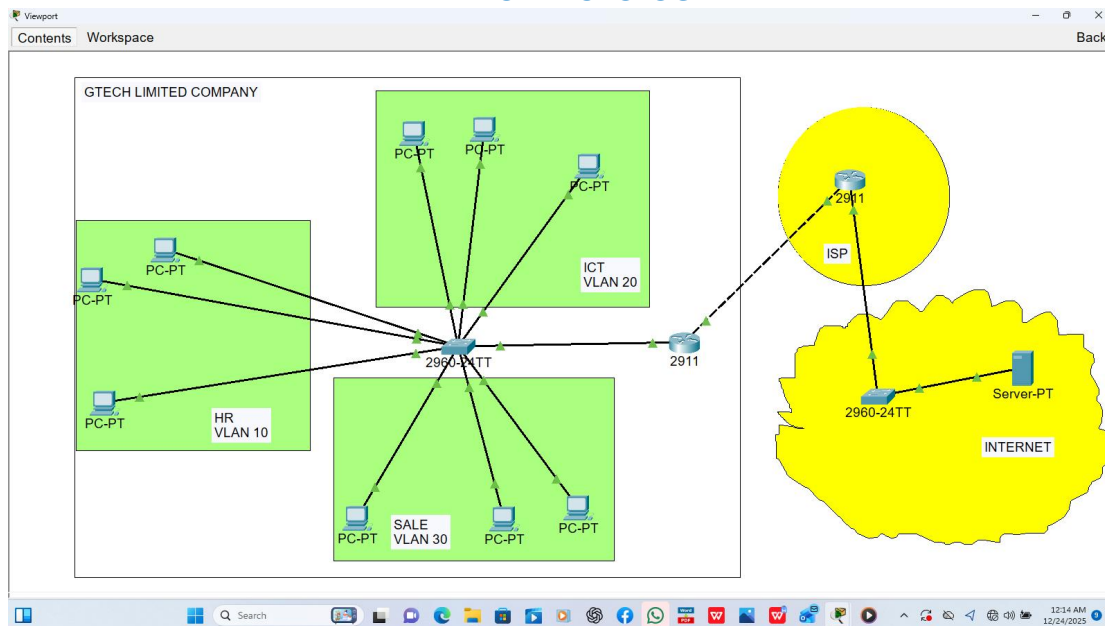


SMALL NETWORK DESIGN

Gtech institute is the small company recently established they want you the network engineer to design them a small network for three departments; HR, ICT and SALES, they only have one router and one switch but they intend to grow their company in future, the network address is 192.168.0.0 subnet it to meet their requirement all department to have 14 hosts. They also want their host to be able to go on the internet

NETWORK TOPOLOGY



LAYER 2 CONFIGURATIONS

```
En
Conf t
Hostname GTECH-MAIN-SW
Enable secret Admin2
Username Admin password Admin123
Service password-encryption
Banner motd # ADMINS ONLY#
Line console 0
Login local
Ex
Line vty 0 15
Login local
Exit
VLAN 10
Name HR
Ex
```

```

VLAN 20
Name ICT
EX
VLAN 30
Name SALES
EX
Int range fa0/2-4
Switchport mode access
Switchport access vlan 10
Ex
Int range fa0/5-7
Switchport mode access
Switchport access vlan 20
Ex
Int range fa0/8-10
Switchport mode access
Switchport access vlan 30
Ex
Int fa0/1
Switchport mode trunk
Do wr
Ex
!SECURING UNUSED PORTS
Int range fa0/11-24
Shut
Int range gig0/1-2
Shut
Ex
Do wr

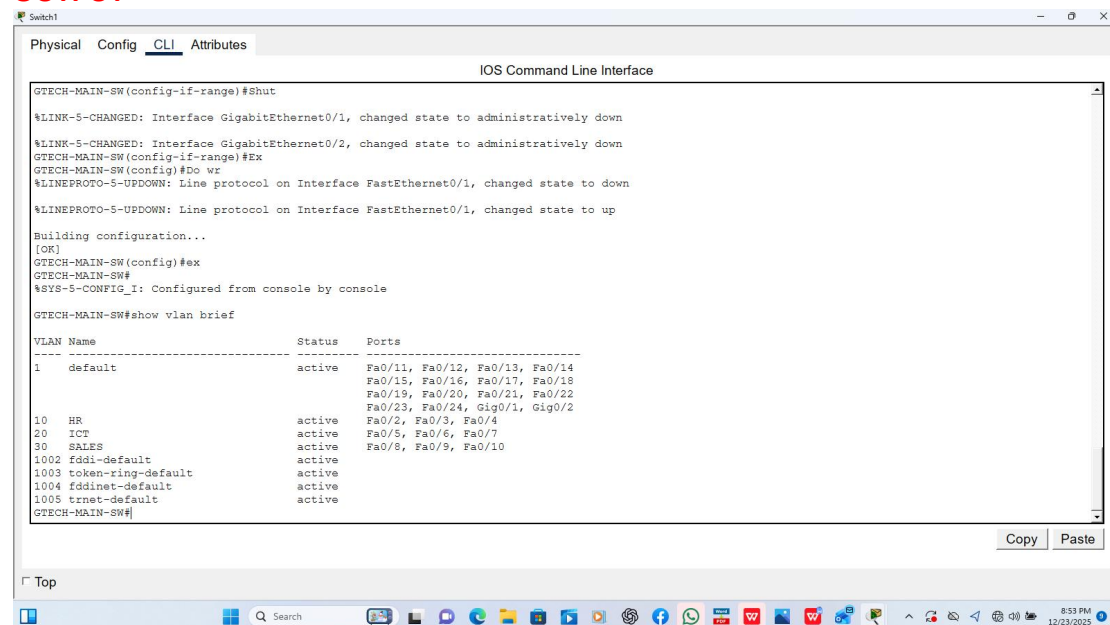
```

Let us verify our VLANS

COMMAND

Show vlan brief

OUTPUT



```

Switch1
Physical Config CLI Attributes
IOS Command Line Interface

GTECH-MAIN-SW(config-if-range)#Shut
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to administratively down
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to administratively down
GTECH-MAIN-SW(config-if-range)#Ex
GTECH-MAIN-SW(config)#Do wr
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Building configuration...
[OK]
GTECH-MAIN-SW(config)#ex
GTECH-MAIN-SW#
%SYS-5-CONFIG_I: Configured from console by console

GTECH-MAIN-SW#show vlan brief

VLAN Name                Status    Ports
-----
1    default                active    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, Gig0/1, Gig0/2
10   HR                     active    Fa0/2, Fa0/3, Fa0/4
20   ICT                     active    Fa0/5, Fa0/6, Fa0/7
30   SALES                   active    Fa0/8, Fa0/9, Fa0/10
1002 fddi-default          active
1003 token-ring-default   active
1004 fddinet-default       active
1005 trnet-default         active
GTECH-MAIN-SW#

```

Our vlans has been created
Let us go to Layer 3.

