Student notes for

David Bombal's

Packet Tracer Labs Course

David Bombal

THANK YOU!

These student notes have been kindly shared by @DJninjaNZ

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These are not official student notes and are not officially supported, but are shared with the hope that they will help you with your CCNA studies.

If you want to share your notes with others on the course, please submit them to sales@ConfigureTerminal.com and we will review them for addition to the course.

Remember: You will probably learn more by making notes like these and sharing them for the benefit of others.

All the best!

David Bombal

DISCLAIMER:

Contents

Brief

This lab is for configuring Network Address Translation there is a total of 3 labs so we can see the operation of all 3 modes of NAT.

Lab requirements

Configure the network as follows:

Part 1: PAT

1. Configure the router to get an IP address via DHCP from your ISP
2. Configure the router to allocate IP addresses via DHCP to clients in your network:
    a. Network = 10.1.1.0/24
    b. Default Gateway = 10.1.1.254
    c. DNS = 8.8.8.8
3. Configure the router so internal hosts can access the internet servers using PAT (router IP address)

Part 2: Static NAT

1. Outside = 8.8.8.100/24
2. Inside = 10.1.1.254/24
3. Default Route to 8.8.8.8
4. Configure static NAT so that the outside PC can access the internal HTTP, FTP servers.
    a. HTTP = 8.8.8.200 (NAT only the required port). DNS = myhttp.com
    b. FTP = 8.8.8.201 (full static NAT). DNS = myftp.com
5. Verify that both the inside and the outside PCs can access the internal servers.
    a. Inside host to use internal IP addresses
    b. Outside host to use DNS names

3: Dynamic / STATIC NAT

1. Outside = 8.8.8.100/24
2. Inside = 10.1.1.254/24
3. Default Route to 8.8.8.8
4. Configure static NAT so that the outside PC can access the internal HTTP, FTP servers.
    a. HTTP = 8.8.8.200 (NAT only the required port). DNS = myhttp.com
    b. FTP = 8.8.8.201 (full static NAT). DNS = myftp.com
5. Configure Dynamic NAT using Router IP address so that internal PCs can access the Internet servers
    a. Verify that the outside PC can access the internal servers using the server DNS names.
    b. Verify that the internal PCs can access the internet servers using their DNS names.

Network Address Translation

Network Address Translation was invented to extend the life of public IPv4 addressing, as a growing demand for internet access and a limited amount of public IPv4 addresses forced to have a mechanism to conserve public IPs. NAT is used to convert private IP addresses to public IP addresses. For internal networks using RFC 1918 defining 10.0.0.0 -10.255.255.255 , 172.16.0.0 – 172.31.255.255 and 192.168.0.0 – 192.168.255.255. These IP addressing ranges are only used internally for devices to have an address that routers can send packets to.

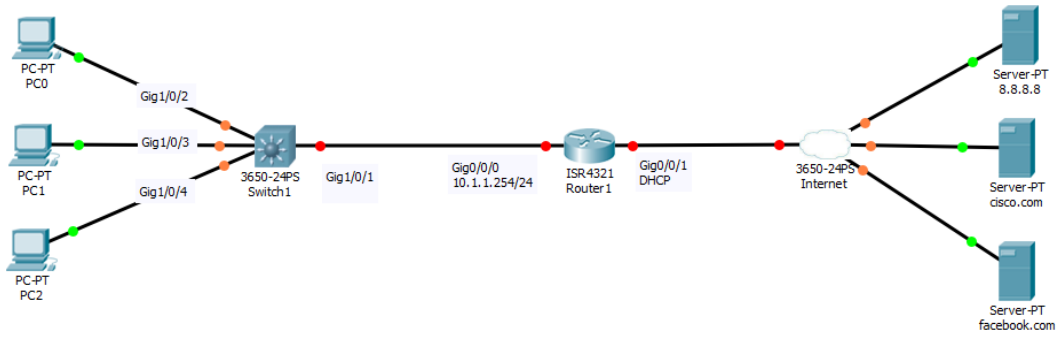
Types of NAT

Static – One to one addressing per private IP address to global IP address.

