IP PHONES CONFIGURATIONS

ACTIVITY

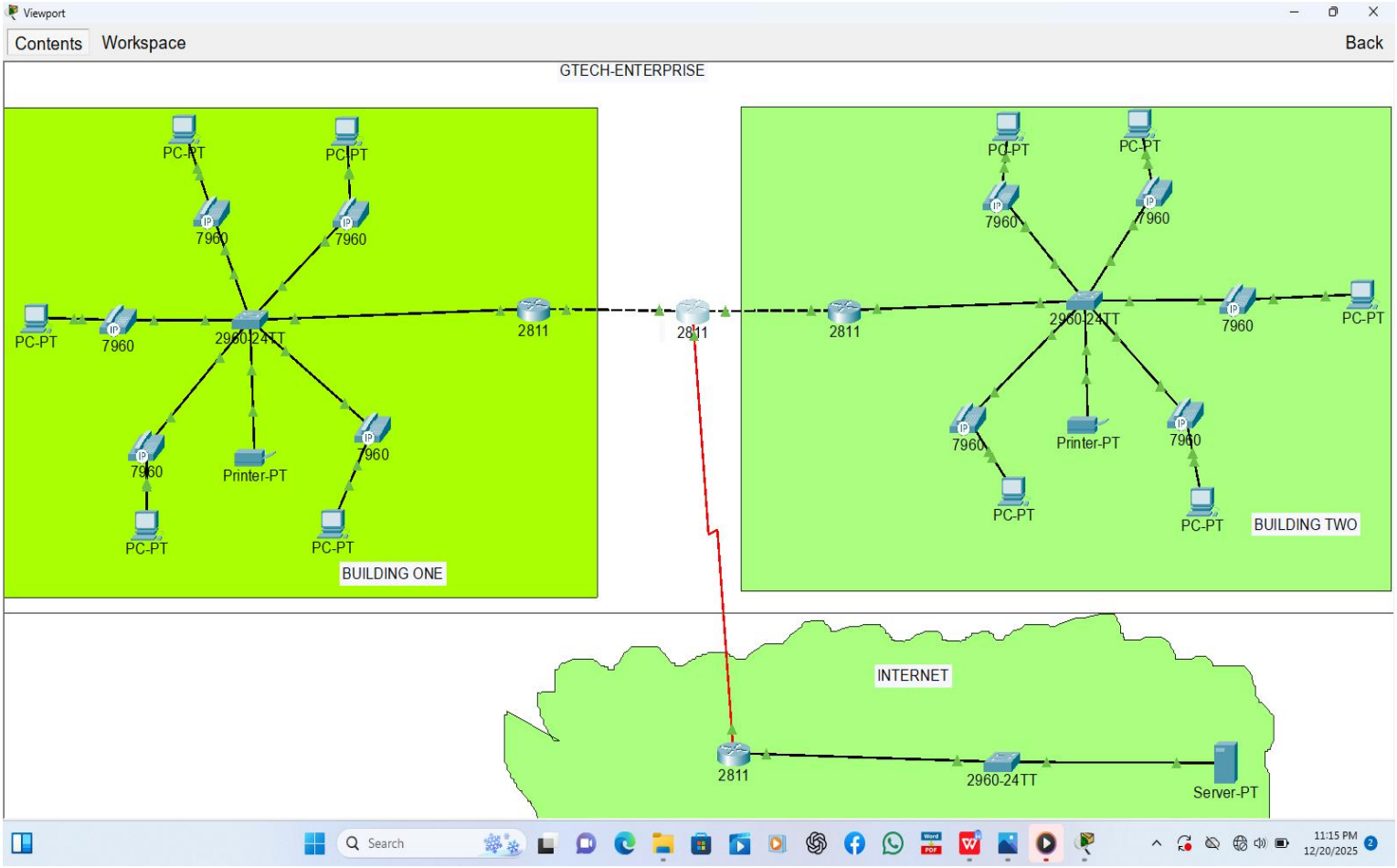
You are the network engineer for Gtech enterprise, they just brought you some ip phones , they are moving away from analog,they have two buildings building one has two departments Sales and Human Resource and building two has Finance and ICT, they doesn't have enough layer 2 switches they only have two 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).

SOLUTION

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

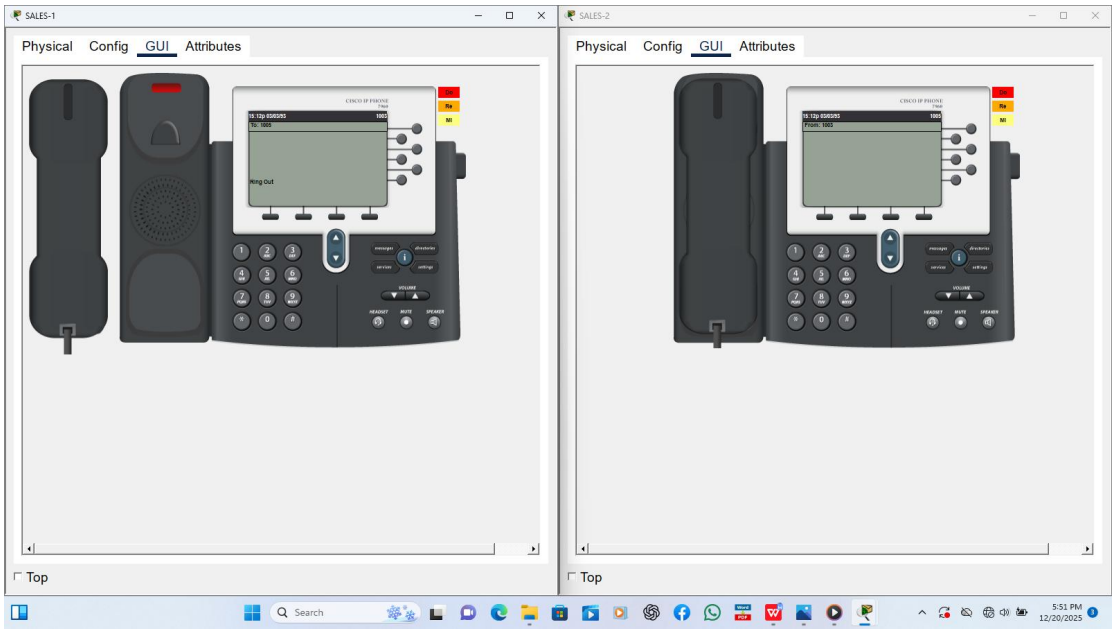
Ip dhcp excluded-address 192.168.0.17 192.168.0.22
Ip dhcp pool VLAN15
Network 192.168.0.16 255.255.255.240
Default-router 192.168.0.17
Option 150 ip 192.168.0.17
Ex
Ip dhcp excluded-address 192.168.0.49 192.168.0.54
Ip dhcp pool VLAN25
Network 192.168.0.48 255.255.255.240
Default-router 192.168.0.49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

