

Serviços de Rede 1 – **Lesson 3 - Practices**

2019-20120

Instituto Politécnico de Coimbra

Departamento de Engenharia Informática

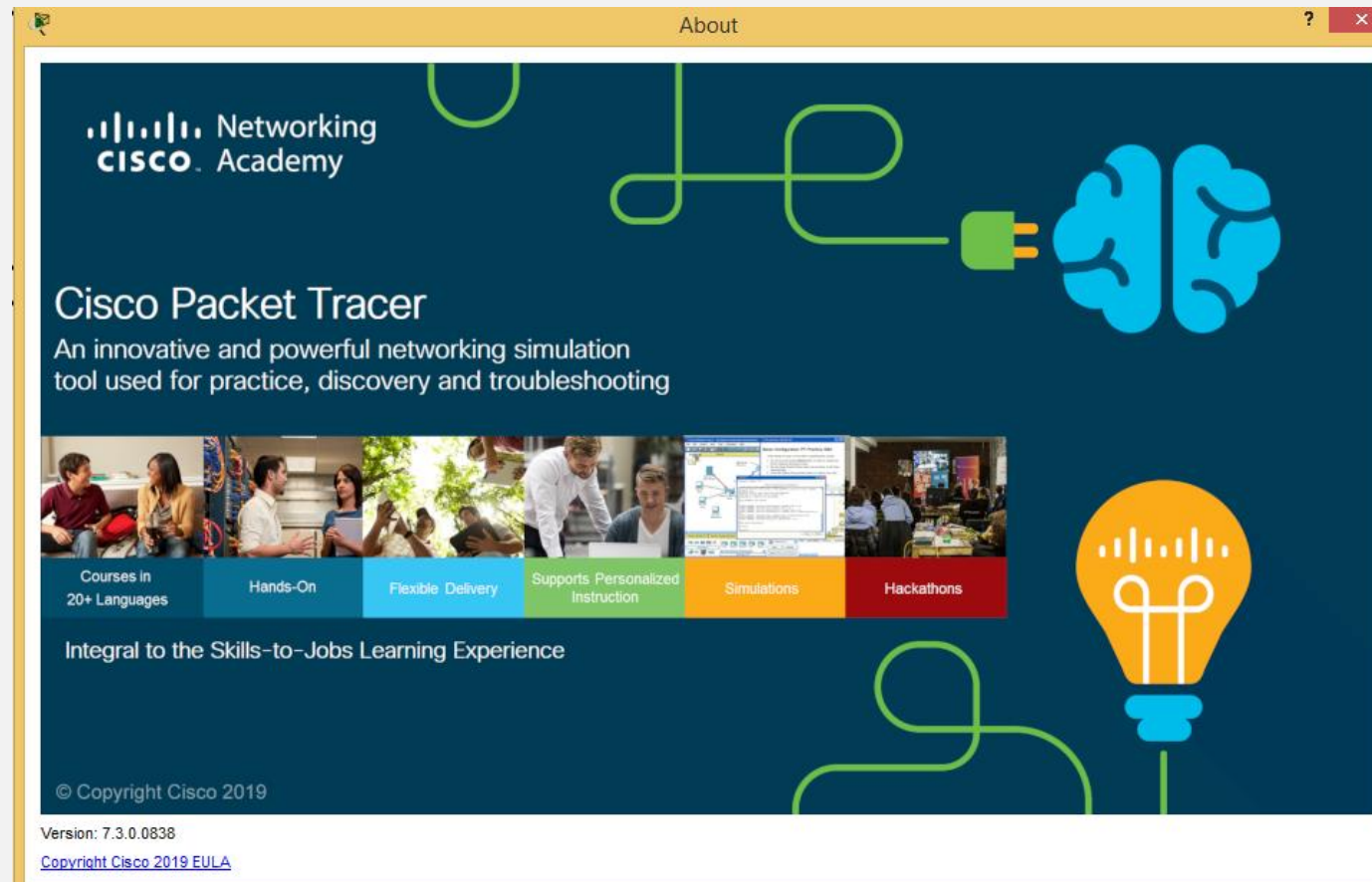


Important note

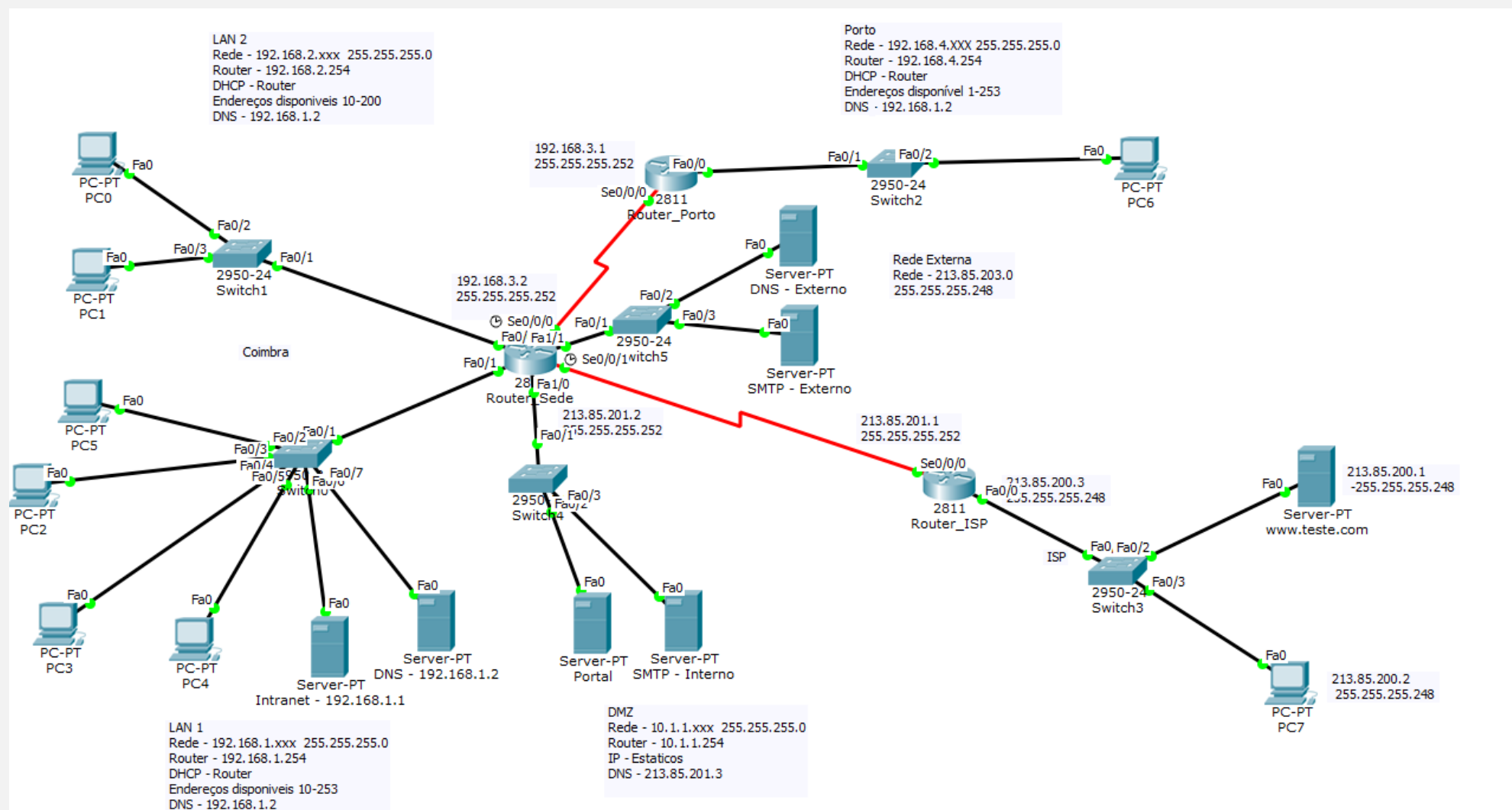
- I hope everyone is in good health !!!
- With the COVID 19 contingency plan, it is certain that the assessment, which was scheduled for March 30 or 31, has to be changed at least in the form of its execution. I am looking at an alternative way of carrying out this assessment.
- As no student pointed out any doubts or questions about the resolution of the exercise in class2, I can conclude that this was solved by everyone.
- Therefore, the prerequisites for this week's classes are based on the exercise of class 2.