Dynamic – Many-to-many addressing mapping between local and global addresses

PAT – Port address translation Many-to-one mapping between local and global addresses. Also known as NAT overloading adding port numbers individual to connections from multiple devices generated by the router.

Lab 1 Topology



Here we have a Router connected to a layer 3 switches with 3 separate PCs attached. We want to configure PAT to the host machines to access the internet. There is also some DHCP configuration.

Configurations and Verification

NAT Lab 1
Router Hostname router1 ! interface GigabitEthernet0/0/1 ip address dhcp ip nat outside ! interface GigabitEthernet0/0/0 ip add 10.1.1.254 255.255.255.0 ip nat inside ! ip dhcp excluded-address 10.1.1.250 10.1.1.254 ! ip dhcp pool nat network 10.1.1.0 255.255.255.0 default-router 10.1.1.254 dns-server 8.8.8.8 ! access-list 1 permit any //real world will want to configure this to only inside addresses ! ip nat inside source list 1 interface GigabitEthernet0/0/1 **overload**//required for PAT !
Verification **DHCP** **Router1#show ip dhcp binding** IP address Client-ID/ Lease expiration Type Hardware address 10.1.1.2 0007.EC6A.6ECE -- Automatic 10.1.1.3 000A.4186.291A -- Automatic 10.1.1.1 0009.7C78.31BE – Automatic **Router1#show ip dhcp pool** Pool nat :

Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 254
Leased addresses : 3
Excluded addresses : 1
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total

10.1.1.1 10.1.1.1 - 10.1.1.254 3 / 1 / 254

Generate traffic

PC0 PC1 PC2

Ping 8.8.8.8 / cisco.com / facebook.com

Web browser access cisco.com / facebook.com

Router1#show ip nat translations
Pro Inside global Inside local Outside local Outside global
icmp 8.8.8.100:1024 10.1.1.3:1 8.8.8.9:1 8.8.8.9:1024
icmp 8.8.8.100:1025 10.1.1.2:2 8.8.8.9:2 8.8.8.9:1025
icmp 8.8.8.100:1026 10.1.1.2:3 8.8.8.9:3 8.8.8.9:1026
icmp 8.8.8.100:1027 10.1.1.2:4 8.8.8.9:4 8.8.8.9:1027
icmp 8.8.8.100:1028 10.1.1.1:1 8.8.8.9:1 8.8.8.9:1028
icmp 8.8.8.100:1029 10.1.1.1:2 8.8.8.9:2 8.8.8.9:1029
icmp 8.8.8.100:1030 10.1.1.1:3 8.8.8.9:3 8.8.8.9:1030
icmp 8.8.8.100:1031 10.1.1.1:4 8.8.8.9:4 8.8.8.9:1031
icmp 8.8.8.100:1 10.1.1.2:1 8.8.8.9:1 8.8.8.9:1
icmp 8.8.8.100:2 10.1.1.3:2 8.8.8.9:2 8.8.8.9:2
icmp 8.8.8.100:3 10.1.1.3:3 8.8.8.9:3 8.8.8.9:3
icmp 8.8.8.100:4 10.1.1.3:4 8.8.8.9:4 8.8.8.9:4
icmp 8.8.8.100:5 10.1.1.2:5 8.8.8.9:5 8.8.8.9:5
icmp 8.8.8.100:6 10.1.1.2:6 8.8.8.8:6 8.8.8.8:6
icmp 8.8.8.100:7 10.1.1.2:7 8.8.8.8:7 8.8.8.8:7
icmp 8.8.8.100:8 10.1.1.2:8 8.8.8.8:8 8.8.8.8:8
icmp 8.8.8.100:9 10.1.1.2:9 8.8.8.8:9 8.8.8.8:9
udp 8.8.8.100:1024 10.1.1.3:1025 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1025 10.1.1.2:1025 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1026 10.1.1.2:1026 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1027 10.1.1.1:1027 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1028 10.1.1.1:1026 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1029 10.1.1.2:1027 8.8.8.8:53 8.8.8.8:53
udp 8.8.8.100:1030 10.1.1.2:1028 8.8.8.8:53 8.8.8.8:53
tcp 8.8.8.100:1024 10.1.1.2:1025 8.8.8.9:80 8.8.8.9:80
tcp 8.8.8.100:1025 10.1.1.1:1025 8.8.8.10:80 8.8.8.10:80
tcp 8.8.8.100:1026 10.1.1.1:1026 8.8.8.10:80 8.8.8.10:80
tcp 8.8.8.100:1027 10.1.1.2:1026 8.8.8.9:80 8.8.8.9:80

