



## Chapter 9: NAT for IPv4



## Routing and Switching Essentials v6.0

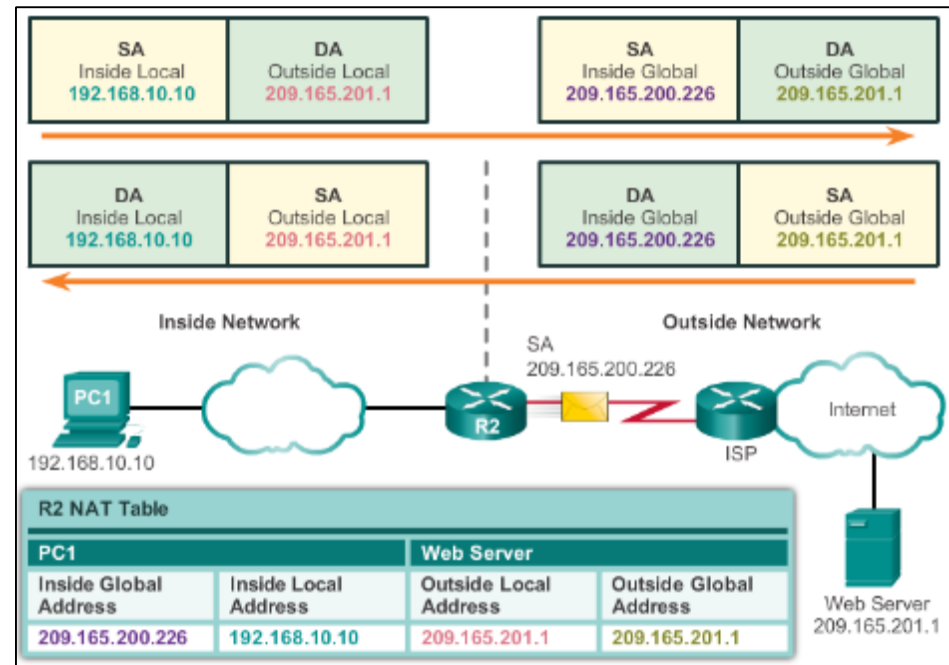
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## NAT Operation

# NAT Characteristics

- IPv4 Private Address Space
  - 10.0.0.0 /8, 172.16.0.0 /12, and 192.168.0.0 /16
- What is NAT?
  - Process to translate network IPv4 address
  - Conserve public IPv4 addresses
  - Configured at the border router for translation
- NAT Terminology
  - Inside address
  - Inside local address
  - Inside global address
  - Outside address
  - Outside local address
  - Outside global address