Pre - Requirements

- You have installed the Cisco Packet Tracer version 7.3



Pre - Requirements



Pre - Requirements

- The company SR1 SA has a network with the topology:
 - At headquarters there are two LANs (LAN1 and LAN2), one DMZ and one outside area.
 - The addresses of the networks are as follows:
 - LAN 1 - 192.168.1.0 - 255.255.255.0
 - LAN 2 - 192.168.2.0 - 255.255.255.0
 - DMZ - 10.1.1.0 - 255.255.255.0
 - External zone - 213.85.203.0 - 255.255.255.248
 - LAN 1 and 2 have DHCP-provided IPs configured on the headquarters router.
 - In the DMZ and external zone, the IPs assigned to the terminals are fixed.
- It has a delegation in Porto with the 192.168.4.0 - 255.255.255.0 network. IPs are given by DHCP configured on the headquarters server.
- It has a delegation in Lisbon with the 192.168.5.0 / 24 network. IPs are given by DHCP configured on the headquarters server (not in the image but it is to be placed between Porto and LAN 2).
- The DHCP server at the headquarters in Coimbra with the address 192.168.1.3. This server has the following characteristics:
 - Lisbon Pool - Start 192.168.5.10 - Maximum 250 users.
 - Porto Pool - Start 192.168.4.10 - Maximum 50 users.
 - Do not forget the information of the gateway and DNS (192.168.1.2).

Pre - Requirements

- The ISP's network is 213.85.200.0 - 255.255.255.248 and the IPs are fixed.
- The connection networks are as follows:
 - Headquarters <-> Porto -> 192.168.3.0/30
 - Headquarters <-> Lisboa -> 192.168.3.4 / 30
 - Headquarters - Internet -> 213.85.201.0 / 30
- **Ensure that your network is functional and that all PCs (headquarters, Lisbon, Porto) access the different internal, external, DMZ and ISP networks. Test the entire network and verify that everything is working correctly.**
- **Enter simulation mode and “follow” the process of assigning an IP via DHCP to a new PC that you place on the Lisbon network. See the format of the packets that are exchanged between the terminals and the server.**

Exercise 1 - Configure NAT with *Cisco Packet Trace*

Exercise

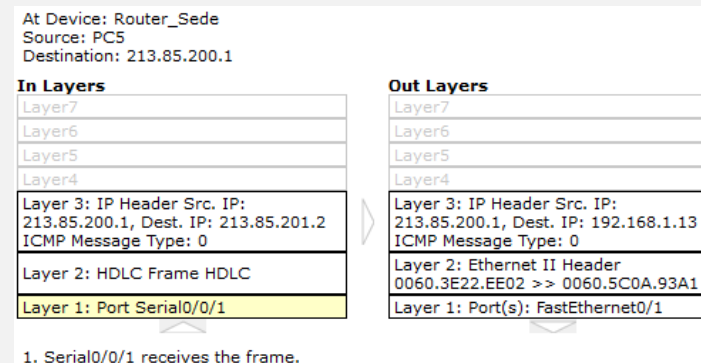
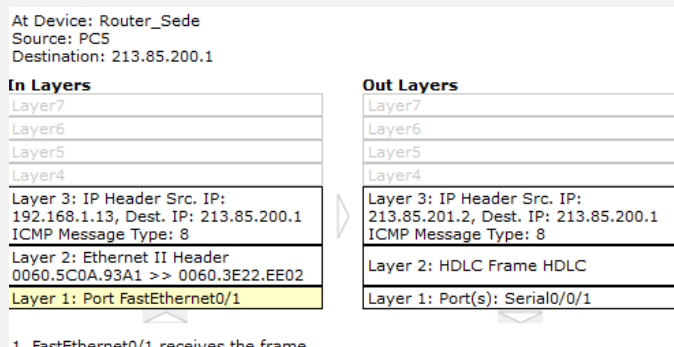
- Implement static NAT for the organization's Portal that is installed on a machine that is in the headquarters DMZ network. This server must leave with an IP of the public network.
- Ensure that this machine continues to access all corporate networks and the ISP network.
- Analyze the data packets before after the router and verify that changes have taken place.

Exercise

- Implement NAT by port (Network Address Port Translation) for all machines in the company using the available address of the external zone network.

```
R_CBR#sh ip nat t
Pro  Inside global      Inside local      Outside local      Outside global
tcp  213.85.201.2:1024  192.168.1.13:1025 213.85.200.1:80    213.85.200.1:80
tcp  213.85.201.2:1025  192.168.2.10:1025 213.85.200.1:80    213.85.200.1:80
tcp  213.85.201.2:1026  192.168.4.1:1025  213.85.200.1:80    213.85.200.1:80
```

- Ensure that your network is functional and that all PCs and servers (headquarters, Porto and Lisbon) access all internal networks and the ISP's network.
- Make the necessary changes to routes ...
- Analyze the data packets before after the router and verify that changes have taken place.

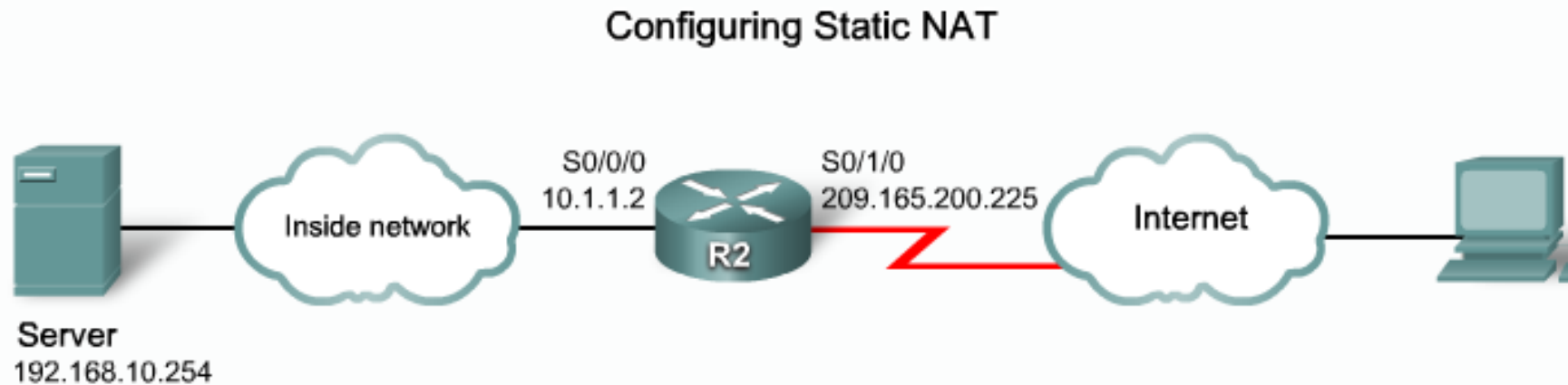


Exercise

- In a text file, place the static NAT demonstration before and after the packet passes through the router where you implemented that service. Make a small explanation of what happened.
- In the same file, place a demonstration of the NAT implementation by port for two machines (one from headquarters and the other from a delegation). Make a little explanation of what happened.
- Save that file with your name (first and last) and send it to `pgerinh@isec.pt` together with the Packet Tracer simulation file (the simulation must also have your name).
- If you have any questions or doubts you should send them by email together with the files described in the previous points.
- Sending this file will be proof of presence in class.