Router1#show ip nat statistics

Total translations: 11 (0 static, 11 dynamic, 11 extended)
Outside Interfaces: GigabitEthernet0/0/1
Inside Interfaces: GigabitEthernet0/0/0
Hits: 518 Misses: 31
Expired translations: 17
Dynamic mappings:

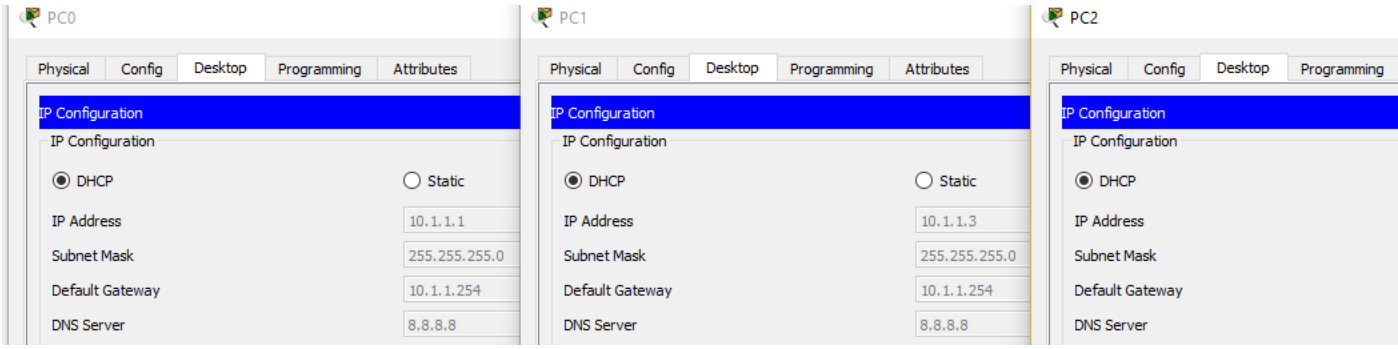
Router1#show ip access-lists

Standard IP access list 1
10 permit any (58 match(es))

