

**Aim: Installation of NS-3, NetAnim and Wireshark in Linux**

**THEORY:**

**Network Simulator:**

Network simulator is a tool used for simulating the real-world network on one computer by writing scripts in C++ or Python. Normally if we want to perform experiments, to see how our network works using various parameters. We don't have required number of computers and routers for making different topologies. Even if we have these resources, it is very expensive to build such a network for experiment purposes.

So, to overcome these drawbacks we used NS3, which is a discrete event network simulator for Internet.

**Ns-3:**

The ns-3 simulator is a discrete-event network simulator targeted primarily for research and educational use. The ns-3 project, started in 2006, is an open-source project developing ns-3.

NS3 helps to create various virtual nodes (i.e., computers in real life) and with the help of various Helper classes it allows us to install devices, internet stacks, application, etc to our nodes.

Using NS3 we can create PointToPoint, Wireless, CSMA, etc connections between nodes. PointToPoint connection is same as a LAN connected between two computers. Wireless connection is same as WiFi connection between various computers and routers. CSMA connection is same as bus topology between computers. After building connections we try to install NIC to every node to enable network connectivity.

Ns3 gives us special features which can be used for real life integrations.

**Features of Ns-3:**

1. **Tracing of the nodes:-** NS3 allows us to trace the routes of the nodes which helps us to know how much data is send or received. Trace files are generated to monitor these activities.
2. **NetAnim:-** It stands for Network Animator. It is an animated version of how network will look in real and how data will be transferred from one node to other.
3. **Pcap file:-** NS3 helps to generate pcap file which can be used to get all information of the packets (e.g., Sequence number, Source IP, destination IP, etc). These pcaps can be seen using a software tool known as wireshark.
4. **gnuPlot:-** GnuPlot is used to plot graphs from the data which we get from trace file of NS3. Gnuplot gives more accurate graph compare to other graph making tools and also it is less complex than other tools.

**NetAnim:**

NetAnim is a stand-alone program which uses the custom trace files generated by the animation interface to graphically display the simulation. NetAnim is based on the multiplatform Qt4 GUI toolkit.

The NetAnim GUI provides play, pause, and record buttons. Play and pause start and stop the simulation. The record button starts a series of screenshots of the animator, which are written to the directory in which the trace file was run. Two slider bars also exist. The top slider provides a “seek” functionality, which allows a user to skip to any moment in the simulation. The bottom slider changes the granularity of the time step for the animation.

Finally, there is a quit button to stop the simulation and quit the animator.

### **WireShark:**

Wireshark is an open-source tool for profiling network traffic and analyzing packets. Such a tool is often referred to as a network analyzer, network protocol analyzer or sniffer.

### **Uses of Wireshark:**

1. It is used by network security engineers to examine security problems.
2. It allows the users to watch all the traffic being passed over the network.
3. It is used by network engineers to troubleshoot network issues.
4. It also helps to troubleshoot latency issues and malicious activities on your network.
5. It can also analyze dropped packets.
6. It helps us to know how all the devices like laptop, mobile phones, desktop, switch, routers, etc., communicate in a local network or the rest of the world.

### **Functionality of Wireshark:**

1. Wireshark is similar to tcpdump in networking. Tcpdump is a common packet analyzer which allows the user to display other packets and TCP/IP packets, being transmitted and received over a network attached to the computer. It has a graphic end and some sorting and filtering functions. Wireshark users can see all the traffic passing through the network.
2. Wireshark can also monitor the unicast traffic which is not sent to the network's MAC address interface. But the switch does not pass all the traffic to the port. Hence, the promiscuous mode is not sufficient to see all the traffic. The various network taps or port mirroring is used to extend capture at any point.
3. Port mirroring is a method to monitor network traffic. When it is enabled, the switch sends the copies of all the network packets present at one port to another port.

### **Features of Wireshark:**

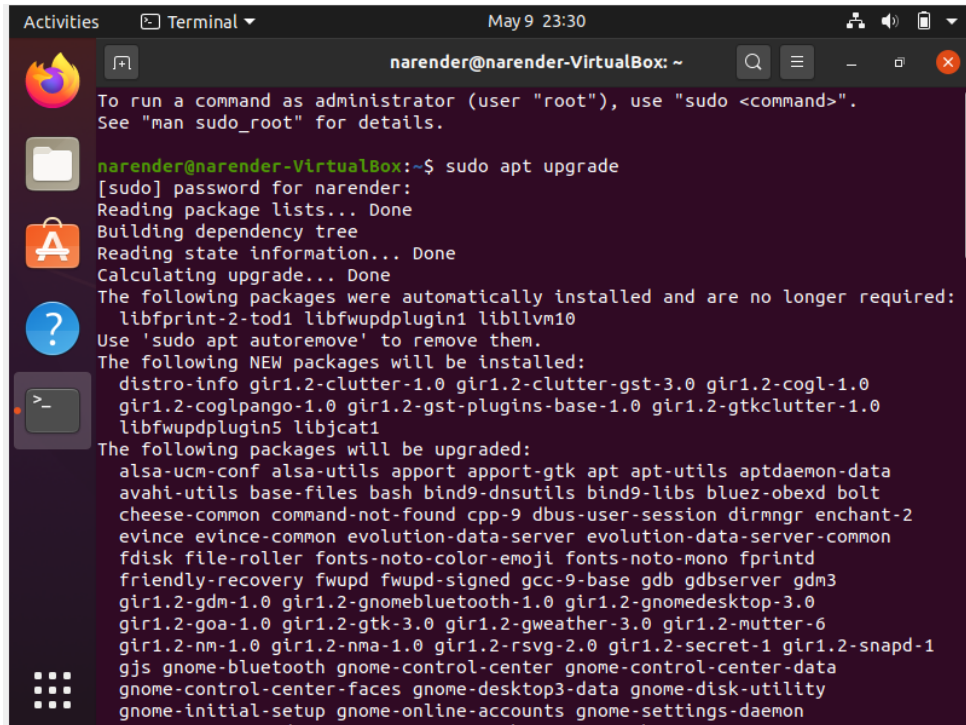
1. It is multi-platform software, i.e., it can run on Linux, Windows, OS X, FreeBSD, NetBSD, etc.
2. It is a standard three-pane packet browser.
3. It performs deep inspection of the hundreds of protocols.
4. It often involves live analysis, i.e., from the different types of the network like the Ethernet, loopback, etc., we can read live data.
5. It has sort and filter options which makes ease to the user to view the data.
6. It is also useful in VoIP analysis.

7. It can also capture raw USB traffic.

### Steps for Installation:

#### 1. Prerequisites:

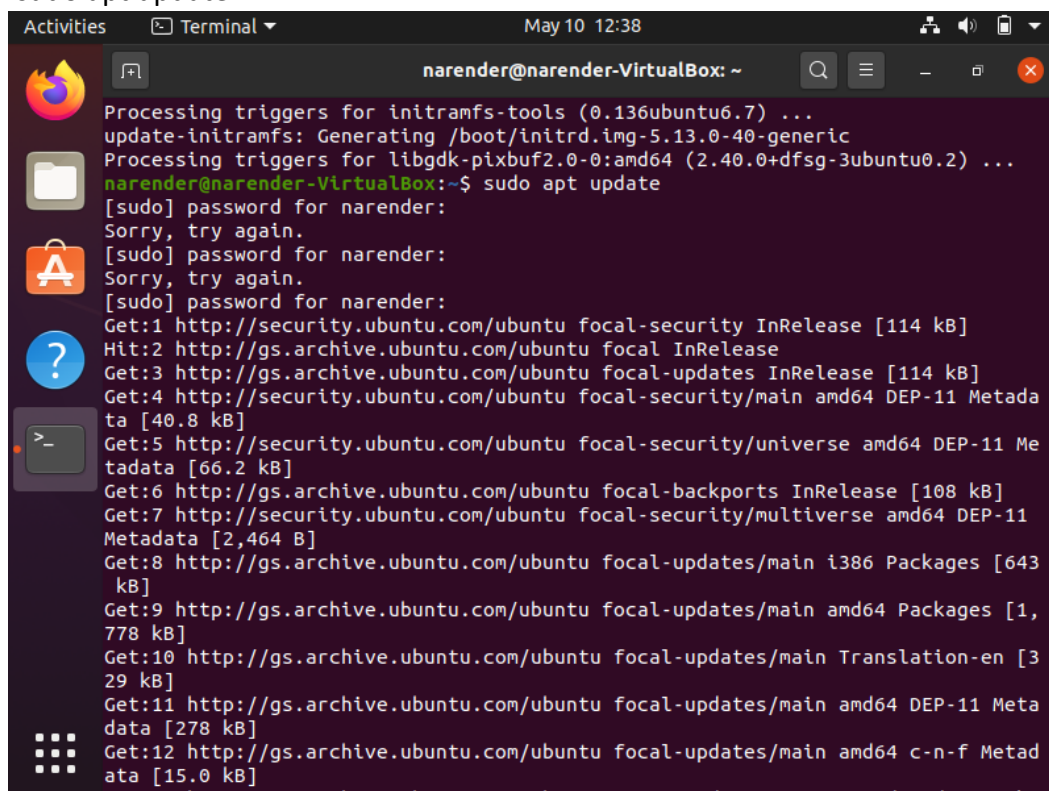
sudo apt upgrade



```
Activities Terminal May 9 23:30
narendern@narendern-VirtualBox: ~
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

narendern@narendern-VirtualBox:~$ sudo apt upgrade
[sudo] password for narendern:
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1 libllvm10
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  distro-info gir1.2-clutter-1.0 gir1.2-clutter-gst-3.0 gir1.2-cogl-1.0
  gir1.2-coglplango-1.0 gir1.2-gst-plugins-base-1.0 gir1.2-gtkclutter-1.0
  libfwupdplugin5 libjcat1
The following packages will be upgraded:
  alsa-ucm-conf alsa-utils appport appport-gtk apt apt-utils aptdaemon-data
  avahi-utils base-files bash bind9-dnsutils bind9-libs bluez-obexd bolt
  cheese-common command-not-found cpp-9 dbus-user-session dirmngr enchant-2
  evince evince-common evolution-data-server evolution-data-server-common
  fdisk file-roller fonts-noto-color-emoji fonts-noto-mono fprintd
  friendly-recovery fwupd fwupd-signed gcc-9-base gdb gdbserver gdm3
  gir1.2-gdm-1.0 gir1.2-gnomebluetooth-1.0 gir1.2-gnomedesktop-3.0
  gir1.2-goa-1.0 gir1.2-gtk-3.0 gir1.2-gweather-3.0 gir1.2-mutter-6
  gir1.2-nm-1.0 gir1.2-nma-1.0 gir1.2-rsvg-2.0 gir1.2-secret-1 gir1.2-snapd-1
  gjs gnome-bluetooth gnome-control-center gnome-control-center-data
  gnome-control-center-faces gnome-desktop3-data gnome-disk-utility
  gnome-initial-setup gnome-online-accounts gnome-settings-daemon
  gnome-shell gnome-shell-common gnome-shell-common-theme-dark gnome-shell-theme-dark
  gnome-shell-theme-light gnome-shell-theme-light-theme-dark
  gnome-shell-theme-light-theme-light
```