!TELEPHONY-SERVICE

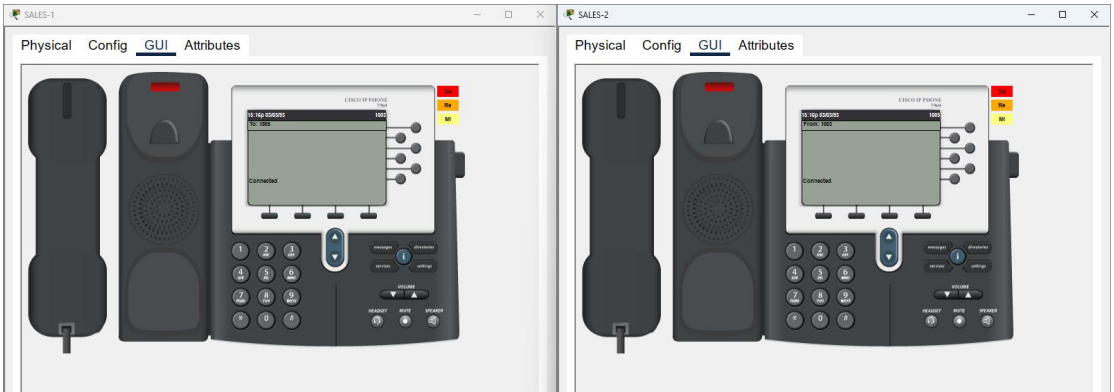
Telephony-service
Max-dn 5
Max-ephones 5
Auto assign 1 to 5
Ip source-address 192.168.0.17 port 2000
Ex
Do wr
Ephone-dn 1

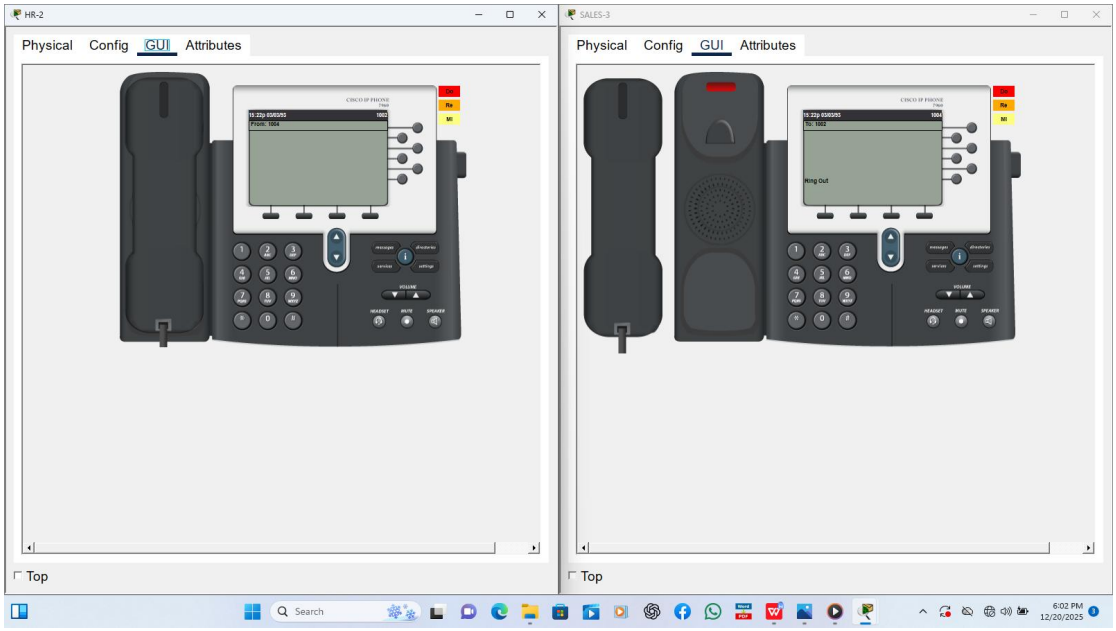
Number 1001
Ephone-dn 2
Number 1002
Ephone-dn 3
Number 1003
Ephone-dn 4
Number 1004
Ephone-dn 5
Number 1005
Ex
Ephone 1
Type 7960
Button 1:1
Ephone 2
Type 7960
Button 1:2
Ephone 3
Type 7960
Button 1:3
Ephone 4
Type 7960
Button 1:4
Ephone 5
Type 7960
Button 1:5
Do wr
Before we go to building two let us try the calls between our phones, we will just do one