Table 1

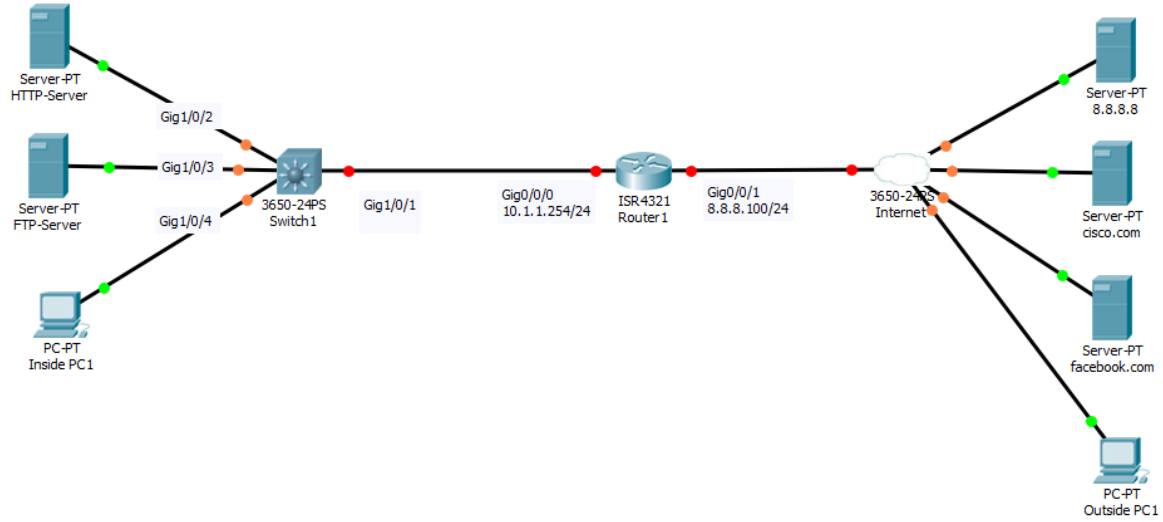
Note: you need to assign DHCP to g0/0/1

Note2: assign correct inside / outside interfaces



We can see the PCs have been assigned DHCP IP addresses with a default gateway and DNS server all from the DHCP configuration. From cmd you may need to use **ipconfig** and then **ipconfig /renew**

Lab 2 Topology



Here we have a Router connected to a layer 3 switches with multiple servers and a PC for inside and outside.

Configurations and Verification

NAT LAB 2

ISR

```
!
interface GigabitEthernet0/0/0
ip address 10.1.1.254 255.255.255.0
ip nat inside
!
interface GigabitEthernet0/0/1
ip address 8.8.8.100 255.255.255.0
ip nat outside
!
ip nat inside source static tcp 10.1.1.100 80 8.8.8.200 80  //HTTP
ip nat inside source static tcp 10.1.1.100 443 8.8.8.200 443 //HTTPS
ip nat inside source static 10.1.1.101 8.8.8.201  //FTP
```

ip classless
ip route 0.0.0.0 0.0.0.0 8.8.8.8
!

Verification

Router1#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 8.8.8.8 to network 0.0.0.0

8.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 8.8.8.0/24 is directly connected, GigabitEthernet0/0/1
L 8.8.8.100/32 is directly connected, GigabitEthernet0/0/1
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 10.1.1.0/24 is directly connected, GigabitEthernet0/0/0
L 10.1.1.254/32 is directly connected, GigabitEthernet0/0/0
S* 0.0.0.0/0 [1/0] via 8.8.8.8

Router1# show ip nat translations //static NAT never leaves the table even with no traffic generated
Pro Inside global Inside local Outside local Outside global
tcp 8.8.8.200:443 10.1.1.100:443 --- ---
tcp 8.8.8.200:80 10.1.1.100:80 --- ---
--- 8.8.8.201 10.1.1.101 --- ---
Testing Inside PC and outside PC to connect to internal servers
10.1.1.100 HTTP server
10.1.1.101 FTP server
10.1.1.105 Server PT
Web browser - Myhttp.com
Cmd - ftp Myftp.com
10.1.1.102 - Inside PC
8.8.8.20 - Outside PC
Router1# show ip nat translations //outside pc to myhttp.com
Pro Inside global Inside local Outside local Outside global
tcp 8.8.8.200:443 10.1.1.100:443 --- ---
tcp 8.8.8.200:80 10.1.1.100:80 --- ---
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1040 8.8.8.20:1040
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1041 8.8.8.20:1041
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1042 8.8.8.20:1042
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1043 8.8.8.20:1043
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1044 8.8.8.20:1044
tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1045 8.8.8.20:1045
--- 8.8.8.201 10.1.1.101 --- ---

Router1# show ip nat translations //outside pc to myftp.com username password cisco - dir
Pro Inside global Inside local Outside local Outside global
tcp 8.8.8.200:443 10.1.1.100:443 --- ---
tcp 8.8.8.200:80 10.1.1.100:80 --- ---
tcp 8.8.8.201:1028 10.1.1.101:1028 8.8.8.20:1051 8.8.8.20:1051
tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1048 8.8.8.20:1048
tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1049 8.8.8.20:1049
tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1050 8.8.8.20:1050
--- 8.8.8.201 10.1.1.101 --- ---

From inside pc connect to FTP server and Http with IP addresses no DNS because the external DNS

