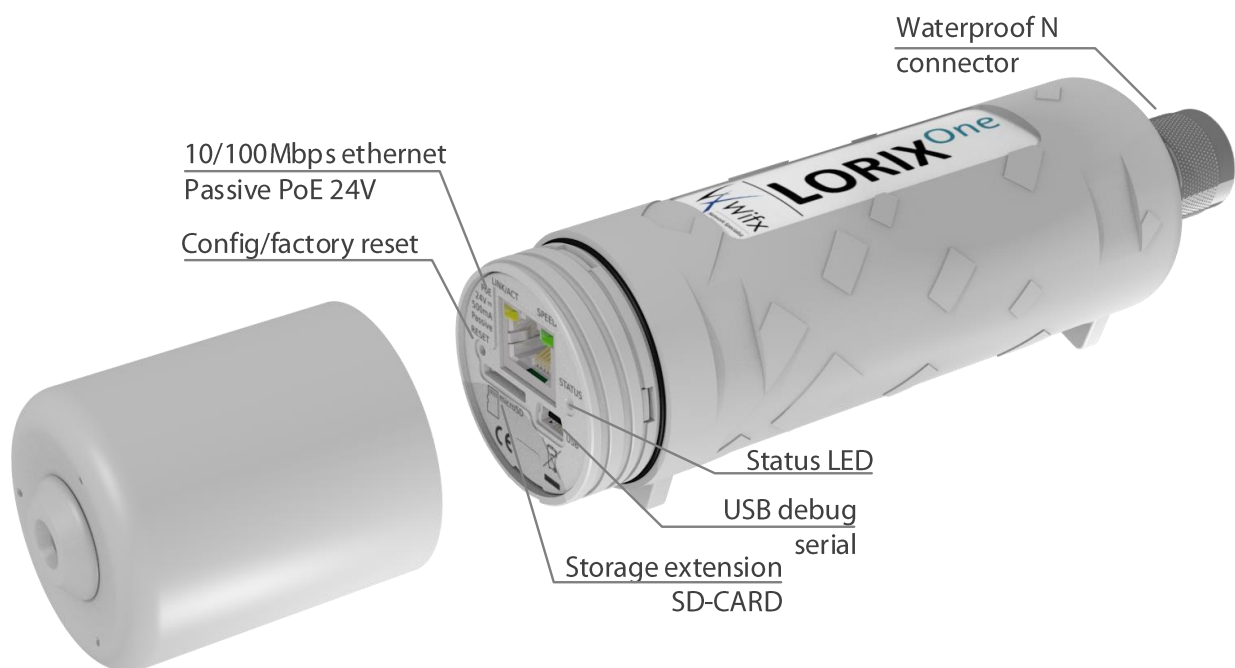


LORIX^{One}

Low cost LoRa IP43/IP65 gateway

User manual



Versions:

Revision	Note	Date
1.0	Added TTN cloud application Added system update	05/03/2017
1.1	Updated operating temperature and power supply following safety certification requirements	07/30/2017
1.2	Added Kersing packet-forwarder and updated others packet-forwarders and clouds-manager with manual forwarder option	21/04/2018
1.3	Added US version	08/05/2018
1.4	Updated FCC and IC legal texts and added installation description	06/07/2018

1 SUMMARY

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2 PRODUCT SPECIFICATIONS

Version	IP43 (Semi-waterproof)	IP64 (Waterproof)
Physical specifications		
Dimensions	See 10.1.1 IP43 (Semi-waterproof)	See 10.1.2 IP65 (Waterproof)
Weight	< 230 grams	
Connectors		
	1 RJ45 Ethernet 10/100Mbps port Max 100m. length, use shielded cable for outdoor use	
	1 USB micro-B service connector (service access only)	
	1 N type RF antenna connector	
	1 microSD SD Memory Card Specification v2.0 slot	
Power specifications		
Input supply	24VDC 500mA (through passive PoE)	
Power supply	See 5.1 Power through passive PoE	
Consumption	See 9.1 Power consumption	
Climatic specifications		
Operating temperature	-30°C to +55°C -5°C to +40°C for the power supply (S-)HNP12-240L6, indoor use only	
Storage temperature	-20°C to +70°C	
Operating humidity	10% to 90% RH Non-condensing	
Storage humidity	5% to 90% RH Non-condensing	
System		
CPU	ARM® Cortex™-A5 @ 600MHz	
RAM	128 MBytes DDR2 @ 200MHz	
Internal memory	256 MBytes NAND FLASH with 4bit hardware ECC	
External memory	microSD card slot, SDHC compatible, can be used as boot source	

TABLE 1 PRODUCT SPECIFICATIONS

3 REGULATIONS

3.1 VERSION 868MHZ BAND

3.1.1 EUROPE / CE

The LORIX One (IP43 & IP65) 868MHz version complies with requirements listed in article 3 of the RED 2014/53/EU Directive :

Certification compliance	
Radio & EMC	RED 2014/53/EU (European Radio Equipment Directive)
	ETSI EN 300 220-2
	EN 61000-6-1:2007 IEC 61000-6-1:2005 (ed2.0)
	ETSI EN 301 489-3 V1.6.1:2013
Human safety	EN 62209-2 IEC/EN 62479-1
Electrical safety	EN 60950

TABLE 2: CERTIFICATION COMPLIANCE VERSION 868MHZ FOR EUROPE

For use in Europe, the LORIX One must comply with the ERC 70-3 requirements regarding duty cycle and maximum EIRP. These parameters are summarized in the following table:

Duty cycle and maximum EIRP			
ERC 70-3 Band	Frequency (MHz)	Power	Duty cycle
h1.3	863 – 865	14dBm ERP	0.1%
h1.3	865 – 868	14dBm ERP	1%
h1.4	868 – 868.6	14dBm ERP	1%
h1.5	868.7 – 869.2	14dBm ERP	0.1%
h1.6	869.4 – 869.65	27dBm ERP	10%
h1.7	869.7 – 870	14dBm ERP	1%
h2	870 – 873	14dBm ERP	1%
h2.1	870 – 873	14dBm ERP	1%

TABLE 3: DUTY CYCLES AND MAXIMUM EIRP VERSION 868MHZ FOR EUROPE

If the antenna is changed, the output power must be adjusted to take into account the antenna gain to avoid exceeding the values defined by the ERC 70-3 regulation.

Warning: some countries in Europe may have a specific frequency range, a maximum EIRP and duty cycle regulation. Please check the local regulations before installing and using the LORIX One 868MHz version.

For countries outside Europe, please check that the frequency range, the maximum allowed EIRP and duty cycle are authorized.

3.2 VERSION 915MHZ BAND

The LORIX One (IP43 & IP65) 915MHz version complies with both FCC and IC regulation:

Certification compliance	
CFR 47 FCC Part 15	FCC 47 CFR Part 15 : 2014 - Part 15- Radio frequency devices
RSS 247	RSS-Gen – Issue 5, Avril 2018 – General requirements and Information for the Certification of radio Apparatus
	RSS-247 Issue 2, February 2017 – Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

TABLE 4: CERTIFICATION COMPLIANCE VERSION 915MHZ FOR US/CANADA

The associated FCC and IC identifiers of the LORIX One 915MHz version are:

FCC ID : 2APAZ-LORIXONE

IC : 23715-LORIXONE

Model : LORIX One

Some conditions must be met to maintain the FCC and IC compliance of the devices in the USA and Canada. These conditions are detailed in the following paragraphs. For other countries, please check the specific regulations regarding maximum allowed EIRP and duty cycle.

3.2.1 USA / FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at personal expense.

This device must be professionally installed.

Also, some specific recommendations for exposure to magnetic fields must be followed: This equipment complies with FCC's radiation exposure limits set forth for an uncontrolled environment under the following conditions:

1. This equipment should be installed and operated such that a minimum separation distance of 20 cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.
2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

3.2.2 CANADA / IC

This device complies with Industry Canada's license-exempt RSS standards. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, that antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed as accessories with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with the device.

