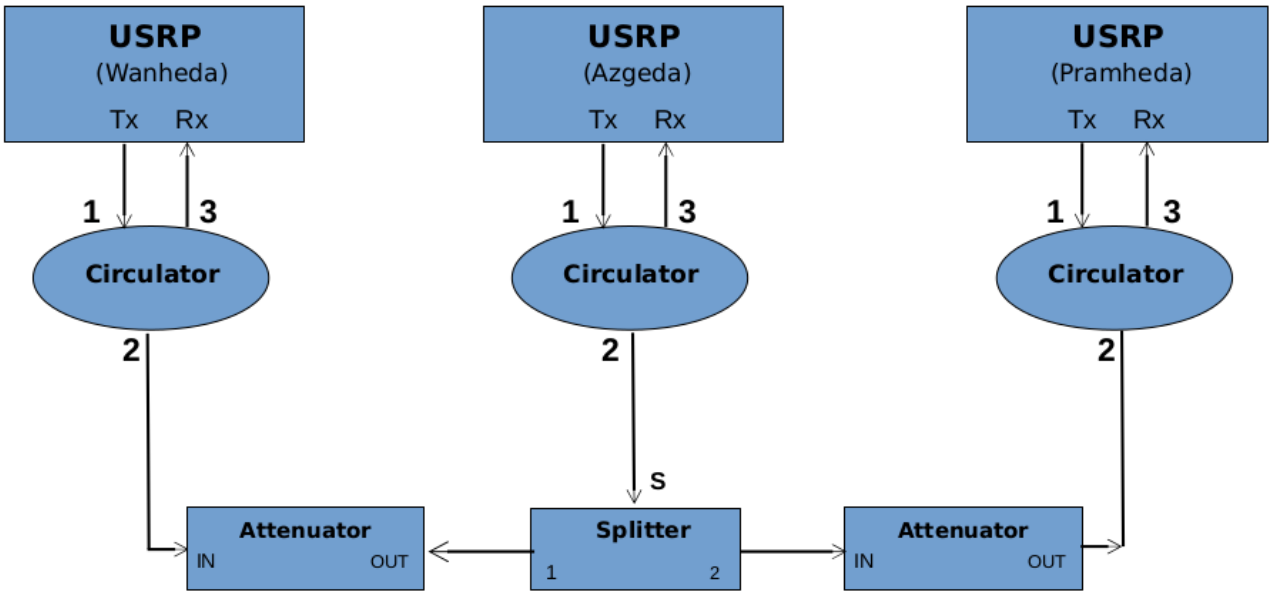
Guidelines

1) Deployment

The scheme for the addressed setup:



2) Initial setting

2.1) Booting the mini-PC

When booting the mini-PC, press PowerOn button for 3 seconds, and then F4 option. See the Grub2 installation menu, and choose lowlatency kernel option. For instance, 4.15.0-141-lowlatency. After booting, check the loaded kernel by typing: uname -r

2.2) Remote connection

Execute the following commands to establish ssh connections:

ssh -X azgeda@192.168.12.215
ssh -X wanheda@192.168.12.170
ssh -X pramheda@192.168.12.160
ssh -X fleimkipa@192.168.19.51
ssh -X praimfaya@192.168.19.50

The required password: linux

2.3) Compilation

Each time, the mini-PC is rebooted, a compilation has to be done in order to load the new UE_IP kernel, so that it is better to avoid booting the mini-PC.

cd ~/openairinterface5g/cmake_targets
./build_oai --UE -w USRP
./build_oai --UE -w USRP -c (if needed)

Here a list of folder that will be used to run the D2D demo:

cd ~/LTE-D2D/openairinterface5g
cd ~/LTE-D2D/openairinterface5g/cmake_targets/tools
cd ~/LTE-D2D/openairinterface5g/cmake_targets
cd ~/LTE-D2D/openairinterface5g/cmake_targets/lte_build_oai/build
cd ~/d2d-l3-stub

3) Configuration for a multihop network

For the configuration of a multihop network as it is shown in the described scheme. We consider one node (Azgeda) with a MAC address 0x02, and two side nodes (Wanheda and Pramheda) with a MAC address 0x01.

	Wanheda (T)	**Azgeda (R)**	**Pramheda (T)**
MAC address	0x01	0x02	0x01

The particular configuration for each node, now labeled as T and R can be done as described in the following section.

