**OAI安裝及使用軟體基地台 第2版**

環境需求（經測試確定可用軟體版本及硬體）

作業系統：Ubuntu 16.04.6, 4.15.0-13-lowlatency

OAI eNB：

OAI CN：

USRP：B210/B200 mini



第一步：安裝Ubuntu並切換至lowlatency模式

1、至Ubuntu正體中文站下載16.04 LTS 64位元版本

2、將.iso檔案下載完成後，使用Rufus或其他iso to USB軟體將其燒錄至隨身碟。

3、開啟終端機，輸入以下指令更新系統套件

sudo apt-get update

sudo apt-get upgrade

4、安裝其他會使用到的套件

sudo apt-get install git vim ssh subversion gitk

5、安裝lowlatency模式

sudo apt-get install linux-image-4.15.0.13-lowlatency

6、重新啟動並在GRUB開機選單中選擇Ubuntu進階選項

選擇4.15.0.13-lowlatency.

第二步：安裝USRP驅動程式

**sudo apt-get install libboost-all-dev libusb-1.0-0-dev python-mako doxygen python-docutils python-requests cmake build-essential**

**git clone git://github.com/EttusResearch/uhd.git**

**cd uhd; mkdir host/build; cd host/build**

**cmake -DCMAKE\_INSTALL\_PREFIX=/usr ..**

**make -j4**

**sudo make install**

**sudo ldconfig**

**sudo /usr/lib/uhd/utils/uhd\_images\_downloader.py**

在安裝過程中可能會提示非root權限問題，解決方法如下：

到uhd安裝資料夾中的utils資料夾

開啟終端機並輸入

**sudo cp uhd-usrp.rules /etc/udev/rules.d/**

**sudo udevadm control --reload-rules**

**sudo udevadm trigger**

第三部：下載及編譯OAI eNB

1. 下載補丁<https://github.com/xrh003/OAI_ALLINONE_patch/archive/master.zip>
2. 解壓縮補丁
3. 開啟終端機輸入以下指令下載eNB

**git clone** <https://gitlab.eurecom.fr/oai/openairinterface5g.git>

**cd openairinterface5g  
git checkout develop  
git reset --hard 7580d021d**

1. 將前面下載補丁解壓縮後資料夾中的opencells-mods資料夾複製到openairinterface5g中，為了避免之後出現權限問題，請用

**sudo nautilus**

開啟檔案管理並複製。

1. 輸入以下指令將原本文件用補丁文件替換

**cp opencells-mods/cmake\_targets/tools/build\_helper cmake\_targets/tools/build\_helper**

1. 編譯eNB

**source oaienv**

**./cmake\_targets/build\_oai -I**

**./cmake\_targets/build\_oai  -w USRP --eNB**

第四部：下載及編譯OAI EPC

1. 開啟終端機輸入以下指令下載EPC

**git clone https://github.com/uw-ictd/openair-cn.git**  
**cd openair-cn**  
**git checkout develop**  
git reset **--hard 67180ca07c**

1. 使用補丁文件置換，同樣將opencells-mods複製到openair-cn資料夾下，並輸入以下指令

**cp opencells-mods/build/tools/build\_helper  build/tools/build\_helper**  
**patch -i opencells-mods/src/common/common\_defs.h.patch src/common/common\_defs.h**  
**patch -i opencells-mods/src/oai\_mme/oai\_mme.c.patch src/oai\_mme/oai\_mme.c**  
**patch -i opencells-mods/src/oai\_hss/utils/hss\_config.c.patch src/oai\_hss/utils/hss\_config.c**  
**patch -i opencells-mods/src/s6a/s6a\_peer.c.patch src/s6a/s6a\_peer.c**  
**patch -i opencells-mods/src/gtpv1-u/gtp\_mod\_kernel.c.patch src/gtpv1-u/gtp\_mod\_kernel.c**  
**patch -i opencells-mods/src/gtpv1-u/gtp\_mod\_kernel.h.patch src/gtpv1-u/gtp\_mod\_kernel.h**  
**patch -i opencells-mods/src/gtpv1-u/gtpv1u\_task.c.patch src/gtpv1-u/gtpv1u\_task.c**

1. 輸入以下指令安裝hss、mme、spgw及安裝額外軟體

**cd openair-cn**

**source oaienv**

**cd scripts**

**./build\_hss -i**

**./build\_mme -i**

**./build\_spgw -i**

**中間過程中提示是否要安裝額外軟體皆輸入y即可。**

**安裝phpmyadmin時會要求設定密碼，請務必記住。**

1. 將本機以及hss加入host文件

輸入以下指令確認本機名稱

sudo cat /etc/hostname

輸入以下指令編輯host文件

sudo vim /etc/hosts

將host文件修改為

|  |
| --- |
| 127.0.0.1 localhost  127.0.1.1 本機名稱.isip.cs.nctu.edu.tw 本機名稱  127.0.33.1 hss.isip.cs.nctu.edu.tw hss |