This equipment should be installed and operated such that a minimum separation distance of 20 cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.

4 GENERAL INFORMATION

4.1 WIKI

The LORIX One wiki is accessible at www.lorixone.io/wiki and contains information about technical use of the product. It contains information such as explanations on how to use the toolchain to create custom binaries or to flash the internal NAND memory.

4.1.1 UPDATE INFORMATION

The modifications made between each new release of the Yocto Linux are described under the Wiki changelog page <http://lorixone.io/wiki/Changelog>

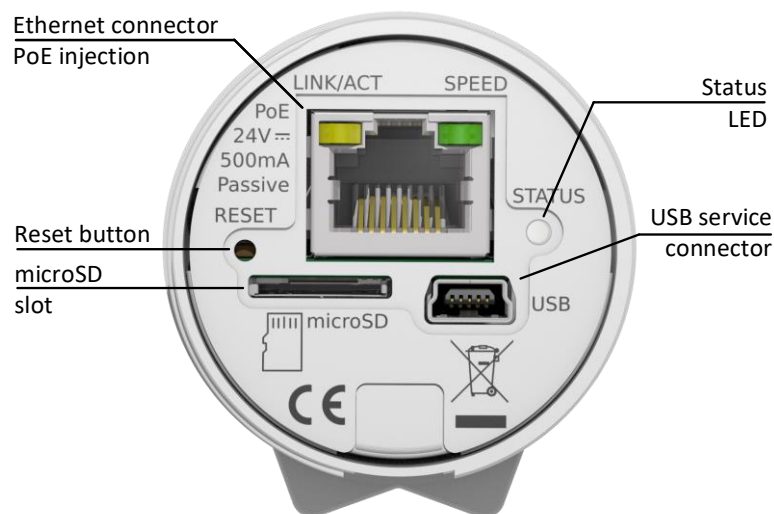
4.1.2 TROUBLESHOOTING

Frequent encountered problems are summarized under the Wiki troubleshooting page, with suggested solutions: <http://lorixone.io/wiki/Troubleshooting>

4.1.3 OPEN SOURCE LICENSES

All the licenses of the open source software used or available in the packages repository of the LORIX One are available at the following address: <https://lorixone.io/yocto/licenses/2.1.2>

4.2 CONNECTIVITY/INTERFACE



4.3 START/RESET

The gateway automatically boots when connected to a power supply through passive PoE on the Ethernet cable. After start-up, the status LED should blink briefly and turn off. Once the Linux OS starts, the status LED will start blinking in “heartbeat” mode.

The reset button can be used to reset the gateway, to reset it close to its original factory settings, or to enter in programming mode. For a simple reset, shortly press the reset button with a thin tool such as a paper clip. Upon release, the status LED will briefly flash and then stop to signal the reset action.

4.3.1 PROCEDURES

**Short-press**

Press briefly, for less than 1 second. The blue LED will briefly blink upon release

**Long-press**

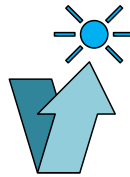
Press and hold for several seconds. The blue LED will briefly blink after the delay specified below

**Status LED**

A short flash of the blue LED

Normal reset procedure

1. Short-press
2. The status LED will flash upon release and the gateway will reboot

**Factory reset procedure**

The factory reset procedure can be used to reset the initial default configuration and thus restore the device to its original settings. This procedure is useful to solve a network misconfiguration or to recover a forgotten password.

Scope of the factory reset

The factory reset does not reset the device to its original factory settings. It does not perform a complete restoration and some issues cannot be solved. A complete factory reset can be done following the procedure described on the [NAND Programming](#) page of the wiki.

1. Wait at least 1 second after another reset pressure
2. Long-press for at least 10 seconds
3. After the LED starts blinking, release the reset button
4. The gateway will boot in factory reset mode. When Linux has started, a script will copy the default files

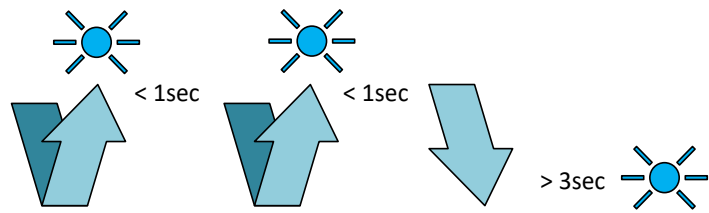


> 10sec

**Programming mode procedure**

This procedure is used to enter in programming mode. It enables the possibility to reprogram the gateway using the Atmel SAM-BA programming tool through the USB port as summarized on the [NAND Programming](#) page of the wiki.

1. Remove the microSD card from the device
2. Wait at least 1 second for another reset pressure
3. Perform 2 short presses with less than 1 second between each press
4. Perform a third long press for more than 3 seconds (but less than 5 seconds)



5 ETHERNET/POE

Connector details:

RJ45 Pin number	Wire color	Function	
1	Green	TX+	
2	Green/white	TX-	
3	Orange	RX+	
4	Blue	VPOE1	Voltage 1 for PoE powering (must be connected with pin 5)
5	Blue/white	VPOE1	Voltage 1 for PoE powering (must be connected with pin 4)
6	Orange/white	RX-	
7	Brown	VPOE2	Voltage 2 for PoE powering (must be connected with pin 8)
8	Brown/white	VPOE2	Voltage 2 for PoE powering (must be connected with pin 7)

TABLE 5 ETHERNET/POE CONNECTION

The yellow LED shows the LINK and the ACTIVITY on the Ethernet connection:

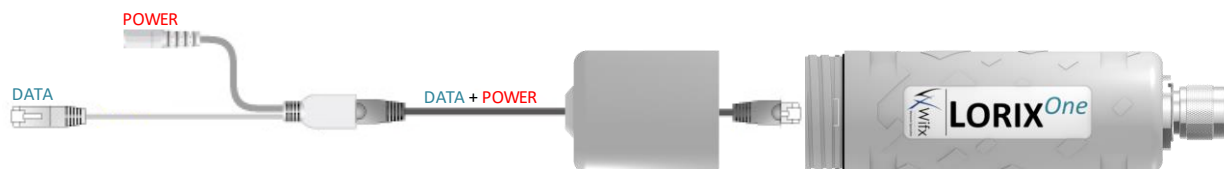
OFF	No link
ON	Link
Blink	Link and activity

The green LED shows the actual SPEED of the Ethernet connection:

OFF	10Base-T
ON	100Base-TX

5.1 POWER THROUGH PASSIVE POE

The LORIX One gateway is exclusively powered through passive PoE using the Ethernet connector. The power is injected through a PoE injector as shown below:



V_{POE1} and V_{POE2} (in Table 5) represent both power lines of the gateway. Power must be injected in the power input connector using the switching power supply provided with the LORIX One only:

Reference	HNP12-240L6
Output voltage	24VDC
Output courant	500mA

6 ADMINISTRATION TERMINAL ACCESS

The embedded Linux can be accessed either through the USB connector or through SSH with a working Ethernet connection.

6.1 USB

The gateway has a USB micro-B type connector which provides virtual COM port. Accessing the gateway this way allows you to debug and configure the software. This is the only way to access the terminal when the network is not accessible (without SSH access).

