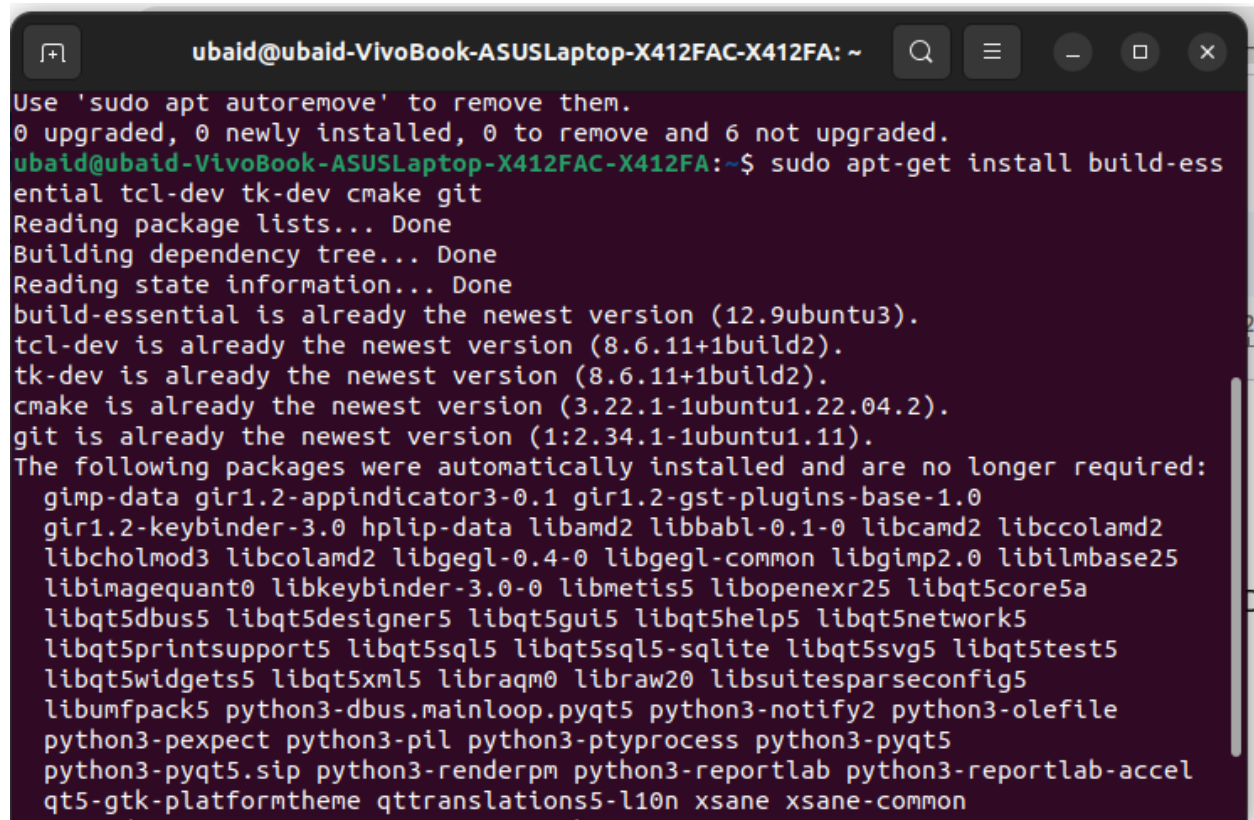


Tutorial 7

To Install OpenSTA

Before installing OpenSTA, make sure you have the necessary development tools and libraries installed. You can install them using the following commands:

- On your Home Directory type the following command
`sudo apt-get update`
`sudo apt-get install build-essential tcl-dev tk-dev cmake git`



```

ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 6 not upgraded.
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~$ sudo apt-get install build-ess
essential tcl-dev tk-dev cmake git
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
build-essential is already the newest version (12.9ubuntu3).
tcl-dev is already the newest version (8.6.11+1build2).
tk-dev is already the newest version (8.6.11+1build2).
cmake is already the newest version (3.22.1-1ubuntu1.22.04.2).
git is already the newest version (1:2.34.1-1ubuntu1.11).
The following packages were automatically installed and are no longer required:
gimp-data gir1.2-appindicator3-0.1 gir1.2-gst-plugins-base-1.0
gir1.2-keybinder-3.0 hplip-data libamd2 libbabl-0.1-0 libcamd2 libccolamd2
libcholmod3 libcolamd2 libgegl-0.4-0 libgegl-common libgimp2.0 libilmbase25
libimagequant0 libkeybinder-3.0-0 libmetis5 libopenexr25 libqt5core5a
libqt5dbus5 libqt5designer5 libqt5gui5 libqt5help5 libqt5network5
libqt5printsupport5 libqt5sql5 libqt5sql5-sqlite libqt5svg5 libqt5test5
libqt5widgets5 libqt5xml5 libraqm0 libraw20 libsuitesparseconfig5
libumfpack5 python3-dbus.mainloop.pyqt5 python3-notify2 python3-olefile
python3-pexpect python3-pil python3-ptyprocess python3-pyqt5
python3-pyqt5.sip python3-renderpm python3-reportlab python3-reportlab-accel
qt5-gtk-platformtheme qttranslations5-l10n xsane xsane-common

```

- Clone the OpenSTA repository by executing the following command:
`git clone https://github.com/The-OpenROAD-Project/OpenSTA.git`
- Move into the OpenSTA directory that was created during the cloning process using the following command:
`cd OpenSTA`
- Create a build directory using the following command:
`mkdir build`
- Move into the build directory using the following command:
`cd build`

- Configure the build by executing the following command:
`cmake ..`

This command configures the build process for OpenSTA, generating the necessary build files based on the project's configuration.

```
-- TCL library: /usr/lib/x86_64-linux-gnu/libtcl.so
-- TCL header: /usr/include/tcl/tcl.h
-- TCL readline library: NOT FOUND
-- TCL readline header: NOT FOUND
-- Found ZLIB: /usr/lib/x86_64-linux-gnu/libz.so (found version "1.2.11")
-- Looking for C++ include pthread.h
-- Looking for C++ include pthread.h - found
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD - Success
-- Found Threads: TRUE
CMake Error at CMakeLists.txt:377 (find_package):
  By not providing "FindEigen3.cmake" in CMAKE_MODULE_PATH this project has
  asked CMake to find a package configuration file provided by "Eigen3", but
  CMake did not find one.

  Could not find a package configuration file provided by "Eigen3" with any
  of the following names:

    Eigen3Config.cmake
    eigen3-config.cmake

  Add the installation prefix of "Eigen3" to CMAKE_PREFIX_PATH or set
  "Eigen3_DIR" to a directory containing one of the above files.  If "Eigen3"
  provides a separate development package or SDK, be sure it has been
  installed.
```

If it shows an error like this then you have to install Eigen3 by using this command.

- Move to the home directory using following command:
`cd`
- Install the eigen by using following command:
`sudo apt-get install libeigen3-dev`
again move to the build directory in OpenSTA and Configure the build by executing the following command:
`cmake ..`

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/Op...
Resolving deltas: 100% (12389/12389), done.
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~$ cd OpenSTA
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA$ mkdir build
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA$ cd build
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$ cmake ..
-- The CXX compiler identification is GNU 11.4.0
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Check for working CXX compiler: /usr/bin/c++ - skipped
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- STA version: 2.6.0
-- STA git sha: aafee90f8a21bf7867cef2e159929440cf45b2e5
-- System name: Linux
-- Compiler: GNU 11.4.0
-- Build type: RELEASE
-- Build CXX_FLAGS: -O3 -DNDEBUG
-- Install prefix: /usr/local
-- Found FLEX: /usr/bin/flex (found version "2.6.4")
-- Found BISON: /usr/bin/bison (found version "3.8.2")
-- TCL library: /usr/lib/x86_64-linux-gnu/libtcl.so
-- TCL header: /usr/include/tcl/tcl.h
-- TCL readline library: NOT FOUND
-- TCL readline header: NOT FOUND