## NAT Operation

# Types of NAT

### ■ Static NAT

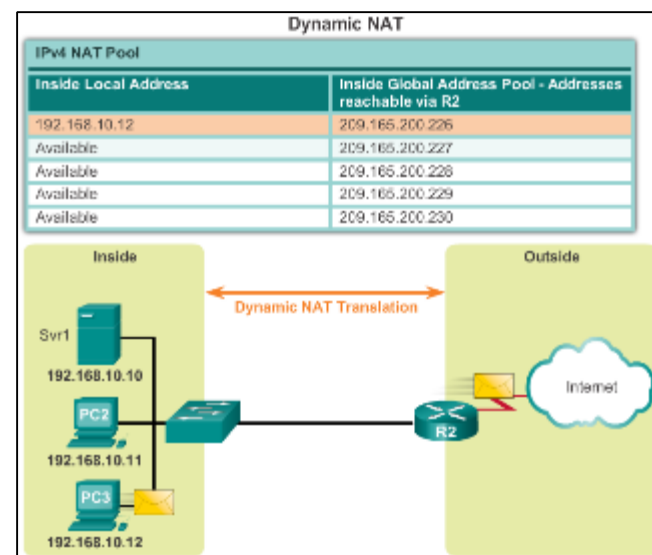
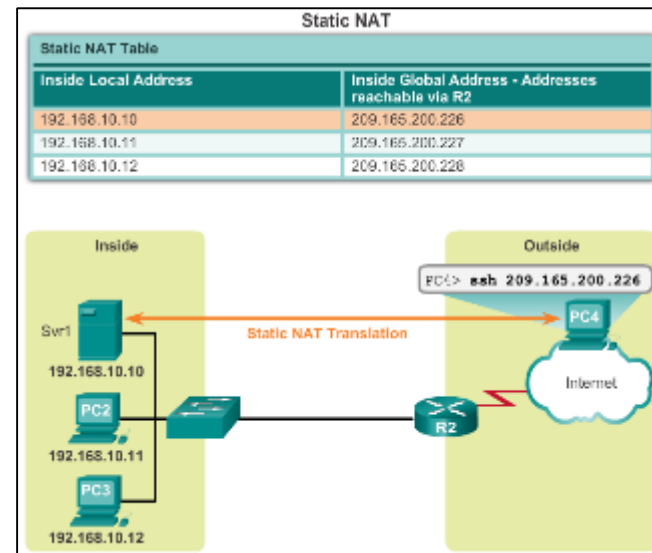
- One-to-one mapping of local and global addresses
- Configured by the network administrator and remain constant.

### ■ Dynamic NAT

- Uses a pool of public addresses and assigns them on a first-come, first-served basis
- Requires that enough public addresses for the total number of simultaneous user sessions

### ■ Port Address Translation (PAT)

- Maps multiple private IPv4 addresses to a single public IPv4 address or a few addresses
- Also known as NAT overload
- Validates that the incoming packets were requested
- Uses port numbers to forward the response packets to the correct internal device





## NAT Operation

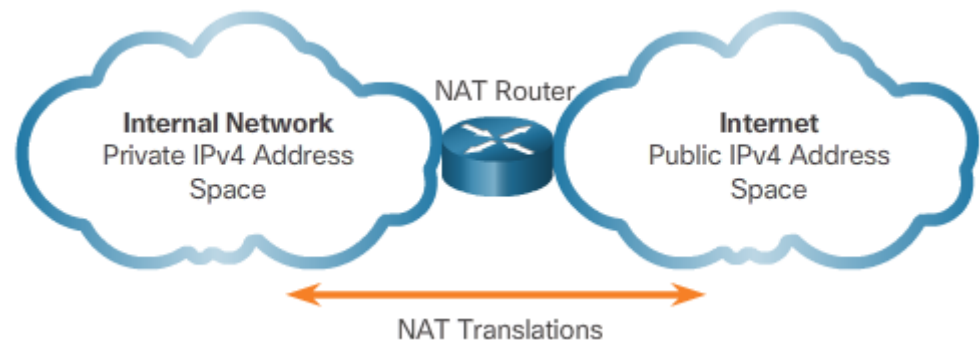
# NAT Advantages

### ■ Advantages of NAT

- Increases the flexibility of connections to the public network
- Provides consistency for internal network addressing schemes
- Provides network security

### ■ Disadvantages of NAT

- Performance is degraded
- End-to-end functionality is degraded
- End-to-end IP traceability is lost
- Tunneling is more complicated
- Initiating TCP connections can be disrupted





