

COMPUTER NETWORKS, MULTIMEDIA LAB

010

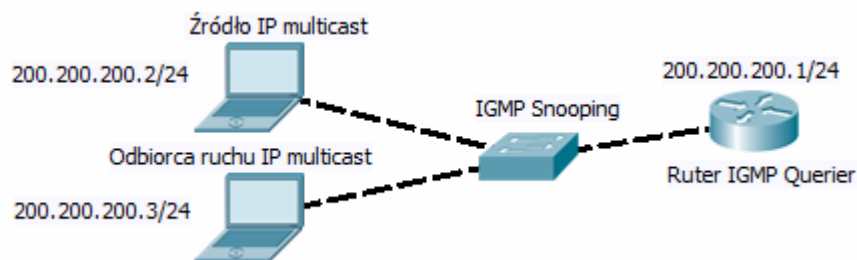
Subject:

Cisco IOS - IP multicast.
 IGMP Snooping on Ethernet switches
 IP PIM dense mode
 IP PIM sparse mode, Rendezvous Points.

1. Task A: IGMP. IGMP snooping in Ethernet switches.

1. Prepare a Cisco Ethernet switch, which is connected to the two PC computers and a Cisco router.

Define IP addressing for that network:



2. Turn the switch IGMP snooping (for the entire switch or for VLAN to which PC computers are connected):
Switch (config) #ip igmp snooping
3. The router required to act as the IGMP querier. The IGMP communication will be sent between it and PC computers, additionally overheard by the switch. Multicast streaming will then be directed only to specific ports.
4. Turn on multicast routing on the router and add pim dense-mode functionality to the interface:

```
Router (config)#ip multicast-routing
Router (config)#int fa 0 / 0
Router (config-if)#ip pim dense-mode
```

5. On one of the PCs enable IP multicast source (e.g. using a VideoLAN / VLC Player software). For this particular tool, use the command:

```
vlc.exe file :sout=#rtp{dst=224.1.1.1,port=5004,mux=ts,ttl=10} :sout-all :sout-keep --repeat
```

where *file* is the path to the media file. Mux (muxer) is a type of formatting for the multimedia stream (self-describing, with Session Description Protocol defining a multimedia stream format).

Note: it is necessary to emit an IP multicast datagrams with a TTL greater than the number of routers planned to go through. Modify the TTL if needed (default value is 1).

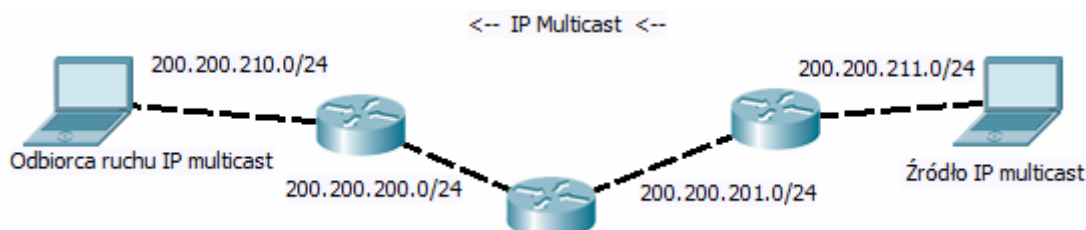
On the second PC computer turn the media player (multicast streaming will be received over the RTP protocol there), e.g.:

```
vlc.exe rtp://224.1.1.1:5004
```

6. Check the register of IGMP:
Switch # show ip igmp snooping
Switch # show ip igmp snooping group
Switch # show mac-address-table multicast vlan 1 igmp-snooping
7. Check the switch against IGMP management information and IGMP router itself:
Switch # show ip igmp snooping querier
Switch # show ip igmp snooping mrouter
8. Observe to which traffic has been routed station (router, the second PC?) In situations where IGMP snooping is active or not.
Deleting groups IGMP router: Router # clear ip igmp group
9. Start Wireshark on your PC. Observe traffic caused by IGMP sessions and IP multicast transmission. Pay attention to IP addressing in datagrams and Ethernet frames carrying IP multicast traffic.
10. Turn off the igmp snooping and observe the traffic again:
Switch (config) #no ip igmp snooping
Switch (config) #ip igmp snooping

Task B: IP multicast routing - IP PIM dense mode

1. PIM dense mode (i.e. push mode) assumes initial automatic multicast IP traffic broadcast to available interfaces in routers. After a while - when routers do not need IP multicast traffic for some multicast group – the prune messages is send to multicast emitter. Therefore IP PIM dense mode is not optimal (generates temporary unnecessary network traffic), but is easy to setup (no need to look for multicast sources of IP multicast traffic table). Prepare three Cisco routers, connecting them as shown below.