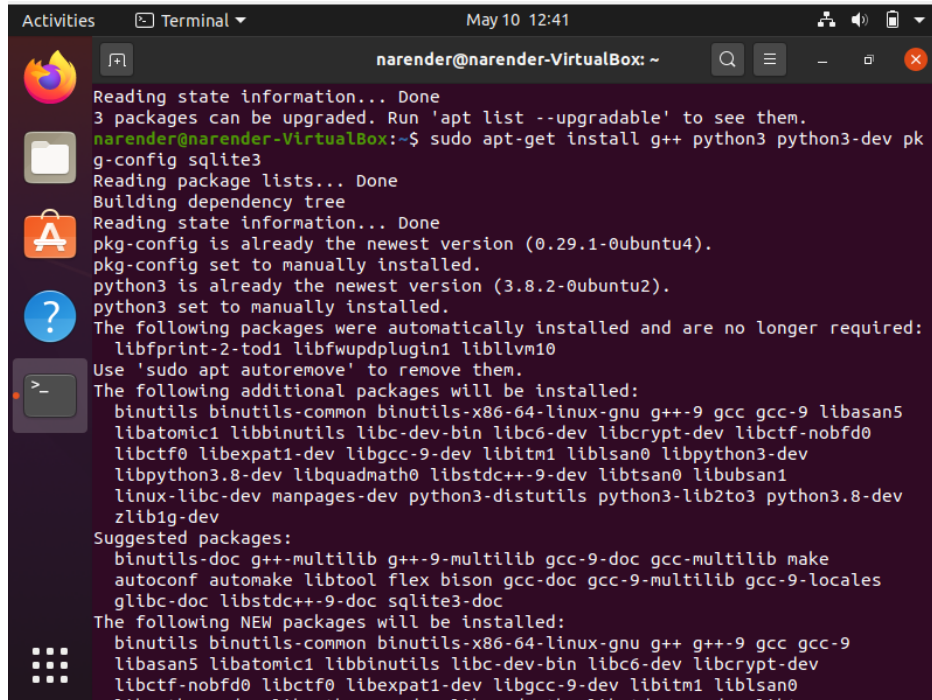
sudo apt update



```
Activities Terminal May 10 12:38
narendern@narendern-VirtualBox: ~
Processing triggers for initramfs-tools (0.136ubuntu6.7) ...
update-initramfs: Generating /boot/initrd.img-5.13.0-40-generic
Processing triggers for libgdk-pixbuf2.0-0:amd64 (2.40.0+dfsg-3ubuntu0.2) ...
narendern@narendern-VirtualBox:~$ sudo apt update
[sudo] password for narendern:
Sorry, try again.
[sudo] password for narendern:
Sorry, try again.
[sudo] password for narendern:
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:2 http://gs.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://gs.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/main amd64 DEP-11 Metadata [40.8 kB]
Get:5 http://security.ubuntu.com/ubuntu focal-security/universe amd64 DEP-11 Metadata [66.2 kB]
Get:6 http://gs.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:7 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 DEP-11 Metadata [2,464 B]
Get:8 http://gs.archive.ubuntu.com/ubuntu focal-updates/main i386 Packages [643 kB]
Get:9 http://gs.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [1,778 kB]
Get:10 http://gs.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [329 kB]
Get:11 http://gs.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [278 kB]
Get:12 http://gs.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [15.0 kB]
Get:13 http://gs.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [1,778 kB]
```

## 2. Minimal requirements for Python API users

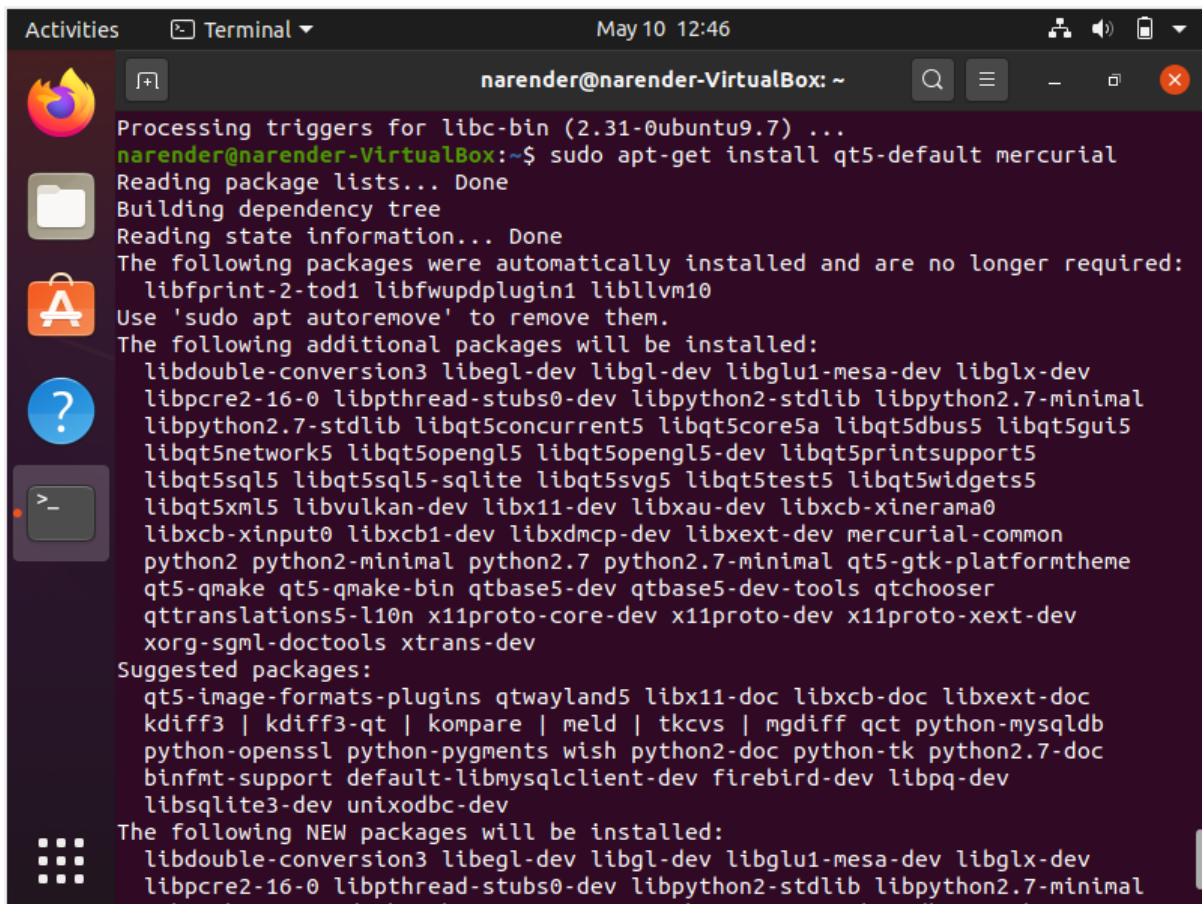
`sudo apt-get install g++ python3 python3-dev pkg-config sqlite3`



```
Activities Terminal May 10 12:41
narendar@narendar-VirtualBox: ~
Reading state information... Done
3 packages can be upgraded. Run 'apt list --upgradable' to see them.
narendar@narendar-VirtualBox:~$ sudo apt-get install g++ python3 python3-dev pk
g-config sqlite3
Reading package lists... Done
Building dependency tree
Reading state information... Done
pkg-config is already the newest version (0.29.1-0ubuntu4).
pkg-config set to manually installed.
python3 is already the newest version (3.8.2-0ubuntu2).
python3 set to manually installed.
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1 libllvm10
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu g++-9 gcc gcc-9 libasan5
  libatomic1 libbinutils libc-dev-bin libc6-dev libcrypt-dev libctf-nobfd0
  libctf0 libexpat1-dev libgcc-9-dev libitm1 liblsan0 libpython3-dev
  libpython3.8-dev libquadmath0 libstdc++-9-dev libtsan0 libubsan1
  linux-libc-dev manpages-dev python3-distutils python3-lib2to3 python3.8-dev
  zlib1g-dev
Suggested packages:
  binutils-doc g++-9-multilib g++-9-multilib gcc-9-doc gcc-multilib make
  autoconf automake libtool flex bison gcc-doc gcc-9-multilib gcc-9-locales
  glibc-doc libstdc++-9-doc sqlite3-doc
The following NEW packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu g++ g++-9 gcc gcc-9
  libasan5 libatomic1 libbinutils libc-dev-bin libc6-dev libcrypt-dev
  libctf-nobfd0 libctf0 libexpat1-dev libgcc-9-dev libitm1 liblsan0
  libpython3-dev libpython3.8-dev libquadmath0 libstdc++-9-dev libtsan0
  libubsan1 linux-libc-dev manpages-dev python3-distutils python3-lib2to3
  python3.8-dev zlib1g-dev
```