## 9.2 Configuring NAT



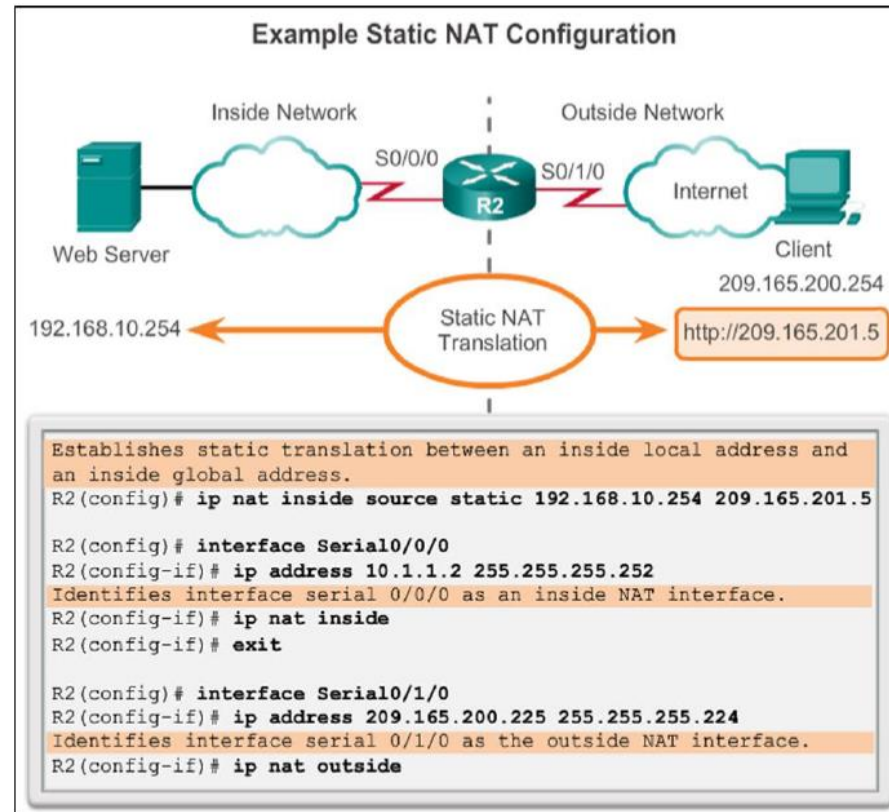
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## Configuring NAT

# Configuring Static NAT

Create the mapping between the inside local and outside local addresses

- **ip nat inside source static** *local-ip global-ip*
- Define which interfaces belong to the inside network and which belong to the outside network
- **ip nat inside**
- **ip nat outside**





## Configuring NAT

# Configuring Dynamic NAT

### ■ Dynamic NAT Operation

- The pool of public IPv4 addresses (inside global address pool) is available to any device on the inside network on a first-come, first-served basis.
- With dynamic NAT, a single inside address is translated to a single outside address.
- The pool must be large enough to accommodate all inside devices.
- A device is unable to communicate to any external networks if no addresses are available in the pool.

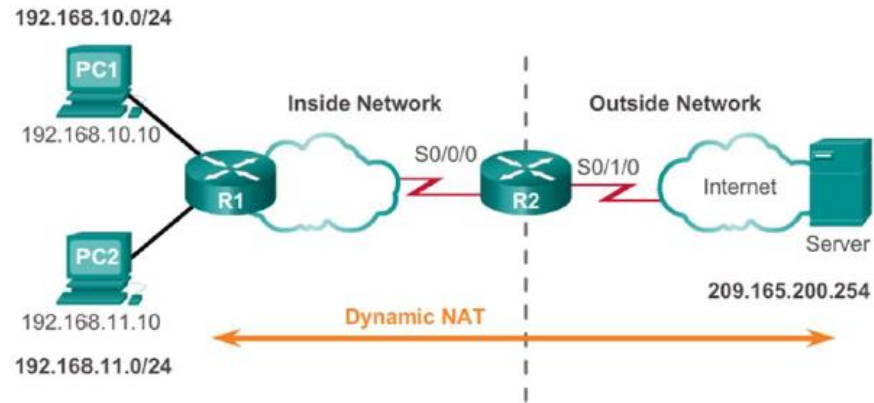




## Configuring NAT

# Configuring Dynamic NAT

- Create the mapping between the inside local and outside local addresses
- `ip nat pool name start-ip end-ip {netmask netmask | prefix-length prefix-length}`
- Create a standard ACL to permit those addresses to be translated
- `access-list access-list-number permit source [source-wildcard]`
- Bind the ACL to the pool
- `ip nat inside source list access-list-number pool name`
- Identify the inside and outside interfaces
- `ip nat inside`
- `ip nat outside`



