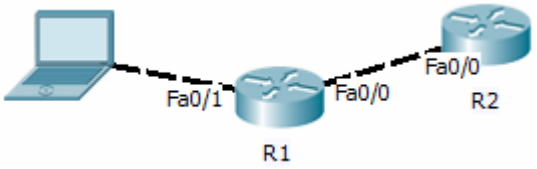
COMPUTER NETWORKS - LABORATORY 070

Subject:

Basic Cisco routers configuration using Cisco IOS.
DHCP server in the Cisco router.
Network bridges in Cisco routers.

Task A: Basics of Cisco IOS configuration – IP routers

1. Prepare two Cisco routers and one computer (PC station). Connect these devices with TP (twisted pair) wiring as shown below:



   Initially, the exercise will be conducted only with router R1.
2. When powered up, if there is no IOS image file selected in router configuration, the router goes into rommon state. It looks like this:
   rommon>
   You can then instruct the system to run from the first available image found in the flash memory:
   rommon> reset
   or start another selected IOS (also from a device other than flash, depending on the equipment of the router):
   rommon> dir flash:
   ....
   rommon> boot flash: /plik_obrazu_IOS.bin
   rommon> boot disk0: /plik_obrazu_IOS.bin
   rommon> boot slot0: /plik_obrazu_IOS.bin
   rommon> boot: USB /plik_obrazu_IOS.bin

3. The initial router configuration steps must be performed using the console port. After running the Cisco IOS CLI you get a prompt:
   router>
   to go to privileged mode (exec), use the command:
   Router> enable
   Router #
   To configure the router switches into config
   Router # configure terminal
   Router (config) #
   Commands can be shortened - the first prefix uniquely identifying components by command. For example, instead of the previous command can be written:
   Router # conf t
   Router (config) #

It is advisable to enter the initial configuration of the router in the following points:

- disable the DNS client (IOS is made automatically when the DNS query does not recognize the command introduced, causing temporary shut CLI, pending a response DNS):
  Router (config) #no ip domain-lookup
- set “do not download the configuration feature” (TFTP will be charged only with NVRAM or not at all):
  Router (config) #no service config
- disable paging for printing out the reports (on the console):
  Router # terminal length 0

4. Like in the switches case, there are two basic router configurations: Startup (NVRAM) and running (modified with commands and currently used). Saving configuration in NVRAM permanently can be done with a command (don’t do that now):
   Router # write mem
   or
   Router # copy running-config startup-config.
   Restarting the router (also don’t do that now):
   Router # reload
   Like the switch, router starts reading the configuration from NVRAM. When it does not find it - starts the procedure of setting it up interactively:
   Continue with configuration dialog? [Yes / no]:

   You can use it or not, but generally – we wont be using this procedure during labs.

   Caution: Clear our configuration in NVRAM after your lab experiments to prevent problems for subsequent students. Resetting NVRAM configuration:
   Router # write erase

5. Similarly to the switches, configuring of interface / sub-interfaces / ports / lines / terminals / modules is possible and also done by entering the CLI mode configuration. This time however, there are many types of interfaces and these interfaces are mainly a third layer ISO OSI (operating over the IP protocol). The name of the interface is dependent on the device installed expansion cards and base interfaces.
   Note: The (base) crawling interfaces in routers is 0, not 1 as in the case of Ethernet interfaces (second layer) in the switches. IP interface identifiers, for example: serial 0/0 or 0/0 sec (first-in first serial interface card), p 2/1/0 (first serial interface card in the second and third module, router). Similarly Eth 0 (first Ethernet interface), or Fast Ethernet 0 F 0 (the first Fast Ethernet interface), Gigabit Ethernet 0 or gi 0 (first Gigabit Ethernet interface) and the like.
   Example of activating the interface for editing:
   Router (config) #interface serial 0/0
   Router (config-if) #
   E.g. IP address configuration 0/1 Fast Ethernet interface, and run the interface
   Router (config) #interface Fast Ethernet 0 / 1
   Router (config-if) #ip address 192.168.123.100 255.255.255.0

Router (config-if) #no shutdown
Like the Cisco switches - prefix 'no' means choosing opposites command (is most commonly used power on / off).
settings, or adding / deleting entries on the list configuration) Note: Most types of physical interfaces on Cisco routers is disabled by default (status: administratively down). For activation, it is necessary to include an interface (not shut)

6. It is possible to create virtual interfaces (built by the system at the time of the first references to them). Example is the loopback interface (they can also present in many router and may be any, but not interfering with other networks IP)
   Router (config) #interface Loopback 0
   Router (config-if) #ip address 10.0.0.1 255.255.255.0
   Router (config-if) shutdown #no
7. Set up pre-router interfaces, adding the loopback interfaces. Check the settings and status interface (command are examples):
   Router # show ip int fa 0/1
   Router # show interfaces summary
   Router # show interfaces fa 0 / 1summary
   Router # show interfaces description
   Router # show interfaces accounting
   Router # show interfaces accounting fa 0/1
   Router # show interfaces fa 0/1
   Router # show controllers fa 0/1
   Router # show run

