# FPGA Based System Design
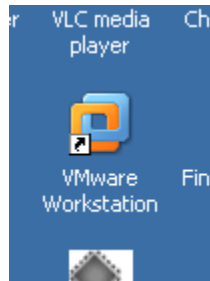
## LAB #7: Inverter Design in Design Architect
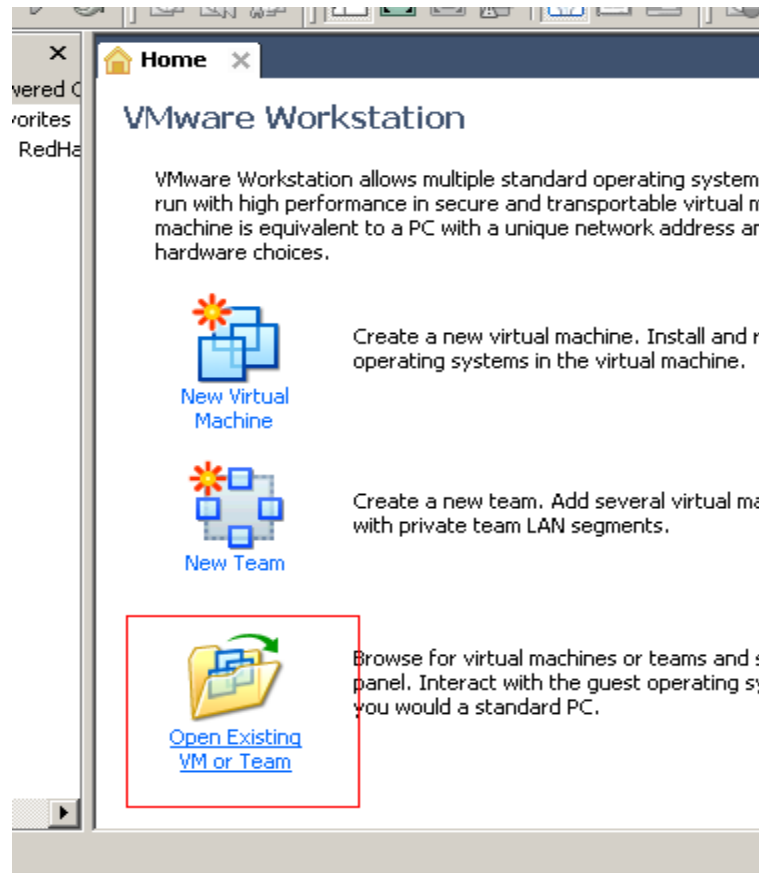
**Introduction**

In this lab we will be designing inverter using PMOS and NMOS transistors in Design Architect and verify its functionality using ELDO.
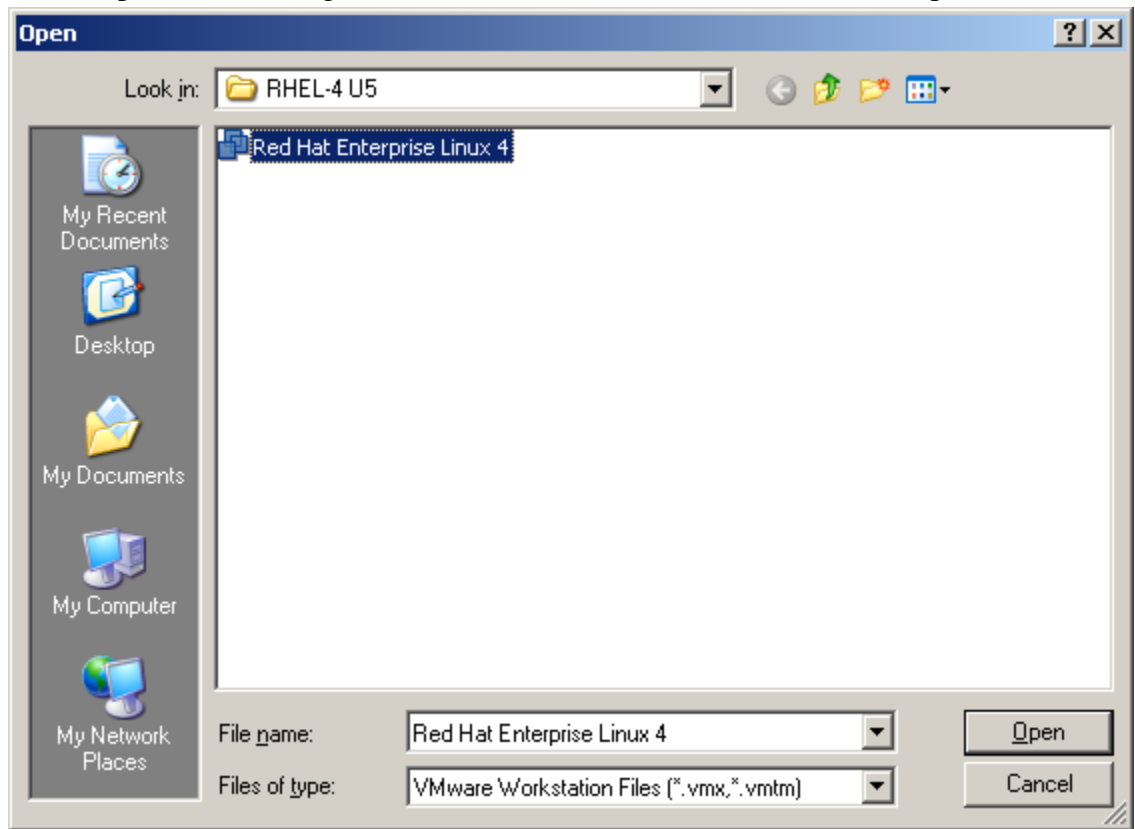
**Procedure**

1. Open Virtual Machine by double clicking on the Following icon on Desktop


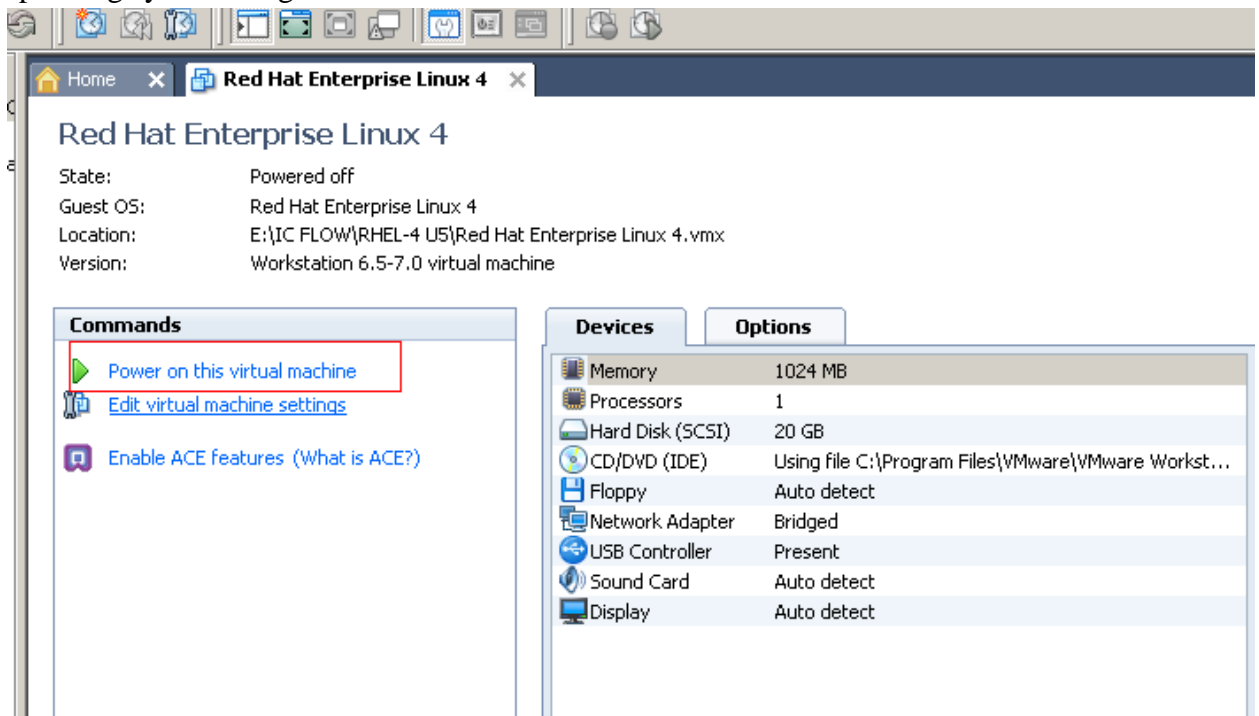
2. After the Virtual Machine main window opens, click on open existing VM or Team as shown below

