

2019 TGWG Mini-Workshop on Gravitational Wave Data Analysis

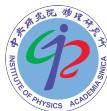
Installation of LALSuite on CUHK Workstation

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Outline

1 Workstation

2 Installation of LALSuite

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2 Installation of LALSuite

Workstation in CUHK

- Systems
 - Windows: needs to install Xming, PuTTY and WinSCP.
 - MacOS, Linux.
- For TGWG and NCTU members:
 - AC: [USERNAME], PW: [PASSWORD].

```
$ ssh [USERNAME]@137.189.40.204
$ [PASSWORD]
```

- ssh LIGO-VM → make environment the same as LIGO cluster.
- **5 failure log-in will result in banning of IP address for 24 hours.**
- Change the password

```
$ ldapasswd -x -S [NEW_PASSWORD] -W -D
↪ 'cn=Chia-Jui.Chou,cn=lvk,dc=cuhk-gw,dc=org'
$ [NEW_PASSWORD]
$ [NEW_PASSWORD]
$ [OLD_PASSWORD]
```

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1 Workstation

2 Installation of LALSuite

.bashrc file

- Add the following lines to `.bashrc` for linux system or `.bash_profile`:

```
LOCAL_SRC=${HOME}/src # Location to store source codes
```

```
→ locally. Change if necessary.
```

```
LOCAL_PREFIX=${HOME} # Location to install libraries
```

```
→ locally. Change if necessary.
```

```
export LD_LIBRARY_PATH=
```

```
→ "${LOCAL_PREFIX}/lib:${LD_LIBRARY_PATH}"
```

```
export C_INCLUDE_PATH=
```

```
→ "${LOCAL_PREFIX}/include:${C_INCLUDE_PATH}"
```

```
export CPLUS_INCLUDE_PATH=
```

```
→ "${LOCAL_PREFIX}/include:${CPLUS_INCLUDE_PATH}"
```

```
export LIBRARY_PATH= "${LOCAL_PREFIX}/lib:${LIBRARY_PATH}"
```

```
export PKG_CONFIG_PATH=
```

```
→ "${LOCAL_PREFIX}/lib/pkgconfig:${PKG_CONFIG_PATH}"
```

```
export PATH= "${LOCAL_PREFIX}/bin:${PATH}"
```

- Reload `.bashrc` file:

```
$ source ~/.bashrc
```

LALSuite

- URL <https://github.com/lscsoft/lalsuite>
- Select Branch: e.g. ringdownFD_nikhef branch
lalsuite → lalsimulation → src/LALSimRingdownMMRDNS.c
- Branches: <https://git.ligo.org/lscsoft/lalsuite/branches>
- Tutorial:
<http://users.monash.edu.au/~erict/Resources/lal/>
- Pre-installed packages for LALSuite:
 - libframe;
 - metato;
 - xml2;
 - fftw3;
 - gsl;
 - hdf5 (zlib, sztp).
- Other packages may be needed, it depends on the system.

fftw3

- Run the following command:

```
$ mkdir $LOCAL_SRC
$ ll
$ cd src
$ src
```

- Install fftw3.

```
$ mkdir fftw3
$ cd fftw3
$ wget http://www.fftw.org/fftw-3.3.8.tar.gz
$ tar -xzvf fftw-3.3.8.tar.gz
$ rm -r fftw-3.3.8.tar.gz
$ cd fftw-3.3.8/
$ ./configure --prefix=${LOCAL_PREFIX} --enable-float
↪ --enable-shared --enable-static --enable-threads
$ make
$ make install
$ make clean
```


gsl

■ Install gsl.

```
$ cd $LOCAL_SRC
$ mkdir gsl
$ cd gsl
$ wget http://ftp.yzu.edu.tw/gnu/gsl/gsl-2.5.tar.gz
$ tar -xzvf gsl-2.5.tar.gz
$ rm -r gsl-2.5.tar.gz
$ cd gsl-2.5
$ ./configure --prefix=${LOCAL_PREFIX}
$ make
$ make install
$ make clean
```

zlib

■ Install zlib.

```
$ cd $LOCAL_SRC
$ mkdir zlib
$ cd zlib
$ wget https://zlib.net/zlib-1.2.11.tar.gz
$ tar -xzvf zlib-1.2.11.tar.gz
$ rm -r zlib-1.2.11.tar.gz
$ cd zlib-1.2.11
$ ./configure --prefix=${LOCAL_PREFIX}
$ make
$ make install
$ make clean
```

