OpenAirInterface 5G Stand-Alone Deployment

System Requirement

OpenAirInterface is a computer-based software setup connected to SDRs, acting as the radio frontend and the User Equipment. We required robust and high-processing CPUs for our implementation and deployment as the platform uses almost all the memory while executing.

As per my setup I am listing below system details those I have used -

1. Hardware and Software Requirement

- CPU:
  - Intel i5 11th generation (For 5G core)
  - Xeon e3-1200 Workstation (gNB)
- Operating System
  - Ubuntu 18.04 (For 5GC)
  - Ubuntu 16.04 (For gNodeB)
- SDR
  - USRP B210
  - USRP N310
- Antenna
  - Quectel YE0001BA 5G Terminal Mount Antenna (600 - 6000 MHz)
- Sim Card
  - OpenCell
- COTS UE
  - Oneplus 8t
  - Google Pixel 5

Steps Need to be followed

- Installation of docker and docker compose
- Give proxy to docker (optional)
- Pull Git Repo
    - Pull oai-cn5g-fed repo from GitLab for 5GC
    - Creating docker images
    - Pull openairinterface5g repo from GitLab and install USRP device drivers for gNodeB
- Write SIM card, Configure 5GC and gNodeB with your parameters
- Start in sequence
    - 5GC
    - gNodeB
    - Turn of flight mode of UE
- UE will be connected with 5G Network

PRE_REQUESITES

1. Installation of Docker and Docker Compose
    a. sudo apt install -y apt-transport-https ca-certificates curl software-properties-common
    b. curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
    c. sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"
    d. sudo apt update
    e. sudo apt install -y docker docker-ce
    f. # Add your username to the docker group, otherwise you will have to run in sudo mode.
    sudo usermod -a -G docker $(whoami)
    g. reboot
    h. sudo curl -L "https://github.com/docker/compose/releases/download/1.29.2/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose
    i. sudo chmod +x /usr/local/bin/docker-compose

2. Install Python 3 (at least 3.6)
3. Pull base images
    - docker pull ubuntu:bionic
    - docker pull mysql:5.7

4. Network Configuration
    - sudo sysctl net.ipv4.conf.all.forwarding=1
    - sudo iptables -P FORWARD ACCEPT

5. For Docker Proxy configuration refer to NSA setup doc.

Pulling oai-cn5g-fed repo and creating Docker images

1. Pull oai-cn5g-fed repo from git Lab
   git clone --branch v1.4.0 https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed.git
2. cd oai-cn5g-fed
3. If system is behind proxy you need to give proxy details to config file (file to create docker image). For this refer to NSA doc.
4. #If you forgot to clone directly to the latest release tag
   git checkout -f v1.4.0

5. ./scripts/syncComponents.sh (after executing this script output will be like this)

```
------------------------------------------------------
OAI-NRF      component branch : master
OAI-AMF      component branch : master
OAI-SMF      component branch : master
OAI-SPGW-U   component branch : master
OAI-AUSF     component branch : master
OAI-UDM      component branch : master
OAI-UDR      component branch : master
OAI-UPF-VPP component branch : master
OAI-NSSF     component branch : master
------------------------------------------------------
git submodule deinit --all --force
git submodule init
git submodule update
```

6. If you want to use develop branch

   ./scripts/syncComponents.sh --nrf-branch develop --amf-branch develop --smf-branch develop --spgwu-tiny-branch develop--ausf-branch develop --udm-branch develop --udr-branch develop --upf-vpp-branch develop --nssf-branch develop

7. For building docker images refer to link
   https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed/-/blob/master/docs/BUILD_IMAGES.md

Pull openairinterface5G repo and install gNodeB

```
git clone https://gitlab.eurecom.fr/oai/openairinterface5g.git
git checkout develop
cd openairinterface5g/
source oaienv
cd cmake_targets/
./build_oai -I -w USRP #For OAI first time installation only to install software dependencies
./build_oai --gNB -w USRP
```

For more deatailes refer the link –

https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/TESTING_5GSA_setup.md

Sim Writing, Configuration of 5GC and gNodeB

1. **Sim Writing**

   sudo ./program_uicc --adm 12345678 --imsi 208990000000001 --isdn 00000001 --acc 0001 --key fec86ba6eb707ed08905757b1bb44b8f --opc C42449363BBAD02B66D16BC975D77CC1 -spn "OpenAirInterface" –authenticate

   change these as per your configuration

   - adm
   - imsi
   - key
   - opc
   - spn

for more details refer to the link -

https://docs.google.com/document/d/1pL8Szm0ocGxdl5ESVp12Ff71a4PbhCb9SpvbLZzwYbo/edit (sim Card Setup)

2. **5GC Configuration**

   For 5GC container configuration refer to the link –

   - https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed/-/blob/master/docs/CONFIGURE_CONTAINERS.md

   - https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed/-/blob/master/docs/DEPLOY_SA5G_BASIC_DEPLOYMENT.md

3. **gNodeB Configuration**

   For gNodeB configuration refer to the link –

   - https://gitlab.eurecom.fr/oai/openairinterface5g/-/blob/develop/doc/TESTING_5GSA_setup.md

UE configuration

Same as NSA setup.

Note.

1. **Google Pixel 5:** If it is not connecting with SA Network, you may need to turn on 5G NR only by code - *#*#4636#*#*