3. Enter the path for the image saved in D drive as shown below and click open.



4. In the next window click on power on this Virtual Machine. This should start the Linux operating system Image.

5. To logon enter the following
   Username: *root*
   Password: *bhatti*
6. Open Terminal window as shown below. ( you can make a shortcut on desktop by dragging the terminal to desktop)



7. Enter the following lines at the terminal



```
[root@localhost ~]# MGC_WD=/root/Desktop/wd/inverter
[root@localhost ~]# export MGC_WD
[root@localhost ~]# source adk_da_ic
[root@localhost ~]#
```

*Note: **MGC_WD** contains the path for the working directory. Linux is **case sensitive** so 'T' is not same as 't'. **source adk_da_ic** sets up environment variables required for the applications.*

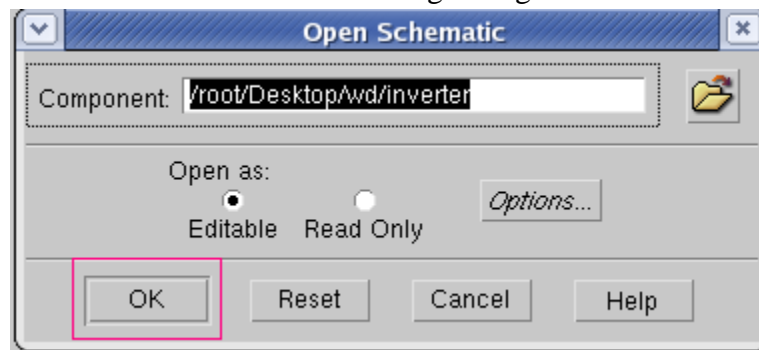**Before moving on make sure you are able to ping the server. Eg**
   *$ping asic-13*

8. Then enter the following command to run Design Architect
   $adk_daic

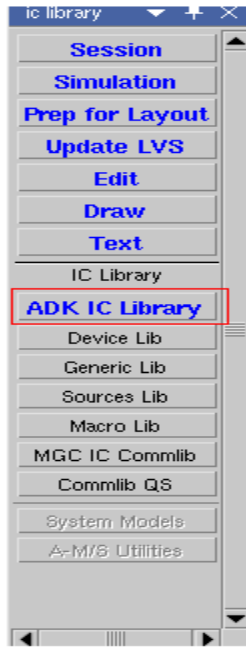   Following window should open. This the Design Architect Graphical interface.
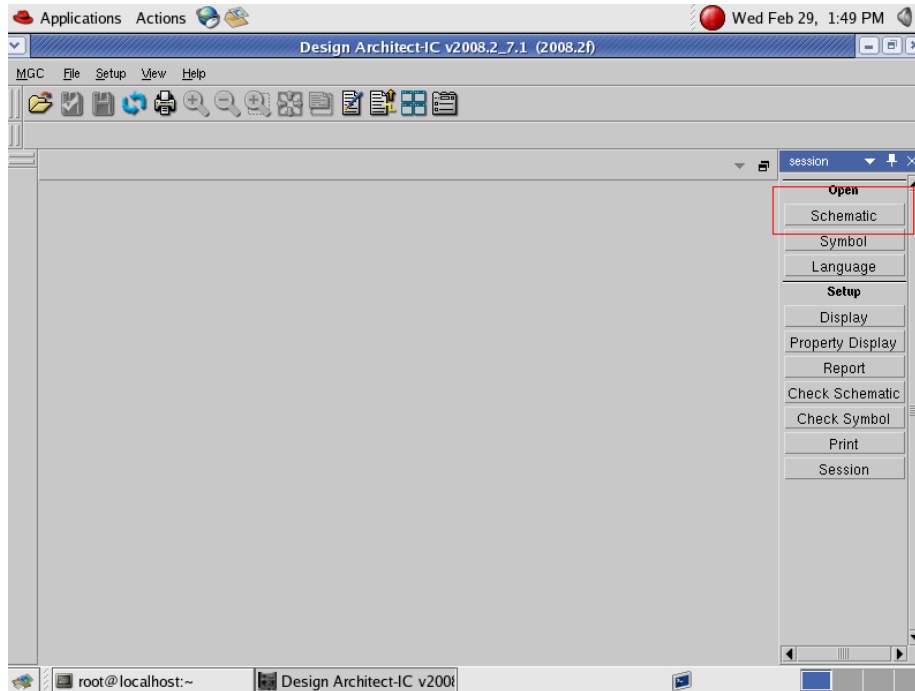
9.  Click Schematic as shown above.  The following dialog window should open.  Click Ok.



This will create a new sheet in the inverter table.

10. On the right side library window can be seen with some selections as shown below.
    Click ADK IC Library.

11. In the ADK IC library palette, select, one by one, each component with red rectangular box around as shown below. Place the selected component by moving the cursor on the sheet and by clicking on the sheet where to put the component.
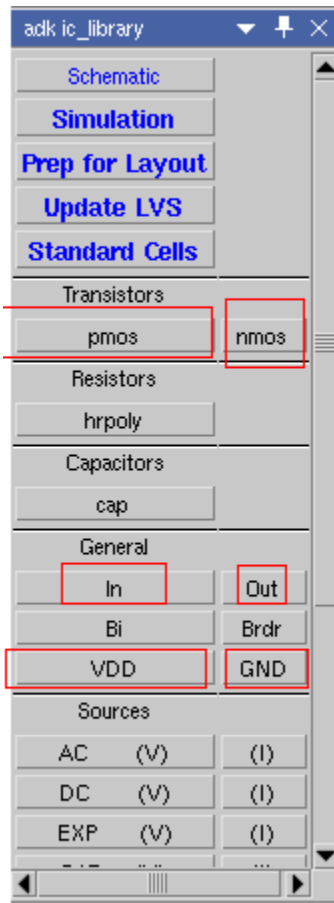