1. 修改conf文件，網卡名稱、聯外網路ip需照自己電腦設定。

ip位置按照自己的位置修改，遮罩為化成二進制後1的個數，255為8個1，255.255.255.0及為24

/usr/local/etc/oai/mme.conf

|  |
| --- |
| REALM = "isip.cs.nctu.edu.tw";  NETWORK\_INTERFACES :  {  # MME binded interface for S1-C or S1-MME communication (S1AP), can be ethernet interface, virtual ethernet interface, we don't advise wireless interfaces  MME\_INTERFACE\_NAME\_FOR\_S1\_MME = "網卡"; # YOUR NETWORK CONFIG HERE  MME\_IPV4\_ADDRESS\_FOR\_S1\_MME = "ip位置/遮罩"; # YOUR NETWORK CONFIG HERE  # MME binded interface for S11 communication (GTPV2-C)  MME\_INTERFACE\_NAME\_FOR\_S11\_MME = "lo"; # YOUR NETWORK CONFIG HERE  MME\_IPV4\_ADDRESS\_FOR\_S11\_MME = "127.0.8.11/8"; # YOUR NETWORK CONFIG HERE  MME\_PORT\_FOR\_S11\_MME = 2123; # YOUR NETWORK CONFIG HERE  };  S-GW :  {  # S-GW binded interface for S11 communication (GTPV2-C), if none selected the ITTI message interface is used  SGW\_IPV4\_ADDRESS\_FOR\_S11 = "127.0.8.1/8"; # YOUR NETWORK CONFIG HERE  }; |

/usr/local/etc/oai/spgw.conf

|  |
| --- |
| S-GW :  {  NETWORK\_INTERFACES :  {  # S-GW binded interface for S11 communication (GTPV2-C), if none selected the ITTI message interface is used  SGW\_INTERFACE\_NAME\_FOR\_S11 = "lo"; # YOUR NETWORK CONFIG HERE  SGW\_IPV4\_ADDRESS\_FOR\_S11 = "127.0.8.1/8"; # YOUR NETWORK CONFIG HERE  # S-GW binded interface for S1-U communication (GTPV1-U) can be ethernet interface, virtual ethernet interface, we don't advise wireless interfaces  SGW\_INTERFACE\_NAME\_FOR\_S1U\_S12\_S4\_UP = "lo"; # YOUR NETWORK CONFIG HERE, USE "lo" if S-GW run on eNB host  SGW\_IPV4\_ADDRESS\_FOR\_S1U\_S12\_S4\_UP = "127.0.6.1/24"; # YOUR NETWORK CONFIG HERE  SGW\_IPV4\_PORT\_FOR\_S1U\_S12\_S4\_UP = 2152; # PREFER NOT CHANGE UNLESS YOU KNOW WHAT YOU ARE DOING  P-GW =  {  NETWORK\_INTERFACES :  {  # P-GW binded interface for S5 or S8 communication, not implemented, so leave it to none  PGW\_INTERFACE\_NAME\_FOR\_S5\_S8 = "none"; # DO NOT CHANGE (NOT IMPLEMENTED YET)  PGW\_IPV4\_ADDRESS\_FOR\_S5\_S8 = "0.0.0.0/24"; # DO NOT CHANGE (NOT IMPLEMENTED YET)  # P-GW binded interface for SGI (egress/ingress internet traffic)  PGW\_INTERFACE\_NAME\_FOR\_SGI = "網卡"; # YOUR NETWORK CONFIG HERE(your Static IP)  PGW\_IPV4\_ADDRESS\_FOR\_SGI= " ip位置/遮罩" #Add this yourself  **PGW\_MASQUERADE\_SGI = "yes"; # YOUR NETWORK CONFIG HERE**  UE\_TCP\_MSS\_CLAMPING = "no"; # STRING, {"yes", "no"}.  };  ...  # DNS address communicated to UEs  DEFAULT\_DNS\_IPV4\_ADDRESS = "8.8.8.8"; # YOUR NETWORK CONFIG HERE  DEFAULT\_DNS\_SEC\_IPV4\_ADDRESS = "8.8.4.4"; # YOUR NETWORK CONFIG HERE  ...  } |

/usr/local/etc/oai/hss.conf

|  |
| --- |
| MYSQL\_user = "root";  MYSQL\_pass = "yourpassword"; #輸入前面安裝時設定之密碼  OPERATOR\_key = "11111111111111111111111111111111"; # OP key for oai\_db.sql, Must match to that of UE Sim card, OP\_Key |

