NAT
## Network Address Translation

NAT Terminology

- Inside network: LAN

- Outside network: WAN/internet

- SA/DA: Source address/destination address

- Address mapping: Translation of private IPs to public IPs using a NAT table

## How NAT Works

- Used to address IPv4 address exhaustion
- Translates a public IP into 1+ private IPs
- Can translate statically or dynamically

NAT Router

Internal Network
Private IPv4 Address Space

Internet
Public IPv4 Address Space

NAT Translations
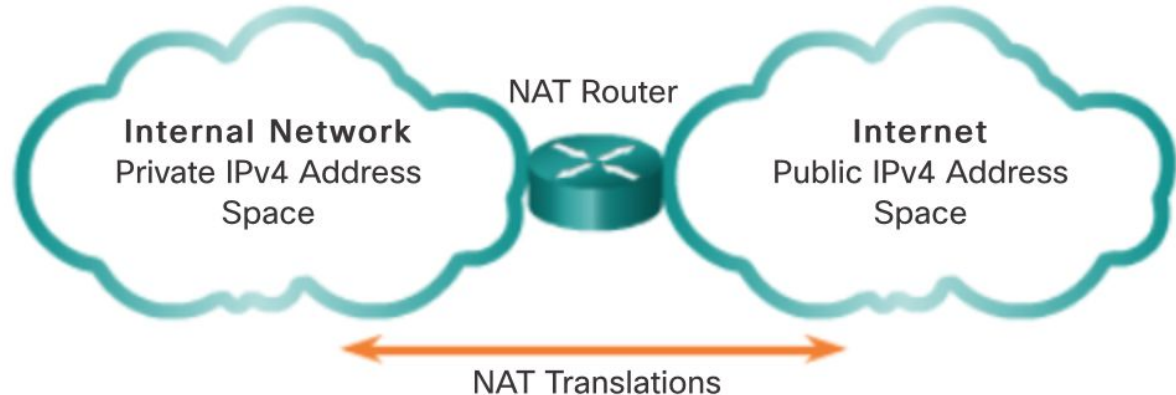
Types of NAT Addresses

- **Inside local address**: address of the source as seen from inside the network
- **Inside global address**: address of source as seen from the outside network
- **Outside global address**: address of the destination as seen from the outside network
- **Outside local address**: address of the destination as seen from the inside network
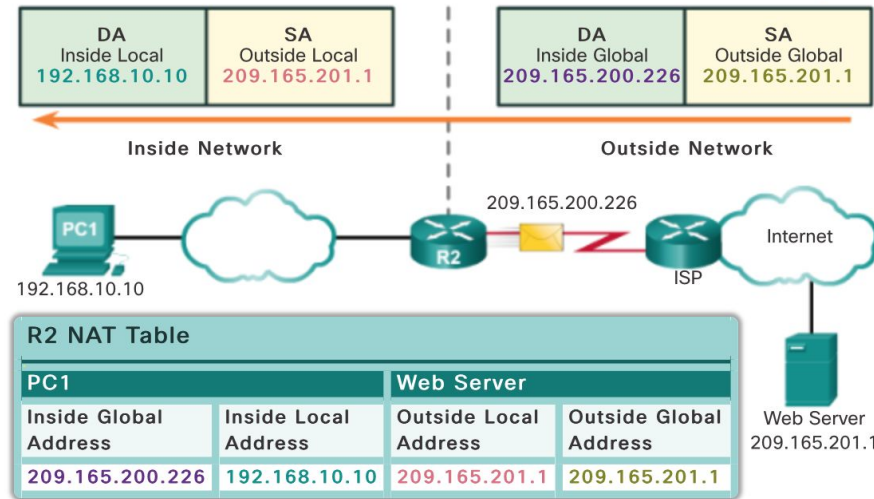
Types of NAT

- ▶ Static address translation (static NAT): One-to-one address mapping between local and global addresses

- ▶ Dynamic address translation (dynamic NAT): Many-to-many address mapping between local and global addresses

- ▶ Port Address Translation (PAT): Many-to-one address mapping between local and global addresses (aka NAT overloading)

Pros and Cons of NAT

Pros

- ▸ Conserves the legally registered addressing scheme
- ▸ Increases the flexibility of connections to the public network
- ▸ Provides consistency for internal network addressing schemes
- ▸ Provides network security

Cons

- ▸ Slower
- ▸ Some applications do not work with NAT
- ▸ End-to-end IPv4 traceability is lost
- ▸ Complicates tunneling protocols
- ▸ Services that require the initiation of TCP connections from the outside network can be disrupted

