5️⃣

Open5gs with OAIRAN

1-) Installation of MongoDB database system

```
# install gpg key manager
sudo apt-get install gnupg
# install curl from local rep.
sudo apt-get install curl
# import mongoDB public gpg key via
curl -fsSL https://pgp.mongodb.com/server-6.0.asc | \ sudo gpg -o /usr/share/keyrings/mongodb-server-6.0.gpg \ --dearmor
# depending on the release  create a list file for installation (here ubuntu 20.04 used, for other versions refer to website)
echo "deb [ arch=amd64,arm64 signed-by=/usr/share/keyrings/mongodb-server-6.0.gpg ] https://repo.mongodb.org/apt/ubuntu focal/mongodb-

#update the packages
sudo apt-get update
#install latest stable version
sudo apt-get install -y mongodb-org
# start the service
sudo systemctl start mongod
#enable starting at bootup
sudo systemctl enable mongod
```

2-) create TUN device (should be done at every bootup)

```
$ sudo ip tuntap add name ogstun mode tun
$ sudo ip addr add 10.45.0.1/16 dev ogstun
$ sudo ip addr add 2001:db8:cafe::1/48 dev ogstun
$ sudo ip link set ogstun up
```

3-) Build Open5gs

```
$ sudo apt install python3-pip python3-setuptools python3-wheel ninja-build build-essential flex
bison git cmake libsctp-dev libgnutls28-dev libgcrypt-dev libssl-dev libidn11-dev libmongoc-dev
libbson-dev libyaml-dev libnghttp2-dev libmicrohttpd-dev libcurl4-gnutls-dev libnghttp2-dev
libtins-dev libtalloc-dev meson

$ git clone https://github.com/open5gs/open5gs

$ cd open5gs
$ meson build --prefix=`pwd`/install


This part is required for the connection of OAI-UE (I'm not sure but this is what I did)
reference to https://github.com/open5gs/open5gs/issues/1900

go ~/open5gs/src/amf/gmm_handler.c line 107

and replace these lines

#define OGS_REGISTRATION_CLEARTEXT_PRESENT \
        (OGS_NAS_5GS_REGISTRATION_REQUEST_UE_SECURITY_CAPABILITY_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_UE_STATUS_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_EPS_NAS_MESSAGE_CONTAINER_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_NAS_MESSAGE_CONTAINER_PRESENT)

with these

#define OGS_REGISTRATION_CLEARTEXT_PRESENT \
        (OGS_NAS_5GS_REGISTRATION_REQUEST_UE_SECURITY_CAPABILITY_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_UE_STATUS_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_EPS_NAS_MESSAGE_CONTAINER_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_NAS_MESSAGE_CONTAINER_PRESENT| \
        OGS_NAS_5GS_REGISTRATION_REQUEST_5GMM_CAPABILITY_PRESENT)


$ ninja -C build


# TESTS (OPTIONAL BUT RECOMMENDED)
$ ./build/tests/registration/registration ## 5G Core Only
$ cd build
$ meson test -v

# BUILD OPEN5GS
ninja install
```