SUBNETTING

VLAN	MASK	NETWORK	VALID RANGE	BROADCAST
10	/28	192.168.0.0	192.168.0.1-192.168.0.14	192.168.0.15
20	/28	192.168.0.16	192.168.0.17-192.168.0.30	192.168.0.31
30	/28	192.168.0.32	192.168.0.33-192.168.0.46	192.168.0.47

LAYER 3 CONFIGURATIONS

```
En
Conf t
Hostname GTECH-MAIN-ROUTER
Enable secret Admin1
Username Admin password Admin123
Service password-encryption
Banner motd # ADMINS ONLY#
Line console 0
Login local
Ex
Line vty 0 15
Login local
Exit
Int range gig0/0-1
No shut
```

SUB-INTERFACES

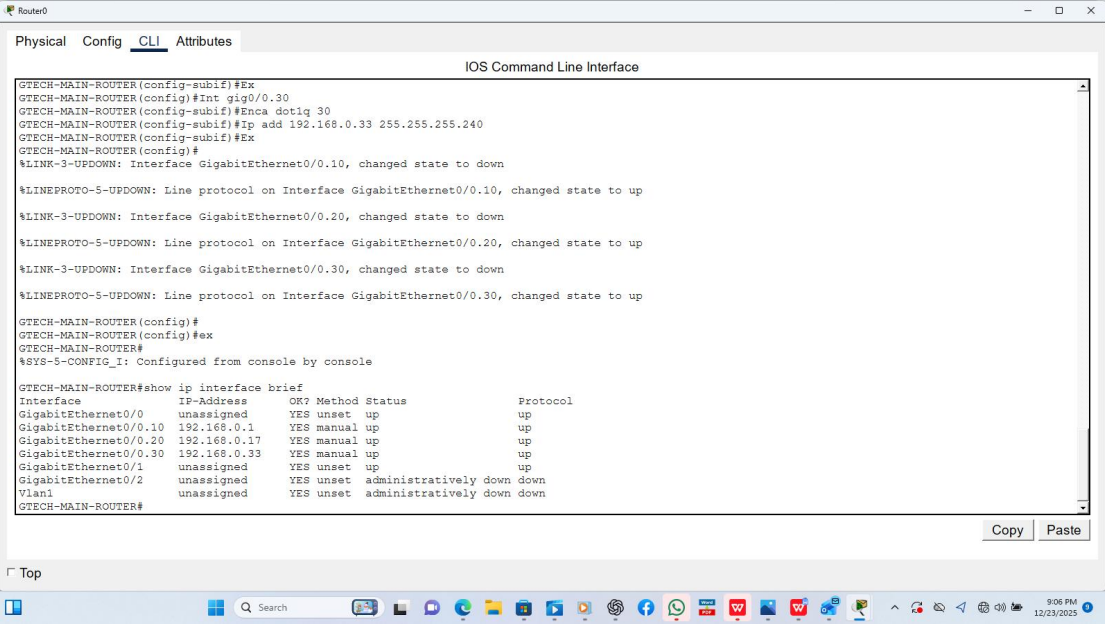
```
Int gig0/0.10
Enca dot1q 10
Ip add 192.168.0.1 255.255.255.240
Ex
Int gig0/0.20
Enca dot1q 20
Ip add 192.168.0.17 255.255.255.240
Ex
Int gig0/0.30
Enca dot1q 30
Ip add 192.168.0.33 255.255.255.240
Ex
```

VERIFYING THE SUB-INTERFACES

COMMAND

Show ip interface brief

OUTPUT



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#int gig0/0.30
GTECH-MAIN-ROUTER(config-subif)#Encapsulation dot1q 30
GTECH-MAIN-ROUTER(config-subif)#ip address 192.168.0.33 255.255.255.240
GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#
%LINK-3-UPDOWN: Interface GigabitEthernet0/0.10, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up
%LINK-3-UPDOWN: Interface GigabitEthernet0/0.20, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20, changed state to up
%LINK-3-UPDOWN: Interface GigabitEthernet0/0.30, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30, changed state to up

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

GTECH-MAIN-ROUTER#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0 unassigned YES unset up up
GigabitEthernet0/0.10 192.168.0.1 YES manual up up
GigabitEthernet0/0.20 192.168.0.17 YES manual up up
GigabitEthernet0/0.30 192.168.0.33 YES manual up up
GigabitEthernet0/1 unassigned YES unset up up
GigabitEthernet0/2 unassigned YES unset administratively down down
Vlan1 unassigned YES unset administratively down down
GTECH-MAIN-ROUTER#
```

We are good.

DHCP CONFIGURATION

!VLAN 10

Ip dhcp excluded-address 192.168.0.1 192.168.0.5

Ip dhcp pool HR

Network 192.168.0.0 255.255.255.240

Default-router 192.168.0.1

Dns-server 8.8.8.8

Ex

!VLAN 20

Ip dhcp excluded-address 192.168.0.17 192.168.0.22

Ip dhcp pool ICT

Network 192.168.0.16 255.255.255.240

Default-router 192.168.0.17

Dns-server 8.8.8.8

Ex

!VLAN 30

Ip dhcp excluded-address 192.168.0.33 192.168.0.38

Ip dhcp pool SALES

Network 192.168.0.32 255.255.255.240

Default-router 192.168.0.33

Dns-server 8.8.8.8

Ex

Do wr

We are done, let us go on any PC to see if it has ip address

COMMAND

Ipconfig

OUTPUT

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

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: FE80::201:C9FF:FED1:DEA
    IPv6 Address . . . . . : 
    IPv4 Address . . . . . : 192.168.0.6
    Subnet Mask . . . . . : 255.255.255.240
    Default Gateway . . . . . : 
                                192.168.0.1

Bluetooth Connection:

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: 
    IPv6 Address . . . . . : 
    IPv4 Address . . . . . : 0.0.0.0
    Subnet Mask . . . . . : 0.0.0.0
    Default Gateway . . . . . : 
                                0.0.0.0

C:\>
```

We could go on all the PCs to do the same but for the sake of making this project short I will just do one.

Next we try to ping from vlan 10 to 20, 20 to 30 and 30 to 10

VLAN 10 TO 20

Ping

OUTPUT

```
FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: FE80::201:C9FF:FED1:DEA
    IPv6 Address . . . . . : 
    IPv4 Address . . . . . : 192.168.0.6
    Subnet Mask . . . . . : 255.255.255.240
    Default Gateway . . . . . : 
                                192.168.0.1

Bluetooth Connection:

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: 
    IPv6 Address . . . . . : 
    IPv4 Address . . . . . : 0.0.0.0
    Subnet Mask . . . . . : 0.0.0.0
    Default Gateway . . . . . : 
                                0.0.0.0

C:\>ping 192.168.0.23

Pinging 192.168.0.23 with 32 bytes of data:

Request timed out.
Reply from 192.168.0.23: bytes=32 time<1ms TTL=127
Reply from 192.168.0.23: bytes=32 time<1ms TTL=127
Reply from 192.168.0.23: bytes=32 time<1ms TTL=127

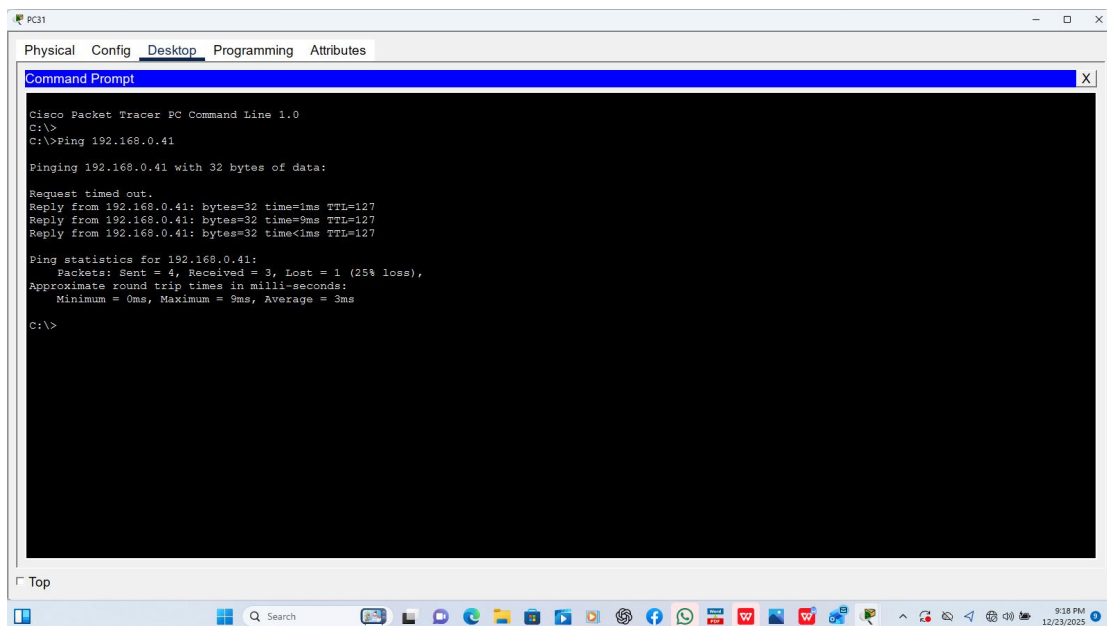
Ping statistics for 192.168.0.23:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

FROM VLAN 20 TO 30

Ping 192.168.0.41

OUTPUT



