

06-03-25

<https://docs.srsran.com/projects/project/en/latest/tutorials/source/near-rt-ric/source/index.html#>

5G Core

```
sudo apt-get install cmake make gcc g++ pkg-config libfftw3-dev libmbdtdls-dev libsctp-dev libyaml-cpp-dev libgtest-dev
sudo apt-get install libzmq3-dev -y
```

```
git clone https://github.com/srsran/srsRAN_Project.git
cd srsRAN_Project
mkdir build
cd build
cmake ../ -DENABLE_EXPORT=ON -DENABLE_ZEROMQ=ON
make -j`nproc`
```

ORAN-SC RIC

```
git clone https://github.com/srsran/oran-sc-ric
```

https://docs.srsran.com/projects/4g/en/latest/general/source/1_installation.html

Download and build srsRAN 4G:

```
sudo apt-get install build-essential cmake libfftw3-dev libmbdtdls-dev libboost-program-options-dev libconfig++-dev libs
git clone https://github.com/srsran/srsRAN_4G.git
cd srsRAN_4G
mkdir build
cd build
cmake ../
make
make test
```

Start 5G RAN Core

```
cd ./srsRAN_Project/docker
docker compose up 5gc
```

```
open5gs_5gc | 03/10 04:23:16.864: [sbi] INFO: [01f945c6-fd5f-41ef-8613-77c244698152] Subscription created until 2025-03-11T04:23:16.860889+01:00 [duration:86400,validity:86399.996385,patch:43199.998192] (
open5gs_5gc | 03/10 04:23:16.864: [sbi] INFO: [01f94d6c-fd5f-41ef-8613-77c244698152] Subscription created until 2025-03-11T04:23:16.861008+01:00 [duration:86400,validity:86399.996408,patch:43199.998204] (
open5gs_5gc | 03/10 04:23:16.864: [sbi] INFO: [01f94d64-fd5f-41ef-8613-77c244698152] Subscription created until 2025-03-11T04:23:16.861073+01:00 [duration:86400,validity:86399.996413,patch:43199.998206] (
open5gs_5gc | 03/10 04:23:16.864: [sbi] INFO: [01f95890-fd5f-41ef-8613-77c244698152] Subscription created until 2025-03-11T04:23:16.861362+01:00 [duration:86400,validity:86399.996646,patch:43199.998323] (
open5gs_5gc | 03/10 04:23:16.865: [sbi] INFO: [01f9625e-fd5f-41ef-8613-77c244698152] Subscription created until 2025-03-11T04:23:16.861613+01:00 [duration:86400,validity:86399.996356,patch:43199.998178] (
open5gs_5gc | > Using external babel configuration
open5gs_5gc | > Location: /open5gs/webui/babelrc"
open5gs_5gc | DONE Compiled successfully in 2897ms4:23:22 AM
open5gs_5gc |
open5gs_5gc | Mongoose: subscribers.ensureIndex({ msid: 1 }, { unique: true, background: true })
open5gs_5gc | Mongoose: accounts.ensureIndex({ username: 1 }, { unique: true, background: true })
open5gs_5gc | (node:123) DeprecationWarning: collection.ensureIndex is deprecated. Use createIndexes instead.
open5gs_5gc | (Use 'node --trace-deprecation ...' to show where the warning was created)
open5gs_5gc | Mongoose: accounts.count({}, {}))
open5gs_5gc | (node:123) DeprecationWarning: collection.count is deprecated, and will be removed in a future version. Use Collection.countDocuments or Collection.estimatedDocumentCount instead
open5gs_5gc | > Ready on http://599f7ca356e9:9999
```

SC RIC platform

```
cd ./oran-sc-ric
docker compose up

# For Flexric
./flexric/build/examples/ric/nearRT-RIC
```

```
ph@ph-Standard-PC-Q35-ICH9-2009:~$ ./flexric/build/examples/ric/nearRT-RIC
Setting the config -c file to /usr/local/etc/flexric/ric.conf
[LibConf]: loading service models from SM_DIR: /usr/local/lib/flexric/
[LibConf]: reading configuration for NearRT_RIC
[LibConf]: NearRT_RIC IP: 127.0.0.1
[LibConf]: E2_Port Port: 36421
[LibConf]: E42_Port Port: 36422
[NEAR-RIC]: nearRT-RIC IP Address = 127.0.0.1, PORT = 36421
[NEAR-RIC]: Initializing
[NEAR-RIC]: Loading SM ID = 3 with def = ORAN-E2SM-RC
[NEAR-RIC]: Loading SM ID = 2 with def = ORAN-E2SM-KPM
[NEAR-RIC]: Loading SM ID = 146 with def = TC_STATS_V0
[NEAR-RIC]: Loading SM ID = 143 with def = RLC_STATS_V0
[NEAR-RIC]: Loading SM ID = 144 with def = PDCP_STATS_V0
[NEAR-RIC]: Loading SM ID = 142 with def = MAC_STATS_V0
[NEAR-RIC]: Loading SM ID = 148 with def = GTP_STATS_V0
[NEAR-RIC]: Loading SM ID = 145 with def = SLICE_STATS_V0
[iApp]: Initializing ...
[iApp]: nearRT-RIC IP Address = 127.0.0.1, PORT = 36422
[NEAR-RIC]: Initializing Task Manager with 4 threads
```