12. After placing each component on the sheet. Wire them as shown below.
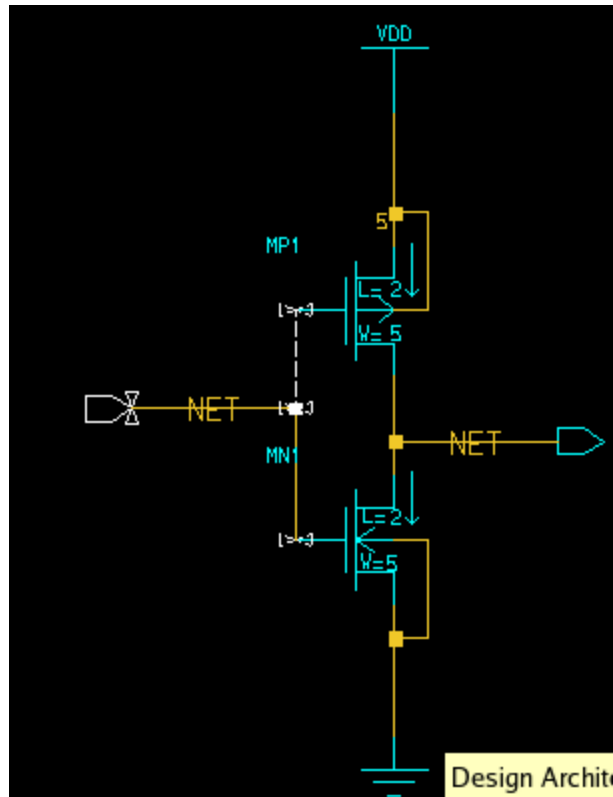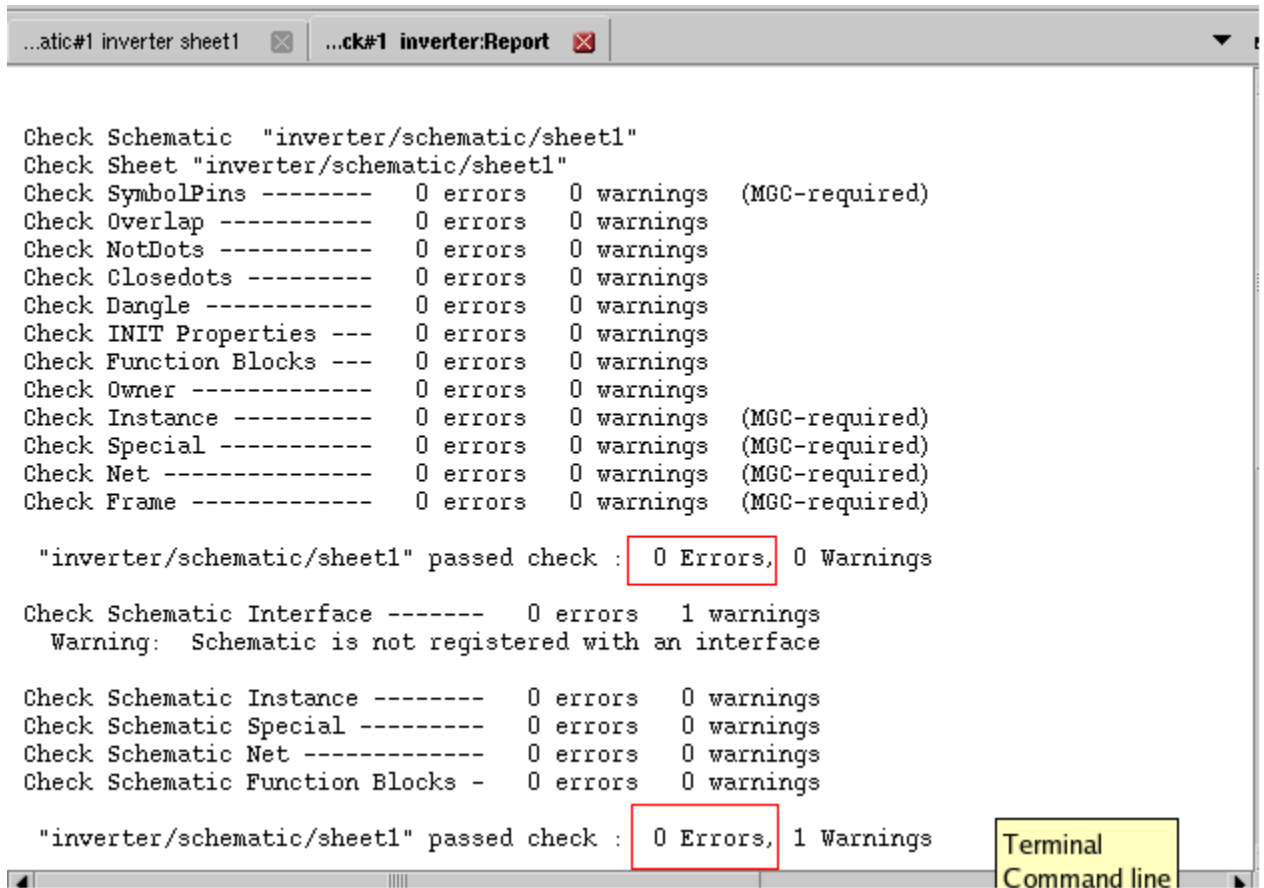
13. Next step is to change the name on in and out NETS. Select the in NET by clicking on it. After selecting the net, right click to see "Name Nets". Select it and a prompt window should be displayed at the bottom of the sheet.



14. Enter the name of the net at 'New Value' and click Ok. Repeat the step for out NET also.

15. From the ADK IC palette, Click Schematic as shown below.
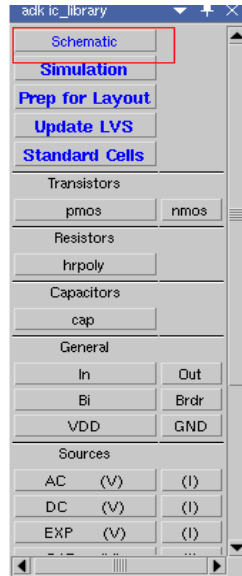
16. In the Schematic palette, click Check and Save. The following window with no error should appear.



```
...atic#1 inverter sheet1      ...ck#1 inverter:Report

Check Schematic   "inverter/schematic/sheet1"
Check Sheet "inverter/schematic/sheet1"
Check SymbolPins --------   0 errors   0 warnings   (MGC-required)
Check Overlap -----------   0 errors   0 warnings
Check NotDots -----------   0 errors   0 warnings
Check Closedots ---------   0 errors   0 warnings
Check Dangle ------------   0 errors   0 warnings
Check INIT Properties ---   0 errors   0 warnings
Check Function Blocks ---   0 errors   0 warnings
Check Owner -------------   0 errors   0 warnings
Check Instance ----------   0 errors   0 warnings   (MGC-required)
Check Special -----------   0 errors   0 warnings   (MGC-required)
Check Net ---------------   0 errors   0 warnings   (MGC-required)
Check Frame -------------   0 errors   0 warnings   (MGC-required)

 "inverter/schematic/sheet1" passed check :  0 Errors, 0 Warnings

Check Schematic Interface -------   0 errors   1 warnings
  Warning:  Schematic is not registered with an interface

Check Schematic Instance --------   0 errors   0 warnings
Check Schematic Special ---------   0 errors   0 warnings
Check Schematic Net -------------   0 errors   0 warnings
Check Schematic Function Blocks -   0 errors   0 warnings

 "inverter/schematic/sheet1" passed check :  0 Errors, 1 Warnings
```
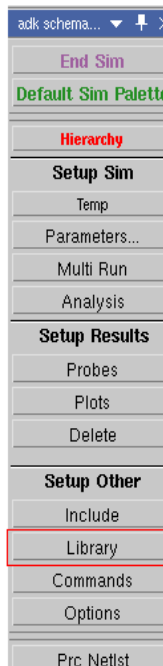
Terminal
Command line

