

Practical - 1

AIM: Installation of NS-3 in Linux

Objective: To learn to Install NS3 in Ubuntu Linux

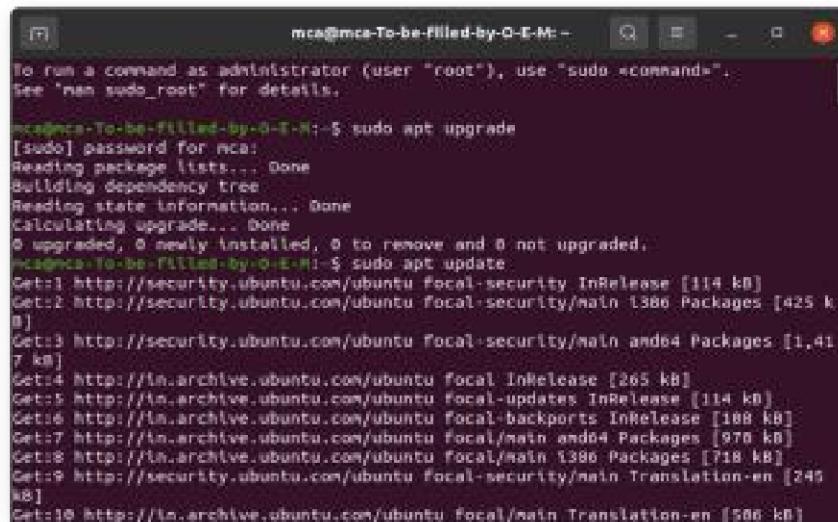
Step to Install:

After Installing Ubuntu 20.04 LTS successfully, you can now start with installing of NS3 packages.

List of Packages for Installing ns-3 in Ubuntu Systems

Prerequisite for installing NS3.32

- 1] sudo apt upgrade
- 2] Sudo apt update



```
mca@mca-To-be-Filled-by-O-E-M: ~$ sudo apt upgrade
[sudo] password for mca:
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mca@mca-To-be-Filled-by-O-E-M: ~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:2 http://security.ubuntu.com/ubuntu focal-security/main 1386 Packages [425 kB]
Get:3 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [1.41 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal/main amd64 Packages [970 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal/main 1386 Packages [718 kB]
Get:9 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [245 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal/main Translation-en [506 kB]
```

3] Minimal requirements for C++ users apt-get
install g++ python3

```
mcal@cs-16-be-filled-by-0-8-ri-5:~$ sudo apt-get install g++ python3
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3 is already the newest version (3.8.2-0ubuntu2).
python3 set to manually installed.
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cpp-9 g++-9 gcc gcc-9
  gcc-9-base libasan5 libatomic1 libbinutils libc-dev-bin libc6 libc6-dbg
  libc6-dev libcrypt-dev libctf-nobfd0 libctf0 libgcc-9-dev libitm1 liblsan0
  libquadmath0 libstdc++-9-dev libtsan0 libubsan1 linux-libc-dev manpages-dev
Suggested packages:
  binutils-doc gcc-9-locales g++-multilib g++-9-multilib gcc-9-doc
  gcc-multilib make autoconf automake libtool flex bison gcc-doc
  gcc-9-multilib glibc-doc libstdc++-9-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 libgcc-9-dev libitm1 liblsan0 libquadmath0
  libstdc++-9-dev libtsan0 libubsan1 linux-libc-dev manpages-dev
```

4] Minimal requirements for Python API users apt-get
install g++ python3 python3-dev pkg-config sqlite3

```
mcal@cs-16-be-filled-by-0-8-ri-5:~$ sudo apt-get install g++ python3 python3-dev pkg-config sqlite3
Reading package lists... Done
Building dependency tree
Reading state information... Done
g++ is already the newest version (4:9.3.0-ubuntu2).
pkg-config is already the newest version (0.29.1-0ubuntu1).
pkg-config set to manually installed.
python3 is already the newest version (3.8.2-0ubuntu2).
The following additional packages will be installed:
  libexpat1 libexpat1-dev libpython3.8 libpython3.8-minimal libpython3.8-stdlib python3.8 python3.8-dev
  python3.8-venv python3.8-wheel python3.8-zipimport python3.8-zipimport-dev
Suggested packages:
  python3.8-doc python3.8-venv python3.8-wheel python3.8-zipimport python3.8-zipimport-dev
The following NEW packages will be installed:
  libexpat1-dev libpython3.8 python3.8 python3.8-dev python3.8-stdlib python3.8-venv python3.8-wheel python3.8-zipimport python3.8-zipimport-dev
The following packages will be upgraded:
  libexpat1 python3.8 python3.8-minimal python3.8-stdlib python3.8-venv python3.8-wheel python3.8-zipimport python3.8-zipimport-dev
7 upgraded, 9 newly installed, 0 to remove and 0 not upgraded.
Need to get 11.2 MB of archives.
After this operation, 28.2 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8 amd64 3.8.10-0ubuntu1~20.04.4 [387 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8 amd64 3.8.10-0ubuntu1~20.04.4 [5,433 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-stdlib amd64 3.8.10-0ubuntu1~20.04.4 [1,675 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-minimal amd64 3.8.10-0ubuntu1~20.04.4 [1,399 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-minimal amd64 3.8.10-0ubuntu1~20.04.4 [717 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libexpat1 amd64 2.2.9-2ubuntu0.4 [74,4 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-dev amd64 3.8.10-0ubuntu1~20.04.4 [10,8 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libexpat1-dev amd64 2.2.9-2ubuntu0.4 [117 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-dev amd64 3.8.10-0ubuntu1~20.04.4 [1,842 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-venv amd64 3.8.10-0ubuntu1~20.04.4 [1,232 kB]
Get:11 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-wheel amd64 3.8.10-0ubuntu1~20.04.4 [1,342 kB]
Get:12 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-zipimport amd64 3.8.10-0ubuntu1~20.04.4 [1,342 kB]
Get:13 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-zipimport-dev amd64 3.8.10-0ubuntu1~20.04.4 [1,342 kB]
Get:14 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-zipimport-dev amd64 3.8.10-0ubuntu1~20.04.4 [1,342 kB]
Get:15 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-zipimport-dev amd64 3.8.10-0ubuntu1~20.04.4 [1,342 kB]
Fetched 11.2 MB in 4s (2,685 kB/s)
(Reading database ... 150000 files and directories currently installed.)
```

5] Netanim animator: qt5 development tools are needed for
Netanim animator; apt-get install qt5-default mercurial


```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install doxygen graphviz imagemagick
Reading package lists... Done
Building dependency tree
Reading state information... Done
doxygen is already the newest version (1.8.17-0ubuntu2).
graphviz is already the newest version (2.42.2-3build2).
imagemagick is already the newest version (8:6.9.10.23+dfsg-2.1ubuntu11.4).
```

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

```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install texlive texlive-extra-utils texlive-latex-extra texlive-font-utils dvipng latexmk
Reading package lists... Done
Building dependency tree
Reading state information... Done
dvipng is already the newest version (1.15-1.1).
latexmk is already the newest version (1:4.07-0.1).
texlive is already the newest version (2019.20200218-1).
texlive-extra-utils is already the newest version (2019.20200218-1).
texlive-font-utils is already the newest version (2019.20200218-1).
texlive-latex-extra is already the newest version (2019.20200218-1).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

10] 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):

apt-get install python3-sphinx dia

```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install python3-sphinx dia
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3-sphinx is already the newest version (1.8.5-7ubuntu3).
dia is already the newest version (0.97.3+git20160930-9).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

11] To read pcap packet traces

apt-get install tcpdump

```
mca@mca-To-be-filled-by-O-E-M:~$ 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).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

12] **Support for generating modified python bindings** apt-get
install cmake libc6-dev libc6-dev-i386 libclang
6.0-dev llvm-6.0-dev automake python3-pip

```
mc@mc16:~$ sudo apt-get install cmake libc6-dev libc6-dev-i386 libclang-6.0-dev llvm-6.0-dev automake python3-pip
Reading package lists... Done
Building dependency tree
Reading state information... Done
automake is already the newest version (1:1.16.1-4ubuntu6).
cmake is already the newest version (3.16.3-1ubuntu1).
libclang-6.0-dev is already the newest version (1:6.0.1-14).
llvm-6.0-dev is already the newest version (1:6.0.1-14).
libc6-dev is already the newest version (2.31-0ubuntu9.7).
libc6-dev-i386 is already the newest version (2.31-0ubuntu9.7).
python3-pip is already the newest version (20.0.2-5ubuntu1.6).
The following package was automatically installed and is no longer required:
  libfvpdpplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

After installing the required packages,

1. create a folder named workspace in the home directory and then put the NS3 tar package into the workspace.
2. Go to terminal and input these commands consecutively after each command finishes executing:
 - 2.1. cd
 - 2.2. cd workspace tar xjf <name of NS3 downloaded file>
 - 2.3. cd <name of extracted NS3>
 - 2.4. ./build.py --enable-examples --enable-tests
 - 2.5. It takes time be patient !!
3. Test the NS3 build and installation success by running test.py in the ns directory using the following commands:
 - 3.1. cd ns-<version number>
 - 3.2. ./test.py

```
mca@mca-To-be-filled-by-Q-E-M: ~/Workspace/mc-alliance-3.32
1842/2894 Compiling src/adb/model/adb-routing-protocol.cc
1843/2894 Compiling src/adb/model/adb-rpcmsg.cc
1844/2894 Compiling src/adb/model/adb-scheduler.cc
1845/2894 Compiling src/adb/helper/adb-helper.cc
1846/2894 Compiling src/adb/model/adb-routing-protocol.cc
1847/2894 Compiling src/adb/model/adb-rpcmsg.cc
1848/2894 Compiling src/adb/model/adb-scheduler.cc
1849/2894 Compiling src/adb/model/adb-scheduler-queue.cc
1850/2894 Linking build/lib/libad3.32-netapi-debug.so
1851/2894 Linking build/lib/libad3.32-adb-debug.so
1852/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1853/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1854/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1855/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1856/2894 Linking build/lib/libad3.32-adb-debug.so
1857/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1858/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1859/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1860/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1861/2894 Linking build/lib/libad3.32-adb-debug.so
1862/2894 Linking build/lib/libad3.32-adb-debug.so
1863/2894 Linking build/lib/libad3.32-adb-debug.so
1864/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1865/2894 Linking build/lib/libad3.32-adb-debug.so
1866/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1867/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1868/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1869/2894 Linking build/lib/libad3.32-adb-debug.so
1870/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1871/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1872/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1873/2894 Linking build/lib/libad3.32-adb-debug.so
1874/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1875/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1876/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1877/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
1878/2894 Compiling src/adb/helper/adb-scheduler-queue.cc
```

```
mca@mca-To-be-filled-by-Q-E-M: ~/Workspace/mc-alliance-3.32
2783/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2784/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2785/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2786/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2787/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2788/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2789/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2790/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2791/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2792/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2793/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2794/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2795/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2796/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2797/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2798/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2799/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2800/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2801/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2802/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2803/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2804/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2805/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2806/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2807/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2808/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2809/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2810/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2811/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2812/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2813/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2814/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2815/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2816/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2817/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
2818/2894 Linking build/examples/tcp/tcp-tls-ssl-connection-debug
2819/2894 Compiling examples/tcp/tcp-tls-ssl-connection.cc
```

