

Lab Project

Network Slicing in 5g Drones

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NS-3 Setup

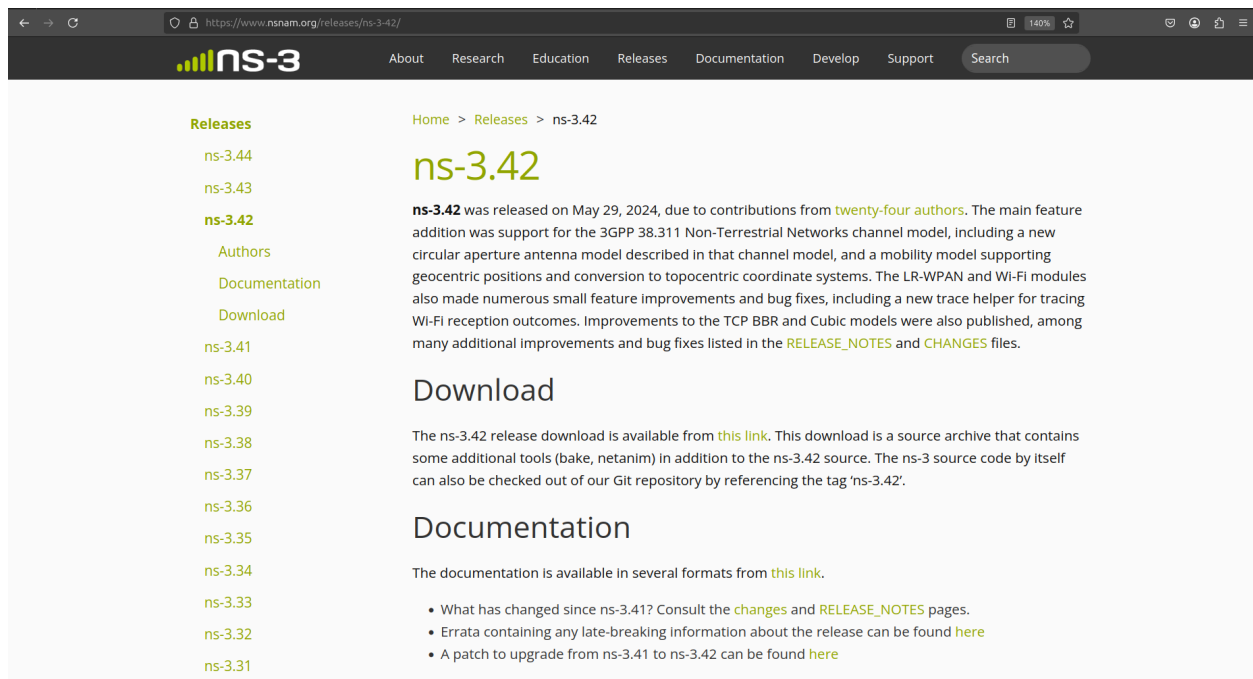
Installation

1. Downloading NS-3

(We will use ns-3.42 for compatibility with 5g-lena)

Step1: Go to Link: <https://www.nsnam.org/releases/ns-3-42/>

Step2: Click on [this link](#) or from website as shown in the below image to download the zipped file from the ns3 website.



Step3: Make your project directory

(Consider we are at /username directory)

Go to Terminal:

```
cd Desktop
```

```
mkdir project
```

A terminal window with a dark background and light text. The title bar shows 'ns3@ns3: ~/Desktop'. The terminal content shows three lines of commands and their outputs: 'ns3@ns3:~\$ cd Desktop', 'ns3@ns3:~/Desktop\$ mkdir project', and 'ns3@ns3:~/Desktop\$' followed by a cursor.

```
ns3@ns3:~$ cd Desktop
ns3@ns3:~/Desktop$ mkdir project
ns3@ns3:~/Desktop$
```

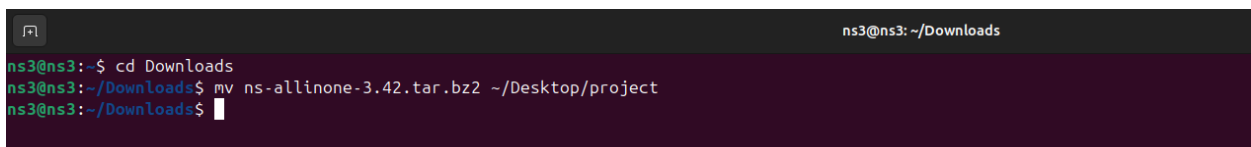
Step4: Move the file to your project directory

(Consider we are at /username directory)

Go to Terminal:

```
cd Downloads
```

```
mv ns-allinone-3.42.tar.bz2 ~/Desktop/project
```

A terminal window with a dark background and light text. The title bar shows 'ns3@ns3: ~/Downloads'. The terminal content shows three lines of commands and their outputs: 'ns3@ns3:~\$ cd Downloads', 'ns3@ns3:~/Downloads\$ mv ns-allinone-3.42.tar.bz2 ~/Desktop/project', and 'ns3@ns3:~/Downloads\$' followed by a cursor.

```
ns3@ns3:~$ cd Downloads
ns3@ns3:~/Downloads$ mv ns-allinone-3.42.tar.bz2 ~/Desktop/project
ns3@ns3:~/Downloads$
```

Step5: Go to project Directory and extract the file

(Consider we are at /username directory)

Go to Terminal:

```
cd Desktop
```

```
cd project
```

```
sudo apt update && sudo apt install bzip2
```

```
ns3@ns3: ~/Desktop/project
ns3@ns3:~$ cd Desktop
ns3@ns3:~/Desktop$ cd project/
ns3@ns3:~/Desktop/project$ sudo apt update && sudo apt install bzip2
```

```
tar -xvf ns-allinone-3.42.tar.bz2
```

```
ns3@ns3:~/Desktop/project$ tar -xvf ns-allinone-3.42.tar.bz2
ns-allinone-3.42/ns-3.42/ns3
ns-allinone-3.42/ns-3.42/AUTHORS
ns-allinone-3.42/ns-3.42/setup.py
ns-allinone-3.42/ns-3.42/.clang-tidy
ns-allinone-3.42/ns-3.42/CONTRIBUTING.md
ns-allinone-3.42/ns-3.42/CMakeLists.txt
ns-allinone-3.42/ns-3.42/RELEASE_NOTES.md
ns-allinone-3.42/ns-3.42/VERSION
ns-allinone-3.42/ns-3.42/.clang-format
ns-allinone-3.42/ns-3.42/test.py
ns-allinone-3.42/ns-3.42/pyproject.toml
ns-allinone-3.42/ns-3.42/.editorconfig
ns-allinone-3.42/ns-3.42/CHANGES.md
ns-allinone-3.42/ns-3.42/utils.py
ns-allinone-3.42/ns-3.42/LICENSE
ns-allinone-3.42/ns-3.42/README.md
ns-allinone-3.42/ns-3.42/setup.cfg
ns-allinone-3.42/ns-3.42/.vscode/launch.json
ns-allinone-3.42/ns-3.42/.vscode/tasks.json
ns-allinone-3.42/ns-3.42/bindings/python/ns__init__.py
ns-allinone-3.42/ns-3.42/contrib/.gitignore
ns-allinone-3.42/ns-3.42/scratch/scratch-simulator.cc
ns-allinone-3.42/ns-3.42/scratch/CMakeLists.txt
ns-allinone-3.42/ns-3.42/scratch/subdir/scratch-subdir.cc
ns-allinone-3.42/ns-3.42/scratch/subdir/scratch-subdir-additional-header.cc
ns-allinone-3.42/ns-3.42/scratch/subdir/scratch-subdir-additional-header.h
ns-allinone-3.42/ns-3.42/scratch/nested-subdir/scratch-nested-subdir-executable.cc
ns-allinone-3.42/ns-3.42/scratch/nested-subdir/CMakeLists.txt
ns-allinone-3.42/ns-3.42/scratch/nested-subdir/lib/scratch-nested-subdir-library-source.cc
ns-allinone-3.42/ns-3.42/scratch/nested-subdir/lib/scratch-nested-subdir-library-header.h
ns-allinone-3.42/ns-3.42/build-support/version.cache.in
ns-allinone-3.42/ns-3.42/build-support/empty-main.cc
ns-allinone-3.42/ns-3.42/build-support/version-defines-template.h
```

2. Install Dependencies

Install all the dependencies required to build

(Consider we are at /username directory)

Go to Terminal:

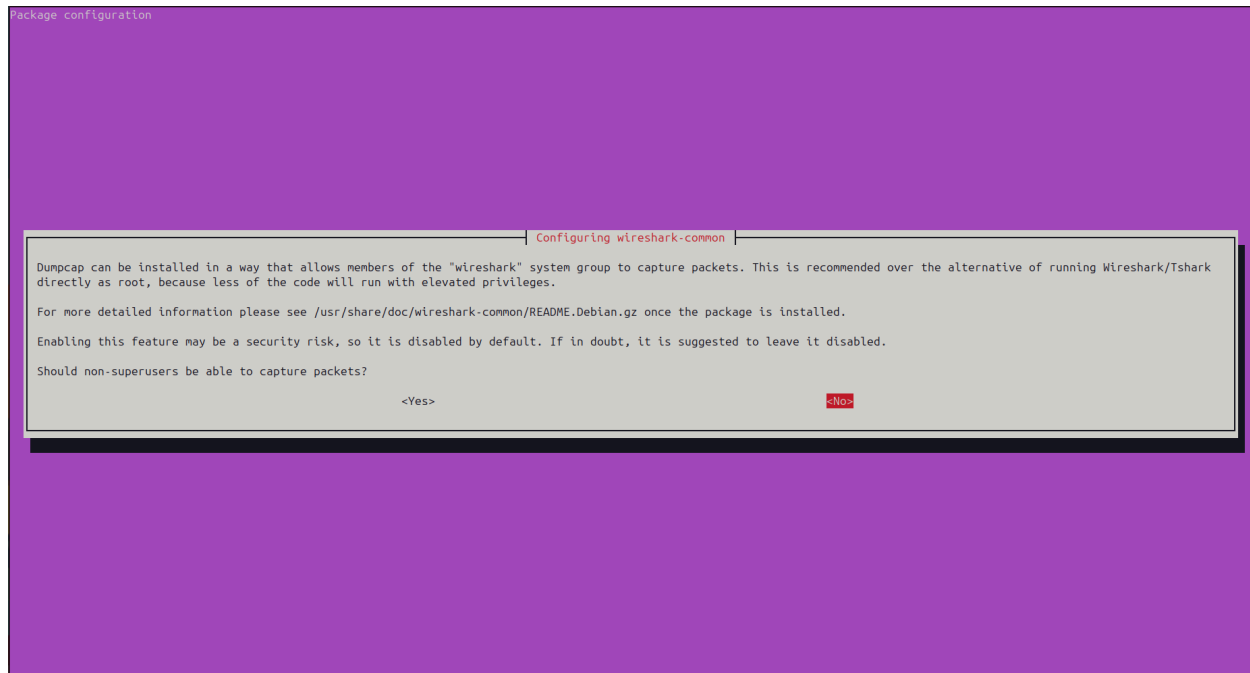
```
sudo apt install g++ python3 cmake ninja-build git
gir1.2-goocanvas-2.0 python3-gi python3-gi-cairo
python3-pygraphviz gir1.2-gtk-3.0 ipython3 tcpdump
wireshark sqlite3 libsqlite3-dev qtbase5-dev qtchooser
qt5-qmake qtbase5-dev-tools openmpi-bin
openmpi-common openmpi-doc libopenmpi-dev doxygen
graphviz imagemagick python3-sphinx dia texlive dvipng
latexmk texlive-extra-utils texlive-latex-extra texlive-font-utils
libeigen3-dev gsl-bin libgsl-dev libgslcblas0 libxml2
libxml2-dev libgtk-3-dev lxc-utils lxc-templates vtun
uml-utilities ebttables bridge-utils libboost-all-dev ccache
```

```
ns3@ns3: $ sudo apt install g++ python3 cmake ninja-build git gir1.2-goocanvas-2.0 python3-gi python3-gi-cairo python3-pygraphviz gir1.2-gtk-3.0 ipython3 tcpdump wireshark sqlite3 libsqlite3-dev qtbase5-dev qtchooser qt5-qmake qtbase5-dev-tools openmpi-bin openmpi-common openmpi-doc libopenmpi-dev doxygen graphviz imagemagick python3-sphinx dia texlive dvipng latexmk texlive-extra-utils texlive-latex-extra texlive-font-utils libeigen3-dev gsl-bin libgsl-dev libgslcblas0 libxml2 libxml2-dev libgtk-3-dev lxc-utils lxc-templates vtun uml-utilities ebttables bridge-utils libboost-all-dev ccache
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
python3 is already the newest version (3.12.3-0ubuntu2).
python3 set to manually installed.
python3-gi is already the newest version (3.48.2-1).
python3-gi set to manually installed.
tcpdump is already the newest version (4.99.4-3ubuntu4).
tcpdump set to manually installed.
```

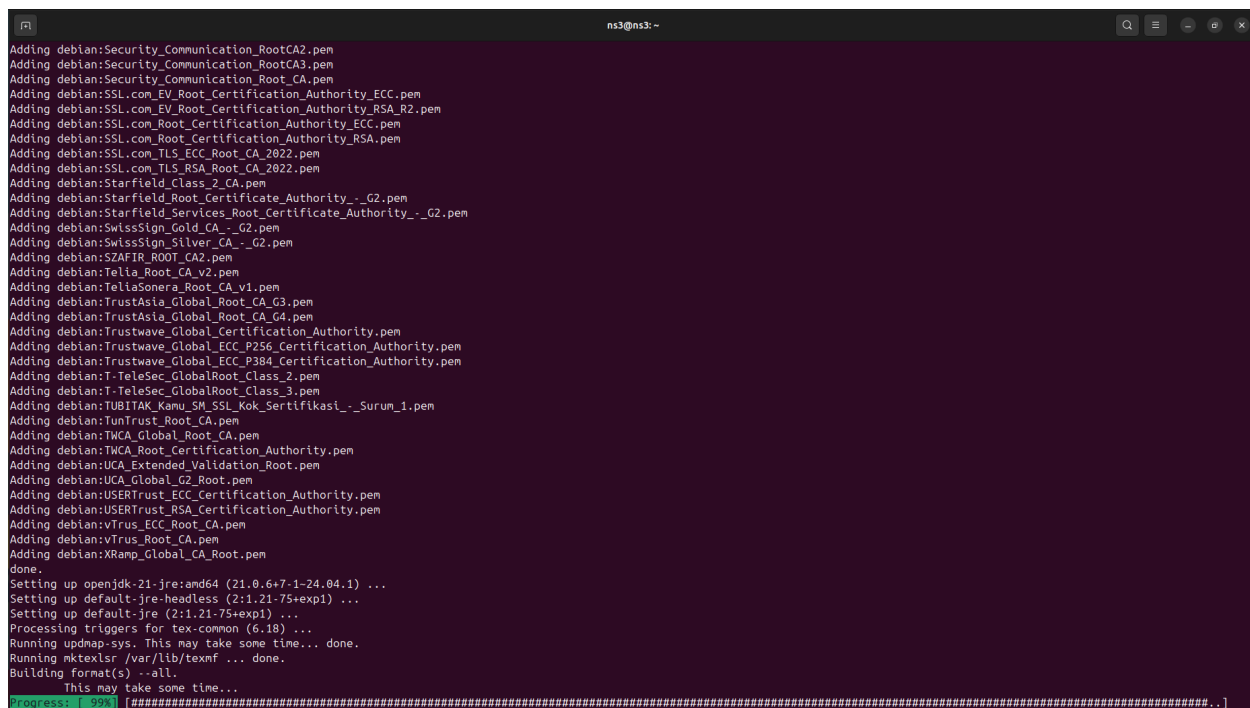
(Type **Y** and continue to Download)

```
The following packages will be upgraded:
  gir1.2-gtk-3.0 gtk-update-icon-cache libexpat1 libgtk-3-0t64 libgtk-3-bin libgtk-3-common liblzma5 libpython3.12-minimal libpython3.12-stdlib xz-utils
14 upgraded, 691 newly installed, 0 to remove and 171 not upgraded.
Need to get 798 MB of archives.
After this operation, 2,974 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
```

(Opt any option as per your preference)



(Wait until the progress hits 100%)



3. Building NS-3

Step1: Go to ns-allinone-3.42 directory

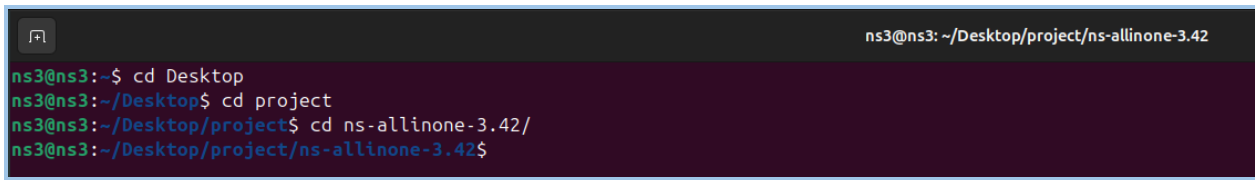
(Consider we are at /username directory)

Go to Terminal:

```
cd Desktop
```

```
cd project
```

```
cd ns-allinone-3.42
```

A terminal window with a dark background. The title bar shows 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42'. The terminal content shows a series of 'cd' commands being executed: 'cd Desktop', 'cd project', and 'cd ns-allinone-3.42'. The prompt changes from '~' to '~/Desktop' and then to '~/Desktop/project' as the user navigates deeper into the directory structure.

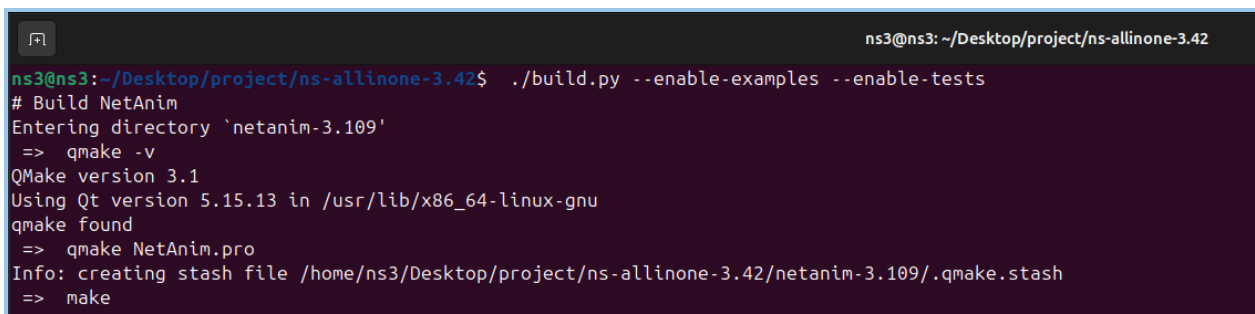
```
ns3@ns3:~$ cd Desktop
ns3@ns3:~/Desktop$ cd project
ns3@ns3:~/Desktop/project$ cd ns-allinone-3.42/
ns3@ns3:~/Desktop/project/ns-allinone-3.42$
```

Step2: Build NS-3

(Consider we are at /ns-allinone-3.42 directory)

Go to Terminal:

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

A terminal window with a dark background. The title bar shows 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42'. The terminal content shows the execution of './build.py --enable-examples --enable-tests'. The script prints information about building NetAnim, including the directory 'netanim-3.109', QMake version 3.1, Qt version 5.15.13, and the creation of a stash file.

```
ns3@ns3:~/Desktop/project/ns-allinone-3.42$ ./build.py --enable-examples --enable-tests
# Build NetAnim
Entering directory 'netanim-3.109'
=> qmake -v
QMake version 3.1
Using Qt version 5.15.13 in /usr/lib/x86_64-linux-gnu
qmake found
=> qmake NetAnim.pro
Info: creating stash file /home/ns3/Desktop/project/ns-allinone-3.42/netanim-3.109/.qmake.stash
=> make
```


(Wait until it completes 1940/1940)

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42
GtkConfigStore      : ON
libxml2 support     : ON
MPI Support         : OFF (not requested)
ns-3 Click Integration : OFF (Missing headers: "simclick.h" and missing libraries: "nsclick click")
ns-3 OpenFlow Integration : OFF (Missing headers: "openflow.h" and missing libraries: "openflow")
Netmap emulation FdNetDevice : OFF (missing dependency)
PyViz visualizer    : OFF (Python Bindings are disabled)
Python Bindings     : OFF (not requested)
SQLite support      : ON
Eigen3 support      : ON
Tap Bridge          : ON
Tap FdNetDevice     : ON
Tests               : ON

Modules configured to be built:
antenna             aadv             applications
bridge              buildings          config-store
core                csma              csma-layout
dsv                 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             topology-read
traffic-control     uan              virtual-net-device
wifi                wimax

