

# NetSim<sup>®</sup>

Accelerate Network R & D

## Emulator

A Network Simulation & Emulation Software

By



The information contained in this document represents the current view of TETCOS LLP on the issues discussed as of the date of publication. Because TETCOS LLP must respond to changing market conditions, it should not be interpreted to be a commitment on the part of TETCOS LLP, and TETCOS LLP cannot guarantee the accuracy of any information presented after the date of publication.

This manual is for informational purposes only.

The publisher has taken care in the preparation of this document but makes no expressed or implied warranty of any kind and assumes no responsibility for errors or omissions. No liability is assumed for incidental or consequential damages in connection with or arising out of the use of the information contained herein.

### **Warning! DO NOT COPY**

Copyright in the whole and every part of this manual belongs to TETCOS LLP and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or in any media to any person, without the prior written consent of TETCOS LLP. If you use this manual you do so at your own risk and on the understanding that TETCOS LLP shall not be liable for any loss or damage of any kind.

TETCOS LLP may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from TETCOS LLP, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property. Unless otherwise noted, the example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events depicted herein are fictitious, and no association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Rev 13.0 (V), March 2021, TETCOS LLP. All rights reserved.

**All trademarks are property of their respective owner.**

### **Contact us at**

TETCOS LLP

# 214, 39<sup>th</sup> A Cross, 7<sup>th</sup> Main, 5<sup>th</sup> Block Jayanagar,

Bangalore - 560 041, Karnataka, INDIA.

Phone: +91 80 26630624

E-Mail: [sales@tetcos.com](mailto:sales@tetcos.com)

Visit: [www.tetcos.com](http://www.tetcos.com)

## Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>5</b>
1.1	Emulation: How Simulation interacts with the real world .....	5
<b>2</b>	<b>Emulation Set-up .....</b>	<b>7</b>
2.1	Setting up the NetSim Server .....	8
2.2	Setting up the Client systems (Real Source and Destination system).....	10
2.2.1	Configuring Windows clients .....	10
2.2.2	Configuring Linux clients running RHEL 7 .....	11
2.2.3	Configuring Linux clients running Ubuntu .....	15
2.2.4	Configuring Raspberry Pi clients .....	16
2.3	Setting up the network for client systems communicating across the network .....	17
2.3.1	System Configuration .....	18
2.4	Performing Multicast Emulation .....	19
2.5	Setting up the network for Database PostgreSQL Emulation .....	24
2.5.1	System Configuration .....	24
2.5.2	Steps to Start generating Network Traffic .....	25
2.5.3	Steps to configure application for NetSim Emulation .....	26
2.5.4	Results and Analysis .....	28
2.6	Setting up the network for GeoServer Application Emulation .....	29
2.6.1	System Configuration .....	29
2.6.2	Steps to Start generating Network Traffic .....	30
2.6.3	Steps to configure application for NetSim Emulation .....	30
2.6.4	Results and Analysis .....	32
2.7	Setting multiple Virtual Machines (VM) to act as Nodes for Emulation .....	33
2.7.1	VMs sharing the same network as the host .....	33
2.8	VMs sharing a network but insulated from the host network .....	34
<b>3</b>	<b>Model Features .....</b>	<b>36</b>
3.1	Working of an Emulation Application in NetSim .....	36
3.1.1	Delay measurement when pinging through NetSim Emulator .....	38
3.2	Jitter in NetSim Emulations .....	42
3.2.1	Introducing Jitter using Background traffic .....	42
<b>4</b>	<b>Featured Examples .....</b>	<b>43</b>
4.1	Example Application 1 – PING (One way Communication) .....	43
4.2	Example Application 1 – PING (Two-way Communication) .....	45
4.3	Example Application 2 – Video (One way Communication) .....	46

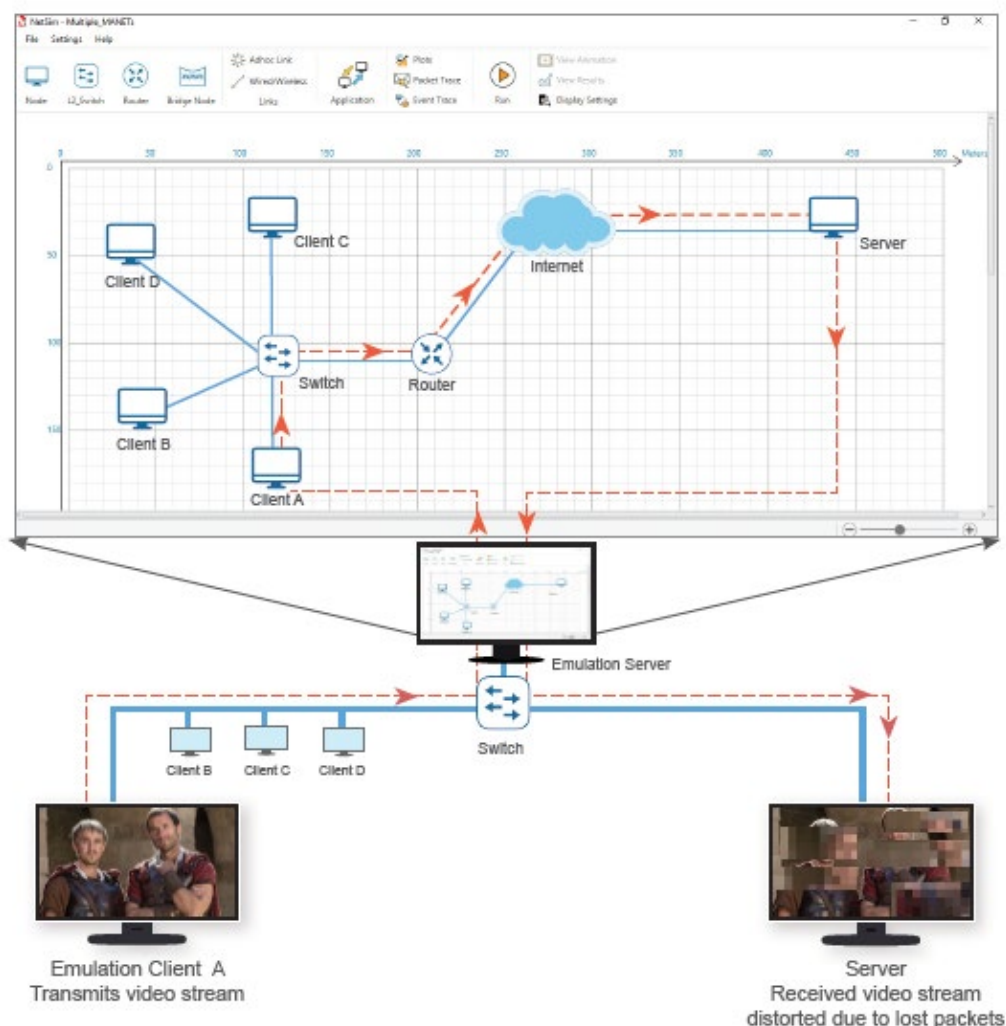
4.4	Example Application 3 – File Transfer using FileZilla (One-way) .....	52
4.5	Example Application 4 –Skype (Two way Communication).....	56
4.6	Example Application 5 – Using JPerf.....	59
4.7	Providing pcap file as input to NetSim Emulator.....	62
4.7.1	Generating a pcap file for NetSim .....	62
4.7.2	Providing pcap file as input to NetSim .....	64
<b>5</b>	<b>Latest FAQs.....</b>	<b>67</b>

# 1 Introduction

A network simulator mimics the behaviour of networks but cannot connect to real networks. NetSim Emulator enables users to connect NetSim simulator to real hardware and interact with live applications.

- NetSim emulator is an IP based, data plane, flow-through emulator. This means:
- It can interact with IP based devices.
- It can emulate data plane functionality and not control plane functionality.
- The source and destination for traffic should be external. A virtual device within NetSim cannot be a source or sink for traffic.

## 1.1 Emulation: How Simulation interacts with the real world



**Figure 1-1:** Simulator interacting with the real world

A real PC (running NetSim Emulation Client) sends live traffic to the PC (running NetSim Emulation Server). Whenever a packet arrives at the interface of server, this packet is “converted” into a simulation packet and sent from a source node (user selectable) in the simulated network (user configurable) to a destination node (again user selectable). Upon receipt of this packet at the destination, the packet is then “re-converted” and sent back to a real PC destination node (running NetSim Emulation Client). The real packet thus undergoes network effects such as delay, loss, error etc. created virtually by NetSim Simulator.

## 2 Emulation Set-up

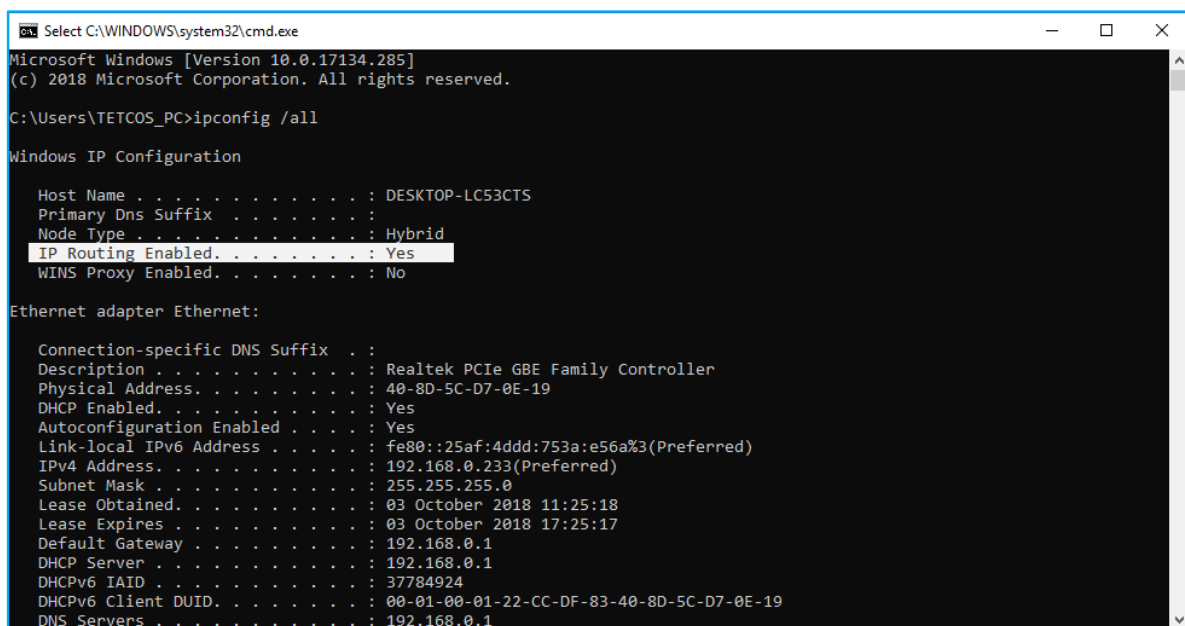
The ideal set-up to run emulation would be to have a minimum of three (3) PC's. One would be the real source, the second would run NetSim emulation server, and the third would be the real destination.

Alternately, this set-up can also be managed where the two (2) PC's are running client applications that communicate with the central server, where NetSim Emulation server is running.

Prerequisite for NetSim Emulation: Enabling IP routing in windows.

IP Routing is the process that allows data to cross over a network of computers rather than just one. Routing is often disabled by default in Windows, to check whether IP routing enabled or not.

Open Command Prompt (cmd.exe) type **ipconfig /all**. It will show if IP Routing Enabled: **Yes\No**. If IP Routing Enabled is set to **No** we may have to manually enable IP routing as shown **Figure 2-1**.



```
Select C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.17134.285]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\TETCOS_PC>ipconfig /all

Windows IP Configuration

    Host Name . . . . . : DESKTOP-LC53CTS
    Primary Dns Suffix . . . . . :
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : Yes
    WINS Proxy Enabled. . . . . : No

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix . :
    Description . . . . . : Realtek PCIe GBE Family Controller
    Physical Address. . . . . : 40-8D-5C-D7-0E-19
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::25af:4ddd:753a:e56a%3(Preferred)
    IPv4 Address. . . . . : 192.168.0.233(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : 03 October 2018 11:25:18
    Lease Expires . . . . . : 03 October 2018 17:25:17
    Default Gateway . . . . . : 192.168.0.1
    DHCP Server . . . . . : 192.168.0.1
    DHCPv6 IAID . . . . . : 37784924
    DHCPv6 Client DUID. . . . . : 00-01-00-01-22-CC-DF-83-40-8D-5C-D7-0E-19
    DNS Servers . . . . . : 192.168.0.1
```

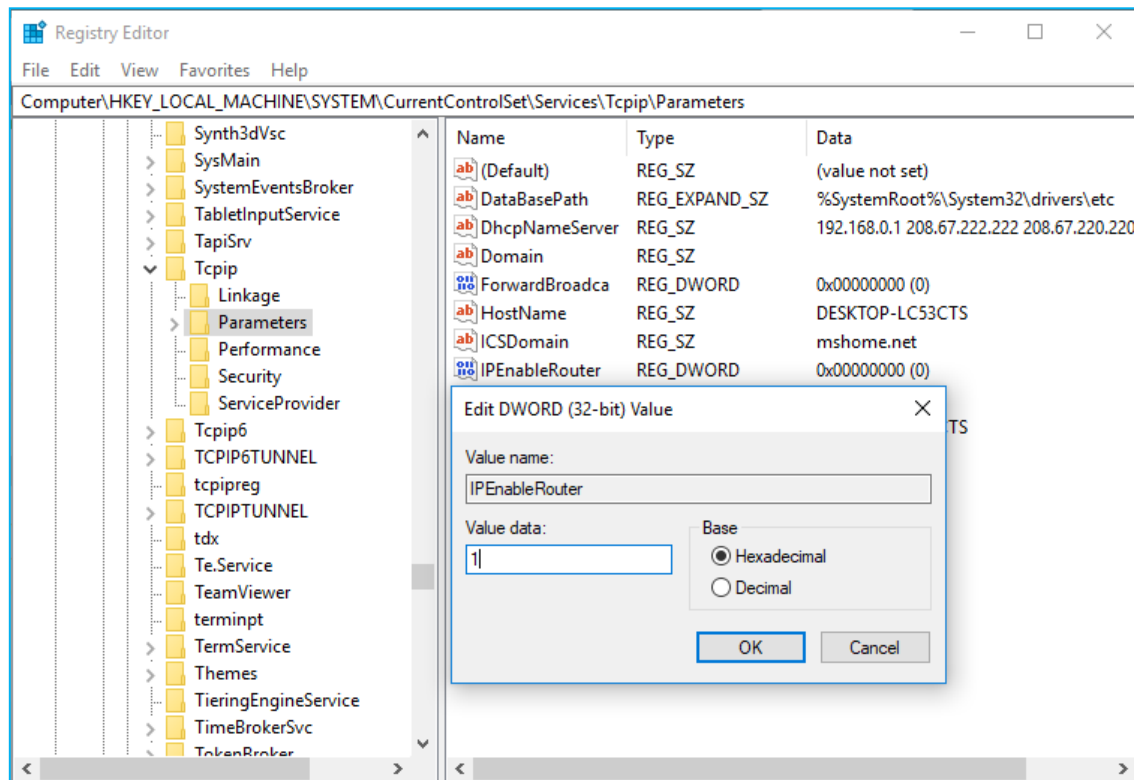
**Figure 2-1: IP Routing Enabled**

### Steps to enable IP routing in windows:

1. Open the start menu, and type REGEDIT32.EXE into the search box. Hit enter. You can also click on "Run" and type REGEDIT to open it.
2. Navigate to the

**HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters**  
**\IPEnableRouter setting**

- Right click and select Modify. Change **0 to 1** and click OK then exit the editor as shown below **Figure 2-2**.



**Figure 2-2:** IP Enable Router value is set to 1

- Restart the system and check if IP Enabled Router is set to Yes by using the command **ipconfig /all**

## 2.1 Setting up the NetSim Server

**Note:** Never use NetSim License server as Source or destination for emulation application. Also, if the license server is running on Virtual Machine (VM) than any VM on that physical system cannot be used as source or destination. If used, this will lead to license check out problems in the license server.

- Run NetSim in Administrative Mode (Right Click on NetSim.exe → Run as Administrator).
- User has to open any Stack based Network (Any network except Legacy Networks and Cellular Network) in NetSim with Emulation.
- Create a network scenario of your choice (refer application examples provided) and set the Application properties as shown below **Figure 2-3**.



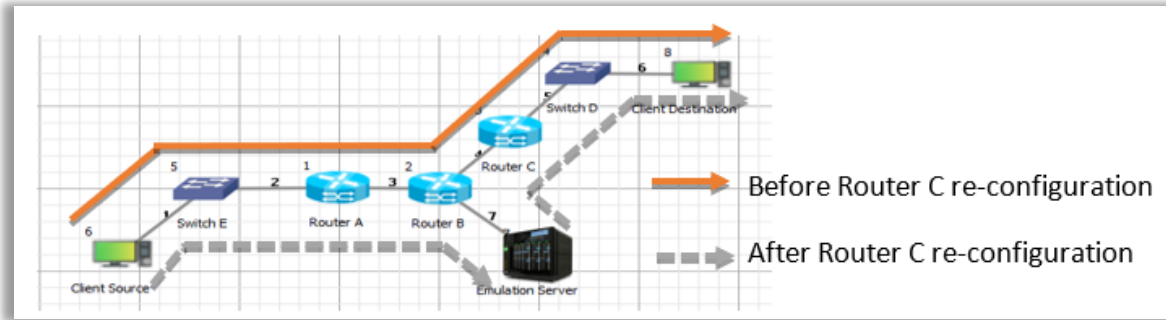
APPLICATION	
Application_Method	UNICAST
Application_Type	CBR
Application_ID	1
Application_Name	App1_CBR
Source_Count	1
Source_ID	2
Destination_Count	1
Destination_ID	3
Start_Time(s)	0
End_Time(s)	100000
Src to Dest	Show line
Encryption	NONE
Random_Startup	FALSE
Session_Protocol	NONE
Transport_Protocol	UDP
QoS	BE

**Figure 2-3:** Application properties window

- In the Application Properties, set Application Type as “EMULATION”. Assign real Source IP address and Destination IP address in the respective fields. Then Click OK.
- Set the Simulation Time as how long you want to perform the Emulation in Real World.  
**Do not run the simulation until setting up Emulation in the Client system.**

**NOTE: If the Emulation Server is located in a different subnet from clients**

- User has to configure the router settings of the real-world network so as to allow the packets to be transmitted to the Emulation Server.
- For Example, if we consider a sample real world network scenario where the Emulation clients and server are located in different subnets as shown **Figure 2-4**.



**Figure 2-4:** Emulation Server is located in a different subnet from clients

- Routing table of router 3 needs to be configured such that any packet having Source Address as IP Address of Node 6(Client Source) and Destination Address as IP Address of Node 8(Client Destination) must be routed to Emulation Server. NetSim configuration will ensure that the packet is re-injected with destination set to the appropriate IP Address (set in the application properties)

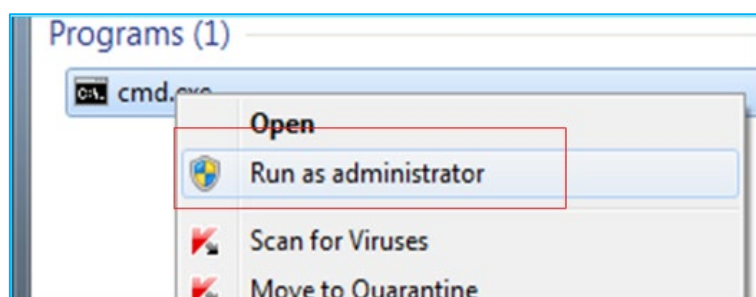
## 2.2 Setting up the Client systems (Real Source and Destination system)

The client systems which are sources of real traffic can be connected to NetSim emulator by resetting the gateway. NetSim Emulator supports both Windows and Linux clients. Once the gateway for the client system is set as the NetSim Emulator PC then traffic from the clients will go via NetSim Emulator PC. The steps involved in configuring the gateway will vary based on the operating system used.

### 2.2.1 Configuring Windows clients

The following steps can be used to configure the gateway IP address in systems running windows operating system.

- Open command prompt in administrative mode as shown **Figure 2-5**.



**Figure 2-5:** Run Command prompt in administrative mode

- Type command,  
**route delete <Network Address>**

Then press Enter key. You will get “OK”. For example, if your IP address is 192.168.0.4 and the subnet mask is 255.255.255.0 then the network address is 192.168.0.0 (Got by performing a bitwise AND of the IP Address and the subnet mask)

- Type command

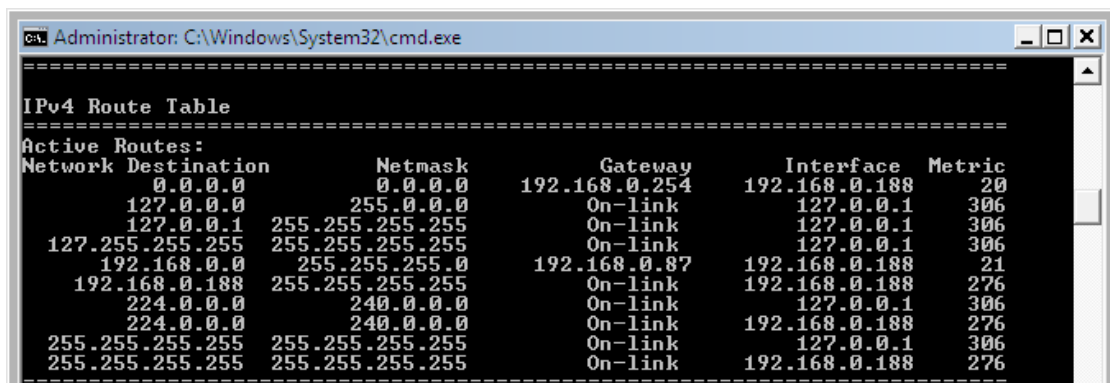
**route add <Network Address>mask 255.255.255.0 <IP Address where NetSim Emulation server is running> metric 1**

Here the subnet mask is taken as 255.255.255.0). After execution, you will get “OK”.