Configuring Static NAT

Step Description	Placement	Command	Category
set the inside interface for translation	interface connected to LAN	ip nat inside	requirement
set the outside interface for translation	interface connected to WAN	ip nat outside	requirement
determine which IP addresses to translate	router config	ip nat inside source static [inside ip] [outside ip]	requirement

```
R2(config)# ip nat inside source static 192.168.10.254 209.165.201.5

R2(config)# interface Serial0/0/0
R2(config-if)# ip address 10.1.1.2 255.255.255.252
Identifies interface serial 0/0/0 as an inside NAT interface.
R2(config-if)# ip nat inside
R2(config-if)# exit

R2(config)# interface Serial0/1/0
R2(config-if)# ip address 209.165.200.1 255.255.255.252
Identifies interface serial 0/1/0 as the outside NAT interface.
R2(config-if)# ip nat outside
```
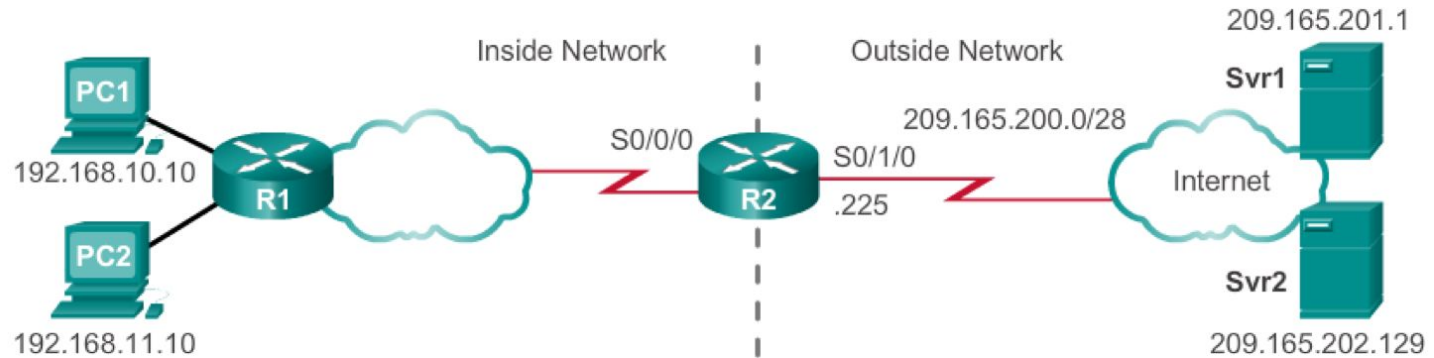
Configuring Dynamic NAT and PAT

Step Description	Placement	Command	Category	Notes
define a pool of global addresses	router config	ip nat pool [pool name] [start ip] [end ip] netmask [subnet mask]	requirement	
create a standard ACL defining a pool of local addresses to be translated	router config	access-list [# between 1-99] permit [network ip] [wildcard]	requirement	can also be a named standard ACL
enable dynamic NAT	router config	ip nat inside source list [access list number/name] pool [pool name]	requirement	add "overload" to the end of the command to enable PAT
set the inside interface for translation	interface connected to LAN	ip nat inside	requirement	
set the outside interface for translation	interface connected to WAN	ip nat outside	requirement	

Configuring Dynamic NAT and PAT (Example)

Example PAT with Address Pool

Inside Network | Outside Network

PC1 — 192.168.10.10
PC2 — 192.168.11.10
R1
S0/0/0
R2   S0/1/0
209.165.200.0/28
.225
209.165.201.1 Svr1
209.165.202.129 Svr2
Internet

Define a pool of public IPv4 addresses under the pool name NAT-POOL2.
R2(config)# **ip nat pool NAT-POOL2 209.165.200.226 209.165.200.240 netmask 255.255.255.224**
Define which addresses are eligible to be translated.
R2(config)# **access-list 1 permit 192.168.0.0 0.0.255.255**
Bind NAT-POOL2 with ACL 1.
R2(config)# **ip nat inside source list 1 pool NAT-POOL2 overload**

Identify interface serial 0/0/0 as an inside NAT interface.
R2(config)# **interface Serial0/0/0**
R2(config-if)# **ip nat inside**

Identify interface serial 0/1/0 as the outside NAT interface.
R2(config)# **interface Serial0/1/0**
R2(config-if)# **ip nat outside**

- Use **do show ip nat statistics** to view NAT configuration stats
- Use **do show ip nat translations** to view a list of translations

```
R2# show ip nat statistics
Total active translations: 1 (0 static, 1 dynamic; 1 extended)
Peak translations: 1, occurred 00:00:09 ago
Outside interfaces:
     Serial0/0/1
Inside interfaces:
     Serial0/0/0
Hits: 31 Misses: 0
CEF Translated packets: 31, CEF Punted packets: 0
Expired translations: 0
Dynamic mappings:
-- Inside Source
[Id: 5] access-list 1 pool NAT-POOL2 refcount 1
  pool NAT-POOL2: netmask 255.255.255.224
start 209.165.200.226 end 209.165.200.240
type generic, total addresses 15, allocated 1 (6%), misses 0
 <output omitted>

R2# show ip nat translations

 Pro Inside global        Inside local       Outside local

  tcp 209.165.200.226:19005 192.168.10.10:19005 209.165.201.1:23

R2#
```

Packet Tracer Labs

CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- ▶ Presentation template by SlidesCarnival
- ▶ Photographs by Unsplash