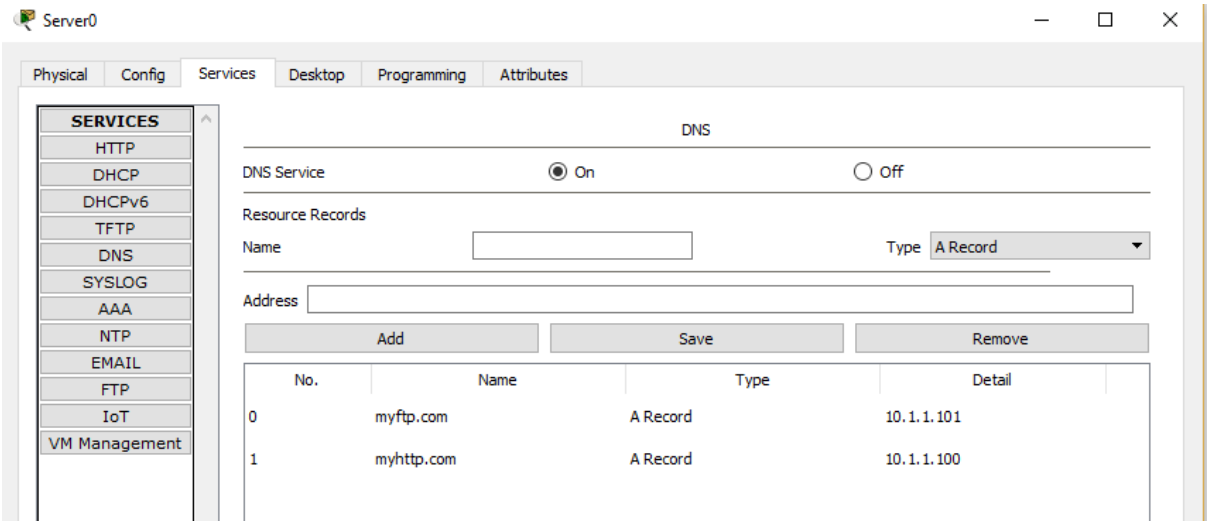
8.8.8.8 is translating the wrong IP addresses 10.1.1.100 HTTP 10.1.1.100 FTP **With internal DNS server 10.1.1.105having correct records for internal IP addresses**