Modules that cannot be built:
brite               click             mpi
openflow            visualizer

-- Configuring done (5.9s)
-- Generating done (1.9s)
-- Build files have been written to: /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42/cmake-cache
Finished executing the following commands:
mkdir cmake-cache
/usr/bin/cmake -S /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42 -B /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42/cmake-cache -DCMAKE_BUILD_TYPE=default -DNS3_ASSERT=ON -DNS3_LOG=ON -DNS3_WARNINGS_AS_ERRORS=OFF -DNS3_NATIVE_OPTIMIZATIONS=OFF -DNS3_EXAMPLES=ON -DNS3_TESTS=ON -G Ninja --warn-uninitialized
=> /usr/bin/python3 ns3 build
[0/2] Re-checking globbed directories...
[171/1940] Building CXX object src/network/CMakeFiles/libnetwork-obj.dir/utls/queue.cc.o
```

Step3: Check the Built

(Consider we are at /ns-allinone-3.42 directory)

Go to Terminal:

```
cd ns-3.42
```

```
./ns3 run hello-simulator
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42
ns3@ns3: ~/Desktop/project/ns-allinone-3.42$ cd ns-3.42/
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42$ ./ns3 run hello-simulator
[0/2] Re-checking globbed directories...
ninja: no work to do.
Hello Simulator
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42$
```

(It is showing Hello Simulator)

NetSimulyzer Setup

Installation

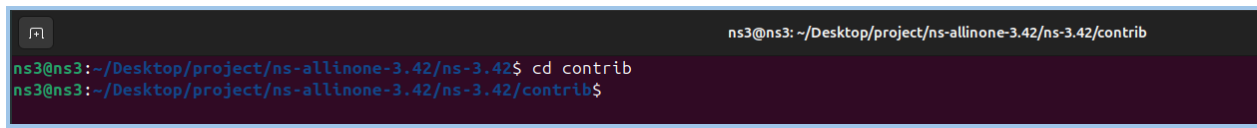
1. Downloading NetSimulyzer NS-3 module

Step1: Go to /contrib directory

(Consider we are at /ns-3.42 directory)

Go to Terminal:

```
cd contrib
```

A terminal window with a dark background. The title bar shows 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib'. The terminal content shows two lines: 'ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42\$ cd contrib' and 'ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib\$'.

Step2: Go to /contrib directory

(Consider we are at /ns-3.42 directory)

Go to Terminal:

```
wget
```

```
https://github.com/usnistgov/NetSimulyzer-ns3-module/archive/master.zip -O NetSimulyzer-ns3-module-master.zip
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib$ wget https://github.com/usnistgov/NetSimulyzer-ns3-module/archive/master.zip -O NetSimulyzer-ns3-module-master.zip
--2025-04-24 16:17:42-- https://github.com/usnistgov/NetSimulyzer-ns3-module/archive/master.zip
Resolving github.com (github.com)... 20.207.73.82
Connecting to github.com (github.com)|20.207.73.82|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://codeload.github.com/usnistgov/NetSimulyzer-ns3-module/zip/refs/heads/master [following]
--2025-04-24 16:17:42-- https://codeload.github.com/usnistgov/NetSimulyzer-ns3-module/zip/refs/heads/master
Resolving codeload.github.com (codeload.github.com)... 20.207.73.88
Connecting to codeload.github.com (codeload.github.com)|20.207.73.88|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/zip]
Saving to: 'NetSimulyzer-ns3-module-master.zip'

NetSimulyzer-ns3-module-master.zip           [          ] 3.06M 1.35MB/s   in 2.3s

2025-04-24 16:17:45 (1.35 MB/s) - 'NetSimulyzer-ns3-module-master.zip' saved [3205495]

ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib$
```

Step3: Unzip downloaded file

(Consider we are at /contrib directory)

Go to Terminal:

```
unzip NetSimulyzer-ns3-module-master.zip
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib$ unzip NetSimulyzer-ns3-module-master.zip
Archive: NetSimulyzer-ns3-module-master.zip
38ef6a2bdac16796063c900f99a3edf2d7e8726e
  creating NetSimulyzer-ns3-module-master/
  inflating NetSimulyzer-ns3-module-master/.clang-tidy
  inflating NetSimulyzer-ns3-module-master/CMakeLists.txt
  inflating NetSimulyzer-ns3-module-master/LICENSE.md
  inflating NetSimulyzer-ns3-module-master/README.md
  inflating NetSimulyzer-ns3-module-master/THIRD_PARTY_LICENSES.md
  creating NetSimulyzer-ns3-module-master/doc/
  extracting NetSimulyzer-ns3-module-master/doc/.gitignore
```

Step3: Rename the resulting directory to netsimulyzer

(As ns-3 will not accept a module named differently than its directory.)

(Consider we are at /contrib directory)

Go to Terminal:

```
mv NetSimulyzer-ns3-module-master netsimulyzer
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib$ mv NetSimulyzer-ns3-module-master netsimulyzer
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/contrib$
```

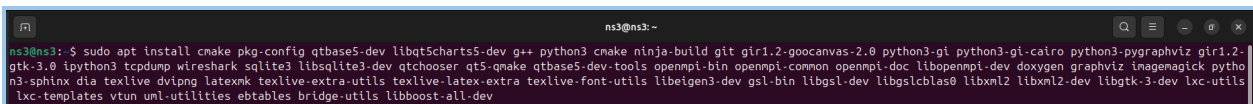
2. Install Dependencies

Install all dependencies for NetSimulyzer

(Consider we are at /username directory)

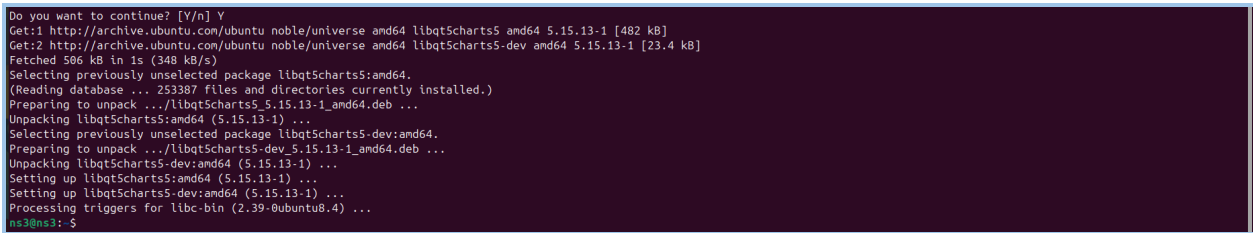
Go to Terminal:

```
sudo apt install cmake pkg-config qtbase5-dev  
libqt5charts5-dev g++ python3 cmake ninja-build git  
gir1.2-goocanvas-2.0 python3-gi python3-gi-cairo  
python3-pygraphviz gir1.2-gtk-3.0 ipython3 tcpdump  
wireshark sqlite3 libsqlite3-dev qtchooser qt5-qmake  
qtbase5-dev-tools openmpi-bin openmpi-common  
openmpi-doc libopenmpi-dev doxygen graphviz  
imagemagick python3-sphinx dia texlive dvipng latexmk  
texlive-extra-utils texlive-latex-extra texlive-font-utils  
libeigen3-dev gsl-bin libgsl-dev libgslcblas0 libxml2  
libxml2-dev libgtk-3-dev lxc-utils lxc-templates vtun  
uml-utilities ebttables bridge-utils libboost-all-dev
```



```
ns3@ns3:~$ sudo apt install cmake pkg-config qtbase5-dev libqt5charts5-dev g++ python3 cmake ninja-build git gir1.2-goocanvas-2.0 python3-gi python3-gi-cairo python3-pygraphviz gir1.2-gtk-3.0 ipython3 tcpdump wireshark sqlite3 libsqlite3-dev qtchooser qt5-qmake qtbase5-dev-tools openmpi-bin openmpi-common openmpi-doc libopenmpi-dev doxygen graphviz imagemagick python3-sphinx dia texlive dvipng latexmk texlive-extra-utils texlive-latex-extra texlive-font-utils libeigen3-dev gsl-bin libgsl-dev libgslcblas0 libxml2 libxml2-dev libgtk-3-dev lxc-utils lxc-templates vtun uml-utilities ebttables bridge-utils libboost-all-dev
```

(Press Y to continue)



```
Do you want to continue? [Y/n] Y  
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt5charts5 amd64 5.15.13-1 [482 kB]  
Get:2 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt5charts5-dev amd64 5.15.13-1 [23.4 kB]  
Fetched 506 kB in 1s (348 kB/s)  
Selecting previously unselected package libqt5charts5:amd64.  
(Reading database ... 253387 files and directories currently installed.)  
Preparing to unpack .../libqt5charts5_5.15.13-1_amd64.deb ...  
Unpacking libqt5charts5:amd64 (5.15.13-1) ...  
Selecting previously unselected package libqt5charts5-dev:amd64.  
Preparing to unpack .../libqt5charts5-dev_5.15.13-1_amd64.deb ...  
Unpacking libqt5charts5-dev:amd64 (5.15.13-1) ...  
Setting up libqt5charts5:amd64 (5.15.13-1) ...  
Setting up libqt5charts5-dev:amd64 (5.15.13-1) ...  
Processing triggers for libc-bin (2.39-0ubuntu8.4) ...  
ns3@ns3:~$
```

3. Building NS-3 for NetSimulyzer

Step1: Go to ns-allinone-3.42 directory

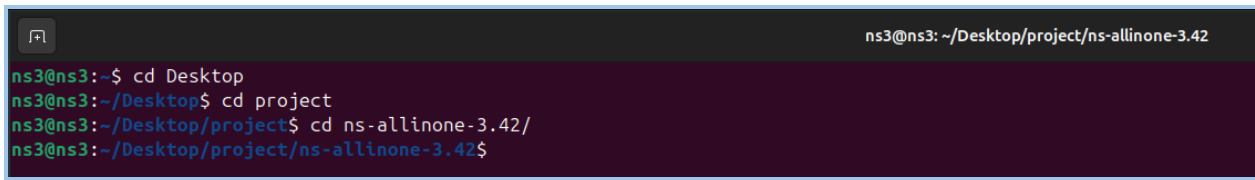
(Consider we are at /username directory)

Go to Terminal:

```
cd Desktop
```

```
cd project
```

```
cd ns-allinone-3.42
```

A terminal window with a dark background. The title bar shows 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42'. The terminal content shows a series of 'cd' commands: 'cd Desktop', 'cd project', and 'cd ns-allinone-3.42', each followed by a new prompt line.

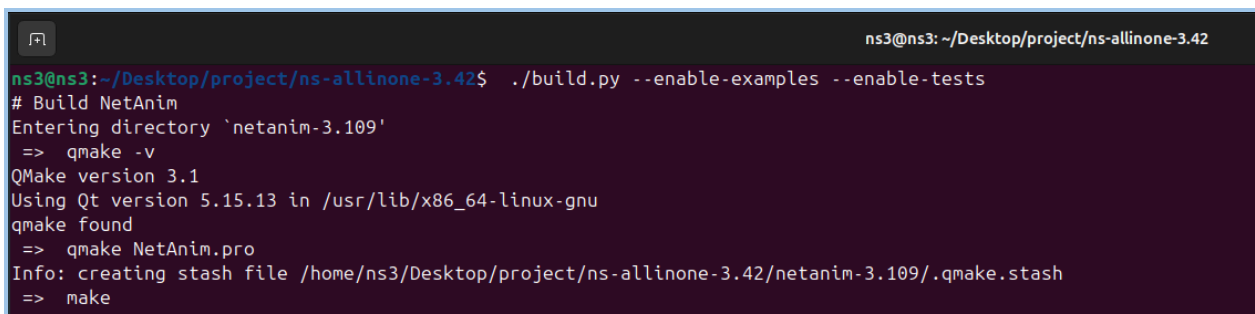
```
ns3@ns3:~$ cd Desktop
ns3@ns3:~/Desktop$ cd project
ns3@ns3:~/Desktop/project$ cd ns-allinone-3.42/
ns3@ns3:~/Desktop/project/ns-allinone-3.42$
```

Step2: Build NS-3

(Consider we are at /ns-allinone-3.42 directory)

Go to Terminal:

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

A terminal window with a dark background. The title bar shows 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42'. The terminal content shows the execution of './build.py --enable-examples --enable-tests', which triggers a build process for NetAnim, including qmake and make commands.

```
ns3@ns3:~/Desktop/project/ns-allinone-3.42$ ./build.py --enable-examples --enable-tests
# Build NetAnim
Entering directory 'netanim-3.109'
=> qmake -v
QMake version 3.1
Using Qt version 5.15.13 in /usr/lib/x86_64-linux-gnu
qmake found
=> qmake NetAnim.pro
Info: creating stash file /home/ns3/Desktop/project/ns-allinone-3.42/netanim-3.109/.qmake.stash
=> make
```

(Wait until it completes 53/53)

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42
GtkConfigStore      : ON
libxml2 support     : ON
MPI Support         : OFF (not requested)
ns-3 Click Integration : OFF (Missing headers: "simclick.h" and missing libraries: "nsclick click")
ns-3 OpenFlow Integration : OFF (Missing headers: "openflow.h" and missing libraries: "openflow")
Netmap emulation FdNetDevice : OFF (missing dependency)
PyViz visualizer    : OFF (Python Bindings are disabled)
Python Bindings     : OFF (not requested)
SQLite support      : ON
Eigen3 support      : ON
Tap Bridge          : ON
Tap FdNetDevice     : ON
Tests               : ON

Modules configured to be built:
antenna             aodv                 applications
bridge              buildings            config-store
core                csma                 csma-layout
dsv                 dsr                  energy
fd-net-device        flow-monitor          internet
internet-apps        lr-wpan              lte
mesh                mobility             netanim
netsimulyzer        network              nix-vector-routing
olsr                 point-to-point        point-to-point-layout
propagation          stxlowpan             spectrum
stats               tap-bridge            test
topology-read        traffic-control        uan
virtual-net-device   wifi                  wimax

Modules that cannot be built:
brite               click                mpi
openflow            visualizer

-- Configuring done (1.2s)
-- Generating done (1.6s)
-- Build files have been written to: /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42/cmake-cache
Finished executing the following commands:
/usr/bin/cmake -S /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42 -B /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42/cmake-cache -DNS3_EXAMPLES=ON -DNS3_TESTS=ON --warn-uninitialized
=> /usr/bin/python3 ns3 build
[0/2] Re-checking globbed directories...
[7/53] Building CXX object contrib/netsimulyzer/CMakeFiles/libnetsimulyzer-obj.dir/model/netsimulyzer-version.cc.o
```

Step3: Check the Built

(Consider we are at /ns-allinone-3.42 directory)

Go to Terminal:

```
cd ns-3.42
```

```
./ns3 run contrib/netsimulyzer/examples
mobility-buildings-example.cc
```

4. Installing NetSimulyzer Software

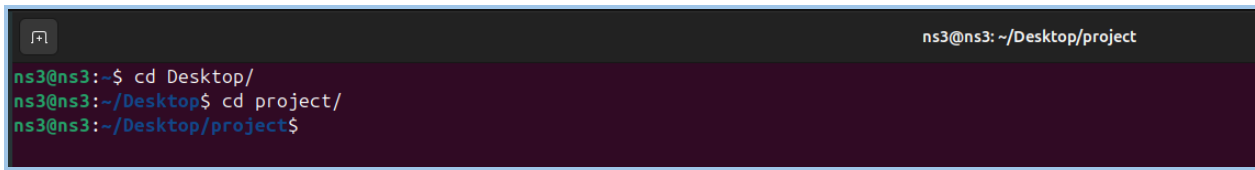
Step1: Go to project directory

(Consider we are at /username directory)

Go to Terminal:

```
cd Desktop
```

```
cd project
```



```
ns3@ns3: ~/Desktop/project
ns3@ns3:~$ cd Desktop/
ns3@ns3:~/Desktop$ cd project/
ns3@ns3:~/Desktop/project$
```

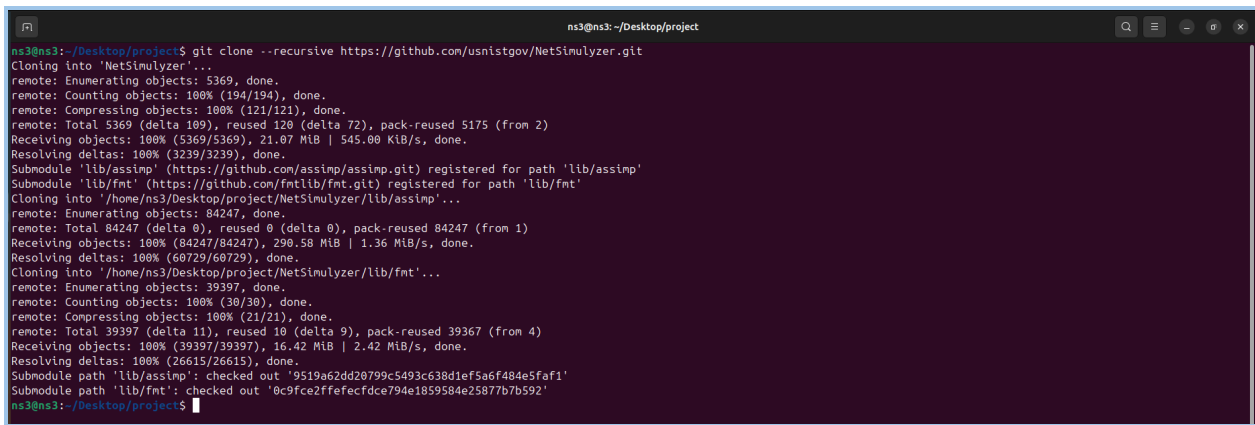
Step2: Clone the NetSimulyzer Repo

(Consider we are at /project directory)

Go to Terminal:

```
clone --recursive
```

```
https://github.com/usnistgov/NetSimulyzer.git
```



```
ns3@ns3: ~/Desktop/project
ns3@ns3:~/Desktop/project$ git clone --recursive https://github.com/usnistgov/NetSimulyzer.git
Cloning into 'NetSimulyzer'...
remote: Enumerating objects: 5369, done.
remote: Counting objects: 100% (194/194), done.
remote: Compressing objects: 100% (121/121), done.
remote: Total 5369 (delta 109), reused 120 (delta 72), pack-reused 5175 (from 2)
Receiving objects: 100% (5369/5369), 21.07 MiB | 545.00 KiB/s, done.
Resolving deltas: 100% (3239/3239), done.
Submodule 'lib/assimp' (https://github.com/assimp/assimp.git) registered for path 'lib/assimp'
Submodule 'lib/fmt' (https://github.com/fmtlib/fmt.git) registered for path 'lib/fmt'
Cloning into '/home/ns3/Desktop/project/NetSimulyzer/lib/assimp'...
remote: Enumerating objects: 84247, done.
remote: Total 84247 (delta 0), reused 0 (delta 0), pack-reused 84247 (from 1)
Receiving objects: 100% (84247/84247), 290.58 MiB | 1.36 MiB/s, done.
Resolving deltas: 100% (60729/60729), done.
Cloning into '/home/ns3/Desktop/project/NetSimulyzer/lib/fmt'...
remote: Enumerating objects: 39397, done.
remote: Counting objects: 100% (30/30), done.
remote: Compressing objects: 100% (21/21), done.
remote: Total 39397 (delta 11), reused 10 (delta 9), pack-reused 39367 (from 4)
Receiving objects: 100% (39397/39397), 16.42 MiB | 2.42 MiB/s, done.
Resolving deltas: 100% (26615/26615), done.
Submodule path 'lib/assimp': checked out '9519a62dd20799c5493c638d1ef5a6f484e5faf1'
Submodule path 'lib/fmt': checked out '0c9fce2ffeecfdce794e1859584e25877b7b592'
ns3@ns3:~/Desktop/project$
```

Step3: Make /build directory

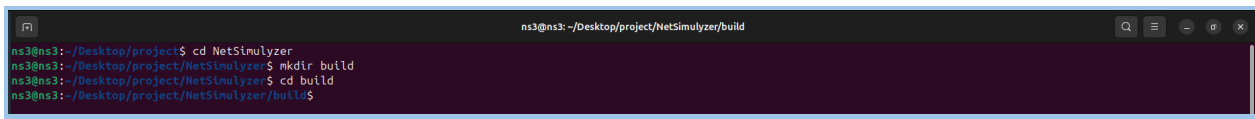
(Consider we are at /project directory)