Practical No - 2

AIM: Installation of Net anim in Linux

Objective: To learn to Install Net anim in Ubuntu Linux

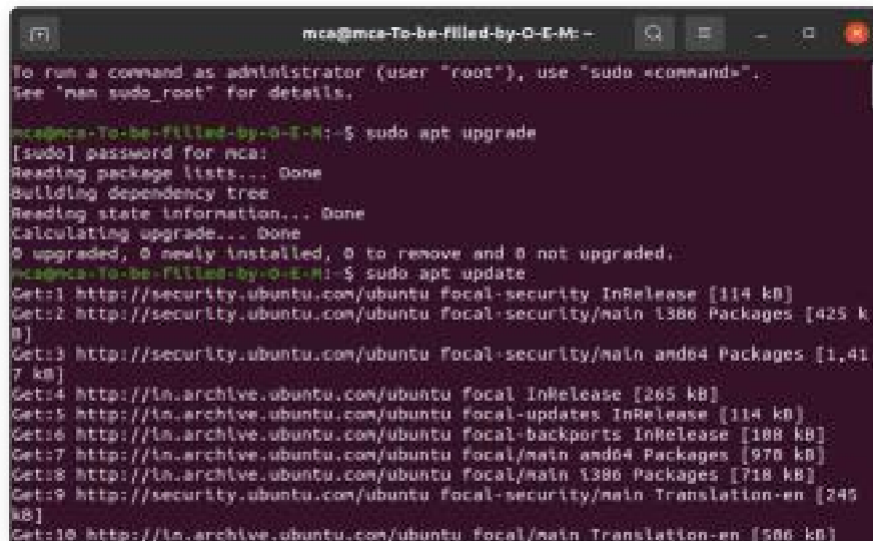
Step to Install:

After Installing Ubuntu 20.04 LTS successfully, you can now start with installing of Net anim packages.

List of Packages for Installing ns-3 in Ubuntu Systems

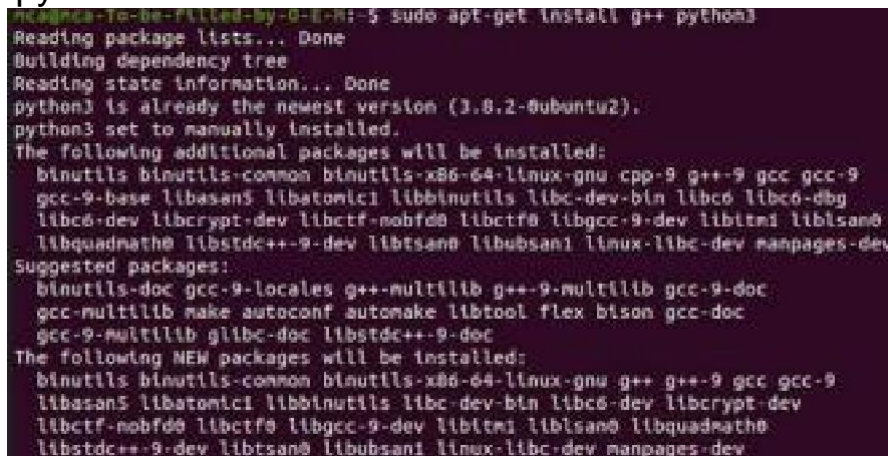
Prerequisite for installing NS3.32

- 1] sudo apt upgrade
- 2] Sudo apt update



```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt upgrade
[sudo] password for mca:
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:2 http://security.ubuntu.com/ubuntu focal-security/main 1386 Packages [425 kB]
Get:3 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [141 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal/main amd64 Packages [970 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal/main 1386 Packages [718 kB]
Get:9 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [245 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal/main Translation-en [586 kB]
```

3] Minimal requirements for C++ users apt-get install g++ python3



```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install g++ python3
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3 is already the newest version (3.8.2-0ubuntu2).
python3 set to manually installed.
The following additional packages will be installed:
  binutils binutils-common binutils-x86-64-linux-gnu cpp-9 g++-9 gcc gcc-9
  gcc-9-base libasan5 libatomic1 libbinutils libc-dev-bin libc6 libc6-dbg
  libc6-dev libcrypt-dev libctf-nobfd0 libctf0 libgcc-9-dev libitm1 liblsan0
  libquadmath0 libstdc++-9-dev libstdc++6 libubsan1 linux-libc-dev manpages-dev
Suggested packages:
  binutils-doc gcc-9-locales g++-multilib g++-9-multilib gcc-9-doc
  gcc-multilib make autoconf automake libtool flex bison gcc-doc
  gcc-9-multilib glibc-doc libstdc++-9-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 libgcc-9-dev libitm1 liblsan0 libquadmath0
  libstdc++-9-dev libstdc++6 libubsan1 linux-libc-dev manpages-dev
```

4] Minimal requirements for Python API users apt-get install g++ python3 python3-dev pkg-config sqlite3


```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install g++ python3 python3-dev pkg-config sqlite3
Reading package lists... Done
Building dependency tree
Reading state information... Done
g++ is already the newest version (4:9.3.0-1ubuntu2).
pkg-config is already the newest version (0.29.1-0ubuntu4).
python3 is already the newest version (3.8.2-0ubuntu2).
The following additional packages will be installed:
  libexpat1-dev libpython3-dev libpython3.8-dev libpython3.8-minimal libpython3.8-stdlib python3-distutils python3.8
  python3.8-dev python3.8-minimal zlib1g-dev
Suggested packages:
  python3.8-venv python3.8-doc binfmt-support sqlite3-doc
The following NEW packages will be installed:
  libexpat1-dev libpython3-dev libpython3.8-dev python3-dev python3-distutils python3.8-dev sqlite3 zlib1g-dev
The following packages will be upgraded:
  libexpat1 libpython3.8 libpython3.8-minimal libpython3.8-stdlib python3.8 python3.8-minimal zlib1g
7 upgraded, 8 newly installed, 0 to remove and 266 not upgraded.
Need to get 12.2 MB of archives.
After this operation, 26.3 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8 amd64 3.8.10-0ubuntu1-20.04.4 [387 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8 amd64 3.8.10-0ubuntu1-20.04.4 [1,625 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-stdlib amd64 3.8.10-0ubuntu1-20.04.4 [1,675 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-minimal amd64 3.8.10-0ubuntu1-20.04.4 [1,899 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-minimal amd64 3.8.10-0ubuntu1-20.04.4 [717 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libexpat1 amd64 2.2.9-1ubuntu0.4 [74.4 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 zlib1g amd64 1:1.2.11.dfsg-2ubuntu1.3 [53.8 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libexpat1-dev amd64 2.2.9-1ubuntu0.4 [117 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libpython3.8-dev amd64 3.8.10-0ubuntu1-20.04.4 [3,952 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal/main amd64 libpython3-dev amd64 3.8.2-0ubuntu2 [7,236 B]
Get:11 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 zlib1g-dev amd64 1:1.2.11.dfsg-2ubuntu1.3 [155 kB]
Get:12 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3.8-dev amd64 3.8.10-0ubuntu1-20.04.4 [514 kB]
Get:13 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 python3-distutils all 3.8.10-0ubuntu1-20.04 [141 kB]
Get:14 http://in.archive.ubuntu.com/ubuntu focal/main amd64 python3-dev amd64 3.8.2-0ubuntu2 [1,212 B]
Get:15 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 sqlite3 amd64 3.31.1-4ubuntu0.2 [860 kB]
Fetched 12.2 MB in 4s (3,005 kB/s)
(Reading database ... 150639 files and directories currently installed.)
Preparing to unpack .../python3.8_3.8.10-0ubuntu1-20.04.4_amd64.deb...
```

5] Netanim animator: qt5 development tools are needed for Netanim animator; apt-get install qt5-default mercurial

```
mca@mca-To-be-filled-by-O-E-M:~$ sudo apt-get install qt5-default mercurial
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libdouble-conversion3 libegl-dev libgl-dev libgl1 libgles2 libglu1-mesa-dev libglvnd0 libglx-dev libglx0 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
  qtranslations5-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 wslsh 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 mercurial-common python2
  python2-minimal python2.7 python2.7-minimal qt5-default qt5-gtk-platformtheme qt5-qmake qt5-qmake-bin qtbase5-dev qtbase5-dev-tools
  qtchooser qtranslations5-l10n x11proto-core-dev x11proto-dev x11proto-xext-dev xorg-sgml-doctools xtrans-dev
The following packages will be upgraded:
  libegl1 libgl1 libgles2 libglvnd0 libglx0
5 upgraded, 51 newly installed, 0 to remove and 261 not upgraded.
Need to get 23.2 MB of archives.
After this operation, 117 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 libdouble-conversion3 amd64 3.1.5-4ubuntu1 [37.9 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal/main amd64 libpcre2-16-0 amd64 10.34-7 [181 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal-updates/universe amd64 libqt5core5a amd64 5.12.8+dfsg-0ubuntu2.1 [2,006 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libgl1 amd64 1.3.2-1-ubuntu0.20.04.2 [85.8 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libglx0 amd64 1.3.2-1-ubuntu0.20.04.2 [32.5 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libgles2 amd64 1.3.2-1-ubuntu0.20.04.2 [15.6 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libegl1 amd64 1.3.2-1-ubuntu0.20.04.2 [31.9 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 libglvnd0 amd64 1.3.2-1-ubuntu0.20.04.2 [48.1 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal-updates/universe amd64 libqt5dbus5 amd64 5.12.8+dfsg-0ubuntu2.1 [208 kB]
```