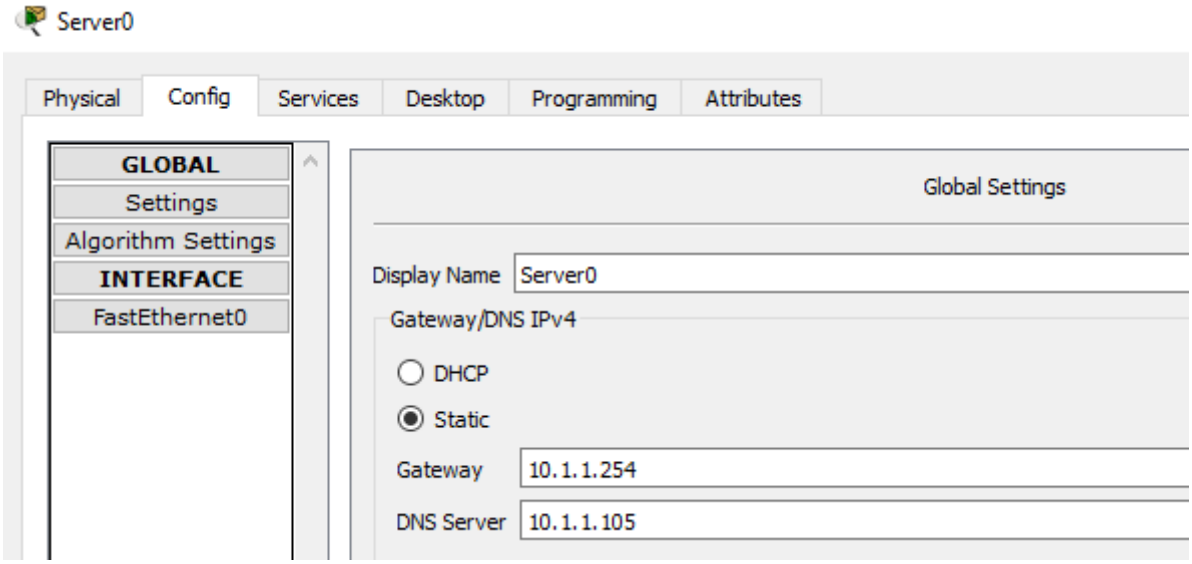
Table 2

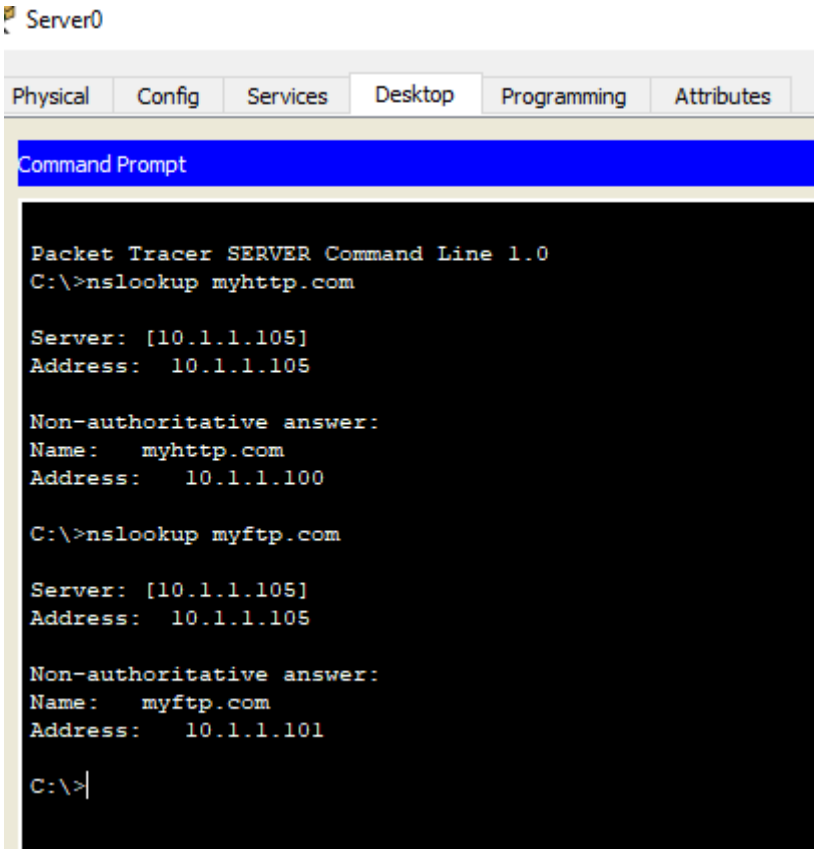
Note: FTP control uses port 21 if passive mode is on client initiates the session to the server.

FTP data port 20

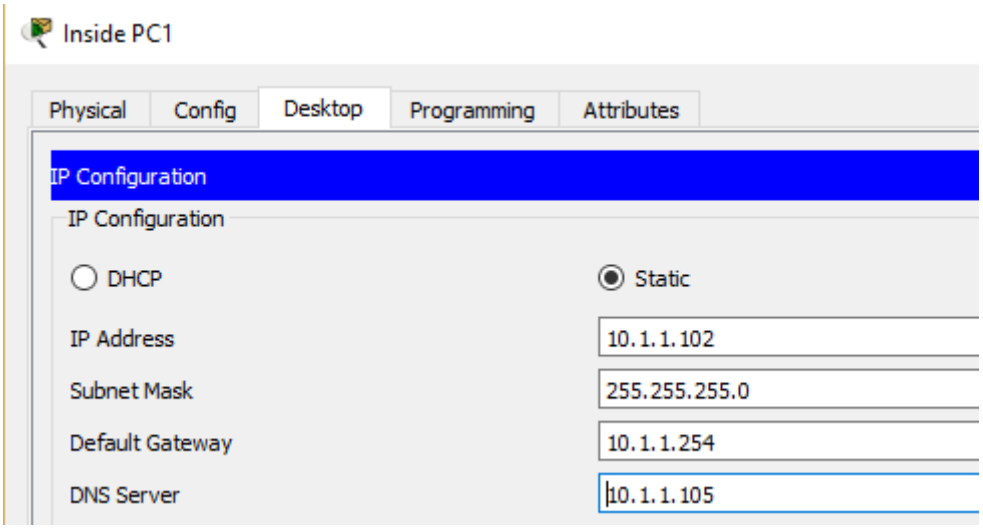
Note 2: Configured Internal DNS server **EXTRA check against the external DNS server settings and verify from outside PC**