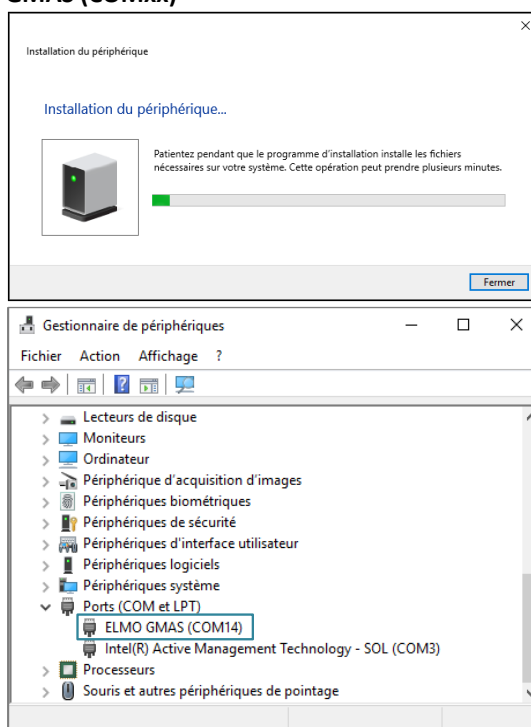
USB Connection consideration

Please note that the gateway cannot be powered through the USB port and needs to be powered with the passive PoE through the Ethernet connector.

The USB connection should exclusively be used for administration/configuration and should not be left connected during normal use. The IPxx level is also not guaranteed during USB service connector use.

To access the gateway through USB:

1. Power up the gateway with passive PoE through the Ethernet connector
2. Connect a PC to the gateway with a A ↔ mini-B cable
3. The virtual COM port is automatically detected by the PC
 - a. On Windows a new virtual COM port will appear in the device manager under the name **ELMO GMAS (COMxx)**



- b. On Linux a new virtual COM port will appear in the folder **/dev/ttyACMxx**
4. A terminal program like PuTTY or minicom can be used with the following parameters:

baudrate	115200
data bits	8
stop bits	1
parity	none
flow control	none

6.2 SSH

The gateway provides a SSH server and can be accessed through the SSH as soon as it is connected to a working network using a SSH client program like PuTTY or ssh on Linux.

You need to know the IP address in order to access the gateway through SSH.

To access the gateway with SSH:

1. Power up the gateway with passive PoE through the Ethernet connector
2. A terminal program like PuTTY or ssh can be used with the following parameters:
address **depending on your configuration**
port **22**
3. Accept the RSA key fingerprint if asked

7 SYSTEM ACCESS & CONFIGURATION

7.1 LOGIN

When the connection is made via USB, the following text will appear:

```
Poky (Yocto Project Reference Distro) 2.1.2 sama5d4-lorix-one /dev/ttyGS0
sama5d4-lorix-one login:
```

If the prompt does not appear, press on the ENTER key to restart the login query.

With SSH:

```
Login as:
```

The default login user name is **admin** and the password is **lorix4u**. It is strongly recommended to change the password as soon as possible. The procedure to change the password is found in the chapter [user/password](#).

Enter the login and validate with ENTER, the password will then be asked:

```
login as: admin
admin@root's password:

LORIX One
-----
LoRa gateway                www.lorixone.io

sama5d4-lorix-one:~$
```

7.2 USER/PASSWORD

Security issue with the default password

By default, all the LORIX One gateways have the same password and users should change it before any “production” use. It is recommended to create a strong password which consists of numerals, special characters, upper- and lower-case letters to increase the security of the access.

7.2.1 DEFINE OR CHANGE A PASSWORD

To define a new password, use the **passwd** command as follows:

```
sama5d4-lorix-one:~$ passwd
Changing password for admin
Enter the new password (minimum of 5 characters)
Please use a combination of upper and lower case letters and numbers.
New password: <new password>
Re-enter new password: <new password>
passwd: password changed.
```

7.3 ROOT PRIVILEGES

Most of the files or executables are limited to root access on the gateway to protect from any mishandling. Depending on the rights of these files, only the root user can read, write or execute them.

7.3.1 SUDO COMMAND

For security reasons, the root user does not have access to the terminal. However, the root user can temporarily use the **sudo** command to execute a command:

```
sama5d4-lorix-one:~$ sudo reboot
Password:
```

The reboot command will be executed by the root user after entering the password. This action is not possible for the admin user. The sudo command is valid only once and must be applied for each command. Once the password is entered, the command is available for 15 minutes.

7.3.2 SU COMMAND

It is sometimes useful to manipulate multiple files with a root access without using the sudo command for each action. This can be done by using the **su** command (short for substitute user) which allows you to change the current session's owner. This action can allow you to become a root user and to benefit from its privileges.

The whoami (Who Am I) command will allow you to see which user you are currently:

```
sama5d4-lorix-one:~$ whoami
admin
```

The current user is **admin**.

```
sama5d4-lorix-one:~$ sudo su
Password:
sama5d4-lorix-one:/home/admin# whoami
root
```

The **sudo su** command allows you to become the root (su command without argument is a shortcut for su root).

```
sama5d4-lorix-one:/home/admin# su admin
sama5d4-lorix-one:~$ whoami
admin
```

As the root user, the sudo command is not necessary to use the su command.

Security issue or error using the su command

The sudo and su commands are powerful and allow users to modify/corrupt important files or (mis)use critical commands. Su command is particularly dangerous since users may forget its privileges over time.

7.4 EDIT A FILE

There are two different programs to edit files on the gateway, namely **Vi** or **Nano**. They are both very simple but very different in terms of use.

7.4.1 USING VI

Vi is less intuitive but very efficient when it is mastered. It allows you to edit a text file, existing or not, using the following command:

```
sama5d4-lorix-one:~$ vi file.txt
```

Or prefixed with sudo if the file is root access protected.

Once the file is open, there are two main modes: insert or command. The insert mode is indicated by an I in the bottom left corner of the terminal.

You can switch from command mode to insert mode by typing "i" or "a".

- "i" for insert – the insertion will begin where the cursor is positioned
- "a" for append – the insertion will begin from the following character.

In the insert mode, you can modify the file as in any text editor and you can simply quit the insert mode with the ESC key.

In command mode, you can type ":" followed by one or several commands:

- ":w" for writing – to write the modifications
- ":q" for quitting – to quit the program
- ":q!" to force quit the program even if the modifications have not been saved
- ":wq" ou ":x" to write and quit

There are other possible options which are not provided here but many tutorials can be found on the internet.

7.4.2 USING NANO

Nano is less efficient but far more intuitive and user friendly. This program is recommended if you are not familiar with a terminal or Vi. You can edit a text file, existing or not, using the following command:

```
sama5d4-lorix-one:~$ nano file.txt
```

Or prefixed with sudo if the file is root access protected.

Once opened, you can navigate through the file with the arrow keys and modify, add or delete text like any standard file editor.

Nano uses the CTRL key to accept commands and is easy to use since all the commands are detailed at the bottom. The "^" character represents the CTRL key. For example, you can quit nano using the CTRL+X combination.

7.5 CONFIGURING LAN CONNECTION PARAMETERS

The network parameters are in the file **/etc/network/interfaces**. You can use your favorite editing program to modify it:

```
sama5d4-lorix-one:~$ sudo vi /etc/network/interfaces
```

And the default content:

```
# /etc/network/interfaces -- configuration file for ifup(8), ifdown(8)

# The loopback interface
auto lo
iface lo inet loopback

# Wired or wireless interfaces
auto eth0
iface eth0 inet static
    address 192.168.1.50
    netmask 255.255.255.0
    gateway 192.168.1.1
    dns-nameservers 192.168.1.1
```

The first group defines the local network loop and should not be modified unless you know what you are doing. The second group defines the main Ethernet port of the gateway (named eth0). It is configured with a default static IP address (192.168.1.50).

7.5.1 STATIC CONFIGURATION

It possible to configure a static configuration the following parameters:

```
auto eth0
iface eth0 inet static
    address <IP address>
    netmask <Network mask>
    gateway <Gateway IP address>
    dns-nameservers <DNS1 address> [<DNS2 address>] [<DNS3 address>]
```


7.5.2 DHCP CONFIGURATION

It is possible to configure a DHCP configuration with the following parameters:

```
auto eth0
iface eth0 inet dhcp
```

7.5.3 NETWORK RESTARTING

Once the new parameters are saved, you can restart (or simply stop) the networking system by using the networking script file:

```
sama5d4-lorix-one:~$ sudo /etc/init.d/networking {start|stop|restart}
```

This step is required to apply the new parameters.

