ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

KHOA CÔNG NGHỆ THÔNG TIN

MÔN:THỰC TẬP MẠNG MÁY TÍNH

BÁO CÁO BÀI TẬP TUẦN 9

Network Address Translation (NAT)

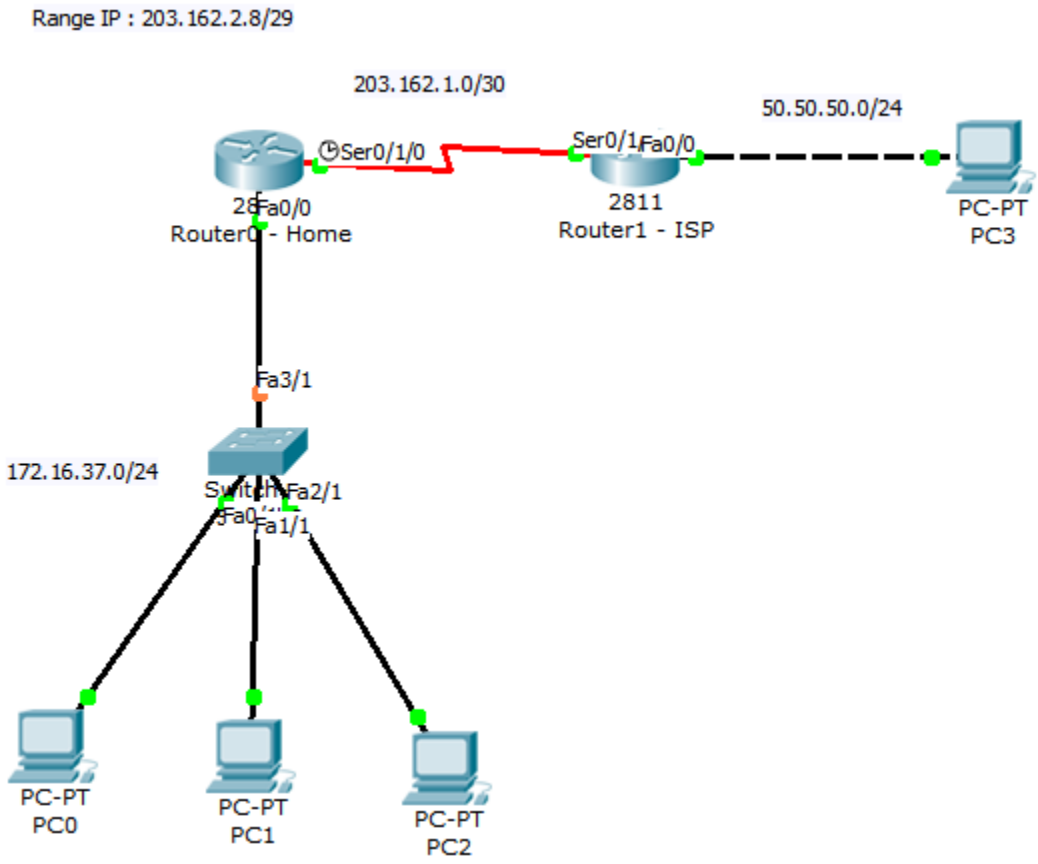
Lớp: 09HCA

Họ tên : Võ Huỳnh Đan

MSSV : 0941037

Bài làm:

1. Mô hình thực hiện :

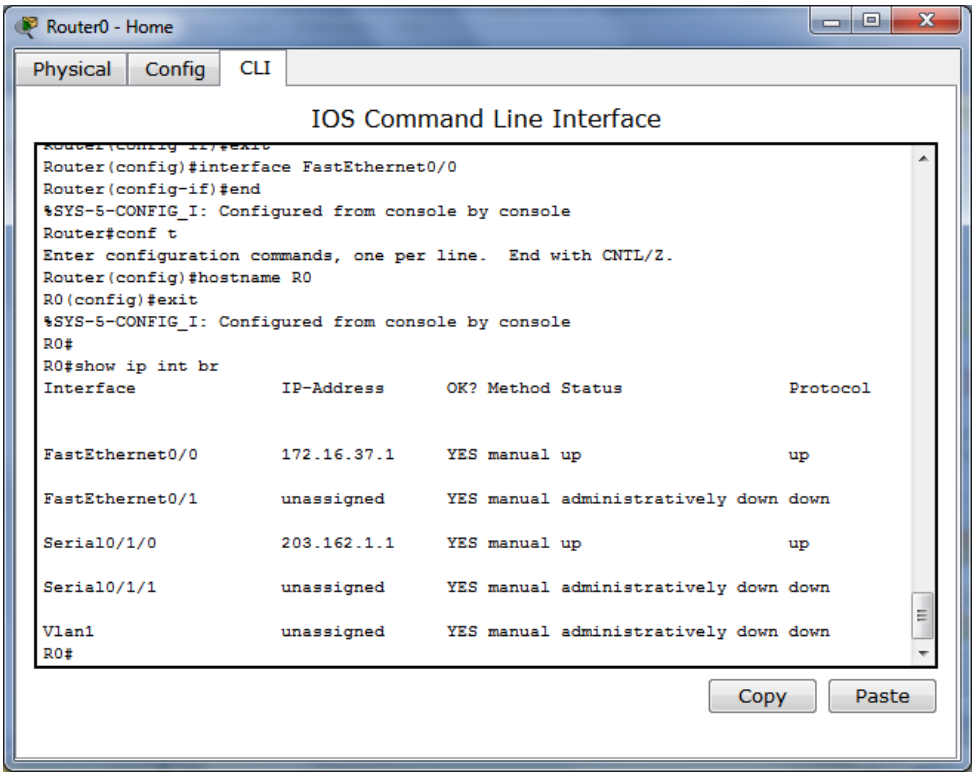


2. Thiết lập hệ thống mạng như hình vẽ

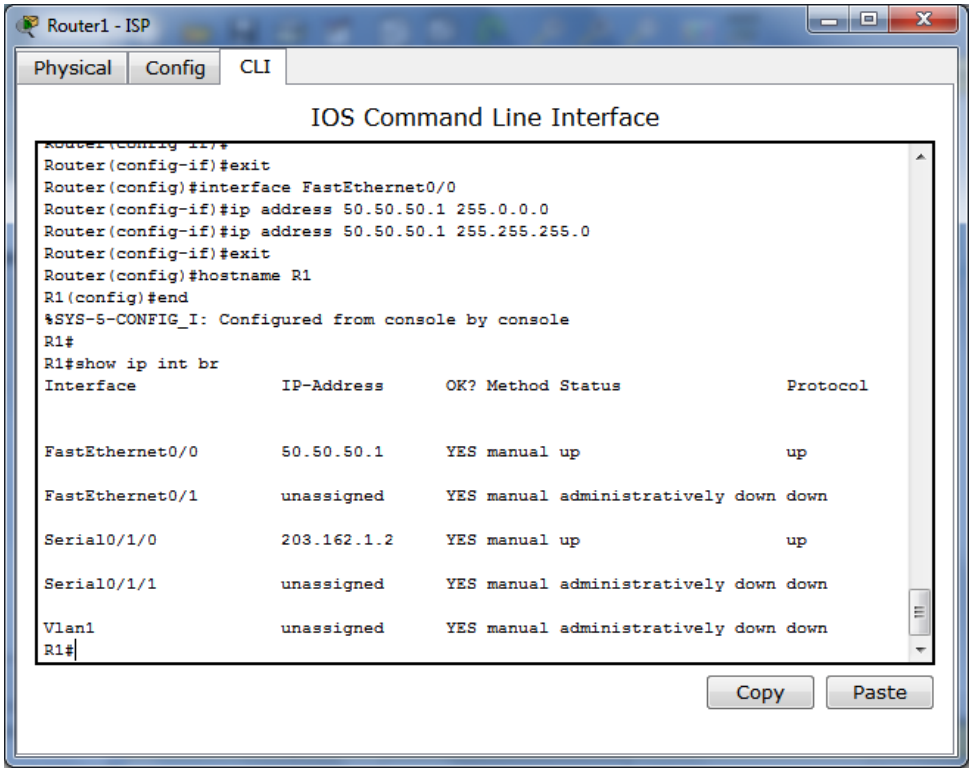
Doanh nghiệp đã mua 1 gói địa chỉ gồm 6 địa chị IP public **203.162.2.8/29**

Cấu hình IP cho các thiết bị :

R0

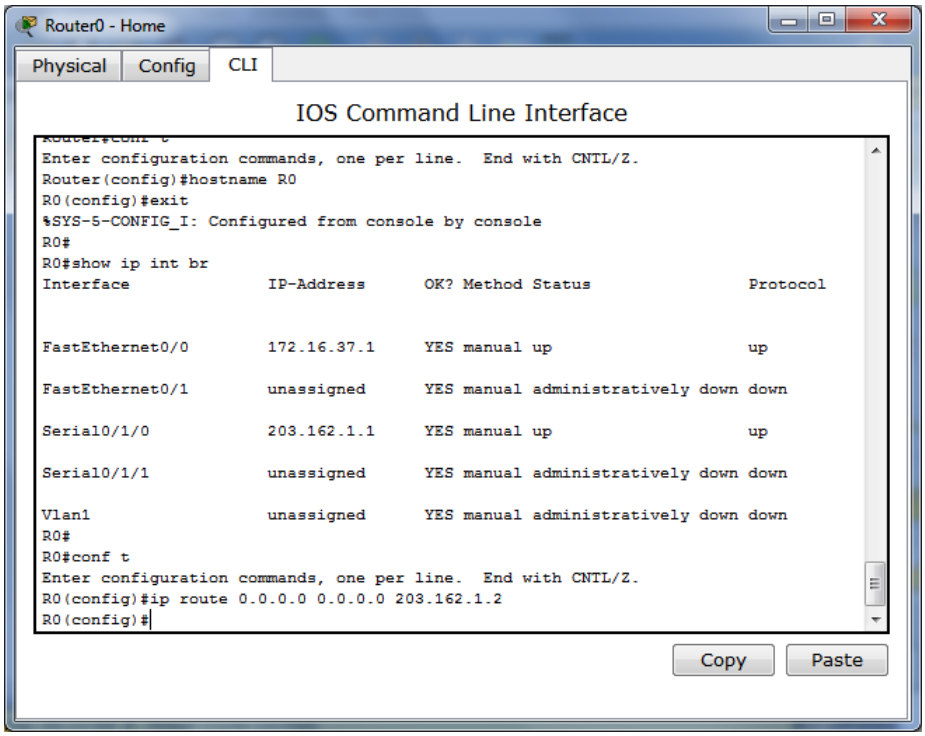

Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
Router(config)#interface FastEthernet0/0
Router(config-if)#end
%SYS-5-CONFIG_I: Configured from console by console
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R0
R0(config)#exit
%SYS-5-CONFIG_I: Configured from console by console
R0#
R0#show ip int br
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 172.16.37.1 YES manual up up
FastEthernet0/1 unassigned YES manual administratively down down
Serial0/1/0 203.162.1.1 YES manual up up
Serial0/1/1 unassigned YES manual administratively down down
Vlan1 unassigned YES manual administratively down down
R0#
Copy
Paste