6] ns-3-pyviz visualizer

apt-get install gir1.2-gooCanvas-2.0 python-gi python-gi-cairo
python-pygraphviz python3-gi python3-gi-cairo python3-
pygraphviz gir1.2-gtk-3.0 ipython ipython3

```
mc@mc-16-be-filled-by-0-E-M:~$ sudo apt-get install gir1.2-gooCanvas-2.0 python-gi python-gi-cairo python3-gi python3-gi-cairo python3-pygraphviz gir1.2-gtk-3.0
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3-gi is already the newest version (3.36.0-1).
python3-gi-cairo is already the newest version (3.36.0-1).
gir1.2-gooCanvas-2.0 is already the newest version (2.0.4-1).
python-gi is already the newest version (3.36.0-1).
python-gi-cairo is already the newest version (3.36.0-1).
python3-pygraphviz is already the newest version (1.5-4build1).
gir1.2-gtk-3.0 is already the newest version (3.24.20-0ubuntu1.1).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

7] Debugging:**8] apt-get install gdb valgrind**

```
mc@mc-16-be-filled-by-0-E-M:~$ 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).
valgrind is already the newest version (1:3.15.0-1ubuntu9.1).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

9] Doxygen and related inline documentation: apt-get install doxygen graphviz imagemagick

```
mc@mc-16-be-filled-by-0-E-M:~$ sudo apt-get install doxygen graphviz imagemagick
Reading package lists... Done
Building dependency tree
Reading state information... Done
doxygen is already the newest version (1.8.17-0ubuntu2).
graphviz is already the newest version (2.42.2-3build2).
imagemagick is already the newest version (8:6.9.10.23+dfsg-2.1ubuntu11.4).
```

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

```
mc@mc-16-be-filled-by-0-E-M:~$ sudo apt-get install texlive texlive-extra-utils texlive-latex-extra texlive-font-utils dvipng latexmk
Reading package lists... Done
Building dependency tree
Reading state information... Done
dvipng is already the newest version (1.15-1.1).
latexmk is already the newest version (1:4.67-0.1).
texlive is already the newest version (2019.20200218-1).
texlive-extra-utils is already the newest version (2019.20200218-1).
texlive-font-utils is already the newest version (2019.20200218-1).
texlive-latex-extra is already the newest version (2019.20200218-1).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```


10] 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):
`apt-get install python3-sphinx dia`

```
mca@mca-To-be-filled-by-U-E-M:~$ sudo apt-get install python3-sphinx dia
Reading package lists... Done
Building dependency tree
Reading state information... Done
python3-sphinx is already the newest version (1.8.5-7ubuntu3).
dia is already the newest version (0.97.3+git20160930-9).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

11] To read pcap packet traces `apt-get install tcpdump`

```
mca@mca-To-be-filled-by-U-E-M:~$ 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).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

12] Support for generating modified python bindings `apt-get install cmake libc6-dev libc6-dev-i386 libclang-6.0-dev llvm-6.0-dev automake python3-pip`

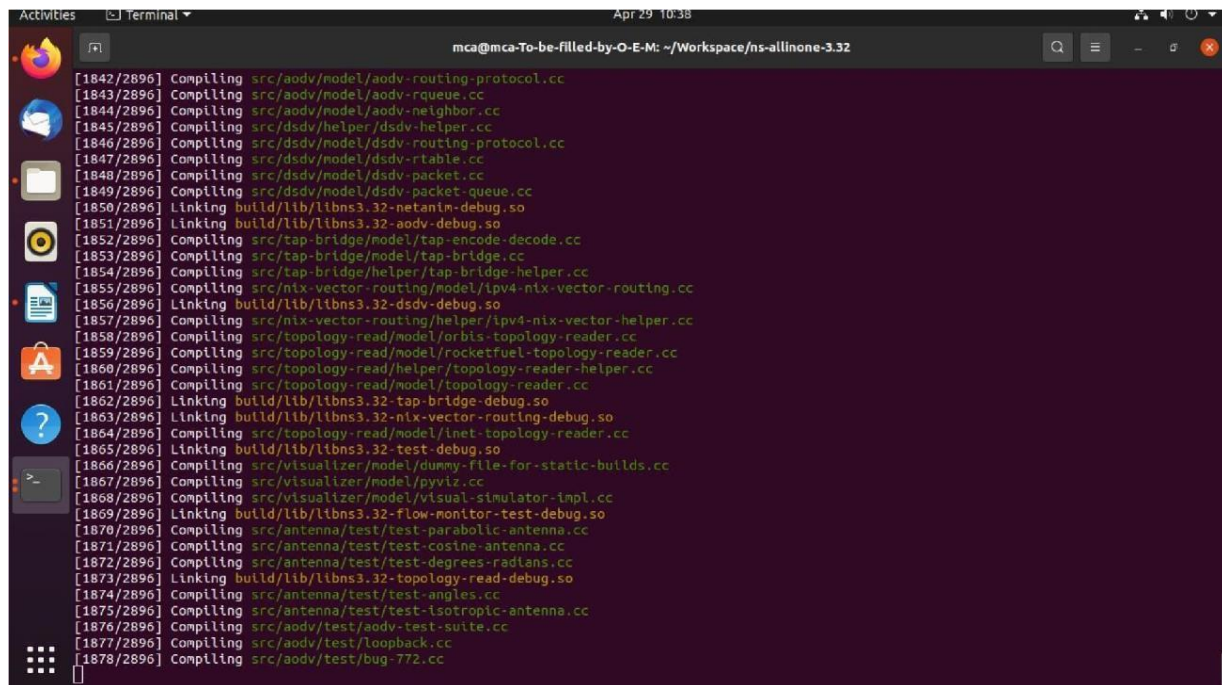
```
mca@mca-To-be-filled-by-U-E-M:~$ sudo apt-get install cmake libc6-dev libc6-dev-i386 libclang-6.0-dev llvm-6.0-dev automake python3-pip
Reading package lists... Done
Building dependency tree
Reading state information... Done
automake is already the newest version (1:1.16.1-4ubuntu6).
cmake is already the newest version (3.16.3-1ubuntu1).
libclang-6.0-dev is already the newest version (1:6.0.1-14).
llvm-6.0-dev is already the newest version (1:6.0.1-14).
libc6-dev is already the newest version (2.31-0ubuntu9.7).
libc6-dev-i386 is already the newest version (2.31-0ubuntu9.7).
python3-pip is already the newest version (20.0.2-5ubuntu1.6).
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

After installing the required packages,

4. create a folder named workspace in the home directory and then put the NS3 tar package into the workspace.
5. Go to terminal and input these commands consecutively after each command finishes executing:

5.1. `cd`

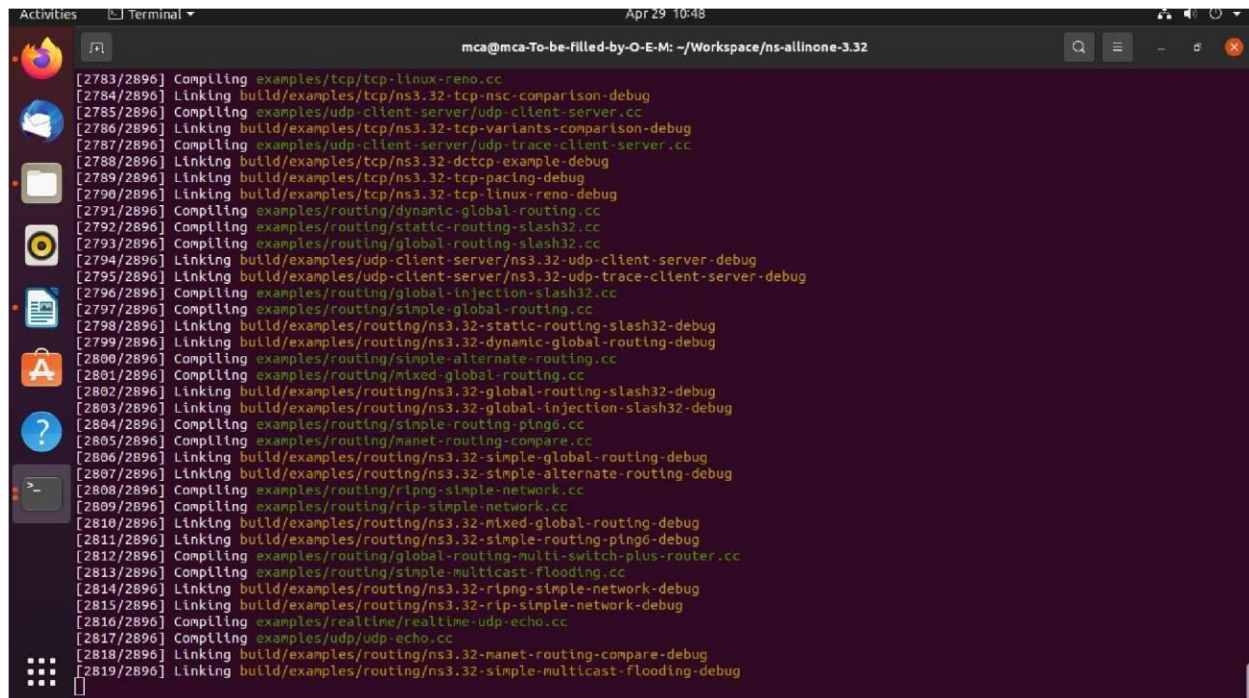
- 5.2. cd workspace tar xjf <name of NS3 downloaded file name>;
- 5.3. cd <name of extracted NS3>;
- 5.4. ./build.py --enable-examples --enable-tests
- 5.5. It takes time be patient !!
6. Test the NS3 build and installation success by running test.py in the ns directory using the following commands:
 - 6.1. cd ns-<version number>;
 - 6.2. ./test.py



```

[1842/2896] Compiling src/aodv/model/aodv-routing-protocol.cc
[1843/2896] Compiling src/aodv/model/aodv-rqueue.cc
[1844/2896] Compiling src/aodv/model/aodv-neighbor.cc
[1845/2896] Compiling src/dsdv/helper/dsdv-helper.cc
[1846/2896] Compiling src/dsdv/model/dsdv-routing-protocol.cc
[1847/2896] Compiling src/dsdv/model/dsdv-rtable.cc
[1848/2896] Compiling src/dsdv/model/dsdv-packet.cc
[1849/2896] Compiling src/dsdv/model/dsdv-packet-queue.cc
[1850/2896] Linking build/lib/libns3.32-netanim-debug.so
[1851/2896] Linking build/lib/libns3.32-aodv-debug.so
[1852/2896] Compiling src/tap-bridge/model/tap-encode-decode.cc
[1853/2896] Compiling src/tap-bridge/model/tap-bridge.cc
[1854/2896] Compiling src/tap-bridge/helper/tap-bridge-helper.cc
[1855/2896] Compiling src/nix-vector-routing/model/ipv4-nix-vector-routing.cc
[1856/2896] Linking build/lib/libns3.32-dsdv-debug.so
[1857/2896] Compiling src/nix-vector-routing/helper/ipv4-nix-vector-helper.cc
[1858/2896] Compiling src/topology-read/model/orbis-topology-reader.cc
[1859/2896] Compiling src/topology-read/model/rocketfuel-topology-reader.cc
[1860/2896] Compiling src/topology-read/helper/topology-reader-helper.cc
[1861/2896] Compiling src/topology-read/model/topology-reader.cc
[1862/2896] Linking build/lib/libns3.32-tap-bridge-debug.so
[1863/2896] Linking build/lib/libns3.32-nix-vector-routing-debug.so
[1864/2896] Compiling src/topology-read/model/inet-topology-reader.cc
[1865/2896] Linking build/lib/libns3.32-test-debug.so
[1866/2896] Compiling src/visualizer/model/dummy-file-for-static-bulldo.cc
[1867/2896] Compiling src/visualizer/model/pyviz.cc
[1868/2896] Compiling src/visualizer/model/visual-simulator-impl.cc
[1869/2896] Linking build/lib/libns3.32-flow-monitor-test-debug.so
[1870/2896] Compiling src/antenna/test/test-parabolic-antenna.cc
[1871/2896] Compiling src/antenna/test/test-cosine-antenna.cc
[1872/2896] Compiling src/antenna/test/test-degrees-radians.cc
[1873/2896] Linking build/lib/libns3.32-topology-read-debug.so
[1874/2896] Compiling src/antenna/test/test-angles.cc
[1875/2896] Compiling src/antenna/test/test-isotropic-antenna.cc
[1876/2896] Compiling src/aodv/test/aodv-test-suite.cc
[1877/2896] Compiling src/aodv/test/loopback.cc
[1878/2896] Compiling src/aodv/test/bug-772.cc

