

building a new flexric on top of the original core network cloudlab profile

You would want to have at least GCC-9. The current version of GCC 7 on the cloudlab profile is just way too old to compile the flexric and OAI. Follow the instructions below:

```
# Add the ubuntu-toolchain-r PPA:
sudo add-apt-repository ppa:ubuntu-toolchain-r/test
sudo apt-get update
# install actually
sudo apt-get install gcc-9 g++-9
# set the new version as the default
sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-9 60 --slave /usr/bin/g++ g++
sudo update-alternatives --config gcc
# verify the installation
gcc --version
```

1. need to install the libpcrc2-dev

```
sudo apt-get install libpcrc2-dev
```

2. need to update the cmake to at least 3.15

```
sudo apt-get remove cmake
wget https://github.com/Kitware/CMake/releases/download/v3.15.7/cmake-3.15.7.tar.gz
tar -xzf cmake-3.15.7.tar.gz
cd cmake-3.15.7
./bootstrap
# the make may take a while, accelerate that with multi threading with make -j 8, but I always
make
sudo make install
# adding to the path
export PATH=/users/PeterYao/cmake-3.15.7/bin:$PATH

cmake --version
```

3. follow the commands at the flexric readme to install swig, checkout felxric, and build the file

4. run the local test suite to check if the installation is successful

ctest

5. before starting the CU/DU, add the following lines to the CU configuration file at the location:
/local/repository/etc/cu.conf

```
e2_agent = {
    near_ric_ip_addr = "127.0.0.1";
    sm_dir = "/usr/local/lib/flexric/"
}
```

in order to configure the E2 agent.

6. Do the same thing for the DU, add the same block to the DU configuration file at location
/local/repository/etc/du.conf

7. Because we follow a CU/DU split, bring up the CU/DU as follows:

```
cd /opt/openairinterface5g/cmake_targets/
sudo RFSIMULATOR=server ./ran_build/build/nr-softmodem --rfsim --sa -O /local/repository/etc/cu
```

```
cd /opt/openairinterface5g/cmake_targets/
sudo RFSIMULATOR=server ./ran_build/build/nr-softmodem --rfsim --sa -O /local/repository/etc/du
```



8. In another windows, Start the UE

```
cd /opt/openairinterface5g/cmake_targets
sudo RFSIMULATOR=127.0.0.1 ./ran_build/build/nr-uesoftmodem -O /local/repository/etc/ue.conf -r
```



9. After running the RIC and the xApp with the following commands, an assertion failure occurs.

```
cd flexric
./build/examples/ric/nearRT-RIC
./build/examples/xApp/c/monitor/xapp_kpm_moni
```

```
nearRT-RIC: /users/PeterYao/flexric/src/lib/e2ap/v2_03/enc/e2ap_msg_enc_asn.c:3165:
e2ap_enc_e42_setup_response_asn_pdu: Assertion `sr->len_e2_nodes_conn > 0 && "No global
node conected??'" failed.
Aborted
```

The RIC crashes after trying to start the Service Model. Based on the error message, suspect that the e2 nodes are not attached successfully.

10. It turns out that the OAI RAN version is just too old to support E2 interface. We need to reinstall the latest version from source.

```
git clone https://gitlab.eurecom.fr/oai/openairinterface5g.git

# install all dependencies
cd openairinterface5g/cmake_targets/

# but before that we want the UHD package to be of correct version. If we just pull the latest
export BUILD_UHD_FROM_SOURCE=True
export UHD_VERSION=3.15.0.0
./build_oai -I -w USRP

# I did not install the new asn1c from source

# build the physical simulators (this part can be extremely lengthy)
cd openairinterface5g/cmake_targets/
./build_oai --phy_simulators

# we also need to build the base stations and the UEs
cd openairinterface5g/cmake_targets/
./build_oai -w USRP --eNB --UE --nrUE --gNB
```

It turns out that the d430 node on emulab does not have enough storage for compilation. I am now swithing to the d820 node. And Gosh, it is taking forever to boot that machine. We need to rebuild the cmake and the gcc after the new machine boots up.

It turns out that event he d820 node does not have enough space.

To turn around the situation, we should really allocate enough space at the beginning, and then compile and do everything in the newly mounted space

```
# check how much space has been mounted
df -h

# allocate space during the experiment
cd /
sudo mkdir mydata
sudo /usr/local/etc/emulab/mkextrafs.pl /mydata

# check space usage again
df -h

# change the ownership of this new space
sudo chown PeterYao:nyunetworks mydata

chmod 775 mydata

# verify the result
ls -ld mydata
```

You should see something like this

```
drwxrwxr-x 4 PeterYao nyunetworks 4096 Jun 18 14:55 mydata
```

Then redownload the OAI RAN repo, and recompile it again inside mydata.

```
git clone https://gitlab.eurecom.fr/oai/openairinterface5g.git
```