Go to Terminal:

```
cd NetSimulyzer
```

```
mkdir build
```

```
cd build
```



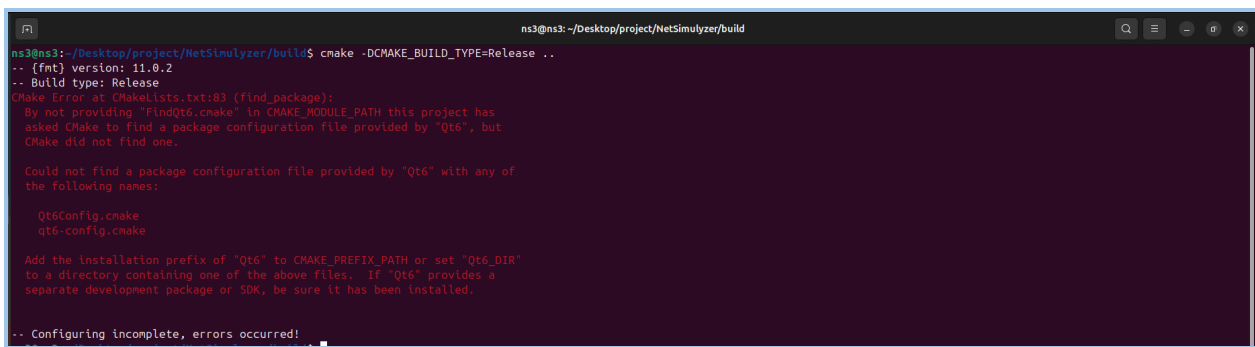
```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build
ns3@ns3: ~/Desktop/project$ cd NetSimulyzer
ns3@ns3: ~/Desktop/project/NetSimulyzer$ mkdir build
ns3@ns3: ~/Desktop/project/NetSimulyzer$ cd build
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$
```

Step4: Build Software

(Consider we are at /build directory)

Go to Terminal:

```
cmake -DCMAKE_BUILD_TYPE=Release ..
```



```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$ cmake -DCMAKE_BUILD_TYPE=Release ..
-- [fmt] version: 11.0.2
-- Build type: Release
CMake Error at CMakeLists.txt:83 (find_package):
  By not providing "FindQt6.cmake" in CMAKE_MODULE_PATH this project has
  asked CMake to find a package configuration file provided by "Qt6", but
  CMake did not find one.

Could not find a package configuration file provided by "Qt6" with any of
the following names:

  Qt6Config.cmake
  qt6-config.cmake

Add the installation prefix of "Qt6" to CMAKE_PREFIX_PATH or set "Qt6_DIR"
to a directory containing one of the above files.  If "Qt6" provides a
separate development package or SDK, be sure it has been installed.

-- Configuring incomplete, errors occurred!
```

(Error Occurred, we will solve the error by installing required dependencies)


```
sudo apt install libassimp-dev
```

```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$ sudo apt install libassimp-dev
[sudo] password for ns3:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libassimp5 libdraco8 libpugixml-dev libpugixmlv5
The following NEW packages will be installed:
  libassimp-dev libassimp5 libdraco8 libpugixml-dev libpugixmlv5
0 upgraded, 5 newly installed, 0 to remove and 171 not upgraded.
Need to get 3,458 kB of archives.
After this operation, 12.3 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 libdraco8 amd64 1.5.6+dfsg-3build1 [833 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble/universe amd64 libpugixmlv5 amd64 1.14-0.1build1 [91.9 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble/universe amd64 libassimp5 amd64 5.3.1+ds-2build1 [2,273 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble/universe amd64 libpugixml-dev amd64 1.14-0.1build1 [113 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble/universe amd64 libassimp-dev amd64 5.3.1+ds-2build1 [147 kB]
Fetched 3,458 kB in 2s (1,435 kB/s)
Selecting previously unselected package libdraco8:amd64.
(Reading database ... 253515 files and directories currently installed.)
Preparing to unpack .../libdraco8_1.5.6+dfsg-3build1_amd64.deb ...
Unpacking libdraco8:amd64 (1.5.6+dfsg-3build1) ...
Selecting previously unselected package libpugixmlv5:amd64.
Preparing to unpack .../libpugixmlv5_1.14-0.1build1_amd64.deb ...
Unpacking libpugixmlv5:amd64 (1.14-0.1build1) ...
Selecting previously unselected package libassimp5:amd64.
Preparing to unpack .../libassimp5_5.3.1+ds-2build1_amd64.deb ...
Unpacking libassimp5:amd64 (5.3.1+ds-2build1) ...
Selecting previously unselected package libpugixml-dev:amd64.
Preparing to unpack .../libpugixml-dev_1.14-0.1build1_amd64.deb ...
Unpacking libpugixml-dev:amd64 (1.14-0.1build1) ...
Selecting previously unselected package libassimp-dev:amd64.
Preparing to unpack .../libassimp-dev_5.3.1+ds-2build1_amd64.deb ...
Unpacking libassimp-dev:amd64 (5.3.1+ds-2build1) ...
Setting up libpugixmlv5:amd64 (1.14-0.1build1) ...
Setting up libdraco8:amd64 (1.5.6+dfsg-3build1) ...
Setting up libassimp5:amd64 (5.3.1+ds-2build1) ...
Setting up libpugixml-dev:amd64 (1.14-0.1build1) ...
Setting up libassimp-dev:amd64 (5.3.1+ds-2build1) ...
Processing triggers for libc-bin (2.39-0ubuntu8.4) ...
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$
```

```
sudo apt install qt6-base-dev qt6-base-dev-tools
```

```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$ sudo apt install qt6-base-dev qt6-base-dev-tools
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libqt6concurrent6t64 libqt6openglwidgets6t64 libqt6sql6-sqlite libqt6sql6t64 libqt6test6t64 libqt6xml6t64 qmake6 qmake6-bin
The following NEW packages will be installed:
  libqt6concurrent6t64 libqt6openglwidgets6t64 libqt6sql6-sqlite libqt6sql6t64 libqt6test6t64 libqt6xml6t64 qmake6 qmake6-bin qt6-base-dev qt6-base-dev-tools
0 upgraded, 10 newly installed, 0 to remove and 171 not upgraded.
Need to get 3,746 kB of archives.
After this operation, 25.6 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6concurrent6t64 amd64 6.4.2+dfsg-21.1build5 [33.4 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6openglwidgets6t64 amd64 6.4.2+dfsg-21.1build5 [40.4 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6sql6t64 amd64 6.4.2+dfsg-21.1build5 [141 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6sql6-sqlite amd64 6.4.2+dfsg-21.1build5 [57.8 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6test6t64 amd64 6.4.2+dfsg-21.1build5 [167 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble/universe amd64 libqt6xml6t64 amd64 6.4.2+dfsg-21.1build5 [75.9 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble/universe amd64 qmake6-bin amd64 6.4.2+dfsg-21.1build5 [624 kB]
Get:8 http://archive.ubuntu.com/ubuntu noble/universe amd64 qmake6 amd64 6.4.2+dfsg-21.1build5 [178 kB]
Fetched 3,746 kB in 2s (1,873 kB/s)
Selecting previously unselected package libqt6concurrent6t64:amd64.
(Reading database ... 253515 files and directories currently installed.)
Preparing to unpack .../libqt6concurrent6t64_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6concurrent6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package libqt6openglwidgets6t64:amd64.
Preparing to unpack .../libqt6openglwidgets6t64_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6openglwidgets6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package libqt6sql6t64:amd64.
Preparing to unpack .../libqt6sql6t64_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6sql6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package libqt6sql6-sqlite:amd64.
Preparing to unpack .../libqt6sql6-sqlite_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6sql6-sqlite:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package libqt6test6t64:amd64.
Preparing to unpack .../libqt6test6t64_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6test6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package libqt6xml6t64:amd64.
Preparing to unpack .../libqt6xml6t64_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking libqt6xml6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package qmake6-bin.
Preparing to unpack .../qmake6-bin_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking qmake6-bin (6.4.2+dfsg-21.1build5) ...
Selecting previously unselected package qmake6.
Preparing to unpack .../qmake6_6.4.2+dfsg-21.1build5_amd64.deb ...
Unpacking qmake6 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6concurrent6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6openglwidgets6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6sql6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6sql6-sqlite:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6test6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up libqt6xml6t64:amd64 (6.4.2+dfsg-21.1build5) ...
Setting up qmake6-bin (6.4.2+dfsg-21.1build5) ...
Setting up qmake6 (6.4.2+dfsg-21.1build5) ...
Setting up qt6-base-dev (6.4.2+dfsg-21.1build5) ...
Setting up qt6-base-dev-tools (6.4.2+dfsg-21.1build5) ...
ns3@ns3: ~/Desktop/project/NetSimulyzer/build$
```

(Now Again)

```
cmake -DCMAKE_BUILD_TYPE=Release ..
```

```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build
ns3@ns3:~/Desktop/project/NetSimulyzer/build$ cmake -DCMAKE_BUILD_TYPE=Release ..
-- {fmt} version: 11.0.2
-- Build type: Release
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD - Success
-- Found Threads: TRUE
-- Performing Test HAVE_STDATOMIC
-- Performing Test HAVE_STDATOMIC - Success
-- Found WrapAtomic: TRUE
-- Found OpenGL: /usr/lib/x86_64-linux-gnu/libOpenGL.so
-- Found WrapOpenGL: TRUE
-- Found XKB: /usr/lib/x86_64-linux-gnu/libxkbcommon.so (found suitable version "1.6.0", minimum required is "0.5.0")
-- Found WrapVulkanHeaders: /usr/include
-- Configuring done (0.7s)
-- Generating done (0.8s)
-- Build files have been written to: /home/ns3/Desktop/project/NetSimulyzer/build
ns3@ns3:~/Desktop/project/NetSimulyzer/build$
```

cmake --build .

```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build
ns3@ns3:~/Desktop/project/NetSimulyzer/build$ cmake --build . --parallel
[ 0%] Built target QCustomPlot_autogen_timestamp_deps
[ 1%] Building CXX object lib/fmt/CMakeFiles/fmt.dir/src/format.cc.o
[ 3%] Building CXX object lib/fmt/CMakeFiles/fmt.dir/src/os.cc.o
[ 4%] Automatic MOC and UIF For target QCustomPlot
[ 4%] Built target QCustomPlot_autogen
[ 6%] Building CXX object lib/QCustomPlot/CMakeFiles/QCustomPlot.dir/QCustomPlot_autogen/mocs_compilation.cpp.o
[ 8%] Building CXX object lib/QCustomPlot/CMakeFiles/QCustomPlot.dir/qcustomplot.cpp.o
[ 9%] Linking CXX static library libfmt.a
[ 9%] Built target fmt
[13%] Building CXX object parser/CMakeFiles/parser.dir/file-parser.cpp.o
[13%] Building CXX object parser/CMakeFiles/parser.dir/handler/JsonHandler.cpp.o
```