## 3. qt5 development tools are needed for Netanim animator:

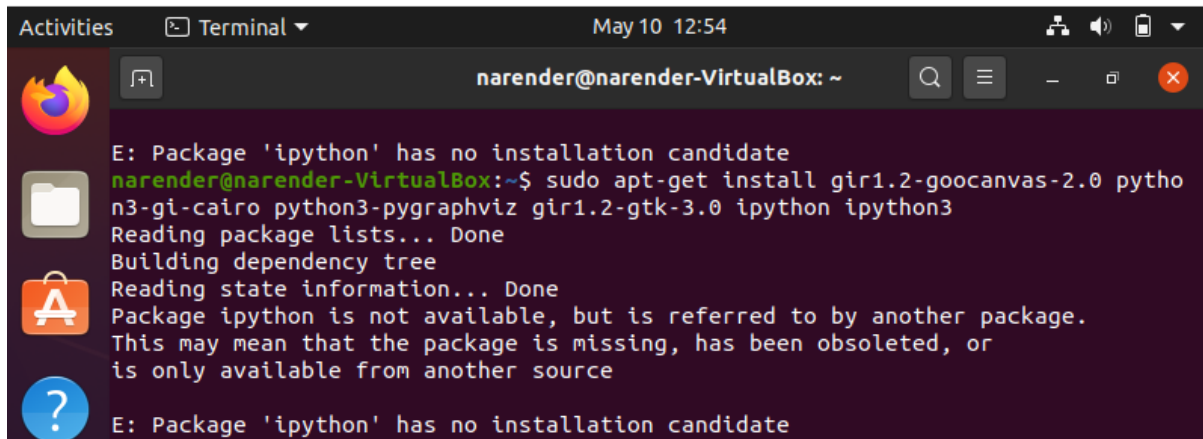
`sudo apt-get install qt5-default mercurial`



```
Activities Terminal May 10 12:46
narendar@narendar-VirtualBox: ~
Processing triggers for libc-bin (2.31-0ubuntu9.7) ...
narendar@narendar-VirtualBox:~$ sudo apt-get install qt5-default mercurial
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1 libllvm10
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libdouble-conversion3 libegl-dev libgl-dev libglu1-mesa-dev libglx-dev
  libpcre2-16-0 libpthread-stubs0-dev libpython2-stdlib libpython2.7-minimal
  libpython2.7-stdlib libqt5concurrent5 libqt5core5a libqt5dbus5 libqt5gui5
  libqt5network5 libqt5opengl5 libqt5opengl5-dev libqt5printsupport5
  libqt5sql5 libqt5sql5-sqlite libqt5svg5 libqt5test5 libqt5widgets5
  libqt5xml5 libvulkan-dev libx11-dev libxau-dev libxcb-xinerama0
  libxcb-xinput0 libxcb1-dev libxdmcp-dev libxext-dev mercurial-common
  python2 python2-minimal python2.7 python2.7-minimal qt5-gtk-platformtheme
  qt5-qmake qt5-qmake-bin qtbase5-dev qtbase5-dev-tools qtchooser
  qttranslations5-l10n x11proto-core-dev x11proto-dev x11proto-xext-dev
  xorg-sgml-doctools xtrans-dev
Suggested packages:
  qt5-image-formats-plugins qtwayland5 libx11-doc libxcb-doc libxext-doc
  kdiff3 | kdiff3-qt | kompare | meld | tkcvs | mgdiff qct python-mysqldb
  python-openssl python-pygments wish python2-doc python-tk python2.7-doc
  binfmt-support default-libmysqlclient-dev firebird-dev libpq-dev
  libsqlite3-dev unixodbc-dev
The following NEW packages will be installed:
  libdouble-conversion3 libegl-dev libgl-dev libglu1-mesa-dev libglx-dev
  libpcre2-16-0 libpthread-stubs0-dev libpython2-stdlib libpython2.7-minimal
  libpython2.7-stdlib libqt5concurrent5 libqt5core5a libqt5dbus5 libqt5gui5
  libqt5network5 libqt5opengl5 libqt5opengl5-dev libqt5printsupport5
  libqt5sql5 libqt5sql5-sqlite libqt5svg5 libqt5test5 libqt5widgets5
  libqt5xml5 libvulkan-dev libx11-dev libxau-dev libxcb-xinerama0
  libxcb-xinput0 libxcb1-dev libxdmcp-dev libxext-dev mercurial-common
  python2 python2-minimal python2.7 python2.7-minimal qt5-gtk-platformtheme
  qt5-qmake qt5-qmake-bin qtbase5-dev qtbase5-dev-tools qtchooser
  qttranslations5-l10n x11proto-core-dev x11proto-dev x11proto-xext-dev
  xorg-sgml-doctools xtrans-dev
```

#### 4. ns-3-pyviz visualizer:

```
sudo apt-get install gir1.2-gooCanvas-2.0 python3-gi python3-gi-cairo
python3pygraphviz gir1.2-gtk-3.0 ipython ipython3
```



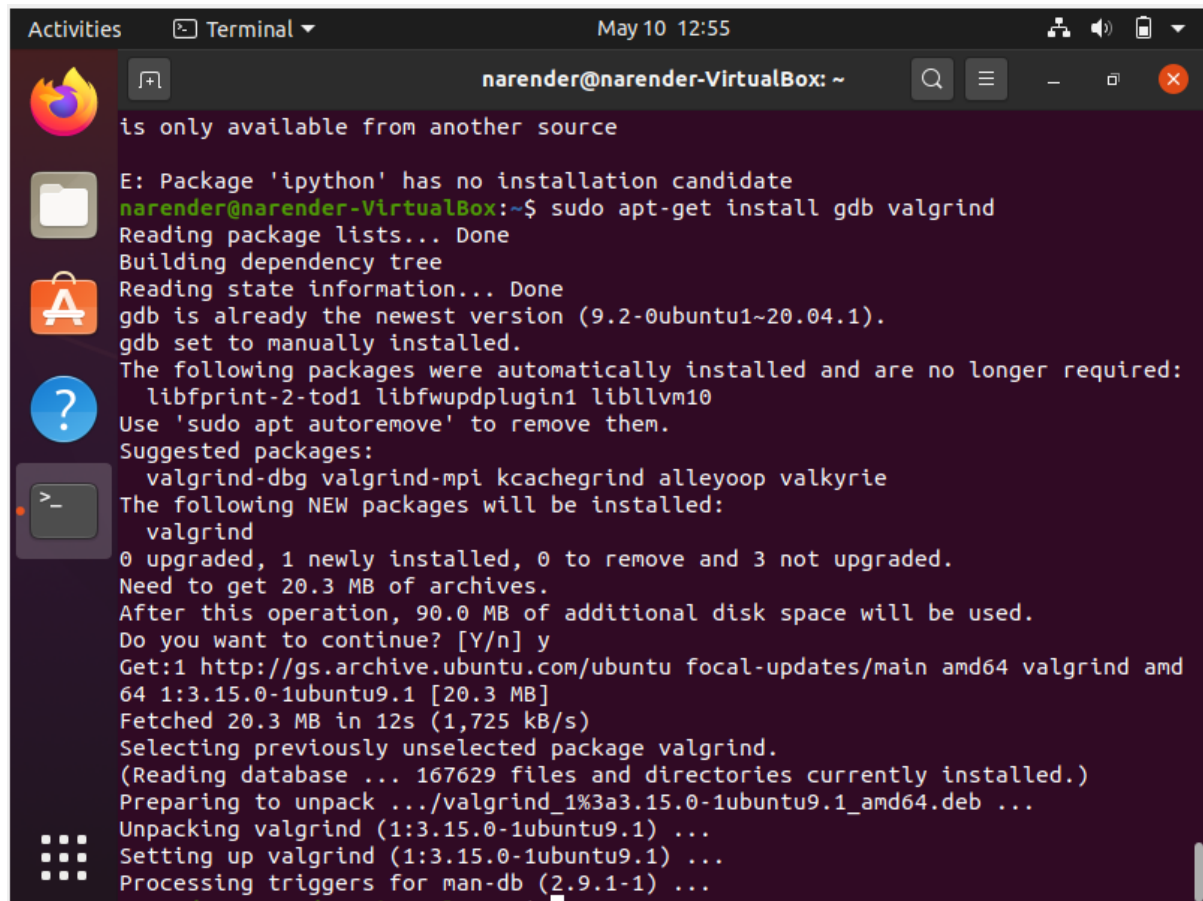
```

narenderr@narenderr-VirtualBox: ~
E: Package 'ipython' has no installation candidate
narenderr@narenderr-VirtualBox:~$ sudo apt-get install gir1.2-gooCanvas-2.0 python3-gi python3-gi-cairo python3pygraphviz gir1.2-gtk-3.0 ipython ipython3
Reading package lists... Done
Building dependency tree
Reading state information... Done
Package ipython is not available, but is referred to by another package.
This may mean that the package is missing, has been obsoleted, or
is only available from another source
E: Package 'ipython' has no installation candidate