4-) Configure

```
we can finds network function on the directory $(Open5gs)/install/etc/open5gs/

I've bolded the lines where I changed but basically mcc,mnc,s_nssai, values should exactly be the same with the ue,
also I only included the parts of the files that only changes occured.

for amf.yaml

amf:
    sbi:
      - addr: 127.0.0.5
        port: 7777
    ngap:
      - addr: 10.162.149.171
    metrics:
      - addr: 127.0.0.5
        port: 9090
    guami:
      - plmn_id:
          mcc: 999
          mnc: 70
        amf_id:
          region: 2
          set: 1
    tai:
      - plmn_id:
          mcc: 999
          mnc: 70
        tac: 1
    plmn_support:
      - plmn_id:
          mcc: 999
          mnc: 70
        s_nssai:
          - sst: 1
    security:
        integrity_order : [ NIA2, NIA1, NIA0 ]
        ciphering_order : [ NEA0, NEA1, NEA2 ]
    network_name:
        full: Open5GS
    amf_name: open5gs-amf0


for smf.yaml


smf:
    sbi:
      - addr: 127.0.0.4
        port: 7777
    pfcp:
      - addr: 10.162.149.171
    gtpc:
      - addr: 127.0.0.4
    gtpu:
      - addr: 10.162.149.171
    metrics:
      - addr: 127.0.0.4
        port: 9090
    subnet:
      - addr: 10.45.0.1/16
        dnn: internet
    dns:
      - 8.8.8.8
      - 8.8.4.4
      - 2001:4860:4860::8888
      - 2001:4860:4860::8844
    mtu: 1400
    ctf:
      enabled: auto
    freeDiameter: /home/o5gs/open5gs/install/etc/freeDiameter/smf.conf

upf:
    pfcp:
      - addr: 127.0.0.7
        dnn: internet
```

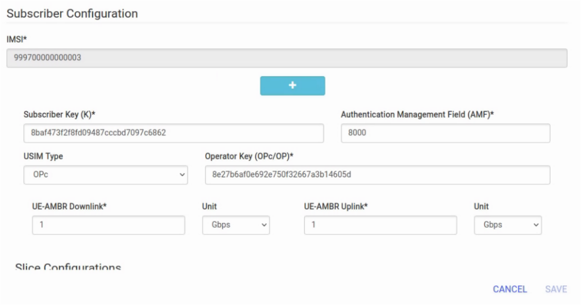
```
for upf.yaml

upf:
    pfcp:
      - addr: 127.0.0.7
    gtpu:
      - addr: 127.0.0.7
    subnet:
      - addr: 10.45.0.1/16
        dnn: internet
        dev: ogstun
    metrics:
      - addr: 127.0.0.7
        port: 9090
```

5-) Building the webui

```
$ curl -fsSL https://deb.nodesource.com/setup_18.x | sudo -E bash -
$ sudo apt-get install nodejs
$ cd webui
$ sudo npm ci
$ sudo npm run dev
```

after this line open the browser and go the the website: `http://127.0.0.1:3000` where `id:admin`, `pw:1423`
this step depends on user but my configuration was like this:



Subscriber Configuration

IMSI*: 999700000000003

Subscriber Key (K)*: 8baf473f2f8fd09487cccbd7097c6862

Authentication Management Field (AMF)*: 8000

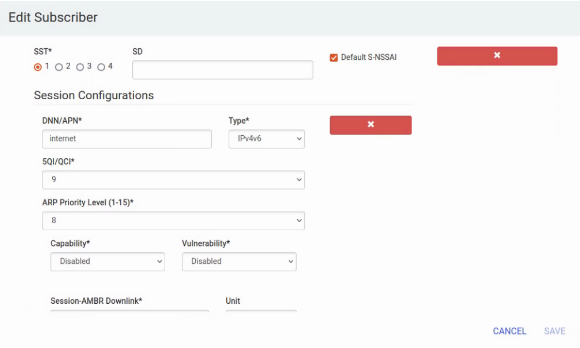
USIM Type: OPc

Operator Key (OPc/OP)*: 8e27b6af0e692e750f32667a3b14605d

UE-AMBR Downlink*: 1 Unit: Gbps

UE-AMBR Uplink*: 1 Unit: Gbps

Slice Configurations



Edit Subscriber

SST*: ● 1 ○ 2 ○ 3 ○ 4

SD:

☑ Default S-NSSAI

Session Configurations

DNN/APN*: internet

Type*: IPv4v6

5QI/QCI*: 9

ARP Priority Level (1-15)*: 8

Capability*: Disabled

Vulnerability*: Disabled

Session-AMBR Downlink*

Unit

Here I did not add SD value, you can leave it empty.