R1

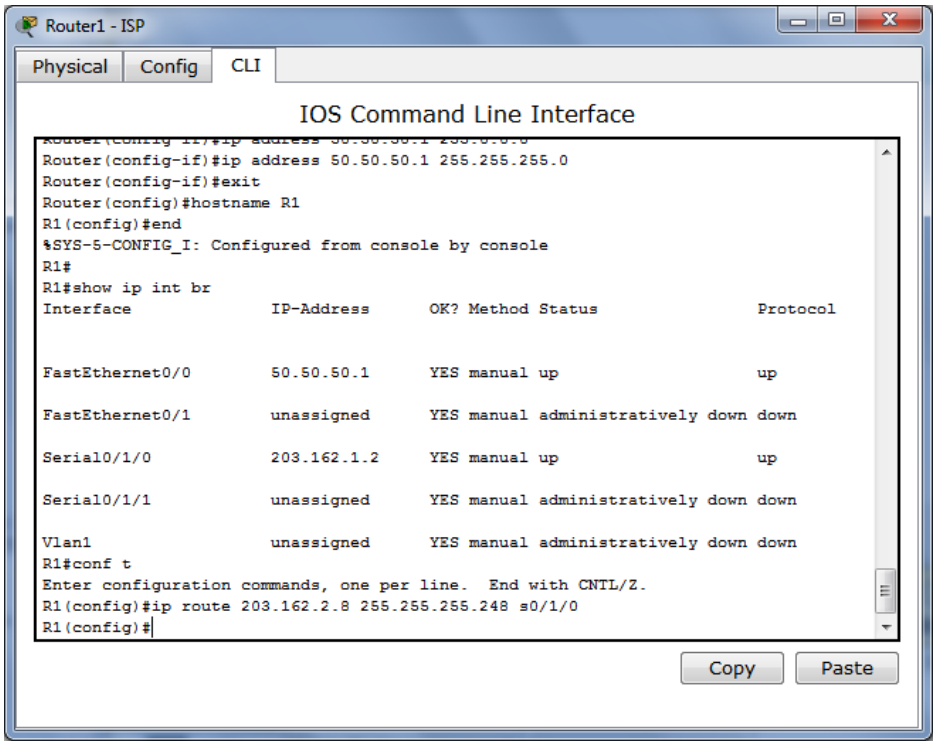

Router1 - ISP
Physical
Config
CLI
IOS Command Line Interface
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 50.50.50.1 255.0.0.0
Router(config-if)#ip address 50.50.50.1 255.255.255.0
Router(config-if)#exit
Router(config)#hostname R1
R1(config)#end
%SYS-5-CONFIG_I: Configured from console by console
R1#
R1#show ip int br
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 50.50.50.1 YES manual up up
FastEthernet0/1 unassigned YES manual administratively down down
Serial0/1/0 203.162.1.2 YES manual up up
Serial0/1/1 unassigned YES manual administratively down down
Vlan1 unassigned YES manual administratively down down
R1#
Copy
Paste

Routing :

R0



R1



3. NAT Tĩnh (Static NAT) :

Giả sử ở đây chúng ta có yêu cầu :

NAT tĩnh cho ip máy tính PC1 172.16.37.3 trở thành ip 203.162.2.9 đối với mạng bên ngoài.

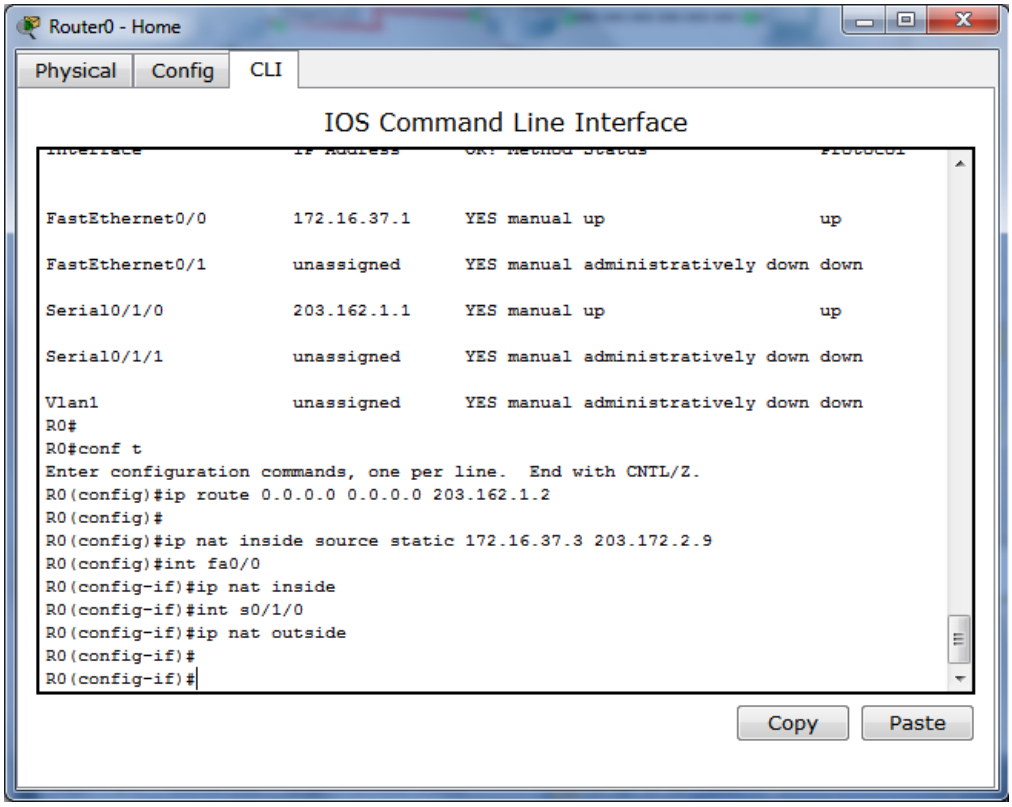
Câu lệnh cần dùng :

- **Ip nat inside source static**
- **Ip nat inside**
- **Ip nat ousite**
-

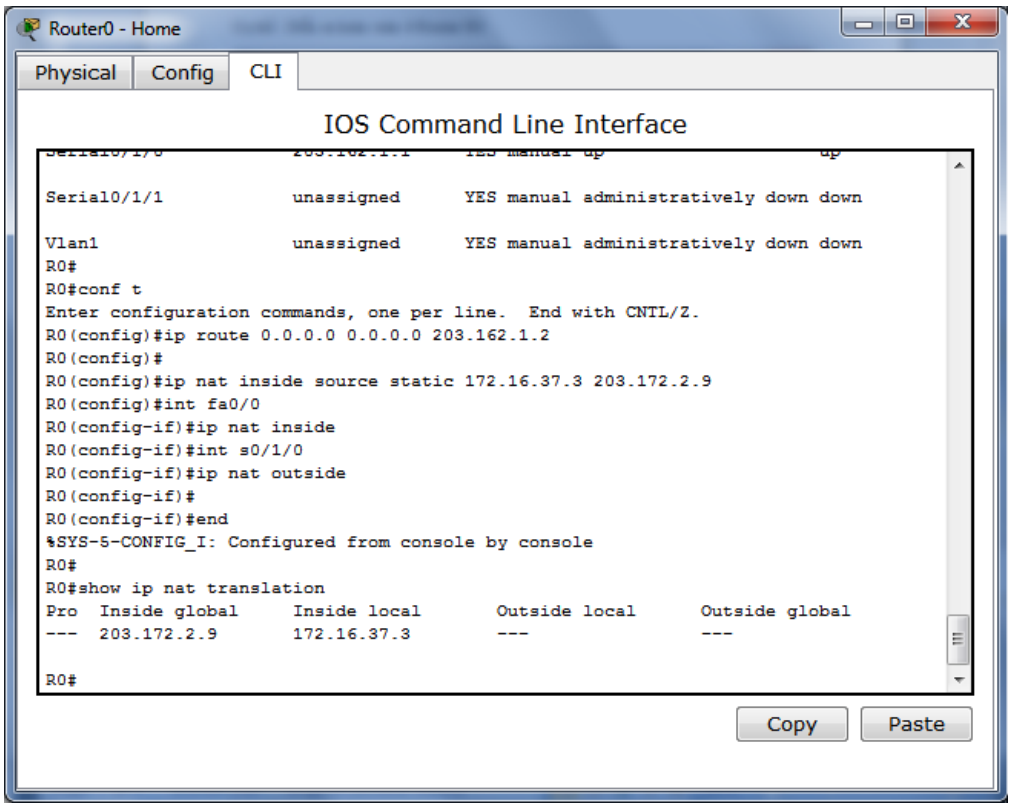
Cụ thể : *Diễn ra hoàn toàn ở Router R0*

NAT tĩnh 172.16.1.3 thành 203.162.2.9 bằng câu lệnh IP nat inside source static.

Sau đó lên cổng mạng LAN (fa0/0) gõ câu lệnh ip nat inside; cổng mạng WAN s0/1/0 gõ câu lệnh ip nat ouside.