-- TCL readline library: NOT FOUND
-- TCL readline header: NOT FOUND
-- Found ZLIB: /usr/lib/x86_64-linux-gnu/libz.so (found version "1.2.11")
-- Looking for C++ include pthread.h
-- Looking for C++ include pthread.h - found
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD
-- Performing Test CMAKE_HAVE_LIBC_PTHREAD - Success
-- Found Threads: TRUE
-- CUDD library: not found
-- SSTA: 0
-- Found SWIG: /usr/bin/swig4.0 (found suitable version "4.0.2", minimum require
d is "3.0")
-- STA executable: /home/ubaid/OpenSTA/app/sta
-- Configuring done
CMake Error: The following variables are used in this project, but they are set
to NOTFOUND.
Please set them or make sure they are set and tested correctly in the CMake file
s:
CUDD_LIB
   linked by target "OpenSTA" in directory /home/ubaid/OpenSTA

-- Generating done
CMake Generate step failed.  Build files cannot be regenerated correctly.
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$
```

If the above error occurred then you have to install CUDD

- move to your home directory and Clone the CUDD repository by executing the following command:

`git clone https://github.com/ivmai/cudd.git`

- And you have to install these 2 dependencies by following commands:

`sudo apt-get install automake`

`sudo apt-get install autoconf m4 perl`

- Then move into the directory cudd by typing command

`cd cudd`

- After that run following commands to configure CUDD:

`autoreconf -i`

- Create a build directory using the following command:

`mkdir build`

- Move into the build directory using the following command:

`cd build`

`../configure --prefix=$HOME/cudd`

```

use sudo apt autoremove to remove them.
0 upgraded, 0 newly installed, 0 to remove and 6 not upgraded.
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~$ cd cudd
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd$ autoreconf -i
libtoolize: putting auxiliary files in AC_CONFIG_AUX_DIR, 'build-aux'.
libtoolize: copying file 'build-aux/ltmain.sh'
libtoolize: putting macros in AC_CONFIG_MACRO_DIRS, 'm4'.
libtoolize: copying file 'm4/libtool.m4'
libtoolize: copying file 'm4/ltoptions.m4'
libtoolize: copying file 'm4/ltversion.m4'
configure.ac:131: warning: The macro `AC_TRY_RUN' is obsolete.
configure.ac:131: You should run autoupdate.
./lib/autoconf/general.m4:2997: AC_TRY_RUN is expanded from...
lib/m4sugar/m4sh.m4:692: _AS_IF_ELSE is expanded from...
lib/m4sugar/m4sh.m4:699: AS_IF is expanded from...
./lib/autoconf/general.m4:2249: AC_CACHE_VAL is expanded from...
configure.ac:131: the top level
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd$ mkdir build
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd$ cd build
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd/build$ ../configure --pref
ix=$HOME/cudd
checking build system type... x86_64-unknown-linux-gnu
checking host system type... x86_64-unknown-linux-gnu
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes

```

- Build CUDD by running the following command:

`make`

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/cud...  
Build system : x86_64-unknown-linux-gnu  
Host system  : x86_64-unknown-linux-gnu  
Prefix       : '/home/ubaid/cudd'  
Compilers    : 'gcc      -Wall -Wextra -g -O3'  
              : 'g++      -Wall -Wextra -std=c++0x -g -O3'  
Shared library : no  
  dddmp enabled : no  
  obj enabled   : no  
-----  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd/build$ make  
/bin/bash ./libtool --tag=CC --mode=compile gcc -DHAVE_CONFIG_H -I. -I.. -I.  
./cudd -I../st -I../epd -I../mtr -I../util -Wall -Wextra -g -O3 -MT cudd/libcu  
dd_la-cuddAddAbs.lo -MD -MP -MF cudd/.deps/libcudd_la-cuddAddAbs.Tpo -c -o cudd/  
libcudd_la-cuddAddAbs.lo `test -f 'cudd/cuddAddAbs.c' || echo '../`cudd/cuddAdd  
Abs.c  
libtool: compile: gcc -DHAVE_CONFIG_H -I. -I.. -I../cudd -I../st -I../epd -I../  
mtr -I../util -Wall -Wextra -g -O3 -MT cudd/libcudd_la-cuddAddAbs.lo -MD -MP -MF  
cudd/.deps/libcudd_la-cuddAddAbs.Tpo -c ../cudd/cuddAddAbs.c -o cudd/libcudd_la  
-cuddAddAbs.o  
mv -f cudd/.deps/libcudd_la-cuddAddAbs.Tpo cudd/.deps/libcudd_la-cuddAddAbs.Plo  
/bin/bash ./libtool --tag=CC --mode=compile gcc -DHAVE_CONFIG_H -I. -I.. -I.  
./cudd -I../st -I../epd -I../mtr -I../util -Wall -Wextra -g -O3 -MT cudd/libcu  
dd_la-cuddAddApply.lo -MD -MP -MF cudd/.deps/libcudd_la-cuddAddApply.Tpo -c -o c
```