How To

Configuring Static NAT



```
ip nat inside source static 192.168.10.254 209.165.200.254
```

!—Establishes static translation between an inside local address and an inside global address.

```
interface serial 0/0/0
```

```
ip nat inside
```

!—Identifies Serial 0/0/0 as an inside NAT interface.

```
interface serial 0/1/0
```

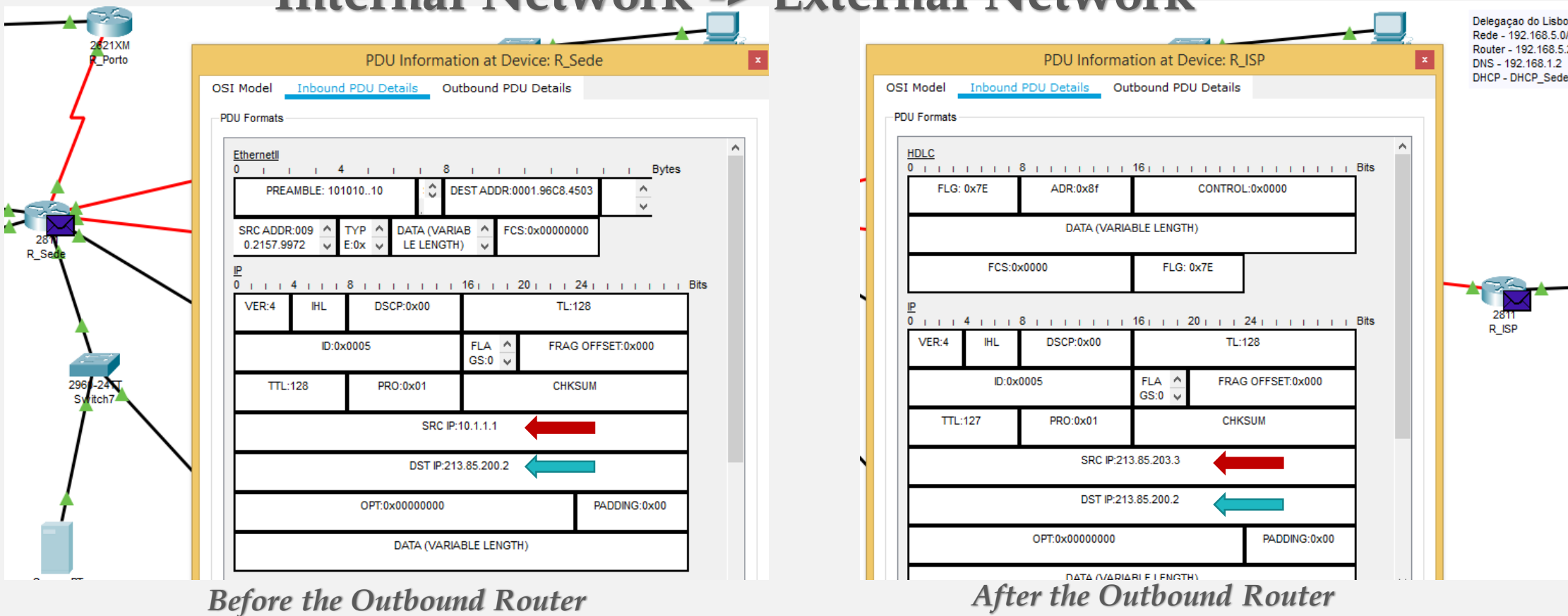
```
ip nat outside
```

!—Identifies Serial 0/1/0 as an outside NAT interface.

