

# Multicasting and Tunneling

## Set up GNS3

To download GNS3 : <https://www.gns3.com/software>. In this lab, you will use GNS3 to setup routers, and managing the connections. Then you have to import a Cisco Router IOS image into GNS3 by following the steps below.

- Save the bin file for Cisco router (in the attachment) in a folder, e.g., on your desktop.
- Go to Edit → Preferences. Depending on the installed version, it might also be GNS3 → Preferences.
- In the left-hand pane, click on the arrow next to Dynamics, then click on the sub-menu IOS routers and click New.
- Then click on Browse to select the Cisco IOS image on your computer c3640-jk9s-mz.124-16.bin. Click Next.
- Edit Name as c3640, select the Platform as c3600 and Chassis as 3640.
- Click Next to choose default RAM size. Click Next to get to Network adapter selection. Choose NM-1FE-TX from the drop-down menu for slot 0 through slot 3. This action configures 4 slots as 4 Fast Ethernet ports.
- Click Next. Find the Idle PC value by clicking on Idle-PC finder. Choose an Idle-PC value with an asterisk (if available). Click Finish. Click Apply, then click OK.
- In upper left hand corner or choose New blank project from File menu.
- Click on Browse All Devices icon, (5th icon on the left-hand side shown in red rectangle), to browse all possible network devices. Select c3640 and drag it to the empty space (project pane) to the right of the devices window.

## 1 Multicasting in IPv4

- Configure each router with the IP address indicated in the Figure 1.
- Enable the interface, then exit the conf t mode to next top level, check the IP address you configured. Show it for each router in the report.
- For each router, configure the ospf routing protocol `router ospf 1` and add to network `network 0.0.0.0 255.255.255.255 area 0`

```
1 R1:
2 conf t
3 interface FastEthernet 0/0
4 ip addr 192.168.12.1 255.255.255.0
5 no shutdown
6 exit
7 interface FastEthernet 1/0
8 ip addr 192.168.13.1 255.255.255.0
9 no shutdown
10 exit
11 exit
12 show ip int brief
13 conf t
14 router ospf 1
15 network 0.0.0.0 255.255.255.255 area 0
16 exit
17 exit
18
19 R2:
20 conf t
21 interface FastEthernet 0/0
22 ip addr 192.168.12.2 255.255.255.0
```

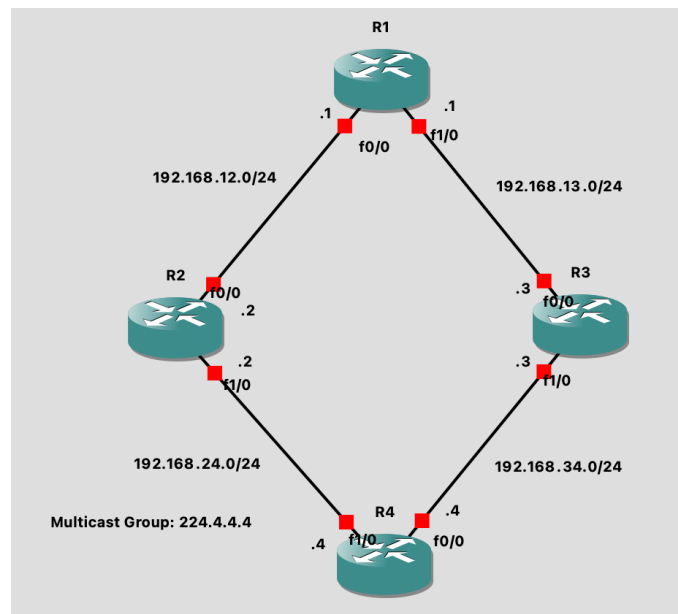


FIGURE 1 – Multicast

```

23 no shutdown
24 exit
25 interface FastEthernet 1/0
26 ip addr 192.168.24.2 255.255.255.0
27 no shutdown
28 exit
29 exit
30 show ip int brief
31 conf t
32 router ospf 1
33 network 0.0.0.0 255.255.255.255 area 0
34 exit
35 exit
36
37 R3:
38 conf t
39 interface FastEthernet 0/0
40 ip addr 192.168.13.3 255.255.255.0
41 no shutdown
42 exit
43 interface FastEthernet 1/0
44 ip addr 192.168.34.3 255.255.255.0
45 no shutdown
46 exit
47 exit
48 show ip int brief
49 conf t
50 router ospf 1
51 network 0.0.0.0 255.255.255.255 area 0
52 exit
53 exit
54
55 R4:
56 conf t

```

```
57 interface FastEthernet 0/0
58 ip addr 192.168.34.4 255.255.255.0
59 no shutdown
60 exit
61 interface FastEthernet 1/0
62 ip addr 192.168.24.4 255.255.255.0
63 no shutdown
64 exit
65 exit
66 show ip int brief
67 conf t
68 router ospf 1
69 network 0.0.0.0 255.255.255.255 area 0
70 exit
71 exit
```

## 1.1 PIM-Dense Mode

PIM-Dense model : we forward multicast traffic on all interfaces until a downstream router requests us to stop forwarding. First we need to configure the dense model on all the routers. Then for the router who wants to join the multicast group, we configure that router to join.

