Serviços de Rede 1 –
Aula 1 - Practical class

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Instituto Politécnico de Coimbra

Departamento de Engenharia Informática

Pre - Requirements

- You have installed the Cisco Packet Tracer version 7.1

Exercise 1 - Configure a Network with Cisco Packet Trace

Exercise

- Start Packet Tracer .

- Create the network that is in the drawing (does not need to be with the same models of active equipment).

- The router must have at least one port series and two Fast Ethernet .

- Change the router name to SR1 - CBR .

- Place the password enable to erasmus.

- Place the following addresses:
  - LAN 1 -192.168.1.xx -> 255.255.255.0
  - PC0 - 192.168.1.1 -> 255.255.255.0
  - PC1 10.168.1.2 -> 255.255.255.0
  - Router - 192.168.1.254 -> 255.255.255.0
  - LAN 2 -192.168.2.xx -> 255.255.255.0
  - PC4 - 192.168.2.1 -> 255.255.255.0
  - Router - 192.168.2.254 -> 255.255.255.0

- Test the connections on the local network .

4
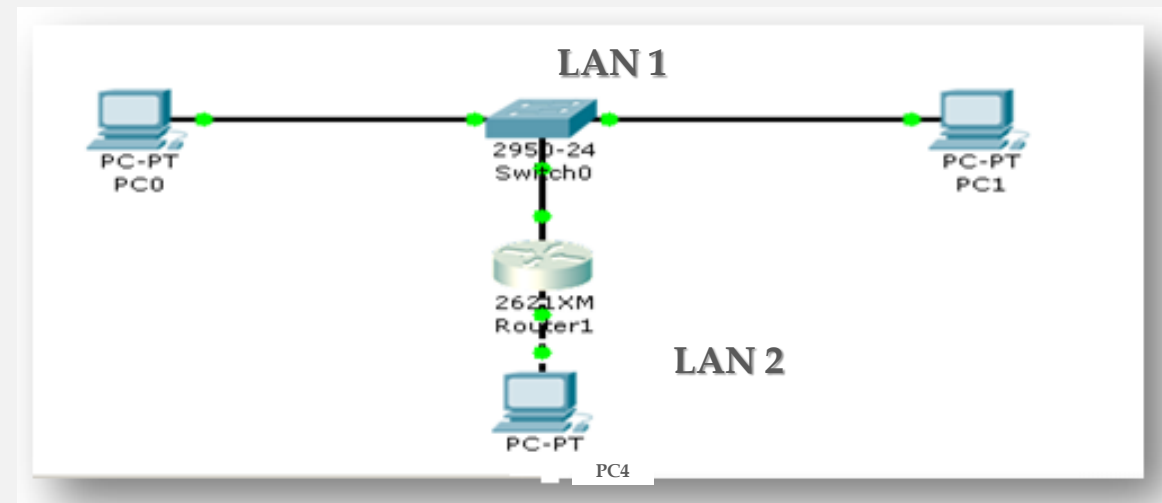
Exercise (Cont.)

- Put a description on both interfaces of the local area networks.

- Try to access the router using telnet. Can you?

- Make the necessary changes to make this happen .

- Place a banner indicating that you are accessing a secure system.

