Instruction for lab - Static routing (rev. 170425)

**Network topology in lab 8**

Connect your computers directly to the switch . Make the connection between the switch and router. The router should be connected via serial cables to the routers of adjacent group.

PC1, PC2 ---------- | S\_X | ---------- | R\_X | ---------- | RY | -------- - | SY | ---------- PC1, PC2

Each group will configure the router marked as R\_X.  Router R\_Y represents a router of adjacent group.

PC1 console cable should be connected to the console port of the router R\_X.

PC1 "Cisco" NIC should be connected to the port Fa 0/1 on the switch.

PC2 "Cisco" NIC should be connected to the port Fa 0/11 on the switch.

The router via the FastEthernet port should be connected to the port Fa 0/23 on the switch.

Designations and addresses used int the lab 10:

X is the number of devices on a rack . It should correspond to the group number.

Switch name: S\_L

Router name: R\_L

Management VLAN: 1

Switch should have cleared configurations :

All ports are set by default to VLAN 1

Alternatively, you can set the switch IP address for VLAN 1 :

S\_L VLAN 1 IP: 172.16.L.L9/24 gate : 172.16.L.L0

The [IP addresses](https://eportal.pwr.edu.pl/mod/resource/view.php?id=56957) assigned to the interfaces of subsequent computer :

PC1 : 172.16.L.L1/24 gate : 172.16.L.L0

PC2 : 172.16.L.L2/24 gate : 172.16.L.L0

[IP addresses](https://eportal.pwr.edu.pl/mod/resource/view.php?id=56957) assigned to the router's LAN interfaces :

LAN1 : Eth / Fa 0/ 0: 172.16.L.L0/24 ,

LAN2 : Eth / Fa 0 /1: 172.16.100 + L.L0/24 ,

[IP addresses](https://eportal.pwr.edu.pl/mod/resource/view.php?id=56957) assigned to the router's WAN interfaces :

WAN1 : 10.L.M.1/ 24, eg 10.1.2.1 for network between groups 1 and 2

WAN2 : 10 K.L.2, eg 10.5.1.2 for network between groups of 5 and 1 (connection in loops )

.. ( the same pattern for the other interfaces )

K - number of "left" (previous) router

L - number of our router

M - number of "right" (next) router

\* [ 4.4.1.1 ] CCNA2 v. 5.0 - analysis of the routing table , the different types of routes.

\* [ 6.2.2.5 ] CCNA2 v. 5.0 - Configure IPv4 static routing .

- Recursive static route ( the IP address of the next hop is given. That makes the router to search the routing tables a few times)

- Directly connected static route ( specify the output interface name instead of an IP address of next hop. That makes the router to search the routing table only once)

- Configuration of the default gateway

\* [ 6.2.2.4 ] CCNA2 v. 5.0 - Configure IPv6 static routing

- configure static recursive routes,

- configure static direct routes,

- configure the default gateway.

\* [ 6.3.3.7 ] CCNA2 v. 5.0 - create a VLSM addressing IPv4 and its implementation in a real environment - at home in PT

\* [ 6.4.2.5 ] CCNA2 v. 5.0 - summarization of routes in IPv4 and IPv6 networks

\* [ 6.5.2.5 ] CCNA2 v. 5.0 - troubleshoot static routing in IPv4 and IPv6 - as an extra or in the home

\* [ 6.6.1.1] CCNA2 v. 5.0 - Setting an IPv6 static route - at home

Task 1 - Basic configuration of a Cisco router .

0 points  
\* [ 6.2.2.5 ] CCNA2 v. 5.0

[1.1.4.6] CCNA2 v. 6.0 - Configuring Basic Router Settings with [IOS](https://eportal.pwr.edu.pl/mod/folder/view.php?id=56895) CLI

Erase the VLANs and old configuration on the switch. Create the base configuration (name, passwords, IP address).

Switch configuration

(We do it in the second order or in the lac of the LAN connections)

- Delete the previous configuration and restart the switch :

delete vlan.dat file containing VLAN information

S\_X#delete flash:vlan.dat  
Delete filename[vlan.dat]?<Enter>  
Delete flash:vlan.dat?[confirm]<Enter>

delete nvram memory ( startup-config )

S\_X#erase startup-config  
S\_X#reload Proceed with reload ?[confirm]<Enter>

- Create a basic configuration on the switch :

\* Name ,

\* console password - cisco

\* VTY terminal password - cisco

\* enable password - class,

\* default gateway,

\* A description of the connected interfaces ,

\* disable DNS to [IP addresses](https://eportal.pwr.edu.pl/mod/resource/view.php?id=56957) translation,

S\_X(config)#no ip domain-lookup<Enter>

- Set up all ports using range command:

S\_X(config)#interface range Fa0/1-24  
S\_X(config-if-range)#no shutdown  
S\_X(config-if-range)#end  
S\_X#

- Configure the management VLAN (IP address, turn on the interface).