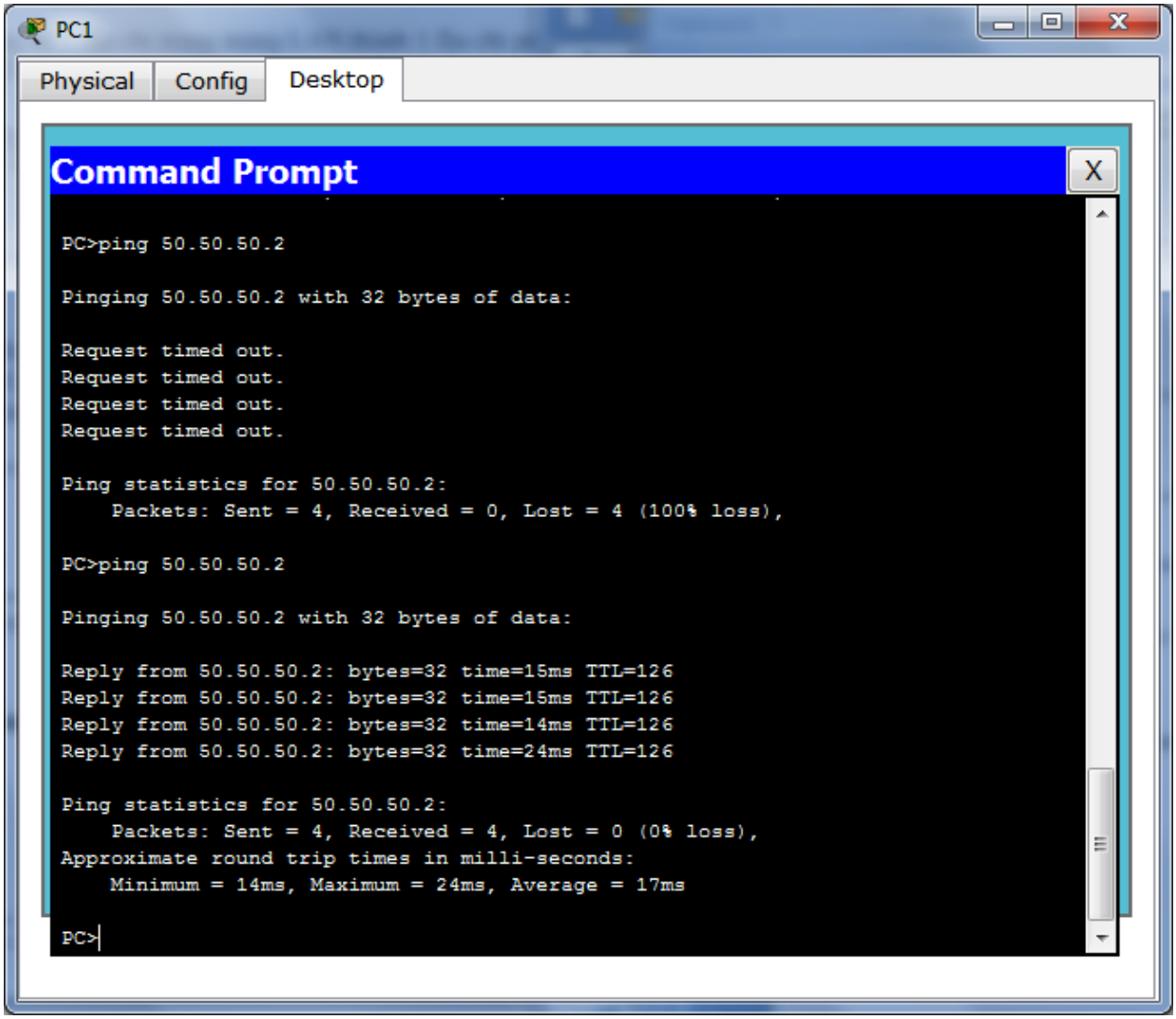


#show ip nat translation

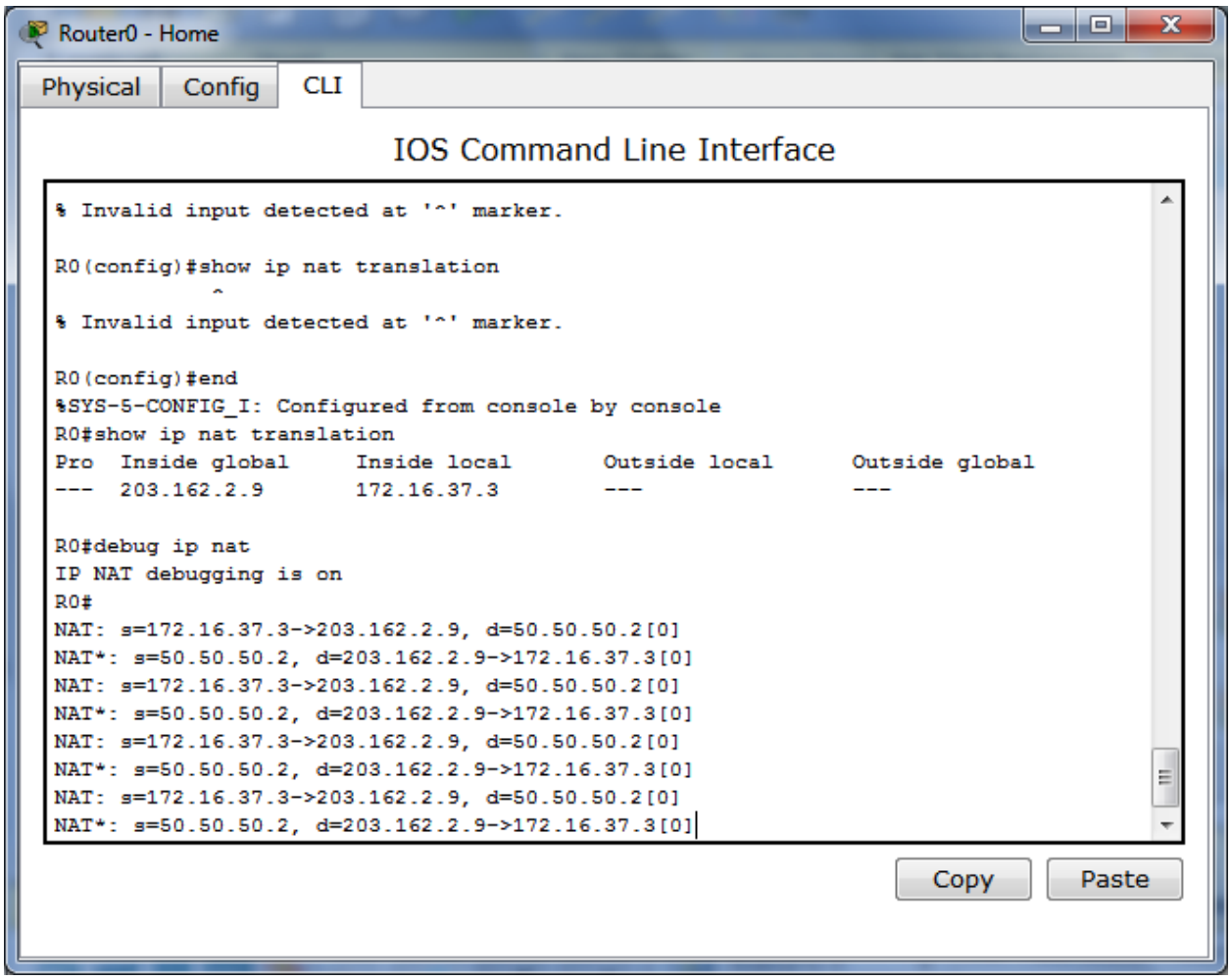


Theo câu lệnh show bên trên, máy tính 172.17.37.3 trước khi ra ngoài sẽ được đổi thành 203.162.2.9

Ta thử ping từ máy tính này ra mạng ngoài :



Bật câu lệnh debug ip nat và ping lại lần nữa, quan sát trên router:



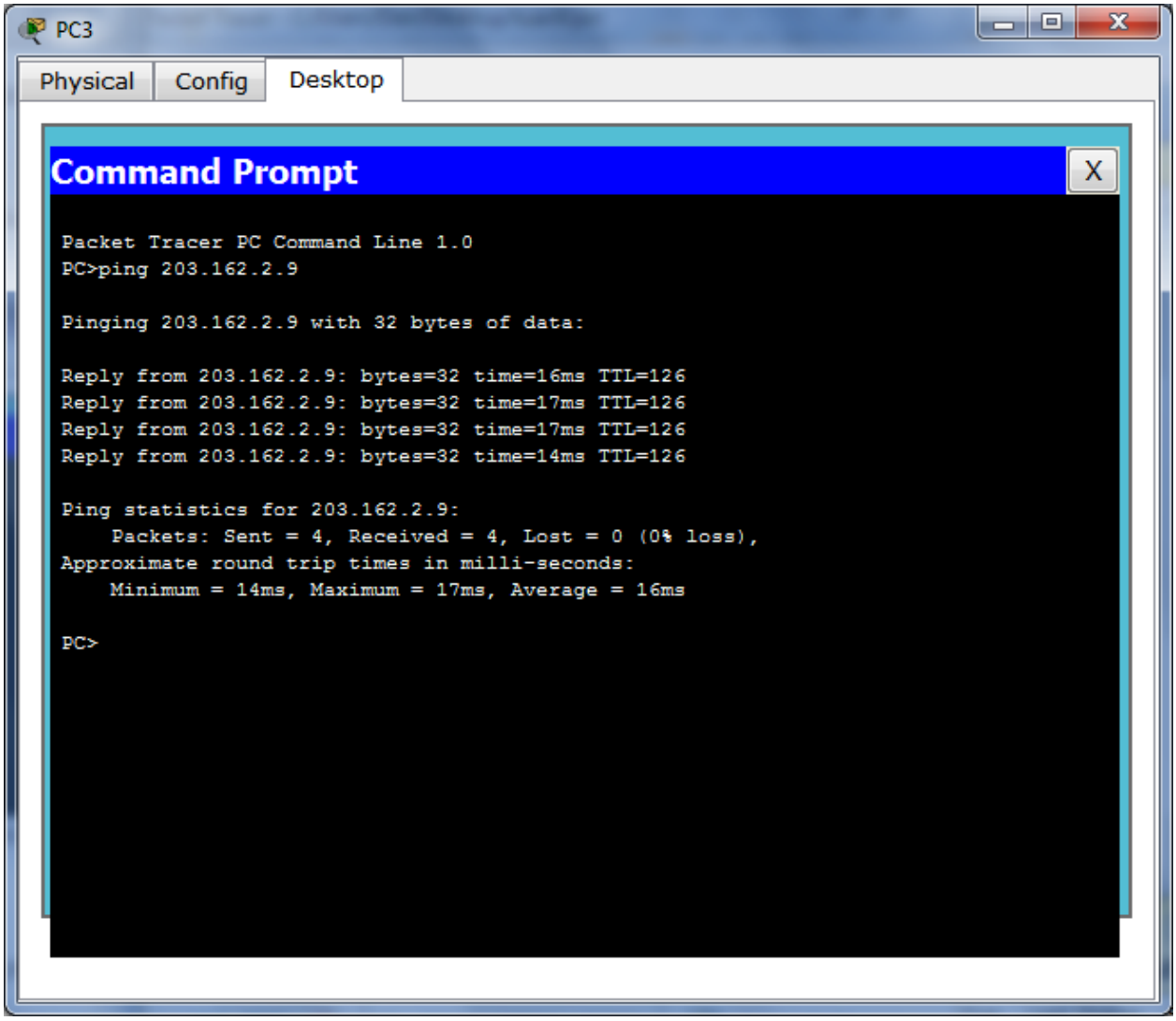
Khi gói tin đi ra ngoài (echo request), source **ip = 172.16.37.3** sẽ được chuyển thành **203.162.2.9**

Khi gói tin đi vào (echo reply), **dest ip = 203.172.2.9** sẽ được chuyển trở lại thành **172.17.37.3** và đưa vào mạng LAN

Lúc này, ISP không hề biết có sự tồn tại của network **172.29.37.0/24**

Từ PC bên ngoài **(50.50.50.2)** cũng dễ dàng liên lạc vào máy tinh trên theo địa chỉ ip **203.162.2.9**

Lúc này, ta có 1 **ánh xạ 1-1** giữa **172.29.37.3 <-> 203.162.2.9**



Loại NAT này không tiết kiệm được địa chỉ public IP, vì 1 địa chỉ private sẽ tương ứng 1 địa chỉ public.

4. NAT động (Dynamic NAT):

NAT tĩnh ta phải tự thiết lập ánh xạ **private <-> public** cho từng cặp

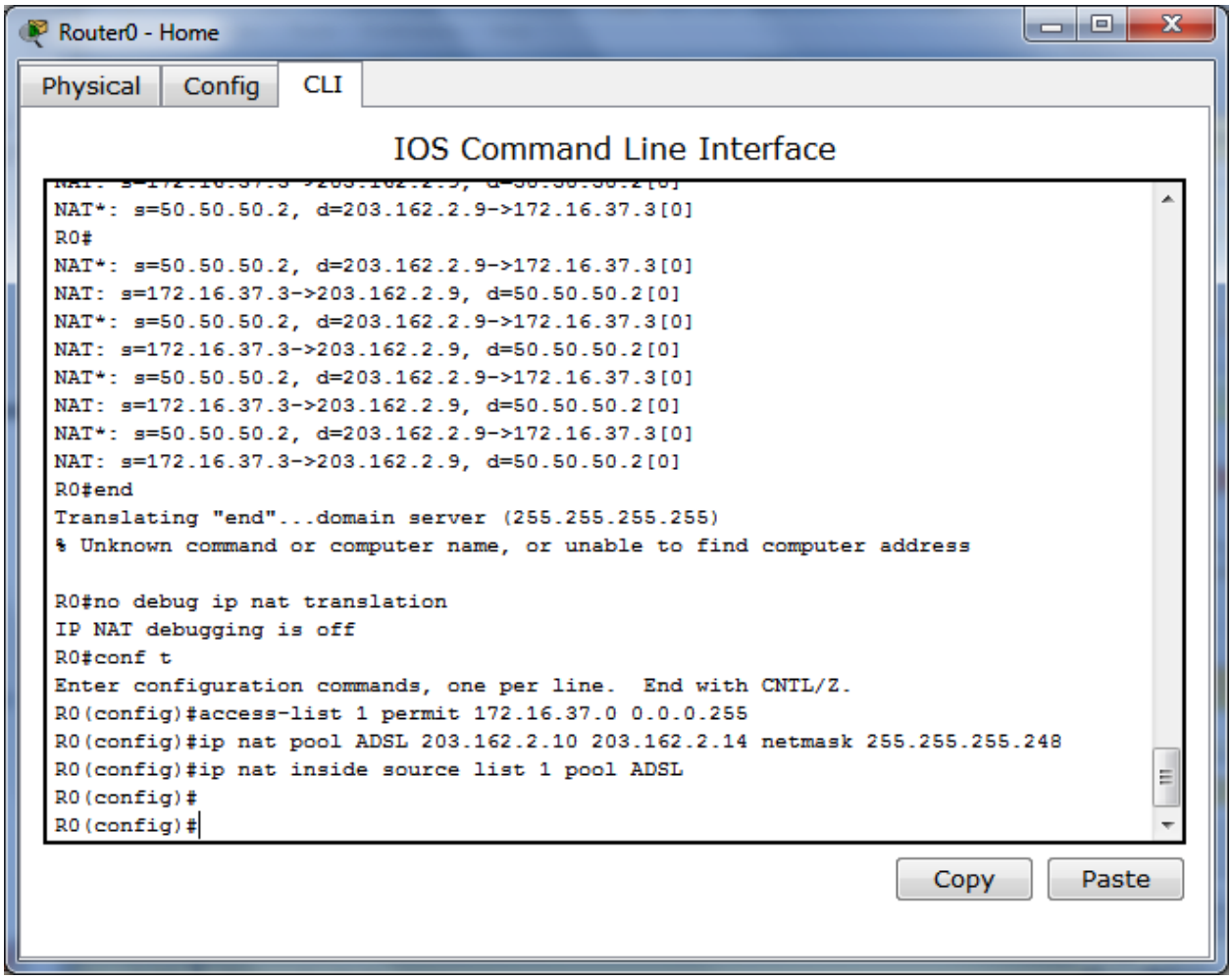
Ta có thể định nghĩa tất cả ip private và tất cả ip public trên router. Khi 1 gói tin private ip đến router, nó sẽ tự lựa 1 địa chỉ public ip còn rãnh để NAT

Cấu hình : Câu lệnh ip nat inside và ip nat outside trên fa0/0 và s0/1/0 vẫn giữ nguyên