If we get this error shown below restart the 5G RAN Core if still the error persists then close all the docker 5G RAN Core, RIC docker and also close srsue, gNB(if used before)

the first start 5G RAN Core then start

RIC docker and check if the

"ric_e2term" is giving the below error if it is then close the RIC and start again and then also the error persists then restart the 5G RAN Core and try again



```
ric_e2term | {"ts":1741577041294,"crit":"ERROR","id":"E2Terminator","mdc":
{"PID":"1","POD_NAME":"e2term_pod","CONTAINER_NAME":"ric_e2term","SERVICE_NAME":"ric_e2term_service","HC
sending E2_TERM_INIT cause : RMR_ERR_NOENDPT - send//call could not find an endpoint based on msg type "}
```

```
ric_dbbaas | 1:M 10 Mar 2025 03:23:54.560 # Done loading RDB; keys loaded: 6, keys expired: 0.
ric_dbbaas | 1:M 10 Mar 2025 03:23:54.560 * DB loaded from disk: 0.001 seconds
ric_dbbaas | 1:M 10 Mar 2025 03:23:54.560 * Ready to accept connections
ric_e2mgr exited with code 1
ric_e2term | 1741577037195 1/RMR [INFO] ric message routing library on S195 p=38000 mv=3 flg=00 id=a (f447e29 4.9.4 built: Dec 13 2023)
ric_submgr | {"ts":1741577037361,"crit":"INFO","id":"submgr","mdc":{"time":"2025-03-10T03:23:57"},"msg":"Using config file: /opt/config/submgr-config.yaml"}
ric_submgr | redis: got 7 elements in COMMAND reply, wanted 6
ric_submgr | redis: got 7 elements in COMMAND reply, wanted 6
ric_submgr | redis: got 7 elements in COMMAND reply, wanted 6
ric_submgr | redis: got 7 elements in COMMAND reply, wanted 6
ric_submgr | 1741577037393 1/RMR [INFO] ric message routing library on S195 p=4560 mv=3 flg=00 id=a (f447e29 4.9.4 built: Dec 13 2023)
ric_submgr | 2025/03/10 03:23:57 Serving xapp framework at http://[::]:8088
ric_appmgr | 2025/03/10 03:23:58 Serving app manager at http://[::]:8080
ric_submgr | RMR is ready now ...
ric_e2term | {"ts":1741577041294,"crit":"ERROR","id":"E2Terminator","mdc":{"PID":"1","POD_NAME":"e2term_pod","CONTAINER_NAME":"ric_e2term","SERVICE_NAME":"ric_e2term_service","HOST_NAME":"ric_e2term_pod"},"msg":"Error sending E2_TERM_INIT cause : RMR_ERR_NOENDPT - send//call could not find an endpoint based on msg type "}
```

Start gNB

```
cd ./srsRAN_Project/build/apps/gnb/
sudo ./gnb -c ~/oran-sc-ric/e2-agents/srsRAN/gnb_zmq.yaml e2 --addr="10.0.2.10" --bind_addr="10.0.2.1"
```