6-) Adding a route for the UE to have WAN connectivity (should be done at every bootup)

```
### Enable IPv4/IPv6 Forwarding
$ sudo sysctl -w net.ipv4.ip_forward=1
$ sudo sysctl -w net.ipv6.conf.all.forwarding=1

### Add NAT Rule
$ sudo iptables -t nat -A POSTROUTING -s 10.45.0.0/16 ! -o ogstun -j MASQUERADE
$ sudo ip6tables -t nat -A POSTROUTING -s 2001:db8:cafe::/48 ! -o ogstun -j MASQUERADE

$ sudo ufw status
Status: active
$ sudo ufw disable
Firewall stopped and disabled on system startup
$ sudo ufw status
Status: inactive

### Ensure that the packets in the `INPUT` chain to the `ogstun` interface are accepted
$ sudo iptables -I INPUT -i ogstun -j ACCEPT
```

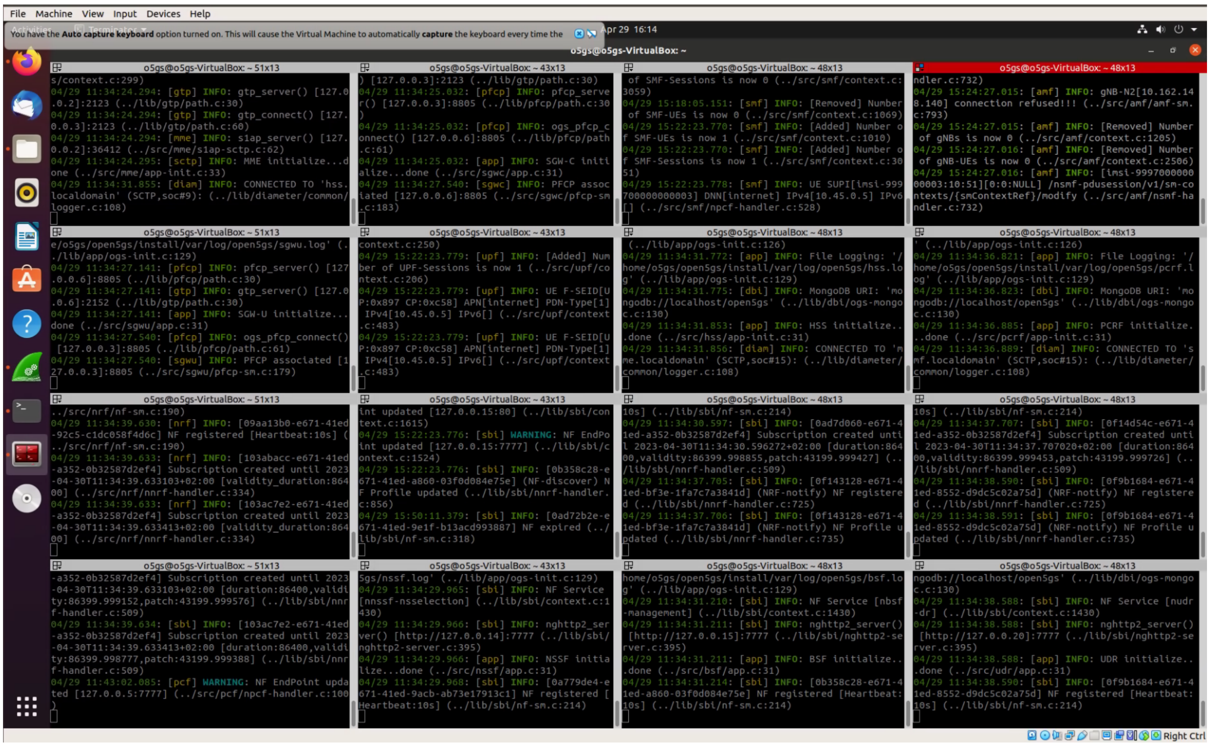
7-) RUN Open5gs

```
cd ~/open5gs/install/bin
#optional (to be able to run the services from anywhere)
cp open5gs* /usr/bin/

I run 16 services on a different terminal because the suggested line did not worked on me.

open5gs-mmed
open5gs-sgwcd
open5gs-smfd
open5gs-amfd
open5gs-sgwud
open5gs-upfd
open5gs-hssd
open5gs-pcrfd
open5gs-nrfd
open5gs-scpd
open5gs-ausfd
open5gs-udmd
open5gs-pcfd
open5gs-nssfd
open5gs-bsfd
open5gs-udrd
```