(Wait until the build)

```
ns3@ns3: ~/Desktop/project/NetSimulyzer/build
[18%] Built target netsimulyzer_autogen_timestamp_deps
[19%] Built target netsimulyzer_autogen
[21%] Building CXX object CMakeFiles/netsimulyzer.dir/netsimulyzer_autogen/mocs_compilation.cpp.o
[22%] Building CXX object CMakeFiles/netsimulyzer.dir/main.cpp.o
[24%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/area/Area.cpp.o
[26%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/building/Building.cpp.o
[27%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/decoration/Decoration.cpp.o
[29%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/link/LogicLink.cpp.o
[31%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/link/WiredLink.cpp.o
[32%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/node/Node.cpp.o
[34%] Building CXX object CMakeFiles/netsimulyzer.dir/src/group/node/TrailBuffer.cpp.o
[36%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/camera/ArcCamera.cpp.o
[37%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/camera/Camera.cpp.o
[39%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/font/FontManager.cpp.o
[40%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/framebuffer/PickingFramebuffer.cpp.o
[42%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/helper/Floor.cpp.o
[44%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/mesh/Mesh.cpp.o
[45%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/model/Model.cpp.o
[47%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/model/ModelCache.cpp.o
[49%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/renderer/Renderer.cpp.o
[50%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/shader/Shader.cpp.o
[52%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/helper/SkyBox.cpp.o
[54%] Building CXX object CMakeFiles/netsimulyzer.dir/src/render/texture/TextureCache.cpp.o
[55%] Building CXX object CMakeFiles/netsimulyzer.dir/src/settings/SettingsManager.cpp.o
[57%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/about/AboutDialog.cpp.o
[59%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/loadworker.cpp.o
[60%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/mainwindow.cpp.o
[62%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/scene/SceneWidget.cpp.o
[63%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/settings/SettingsDialog.cpp.o
[65%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/util/file-operations.cpp.o
[67%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/chart/ChartManager.cpp.o
[68%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/chart/ChartWidget.cpp.o
[70%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/chart/controls/ChartView.cpp.o
[72%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/controls/SingleKeySequenceEdit/SingleKeySequenceEdit.cpp.o
[73%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/log/ScenarioLogWidget.cpp.o
[75%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/node/NodeWidget.cpp.o
[77%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/detail/DetailManager.cpp.o
[78%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/detail/DetailWidget.cpp.o
[80%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/playback/PlaybackJumpDialog.cpp.o
[81%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/playback/PlaybackTimeStepDialog.cpp.o
[83%] Building CXX object CMakeFiles/netsimulyzer.dir/src/window/playback/PlaybackWidget.cpp.o
[85%] Building CXX object CMakeFiles/netsimulyzer.dir/src/conversion.cpp.o
[86%] Linking CXX executable netsimulyzer
[100%] Built target netsimulyzer
ns3@ns3:~/Desktop/project/NetSimulyzer/build$
```

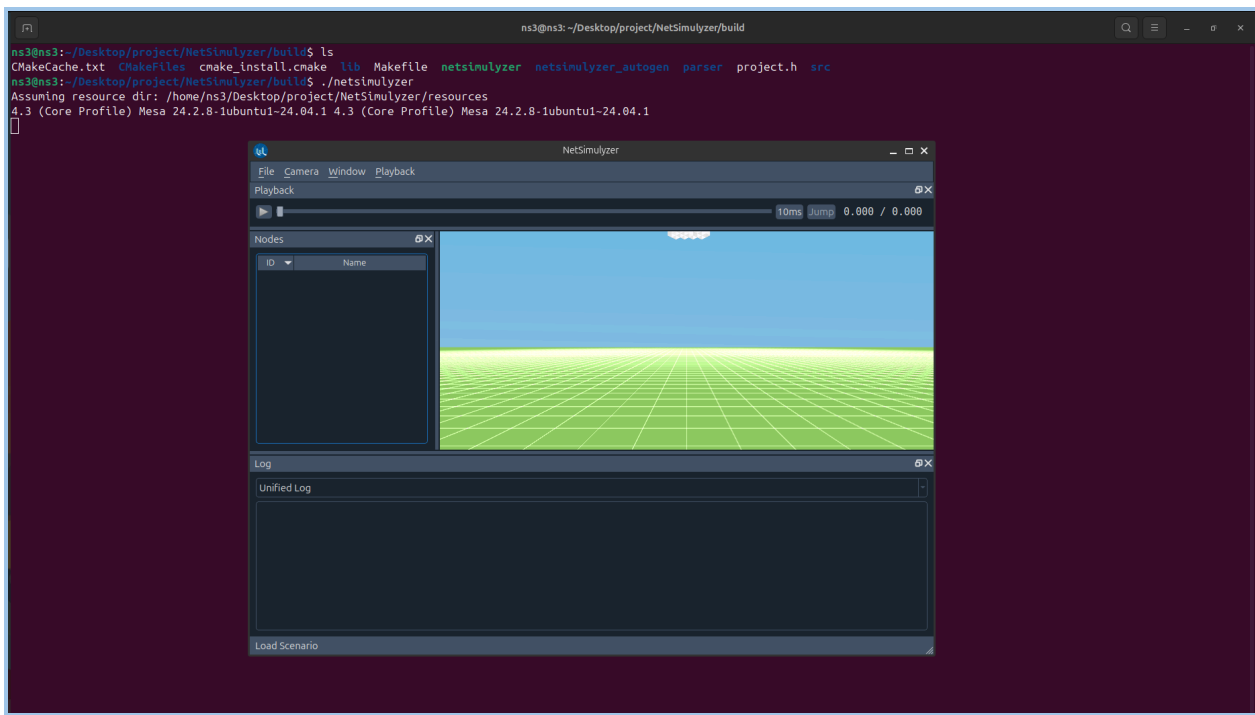
Step5: Check NetSimulyzer

(Consider we are at /build directory)

Go to Terminal:

```
cd NetSimulyzer
```

```
./netsimulyzer
```



Drone Simulation

Setup Code & Simulation

1. Write Code

Step1: Go to /scratch directory

(Consider we are at /username directory)

Go to Terminal:

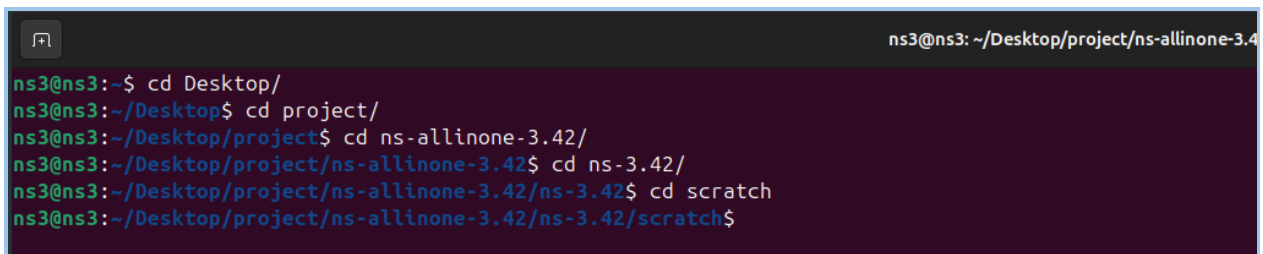
```
cd Desktop
```

```
cd project
```

```
cd ns-allinone-3.42
```

```
cd ns-3.42
```

```
cd scratch
```

A terminal window with a dark background and light text. The title bar shows a window icon and the text 'ns3@ns3: ~/Desktop/project/ns-allinone-3.42'. The terminal content shows a series of 'cd' commands being executed to navigate through the directory structure: Desktop, project, ns-allinone-3.42, ns-3.42, and finally scratch. The prompt changes as each directory is entered.

```
ns3@ns3:~$ cd Desktop/  
ns3@ns3:~/Desktop$ cd project/  
ns3@ns3:~/Desktop/project$ cd ns-allinone-3.42/  
ns3@ns3:~/Desktop/project/ns-allinone-3.42$ cd ns-3.42/  
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42$ cd scratch  
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/scratch$
```

Code

```
#include "ns3/aodv-module.h"

#include "ns3/core-module.h"

#include "ns3/internet-module.h"

#include "ns3/mobility-module.h"

#include "ns3/network-module.h"

#include "ns3/ping-helper.h"

#include "ns3/point-to-point-module.h"

#include "ns3/yans-wifi-helper.h"

#include <ns3/netsimulyzer-module.h>

#include <cmath>

#include <iostream>


using namespace ns3;


/**
 * @defgroup aodv-examples AODV Examples
 *
 * @ingroup aodv
```

```
* @ingroup examples
```

```
*/
```

```
/**
```

```
* @ingroup aodv-examples
```

```
* @ingroup examples
```

```
* @brief Test script.
```

```
*
```

```
* This script creates 1-dimensional grid topology and then ping last  
node from the first one:
```

```
*
```

```
* [10.0.0.1] <-- step --> [10.0.0.2] <-- step --> [10.0.0.3] <-- step --> [10.0.0.4]
```

```
*
```

```
* ping 10.0.0.4
```

```
*
```

```
* When 1/3 of simulation time has elapsed, one of the nodes is moved  
out of
```

```
* range, thereby breaking the topology. By default, this will result in
```

```
* stopping ping replies reception after sequence number 33. If the step  
size is reduced
```

* to cover the gap, then also the following pings can be received.