Call from SALES-1 TO SALES 2

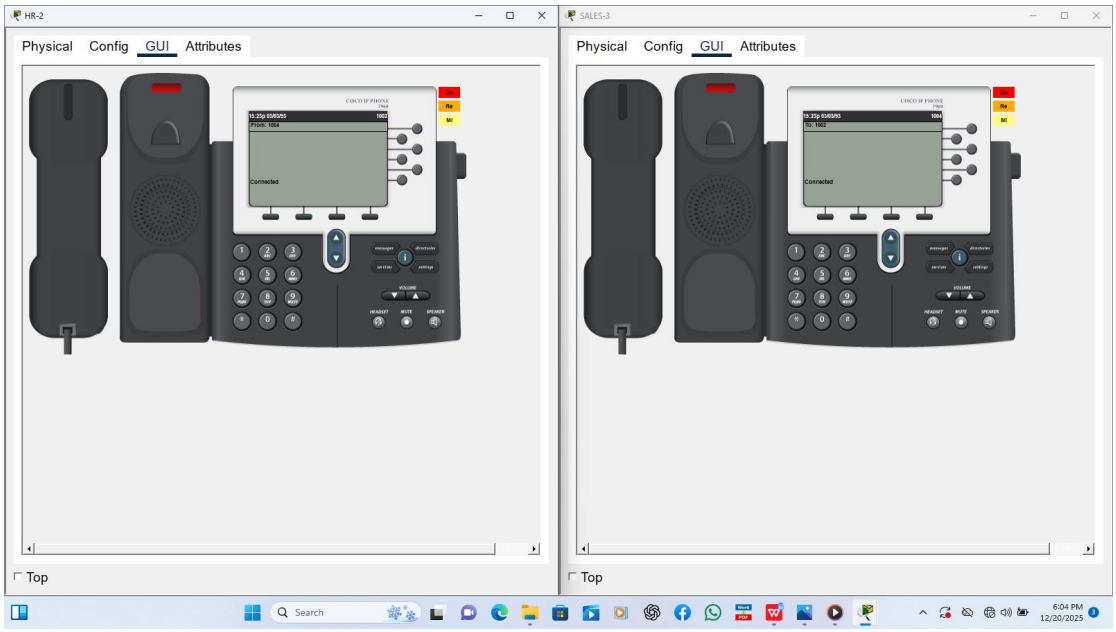


From the above picture we can see the phone ringing
Now let SALES-2 answer



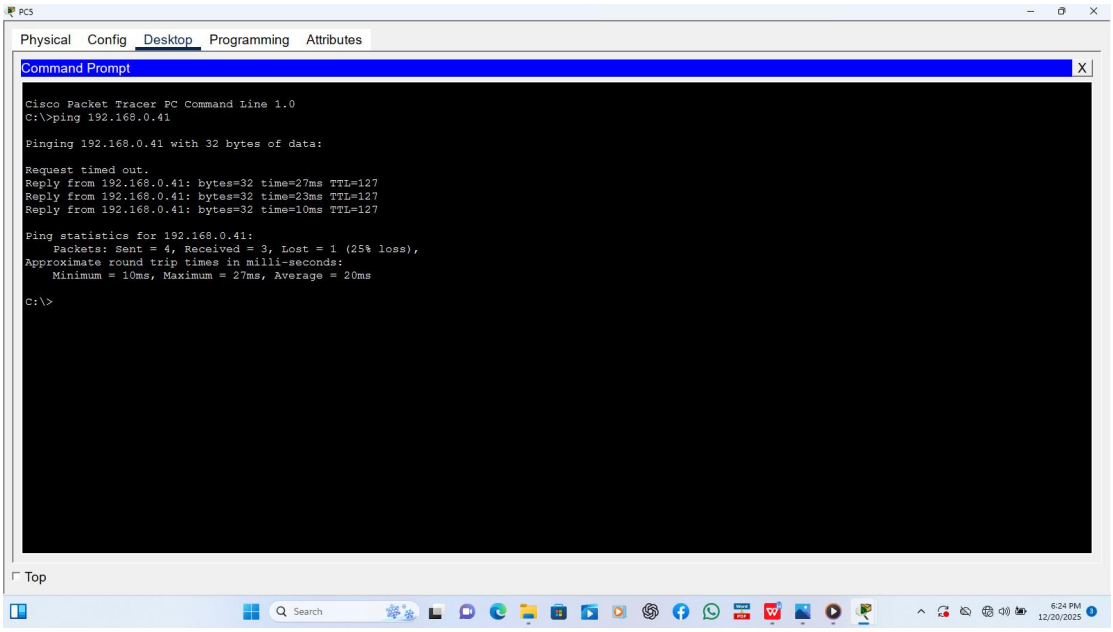


HR can answer the call



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

OUTPUT



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

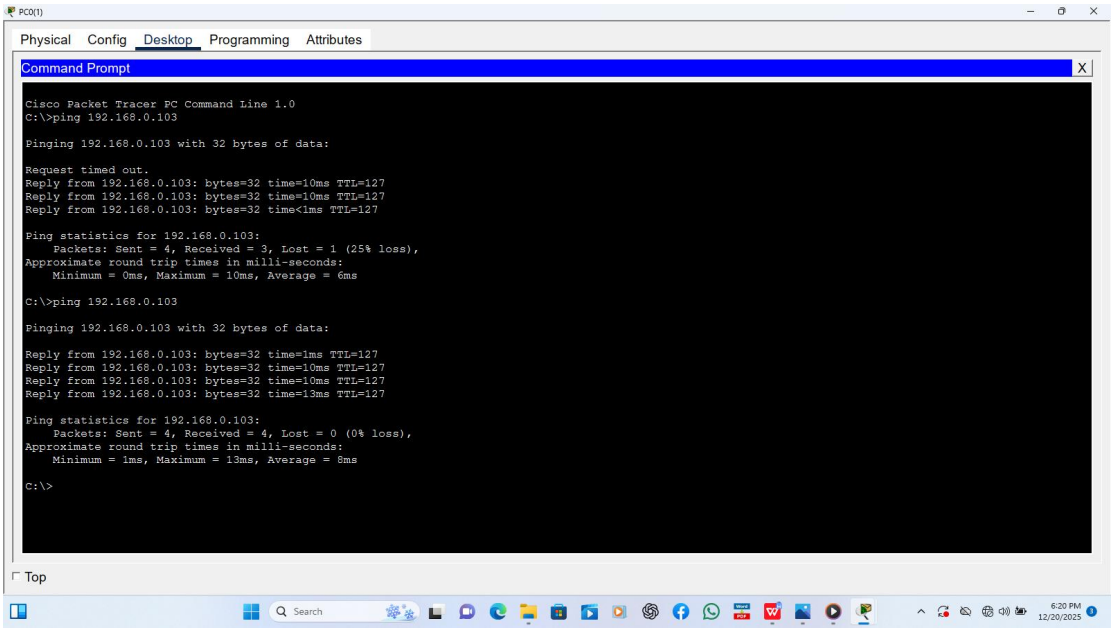
!DATA

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

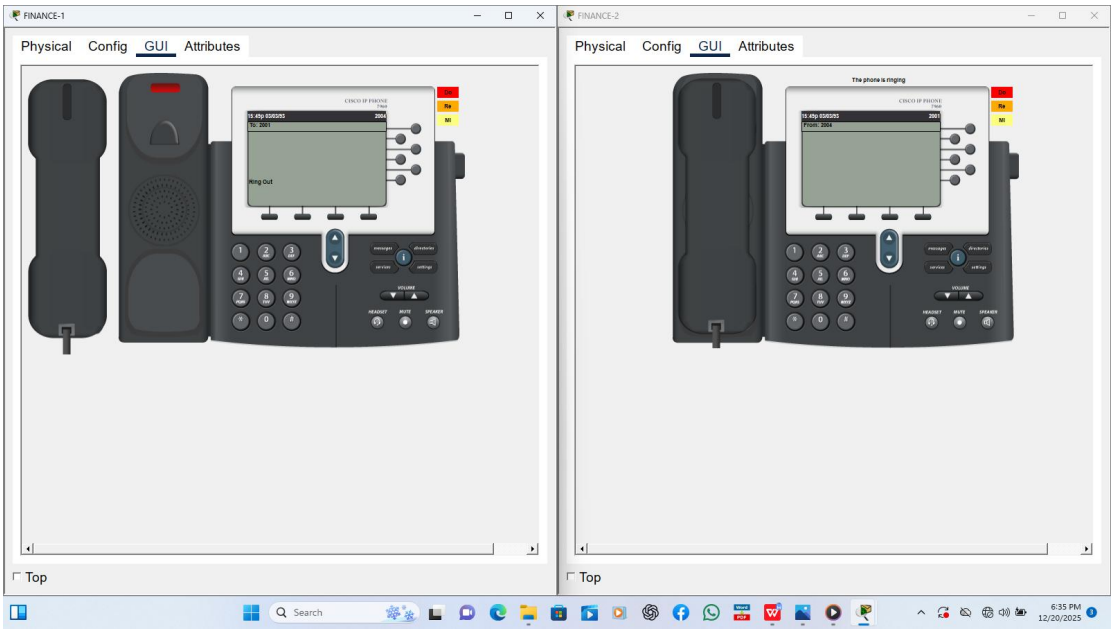


Let us configure telephony-service