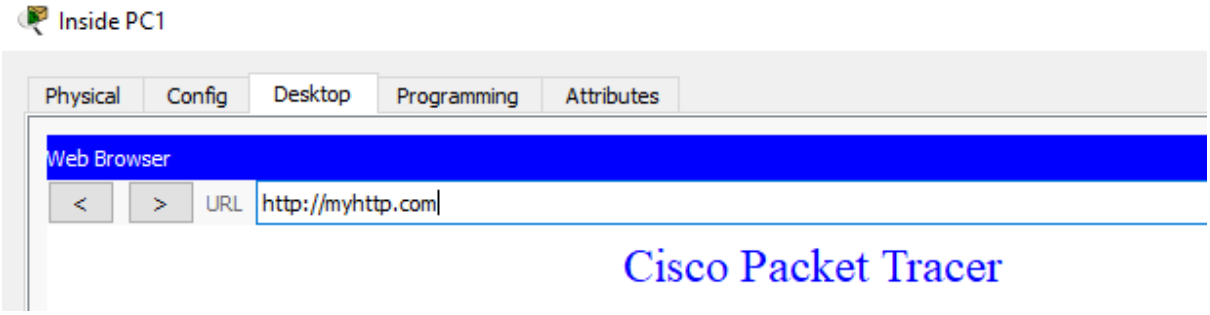




nslookup from internal dns



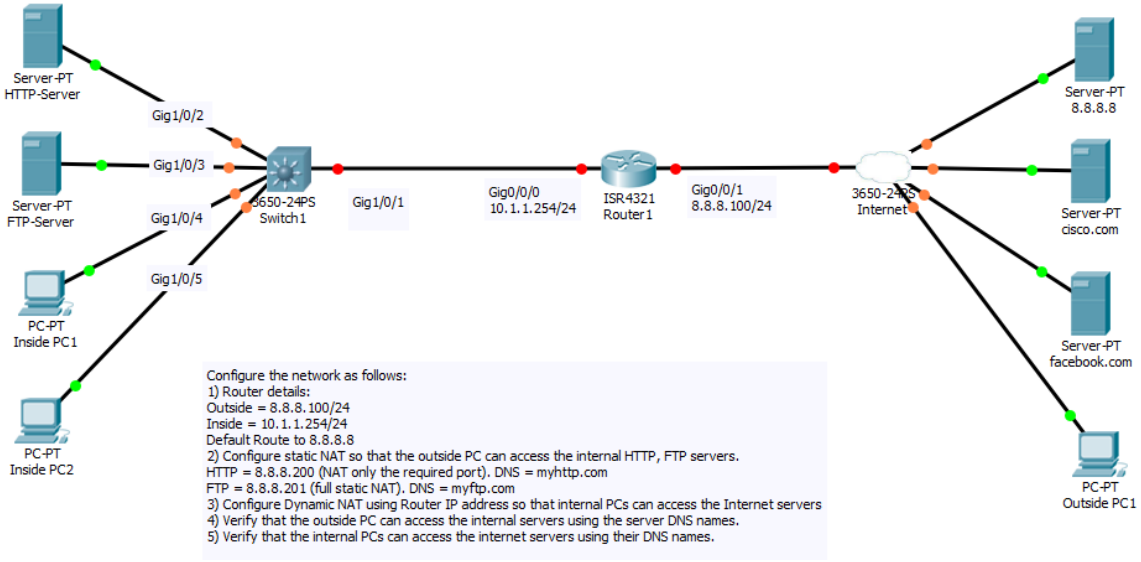
Configure Inside PC to point to internal DNS server




```
C:\>ftp myftp.com
Trying to connect...myftp.com
Connected to myftp.com
220- Welcome to PT Ftp server
Username:cisco
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dir

Listing /ftp directory from myftp.com:
0    : asa842-k8.bin                                5571584
1    : asa923-k8.bin                                30468096
2    : c1841-advipservicesk9-mz.124-15.T1.bin       33591768
```