My observation is that after starting the monolithic gnb using the command:

```
# from https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/NR_SA_Tutorial_OAI_r
sudo ./nr-softmodem -O ../../../../targets/PROJECTS/GENERIC-NR-5GC/CONF/gnb.sa.band78.fr1.106PRB.u
# or this from https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/openair2/E2AP/Rf
sudo ./nr-softmodem -O ../../../../targets/PROJECTS/GENERIC-NR-5GC/CONF/gnb.sa.band78.fr1.106PRB.u
```



the core network does not seem to register this gNB, with output like this:

```
[2024-06-19T12:48:27.771306] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771376] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771424] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771432] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771439] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771465] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771472] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771478] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771484] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771491] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771498] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771513] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771524] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771530] [AMF] [amf_app] [info ]
[2024-06-19T12:48:27.771537] [AMF] [amf_app] [info ]

-----gNBs' information-----
Index | Status | Global ID | gNB Name | PLMN
-----
1 | 5GMM-DEREGISTERED | 001010000000001 | 2823222046 | 5 | 208, 95 | 14680064
2 | 5GMM-DEREGISTERED | 208950000000031 | 2048479185 | 2 | 208, 95 | 14680064
-----

-----UEs' information-----
Index | 5GMM state | IMSI | GUTI | RAN UE NGAP ID | AMF UE ID | PLMN | Cell ID
-----
1 | 5GMM-DEREGISTERED | 001010000000001 | 2823222046 | 5 | 208, 95 | 14680064
2 | 5GMM-DEREGISTERED | 208950000000031 | 2048479185 | 2 | 208, 95 | 14680064
-----
```

This is weird, because the core network should have registered the device.

Try again by bringing up the core network according to the tutorial.

https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/NR_SA_Tutorial_OAI_CN5G.md

Shut down the original core network with

```
cd /opt/oai-cn5g-fed/docker-compose

sudo python3 ./core-network.py --type stop-basic --scenario 1
```

check with sudo docker ps

Alright, here is what I did:

1. Start the core network latest version following instructions from https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/NR_SA_Tutorial_OAI_CN5G.md#21-oai-cn5g-pre-requisites and brings up the dockerized core network containers.
2. start the monolithic Gnb and UE following instructions from <https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/RUNMODEM.md#launch-gnb>. Brings them up with RF simulators with the commands:

```
sudo ./nr-softmodem -O ../../../../targets/PROJECTS/GENERIC-NR-5GC/CONF/gnb.sa.band78.fr1.106PRB.u
sudo ./nr-uesoftmodem -r 106 --numerology 1 --band 78 -C 3619200000 --ssb 516 --rfsim --sa
```



One can verify that the both the gnb and the UE have been connected to the core network from the AMF log:

```
[2024-06-19 16:55:22.310] [amf_sbi] [info] Receive Update NF Instance Request, handling ...
[2024-06-19 16:55:22.310] [amf_sbi] [debug] Send NF Update to NRF
[2024-06-19 16:55:22.310] [amf_sbi] [debug] Send NF Update to NRF, Msg body [{"op":"replace","path":"/nfStatus","value":"REGISTERED"}]
[2024-06-19 16:55:22.310] [amf_sbi] [debug] Send NF Update to NRF, NRF URI http://oai-nrf:8080/nrf-nfm/v1/nf-instances/f4df1422-a713-4c87-9325-b8aaf671c047
[2024-06-19 16:55:22.310] [amf_sbi] [info] Send HTTP message to http://oai-nrf:8080/nrf-nfm/v1/nf-instances/f4df1422-a713-4c87-9325-b8aaf671c047
[2024-06-19 16:55:22.310] [amf_sbi] [info] HTTP message Body: [{"op":"replace","path":"/nfStatus","value":"REGISTERED"}]
[2024-06-19 16:55:22.310] [amf_sbi] [debug] Send a simple HTTP request
[2024-06-19 16:55:22.312] [amf_sbi] [info] Get response with HTTP code (204)
[2024-06-19 16:55:22.312] [amf_sbi] [info] Could not get JSON content from the response
[2024-06-19 16:55:22.312] [amf_sbi] [debug] NF Update, response from NRF, JSON data:
null
[2024-06-19 16:55:22.312] [amf_app] [debug] Received SBI_UPDATE_NF_INSTANCE_RESPONSE
[2024-06-19 16:55:22.312] [amf_app] [debug] Handle NF Update response
[2024-06-19 16:55:22.312] [amf_app] [debug] Set a timer to the next Heart-beat (10)
[2024-06-19 16:55:32.134] [amf_app] [info]

-----gNBs' Information-----
Index | Status | Global Id | gNB Name | PLMN
  1 | Connected | 0xE000 | gNB-OAI | 001,01

-----UEs' Information-----
Index | 5GMM State | IMSI | GUTI | RAN UE NGAP ID | AMF UE NGAP ID | PLMN | Cell Id
  1 | COMM-PROC-INIT | 2089900007487 |  | 0x01 | 0x01 | 001,01 | 0xE00000

[2024-06-19 16:55:32.313] [amf_app] [debug] Send ITTI msg to SBI task to trigger NRF Heartbeat
[2024-06-19 16:55:32.313] [amf_sbi] [info] Receive Update NF Instance Request, handling ...
[2024-06-19 16:55:32.313] [amf_sbi] [debug] Send NF Update to NRF
[2024-06-19 16:55:32.313] [amf_sbi] [debug] Send NF Update to NRF, Msg body [{"op":"replace","path":"/nfStatus","value":"REGISTERED"}]
[2024-06-19 16:55:32.313] [amf_sbi] [debug] Send NF Update to NRF, NRF URI http://oai-nrf:8080/nrf-nfm/v1/nf-instances/f4df1422-a713-4c87-9325-b8aaf671c047
[2024-06-19 16:55:32.313] [amf_sbi] [info] Send HTTP message to http://oai-nrf:8080/nrf-nfm/v1/nf-instances/f4df1422-a713-4c87-9325-b8aaf671c047
[2024-06-19 16:55:32.313] [amf_sbi] [info] HTTP message Body: [{"op":"replace","path":"/nfStatus","value":"REGISTERED"}]
[2024-06-19 16:55:32.313] [amf_sbi] [debug] Send a simple HTTP request
[2024-06-19 16:55:32.315] [amf_sbi] [info] Get response with HTTP code (204)
[2024-06-19 16:55:32.315] [amf_sbi] [info] Could not get JSON content from the response
[2024-06-19 16:55:32.315] [amf_sbi] [debug] NF Update, response from NRF, JSON data:
null
[2024-06-19 16:55:32.315] [amf_app] [debug] Received SBI_UPDATE_NF_INSTANCE_RESPONSE
[2024-06-19 16:55:32.315] [amf_app] [debug] Handle NF Update response
[2024-06-19 16:55:32.315] [amf_app] [debug] Set a timer to the next Heart-beat (10)
```

