Amarisoft Software Install Guide

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1 Introduction

This document describes how to install and use your software binary LTE 100 and LTE UE 100. It explains basic install procedure and where to find software. For advanced use, please refer to software documentations.

1.1 Background

The LTE 100 product includes the following components:

- `lteenb`: This component is a LTE base station (eNodeB).
- `ltemme`: This component is a LTE EPC including MME (Mobility Management Entity), SGW (Serving Gateway), PGW (Packet Data Network Gateway) and HSS (Home Subscriber Server).
- `lteims`: This component is an IMS test server.
- `ltembmsgw`: This component is a LTE MBMS Gateway.
- `trx_<name>`: This component is your radio frontend driver where <name> represents your radio frontend type. Examples are `trx_sdr` for PCIe SDR card and `trx_uhd` for USRP SDR cards.
- `www`: this component is in charge of web interface to Amarisoft LTE software. It allows you to control the software and visualize logs.

The LTE UE 100 product includes the following components:

- `lteue`: This component is a LTE UE simulator. It simulates one or more UEs by communicating through a RF system with an eNodeB and core network.
- `trx_<name>`: This component is your radio frontend driver where <name> represents your radio frontend type. Examples are `trx_sdr` for PCIe SDR card and `trx_uhd` for USRP SDR cards.
- `www`: this component is in charge of web interface to Amarisoft LTE software. It allows you to control the software and visualize logs.

Note that each component has a *doc* directory where you can find its documentation. Alternatively, all documentations are available for download in our Extranet.

2 Install Guide

2.1 Requirements

Before proceeding, make sure that you have:

- A fast PC. For best performances, a quad core Intel Core i7 CPU with AVX2 support (Haswell architecture or later) running at a clock of 3.6 GHz is recommended.
- One PCIe slot to insert the PCIe SDR card (the PCIe bus should be minimum 1x gen 2) or at least one Gigabit Ethernet port if you use a USRP device such as N210 (2 GE ports are needed for MIMO when using N210).
- Root privileges to be able to install the software.
- A 64 bit Linux distribution. Fedora 25 is the officially supported distribution.
  The following distributions are known as compatible:
  - Fedora 17 to 26
  - Ubuntu 12 to 16
- Internet access as new packages might be required to get installed on your PC.
- Firewall disabled. In Fedora, you can type `service firewalld stop`.
- SELinux disabled. In Fedora you can edit the file `/etc/selinux/config` and set `SELINUX = disabled`.

2.2 Installation Steps

To automatically install the LTE software package on your PC, you need to follow these steps. Depending on your RF board, you will find a TRX driver in your package. The installation process will also update eNodeB configuration to use the corresponding TRX driver.

- Download your release from Amarisoft Extranet at `https://extranet.amarisoft.com/`. The downloaded file would be a tarball file: *amarisoft.YYYY-MM-DD.tar.gz* where YYYY-MM-DD is the release date.
- Put this file on the PC at any place using the method you want (scp, http, USB key...) and extract it:

  ```
  tar xzf amarisoft.YYYY-MM-DD.tar.gz
  ```

  This would create a directory called YYYY-MM-DD.
- Go to the directiry YYYY-MM-DD and execute the provided script *install.sh* with root access as follows:

  ```
  ./install.sh <path> --default
  ```

  – By default if no `<path>` is specified, components are installed in `/root`, you can choose other directories by specifying a new destnation in `<path>`. Please note that `www` component will always be located under `/var/www/html` in Fedora or `/var/www` in Ubuntu.

