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## Simulating a Network Lab

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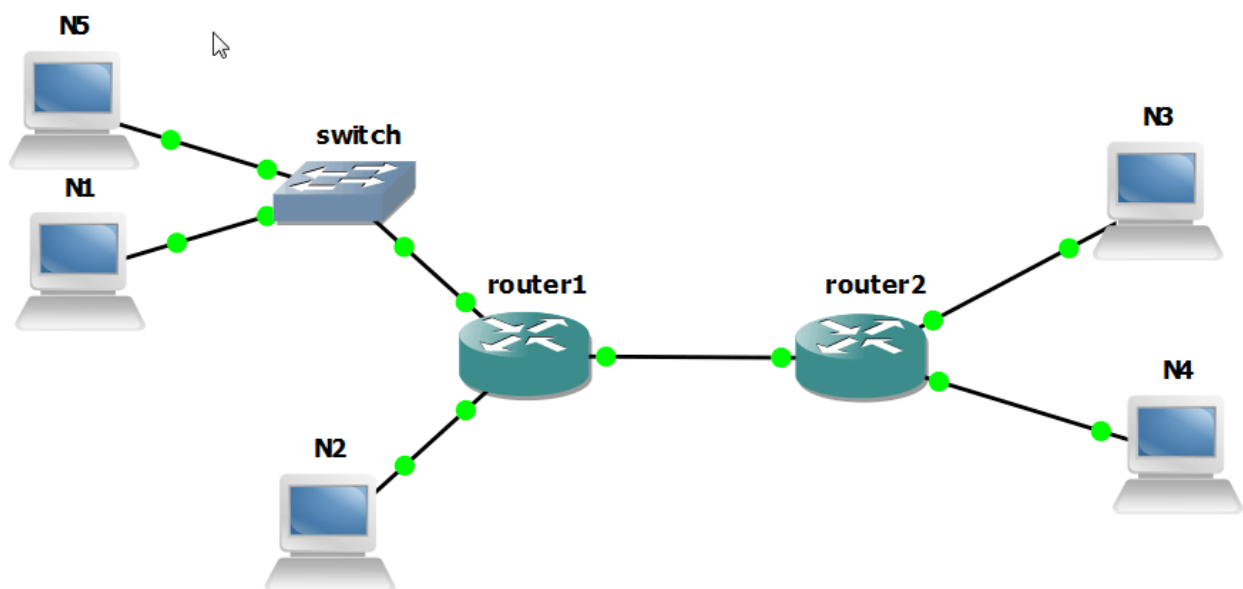
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## Simulating Network Lab using GNS3 and VMware on your PC:

In this module we are going to setup, configure and test an entire network topology on your stand-alone PC using Virtualization.

This article is useful for Learning and testing Networks, Also helpful for making home labs for industry certification exams such as Cisco and Linux certifications.



In this module, we will -

- Create 5 Virtual Linux boxes using VMware and configure them on different subnets.
- Simulate 2 virtual Cisco routers using GNS3 and connect them using Ethernet.
- Configure Cisco routers for RIP routing.
- Setup an Ethernet switch to connect two Linux nodes.
- Use Wireshark to sniff the network traffic for troubleshooting.

So let's get started -

Things that you'll need -

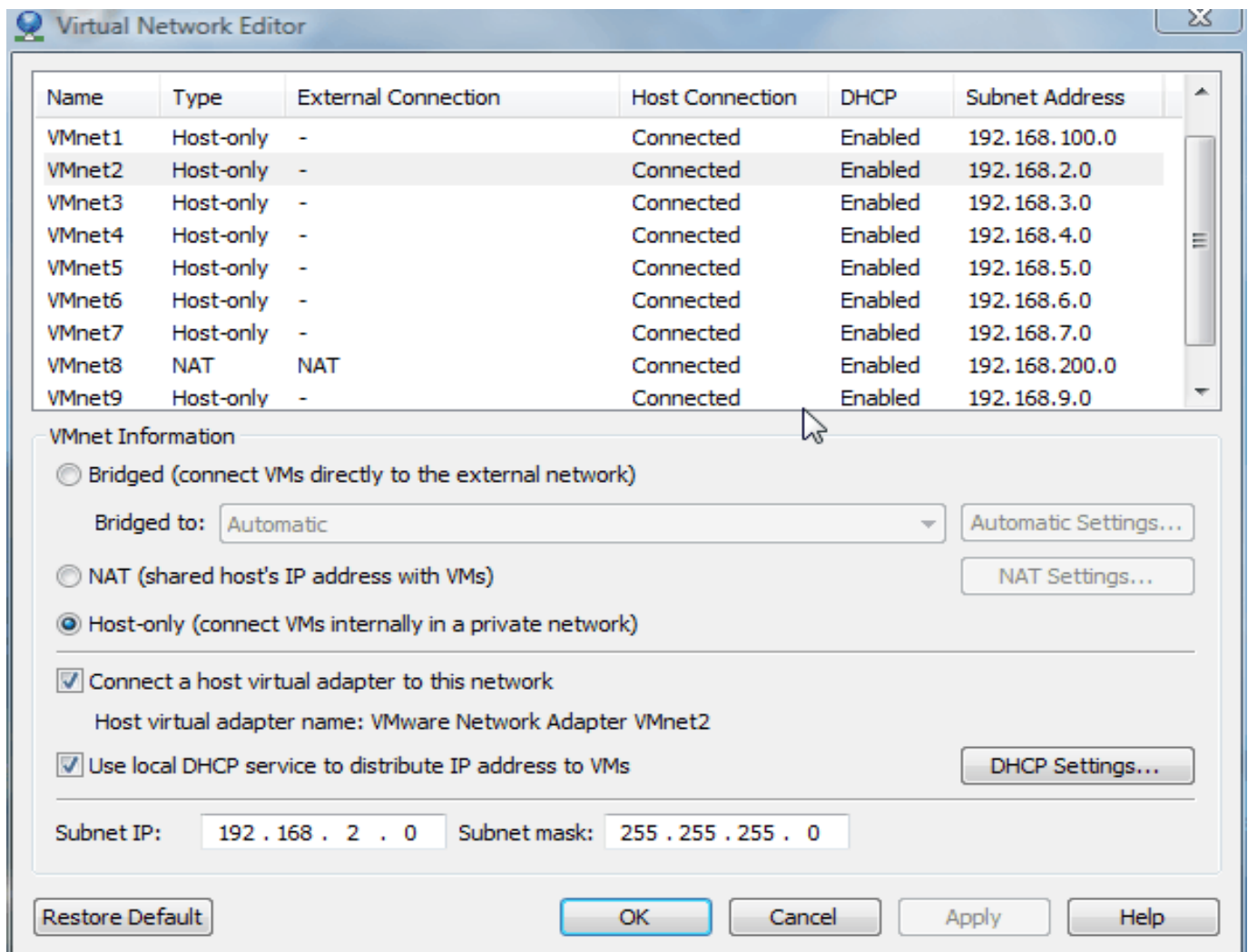
1. Licensed VMware workstation. You can also get 30-days trial from the site <http://vmware.com/>
2. Cisco IOS 12.4 - Router 3600 or any other supported by GNS3. Note: users have to provide their own Cisco IOS to use with GNS3.
3. GNS3 application to be downloaded from <http://www.gns3.net/download>
4. Wireshark application to be downloaded from <http://www.wireshark.org/>