*/

class AodvExample

{

public:

AodvExample();

/**

* @brief Configure script parameters

* @param argc is the command line argument count

* @param argv is the command line arguments

* @return true on successful configuration

*/

bool Configure(int argc, char** argv);

/// Run simulation

void Run();

/**

* Report results

* @param os the output stream

*/

```
void Report(std::ostream& os);

private:
    // parameters
    /// Number of nodes
    uint32_t size;
    /// Distance between nodes, meters
    double step;
    /// Simulation time, seconds
    double totalTime;
    /// Write per-device PCAP traces if true
    bool pcap;
    /// Print routes if true
    bool printRoutes;

    // network
    /// nodes used in the example
    NodeContainer nodes;
    /// devices used in the example
```



```

NetDeviceContainer devices;

/// interfaces used in the example

Ipv4InterfaceContainer interfaces;

private:

    /// Create the nodes
    void CreateNodes();

    /// Create the devices
    void CreateDevices();

    /// Create the network
    void InstallInternetStack();

    /// Create the simulation applications
    void InstallApplications();
};

int
main(int argc, char** argv)
{
    AodvExample test;

```

```
if (!test.Configure(argc, argv))
{
    NS_FATAL_ERROR("Configuration failed. Aborted.");
}

test.Run();

test.Report(std::cout);

return 0;
}

//-----
AodvExample::AodvExample()
: size(10),
  step(5),
  totalTime(100),
  pcap(true),
  printRoutes(true)
{
}
```

bool

```
AodvExample::Configure(int argc, char** argv)
```

{

```
// Enable AODV logs by default. Comment this if too noisy
```

```
// LogComponentEnable("AodvRoutingProtocol",  
LOG_LEVEL_ALL);
```

```
SeedManager::SetSeed(12345);
```

```
CommandLine cmd(__FILE__);
```

```
cmd.AddValue("pcap", "Write PCAP traces.", pcap);
```

```
cmd.AddValue("printRoutes", "Print routing table dumps.",
printRoutes);
```

```
cmd.AddValue("size", "Number of nodes.", size);
```

```
cmd.AddValue("time", "Simulation time, s.", totalTime);
```

```
cmd.AddValue("step", "Grid step, m", step);
```

```
cmd.Parse(argc, argv);
```

```
return true;
```

```

}

void
AodvExample::Run()
{
    // Config::SetDefault
    ("ns3::WifiRemoteStationManager::RtsCtsThreshold", UIntegerValue (1));
    //

    // enable rts cts all the time.

    CreateNodes();

    CreateDevices();

    InstallInternetStack();

    InstallApplications();


    std::cout << "Starting simulation for " << totalTime << " s ...\n";

    // AnimationInterface anim("testing.xml");

    Simulator::Stop(Seconds(totalTime));

    Simulator::Run();

    Simulator::Destroy();
}

```



```
void
```

```
AodvExample::Report(std::ostream&)
```

```
{
```

```
}
```

```
void
```

```
AodvExample::CreateNodes()
```

```
{
```

```
auto orchestrator = CreateObject<netsimulyzer::Orchestrator>  
("testing.json");
```

```
netsimulyzer::NodeConfigurationHelper nodeHelper{orchestrator};
```

```
nodeHelper.Set ("Model",  
netsimulyzer::models::QUADCOPTER_UAV_VALUE);
```

```
// Shows every Node in the scenario
```

```
for (auto node = NodeList::Begin (); node != NodeList::End (); node++)
```

```
    nodeHelper.Install (*node);
```

```
    std::cout << "Creating " << (unsigned)size << " nodes " << step << "  
m apart.\n";
```

```
nodes.Create(size);

// Name nodes
for (uint32_t i = 0; i < size; ++i)
{
    std::ostringstream os;

    os << "node-" << i;

    Names::Add(os.str(), nodes.Get(i));
}

nodeHelper.Install (nodes);

// Create static grid
MobilityHelper mobility;

mobility.SetPositionAllocator("ns3::GridPositionAllocator",

    "MinX",

    DoubleValue(0.0),

    "MinY",

    DoubleValue(0.0),

    "Z",

    DoubleValue(15.0),

    "DeltaX",
```

```

        DoubleValue(step),
        "DeltaY",
        DoubleValue(0),
        "GridWidth",
        UIntegerValue(size),
        "LayoutType",
        StringValue("RowFirst"));

mobility.SetMobilityModel("ns3::GaussMarkovMobilityModel",
    "Bounds", BoxValue(Box(-5, 5, -5, 5, 0, 15)),
    "TimeStep", TimeValue(Seconds(0.05)),
    "Alpha", DoubleValue(0.85),
    "MeanVelocity",
    StringValue("ns3::UniformRandomVariable[Min=5|Max=20]"),
    "MeanDirection",
    StringValue("ns3::UniformRandomVariable[Min=0|Max=6.283185307]"),
    "MeanPitch",
    StringValue("ns3::UniformRandomVariable[Min=0.05|Max=0.05]"),
    "NormalVelocity",
    StringValue("ns3::NormalRandomVariable[Mean=0.0|Variance=0.0|Bound=0.0]"),

```

```
    "NormalDirection",  
    StringValue("ns3::NormalRandomVariable[Mean=0.0|Variance=0.2|Bound=0.4]"),
```

```
    "NormalPitch",  
    StringValue("ns3::NormalRandomVariable[Mean=0.0|Variance=0.02|Bound=0.04]");
```

```
    mobility.Install(nodes);  
}
```

```
void
```

```
AodvExample::CreateDevices()
```

```
{
```

```
    WifiMacHelper wifiMac;
```

```
    wifiMac.SetType("ns3::AdhocWifiMac");
```

```
    YansWifiPhyHelper wifiPhy;
```

```
    YansWifiChannelHelper wifiChannel =  
    YansWifiChannelHelper::Default();
```

```
    wifiPhy.SetChannel(wifiChannel.Create());
```

```
    WifiHelper wifi;
```



```

wifi.SetRemoteStationManager("ns3::ConstantRateWifiManager",
                             "DataMode",
                             StringValue("OfdmRate6Mbps"),
                             "RtsCtsThreshold",
                             UIntegerValue(0));

devices = wifi.Install(wifiPhy, wifiMac, nodes);

if (pcap)
{
    wifiPhy.EnablePcapAll(std::string("aodv"));
}
}

void
AodvExample::InstallInternetStack()
{
    AodvHelper aodv;

    // you can configure AODV attributes here using aodv.Set(name,
    value)

    InternetStackHelper stack;

```

```

stack.SetRoutingHelper(aodv); // has effect on the next Install ()

stack.Install(nodes);

Ipv4AddressHelper address;

address.SetBase("10.0.0.0", "255.0.0.0");

interfaces = address.Assign(devices);


if (printRoutes)
{
    Ptr<OutputStreamWrapper> routingStream =
        Create<OutputStreamWrapper>("aodv.routes", std::ios::out);

    Ipv4RoutingHelper::PrintRoutingTableAllAt(Seconds(8),
routingStream);
}
}

void
AodvExample::InstallApplications()
{
    PingHelper ping(interfaces.GetAddress(size - 1));

```

```
ping.SetAttribute("VerboseMode",
EnumValue(Ping::VerboseMode::VERBOSE));

ApplicationContainer p = ping.Install(nodes.Get(0));

p.Start(Seconds(0));

p.Stop(Seconds(totalTime) - Seconds(0.001));

// move node away

Ptr<Node> node = nodes.Get(size / 2);

Ptr<MobilityModel> mob = node->GetObject<MobilityModel>();

Simulator::Schedule(Seconds(totalTime / 3),

&MobilityModel::SetPosition,

mob,

Vector(1e5, 1e5, 1e5));
}
```

Step2: Write code

(Consider we are at /scratch directory)

Go to Terminal:

nano test.cc



```
GNU nano 7.2 test.cc *
#include "ns3/aodv-module.h"
#include "ns3/core-module.h"
#include "ns3/internet-module.h"
#include "ns3/mobility-module.h"
#include "ns3/network-module.h"
#include "ns3/ping-helper.h"
#include "ns3/point-to-point-module.h"
#include "ns3/yans-wifi-helper.h"
#include "ns3/netsimalyzer-module.h"
#include <cmath>
#include <iostream>

using namespace ns3;

class AodvExample
{
public:
    AodvExample();
    bool Configure(int argc, char** argv);
    void Run();
    void Report(std::ostream& os);

private:
    uint32_t size;
    double step;
    double totalTime;
    bool pcap;
    bool printRoutes;

    NodeContainer nodes;
    NetDeviceContainer devices;
    Ipv4InterfaceContainer interfaces;

    void CreateNodes();
    void CreateDevices();
    void InstallInternetStack();
    void InstallApplications();
};

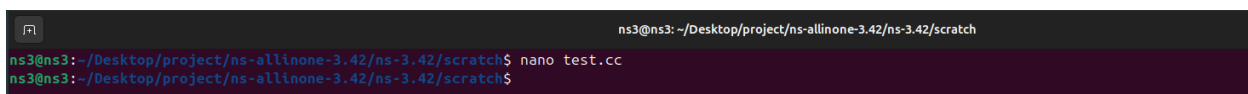
int main(int argc, char** argv)
{
    AodvExample example;
    example.Configure(argc, argv);
    example.Run();
    example.Report(stdout);
}
```

(Paste the code provided below)

Press: **Ctrl+x**

Write: **Y**

Press: **Enter**



```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42/scratch
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/scratch$ nano test.cc
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/scratch$
```

Step2: Run Code

(Consider we are at /scratch directory)

Go to Terminal:

```
cd ..
```

```
./ns3 run scratch/test.cc
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42/scratch$ cd ..
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42$ ./ns3 run /scratch/test.cc
-- Using default output directory /home/ns3/Desktop/project/ns-allinone-3.42/ns-3.42/build
-- CCache is enabled.
-- Proceeding without cmake-format
-- find_external_library: SQLite3 was found.
-- GSL was found.
```

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42
64 bytes from 10.0.0.10: icmp_seq=60 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=61 ttl=64 time=0.738 ms
64 bytes from 10.0.0.10: icmp_seq=62 ttl=64 time=0.739 ms
64 bytes from 10.0.0.10: icmp_seq=63 ttl=64 time=0.74 ms
64 bytes from 10.0.0.10: icmp_seq=64 ttl=64 time=0.739 ms
64 bytes from 10.0.0.10: icmp_seq=65 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=66 ttl=64 time=0.735 ms
64 bytes from 10.0.0.10: icmp_seq=67 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=68 ttl=64 time=0.744 ms
64 bytes from 10.0.0.10: icmp_seq=69 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=70 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=71 ttl=64 time=0.738 ms
64 bytes from 10.0.0.10: icmp_seq=72 ttl=64 time=0.743 ms
64 bytes from 10.0.0.10: icmp_seq=73 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=74 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=75 ttl=64 time=0.738 ms
64 bytes from 10.0.0.10: icmp_seq=76 ttl=64 time=0.739 ms
64 bytes from 10.0.0.10: icmp_seq=77 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=78 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=79 ttl=64 time=0.743 ms
64 bytes from 10.0.0.10: icmp_seq=80 ttl=64 time=0.744 ms
64 bytes from 10.0.0.10: icmp_seq=81 ttl=64 time=0.742 ms
64 bytes from 10.0.0.10: icmp_seq=82 ttl=64 time=0.74 ms
64 bytes from 10.0.0.10: icmp_seq=83 ttl=64 time=0.738 ms
64 bytes from 10.0.0.10: icmp_seq=84 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=85 ttl=64 time=0.743 ms
64 bytes from 10.0.0.10: icmp_seq=86 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=87 ttl=64 time=0.74 ms
64 bytes from 10.0.0.10: icmp_seq=88 ttl=64 time=0.738 ms
64 bytes from 10.0.0.10: icmp_seq=89 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=90 ttl=64 time=0.743 ms
64 bytes from 10.0.0.10: icmp_seq=91 ttl=64 time=0.741 ms
64 bytes from 10.0.0.10: icmp_seq=92 ttl=64 time=0.736 ms
64 bytes from 10.0.0.10: icmp_seq=93 ttl=64 time=0.743 ms
64 bytes from 10.0.0.10: icmp_seq=94 ttl=64 time=0.741 ms
64 bytes from 10.0.0.10: icmp_seq=95 ttl=64 time=0.739 ms
64 bytes from 10.0.0.10: icmp_seq=96 ttl=64 time=0.737 ms
64 bytes from 10.0.0.10: icmp_seq=97 ttl=64 time=0.741 ms
64 bytes from 10.0.0.10: icmp_seq=98 ttl=64 time=0.741 ms
64 bytes from 10.0.0.10: icmp_seq=99 ttl=64 time=0.736 ms