Warning concerning network modification and SSH

If you access the gateway with SSH, keep in mind that any modification in the network interface could stop your connection with the gateway and it could be impossible to access the gateway if you cannot use the service USB port.

7.6 SYSTEM UPDATE

The gateway has the possibility to be updated manually using the package manager **opkg** which is similar to the Debian package manager **dpkg** in a lighter version.

7.6.1 MAIN SERVER

The main server containing the packages is located at <http://lorixone.io/yocto/feeds/2.1.2/>. This information is written in the file **/etc/opkg/base-feeds.conf** and can be modified to handle more server addresses for example.

Further information about **opkg** can be found at <https://code.google.com/archive/p/opkg/> or in the Yocto documentation which can generate directly all the packages for the gateway.

7.6.2 MANUAL UPDATE

To update the list of available packages (without updating the packages), the following command must be done prior to any update (it will not affect the system at this point):

```
sama5d4-lorix-one:~$ sudo opkg update
Downloading http://lorixone.io/yocto/feeds/2.1.2/all/Packages.gz.
Updated source 'all'.
Downloading http://lorixone.io/yocto/feeds/2.1.2/cortexa5hf-neon/Packages.gz.
Updated source 'cortexa5hf-neon'.
Downloading http://lorixone.io/yocto/feeds/2.1.2/sama5d4_lorix_one/Packages.gz.
Updated source 'sama5d4_lorix_one'.
Downloading http://lorixone.io/yocto/feeds/2.1.2/sama5d4_lorix_one/Packages.gz.
Updated source 'sama5d4_lorix_one_sd'.
```

Once the list of packages updated, you can start the update by running:

```
sama5d4-lorix-one:~$ sudo opkg upgrade
```

This command will update every package already installed and which is not up to date.

Services stop during updates

If any updates are available, some services such as LoRa cloud applications could be stopped during the update and restarted afterwards.

Errors during updates

If any error appears during the update, do not hesitate to read the trouble section of the wiki under [4.1.2 Troubleshooting](#).

7.6.3 PACKAGE INSTALLATION

Packages that are not installed by default can be added using the following command:

```
sama5d4-lorix-one:~$ sudo opkg install <pkgs>
```

Package availability can be consulted at the following address: <http://lorixone.io/yocto/feeds/2.1.2/> under each subdirectories in the file **Packages**.

Installation of new packages

If you have an older version of the software, the recently added packages are available on the packages server. However, the **opkg upgrade** command will not install these packages and you will need to install them manually using the **opkg install** command followed by the package's name.

Example: `opkg install kersing-packet-forwarder`

7.7 CLOUD APPLICATIONS

7.7.1 LORIOT

7.7.1.1 SUMMARY

Website: <https://loriot.io>
Yocto package name: loriot
Rootfs location: /opt/lorix/clouds/loriot
Init script: /etc/init.d/loriot-gw
Status: STABLE

The LORIX One gateway is preinstalled with the LORIOT cloud application.

7.7.1.2 CONFIGURATION

To test the LORIOT cloud, create a free account on loriot.io and add the new gateway using the MAC address of your LORIX One (under the XX:XX:XX:XX:XX:XX form) which you can find on the back label or using the command `ifconfig` under Linux (SSH or USB):

```
sama5d4-lorix-one:~$ ifconfig
eth0      Link encap:Ethernet HWaddr XX:XX:XX:XX:XX:XX
          [...]
lo        Link encap:Local Loopback
          [...]
```

7.7.1.3 MANUAL TEST

Before conducting any manual test, make sure you do not have any other packet-forwarder already running and launched with the `clouds-manager script` using the following command:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh stop
Password:
Stopping cloud <running cloud>... done.
```

Once stopped, the LORIOT packet-forwarder can be launched manually by using the following command:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/loriot/
sama5d4-lorix-one:/opt/lorix/clouds/loriot$ sudo ./loriot-gw -f
Password:
[2018-05-01 14:08:27.155][DEBUG] No interface set
[2018-05-01 14:08:27.157][LOG ] Gateway loriot_lorix_spi version 2.8.870-JKS-EU1-2.8.870
[2018-05-01 14:08:27.159][LOG ] Openssl version OpenSSL 1.0.2h 3 May 2016
[2018-05-01 14:08:27.161][LOG ] Using eth0 for GW EUI FCC23DFFF0E23D7
[2018-05-01 14:08:27.164][LOG ] Requesting system route
[2018-05-01 14:08:27.677][LOG ] Connecting config server eu1.loriot.io
[2018-05-01 14:08:27.712][LOG ] SSL: Will use internal certificate validation
[2018-05-01 14:08:27.736][DEBUG] Hostname eu1.loriot.io addr <address>
[2018-05-01 14:08:27.829][Cfgr] HTTP response HTTP/1.1 200 OK
[2018-05-01 14:08:27.831][Cfgr] Timestamp Tue, 01 May 2018 14:08:27 GMT
[2018-05-01 14:08:27.832][Cfgr] Content-type application/json; charset=utf-8
[2018-05-01 14:08:27.835][INFO ] Parsing configuration file ...
[2018-05-01 14:08:27.837][INFO ] 5 configuration parameters found
[2018-05-01 14:08:27.838][RADIO] running PUBLIC network, clock fed from radio #1
[2018-05-01 14:08:27.839][RADIO] radio 0 enabled, SX1257, center frequency 867500000, RSSI offset -164.0, TX enabled
[2018-05-01 14:08:27.841][RADIO] radio 1 enabled, SX1257, center frequency 868500000, RSSI offset -164.0, TX disabled
[2018-05-01 14:08:27.843][INFO ] LoRa Multi-SF channel 0 >> Radio 1, IF -400000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.844][INFO ] LoRa Multi-SF channel 1 >> Radio 1, IF -200000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.845][INFO ] LoRa Multi-SF channel 2 >> Radio 1, IF 0 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.845][INFO ] LoRa Multi-SF channel 3 >> Radio 0, IF -400000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.846][INFO ] LoRa Multi-SF channel 4 >> Radio 0, IF -200000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.847][INFO ] LoRa Multi-SF channel 5 >> Radio 0, IF 0 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.847][INFO ] LoRa Multi-SF channel 6 >> Radio 0, IF 200000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.848][INFO ] LoRa Multi-SF channel 7 >> Radio 0, IF 400000 Hz, 125 kHz BW Enabled
[2018-05-01 14:08:27.848][INFO ] Lora std channel> radio 1, IF -200000 Hz, 250000 Hz bw, SF 7
[2018-05-01 14:08:27.848][INFO ] FSK channel> radio 1, IF 300000 Hz, 125000 Hz bw, 50000 bps datarate
[2018-05-01 14:08:27.867][DEBUG] Connecting update server
[2018-05-01 14:08:27.870][DEBUG] Hostname eu1.loriot.io addr <address>
[2018-05-01 14:08:27.970][Cfgr] HTTP response HTTP/1.1 204 No Content
[2018-05-01 14:08:27.972][INFO ] No update available for current version
[2018-05-01 14:08:27.977][LOG ] Starting LoRa Concentrator
FPGA version 0
[2018-05-01 14:08:31.432][LOG ] LoRa starting HAL 4.1.3
ERROR: Spectral Scan is not supported (0x70)
[2018-05-01 14:08:31.435][DEBUG] gpsThread starting
[2018-05-01 14:08:31.436][DEBUG] gpsThread end
LOOP
[2018-05-01 14:08:31.541][LOG ] Connecting websocket server eu1.loriot.io
[2018-05-01 14:08:31.545][DEBUG] Hostname eu1.loriot.io addr <address>
[2018-05-01 14:08:31.631][NWK ] HTTP response HTTP/1.1 101 Switching Protocols
[2018-05-01 14:08:31.632][NWK ] Connection to network server established.
{"cmd":"gwifstat","stat":[{"name":"eth0","run":true,"rx":1400878,"tx":1279521}]}
{"cmd":"gwifip","ip":[{"name":"eth0","used":true,"ip":"192.168.1.50"}]}
{"cmd":"gwsysinfo","uname":{"machine":"armv7l","name":"sama5d4-lorix-one","release":"4.4.39-00526-gcb52511","sys":"Linux","version":"#1 Wed May 24 19:35:10 CEST 2017"},"storage":[{"free":164196352,"size":225832960,"folder":"."},"free":87998464,"size":126918656,"loads":[0.04,0.03,0.00],"uptime":4320,"cpus":1}]
```

In manual mode, the terminal on which the packet-forwarder has been launched must be kept open during the whole time of use.

