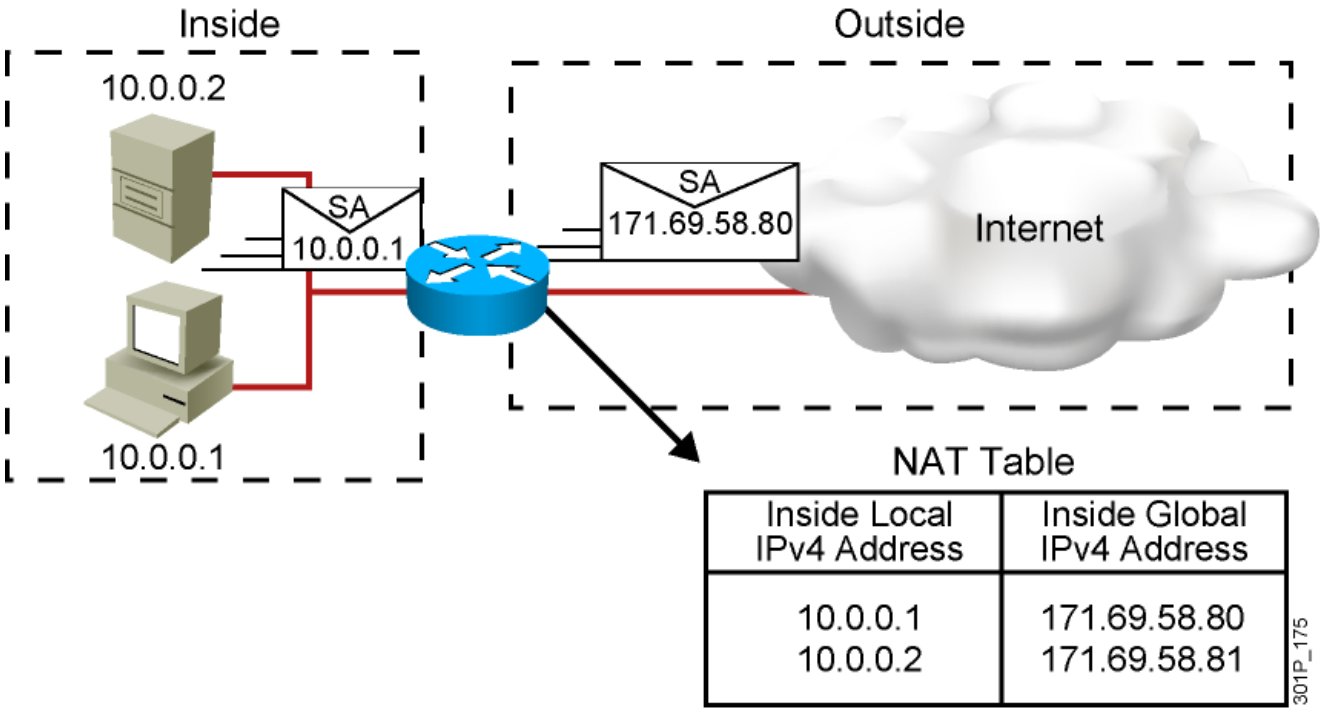
Address Space Management

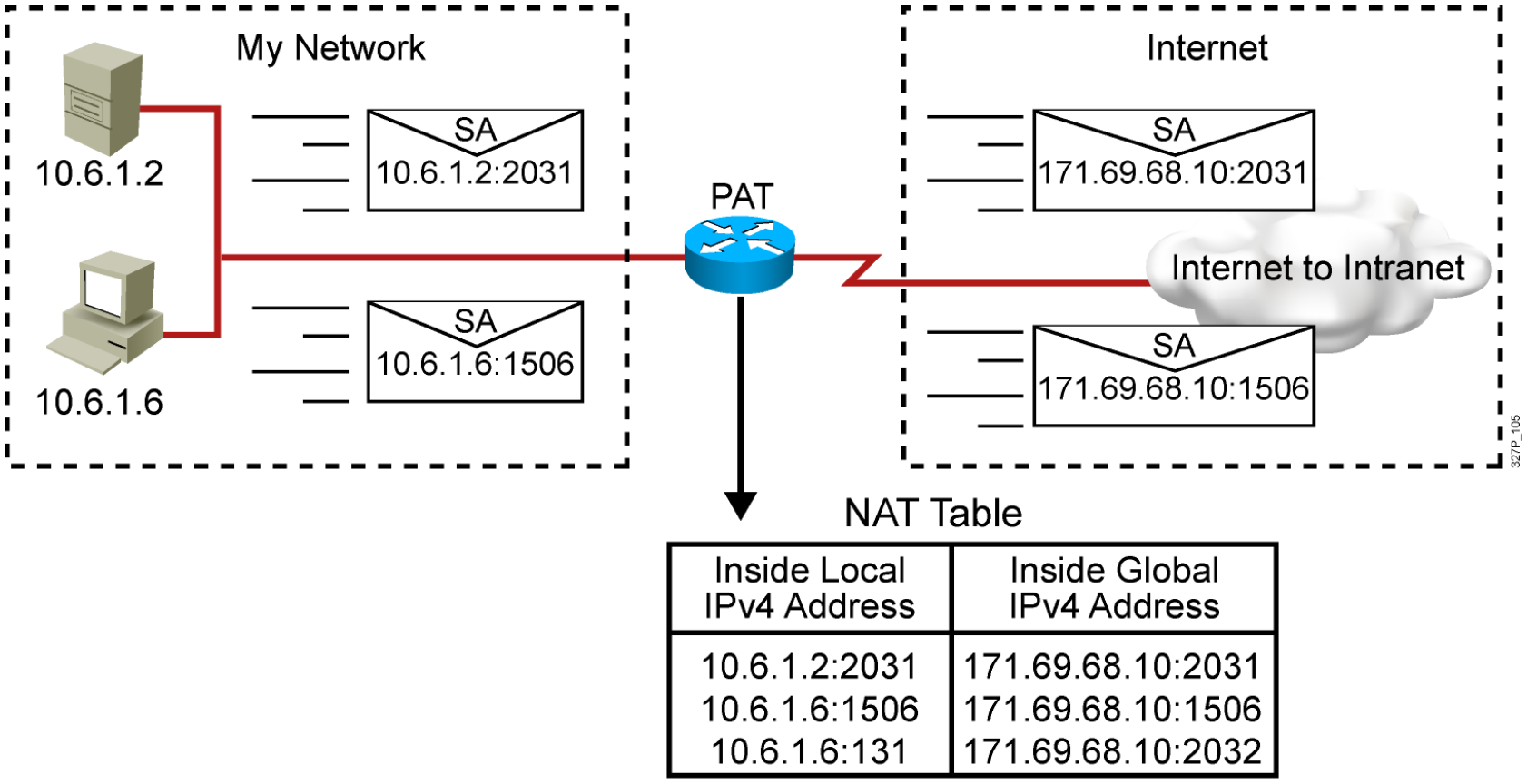
Scaling the Network with NAT and PAT

Network Address Translation

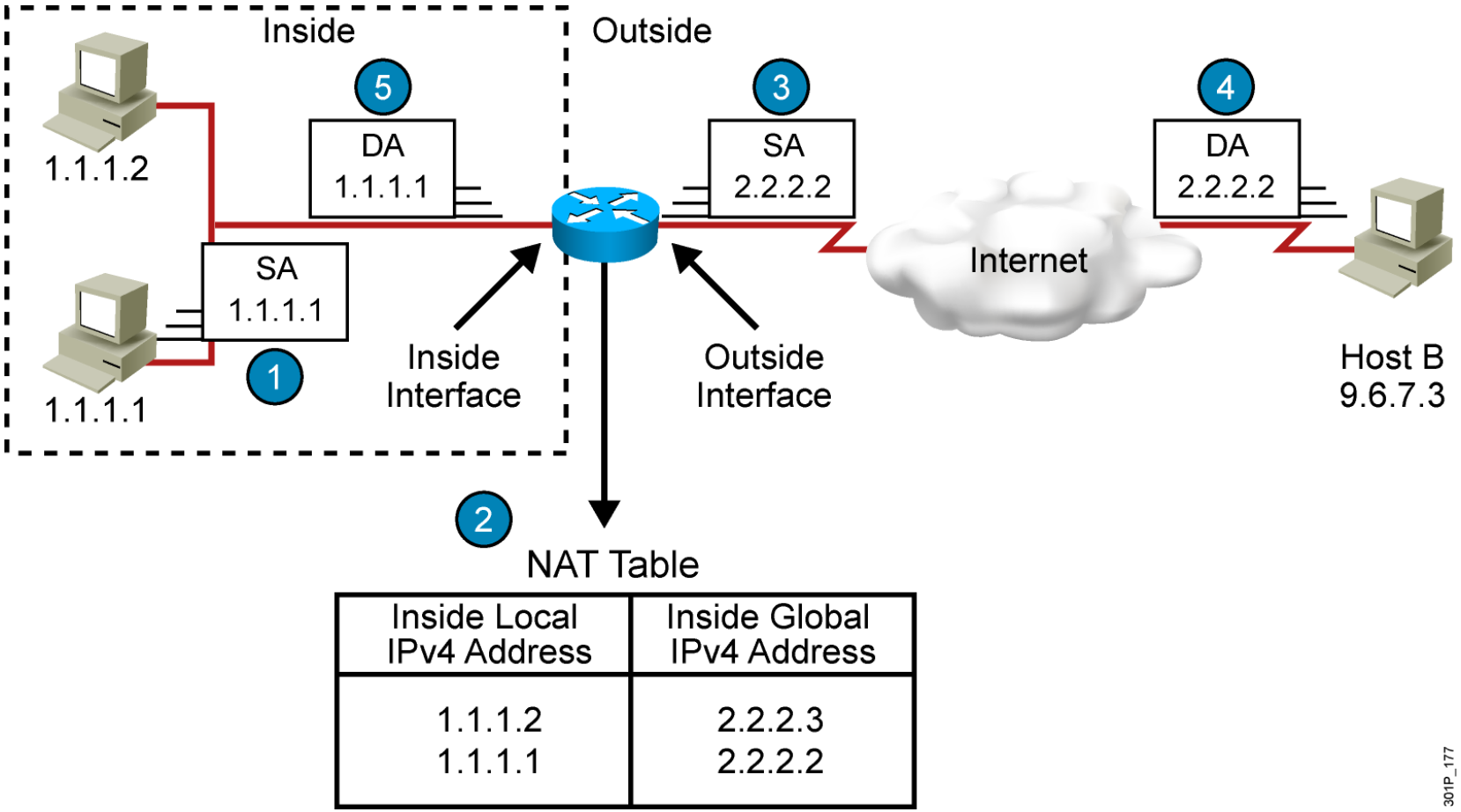


- **An IP address is either local or global.**