- Write a meaningless word in the setting. What happens? Disable the native functionality of the routers to do name resolution. Repeat the word writing. What happens?.
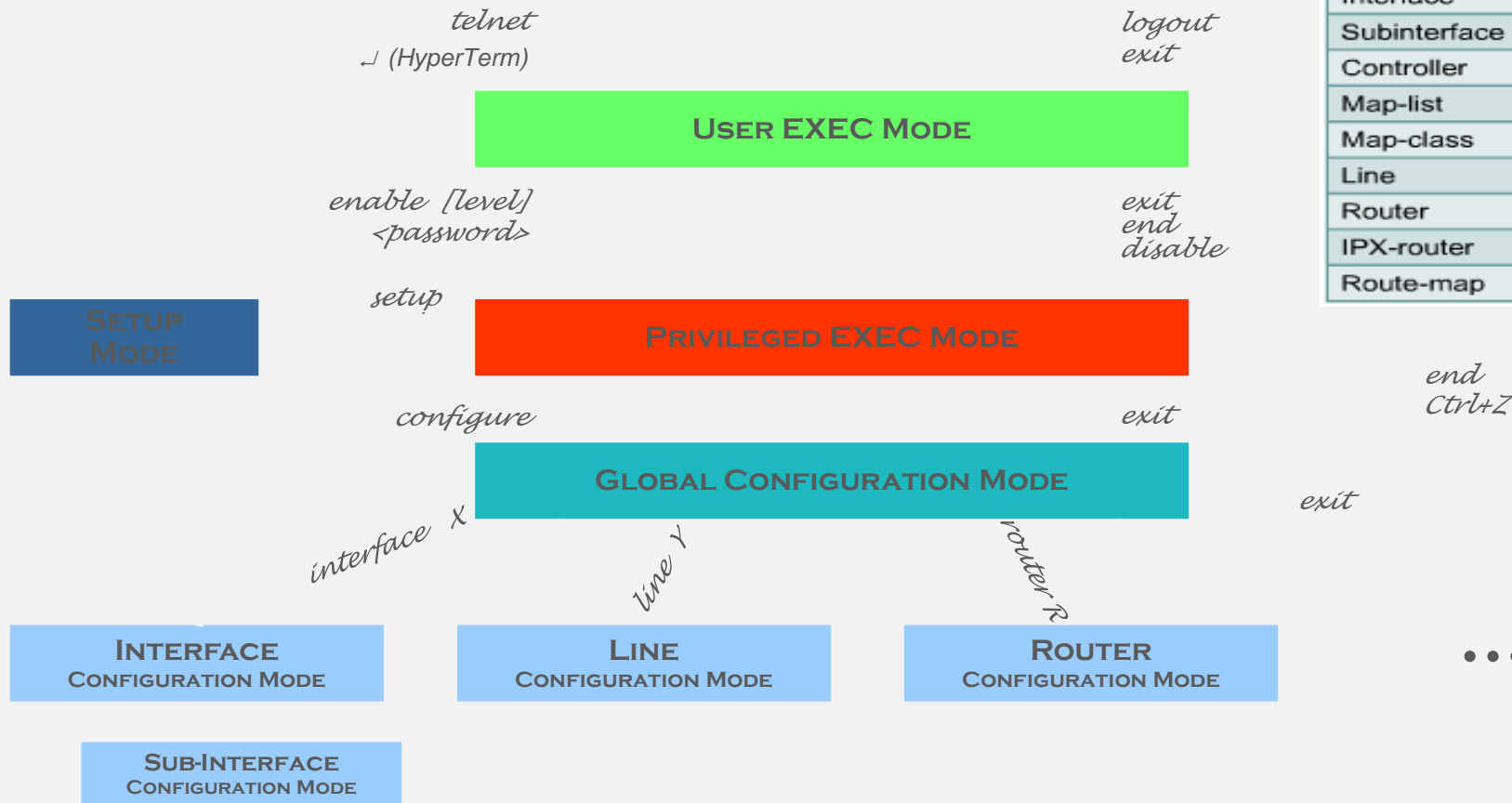
How To

Installation

Command line interface

- The most complete and most flexible way of configuring a router is through the command line interface (command line interface - CLI) IOS operating system.

Command line interface

Configuration Mode	Prompt
Interface	Router(config-if)#
Subinterface	Router(config-subif)#
Controller	Router(config-controller)#
Map-list	Router(config-map-list)#
Map-class	Router(config-map-class)#
Line	Router(config-line)#
Router	Router(config-router)#
IPX-router	Router(config-ipx-router)#
Route-map	Router(config-route-map)#

telnet

↵ (HyperTerm)

logout
exit

User EXEC Mode

enable [level]
<password>

exit
end
disable

setup

Setup Mode

Privileged EXEC Mode

configure

exit

end
Ctrl+Z

Global Configuration Mode

exit

interface X

line Y

router R

Interface Configuration Mode

Line Configuration Mode

Router Configuration Mode

• • •

Sub-Interface Configuration Mode

```
Router con0 is now available.

Press RETURN to get started.

User Access Verification
Password:
Router>          ◄── User-Mode Prompt
Router>enable
Password:
Router#          ◄── Privileged-Mode Prompt
Router#disable
Router>
Router>exit
```