```

#### 5. Debugging:

```
sudo apt-get install gdb valgrind
```



```

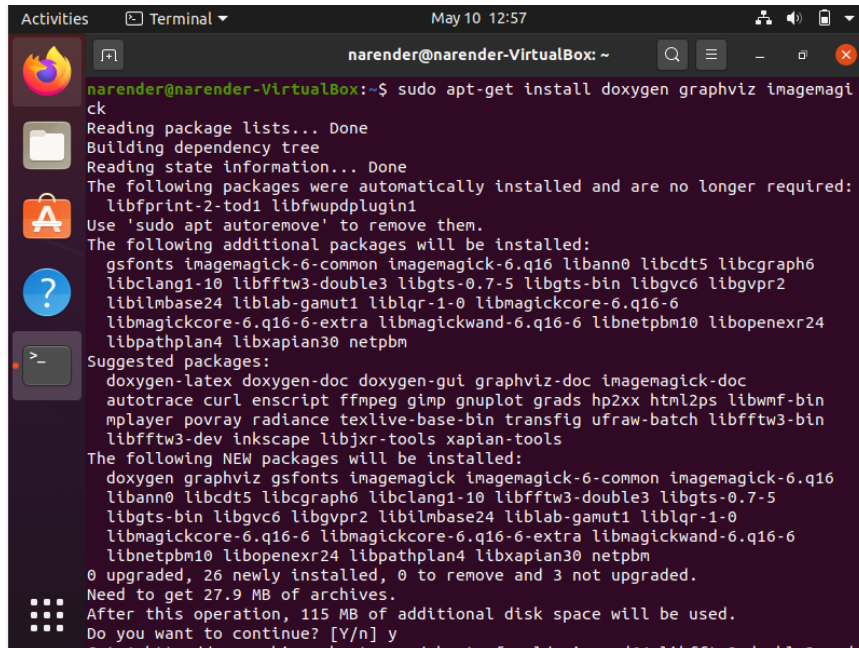
narenderr@narenderr-VirtualBox: ~
is only available from another source
E: Package 'ipython' has no installation candidate
narenderr@narenderr-VirtualBox:~$ sudo apt-get install gdb valgrind
Reading package lists... Done
Building dependency tree
Reading state information... Done
gdb is already the newest version (9.2-0ubuntu1~20.04.1).
gdb set to manually installed.
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1 libllvm10
Use 'sudo apt autoremove' to remove them.
Suggested packages:
  valgrind-dbg valgrind-mpi kcachegrind alieyoop valkyrie
The following NEW packages will be installed:
  valgrind
0 upgraded, 1 newly installed, 0 to remove and 3 not upgraded.
Need to get 20.3 MB of archives.
After this operation, 90.0 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://gs.archive.ubuntu.com/ubuntu focal-updates/main amd64 valgrind amd64 1:3.15.0-1ubuntu9.1 [20.3 MB]
Fetched 20.3 MB in 12s (1,725 kB/s)
Selecting previously unselected package valgrind.
(Reading database ... 167629 files and directories currently installed.)
Preparing to unpack .../valgrind_1%3a3.15.0-1ubuntu9.1_amd64.deb ...
Unpacking valgrind (1:3.15.0-1ubuntu9.1) ...
Setting up valgrind (1:3.15.0-1ubuntu9.1) ...
Processing triggers for man-db (2.9.1-1) ...

```



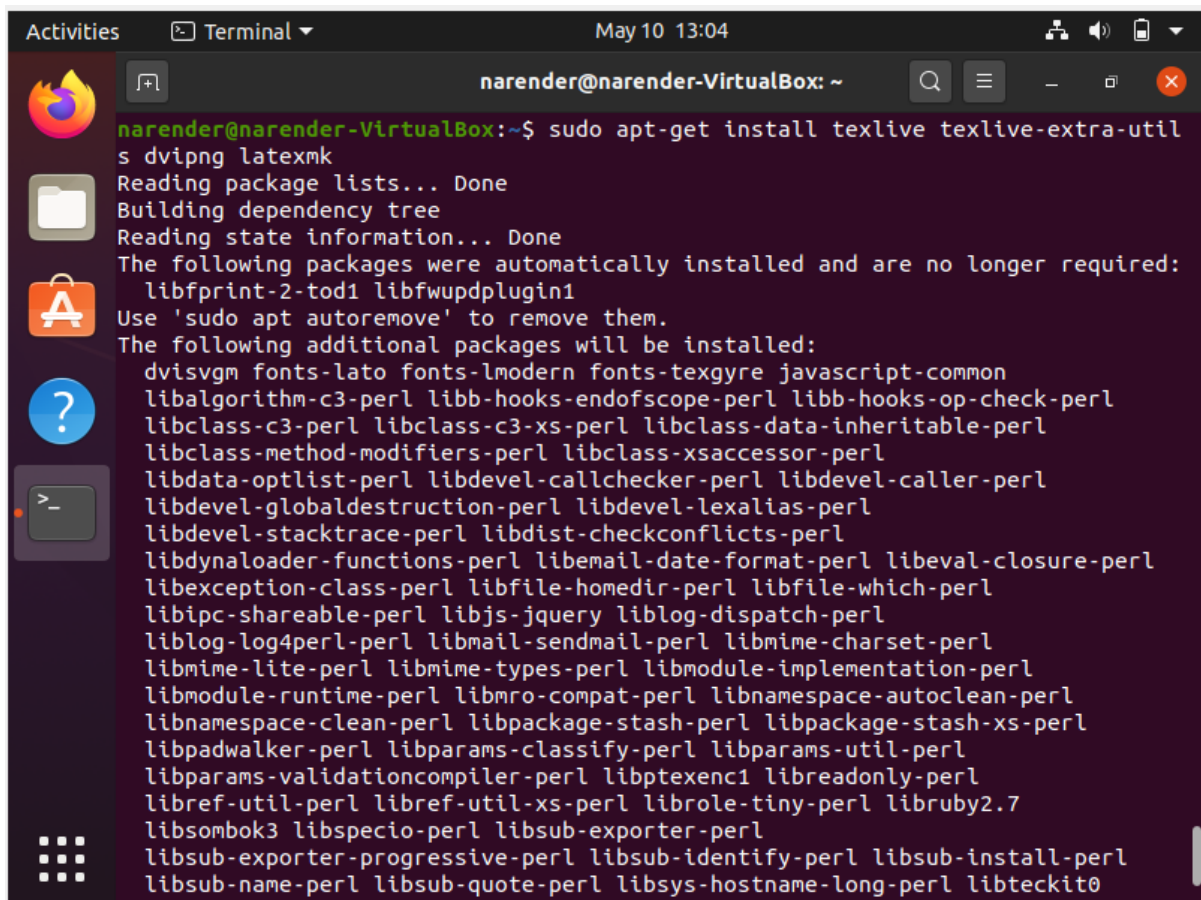
**6. Doxygen and related inline documentation:**

sudo apt-get install doxygen graphviz imagemagick



```
narender@narender-VirtualBox: ~  
narender@narender-VirtualBox:~$ sudo apt-get install doxygen graphviz imagemagick  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  libfprint-2-tod1 libfwupdplugin1  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  gsfonts imagemagick-6-common imagemagick-6.q16 libann0 libcdt5 libcgraph6  
  libclang1-10 libfftw3-double3 libgts-0.7-5 libgts-bin libgvc6 libgvpr2  
  liblmbase24 liblab-gamut1 liblqr-1-0 libmagickcore-6.q16-6  
  libmagickcore-6.q16-6-extra libmagickwand-6.q16-6 libnetpbm10 libopenexr24  
  libpathplan4 libxapian30 netpbm  
Suggested packages:  
  doxygen-latex doxygen-doc doxygen-gui graphviz-doc imagemagick-doc  
  autotrace curl enscript ffmpeg gimp gnuplot grads hp2xx html2ps libwmf-bin  
  mplayer povray radiance texlive-base-bin transfig ufrax-batch libfftw3-bin  
  libfftw3-dev inkscape libjxr-tools xapian-tools  
The following NEW packages will be installed:  
  doxygen graphviz gsfonts imagemagick imagemagick-6-common imagemagick-6.q16  
  libann0 libcdt5 libcgraph6 libclang1-10 libfftw3-double3 libgts-0.7-5  
  libgts-bin libgvc6 libgvpr2 liblmbase24 liblab-gamut1 liblqr-1-0  
  libmagickcore-6.q16-6 libmagickcore-6.q16-6-extra libmagickwand-6.q16-6  
  libnetpbm10 libopenexr24 libpathplan4 libxapian30 netpbm  
0 upgraded, 26 newly installed, 0 to remove and 3 not upgraded.  
Need to get 27.9 MB of archives.  
After this operation, 115 MB of additional disk space will be used.  
Do you want to continue? [Y/n] y
```

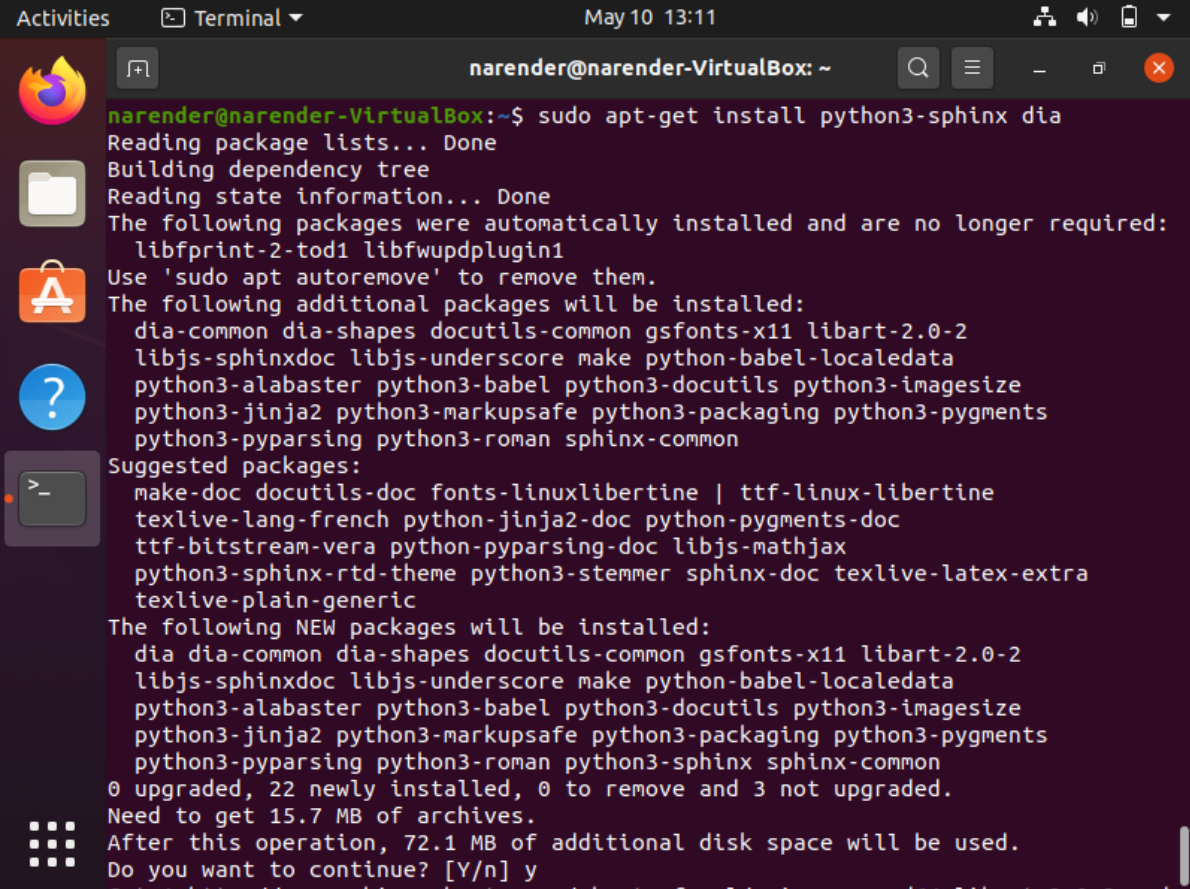
sudo apt-get install texlive texlive-extra-utils texlive-latex-extra texlive-font-utils dvipng latexmk



```
narender@narender-VirtualBox: ~  
narender@narender-VirtualBox:~$ sudo apt-get install texlive texlive-extra-util  
s dvipng latexmk  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  libfprint-2-tod1 libfwupdplugin1  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  dvisvgm fonts-lato fonts-lmodern fonts-texgyre javascript-common  
  libalgorithm-c3-perl libb-hooks-endofscope-perl libb-hooks-op-check-perl  
  libclass-c3-perl libclass-c3-xs-perl libclass-data-inheritable-perl  
  libclass-method-modifiers-perl libclass-xsaccessor-perl  
  libdata-optlist-perl libdevel-callchecker-perl libdevel-caller-perl  
  libdevel-globaldestruction-perl libdevel-lexalias-perl  
  libdevel-stacktrace-perl libdist-checkconflicts-perl  
  libdynaloader-functions-perl libemail-date-format-perl libeval-closure-perl  
  libexception-class-perl libfile-homedir-perl libfile-which-perl  
  libipc-shareable-perl libjs-jquery liblog-dispatch-perl  
  liblog-log4perl-perl libmail-sendmail-perl libmime-charset-perl  
  libmime-lite-perl libmime-types-perl libmodule-implementation-perl  
  libmodule-runtime-perl libmro-compat-perl libnamespace-autoclean-perl  
  libnamespace-clean-perl libpackage-stash-perl libpackage-stash-xs-perl  
  libpadwalker-perl libparams-classify-perl libparams-util-perl  
  libparams-validationcompiler-perl libptexenc1 libreadonly-perl  
  libref-util-perl libref-util-xs-perl librole-tiny-perl libruby2.7  
  libsombok3 libspecio-perl libsub-exporter-perl  
  libsub-exporter-progressive-perl libsub-identify-perl libsub-install-perl  
  libsub-name-perl libsub-quote-perl libsys-hostname-long-perl libteckit0
```