17. To test our circuit, we will now enter Simulation mode.  This can be done by clicking simulation in Schematic palette.  This opens a new window with our inverter circuit but the palette window has changed as shown below.
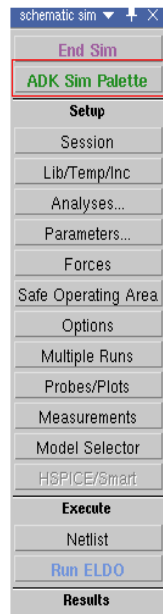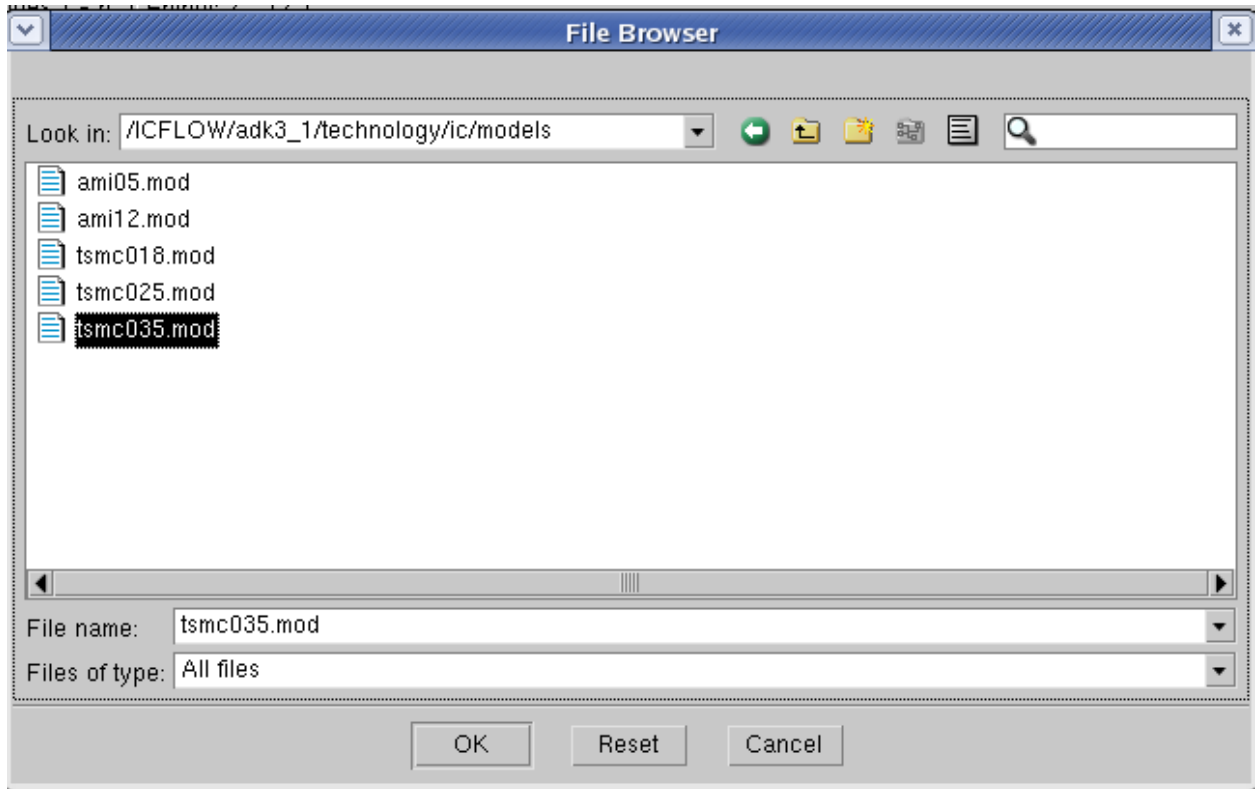


18. Click on ADK Sim Palette as shown above.
19. In the ADK sim Palette, click on Library as shown below.



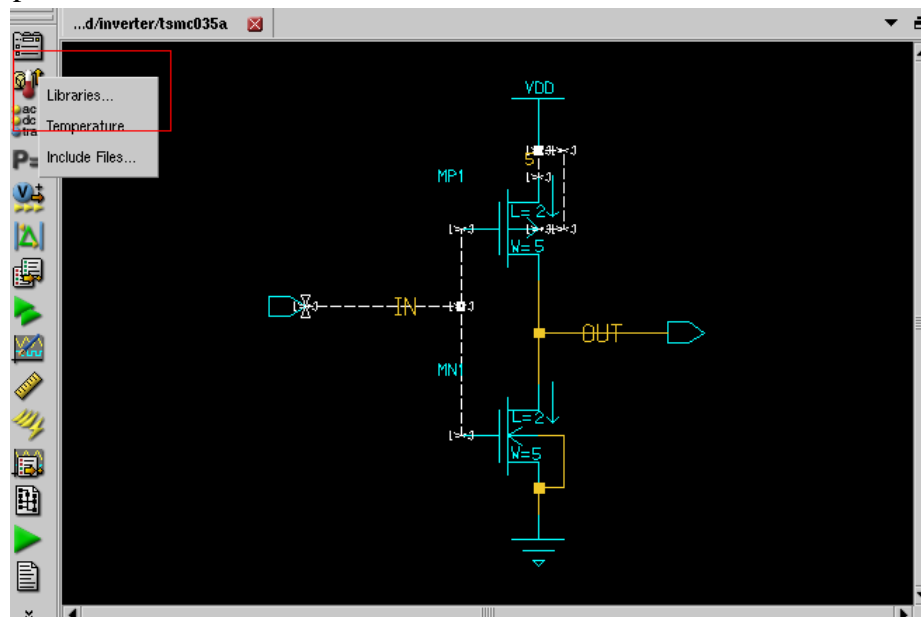20. In the Set Library path window, select and enter the following path
/ICFLOW/adk3_1/technology/ic/models/tsmc035.mod
Also shown below.

21. Click on Default Sim Palette to return back to the original palette.
22. Hold down Ctrl key and select IN and VDD Nets.  These Nets should appear white.
23. On the top left hand corner click the button as shown below and select libraries.