- Type command

**netstat -r**

To check if the IP configuration is done or not.



```

Administrator: C:\Windows\System32\cmd.exe

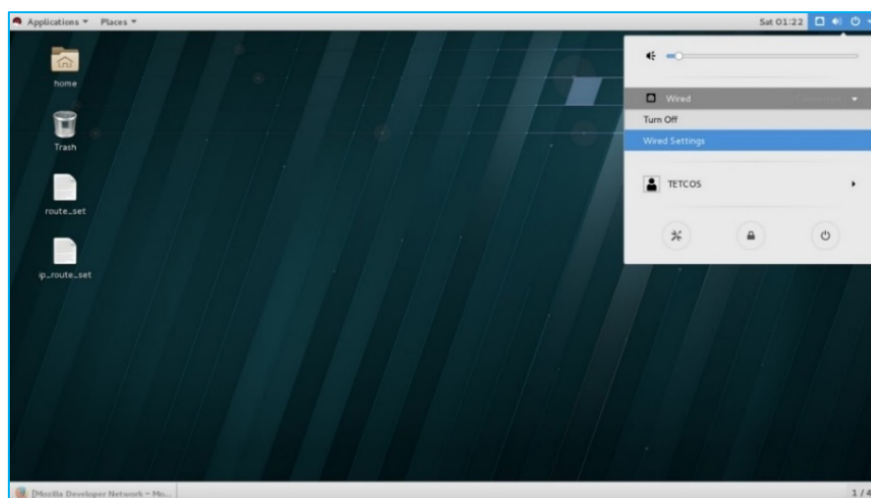
=====
IPv4 Route Table
=====
Active Routes:
Network Destination    Netmask          Gateway          Interface        Metric
0.0.0.0                0.0.0.0          192.168.0.254    192.168.0.188    20
127.0.0.0              255.0.0.0        On-link          127.0.0.1        306
127.0.0.1              255.255.255.255  On-link          127.0.0.1        306
127.255.255.255        255.255.255.255  On-link          127.0.0.1        306
192.168.0.0            255.255.255.0    192.168.0.87    192.168.0.188    21
192.168.0.188          255.255.255.255  On-link          192.168.0.188    276
224.0.0.0              240.0.0.0        On-link          127.0.0.1        306
224.0.0.0              240.0.0.0        On-link          192.168.0.188    276
255.255.255.255        255.255.255.255  On-link          127.0.0.1        306
255.255.255.255        255.255.255.255  On-link          192.168.0.188    276
=====
  
```

**Figure 2-6: Route Table**

*Note that in the above screenshot, for the network 192.168.0.0, the gateway address assigned is 192.168.0.87(Address of the system where NetSim Emulation Server is running).*

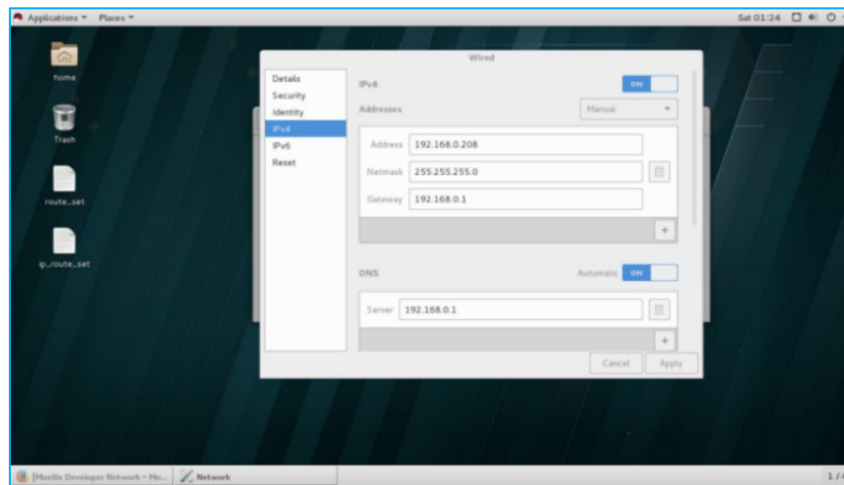
## 2.2.2 Configuring Linux clients running RHEL 7

Go to the Wired Settings option in the Network Adapter Icon.



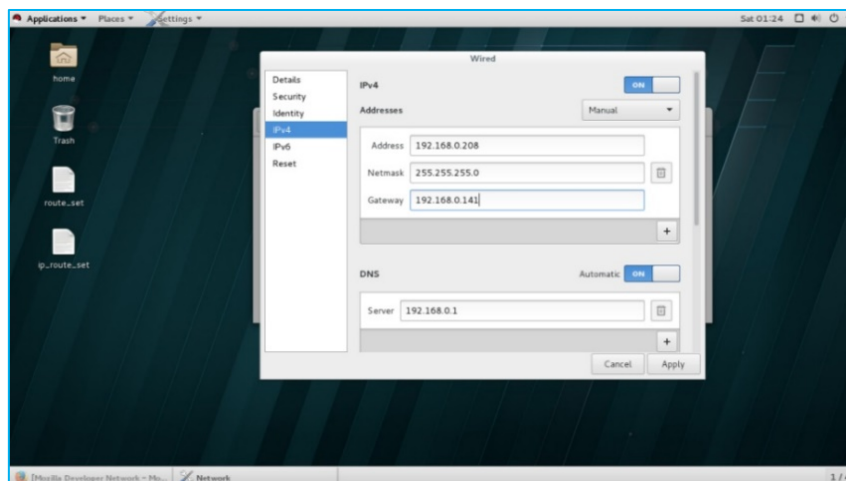
**Figure 2-7: Wired Settings option in the Network Adapter Icon**

In the IPV4 settings, set static IP Address to the machine and specify the Emulation Server IP as the Gateway IP.



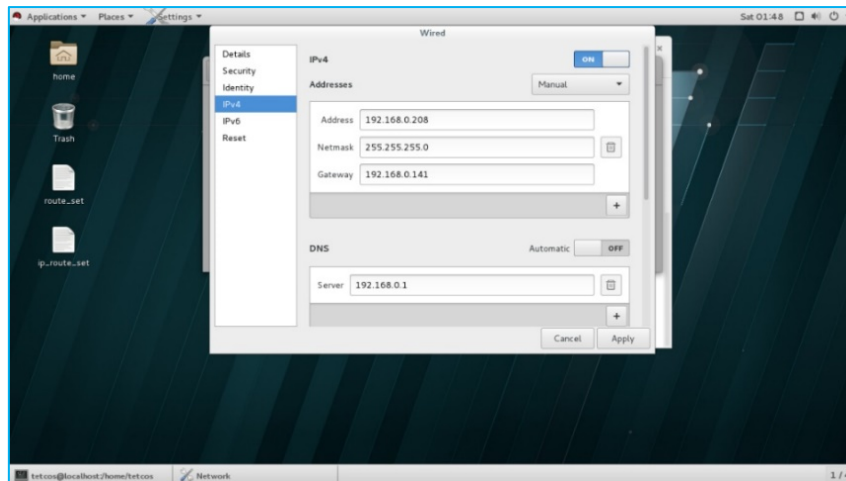
**Figure 2-8:** Set static IP Address to the machine and specify the Emulation Server IP as the Gateway IP

Example: If 192.168.0.141 is the IP of the system where Emulation Server is running. This is specified as the gateway IP.



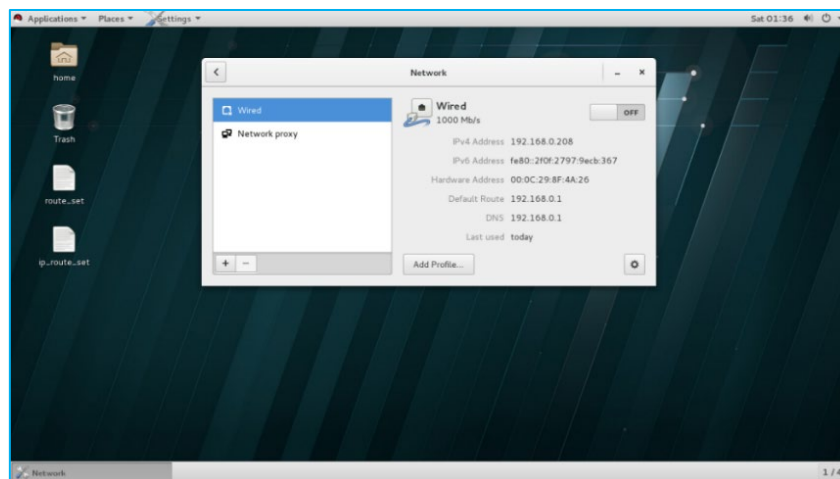
**Figure 2-9:** Setting up Gateway to Emulation Server IP:192.168.0.141

Turn off Automatic DNS.

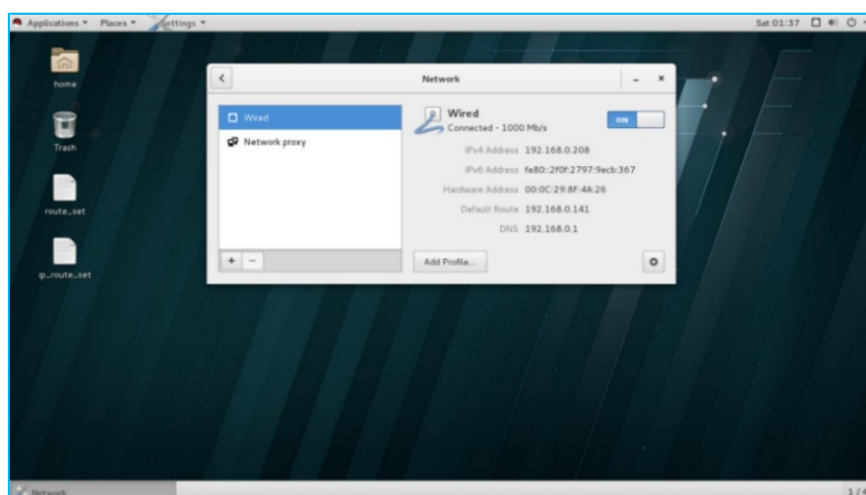


**Figure 2-10: Turn off Automatic DNS**

Turn off and on the Network Adapter



**Figure 2-11: Turn off Network Adapter**



**Figure 2-12: Turn ON Network Adapter**

Open terminal window

## Type command

### su

This is to switch to root user.

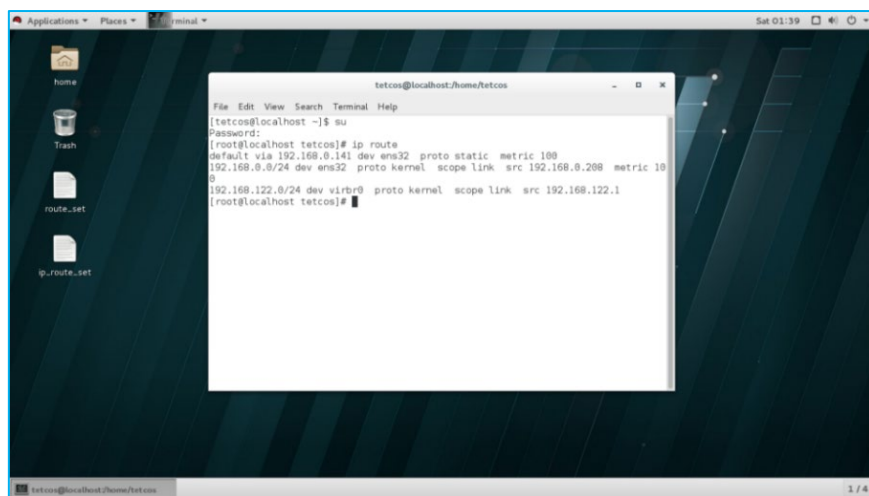
Enter the root password

## Type command

### ip route

This is to check the default route

It will now show the default via <Emulation server IP>

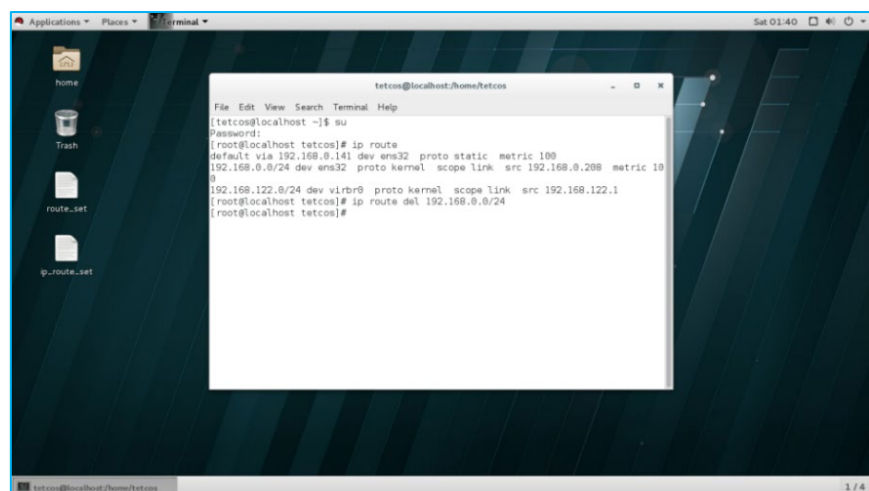


```
tetcos@localhost/home/tetcos
File Edit View Search Terminal Help
[tetcos@localhost ~]$ su
Password:
[root@localhost tetcos]# ip route
default via 192.168.0.141 dev ens32 proto static metric 100
192.168.0.0/24 dev ens32 proto kernel scope link src 192.168.0.208 metric 10
0
192.168.122.0/24 dev virbr0 proto kernel scope link src 192.168.122.1
[root@localhost tetcos]#
```

Figure 2-13: Default route

## Type command

### ip route del <Network Address>



```
tetcos@localhost/home/tetcos
File Edit View Search Terminal Help
[tetcos@localhost ~]$ su
Password:
[root@localhost tetcos]# ip route
default via 192.168.0.141 dev ens32 proto static metric 100
192.168.0.0/24 dev ens32 proto kernel scope link src 192.168.0.208 metric 10
0
192.168.122.0/24 dev virbr0 proto kernel scope link src 192.168.122.1
[root@localhost tetcos]# ip route del 192.168.0.0/24
[root@localhost tetcos]#
```

Figure 2-14: ip route del 192.168.0.0/24

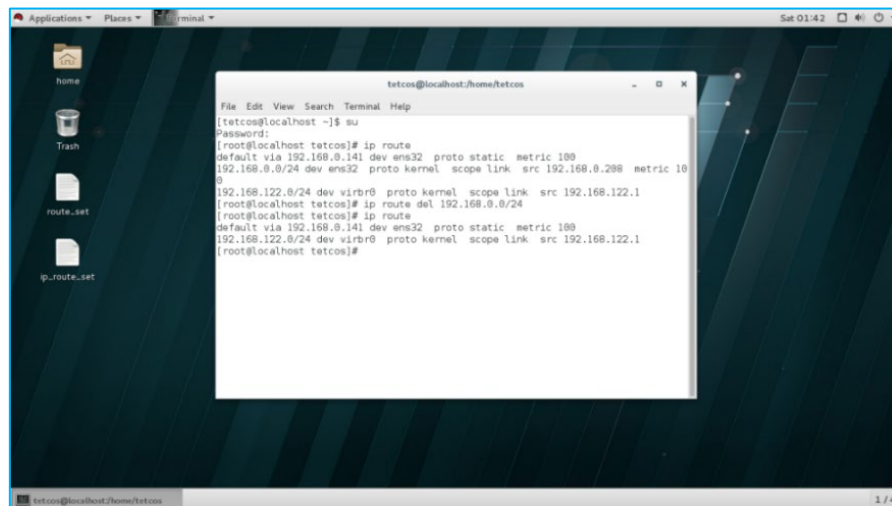
## Example:

**ip route del 192.168.0.0/24**

**Type command**

**ip route**

This is to check if the IP configuration is done.



**Figure 2-15:** IP configuration is done

### 2.2.3 Configuring Linux clients running Ubuntu

In Ubuntu Environment, if you want to set NetSim Emulator as the gateway, you can use command line tool in your Client systems such as

- ip command – show / manipulate routing, devices, policy routing and tunnels.
- route command – show / manipulate the IP routing table.
- Save routing information to a configuration file so that after reboot you get same default gateway.

Any of the following methods can be used for this purpose:

In this example we have considered the NetSim Emulator IP address as 10.244.1.55

- ip command to set a default router to 10.244.1.55  
Login as the root and type:  
**# ip route add default via 10.244.1.55**  
OR  
**\$ sudo ip route add default via 10.244.1.55**
- route command to set a default router to 10.244.1.55  
Login as the root and type:

```
# route add default gw 10.244.1.55
```

OR

```
$ sudo route add default gw 10.244.1.55
```

- Save routing information to a configuration file `/etc/network/interfaces`  
Open `/etc/network/interfaces` file

```
# vi /etc/network/interfaces
```

OR

```
$ sudo vi /etc/network/interfaces
```

Find `eth0` or desired network interface and add following option

```
gateway 10.244.1.55
```

Save and close the file. Restart networking:

```
# /etc/init.d/networking restart
```

OR

```
$ sudo /etc/init.d/networking restart
```

After setting static routes through NetSim Emulator, you can use '`traceroute <destination ip>`' command in the client systems to check if the packets are sent via the NetSim emulator.

### 2.2.4 Configuring Raspberry Pi clients

Open Raspberry PI terminal and apply “`sudo su`”

- Apply “`nano /etc/sysctl.conf`” command and edit the file by adding the following comment  
`net.ipv4.ip_forward=1`
- To save and Exit  
**[Ctrl] + X, then chose yes or no**
- Apply “`nano /etc/sysctl`” command
- Then add the following comments
  - a. `IP_DYNIP="no"`
  - b. `IP_TCP_SYNCOOKIES="yes"`
  - c. `IP_FORWARD="yes"`
- Follow step 3



```
# server, but it should not be run by default.
nohook lookup-hostname

interface eth0
inform 192.168.0.124
static routers=192.168.0.53
static domain_name_servers=192.168.0.1
static domain_search=192.168.0.1
```

Figure 2-16: Print interface ID

- Apply “nano /etc/dhcpd.conf”
  - a. change the “static routers” to NetSim Server IP as shown in the below image
- Apply “route” command

```
Destination      Gateway         Genmask         Flags Metric Ref    Use Iface
default          192.168.0.53   0.0.0.0         UG    202    0      0 eth0
192.168.0.0      *              255.255.255.0   U      202    0      0 eth0
```

Figure 2-17: Route Print

- Apply “ip r del <network ip>/24”

```
root@tetcos:/etc# ip r del 192.168.0.0/24
root@tetcos:/etc# route
Kernel IP routing table
Destination      Gateway         Genmask         Flags Metric Ref    Use Iface
default          192.168.0.53   0.0.0.0         UG    202    0      0 eth0
```

Figure 2-18: ip r del 192.168.0.0/24

### Example: ip r del 192.168.0.0/24

- Apply “ping <any ip within the network>”. Example: ping 192.168.0.202

```
root@tetcos:/etc# ping 192.168.0.202
PING 192.168.0.202 (192.168.0.202) 56(84) bytes of data.
From 192.168.0.53: icmp_seq=1 Redirect Network(New nexthop: 192.168.0.202)
64 bytes from 192.168.0.202: icmp_seq=1 ttl=64 time=0.758 ms
From 192.168.0.53: icmp_seq=2 Redirect Network(New nexthop: 192.168.0.202)
64 bytes from 192.168.0.202: icmp_seq=2 ttl=64 time=0.749 ms
From 192.168.0.53: icmp_seq=3 Redirect Network(New nexthop: 192.168.0.202)
64 bytes from 192.168.0.202: icmp_seq=3 ttl=64 time=0.742 ms
From 192.168.0.53: icmp_seq=4 Redirect Network(New nexthop: 192.168.0.202)
64 bytes from 192.168.0.202: icmp_seq=4 ttl=64 time=0.701 ms
From 192.168.0.53: icmp_seq=5 Redirect Network(New nexthop: 192.168.0.202)
```

Figure 2-19: Pinging to 192.168.0.202

## 2.3 Setting up the network for client systems communicating across the network

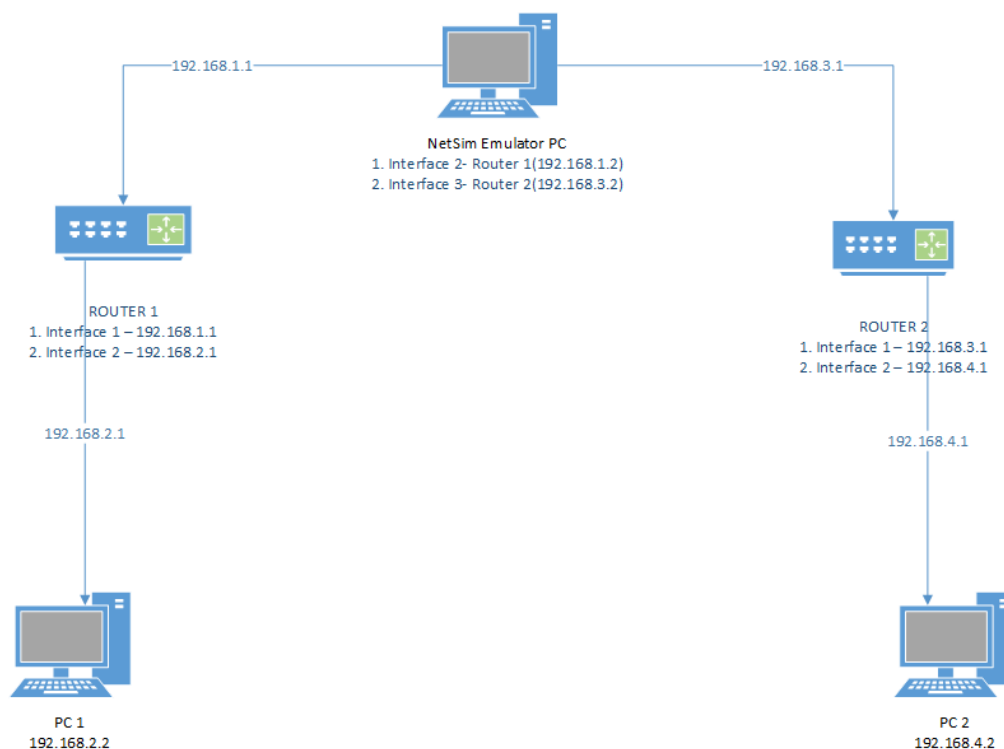
Devices communicating across networks can be connected to NetSim Emulator. This is achieved by connecting the system running NetSim to the routers which connect to the client machines taking part in communication.