- Configure dense mode on all routers, don't forget to do it for all interfaces.
- Now we want to add a new router R4 to join multicast group 224.4.4.4
- Test the new added router R4 by ping it from R1, use Wireshark to capture the packets, and show the results in the report.

For each router, start PIM-DM :

```
1 conf t
2 ip multicast-routing
3 interface f0/0
4 ip pim dense-mode
5 interface f1/0
6 ip pim dense-mode
```

Configure R4 to join multicast group 224.4.4.4

```
1 conf t
2 interface f1/0
3 ip igmp join-group 224.4.4.4
```

R1 ping 224.4.4.4

```
1 ping 224.4.4.4 repeat 999
```

Launch Wireshark to capture the response.

## 2 IPv6 Tunneling over IPv4

IPv6 tunneling is a technique used to transport IPv6 packets over an IPv4 network. It allows communication between IPv6-enabled devices across an IPv4 infrastructure.

### 2.1 IPv4 and IPv6 Configuration

- Create a new project for this section.
- Configure all the IPv4 and IPv6 address as shown in the Figure 2
  - For R1 and R5, it only have IPv6 addresses.

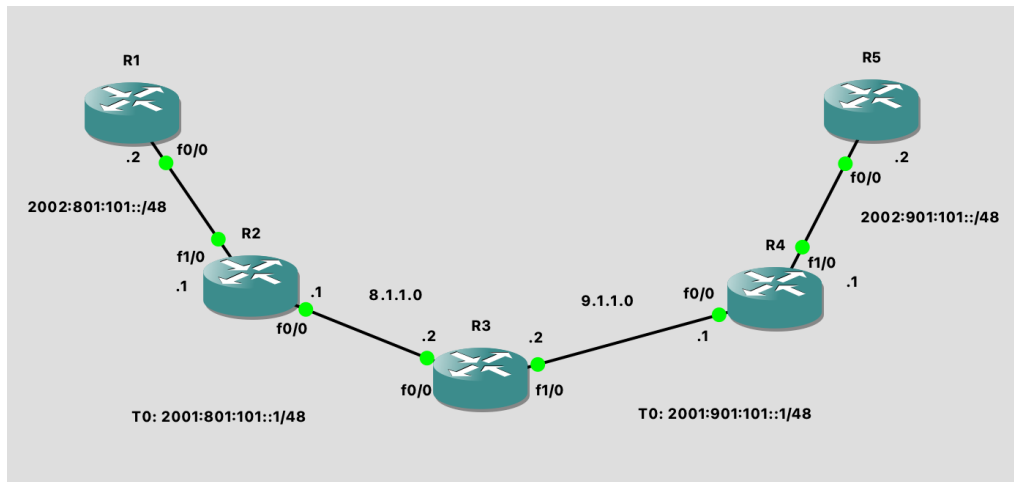


FIGURE 2 – Tunneling

- For R3, it is used as tunnel, so it only has IPv4 address
  - For R2 and R4, they are two ends of the tunnel. They have both IPv6 and IPv4 on two different interface.
  - Show the results in the report
- IPv4 and IPv6 :

```

1 enable
2 show ip int brief
3 conf t
4 ipv6 unicast-routing
5 interface s3/0
6 ip address 192.168.12.1 255.255.255.0
7 no shutdown
8 exit
9 interface FastEthernet 1/0
10 ipv6 address 2020::1/64
11 //ipv6 rip 6bone enable
12 no shutdown
13 exit

```

## IPv4 and IPv6 Configuration

- **Router R1 :**
  - IPv6 Address : 2002:801:101::48 (assigned to interface f0/0)
  - Note : R1 has only IPv6 addresses.
- **Router R2 :**
  - IPv4 Address : 8.1.1.0 (interface f0/0)
  - IPv6 Address : 2002:801:101::48 (interface f0/0)
  - IPv4 Address : 8.1.1.0 (interface f1/0)
  - IPv6 Route : 2001:801:101::1/48 (to R3)
- **Router R3 :**
  - IPv4 Address : 8.1.1.0 (interface f0/0)
  - IPv4 Address : 9.1.1.0 (interface f1/0)
  - IPv6 Route : 2001:801:101::1/48 (from R2)
  - IPv6 Route : 2001:901:101::1/48 (to R4)
- **Router R4 :**

- IPv4 Address : 9.1.1.0 (interface f0/0)
- IPv6 Address : 2002:901:101::48 (interface f0/0)
- IPv4 Address : 9.1.1.0 (interface f1/0)
- IPv6 Route : 2001:901:101::1/48 (from R3)
- **Router R5 :**
  - IPv6 Address : 2002:901:101::48 (assigned to interface f0/0)
  - Note : R5 has only IPv6 addresses.