24. In the Setup Simulation window under the *setup* menu click Edit Forces.
25. Then, click on VDD in *signal* Window and In the *Type* menu under Independent Tab, Select DC.  Enter the Magnitude to be 5.  This is shown below.
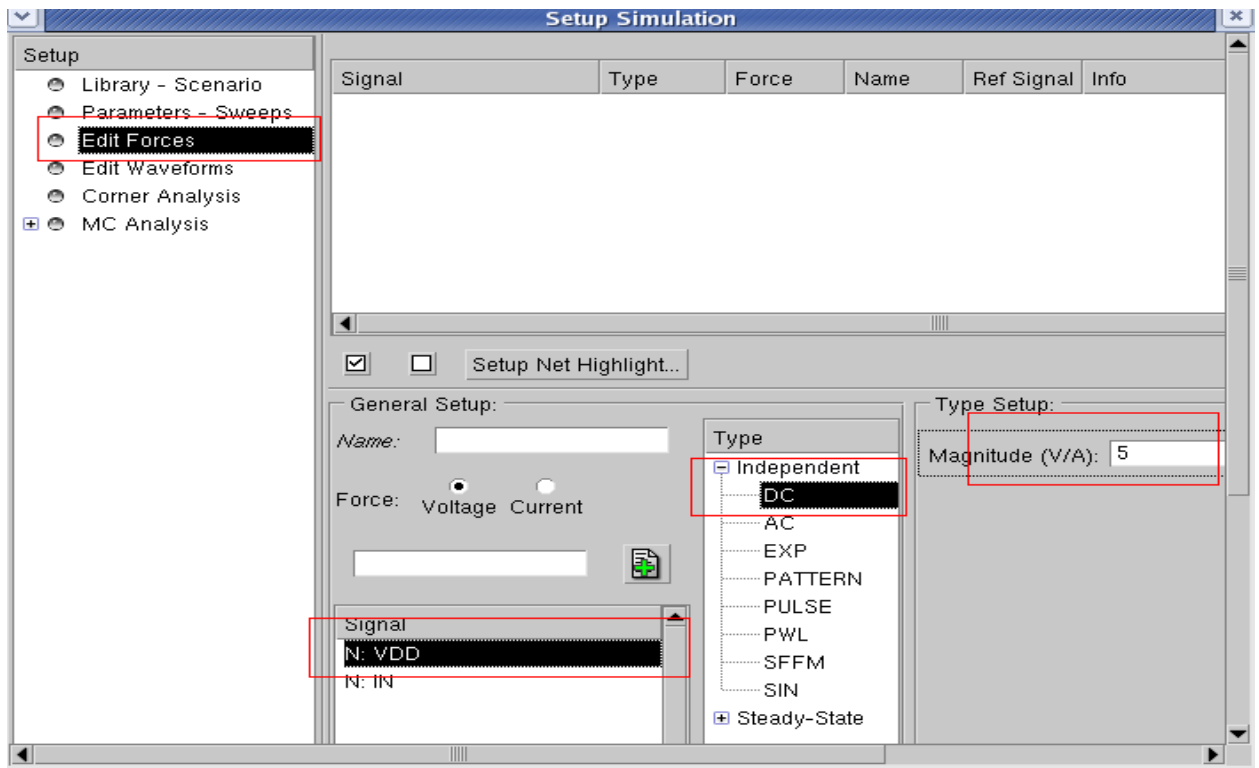
26. Now Select IN from *Signal* Menu. Under *Type* Menu Select PULSE and enter 5 for Pulsed Value.
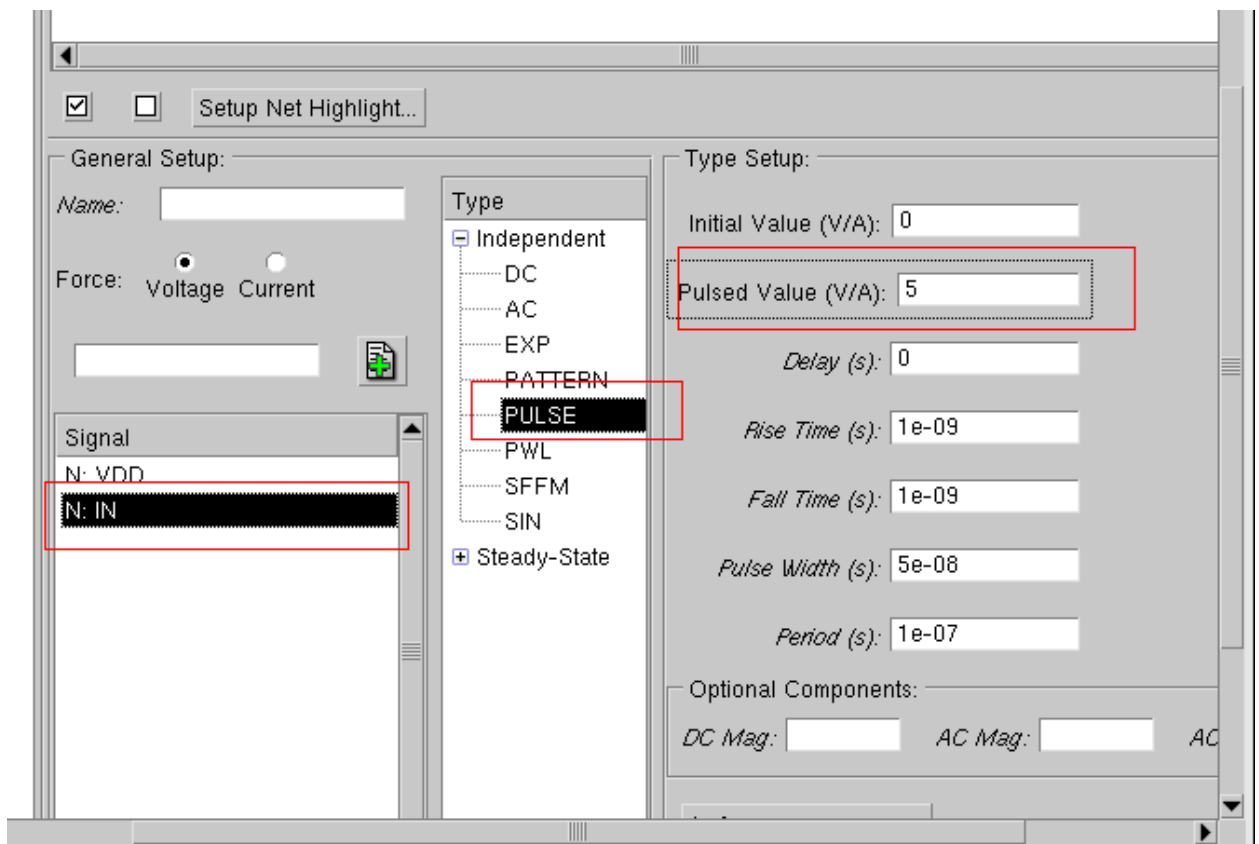
27. Before closing the setup window make sure both VDD and IN appear in the added list of signals. This can be done by selecting each signal and then clicking on the green + icon as shown below.
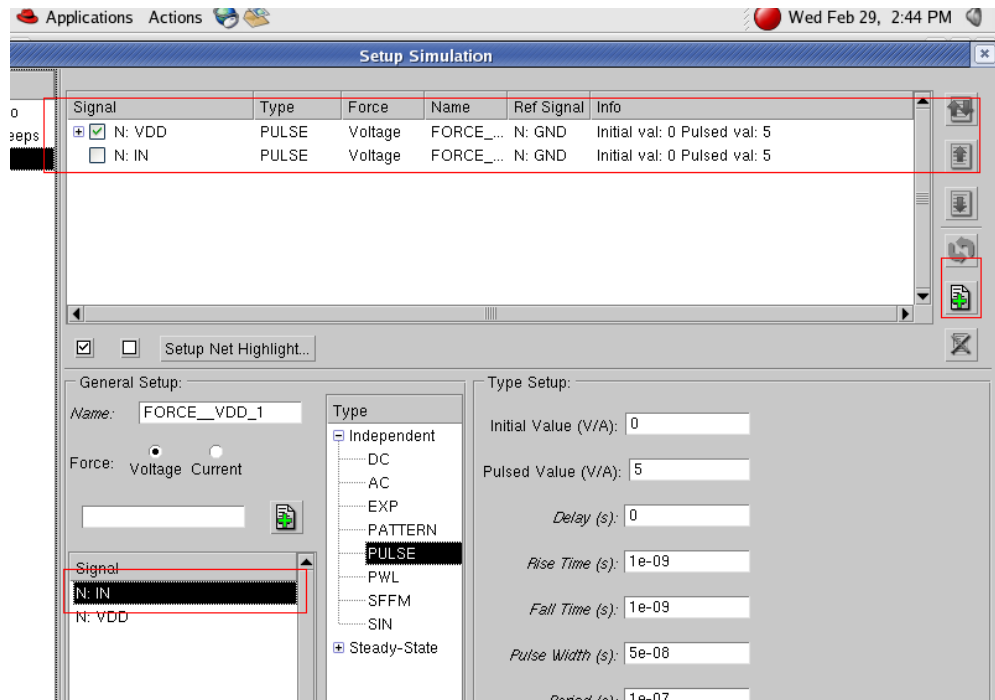