- Install CUDD by executing the following command:
[make install](#)


```
libtool: link: ( cd "cplusplus/.libs" && rm -f "libobj.la" && ln -s "../libobj.la" "libobj.la" )
make[1]: Leaving directory '/home/ubaid/cudd/build'
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd/build$ make install
make[1]: Entering directory '/home/ubaid/cudd/build'
  /usr/bin/mkdir -p '/home/ubaid/cudd/lib'
  /bin/bash ./libtool  --mode=install /usr/bin/install -c  cudd/libcudd.la '/home/ubaid/cudd/lib'
libtool: install: /usr/bin/install -c cudd/.libs/libcudd.lai /home/ubaid/cudd/lib/libcudd.la
libtool: install: /usr/bin/install -c cudd/.libs/libcudd.a /home/ubaid/cudd/lib/libcudd.a
libtool: install: chmod 644 /home/ubaid/cudd/lib/libcudd.a
libtool: install: ranlib /home/ubaid/cudd/lib/libcudd.a
libtool: finish: PATH="/home/ubaid/.local/bin:/home/ubaid/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/snap/bin:/home/ubaid/bin:/sbin" ldconfig -n /home/ubaid/cudd/lib
-----
Libraries have been installed in:
  /home/ubaid/cudd/lib

If you ever happen to want to link against installed libraries
in a given directory, LIBDIR, you must either use libtool, and
specify the full pathname of the library, or use the '-LLIBDIR'
```

```
sr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/snap/bin:/home/ubaid/bin:/sbin" ldconfig -n /home/ubaid/cudd/lib
-----
Libraries have been installed in:
  /home/ubaid/cudd/lib

If you ever happen to want to link against installed libraries
in a given directory, LIBDIR, you must either use libtool, and
specify the full pathname of the library, or use the '-LLIBDIR'
flag during linking and do at least one of the following:
  - add LIBDIR to the 'LD_LIBRARY_PATH' environment variable
    during execution
  - add LIBDIR to the 'LD_RUN_PATH' environment variable
    during linking
  - use the '-Wl,-rpath -Wl,LIBDIR' linker flag
  - have your system administrator add LIBDIR to '/etc/ld.so.conf'

See any operating system documentation about shared libraries for
more information, such as the ld(1) and ld.so(8) manual pages.
-----
  /usr/bin/mkdir -p '/home/ubaid/cudd/include'
  /usr/bin/install -c -m 644 ../cudd/cudd.h '/home/ubaid/cudd/include'
make[1]: Leaving directory '/home/ubaid/cudd/build'
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd/build$
```

Now CUDD is installed Successfully.

- Move into the OpenSTA directory that was created during the cloning process using the

following command:

`cd OpenSTA`

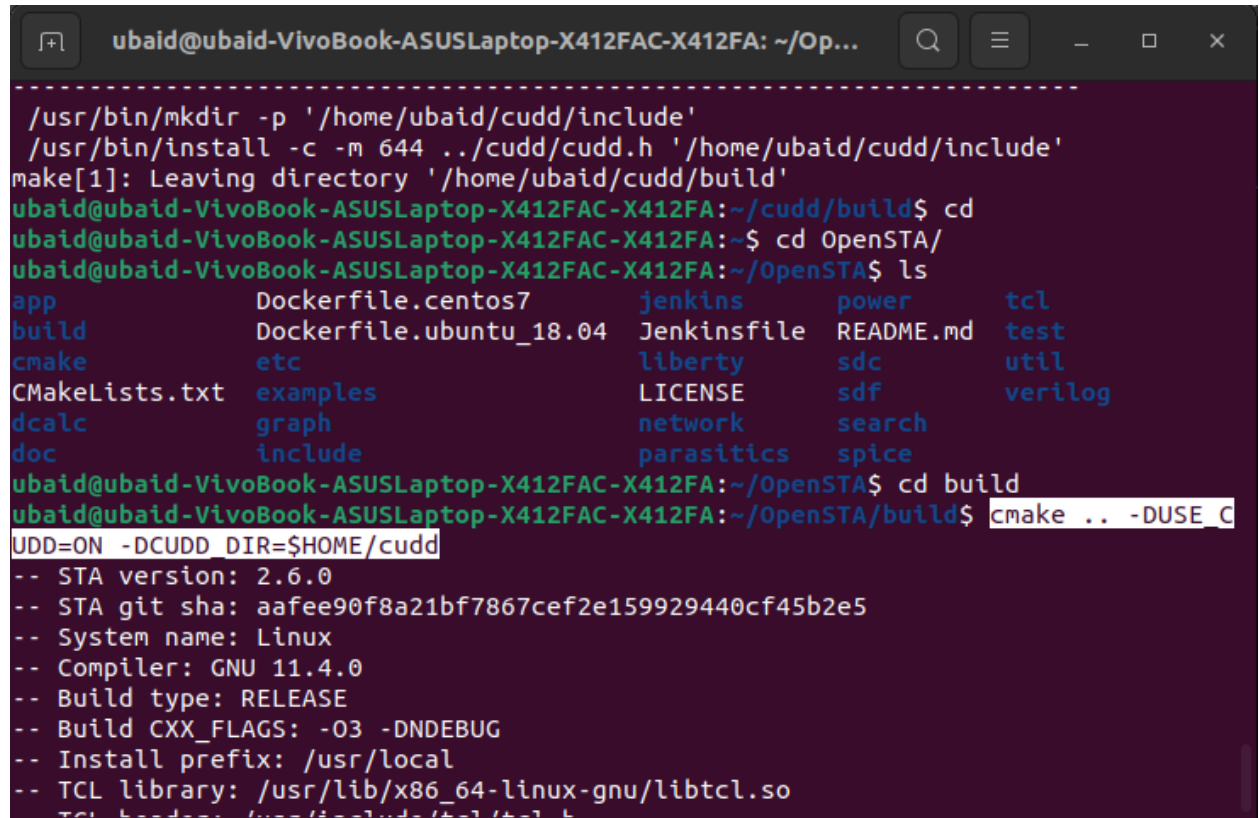
- Move into the build directory using the following command in the OpenSTA :

`cd build`

- Configure the build by executing the following command:

`cmake .. -DUSE_CUDD=ON -DCUDD_DIR=$HOME/cudd`

This command configures the build process for OpenSTA, generating the necessary build files based on the project's configuration.



```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/Op...  
-----  
/usr/bin/mkdir -p '/home/ubaid/cudd/include'  
/usr/bin/install -c -m 644 ../cudd/cudd.h '/home/ubaid/cudd/include'  
make[1]: Leaving directory '/home/ubaid/cudd/build'  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/cudd/build$ cd  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~$ cd OpenSTA/  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA$ ls  
app          Dockerfile.centos7    jenkins        power         tcl  
build        Dockerfile.ubuntu_18.04 Jenkinsfile  README.md    test  
cmake        etc                   liberty        sdc           util  
CMakeLists.txt examples              LICENSE       sdf           verilog  
dcalc        graph                 network       search  
doc          include               parasitics    spice  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA$ cd build  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$ cmake .. -DUSE_C  
UDD=ON -DCUDD_DIR=$HOME/cudd  
-- STA version: 2.6.0  
-- STA git sha: aafee90f8a21bf7867cef2e159929440cf45b2e5  
-- System name: Linux  
-- Compiler: GNU 11.4.0  
-- Build type: RELEASE  
-- Build CXX_FLAGS: -O3 -DNDEBUG  
-- Install prefix: /usr/local  
-- TCL library: /usr/lib/x86_64-linux-gnu/libtcl.so  
TCL headers: /usr/lib/x86_64-linux-gnu/tcl/tcl.h
```