Task B: Basic setup for Cisco IOS routers

1. Defining a hostname for the router (the router from this moment will be reported with its name change, which allows its identification):
   Router (config) #hostname R1
   R1 (config) #
   When you configure more than one router should define their unique names (this allows to avoid mistakes in the identification of routers).
   Check the status of IP interfaces:
   Router # show ip interface brief
   Router # show interfaces description

2. Enable filtering the type of system messages displayed on the console CLI (there are 8 levels of detail):
   Router (config) #logging console 2

3. Checking the configuration (and the current temporary):
   Router # show running-config
   Checking NVRAM (non-volatile):
   Router # show startup-config

4. Checking the list of registered users (telnet, ssh) and their session:
   Router # sh users
   Router # sh sessions

5. Diagnosis ICMP / ping: it is possible to run a long series of ping:
   Router # ping 192.168.1.1 rep 1000

where 1000 is the number of repetitions.
Caution: cancel this process (as well as many others blocking CLI), we cause a combination of keys CTRL + SHIFT + 6

6. Check the contents of the ARP table (the extended under the third active layer of the ISO OSI associated with the acquisition of the MAC address)
Router # show arp

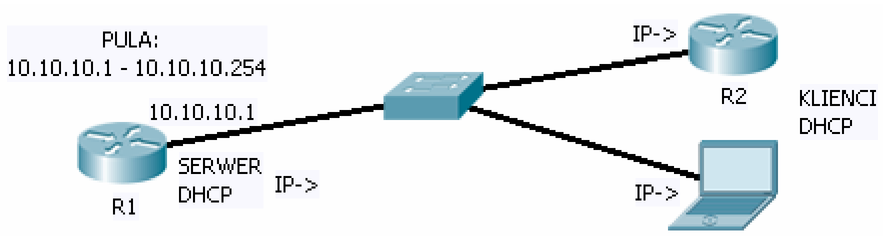
7. Testing the operation of the CDP (Cisco Discovery Protocol) allows the identification of the CDP neighbors router (use CDP allows you to see which interface to the router or switch is connected to another device, whether it is active and whether it is connected with it). Connect cable to the router's interface and interface of the second Cisco router. Configure the interfaces on routers, giving them the correct IP addressing (so that the addresses were in a single IP network).

Router # sh cdp
Router # sh cdp neighbors
Router # sh cdp neighbors detail
Enable / disable cdp:
Router (config) #no cdp run

Router (config) # cdp run
Disable CDP on a specific interface, eg .:
Router (config) #interface fa 0/1
Router (config) #no cdp enable
Checking CDP interfaces:
Router # sh cdp interface
Erasing the contents of an array with information about other devices gathered by the CDP:
Router # clear cdp table
Setting up speed and time news statement CDP (in seconds):
Router (config) #cdp timer 10
Router (config) #cdp holdtime 90
Change the parameters of speed and time broadcasting news about the two routers. Then, set up in one of them a new hostname, watching time disseminate this information to the opposite router using CDP:
Router1 (config) #hostname other
Router1 # show cdp neighbors

Task C: DHCP Server configuration

1. The current task is configure DHCP service, in Cisco router. PC and other router R2 (DHCP clients) will receive their IP addresses from DHCP router R1 via it's interface.



2. Enable DHCP service:
   R1 (config) #service DHCP
   and then to set up the parameters of the DHCP - choosing network addressing (IP configuration):
   Router (config) #ip dhcp pool name
   Router (config-dhcp) #network 10.10.10.0 255.255.255.0
   Router (dhcp-config) # default-router 10.10.10.1
   Router (dhcp-config) # dns-server 123.123.123.3
   Router (dhcp-config) # domain-name domena.pl
   Router (DHCP-config) #exit
   Router (config) #ip dhcp excluded-address 10.10.10.10 10.10.10.20
   Caution! The DHCP address pool must be included in an IP network defined address of the router's interface. The router will choose a proper pool judging on IP interface and it's address (hence the convergence is needed). In the example above it might be the address:
   Router (config-if) #ip addr 10.10.10.1 255.255.255.0
   Here, IP address of DHCP router is also the address of default gateway for the network.
3. PC and another router (R2) must be configured as DHCP clients (automatically obtaining IP addresses):
   R2 (config #interface Fast Ethernet 0 / 0
   R2 (config-if)#ip address DHCP

4. Wait until both client addresses are set, then check the status of DHCP server in router R1:
   Router # show ip dhcp binding
   Diagnostics:
   Router # debug ip dhcp server events

Task D: Basics of configuring Cisco IOS - bridging in IP routers

1. You can also configure the IP router to work as a bridge (in second ISO OSI layer). The IP routing functionality is then disabled on all interfaces involved in such bridge.
   There are three basic configurations of bridging on Cisco router:
   - *legacy bridging* - IP routing is completely disabled, the router acts as a bridge only
   - *CRB (Concurrent Routing and Bridging)* – some router's interfaces work in the bridge, but and other interacts normally a – with IP routing allowed. There is

no connectivity between these two groups of interfaces (we've got two separated devices in one box)