Once started, the application displays its log output and allows easy debugging before passing in production mode. It can be stopped using the CTRL+C keyboard shortcut.

7.7.1.4 PRODUCTION MODE

Once the configuration has been manually tested (optional), the LORIOT packet-forwarder can be automatically started at boot or on command (without the need of keeping the terminal open) using the [Wifx clouds-manager](#).

7.7.2 SEMTECH PACKET-FORWARDER

7.7.2.1 SUMMARY

Sources page: https://github.com/Wifx/packet_forwarder
Forked from: https://github.com/Lora-net/packet_forwarder
License: https://github.com/Lora-net/packet_forwarder/blob/master/LICENSE
Yocto package name: packet-forwarder
Rootfs location: /opt/lorix/clouds/packet-forwarder
Init script: /etc/init.d/packet-forwarder-gw
Status: STABLE

7.7.2.2 CONFIGURATION

The main configuration file is `global_conf.json` and contains the TX lookup table of the gateway along with other parameters. Both files `global_conf_2dBi_indoor.json` and `global_conf_4dBi_outdoor.json` contain respectively the power for indoor and outdoor antennas.

To modify the power table and use the 2dBi antenna:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/packet-forwarder/  
sama5d4-lorix-one:/opt/lorix/clouds/packet-forwarder# sudo cp global_conf_2dBi_indoor.json  
global_conf.json
```

The file `local_conf.json` contains more gateway specific parameters and can be customized according to source code.

Gateway EUI update in configuration files

Do not forget to update the gateway ID in the `global_conf.json` and/or `local_conf.json` files as explained in chapter [7.8.1 Gateway ID update script](#) if you do not use the initial *.json files supplied with the LORIX One.

7.7.2.3 MANUAL TEST

Before conducting any manual test, make sure you do not have any other packet-forwarder already running and launched with the `clouds-manager` script using the following command:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh stop  
Password:  
Stopping cloud <running cloud>... done.
```

Once stopped, the Semtech packet-forwarder can be launched manually by using the following command:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/packet-forwarder/
sama5d4-lorix-one:/opt/lorix/clouds/packet-forwarder$ sudo ./lora_pkt_fwd
Password:
*** Beacon Packet Forwarder for Lora Gateway ***
Version: 3.1.0
*** Lora concentrator HAL library version info ***
Version: 4.1.3;
***
INFO: Little endian host
INFO: found global configuration file global_conf.json, parsing it
INFO: global_conf.json does contain a JSON object named SX1301_conf, parsing SX1301 parameters
INFO: lorawan_public 1, clksrc 1
INFO: no configuration for LBT
INFO: antenna_gain 0 dBi
INFO: Configuring TX LUT with 16 indexes
INFO: radio 0 enabled (type SX1257), center frequency 904300000, RSSI offset -164.000000, tx enabled 1, tx_notch_freq 129000
INFO: radio 1 enabled (type SX1257), center frequency 905000000, RSSI offset -164.000000, tx enabled 0, tx_notch_freq 0
INFO: Lora multi-SF channel 0> radio 0, IF -400000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 1> radio 0, IF -200000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 2> radio 0, IF 0 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 3> radio 0, IF 200000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 4> radio 1, IF -300000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 5> radio 1, IF -100000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 6> radio 1, IF 100000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 7> radio 1, IF 300000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora std channel> radio 0, IF 300000 Hz, 500000 Hz bw, SF 8
INFO: FSK channel 8 disabled
INFO: global_conf.json does contain a JSON object named gateway_conf, parsing gateway parameters
[...]
```

```
INFO: Successfully contacted server localhost
INFO: [main] concentrator started, packet can now be received

INFO: Disabling GPS mode for concentrator's counter...
INFO: host/sx1301 time offset=(1525186558s:400785µs) - drift=721918225µs
INFO: Enabling GPS mode for concentrator's counter.
```

In manual mode, the terminal on which the packet-forwarder has been launched must be kept open during the whole time of use.

Once started, the applications displays its log output and allows easy debugging before passing in production mode. It can be stopped using the CTRL+C keyboard shortcut.

7.7.2.4 PRODUCTION MODE

Once the configuration has been manually tested (optional), the Semtech packet-forwarder can be automatically started at boot or temporarily (without the need of keeping the terminal open) using the [Wifx clouds-manager](#).

7.7.3 TTN PACKET-FORWARDER

7.7.3.1 SUMMARY

Sources page: https://github.com/Wifx/ttn_packet_forwarder
Forked from: https://github.com/TheThingsNetwork/packet_forwarder/tree/legacy
License: https://github.com/TheThingsNetwork/packet_forwarder/blob/legacy/LICENSE
Yocto package name: ttn-packet-forwarder
Rootfs location: /opt/lorix/clouds/ttn
Init script: /etc/init.d/ttn-gw
Status: STABLE

The Things Network is a free and collaborative LoRa network.

TTN packet-forwarder usage

This packet-forwarder is an evolution of the standard packet-forwarder of Semtech. It can be used to connect the gateway to multiple servers. There are no restrictions on its use instead of the standard one, even if you are not using the TTN cloud.

7.7.3.2 CONFIGURATION

The main configuration file is `global_conf.json` and contains the TX lookup table of the gateway as the standard packet-forwarder, along with other parameters. Both files `EU_global_2dBi_indoor.json` and `EU_global_4dBi_outdoor.json` contain respectively the power for indoor and outdoor antennas.

EDIT: From the version 2.1.0r5, the file `EU_global_<antenna version>.json` has been replaced by the file `global_<antenna version>.json`.

To modify the power table and use the 2dBi antenna:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/ttn/  
sama5d4-lorix-one:/opt/lorix/clouds/ttn# sudo cp EU_global_conf_2dBi_indoor.json global_conf.json  
or from the version 2.1.0r5  
sama5d4-lorix-one:/opt/lorix/clouds/ttn# sudo cp global_conf_2dBi_indoor.json global_conf.json
```

The file `local_conf.json` contains information about latitude, longitude, altitude, description and administrator e-mail. This file can be updated:

Gateway EUI update in configuration files

Do not forget to update the gateway ID in the `global_conf.json` and/or `local_conf.json` files as explained in chapter 7.8.1 [Gateway ID update script](#) if you do not use the initial *.json files supplied with the LORIX One.