You can use terminator to run these a bit easier and easily be seen on the screen for example my screen is like:


File Machine View Input Devices Help
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the keyboard every time the
Apr 29 16:14
o5gs@o5gs-VirtualBox: ~
Right Ctrl

```
o5gs@o5gs-VirtualBox: ~ 51x13
s/context.c:299)
04/29 11:34:24.294: [gtp] INFO: gtp_server() [127.0
.0.2]:2123 (../lib/gtp/path.c:30)
04/29 11:34:24.294: [gtp] INFO: gtp_connect() [127.
0.0.3]:2123 (../lib/gtp/path.c:60)
04/29 11:34:24.294: [mme] INFO: s1ap_server() [127.
0.0.2]:36412 (../src/mme/s1ap-sctp.c:62)
04/29 11:34:24.295: [sctp] INFO: MME initialize...d
one (../src/mme/app-init.c:33)
04/29 11:34:31.855: [diam] INFO: CONNECTED TO 'hss.
localdomain' (SCTP,soc#9): (../lib/diameter/common/
logger.c:108)
```

```
o5gs@o5gs-VirtualBox: ~ 43x13
) [127.0.0.3]:2123 (../lib/gtp/path.c:30)
04/29 11:34:25.032: [pfcp] INFO: pfcp_serve
r() [127.0.0.3]:8805 (../lib/pfcp/path.c:30
)
04/29 11:34:25.032: [pfcp] INFO: ogs_pfcp_c
onnect() [127.0.0.6]:8805 (../lib/pfcp/path
.c:61)
04/29 11:34:25.032: [app] INFO: SGW-C initi
alize...done (../src/sgwc/app.c:31)
04/29 11:34:27.540: [sgwc] INFO: PFCP assoc
iated [127.0.0.6]:8805 (../src/sgwc/pfcp-sm
.c:183)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
 of SMF-Sessions is now 0 (../src/smf/context.c:
3059)
04/29 15:18:05.151: [smf] INFO: [Removed] Number
 of SMF-UEs is now 0 (../src/smf/context.c:1069)
04/29 15:22:23.770: [smf] INFO: [Added] Number o
f SMF-UEs is now 1 (../src/smf/context.c:1010)
04/29 15:22:23.770: [smf] INFO: [Added] Number o
f SMF-Sessions is now 1 (../src/smf/context.c:30
51)
04/29 15:22:23.778: [smf] INFO: UE SUPI[imsi-999
700000000003] DNN[internet] IPv4[10.45.0.5] IPv6
[] (../src/smf/npcf-handler.c:528)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
ndler.c:732)
04/29 15:24:27.015: [amf] INFO: gNB-N2[10.162.14
8.140] connection refused!!! (../src/amf/amf-sm.
c:793)
04/29 15:24:27.015: [amf] INFO: [Removed] Number
 of gNBs is now 0 (../src/amf/context.c:1205)
04/29 15:24:27.016: [amf] INFO: [Removed] Number
 of gNB-UEs is now 0 (../src/amf/context.c:2506)
04/29 15:24:27.016: [amf] INFO: [imsi-9997000000
00003:10:51][0:0:NULL] /nsmf-pdusession/v1/sm-co
ntexts/{smContextRef}/modify (../src/amf/nsmf-ha
ndler.c:732)
```

```
o5gs@o5gs-VirtualBox: ~ 51x13
e/o5gs/open5gs/install/var/log/open5gs/sgwu.log' (.
./lib/app/ogs-init.c:129)
04/29 11:34:27.141: [pfcp] INFO: pfcp_server() [127
.0.0.6]:8805 (../lib/pfcp/path.c:30)
04/29 11:34:27.141: [gtp] INFO: gtp_server() [127.0
.0.6]:2152 (../lib/gtp/path.c:30)
04/29 11:34:27.141: [app] INFO: SGW-U initialize...
done (../src/sgwu/app.c:31)
04/29 11:34:27.540: [pfcp] INFO: ogs_pfcp_connect()
 [127.0.0.3]:8805 (../lib/pfcp/path.c:61)
04/29 11:34:27.540: [sgwu] INFO: PFCP associated [1
27.0.0.3]:8805 (../src/sgwu/pfcp-sm.c:179)
```

```
o5gs@o5gs-VirtualBox: ~ 43x13
context.c:250)
04/29 15:22:23.779: [upf] INFO: [Added] Num
ber of UPF-Sessions is now 1 (../src/upf/co
ntext.c:206)
04/29 15:22:23.779: [upf] INFO: UE F-SEID[U
P:0x897 CP:0xc58] APN[internet] PDN-Type[1]
 IPv4[10.45.0.5] IPv6[] (../src/upf/context
.c:483)
04/29 15:22:23.779: [upf] INFO: UE F-SEID[U
P:0x897 CP:0xc58] APN[internet] PDN-Type[1]
 IPv4[10.45.0.5] IPv6[] (../src/upf/context
.c:483)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
 (../lib/app/ogs-init.c:126)
04/29 11:34:31.772: [app] INFO: File Logging: '/
home/o5gs/open5gs/install/var/log/open5gs/hss.lo
g' (../lib/app/ogs-init.c:129)
04/29 11:34:31.775: [dbi] INFO: MongoDB URI: 'mo
ngodb://localhost/open5gs' (../lib/dbi/ogs-mongo
c.c:130)
04/29 11:34:31.853: [app] INFO: HSS initialize..
.done (../src/hss/app-init.c:31)
04/29 11:34:31.856: [diam] INFO: CONNECTED TO 'm
me.localdomain' (SCTP,soc#15): (../lib/diameter/
common/logger.c:108)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
' (../lib/app/ogs-init.c:126)
04/29 11:34:36.821: [app] INFO: File Logging: '/
home/o5gs/open5gs/install/var/log/open5gs/pcrf.l
og' (../lib/app/ogs-init.c:129)
04/29 11:34:36.823: [dbi] INFO: MongoDB URI: 'mo
ngodb://localhost/open5gs' (../lib/dbi/ogs-mongo
c.c:130)
04/29 11:34:36.885: [app] INFO: PCRF initialize.
..done (../src/pcrf/app-init.c:31)
04/29 11:34:36.889: [diam] INFO: CONNECTED TO 's