- **Local IPv4 addresses are seen in the inside network.**
- **Global IPv4 addresses are seen in the outside network.**

Port Address Translation



Translating Inside Source Addresses



Configuring and Verifying Static Translation

```
RouterX(config)# ip nat inside source static local-ip global-ip
```

- Establishes static translation between an inside local address and an inside global address

```
RouterX(config-if)# ip nat inside
```

- Marks the interface as connected to the inside

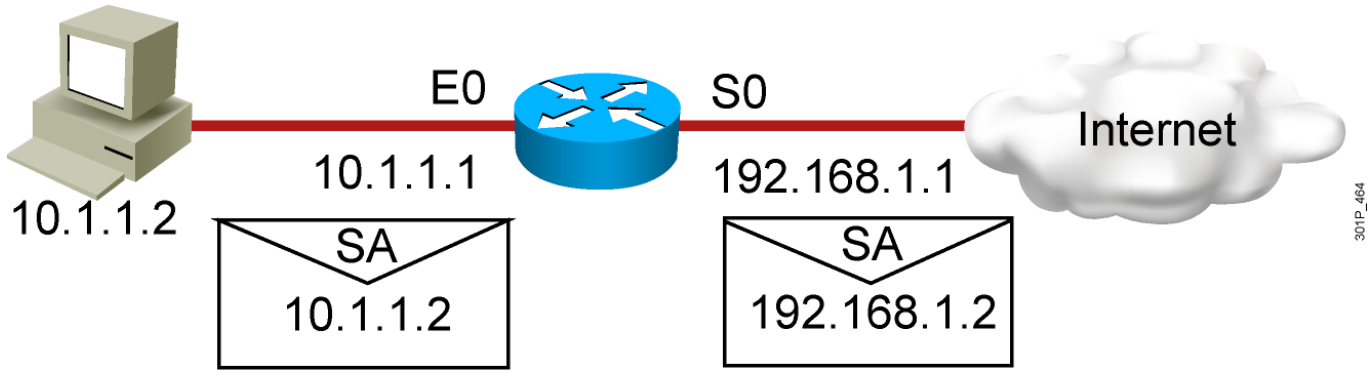
```
RouterX(config-if)# ip nat outside
```