```

```
mca@mca-To-be-filled-by-O-E-M: ~/Workspace/ns-allinone-3.32
[2783/2896] Compiling examples/tcp/tcp-linux-reno.cc
[2784/2896] Linking build/examples/tcp/ns3.32-tcp-nsc-comparison-debug
[2785/2896] Compiling examples/udp-client-server/udp-client-server.cc
[2786/2896] Linking build/examples/tcp/ns3.32-tcp-variants-comparison-debug
[2787/2896] Compiling examples/udp-client-server/udp-trace-client-server.cc
[2788/2896] Linking build/examples/tcp/ns3.32-dctcp-example-debug
[2789/2896] Linking build/examples/tcp/ns3.32-tcp-pacing-debug
[2790/2896] Linking build/examples/tcp/ns3.32-tcp-linux-reno-debug
[2791/2896] Compiling examples/routing/dynamic-global-routing.cc
[2792/2896] Compiling examples/routing/static-routing-slash32.cc
[2793/2896] Compiling examples/routing/global-routing-slash32.cc
[2794/2896] Linking build/examples/udp-client-server/ns3.32-udp-client-server-debug
[2795/2896] Linking build/examples/udp-client-server/ns3.32-udp-trace-client-server-debug
[2796/2896] Compiling examples/routing/global-injection-slash32.cc
[2797/2896] Compiling examples/routing/simple-global-routing.cc
[2798/2896] Linking build/examples/routing/ns3.32-static-routing-slash32-debug
[2799/2896] Linking build/examples/routing/ns3.32-dynamic-global-routing-debug
[2800/2896] Compiling examples/routing/simple-alternate-routing.cc
[2801/2896] Compiling examples/routing/mixed-global-routing.cc
[2802/2896] Linking build/examples/routing/ns3.32-global-routing-slash32-debug
[2803/2896] Linking build/examples/routing/ns3.32-global-injection-slash32-debug
[2804/2896] Compiling examples/routing/simple-routing-ping6.cc
[2805/2896] Compiling examples/routing/manet-routing-compare.cc
[2806/2896] Linking build/examples/routing/ns3.32-simple-global-routing-debug
[2807/2896] Linking build/examples/routing/ns3.32-simple-alternate-routing-debug
[2808/2896] Compiling examples/routing/ripng-simple-network.cc
[2809/2896] Compiling examples/routing/rip-simple-network.cc
[2810/2896] Linking build/examples/routing/ns3.32-mixed-global-routing-debug
[2811/2896] Linking build/examples/routing/ns3.32-simple-routing-ping6-debug
[2812/2896] Compiling examples/routing/global-routing-multi-switch-plus-router.cc
[2813/2896] Compiling examples/routing/simple-multicast-flooding.cc
[2814/2896] Linking build/examples/routing/ns3.32-ripng-simple-network-debug
[2815/2896] Linking build/examples/routing/ns3.32-rip-simple-network-debug
[2816/2896] Compiling examples/realtime/realtime-udp-echo.cc
[2817/2896] Compiling examples/udp/udp-echo.cc
[2818/2896] Linking build/examples/routing/ns3.32-manet-routing-compare-debug
[2819/2896] Linking build/examples/routing/ns3.32-simple-multicast-flooding-debug
```

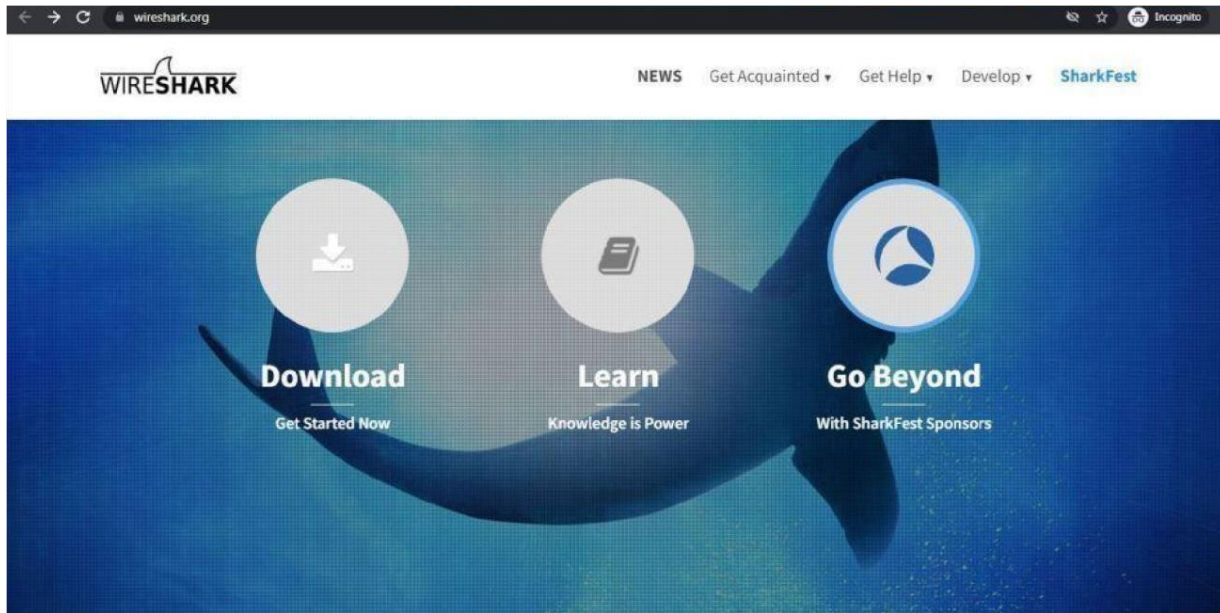
Practical No – 3

AIM: Installation of Wire Shark

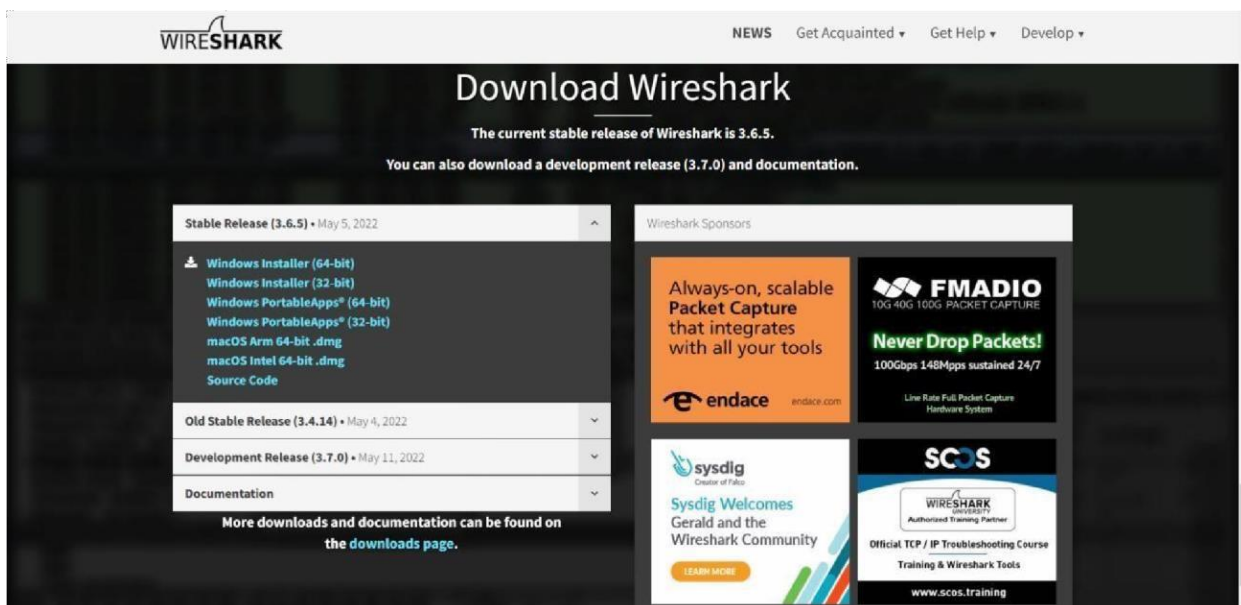
Objective: To learn to Install Wire Shark in Ubuntu Linux

Step to Install:

1] Visit the official Wireshark website using any web browser.