```
PC31
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>
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=1ms TTL=127
Reply from 192.168.0.41: bytes=32 time=9ms TTL=127
Reply from 192.168.0.41: bytes=32 time<1ms TTL=127

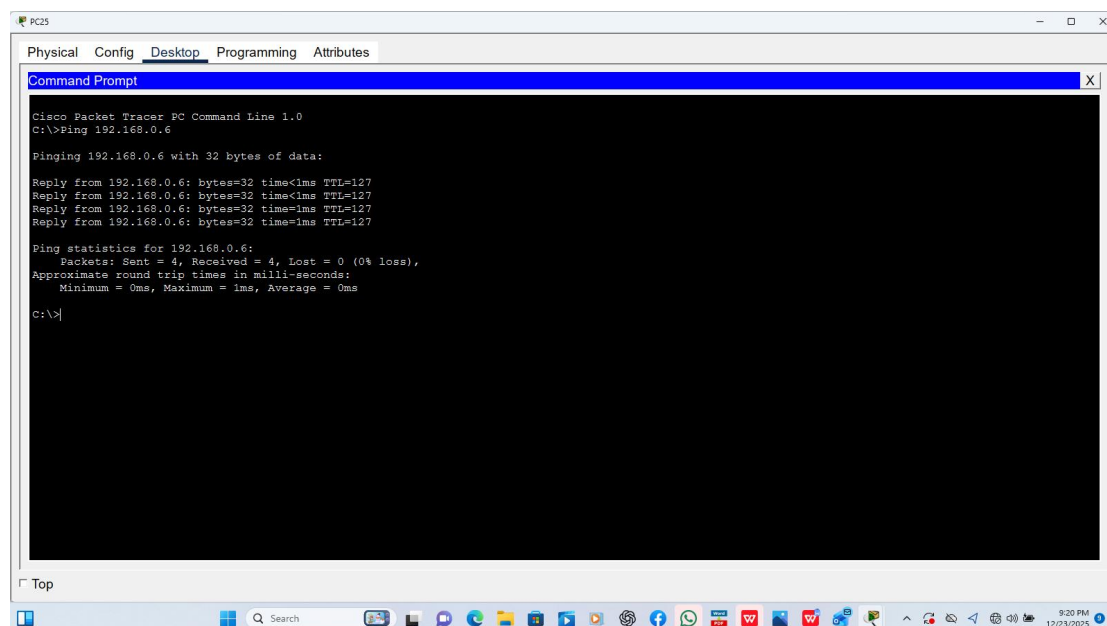
Ping statistics for 192.168.0.41:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 9ms, Average = 3ms

C:\>
```

FROM VLAN 30 TO 10

Ping 192.168.0.6

OUTPUT



```
PC25
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>
C:\>ping 192.168.0.6

Pinging 192.168.0.6 with 32 bytes of data:

Reply from 192.168.0.6: bytes=32 time<1ms TTL=127
Reply from 192.168.0.6: bytes=32 time<1ms TTL=127
Reply from 192.168.0.6: bytes=32 time=1ms TTL=127
Reply from 192.168.0.6: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.0.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

For the ISP router I will not write any configuration here because its outside GTECH I will just configure the ip address on GTECH router facing the ISP(public ip address)