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/Op...
-- BUILD CXX_FLAGS: -O3 -DNDEBUG
-- Install prefix: /usr/local
-- TCL library: /usr/lib/x86_64-linux-gnu/libtcl.so
-- TCL header: /usr/include/tcl/tcl.h
-- TCL readline library: NOT FOUND
-- TCL readline header: NOT FOUND
-- CUDD library: /home/ubaid/cudd/lib/libcudd.a
-- CUDD header: /home/ubaid/cudd/include/cudd.h
-- SSTA: 0
-- STA executable: /home/ubaid/OpenSTA/app/sta
-- Configuring done
-- Generating done
CMake Warning:
  Manually-specified variables were not used by the project:

    USE_CUDD

-- Build files have been written to: /home/ubaid/OpenSTA/build
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$ make
[ 0%] [BISON][VerilogParser] Building parser with bison 3.8.2
[ 0%] [FLEX][LibertyExprLex] Building scanner with flex 2.6.4
[ 1%] [BISON][LibertyExprParser] Building parser with bison 3.8.2
[ 1%] [FLEX][LibertyLex] Building scanner with flex 2.6.4
```

- Build OpenSTA by running the following command:
[make](#)
This command initiates the build process for OpenSTA. It compiles the source code and generates the executable files.
- Install OpenSTA by executing the following command:
[sudo make install](#)

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/Op...
[ 91%] Building CXX object CMakeFiles/OpenSTA.dir/StaTclInitVar.cc.o
[ 91%] Building CXX object CMakeFiles/OpenSTA.dir/LibertyExprLex.cc.o
[ 92%] Building CXX object CMakeFiles/OpenSTA.dir/LibertyExprParse.cc.o
[ 92%] Building CXX object CMakeFiles/OpenSTA.dir/LibertyLex.cc.o
[ 93%] Building CXX object CMakeFiles/OpenSTA.dir/LibertyParse.cc.o
[ 93%] Building CXX object CMakeFiles/OpenSTA.dir/SpexLex.cc.o
[ 94%] Building CXX object CMakeFiles/OpenSTA.dir/SpexParse.cc.o
[ 94%] Building CXX object CMakeFiles/OpenSTA.dir/SdfLex.cc.o
[ 95%] Building CXX object CMakeFiles/OpenSTA.dir/SdfParse.cc.o
[ 96%] Building CXX object CMakeFiles/OpenSTA.dir/VerilogLex.cc.o
[ 96%] Building CXX object CMakeFiles/OpenSTA.dir/VerilogParse.cc.o
[ 97%] Linking CXX static library ../app/libOpenSTA.a
[ 97%] Built target OpenSTA
Scanning dependencies of target sta_swig_swig_compilation
[ 98%] Swig compile app/StaApp.i for tcl
[ 98%] Built target sta_swig_swig_compilation
[ 98%] Building CXX object CMakeFiles/sta_swig.dir/CMakeFiles/sta_swig.dir/StaAp
pTCL_wrap.CXX.o
[ 99%] Linking CXX static library sta_swig.a
[ 99%] Built target sta_swig
[ 99%] Building CXX object CMakeFiles/sta.dir/app/Main.cc.o
[100%] Linking CXX executable ../app/sta
[100%] Built target sta
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$
```