28. Close this window which should return you the schematic simulation window.
29. Select IN and OUT NETs by using Ctrl. Go back to setup simulation window by clicking the left icon as in step 23.
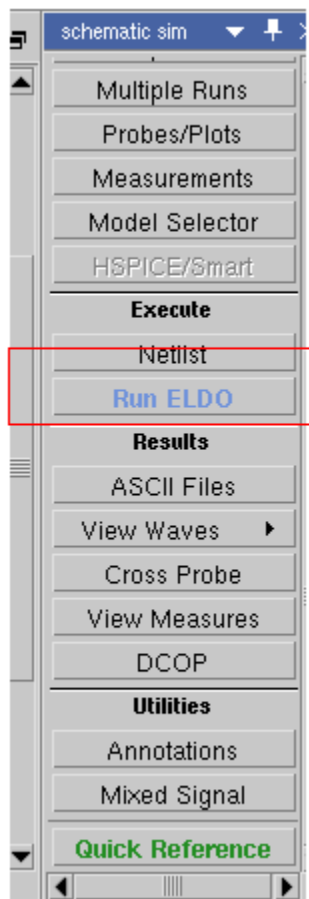30. Carry out the steps shown in the figure below and close this window.
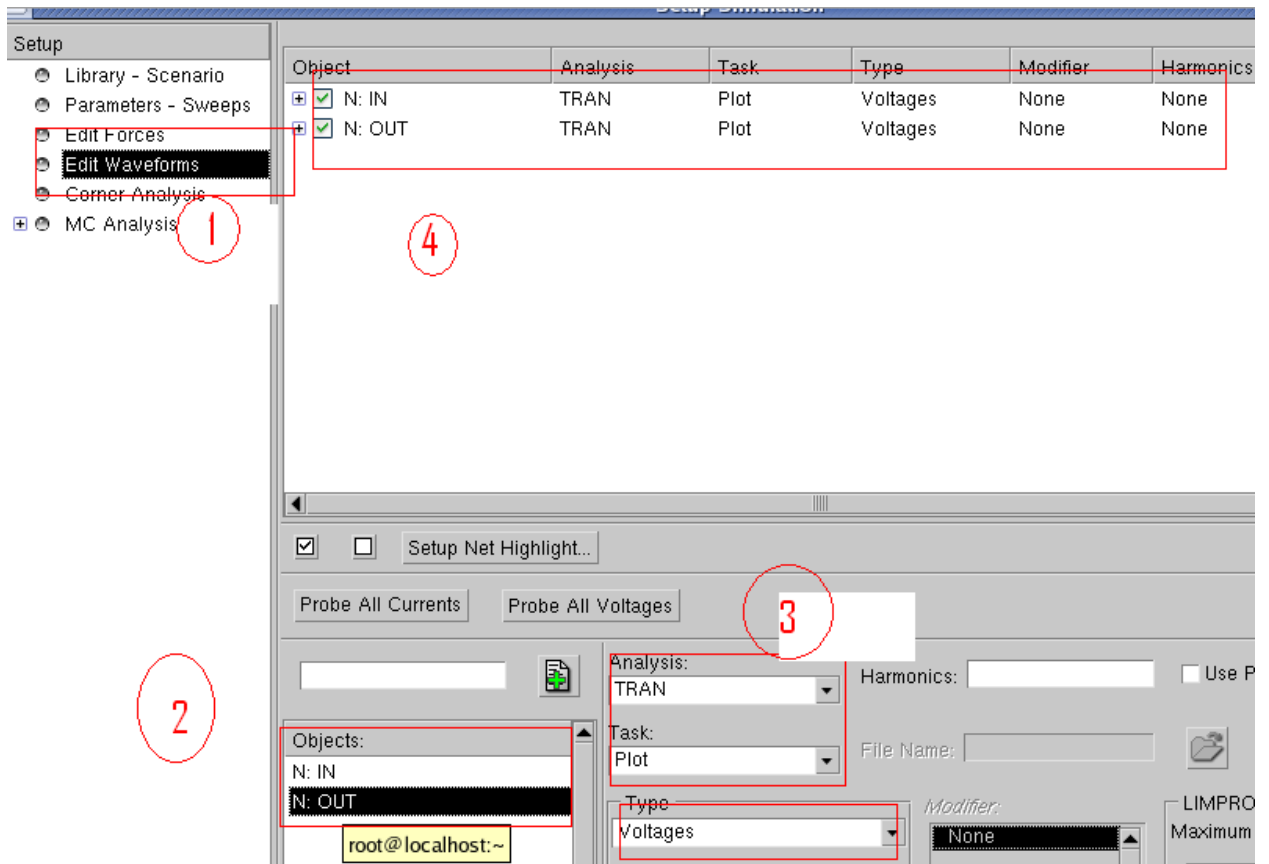
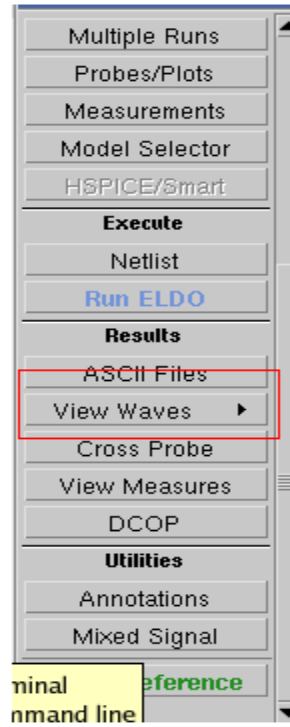31. Now Select AC-DC, Transient Button on the left pane and select Transient and click on setup as shown below.
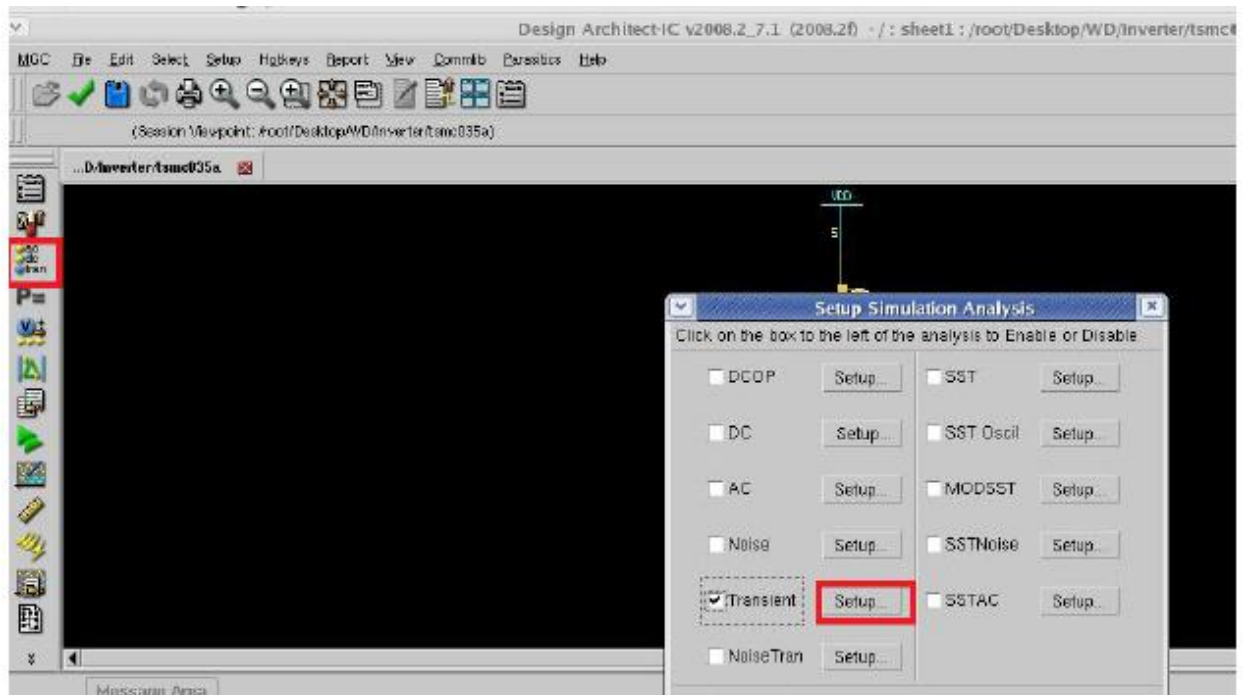