With this configuration, 192.168.10.254 will always translate to 209.165.200.254

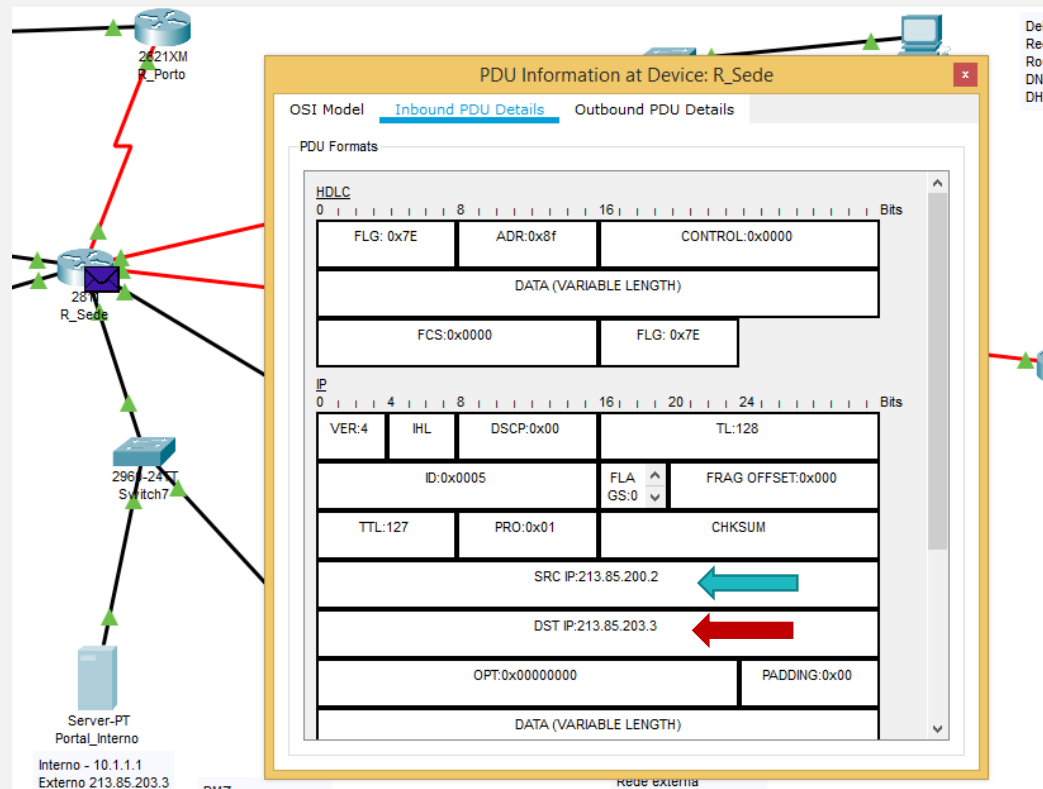
Static NAT

Direction Internal Network -> External Network

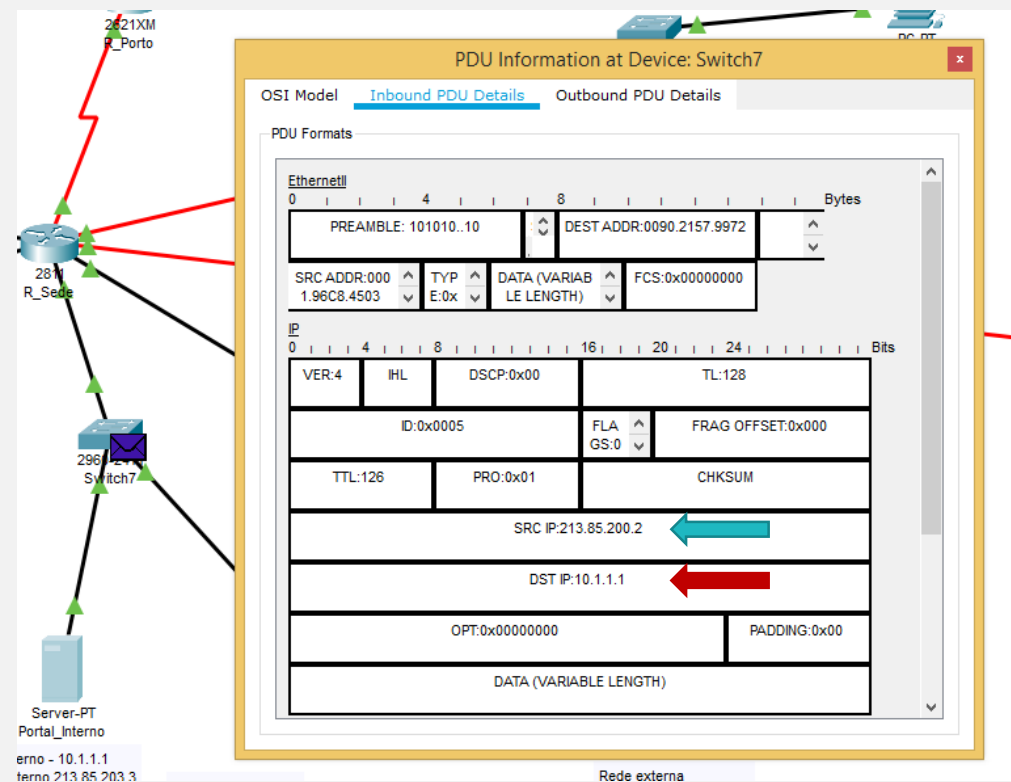


NAT Estático

Direction External Network -> Internal Network

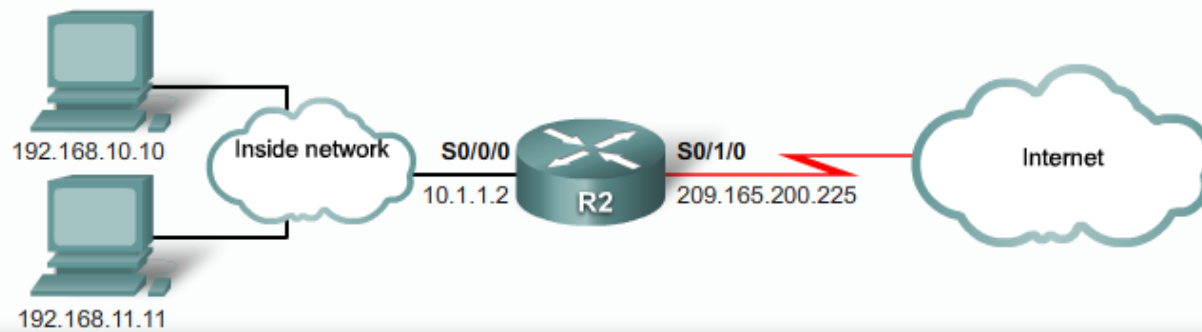


Before the Outbound Router



After the Outbound Router

Configuring dynamic NAT



```
ip nat pool NAT-POOL1 209.165.200.226 209.165.200.240 netmask 255.255.255.224
```

!—Defines a pool of public IP addresses under the pool name NAT-POOL1

```
access-list 1 permit 192.168.0.0 0.0.255.255
```

!—Defines which addresses are eligible to be translated

```
ip nat inside source list 1 pool NAT-POOL1
```

!—Binds the NAT pool with ACL 1

```
interface serial 0/0/0
```

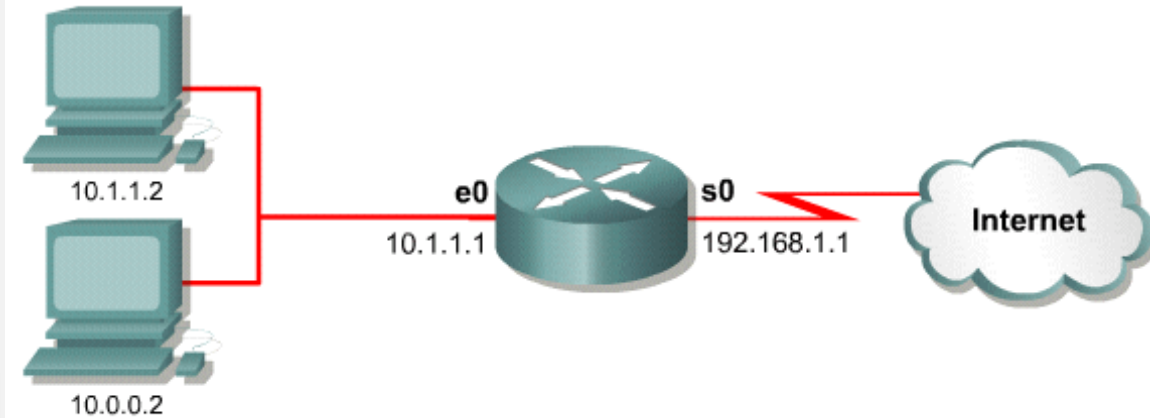
```
ip nat inside
```

!—Identifies interface Serial 0/0/0 as an inside NAT interface

```
interface serial 0/1/0
```

```
ip nat outside
```

!—Identifies interface Serial 0/1/0 as the outside NAT interface



```
ip nat pool nat-pool 1 179.9.8.80 179.9.8.95 netmask 255.255.255.0
```

```
ip nat inside source list 1 pool nat-pool1
```

!

```
interface ethernet 0
```

```
ip address 10.1.1.1 255.255.255.0
```

```
ip nat inside
```