Command line interface

- **Help**

```
Cisco>?
Exec commands:
access-enable    Create a temporary Access-
                 entry
access-profile   Apply user-profile to inte
```

```
Cisco#cl?
clear   clock
Cisco#clock
% Incomplete command.
Cisco#clock ?
  set   Set the time and date
Cisco#clock set
% Incomplete command
```

- **Error signaling**

```
Router#comfigure terminal
           ^
% Invalid input detected at '^' marker.
Router#configure terminal
```

- **Short commands**

```
Router# conf term
Router(config)#i
% Ambiguous command: "i"
```

- **Negate commands**

```
Router# conf term
Router(config)# no cmd…
```

Initial Setup

- **Router Name**

  Router(config)# **hostname Tokyo**
  Tokyo (config)#

- **Disable DNS**

  ```
  Router(config)# no ip domain-lookup
  ```

- **Host table**

  ```
  Router(config)#ip host Auckland 172.16.32.1
  Router(config)#ip host Beirut 192.168.53.1
  Router(config)#ip host Capetown 192.168.89.1
  Router(config)#ip host Denver 10.202.8.1
  ```

  ```
  LAB_A#show hosts
  Default domain is not set
  Name/address lookup uses domain service
  Name servers are

  Host     Flags       Age   Type   Address(es)
  LAB_A    (perm, OK)  **    IP     192.5.5.1 205.7.5.1 201.100.11.1
  LAB_B    (perm, OK)  **    IP     219.17.100.2 199.6.13.1 201.100.11.2
  LAB_C    (perm, OK)  **    IP     223.8.151.1 204.204.7.1 199.6.13.2
  LAB_D    (perm, OK)  **    IP     210.93.105.1 204.204.7.2
  LAB_E    (perm, OK)  **    IP     210.93.105.2
  ```

11

Initial Setup

- **_Passwords_**

Console Password
```
Router(config)#line console 0
Router(config-line)#login
Router(config-line)#password cisco
```
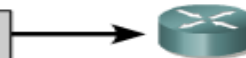
Virtual Terminal Password
```
Router(config)#line vty 0 4
Router(config-line)#login
Router(config-line)#password cisco
```

Enable Password
```
Router(config)#enable password san-fran
```

Perform Password Encryption
```
Router(config)#service password-encryption
(set passwords here)
Router(config)#no service password-encryption
```

Terminal Lines	
0	con0
1	aux0
2	vty0
3	vty1
4	vty2
5	vty3
6	vty4

```
Router(config)# enable secret <password>
```

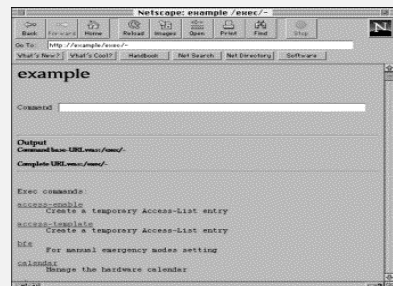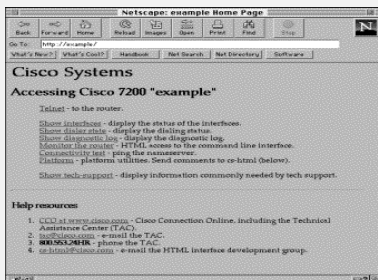# Initial Setup

- **Web browser access**
  - Http server

  ```
  Router# configure teminal
  Router(config)# ip http server
  ```

  - Change the port

  ```
  Router(config)# ip http port number
  ```

  - Acesso: http://IP/

- **Banners**
  - MOTD – Message of the Day


```
LAB_A con0 is now available

Press RETURN to get started.

This is a secure system.  Authorized Access ONLY!!!

User Access Verification

Password:

LAB A>enable
```

```
LAB_A(config)# banner motd # This is a secure system.
Authorized access ONLY!!! #
```

13

Other Basic Commands

- *Enable* – privileged mode

- *Conf t* – configuration mode

- *No command* – Undo command

- *Ctrl+z ou exit* – leave configuration mode

- *Show running-config -* Shows the running configuration

- *Show startup-config -* Shows the setting that is saved

- *Write memory -* Save to memory the configuration that are running

- *Clock -* update the clock

Configuring an Ethernet Interface

R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 172.16.1.254 255.255.255.0
R1(config-if)#no shutdown