/usr/local/etc/oai/freeDiameter/hss\_fd.conf

|  |
| --- |
| Identity = "hss.isip.cs.nctu.edu.tw ";  Realm = "isip.cs.nctu.edu.tw"; |

/usr/local/etc/oai/freeDiameter/mme\_fd.conf

|  |
| --- |
| Identity = "epc01.isip.cs.nctu.edu.tw";  Realm = "isip.cs.nctu.edu.tw";  ConnectPeer= "hss.isip.cs.nctu.edu.tw" { ConnectTo = "127.0.33.1"; No\_SCTP ; No\_IPv6; Prefer\_TCP; No\_TLS; port = 3868; realm = "isip.cs.nctu.edu.tw";}; |

/usr/local/etc/oai/freeDiameter/acl.conf

|  |
| --- |
| ALLOW\_OLD\_TLS \*.isip.cs.nctu.edu.tw |

1. 安裝證書

開啟終端機並移動至/opt/epc/openair-cn/scripts，輸入以下指令安裝證書

sudo ./check\_hss\_s6a\_certificate /usr/local/etc/oai/freeDiameter/ hss.isip.cs.nctu.edu.tw

sudo ./check\_mme\_s6a\_certificate /usr/local/etc/oai/freeDiameter/ epc01.isip.cs.nctu.edu.tw

1. 編譯hss、mme、spgw

sudo ./build\_hss -c

sudo ./build\_mme -c

sudo ./build\_spgw -c

1. 匯入sql資料表檔案（僅第一次執行需要，password記得修改為前步驟設定之密碼）

sudo ./hss\_db\_import 127.0.0.1 root password oai\_db opencells-mods/opencells\_db.sql

1. 運行hss、mme、spgw，需要分開終端機執行！停止執行請按CTRL + C

sudo ./run\_hss

sudo ./run\_mme

sudo ./run\_spgw

1. 打開瀏覽器確認資料庫，網址為<http://localhost/phpmyadmin/>

此時應該能看到oai\_db的資料庫。

如果出現404 Not found

請編輯/etc/apache2/apache2.conf

在下方添加

Include /etc/phpmyadmin/apache.conf

並在終端機輸入/etc/init.d/apache2 restart重新啟動apache。

1. 建置OAI

cd openairinterface5g

source oaienv

cd cmake\_targets

sudo ./build\_oai -I

sudo ./build\_oai -c --eNB -w USRP

sudo ./build\_oai -c --eNB -w USRP -x

sudo ./build\_oai -c --eNB -w USRP -V

第五步：執行eNB

1. 修改eNB文件

/openairinterface5g/targets/PROJECTS/GENERIC-LTE-EPC/CONF/enb.band7.tm1.usrpb210.conf

|  |
| --- |
| mobile\_country\_code = "208";  mobile\_network\_code = "93";  ////////// MME parameters:  mme\_ip\_address = ( { ipv4 = "127.0.1.10";  ipv6 = "192:168:30::17";  active = "yes";  preference = "ipv4";  }  );  NETWORK\_INTERFACES :  {  ENB\_INTERFACE\_NAME\_FOR\_S1\_MME = "lo";  ENB\_IPV4\_ADDRESS\_FOR\_S1\_MME = "127.0.1.2/8";  ENB\_INTERFACE\_NAME\_FOR\_S1U = "lo";  ENB\_IPV4\_ADDRESS\_FOR\_S1U = "127.0.6.2/8";  ENB\_PORT\_FOR\_S1U = 2152; # Spec 2152  }; |

1. 執行eNB，開啟新的終端機，輸入以下指令

cd openairinterface5g/cmake\_targets/lte\_build\_oai/build

sudo ./lte-softmodem -O ../../../targets/PROJECTS/GENERIC-LTE-EPC/CONF/enb.band7.tm1.usrpb210.conf -d

第七步：燒錄空白SIM卡

1. 插入讀寫器及空白SIM卡
2. 下載讀寫軟體
3. 輸入以下指令建立讀寫執行程式。（如果已經存在program\_uicc請先刪除）

make

1. 查看資料庫已有的SIM卡資料，並修改對應參數進行燒錄。

sudo ./program\_uicc --adm xxxxxxxx --opc xxxxxxxx --imsi xxxxxxxxxxxxxxxx --key xxxxxxx --spn openairinterface --authenticate

第六步：設定手機或無線網卡等裝置

1. 設定APN網路存取資訊。

apn 設定為與資料庫相同，名稱隨意，儲存即可

1. 重新開機，或重新開關飛航模式
2. 打開行動數據。
3. 打開漫遊，並允許數據漫遊傳輸。

參考資料：

[1] 教育部5G行動寬頻課程推廣計畫聯盟

[2] OpenAirInterface (OAI) Ubuntu 17.04/16.04 All In One 安装教程(https://blog.csdn.net/xrh003/article/details/75285108)