Defines a pool of public IPv4 addresses under the pool name NAT-POOL1.

```
R2(config)# ip nat pool NAT-POOL1 209.165.200.226
209.165.200.240 netmask 255.255.255.224
```

Defines which addresses are eligible to be translated.

```
R2(config)# access-list 1 permit 192.168.0.0 0.0.255.255
```

Binds NAT-POOL1 with ACL 1.

```
R2(config)# ip nat inside source list 1 pool NAT-POOL1
```

Identifies interface serial 0/0/0 as an inside NAT interface.

```
R2(config)# interface Serial0/0/0
R2(config-if)# ip nat inside
```

Identifies interface serial 0/1/0 as an outside NAT interface.

```
R2(config)# interface Serial0/1/0
R2(config-if)# ip nat outside
```





## Configuring NAT

# Configuring Port Address Translations

### ■ Configuring PAT: Single Address

- Define a standard ACL to permit those addresses to be translated

```
access-list access-list-number permit source [source-wildcard]
```

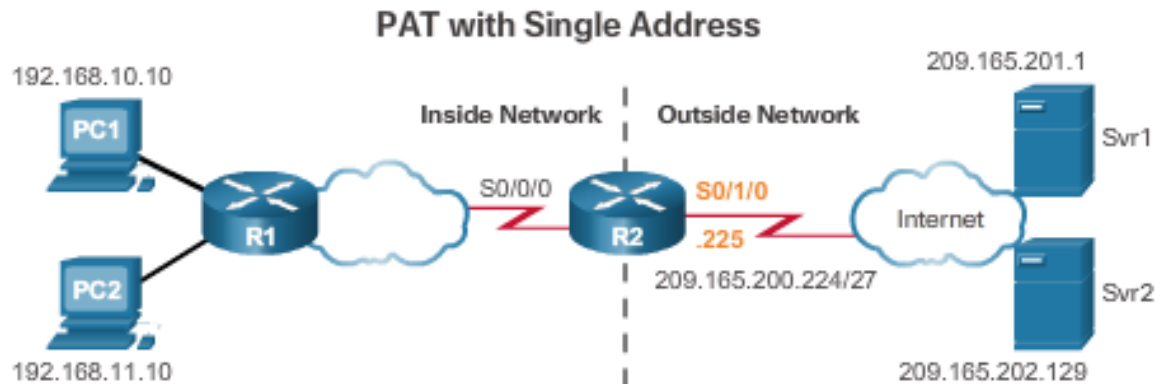
- Establish dynamic source translation, specify the ACL, exit interface, and overload option

```
ip nat inside source list access-list-number interface type name overload
```

- Identify the inside and outside interfaces

```
ip nat inside
```

```
ip nat outside
```