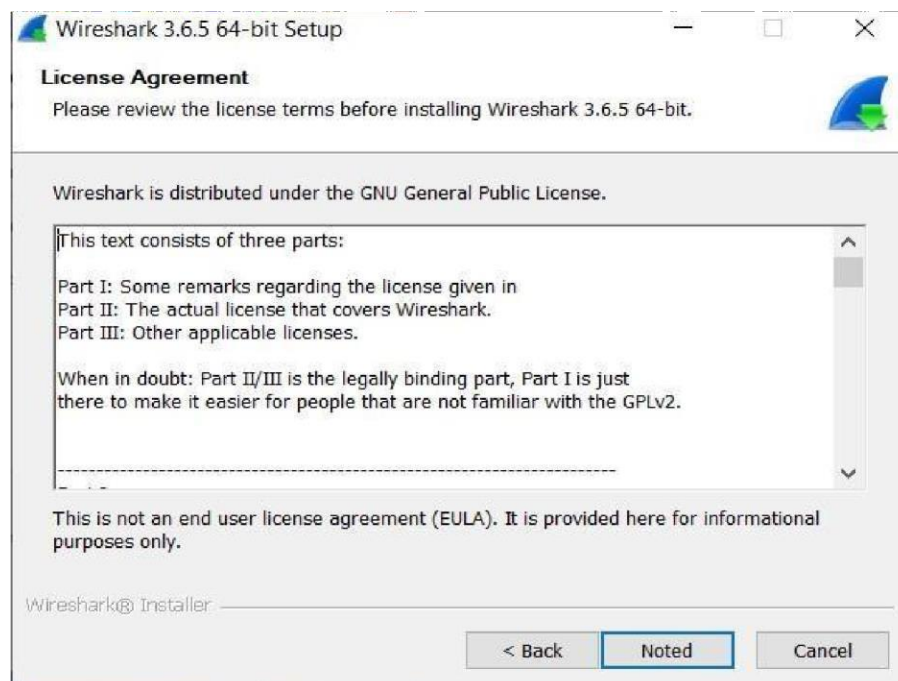
2] Click on Download, a new webpage will open with different installers of Wireshark



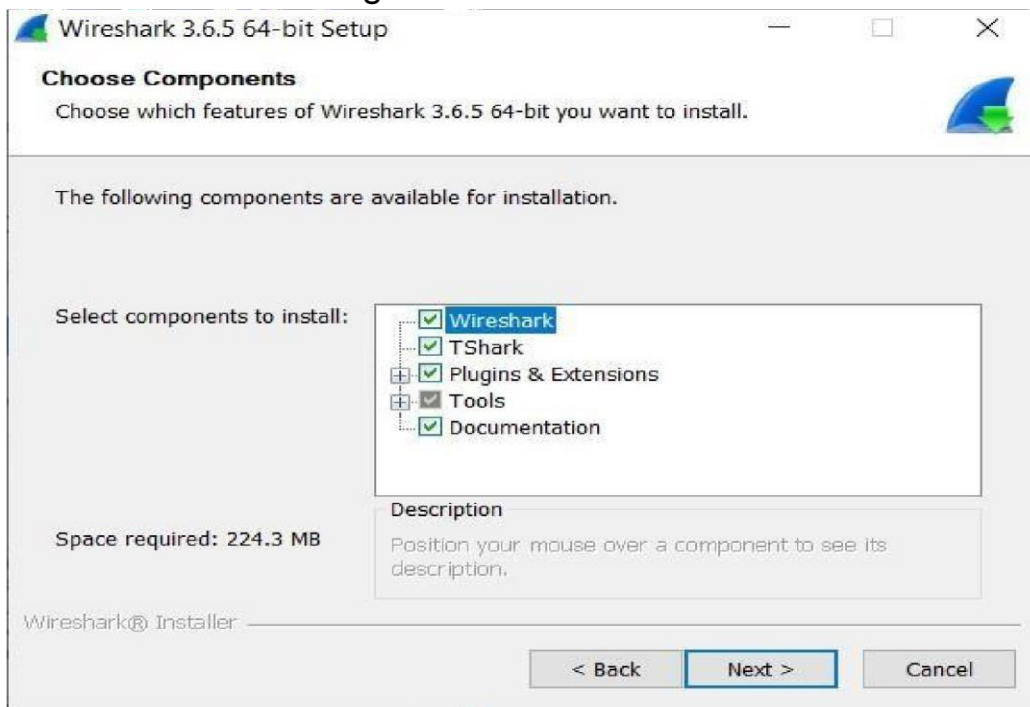
- 3] Downloading of the executable file will start shortly. It is a small 73.69 MB file that will take some time
- 4] Now check for the executable file in downloads in your system and run it
- 5] It will prompt confirmation to make changes to your system. Click on Yes
- 6] Setup screen will appear, click on Next.



- 7] The next screen will be of License Agreement, click on Noted.

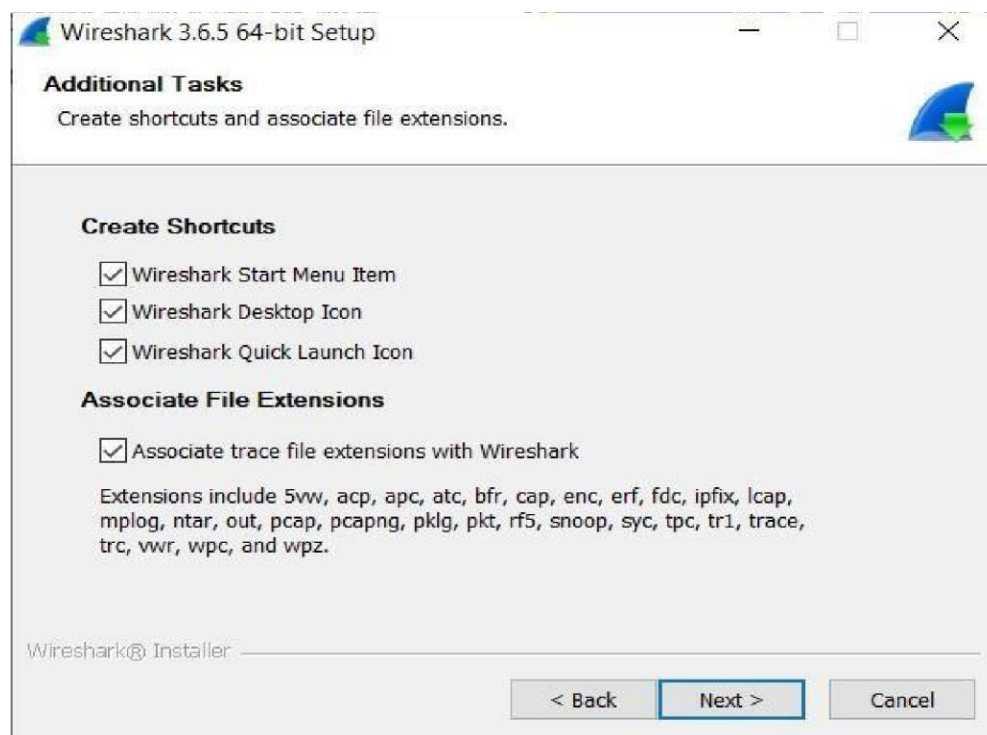


- 8] This screen is for choosing components, all components are already marked so don't change

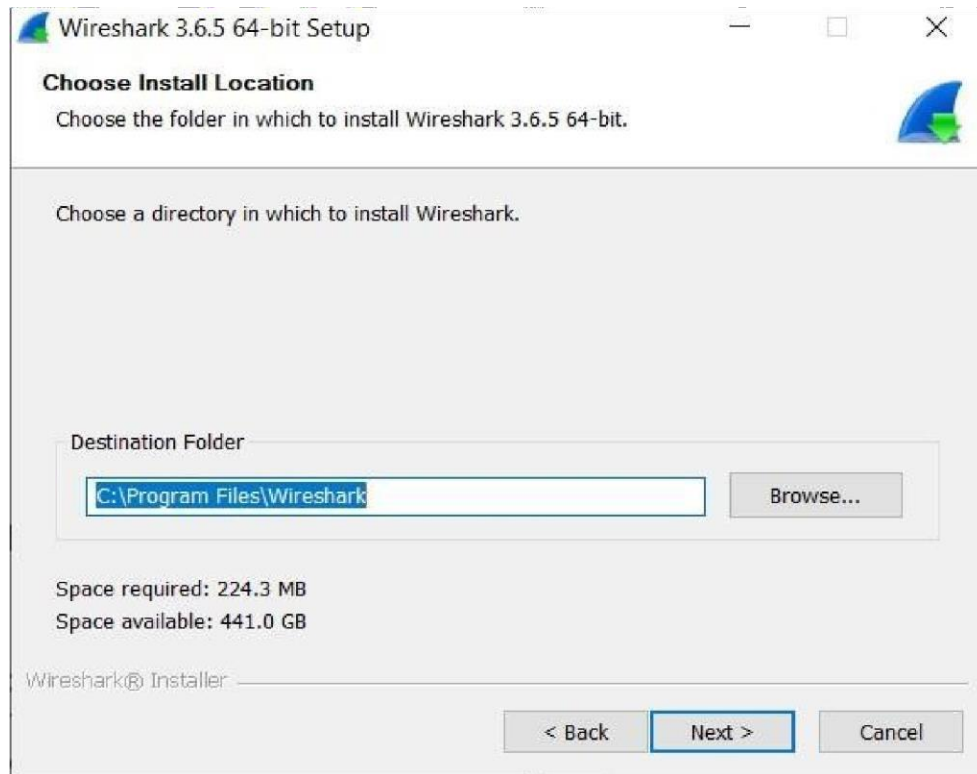


anything just click on the Next button.