7. The ns-3 manual and tutorial are written in reStructuredText for Sphinx (doc/tutorial, doc/manual, doc/models), and figures typically in dia (also needs the texlive packages above):

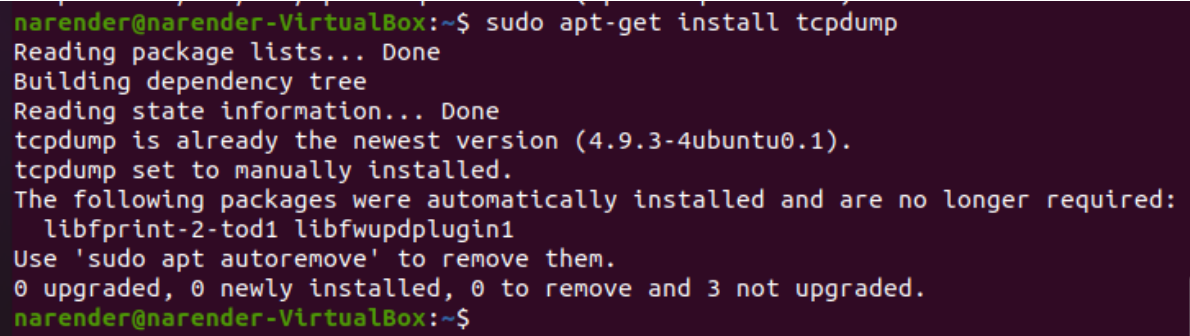
sudo apt-get install python3-sphinx dia



```
narender@narender-VirtualBox: ~  
narender@narender-VirtualBox:~$ sudo apt-get install python3-sphinx dia  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  libfprint-2-tod1 libfwupdplugin1  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  dia-common dia-shapes docutils-common gsfonts-x11 libart-2.0-2  
  libjs-sphinxdoc libjs-underscore make python-babel-localedata  
  python3-alabaster python3-babel python3-docutils python3-imagesize  
  python3-jinja2 python3-markupsafe python3-packaging python3-pygments  
  python3-pyparsing python3-roman sphinx-common  
Suggested packages:  
  make-doc docutils-doc fonts-linuxlibertine | ttf-linux-libertine  
  texlive-lang-french python-jinja2-doc python-pygments-doc  
  ttf-bitstream-vera python-pyparsing-doc libjs-mathjax  
  python3-sphinx-rtd-theme python3-stemmer sphinx-doc texlive-latex-extra  
  texlive-plain-generic  
The following NEW packages will be installed:  
  dia dia-common dia-shapes docutils-common gsfonts-x11 libart-2.0-2  
  libjs-sphinxdoc libjs-underscore make python-babel-localedata  
  python3-alabaster python3-babel python3-docutils python3-imagesize  
  python3-jinja2 python3-markupsafe python3-packaging python3-pygments  
  python3-pyparsing python3-roman python3-sphinx sphinx-common  
0 upgraded, 22 newly installed, 0 to remove and 3 not upgraded.  
Need to get 15.7 MB of archives.  
After this operation, 72.1 MB of additional disk space will be used.  
Do you want to continue? [Y/n] y
```

8. To read pcap packet traces:

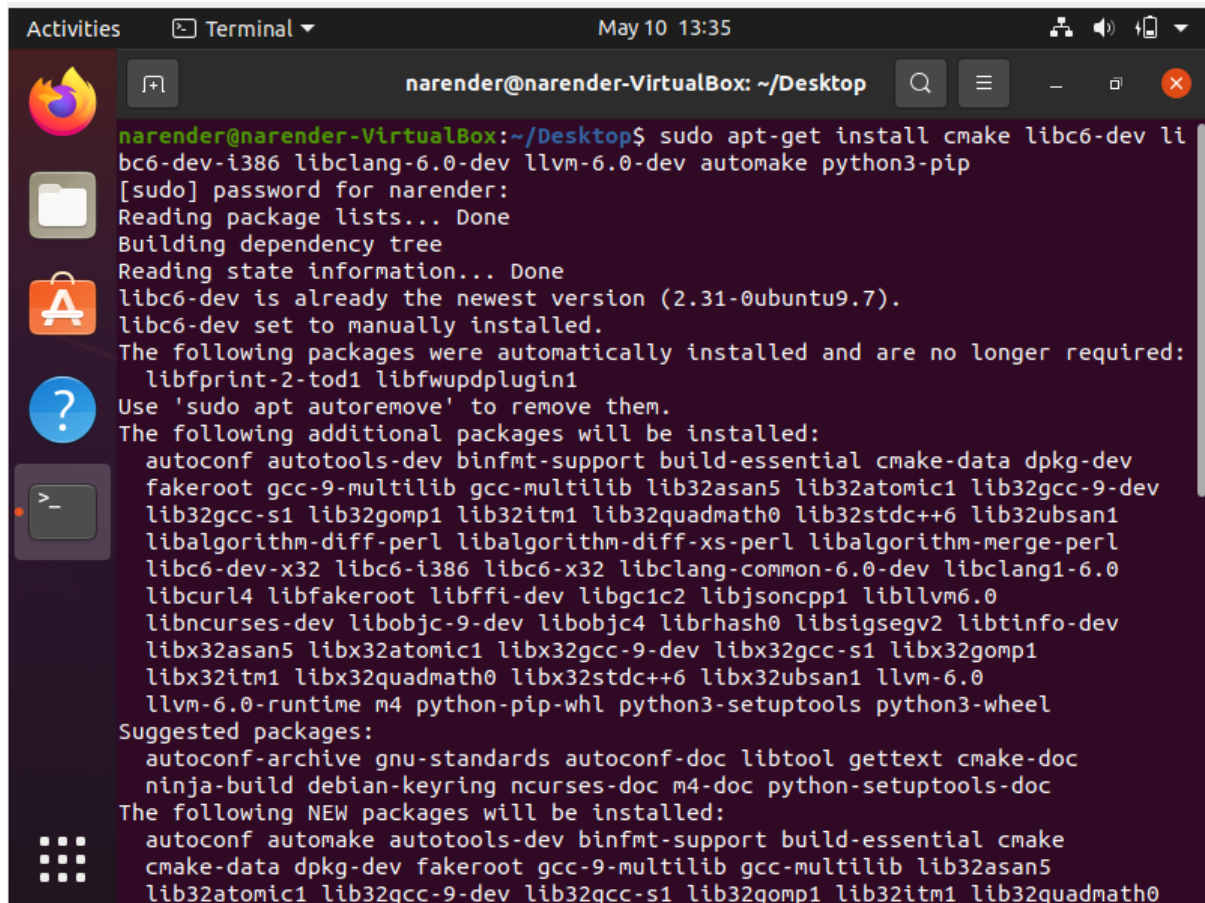
sudo apt-get install tcpdump



```
narender@narender-VirtualBox:~$ sudo apt-get install tcpdump  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
tcpdump is already the newest version (4.9.3-4ubuntu0.1).  
tcpdump set to manually installed.  
The following packages were automatically installed and are no longer required:  
  libfprint-2-tod1 libfwupdplugin1  
Use 'sudo apt autoremove' to remove them.  
0 upgraded, 0 newly installed, 0 to remove and 3 not upgraded.  
narender@narender-VirtualBox:~$
```