### 2.3.1 System Configuration

Connecting devices across network to NetSim emulator involves configurations at the router and in the NetSim Emulator system. There is no configuration required in the client systems communicating across the network, unlike the case of emulation within the same network.

- The System running NetSim Emulator will require two or more Network Interface Cards (NICs) to connect to different networks.
- Static routes should be set to route packets to specific Network Interfaces as they come in.
- Static routes should be set for routing any external network traffic to the interface that connects to NetSim emulator.

Consider the network shown in the figure below **Figure 2-20**.



**Figure 2-20: LAB Setup**

PC 1 and PC 2 are connected to Router 1 and Router 2 respectively. NetSim Emulation PC connects to Router 1 in one of its interface and Router 2 in the other.

To send packets exchanged between PC1 and PC2 via NetSim Emulator, following settings are to be done:

#### Router 1

Route is added to send any packet to PC 2(192.168.4.2), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.1.2)

## Router 2

Route is added to send any packet to PC 1(192.168.2.2), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.3.2)

## NetSim Emulator

Route is added to send any packet to PC1(192.168.2.2), to its first interface (192.168.1.2)

Route is added to send any packet to PC2(192.168.4.2), to its second interface (192.168.3.2)

After performing the above settings, packets from PC 1 to PC 2 will take the following route:

PC 1 -> NetSim Emulator Interface 1 -> NetSim Emulator Interface 2 -> PC 2

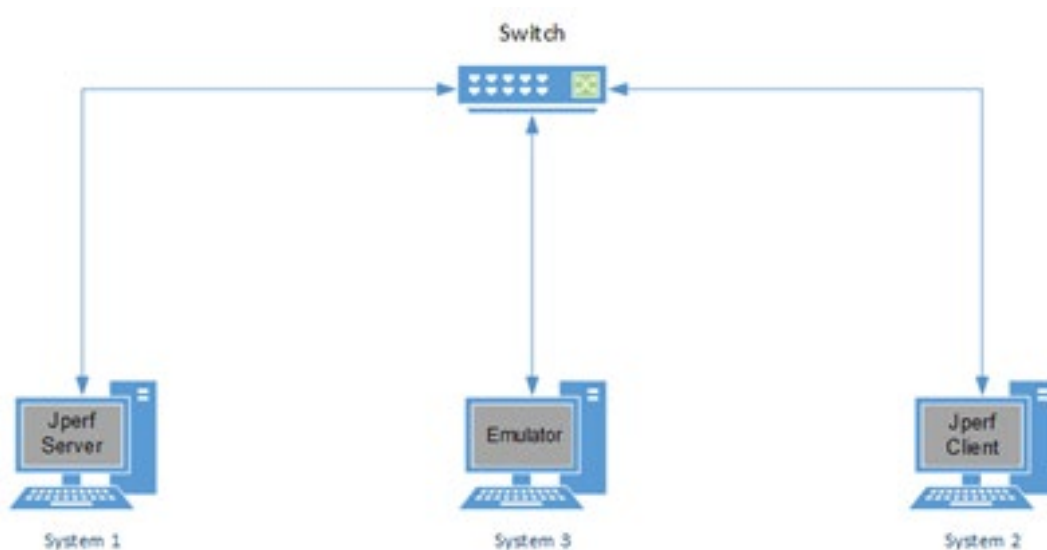
And vice versa for packets from PC 2 to PC 1.

## 2.4 Performing Multicast Emulation

IP multicast is a method of sending Internet Protocol (IP) datagrams to a group of interested receivers in a single transmission. It is the IP-specific form of multicast and is used for streaming media and other network applications.

NetSim emulator allows sending real traffic via the virtual network modelled in its environment. The real packets will experience the effect of the network conditions modelled in NetSim's virtual network in addition to the real network. This is usually achieved by setting the system hosting NetSim emulator as the gateway in the systems that are the sources of traffic.

Consider the following network setup where there are two systems running JPERF client and server applications and one system running NetSim emulator.

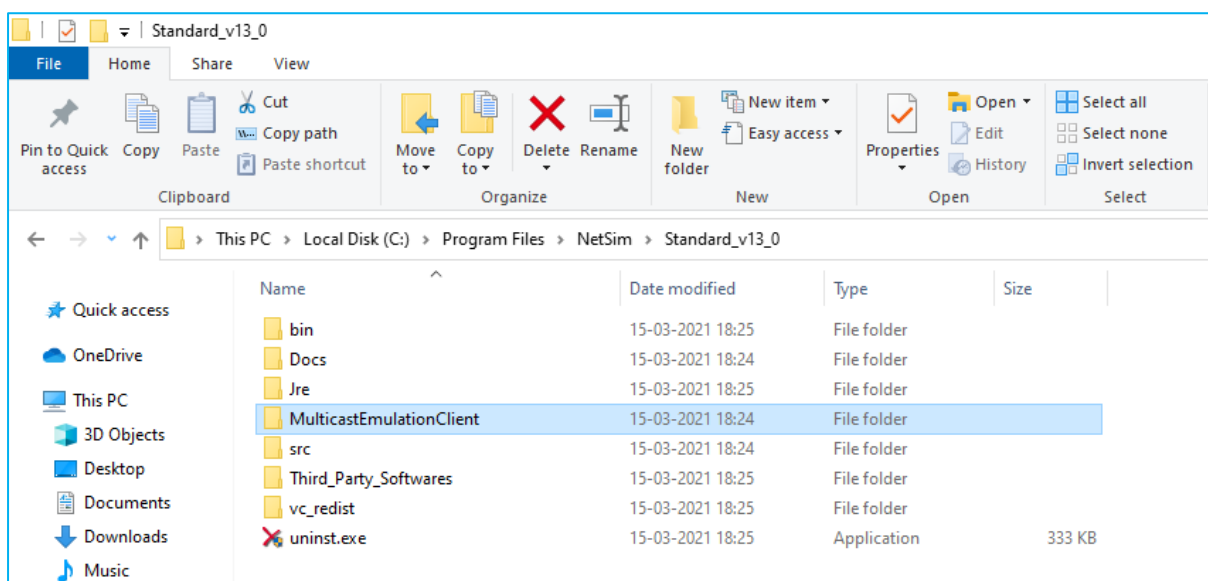


**Figure 2-21:** JPERF client - server and NetSim Emulator connected to Switch

In the above network the gateway/nexthop of System 1 (and system 2 if traffic is bi-directional) needs to be set as System 3 for packets to reach NetSim Emulator prior to reaching the destination. NetSim can then take care of sending the real packets over the virtual network modelled in its design environment.

However, this works only in case of simple application models such as Unicast. In case of application models such as Multicast NetSim offers different techniques to ensure that the packets go through the emulated network prior to reaching the destination devices.

NetSim provides a Multicast Emulation Client application specifically to perform multicast emulation. This application can be found in the install directory of NetSim within as shown below:



**Figure 2-22: NetSim Installation Directory**

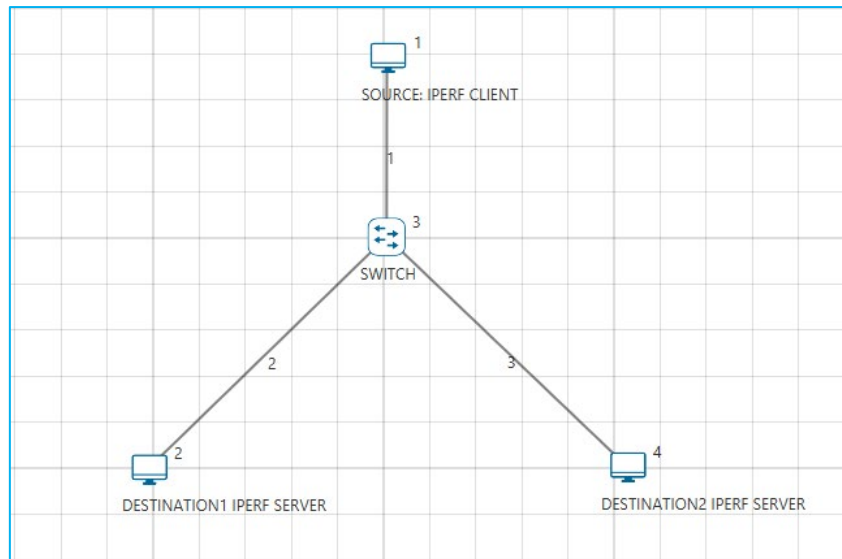
Following is an example related to performing multicast emulation in NetSim. This example involves 4 real PC's

### System Setup:

- SYSTEM 1 - NetSim Emulator (IP:192.168.0.34)
- SYSTEM 2 - Source (iperf Client) (IP:192.168.0.11)
- SYSTEM 3 - Destination 1 (iperf server 1) (IP:192.168.0.36)
- SYSTEM 4 - Destination 2 (iperf server 2) (IP: 192.168.0.19)
- All 4 systems must be in a single network.

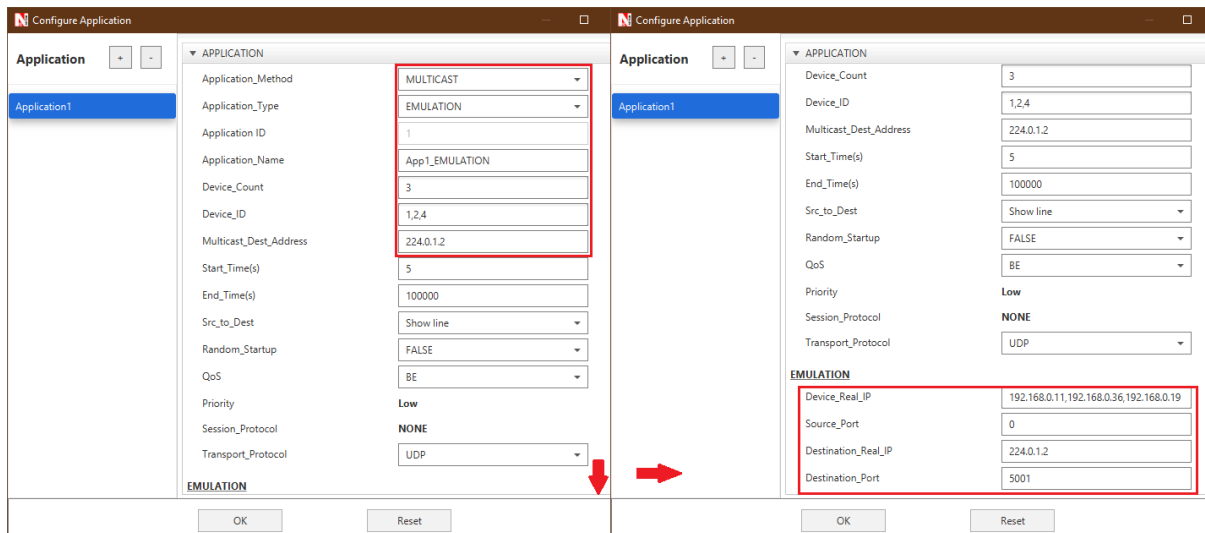
### System 1:

1. Install NetSim Standard version including Emulator License
2. Run NetSim, open Internetworks create a scenario as shown below **Figure 2-23**.



**Figure 2-23: Network Topology**

3. Create Multicast Emulation with following properties:
  - Application Method: Multicast
  - Application Type: Emulation
  - Device Count: Count of devices which act as multicast server and client. 3 in this case (excludes the system hosting NetSim emulator, includes the Iperf client and two Iperf servers)
  - Device ID: The ID's of the virtual devices representing the multicast clients and servers.
  - Multicast Dest Address: The multicast IP address to which nodes are listening.
  - Device Real IP: The IP Address of all the systems involved in Multicast (Excluding the system running NetSim emulator)
  - Destination Real IP: The multicast IP Address
  - Source Port: Can be set to 0.
  - Destination Port: The port to which the server is listening.



**Figure 2-24: Application Configuration Window**

4. Configure all other systems in the Network and the perform simulation.
5. Run the simulation.

## System 2:

1. Copy Multicast Emulation Client folder from NetSim installation directory to the current system.

**E.g.:** C:\Program Files\NetSim Standard\MulticastEmulationClient

2. Run iperf with the following command:

*iperf -c 224.1.2.3 -u -i 1 -t 1000*

3. Run multicastEmulationclient in client system in command prompt in admin mode:

### Command:

*MulticastEmulationClient.exe <Client system Ip> <Emulation server Ip> <Multicast Ip> <port>*

```

C:\Users\TETCOS-DEMO SYSTEM\Desktop\iperf-2.0.8-win32>iperf.exe -c 224.0.1.2 -u -i 1 -t 1000
-----
Client connecting to 224.0.1.2, UDP port 5001
Sending 1470 byte datagrams, IPG target: 11215.21 us (kalman adjust)
Setting multicast TTL to 1
UDP buffer size: 64.0 KByte (default)
-----
[384] local 192.168.0.11 port 50184 connected with 224.0.1.2 port 5001
[ ID] Interval      Transfer    Bandwidth
[384] 0.0- 1.0 sec   131 KBytes  1.07 Mbits/sec
[384] 1.0- 2.0 sec   128 KBytes  1.05 Mbits/sec
[384] 2.0- 3.0 sec   128 KBytes  1.05 Mbits/sec
[384] 3.0- 4.0 sec   128 KBytes  1.05 Mbits/sec
[384] 4.0- 5.0 sec   128 KBytes  1.05 Mbits/sec

```

Figure 2-25: Iperf- Multicast command for system 2

### System 3 and System 4:

1. Copy Multicast Emulation Client folder from NetSim installation directory to the current system.

**E.g.:** C:\Program Files\NetSim Standard\MulticastEmulationClient

2. Run jperf with the following command:

*iperf -s -B 224.1.2.3 -u -i 1*

3. Run multicastEmulationclient in client system with the following CMD:

#### Command:

*MulticastEmulationClient.exe <Client system Ip> <Emulation server Ip> <Multicast Ip> <port>*

```

C:\WINDOWS\system32>iperf -s -B 224.0.1.2 -u -i 1
-----
Server listening on UDP port 5001
Binding to local address 224.0.1.2
Joining multicast group 224.0.1.2
Receiving 1470 byte datagrams
UDP buffer size: 64.0 KByte (default)
-----
[372] local 192.168.0.36 port 5001 connected with 192.168.0.11 port 65208
[ ID] Interval      Transfer    Bandwidth    Jitter    Lost/Total Datagrams
[372] 0.0- 1.0 sec   129 KBytes  1.06 Mbits/sec  6.192 ms  13202/13292 (99%)
[372] 1.0- 2.0 sec   129 KBytes  1.06 Mbits/sec  6.393 ms   0/   90 (0%)
[372] 2.0- 3.0 sec   128 KBytes  1.05 Mbits/sec  6.238 ms   0/   89 (0%)
[372] 3.0- 4.0 sec   128 KBytes  1.05 Mbits/sec  6.330 ms   0/   89 (0%)
[372] 4.0- 5.0 sec   128 KBytes  1.05 Mbits/sec
[372] 5.0- 6.0 sec   128 KBytes  1.05 Mbits/sec
[372] 6.0- 7.0 sec   128 KBytes  1.05 Mbits/sec
[372] 7.0- 8.0 sec   129 KBytes  1.06 Mbits/sec
[372] 8.0- 9.0 sec   128 KBytes  1.05 Mbits/sec
[372] 9.0-10.0 sec   128 KBytes  1.05 Mbits/sec
[372] 10.0-11.0 sec   128 KBytes  1.05 Mbits/sec
[372] 11.0-12.0 sec   128 KBytes  1.05 Mbits/sec
[372] 12.0-13.0 sec   128 KBytes  1.05 Mbits/sec
[372] 13.0-14.0 sec   128 KBytes  1.05 Mbits/sec
[372] 14.0-15.0 sec   129 KBytes  1.06 Mbits/sec
[372] 15.0-16.0 sec   128 KBytes  1.05 Mbits/sec
[372] 16.0-17.0 sec   128 KBytes  1.05 Mbits/sec
[372] 17.0-18.0 sec   128 KBytes  1.05 Mbits/sec
[372] 18.0-19.0 sec   128 KBytes  1.05 Mbits/sec

```

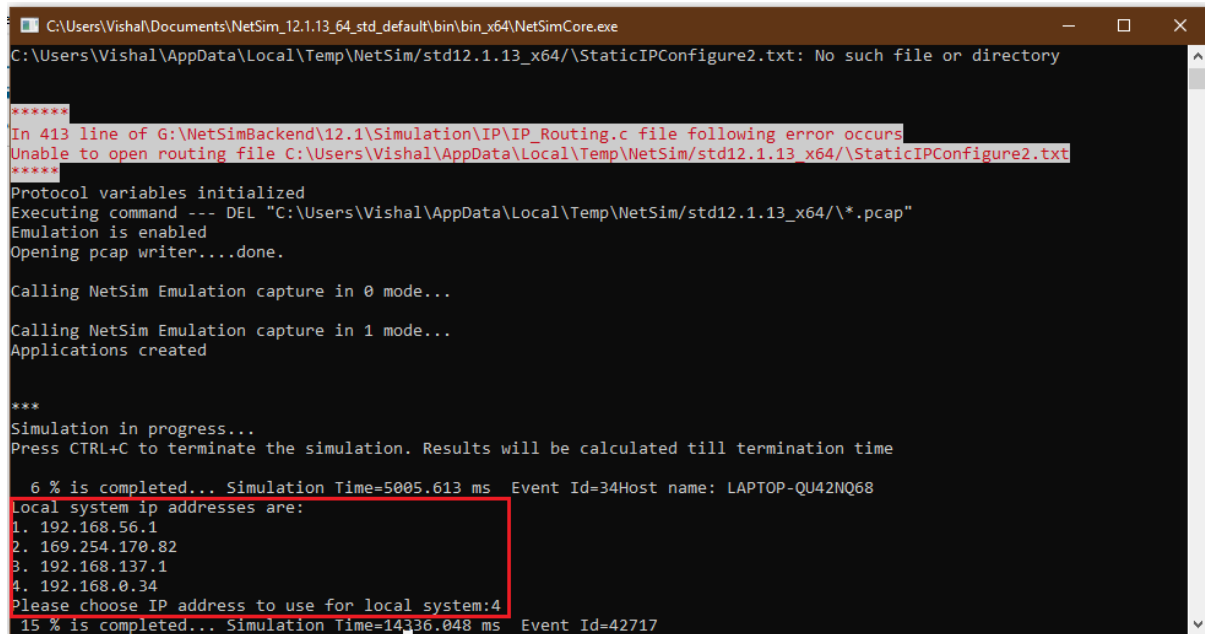
```

Administrator: Command Prompt - MulticastEmulationClient.exe 192.168.0.36 192.168.0.34 224.0.1.2 5001
C:\WINDOWS\system32>cd C:\Program Files\NetSim Standard\MulticastEmulationClient\Windows\x64
C:\Program Files\NetSim Standard\MulticastEmulationClient\Windows\x64>MulticastEmulationClient.exe
Usage: MulticastEmulationClient.exe <myip> <server_ip> <multicast_ip> <port>
C:\Program Files\NetSim Standard\MulticastEmulationClient\Windows\x64>MulticastEmulationClient.exe 192.168.0.36 192.168.0.34 224.0.1.2 5001

```

Figure 2-26: Iperf- Multicast command for system 3 and 4

Now perform Step 5 of System 1 i.e. Run the simulation in System 1. User will be asked to Enter an option to choose local IP while simulation. Please enter the option that displays the server-IP given as <multicast ip> for MulticastEmulationClient.exe. In this example its 192.168.0.34.



```
C:\Users\Vishal\Documents\NetSim_12.1.13_64_std_default\bin\bin_x64\NetSimCore.exe
C:\Users\Vishal\AppData\Local\Temp\NetSim\std12.1.13_x64\StaticIPConfigure2.txt: No such file or directory

*****
In 413 line of G:\NetSimBackend\12.1\Simulation\IP\IP_Routing.c file following error occurs
Unable to open routing file C:\Users\Vishal\AppData\Local\Temp\NetSim\std12.1.13_x64\StaticIPConfigure2.txt
*****
Protocol variables initialized
Executing command --- DEL "C:\Users\Vishal\AppData\Local\Temp\NetSim\std12.1.13_x64\*.pcap"
Emulation is enabled
Opening pcap writer....done.

Calling NetSim Emulation capture in 0 mode...

Calling NetSim Emulation capture in 1 mode...
Applications created

***
Simulation in progress...
Press CTRL+C to terminate the simulation. Results will be calculated till termination time

 6 % is completed... Simulation Time=5005.613 ms Event Id=34Host name: LAPTOP-QU42NQ68
Local system ip addresses are:
1. 192.168.56.1
2. 169.254.170.82
3. 192.168.137.1
4. 192.168.0.34
Please choose IP address to use for local system:4
15 % is completed... Simulation Time=14336.048 ms Event Id=42717
```

**Figure 2-27:** Choose Multicast IP during Emulation

On successful completion of Simulation, NetSim provides performance metrics in the Simulation Results dashboard.