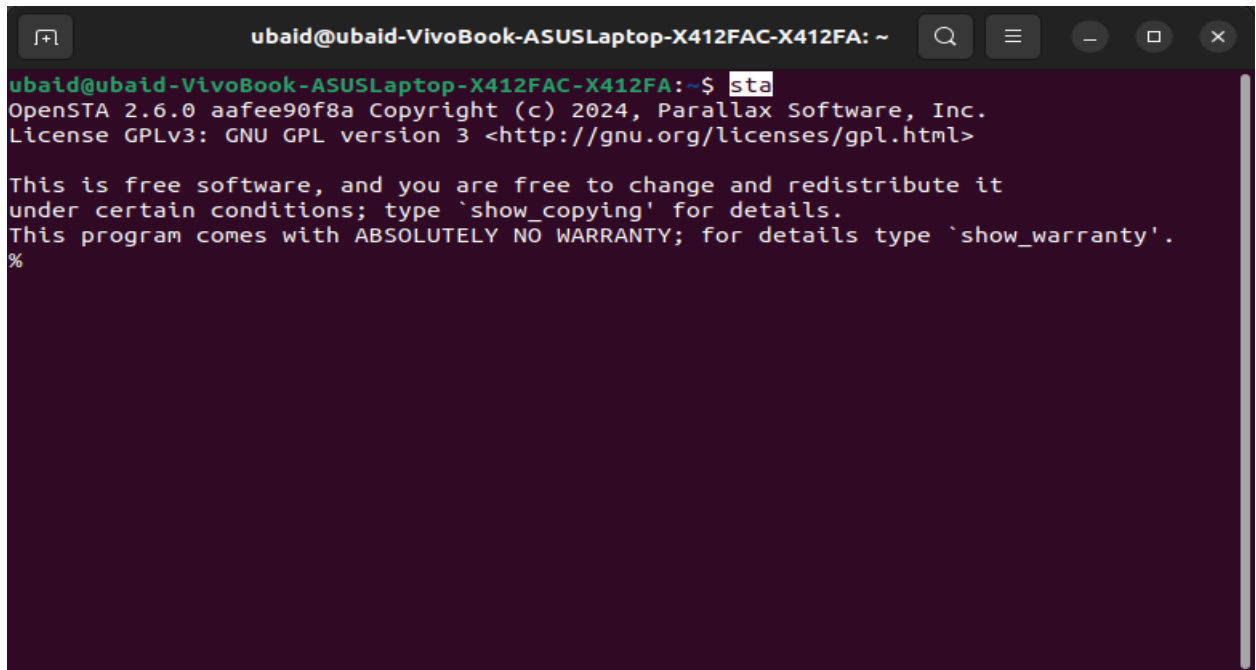


```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/OpenSTA...  
[ 98%] Building CXX object CMakeFiles/sta_swig.dir/CMakeFiles/sta_swig.dir/StaAppTCL_...  
wrap.cxx.o  
[ 99%] Linking CXX static library sta_swig.a  
[ 99%] Built target sta_swig  
[ 99%] Building CXX object CMakeFiles/sta.dir/app/Main.cc.o  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$ sudo make install  
[sudo] password for ubaid:  
Consolidate compiler generated dependencies of target OpenSTA  
[ 97%] Built target OpenSTA  
[ 98%] Built target sta_swig_swig_compilation  
Consolidate compiler generated dependencies of target sta_swig  
[ 99%] Built target sta_swig  
Consolidate compiler generated dependencies of target sta  
[100%] Built target sta  
Install the project...  
-- Install configuration: "RELEASE"  
-- Installing: /usr/local/bin/sta  
-- Installing: /usr/local/lib/libOpenSTA.a  
-- Up-to-date: /usr/local/include/sta  
-- Installing: /usr/local/include/sta/MakeConcreteParasitics.hh  
-- Installing: /usr/local/include/sta/Clock.hh  
-- Installing: /usr/local/include/sta/Bdd.hh  
-- Installing: /usr/local/include/sta/DelayCalc.hh  
-- Installing: /usr/local/include/sta/TimingArc.hh
```