for Flexric

```
sudo ./gnb -c ~/oran-sc-ric/e2-agents/srsRAN/gnb_zmq.yaml e2 --addr="127.0.0.1" --bind_addr="127.0.0.1"
```

```
ph@ph-Standard-PC-Q35-ICH9-2009:~/srsRAN_Project/build/apps/gnb$ sudo ./gnb -c ~/oran-sc-ric/e2-agents/srsRAN/gnb_zmq.yaml e2 --addr="10.0.2.10" --bind_addr="10.0.2.10"
=== srsRAN gNB (commit 8120ffbc) ===
Lower PHY in executor blocking mode.
Available radio types: zmq.
Cell pci=1, bw=10 MHz, 1T1R, dl_arfcn=368500 (n3), dl_freq=1842.5 MHz, dl_ssb_arfcn=368410, ul_freq=1747.5 MHz
N2: Connection to AMF on 10.53.1.2:38412 completed
E2AP: Connection to Near-RT-RIC on 10.0.2.10:36421 completed
==== gNB started ====
Type <h> to view help
```

```
ph@ph-Standard-PC-Q35-ICH9-2009:~/srsRAN_Project/build/apps/gnb$ sudo ./gnb -c ~/oran-sc-ric/e2-agents/srsRAN/gnb_zmq.yaml e2 --addr="127.0.0.1" --bind_addr="127.0.0.1"
=== srsRAN gNB (commit 2be82d8ea) ===
Lower PHY in executor blocking mode.
Available radio types: zmq.
Cell pci=1, bw=10 MHz, 1T1R, dl_arfcn=368500 (n3), dl_freq=1842.5 MHz, dl_ssb_arfcn=368410, ul_freq=1747.5 MHz
N2: Connection to AMF on 10.53.1.2:38412 completed
E2AP: Connection to Near-RT-RIC on 127.0.0.1:36421 completed
==== gNB started ====
Type <h> to view help
```

If the connection attempt is successful, the following (or similar) will be displayed on the NearRT-RIC console:

```
ric_dbaas | 15:06:06 Mar 2025 08:15:10.074 * DB saved on disk
ric_dbaas | 15:06:06 Mar 2025 08:15:10.074 * RDB: 0 MB of memory used by copy-on-write
ric_dbaas | 15:06:06 Mar 2025 08:15:10.109 * Background saving terminated with success
ric_rtcgr_sim | 2025/03/06 08:15:41.09 POST /ric/v1/handles/associate-ran-to-e2t body: [{"E2Address":"10.0.2.10:38800","ranNameList":["gnb_001_00190_0"]}]] elapsed: 20.686µs
ric_dbaas | 15:06:06 Mar 2025 08:16:02.040 * 100 changes in 300 seconds. Saving...

[NEAR-RIC]: Initializing Task Manager with 4 threads
[E2AP]: E2 SETUP-REQUEST rx from PLMN 1.1 Node ID 411 RAN type ngran_gNB_DU ID 0
[NEAR-RIC]: Accepting RAN function ID 2 with def = ORAN-E2SM-KPM
[NEAR-RIC]: Accepting RAN function ID 3 with def = ORAN-E2SM-RC
[iApp]: no xApp connected, no need to generate E42 UPDATE-E2-NODE
```

Start srsUE

```
sudo ip netns add ue1
```

```
cd ./srsRAN_4G/build/srsue/src/
```

```
sudo ./srsue ~/oran-sc-ric/e2-agents/srsRAN/ue_zmq.conf
```

```

Killed
ph@ph-Standard-PC-Q35-ICH9-2009:~/srsRAN_4G/build/srsue/src$ sudo ip netns add ue1
Cannot create namespace file "/run/netns/ue1": File exists
ph@ph-Standard-PC-Q35-ICH9-2009:~/srsRAN_4G/build/srsue/src$ sudo ip netns add ue2
ph@ph-Standard-PC-Q35-ICH9-2009:~/srsRAN_4G/build/srsue/src$ sudo ./srsue ~/oran-sc-ric/e2-agents/srsRAN/ue_zmq.conf
Active RF plugins: librsran_rf_zmq.so
Inactive RF plugins:
Reading configuration file /home/ph/oran-sc-ric/e2-agents/srsRAN/ue_zmq.conf...

Built in Release mode using commit ec29b0c1f on branch master.

Opening 1 channels in RF device=zmq with args=tx_port=tcp://127.0.0.1:2001,rx_port=tcp://127.0.0.1:2000,base_srate=11.52e6
Supported RF device list: zmq file
CHx base_srate=11.52e6
Current sample rate is 1.92 MHz with a base rate of 11.52 MHz (x6 decimation)
CH0 rx_port=tcp://127.0.0.1:2000
CH0 tx_port=tcp://127.0.0.1:2001
Current sample rate is 11.52 MHz with a base rate of 11.52 MHz (x1 decimation)
Current sample rate is 11.52 MHz with a base rate of 11.52 MHz (x1 decimation)
Waiting PHY to initialize ... done!
Attaching UE...
Random Access Transmission: prach_occasion=0, preamble_index=0, ra-rnti=0x39, tti=334
Random Access Complete. c-rnti=0x4601, ta=0
RRC Connected
PDU Session Establishment successful. IP: 10.45.1.2
RRC NR reconfiguration successful.

```

IP Traffic with ping

Ping is the simplest tool to test the end-to-end connectivity in the network, i.e., it tests whether the UE and core can communicate. Here, we use it to generate traffic from UE, hence the gNB can measure data transmission-related metrics (e.g., throughput).