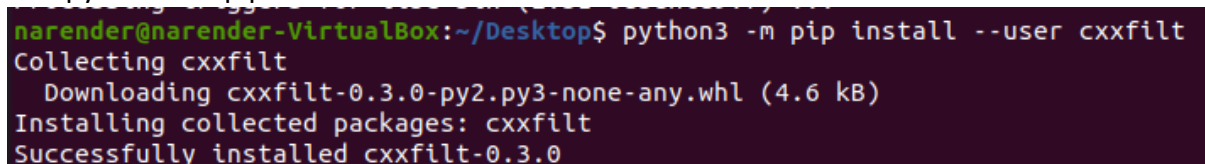
9. Support for generating modified python bindings:

sudo apt-get install cmake libc6-dev libc6-dev-i386 libclang-6.0-dev llvm-6.0-dev  
automake python3-pip



```
narender@narender-VirtualBox: ~/Desktop
narender@narender-VirtualBox:~/Desktop$ sudo apt-get install cmake lib64-dev lib64-dev-i386 libclang-6.0-dev llvm-6.0-dev automake python3-pip
[sudo] password for narender:
Reading package lists... Done
Building dependency tree
Reading state information... Done
lib64-dev is already the newest version (2.31-0ubuntu9.7).
lib64-dev set to manually installed.
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  autoconf autotools-dev binfmt-support build-essential cmake-data dpkg-dev
  fakeroot gcc-9-multilib gcc-multilib lib32asan5 lib32atomic1 lib32gcc-9-dev
  lib32gcc-s1 lib32gomp1 lib32itm1 lib32quadmath0 lib32stdc++6 lib32ubsan1
  libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl
  libc6-dev-x32 libc6-i386 libc6-x32 libclang-common-6.0-dev libclang1-6.0
  libcurl4 libfakeroot libffi-dev libgc1c2 libjsoncpp1 libllvm6.0
  libncurses-dev libobjc-9-dev libobjc4 librtmp0 libsigsegv2 libtinfo-dev
  libx32asan5 libx32atomic1 libx32gcc-9-dev libx32gcc-s1 libx32gomp1
  libx32itm1 libx32quadmath0 libx32stdc++6 libx32ubsan1 llvm-6.0
  llvm-6.0-runtime m4 python-pip-whl python3-setuptools python3-wheel
Suggested packages:
  autoconf-archive gnu-standards autoconf-doc libtool gettext cmake-doc
  ninja-build debian-keyring ncurses-doc m4-doc python-setuptools-doc
The following NEW packages will be installed:
  autoconf automake autotools-dev binfmt-support build-essential cmake
  cmake-data dpkg-dev fakeroot gcc-9-multilib gcc-multilib lib32asan5
  lib32atomic1 lib32gcc-9-dev lib32gcc-s1 lib32gomp1 lib32itm1 lib32quadmath0
```

python3 -m pip install --user cxxfilt



```
narender@narender-VirtualBox:~/Desktop$ python3 -m pip install --user cxxfilt
Collecting cxxfilt
  Downloading cxxfilt-0.3.0-py2.py3-none-any.whl (4.6 kB)
Installing collected packages: cxxfilt
Successfully installed cxxfilt-0.3.0
```

#### 10. ns-3 Build and test:

Go to ns-3.33 folder

cd workspace/ ns-allinone-3.33/

./build.py --enable-examples --enable-tests

wget -c <https://www.nsnam.org/releases/ns-allinone-3.33.tar.bz2>



```
narender@narender-VirtualBox:~/Desktop$ wget -c https://www.nsnam.org/releases/
ns-allinone-3.33.tar.bz2
--2022-05-10 13:58:09-- https://www.nsnam.org/releases/ns-allinone-3.33.tar.bz
2
Resolving www.nsnam.org (www.nsnam.org)... 143.215.76.161
Connecting to www.nsnam.org (www.nsnam.org)|143.215.76.161|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 28412785 (27M) [application/x-bzip2]
Saving to: 'ns-allinone-3.33.tar.bz2'

ns-allinone-3.33.ta 100%[=====] 27.10M 1.98MB/s in 17s

2022-05-10 13:58:27 (1.59 MB/s) - 'ns-allinone-3.33.tar.bz2' saved [28412785/28
412785]

narender@narender-VirtualBox:~/Desktop$
```

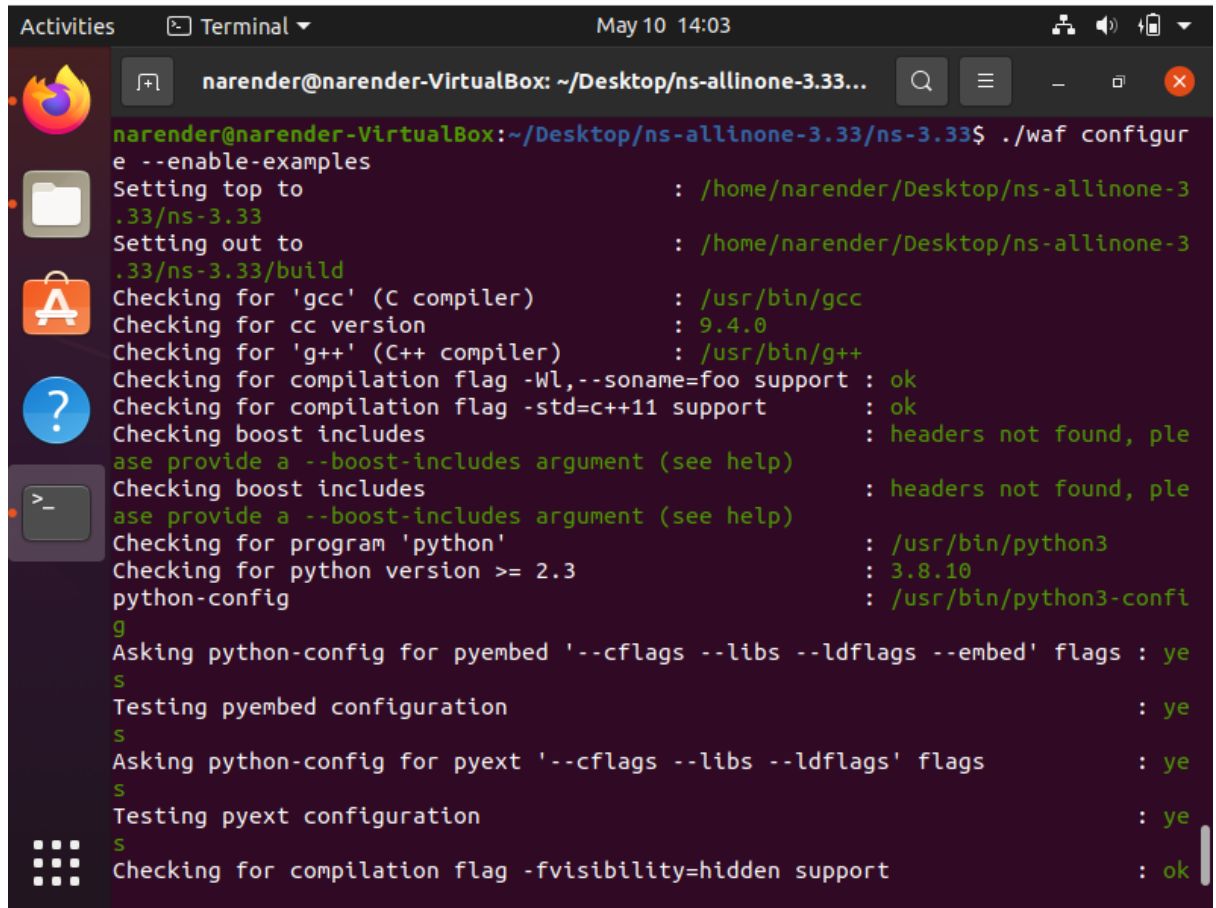
tar -xvzf ns-allinone-3.33.tar.bz2

```
narender@narender-VirtualBox:~/Desktop$ tar -xvzf ns-allinone-3.33.tar.bz2
ns-allinone-3.33/ns-3.33/wscript
ns-allinone-3.33/ns-3.33/utils.py
ns-allinone-3.33/ns-3.33/wutils.py
ns-allinone-3.33/ns-3.33/test.py
ns-allinone-3.33/ns-3.33/LICENSE
ns-allinone-3.33/ns-3.33/CHANGES.html
ns-allinone-3.33/ns-3.33/Makefile
ns-allinone-3.33/ns-3.33/README.md
ns-allinone-3.33/ns-3.33/waf
ns-allinone-3.33/ns-3.33/testpy.supp
ns-allinone-3.33/ns-3.33/AUTHORS
ns-allinone-3.33/ns-3.33/waf.bat
ns-allinone-3.33/ns-3.33/RELEASE_NOTES
ns-allinone-3.33/ns-3.33/CONTRIBUTING.md
ns-allinone-3.33/ns-3.33/VERSION
ns-allinone-3.33/ns-3.33/contrib/wscript
ns-allinone-3.33/ns-3.33/examples/socket/wscript
ns-allinone-3.33/ns-3.33/examples/socket/socket-options-ipv6.cc
ns-allinone-3.33/ns-3.33/examples/socket/socket-options-ipv4.cc
ns-allinone-3.33/ns-3.33/examples/socket/socket-bound-tcp-static-routing.cc
ns-allinone-3.33/ns-3.33/examples/socket/socket-bound-static-routing.cc
ns-allinone-3.33/ns-3.33/examples/traffic-control/wscript
ns-allinone-3.33/ns-3.33/examples/traffic-control/red-vs-nlred.cc
ns-allinone-3.33/ns-3.33/examples/traffic-control/cobalt-vs-codel.cc
```

cd ns-allinone-3.33/ns-3.33/

```
narender@narender-VirtualBox:~/Desktop$ cd ns-allinone-3.33/ns-3.33/
narender@narender-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$
```