szip

■ Install szip.

```
$ cd ${LOCAL_SRC}
$ mkdir szip
$ cd szip
$ wget
  ↳ https://support.hdfgroup.org/ftp/lib-external/szip/2.1.1/src/szip-2.1.1.tar.gz
$ tar -xzvf szip-2.1.1.tar.gz
$ rm -r szip-2.1.1.tar.gz
$ cd szip-2.1.1
$ ./configure --prefix=${LOCAL_PREFIX}
$ make
$ make install
$ make clean
```

hdf5

■ Install hdf5.

```
$ cd $LOCAL_SRC
$ mkdir hdf5
$ cd hdf5
$ wget
  ↳ https://support.hdfgroup.org/ftp/HDF5/releases/hdf5-1.10/hdf5-1.10.4/src/hdf5-1.10.4.tar.gz
$ tar -xzvf hdf5-1.10.4.tar.gz
$ rm -r hdf5-1.10.4.tar.gz
$ cd hdf5-1.10.4
```

■ If zlib is ignored to install.

```
$ ./configure --prefix=${LOCAL_PREFIX} --enable-shared
  ↳ --enable-static --enable-hl
```

hdf5 (cont.)

- If zlib is installed.

```
$ ./configure --prefix=${LOCAL_PREFIX}
↪ --with-zlib=${LOCAL_PREFIX}
↪ --with-szlib=${LOCAL_PREFIX} --enable-shared
↪ --enable-static --enable-hl
```

- Then make the source code.

```
$ make
$ make install
$ make clean
```

libframe

- Install libframe.
- Because one needs the autoconf package without root, remember to login LIGO-VM first.

```
$ ssh LIGO-VM
$ [PASSWORD]
$ cd $LOCAL_SRC
$ mkdir libframe
$ cd libframe
$ wget
  ↪ http://lappweb.in2p3.fr/virgo/FrameL/libframe-8.33.tar.gz
$ tar -xzvf libframe-8.33.tar.gz
$ ls
$ rm -r libframe-8.33.tar.gz
$ cd v8r33
$ autoreconf
$ ./configure --prefix=${LOCAL_PREFIX}
$ make
$ make install
$ make clean
```

metaio

■ Install metaio.

```
$ cd ${LOCAL_SRC}
$ git clone https://git.ligo.org/lscsoft/metaio.git
$ cd metaio
$ git checkout branch-8.4.x
$ ./00boot
$ ./configure --prefix=${LOCAL_PREFIX} --without-matlab
$ make
$ make install
$ make clean
```

xml2

- Create a directory for the python packages manually because of no permission.

```
mkdir -p $LOCAL_PREFIX/lib/python2.7/site-packages
```

- Install xml2 → It is necessary if one needs to use **pycbc**.

```
$ cd $LOCAL_SRC
$ mkdir xml2
$ cd xml2
$ wget ftp://xmlsoft.org/libxml2/libxml2-2.9.9-rc2.tar.gz
$ tar -xzf libxml2-2.9.9-rc2.tar.gz
$ rm -r libxml2-2.9.9-rc2.tar.gz
$ cd libxml2-2.9.9
$ ./configure --prefix=${LOCAL_PREFIX}
  ↳ --with-python-install-dir=$LOCAL_PREFIX/lib/python2.7/
  site-packages
$ make
$ make install
$ make clean
```


lalsuite

■ Install lalsuite.

```
$ cd $LOCAL_SRC
$ git clone https://github.com/lscsoft/lalsuite.git
$ cd lalsuite
$ git checkout lalinference_o2
$ git checkout
$ ./00boot
$ ./configure --prefix=${LOCAL_PREFIX}
$ make
$ make install
$ make clean
```