!

```
interface serial 0
```

```
ip address 192.168.1.1 255.255.255.0
```

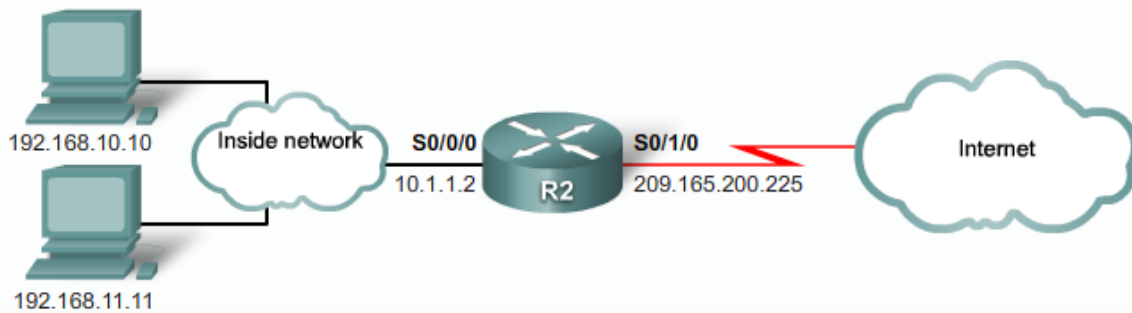
```
ip nat outside
```

!

```
access-list 1 permit 10.0.0.0.0.0.255.255
```


PAT (Network Address Port Translation) or NAT Overload

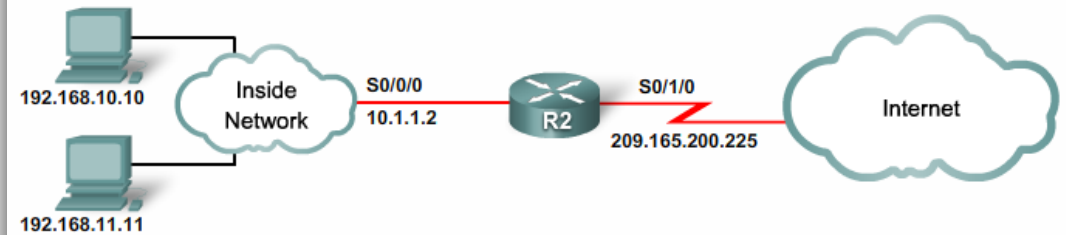
Using an address pool



```
access-list 1 permit 192.168.0.0 0.0.255.255
! - Defines which addresses are eligible to be translated
ip nat pool NAT-POOL2 209.165.200.226 209.165.200.240
! - Defines a pool of addresses named NAT-POOL2 to be used in NAT translation
ip nat inside source list 1 pool NAT-POOL2 overload
! - Binds the NAT pool with ACL 1
interface serial 0/0/0
ip nat inside
! - Identifies interface Serial 0/0/0 as an inside NAT interface
interface serial 0/1/0
ip nat outside
! - Identifies interface Serial 0/1/0 as an outside NAT interface
```

Using an address

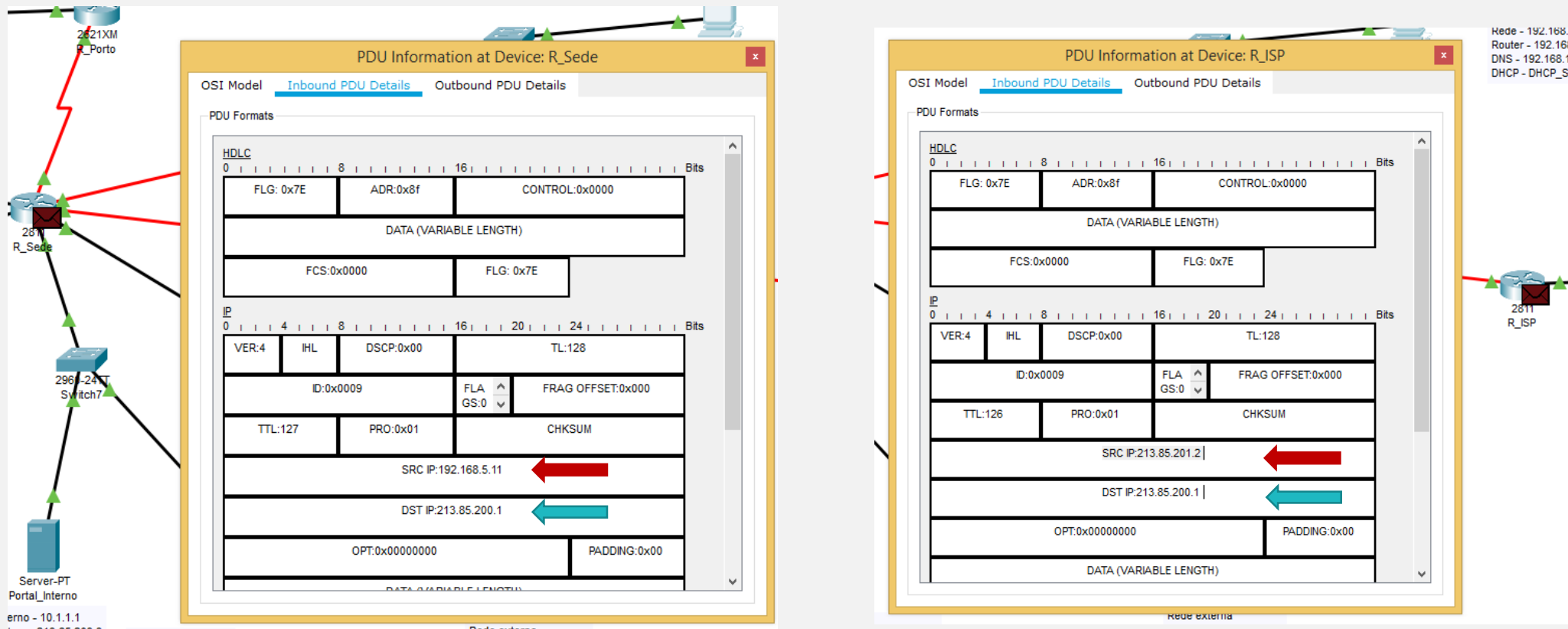
NAT Overload Configuration Example



```
access-list 1 permit 192.168.0.0 0.0.255.255
ip nat inside source list 1 interface serial 0/1/0 overload
interface serial 0/0/0
ip nat inside
interface serial 0/1/0
ip nat outside
```