mf.localdomain' (SCTP,soc#15): (../lib/diameter/
common/logger.c:108)
```

```
o5gs@o5gs-VirtualBox: ~ 51x13
../src/nrf/nf-sm.c:190)
04/29 11:34:39.630: [nrf] INFO: [09aa13b0-e671-41ed
-92c5-c1dc058f4d6c] NF registered [Heartbeat:10s] (
../src/nrf/nf-sm.c:190)
04/29 11:34:39.633: [nrf] INFO: [103abacc-e671-41ed
-a352-0b32587d2ef4] Subscription created until 2023
-04-30T11:34:39.633103+02:00 [validity_duration:864
00] (../src/nrf/nnrf-handler.c:334)
04/29 11:34:39.633: [nrf] INFO: [103ac7e2-e671-41ed
-a352-0b32587d2ef4] Subscription created until 2023
-04-30T11:34:39.633413+02:00 [validity_duration:864
00] (../src/nrf/nnrf-handler.c:334)
```

```
o5gs@o5gs-VirtualBox: ~ 43x13
int updated [127.0.0.15:80] (../lib/sbi/con
text.c:1615)
04/29 15:22:23.776: [sbi] WARNING: NF EndPo
int updated [127.0.0.15:7777] (../lib/sbi/c
ontext.c:1524)
04/29 15:22:23.776: [sbi] INFO: [0b358c28-e
671-41ed-a860-03f0d084e75e] (NF-discover) N
F Profile updated (../lib/sbi/nnrf-handler.
c:856)
04/29 15:50:11.379: [sbi] INFO: [0ad72b2e-e
671-41ed-9e1f-b13acd993887] NF expired (../
lib/sbi/nf-sm.c:318)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
10s] (../lib/sbi/nf-sm.c:214)
04/29 11:34:30.597: [sbi] INFO: [0ad7d060-e671-4
1ed-a352-0b32587d2ef4] Subscription created unti
l 2023-04-30T11:34:30.596272+02:00 [duration:864
00,validity:86399.998855,patch:43199.999427] (..
/lib/sbi/nnrf-handler.c:509)
04/29 11:34:37.705: [sbi] INFO: [0f143128-e671-4
1ed-bf3e-1fa7c7a3841d] (NRF-notify) NF registere
d (../lib/sbi/nnrf-handler.c:725)
04/29 11:34:37.706: [sbi] INFO: [0f143128-e671-4
1ed-bf3e-1fa7c7a3841d] (NRF-notify) NF Profile u
pdated (../lib/sbi/nnrf-handler.c:735)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
10s] (../lib/sbi/nf-sm.c:214)
04/29 11:34:37.707: [sbi] INFO: [0f14d54c-e671-4
1ed-a352-0b32587d2ef4] Subscription created unti
l 2023-04-30T11:34:37.707020+02:00 [duration:864
00,validity:86399.999453,patch:43199.999726] (..
/lib/sbi/nnrf-handler.c:509)
04/29 11:34:38.590: [sbi] INFO: [0f9b1684-e671-4
1ed-8552-d9dc5c02a75d] (NRF-notify) NF registere
d (../lib/sbi/nnrf-handler.c:725)
04/29 11:34:38.591: [sbi] INFO: [0f9b1684-e671-4
1ed-8552-d9dc5c02a75d] (NRF-notify) NF Profile u
pdated (../lib/sbi/nnrf-handler.c:735)
```

```
o5gs@o5gs-VirtualBox: ~ 51x13
-a352-0b32587d2ef4] Subscription created until 2023
-04-30T11:34:39.633103+02:00 [duration:86400,validi
ty:86399.999152,patch:43199.999576] (../lib/sbi/nnr
f-handler.c:509)
04/29 11:34:39.634: [sbi] INFO: [103ac7e2-e671-41ed
-a352-0b32587d2ef4] Subscription created until 2023
-04-30T11:34:39.633413+02:00 [duration:86400,validi
ty:86399.998777,patch:43199.999388] (../lib/sbi/nnr
f-handler.c:509)
04/29 11:43:02.085: [pcf] WARNING: NF EndPoint upda
ted [127.0.0.5:7777] (../src/pcf/npcf-handler.c:100
)
```

```
o5gs@o5gs-VirtualBox: ~ 43x13
5gs/nssf.log' (../lib/app/ogs-init.c:129)
04/29 11:34:29.965: [sbi] INFO: NF Service
[nnssf-nsselection] (../lib/sbi/context.c:1
430)
04/29 11:34:29.966: [sbi] INFO: nghttp2_ser
ver() [http://127.0.0.14]:7777 (../lib/sbi/
nghttp2-server.c:395)
04/29 11:34:29.966: [app] INFO: NSSF initia
lize...done (../src/nssf/app.c:31)
04/29 11:34:29.968: [sbi] INFO: [0a779de4-e
671-41ed-9acb-ab73e17913c1] NF registered [
Heartbeat:10s] (../lib/sbi/nf-sm.c:214)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
home/o5gs/open5gs/install/var/log/open5gs/bsf.lo
g' (../lib/app/ogs-init.c:129)
04/29 11:34:31.210: [sbi] INFO: NF Service [nbsf
-management] (../lib/sbi/context.c:1430)
04/29 11:34:31.211: [sbi] INFO: nghttp2_server()
 [http://127.0.0.15]:7777 (../lib/sbi/nghttp2-se
rver.c:395)
04/29 11:34:31.211: [app] INFO: BSF initialize..
.done (../src/bsf/app.c:31)
04/29 11:34:31.214: [sbi] INFO: [0b358c28-e671-4
1ed-a860-03f0d084e75e] NF registered [Heartbeat:
10s] (../lib/sbi/nf-sm.c:214)
```

```
o5gs@o5gs-VirtualBox: ~ 48x13
ngodb://localhost/open5gs' (../lib/dbi/ogs-mongo
c.c:130)
04/29 11:34:38.588: [sbi] INFO: NF Service [nudr
-dr] (../lib/sbi/context.c:1430)
04/29 11:34:38.588: [sbi] INFO: nghttp2_server()
 [http://127.0.0.20]:7777 (../lib/sbi/nghttp2-se
rver.c:395)
04/29 11:34:38.588: [app] INFO: UDR initialize..
.done (../src/udr/app.c:31)
04/29 11:34:38.590: [sbi] INFO: [0f9b1684-e671-4
1ed-8552-d9dc5c02a75d] NF registered [Heartbeat:
10s] (../lib/sbi/nf-sm.c:214)
```