*Mar 1 01:16:08.212: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar 1 01:16:09.214: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
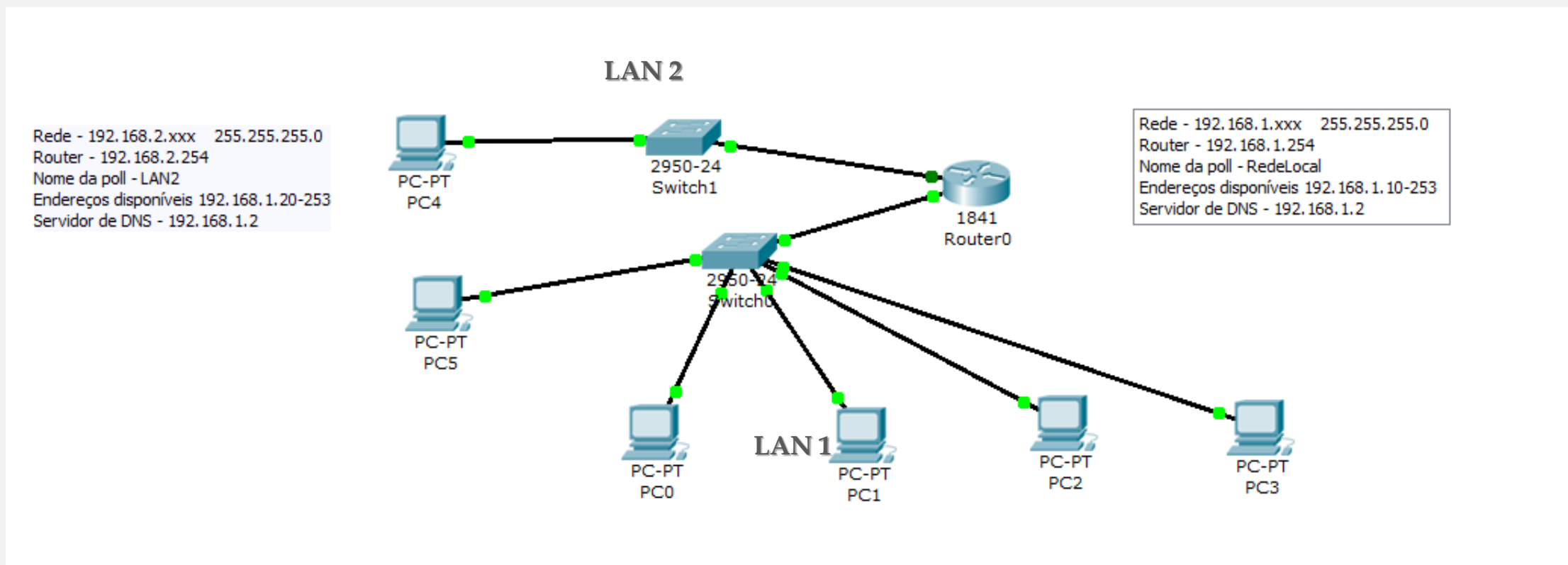
```
R1#show interfaces fastethernet 0/0
FastEthernet0/0 is up, line protocol is up
  Hardware is AmdFE, address is 000c.3010.9260 (bia 000c.3010.9260)
  Internet address is 172.16.3.1/24

R1#
```