## 2.5 Setting up the network for Database PostgreSQL Emulation

Devices running Database Management Systems such as PostgreSQL can be connected to NetSim Emulator. This is achieved by connecting the systems running the database server, the database web client and the system running NetSim Emulator to a switch.

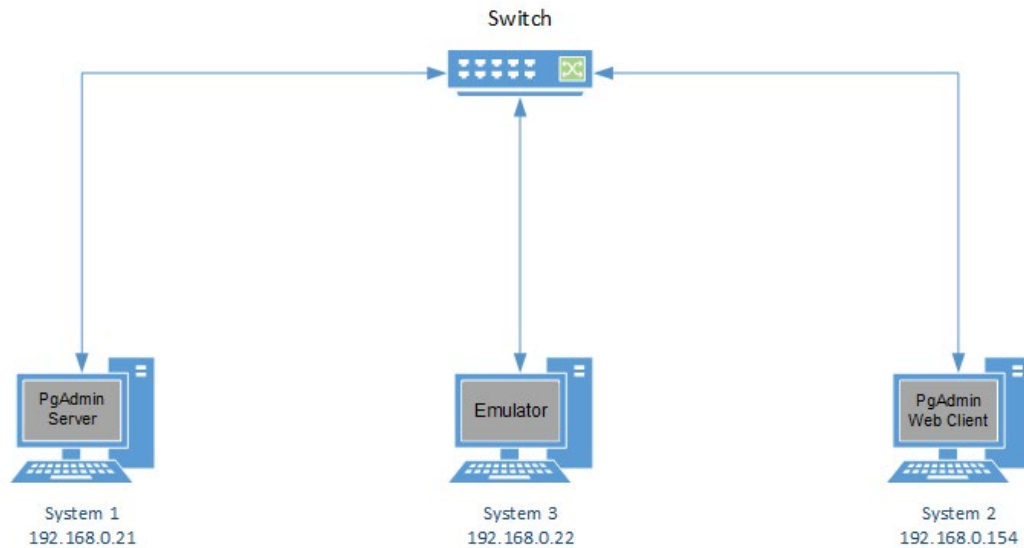
### 2.5.1 System Configuration

Connecting devices involved in database application to NetSim emulator involves configurations at both the systems that run the database server and the web client.

- Static routes should be set to route all outgoing packets to the system running NetSim Emulator.

Consider the network shown in the figure below **Figure 2-28**.





**Figure 2-28:** PgAdmin web client and server with NetSim Emulator to switch

System 1, System 2 and System 3 are connected to a L2 switch and are part of the same network.

To send packets exchanged between System 1 and System 2 via System 3(NetSim Emulator), following settings are to be done:

#### **System 1**

Route is added to send any packet to System 2(192.168.0.154), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.0.22)

#### **System 2**

Route is added to send any packet to System 1(192.168.0.21), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.0.22)

After performing the above settings, packets from PC 1 to PC 2 will take the following route:

**System 1**(PgAdmin Server) -> **System 3**(NetSim Emulator)-> **System 2**(PgAdmin WebClient)

And vice versa for packets from System 2 to System 1.

### **2.5.2 Steps to Start generating Network Traffic**

- Start PgAdmin application in System 1 and create a database with 100000 Records in it.

- Now open PgAdmin application in System 2 and connect to the database created in System 1. In the example shown below, we are attempting to retrieve the records from a large csv file.

Query Editor   Query History

```
1 select * from Public."Event"
```

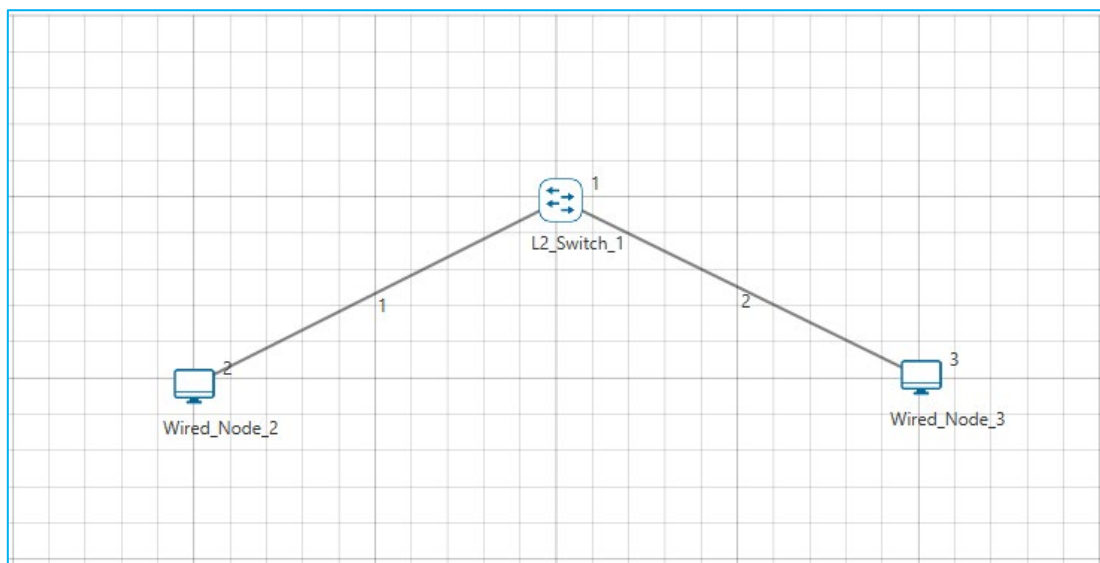
Data Output   Explain   Messages   Notifications

	event_id integer	event_type character varying (100)	event_time integer	device_type character varying (50)	device_id integer
1	1	TIMER_EVENT	0	NODE	1
2	2	TIMER_EVENT	0	NODE	2
3	3	TIMER_EVENT	0	ROUTER	4
4	4	TIMER_EVENT	0	NODE	5
5	5	TIMER_EVENT	0	NODE	1
6	6	TIMER_EVENT	0	NODE	2
7	7	TIMER_EVENT	0	SWITCH	3

**Figure 2-29:** PgAdmin application in System 2

### 2.5.3 Steps to configure application for NetSim Emulation

- Once the database connection is established, In System 3, create a simple scenario in internetworks as shown below:



**Figure 2-30:** Network Topology

- Configure an Emulation Application from Wired Node 2 to Wired Node 3 as shown below:

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.21

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.154

Destination\_Port: 0

OK Reset

**Figure 2-31:** Application properties window for Application 1

- Configure an Emulation Application from Wired Node 3 to Wired Node 2 as shown below:

**Configure Application**

**Application** + -

Application1

Application2

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 2

Application\_Name: App2\_EMULATION

Source\_Count: 1

Source\_ID: 3

Destination\_Count: 1

Destination\_ID: 2

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.21

Destination\_Port: 0

OK Reset

**Figure 2-32:** Application properties window for Application 2

The above settings will ensure that packets from System 1 to System 2 and vice versa will be sent via NetSim Emulator.

### 2.5.4 Results and Analysis

- Start Simulation in NetSim
- Perform any query on the database while NetSim simulation is running.
- Analyse the impact of flow of the packets through the network designed in NetSim based on the time taken for the query response.
- The pcap log files such as All Network Packets Capture, Dispatched to Emulator, Rejected from Emulator, Not Dispatched to Emulator that are accessible from the NetSim results dashboard after the simulation is over, can be used for further analysis.

## 2.6 Setting up the network for GeoServer Application Emulation

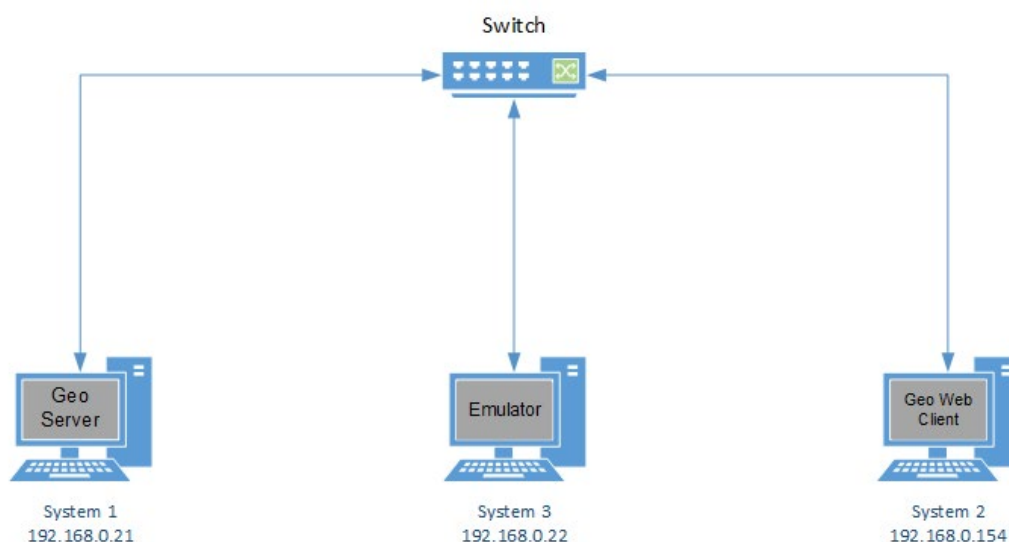
Devices running Database Management Systems such as PostgreSQL can be connected to NetSim Emulator. This is achieved by connecting the systems running the database server, the database web client and the system running NetSim Emulator to a switch.

### 2.6.1 System Configuration

Connecting devices involved in database application to NetSim emulator involves configurations at both the systems that run the database server and the web client.

- Static routes should be set to route all outgoing packets to the system running NetSim Emulator.

Consider the network shown in the figure below **Figure 2-33**.



**Figure 2-33:** Geo web client and server applications and server with NetSim Emulator to switch  
System 1, System 2 and System 3 are connected to a L2 switch and are part of the same network.

To send packets exchanged between System 1 and System 2 via System 3(NetSim Emulator), following settings are to be done:

#### System 1

Route is added to send any packet to System 2(192.168.0.154), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.0.22)

## System 2

Route is added to send any packet to System 1(192.168.0.21), to NetSim Emulator interface that is connected to it. (Interface with IP 192.168.0.22)

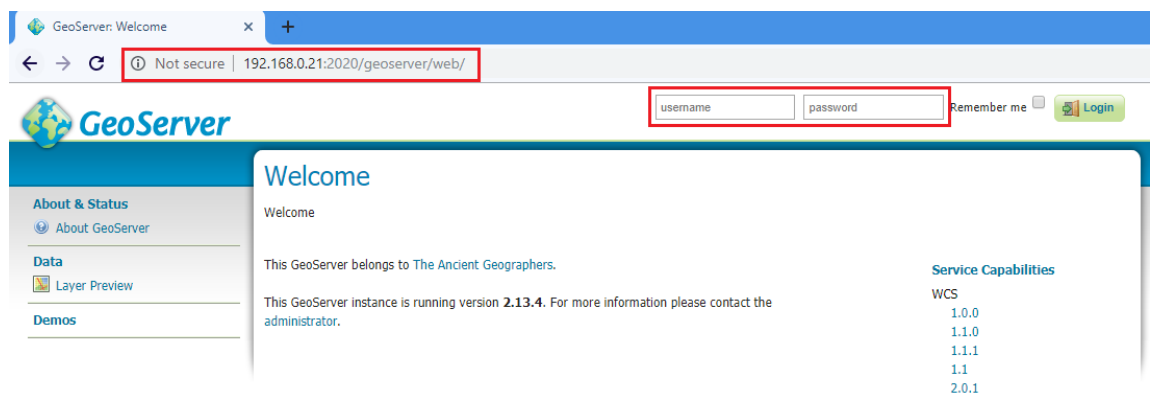
After performing the above settings, packets from PC 1 to PC 2 will take the following route:

**System 1**(Geo Server) -> **System 3**(NetSim Emulator)-> **System 2**(Geo WebClient)

And vice versa for packets from System 2 to System 1.

### 2.6.2 Steps to Start generating Network Traffic

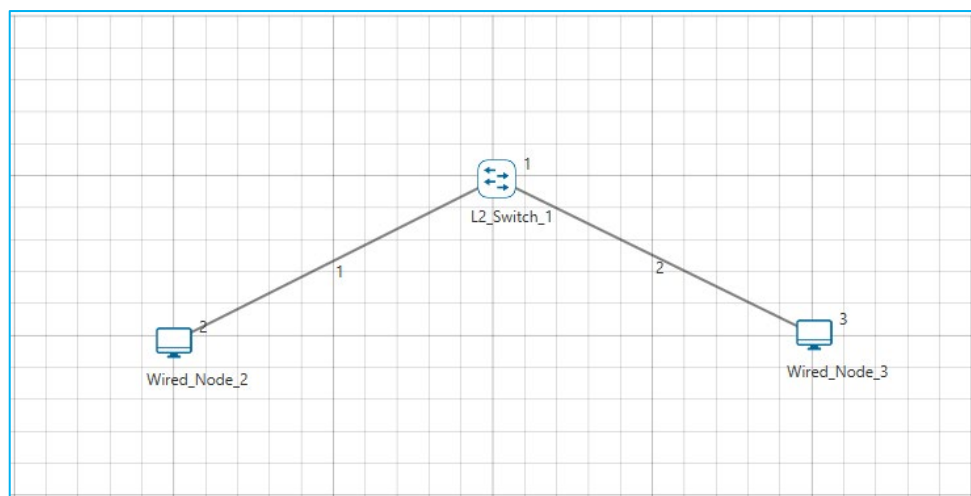
- Start GeoServer application in System 1
- Now access GeoServer via web browser in System 2 by specifying IP address: GeoServerPort//Geoserver/browser. Eg:192.168.0.21:2020/Geoserver/browser



**Figure 2-34:** GeoServer application in System 2

### 2.6.3 Steps to configure application for NetSim Emulation

- Once the database connection is established, In System 3, create a simple scenario in internetworks as shown below **Figure 2-35**.



**Figure 2-35:** Network Topology

- Configure an Emulation Application from Wired Node 2 to Wired Node 3 as shown below:

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.21

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.154

Destination\_Port: 0

OK Reset

**Figure 2-36:** Application properties window for Application 1

- Configure an Emulation Application from Wired Node 3 to Wired Node 2 as shown below:

**Configure Application**

**Application** + -

Application1

**Application2**

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 2

Application\_Name: App2\_EMULATION

Source\_Count: 1

Source\_ID: 3

Destination\_Count: 1

Destination\_ID: 2

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.21

Destination\_Port: 0

OK Reset

**Figure 2-37:** Application properties window for Application 2

The above settings will ensure that packets from System 1 to System 2 and vice versa will be sent via NetSim Emulator.

## 2.6.4 Results and Analysis

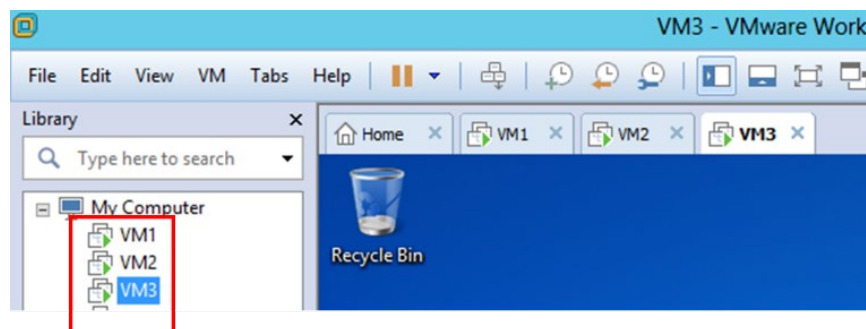
- Start Simulation in NetSim
- Try to access specific regions of the map by zooming in and other operations to generate live network traffic.
- Analyse the impact of flow of the packets through the network designed in NetSim based on the time taken for the map to load.
- The pcap log files such as All Network Packets Capture, Dispatched to Emulator, Reinjectd from Emulator, Not Dispatched to Emulator that are accessible from the NetSim results dashboard after the simulation is over, can be used for further analysis.



## 2.7 Setting multiple Virtual Machines (VM) to act as Nodes for Emulation

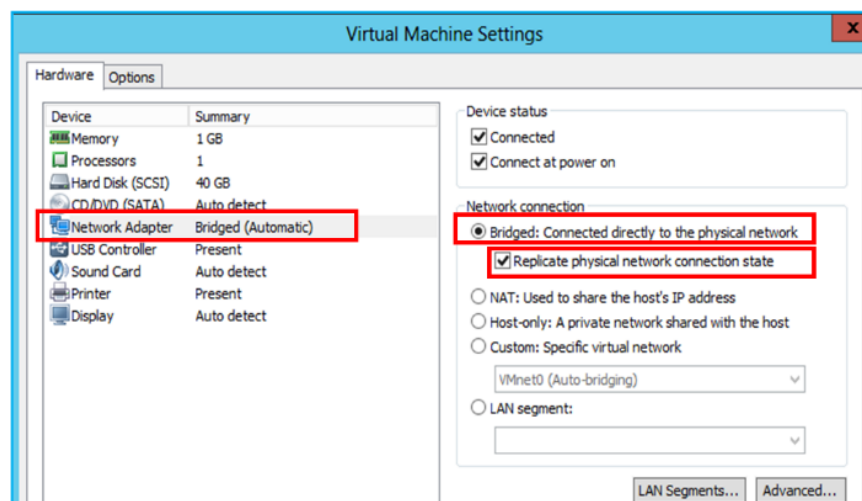
### 2.7.1 VMs sharing the same network as the host

A computer on which one or more virtual machines are running is defined as a Host Machine. Each virtual machine is called a Guest Machine. In this scenario, we have 3 VMs running in a Host Machine – VM1, VM2 and VM3. Users can run NetSim License server in any system connected to the network in which Host Machine is running.



**Figure 2-38:** Multiple Virtual Machines (VM)

Now right click on each VM and select Settings. Click on Network Adapter, and select **“Bridged: Connected directly to the physical network”**. Also enable the **“Replicate Physical network connection state”**.

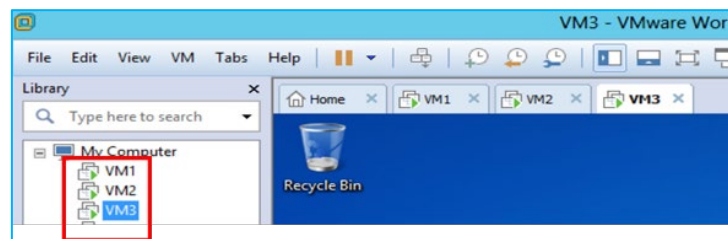


**Figure 2-39:** Multiple Virtual Machines setting window

An advantage of this technique is that, if the license server is running in another system, connected to the same network as the original host, then NetSim running in the VM can obtain the licenses.

## 2.8 VMs sharing a network but insulated from the host network

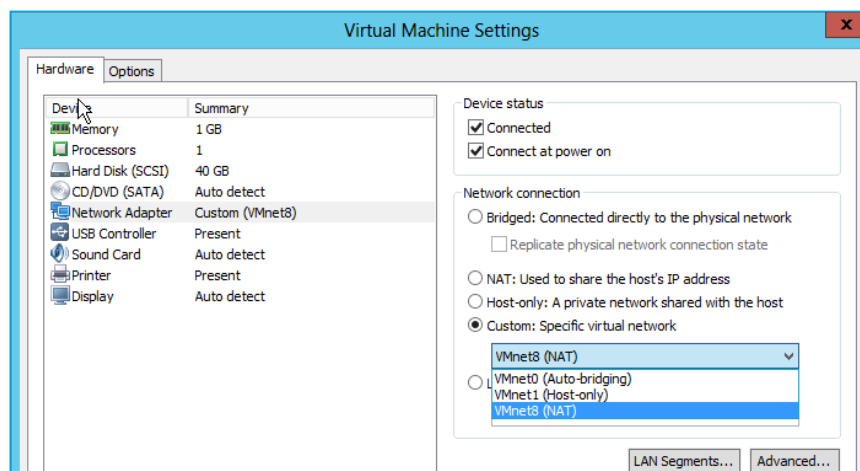
A computer on which one or more virtual machines are running is defined as a Host Machine. Each virtual machine is called a Guest Machine. In this scenario, we have 3 VMs running in a Host Machine – VM1, VM2 and VM3. NetSim License server is running in one of these 3 VMs.