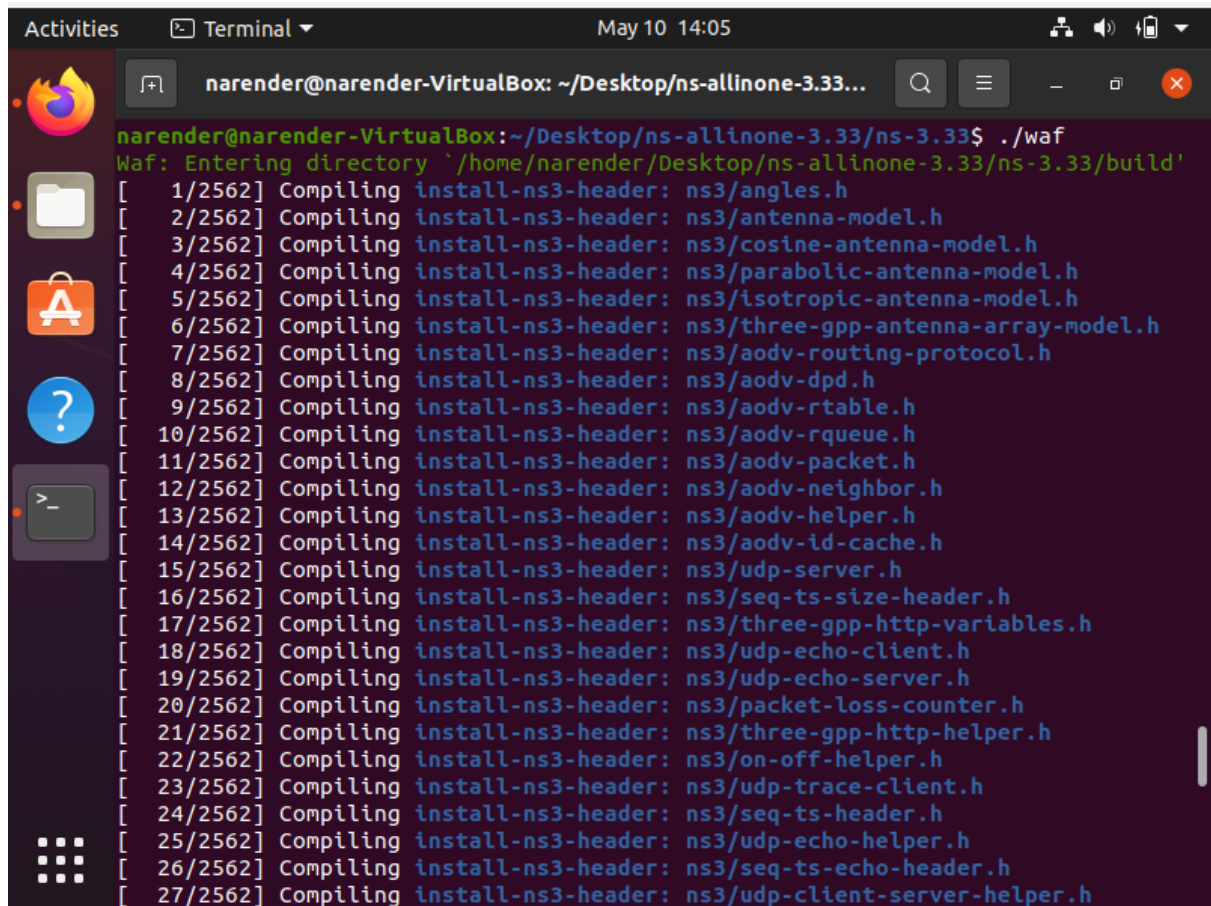
# Configure the installation  
./waf configure --enable-examples



```

narenderr@narenderr-VirtualBox: ~/Desktop/ns-allinone-3.33...
narenderr@narenderr-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$ ./waf configure --enable-examples
Setting top to : /home/narenderr/Desktop/ns-allinone-3.33/ns-3.33
Setting out to : /home/narenderr/Desktop/ns-allinone-3.33/ns-3.33/build
Checking for 'gcc' (C compiler) : /usr/bin/gcc
Checking for cc version : 9.4.0
Checking for 'g++' (C++ compiler) : /usr/bin/g++
Checking for compilation flag -Wl,--soname=foo support : ok
Checking for compilation flag -std=c++11 support : ok
Checking boost includes : headers not found, please provide a --boost-includes argument (see help)
Checking boost includes : headers not found, please provide a --boost-includes argument (see help)
Checking for program 'python' : /usr/bin/python3
Checking for python version >= 2.3 : 3.8.10
python-config : /usr/bin/python3-config
Asking python-config for pyembed '--cflags --libs --ldflags --embed' flags : yes
Testing pyembed configuration : yes
Asking python-config for pyext '--cflags --libs --ldflags' flags : yes
Testing pyext configuration : yes
Checking for compilation flag -fvisibility=hidden support : ok
  
```

# Build ns-3 installation  
./waf



```
narendar@narendar-VirtualBox: ~/Desktop/ns-allinone-3.33...
narendar@narendar-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$ ./waf
Waf: Entering directory `/home/narendar/Desktop/ns-allinone-3.33/ns-3.33/build'
[ 1/2562] Compiling install-ns3-header: ns3/angles.h
[ 2/2562] Compiling install-ns3-header: ns3/antenna-model.h
[ 3/2562] Compiling install-ns3-header: ns3/cosine-antenna-model.h
[ 4/2562] Compiling install-ns3-header: ns3/parabolic-antenna-model.h
[ 5/2562] Compiling install-ns3-header: ns3/isotropic-antenna-model.h
[ 6/2562] Compiling install-ns3-header: ns3/three-gpp-antenna-array-model.h
[ 7/2562] Compiling install-ns3-header: ns3/aodv-routing-protocol.h
[ 8/2562] Compiling install-ns3-header: ns3/aodv-dpd.h
[ 9/2562] Compiling install-ns3-header: ns3/aodv-rtable.h
[10/2562] Compiling install-ns3-header: ns3/aodv-rqueue.h
[11/2562] Compiling install-ns3-header: ns3/aodv-packet.h
[12/2562] Compiling install-ns3-header: ns3/aodv-neighbor.h
[13/2562] Compiling install-ns3-header: ns3/aodv-helper.h
[14/2562] Compiling install-ns3-header: ns3/aodv-id-cache.h
[15/2562] Compiling install-ns3-header: ns3/udp-server.h
[16/2562] Compiling install-ns3-header: ns3/seq-ts-size-header.h
[17/2562] Compiling install-ns3-header: ns3/three-gpp-http-variables.h
[18/2562] Compiling install-ns3-header: ns3/udp-echo-client.h
[19/2562] Compiling install-ns3-header: ns3/udp-echo-server.h
[20/2562] Compiling install-ns3-header: ns3/packet-loss-counter.h
[21/2562] Compiling install-ns3-header: ns3/three-gpp-http-helper.h
[22/2562] Compiling install-ns3-header: ns3/on-off-helper.h
[23/2562] Compiling install-ns3-header: ns3/udp-trace-client.h
[24/2562] Compiling install-ns3-header: ns3/seq-ts-header.h
[25/2562] Compiling install-ns3-header: ns3/udp-echo-helper.h
[26/2562] Compiling install-ns3-header: ns3/seq-ts-echo-header.h
[27/2562] Compiling install-ns3-header: ns3/udp-client-server-helper.h
```