Let us add the public ip address before we do the NAT

Int gig0/1

Ip add 203.0.113.2 255.255.255.240

Ex

Let us add static router to tell the router where to send unknown packet

Ip route 0.0.0.0 0.0.0.0 203.0.113.1

Ex

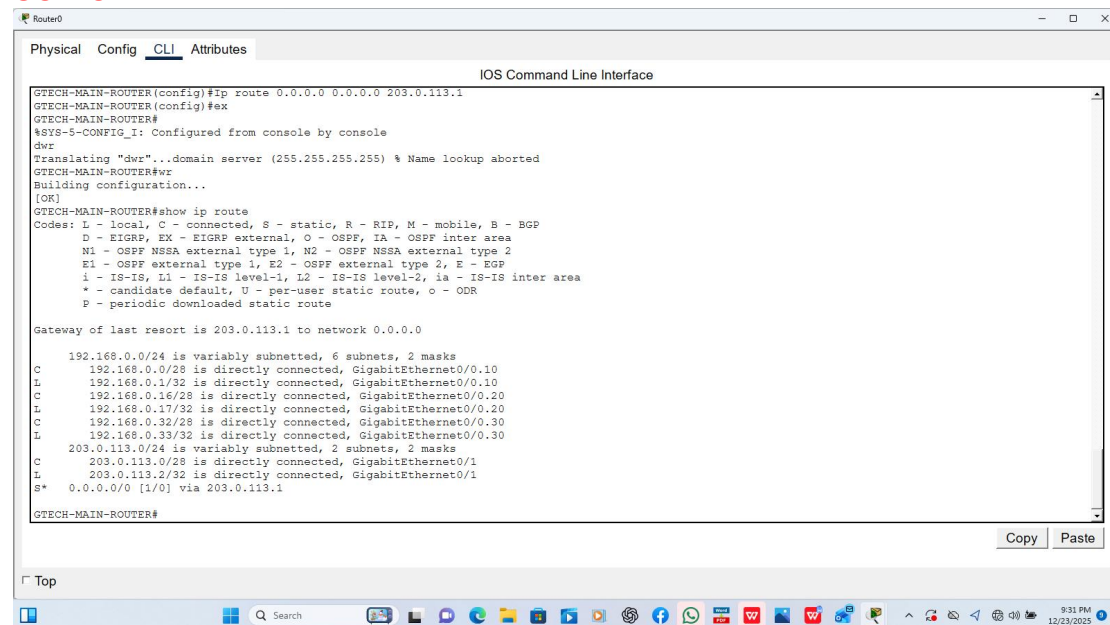
Wr

Let us verify if our static route exist in the router's routing table

COMMAND

Show ip route

OUTPUT



```
GTECH-MAIN-ROUTER(config)#Ip route 0.0.0.0 0.0.0.0 203.0.113.1
GTECH-MAIN-ROUTER(config)#ex
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
dwr
Translating "dwr"...domain server (255.255.255.255) % Name lookup aborted
GTECH-MAIN-ROUTER#wr
Building configuration...
[OK]
GTECH-MAIN-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

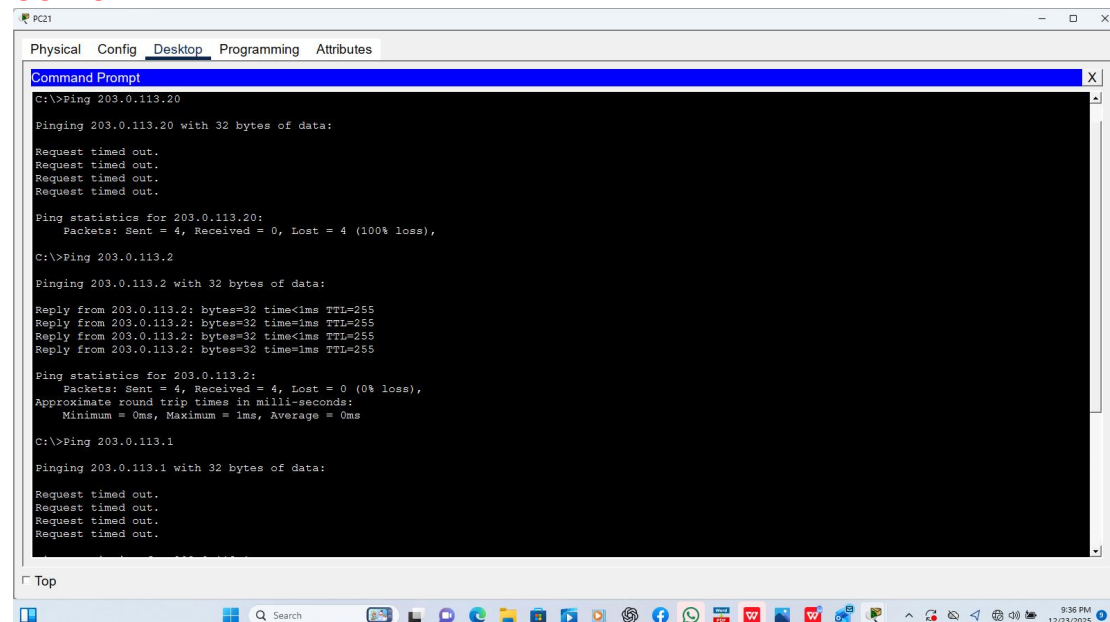
Gateway of last resort is 203.0.113.1 to network 0.0.0.0

    192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
      C      192.168.0.0/28 is directly connected, GigabitEthernet0/0.10
      L      192.168.0.1/32 is directly connected, GigabitEthernet0/0.10
      C      192.168.0.16/28 is directly connected, GigabitEthernet0/0.20
      L      192.168.0.17/32 is directly connected, GigabitEthernet0/0.20
      C      192.168.0.32/28 is directly connected, GigabitEthernet0/0.30
      L      192.168.0.33/32 is directly connected, GigabitEthernet0/0.30
      C      203.0.113.0/24 is variably subnetted, 2 subnets, 2 masks
      L      203.0.113.0/28 is directly connected, GigabitEthernet0/1
      L      203.0.113.2/32 is directly connected, GigabitEthernet0/1
      S*    0.0.0.0/0 [1/0] via 203.0.113.1
GTECH-MAIN-ROUTER#
```

We are good, let us now try to ping the external server/internet server from any pc

Ping 203.0.113.20

OUTPUT



```
C:\>ping 203.0.113.20

Pinging 203.0.113.20 with 32 bytes of data:

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

Ping statistics for 203.0.113.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

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=255
Reply from 203.0.113.2: bytes=32 time<1ms TTL=255
Reply from 203.0.113.2: bytes=32 time<1ms TTL=255
Reply from 203.0.113.2: bytes=32 time<1ms TTL=255

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

C:\>ping 203.0.113.1

Pinging 203.0.113.1 with 32 bytes of data:

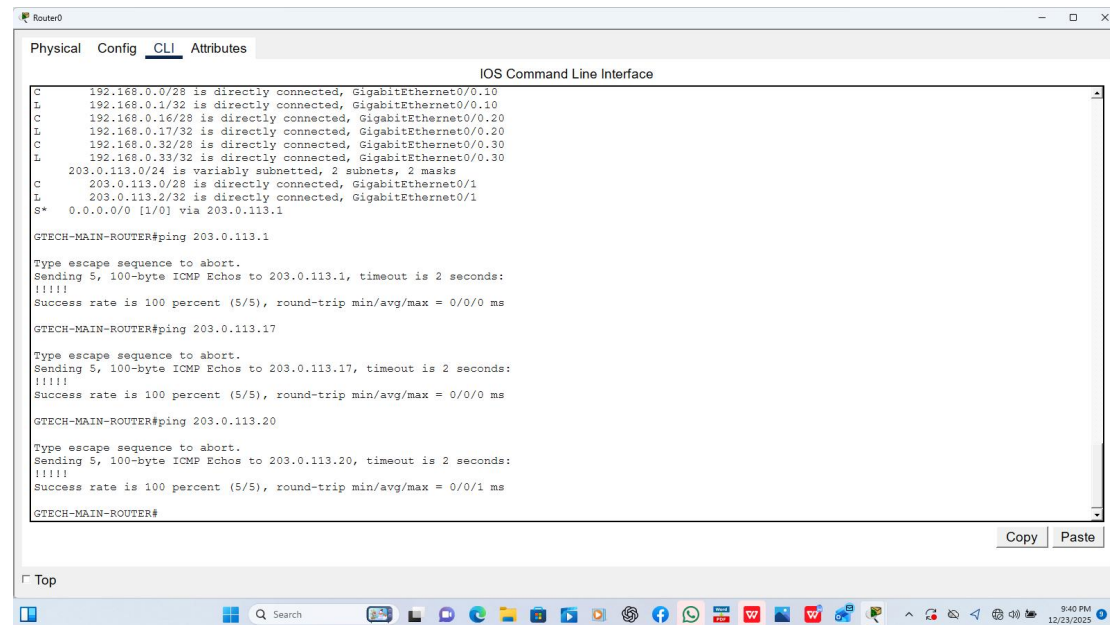
Request timed out.
Request timed out.
Request timed out.
Request timed out.
```

It looks like we got ourselves early work, The PC is unable to ping the external server and the ISP but its able to ping the exit interface.

Let us go o our router and see if we can ping the ISP and the external server

Ping 203.0.113.1 and ping 203.0.113.17 and ping 203.0.113.20 let us ping l that order

OUTPUT



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface
C 192.168.0.0/28 is directly connected, GigabitEthernet0/0.10
L 192.168.0.1/32 is directly connected, GigabitEthernet0/0.10
C 192.168.0.16/28 is directly connected, GigabitEthernet0/0.20
L 192.168.0.17/32 is directly connected, GigabitEthernet0/0.20
C 192.168.0.32/28 is directly connected, GigabitEthernet0/0.30
L 192.168.0.33/32 is directly connected, GigabitEthernet0/0.30
C 203.0.113.0/24 is variably subnetted, 2 subnets, 2 masks
L 203.0.113.0/28 is directly connected, GigabitEthernet0/1
L 203.0.113.2/32 is directly connected, GigabitEthernet0/1
S* 0.0.0.0/0 [1/0] via 203.0.113.1

GTECH-MAIN-ROUTER#ping 203.0.113.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.1, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

GTECH-MAIN-ROUTER#ping 203.0.113.17

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.17, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

GTECH-MAIN-ROUTER#ping 203.0.113.20

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.20, timeout is 2 seconds:
!!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/1 ms

GTECH-MAIN-ROUTER#
```

Why is our PCs unable to ping the ISP and the external server?

Well the reason is that our router doesn't know where to send data or packets received from our vlan, for example, vlan 10 packets whose network is 192.168.0.0, we could as well configure routing protocol RIP (for small company)

Let us try configuring RIP

Router rip

Version 2

No auto-summary

Network 192.168.0.0

Network 192.168.0.16

Network 192.168.0.32

Network 203.0.113.0

Let us verify our RIP

COMMAND

Show ip route

OUTPUT