7.7.3.3 MANUAL TEST

Before conducting any manual test, make sure you do not have any other packet-forwarder already running and launched with the `clouds-manager` script using the following command:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh stop  
Password:  
Stopping cloud <running cloud>... done.
```

Once stopped, the TTN packet-forwarder can be launched manually by using the following command:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/ttn/
sama5d4-lorix-one:/opt/lorix/clouds/ttn$ sudo ./poly_pkt_fwd
Password:
*** Poly Packet Forwarder for Lora Gateway ***
Version: 2.1.0
*** Lora concentrator HAL library version info ***
Version: 3.1.0; Options: native;
***
INFO: Little endian host
INFO: found global configuration file global_conf.json, parsing it
INFO: global_conf.json does contain a JSON object named SX1301_conf, parsing SX1301 parameters
INFO: lorawan_public 1, clksrc 1
INFO: Configuring TX LUT with 16 indexes
INFO: radio 0 enabled (type SX1257), center frequency 904300000, RSSI offset -164.000000, tx enabled 1
INFO: radio 1 enabled (type SX1257), center frequency 905000000, RSSI offset -164.000000, tx enabled 0
INFO: Lora multi-SF channel 0> radio 0, IF -400000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 1> radio 0, IF -200000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 2> radio 0, IF 0 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 3> radio 0, IF 200000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 4> radio 1, IF -300000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 5> radio 1, IF -100000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 6> radio 1, IF 100000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora multi-SF channel 7> radio 1, IF 300000 Hz, 125 kHz bw, SF 7 to 12
INFO: Lora std channel> radio 0, IF 300000 Hz, 500000 Hz bw, SF 8
INFO: FSK channel 8 disabled
INFO: global_conf.json does contain a JSON object named gateway_conf, parsing gateway parameters
[...]
```

In manual mode, the terminal on which the packet-forwarder has been launched must be kept open during the whole time of use.

Once started, the applications displays its log output and allows easy debugging before passing in production mode. It can be stopped using the CTRL+C keyboard shortcut.

7.7.3.4 PRODUCTION MODE

Once the configuration has been manually tested (optional), the TTN packet-forwarder can be automatically started at boot or temporarily (without the need of keeping the terminal open) using the [Wifx clouds-manager](#).

7.7.4 KERSING MP-PACKET-FORWARDER

7.7.4.1 SUMMARY

Sources page: https://github.com/Wifx/mp_packet_forwarder
Forked from: https://github.com/kersing/packet_forwarder
License: https://github.com/kersing/packet_forwarder/blob/master/LICENSE
Yocto package name: kersing-packet-forwarder
Rootfs location: /opt/lorix/clouds/mp-pkt-fwd
Init script: /etc/init.d/mp-pkt-fwd-gw
Status: UNSTABLE

The Kersing packet-forwarder is another fork for the Semtech packet-forwarder

UNSTABLE Status

The Kersing packet-forwarder is a great improvement of the standard Semtech packet-forwarder version. It brings more interesting features such as MQTT support. However, it is still under development and could work in an unexpected manner. If the gateway is not connected to internet when launched, it will stop.

7.7.4.2 CONFIGURATION

The main configuration file is `global_conf.json` and contains the TX lookup table of the gateway, along with other parameters. Both files `global_conf_2dBi_indoor.json` and `global_conf_4dBi_outdoor.json` contain respectively the power for indoor and outdoor antennas.

To modify the power table and use the 2dBi antenna:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/mp-pkt-fwd /  
sama5d4-lorix-one:/opt/lorix/clouds/packet-forwarder# sudo cp global_conf_2dBi_indoor.json  
global_conf.json
```

The file `local_conf.json` contains information about latitude, longitude, altitude, description and administrator e-mail. This file can be updated.

Gateway EUI update in configuration files

Do not forget to update the gateway ID in the `global_conf.json` and/or `local_conf.json` as explained in chapter [7.8.1 Gateway ID update script](#) if you do not use the initial *.json files supplied with the LORIX One.

7.7.4.3 MANUAL TEST

Before conducting any manual test, make sure you do not have any other packet-forwarder already running and launched with the `clouds-manager` script using the following command:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh stop  
Password:  
Stopping cloud <running cloud>... done.
```

Once stopped, the TTN packet-forwarder can be launched manually by using the following command:

```
sama5d4-lorix-one:~$ cd /opt/lorix/clouds/mp-pkt-fwd/
sama5d4-lorix-one:/opt/lorix/clouds/mp-pkt-fwd$ sudo ./mp_pkt_fwd
Password:
16:01:27 *** Multi Protocol Packet Forwarder for Lora Gateway ***
Version: 3.0.20
16:01:27 *** Lora concentrator HAL library version info ***
Version: 5.0.1; Options: native;
***
16:01:27 INFO: Little endian host
16:01:27 INFO: found global configuration file global_conf.json, parsing it
16:01:27 INFO: global_conf.json does contain a JSON object named SX1301_conf, parsing SX1301 parameters
16:01:27 INFO: lorawan_public 1, clksrc 1
16:01:27 INFO: no configuration for LBT
16:01:27 INFO: antenna_gain 0 dBi
16:01:27 INFO: Configuring TX LUT with 16 indexes
16:01:27 INFO: radio 0 enabled (type SX1257), center frequency 904300000, RSSI offset -164.000000, tx enabled 1
16:01:27 INFO: radio 1 enabled (type SX1257), center frequency 905000000, RSSI offset -164.000000, tx enabled 0
16:01:27 INFO: Lora multi-SF channel 0> radio 0, IF -400000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 1> radio 0, IF -200000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 2> radio 0, IF 0 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 3> radio 0, IF 200000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 4> radio 1, IF -300000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 5> radio 1, IF -100000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 6> radio 1, IF 100000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora multi-SF channel 7> radio 1, IF 300000 Hz, 125 kHz bw, SF 7 to 12
16:01:27 INFO: Lora std channel> radio 0, IF 300000 Hz, 500000 Hz bw, SF 8
16:01:27 INFO: FSK channel 8 disabled
16:01:27 INFO: global_conf.json does contain a JSON object named gateway_conf, parsing gateway parameters
[...]
16:01:27 INFO: [Transports] Initializing protocol for 1 servers
16:01:27 INFO: Successfully contacted server router.eu.thethings.network
16:01:27 INFO: Successfully contacted server iot.semtech.com
16:01:27 INFO: [main] Starting the concentrator
16:01:30 INFO: [main] concentrator started, radio packets can now be received.
16:01:30 INFO: Disabling GPS mode for concentrator's counter...
16:01:30 INFO: JIT thread activated.
16:01:30 INFO: host/sx1301 time offset=(1525190488s:141055µs) - drift=356691199µs
16:01:30 INFO: Enabling GPS mode for concentrator's counter.
```

In manual mode, the terminal on which the packet-forwarder has been launched must be kept open during the whole time of use.

Once started, the applications displays its log output and allows easy debugging before passing in production mode. It can be stopped using the CTRL+C keyboard shortcut.

7.7.4.4 PRODUCTION MODE

Once the configuration has been manually tested (optional), the Kersing packet-forwarder can be automatically started at boot or temporarily (without the need of keeping the terminal open) using the [Wifx clouds-manager](#) with the manual option.

To use the manual, follow the description in the chapter about [manual configuration of the clouds-manager script](#) using the following values:

```
# Manual cloud client
# Replace this path by your customized cloud application start script
MANUAL_INIT_FILE="/etc/init.d/mp-pkt-fwd-gw"
MANUAL_CLOUD_NAME="kersing"
```

Then, select the manual packet-forwarder using the configure command of the clouds-manager as described in the following chapters.

7.7.5 WIFX CLOUDS-MANAGER

The desired clouds can be easily configured by SSH or USB using the following command:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh {start|stop|restart|force-reload|status|configure}
```

It allows to see the current status of the running cloud without any special permission. However, you need special permission (root access) to be able to modify configurations, or to start, stop and restart it.

7.7.5.1 CONFIGURATION

Before running the configuration, you need to stop any running cloud:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh stop
Password:
Stopping cloud <running cloud>... done.
```

Once stopped, you can modify the configuration:

```
sama5d4-lorix-one:~$ /etc/init.d/clouds-manager.sh configure
=====
| LORIX One clouds manager configuration |
=====

Actual configuration:
  autostart=true
  cloud=loriot

Do you want to enable autostart at boot time?
[Yes|No]
> no

Which cloud app. do you want to use ?
[loriot|packet-forwarder|ttn|manual]
> loriot

New configuration:
  autostart=false
  cloud=loriot
```

It allows to modify two parameters, the first one is “autostart” which defines whether the cloud will be started automatically at boot time or not (default=yes).