## 2.2 Tunneling

After the pre-setting of all ipv4 and ipv6 address of routers, and routing table in them. We will build the tunnel.

- For R1 and R5, configure unicast routing, and add neighbor into the routing table.
- For R2 and R4 : configure the interface tunnel (IPv6) address as shown in the figure 2.
  - Enable IPv6 on interface tunnel 0, and configure the address
  - configure the source address and mode of tunnel.
  - Setup IPv4 route for IPv4 network address range 9.1.1.0 or 8.1.1.0 via gateway.
  - Set up route for IPv6 network address range 2002:901:101::/48 or 2002:801:101::/48, through a tunnel interface.
- Ping R1 from R2 to check the IPv6 routing. Show the result of Wireshark in the report.
- Ping R5 from R1 ping 2002:901:101::2 to check the tunnel. Show the result of Wireshark in the report.

```

1  R1
2  config t
3  inter FastEthernet0/0
4  ipv6 enable
5  ipv6 add 2002:801:101::2/48
6  no shut
7  exit
8  ipv6 uni
9  ipv6 route ::/0 2002:801:101::1
10
11
12  R5
13  config t
14  inter FastEthernet 0/0
15  ipv6 enable
16  ipv6 add 2002:901:101::2/48
17  no shut
18  exit
19  ipv6 uni
20  ipv6 route ::/0 2002:901:101::1
21
22
23  R3
24  config t
25  inter FastEthernet 0/0
26  ip add 8.1.1.2 255.255.255.0
27  no shut
28  inter FastEthernet 1/0
29  ip add 9.1.1.2 255.255.255.0
30  no shut
31  exit
32
33
34  R2

```

```
35 config t
36 inter FastEthernet 0/0
37 ip add 8.1.1.1 255.255.255.0
38 no shut
39 inter FastEthernet 1/0
40 ipv6 ena
41 ipv6 add 2002:801:101::1/48
42 no shut
43 inter tunnel 0
44 ipv6 ena
45 ipv6 add 2001:801:101::1/48
46 tunnel source 8.1.1.1
47 tunnel mode ipv6ip 6to4
48 no shut
49 exit
50 ip route 9.1.1.0 255.255.255.0 8.1.1.2
51 ipv6 uni
52 ipv6 route 2002:901:101::/48 tunnel 0
53
54
55 R4 config t
56 inter FastEthernet 0/0
57 ip add 9.1.1.1 255.255.255.0
58 no shut
59 inter FastEthernet 1/0
60 ipv6 ena
61 ipv6 add 2002:901:101::1/48
62 no shut
63 inter tunnel 0
64 ipv6 ena
65 ipv6 add 2001:901:101::1/48
66 tunnel source 9.1.1.1
67 tunnel mode ipv6ip 6to4
68 no shut
69 exit
70 ip route 8.1.1.0 255.255.255.0 9.1.1.2
71 ipv6 uni
72 ipv6 route 2002:801:101::/48 tunnel 0
73
74
75
76 R1#ping 2002:901:101::2
77 R2#ping 2002:801:101::2
```

## 3 Appendix

To stop a line from running : ctrl+shift+6

### 3.1 Configure IP address

- configure the terminal : `configure terminal / conf t`
- set up IPv4 address :

```
interface <interface-name>
ip address <ip-address> <subnet-mask>
```
- enable configuring IPv6 address

```
ipv6 ena
```

- set up IPv6 address interface <interface-name>  
    ipv6 address <ipv6-address>/64
- delete ip address  
    no ip address <ip-address> <subnet-mask>
- **Enable interface no shutdown**
- back to next top level command : exit
- back to top level command : end
- Show the interface ip address briefly  
    show ip int brief  
    show ipv6 int brief

### 3.2 PIM-Dense Model

- Configure dense model on all routers :  
    ip multicast-routing  
    interface <interface-name>  
    ip pim dense-mode
- Add new router to the multicast group (in conf t model) :  
    interface <interface-name>  
    ip igmp join-group <multicast-address>

### 3.3 Tunneling

- Configure the tunnel interface

```

1 inter <tunnel-name>
2 ipv6 ena
3 ipv6 add <tunnel-source-address>
4 tunnel source <ipv4-address-source>
5 tunnel mode ipv6ip 6to4

```

- Configure static route for IPv6 routing table.

```

1 ipv6 uni
2 ipv6 route ::/0 <ipv6-gateway>

```

- Configure both IPv4 route for the tunnel :

```

1 ip route <ipv4-desti-net-address> <subnet-mask> <gateway>

```

- Configure IPv6 route via the tunnel :

```

1 ipv6 uni
2 ipv6 route <ipv6-desti-net-address> <tunnel-name>

```

\* Here <ipv6-desti-net-address> indicates the network addresses of IPv6 (not a single router's IPv6 address) you want to reach in the destination via connection of tunnel.