One can also check that in the configuration, the e2 agent information has already been incorporated into gnb configuration file.

```
PeterYao@node:/mydata/openairinterface5g/cmake_targets/ran_build/build$ tail ../../../../targets/PROJECTS/GENERIC-NR-5GC/CONF/gnb.sa.band78.fr1.106PRB.usrpb210.conf
rrc_log_level          = "info";
ngap_log_level         = "debug";
flap_log_level         = "debug";
};

e2_agent = {
  near_ric_ip_addr = "127.0.0.1";
  #sm_dir = "/path/where/the/SMs/are/located/"
  sm_dir = "/usr/local/lib/flexric/"
};
```

3. Brings up the Flexric and xapp following the guide at

<https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/openair2/E2AP/README.md>

with the commands:

```
# brings up flexric first
cd flexric
./build/examples/xApp/c/monitor/xapp_kpm_moni
# brings up xapp
./build/examples/xApp/c/monitor/xapp_rc_moni
```

the flexric still crashed immediately

```
PeterYao@node:~/flexric$ ./build/examples/ric/nearRT-RIC
[UTIL]: Setting the config -c file to /usr/local/etc/flexric/flexric.conf
[UTIL]: Setting path -p for the shared libraries to /usr/local/lib/flexric/
[NEAR-RIC]: nearRT-RIC IP Address = 127.0.0.1, PORT = 36421
[NEAR-RIC]: Initializing
[NEAR-RIC]: Loading SM ID = 142 with def = MAC_STATS_V0
[NEAR-RIC]: Loading SM ID = 146 with def = TC_STATS_V0
[NEAR-RIC]: Loading SM ID = 148 with def = GTP_STATS_V0
[NEAR-RIC]: Loading SM ID = 2 with def = ORAN-E2SM-KPM
[NEAR-RIC]: Loading SM ID = 143 with def = RLC_STATS_V0
[NEAR-RIC]: Loading SM ID = 3 with def = ORAN-E2SM-RC
[NEAR-RIC]: Loading SM ID = 145 with def = SLICE_STATS_V0
[NEAR-RIC]: Loading SM ID = 144 with def = PDCP_STATS_V0
[iApp]: Initializing ...
[iApp]: nearRT-RIC IP Address = 127.0.0.1, PORT = 36422
[NEAR-RIC]: Initializing Task Manager with 2 threads
[iApp]: E42 SETUP-REQUEST rx
[iApp]: E42 SETUP-RESPONSE tx
nearRT-RIC: /users/PeterYao/flexric/src/lib/e2ap/v2_03/enc/e2ap_msg_enc_asn.c:3165: e2ap_enc_e42_setup_response_asn_p
du: Assertion `sr->len_e2_nodes_conn > 0 && "No global node conected??"' failed.
Aborted
```