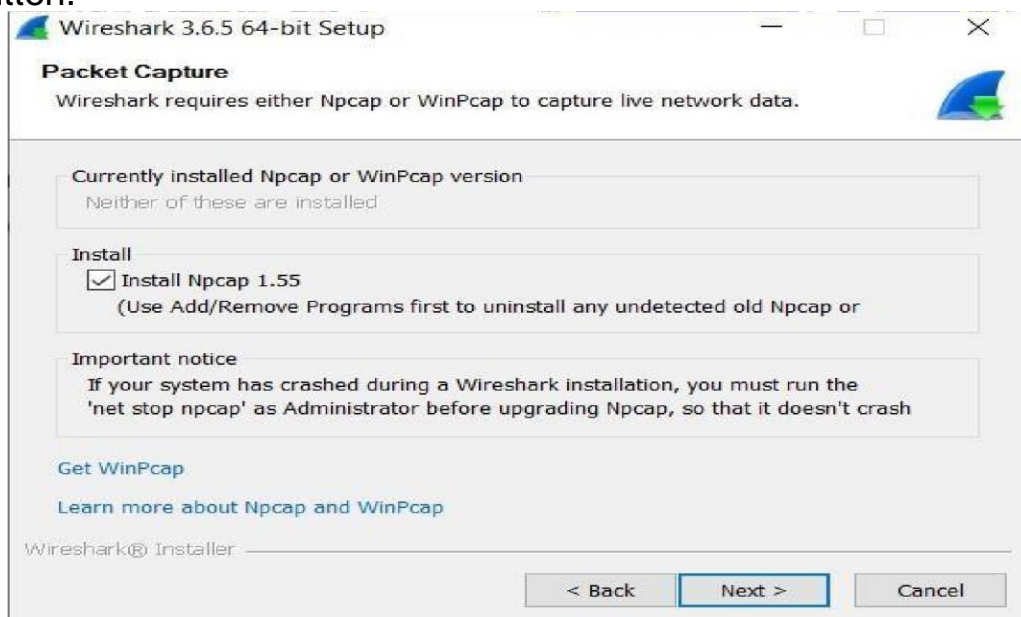
- 9] This screen is of choosing shortcuts like start menu or desktop icon along with file extensions which can be intercepted by Wireshark, tick all boxes and click on Next button.



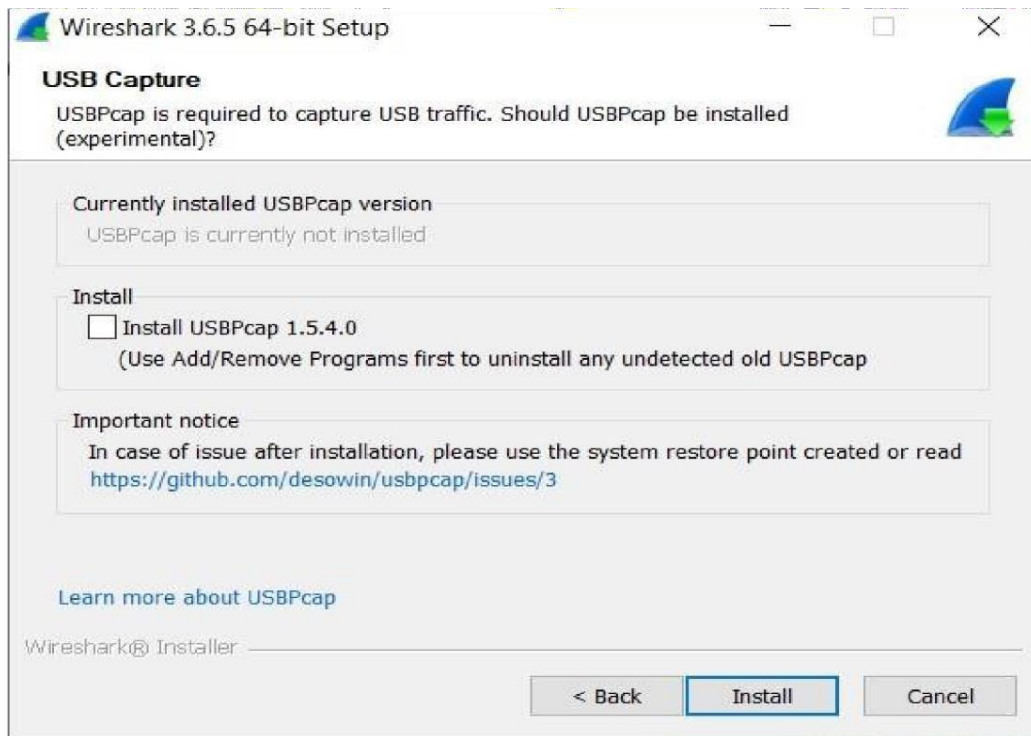
- 6] The next screen will be of installing location so choose the drive which will have sufficient memory space for installation. It needed only a memory space of 224.3 MB



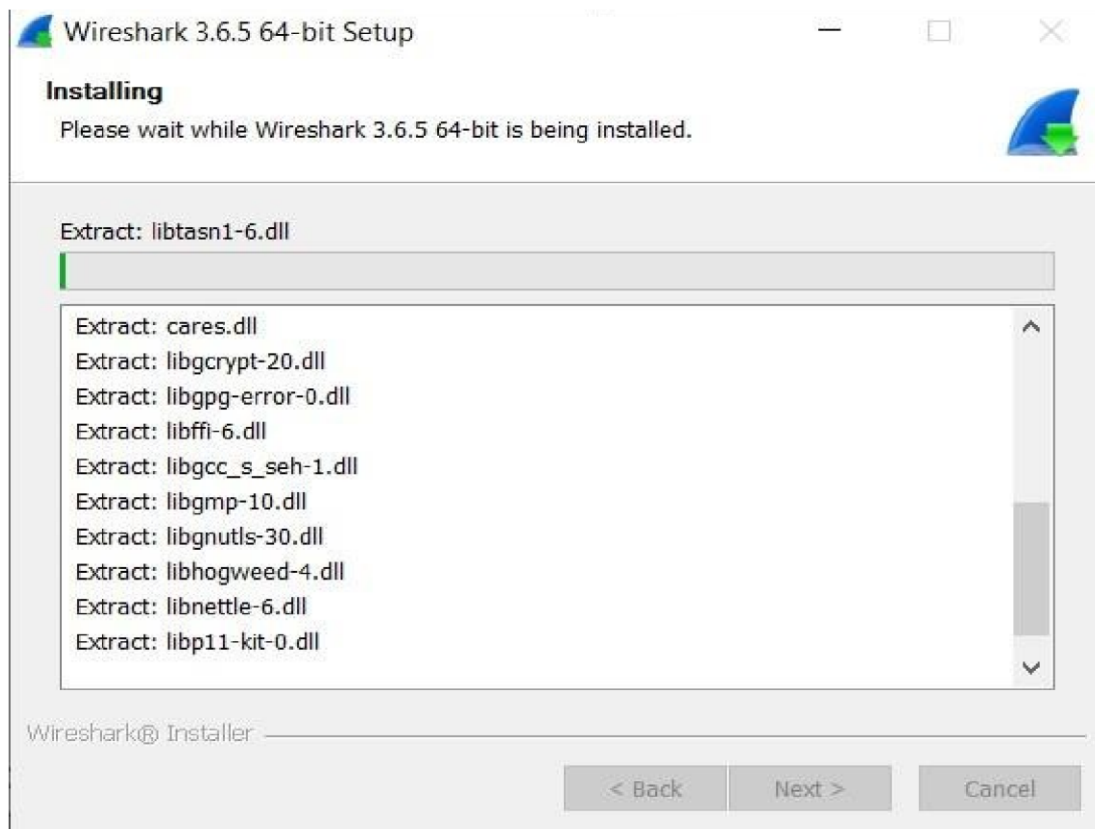
- 7] Next screen has an option to install Npcap which is used with Wireshark to capture packets pcap means packet capture so the install option is already checked don't change anything and click the next button.



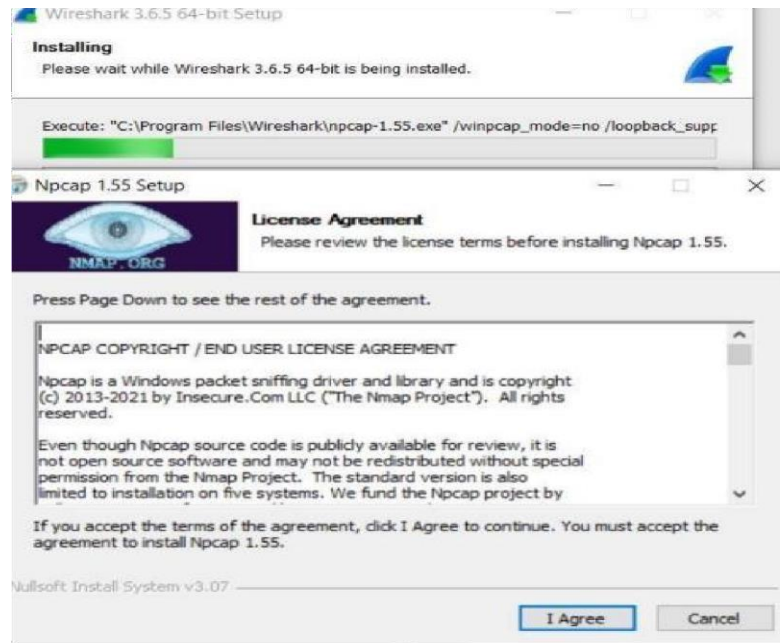
- 6] Next screen is about USB network capturing so it is one's choice to use or not, click on Install.