- Files generated in the home/etc.
- “lalsuiterc” is the top-level LALSuite runtime.

```
wei — ling-wei.luo@cuhk-gw: ~/etc — ssh ling-wei.luo@137.189.40.204 — 80x...
219 packages can be updated.
1 update is a security update.

*** System restart required ***
Last login: Fri May 10 14:38:18 2019 from 140.122.136.50
[ling-wei.luo@cuhk-gw:~$ ls
2019_NTHU_visit bin etc include lib libexec share src test textst.c
[ling-wei.luo@cuhk-gw:~$ cd etc/
[ling-wei.luo@cuhk-gw:~/etc$ ls
lalapps-user-env.csh          lalmetaio-user-env.sh
lalapps-user-env.csh         lalpulsar-user-env.csh
lalburst-user-env.csh        lalpulsar-user-env.sh
lalburst-user-env.sh         lalsimulation-user-env.csh
laldetchar-user-env.csh     lalsimulation-user-env.sh
laldetchar-user-env.sh      lalstochastic-user-env.csh
lalframe-user-env.csh       lalstochastic-user-env.sh
lalframe-user-env.sh        lalsuiterc
lalinference-user-env.csh   lal-user-env.csh
lalinference-user-env.sh    lal-user-env.sh
lalinspiral-user-env.csh    lalxml-user-env.csh
lalinspiral-user-env.sh     lalxml-user-env.sh
lalmetaio-user-env.csh
ling-wei.luo@cuhk-gw:~/etc$
```

.bashrc again

- Option 1: add the following lines to `~/.profile` for Bourne shells (e.g. bash):

```
. ${LOCAL_PREFIX}/etc/lalsuiterc
```

- Reload `~/.profile` (by `$ source ~/.profile`).
- Option 2: add the following lines to `~/.login` for C shells (e.g. tcsh):

```
source ${LOCAL_PREFIX}/etc/lalsuiterc
```

- Reload `~/.login` (by `$ source ~/.login`).
- Option 3: add the following lines to `~/.bashrc`:

```
source ${LOCAL_PREFIX}/etc/lalsuiterc
```

- Reload `~/.bashrc` (by `$ source ~/.bashrc`).

End

Thank You!!!

Outline

3 Backup Slides

Simulation

```
$ cd /home/ling-wei.luo/etc
$ . lalsimulation-user-env.sh
$ . lalinference-user-env.sh
$ . lalinspiral-user-env.sh

$ mkdir /home/[USERNAME]/test/example1
$ cd /home/[USERNAME]/test/example1
```

■ Create a makefile

```
$ vim makefile
```

makefile

```
all: IMRPhenomPv2.hdf5

IMR_injection.xml:
    lalapps_inspinj --output IMR_injection.xml --seed 0
    ↪ --f-lower 40 --gps-start-time 966384015 --gps-end-time
    ↪ 966470415 --t-distr uniform --time-step 3600
    ↪ --time-interval 20 --i-distr uniform --l-distr random
    ↪ --d-distr uniform --min-distance 200000 --max-distance
    ↪ 200000 --m-distr fixMasses --fixed-mass1 15.0
    ↪ --fixed-mass2 15.0 --disable-spin --amp-order -1
    ↪ --waveform IMRPhenomPv2threePointFivePN
    ↪ --taper-injection start

IMRPhenomPv2.hdf5:IMR_injection.xml
```

makefile (cont.)

```
lalinference_nest --progress --L1-timeslide 0 --L1-flow  
→ 40 --approx IMRPhenomPv2threePointfivePN --nlive 16  
→ --srate 8192 --seglen 4 --L1-channel  
→ L1:DCS-CALIB_STRAIN_C02 --H1-channel  
→ H1:DCS-CALIB_STRAIN_C02 --fix-distance 200 --trigtime  
→ 966387623 --dt 0.1 --maxmcmc 16 --deltalogl 5  
→ --L1-cache LALSimAdLIGO --ifo L1 --H1-cache  
→ LALSimAdLIGO --ifo H1 --randomseed 108107666 --amporder  
→ 0 --psdstart 966384026 --psdlength 128 --outfile  
→ IMRPhenomPv2.hdf5 --disable-spin --dataseed 8000 --inj  
→ --event 1 --pinparams [mass1,mass2,time,distance,  
→ declination ,rightascension ,polarisation ,phase ,costheta_jn]
```

- Everything in square brackets is optional.

Tips

- Details of parameters can be found by command `lal_inference_nest --help`.
- `injection` → simulation
- `lalapps_inspinj` → to load an injection table.
- `--amp-order -1` → post-Newtonian approximation (PNN) for all stage of the injection.
 - `-1` → the most accurate choice.
 - 1 PN order → $1/2 = 0.5$ th PN order;
 - ...
 - 8 PN order → $8/2 = 4$ th PN order (However we do NOT have 4th PN order now!).
 - Details can be found in the file of source code: `"/lalsuite/lalsimulation/src/LALSimInspiralTaylorEt.c"`.
- Remember to put `--Resume` when you work on the cluster!!!
- `Zratio` → $\log(\text{Zratio})$, the value should not be too low!!!