32. In the next dialog window enter the following and close all of the AC-DC windows.
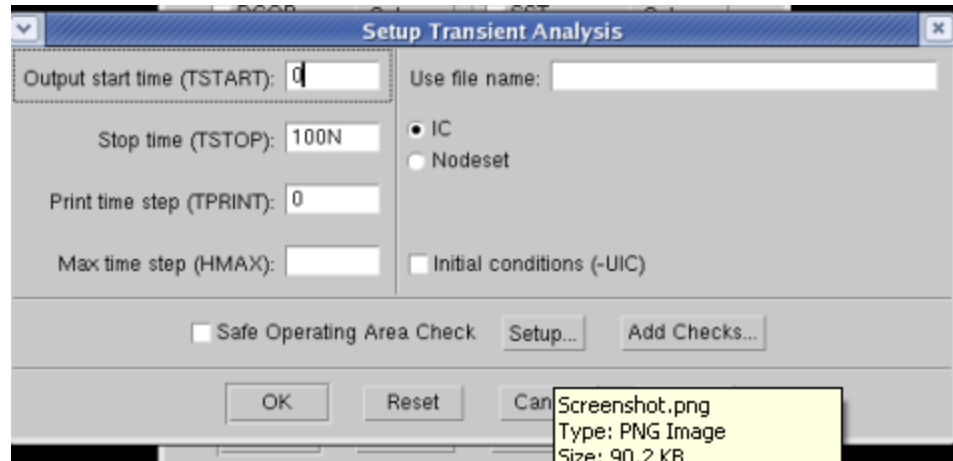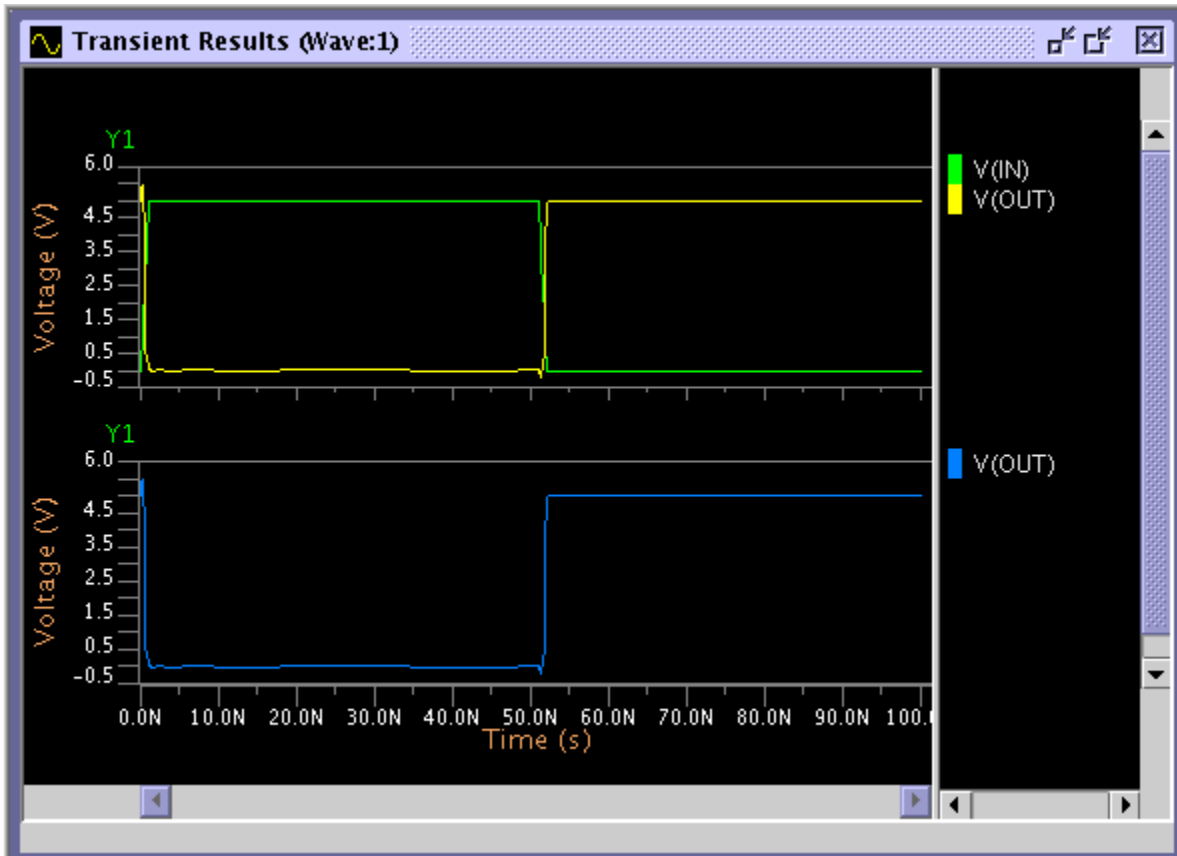
33. After, click RUN ELDO from the right palette.