S\_X(config)#interface vlan 1  
S\_X(config-if)#ip address 172.16.X.X9 255.255.255.0  
S\_X(config-if)#no shutdown

- Check the connection between computers,

- Check the connection between computers and switch,

- Copy the configuration to NVRAM.

PC configuration

- assign the proper addresses:

PC1 : 172.16.X.X1/24 gate : 172.16.X.X0

PC2 : 172.16.X.X2/24 gate : 172.16.X.X0

...

X - is the group number.

Basic router configuration

Depending on the operating system version and model of your router [IOS](https://eportal.pwr.edu.pl/mod/folder/view.php?id=56895) command set can differ slightly . The names and numbers of interfaces can be different than in the instruction.

- check the connection of PC1 console cable to the console port of the router ,

- check the connection of PC1 and PC2 NIC to port Fa 0 /1 and Fa 0/11 on the switch,

- check the connection between router Fa port and switch Fa0/23 port,

- run the putty or HyperTerminal program and check the console connection .

- display the current configuration of the router. Note the names of interfaces .

Router#show running-config

- check the memory size: ram , nvram , flash and the processor type in the router,

Router#show version

- If there is a startup configuration page delete it and reload the router

R4#erase startup-config  
R4#reload  
... do not save the old configuration during reloading

After reload unconfigured router proposes entering into the initial configuration mode . Skip these typing respectively:

Would you like to terminate autoinstall?[yes/no]:**yes**  
Would you like to enter the initial configuration dialog?[yes/no]:**no**

- See the CLI initerface

- Check the various configuration levels (user, privileged user, interface, console, terminals, ...)

Router>  
Router>enable  
Router#configure terminal  
Router(config)# ...

- Configure the router name,

Router(config)#hostname R\_L  
R\_L(config)#

- Configure message of the day ( MOTD )

R\_L(config)#banner motd  #  The supervised. Access only to authorized users   #

- Set up a password to access : enable password unencrypted - class, console password - cisco, VTY terminals password - cisco

R\_L# configure terminal  
R\_L(config)#enable password class  
R\_L(config)#line console 0  
R\_L(config-line)#password cisco  
R\_L(config-line)#logging synchronous  
R\_L(config-line)#exec-timeout 0 0  
R\_L(config-line)#login  
  
R\_L(config-line)exit  
R\_L(config)#line vty 0 4  
R\_L(config-line)#password cisco  
R\_L(config-line)#logging synchronous  
R\_L(config-line)#exec-timeout 0 0  
R\_L(config-line)#login  
R\_L(config-line)#exit

Logging synchronous command prevents the user before interrupting his commands through the messages printed on the console.

Exec-timeout command specifies the idle time after which the connection to the router is to be interrupted . A value of 0 makes the connection will not be interrupted. The default value is 10 minutes.

- Disable translation of DNS to [IP addresses](https://eportal.pwr.edu.pl/mod/resource/view.php?id=56957),

R\_L(config)#no ip domain-lookup<Enter>

By default the router treats the typing characters as a dns internet address and tries to connect to it via telnet . If your address is in the form of digital IP router connects to it when you press the ENTER key. If this is the domain address , the router first converts it into an IP address , and then performs a telnet connection to it. When router does not recognize a string as a command  treats it as domain internet address and try to solve it. Unfortunately this procedure is long .

Good practice in order to avoid confusion and typos when writing is using the TAB button to complement long commands.

- Save the configuration to nvram,

R\_L#copy running-config startup-config  
Destinatiion filename[startup-config]?<Enter>

- Compare the configurations in RAM and NVRAM

- Back up your configuration into a text file: c:/cisco/users/firstname.secondname/R\_L\_config.txt

In the Cisco [IOS](https://eportal.pwr.edu.pl/mod/folder/view.php?id=56895) configuration listing is also a configuration script . Capturing of configuration is an equivalent of creation of configuration script. Both the HyperTerminal and putty application have the opportunity to capture the text appearing on the console into the text file.