- Marks the interface as connected to the outside

```
RouterX# show ip nat translations
```

- Displays active translations

Enabling Static NAT Address Mapping Example




```
interface s0
ip address 192.168.1.1 255.255.255.0
ip nat outside
!
interface e0
ip address 10.1.1.1 255.255.255.0
ip nat inside
!
ip nat inside source static 10.1.1.2 192.168.1.2
```

```
RouterX# show ip nat translations
     Pro Inside global    Inside local    Outside local    Outside global
     --- 192.168.1.2       10.1.1.2           ---              ---
```

Configuring and Verifying Dynamic Translation

```
RouterX(config)# ip nat pool name start-ip end-ip
{netmask netmask | prefix-length prefix-length}
```

- Defines a pool of global addresses to be allocated as needed

```
RouterX(config)# access-list access-list-number permit
source [source-wildcard]
```

- Defines a standard IP ACL permitting those inside local addresses that are to be translated

```
RouterX(config)# ip nat inside source list
access-list-number pool name
```

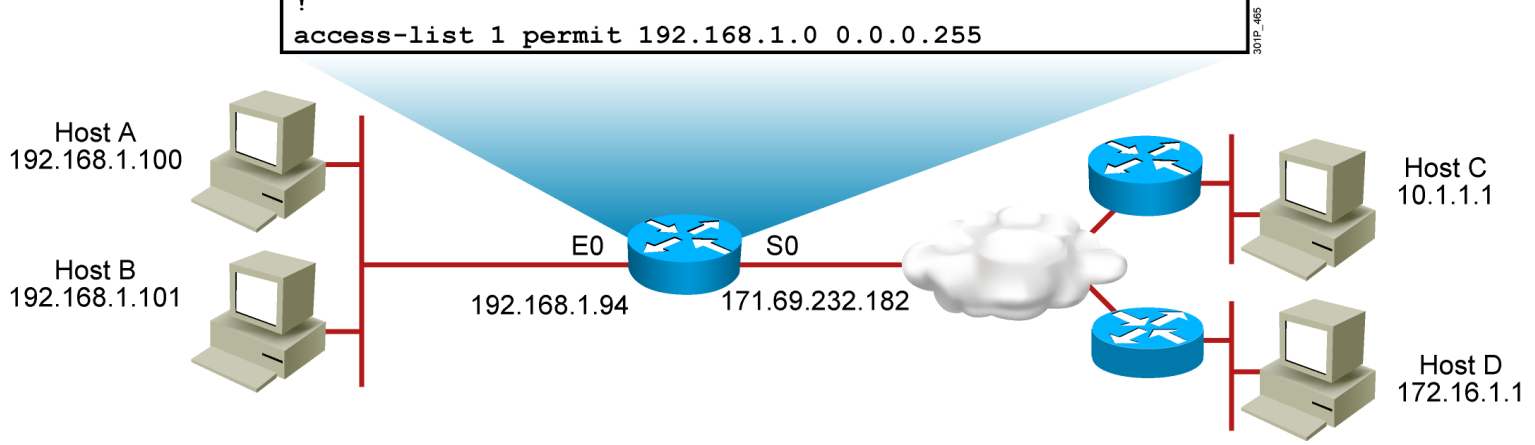
- Establishes dynamic source translation, specifying the ACL that was defined in the previous step

```
RouterX# show ip nat translations
```

