KTH CSC

PIM-SM lab

Juniper version

Group Nr	
Name1	
Name2	
Name3	
Name4	
Name5	
Grade	
Instructor's Signature	

Table of Contents

1 Goals

The goal with this lab is to introduce you to multicast routing within an internal network using Protocol Independent Multicast – Sparse Mode. In the lab, you will use IS-IS to provide unicast routing and the `mcast` tool to generate and monitor multicast traffic. You will also get an insight into IGMP anycast-RP and MSDP.

2 Preparations

Before you begin this lab, please consult documents [1] and [2]. Ensure that you have the network map of topology 1 [3]. You should also have read the lecture notes and RFC pages about PIM-SM and IGMP.

It is assumed that you have completed the IS-IS lab [4] before this lab.

Before you begin the lab, answer the following questions:

1. Which IGMPv2 messages exists?
   _____
   _____

2. What is the difference between a RP Tree and a Shortest path tree?
   _____
   _____
   _____
   _____

3. How does PIM-SM switch between the two trees?
   _____
   _____

4. What is the purpose of MSDP?
   _____
   _____

Milestone 1: Preparations.
Signature: _____

3 Install the multicast application

In this lab, you will use a multicast application on the hosts called mcast. Mcast consists of two applications:

1. `mcast` - sends UDP/IP multicast packets to a multicast group.
2. `mrcv` - joins a group and receives UDP/IP multicast packets.

Retrieve the software package from

http://www.csc.kth.se/utbildning/kth/kurser/DD2490/ipro1-09/labs/mcast.tgz (the course homepage, section Labs)
and unpack it like so:

```
> wget
http://www.csc.kth.se/utbildning/kth/kurser/DD2490/ipro1-11/labs/mcast.tgz
> tar xzf mcast.tgz
> cd mcast
```

You can modify the use of the mcast applications using command-line options: use -h to see which exists.

Example 1: Send traffic of an unbounded duration to multicast group 239.0.2.3, port 8023 on interface eth0. By default, the application sends one datagram per second.

```
> ./mcast -i eth0 -d 0 239.0.2.3:8023
```

Example 2: Receive traffic destined to 239.0.2.3 port 8023 on interface eth0:

```
> ./mrcv -i eth0 239.0.2.3:8023
```

If traffic arrives to mrcv, it will print messages on the terminal. If not, it will remain silent.

One multicast address will be used per host for sending traffic. This multicast address is:

239.0.X.Y

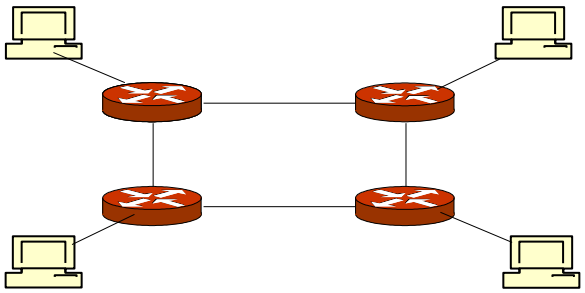
where X is 1 for group A, 2 for group B, etc; and Y is 1 for RTX1, 2 for RTX2, etc.
Example: RTC4 uses sending multicast address 239.0.3.4.

Write your sending multicast address:

_____

WARNING!
Due to a limitation (or rather, a bug) in the router software the PIM-SM trees are not properly built. Therefore you may experience problems when sending and receiving multicast. The safest bet is to send from the host connected to the RP.

4 Setting up unicast routing using ISIS



Set up your network as a square according to the figure and network topology 1 [3].

Set up ISIS as IGP to take care of your unicast routing. You always need a unicast routing protocol in order for PIM to work. Why?