Exercise 2 - Configure DHCP service on a Cisco Router

Exercise 2

- Make the necessary changes to the previous exercise to get the following image:
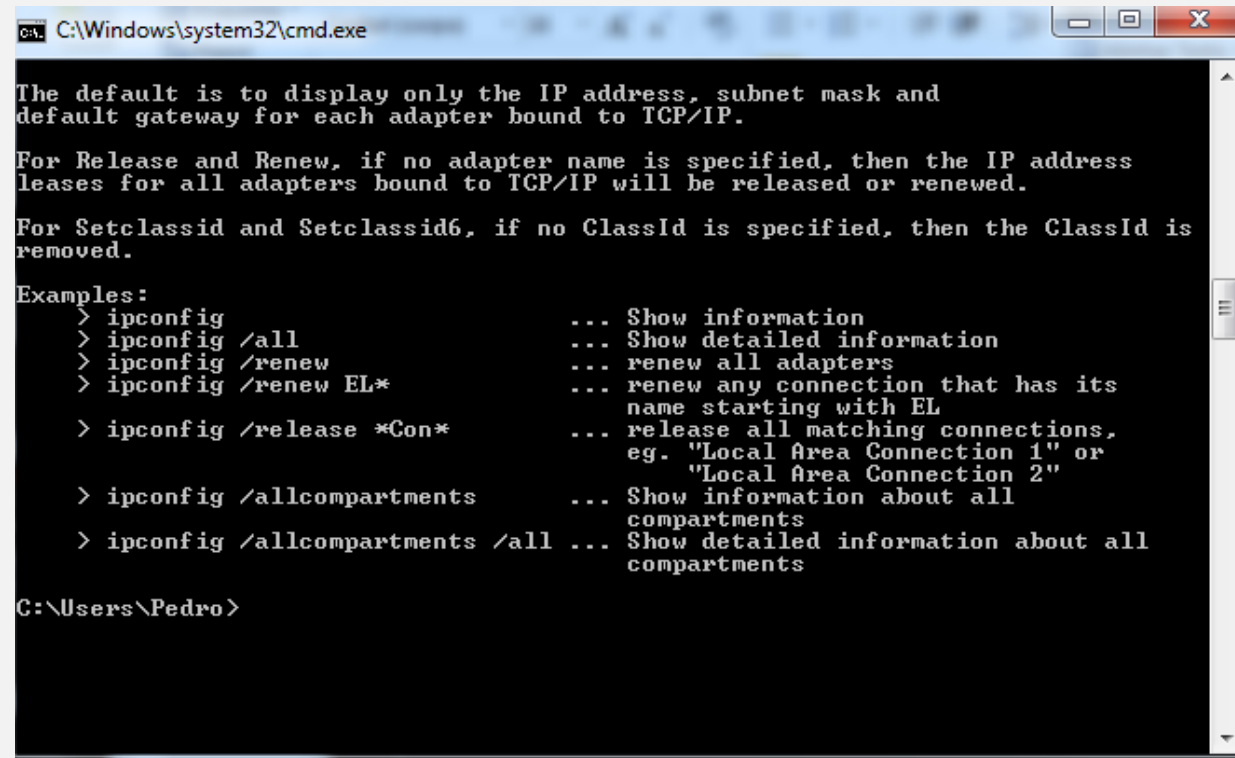
Exercise 2 (cont.)

- Test if your network continues to function.

- Configure DHCP for LAN1 (all machines must have automatic address and basic network settings).

- Check that all equipment is properly configured and that you have access to network resources.

- Configure DHCP for LAN2.

- Make sure your network is still functional.

How To

DHCP (Client)

- In a client and to know / change your IP configuration you can use these commands:
    - *Ipconfig /all*
    - *Ipconfig /renew*
    - *Ipconfig /release*

DHCP (Client)

- In the client configuration you can define which parameters are obtained automatically (DHCP) or manual.

Serviços de Rede 1

Dynamic Host Configuration Protocol (DHCP)

 - Cisco

Cisco

- Configuration steps
  - Activate service: **service dhcp**
  - By default, it is active

- Set a range of addresses to be used in dynamic allocation
  - Exceptions may be given - set of addresses or addresses belonging to the range but must not be assigned
  - Create a pool
    - Use the **ip dhcp pool** command
  - Configure specific parameters pool (Default Gateway, DNS server,….)

Cisco

Configuring DHCP Step 1: Excluding IP Addresses

```
R1(config)#ip dhcp excluded-address low-address [high-address]
```

```
R1(config)#ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)#ip dhcp excluded-address 192.168.10.254
```

Cisco

- Give the pool a name

Configuring DHCP Step 2: Configuring a DHCP Pool

```
R1(config)#ip dhcp pool pool-name
```

```
R1(config)#ip dhcp pool LAN-POOL-1
R1(dhcp-config)#
```

Cisco

Configuring DHCP Step 1: Excluding IP Addresses

```
R1(config)#ip dhcp excluded-address low-address [high-address]
```

```
R1(config)#ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)#ip dhcp excluded-address 192.168.10.254
```

Configuring DHCP Step 2: Configuring a DHCP Pool

```
R1(config)#ip dhcp pool pool-name
```

```
R1(config)#ip dhcp pool LAN-POOL-1
R1(dhcp-config)#
```

Cisco

Configuring DHCP Step 3: Specific Tasks

Required Tasks	Command
Define the address pool	`network network-number [mask	/prefix-length]`
Define the default router or gateway	`default-router address [address2...address8]`