The second option which is asked for is the cloud itself and will let you decide between LORIOT, the Semtech packet-forwarder, the TTN (The Things Network) packet-forwarder or manual to use another packet-forwarder as explained in the following chapter.

7.7.5.2 MANUAL CONFIGURATION

Since the version 1.1.0-r0, the LORIX One clouds-manager package supports a new packet-forwarder mode, namely **manual**. It does not belong to a particular packet-forwarder but instead, it allows you to choose any application to be started at boot time. It permits to virtually support any new packet-forwarder like the [Kersing packet-forwarder](#) for instance.

To configure the manual packet-forwarder, you must stop any running packet-forwarder:

```
sama5d4-lorix-one:~$ sudo /etc/init.d/clouds-manager.sh stop
Password:
Stopping cloud <running cloud>... done.
```

Once stopped, you can edit the script (using sudo) `/etc/init.d/clouds-manager.sh` with [Vi](#) or [Nano](#) and define the variable **MANUAL_INIT_FILE** to point towards the initiation script located in the folder `/etc/init.d` and normally following the convention name `<cloud name>-gw`.

Optionally, you can also define the variable **MANUAL_CLOUD_NAME** with a customized name which is only used to give more information when using the `clouds-manager.sh` script.

An example is available in the [Kersing packet-forwarder](#) chapter.

7.8 LORA CONCENTRATOR UTILITIES

Clouds-manager incompatibility

Please note that the clouds-manager and its sub applications cannot be running during the use of test and utility applications (LoRa). Before using these tools, the clouds-manager must be stopped as explained in point 7.7.5 [Wifx clouds-manager](#).

Semtech provides utilities to test the SX1301 LoRa concentrator chip and to perform RX/TX performance tests. All the binaries relative to the gateway are located in the file **/opt/lorix/utlis** and arranged into subfiles.

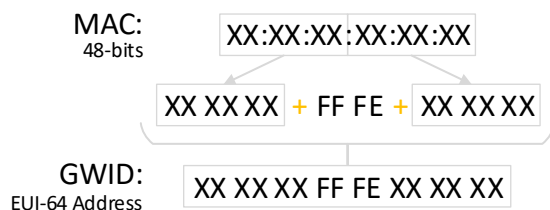
7.8.1 GATEWAY ID UPDATE SCRIPT

The Semtech **packet-forwarder** package provides also a script which allows to update any packet-forwarder configuration *.json file by modifying the **gateway_ID** field with the correct gateway ID (or EUI) according to the unique MAC address number as described in the next chapter.

7.8.1.1 GWID FORMAT

The gateway ID is a 64 bits unique ID based on the 48 bits unique MAC address. The extended 64 bits address is simply created by removing the “.” of the MAC address and by adding the 2 Bytes 0xFF and 0xFE between the 3rd and 4th Bytes.

The format of the gateway ID (GWID) is the following:



Following this process, the MAC address **01:00:5E:22:BB:33** becomes the gateway ID **01005EFFFFE22BB33**.

The gateway ID is also, on some clouds, under the form eui-<gateway ID>. In this case **eui-01005efffe22bb33**.

7.8.1.2 GATEWAY ID UPDATE

You can either modify the **gateway_ID** field in the **global_conf.json** and **local_conf.json** files manually using **Vi** or **Nano** ; or use the **update_gwid.sh** script located in the file **/opt/lorix/utlis** with the following commands:

```
sama5d4-lorix-one:~$ cd /opt/lorix/utlis/
sama5d4-lorix-one:/opt/lorix/utlis$ sudo ./update_gwid.sh /opt/lorix/clouds/ttn/global_conf.json
Password:
Gateway_ID set to <gateway ID> in file /opt/lorix/clouds/ttn/global_conf.json
```

The script takes the *.json file to update as first argument

7.8.2 SX1301 RESET PIN CONTROL

The reset pin of the SX1301 LoRa concentrator chip is accessible through the script **/etc/init.d/reset_lgw**.

```
sama5d4-lorix-one:~$ sudo /etc/init.d/reset_lgw {start|stop|restart}
```

The **start** argument will disable the reset signal and activate the SX1301.

The **stop** argument will enable the reset signal and deactivate the SX1301.

The **restart** will perform a pulse on the reset signal to restart the SX1301.

This script is automatically called with **start** during system startup and with **stop** during system shutdown.

7.8.3 TEST BINARIES

All the test binaries related to the **libloragw** (https://github.com/Lora-net/lora_gateway) are located in the file **/opt/lorix/tests**.

The following tests are available:

```
test_loragw_cal  
test_loragw_hal  
test_loragw_spi  
test_loragw_gps  
test_loragw_reg
```

The related Git repository gives more information about their use.

7.8.4 UTIL BINARIES

On the top of the **libloragw** library, the **lora_gateway** repository provides utilities to test RX/TX functionalities of the SX1301 LoRa concentrator.

The following utils are available in the file **/opt/lorix/utils**:

```
util_lbt_test  
util_pkt_logger  
util_spectral_scan  
util_spi_stress  
util_tx_continuous  
util_tx_test
```

In addition, the configuration files **global_conf.json** and **local_conf.json** are used by the program **util_pkt_logger**. They provide parameters for channel configuration, etc.

8 SD CARD

The gateway has a microSD slot and is compatible with all microSD cards according to the SD Memory Card Specification Version 2.0 including the SDHC standard.

A microSD card can be used to extend the internal FLASH memory (256MB), alternatively, the gateway can boot from the SD card if startup files are detected at startup.

8.1.1 INSERTION/REMOVAL



To insert an SD card, simply push it into the hole until it makes a “click” sound. To remove the card, simply push it back until you hear the “click” sound. The SD card will come out on release.

8.1.2 SD CARD DETECTION

Once inserted, you can verify that the SD Card is correctly detected by the Linux system using the command `dmesg` (“display message”) which will display important system information:

```
sama5d4-lorix-one:~$ dmesg
[...]
```

[24.710000]	mmc0: host does not support reading read-only switch, assuming write-enable
[24.720000]	mmc0: new high speed SDHC card at address 59b4
[24.730000]	mmcblk0: mmc0:59b4 BB2MW 29.8 GiB
[24.740000]	mmcblk0: p1

8.1.3 SD CARD (UN)MOUNTING

It is possible to mount the SD card in the Linux system using the following command:

```
sama5d4-lorix-one:~$ sudo mount -t <filesystem type> /dev/mmcblk0p1 /mnt
```

The `-t` parameter is used to specify the filesystem of the SD card to be mounted. Currently, the gateway only supports ext2, 3, 4 filesystem types. It can however be extended by adding other filesystem supports in the Linux kernel.

To unmount a mounted SD card, use the `sync` command to synchronize any eventual files that are not yet written in the SD card and unmount the card from the Linux filesystem:

```
sama5d4-lorix-one:~$ sync /mnt
sama5d4-lorix-one:~$ sudo umount /mnt
```