Lab 3 Topology



Here we have a Router connected to a layer 3 switches internal two PCs, HTTP/FTP server and external internet and PC. To use NAT we want to access each network, NAT is only used when accessing servers / pcs outside of the LAN. For Inside PC's they need to access the internet servers facebook.com, cisco.com. For Outside PC's they need to connect to the internal servers myhttp.com and myftp.com.

Configurations and Verification

Campus network configuration part 3
Router1 interface GigabitEthernet0/0/0 ip address 10.1.1.254 255.255.255.0 ip nat inside ! interface GigabitEthernet0/0/1 ip address 8.8.8.100 255.255.255.0 ip nat outside ! ip nat inside source list 1 interface GigabitEthernet0/0/1 overload //PAT Configuration on interface g0/0/1 ip nat inside source static tcp 10.1.1.100 80 8.8.8.200 80 //Static NAT for web server ip nat inside source static 10.1.1.101 8.8.8.201 //static NAT for FTP ! access-list 1 permit any !
Verification **Router1#show ip nat translations** Pro Inside global Inside local Outside local Outside global tcp 8.8.8.200:80 10.1.1.100:80 --- --- --- 8.8.8.201 10.1.1.101 --- --- **Generate traffic by trying to reach** **Outside PC** ftp - myftp.com browser -myhttp.com **Inside PC** cisco.com facebook.com **Router1#show ip nat translations** Pro Inside global Inside local Outside local Outside global udp 8.8.8.100:1024 10.1.1.102:1025 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1025 10.1.1.103:1025 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1026 10.1.1.102:1026 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1027 10.1.1.102:1027 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1028 10.1.1.102:1028 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1029 10.1.1.103:1026 8.8.8.8:53 8.8.8.8:53 udp 8.8.8.100:1030 10.1.1.103:1027 8.8.8.8:53 8.8.8.8:53 //DNS tcp 8.8.8.100:1024 10.1.1.103:1028 8.8.8.9:80 8.8.8.9:80 tcp 8.8.8.100:1027 10.1.1.103:1027 8.8.8.9:80 8.8.8.9:80 tcp 8.8.8.100:1028 10.1.1.102:1028 8.8.8.10:80 8.8.8.10:80 tcp 8.8.8.100:1029 10.1.1.102:1029 8.8.8.10:80 8.8.8.10:80 tcp 8.8.8.100:1030 10.1.1.102:1030 8.8.8.10:80 8.8.8.10:80 tcp 8.8.8.100:1031 10.1.1.102:1031 8.8.8.10:80 8.8.8.10:80 //HTTP tcp 8.8.8.200:80 10.1.1.100:80 --- --- tcp 8.8.8.200:80 10.1.1.100:80 8.8.8.20:1027 8.8.8.20:1027 tcp 8.8.8.201:1030 10.1.1.101:1030 8.8.8.20:1026 8.8.8.20:1026 tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1025 8.8.8.20:1025 --- 8.8.8.201 10.1.1.101 --- --- tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1025 8.8.8.20:1025 tcp 8.8.8.201:21 10.1.1.101:21 8.8.8.20:1030 8.8.8.20:1030 / --- 8.8.8.201 10.1.1.101 --- --- //FTP

Extra Examples and Resources

Static NAT

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus3548/sw/interfaces/b_N3548_Interfaces_Config_503_A1/b_N3548_Interfaces_Config_503_A1_chapter_0101.html

https://www.cisco.com/c/en/us/td/docs/security/asa/asa82/configuration/guide/config/nat_static.html

Dynamic NAT

https://www.cisco.com/c/en/us/td/docs/security/asa/asa82/configuration/guide/config/nat_dynamic.html

NAT basics

https://www.cisco.com/c/en/us/support/docs/ip/network-address-translation-nat/13772-12.html