  – The `--default` option forces answer to default for all questions asked during install phase. The default answers for `LTE 100` are depicted below:

```
* Installing Amarisoft LTE 2017-07-04 *
**************************************

Fedora 20 found
1) Configuration
  You can exit install script during this step, nothing will be changed
  until next step
  * Do you want to install LTE automatic service ? y
      - Do you want to enable LTE automatic service ? y
  * Do you want to install EPC ? y
      - Do you want to install IMS ? y
      - Do you want to use IPv6 ? n
  * Do you want to install eNB ? y
    - Select TRX radio frontend:
      1) sdr (default)
      > sdr
    - Do you want to use MIMO ? y
  * Do you want to install MBMS gateway ? y
  * Do you want to install Web interface ? y
2) Configure Automatic Service
3) Install Web interface
4) Install TRX sdr
5) Install eNB
    Use TRX sdr
    [TRX] Fedora 20 found
    [TRX] === Device /dev/sdr0 ===
    [TRX] Hardware ID=0x4b02
    [TRX] FPGA revision=0.9.51
    [TRX] Software version=2017-03-28
    [TRX] === Device /dev/sdr1 ===
    [TRX] Hardware ID=0x4b02
    [TRX] FPGA revision=0.9.51
    [TRX] Software version=2017-03-28
    [TRX] === Device /dev/sdr2 ===
    [TRX] Hardware ID=0x4b01
    [TRX] FPGA revision=0.9.51
    [TRX] Software version=2017-03-28
    [TRX] === Device /dev/sdr0 ===
    [TRX] The FPGA firmware is already up to date
    [TRX] === Device /dev/sdr1 ===
    [TRX] The FPGA firmware is already up to date
    [TRX] === Device /dev/sdr2 ===
    [TRX] The FPGA firmware is already up to date
6) Install EPC
7) Install IMS
8) Install MBMS gateway
9) Start service

#########################
# Installation successful #
#########################
```

The default answers for `LTE UE 100` are depicted below:

```
File  Edit  View  Search  Terminal  Help
[root@localhost 2017-07-04]# ./install.sh --default
**************************************
* Installing Amarisoft LTE 2017-07-04 *
**************************************

Fedora 23 found
1) Configuration
  You can exit install script during this step, nothing will be changed
  until next step
  * Do you want to install LTE automatic service ? y
      - Do you want to enable LTE automatic service ? y
  * Do you want to install UE simulator ? y
    - Select TRX radio frontend:
      1) sdr (default)
      > sdr
  * Do you want to install Web interface ? y
2) Configure Automatic Service
3) Install Web interface
4) Install TRX sdr
5) Install UE simulator
    Use TRX sdr
    [TRX] Fedora 23 found
    [TRX] === Device /dev/sdr0 ===
    [TRX] Hardware ID=0x4b02
    [TRX] FPGA revision=0.9.51
    [TRX] Software version=2017-03-28
    [TRX] === Device /dev/sdr1 ===
    [TRX] Hardware ID=0x4b01
    [TRX] FPGA revision=0.9.51
    [TRX] Software version=2017-03-28
    [TRX] === Device /dev/sdr0 ===
    [TRX] The FPGA firmware is already up to date
    [TRX] === Device /dev/sdr1 ===
    [TRX] The FPGA firmware is already up to date
6) Start service

#########################
# Installation successful #
#########################
```

Take a look at messages at the end of install phase, you may be requested to power on/off your PC. This would be the case if there is, for example, an FPGA upgrade of your PCIe SDR card.
If you would like to have a custom install, you can run the script without `--default` option and answer each question separately. For `LTE 100` product, this would typically be the case if you do not want to enable automatic LTE service or if you would like to install eNB and MME components on different PCs.

Once the install phase is completed, you need license files to be able to use your system. License files are generated based on the hexadecimal codes that are printed on each component screen after the initial execution of the software package.

2.3 How to Retrieve the Hexadecimal Codes

2.3.1 LTE 100

First thing is to start the software. If you have answered `yes` to the question `Do you want to enable LTE automatic service?`, then the software has already been started. In this case, you need to access LTE service screen to get the code. You can use the following command for this purpose:

```
screen -x lte
```

This will connect you to different component monitors. You should see a message stating that the license key is not present and printing a 16 digits hexadecimal code.