The content of this file can be edited . In Windows editor suitable for this purpose is Wordpad , which is able to recognize correctly the Unix end of line characters .

If you want to restore the configuration from the saved copy you must copy the contents of the file and past it from the clipboard into a terminal window in a global configuration mode:

Switch#configure terminal  
Switch(config)#... here pasting the copied text (paste command)

Task 2 - Configuring static IPv4 routing .

2 points

\*[ 6.2.2.5 ] CCNA2 v. 5.0

[2.2.2.5] CCNA2 v. 6.0 - Configuring IPv4 Static and Default Routes

Exercise should be performed in groups of 4-students (two laboratory groups). In practice, the exercise will jointly attend all groups , because all routers are interconnected .

- Activate debug options to see changes in the routing table

R\_L#debug ip routing  
IP routing debugging is on

- Configure the router LAN interfaces (description , IP address, mask , no shutdown ) ,

R\_L(config)#interface FastEthernet 0/0 (or FatsEthernet 0/2/0 or ID of Ethernet interface connected to local network)  
R\_L(config-if)#ip address 172.16.L.L0 255.255.255.0  
R\_L(config-if)#description Connecting to S\_L  
R\_L(config-if)#no shutdown

What routes have been added to the routing table ?

- list the routing tables

R\_L#show ip route

- Configure the router WAN interfaces (description , IP address, mask , clock, no shutdown) ,

R\_L(config)#interface Serial 0/0/0 (or ID of Serial interface connected to the next router - R\_M)  
R\_L(config-if)#ip address 10.L.M.1 255.255.255.0  
R\_L(config-if)#clock rate 64000  
R\_L(config-if)#description Connection to R\_M  
R\_L(config-if)#no shutdown  
  
R\_L(config)#interface Serial 0/0/1 (or Serial 0/1/0 or ID of Serial interface connected to router R\_K)  
R\_L(config-if)#ip address 10.K.L.2 255.255.255.0  
R\_L(config-if)#description Connection to R\_K  
R\_L(config-if)#no shutdown  
  
K - left neighbor group number  
L - our group number  
M - right neighbor group number

For DCE serial interfaces set the clock 128k .

What routes have been added to the routing table ?

- List the routing tables

- Check all connections using the ping command:

computer - computer connections ,

PC - router connections ,

router - router connections.

- Check the status of interfaces:

R\_X#show ip interface brief

- Repair broken connections (if exist),

- Check the connections to the neighboring groups :

PC\_L - PC\_M

PC\_L - R\_M

R\_L - R\_M

What are the results? Which connections are working and which not, why?

- Configure the static route to local network on the neighbor router R\_M: 172.16.M.0/24. Routes must be added symmetrically in both groups. Use the recursive version of ip route command.

**R\_L(config)#ip route *network\_address\_of\_neighbor\_R\_M\_Fa subnet\_mask ip\_address\_of\_neighbor\_serial\_interface***

*network\_address* - the address of the network , which we want to add to the routing table

*subnet\_mask* - mask of the added network

*ip\_address* - specifies the IP address of the next router interface , by which the packets can be delivered to the new added network.

*exit\_interface* - instead of the IP address the name of output interface  which leads to added network can be specified.

- Check the changes in the routing table ,

What do different things new entries from the previous ?

What means the parameter C and S ?

What weight have the particular entries?

Is it possible to redirect directly connected network to a different interface? See if you can cheat router entering a false entry?

- Check the connection between computers with neighboring groups .

Check whether it has worked . If it does not try to fix it.

- Routes must be added symmetrically in both groups.

Configure the static route to local network 172.16.L.0/24 from the neighbor router R\_M. Use the direct version of ip route command.

From router R\_L telnet to the next router - R\_M.

**R\_L#*telnet 10.L.M.2  
vty pasword: cisco  
enable password: class***

Configure the static route to local network on the router R\_L: 172.16.L.0/24

**R\_M(config)#ip route *network\_address\_of\_local\_router\_Fa subnet\_mask exit\_interface\_to\_router\_R\_L***

- Check changes in the routing table of router R\_M,

- Test the connectivity between Local and remote network:

PC\_L1 - PC\_M1(2)

R\_L - PC\_M1(2)

**ping 172.168.M.M1(2)**

In case of problems repair the connection.

- Add static routes to the WAN network of successive groups (network configured on the serial interfaces of two consecutive and two previous routers).