*# to check whether installation was a success*

`./waf --run hello-simulator`

*# navigate to netanim dir.*

`cd ns-allinone-3.33/netanim-3.108/`

*# configure the build*

`make clean`

*# compile the build*

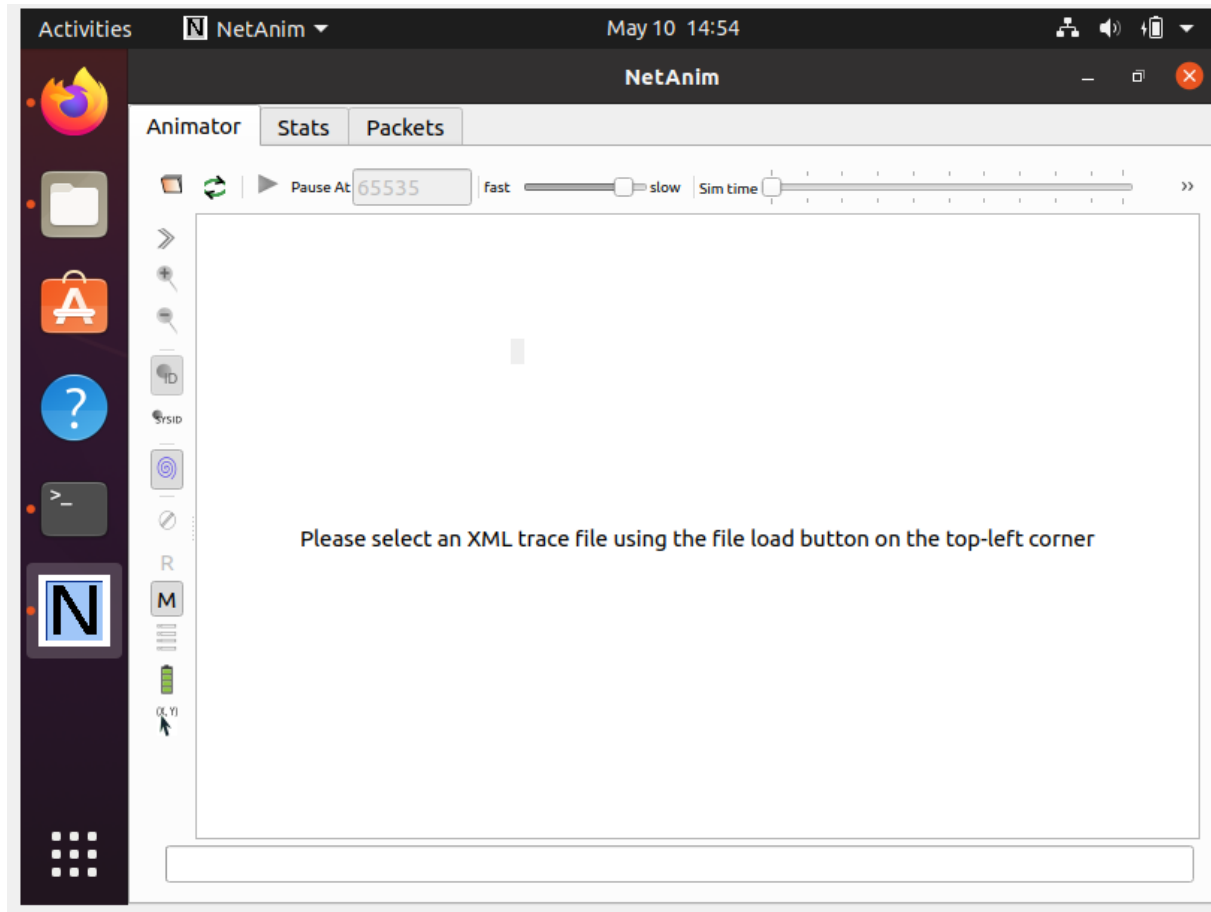
`qmake NetAnim.pro`

*# build netanim installation*

`make`

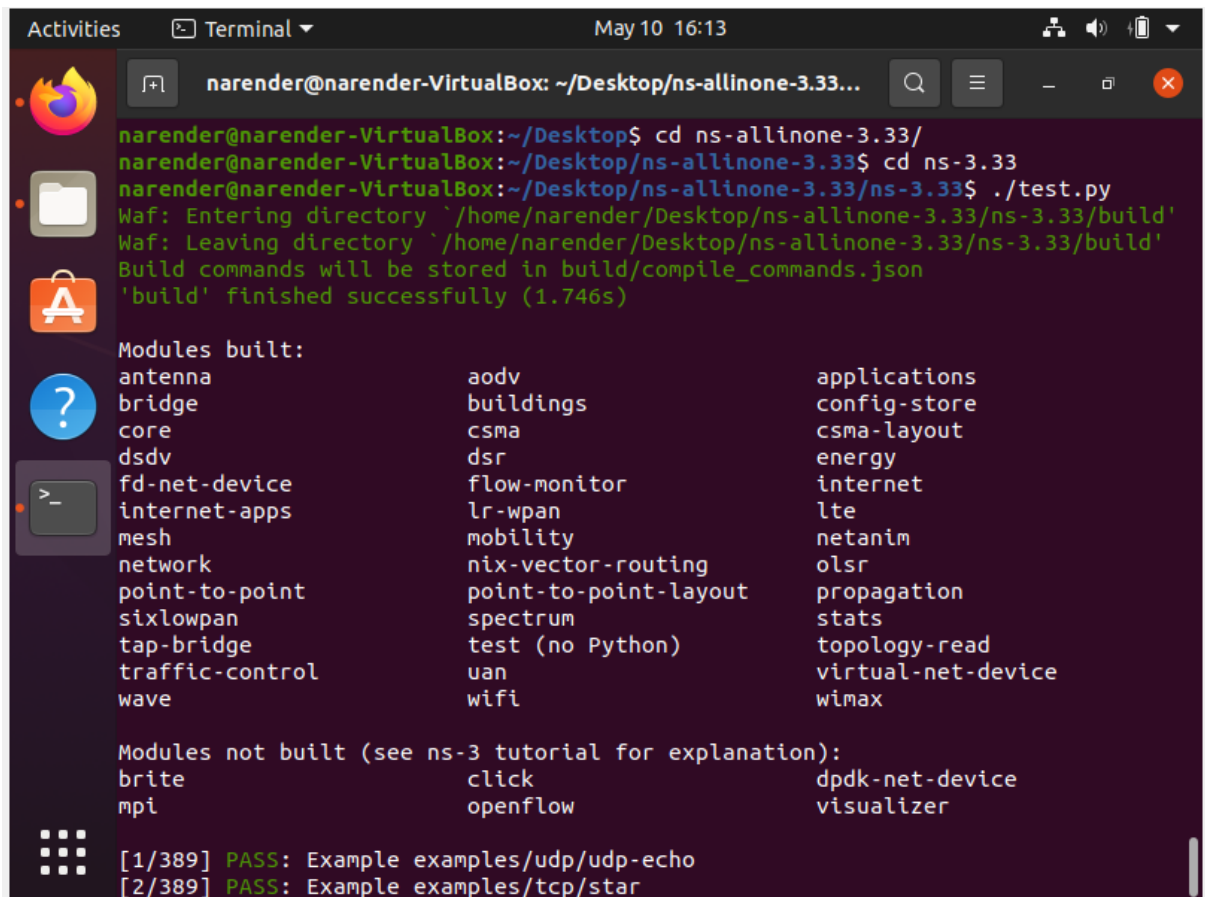
*# to execute NetAnim*

`./NetAnim`



11. **Test the NS3 build and installation success by running test.py in the ns directory using the following commands:**

```
cd workspace/ ns-allinone-3.33/ ns-3.33  
./test.py
```



```

Activities  Terminal  May 10 16:13
narender@narender-VirtualBox: ~/Desktop/ns-allinone-3.33...

narender@narender-VirtualBox:~/Desktop$ cd ns-allinone-3.33/
narender@narender-VirtualBox:~/Desktop/ns-allinone-3.33$ cd ns-3.33
narender@narender-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$ ./test.py
Waf: Entering directory `/home/narender/Desktop/ns-allinone-3.33/ns-3.33/build'
Waf: Leaving directory `/home/narender/Desktop/ns-allinone-3.33/ns-3.33/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (1.746s)

Modules built:
antenna          aodv             applications
bridge           buildings        config-store
core             csma             csma-layout
dsdv             dsr              energy
fd-net-device    flow-monitor     internet
internet-apps    lr-wpan          lte
mesh             mobility         netanim
network          nix-vector-routing olsr
point-to-point   point-to-point-layout propagation
sixlowpan        spectrum         stats
tap-bridge       test (no Python) topology-read
traffic-control  uan              virtual-net-device
wave             wifi             wimax

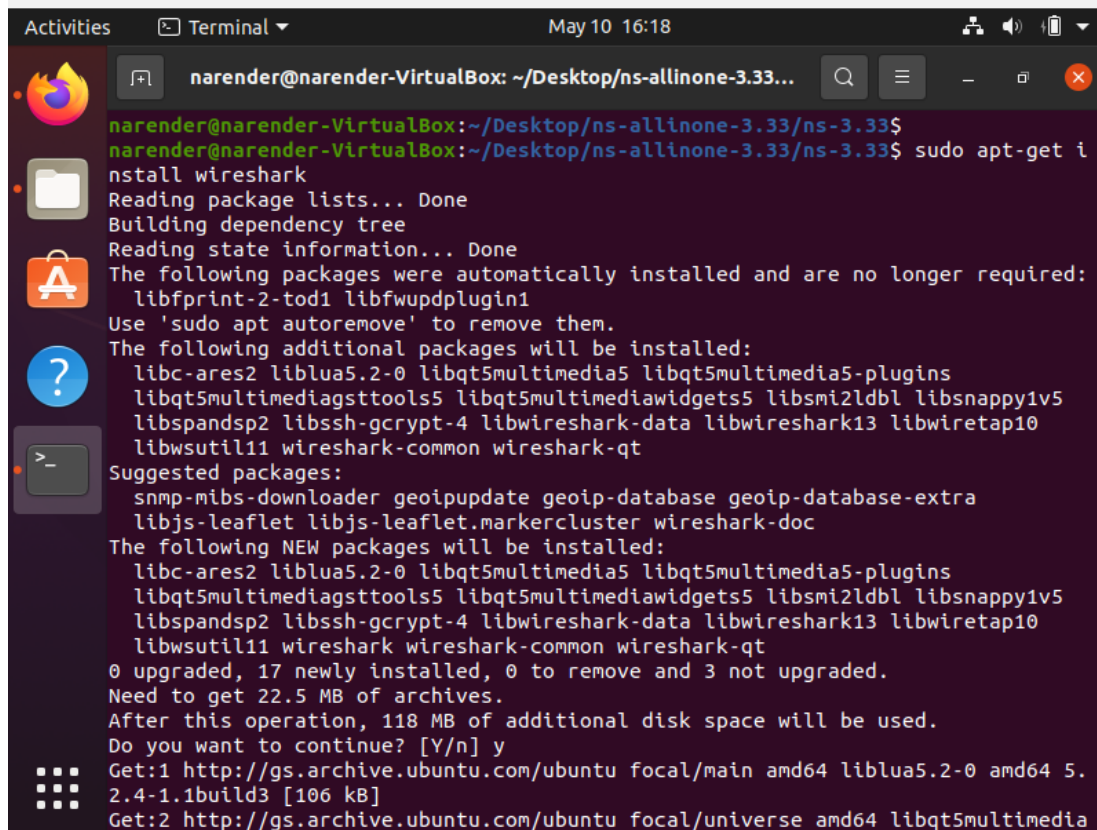
Modules not built (see ns-3 tutorial for explanation):
brite            click            dpdk-net-device
mpi              openflow         visualizer

[1/389] PASS: Example examples/udp/udp-echo
[2/389] PASS: Example examples/tcp/star
  
```

## 12. Install WireShark

sudo apt-get install wireshark





```
Activities Terminal May 10 16:18
narendar@narendar-VirtualBox: ~/Desktop/ns-allinone-3.33...
narendar@narendar-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$
narendar@narendar-VirtualBox:~/Desktop/ns-allinone-3.33/ns-3.33$ sudo apt-get i
nstall wireshark
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libfprint-2-tod1 libfwupdplugin1
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libc-ares2 liblua5.2-0 libqt5multimedia5 libqt5multimedia5-plugins
  libqt5multimediagsttools5 libqt5multimediawidgets5 libsmi2ldbl libsnappy1v5
  libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark13 libwiretap10
  libwsutil11 wireshark-common wireshark-qt
Suggested packages:
  snmp-mibs-downloader geoipupdate geoip-database geoip-database-extra
  libjs-leaflet libjs-leaflet.markercluster wireshark-doc
The following NEW packages will be installed:
  libc-ares2 liblua5.2-0 libqt5multimedia5 libqt5multimedia5-plugins
  libqt5multimediagsttools5 libqt5multimediawidgets5 libsmi2ldbl libsnappy1v5
  libspandsp2 libssh-gcrypt-4 libwireshark-data libwireshark13 libwiretap10
  libwsutil11 wireshark wireshark-common wireshark-qt
0 upgraded, 17 newly installed, 0 to remove and 3 not upgraded.
Need to get 22.5 MB of archives.
After this operation, 118 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://gs.archive.ubuntu.com/ubuntu focal/main amd64 liblua5.2-0 amd64 5.
2.4-1.1build3 [106 kB]
Get:2 http://gs.archive.ubuntu.com/ubuntu focal/universe amd64 libqt5multimedia
```

### Conclusion:

From this practical, I have Successfully installed Ns-3, NetAnim and WireShark.