```
GTECH-MAIN-ROUTER(config-router)#Network 192.168.0.0
GTECH-MAIN-ROUTER(config-router)#Network 192.168.0.16
GTECH-MAIN-ROUTER(config-router)#Network 192.168.0.32
GTECH-MAIN-ROUTER(config-router)#No auto-summary
GTECH-MAIN-ROUTER(config-router)#ex
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
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 203.0.113.1 to network 0.0.0.0

C    192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
L    192.168.0.0/28 is directly connected, GigabitEthernet0/0.10
L    192.168.0.1/32 is directly connected, GigabitEthernet0/0.10
C    192.168.0.16/28 is directly connected, GigabitEthernet0/0.20
L    192.168.0.17/32 is directly connected, GigabitEthernet0/0.20
C    192.168.0.32/28 is directly connected, GigabitEthernet0/0.30
L    192.168.0.33/32 is directly connected, GigabitEthernet0/0.30
L    203.0.113.0/24 is variably subnetted, 2 subnets, 2 masks
C    203.0.113.0/28 is directly connected, GigabitEthernet0/1
L    203.0.113.2/32 is directly connected, GigabitEthernet0/1
S*   0.0.0.0/0 [1/0] via 203.0.113.1

GTECH-MAIN-ROUTER#
```

Our router doesn't have RIP information in its routing table

Let us try the command show run | section router rip

OUTPUT

```
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

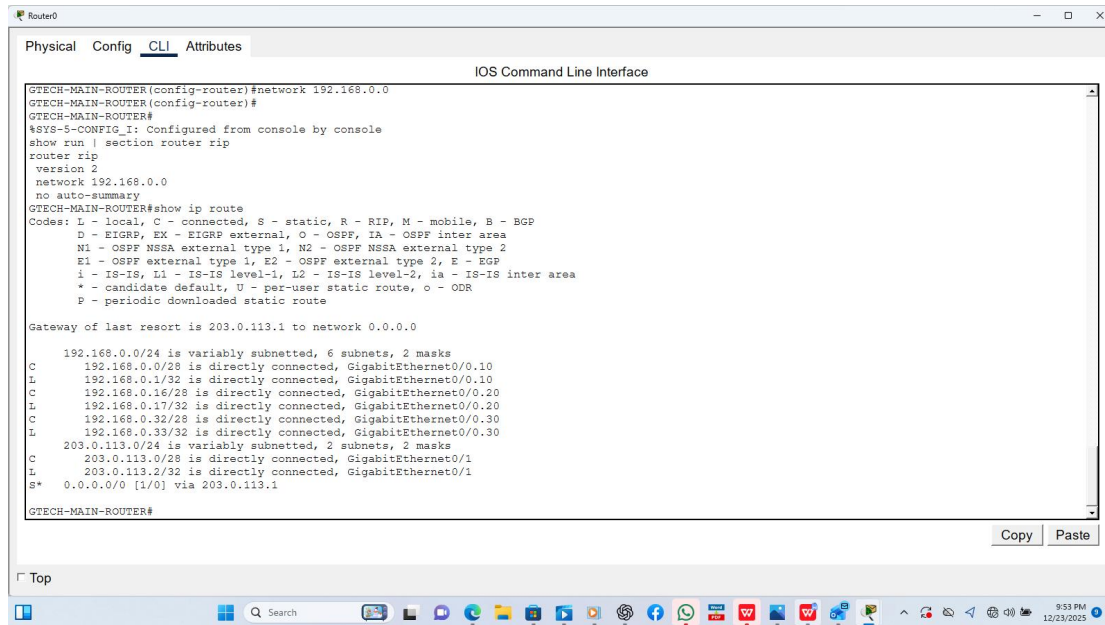
Gateway of last resort is 203.0.113.1 to network 0.0.0.0

C    192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
L    192.168.0.0/28 is directly connected, GigabitEthernet0/0.10
L    192.168.0.1/32 is directly connected, GigabitEthernet0/0.10
C    192.168.0.16/28 is directly connected, GigabitEthernet0/0.20
L    192.168.0.17/32 is directly connected, GigabitEthernet0/0.20
C    192.168.0.32/28 is directly connected, GigabitEthernet0/0.30
L    192.168.0.33/32 is directly connected, GigabitEthernet0/0.30
L    203.0.113.0/24 is variably subnetted, 2 subnets, 2 masks
C    203.0.113.0/28 is directly connected, GigabitEthernet0/1
L    203.0.113.2/32 is directly connected, GigabitEthernet0/1
S*   0.0.0.0/0 [1/0] via 203.0.113.1

GTECH-MAIN-ROUTER#GTECH-MAIN-ROUTER#
GTECH-MAIN-ROUTER#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
GTECH-MAIN-ROUTER(config)#router rip
GTECH-MAIN-ROUTER(config-router)#no network 192.168.0.0
GTECH-MAIN-ROUTER(config-router)#network 192.168.0.0
GTECH-MAIN-ROUTER(config-router)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
show run | section router rip
router rip
 version 2
 network 192.168.0.0
 no auto-summary
GTECH-MAIN-ROUTER#
```

There is our rip information, let us try again

OUTPUT



```
GTECH-MAIN-ROUTER(config-router)#network 192.168.0.0
GTECH-MAIN-ROUTER(config-router)#
GTECH-MAIN-ROUTER#
*SYS-5-CONFIG_I: Configured from console by console
show run | section router rip
router rip
version 2
network 192.168.0.0
no auto-summary
GTECH-MAIN-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 203.0.113.1 to network 0.0.0.0

C    192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
L    192.168.0.0/28 is directly connected, GigabitEthernet0/0.10
L    192.168.0.1/32 is directly connected, GigabitEthernet0/0.10
C    192.168.0.16/28 is directly connected, GigabitEthernet0/0.20
L    192.168.0.17/32 is directly connected, GigabitEthernet0/0.20
C    192.168.0.32/28 is directly connected, GigabitEthernet0/0.30
L    192.168.0.33/32 is directly connected, GigabitEthernet0/0.30
L    203.0.113.0/24 is variably subnetted, 2 subnets, 2 masks
C    203.0.113.0/28 is directly connected, GigabitEthernet0/1
L    203.0.113.2/32 is directly connected, GigabitEthernet0/1
S*   0.0.0.0/0 [1/0] via 203.0.113.1