**Figure 2-40:** NetSim License server is running in one VM

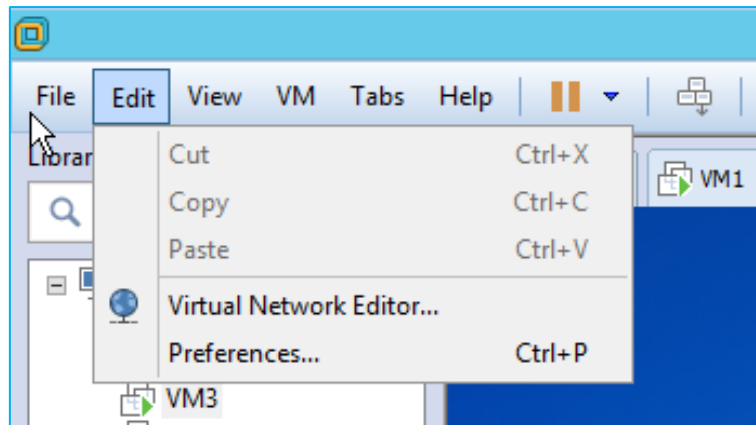
If user needs to create an internal network which is segregated from host network, follow the steps

1. Right click on each VM and select Settings.
2. Click on Network Adapter, and select “Custom: Specific Virtual network”
3. Select “VMnet8 (NAT)”

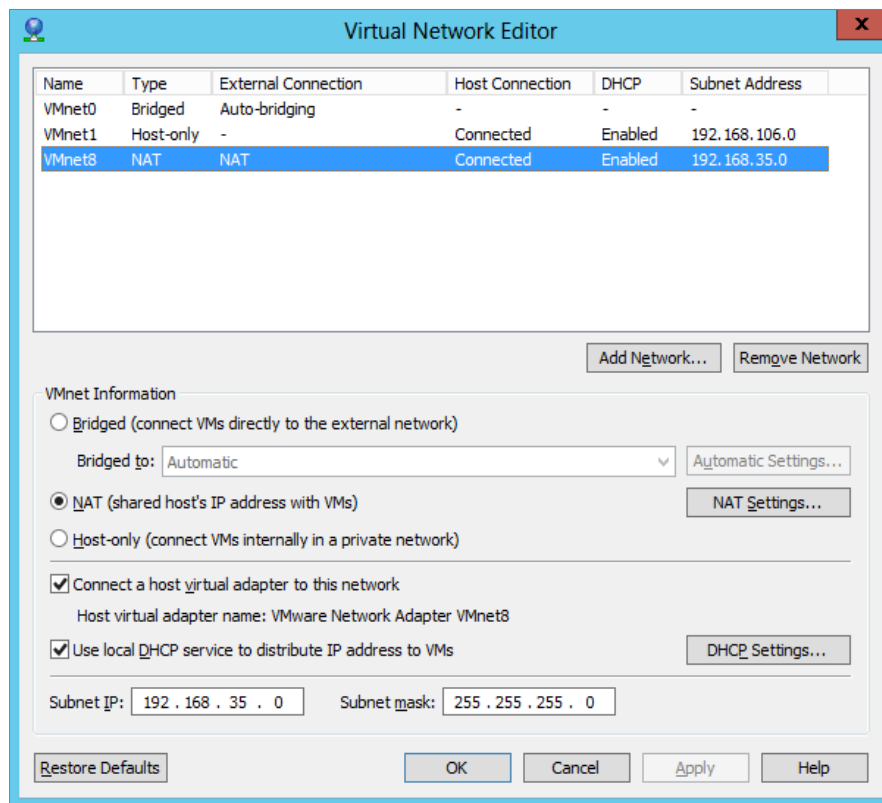


**Figure 2-41:** Select Specific Virtual network to VMnet8 (NAT)

By default, a network address is assigned to this segregated network by VMware. To configure this IP address, go to EDIT → Virtual Network Editor



**Figure 2-42:** Select option to Virtual Network Editor in VM



**Figure 2-43:** Modify the Subnet IP and Subnet Mask in Virtual Network Editor

User can modify the Subnet IP and Subnet Mask to suit their own preference.

The disadvantage of this technique is that, if the license server must compulsorily run in the VM for NetSim to obtain the licenses.

## 3 Model Features

### 3.1 Working of an Emulation Application in NetSim

*Note: The following explanation is provided assuming that you have performed all necessary configuration required to divert network traffic via the system running NetSim Emulator. (This is explained in section 9 of the User Manual.*

The following parameters are specific to Emulation Application in NetSim:

Source\_Real\_IP

Source\_Port

Destination\_Real\_IP

Destination\_Port

Unlike Simulation, if users want to connect real devices running live applications to the simulator, then Emulation component is required. The Emulation Application in the traffic generator allows users to pump in real traffic into the Simulator.

The real application is mapped using the source and destination IP addresses that we set in the Emulation Application.

**Various combination of Emulation Parameters are as follows:**

**Device Specific Emulation:**

**Example 1:**

SOURCE\_REAL\_IP = 192.168.0.151

SOURCE\_PORT = 0

DESTINATION\_REAL\_IP = 192.168.0.202

DESTINATION\_PORT = 0

Dispatches all packets with the source real IP 192.168.0.151 and destination real IP as 192.168.0.202, into the Simulator.

**Example 2:**

SOURCE\_REAL\_IP = 192.168.0.151

SOURCE\_PORT = 0

DESTINATION\_REAL\_IP = 0.0.0.0

DESTINATION\_PORT = 0

Dispatches all packets from source real IP 192.168.0.151 regardless of whatever is the destination real IP, into the Simulator.

**Example 3:**

SOURCE\_REAL\_IP = 0.0.0.0

SOURCE\_PORT = 0

DESTINATION\_REAL\_IP = 192.168.0.202

DESTINATION\_PORT = 0

Dispatches all packets to destination real IP 192.168.0.202 regardless of whatever is the source real IP, into the Simulator.

**Example 4:**

SOURCE\_REAL\_IP = 0.0.0.0

SOURCE\_PORT = 0

DESTINATION\_REAL\_IP = 0.0.0.0

DESTINATION\_PORT = 0

Dispatches all packets that are reaching the Emulator Device regardless of whatever is the source or destination, into the Simulator.

**Application Specific Emulation**

**Example 1:**

SOURCE\_REAL\_IP = 192.168.0.151

SOURCE\_PORT = 5004

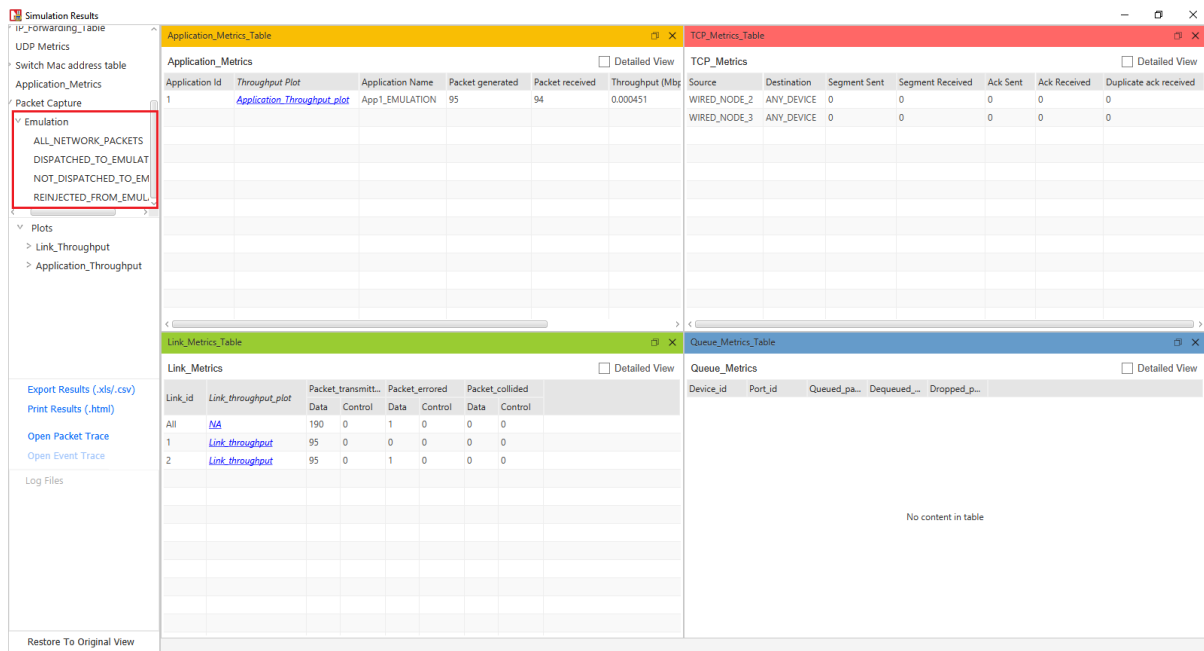
DESTINATION\_REAL\_IP = 192.168.0.202

DESTINATION\_PORT = 6245

Dispatches all packets with the source real IP 192.168.0.151, source Port No 5004, destination real IP as 192.168.0.202 and destination Port No 6245 into the Simulator.

**Emulation Specific Metrics**

On running an Emulation Application Users can optionally obtain the following log files which are Wireshark compatible .pcap files:



**Figure 3-1: Different Emulation Specific Metrics in Result window**

**All\_Network\_Packets** - Log of all packets flowing via the system running NetSim Emulator.

**Dispatched\_To\_Emulator** - Log of packets for which were sent to NetSim based on Emulation Application is configured in NetSim.

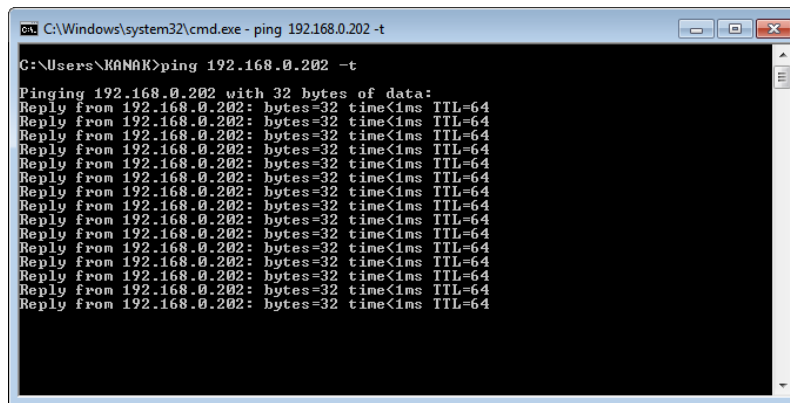
**Reinjected\_From\_Emulator** - Log of packets that successfully reached the virtual destination node in NetSim Simulator and was re-injected into the network.

**Not\_Dispatched\_To\_Emulator** - Log of packets flowing via the system running NetSim emulator but not dispatched to emulator (All\_Network\_Packets minus Disptached\_To\_Emulator)

### 3.1.1 Delay measurement when pinging through NetSim Emulator

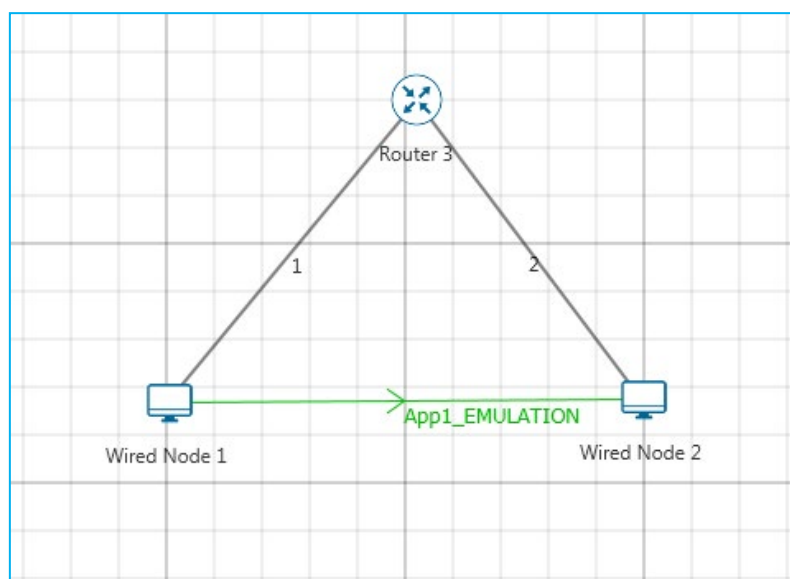
Pinging through NetSim emulator takes only one direction delay, if you have set only one application with Ping Source IP and ping Destination IP. This is because PING is a two way application and constitutes PING\_REQUEST and PING\_REPLY. For ping to take round trip delay users must configure two Emulation Applications, one for forward PING\_REQUEST and other for the reverse PING\_REPLY.

**For example: If you are running a ping from the IP 192.168.0.151 to an IP 192.168.0.202 the time take will normally be around 1ms.**



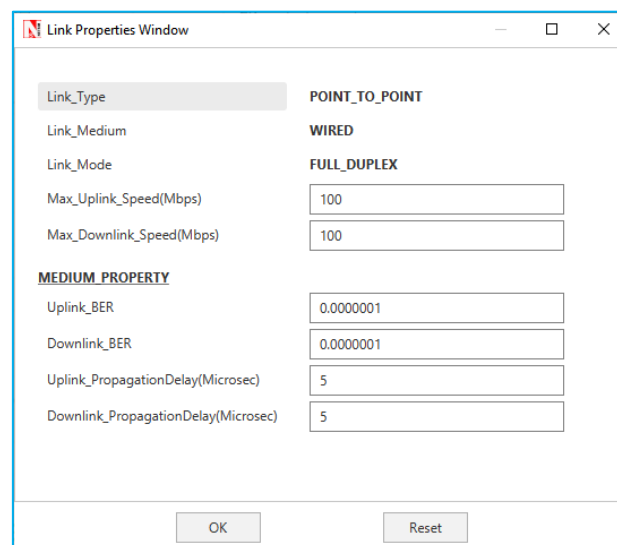
**Figure 3-2:** Pinging from one device to other device and total time taken by 1ms

Now we create a network scenario in NetSim similar to the screenshot shown below **Figure 3-3**.



**Figure 3-3:** Network Topology with Emulation Application

We reset the propagation delay in both the wired links to 5  $\mu$ s.



**Figure 3-4:** Wired Link properties window

We configure an Emulation application between the wired nodes with the source and destination real IP specified, as shown below:

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

**Source\_ID: 1**

Destination\_Count: 1

**Destination\_ID: 2**

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

**Session\_Protocol: NONE**

Transport\_Protocol: UDP

QoS: BE

Priority: **Low**

**EMULATION**

**Source\_Real\_IP: 10.201.200.110**

**Source\_Port: 0**

**Destination\_Real\_IP: 10.201.143.100**

**Destination\_Port: 0**

OK Reset

**Figure 3-5:** Application properties window for Application 1

On running the simulation, you will observe the variation in the time taken to get the ping reply in the source system, as shown below:

[illegible]

**Figure 3-6:** Pinging from one device to other device and total time taken by 11ms and including 10μs additional delay for both the links



Ping packets has experienced an additional delay of 10μs which is a sum of the delay in both the links.

The additional delay experienced by ping packets is not 20μs because, the application that we have configured applies to only the Ping Request Packets which has the Source IP as 192.168.0.151 and Destination IP as 192.168.0.202.

The Ping Reply Packets has the Source IP as 192.168.0.202 and Destination IP as 192.168.0.151, for which we have not configured any application.

For the ping to take the round trip delay, we will have to configure one more application for the reverse traffic. On adding an application for the reverse traffic as shown below:

The screenshot shows the 'Configure Application' window for 'Application2'. The window is divided into two main sections: 'APPLICATION' and 'EMULATION'. The 'APPLICATION' section contains fields for 'Application\_Method' (UNICAST), 'Application\_Type' (EMULATION), 'Application\_ID' (2), 'Application\_Name' (App2\_EMULATION), 'Source\_Count' (1), 'Source\_ID' (2), 'Destination\_Count' (1), 'Destination\_ID' (1), 'Start\_Time(s)' (0), 'End\_Time(s)' (100000), 'Src\_to\_Dest' (Show line), 'Random\_Startup' (FALSE), 'Session\_Protocol' (NONE), 'Transport\_Protocol' (UDP), 'QoS' (BE), and 'Priority' (Low). The 'EMULATION' section contains fields for 'Source\_Real\_IP' (192.168.0.202), 'Source\_Port' (0), 'Destination\_Real\_IP' (192.168.0.150), and 'Destination\_Port' (0). A red box highlights the 'Source\_ID', 'Destination\_Count', and 'Destination\_ID' fields in the 'APPLICATION' section. Another red box highlights the 'EMULATION' section fields.

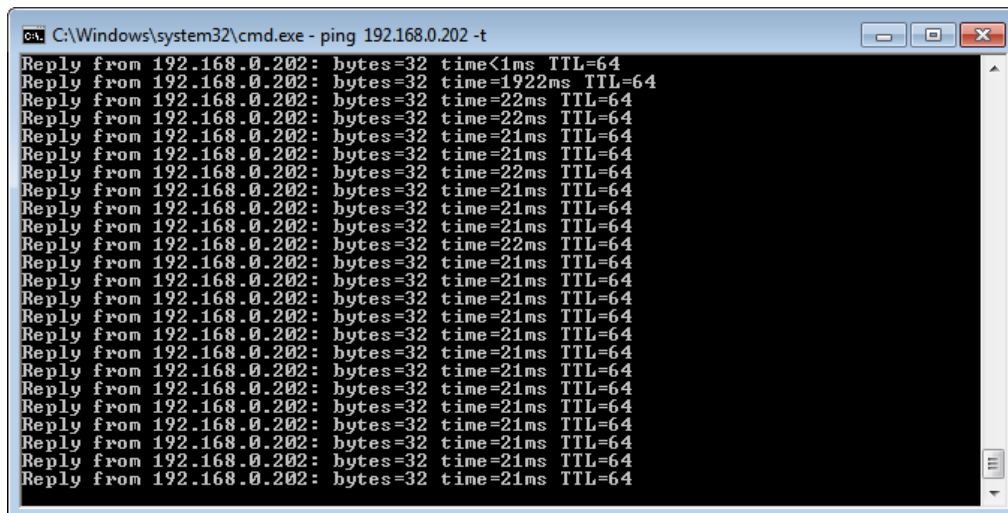
APPLICATION	
Application_Method	UNICAST
Application_Type	EMULATION
Application_ID	2
Application_Name	App2_EMULATION
Source_Count	1
Source_ID	2
Destination_Count	1
Destination_ID	1
Start_Time(s)	0
End_Time(s)	100000
Src_to_Dest	Show line
Random_Startup	FALSE
Session_Protocol	NONE
Transport_Protocol	UDP
QoS	BE
Priority	Low

EMULATION	
Source_Real_IP	192.168.0.202
Source_Port	0
Destination_Real_IP	192.168.0.150
Destination_Port	0

**Figure 3-7:** Application properties window for Second application

We will now be able to see round trip delay being experienced by the PING application, as shown below:



```
C:\Windows\system32\cmd.exe - ping 192.168.0.202 -t
Reply from 192.168.0.202: bytes=32 time<1ms TTL=64
Reply from 192.168.0.202: bytes=32 time=1922ms TTL=64
Reply from 192.168.0.202: bytes=32 time=22ms TTL=64
Reply from 192.168.0.202: bytes=32 time=22ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=22ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=22ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
Reply from 192.168.0.202: bytes=32 time=21ms TTL=64
```

**Figure 3-8:** Total round trip time taken by 20ms

Ping experiences an additional overall delay of 20ms, which is the sum of the delays experienced by Ping Request and Ping Reply (10ms + 10ms).

## 3.2 Jitter in NetSim Emulations

Jitter is defined as a variation in the delay of received packets. Let us suppose at the sending side, packets are sent in a continuous stream with the packets spaced evenly apart. Due to network congestion, improper queuing, or configuration errors, this steady stream can become lumpy, or the delay between each packet can vary instead of remaining constant. This variation in delay is 'jitter'. While there are many ways of measuring this variation, in NetSim 'jitter' is measured as the statistical variance of delay. Variance is defined as the square of deviation from the mean.

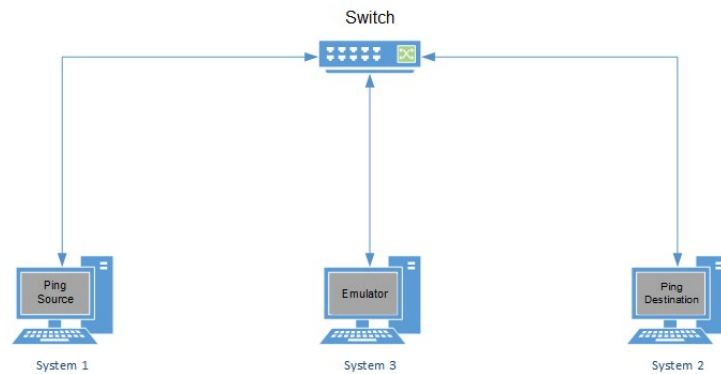
### 3.2.1 Introducing Jitter using Background traffic

Background traffic can be used to test the performance of applications when link bandwidth is consumed by other traffic. It can also be used to induce jitter for testing real-time applications.