34. After successful run, you can view the waveforms as shown below.

35. Your waveform should look similar to as following
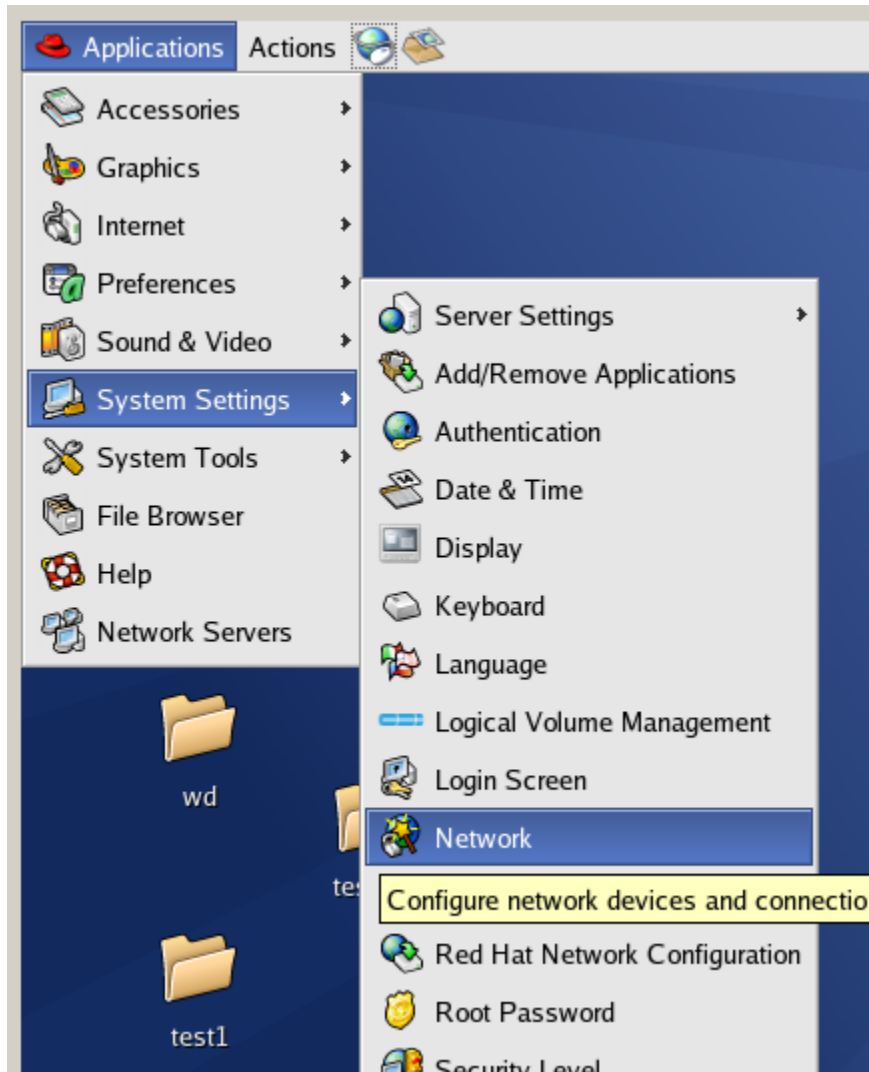
36. Show the results to the Instructor and Follow the procedure to exit and shutdown Linux explained in the next sections.
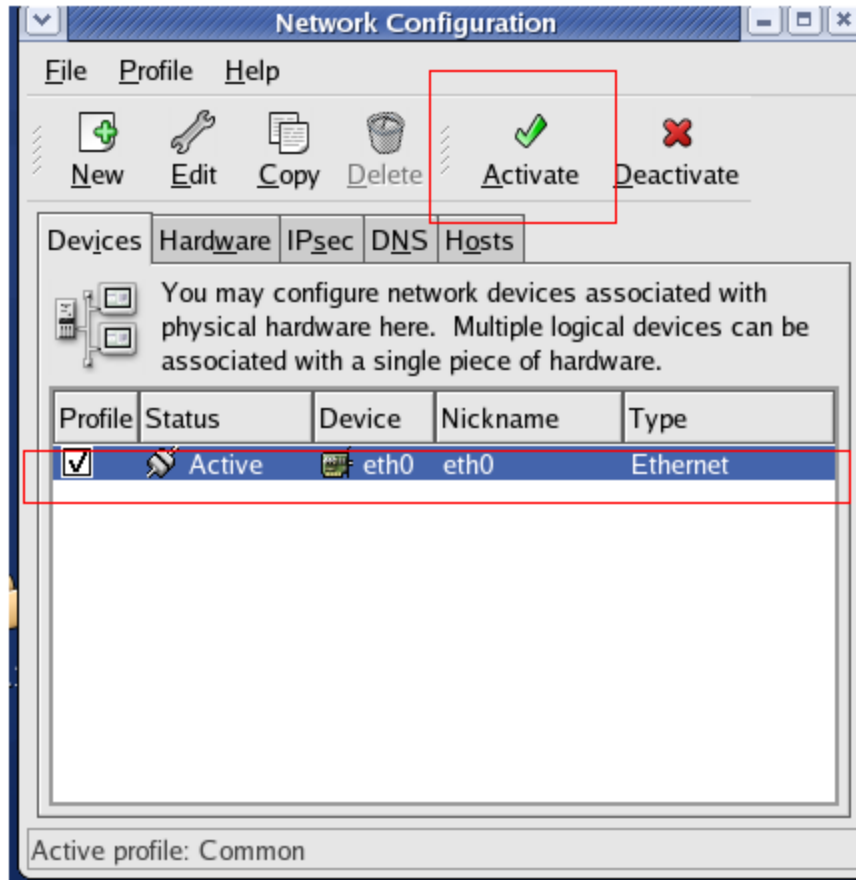
**Troubleshooting**

If you are not able to ping the server then follow these steps.
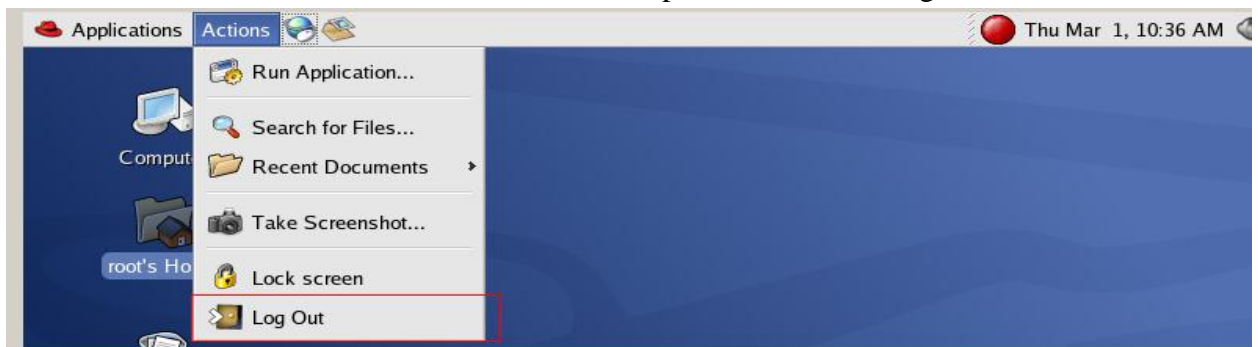
1. Select Network settings as shown below



2. In the Network Settings Dialog window, make sure eth0 (LAN card) is Active

3. If it is not active then click on Activate Button with Green Check Mark as shown above.
4. File > Save the settings and close the dialog window.
5. If not able to ping the server then ask the administrator for assistant.

**HOW to shutdown the Virtual Machine**

1. Always exit the program windows by selecting the exit option under the File menu or in some cases under other menus.
2. To shut down linux, Select Actions from the desktop menus and then logout.



3. Then Select Shutdown.