If you have not started LTE automatic service, then you need to start the software manually. The software package is located by default in `/root` unless you have specified another `path` when running `install.sh` script. Below is the procedure to start all software components one by one assuming default path is used during the install:

```
cd /root/mme
./ltemme config mme.cfg
cd ../ims
./lteims config/ims.cfg
cd ../mbms
./ltembms
cd ../enb
./lteenb config/enb.cfg
```

Once the software started, you will see the same hexadecimal code printed by each software component.

2.3.2 LTE UE 100

The UE simulator software is located by default in `/root` unless you have specified another `path` when running `install.sh` script. You can start it with following commands assuming default path is used during the install:

```
cd /root/ue
./lteue config/ue.cfg
```

Once the software started, you will see the hexadecimal code printed in the screen. Please note that there is no automatic LTE service for LTE UE 100 package and that the software needs to be started manually.

2.4 How to Retrieve the License Files

Next steps are:

- Send this hexadecimal code by email to `delivery@amarisoft.com`. License key files will be generated in Amarisoft Extranet. You will get an email when they are available for download.
- Downloaded your license key files from our Extranet. You need to have an active account to connect to our Extranet. If you do not have one, send an email to `delivery@amarisoft.com` to request one.
- Create a directory called `.amarisoft` under `${HOME}` where `${HOME}` is the home directory of the `root` user.
- Copy the license files inside `.amarisoft` directory.

Once the license key files are installed, the system should start normally.

3 Initial Test and Setup

3.1 How To Access Component Monitors

This section only applies to LTE 100 product with automatic LTE service. Once you are logged in PC, you can access software components (eNB, MME, MBMSGW, ...) using screen command:

```
screen -x lte
```

This will connect you to different component monitor.

Next sections show you basic methods. For more information please refer to `screen` documentation (`https://www.gnu.org/software/screen/manual/screen.html`).

3.1.1 Select component

Each component monitor is inside a window, you can switch from a window to another the following way:

```
ctrl+a <window index>
```

Where window index is:

- 0 MME
- 1 eNB
- 2 MBMSGW
- 3 IMS

NB: press simultaneously `CTRL` key and `a` key, release them, then press number key.

You can also switch to next window:

```
ctrl+a <space>
```

3.1.2 Exit screen

```
ctrl+a d
```

3.2 How To Manage Your LTE Automatic Service

This section only applies to LTE 100 product with automatic LTE service.

3.2.1 Stop

You can stop all LTE components this way:

```
service lte stop
```

3.2.2 Start

You can start them again thius way:

```
service lte start
```

3.2.3 Disable

You may also prevent them to start at boot time:

```
systemctl disable lte
```

NB: it does not stop service right now.
NB2: this command is not available on Ubuntu version <= 14

3.2.4 Enable

You may enable service at boot time this way:

```
systemctl enable lte
```

NB: it does not stop service right now.
NB2: this command is not available on Ubuntu version <= 14

3.3 How To Change Software Configuration

This section only applies to LTE 100 product with automatic LTE service.

The LTE automatic service starts each component with the following config files:

- eNB `/root/enb/config/enb.cfg`
- MME `/root/mme/config/mme.cfg`
- IMS `/root/mme/config/ims.cfg`
- MBMSGW `/root/mbms/config/mbmsgw.cfg`

Please note that these files are symbolic links to real configuration files as depicted below for `enb.cfg`.

```
-rw-rw-r-- 1 user user  6643 Jul  4 16:24 enb-ca.cfg
-rw-rw-r-- 1 user user  6675 Jul  4 16:24 enb-catm1.cfg
lrwxrwxrwx 1 root root    17 Jul  4 16:37 enb.cfg -> mimo-2x2-5mhz.cfg
-rw-rw-r-- 1 user user  5500 Jul  4 16:24 enb.default.cfg
```

In order to change the configuration, you have two options:

- Editing the above files to change the configuration directly.
- Changing the symbolic link to point to another configuration file. Following example shows the commands to change the default config to a carrier aggregation configuration on eNodeB side.

```
cd /root/enb/config
rm enb.cfg
ln -s enb-ca.cfg enb.cfg
```

Once you have changed your config, you need to restart the LTE service using the following command:

```
service lte restart
```

NB: you may use screen to check that all components are correctly started.