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/OpenSTA...  
-- Installing: /usr/local/include/sta/RiseFallValues.hh  
-- Installing: /usr/local/include/sta/Wireload.hh  
-- Installing: /usr/local/include/sta/StaMain.hh  
-- Installing: /usr/local/include/sta/DisabledPorts.hh  
-- Installing: /usr/local/include/sta/TimingRole.hh  
-- Installing: /usr/local/include/sta/FuncExpr.hh  
-- Installing: /usr/local/include/sta/LibertyClass.hh  
-- Installing: /usr/local/include/sta/StaConfig.hh  
-- Installing: /usr/local/include/sta/MakeConcreteNetwork.hh  
-- Installing: /usr/local/include/sta/CircuitSim.hh  
-- Installing: /usr/local/include/sta/TokenParser.hh  
-- Installing: /usr/local/include/sta/PatternMatch.hh  
-- Installing: /usr/local/include/sta/GraphDelayCalc.hh  
-- Installing: /usr/local/include/sta/ObjectTable.hh  
-- Installing: /usr/local/include/sta/DelayFloat.hh  
-- Installing: /usr/local/include/sta/ConcreteLibrary.hh  
-- Installing: /usr/local/include/sta/ClockInsertion.hh  
-- Installing: /usr/local/include/sta/StringSet.hh  
-- Installing: /usr/local/include/sta/Path.hh  
-- Installing: /usr/local/include/sta/LibertyWriter.hh  
-- Installing: /usr/local/include/sta/DataCheck.hh  
-- Installing: /usr/local/include/sta/Zlib.hh  
-- Installing: /usr/local/include/sta/PinPair.hh  
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/OpenSTA/build$
```

OpenSTA is installed successfully.

- To check that type sta on your terminal
[sta](#)

A terminal window with a dark background and light-colored text. The window title is 'ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~'. The prompt is 'ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~\$' followed by the command 'sta'. The output shows the OpenSTA version (2.6.0), a hash (aafee90f8a), copyright information (© 2024, Parallax Software, Inc.), and the license (GPLv3). It also includes a disclaimer about warranty and instructions to type 'show_copying' or 'show_warranty' for more details. The prompt changes to '%' after the output.

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~$ sta
OpenSTA 2.6.0 aafee90f8a Copyright (c) 2024, Parallax Software, Inc.
License GPLv3: GNU GPL version 3 <http://gnu.org/licenses/gpl.html>

This is free software, and you are free to change and redistribute it
under certain conditions; type `show_copying' for details.
This program comes with ABSOLUTELY NO WARRANTY; for details type `show_warranty'.
%
```

- After installation process is successful.
move the folder where you have your Netlist(top.v), constraint file(top.sdc), liberty file(toy.lib), test.tcl
Type the following command to invoke OpenSTA
[sta](#)
you can check if OpenSTA is properly installed. If the installation was successful, the OpenSTA tool interface should launch without any errors or issues
[source test.tcl](#)
This command executes the commands specified in the "test.tcl" script file.

```
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA: ~/Desktop/Thesis/STA
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/Desktop/Thesis/STA$ ls
test.tcl top.sdc top.v toy.lib
ubaid@ubaid-VivoBook-ASUSLaptop-X412FAC-X412FA:~/Desktop/Thesis/STA$ sta
OpenSTA 2.6.0 aafee90f8a Copyright (c) 2024, Parallax Software, Inc.
License GPLv3: GNU GPL version 3 <http://gnu.org/licenses/gpl.html>

This is free software, and you are free to change and redistribute it
under certain conditions; type 'show_copying' for details.
This program comes with ABSOLUTELY NO WARRANTY; for details type 'show_warranty'.
% source test.tcl
Startpoint: F1 (rising edge-triggered flip-flop clocked by CLK)
Endpoint: F2 (rising edge-triggered flip-flop clocked by CLK)
Path Group: CLK
Path Type: max

  Delay    Time    Description
-----
    0.00    0.00    clock CLK (rise edge)
    0.00    0.00    clock network delay (ideal)
    0.00    0.00    ^ F1/CLK (DFFRNQ)
    5.66    5.66    v F1/Q (DFFRNQ)
    1.63    7.29    ^ I2/ZN (INV)
    5.20   12.49    ^ B1/Z (BUF)
    1.91   14.40    v N1/ZN (NAND2)
    1.85   16.25    ^ I3/ZN (INV)
    0.00   16.25    ^ F2/D (DFFRNQ)
               16.25    data arrival time

1000.00 1000.00    clock CLK (rise edge)
    0.00 1000.00    clock network delay (ideal)
    0.00 1000.00    clock reconvergence pessimism
    1000.00 ^ F2/CLK (DFFRNQ)
   -8.36  991.64    library setup time
               991.64    data required time
-----
               991.64    data required time
               -16.25    data arrival time
-----
               975.39    slack (MET)

%
```