### **Configuring Virtual Network on VMware:**

1. Download and Install VMware workstation.
2. After opening the VMware workstation... go to: edit->Virtual Network Editor. Here we will configure virtual interfaces to work with. (Note: The layout of the Virtual Network Editor window differs with the version. Here we are using VMware Workstation 7.0 which is latest at the time of writing this article).
3. Here you can see six columns - Name, Type, External Connection, Host Connection, DHCP, and Subnet Address. There are 10 different Virtual Network Interfaces (VMnet0 to VMnet9). The VMnet0 and VMnet8 are self configured for Bridging and NAT and should not be modified, Rest we have to modify.

4. Double click on VMnet2 and in the VMnet information-

- Chose Host-only option,
- check the box 'connect a Host Virtual adapter to this Network' and also
- check the box 'use local DHCP services to distribute IP address to VMs'
- Put the subnet IP we are going to use: 192.168.2.0 and subnet as: 255.255.255.0



5. Click on DHCP Settings and specify the start IP and the End IP address that we want to assign. In this screenshot I have assigned the entire subnet hosts 192.168.2.1 to 192.168.2.254 for VMnet2.

DHCP Settings

Network: vmnet2  
Subnet IP: 192.168.2.0  
Subnet mask: 255.255.255.0  
Start IP address: 192.168.2.1  
End IP address: 192.168.2.254  
Broadcast address: 192.168.2.255

Default lease time: Days: 1 Hours: 0 Minutes: 30  
Max lease time: Days: 1 Hours: 2 Minutes: 0

OK Cancel Help

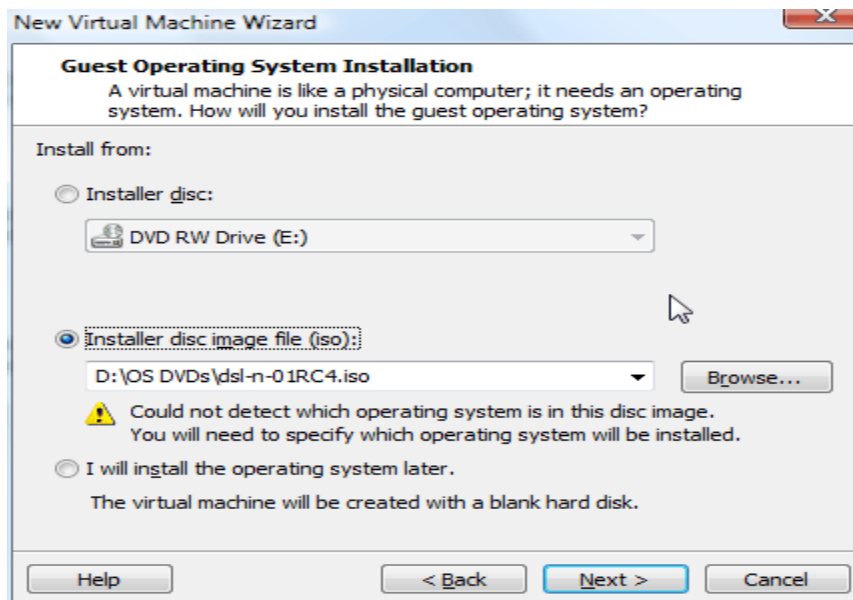
- Click Ok to close.
- Now assign similar settings for each VMnet from VMnet2 to VMnet9. Do not configure VMnet1 and VMnet8.
- Click Ok, it may take some time... and done!

## Installing Linux Box on VMware

Now Let's go ahead making a linux install on vmware..

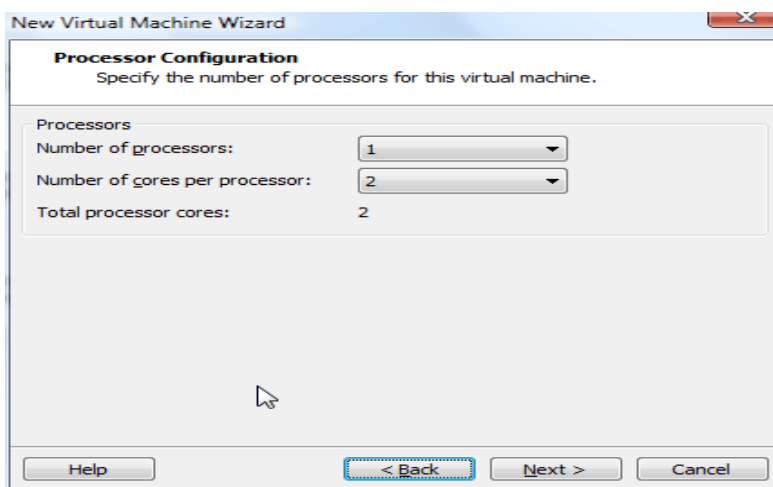
Here we are going to install Damn Small Linux and Ubuntu Distros in VMware-

- Click on: File ->New->Virtual Machine.
- Chose Custom (Advanced) and go next.
- Keep the default option (Highest Version) on VMware hardware capability and click next.
- Chose Installer Disk Image file(iso) and select open the Damn Small Linux (<http://www.damnsmalllinux.org> ) iso file and click next.