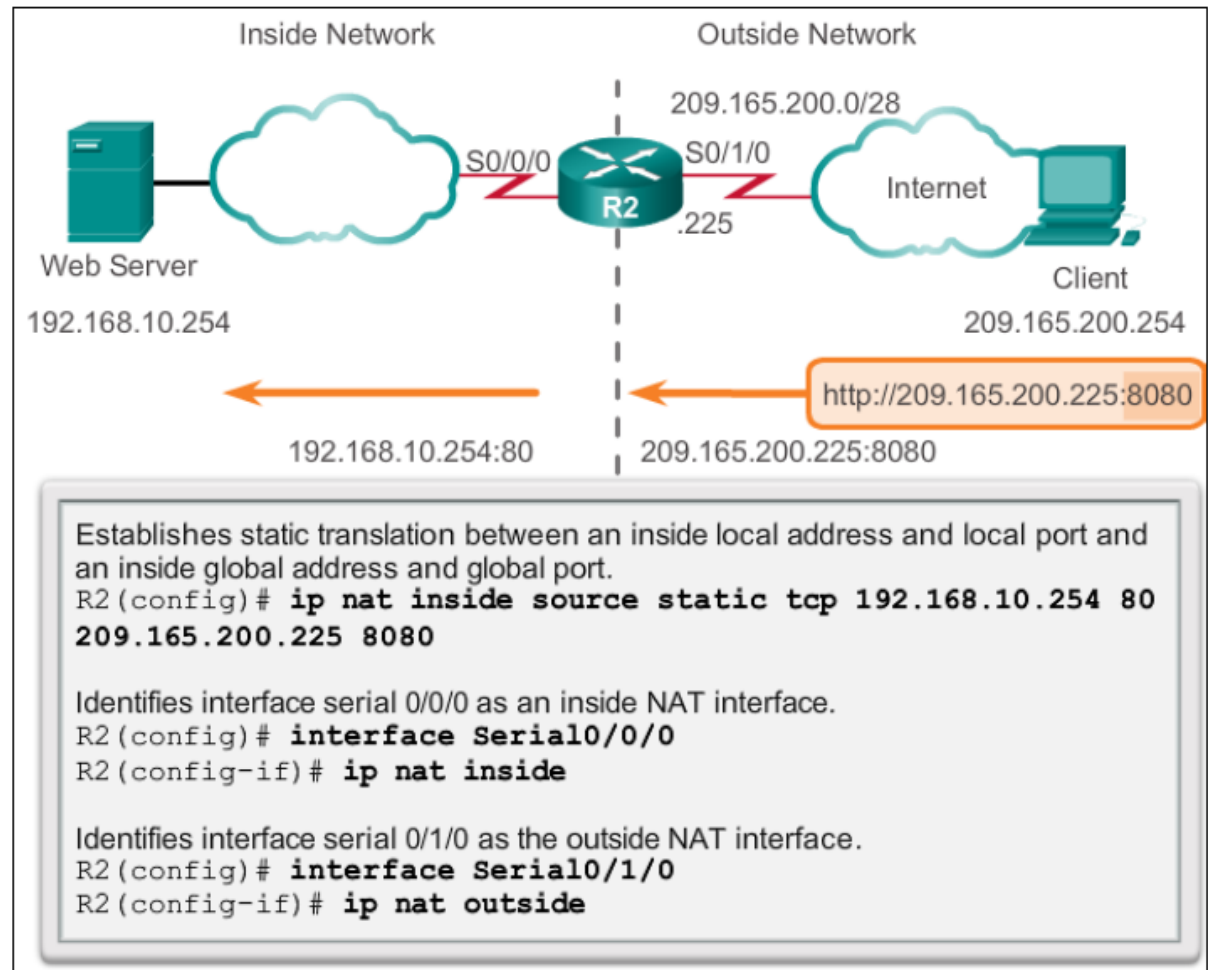


```
R2(config)# access-list 1 permit 192.168.0.0 0.0.255.255
R2(config)# ip nat inside source list 1 interface serial 0/1/0 overload
R2(config)# interface serial0/0/0
R2(config-if)# ip nat inside
R2(config)# interface serial0/1/0
R2(config-if)# ip nat outside
```



# Configuring NAT Port Forwarding

- Port forwarding is the act of forwarding a network port from one network node to another.
- A packet sent to the public IP address and port of a router can be forwarded to a private IP address and port in inside network.
- Port forwarding is helpful in situations where servers have private addresses, not reachable from the outside networks.





## Troubleshooting NAT

# Troubleshooting NAT Configurations

- Troubleshooting NAT: show commands
  - `clear ip nat statistics`
  - `clear ip nat translations *`
  - `show ip nat statistics`
  - `Show ip nat translations`
- Troubleshooting NAT: debug commands
  - `debug ip nat`