

## USER GUIDE

### DEMO\_GPS\_LORAMOTE

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## OPEN POINTS

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## GLOSSARY

Abréviation	Description
LoRa	Long Range

## INTRODUCTION

The aim of this document is to setup the LoRa Mote demonstration between the Kerlink LoRa IoT Station and several LoRa Mote end-points.

A web interface provided by Semtech is used to monitor messages sent by the LoRaMotes to the Station (even the LoRaMote and LoRa Station GPS position displayed on a map).

## 1. Pre-requisit

### 1.1 Version software

LoRa IoT Station must be set with :

- Firmware « wirmaV2\_wirgrid\_v1.1 »
- Dota « dota\_demo\_gps\_loramote\_v1.4\_station\_iot\_v1.1.tar »

Once installed, the system contains the following files :

```
[root@Wirgrid_0804000d /root]# ll /mnt/fsuser-1/demo_gps_loramote/
drwxr-xr-x  1 root  root      2048 Jun 24 17:00 .
drwxr-xr-x  1 root  root      2048 Jun 24 17:00 ..
-rw-r--r--  1 root  root      1353 May 28 18:20 global_conf.json
-rwxr-xr-x  1 root  root        202 Jun 23 15:30 gps_pkt_fwd.sh
-rwxr-xr-x  1 root  root     98403 May 28 18:20 gps_pkt_fwd
-rw-r--r--  1 root  root        110 Jun 24 17:00 local_conf.json
-rw-r--r--  1 root  root        153 Jun 23 15:12 manifest.xml
[root@Wirgrid_0804000d /root]#
```

### 1.2 LoRaMote Power supply

LoRaMotes can be powered by a 9V battery pack (not provided), or by USB (cable not provided).

A switch is available on the side of the LoRaMote, beside the mini usb connector.

#### 1.2.1 Battery

LoRaMotes can be powered by a 9V battery pack (6LR61 or compatible).

Slide the battery cover at the LoRaMote backside and plug the battery pack.

Slide the selector switch to the mini-usb connector side.

3 leds (green, orange, red on the PCB) flash 1 time, then the red light flashes every time a LoRa packet is sent.

#### 1.2.2 Usb

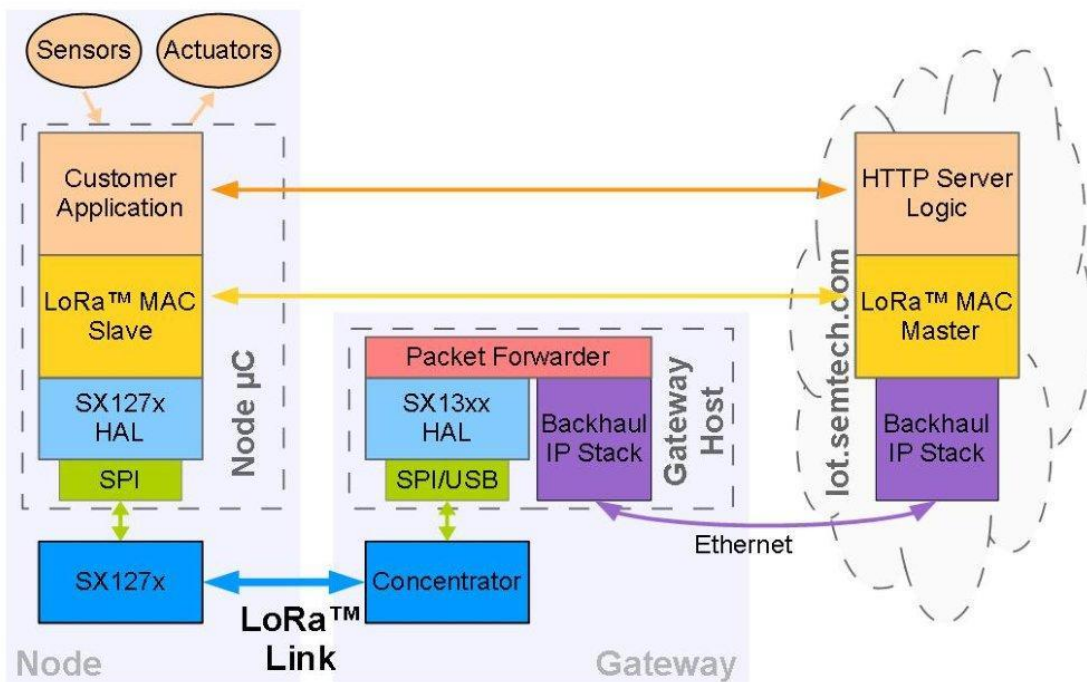
LoRaMotes can be powered by USB (for example from a PC).

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Plug a « mini-usb type B ⇔ standard USB type A » between the LoRaMote and a PC, Slide the selector switch to the mini-usb connector opposite side.

3 leds (green, orange, red on the PCB) flash 1 time, then the red light flashes every time a LoRa packet is sent.

## 2. Demonstration LoRa IoT Station : ethernet connected



The demonstrator is composed of 3 elements

- Kerlink LoRa IOT Station
- LoRaMote (called node, or end-point)
- The iot.semtech.com Semtech server

Kerlink LoRa IoT Station waits for LoRa packets from LoRaMotes.

When a correct packet is received from a LoRaMote, the LoRa IoT Station forwards the packet to the iot.semtech.com server via Ethernet (by default) or GPRS (after configuration).

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## 2.1 Startup the LoRa IOT Station

Network infrastructure must provide an IP address to the LoRa IoT Station, and internet access.

