The actual address of the external device**

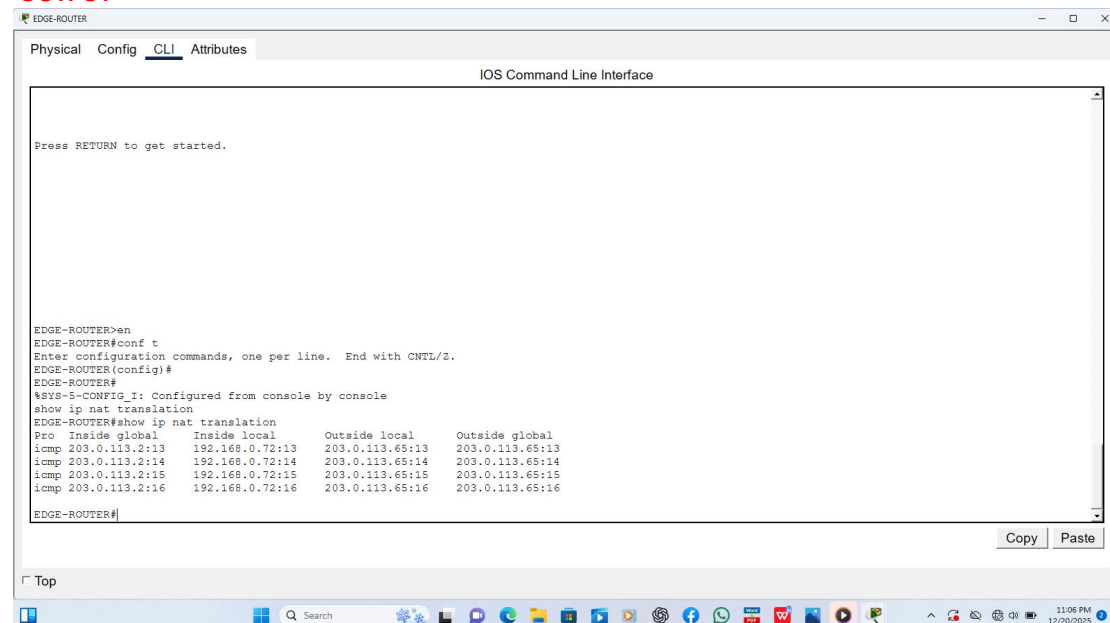
The above output shown is from building 1 let us try building 2

Ping 203.0.113.65

After the ping let us check our nat again

On the edge router "show ip nat translation"

### OUTPUT



```
EDGE-ROUTER
Physical Config CLI Attributes
IOS Command Line Interface

Press RETURN to get started.

EDGE-ROUTER>en
EDGE-ROUTER#conf t
Enter configuration commands, one per line. End with CNTL/Z.
EDGE-ROUTER(config)#
EDGE-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
EDGE-ROUTER#show ip nat translation
EDGE-ROUTER#show ip nat translation
Pro Inside global Inside local Outside local Outside global
icmp 203.0.113.2:13 192.168.0.72:13 203.0.113.65:13 203.0.113.65:13
icmp 203.0.113.2:14 192.168.0.72:14 203.0.113.65:14 203.0.113.65:14
icmp 203.0.113.2:15 192.168.0.72:15 203.0.113.65:15 203.0.113.65:15
icmp 203.0.113.2:16 192.168.0.72:16 203.0.113.65:16 203.0.113.65:16

EDGE-ROUTER#
```

It is working perfect as well.

This marks the end of this project

The goal/achievements are;

- Inter vlan routing
- DHCP configured
- Dynamic routing-RIP
- Telephony-service configured
- Dial-peer for voice communication between buildings
- Default routes on all the routers
- Network Address Translation (NAT)