



**Helsinki University of Technology**  
**Department of Electrical and Communications Engineering**  
**Networking Laboratory**

**S-38.3133 – Networking Technology, Laboratory Course B**

## **Work number 31: Multicast Routing - I**

Preliminary exercises, laboratory assignment, questions for final report

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## Preliminary Exercises

**Instructions:** Answer the following questions shortly but *clearly*. Too long answers will decrease your points. Use only *English* to answer the questions.

1. What are the main differences between multicast and broadcast delivery methods? Why isn't it a good idea to use just broadcast in order to send data to multiple recipients.
2. In Internet multicast data is usually sent on UDP protocol. Why isn't TCP suitable for multicasting?
3. What is the meaning of TTL field in IP header in multicast routing? Why is TTL more important in multicast routing than in normal unicast routing?
4. What is Protocol Independent Multicast-Sparse Mode (PIM-SM)? What are the differences between Any Source Multicast (ASM) and Source Specific Multicast (SSM)?
5. Explain the followings:
  - a) Static RP in PIM-SM
  - b) Bootstrap Router Mechanism in PIM-SM
  - c) FIB2MRIB
6. In Multicast Distribution trees, explain Source Based and Core Based Distribution Tree.
7. In IPv4 there is special multicast address space. Actually these are not just traditional addresses, but they are multicast group identifiers. What addresses have been reserved for multicast routing? Explain also the address format of IPv6 multicast.
8. Draw and explain how PIM-SM forms multicast routes in the network in **figure 1**. The member of the group is marked with G, the sender with S and the rendezvous point with RP.

