

# ARQUITETURA DE REDES

## LABORATORY GUIDE

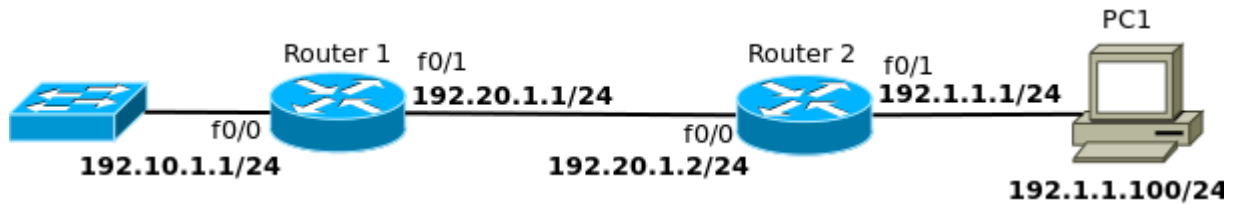
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### Objectives

- IPv4 Multicast
  - Analysis of the IGMP protocol
  - Analysis of the PIM Dense Mode and PIM Sparse Mode protocols

## IGMP Protocol

1. Set up the following network, configure the IP addresses of all interfaces and the RIP protocol in order to assure full connectivity in the network.



2. Activate the IP multicast routing in the routers and configure the PIM Dense Mode protocol in all interfaces:

```
Router#configure terminal
Router(config)#ip multicast-routing
---
Router(config)#interface f0/0
Router(config-if)#ip pim dense-mode
```

Start capturing packets with Wireshark at network 192.20.1.1 using a visualization filter for the IGMP and PIM protocols (`igmp || pim`). Analyze the resulting capture<sup>1</sup>: what kind of packets was observed, what is their periodicity and function, who is the *querier router* on the LAN, how is it selected and what is its function?

3. Examine and register the IP multicast routing tables in both routers and the active multicast groups at their interfaces:

```
Router#show ip mroute          ! Examination of the IP Multicast routing tables
Router#show ip igmp groups     ! Examination of the active IP multicast groups
```

Justify the obtained results.

4. Configure the f0/0 interface of *Router 1* to join the *multicast* session 234.234.234.234:

```
Router#configure terminal
Router(config)#interface f0/0
Router(config-if)#ip igmp static-group <multicast_address>
```

Re-examine the IP multicast routing tables in both routers and the active multicast groups at their interfaces. Analyzing the captured packets and the routing tables, what can you conclude about how the IGMP protocol works?

## PIM Dense Mode

5. Start a capture using a filter for the IGMP, PIM and UDP protocols. At PC1 start sending UDP packets to the multicast address 234.234.234.234 using command (`ping 234.234.234.234 -2 -t`). Analyze the captured packets and record the IP *multicast* routing tables and the active *multicast* groups.

6. Cancel the joining configuration of *Router 1* to the *multicast* session 234.234.234.234:

```
Router(config)#interface f0/0
Router(config-if)# no ip igmp static-group <multicast_address>
```

Record again the IP *multicast* routing table and the active *multicast* groups. Analyzing the captured packets and the routing tables, explain how PIM *Dense Mode* works when a terminal leaves an existing session.

<sup>1</sup> Cisco routers create by default the 224.0.1.40 (Cisco RP-Discovery) group that supports the automatic discovery of the *rendez-vous point* address in the PIM Sparse Mode protocol.

## PIM Sparse Mode

7. At PC1, cancel the sending of UDP packets. At the *routers* interfaces, change the PIM configuration to *Sparse Mode*:

```
Router(config-if)#ip pim sparse-mode
```

Clear the *multicast* routing table in all routers:

```
Router#clear ip mroute *
```

8. Start a new capture with a filter for the IGMP, PIM and UDP protocols. At PC1, restart sending UDP packets to the multicast address 234.234.234.234. What can you conclude about how PIM *Sparse Mode* works when *rendez-vous point* (RP) is not configured? Stop sending UCP packets.

9. Configure both routers assuming that the RP (*rendez-vous point*) address is the *Router 1* interface connected to 192.20.#group.0 network:

```
Router#configure terminal
```

```
Router(config)# ip pim rp-address <address_rp>          ! Rendez-vous point (RP) configuration
```

```
---
```

```
Router#show ip pim rp          ! Examination of the information associated with a RP
```

Clear the *multicast* routing table in all routers:

```
Router#clear ip mroute *
```

Start a capture with the previous filter. Restart sending UDP packets. Record the IP *multicast* routing tables and the active *multicast* groups. Analyzing the captured packets and the observed routing tables, explain how *Sparse Mode* works when there are no active multicast receivers.

10. Configure *Router 1* to join the *multicast* session 234.234.234.234 in its interface connected to the 192.10.#group.0 network. Record the IP *multicast* routing tables and the active *multicast* groups. Analyzing the captured packets and the observed routing tables, explain how PIM *Sparse Mode* works when a receiver joins an existing session.

11. Cancel the joining configuration of *Router 1* to the *multicast* session 234.234.234.234. Record the IP *multicast* routing table from the active routers and active *multicast* groups. Analyzing the captured packets and the observed routing tables, explain how PIM *Sparse Mode* works when a receiver leaves an existing session.

12. Repeat the three last experiments assuming now that the RP address is the *router 2* interface connected to the 192.20.#group.0 network.