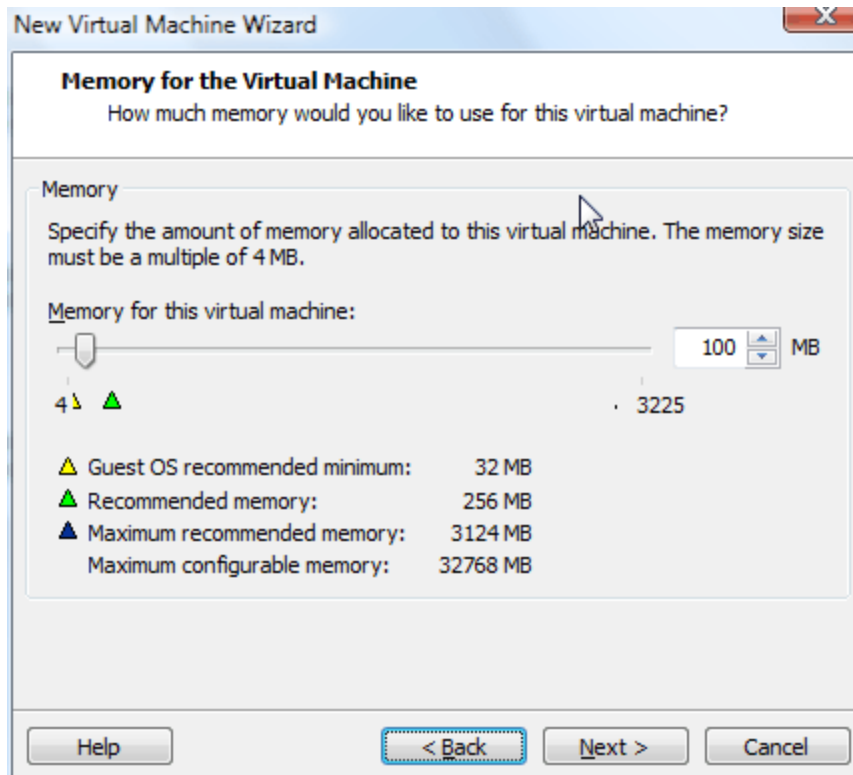


- Chose Linux and in the version chose 'Other Linux 2.6.x Kernel'. And click next.

- Chose a Virtual Machine name here I've chosen DSL. And specify the path where u want to keep VMware files. Click Next.
- Chose the proper processor info.. If it's a processor with 2 cores then select No. of Processors: 1 and No. of cores per Processor: 2 and click Next.



- Since it's a very small Linux live CD with no install, allocate 100 MB RAM Memory for this install and click next.

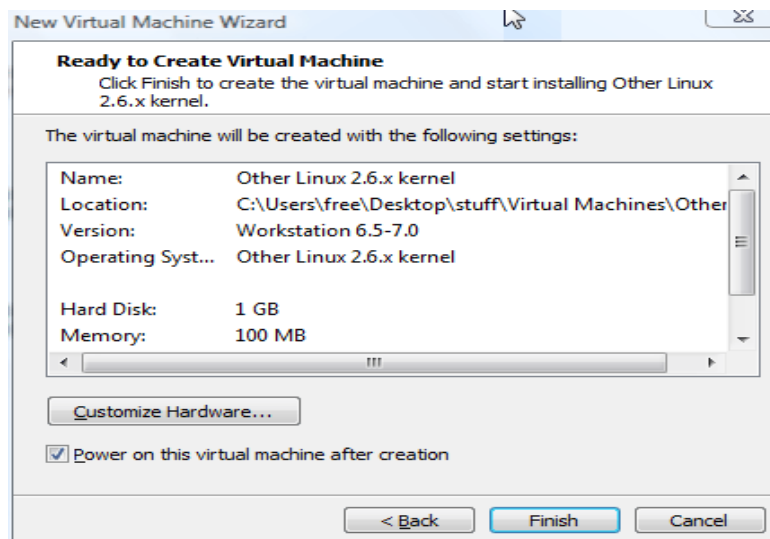


- In the network Type chose 'Use Bridge Networking' to enable internet connection to your guest machine in VMware... and click Next.
- Chose the Recommended I/O adapter and click Next.
- Select 'Create a New Virtual Disk' and click Next.
- Use the recommended disk type and click Next.
- Memory Disk Space chose 1GB. Make sure than 'Allocate all the disk space now' is NOT checked. Chose 'Store virtual disk as a single file'. Click Next.

- Specify disk file name.. Better Keep it default. Click Next.
- Now the configuration is almost complete and we have to customize the Hardware to make install additional VMnets that we had created.

### Virtual Network Adapters \*[1]

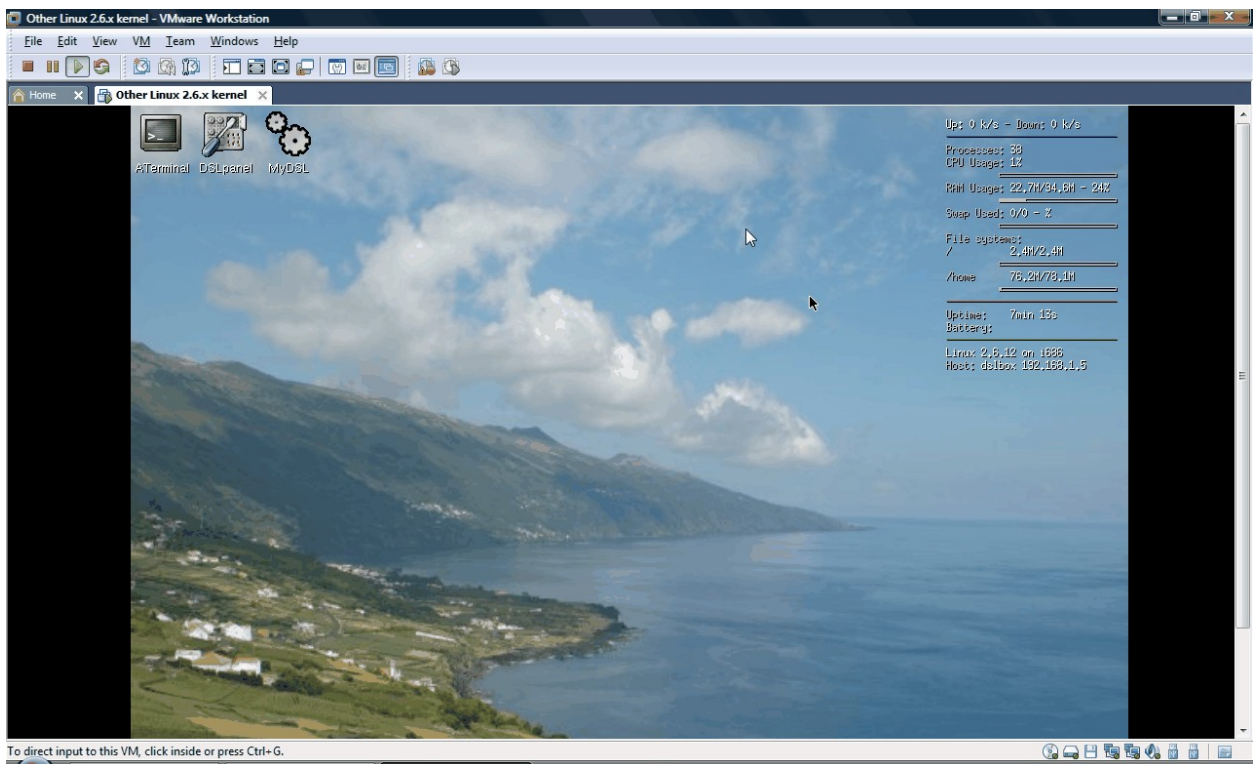
- Click on 'Customize Hardware' and click on Add.
- Select Network Adapter and click Next.
- Chose Custom and select VMnet2.
- Check 'Connect on Power on'