- Displays active translations

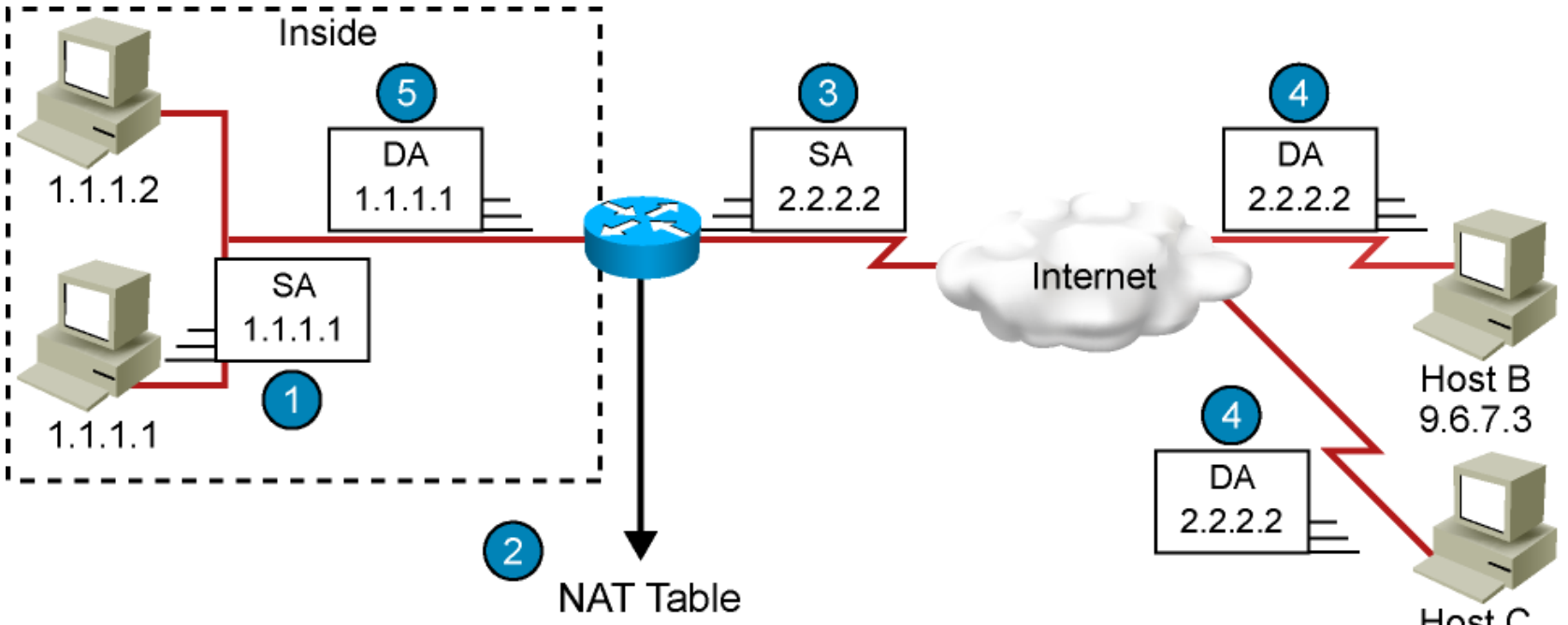
Dynamic Address Translation Example

```
ip nat pool net-208 171.69.233.209 171.69.233.222 netmask
255.255.255.240
ip nat inside source list 1 pool net-208
!
interface serial 0
 ip address 171.69.232.182 255.255.255.240
 ip nat outside
!
interface ethernet 0
 ip address 192.168.1.94 255.255.255.0
 ip nat inside
!
access-list 1 permit 192.168.1.0 0.0.0.255
```




```
RouterX# show ip nat translations
   Pro Inside global     Inside local      Outside local     Outside global
   --- 171.69.233.209    192.168.1.100          ---               ---
   --- 171.69.233.210    192.168.1.101          ---               ---
```

Overloading an Inside Global Address



Protocol	Inside Local IPv4 Address:Port	Inside Global IPv4 Address:Port	Outside Global IPv4 Address:Port
TCP	1.1.1.2:1723	2.2.2.2:1723	6.5.4.7:23
TCP	1.1.1.1:1024	2.2.2.2:1024	9.6.7.3:23

Configuring Overloading

```
RouterX(config)# access-list access-list-number permit
source source-wildcard
```

- Defines a standard IP ACL that will permit the inside local addresses that are to be translated