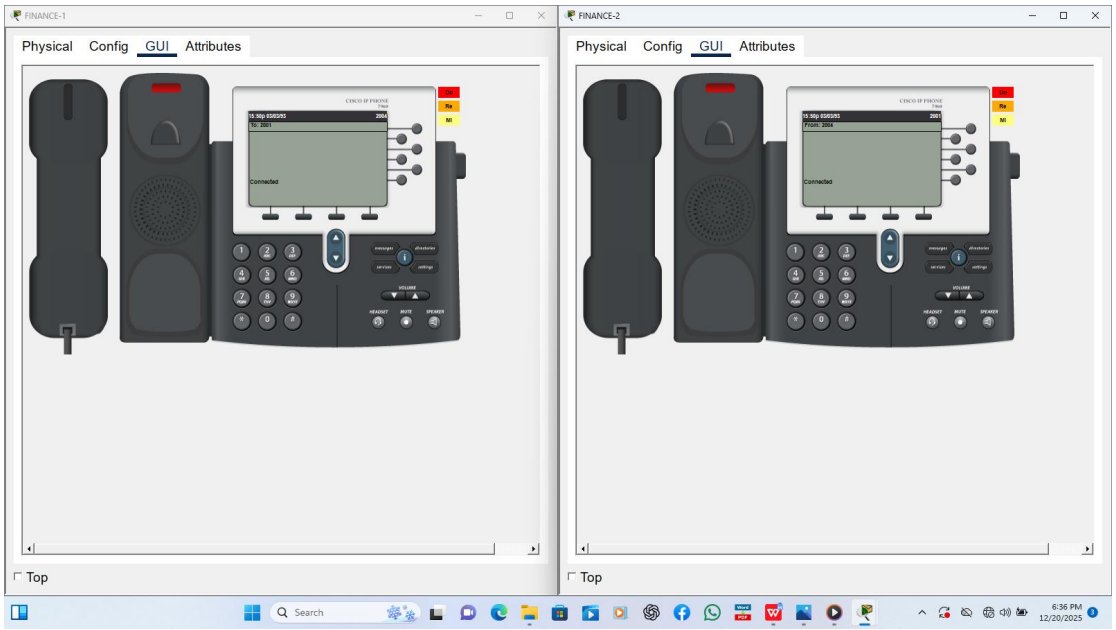
!TELEPHONY-SERVICE
Telephony-service
Max-dn 5
Max-ephones 5
Auto assign 1 to 5
Ip source-address 192.168.0.113 port 2000
Ex
Do wr
Ephone-dn 1
Number 2001
Ephone-dn 2
Number 2002
Ephone-dn 3
Number 2003
Ephone-dn 4
Number 2004
Ephone-dn 5
Number 2005
Ex
Ephone 1
Type 7960
Button 1:1
Ephone 2
Type 7960
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

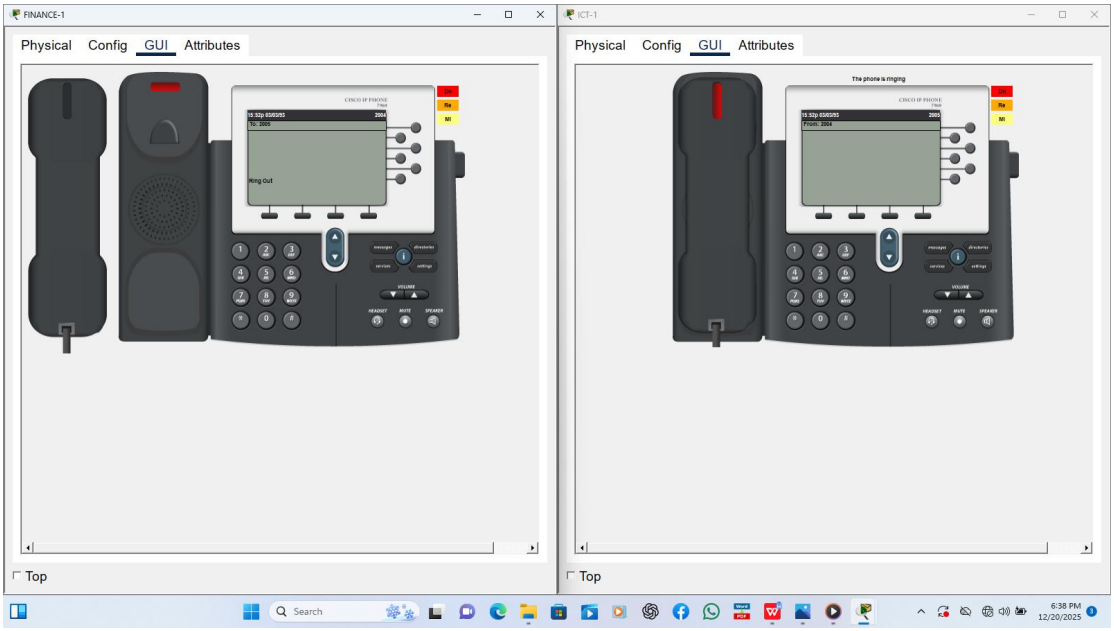


Let us answer,

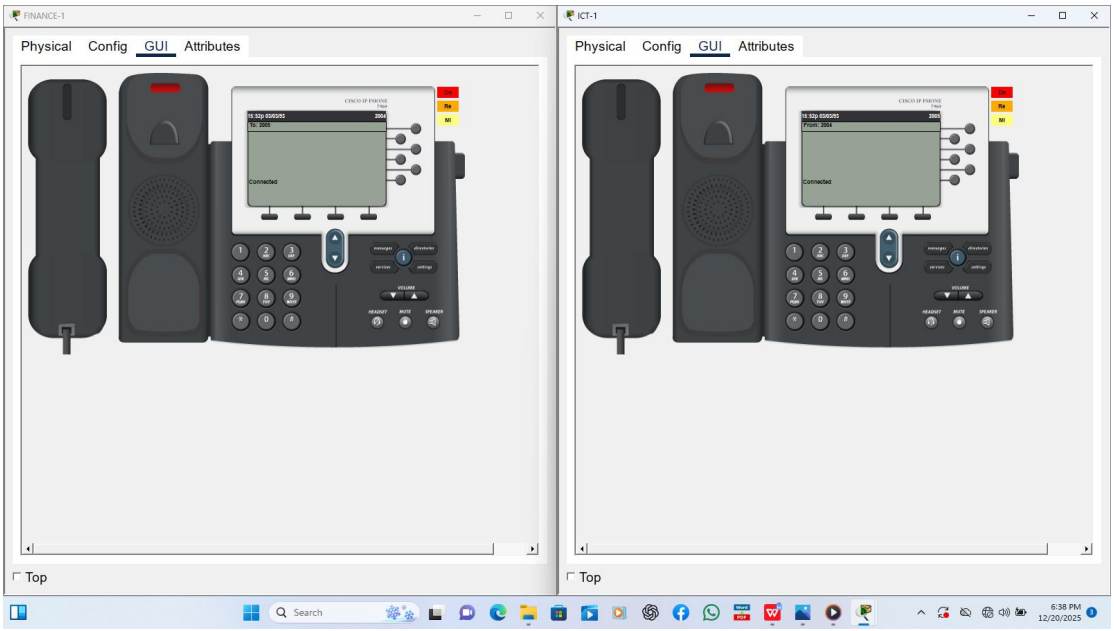


It is working.