- You would see additional Network Adapter being added to the hardware.
- Click OK to proceed with the install.
- Select 'Power on this Virtual machine after creation' and click on 'FINISH'
- Damn Small Linux is now ready to run on vmware. 😊

Note: To work with the linux box inside vmware use ctrl+g

To work with the host machine use ctrl+alt.



Now you must be seeing the damn small Linux running inside the VMware.

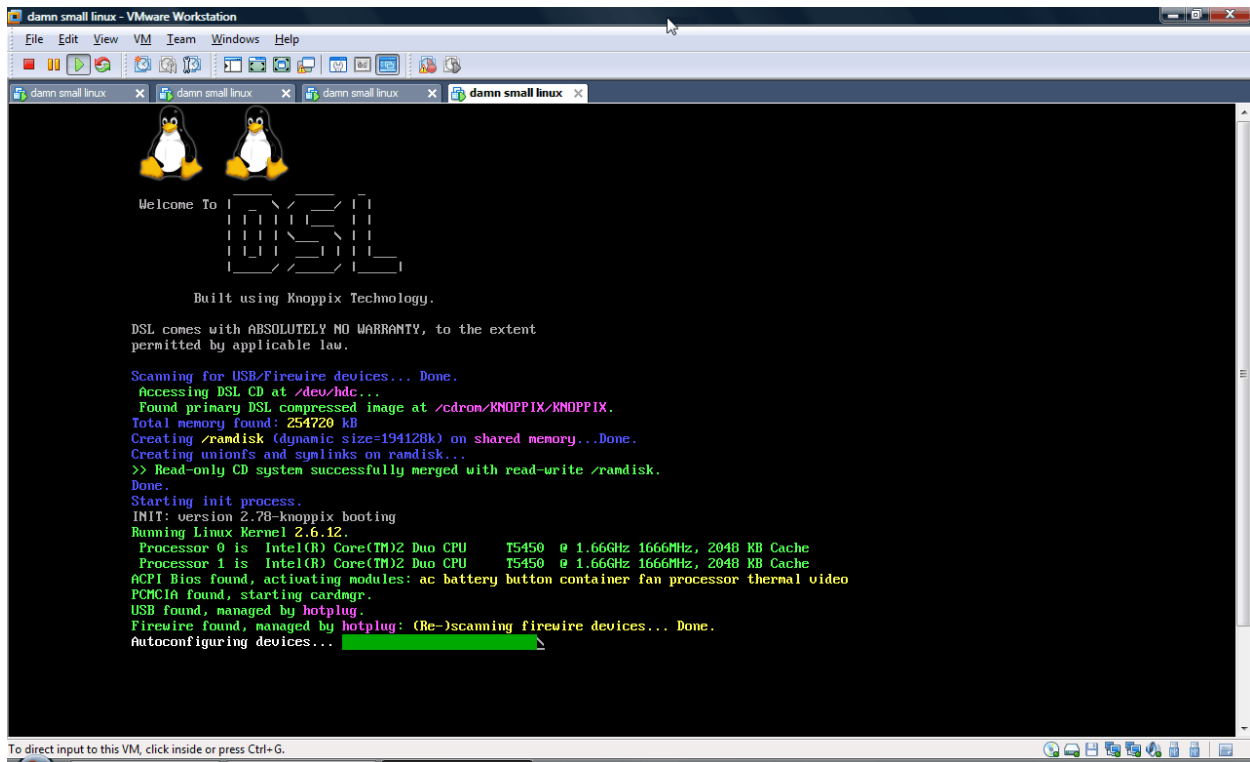
Now let's verify the network install...

In the Damn small Linux virtual machine.. Click on ATerminal for shell.

- Login as super user by entering the command 'su'.
- Use command 'ifconfig' to see the list of interfaces and the assigned IP addresses. Verify the IP address assigned to the virtual Interface VMnet2 to verify DHCP.

- Go to the host machine and check the IP address assigned to the VMnet2 and try to ping the guest from the host.
- Now the Virtual Linux Box (guest) and the Host machines are connected virtually and appear to be on the same Ethernet Switched Network.

Since we need 5 Linux boxes... We can just make 5 copies of the current virtual machine folder and we are done!



Note: All the different VMnet (VMnet 2 to 9) should be on different subnets which we are going to use it in our routing topology.

Note: We have to modify the Network Adapter settings for each Virtual Box. (The copies that we had made). We must assign each virtual box with different VMnets\*[1]. Since we are going to connect them across routers, we must use different VMnets for each virtual Linux box.

Thus the IP addresses assigned to the Virtual Machines are as follows-

DSL1 = 192.168.2.2 (VMnet2)

DSL2 = 192.168.3.2 (VMnet3)

DSL3 = 192.168.4.2 (VMnet4)

DSL4 = 192.168.5.2 (VMnet5)

Now let's configure GNS3 for routing....