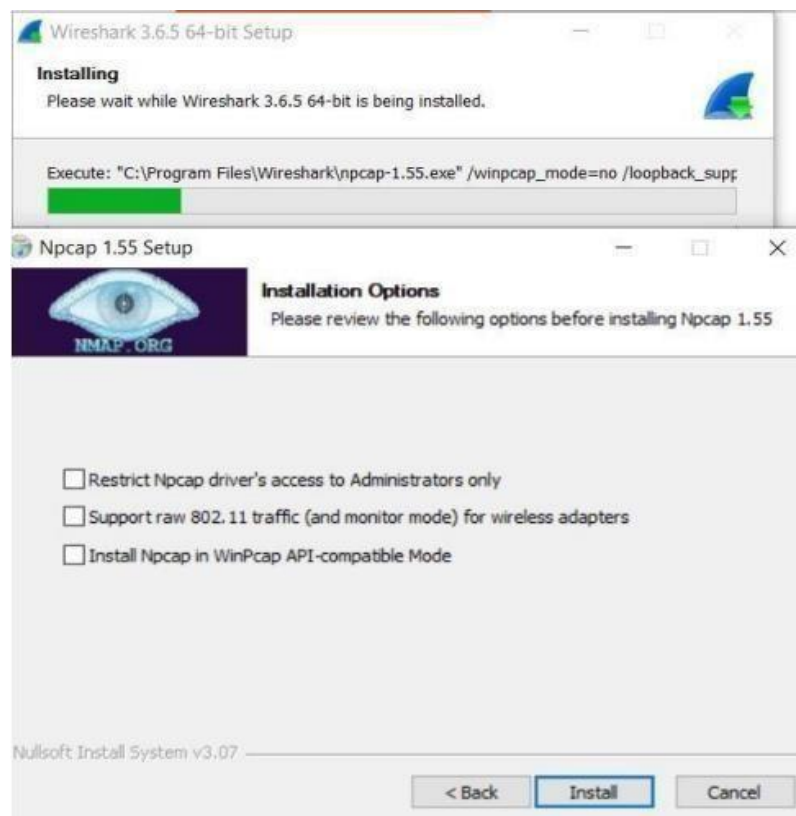
- 7] After this installation process will start.



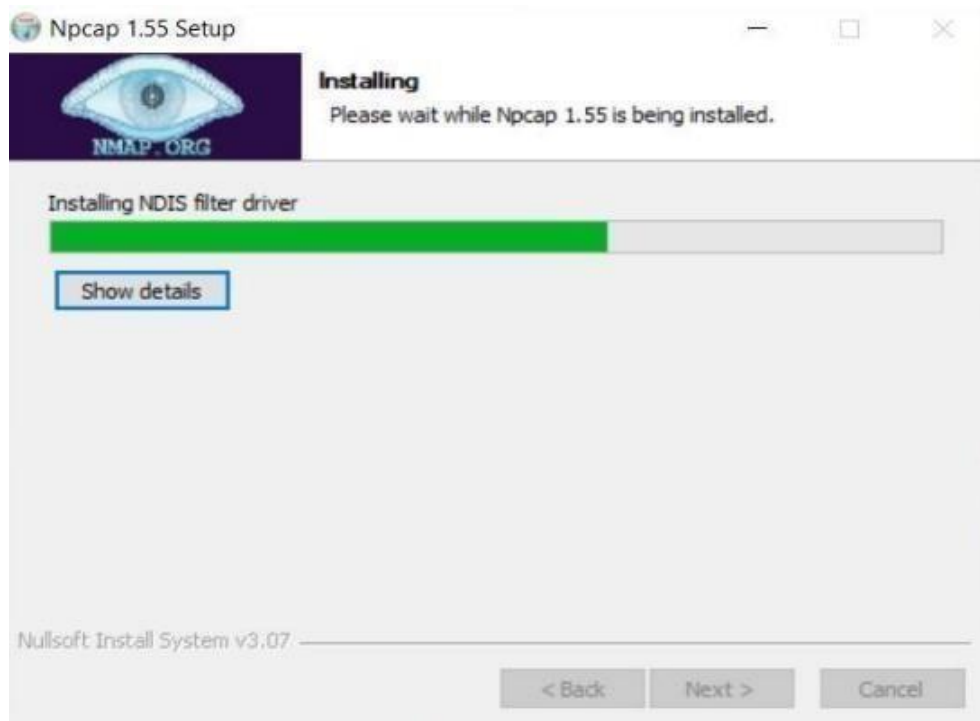
- 6] This installation will prompt for Npcap installation as already checked so the license agreement of Npcap will appear to click on the I Agree button.



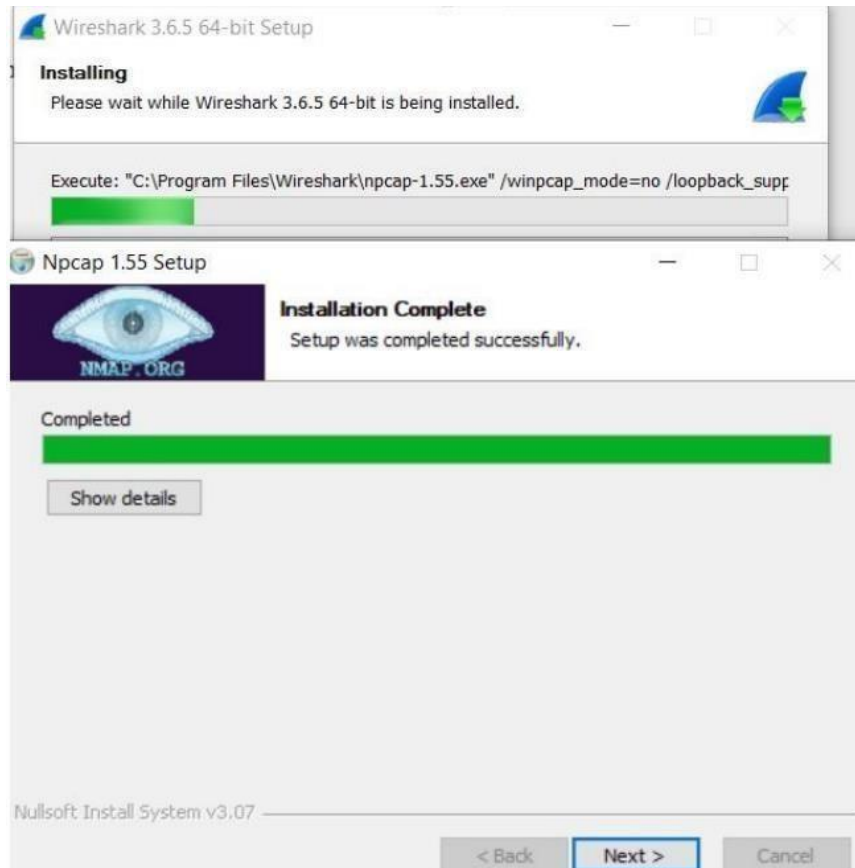
- 6] Next screen is about different installing options of npcap, don't do anything click on Install



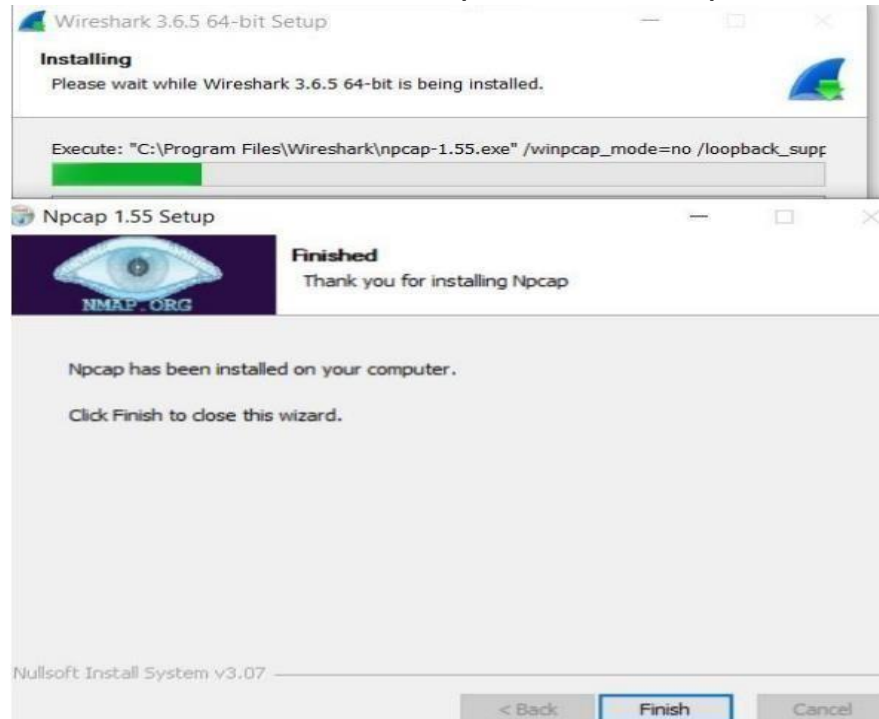
7] After this installation process will start which will take only a minute.



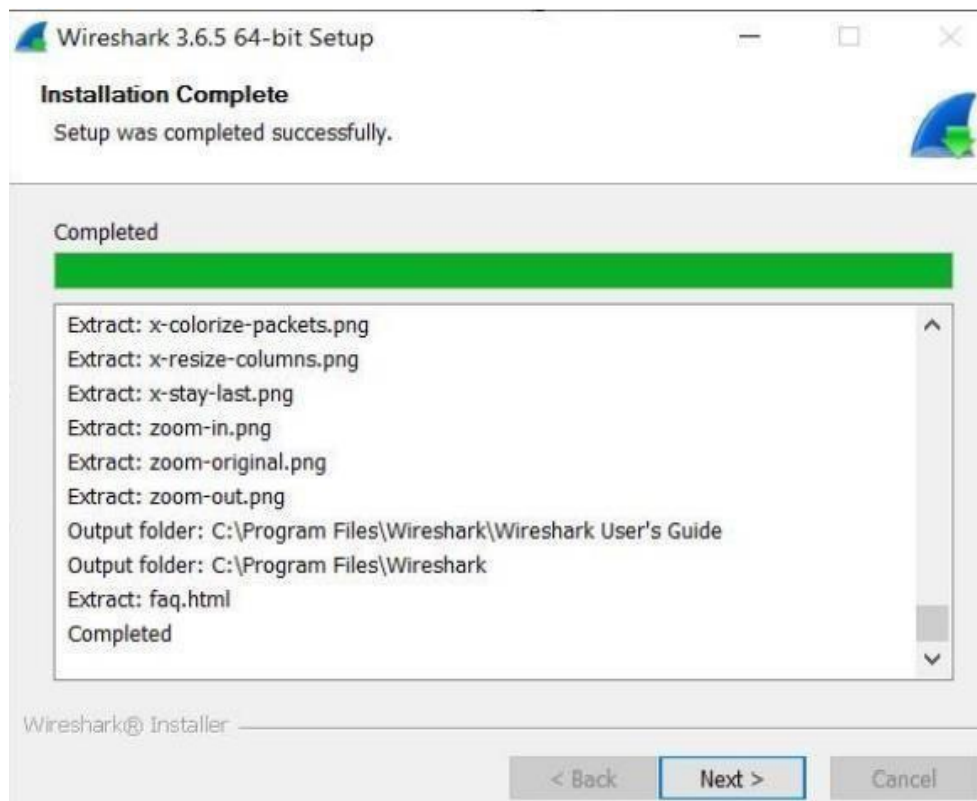
8] After this installation process will start which will take only a minute.