Optional Tasks	Command
Define a DNS server.	`dns-server address [address2...address8]`
Define the domain name	`domain-name domain`
Define the duration of the DHCP lease	`lease { days [hours] [minutes]	infinite}`
Define the NetBIOS WINS server	`netbios-name-server address [address2...addr`

DHCP Configuration Example

```
R1(config)# ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)# ip dhcp excluded-address 192.168.10.254
R1(config)# ip dhcp pool LAN-POOL-1
R1(dhcp-config)# network 192.168.10.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.10.1
R1(dhcp-config)# domain-name span.com
R1(dhcp-config)# end
```

Cisco

- A router can have multiple configured 'pools'
  - The 'pool' to be used for the dynamic allocation of IP information is based on the interface that receives the DHCP request (DHCPDISCOVER message)

CISCO
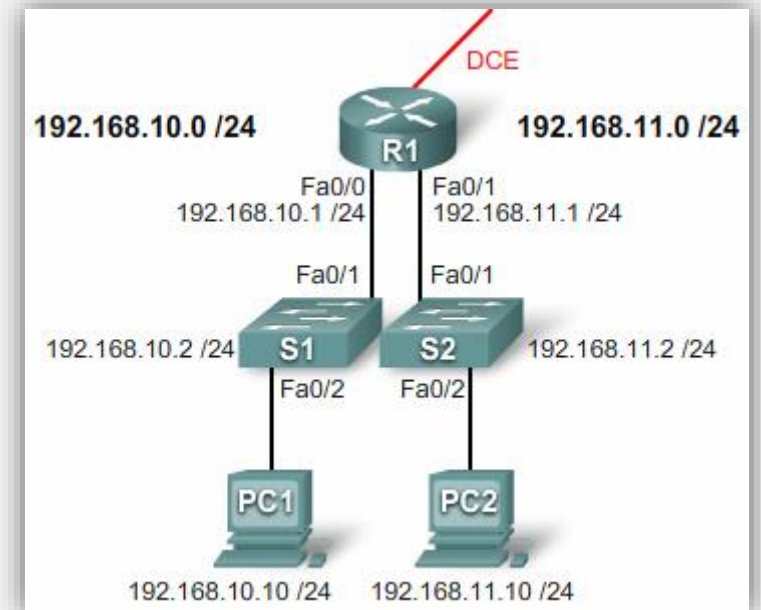
- Commands used to verify configuration:
  - **show ip dhcp binding -** information about the clients who are using the DHCP service
  - **show ip dhcp server statistics -** shows service statistics, for example how many DHCP packets were transmitted / received.
  - **show ip dhcp pool -** shows information about the pool that was created
  - **clear ip dhcp binding {address | *} -** clears a DHCP entry
  - **clear ip dhcp server statistics - clear stats**

```
R1#sho ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name
192.168.10.10       0100.e018.5bdd.35       Oct 03 2007 06:14 PM    Automatic
192.168.11.10       0100.b0d0.d817.e6       Oct 03 2007 06:18 PM    Automatic


R1#sho ip dhcp server statistics
Memory usage        25307
Address pools       2
Database agents     0
Automatic bindings  2
Manual bindings     0
Expired bindings    0
Malformed messages  0
Secure arp entries  0

Message             Received
BOOTREQUEST         0
DHCPDISCOVER        8
DHCPREQUEST         3
DHCPDECLINE         0
DHCPRELEASE         0
DHCPINFORM          0

Message             Sent
BOOTREPLY           0
DHCPOFFER           3
DHCPACK             3
DHCPNAK             0
R1#
```

```
R1#show ip dhcp pool

Pool LAN-POOL-1 :
 Utilization mark (high/low)   : 100 / 0
 Subnet size (first/next)      : 0 / 0
 Total addresses               : 254
 Leased addresses              : 1
 Pending event                 : none
 1 subnet is currently in the pool :
 Current index      IP address range                     Leased addresses
 192.168.10.11      192.168.10.1    - 192.168.10.254     1

Pool LAN-POOL-2 :
 Utilization mark (high/low)   : 100 / 0
 Subnet size (first/next)      : 0 / 0
 Total addresses               : 254
 Leased addresses              : 1
 Pending event                 : none
 1 subnet is currently in the pool :
 Current index      IP address range                     Leased addresses
 192.168.11.11      192.168.11.1    - 192.168.11.254     1
R1#
```

Exercise 3 - Set up a serial connection

Exercise 3

- The company opened an office in Porto (see the topology to create on the next slide).