## Installing GNS3

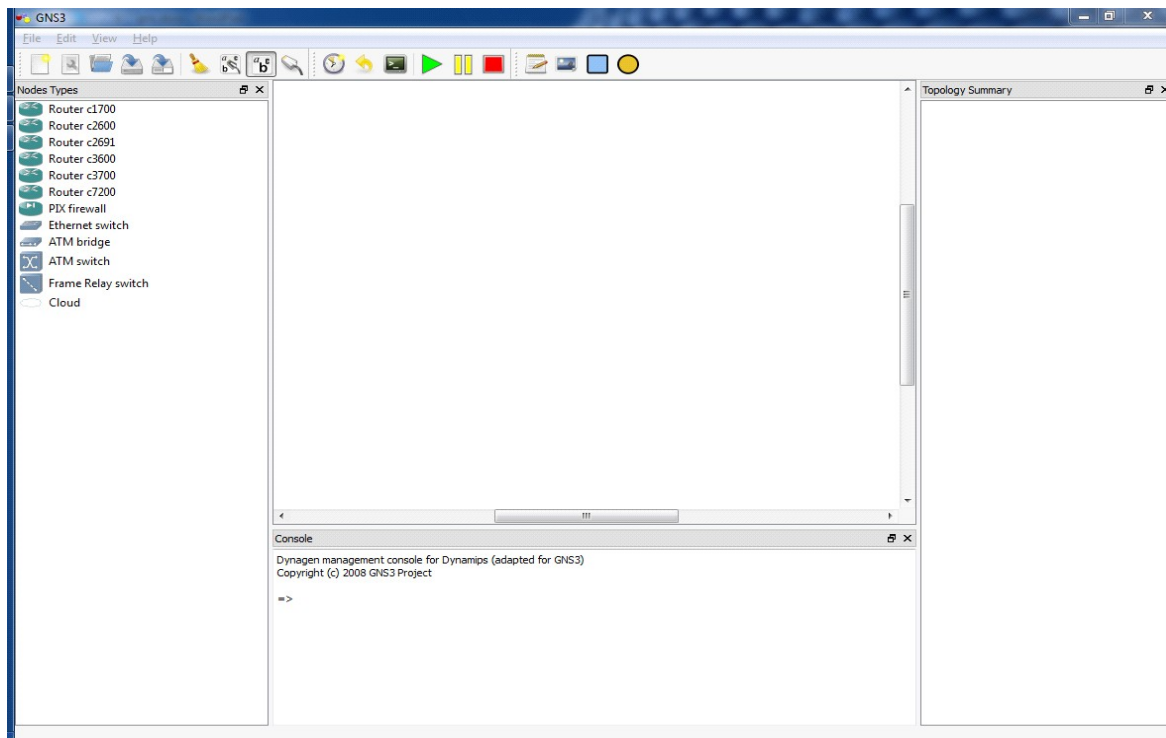
GNS3 is a graphical network simulator that allows simulation of complex networks using Cisco IOS, which is the most stable and popular networking devices on earth.

GNS3 is an excellent complementary tool to real labs for Cisco network engineers, administrators and people wanting to pass certifications such as CCNA, CCNP, CCIP or CCIE.

It's an open source project and has gained great respect in Cisco developers' community. So let's go ahead installing it.

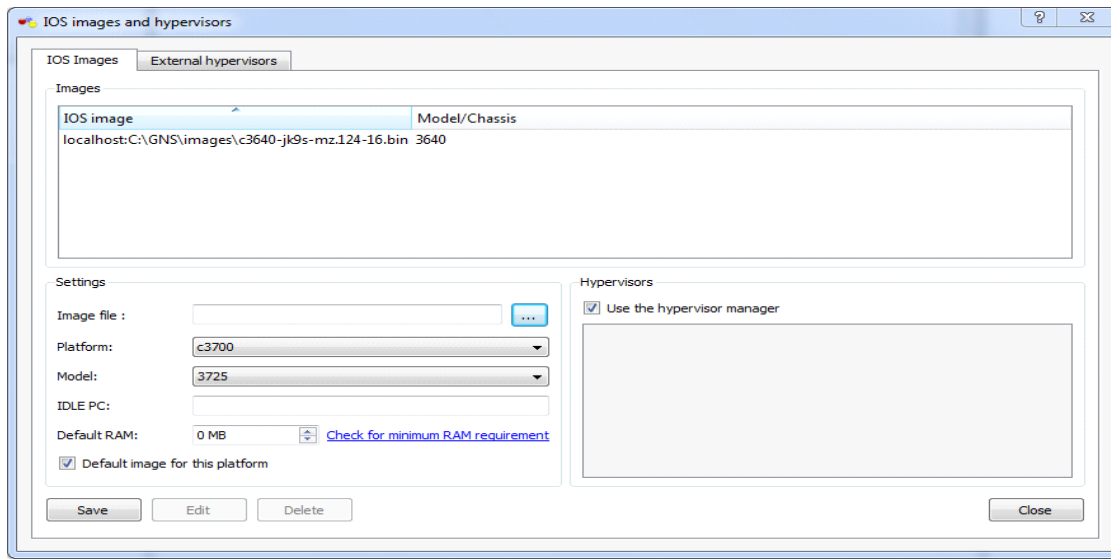
## Installing and configuring GNS3

1. Download GNS3 from <http://gns3.net/> download win32-all-in-one.
2. Double click install with all default options.. Keep clicking 'Next' until install is finished.
3. Open GNS3 from desktop.. Setup wizard will open.. This can be closed as of now.



4. To start working with GNS3, you must be having Cisco IOS.

Now press ctrl+shift+I.. You will get a dialogue box 'IOS images and hypervisors'.



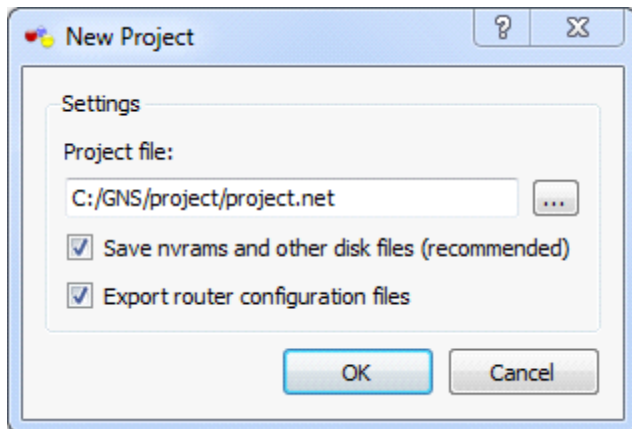
5. Put the path of the Cisco IOS file (file type: .bin) in the image file: option. And make sure that the platform and model is appropriate to the image file u have selected. (I would recommend Cisco IOS C3640 router. Because it supports both routing and switching.) And click on save.

The above steps were mandatory only for the initial setup.