--- 10.0.0.10 ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99999ms
rtt min/avg/max/ndev = 0/0.16/16/1.6 ms
ns3@ns3:~/Desktop/project/ns-allinone-3.42/ns-3.42$
```

(Now we can find there is a testing.json file in the /ns-3.42 directory)

```
ns3@ns3: ~/Desktop/project/ns-allinone-3.42/ns-3.42$ ls
aodv-node-0-0.pcap  aodv-node-4-0.pcap  aodv-node-8-0.pcap  bindings      cmake-cache  doc      pyproject.toml  setup.cfg  test.py
aodv-node-1-0.pcap  aodv-node-5-0.pcap  aodv-node-9-0.pcap  build         CMakeLists.txt  examples  README.md      setup.py   utils
aodv-node-2-0.pcap  aodv-node-6-0.pcap  aodv.routes        build-support  contrib       LICENSE  RELEASE_NOTES.md  src        utils.py
aodv-node-3-0.pcap  aodv-node-7-0.pcap  AUTHORS            CHANGES.md   CONTRIBUTING.md  ns3      scratch        testing.json  VERSION
```

2. Running Simulation

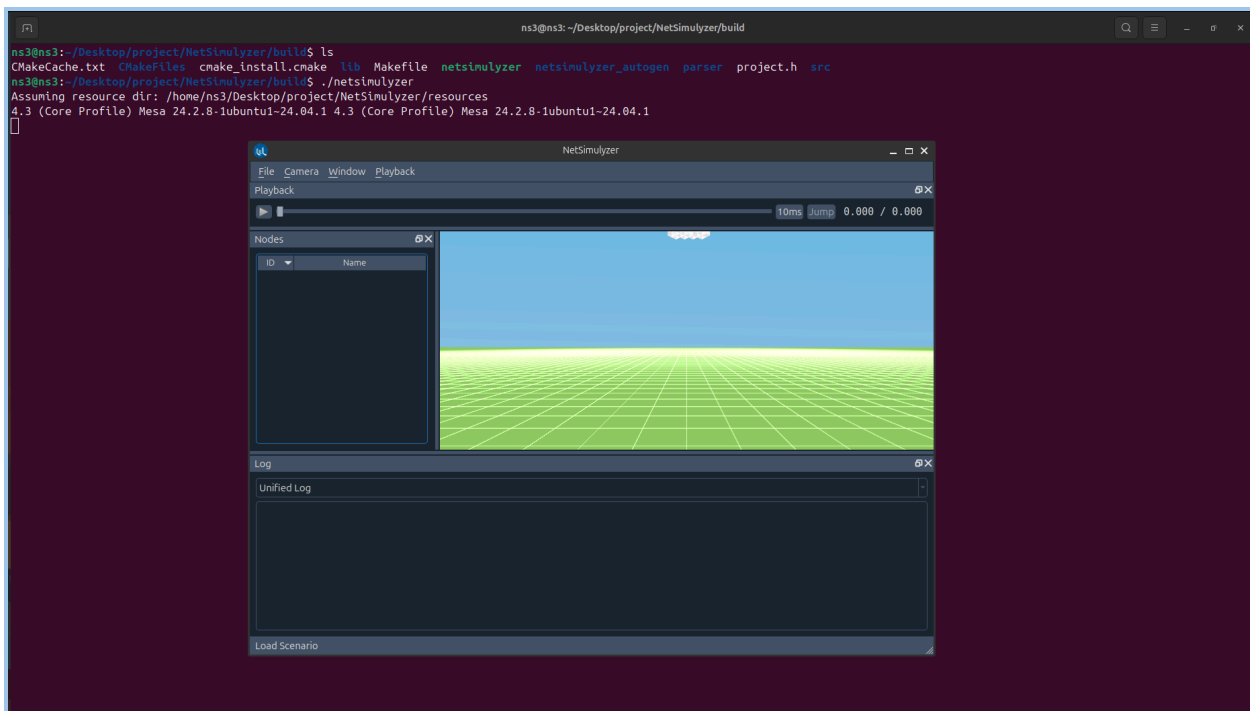
Step1: Run NetSimulyzer

(Consider we are at /username directory)

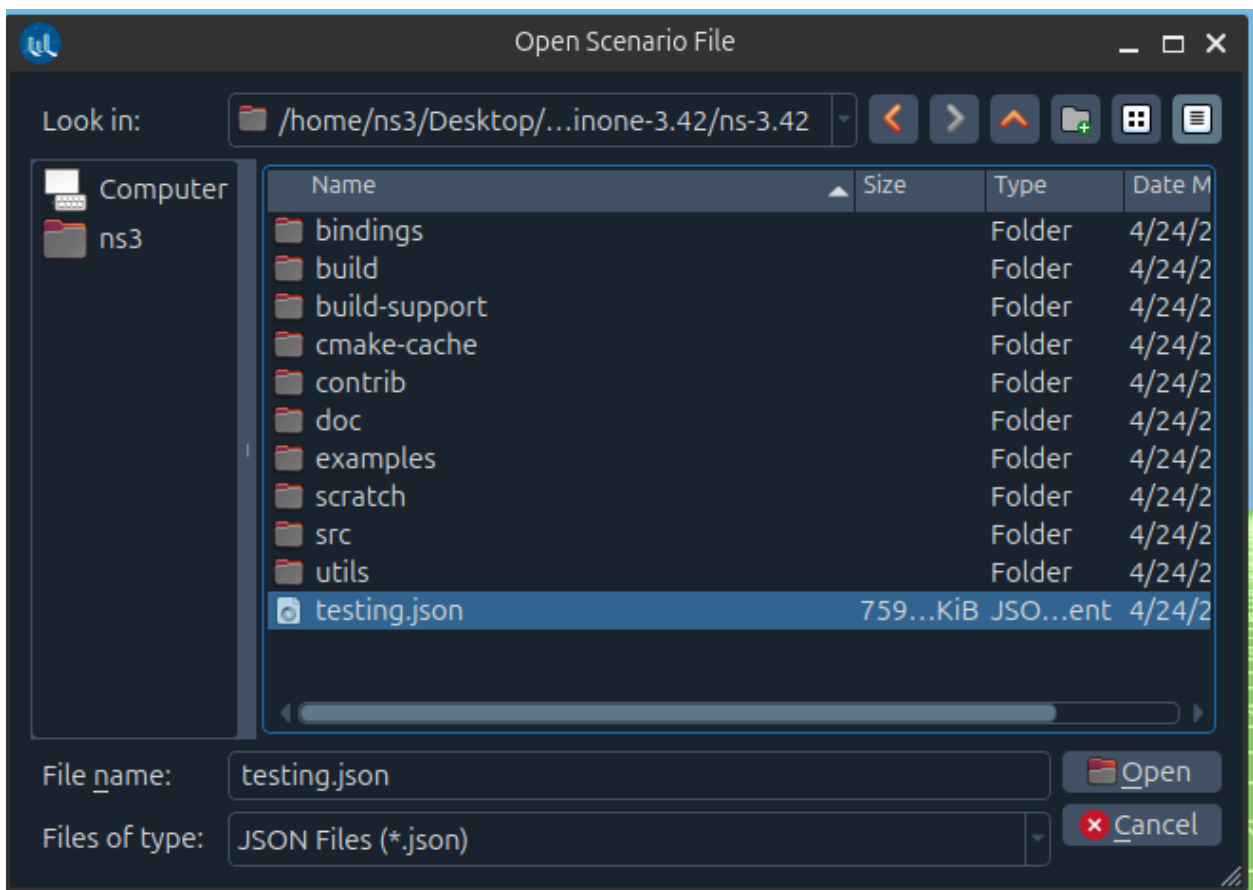
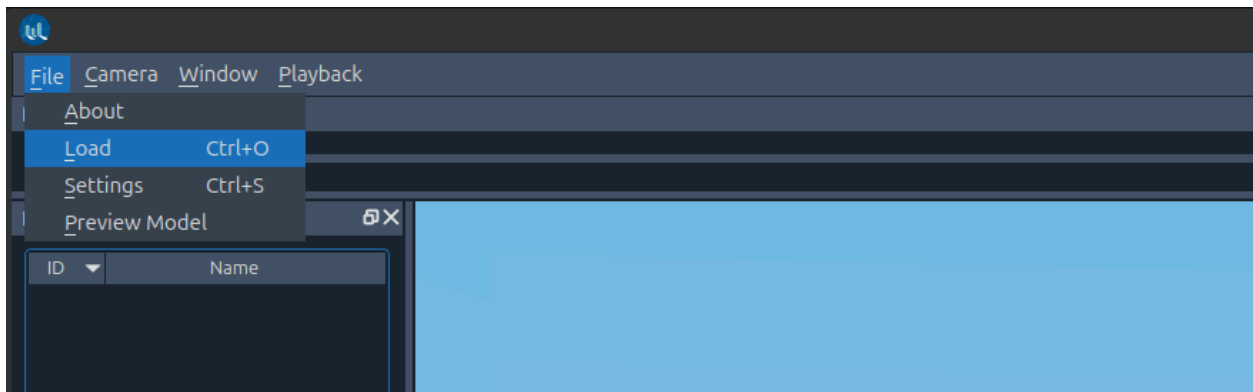
Go to Terminal:

```
cd Desktop/project/NetSimulyzer/build
```

```
./netsimulyzer
```



Step2: Load The testing.json File



(Open)

Step3: Play the simulation