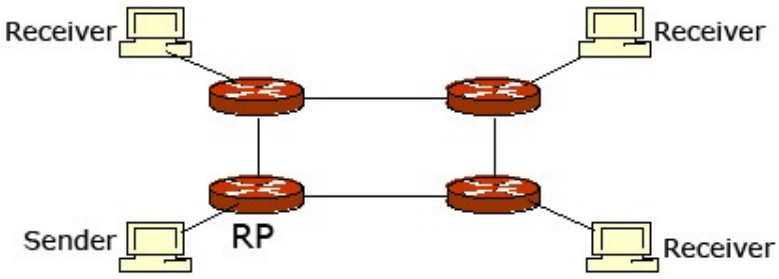
_____

_____

Set up IS-IS by configuring all networks according to the topology map. Remember to add family iso on all interfaces. Configure fe-0/0/0 and lo0 as passive ISIS interfaces. Also disable level 1. Configure loopback according to the netmap and assign it as router-id.

Ensure that unicast works between all hosts and routers using ping and traceroute.

5 PIM-SM Multicast



You will now try to configure PIM for the simple case of one sender, one receiver, and one RP as shown in the figure. The aim of this part is to investigate shared RP-trees and source-based SPT:s.

Turn on pim on fe-0/0/0, fe-1/0/0, fe-1/0/1 and lo0 on all routers. Hint: you can turn on PIM on all interfaces using: `interface all` (but then you will have to disable fe-0/0/1).

Assign the router-id of RTX2 as a static RP. Do this on all routers except RTX2 itself. On the RP you need to specify which local address you have chosen as RP-address.

Investigate the PIM state. What does the *show pim rps* command show?

_____
_____

Start a multicast receiver on x4 and a sender on x2. If this works, start receivers on x1 and x3 as well.

Ensure that you use the -i option on mcast/mrcv so that you use the router network. Use UDP port 80xy where x is group and y is host.

Use monitoring with the flag join (with detail) for example to detect multicast activity on the sender as well as the receiver hosts. What multicast activity do you see? Can you explain how the trees are created?

_____
_____
_____
_____

Investigate the IGMP state on the routers. How can you find out the IGMP querier on the networks?

_____

On which router interfaces is IGMP enabled?

_____

Investigate the PIM state. Explain the output of *show pim join extensive* on the relevant routers RTX2 and RTX4. How many trees do you see? Try to explain every field of the output.

_____
_____
_____
_____
_____
_____

Has an SPT been created directly from the sender to the receiver? How can you see this?

_____
_____

Milestone 2: Show a working multicast configuration.
Signature: _____

6 RP Load sharing: Anycast-RP and MSDP

In order for Anycast-RP to work, you should first define an anycast address. All the groups shall choose 192.168.6.1/32 as the anycast address on the RP. This is simply an extra loopback address on the RP, but you must ensure that you declare your default loopback address as `primary` and `preferred`.

Why do you think this is necessary?

_____
_____

Ensure that this address is announced via ISIS and that you change the RP configuration to 192.168.6.1 on all routers.
How is the anycast address displayed in ISIS?

_____
_____

Check that multicast traffic within your group still works as before. When you have reached this far you must report to the lab assistants.

Now connect to the other groups by connecting RTX2 to the shared network on fe-2/0/0 according to the topology map. Make sure that you have ISIS connectivity to the other groups. Remember that pim may not yet be activated on this interface.

You now have to configure MSDP between the RP:s. You do this by declaring which other RP:s are peers. You also need to define a local address. Do not use the anycast address as local! MSDP is very picky so make sure that the peerings are up and running, you can use the *show msdp* and *show msdp source-active* commands.

How many active sources can you see? Which are they and from where to they originate?

_____
_____
_____
_____
_____
_____

Start receivers for all the other groups. Verify that you can receive the traffic from the active source.

Investigate the PIM state. Explain the output of *show pim join extensive* on the relevant routers. How many trees do you see? Try to explain every field of the output.

_____
_____
_____
_____
_____
_____

Investigate the routing tables. Which new routing tables are used (apart from inet.0)? What are their roles?

_____
_____

Milestone 3: Anycast-RP and MSDP.
Signature: _____

7 References

[1] KTH CSC Router lab Introduction - Juniper version
[2] KTH CSC Router lab Reference - Juniper version
[3] KTH CSC Router lab Netmap - Topology 1
[4] KTH CSC IS-IS lab