To run ping from UE to the core

```
sudo ip netns exec ue1 ping -i 0.1 10.45.1.1
```

Run xApps

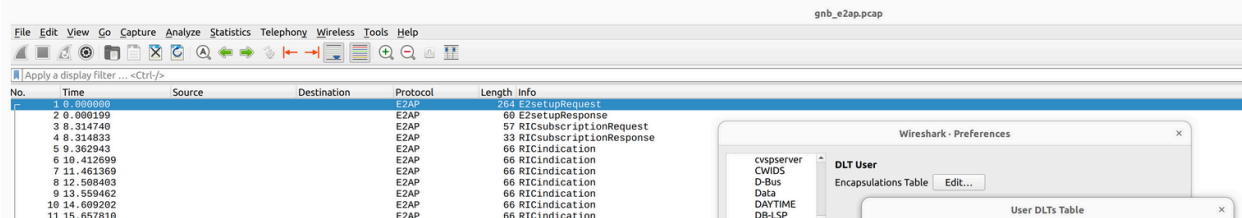
```
docker exec -it python_xapp_runner bash
./simple_rc_xapp.py
```

```
~/flexric/build/examples/xApp/c/monitor/xapp_oran_moni -c ~/xapp_mon_e2sm_kpm.conf
```

E2AP

To analyze an E2AP PCAP using Wireshark, you will need to configure User DLT 155 for E2AP:

1. Go to Edit->Preferences->Protocols->DLT_USER->Edit and add an entry with DLT=155 and Payload Protocol=e2ap.





```
"Containers": {
  "32f80fb6dff906b2ae845188e51a8e31cf36358375693f040e14337efee39416": {
    "Name": "ric_appmgr",
    "EndpointID": "0f530031c8af5742e71e71abcfce203679b77b7b15a5b9ddd61ae526bc897e2d7",
    "MacAddress": "d2:a3:00:17:b2:80",
    "IPv4Address": "10.0.2.14/24",
    "IPv6Address": ""
  },
  "6c384c662631c056667a145517747aa4196bbdf811d11b7ae66e0dad634d16e5": {
    "Name": "ric_e2term",
    "EndpointID": "ea69bd3d0f4872fb861bf638cd16b32b9c881959081c722fad3e5bc20cbdcfbb",
    "MacAddress": "2e:d5:16:39:27:9d",
    "IPv4Address": "10.0.2.10/24",
    "IPv6Address": ""
  },
  "72de69f4f1cc821d8a488ca0f94d128e01ec5382ebd101166355f7aae86c37e6": {
    "Name": "python_xapp_runner",
    "EndpointID": "4bcb9cb33fbefda5bf079c40052c5f31393f9e49cdc21cb126cb1f83fcb3af24",
    "MacAddress": "b2:aa:d8:4f:e8:eb",
    "IPv4Address": "10.0.2.20/24",
    "IPv6Address": ""
  },
  "a399994ed95e3bc0430ffa6817b6f04f05a0a5ea66406bbf40085a4e70732899": {
    "Name": "ric_rtmgrr_sim",
    "EndpointID": "4b4cbd1e3e0f2fedb9f6cf0573918560ba3721825bd0134521e82a51010e26e3",
    "MacAddress": "06:c3:5f:4e:18:5a",
    "IPv4Address": "10.0.2.15/24",
    "IPv6Address": ""
  },
  "bda8d48758b022d2e4099d5ec0c5927a6a48951d6a9f428f79d0dbc778dcf20c": {
    "Name": "ric_e2mgr",
    "EndpointID": "483bb2d9af45083ee58d4af87b6fd7a70f55b9140ecf7680a18bcd5230a84c5",
    "MacAddress": "02:22:4b:79:ab:de",
    "IPv4Address": "10.0.2.11/24",
    "IPv6Address": ""
  },
  "c3a14f0ad9f7ee89ca3ba1a04101e677287906bfb97a5fe0598670f3a1dfcb5d": {
    "Name": "ric_dbaas",
    "EndpointID": "2fc51e427326a13999e4d0c48ef3d659cbc00b433cf7ffae31c4706bd96023d5",
    "MacAddress": "7e:fb:93:bf:c1:28",
    "IPv4Address": "10.0.2.12/24",
    "IPv6Address": ""
  },
  "dffac8e65196a04ee6946c2f80258a4ba7fac348839b800d1b6e256d70da92a3": {
    "Name": "ric_submgr",
    "EndpointID": "3aa62815f1b7345f2aec4a11103d2caea4a3c242669194b2b4a1d242a4f1a65b",
    "MacAddress": "86:fe:d8:76:98:1e",
    "IPv4Address": "10.0.2.13/24",
    "IPv6Address": ""
  }
}
```