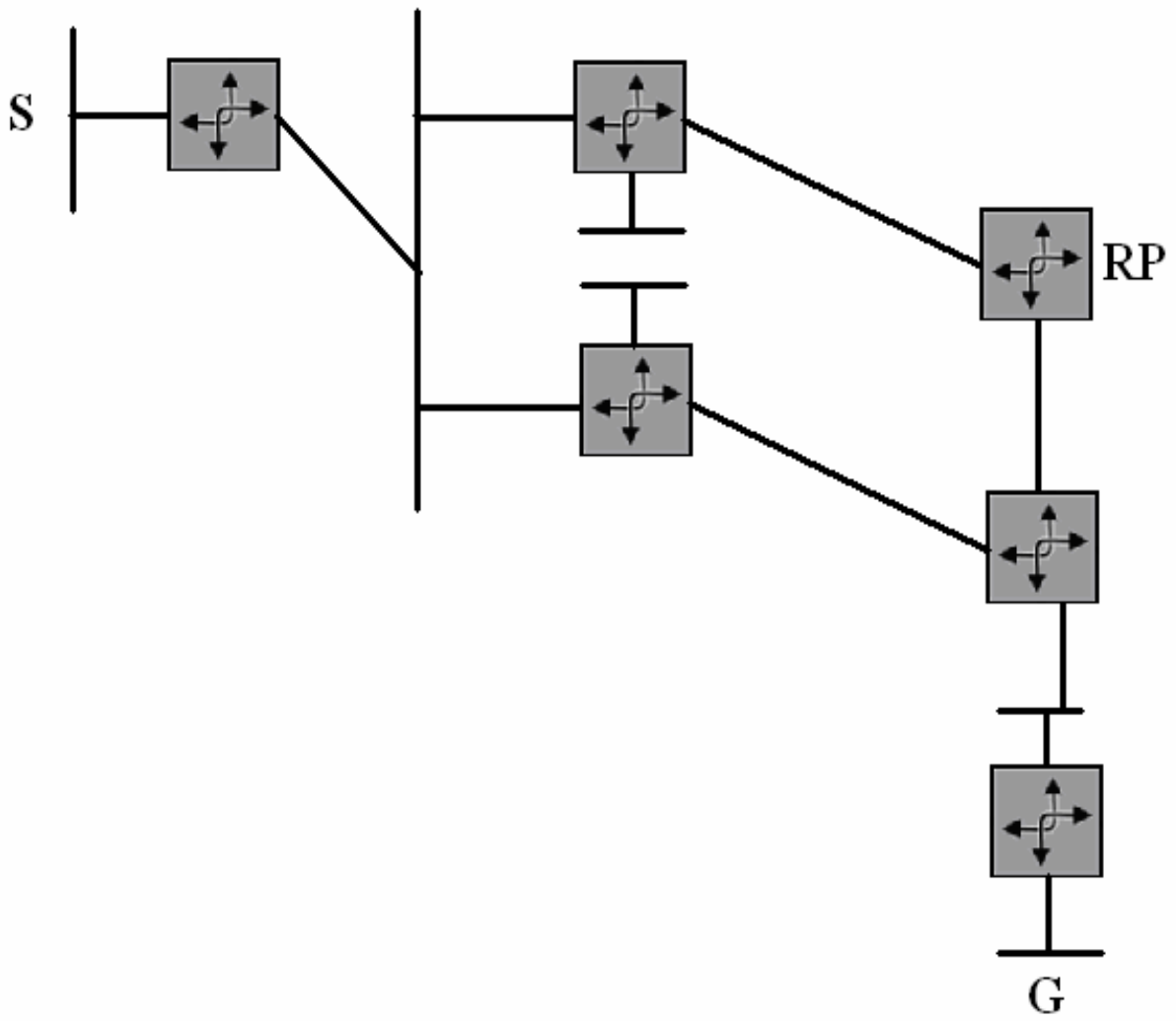


Figure 1: Network for question number 8

## Laboratory Assignment

**Instructions:** *It could be a good idea to examine the laboratory assignment beforehand. There is only 3 hours work time on your lab turn. This time is enough for the lab work.*

### Introduction

In this work you will configure multicast routing to the test network and analyse how it works. You will get familiar with *XORP* (eXtensible Open Router Platform) router and *RAT* audio tool and do some measure.

You need to configure multicast routing with **PIM-SM** protocol by using static RP (Rendezvous Point) and then Bootstrap Router mechanism. The IP addresses have already been configured to the routers. After the configurations you will test the multicasting properties with a few clients.

In your final report you have to answer questions, which are located in different places of this document. All questions are repeated at the end with some additional questions. Please answer the questions only in **English**. Also answer them shortly, but precisely. Any comments and questions concerning this work should be addressed to [arashid@netlab.hut.fi](mailto:arashid@netlab.hut.fi)

### Working Environment

There is a test network with many routers and with a few PCs. In this work we will only use 4 PCs and 3 routers. One of the PC is used to capture traffic going through the wires by using TAP. Other PCs are used to test multicast delivery. *Vyatta* (commercial version of *XORP*) OFR is running as routers.

In order to test multicast delivery we use conference software called *Robust Audio Tool* (RAT). You can use RAT to create multicast based audio conferences. RAT also supports IPv6 multicasting, but we will only test multicasting properties with IPv4 this time.

Figure 2 describes the network.