Let us do between vlans,thus from FINANCE to ICT

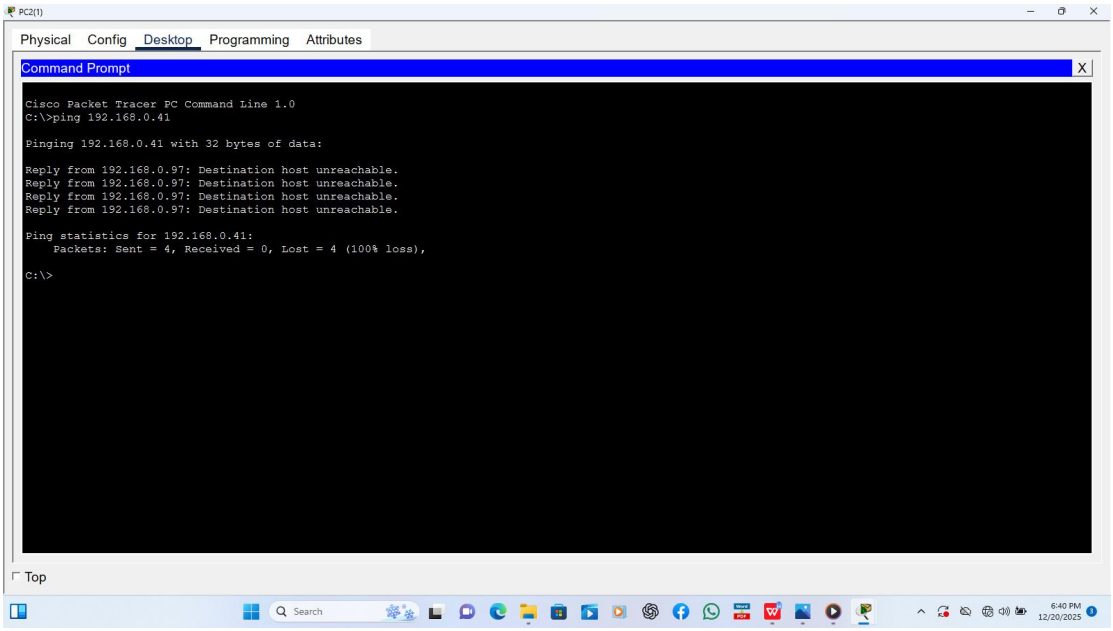


We can pick



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 known 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 ensure 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

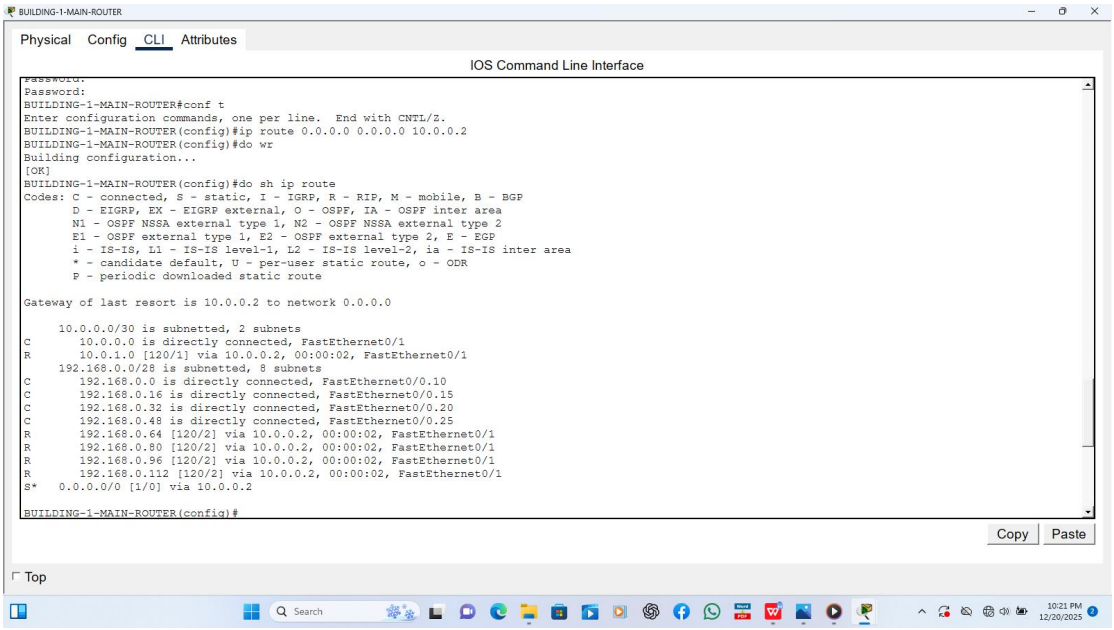
!BUILDING-1-MAIN-ROUTER
Ip route 0.0.0.0 0.0.0.0 10.0.0.1
Router rip
Version 2
No auto-summary
Network 192.168.0.0
Network 192.168.0.16
Network 192.168.0.32
Network 192.168.0.48
Network 10.0.0.0
Do wr
Ex
!EDGE ROUTER
Router rip
Version 2
No auto-summary
Network 10.0.1.0
Network 10.0.0.0
Network 203.0.113.0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

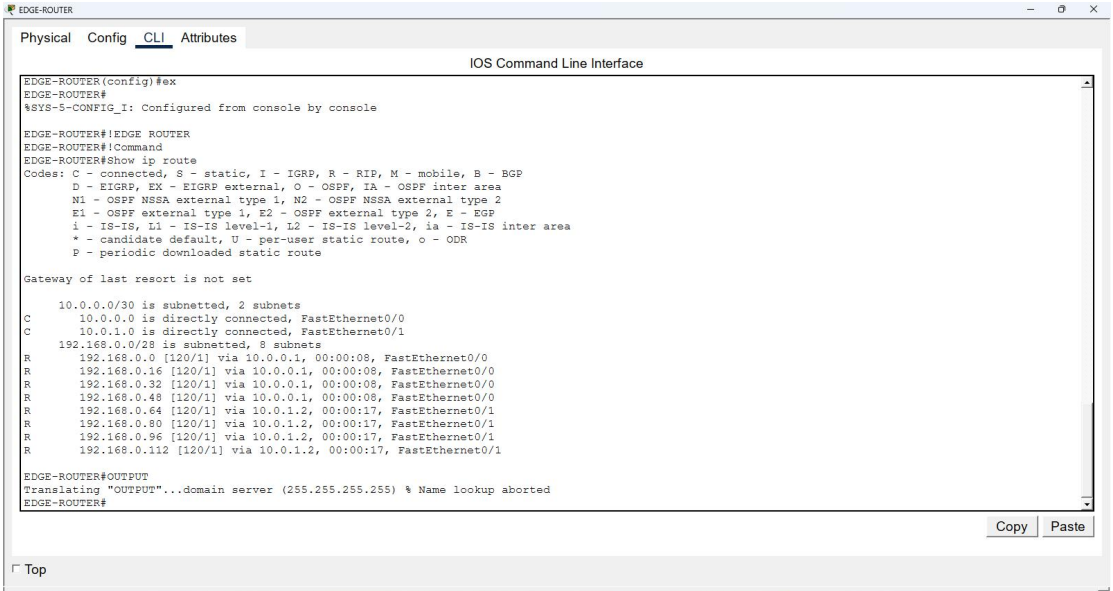
We are done, now let us try to verify the configuration to see if the routers do know how reach each other.
I added a static route on building 1 router and building two router this is going to be used as gateway of last resort
BUILDING 1
Command
Show ip route