GTECH-MAIN-ROUTER#
```

Nothing still, we will remove the rip configurations and re-configure it

No router rip

Router rip

Version 2

No auto-summary

Network 192.168.0.0

Network 192.168.0.16

Network 192.168.0.32

Network 203.0.113.0

Still nothing, Routing protocol isn't really necessary we just have to tell the router where to send the packet from our vlans

No router rip

Why are we still failing to ping the ISP and the external server? Well the reason is because we are trying to ping the public address of which we have not translated our ip addresses into public. Private networks are not routable on the internet, so what is the fix here? The fix is to translate our ip address, there is static NAT, Dynamic NAT and PAT, Static is used for servers that need to receive outside connection, Dynamic is where we have a pool and our hosts gets the public based on first come first serve and last we have PAT or port Address Translation, PAT enables us to use a single public address for all our hosts, every host will be given a port number.

Now we know the fix let us configure NAT

To configure NAT we have first to define the interfaces; inside and outside then we create the access list for the ip address or network we want to permit or to translate from their we link our access list to the interfaces with the public address

DEFINING INTERFACES

Int gig0/0.10

Ip nat inside

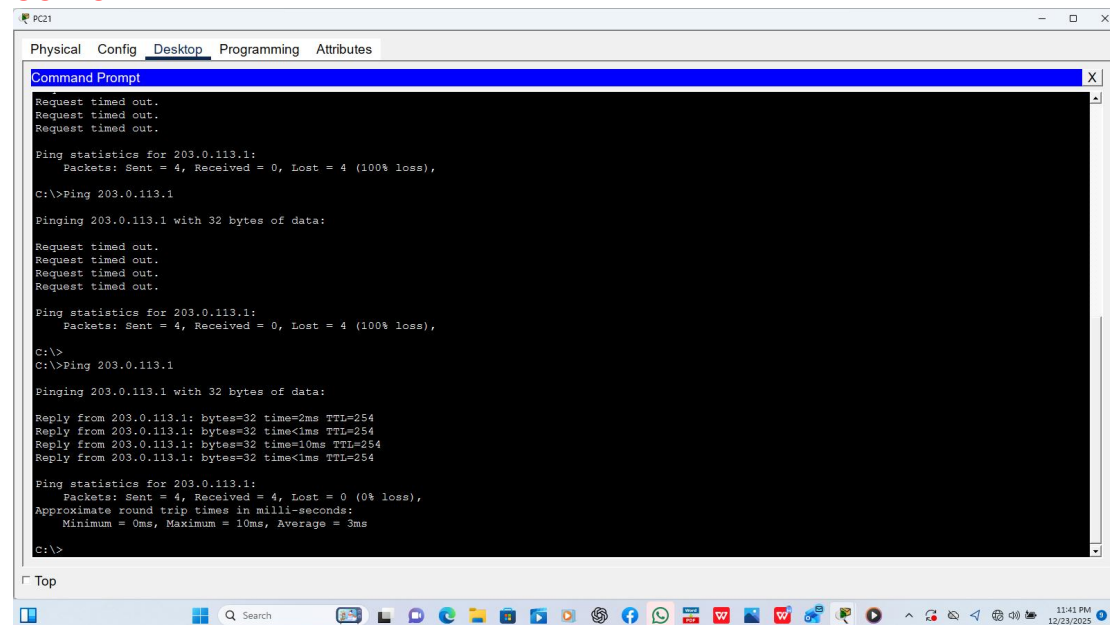
Ex

Int gig0/0.20

Ip nat inside

```
Ex
Int gig0/0.30
Ip nat inside
Ex
Int gig0/1
Ip nat outside
Ex
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
Ip nat inside source list 1 int gig0/1 overload
Do wr
Let us try to ping the ISP from any PC
Ping 203.0.113.1
```

OUTPUT



```
Command Prompt
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 203.0.113.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>Ping 203.0.113.1

Pinging 203.0.113.1 with 32 bytes of data:

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

Ping statistics for 203.0.113.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
C:\>Ping 203.0.113.1

Pinging 203.0.113.1 with 32 bytes of data:

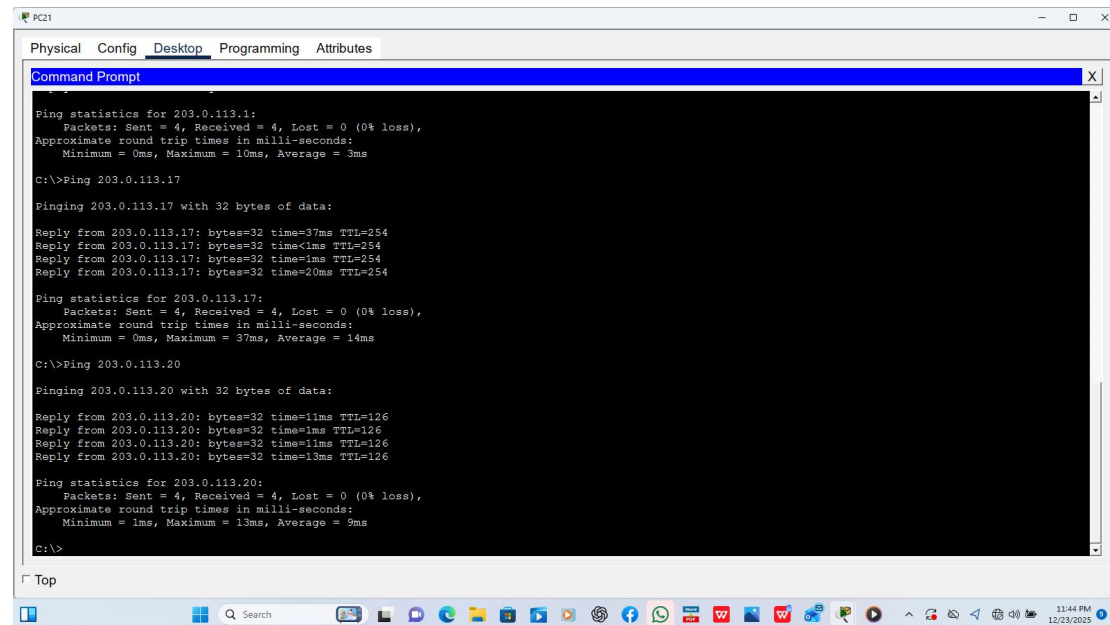
Reply from 203.0.113.1: bytes=32 time=2ms TTL=254
Reply from 203.0.113.1: bytes=32 time<1ms TTL=254
Reply from 203.0.113.1: bytes=32 time=10ms TTL=254
Reply from 203.0.113.1: bytes=32 time<1ms TTL=254

Ping statistics for 203.0.113.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>
```

Let us try the gateway of the external server and the external server itself
Ping 203.0.113.17 and ping 203.0.113.20 in that order

OUTPUT



```
PC21
Physical Config Desktop Programming Attributes
Command Prompt

Ping statistics for 203.0.113.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>Ping 203.0.113.17

Pinging 203.0.113.17 with 32 bytes of data:

Reply from 203.0.113.17: bytes=32 time=37ms TTL=254
Reply from 203.0.113.17: bytes=32 time<1ms TTL=254
Reply from 203.0.113.17: bytes=32 time=1ms TTL=254
Reply from 203.0.113.17: bytes=32 time=20ms TTL=254

Ping statistics for 203.0.113.17:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 37ms, Average = 14ms

C:\>Ping 203.0.113.20

Pinging 203.0.113.20 with 32 bytes of data:

Reply from 203.0.113.20: bytes=32 time=11ms TTL=126
Reply from 203.0.113.20: bytes=32 time=1ms TTL=126
Reply from 203.0.113.20: bytes=32 time=11ms TTL=126
Reply from 203.0.113.20: bytes=32 time=13ms TTL=126

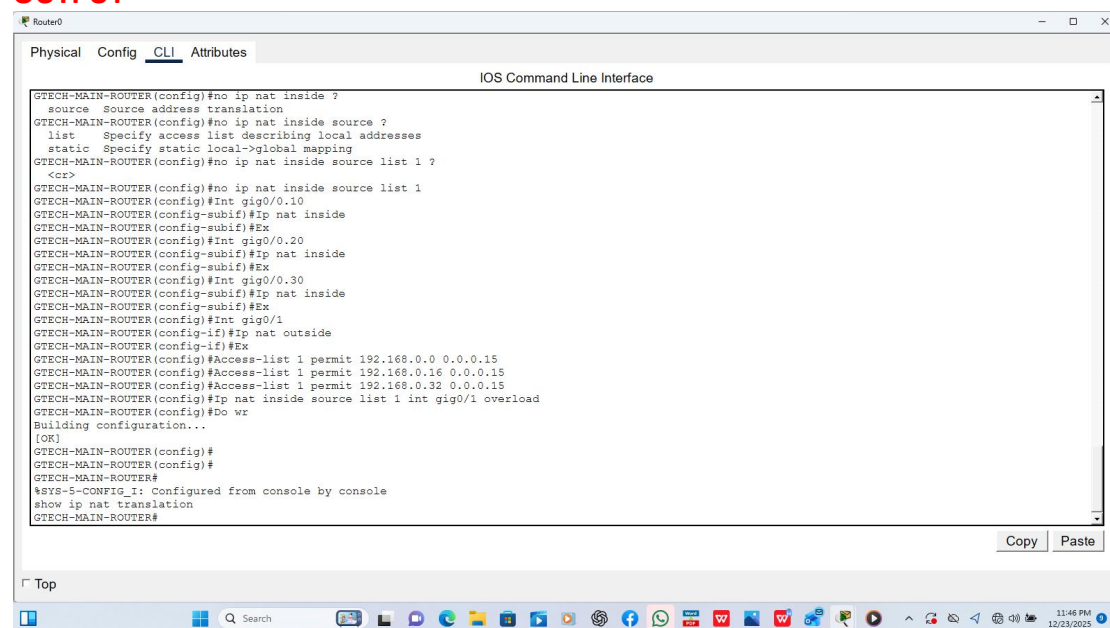
Ping statistics for 203.0.113.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 13ms, Average = 9ms