- Configure:
  - The IP address structure (LAN and WAN port connection <-> Headquarters). You should consider that in LAN you have up to 254 devices and in the WAN you only have two devices to connect. Link the delegation to headquarters with a series point-to - point with a 1M bandwidth .
  - As a first step put the PC to have a fixed IP address
  - Test connectivity .
  - Place the router of the delegation to distribute DHCP addresses to hosts on the local network

  NOTE:
  - When talking about network connectivity, it is ensured that the machines have access on your local network and the on the WAN (ie for example that a LAN1 network PC can reach machines that are in LAN1, LAN2 and Porto).

Exercise 3

Delegação do Porto

PC-PT
PC6

2960-24TT
Switch2

2901
Router1

Rede de ligação

2960-24TT
Switch0

2901
Router0

2960-24TT
Switch1

PC-PT
PC2

PC-PT
PC0

PC-PT
PC3

PC-PT
PC4

PC-PT
PC5

PC-PT
PC1

LAN 2
Rede - 192.168.2.0/24
Router - 192.168.2.254
DNS - 192.168.1.2

LAN 1
Rede - 192.168.1.0/24
Router - 192.168.1.254
DNS - 192.168.1.2
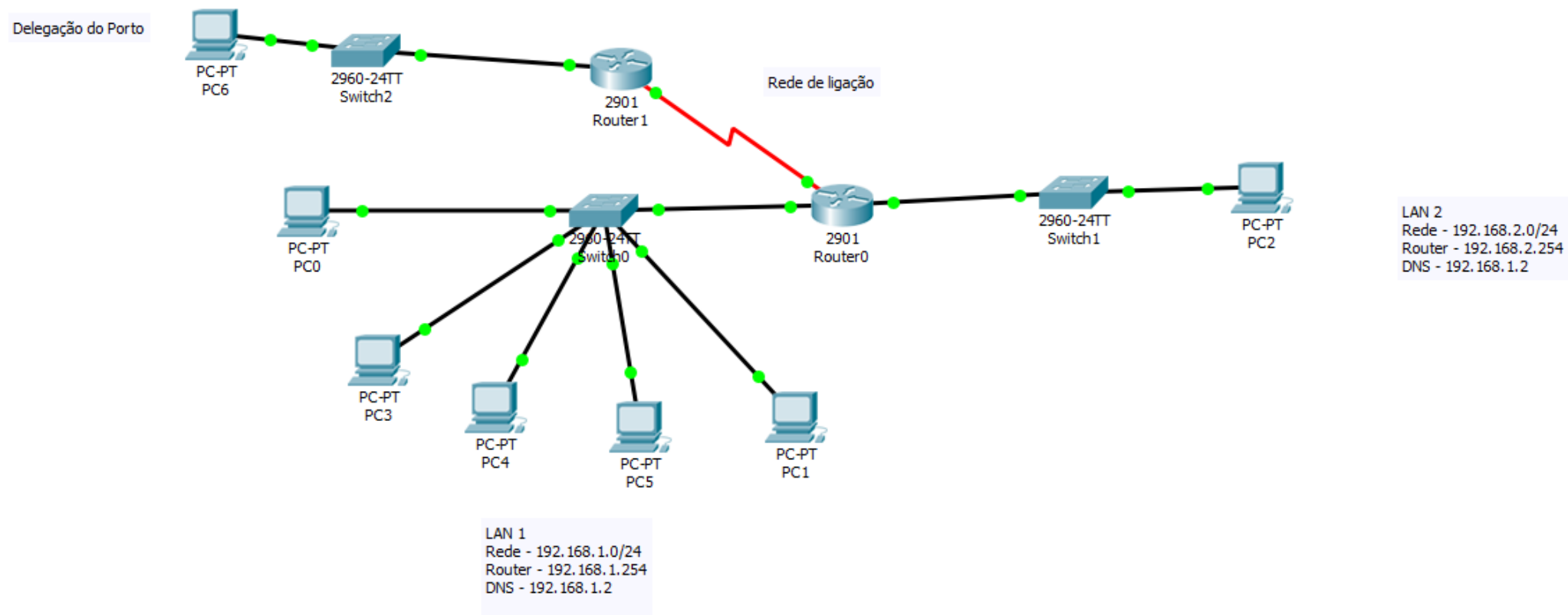
How To