The Background traffic in NetSim can be modelled as a Poisson process in which bursts of data of a fixed size are transmitted at an average rate such that the link will be occupied at the specified link utilization rate. Because it is a random process, over short periods the actual background traffic link utilization rate may vary from the configured value. The rate of arrival of background traffic frames affects the jitter. Larger number of background packets induce greater jitter in competing traffic. In NetSim, the way to increase the number of background packets arriving is to reduce the inter-arrival time of that application, as explained in the link <https://tetcos.freshdesk.com/support/solutions/articles/14000067807-how-do-i-introduce-jitter-in-netsim-simulations-emulations->

## 4 Featured Examples

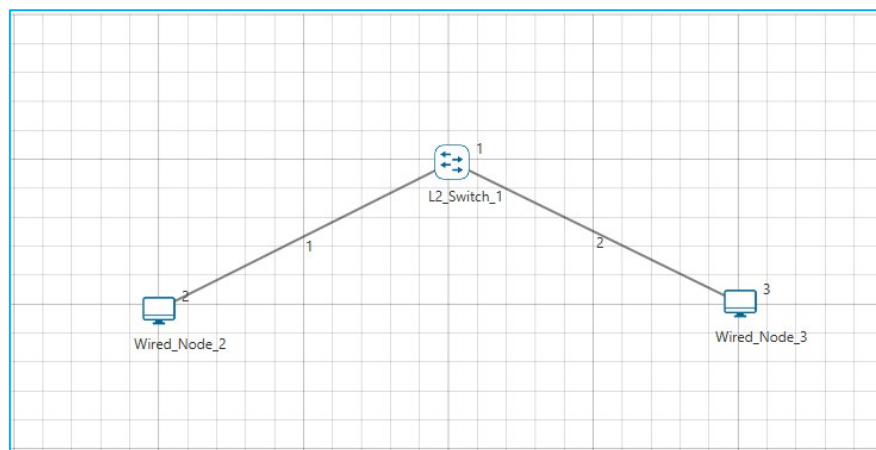
### 4.1 Example Application 1 – PING (One way Communication)



**Figure 4-1:** One way Communication

#### Steps at Emulation Server

1. Run NetSim in Administrative Mode and create a basic network Scenario in any stack based protocol (Any network except Legacy Networks, Wireless Sensor Network, and Cellular Network) in NetSim. Screenshot of a sample scenario in Internetworks is shown below **Figure 4-2**.



**Figure 4-2:** Network Topology

- Go to Properties of Link1 and Link2 and set Uplink and Downlink Delay to 5000μs. Click on the Application icon present on the ribbon and set properties.
- In the Application Type select Emulation.
- Select Source and Destination ID according to the network scenario and change the Source and Destination IP address according to the IP address of the real system.

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.101

Destination\_Port: 0

OK Reset

**Figure 4-3:** Application properties window

2. Provide the Simulation Time as how long you want the Emulation to be performed. Make sure client system(s) are ready and then click Run Simulation.

### Steps at Source PC

- Before running simulation, start pinging the Destination from Source using command "ping <Destination\_IP> -t" and note down the time duration.

```
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
Reply from 192.168.0.133: bytes=32 time<1ms TTL=127
```

**Figure 4-4:** Before running simulation, total time taking by 1ms

- Follow steps as provided before in “Emulation Set-up: Setting up the NetSim Client”.
- Perform the steps at Emulation Server as provided and simulate. During simulation, ping the destination system. You will notice that the present time duration is higher than the earlier ping results. This is because the network created in NetSim has link propagation delay. Also, Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.

```

Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127
Reply from 192.168.0.133: bytes=32 time=11ms TTL=127

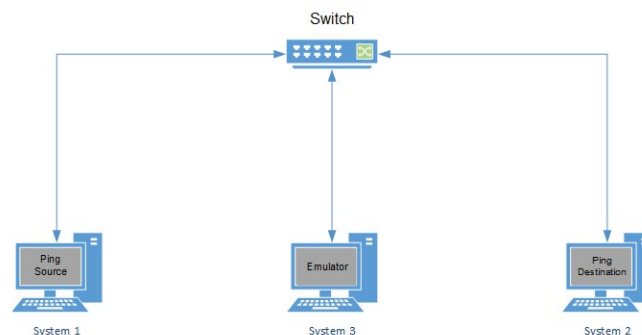
```

**Figure 4-5:** After running simulation, total time taking by 11ms

*(NOTE: In case if no ping messages can be sent from source to destination, disable windows firewall and try again.)*

- The impact of the link propagation delay in NetSim Emulator is seen on a real packet.

## 4.2 Example Application 1 – PING (Two-way Communication)

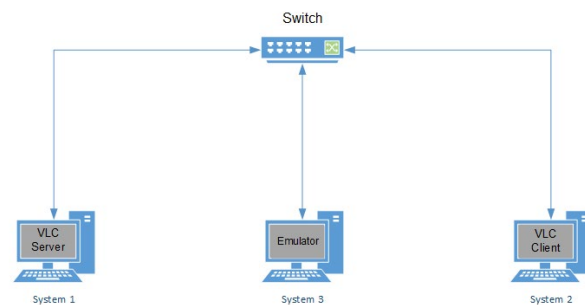


**Figure 4-6:** Two-way Communication

In PING (Two-way communication), almost all the steps are same as PING (One way communication), except that in NetSim Emulation server there will be two application instead of one. One Application will be directed from Source to Destination node, while the other application will be directed from Destination to Source node.

The difference caused in the network behaviour is that in the first case (PING -One way communication), the PING reply packets were not routed via NetSim Emulator. But in the second case (PING -Two way communication), the PING reply packets will be routed via NetSim Emulator, thereby the total delay will be approximately 21milliseconds.

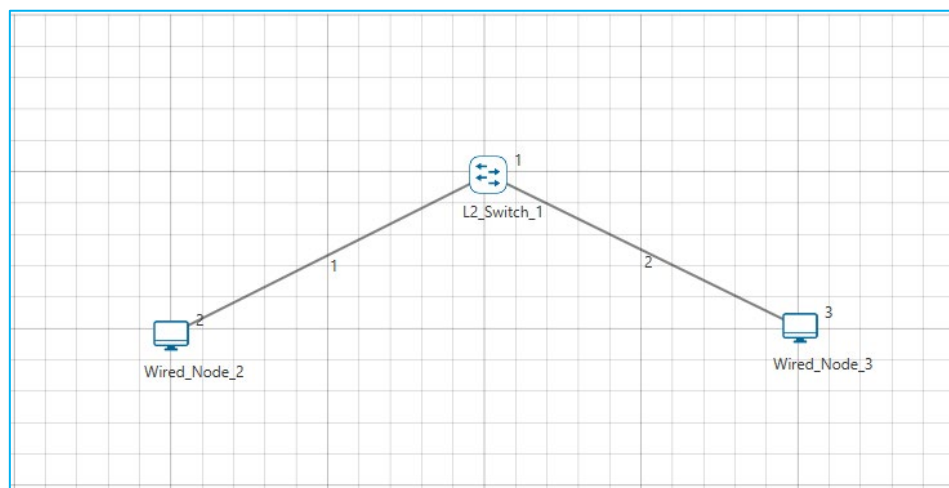
## 4.3 Example Application 2 – Video (One way Communication)



**Figure 4-7:** Video One-way Communication

### Steps at NetSim Emulation Server

1. Run NetSim in Administrative Mode and create a basic network Scenario in any stack based protocol (Any network except Legacy Networks, Wireless Sensor Network, and Cellular Network) in NetSim. Screenshot of a sample scenario in Internetworks is shown below **Figure 4-8**.



**Figure 4-8:** Network Topology

- Click on the Application icon present on the ribbon and set properties.
- In the Application Type select Emulation.
- Select Source and Destination ID according to the network scenario and change the Source and Destination IP address according to the IP Address of the real system and click OK.

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.101

Destination\_Port: 0

OK Reset

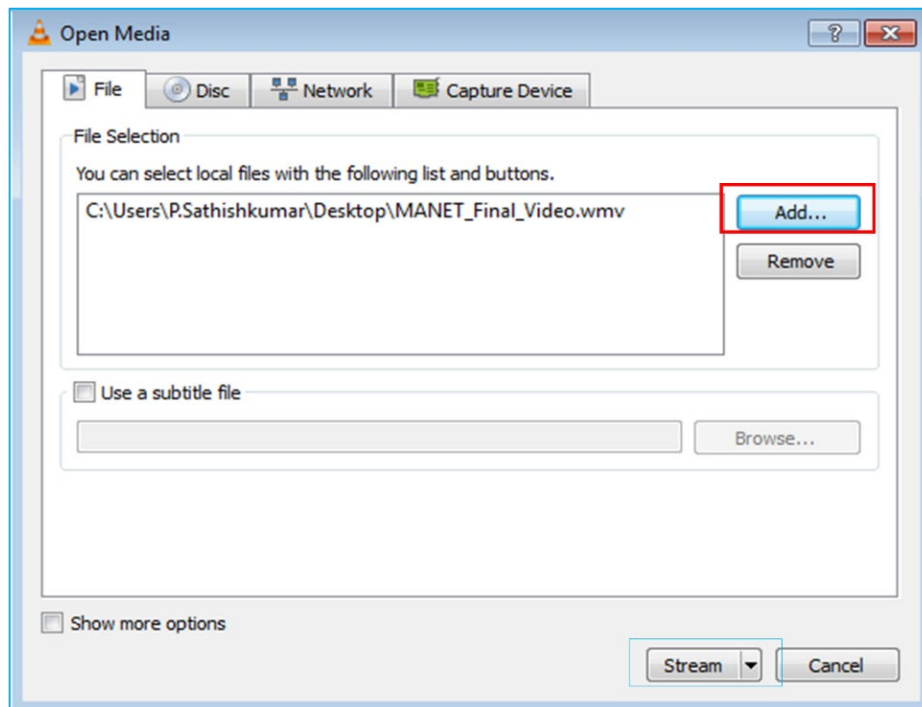
**Figure 4-9: Application properties window**

2. Provide the Simulation Time as how long you want the Emulation to be performed. Make sure client system(s) are ready and then click Run Simulation.

During Simulation you will notice a change in the quality of the video being played in the destination PC. This is because the network created in NetSim has errors / delays etc in the links. The impact of this loss / jitter / delay etc in NetSim Emulator is seen on a real video stream.

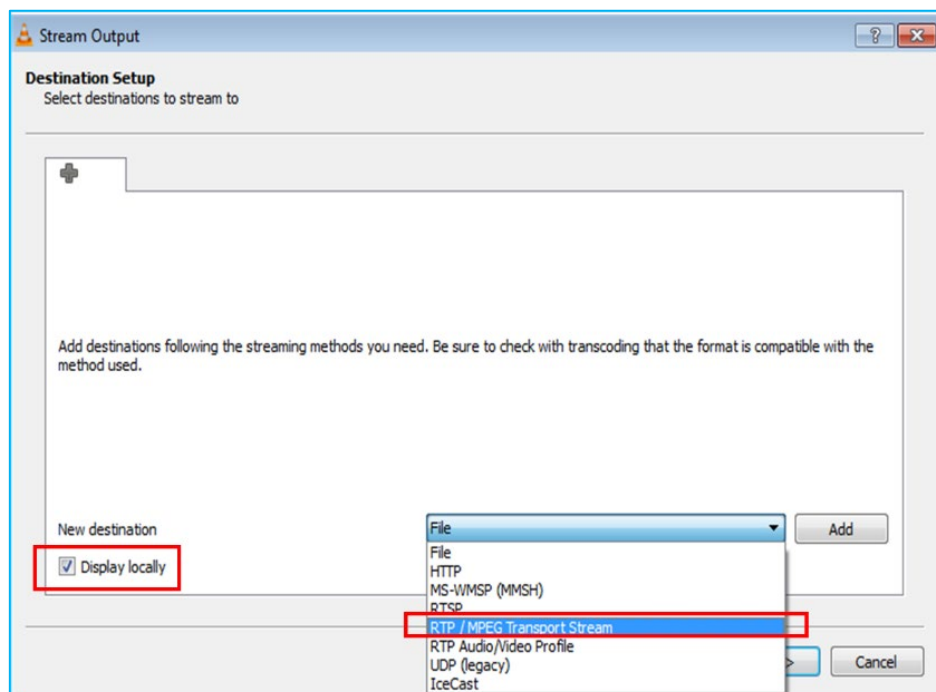
### Steps at Source PC

1. Follow steps as provided before in "Running Emulation via GUI → Setting up the NetSim Client". Then open VLC Media player → Click Media menu → Select Stream Option.
2. Click add button then select the video which you want to play.



**Figure 4-10:** Select a video using Add option in VLC media

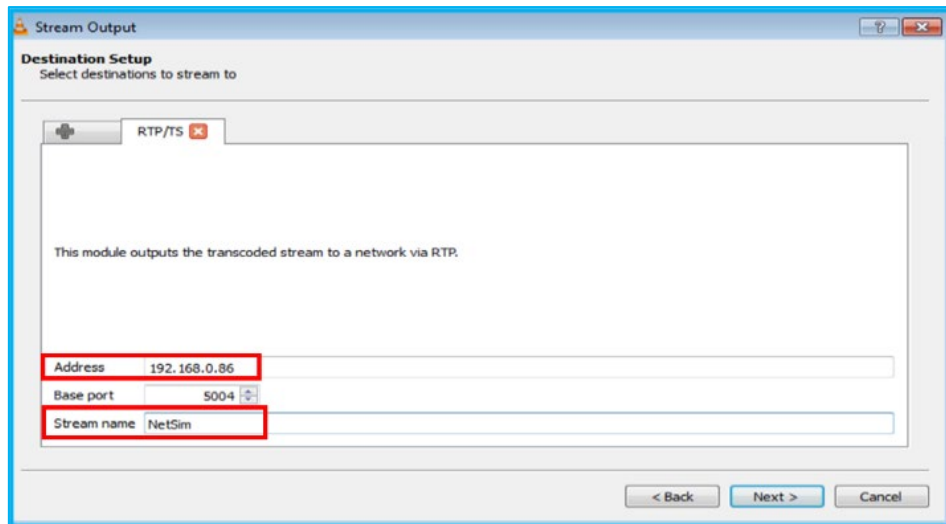
3. Click on Stream Option. Then click next button
4. Enable the display locally checkbox. Then select the RTP / MPEG Transport Stream from the drop down list as shown in the below screen shot



**Figure 4-11:** Select the RTP / MPEG Transport Stream from the drop down list in VLC media

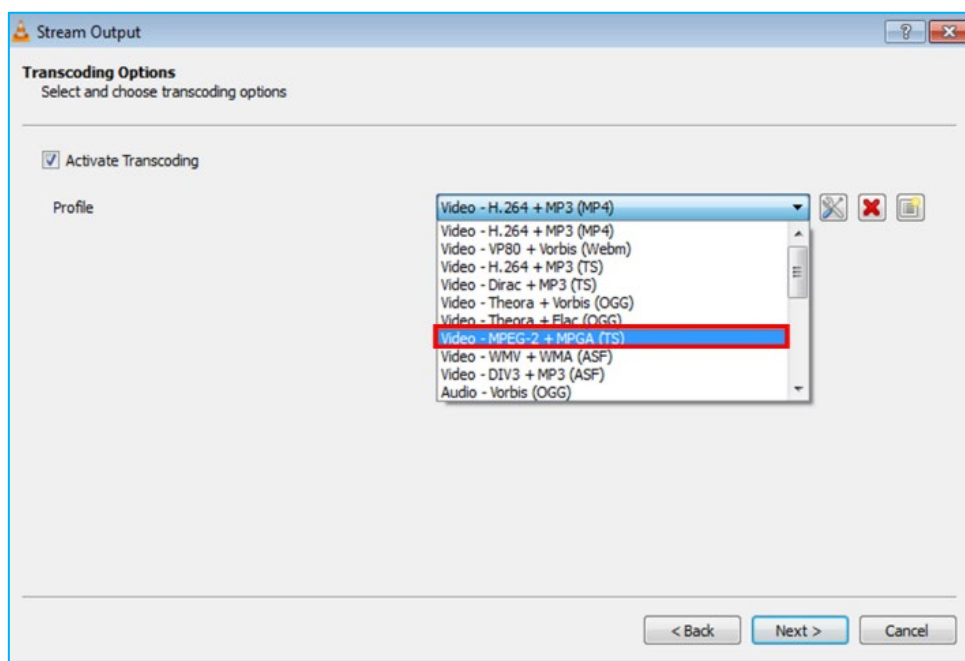
5. Click on Add Button. Then enter the Destination IP address in the Address field and enter a stream name (user defined) and click next button.





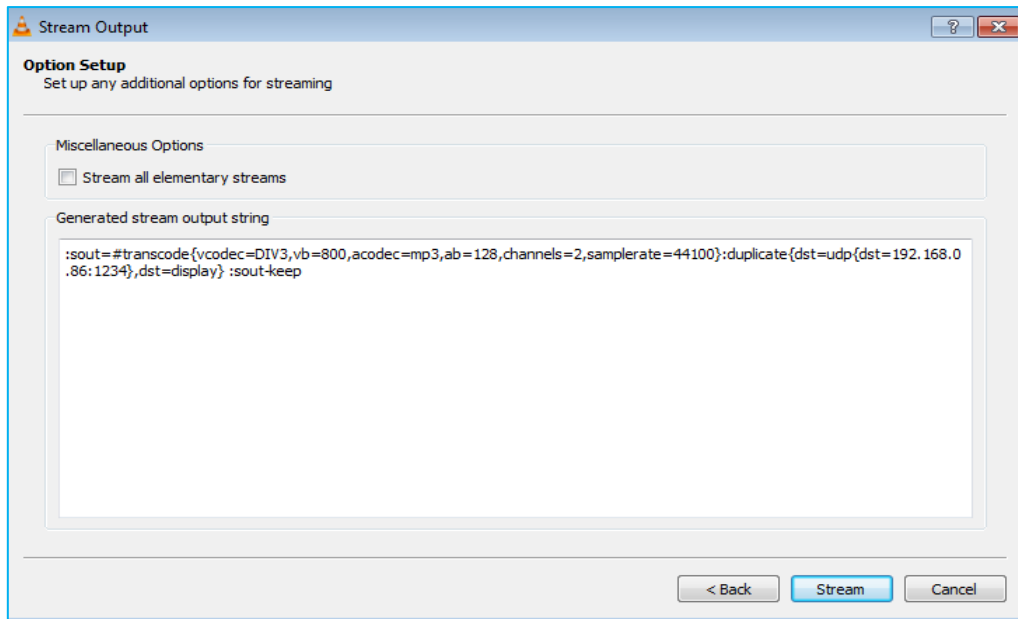
**Figure 4-12:** Enter the Destination IP address in the Address field and enter a stream name (user defined)

6. Select Video –MPEG-2 + MPGA (TS) option from the drop down list as shown in the below screen shot. Then click next button.



**Figure 4-13:** Select Video –MPEG-2 + MPGA (TS) option from the drop down list

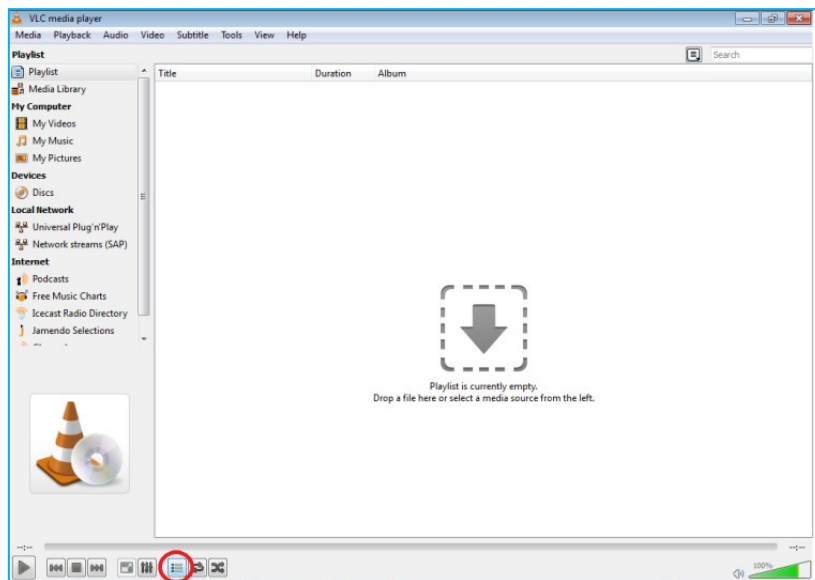
7. Perform all the steps at Emulation Server and then click on Stream button. Also, Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.