PAT

Direction Internal Network -> External Network



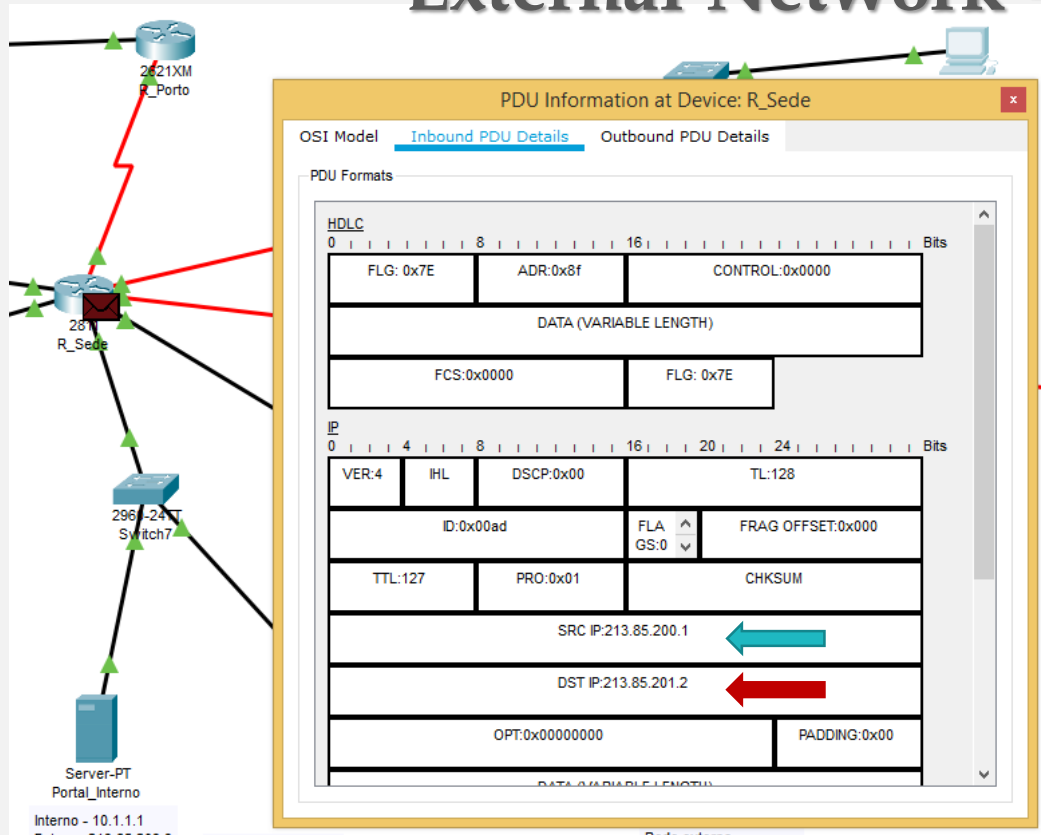
Before the Outbound Router

After the Outbound Router

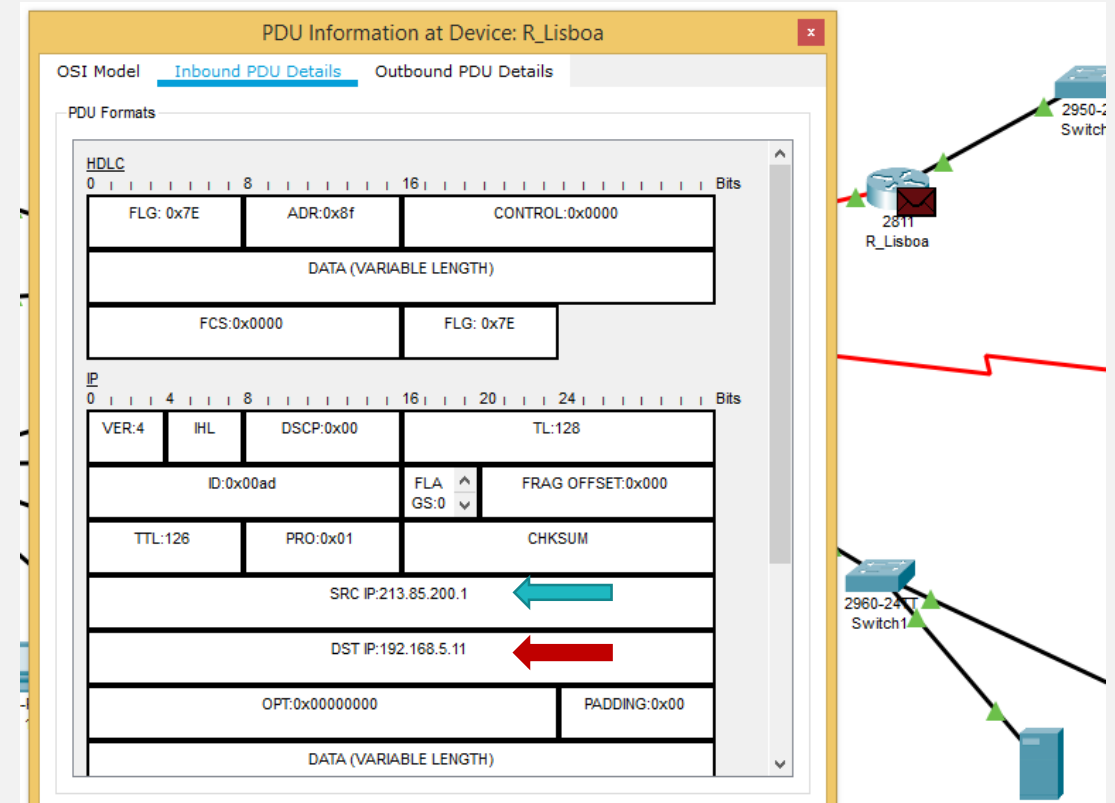
192.168.5.11->213.85.201.2

PAT

Direction External Network -> Internal Network



Before the Outbound Router



After the Outbound Router

213.85.201.2->192.168.5.11

Without NAT

External zone machines must not have NAT as they have public IP

The screenshot displays two main windows in Packet Tracer: a Command Prompt and a PDU Details window.

Command Prompt (SMTP - EXTERNO 213.85.203.1):

```
Packet Tracer SERVER Command Line 1.0
C:\>ping 213.85.200.1

Pinging 213.85.200.1 with 32 bytes of data:

Reply from 213.85.200.1: bytes=32 time=2ms TTL=126
Reply from 213.85.200.1: bytes=32 time=13ms TTL=126
Reply from 213.85.200.1: bytes=32 time=5ms TTL=126
Reply from 213.85.200.1: bytes=32 time=2ms TTL=126

Ping statistics for 213.85.200.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 13ms, Average = 5ms

C:\>ping 213.85.200.1

Pinging 213.85.200.1 with 32 bytes of data:
```

PDU Information at Device: R_ISP (Inbound PDU Details):

8		16		Bits	
FLG: 0x7E	ADR: 0x8f	CONTROL: 0x0000			
DATA (VARIABLE LENGTH)					
FCS: 0x0000		FLG: 0x7E			

4		8		16		20		24		Bits	
ER: 4	IHL	DSCP: 0x00		TL: 128							
ID: 0x0005				FLA: 0		GS: 0		FRAG OFFSET: 0x0000			
TTL: 127		PRO: 0x01		CHKSUM							
SRC IP: 213.85.203.1 ←											
DST IP: 213.85.200.1											
OPT: 0x00000000								PADDING: 0x00			
DATA (VARIABLE LENGTH)											

Network Diagram:

- Server-PT SMTP - EXTERNO 213.85.203.1** (Public IP) is connected to **Server-PT DNS - EXTERNO - 213.85.203.2**.
- Both external servers are connected to the **R_ISP** router.
- The **R_ISP** router is connected to the internal network.

NAT Configuration Check

NAT Translations Example

```
R2#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
tcp 209.165.200.225:16642 192.168.10.10:16642 209.165.200.254:80 209.165.200.254:80
tcp 209.165.200.225:62452 192.168.11.10:62452 209.165.200.254:80 209.165.200.254:80

R2#show ip nat translations verbose
Pro Inside global      Inside local      Outside local      Outside global
tcp 209.165.200.225:16642 192.168.10.10:16642 209.165.200.254:80 209.165.200.254:80
   create 00:01:45, use 00:01:43 timeout:86400000, left 23:58:16, Map-Id(In): 1,
   flags:
extended, use_count: 0, entry-id: 4, lc_entries: 0
tcp 209.165.200.225:62452 192.168.11.10:62452 209.165.200.254:80 209.165.200.254:80
   create 00:00:37, use 00:00:35 timeout:86400000, left 23:59:24, Map-Id(In): 1,
   flags:
extended, use_count: 0, entry-id: 5, lc_entries: 0
R2#
```