C:\>
```

Everything is working perfect, now let us verify our NAT

We go on the router and issue a show ip nat translation

OUTPUT



```
Router0
Physical Config CLI Attributes
IOS Command Line Interface

GTECH-MAIN-ROUTER(config)#no ip nat inside ?
    source Source address translation
GTECH-MAIN-ROUTER(config)#no ip nat inside source ?
    list Specify access list describing local addresses
    static Specify static local->global mapping
GTECH-MAIN-ROUTER(config)#no ip nat inside source list 1 ?
    <cr>
GTECH-MAIN-ROUTER(config)#no ip nat inside source list 1
GTECH-MAIN-ROUTER(config)#int gig0/0.10
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#ex
GTECH-MAIN-ROUTER(config)#int gig0/0.20
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#ex
GTECH-MAIN-ROUTER(config)#int gig0/0.30
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#ex
GTECH-MAIN-ROUTER(config)#int gig0/1
GTECH-MAIN-ROUTER(config-if)#ip nat outside
GTECH-MAIN-ROUTER(config-if)#ex
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.0 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.16 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.32 0.0.0.15
GTECH-MAIN-ROUTER(config)#ip nat inside source list 1 int gig0/1 overload
GTECH-MAIN-ROUTER(config)#do wr
Building configuration...
[OK]
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
show ip nat translation
GTECH-MAIN-ROUTER#
```

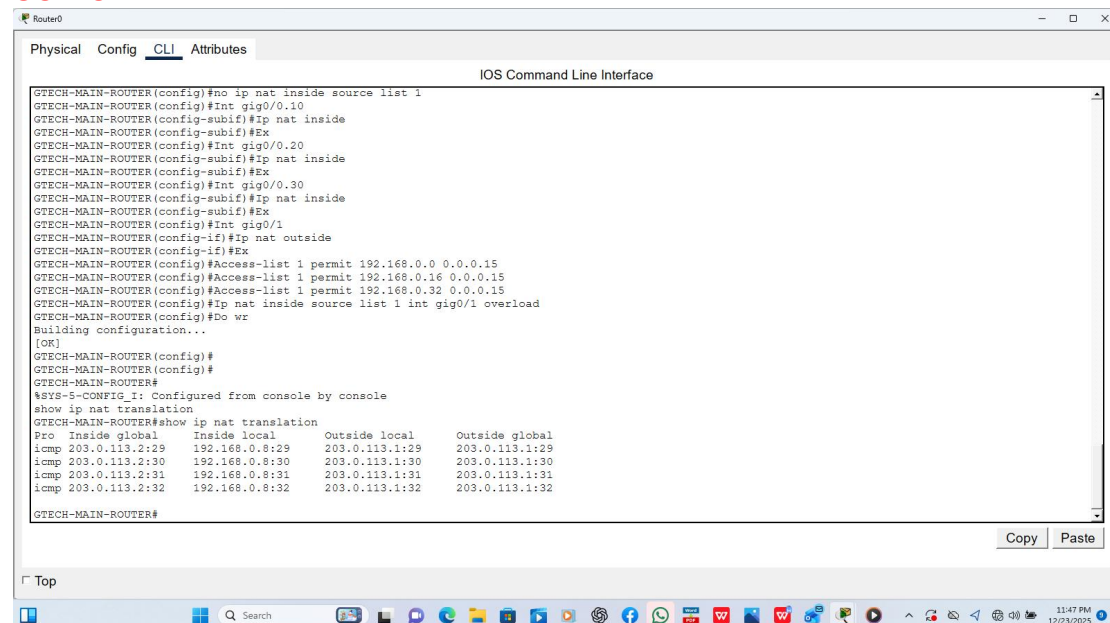
There is nothing, well we first have to generate some traffic

Lets ping the ISP

Let us go back on our router and see again

Show ip nat translation

OUTPUT