- Test the connectivity to Serial networks from your PC

ping 10.L.M.2

ping 10.N1.N2.1(2)

N1, N2 - group numbers of the distant neighbors

Task 3 - Configuring static routes IPv6 routing

1 point

\* [6.2.4.5] CCNA2 v. 5.0 - Configure IPv6 static routing

[2.2.4.5] CCNA2 v. 6.0 - Configuring IPv6 Static and Default Routes

- Configure recursive routes

- Configure direct route,

Similarly as in the task 2 for IPv4, configure static routes for IPv6.

use the followinig IPv6 addresses  
WAN:  
FC00:XY:: 1/64

FC00:XY:: 2/64

LAN

2001:db8:X::X0 /64 (router)  
2001:db8:X::X1 /64 (PC1)  
2001:db8:X::X2 /64 (PC2)

X - correspond to the number of groups.

- Enable IPv6 unicast routing

R\_X(config)# ipv6 unicast-routing

- Configure the LAN network interfaces on the router with IPv6 addresses.

R\_X(config)# interface FastEthernet 0/0 (or FatsEthernet 0/2/0 or ID of Ethernet interface connected to local network)  
R\_X(config-if)# ipv6 address FE80::X0 link-local  
R\_X(config-if)# ipv6 address 2001:DB8:X::X0/64

(alternatively is possible to use automatic configuration using R\_X(config-if)# ipv6 address 2001:DB8:X::/64 eui-64)  
R\_X(config-if)# no shutdown

EUI-64 is used to create the interface identifier portion of the address.  
Check what network identifier was added to the address.  
  
- Configure the WAN network interfaces on the router with IPv6 addresses.

R\_X(config-if)# interface serial 0/0/0 (or ID of Serial interface connected to the next router - R\_Y)  
R\_X(config-if)# ipv6 address FE80::1 link-local  
R\_X(config-if)# ipv6 address FC00:XY::1/64  
R\_X(config-if)# no shutdown  
R\_X(config-if)# exit  
  
R\_Y(config-if)# interface serial 0/0/1 (or Serial 0/1/0 or ID of Serial interface connected to router R\_X)  
R\_Y(config-if)# ipv6 address FE80::2 link-local  
R\_Y(config-if)# ipv6 address FC00:XY::2/64  
R\_Y(config-if)# no shutdown  
R\_Y(config-if)# exit

- Configure the static route to the neighbor LAN networks using next hop address

**1 R\_X(config)#ipv6 route *network\_address subnet\_mask ip\_addres***

- Configure the static route to the distant LAN networks using exit interface

**2 R\_X(config)#ipv6 route *network\_address subnet\_mask exit\_interface***

Configuring the default gateway has been transferred to the task 4 to not interfere with the results.

Task 4 - Setting a static route to the networks of further groups. Route summarization to multiple networks into one entry in the routing table .

1 point

\* [ 6.4.2.5 ] CCNA2 v. 5.0

- Add a static route to the network of another group away two routers from your router. Use the second version of the command ip route. Routes must be added symmetrically also in distant group.

R\_X(config)#ip route network\_address subnet\_mask exit\_interface

Check whether it has worked .

If not , try and fix the connection by entering additional changes.

- Check access to others groups. Is the ping is positive ?

- Set up two virtual interfaces Loopback1 and Loopback2 with the following addresses:

Loopback1 IP: 192.168.X1.X0/24

Loopback2 IP: 192.168.X2.X0/24

R\_X(config)#interface Loopback1

R\_X(config-if)#ip adderss 192.168.X1.X0 255.255.255.0

...

- Add a summary route to distant networks  from Loopback interfaces of neighbor  group. Add two loopback networks in the form of a single entry to the routing table.

Check that the routing is working properly.

- Configure a default gateway as static entry into routing table. Gate should be the interface leading to the next router on the rack.

R\_X(config)#ip route 0.0.0.0 0.0.0.0 {ip\_address | interface}

- Check the changes in the routing table ,

- Check the access to the LAN and WAN all groups.

Is the ping positive ?

- Traceroute command to check the access network , which has not been added as static . What way overcomes ping requests and responses ?

- Check the route to a non-existent network. What is the result ? What caused the traceroute command to stop action ?

- Run the above steps for IPv6 networks .

As Loopback interfaces accept addresses :

Looback1 IPv6 : 2001: db8 : 0: X1 :: X0/64

Looback2 IPv6 : 2001: db8 : 0: X2 :: X0/64

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