OUTPUT

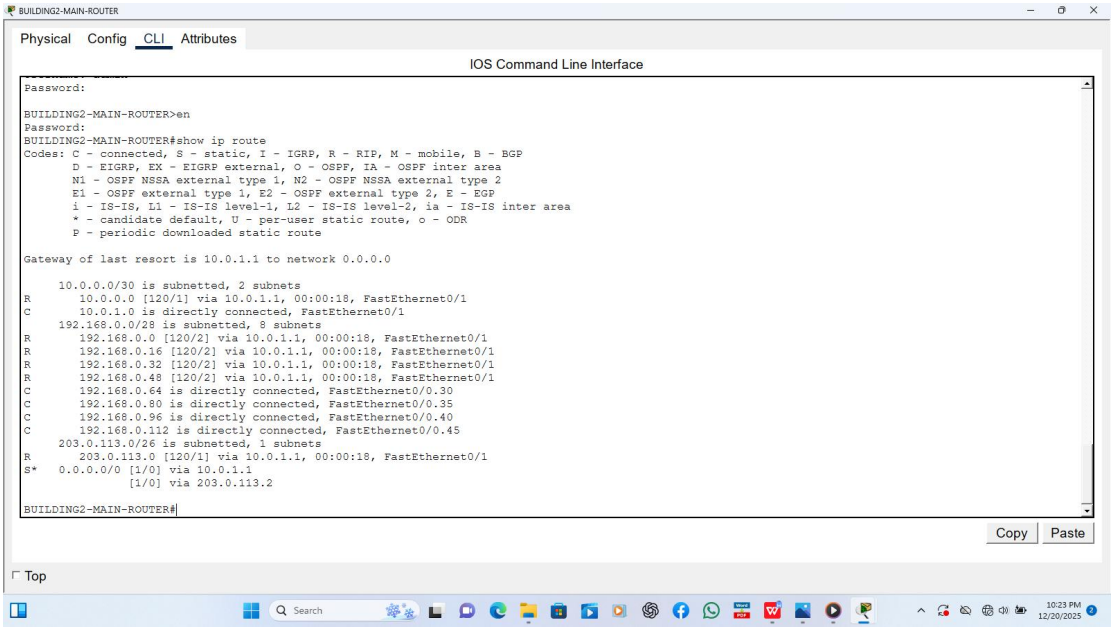


!EDGE ROUTER
!Command
Show ip route

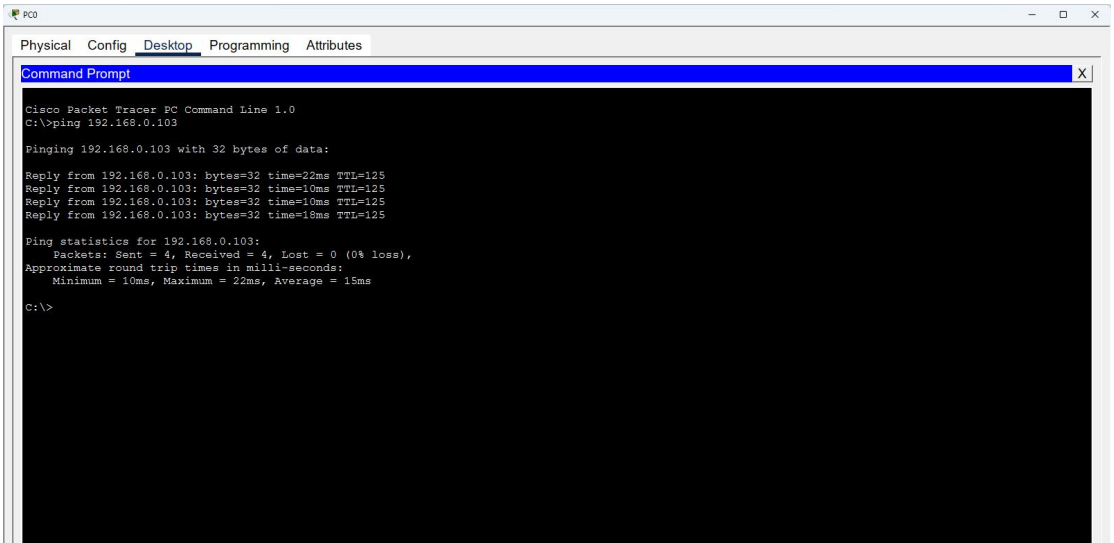
OUTPUT



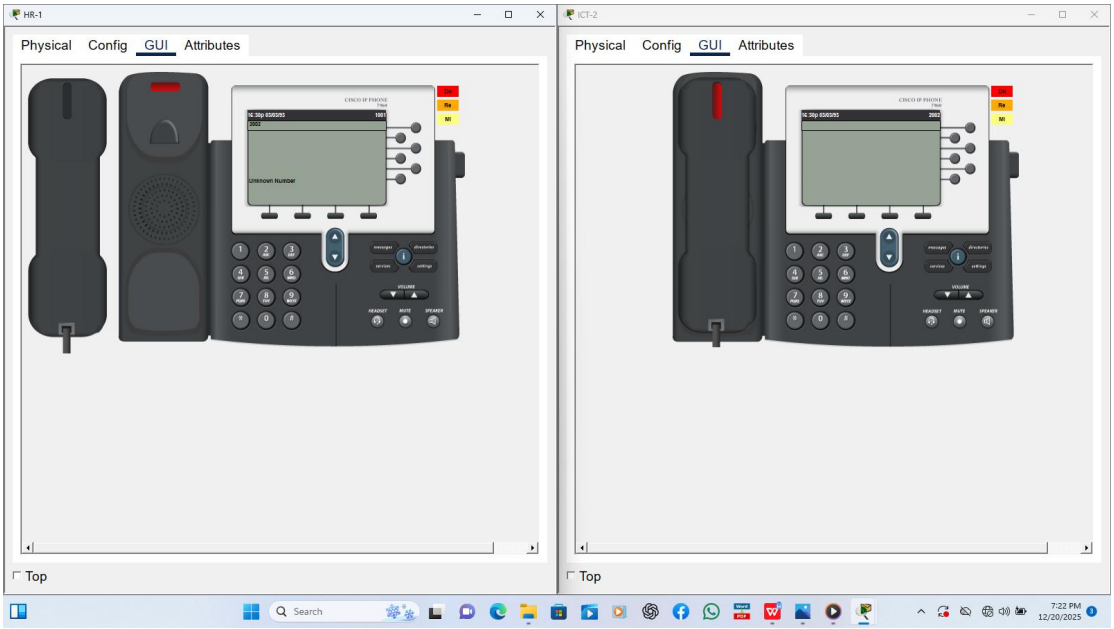
BUILDING 2
Command
Show ip route
OUTPUT



Let us try to ping across from building one to building two
Ping 192.168.0.103
OUTPUT

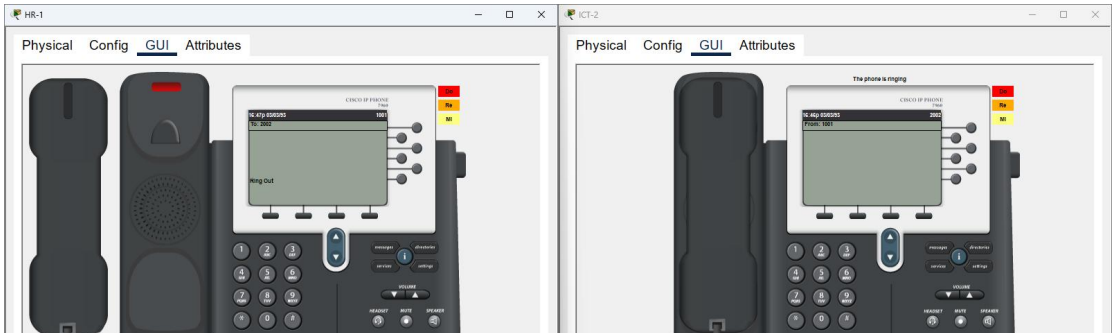


For the data vlans we are good, how about voice vlans, let us try to call from either building one or two