```
GTECH-MAIN-ROUTER(config)#no ip nat inside source list 1
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#int gig0/0.20
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#int gig0/0.30
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#int gig0/1
GTECH-MAIN-ROUTER(config-if)#ip nat outside
GTECH-MAIN-ROUTER(config-if)#Ex
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.0 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.16 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.32 0.0.0.15
GTECH-MAIN-ROUTER(config)#ip nat inside source list 1 int gig0/1 overload
GTECH-MAIN-ROUTER(config)#do wr
Building configuration...
[OK]
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:29    192.168.0.8:29    203.0.113.1:29    203.0.113.1:29
icmp 203.0.113.2:30    192.168.0.8:30    203.0.113.1:30    203.0.113.1:30
icmp 203.0.113.2:31    192.168.0.8:31    203.0.113.1:31    203.0.113.1:31
icmp 203.0.113.2:32    192.168.0.8:32    203.0.113.1:32    203.0.113.1:32
GTECH-MAIN-ROUTER#
```

There we go, there is our nat. There are some new terms from our nat output; Inside global, inside local, outside local and outside global

INSIDE GLOBAL: This is our nat'd address, in other terms, this is the ip address of our pc from the outside.

INSIDE LOCAL: This is the actual ip address of our PC/host from inside. The configured address from the inside.

OUTSIDE LOCAL: The address of the Outside Host as it appears to our inside network

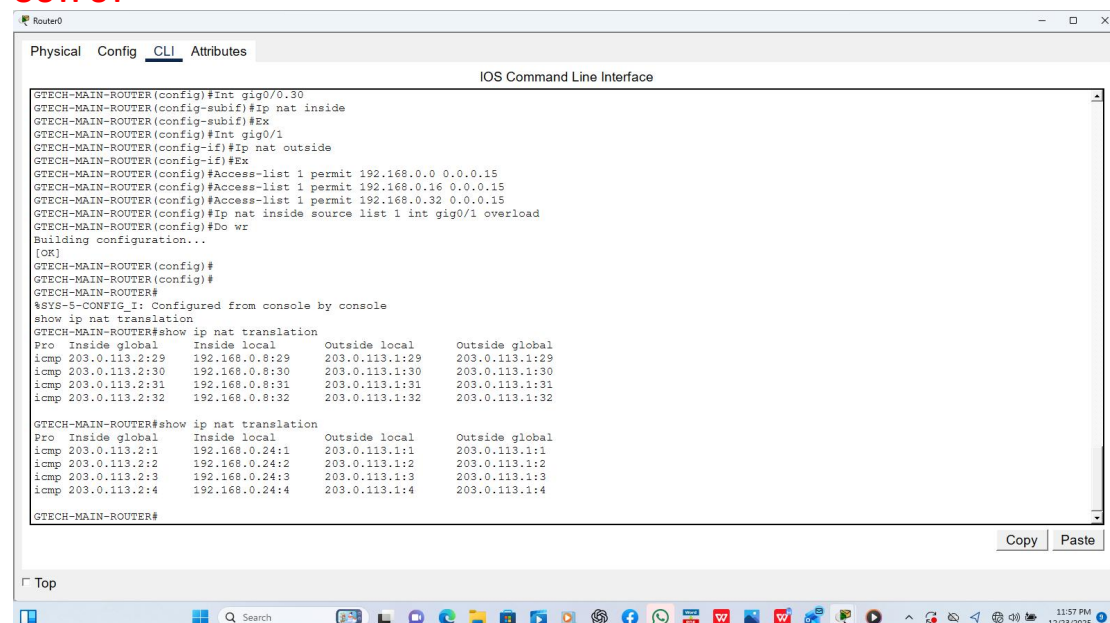
OUTSIDE GLOBAL: The actual address of the outside host.

Notice that our hosts are using 203.0.113.2 as the public address notice at the end there is a port number, let us try to ping the ISP from vlan 20 and 30 to see the port number

VLAN 20

Show ip nat translation

OUTPUT

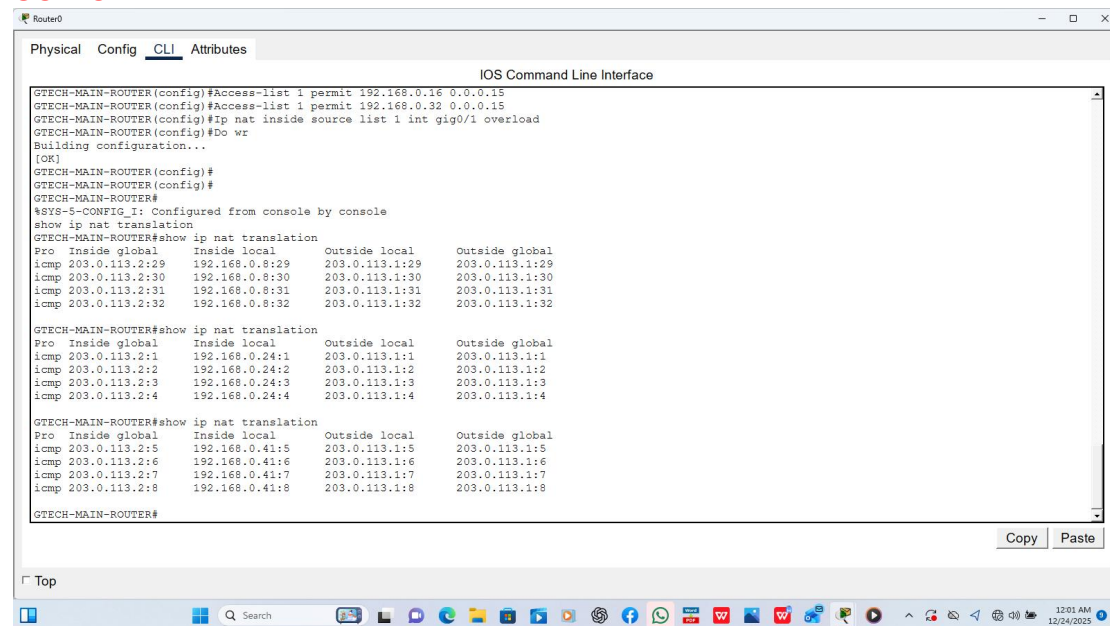


```
GTECH-MAIN-ROUTER(config)#int gig0/0.30
GTECH-MAIN-ROUTER(config-subif)#ip nat inside
GTECH-MAIN-ROUTER(config-subif)#Ex
GTECH-MAIN-ROUTER(config)#int gig0/1
GTECH-MAIN-ROUTER(config-if)#ip nat outside
GTECH-MAIN-ROUTER(config-if)#Ex
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.0 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.16 0.0.0.15
GTECH-MAIN-ROUTER(config)#access-list 1 permit 192.168.0.32 0.0.0.15
GTECH-MAIN-ROUTER(config)#ip nat inside source list 1 int gig0/1 overload
GTECH-MAIN-ROUTER(config)#do wr
Building configuration...
[OK]
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:29    192.168.0.8:29    203.0.113.1:29    203.0.113.1:29
icmp 203.0.113.2:30    192.168.0.8:30    203.0.113.1:30    203.0.113.1:30
icmp 203.0.113.2:31    192.168.0.8:31    203.0.113.1:31    203.0.113.1:31
icmp 203.0.113.2:32    192.168.0.8:32    203.0.113.1:32    203.0.113.1:32

GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:1    192.168.0.24:1    203.0.113.1:1    203.0.113.1:1
icmp 203.0.113.2:2    192.168.0.24:2    203.0.113.1:2    203.0.113.1:2
icmp 203.0.113.2:3    192.168.0.24:3    203.0.113.1:3    203.0.113.1:3
icmp 203.0.113.2:4    192.168.0.24:4    203.0.113.1:4    203.0.113.1:4
GTECH-MAIN-ROUTER#
```

We can see that for host in vlan 10 the port was 29,30,31 and 32 and for vlan 20 its 1,2,3 and 4 let see for vlan 30

OUTPUT



```
GTECH-MAIN-ROUTER(config)#Access-list 1 permit 192.168.0.16 0.0.0.15
GTECH-MAIN-ROUTER(config)#Access-list 1 permit 192.168.0.32 0.0.0.15
GTECH-MAIN-ROUTER(config)#ip nat inside source list 1 int gig0/1 overload
GTECH-MAIN-ROUTER(config)#do wr
Building configuration...
[OK]
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER(config)#
GTECH-MAIN-ROUTER#
%SYS-5-CONFIG_I: Configured from console by console
GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:29     192.168.0.8:29    203.0.113.1:29    203.0.113.1:29
icmp 203.0.113.2:30     192.168.0.8:30    203.0.113.1:30    203.0.113.1:30
icmp 203.0.113.2:31     192.168.0.8:31    203.0.113.1:31    203.0.113.1:31
icmp 203.0.113.2:32     192.168.0.8:32    203.0.113.1:32    203.0.113.1:32

GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:1      192.168.0.24:1    203.0.113.1:1     203.0.113.1:1
icmp 203.0.113.2:2      192.168.0.24:2    203.0.113.1:2     203.0.113.1:2
icmp 203.0.113.2:3      192.168.0.24:3    203.0.113.1:3     203.0.113.1:3
icmp 203.0.113.2:4      192.168.0.24:4    203.0.113.1:4     203.0.113.1:4

GTECH-MAIN-ROUTER#show ip nat translation
Pro Inside global      Inside local      Outside local      Outside global
icmp 203.0.113.2:5      192.168.0.41:5    203.0.113.1:5     203.0.113.1:5
icmp 203.0.113.2:6      192.168.0.41:6    203.0.113.1:6     203.0.113.1:6
icmp 203.0.113.2:7      192.168.0.41:7    203.0.113.1:7     203.0.113.1:7
icmp 203.0.113.2:8      192.168.0.41:8    203.0.113.1:8     203.0.113.1:8

GTECH-MAIN-ROUTER#
```

For vlan 30 the port numbers are 5, 6, 7 and 8

So the port numbers aren't permanent they are given out according to the host that sent traffic.

This marks the end of this SMALL NETWORK PROJECT

OBJECTIVE

- Design network topology for a small company(GTECH) which has 3 department using one switch and one router and then subnet the network

NETWORK OVERVIEW

- Departments are HR, ICT and SALES
- VLAN 10-HR-14 host
- VLAN 20 ICT-14 hosts
- VLAN 30 SALES-14 hosts

TECHNOLOGY USED

- VLANs and trunking (802.1q)
- Inter-VLAN routing
- DHCP
- NAT

VERIFICATION

- PCs were able to communicate with each other
- PCs were able to reach ISP and the Internet