- Các địa chị mang LAN cho phép ra ngoài bằng **access-list**

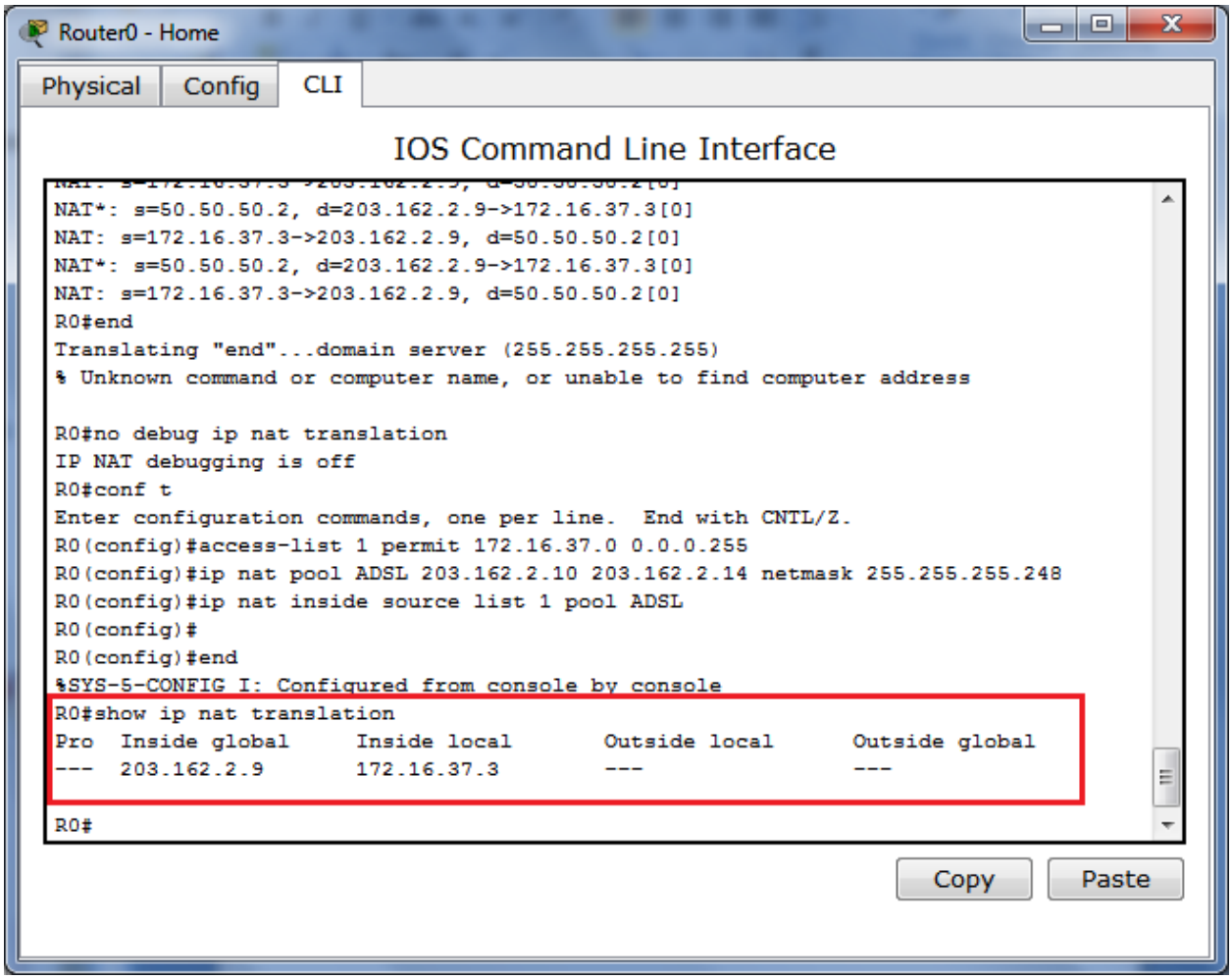
- Các địa chỉ public IP dùng để NAT : câu **lệnh ip nat pool <địa chỉ đầu> <địa chỉ cuối> netmask <subnet mask>**
- Câu lệnh nat : **ip nat inside source list … pool…**

Ví dụ : *Cho phép các máy trong LAN 172.16.37.0/24 ra ngoài internet, các địa chỉ này sẽ được NAT bằng range 203.172.2.14 (địa chỉ 203.162.2.9 đã dùng để NAT tĩnh, mac75 dù ta vẫn có thể dùng lại địa chỉ này).*

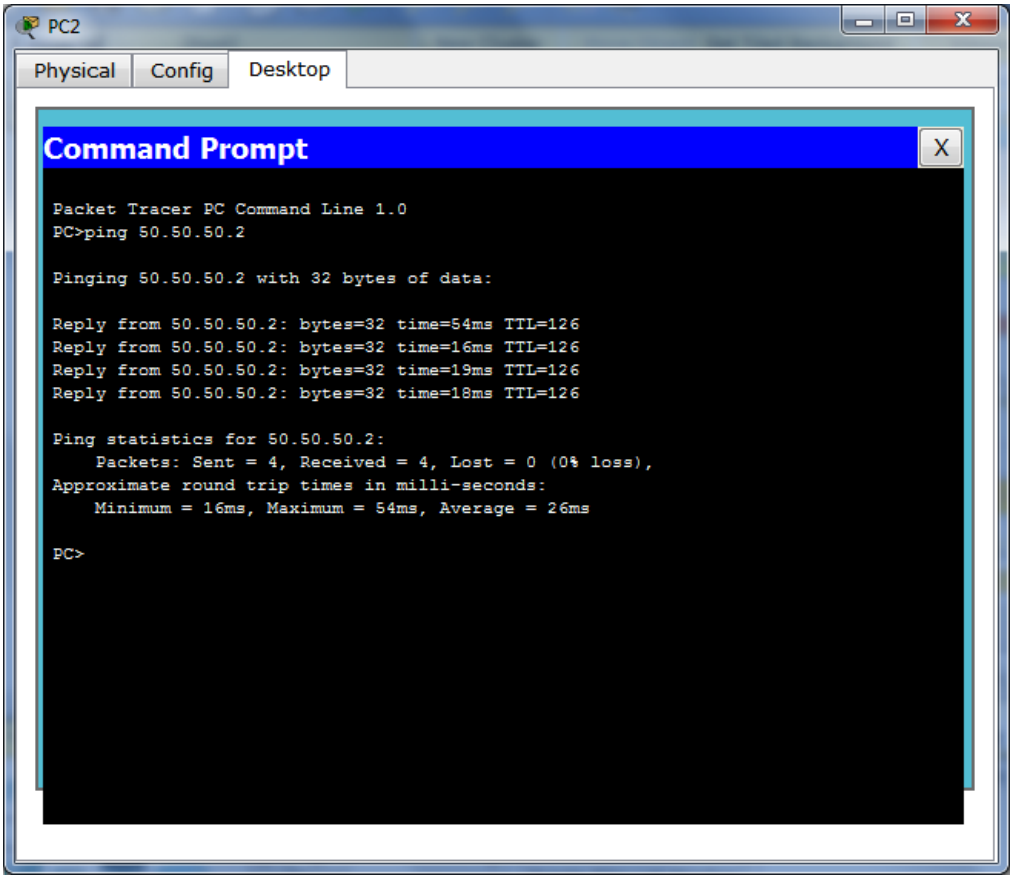


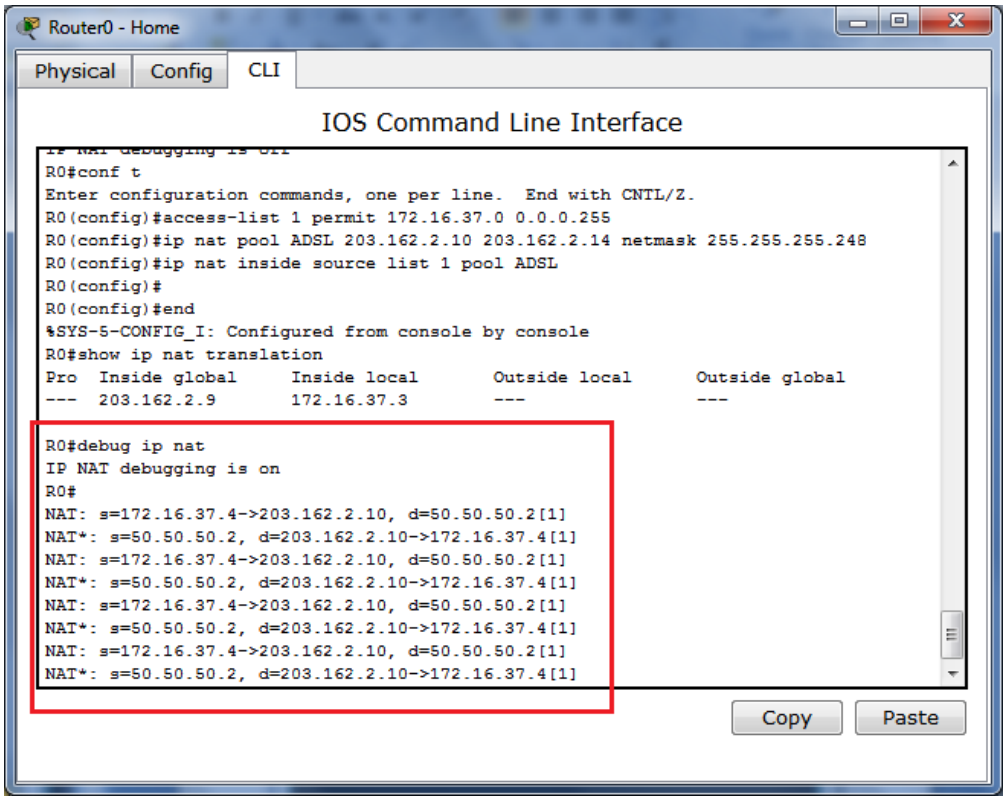
Đặc điểm của dynamic nat :

Khi chưa có gói tin đi ra, quá trình NAT chưa thực thi. Do đó bảng NAT chưa tồn tại các record mới này, chỉ tồn tại record static nat ở bước trước.