**Figure 4-14:** Perform all the steps at Emulation Server and then click on Stream button

### Steps at Destination PC

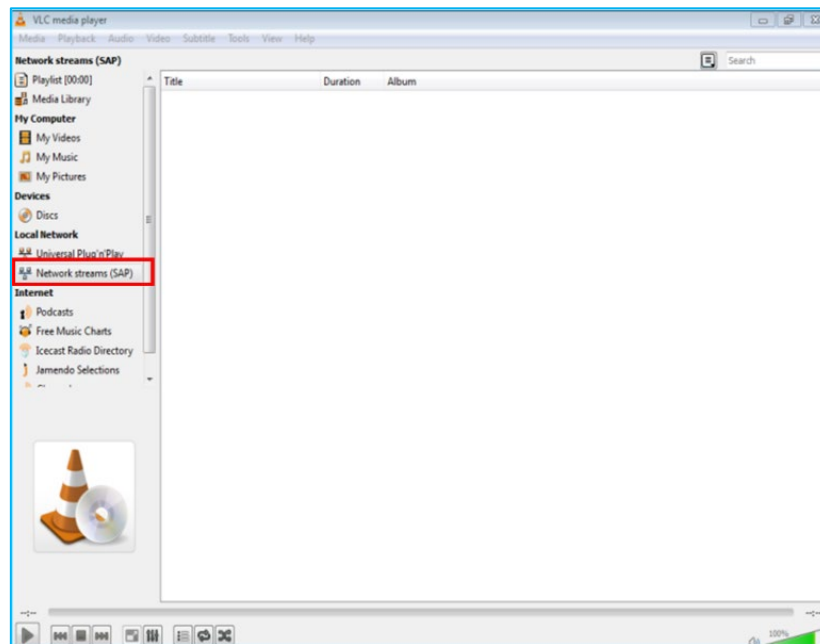
1. Follow steps as provided before in “Running Emulation via GUI–Setting up the NetSim Client”. After performing all the steps at Source PC and NetSim Emulation Server, open VLC Media Player→ Click on Toggle Playlist icon as shown in the below screenshot **Figure 4-15**.



**Figure 4-15:** Select Toggle Playlist icon

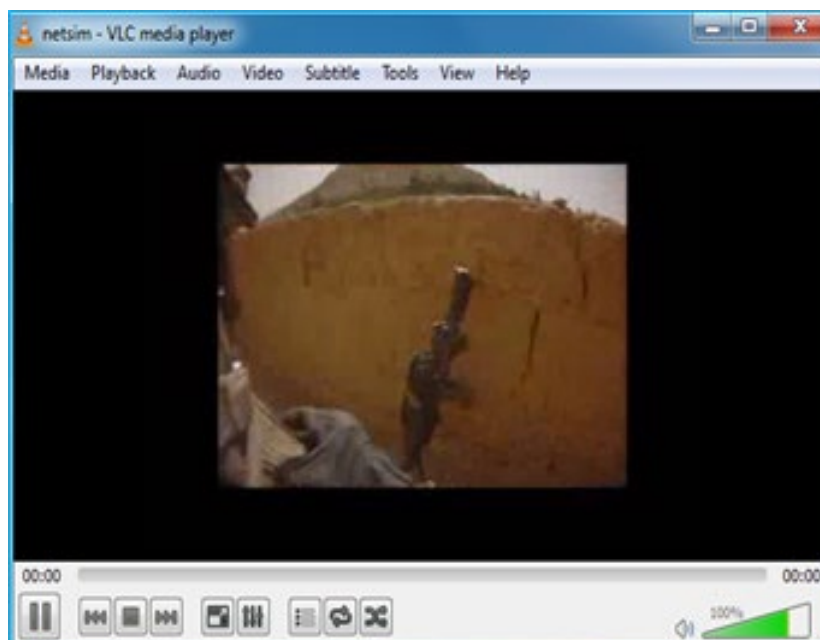
*Toggle button is circled in red at the bottom of the screen shot*

2. Double click on Network Stream (SAP) under local network. Then right click and play on the stream name that appears on the screen.



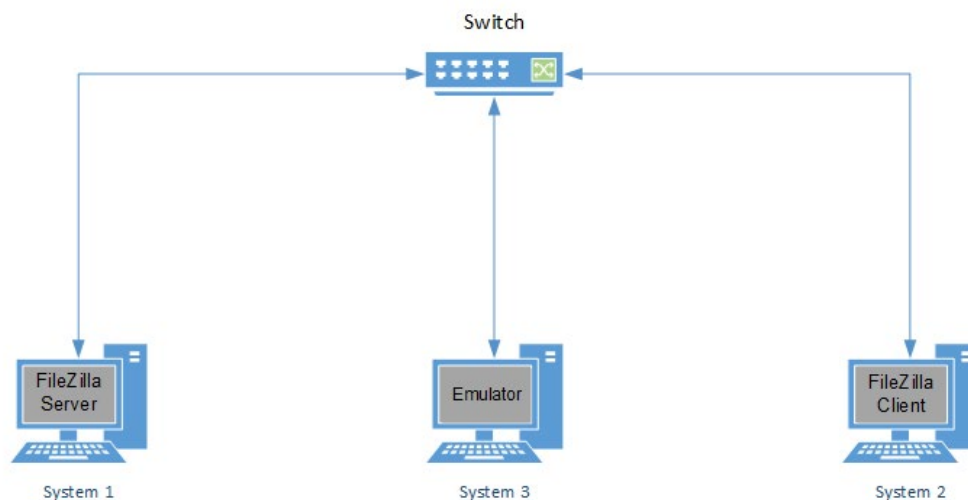
**Figure 4-16:** Double click on Network Stream (SAP) under local network

3. In the streamed video, you will notice a change in the quality of the video being played in the destination PC. Also, Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.



**Figure 4-17:** Change in the quality of the video being played in the destination PC

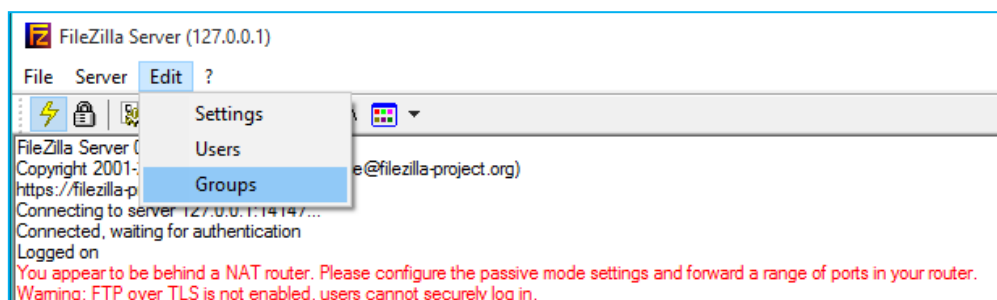
## 4.4 Example Application 3 – File Transfer using FileZilla (One-way)



**Figure 4-18:** File Transfer using FileZilla (One-way communication)

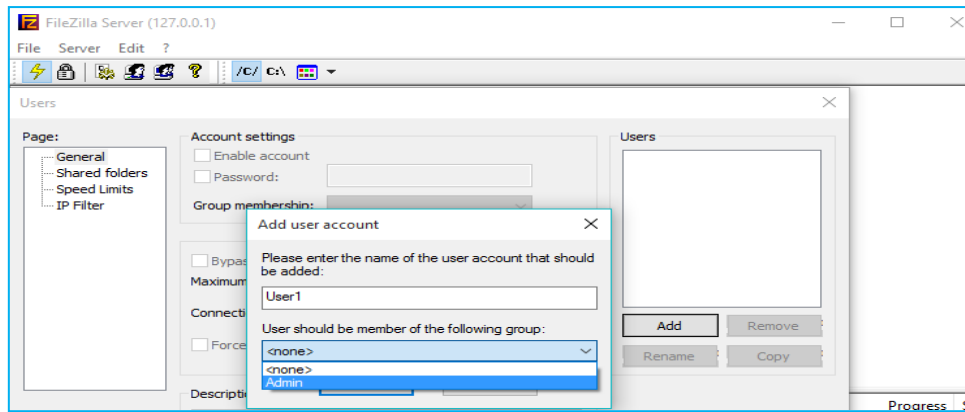
### Steps at Destination PC

1. Follow steps as provided before in “**Emulation Set-up: Setting up the NetSim Client**”. Run FileZilla Server software. Create a group by going to Edit → Groups → Select “General” under Page: → Click Add in Groups → Give Any Name (Ex: Admin) and click ok.



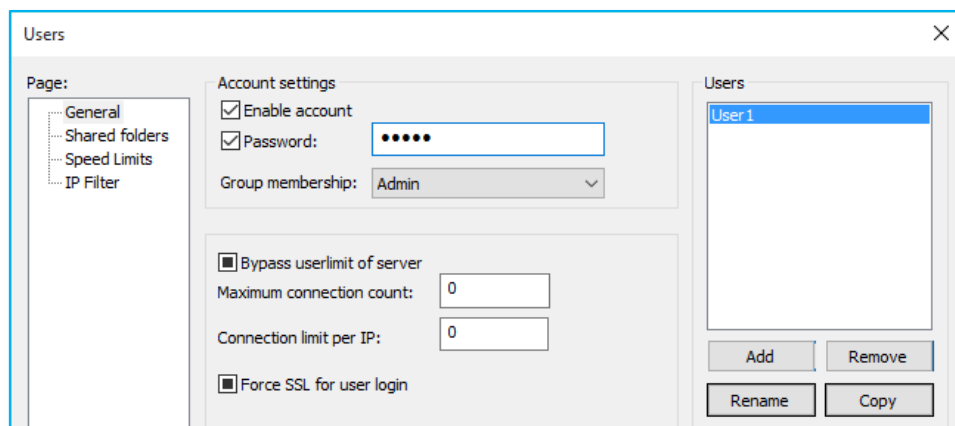
**Figure 4-19:** Give Any Name to group in edit option in FileZilla server

2. Go to Edit → User → General → Click Add in User → Give Any Name (Ex: User1) and Select Group what you given in Group Setting (In this case, we provide “Admin”) and click ok.



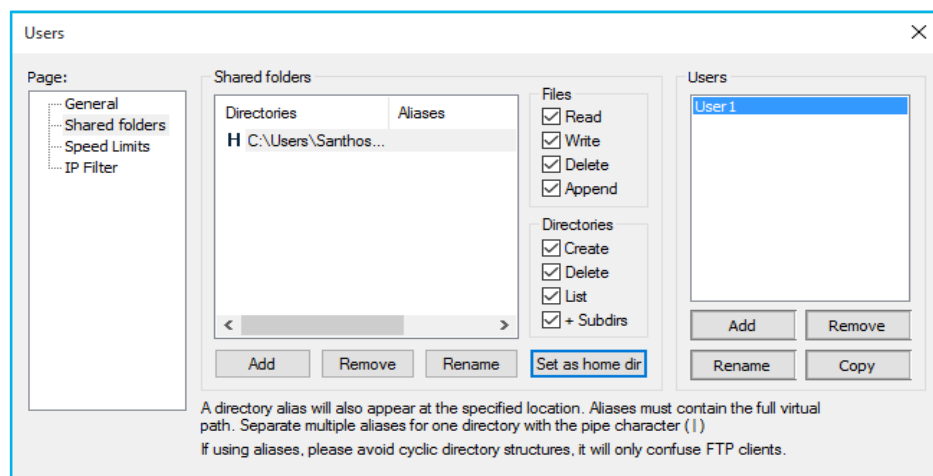
**Figure 4-20:** Add name to Users field in FileZilla server

3. In Account Setting, select Enable account and set password and click ok.



**Figure 4-21:** Enable account and set password in account setting window

4. Go to Shared folder → Add Folder to share (EX: FTP\_FILES from Desktop) → Select all the Files and Directories Permissions and set that folder as Home Directory by selecting “Set as Home Dir”. Click OK.



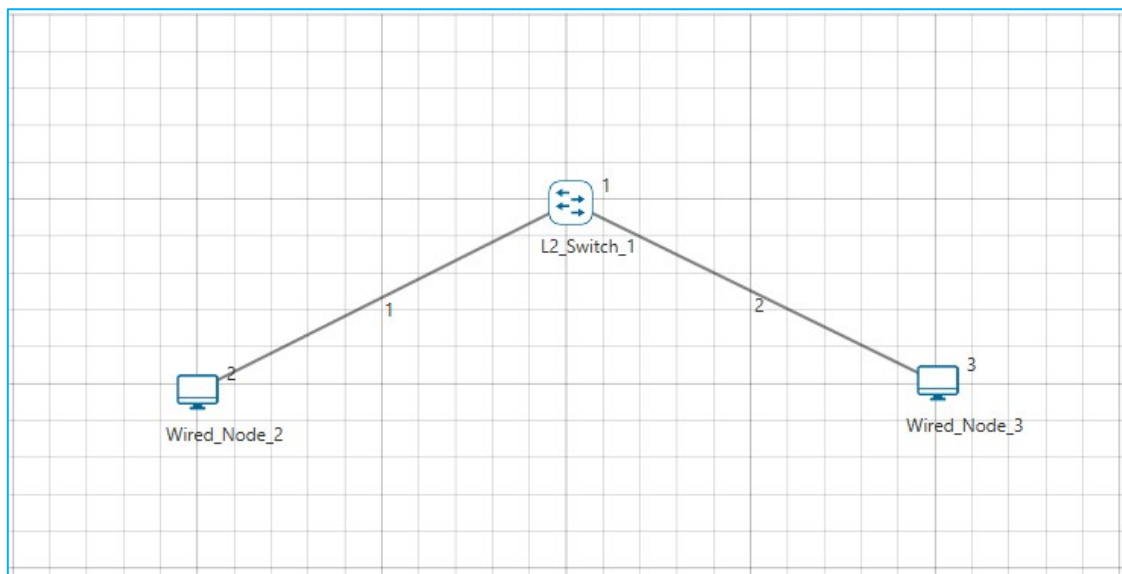
**Figure 4-22:** Select all the Files and Directories Permissions and set that folder as Set as Home Dir

### Steps at Source PC

Follow steps as provided before in “Emulation Set-up: Setting up the NetSim Client”. Run FileZilla Client software. Enter the Host Name(Server System ip (EX: 192.168.0.133)) and Give the User, Password that we created in Server side and give Port No = 21. Run Emulation server and click Quick Connect. Drag and drop files from Local Site to Remote Site.

### Steps at NetSim Emulation Server

1. Run NetSim in Administrative Mode and create a basic network Scenario in any stack based protocol (Any network except Legacy Networks, Cellular Networks, and Wireless Sensor Networks) in NetSim. A sample scenario in Internetworks is performed as shown with link speed set to 1 Mbps.



**Figure 4-23: Network Topology**

- Click on the Application icon present on the ribbon and set properties.
- In the Application Type select Emulation.
- Select Source and Destination ID according to the network scenario and change the Source and Destination IP address according to the IP Address of the real system and click OK.

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.101

Destination\_Port: 0

OK Reset

**Figure 4-24:** Application properties window

2. Provide the Simulation Time as how long you want the Emulation to be performed. Make sure client system(s) are ready and then click Run Simulation.

**Results:** Transfer speed from client without emulation:

	Progress	Speed
/ithEmulatio...	114,433,360 bytes	10.9 MB/s
120,245,749 bytes received 12,13 MB/s 1,151 bytes sent 0 B/s		

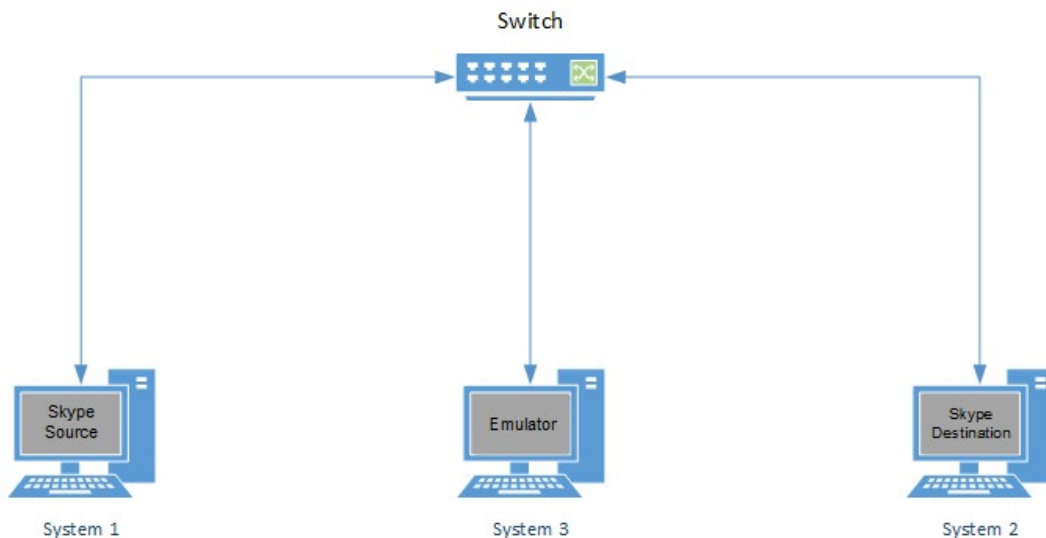
**Figure 4-25:** Transfer speed from client without emulation

**Transfer speed from client with emulation:**

	Progress	Speed	
fithEmulatio...	29,090,728 bytes	113.4 KB/s	
29,101,933 bytes received 110,8 KB/s 1,178 bytes sent 0 B/s			

**Figure 4-26:** Transfer speed from client with emulation

## 4.5 Example Application 4 –Skype (Two way Communication)

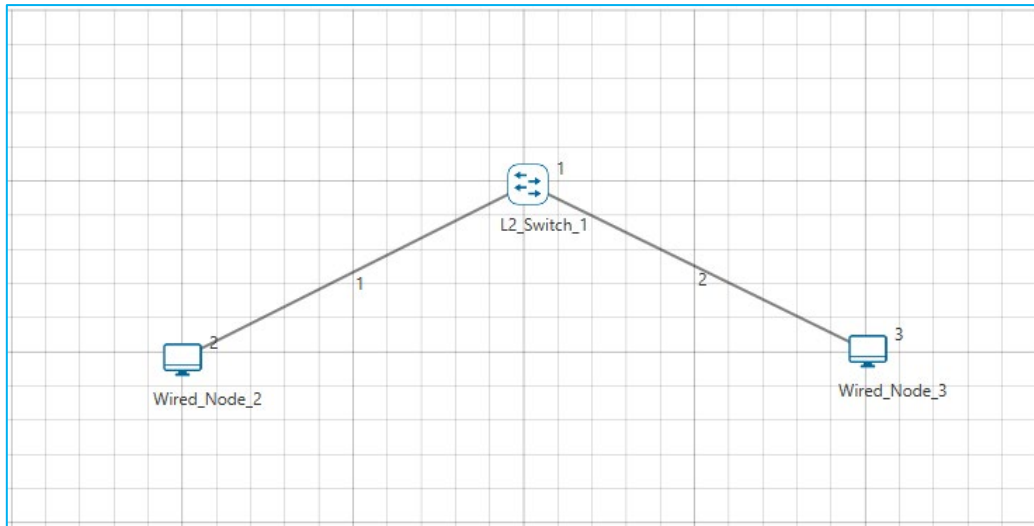


**Figure 4-27:** Skype Two way Communication

### Steps at NetSim Emulation Server

1. Run NetSim in Administrative Mode and create a basic network Scenario in any stack based protocol (Any network except Legacy Networks, Wireless Sensor Network, and Cellular Network) in NetSim. Screenshot of a sample scenario in Internetworks is shown below **Figure 4-28**.





**Figure 4-28:** Network Topology in this experiment

2. Click on the Application icon present on the ribbon and set properties. As it is two way communication, add and create two applications.
3. In both the Application Type select Emulation.
4. In one Application, select Source ID and Destination ID according to the network scenario and change the Source and Destination IP address according to the IP Address of the real system. In the second application, set the opposite of first application, i.e. Source ID and IP address will be exchanged with Destination ID and IP address. (Refer the IP settings in the screen-shot to get a clear picture)

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application_Method	UNICAST
Application_Type	EMULATION
Application_ID	1
Application_Name	App1_EMULATION
Source_Count	1
Source_ID	2
Destination_Count	1
Destination_ID	3
Start_Time(s)	0
End_Time(s)	100000
Src_to_Dest	Show line
Random_Startup	FALSE
Session_Protocol	NONE
Transport_Protocol	UDP
QoS	BE
Priority	Low

**EMULATION**

Source_Real_IP	192.168.0.151
Source_Port	0
Destination_Real_IP	192.168.0.101
Destination_Port	0

OK Reset

**Figure 4-29:** Application properties Window

5. Provide the Simulation Time as how long you want the Emulation to be performed. Make sure client system(s) are ready and then click Run Simulation.