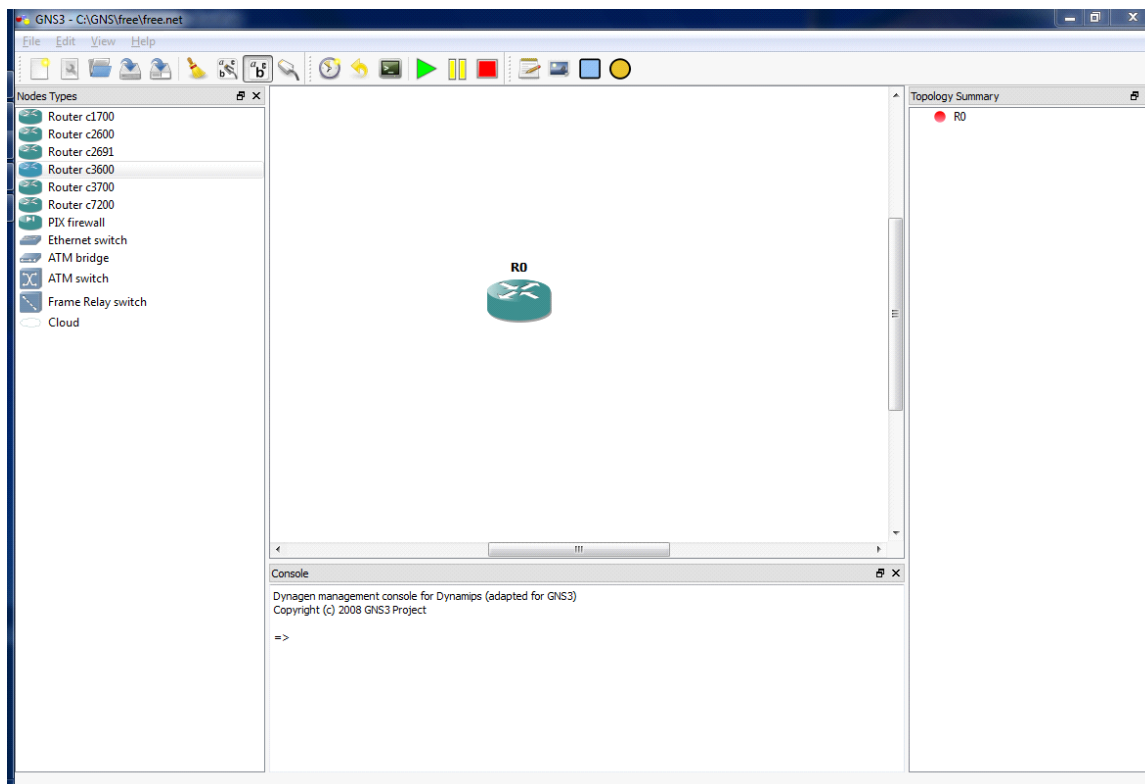
### Starting a project:

1. Press Ctrl+N. Put the project path where u wanna store the project. Its always a good practice to create a folder for every single project. Also select the checkboxes -

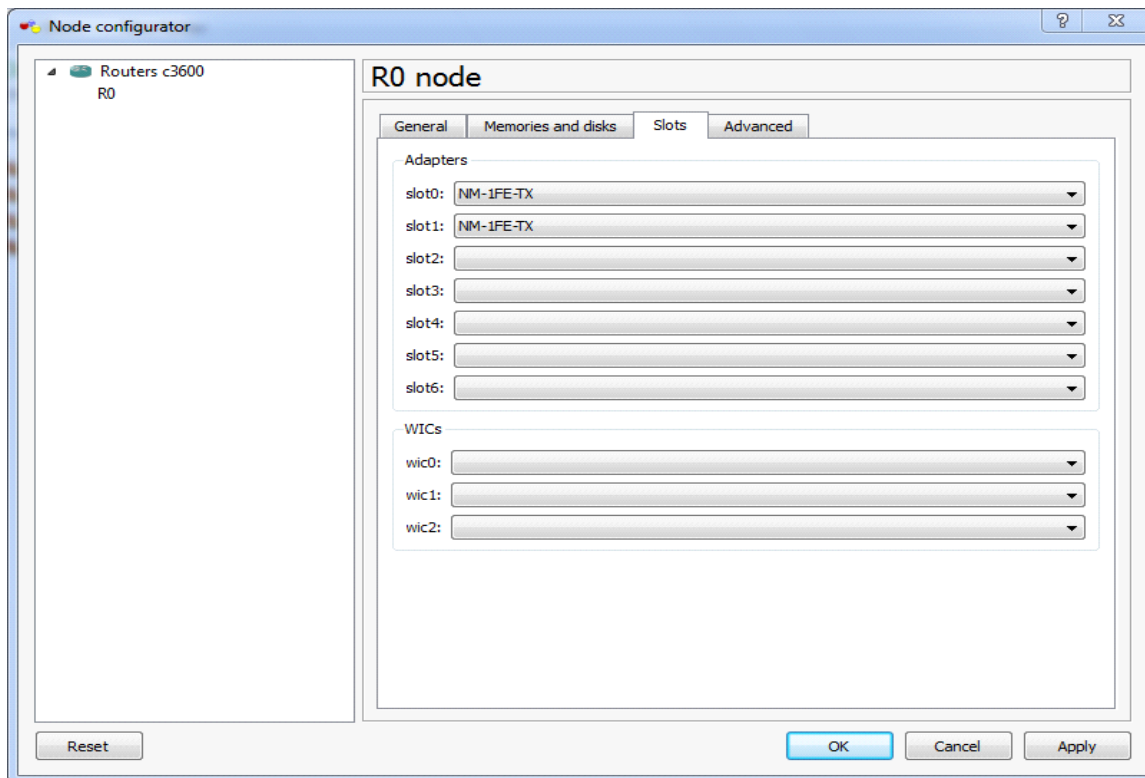
\*Save nvrams and other disk files and \*Export router configuration files.