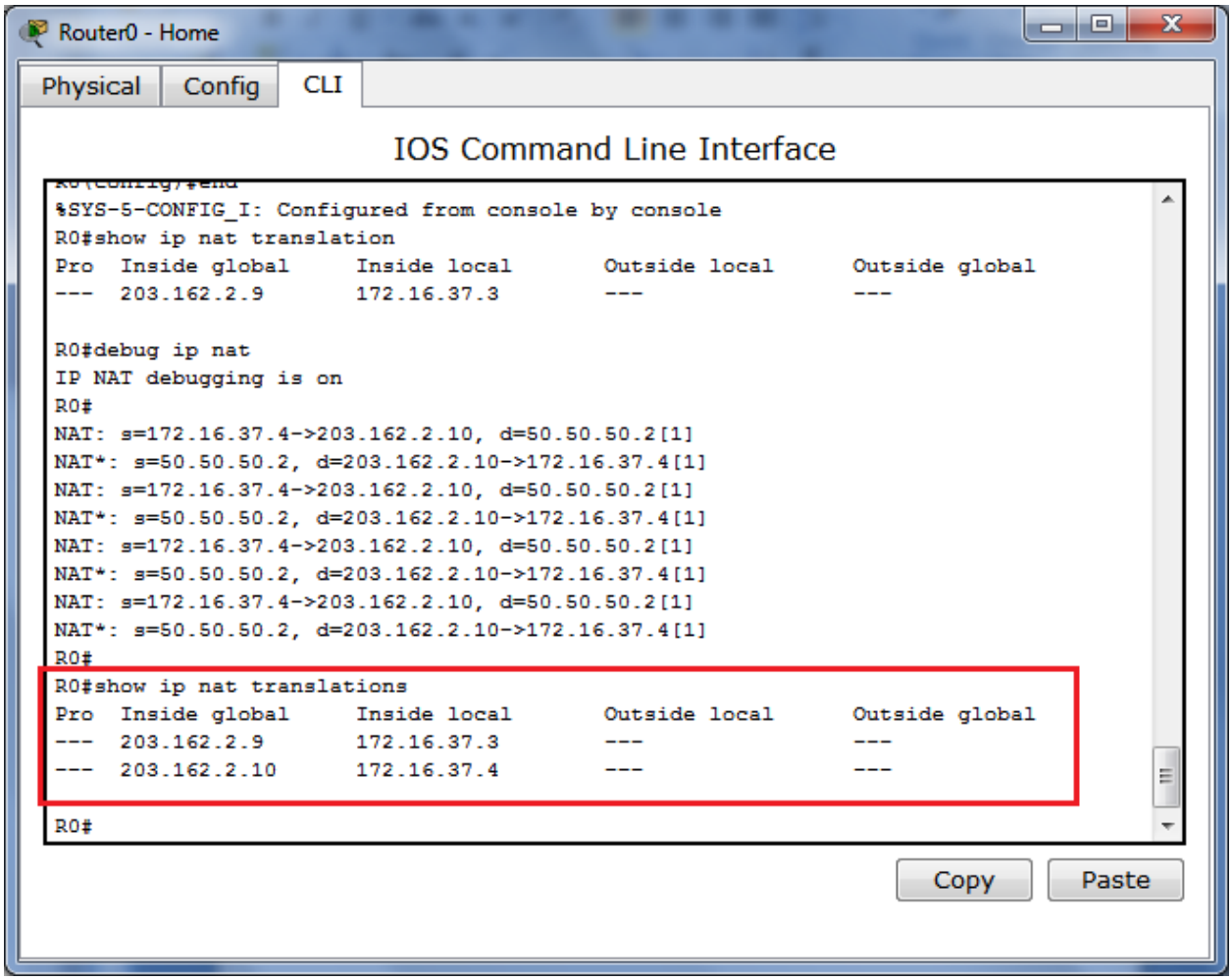


Lấy máy tính 172.16.37.4 ping ra ngoài và debug

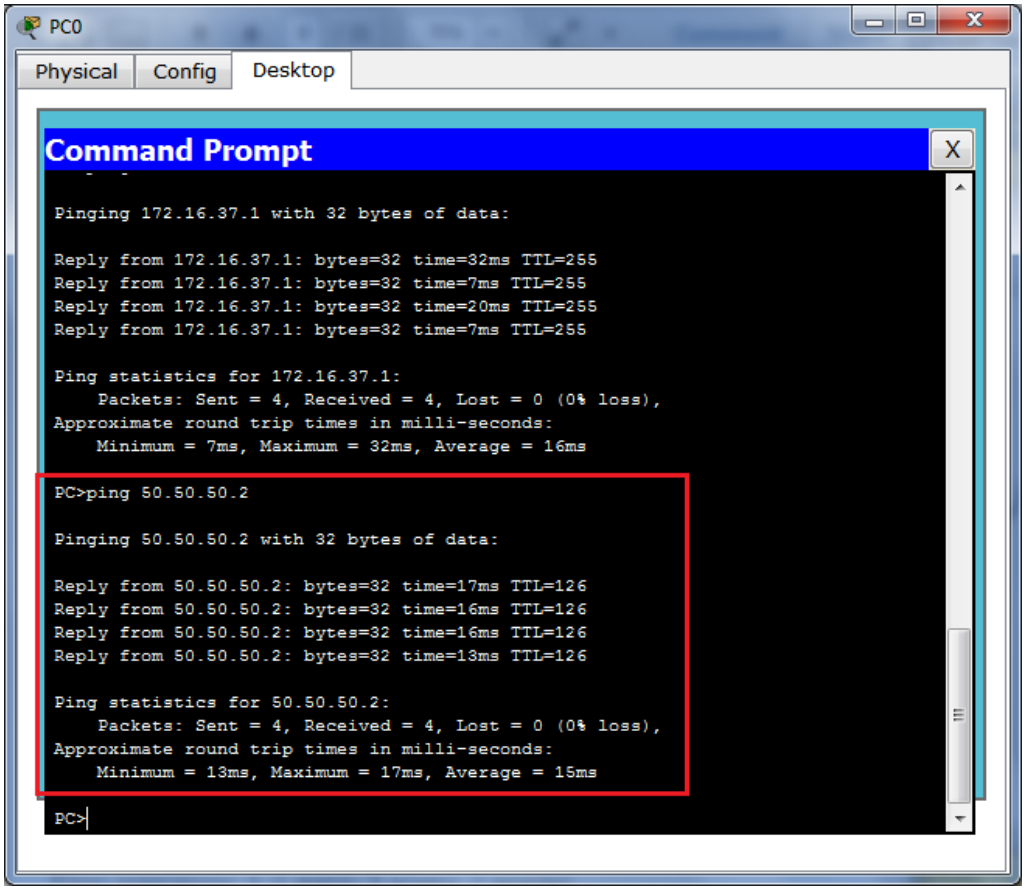

PC2
Physical
Config
Desktop
Command Prompt
X
Packet Tracer PC Command Line 1.0
PC>ping 50.50.50.2
Pinging 50.50.50.2 with 32 bytes of data:
Reply from 50.50.50.2: bytes=32 time=54ms TTL=126
Reply from 50.50.50.2: bytes=32 time=16ms TTL=126
Reply from 50.50.50.2: bytes=32 time=19ms TTL=126
Reply from 50.50.50.2: bytes=32 time=18ms TTL=126
Ping statistics for 50.50.50.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 16ms, Maximum = 54ms, Average = 26ms
PC>

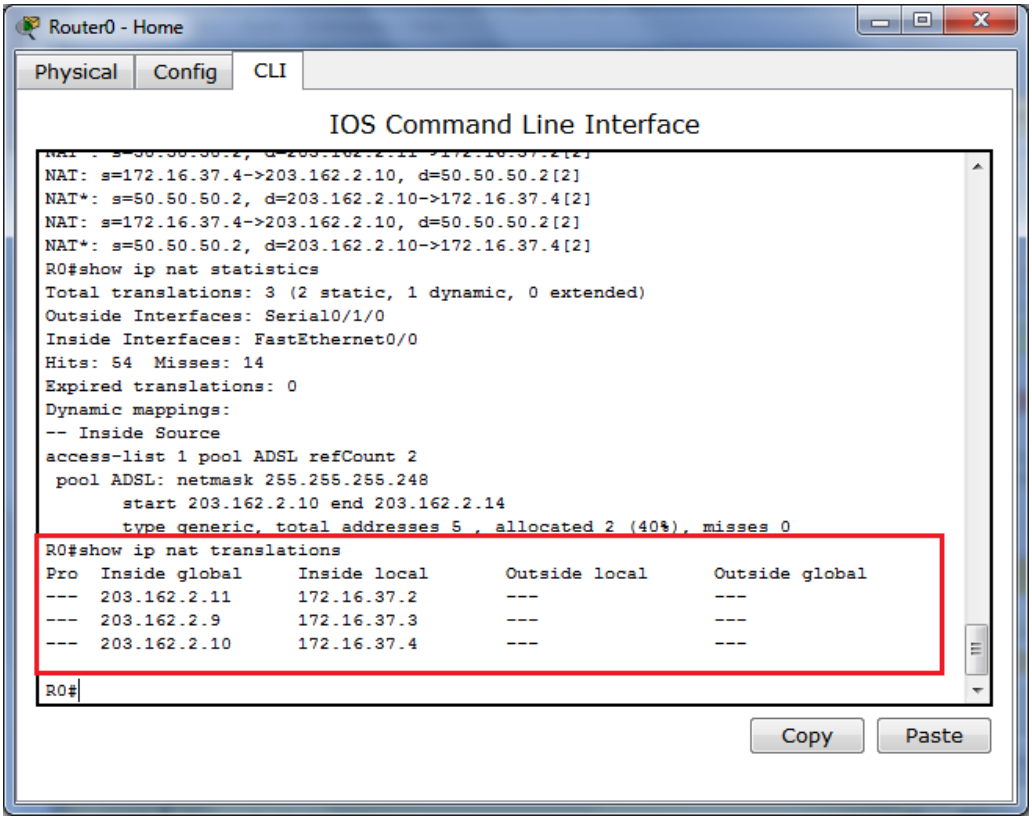

Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
R0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#access-list 1 permit 172.16.37.0 0.0.0.255
R0(config)#ip nat pool ADSL 203.162.2.10 203.162.2.14 netmask 255.255.255.248
R0(config)#ip nat inside source list 1 pool ADSL
R0(config)#
R0(config)#end
%SYS-5-CONFIG_I: Configured from console by console
R0#show ip nat translation
Pro Inside global Inside local Outside local Outside global
--- 203.162.2.9 172.16.37.3 --- ---
R0#debug ip nat
IP NAT debugging is on
R0#
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[1]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[1]
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[1]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[1]
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[1]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[1]
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[1]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[1]
Copy
Paste

Xem lại bảng NAT : Đã tồn tại record này.



Lấy tiếp 1 máy khác, 2 máy ping song song ra mạng ngoài :


PC0
Physical
Config
Desktop
Command Prompt
X
Pinging 172.16.37.1 with 32 bytes of data:
Reply from 172.16.37.1: bytes=32 time=32ms TTL=255
Reply from 172.16.37.1: bytes=32 time=7ms TTL=255
Reply from 172.16.37.1: bytes=32 time=20ms TTL=255
Reply from 172.16.37.1: bytes=32 time=7ms TTL=255
Ping statistics for 172.16.37.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 7ms, Maximum = 32ms, Average = 16ms
PC>ping 50.50.50.2
Pinging 50.50.50.2 with 32 bytes of data:
Reply from 50.50.50.2: bytes=32 time=17ms TTL=126
Reply from 50.50.50.2: bytes=32 time=16ms TTL=126
Reply from 50.50.50.2: bytes=32 time=16ms TTL=126
Reply from 50.50.50.2: bytes=32 time=13ms TTL=126
Ping statistics for 50.50.50.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 13ms, Maximum = 17ms, Average = 15ms
PC>


Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[2]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[2]
NAT: s=172.16.37.4->203.162.2.10, d=50.50.50.2[2]
NAT*: s=50.50.50.2, d=203.162.2.10->172.16.37.4[2]
R0#show ip nat statistics
Total translations: 3 (2 static, 1 dynamic, 0 extended)
Outside Interfaces: Serial0/1/0
Inside Interfaces: FastEthernet0/0
Hits: 54 Misses: 14
Expired translations: 0
Dynamic mappings:
-- Inside Source
access-list 1 pool ADSL refCount 2
pool ADSL: netmask 255.255.255.248
start 203.162.2.10 end 203.162.2.14
type generic, total addresses 5 , allocated 2 (40%), misses 0
R0#show ip nat translations
Pro Inside global Inside local Outside local Outside global
--- 203.162.2.11 172.16.37.2 --- ---
--- 203.162.2.9 172.16.37.3 --- ---
--- 203.162.2.10 172.16.37.4 --- ---
R0#
Copy
Paste

5. NAT overload trên interface :

Ví dụ :

Giả sử router dùng ip 203.162.2.10 để NAT

*Ứng dụng trên máy 172.16.37.4, sử dụng port **10000** (Từ giờ về sau sẽ viết là 172.16.37.4:10000) khi đến Router sẽ được NAT thành 203.162.2.10:**10000** và ra internet.*

*Cùng lúc đó, gói tin 172.16.37.5:**10001** đến router sẽ được NAT thành 203.162.2.10:10001 để ra internet.*

Khi có gói tin từ internet trả về router, router sẽ xem xét Destination port: nếu là 203.162.2.10:10000 sẽ chuyển thành 172.16.37.4:10000 và trả về mạng LAN; nếu là 203.162.2.10:10001 sẽ chuyển thành 172.16.37.5:10001 và trả về mạng LAN.

Với cách thức này, dù chỉ dùng 1 địa chỉ public IP router có thể NAT được cùng lúc cho nhiêu máy khác nhau.