For more details on config files, please refer to each component documentation.

3.4 How To Change Software Versions

All software components are installed in `/root` directory by default. You may find different versions of each component within the `/root` directory.

The systems uses symlinks (mme, enb, mbms, ue) that points to a version of each component as depicted below.

```
lrwxrwxrwx   1 root   root       32 Jul  4 16:37 mbms -> /root/ltembmsgw-linux-2017-07-04
lrwxrwxrwx   1 root   root       29 Jul  4 16:37 mme -> /root/ltemme-linux-2017-07-04
lrwxrwxrwx   1 root   root       29 Jul  4 16:37 enb -> /root/lteenb-linux-2017-07-04
```

You can change those links if you need to change software version to use.

4 Logging

Components put their current logs in `/tmp` directory. You have also an access to a Web tool on the following URL that helps you visualize the logs as well as some useful stats.

```
http://<my IP>/lte/
```

Where `my IP` is the IP address of your PC where the Amarisoft software is running. Take a look at `ltewww` documentation for more details.

5 Troubleshooting

Below are some of the most common issues encountered during install phase with recommended actions to address each issue.

Issue	**Cause/Correction**
`Could not load ./trx_uhd.so' (Operation not supported)`	Fedora 23 and Ubuntu 16 are using C++11 ABI and thus UHD driver is not compatible. If you are in this case, please edit your RF config file and update name of RF driver part from `uhd` to `uhd_cxx11`.
`trx_lms7002m.cpp:30:28: fatal error: lime/LimeSuite.h: No such file or directory`	You need to first install LMS Suite available in URL `https://wiki.myriadrf.org/Lime_Suite`.
`TRX discontinuity too wide` seen after running eNodeB	The most likely explanation is that not enough CPU time is available. Below is a check list: • Run `lte_init.sh` script available under `enb` and `ue` directories. • Run the Linux `top -H` command to check if there is not any process taking the CPU. • Remove unnecessary drivers and peripherals such as WiFi dongle. • If you use a HDMI monitor, remove it and access the system remotely by SSH for instance. • Ensure that your CPU is fast enough. It should be at least a Intel 4 Core i7 with a clock running at 3.6 GHz. • Remove unused daemons or cron jobs.
PC crashes or freezes during install phase or few seconds after running the SW	If you use PCIe card, below is a list to check: • Make sure your PCIe card is correctly inserted in the slot. Sometimes a loose card could lead to PC freeze or software crash. • Change the slot of your PCIe card in case there is an issue with this particular slot. • Check the version of your PCIe bus. You need a PCIe bus 1x generation 2. You can check it by typing the Linux commend `lspci --vv` and looking at a line with `LnkCtl2: Target Link Speed`. The generation of your PCIe bus could be identified by its speed: Data Transfer Rate: PCIe 3.0 = 8.0GT/s, PCIe 2.0= 5.0GT/s, PCIe 1.1 = 2.5GT/s.

5.1 Contact

- Our Extranet site is located at `extranet.amarisoft.com`. This site would give you access to our documentation and new releases.

- For all technical issues, you can create a ticket describing your problem on our support site at `support.amarisoft.com`. Please note that you need to have an active account in our Extranet in order to be able to login to our support site. Your credentials are the same as the ones you use to access Extranet.
- our FTP server is located at `ftp.amarisoft.com`. This server should be used to exchange big logs. Your credentials are the same as the ones you use to access Extranet. Please note that you need to use an FTP client supporting SSL such as Filezilla.
- For any request concerning license delivery or addition of new accounts, please send an email to `delivery@amarisoft.com`.

6 Additional Information

For any technical issue, please raise a ticket at our support side at `support.amarisoft.com`. To learn more about our technology and solutions, e-mail us at `customer@amarisoft.com` or visit `www.amarisoft.com`.