NAT Translations Example

```
R2#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.225:3 192.168.10.10:3 209.165.200.254:3 209.165.200.254:3
tcp 209.165.200.225:11679 192.168.10.10:11679 209.165.200.254:80 209.165.200.254:80
icmp 209.165.200.225:0 192.168.11.10:0 209.165.200.254:0 209.165.200.254:0
tcp 209.165.200.225:14462 192.168.11.10:14462 209.165.200.254:80 209.165.200.254:80

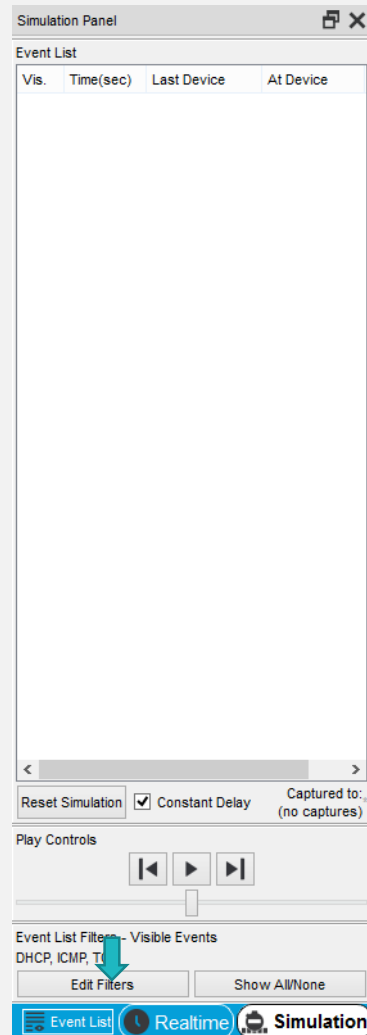
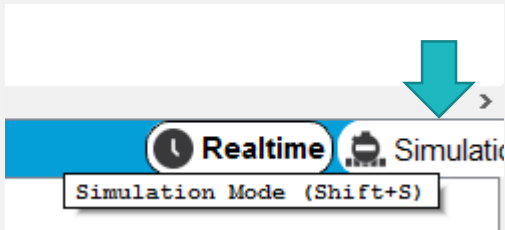
R2#show ip nat statistics
Total active translations: 3 (0 static, 3 dynamic; 3 extended)
Outside interfaces:
  Serial0/1/0
Inside interfaces:
  Serial0/0/0, Serial0/0/1
Hits: 173 Misses: 9
CEF Translated packets: 182, CEF Punted packets: 0
Expired translations: 6
Dynamic mappings:
-- Inside Source
[Id: 1] access-list 1 interface Serial0/1/0 refcount 3
Queued Packets: 0
R2#
```

Clearing NAT Translations

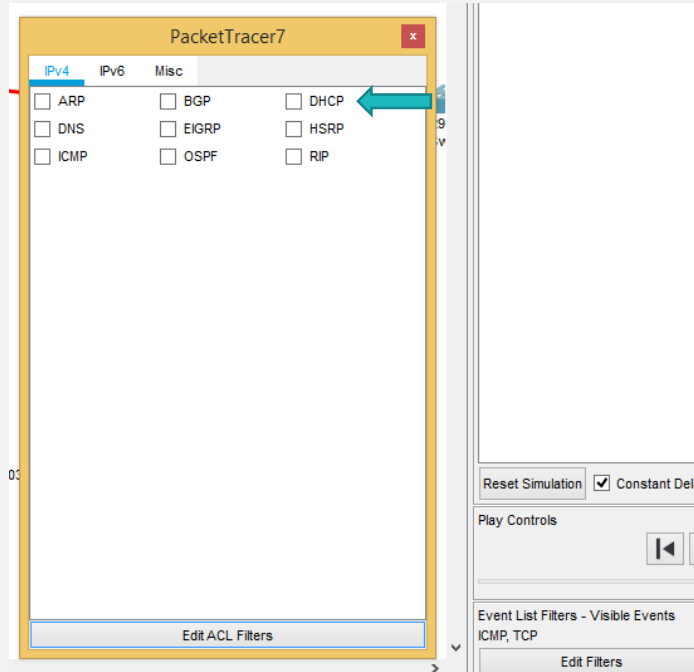
```
R2#clear ip nat translation *
R2#show ip nat translations
R2#
```

Command	Description
<code>clear ip nat translation *</code>	Clears all dynamic address translation entries from the NAT translation table
<code>clear ip nat translation inside global-ip local-ip [outside local-ip global-ip]</code>	Clears a simple dynamic translation entry containing an inside translation or both inside and outside translation
<code>clear ip nat translation protocol inside global-ip global-port local-ip local-port [outside local-ip local-port global-ip global-port]</code>	Clears an extended dynamic translation entry

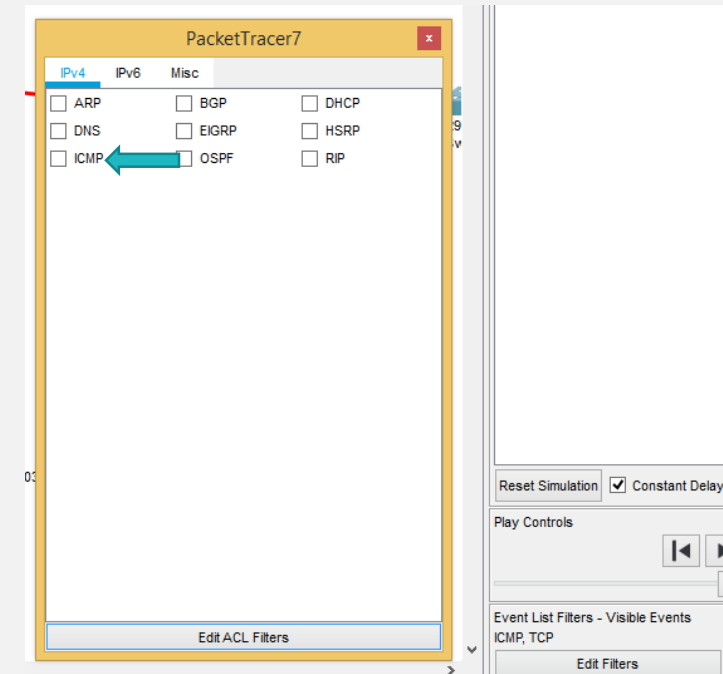
Simulation mode in PT



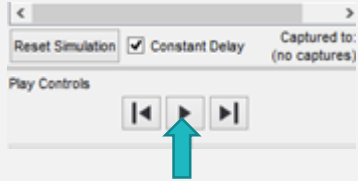
Choose what you want to see. If you are analyzing DHCP:



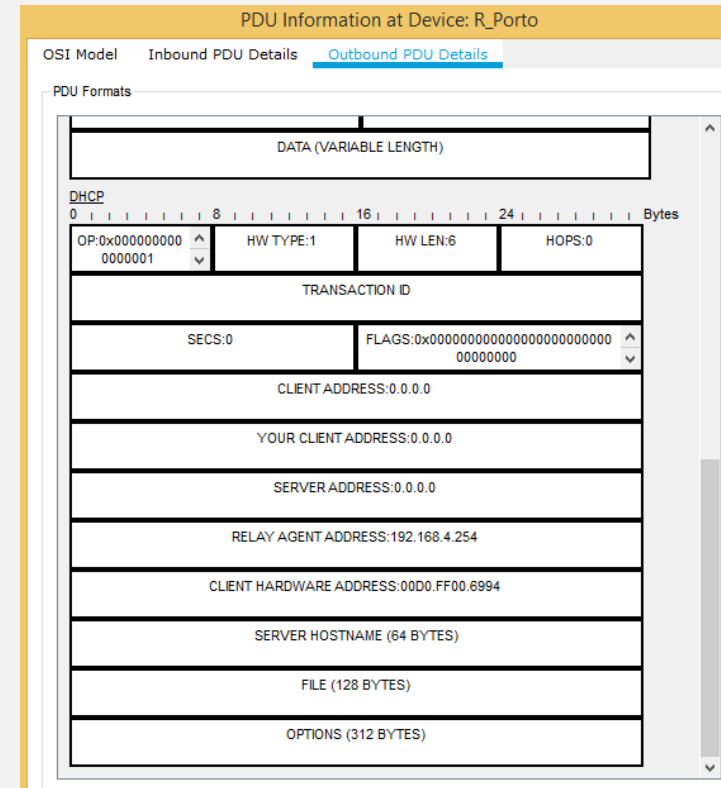
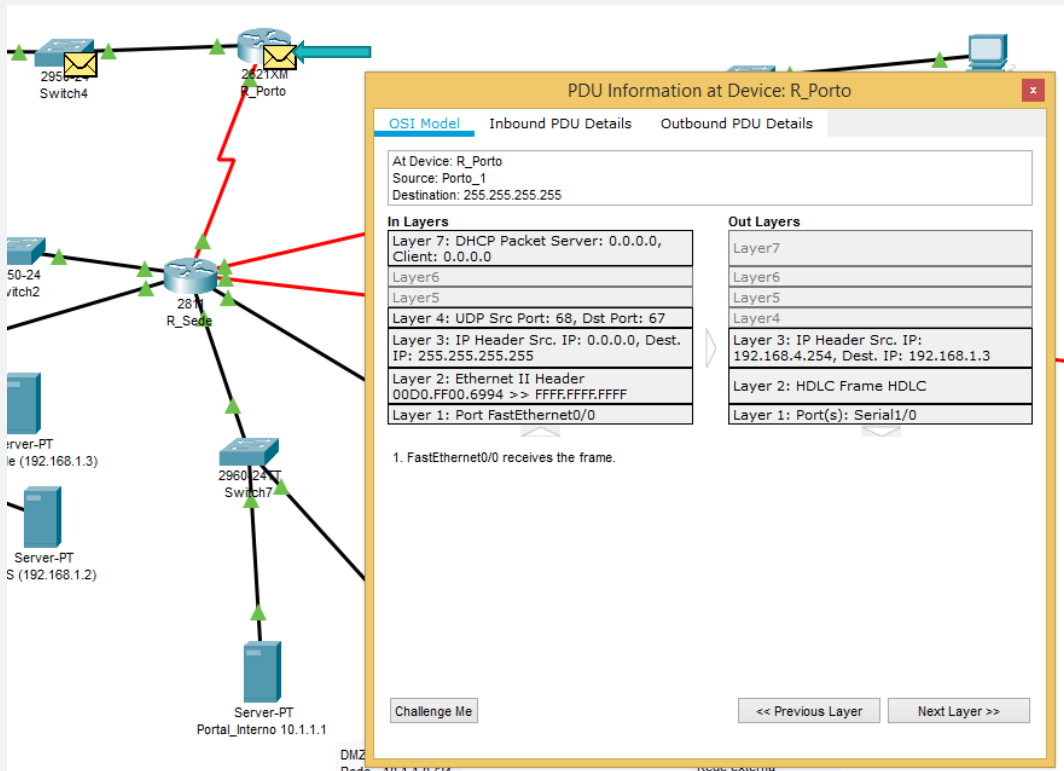
Choose what you want to see. In the case of a generic IP analysis.



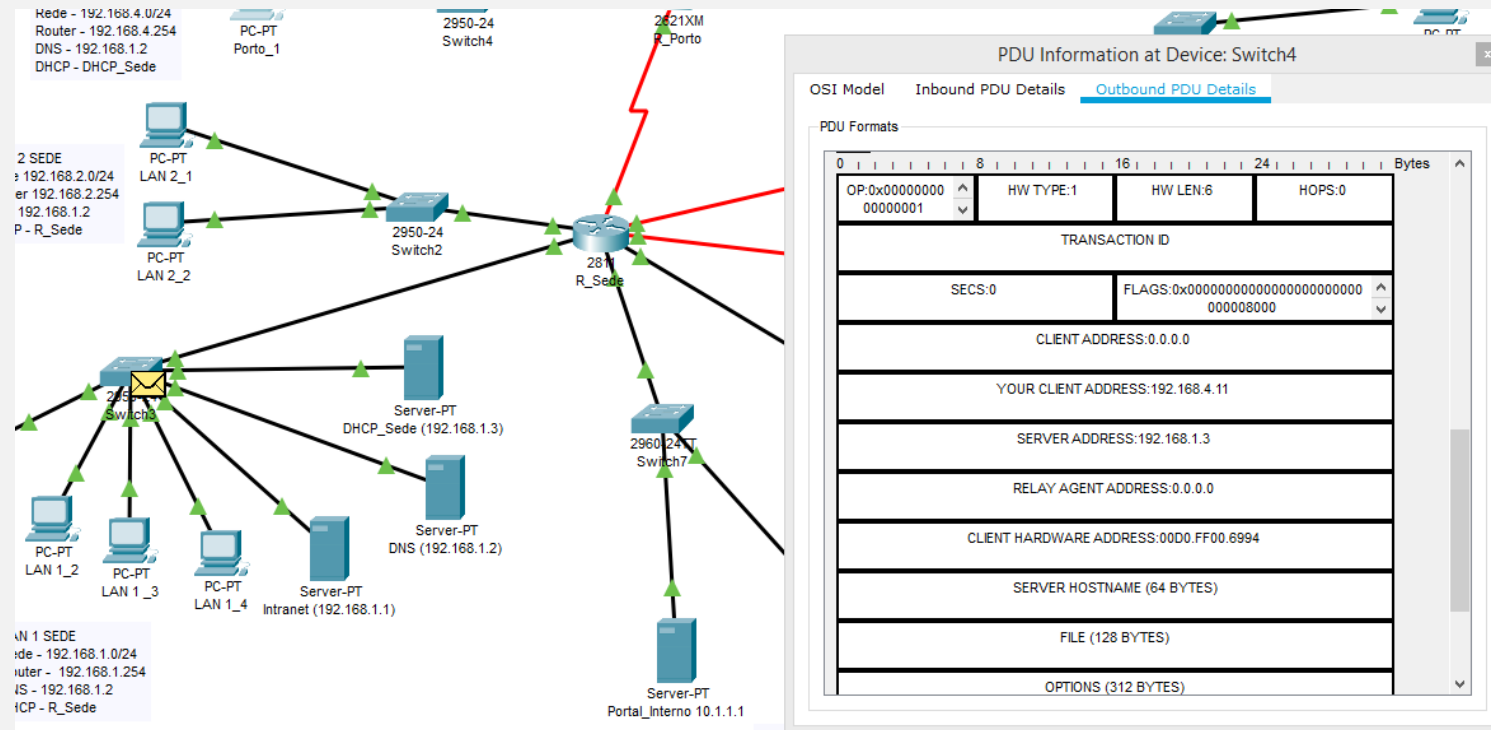
Simulation mode in PT



To analyze the information package, click on the envelope:



DHCP - Exemple



Questions