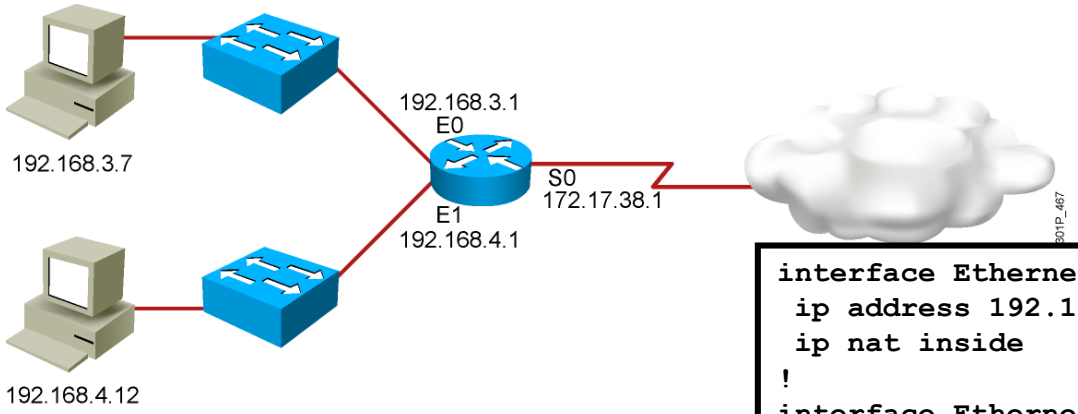
```
RouterX(config)# ip nat inside source list
access-list-number interface interface overload
```

- Establishes dynamic source translation, specifying the ACL that was defined in the previous step

```
RouterX# show ip nat translations
```

- Displays active translations

Overloading an Inside Global Address Example




```
interface Ethernet0
 ip address 192.168.3.1 255.255.255.0
 ip nat inside
!
interface Ethernet1
 ip address 192.168.4.1 255.255.255.0
 ip nat inside
!
interface Serial0
 description To ISP
 ip address 172.17.38.1 255.255.255.0
 ip nat outside
!
ip nat inside source list 1 interface Serial0 overload
!
ip route 0.0.0.0 0.0.0.0 Serial0
!
access-list 1 permit 192.168.3.0 0.0.0.255
access-list 1 permit 192.168.4.0 0.0.0.255
```

```
RouterX# show ip nat translations
     Pro Inside global      Inside local       Outside local      Outside global
     TCP 172.17.38.1:1050   192.168.3.7:1050    10.1.1.1:23        10.1.1.1:23
     TCP 172.17.38.1:1776   192.168.4.12:1776   10.2.2.2:25        10.2.2.2:25
```

Clearing the NAT Translation Table

```
RouterX# clear ip nat translation *
```

- Clears all dynamic address translation entries

```
RouterX# clear ip nat translation inside global-ip
local-ip [outside local-ip global-ip]
```

- Clears a simple dynamic translation entry that contains an inside translation or both an inside and outside translation

```
RouterX# clear ip nat translation outside
local-ip global-ip
```

- Clears a simple dynamic translation entry that contains an outside translation

```
RouterX# clear ip nat translation protocol inside global-ip
global-port local-ip local-port [outside local-ip
local-port global-ip global-port]
```

- Clears an extended dynamic translation entry (PAT entry)

Translation Not Occurring: Translation Not Installed in the Table

Verify that:

- **There are no inbound ACLs that are denying the packets entry to the NAT router**
- **The ACL referenced by the NAT command is permitting all necessary networks**
- **There are enough addresses in the NAT pool**
- **The router interfaces are appropriately defined as NAT inside or NAT outside**

Displaying Information with show and debug Commands

```
RouterX# debug ip nat

NAT: s=192.168.1.95->172.31.233.209, d=172.31.2.132 [6825]
NAT: s=172.31.2.132, d=172.31.233.209->192.168.1.95 [21852]
NAT: s=192.168.1.95->172.31.233.209, d=172.31.1.161 [6826]
NAT*: s=172.31.1.161, d=172.31.233.209->192.168.1.95 [23311]
NAT*: s=192.168.1.95->172.31.233.209, d=172.31.1.161 [6827]
NAT*: s=192.168.1.95->172.31.233.209, d=172.31.1.161 [6828]
NAT*: s=172.31.1.161, d=172.31.233.209->192.168.1.95 [23312]
NAT*: s=172.31.1.161, d=172.31.233.209->192.168.1.95 [23313]
```

```
RouterX# show ip nat statistics
      Total active translations: 1 (1 static, 0 dynamic; 0 extended)
      Outside interfaces:
      Ethernet0, Serial2
      Inside interfaces:
      Ethernet1
      Hits: 5  Misses: 0
      …
```

Translation Occurring: Installed Translation Entry Not Being Used

Verify:

- **What the NAT configuration is supposed to accomplish**
- **That the NAT entry exists in the translation table and that it is accurate**
- **That the translation is actually taking place by monitoring the NAT process or statistics**
- **That the NAT router has the appropriate route in the routing table if the packet is going from inside to outside**
- **That all necessary routers have a return route back to the translated address**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