General configuration interfaces

- Basic Configuration

IP and mask

Interface Identification

```
Router> enable
Router# configure terminal
Router(config)# interface serial0
Router(config-if)# description LAN Engineering, Bldg.2
Router(config-if)# ip address <ip address> <netmask>
Router(config-if)# clock rate 56000
Router(config-if)# no shutdown
```

Active the interface

In serial interfaces when the router acts as DCE (i.e. assumes the role of CSU / DSU) it is necessary to generate clock. Valid bps: 1200, 2400, 9600, 19200, 38400, 56000, 64000, 72000, 125000, 148000, 500000, 800000, 1000000, 1300000, 2000000, 4000000.

Static Routes

- **Command ip route**

  ▪ To configure a static route, use the following command:

```
Router(config)# ip route network-address subnet-mask
{ip-address | exit-interface }
```

Parâmetro	Descrição
network-address	Endereço da rede de destino da rede remota a ser adicionado à tabela de roteamento.
subnet-mask	Máscara de sub-rede da rede remota a ser adicionada à tabela de roteamento. A máscara de sub-rede pode ser modificada para sumarizar um grupo de redes.
ip-address	Normalmente conhecido como o endereço IP do roteador do próximo salto.
exit-interface	Interface de saída usada no encaminhamento de pacotes para a rede de destino.

Static Routes

- Static routes configured with an output interface are more efficient.

- The routing table can identify the output interface in a single query, rather than two when using the IP address.

```
R1(config)#no ip route 192.168.2.0 255.255.255.0 172.16.2.2
R1(config)#ip route 192.168.2.0 255.255.255.0 serial 0/0/0
R1(config)#end
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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 not set

     172.16.0.0/24 is subnetted, 3 subnets
S       172.16.1.0 [1/0] via 172.16.2.2
C       172.16.2.0 is directly connected, Serial0/0/0
C       172.16.3.0 is directly connected, FastEthernet0/0
S     192.168.1.0/24 [1/0] via 172.16.2.2
S     192.168.2.0/24 is directly connected, Serial0/0/0
```

Agora a interface de saída está especificada na rota estática. Não há necessidade de uma pesquisa recursiva.

Static Routes

▪Existing static routes can not be modified. An old route must be removed by placing a no before the **ip route** command.

no ip route 192.168.2.0 255.255.255.0 serial 0/0/1

▪The new static route must be rewritten in the router configuration.

```
R1(config)#no ip route 172.16.1.0 255.255.255.0 172.16.2.2
R1(config)#ip route 172.16.1.0 255.255.255.0 serial 0/0/0
R1(config)#no ip route 192.168.1.0 255.255.255.0 172.16.2.2
R1(config)#ip route 192.168.1.0 255.255.255.0 serial 0/0/0
```

```
R2(config)#no ip route 172.16.3.0 255.255.255.0 172.16.2.1
R2(config)#ip route 172.16.3.0 255.255.255.0 serial 0/0/0
R2(config)#no ip route 192.168.2.0 255.255.255.0 192.168.1.1
R2(config)#ip route 192.168.2.0 255.255.255.0 serial 0/0/1
```

```
R3(config)#no ip route 172.16.1.0 255.255.255.0 192.168.1.2
R3(config)#ip route 172.16.1.0 255.255.255.0 serial 0/0/1
R3(config)#no ip route 172.16.2.0 255.255.255.0 192.168.1.2
R3(config)#ip route 172.16.2.0 255.255.255.0 serial 0/0/1
R3(config)#no ip route 172.16.3.0 255.255.255.0 192.168.1.2
R3(config)#ip route 172.16.3.0 255.255.255.0 serial 0/0/1
```

Static Routes

- To check the static route setting:
  - Use the following commands:
    - **Step 1** - *show running-config*
    - **Step 2** - Verify that the static route has been entered correctly
    - **Step 3** - *show ip route*
    - **Step 4** - Verify that the route has been added in the routing table
    - **Step 5** - Use the *ping* command to verify that the packets can reach the destination and that the return path is working.