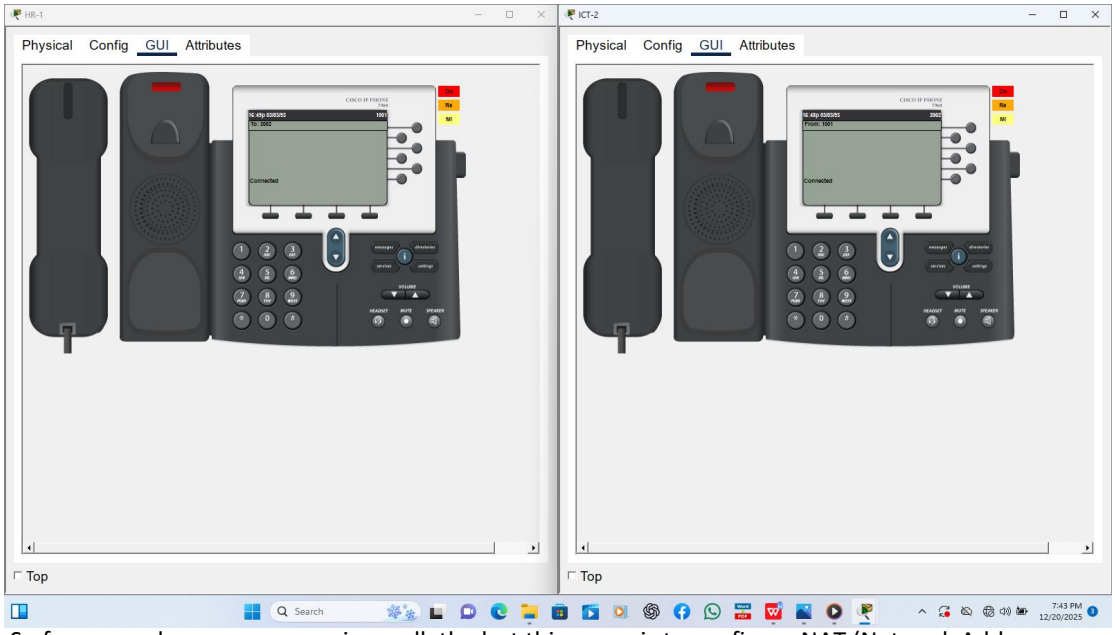


Unknown number.
Why unknown number? We did configured the routing protocol and from the vlans output we can see the routing protocol is working but why with the voice vlan failing?
Well the case is different, we have to configure the dial-peer on the routers
!BUILDING ONE
Dial-peer voice 100 voip
Destination-pattern 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 insideex

Int se0/3/0

Ip nat outside

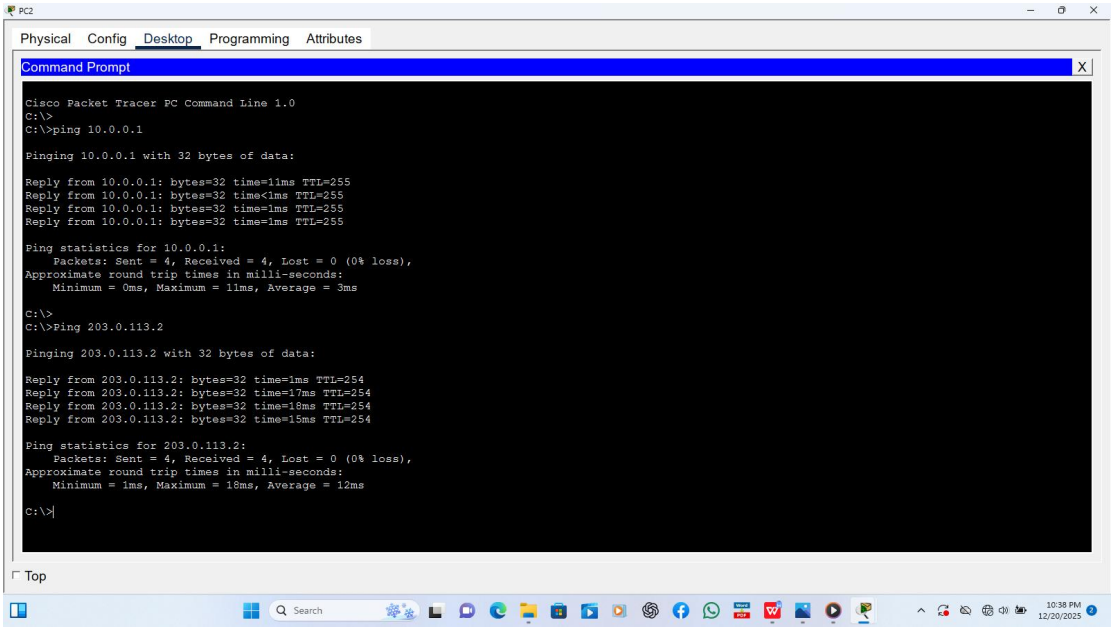
!We have defined our inside interfaces and outside interface

!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

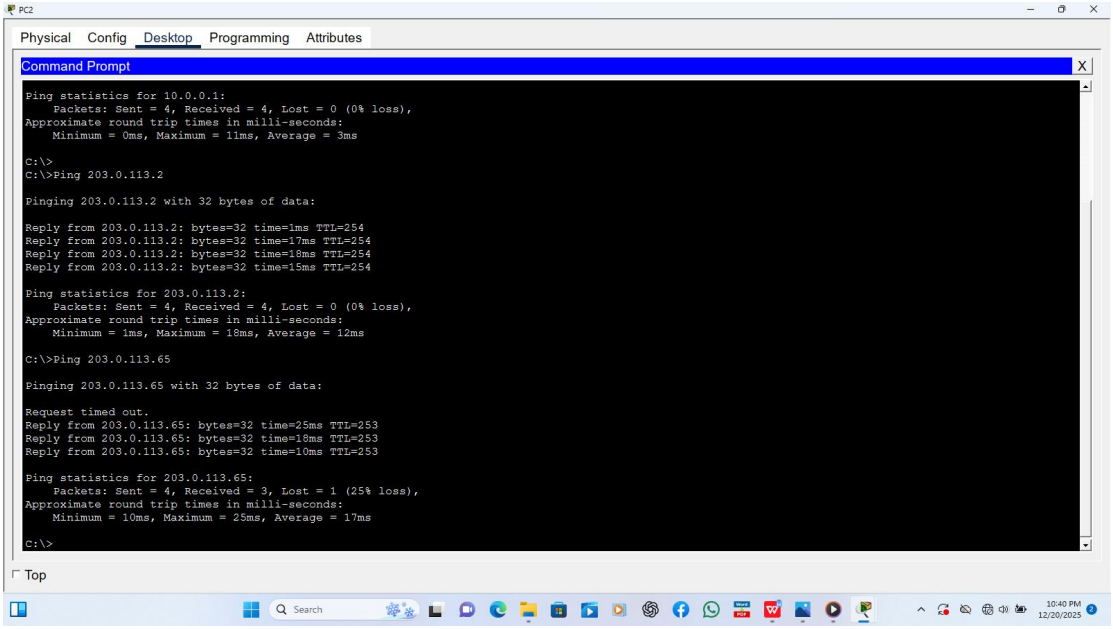
Access-list 1 permit 192.168.0.16 0.0.0.15
Access-list 1 permit 192.168.0.32 0.0.0.15
Access-list 1 permit 192.168.0.48 0.0.0.15
Access-list 1 permit 192.168.0.64 0.0.0.15
Access-list 1 permit 192.168.0.80 0.0.0.15
Access-list 1 permit 192.168.0.96 0.0.0.15
Access-list 1 permit 192.168.0.112 0.0.0.15
!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