FOR OAI-UE,, it sends `non-cleartext-IE which cause open5gs to reject the authentication. In order to solve this:`

```
reference: https://github.com/open5gs/open5gs/issues/1032
~/openairinterface5g/openair3/NAS/COMMON/EMM/RegistrationRequest.c  line 88, and either delete or comment those lines:

// if ((registration_request->presencemask & REGISTRATION_REQUEST_5GMM_CAPABILITY_PRESENT)
  //      == REGISTRATION_REQUEST_5GMM_CAPABILITY_PRESENT) {
  //    if ((encode_result = encode_5gmm_capability(&registration_request->fgmmcapability,
  //                         REGISTRATION_REQUEST_5GMM_CAPABILITY_IEI, buffer + encoded, len -
  //                         encoded)) < 0)
  //      // Return in case of error
  //      return encode_result;
  //    else
  //      encoded += encode_result;
  // }

after commenting those lines, rebuild the OAI via
```

```
cd openairinterface5g/cmake_targets/ran_build/build
sudo ninja nr-uesoftmodem nr-softmodem

then run the gNB via
sudo ./nr-softmodem --sa -O ../../../targets/PROJECTS/GENERIC-NR-5GC/CONF/gnb.sa.band78.fr1.51PRB.1x1.usrpx410_new_o5gs.conf --usrp-tx

after this you'll see on the amf log that gnB is connected

then run the UE via

sudo ./nr-uesoftmodem -r 51 --numerology 1 --band 78 -C 3309480000  --ssb 238 --ue-fo-compensation  --sa -O ../../../targets/PROJECTS/
after this you'll see that PDCP session is established.
```