#### Steps at Source PC

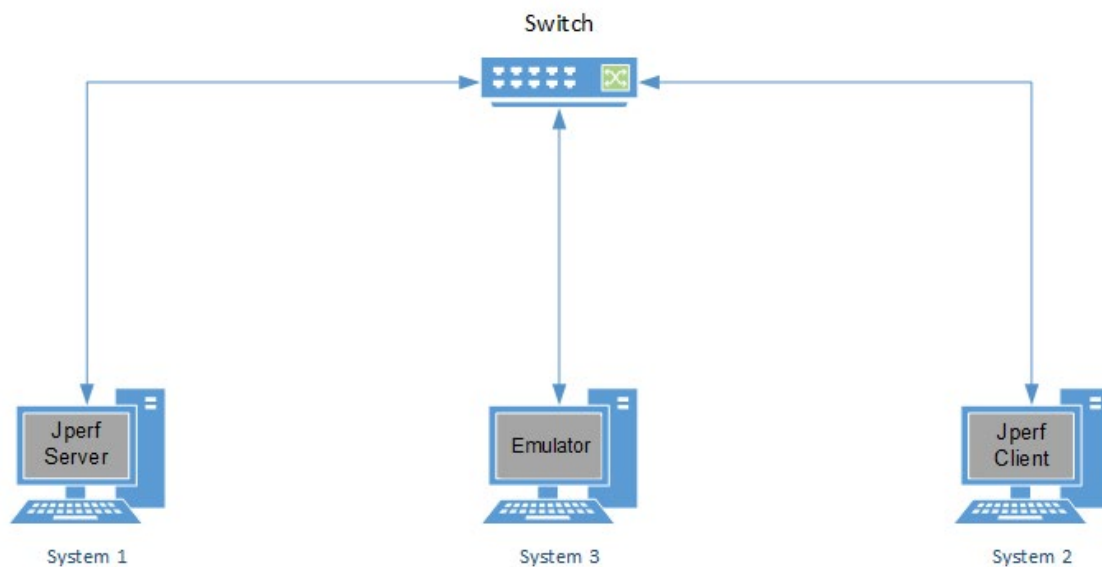
1. Follow steps as provided before in "Emulation Set-up: Setting up the NetSim Client".
2. Run Skype and make a call to the destination system (Make sure that Skype is running in Destination PC).
3. Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.

#### Steps at Destination PC

- Follow steps as provided before in “**Emulation Set-up: Setting up the NetSim Client**”. After performing all the steps at Source PC and NetSim Emulation Server, open Skype.
- Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.

## 4.6 Example Application 5 – Using JPerf

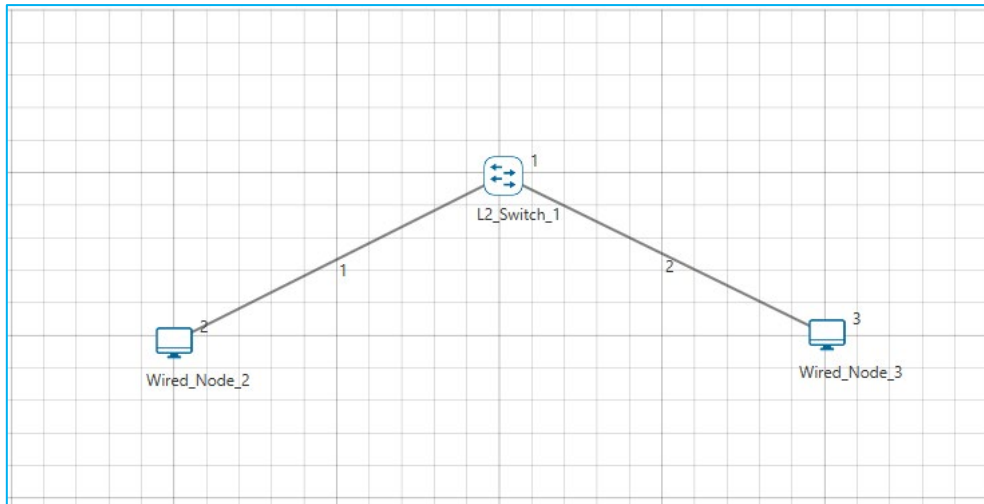
JPerf is a graphical front end for the popular network testing tool lperf. Using JPerf you can quickly test a WAN or LAN connection to determine the maximum network throughput. The test results are automatically graphed and presented in a format that is easy to read. JPerf can also be used to detect packet loss, delay, jitter, and other common network problems.



**Figure 4-30:** Jperf Client and server communication

### Steps at NetSim Emulation Server

1. Run NetSim in Administrative Mode and create a basic network Scenario in any of the networks except Legacy Networks, Wireless Sensor Network, and Cellular Network. Screenshot of a sample scenario in Internetworks is shown below **Figure 4-31**.



**Figure 4-31:** Network Topology in this experiment

- Click on the Application icon present on the ribbon and set properties.
- In the Application Type select Emulation.
- Select Source and Destination ID according to the network scenario and change the Source and Destination IP address according to the IP Address of the real system and click OK.

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 2

Destination\_Count: 1

Destination\_ID: 3

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.151

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.101

Destination\_Port: 0

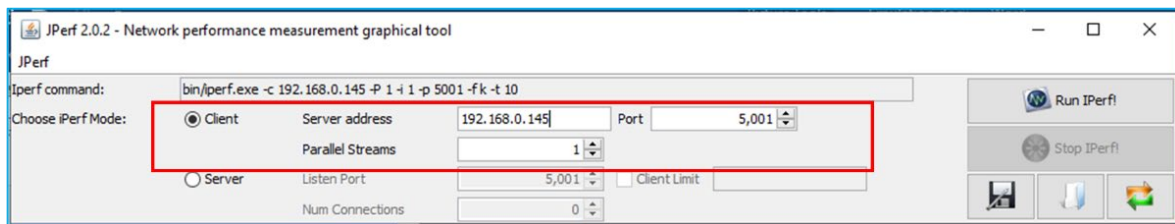
OK Reset

**Figure 4-32: Application properties window**

2. Provide the Simulation Time as per the time for which you want Emulation to be performed. Make sure client system(s) are ready and then click Run Simulation.

### Steps at Source PC

Follow steps as provided before in “Emulation Set-up: Setting up the NetSim Client”. Run JPerf and select Client and set Server Address as <Server IP Address>. User can edit the Application Layer options, Transport Layer options and IP Layer options depending on the type of data they want to transmit in the network.

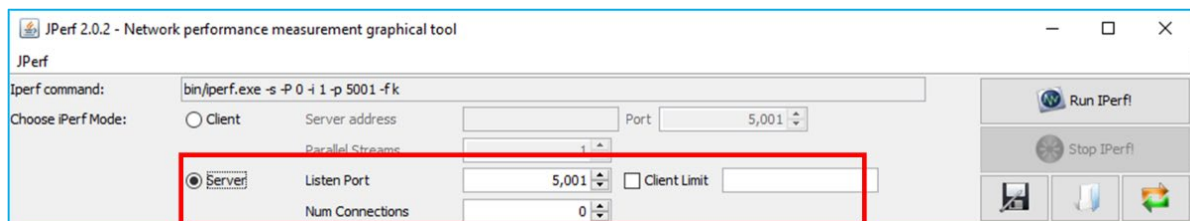


**Figure 4-33:** Select Client and setting done as per above screenshot in JPerf

Do not click “Run IPerf” until all the steps at NetSim Emulation Server are done. Also Wireshark (if installed) will automatically start capturing the packets as soon as Emulation Server starts simulation.

### Steps at Destination PC

Follow steps as provided before in “Emulation Set-up: Setting up the NetSim Client”. Run JPerf and select Server.



**Figure 4-34:** Select Server and setting done as per above screenshot in JPerf

Click on “Run IPerf” after the Source PC starts running JPerf.

## 4.7 Providing pcap file as input to NetSim Emulator

NetSim has an inbuilt traffic generator (Application) which can be used to model unicast/multicast/broadcast traffic in the network with support for application types such as CBR, Custom, Voice, Video, FTP, Database, etc. NetSim also allows users to provide pcap file as input to NetSim traffic generator and configure applications using the real IP addresses and port numbers.

### 4.7.1 Generating a pcap file for NetSim

Any pcap file can be provided as input to NetSim by following the procedure explained here. In this example we are generating a pcap file by running wireshark and generating traffic using ping and saved it as Raw.pcap (while saving please make sure that save as file type must be Wireshark/tcpdump/.. -pcap). Ping is initiated from the **Source IP:** 192.168.0.154 to the **Destination IP:** 192.168.0.192. The pcap file will contain all incoming and outgoing packets from the system in which the capture is being done.

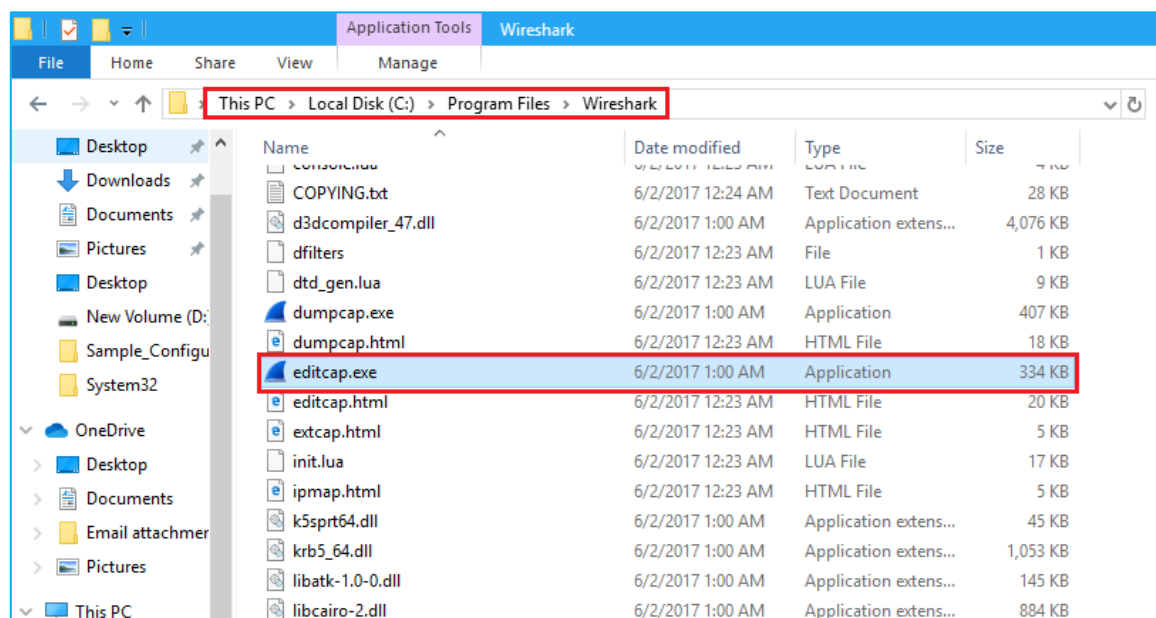
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.0.15	192.168.0.255	NBNS	92	Name query NB DESKTOP-D51C35P<1c>
2	0.129079	192.168.0.7	239.255.255.250	SSDP	216	M-SEARCH * HTTP/1.1
3	0.412924	192.168.0.154	192.168.0.192	ICMP	74	Echo (ping) request id=0x0001, seq=314/14849, ttl=128 (reply in 4)
4	0.413355	192.168.0.192	192.168.0.154	ICMP	74	Echo (ping) reply id=0x0001, seq=314/14849, ttl=128 (request in 3)
5	0.446719	192.168.0.139	255.255.255.255	UDP	82	60274 → 1947 Len=40
6	0.547490	0.0.0.0	255.255.255.255	HIP	102	HIP II (HIP Initiator Packet)
7	0.665863	fe80::e420:3cd8:5f5...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
8	0.686171	fe80::e420:3cd8:5f5...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
9	0.686488	192.168.0.27	224.0.0.252	IGMPv2	60	Membership Report group 224.0.0.252
10	0.687310	fe80::e420:3cd8:5f5...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
11	0.687641	192.168.0.27	224.0.0.2	IGMPv2	60	Leave Group 224.0.0.252
12	0.687642	fe80::e420:3cd8:5f5...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
13	0.688022	192.168.0.27	224.0.0.252	IGMPv2	60	Membership Report group 224.0.0.252
14	0.688022	192.168.0.27	239.255.255.250	SSDP	179	M-SEARCH * HTTP/1.1
15	0.688664	192.168.0.27	224.0.0.251	MDNS	81	Standard query 0x0000 ANY DESKTOP-Q150E8N.local, "QM" question
16	0.689099	fe80::e420:3cd8:5f5...	ff02::fb	MDNS	101	Standard query 0x0000 ANY DESKTOP-Q150E8N.local, "QM" question
17	0.689556	fe80::e420:3cd8:5f5...	ff02::fb	MDNS	139	Standard query response 0x0000 AAAA fe80::e420:3cd8:5f52:503d A 192.168.0.27
18	0.689556	192.168.0.27	224.0.0.252	LLMNR	75	Standard query 0x4fad ANY DESKTOP-Q150E8N
19	0.690067	fe80::e420:3cd8:5f5...	ff02::1:3	LLMNR	95	Standard query 0x4fad ANY DESKTOP-Q150E8N
20	0.690068	192.168.0.27	224.0.0.251	MDNS	119	Standard query response 0x0000 AAAA fe80::e420:3cd8:5f52:503d A 192.168.0.27
21	0.690068	192.168.0.27	224.0.0.251	MDNS	81	Standard query 0x0000 ANY DESKTOP-Q150E8N.local, "QM" question
22	0.690595	fe80::e420:3cd8:5f5...	ff02::fb	MDNS	101	Standard query 0x0000 ANY DESKTOP-Q150E8N.local, "QM" question
23	0.690975	fe80::e420:3cd8:5f5...	ff02::fb	MDNS	139	Standard query response 0x0000 AAAA fe80::e420:3cd8:5f52:503d A 192.168.0.27
24	0.691347	192.168.0.27	224.0.0.251	MDNS	119	Standard query response 0x0000 AAAA fe80::e420:3cd8:5f52:503d A 192.168.0.27
25	0.707350	192.168.0.27	224.0.0.252	IGMPv2	60	Membership Report group 224.0.0.252

**Figure 4-35:** Packet captured in Wireshark

Wireshark capture can be stopped after capturing required packets and saved in desired location with a user defined name (\*.pcap). E.g.: Input\_to\_NetSim.pcap

PCAP file needs to be edited suitably before providing it as input to NetSim. The "editcap" application in Wireshark installation directory can be used to edit any pcap file to be provided as input to NetSim.

Go to wireshark installation directory [C:\Program Files\Wireshark]



**Figure 4-36:** Installation directory of Wireshark

Open command prompt, and execute the following command:

**editcap -C 14 -L -T rawip -F pcap "<File Location where the file is present>/Raw.pcap"**  
**"<File Location where the file need to be saved>/Input\_to\_NetSim.pcap"**

Where,

- **-C** [offset:]<choplen> chop each packet by <choplen> bytes. Positive values chop at the packet beginning, negative values at the packet end. If an optional offset precedes the length, then the bytes chopped will be offset from that value. Positive offsets are from the packet beginning, negative offsets are from the packet end. You can use this option more than once, allowing up to 2 chopping regions within a packet provided that at least 1 choplen is positive and at least 1 is negative.
- **-L** adjust the frame (i.e. reported) length when chopping and/or snapping
- **-T** <encap type> set the output file encapsulation type; default is the same as the input file. An empty "-T" option will list the encapsulation types.
- **-F** <capture type> set the output file type; default is pcapng. An empty "-F" option will list the file types.

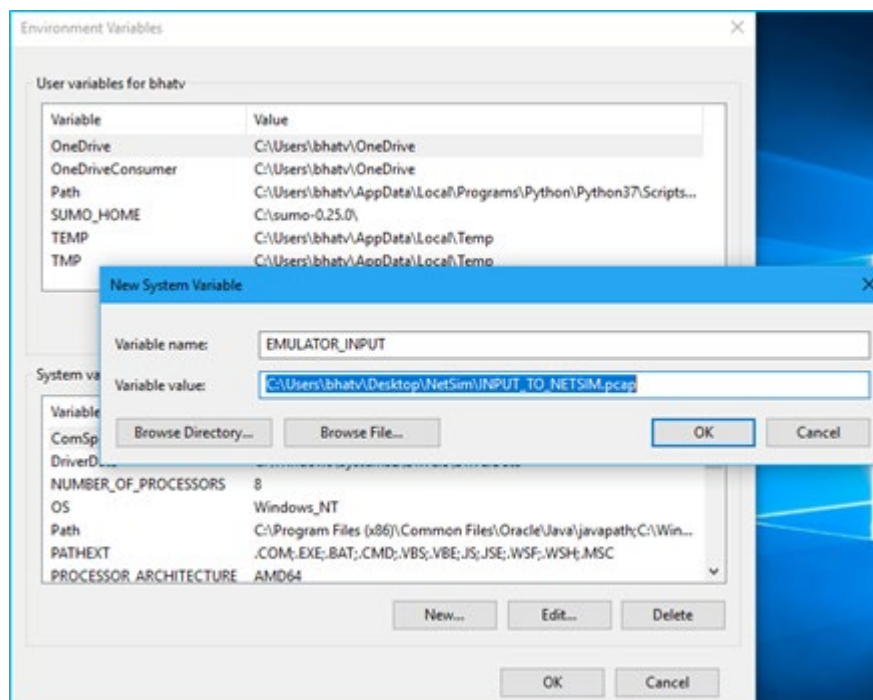
```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.17763.678]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Program Files\Wireshark>editcap -C 14 -L -T rawip -F pcap "C:\Users\PC 1\Desktop\Input.pcap" "C:\Users\PC 1\Desktop\Input_to_NetSim.pcap"
C:\Program Files\Wireshark>
```

**Figure 4-37:** Enter the above command in command prompt

#### 4.7.2 Providing pcap file as input to NetSim

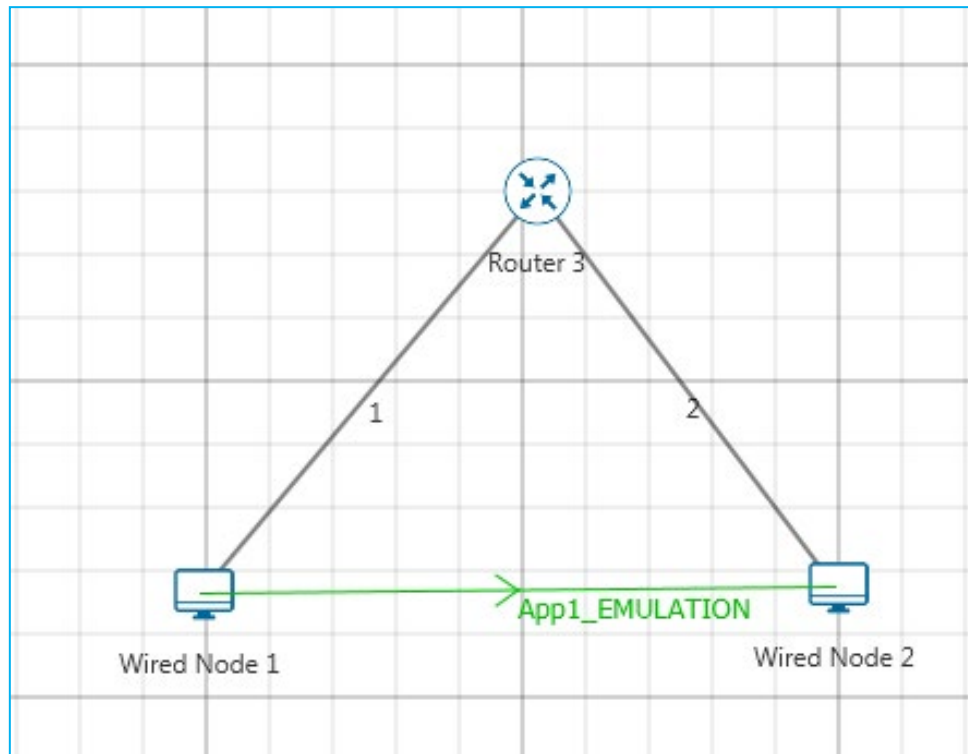
1. Create a system environment Variable with Variable Name as “EMULATOR\_INPUT” and value as the path of the pcap file along with the file name (Ex: C:\Users\bhatv\Desktop\NetSim\INPUT\_TO\_NETSIM.pcap).



**Figure 4-38:** Create a system environment Variable name and providing input file path as input



2. Start NetSim as administrator. Now create a simple scenario in NetSim. For example, create a scenario in Internetworks with 1 router and 2 wired nodes as shown below. Create an Emulation application by giving the real source and destination IP's present in the pcap file. In this case we have used the IP addresses 192.168.0.154 and 192.168.0.192 which we have used for generating traffic using PING.



**Figure 4-39:** Network Topology in this experiment

3. Run NetSim in administrator mode for Emulator application.
4. Now create a simple scenario in NetSim. For example, create a scenario in Internetworks with 1 router and 2 wired nodes.
5. Create an Emulator application by giving the real source and destination IP's present in the pcap file.

**Configure Application**

**Application** + -

Application1

**APPLICATION**

Application\_Method: UNICAST

Application\_Type: EMULATION

Application\_ID: 1

Application\_Name: App1\_EMULATION

Source\_Count: 1

Source\_ID: 1

Destination\_Count: 1

Destination\_ID: 2

Start\_Time(s): 0

End\_Time(s): 100000

Src\_to\_Dest: Show line

Random\_Startup: FALSE

Session\_Protocol: NONE

Transport\_Protocol: UDP

QoS: BE

Priority: Low

**EMULATION**

Source\_Real\_IP: 192.168.0.154

Source\_Port: 0

Destination\_Real\_IP: 192.168.0.192

Destination\_Port: 0

OK Reset

**Figure 4-40:** Application properties Window

- Multiple applications can be configured based on the packets captured. For instance, there can be one more application configured for packets from 192.168.0.192 to 192.168.0.154
- NetSim Emulator will read the packets from pcap file as per the source and destination that we are giving in the application properties.
- After simulation, NetSim results window provides Packet Capture Metrics. Here users can observe 4 different types of log files as explained in section 3.1
- Open Dispatch to Emulator packets, it contains only the packets whose source and destination IP addresses match with the source and destination IP addresses that we have configured.

## 5 Latest FAQs

Up to date FAQs on NetSim's Emulation library is available at  
<https://tetcos.freshdesk.com/support/solutions/folders/14000115083>