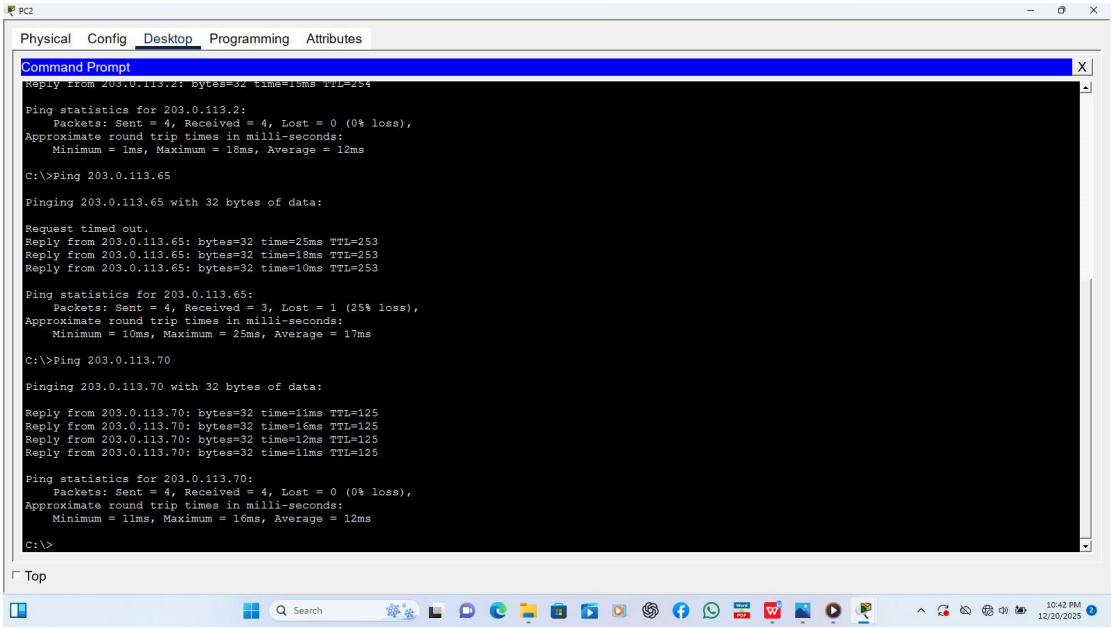
We can aswell ping the gateway of external server
Ping 203.0.113.65

OUTPUT



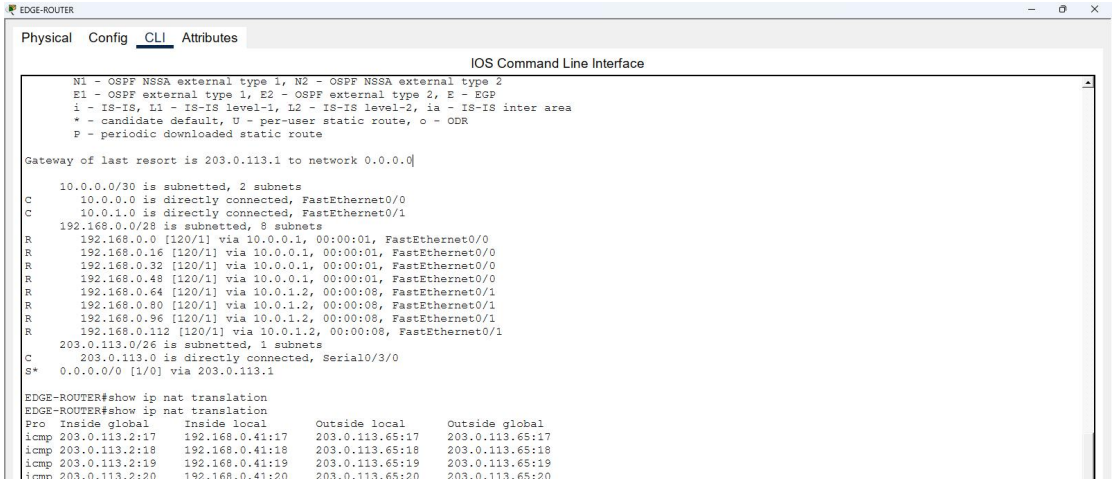
Let us try to reach the external server whose address is 203.0.113.70
Ping 203.0.113.70

OUTPUT



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



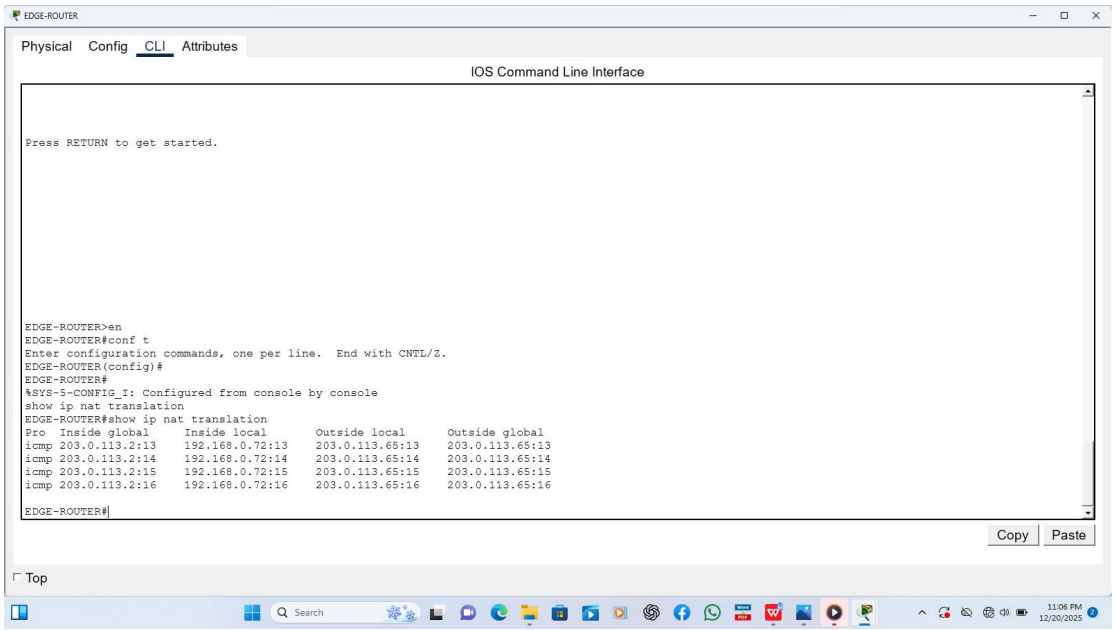
There is our nat output, there are some terms in the output we can see inside global, inside local, outside local and outside global

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



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)**