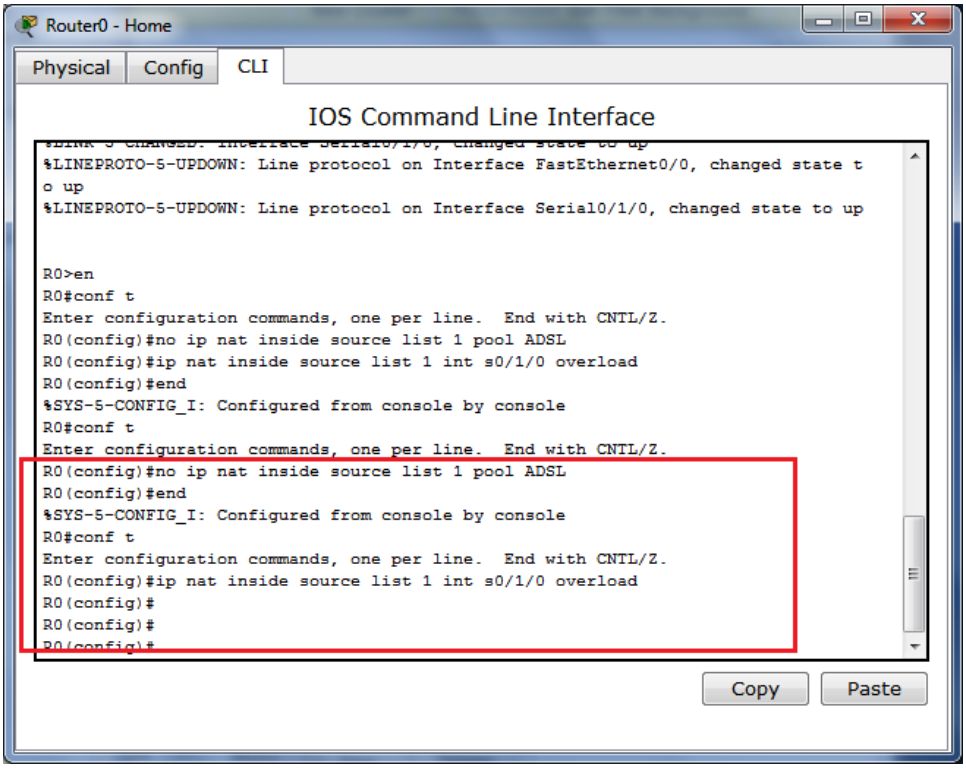
Port trong hệ thống mạng là số 2 byte : 0> 65535

Cấu hình :

Trước hết ta tắt tính năng NAT dynamic ở bước trước

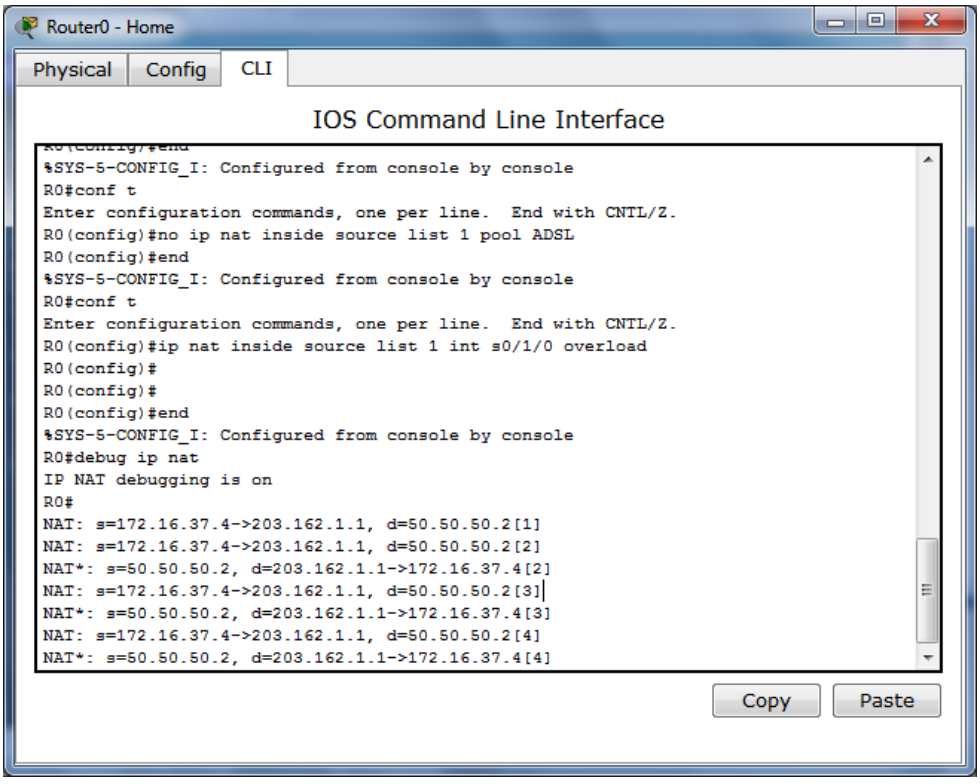
(config)# no ip nat inside source list 1 pool ADSL

Sau đó cấu hình câu lệnh nat overload:

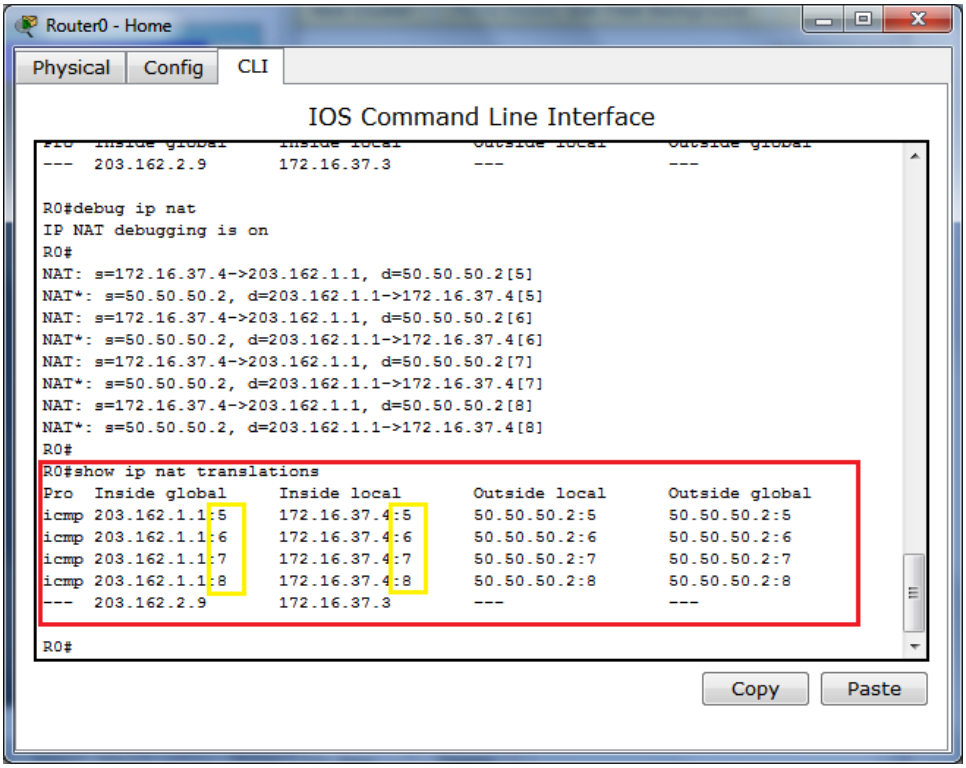


Ping từ máy 172.16.37.4 và kiểm tra :

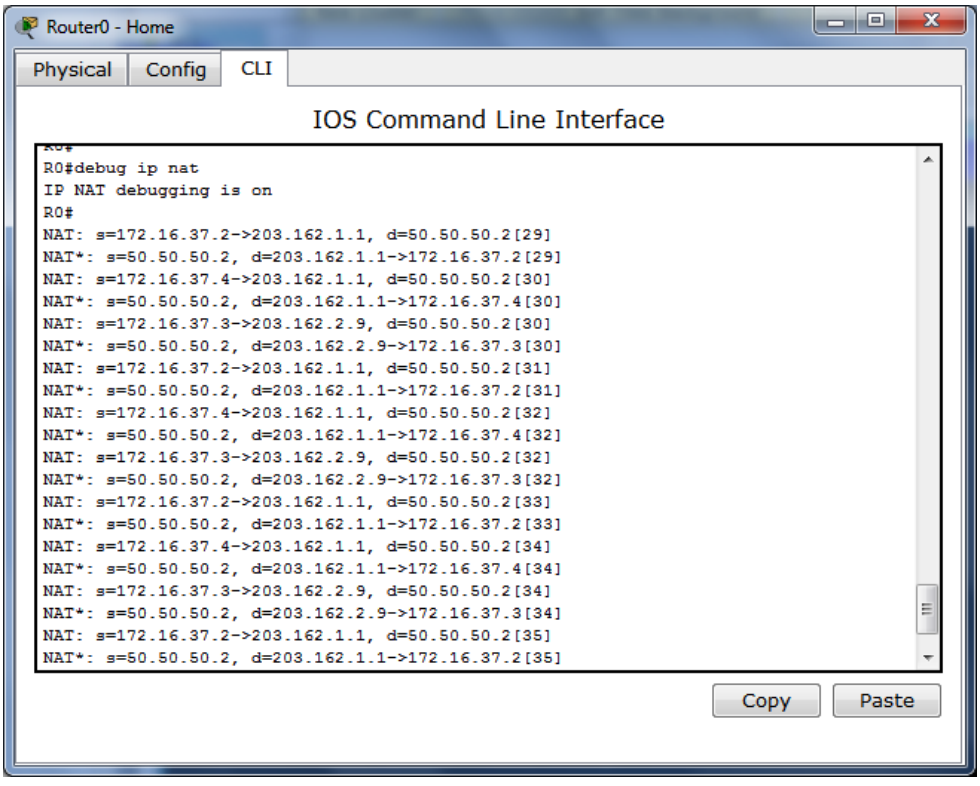
Debug:



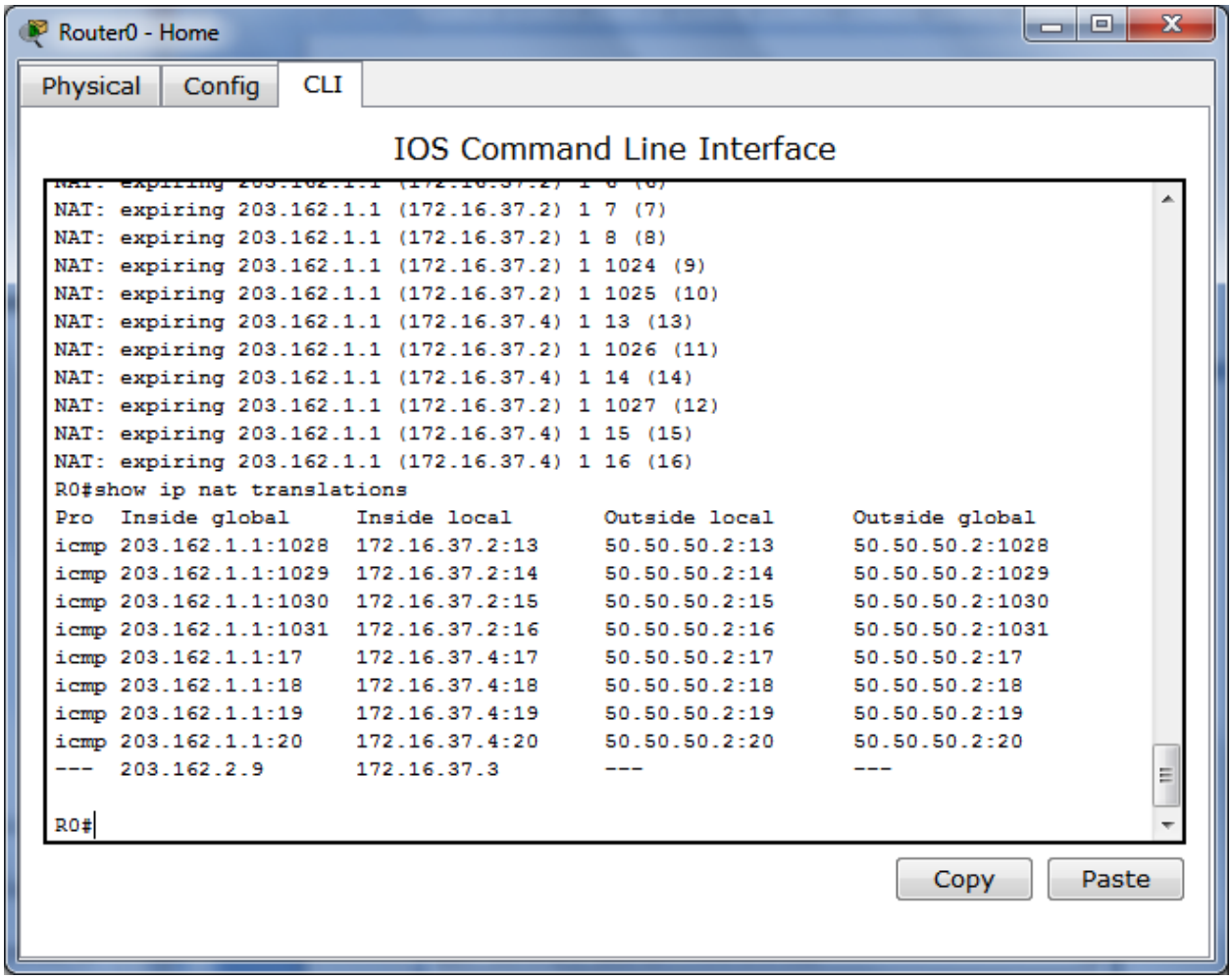
Bảng nat : Có thêm port cụ thể



Ping từ nhiều máy ra ngoài :