9] Click on Finish after the installation process is complete..



10] After this installation process of Wireshark will complete click on the Next button



11] Click on Finish after the installation process of Wireshark is complete.



12] Wireshark is successfully installed on the system and an icon is created on the desktop

Practical No-4

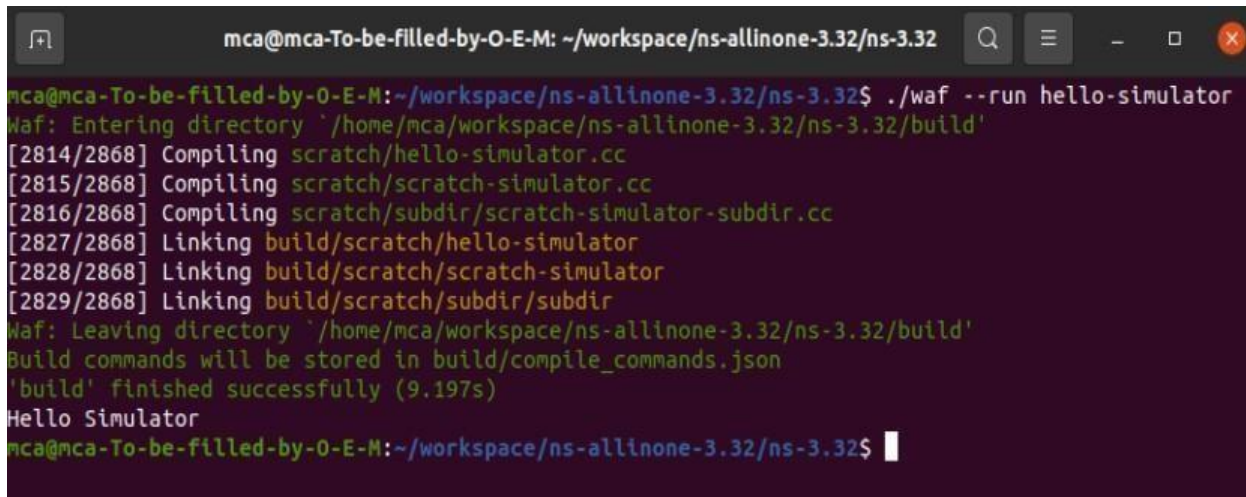
AIM: Program to simulate traffic between two nodes

Objective: To learn simulate traffic between two nodes and print String

Code:

Hello-Simulator.cc

```
/* -*- Mode:C++; c-file-style:"gnu"; indent-tabs-mode:nil; -*- */  
#include "ns3/core-module.h" using  
namespace ns3;  
NS_LOG_COMPONENT_DEFINE ("HelloSimulator");  
Int  
main (int argc, char *argv[])  
{  
NS_LOG_UNCOND ("Hello Simulator");  
}
```

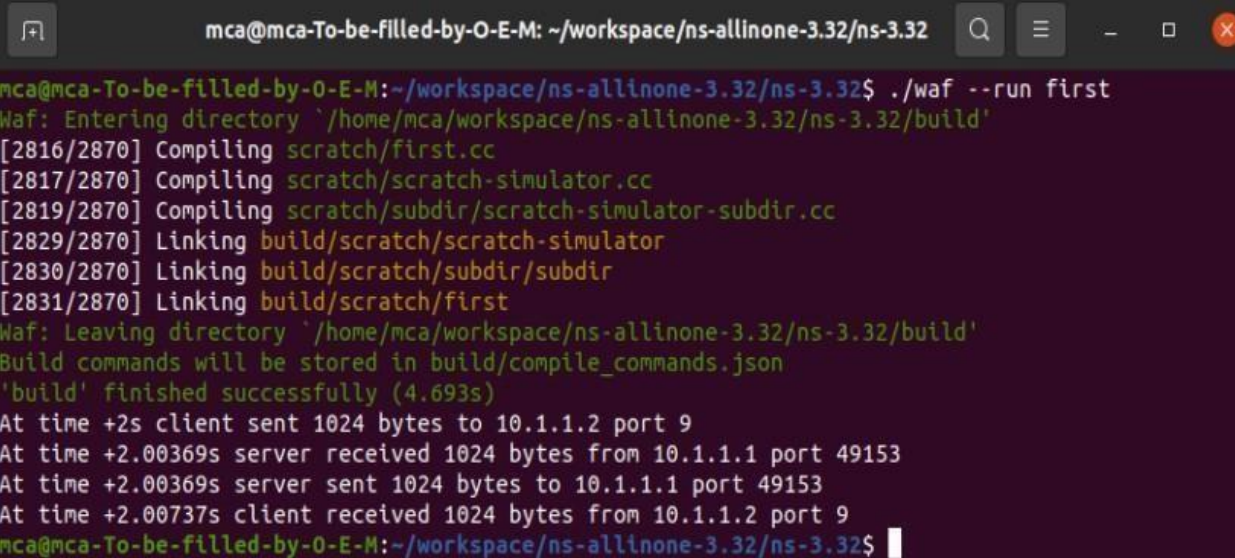



```
mca@mca-To-be-filled-by-O-E-M: ~/workspace/ns-allinone-3.32/ns-3.32$ ./waf --run hello-simulator
waf: Entering directory `/home/mca/workspace/ns-allinone-3.32/ns-3.32/build'
[2814/2868] Compiling scratch/hello-simulator.cc
[2815/2868] Compiling scratch/scratch-simulator.cc
[2816/2868] Compiling scratch/subdir/scratch-simulator-subdir.cc
[2827/2868] Linking build/scratch/hello-simulator
[2828/2868] Linking build/scratch/scratch-simulator
[2829/2868] Linking build/scratch/subdir/subdir
waf: Leaving directory `/home/mca/workspace/ns-allinone-3.32/ns-3.32/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (9.197s)
Hello Simulator
mca@mca-To-be-filled-by-O-E-M:~/workspace/ns-allinone-3.32/ns-3.32$
```

First.cc

```
#include "ns3/core-module.h"
#include "ns3/network-module.h"
#include "ns3/internet-module.h"
#include "ns3/point-to-point-module.h"
#include "ns3/applications-module.h"
// Default Network Topology
//
// 10.1.1.0
// n0 ----- n1
// point-to-point
//
using namespace ns3;
NS_LOG_COMPONENT_DEFINE ("FirstScriptExample");
int
main (int argc, char *argv[])
{
    CommandLine cmd (__FILE__);
    cmd.Parse (argc, argv);
    Time::SetResolution (Time::NS);
    LogComponentEnable ("UdpEchoClientApplication",
LOG_LEVEL_INFO);
    LogComponentEnable ("UdpEchoServerApplication",
LOG_LEVEL_INFO);
    NodeContainer nodes;
    nodes.Create (2);
    PointToPointHelper pointToPoint;
```

```
pointToPoint.SetDeviceAttribute ("DataRate", StringValue
("5Mbps"));
pointToPoint.SetChannelAttribute ("Delay", StringValue
("2ms"));
NetDeviceContainer devices; devices
= pointToPoint.Install (nodes);
InternetStackHelper stack;
stack.Install (nodes);
Ipv4AddressHelper address; address.SetBase
("10.1.1.0", "255.255.255.0");
Ipv4InterfaceContainer interfaces = address.Assign
(devices);
//server
UdpEchoServerHelper echoServer (9);
ApplicationContainer serverApps = echoServer.Install
(nodes.Get (1)); serverApps.Start
(Seconds (1.0));
serverApps.Stop (Seconds (10.0));
//client
UdpEchoClientHelper echoClient (interfaces.GetAddress (1),
9);
echoClient.SetAttribute ("MaxPackets", UIntegerValue (1));
echoClient.SetAttribute ("Interval", TimeValue (Seconds
(1.0)));
echoClient.SetAttribute ("PacketSize", UIntegerValue
(1024));
ApplicationContainer clientApps = echoClient.Install
(nodes.Get (0)); clientApps.Start
(Seconds (2.0)); clientApps.Stop
(Seconds (10.0));
Simulator::Run ();
Simulator::Destroy ();
return 0;
}
```



```
mca@mca-To-be-filled-by-O-E-M: ~/workspace/ns-allinone-3.32/ns-3.32
mca@mca-To-be-filled-by-O-E-M:~/workspace/ns-allinone-3.32/ns-3.32$ ./waf --run first
Waf: Entering directory `/home/mca/workspace/ns-allinone-3.32/ns-3.32/build'
[2816/2870] Compiling scratch/first.cc
[2817/2870] Compiling scratch/scratch-simulator.cc
[2819/2870] Compiling scratch/subdir/scratch-simulator-subdir.cc
[2829/2870] Linking build/scratch/scratch-simulator
[2830/2870] Linking build/scratch/subdir/subdir
[2831/2870] Linking build/scratch/first
Waf: Leaving directory `/home/mca/workspace/ns-allinone-3.32/ns-3.32/build'
Build commands will be stored in build/compile_commands.json
'build' finished successfully (4.693s)
At time +2s client sent 1024 bytes to 10.1.1.2 port 9
At time +2.00369s server received 1024 bytes from 10.1.1.1 port 49153
At time +2.00369s server sent 1024 bytes to 10.1.1.1 port 49153
At time +2.00737s client received 1024 bytes from 10.1.1.2 port 9
mca@mca-To-be-filled-by-O-E-M:~/workspace/ns-allinone-3.32/ns-3.32$
```