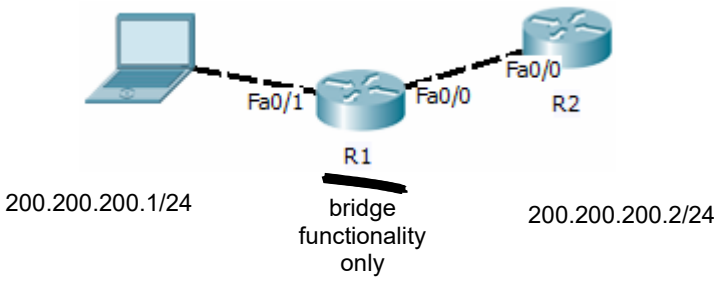
- *IRB (Integrated Routing and Bridging*) - in addition to CRB – there is a virtual interface interacting between routing and bridging, called BVI - Bridge Virtual Interface

In all three situations bridges (isolated) can be plural and active simultaneously.
Note: the above three technologies in must be implemented exclusively.

2. Configuring legacy bridging:

The routing functionality of R1 (directly connected to the PC) must be removed (IP routing is off). Interfaces will be then combined into bridge number 1, with IP addressing cleared:
Router (config) # no ip routing
Router (config) # int fa 0/0
Router (config-if)# brigde-group 1
Router (config-if) # no ip address
Router (config) # exit
Router (config) # int fa 0/1
Router (config-if) # brigde-group 1
Router (config-if) # no ip address
Router (config) # exit

Allow the transmission of Ethernet frames over bridge number 1:
Router (config) # bridge 1 protocol IEEE
Note: In bridge just created at least two interfaces must be classified in up state to make it work.
After configuring the router R1 change the IP addressing in outer R2 interface and the PC station p placing it in the same IP network.
Perform route track (traceroute or tracert command) between R2 and PC.
Note that router R1 has ceased to be visible on this route (it functions as a bridge).
Check the settings in a bridge in router R1:
Router # show bridge group
Router # show bridge

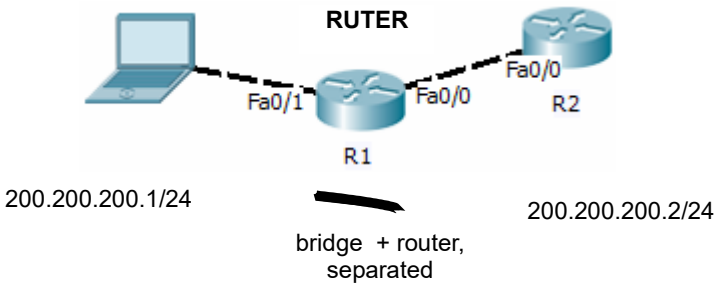


Check the status of Spanning Tree in a bridge (it's also an Ethernet switch now!):
R1 # show spanning-tree brief
Check communication between PC and router R2 (ping)

3. Configuring of CRB:

Make the following modifications to previous configuration:
- re-enable the IP routing in router R1:
  Router (config) # ip routing
- start CRB bridging:
  Router (config) # bridge crb
- turn IP routing process off in CRB bridge 1(CRB bridge is natively integrated into the routing process):
  Router (config) # no bridge 1 route ip
- turn on IP packet bridging in CRB brigde 1:
  Router (config) # bridge 1 bridge ip

Once again perform tracing (traceroute) - this time with IP routing already enabled in Router R1, but not affecting bridging interfaces.
Now it is possible to configure any other of interfaces left in router R1 as fully operational IP interfaces - with an IP routing between them.



Check the communication between PC and router R2 (ping) via the CRB bridge.

4. Configuring of IRB:

Make the following modifications to previous configuration:
- disable CRB bridging and run IRB bridging instead
  Router (config) # no bridge crb
  Router (config) # bridge irb
- turn IP routing process on in CRB bridge 1:
  Router (config) # bridge 1 route ip
- turn IP packet bridging on in CRB brigde 1:
  Router (config) # bridge 1 bridge ip

From now a special virtual IP interface (BVI) can be added bridge 1 allowing the router to contact with that bridge. Subsequently all other devices on the IP network can communicate with this interface. The BVI interface's address must also be set to comply with an IP network (IP addressing compliance must be kept here). Create and configure the BVI and BVI's address:
Router (config) #interface BVI 1
Router (config-if) # ip address 200.200.200.3 255.255.255.0
Router (config-if) #no shutdown

Note! BVI's interface number must match the number given to the bridge previously with bridge-group command

Recheck the route tracking (traceroute). Consider the possibility of communication to router's R2 BVI 1 interface from router R1.
When communication is possible - it will be possible to add another router's BVI interfaces and communicate to another IRB bridge configured in the router.