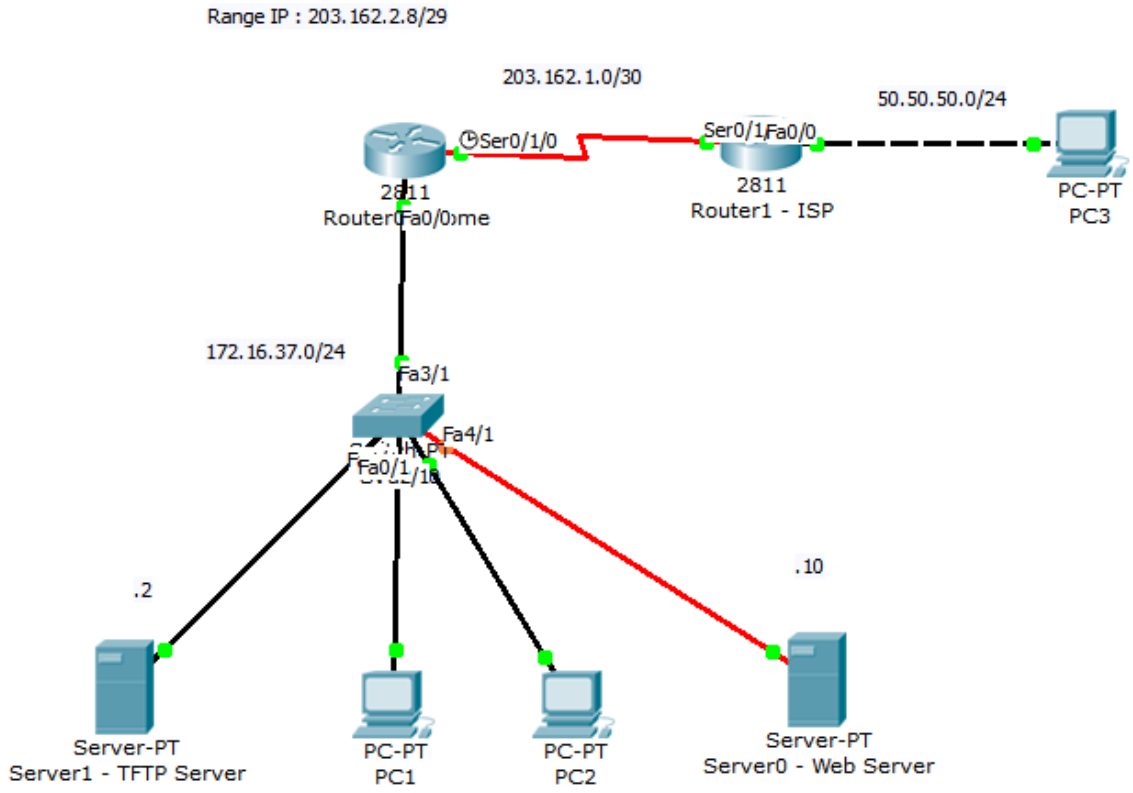


Bảng NAT :



6. Static NAT + Port :

Thay đổi mô hình thành như sau :

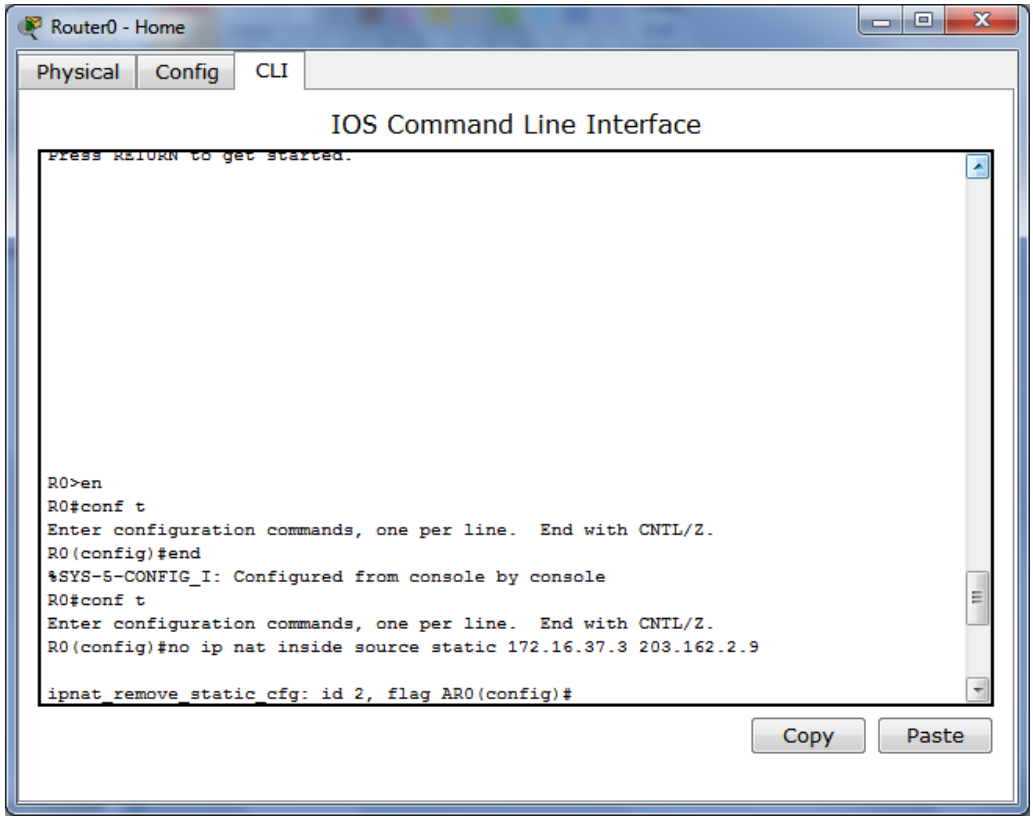


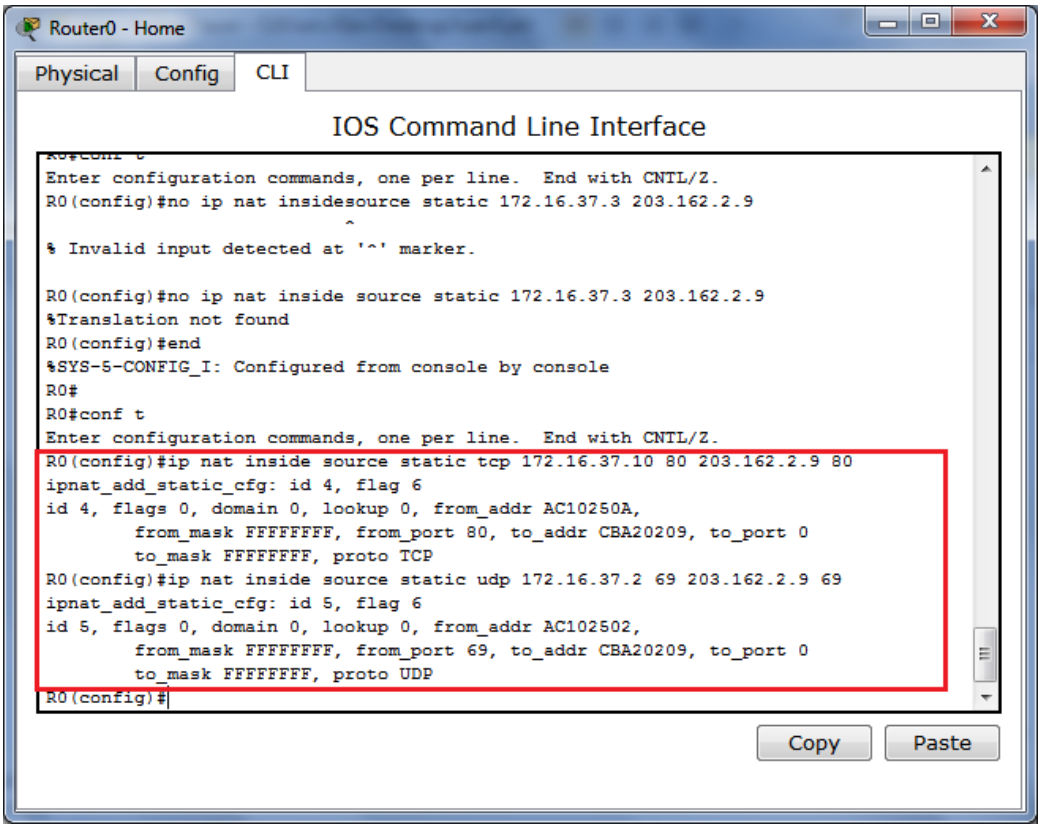
Ví dụ : *Dịch vụ http (tcp:80) nằm trên máy tính 172.16.37.10 (udp : 69) nằm ở máy tính 172.16.37.2.*

Ta có thể NAT 2 server này thành cùng địa chỉ IP 203.162.2.9

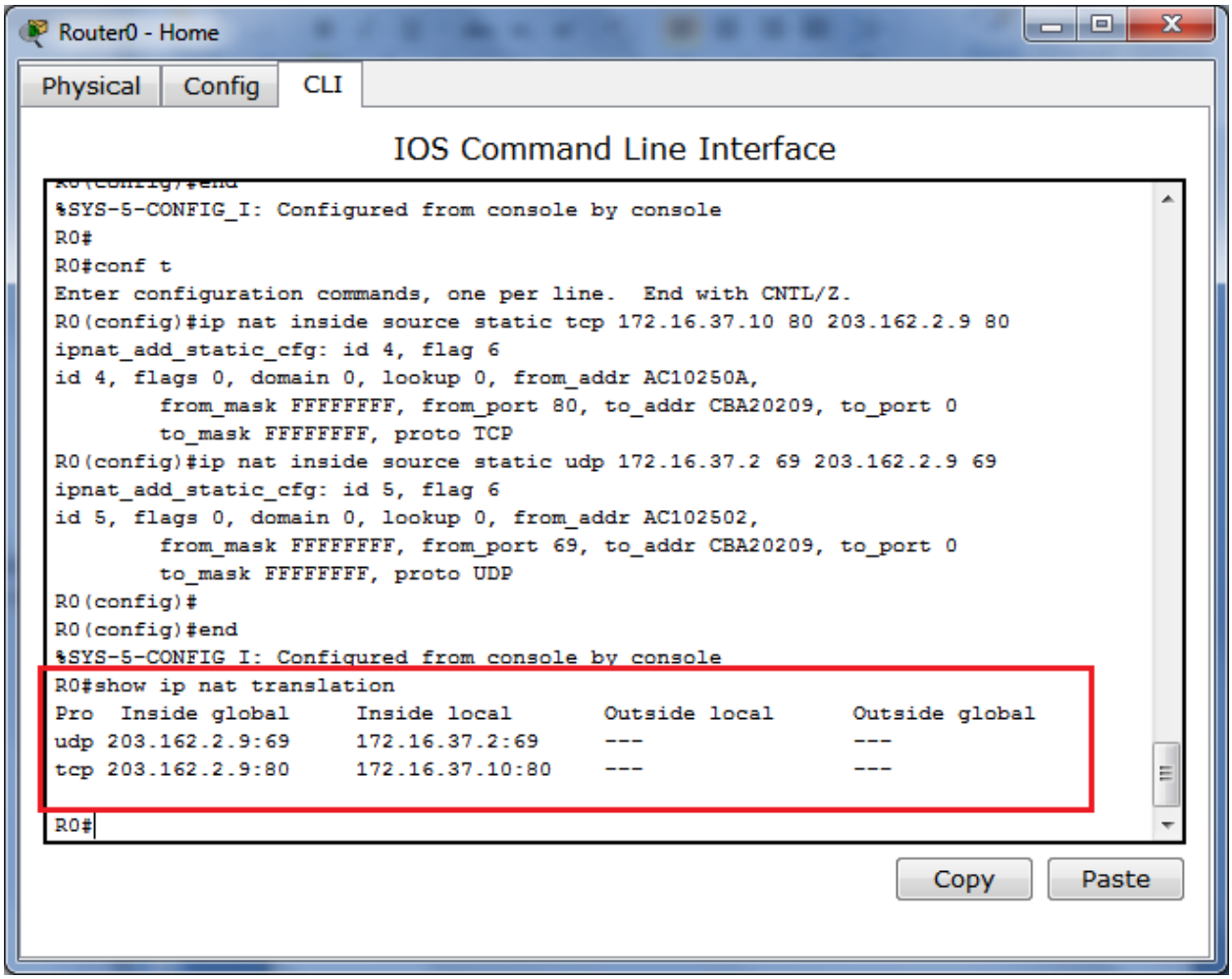
Cấu hình :

Trước hết bỏ câu lệnh static nat đã cấu hình ở mục 1.


Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
Press RETURN to get started.
R0>en
R0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#end
%SYS-5-CONFIG_I: Configured from console by console
R0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#no ip nat inside source static 172.16.37.3 203.162.2.9
ipnat_remove_static_cfg: id 2, flag AR0(config)#
Copy
Paste

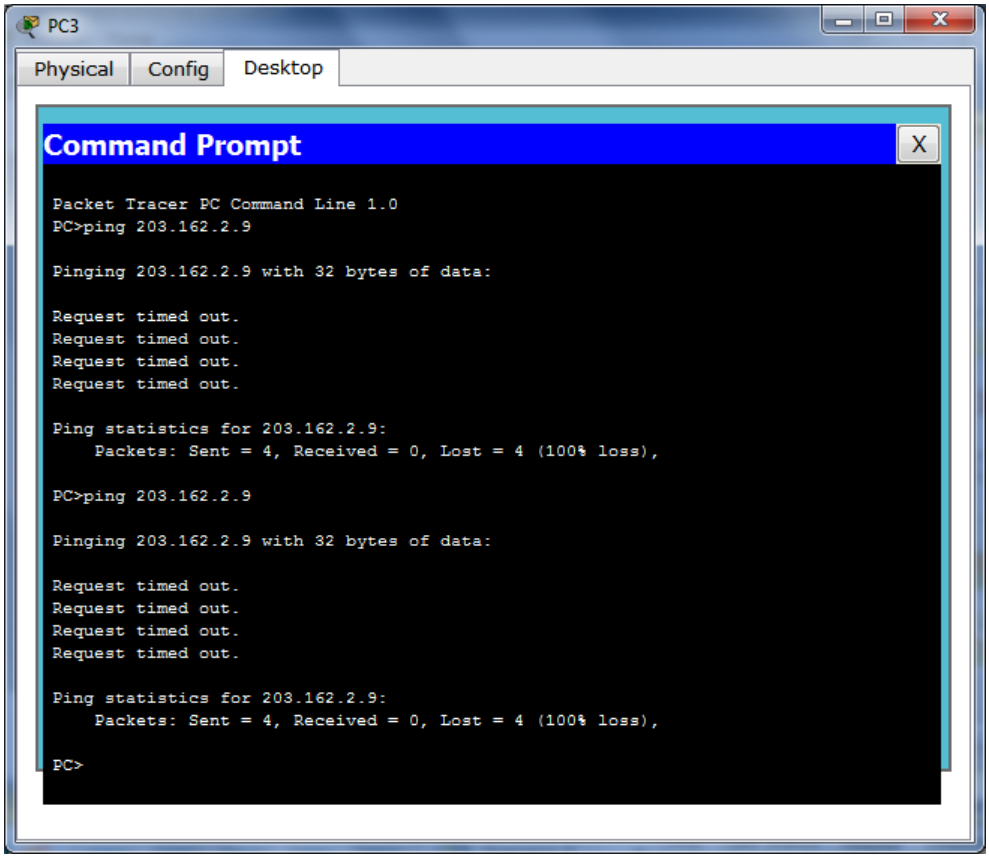

Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#no ip nat insidesource static 172.16.37.3 203.162.2.9
% Invalid input detected at '^' marker.
R0(config)#no ip nat inside source static 172.16.37.3 203.162.2.9
%Translation not found
R0(config)#end
%SYS-5-CONFIG_I: Configured from console by console
R0#
R0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R0(config)#ip nat inside source static tcp 172.16.37.10 80 203.162.2.9 80
ipnat_add_static_cfg: id 4, flag 6
id 4, flags 0, domain 0, lookup 0, from_addr AC10250A,
from_mask FFFFFFFF, from_port 80, to_addr CBA20209, to_port 0
to_mask FFFFFFFF, proto TCP
R0(config)#ip nat inside source static udp 172.16.37.2 69 203.162.2.9 69
ipnat_add_static_cfg: id 5, flag 6
id 5, flags 0, domain 0, lookup 0, from_addr AC102502,
from_mask FFFFFFFF, from_port 69, to_addr CBA20209, to_port 0
to_mask FFFFFFFF, proto UDP
R0(config)#
Copy
Paste

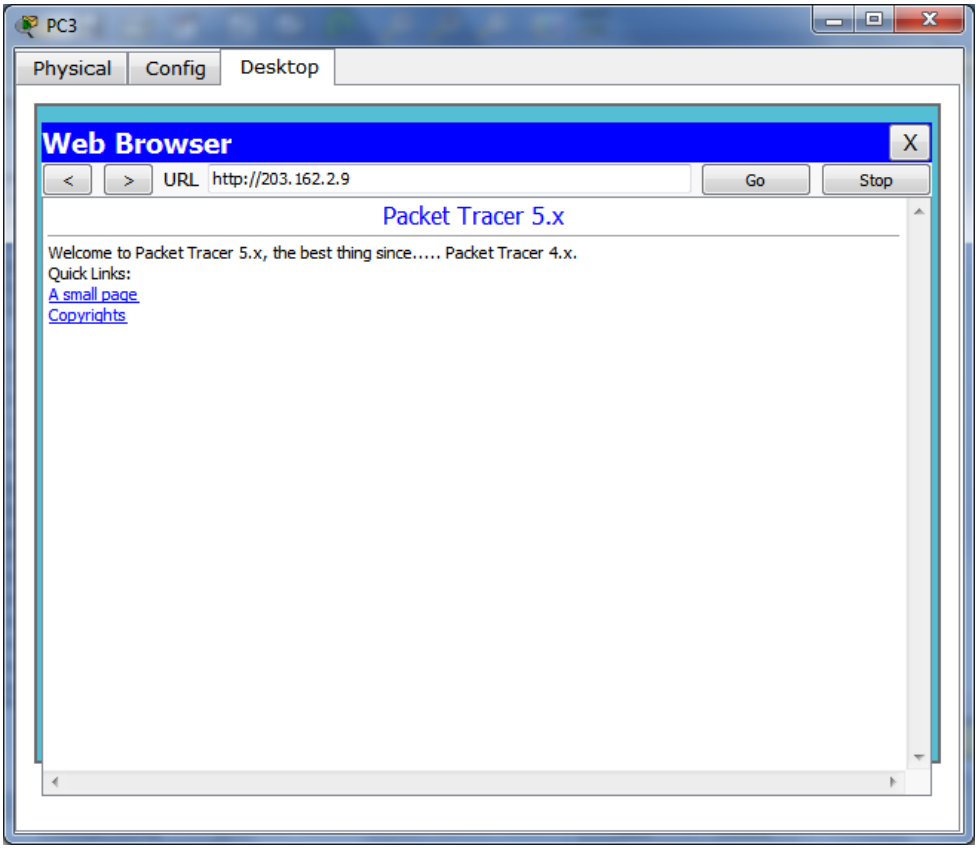
Bảng NAT :

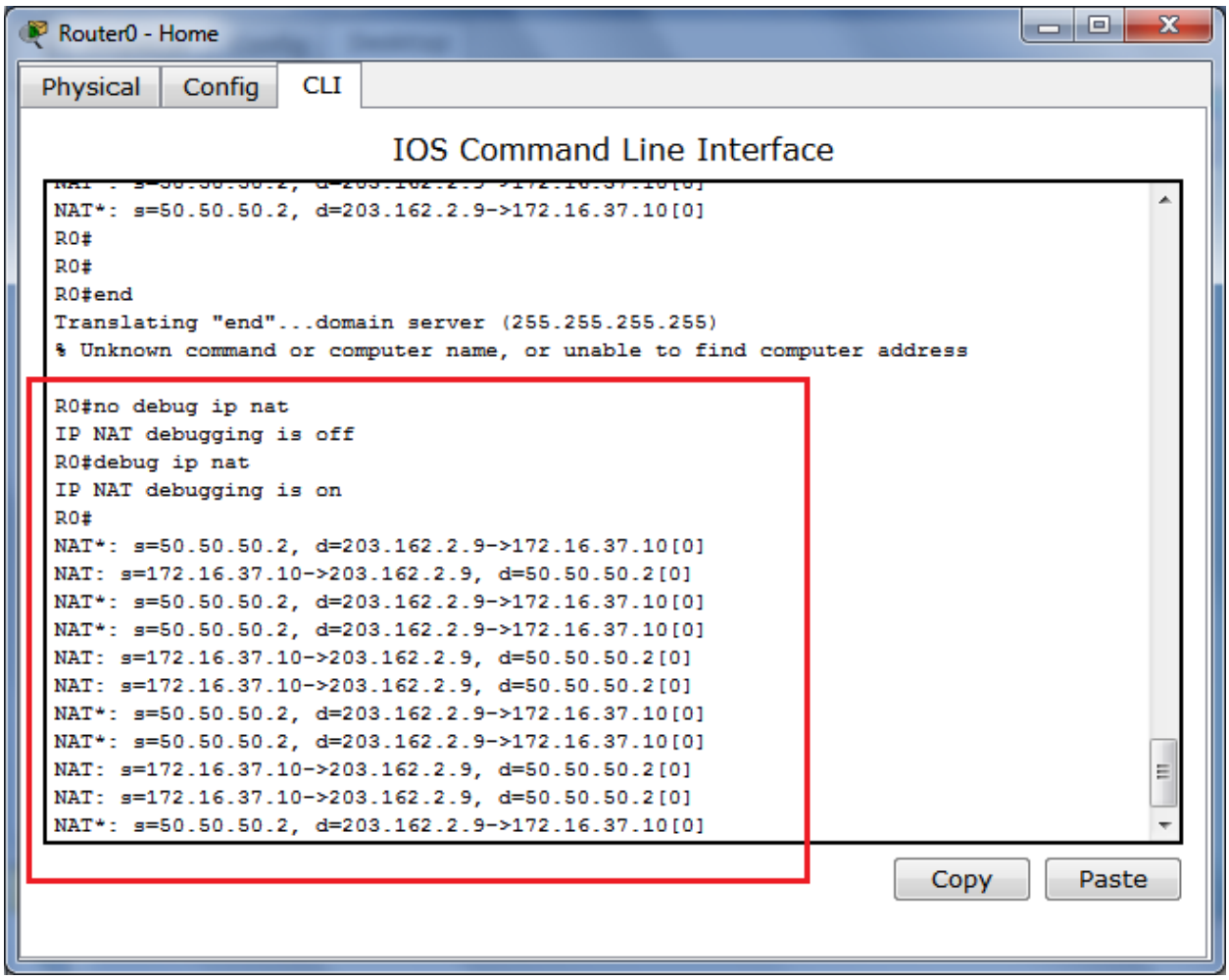


Kiểm tra :

Truy xuất thử web server trên máy 172.16.37.10


PC3
Physical
Config
Desktop
Command Prompt
X
Packet Tracer PC Command Line 1.0
PC>ping 203.162.2.9
Pinging 203.162.2.9 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 203.162.2.9:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 203.162.2.9
Pinging 203.162.2.9 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 203.162.2.9:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>


PC3
Physical
Config
Desktop
Web Browser
X
<
>
URL
http://203.162.2.9
Go
Stop
Packet Tracer 5.x
Welcome to Packet Tracer 5.x, the best thing since..... Packet Tracer 4.x.
Quick Links:
A small page
Copyrights


Router0 - Home
Physical
Config
CLI
IOS Command Line Interface
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
R0#
R0#
R0#end
Translating "end"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address
R0#no debug ip nat
IP NAT debugging is off
R0#debug ip nat
IP NAT debugging is on
R0#
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
NAT: s=172.16.37.10->203.162.2.9, d=50.50.50.2[0]
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
NAT: s=172.16.37.10->203.162.2.9, d=50.50.50.2[0]
NAT: s=172.16.37.10->203.162.2.9, d=50.50.50.2[0]
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
NAT: s=172.16.37.10->203.162.2.9, d=50.50.50.2[0]
NAT: s=172.16.37.10->203.162.2.9, d=50.50.50.2[0]
NAT*: s=50.50.50.2, d=203.162.2.9->172.16.37.10[0]
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