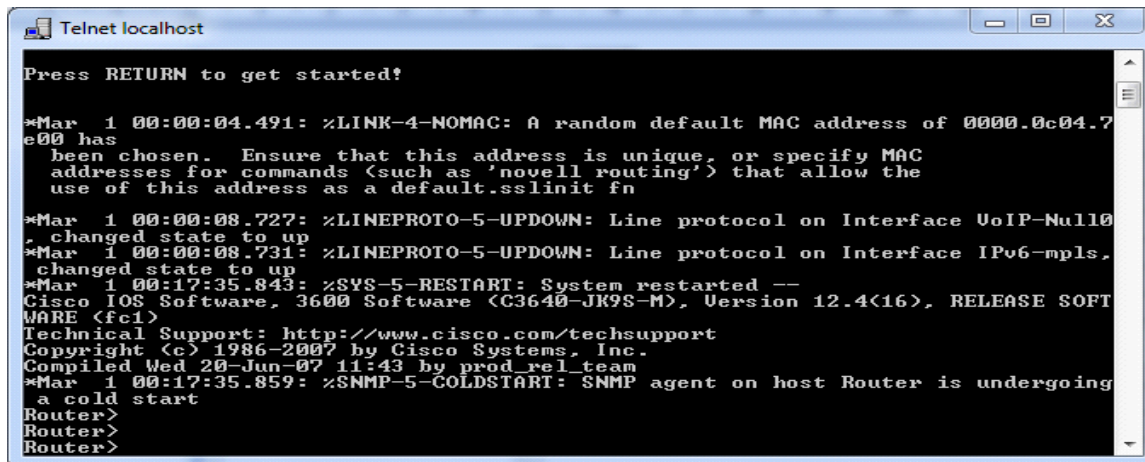
2. Now you have to drag the Router c3600 icon from the left panel to the work space.



3. The work space now has the Cisco 3640 router ready to be configured. :)
4. Right click on the router R0 and click on configure.
5. in the slots option. Add two NM-1FE-TX in slot0 and slot1.(You can add 7 different type of interface adapters/cards in the slots as u wish.. here we add two FE[Fast Ethernet] cards.) and click on Ok.



6. Right click on the router on the workspace and click on start to start the router.
7. Now right click on the router and click on 'Console' to start Telnet session to configure the router.
8. Now you are ready to configure the router as per your wish. (Note: This telnet session is using console port of the router).



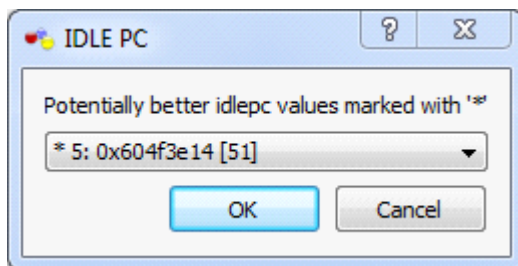
```

Telnet localhost
Press RETURN to get started!

*Mar 1 00:00:04.491: %LINK-4-NOMAC: A random default MAC address of 0000.0c04.7
e00 has
been chosen. Ensure that this address is unique, or specify MAC
addresses for commands (such as 'novell routing') that allow the
use of this address as a default.sslinit fn
*Mar 1 00:00:08.727: %LINEPROTO-5-UPDOWN: Line protocol on Interface VoIP-Null0
, changed state to up
*Mar 1 00:00:08.731: %LINEPROTO-5-UPDOWN: Line protocol on Interface IPv6-mpls,
changed state to up
*Mar 1 00:17:35.843: %SYS-5-RESTART: System restarted --
Cisco IOS Software, 3600 Software (C3640-JK9S-M), Version 12.4(16), RELEASE SOFT
WARE (fci)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2007 by Cisco Systems, Inc.
Compiled Wed 20-Jun-07 11:43 by prod_rel_team
*Mar 1 00:17:35.859: %SNMP-5-COLDSTART: SNMP agent on host Router is undergoing
a cold start
Router>
Router>
Router>

```


9. After working on terminal for say 5-10 min.. go back to the GNS3 topology workspace and right click on the router and click on 'Idle PC' Select the value which is marked with an \*. On doing this, the processor utilization is very much reduced.

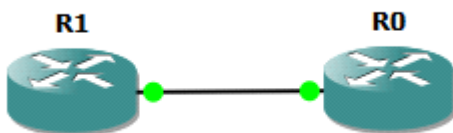


10. To save the project... do Ctrl + S to save the router settings and configuration file.

Thus a single router is successfully simulated and configured. :) Now let's build a multi-router topology...

## Building multi-router topology:

1. Drag as many routers as u need (2 for this module) from the nodes type into the topology workspace and configure them as discussed in the previous section from Pt: 2-10.
2. To connect the routers click on the icon  and select manual option.
3. Now left click on the router and select the interface to be connected. and then click on other router to connect the wire.

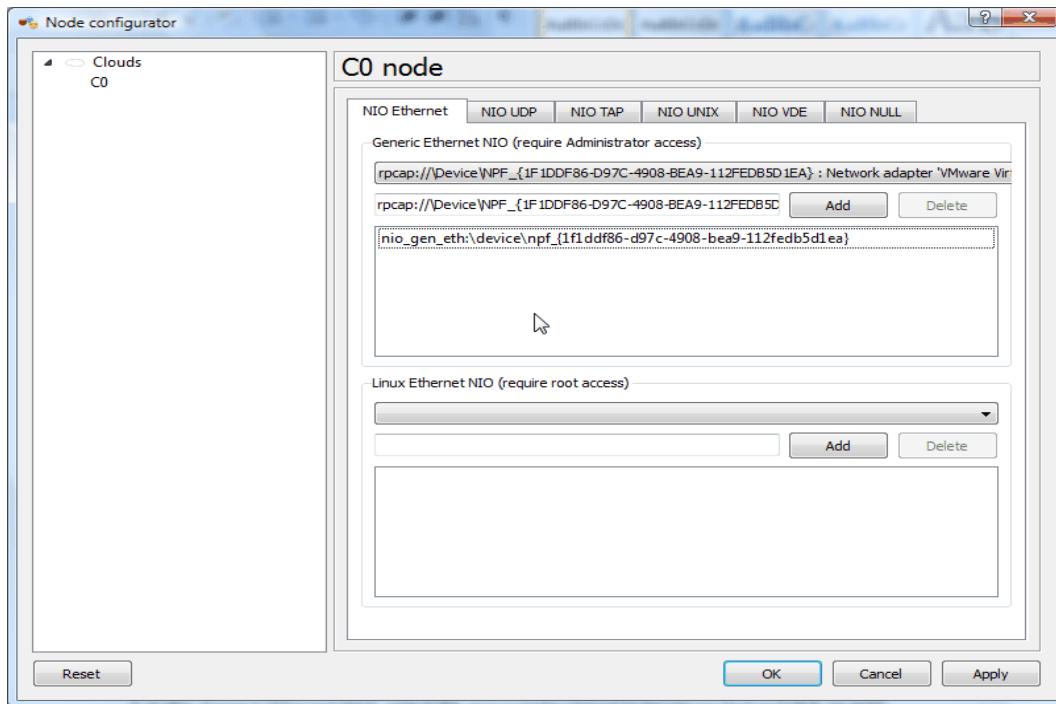



4. Now the routers are connected to each other physically. :)

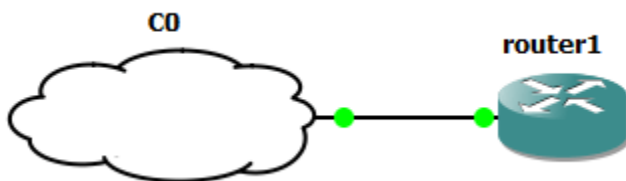
### **Connecting Virtual Machines to the routers:**

It's possible to connect Virtual Machines running on VMware to be connected to the routers. This is done using cloud in the nodes type.