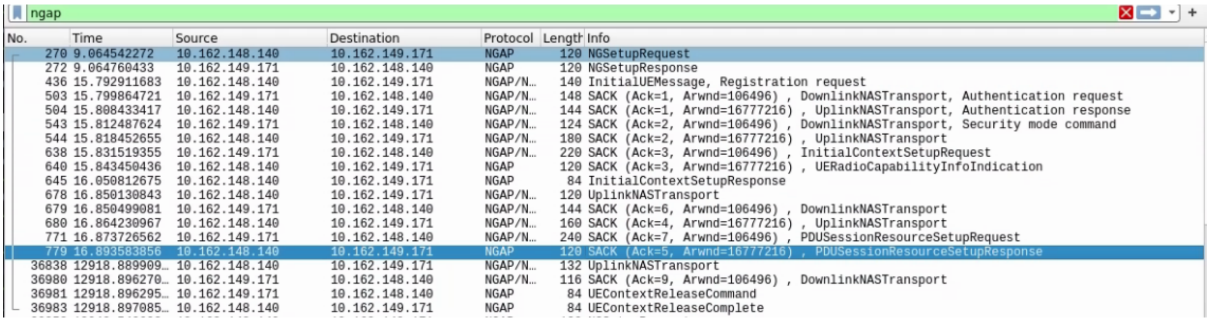
for gNB config file , there is nothing special, it is only the amf ip address should be specified