2. Create IP unicast addressing for all IP networks in accordance with the general principles (e.g. such as in the figure). Apply a proper routing system (static routing, RIP, EIGRP, etc.) such way, that all the networks in the drawing will be addressable .
3. On all the routers enable IP multicast routing:
Router (config) #ip multicast routing
4. For each router's interface enable IP multicast with Protocol Independent Multicast dense mode (without use Rendezvous Points), e.g.:
Router (config) # int fa 0 / 0
Router (config-if) #ip pim dense-mode
5. Using IP multicast streaming applications (e.g. the VLC Player) run any IP multicast transmission between the PC computers (as in the previous task).
6. Checking the status of the configuration of IP multicast traffic:
Router # show ip mroute
Router # show ip igmp groups
Router # show ip igmp membership

Router #show mroute summary
Router #show active mroute
Router #show mroute count
Router #show interfaces summary
7. Unregister the recipient of IP multicast traffic (closing the application that receives a stream on the PC computer) and check the multicast IP status again. Additionally, probe stopped streams:

Router # sh ip mroute pruned
8. Swap functions of the sender and receiver in the PC computers (running the transmission in opposite direction). Is it possible for the same group of IP multicast? Is it possible after removing entry from IGMP groups and IP unicast forwarding table?:

*Router # clear ip mroute **
Router # clear ip igmp groups

A sample configuration of all three routers:

router 1

```
IP multicast routing
int fa 0/0
ip addr 200.200.200.1 255.255.255.0
ip pim dense-mode
no sh
exit
int fa 0/1
ip addr 200.200.210.1 255.255.255.0
ip pim dense-mode
no sh
exit
router eigrp 100
net 200.200.210.0
net 200.200.200.0
```

Router 2 (middle)

```
IP multicast routing
int fa 0/0
ip addr 200.200.200.2 255.255.255.0
ip pim dense-mode
no sh
exit
```

```
int fa 0/1
ip addr 200.200.201.1 255.255.255.0
ip pim dense-mode
no sh
exit
router eigrp 100
net 200.200.201.0
net 200.200.200.0
```

router 3

```
IP multicast routing
int fa 0/0
ip addr 200.200.201.2 255.255.255.0
ip pim dense-mode
no sh
exit
int fa 0/1
ip addr 200.200.211.1 255.255.255.0
ip pim dense-mode
no sh
exit
router eigrp 100
net 200.200.201.0
net 200.200.211.0
```

Simulating IP multicast sources.

It is possible to create a fictitious IP Multicast IP source interface connected to the router. Source does not emit a traffic, but the address of multicast group will be subject of processing within IP PIM (it will be seen in IP multicast forwarding table).

Define the fictitious IP multicast source and check its availability and other routers:

```
Router1 (config) #int fa 0 / 0
```

```
Router1 (config-if) # ip igmp join-group 230.200.200.1
```

```
Router2 # ping 230.200.200.1
```

Diagnostics:

```
Router1 # show ip pim interface count
```

```
Router1 # show ip count mroute
```

Task C: IP Multicast routing - IP PIM sparse mode

1. PIM sparse mode (i.e. a pull mode) triggers a search procedures for sources of IP multicast traffic only when it's are needed (no temporal multicast flooding as it was before in dense mode case). The knowledge about multicast sources location is stored on one of the routers so-called a Rendezvous point (RP). Any other router notifies the RP with the newly connected sources (those existing in directly connected networks). On the other hand, when some recipient contacts the router (with IGMP), asking for multicast traffic, the router gets the source information from RP.

Each router must be informed, where the RP is, even the RP itself.

2. Start IP multicast routing on all routers, if not applied already:
Router (config) #ip multicast routing
 For each router's interface enable Protocol Independent Multicast sparse mode (mode, that uses Rendezvous Points), e.g.:
Router (config) #int fa 0 / 0
Router (config-if) #ip PIM sparse-mode

3. In all three routers, point a router that acts as a Rendezvous Point (choose one):
Router (config) #ip pim rp-address 200.200.200.2

4. Checking the status (RP):

Router # sh ip pim rp
Router # sh ip pim rp mapping
Router #sh ip pim nei

5. Perform test similar to those of in previous task.

A sample configuration of all three routers (sparse mode):

router 1

```
IP multicast routing
int fa 0/0
ip addr 200.200.200.1 255.255.255.0
ip pim sparse-mode
no sh
exit
int fa 0/1
ip addr 200.200.210.1 255.255.255.0
ip pim sparse -mode
no sh
exit
ip pim rp-address 200.200.200.2
router eigrp 100
net 200.200.210.0
net 200.200.200.0
```

Router 2 (middle, Rendezvous Point)

```
IP multicast routing
int fa 0/0
ip addr 200.200.200.2 255.255.255.0
ip pim sparse -mode
no sh
exit
```

```
int fa 0/1
ip addr 200.200.201.1 255.255.255.0
ip pim sparse -mode
no sh
exit
ip pim rp-address 200.200.200.2
router eigrp 100
net 200.200.201.0
net 200.200.200.0
```

router 3

```
IP multicast routing
int fa 0/0
ip addr 200.200.201.2 255.255.255.0
ip pim sparse -mode
no sh
exit
int fa 0/1
ip addr 200.200.211.1 255.255.255.0
ip pim sparse -mode
no sh
exit
ip pim rp-address 200.200.200.2
router eigrp 100
net 200.200.201.0
net 200.200.211.0
```