1. Drag the cloud, present of the left nodes panel to the workspace.
2. Right click on the cloud and click on configure.
3. In the 'Generic Ethernet NIO', select the appropriate VMnet to be connected and click on ADD and click on OK.

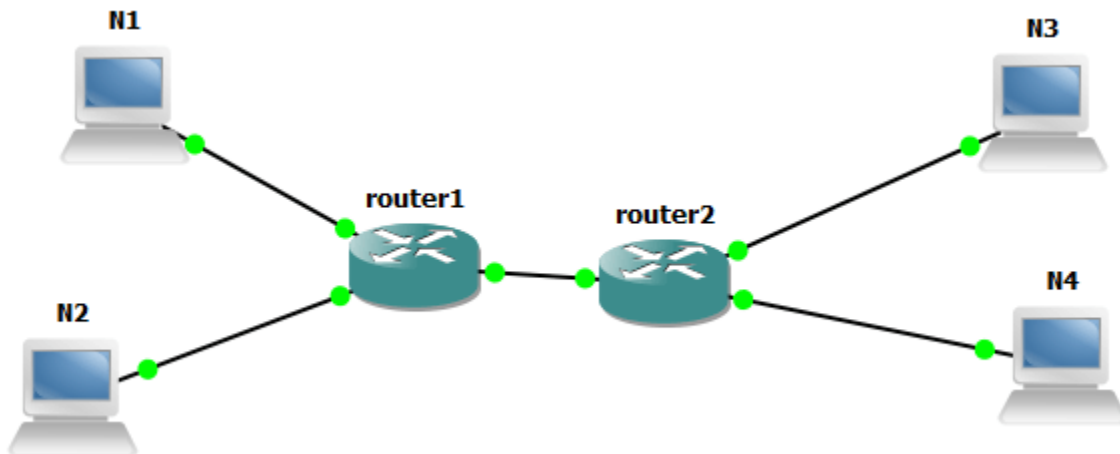


4. Now click on  using manual mode and connect the cloud with the router.



5. Now router and the Virtual Machines are connected using a physical wire.

## Building a Simple Network topology



1. Configure and connect the routers (router1, router2) with the clouds N1, N2, N3, and N4.

2. Configure RIP protocol to enable routing between the two routers as follows:

- Since each router is connected to 3 different wired Ethernet wires. We need to configure the interfaces on each router such that there are atleast 3 Fast Ethernet slots.
- Open telnet console session for Router 1
  - Answer 'No' for initial configuration option.
  - '>' is non-privileged mode, type 'enable' to enter into privileged mode '#'.
  - Type 'show ip int brief' to get the brief list of all the interfaces present on router.
  - To configure the router type 'config terminal'

- To configure the interface IP address use the command 'int fa <interface\_id>' Eg. Int fa 0/0
- 'Ip address <ip add> <subnet\_mask>' to assign the ip.
  - Eg. ip address 192.168.1.1 255.255.255.0
- Similarly assign to all the three interfaces.

```

Telnet localhost
et1/0, changed state to down
*Mar  1 00:00:17.611: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et2/0, changed state to down
Router>
Router>en
Router#
Router#show ip int rbrief
% Invalid input detected at '^' marker.
Router#show ip int brief
Interface                IP-Address      OK? Method Status      Prot
ocol
FastEthernet0/0          unassigned      YES unset    administratively down down
FastEthernet1/0          unassigned      YES unset    administratively down down
FastEthernet2/0          unassigned      YES unset    administratively down down
Router#
Router#
Router#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa 0/0
  
```

- Note: use the command 'no shutdown' on all the interfaces and 'exit' command to come back to the global configuration mode.
- All the interfaces of both the routers must be assigned appropriate IP addresses and no shutdown command is a must.
- Type 'do write' to save the configuration. You need to do this often to save the configuration so that it stays during next start-up.
- Now to start routing.. Use the following commands in global configuration mode:
  - 'Router rip' to enable RIP routing.

- 'Version 2' to use RIP v2
- 'Network <ip address>' to enable rip on those particular IP configured interfaces.
- Do these steps on both the routers and the routing will start.

Note: you may have to set the default gateway for the Virtual boxes to the router's interface IP.

Note: You can also add Ethernet Switches provided in the GNS3 to build switched networks.

Thus now the Virtual linux boxes with different subnets are able to communicate with each other.

Congratulations you have build an entire Network topology on your system. You can test and play with it. Cisco certification freaks will love it.

Now to do more... Wireshark can also be used to sniff the packets on the interfaces by right clicking on the router interface and clicking on capture.

Here is a brief introduction about Wireshark-

## Introduction to Wireshark

It is the second best security assessment tool according to insecure.org.

It allows you to examine data from a live network delving down into just the level of packet detail you need. It also supports hundreds of protocols and media types.

Follow these steps and get started!

1. Download wireshark <http://www.wireshark.org/> Direct install if you are using windows. For Debian users - `sudo apt-get install wireshark`
2. To start capturing the network traffic click on Capture -> Interfaces. you will get a list of interfaces available. click on start to capture.
3. Packets must have started pouring.. To stop the capture. Capture -> stop.
4. Now you are ready to analyze the packets.

As you can see there are 4 different columns-

- No: indicates the order in which the packets are received.
- Time: Sec. since the last packet. Click on view -> Time display format.
- source: source IP or MAC address.
- Destination: Destination IP or MAC address.
- Protocol: Protocol used by the packet.
- Info: summarized info of the packet content.

Now you can click on packet you wanna examine and the details are shown below.

If it's an IP packet... you would see the various TCP/IP layers -

- Frame : provides the physical layer details
- Ethernet II : provides MAC details
- Internet Protocol: provides source logical IP and destination logical IP.
- TCP/UDP: displays port details.
- Data: application data.

Expand the trees and view all the details about the TCP / IP communication.

Note: you can save your network capture and keep a backup as .cap file or .pcap file.

Hope you enjoyed it...

Thanks.

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