9 ELECTRICAL

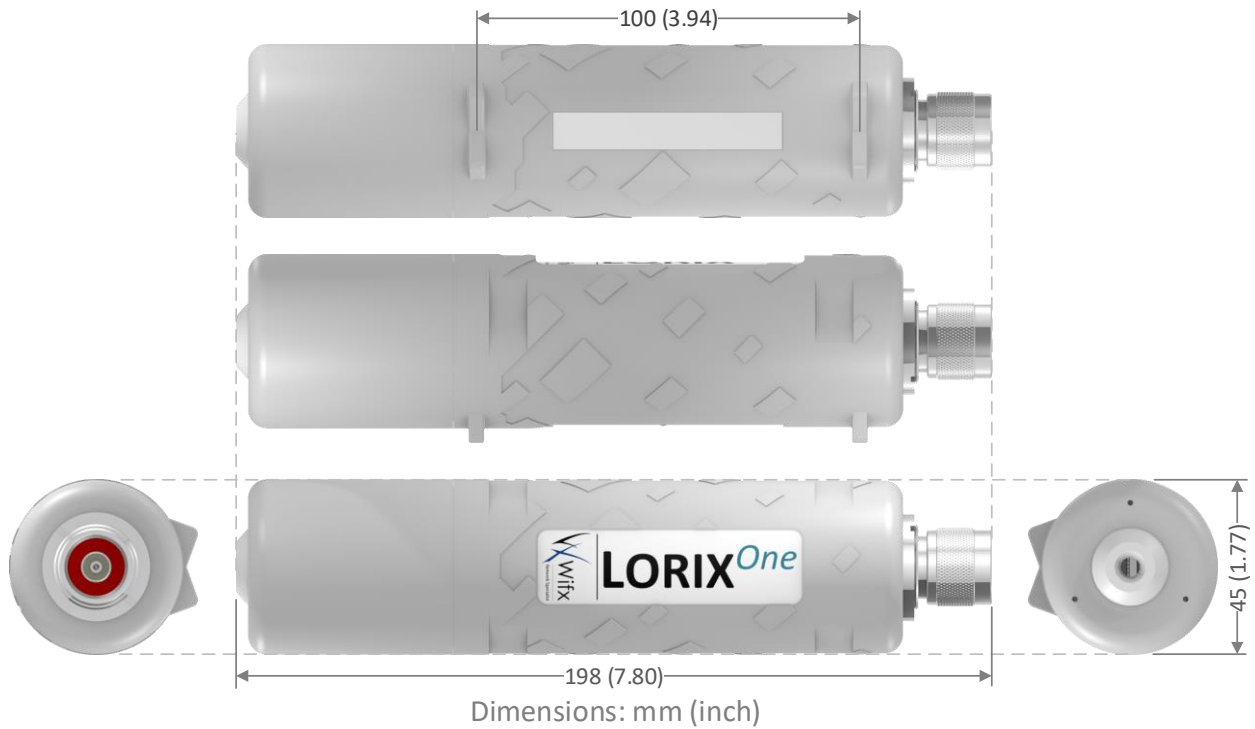
9.1 POWER CONSUMPTION

Task (@ 20°C ambient)	Voltage [V]	Current [mA]	Power [W]
Linux only running RF part disabled	24	42	1,01
LoRa gateway with util_pkt_logger 6 channels for RX	24	105	2,52
LoRa gateway with util_pkt_logger 8 channels for RX	24	117	2,81

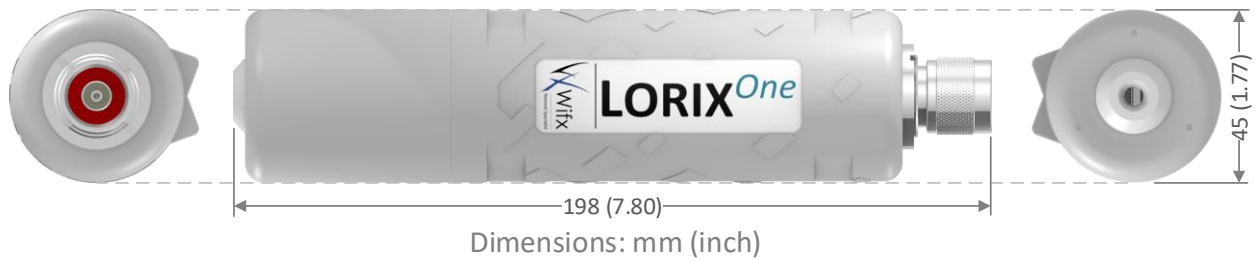
10 MECHANICAL

10.1 LORIX ONE

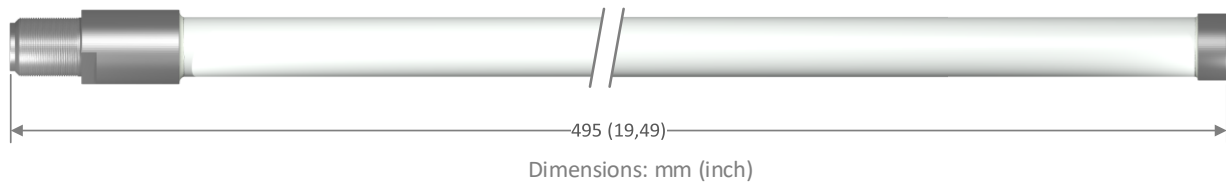
10.1.1 IP43 (SEMI-WATERPROOF)



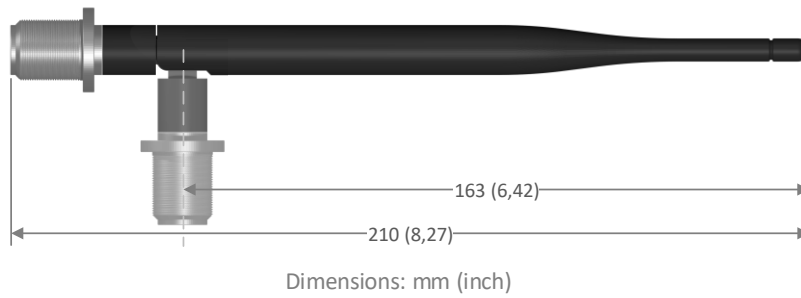
10.1.2 IP65 (WATERPROOF)



10.2 ANTENNA 4DBI (868 & 915 VERSIONS)



10.3 ANTENNA 2.15DBI (868 VERSIONS)



11 SETUP GUIDE

11.1 GENERAL RECOMMENDATIONS

The LORIX One gateway is designed to be placed **vertically** with the antenna pointing **upwards**.

If you wish to attach the LORIX One to a pole, it is strongly recommended to use the plastic mounting loops provided with the gateway which are UV-resistant. Guide the loops around the LORIX One through the edge markings, and attach the gateway around the pole where it will be mounted.

It is strongly recommended to not connect a loose Ethernet cable to the Ethernet port while attaching the gateway to a pole, to avoid adding weight to the port. Ideally, the Ethernet cable should be attached within 2 meters from the gateway device.

11.2 STANDARD MOUNTING USING A POLE



Remove the wire grommet from the cap.



Once the Ethernet cable passed through the cap hole, open the silicon grommet and put it around the cable as showed on the picture.

Be careful with the orientation of the grommet



Press the grommet with your finger from inside the cap (left picture) until take it final position (right picture).



Connect the Ethernet cable.



Move the cap in direction of the body while maintaining the cable with the other hand to keep the cable as straight as possible.



Screw the cap on the body to guarantee as good as possible water and dust protection.

Once fixed, be sure the cable is well placed and verify that the grommet is correctly positioned.



Use only appropriate antenna provided as accessory for the LORIX One.



Engage the antenna connector into the LORIX One RF connector as showed on the picture.

While maintaining the antenna into the LORIX One, start screwing with the other hand the RF LORIX One connector tightening ring.



Never turn or use directly the antenna body to screw it on the LORIX One, it could damage or break the antenna.



Once the cable and the antenna correctly connected and the LORIX One correctly closed, you can install it on a pole using the 2 provided cable tie.

The provided cable tie are black because they are specifically made to support UV.

You should use always the provided one or UV protected specifically.



Once the LORIX One well oriented and the cable tie well tight, use a cutting pliers to cut the exceeding plastic part of the cable tie.



The LORIX One is now installed on a pole using the provided elements (excluding Ethernet cable).

It is strongly recommended to not connect a loose Ethernet cable to the Ethernet port while attaching the gateway to a pole, to avoid adding weight to the port. Ideally, the Ethernet cable should be attached within 2 meters from the gateway device.

On the other side of the cable, use the PoE passive injector provided with the LORIX One as explained in the chapter [5.1 Power through passive PoE](#).

The LORIX One is running by default with the LORIOT Cloud application and is ready to use as soon as it has internet connection and a registered MAC Address in the LORIOT web user space.

Please refer to the chapter [7.7 Cloud applications](#) for more information about how to use and configure others cloud applications.