4) Running a D2D link

Configuration as T (Wanheda and Pramheda):

1) Configurations
cd LTE-D2D/openairinterface5g/cmake_targets/tools
source init_nas_s1 UE

2) IP and MAC addresses
cd LTE-D2D/openairinterface5g/cmake_targets/

sudo ifconfig oip0 10.0.0.1
sudo ifconfig oip0 hw ether 00:00:00:00:00:01
sudo ip neigh add 10.0.0.2 lladdr 00:00:00:00:00:02 dev oip0 nud permanent

# 3) Routing
sudo iptables -t mangle -F
sudo iptables -t nat -F
sudo iptables -A POSTROUTING -t mangle -o oip0 -d 10.0.0.2 -j MARK --set-mark 4

4) Running
cd LTE-D2D/openairinterface5g/cmake_targets/lte_build_oai/build
sudo ./lte-uesoftmodem -C 5900000000 -r 50 --ue-enable-sl --ue-sl-only --ue-rxgain 100 --ue-txgain 10 --usrp-clksrc gpsdo

Configuration as R (Azgeda):

1) Configurations
cd LTE-D2D/openairinterface5g/cmake_targets/tools
source init_nas_s1 UE

# 2) IP and MAC addresses - check it with ip neigh
sudo ifconfig oip0 10.0.0.2
sudo ifconfig oip0 hw ether 00:00:00:00:00:02
sudo ip neigh add 10.0.0.1 lladdr 00:00:00:00:00:01 dev oip0 nud permanent

# 3) Routing
sudo iptables -t mangle -F
sudo iptables -t nat -F
sudo iptables -A POSTROUTING -t mangle -o oip0 -d 10.0.0.1 -j MARK --set-mark 4

4) Running
LTE-D2D/openairinterface5g/cmake_targets/lte_build_oai/build
sudo ./lte-uesoftmodem -C 5900000000 -r 50 --ue-synchref --ue-enable-sl --ue-sl-only --ue-rxgain 100 --ue-txgain 10 --usrp-clksrc gpsdo

Note that under this configuration Azgeda (with address 0x02) provides a synchronization signal (ue-synchref parameter) to Wanheda and Pramheda (with address 0x01).

4.1) Establishing PC5

To establish this link, we must go to the folder d2d-l3-stub to find the executable **d2d_app**, and execute it first at the Wanheda and Pramheda side, and later on Azgeda.

Configuration as T (Wanheda and Pramheda):
./d2d_app -r 0x01 0x02

Configuration as R (Azgeda):
./d2d_app -s 0x02 0x01

If necessary we can compile these utilities as follows:
gcc -I . d2d_app.c -o d2d_app -lpthread
gcc -I . vencore_app.c -o vencore_app -lpthread

5) Testing D2D

One way to test the performance, as sever at the Wanheda/Pramheda side,

sudo iperf -s -i 1 -u -B 10.0.0.1
sudo wireshark

As client at the Azgeda side,
sudo iperf -c 10.0.0.2 -u -b 0.1M --bind 10.0.0.1 -t 100

6) Comments

If using the Ethernet Attenuator, it could be better to slightly increase the value of the transmission power to 10, or 20, so that it can compensate some attenuations.

# Azgeda
sudo ./lte-uesoftmodem -C 5900000000 -r 50 --ue-synchref --ue-enable-sl --ue-sl-only --ue-rxgain 100 **--ue-txgain 20** --usrp-clksrc gpsdo

# Wanheda/Pramheda
sudo ./lte-uesoftmodem -C 5900000000 -r 50 --ue-enable-sl --ue-sl-only --ue-rxgain 100 **--ue-txgain 20** --usrp-clksrc gpsdo

7) Source code

The code for the OAI and PC5 can be downloaded from EURECOM gitlab,

OAI
git clone https://gitlab.eurecom.fr/Julio/lte-sidelink-v2x.git
git checkout LTE-sidelink

#Documentation:
cd openairinterface5g/targets/DOCS

PC5
git clone https://gitlab.eurecom.fr/tien-thinh.nguyen/d2d-l3-stub
cd d2d-l3-stub
gcc -I . d2d_app.c -o d2d_app -lpthread