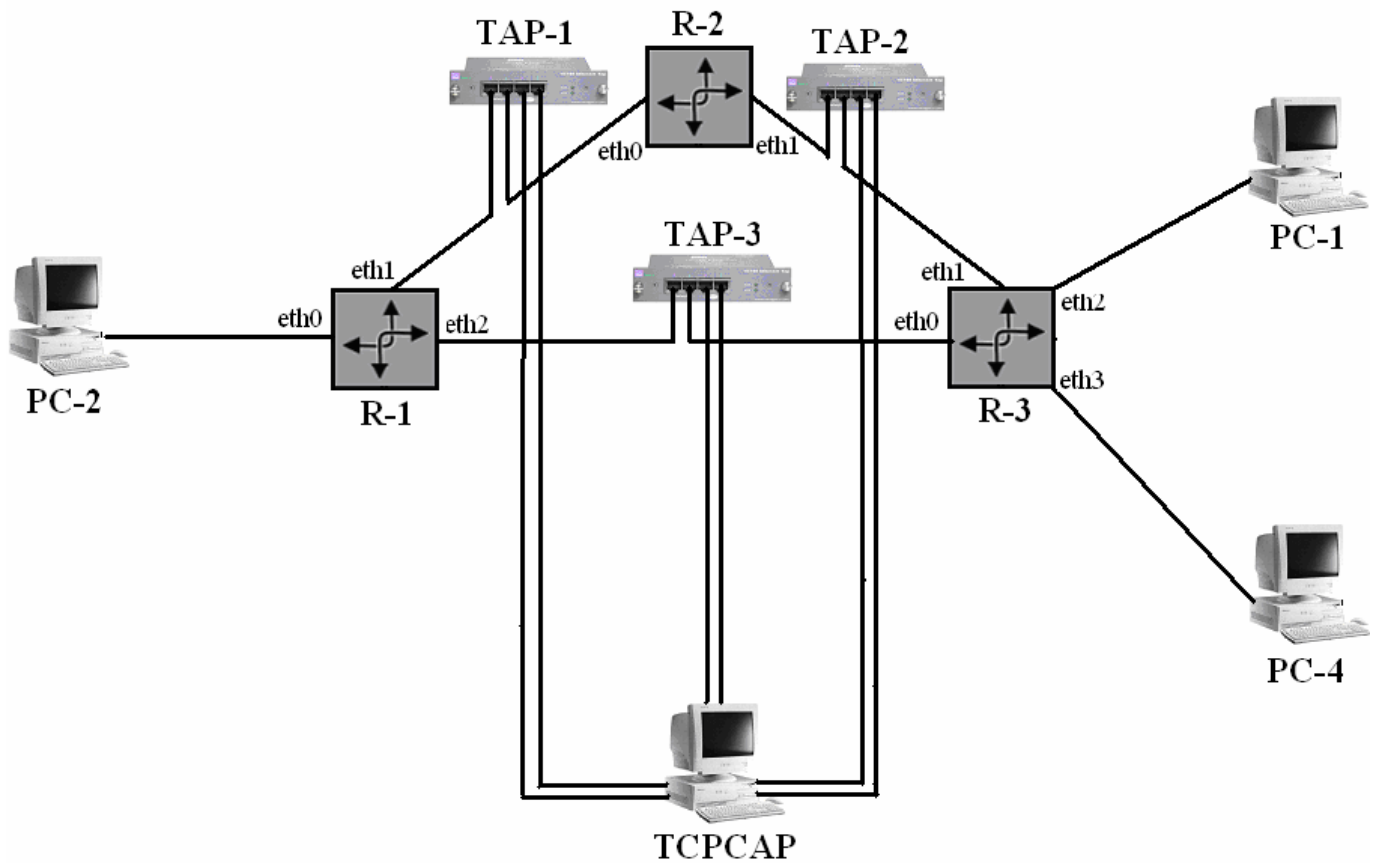


Figure 2: Networking topology for this lab work

IP address allocation for figure 2:

PC-1	10.38.62.30/30	
PC-2	10.38.61.2/30	
PC-4	10.38.62.26/30	
R-1	eth0	10.38.61.1/30
	eth1	10.38.62.1/29
	eth2	10.38.62.9/29
R-2	eth0	10.38.62.2/29
	eth1	10.38.62.17/29
R-3	eth0	10.38.62.10/29
	eth1	10.38.62.18/29
	eth2	10.38.62.29/30
	eth3	10.38.62.25/30

## Exercises in Laboratory

### (I) Starting tcpdump

Before configuring the routers, you need to start *tcpdump* with correct parameters on *TCPCAP* PC. You may ask for help to the assistant if you need. We have used TAP (also called splitter) here for collecting traffic on the wire. TAP will not interfere to any traffic passing between the routers. It'll just gather traffic information. You don't need to do any configuration with the TAP.

### (II) Configuring PIM-SM

To configure and monitor the routers, you need to login as *root* to every router. Assistant will tell you the password. For entering into the command line interface (CLI) of XORP, run *xorpsh*.

You will only need to configure the parts which are related to multicast in the routers. You can find information regarding this from the background materials. At first, you need to configure the routers as they all use static RP. Now test that multicast is working by performing chapter III-V. Then stop *tcpdump* command in *TCPCAP* PC.

After completing the whole procedure, remove your static RP configuration. Start *tcpdump* on *TCPCAP* PC. Now configure the routers as they all use Bootstrap Router Mechanism. Again test that multicast is working in the network by performing chapter III-V.

**Question 1. Explain how did you configure PIM-SM with Static RP and Bootstrap Router Mechanism? Please add all configuration lines in your final report.**

### (III) Robust Audio Tool (RAT)

Now it's time to make an audio conference. First open the command prompt in PCs'. RAT is located in C:\Program Files\Mbone\ directory. It can be started with the command:

```
rat <IP address/port number>
```

Make a conference between the users by using multicast method. Try talking to each other.

**Question 2. What codec did you use? Did RAT send data on the flat rate or did it use compression or silence detection?**

### (IV) Monitoring PIM-SM Multicast Routing State Information

Run the following command in every router and check the results:

```
show pim join
```

**Question 3. Take the result of router R3. Attach the result in your final report. Also explain the result.**

**Question 5. Now you need to give some commands in router R3. Explain the outputs in your final report. The commands are as follows:**

(a) *show pim mfc*

(b) *show pim mrrib*

## **(V) Analyzing tcpdump**

You will try to find REGISTER, JOIN/PRUNE, (\*, G), (S, G) messages from the capture. You will do this part at your home. Please explain every important step from the capture. When you write this chapter in your final report, it will be good if you add PRINTSCREEN of your findings.

## **(VI) Cleaning**

Remove all configurations you have made. Ask the assistant to check everything is ok.

## Questions for final report

*Instructions: There were 6 question groups in this assignment. Questions are repeated here. Answer questions **shortly but precisely**. Use only **English** to answer the questions.*

**Question 1. Explain how did you configure PIM-SM with Static RP and Bootstrap Router Mechanism?**

**Question 2. What codec did you use? Did RAT send data on the flat rate or did it use compression or silence detection?**

**Question 3. Take the result of router R3. Attach the result in your final report. Also explain the result.**

**Question 4. Now you need to give some commands in router R3. Explain the results in your final report. The commands are as follows:**

*(a) show pim mfc*

*(b) show pim mrrib*

**Question 5. See chapter V.**

**Question 6. Explain the selection procedure of Rendezvous Point (RP) in PIM.**