however on the ue config file we must give the same thing as in the corenetwork, for me it was like :

```
uicc0 = {
imsi = "999700000000003";
key = "8baf473f2f8fd09487cccbd7097c6862";
opc= "8e27b6af0e692e750f32667a3b14605d";
dnn= "internet";
nssai_sst=1;
}
```

remember that we specified no sd value, so there is no sd value here as well, if this config and CN config comply with each other then it will result in some authentication error.

if everything worked perfectly you should see something like this on wirehshark filtered with ngap



ngap

No.	Time	Source	Destination	Protocol	Length	Info
270	9.064542272	10.162.148.140	10.162.149.171	NGAP	120	NGSetupRequest
272	9.064760433	10.162.149.171	10.162.148.140	NGAP	120	NGSetupResponse
436	15.792911683	10.162.148.140	10.162.149.171	NGAP/N…	140	InitialUEMessage, Registration request
503	15.799864721	10.162.149.171	10.162.148.140	NGAP/N…	148	SACK (Ack=1, Arwnd=106496) , DownlinkNASTransport, Authentication request
504	15.808433417	10.162.148.140	10.162.149.171	NGAP/N…	144	SACK (Ack=1, Arwnd=16777216) , UplinkNASTransport, Authentication response
543	15.812487624	10.162.149.171	10.162.148.140	NGAP/N…	124	SACK (Ack=2, Arwnd=106496) , DownlinkNASTransport, Security mode command
544	15.818452655	10.162.148.140	10.162.149.171	NGAP/N…	180	SACK (Ack=2, Arwnd=16777216) , UplinkNASTransport
638	15.831519355	10.162.149.171	10.162.148.140	NGAP/N…	220	SACK (Ack=3, Arwnd=106496) , InitialContextSetupRequest
640	15.843450436	10.162.148.140	10.162.149.171	NGAP	120	SACK (Ack=3, Arwnd=16777216) , UERadioCapabilityInfoIndication
645	16.050812675	10.162.148.140	10.162.149.171	NGAP	84	InitialContextSetupResponse
678	16.850130843	10.162.148.140	10.162.149.171	NGAP/N…	120	UplinkNASTransport
679	16.850499081	10.162.149.171	10.162.148.140	NGAP/N…	144	SACK (Ack=6, Arwnd=106496) , DownlinkNASTransport
680	16.864230967	10.162.148.140	10.162.149.171	NGAP/N…	160	SACK (Ack=4, Arwnd=16777216) , UplinkNASTransport
771	16.873726562	10.162.149.171	10.162.148.140	NGAP/N…	240	SACK (Ack=7, Arwnd=106496) , PDUSessionResourceSetupRequest
779	16.893583856	10.162.148.140	10.162.149.171	NGAP	120	SACK (Ack=5, Arwnd=16777216) , PDUSessionResourceSetupResponse
36838	12918.889909…	10.162.148.140	10.162.149.171	NGAP/N…	132	UplinkNASTransport
36980	12918.896270…	10.162.149.171	10.162.148.140	NGAP/N…	116	SACK (Ack=9, Arwnd=106496) , DownlinkNASTransport
36981	12918.896295…	10.162.149.171	10.162.148.140	NGAP	84	UEContextReleaseCommand
36983	12918.897085…	10.162.148.140	10.162.149.171	NGAP	84	UEContextReleaseComplete

UERANSIM

you can also check the CN functionalities whether it is working or not you can use UERANSIM via: https://github.com/aligungr/UERANSIM/wiki/Installation

it is pretty straightforwardly the same with the website.

Thanks

Serden