- Plug the ethernet cable between POE injector (data in) and the ethernet switch (with access to external network).
- Plug the ethernet cable of the LoRa IoT Station to the POE injector (data & power out).

The demonstration software is automatically launched by the embedded Kerlink agent (30 seconds to boot). No user intervention is needed.

You can push the TEST button to display the leds state (inside the box) and check that STATION POW and MODEM POW leds are switched on.

Information concerning the LoRa IoT Station start-up are available in the documentation [http://wikikerlink.fr/lora-station/lib/exe/fetch.php?media=wiki:kerlink\\_install\\_long\\_range\\_iot\\_station\\_v0.3.pdf](http://wikikerlink.fr/lora-station/lib/exe/fetch.php?media=wiki:kerlink_install_long_range_iot_station_v0.3.pdf) that you can download from Kerlink wiki page <http://wikikerlink.fr/lora-station/doku.php?id=wiki:ressources>.

## 2.2 LoRaMotes start-up

Power the LoRa Mote on (battery or USB cable). Slide the power switch in the wanted position. On the PCB, 3 leds (green, orange, red) will flash one time together.

LoRaMotes transmit data randomly between 30 seconds and 1 minute. The red led blinks one time when a frame is sent.

LoRa Motes transmit their GPS position. Please, make sure the LoRaMotes are covered by the GPS signal to receive positioning data.

## 2.3 IoT server connection (monitoring)

From a PC connected to the internet and a web browser (tested with Mozilla Firefox and Google Chrome), reach the internet site <http://iot.semtech.com/demonstrator.php>.

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### 3. LoRaMote monitoring (server interface)

You can reach the IoT server at <http://iot.semtech.com/demonstrator.php>

#### 3.1 Find your LoRa Station (gateway)

In the menu, click on Gateways to display the list of connected gateways.

LoRa Home \ Demonstration \ Gateways

- ▶ Demonstration Home
- ▶ Nodes
- ▶ Gateways
- ▶ Recent Activity
- ▶ Packets by Node
- ▶ Packets by Gateway
- ▶ GPS Demonstration

## Gateways

Report correct as of: Tue, 24 Jun 2014 16:49:22 +0000 GMT

Address	Packets in Last Hour	Time of Last Packet	Time Since Last Packet
00:00:00:4b:03:00:22:33	1444	2014-06-24 16:49:18	00:00:04
00:00:02:4b:08:04:00:0d	66	2014-06-24 16:24:48	00:24:34
00:00:02:4b:08:04:00:3b	4	2014-06-24 16:48:59	00:00:23
00:00:02:4b:08:04:00:5e	1	2014-06-24 16:35:09	00:14:13

LoRa Station IOT (gateway) mac address

To watch the LoRa Packet transmitted to your Station, click on the MAC address.

LoRaMotes mac address

LoRa Station IOT (gateway) mac address

### Packets by Gateway (00:00:02:4b:08:05:00:ae)

Report correct as of: Tue, 15 Jul 2014 10:27:39 +0000 GMT

Sequence #	Time	Node	Chan	Freq (MHz)	BW (kHz)	ADR	SF	RSSI (dBm)	SNR (dB)	Port	Data
3513	2014-07-15 10:27:34	0f:69:ef:a5	LC3	868.5	125	off	SF12	-19	9.5	2	00 27 a1 09 efc 69 00 44 7c 2a fe de 91 ff ec
3512	2014-07-15 10:27:02	0f:69:ef:a5	LC2	868.3	125	off	SF12	-21	8.2	2	00 27 a1 09 efc 6d 00 44 7c 0b fe de 8f ff e7
3511	2014-07-15 10:26:28	0f:69:ef:a5	LC1	868.1	125	off	SF12	-20	10.5	2	00 27 a0 09 efc 6e 00 44 7b f4 fe de 91 ff e6

Data payload

The data payload is encoded following the C source code below:

<https://github.com/Lora-net/LoRaMac-node/blob/master/src/apps/LoRaMac/classA/LoRaMote/main.c#L343>

```

AppData[0] = AppLedStateOn;
AppData[1] = ( pressure >> 8 ) & 0xFF;
AppData[2] = pressure & 0xFF;
AppData[3] = ( temperature >> 8 ) & 0xFF;
AppData[4] = temperature & 0xFF;
AppData[5] = ( altitudeBar >> 8 ) & 0xFF;
AppData[6] = altitudeBar & 0xFF;
AppData[7] = batteryLevel;
AppData[8] = ( latitude >> 16 ) & 0xFF;
AppData[9] = ( latitude >> 8 ) & 0xFF;
AppData[10] = latitude & 0xFF;
AppData[11] = ( longitude >> 16 ) & 0xFF;
AppData[12] = ( longitude >> 8 ) & 0xFF;
AppData[13] = longitude & 0xFF;
AppData[14] = ( altitudeGps >> 8 ) & 0xFF;
AppData[15] = altitudeGps & 0xFF;

```

The payload is encrypted.

The encryption scheme used is based on the generic algorithm described in IEEE 802.15.4/2006 Annex B [IEEE802154] using AES with a key length of 128 bits.

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### 3.2 <GPS Demo>

lot.semtech.com server is used to display LoRaMotes and LoRa Stations on a GoogleMap map.

<http://iot.semtech.com/gpsdemo/>


#### 3.2.1 LoRaMotes positioning


Connected LoRaMotes are displayed in the tab <Nodes>

Click on the lora mote's MAC address (**green area**), the map will move to display the LoRa mote location (with an orange pin).



The gateway MAC address (connected to this LoRa Mote) is displayed.

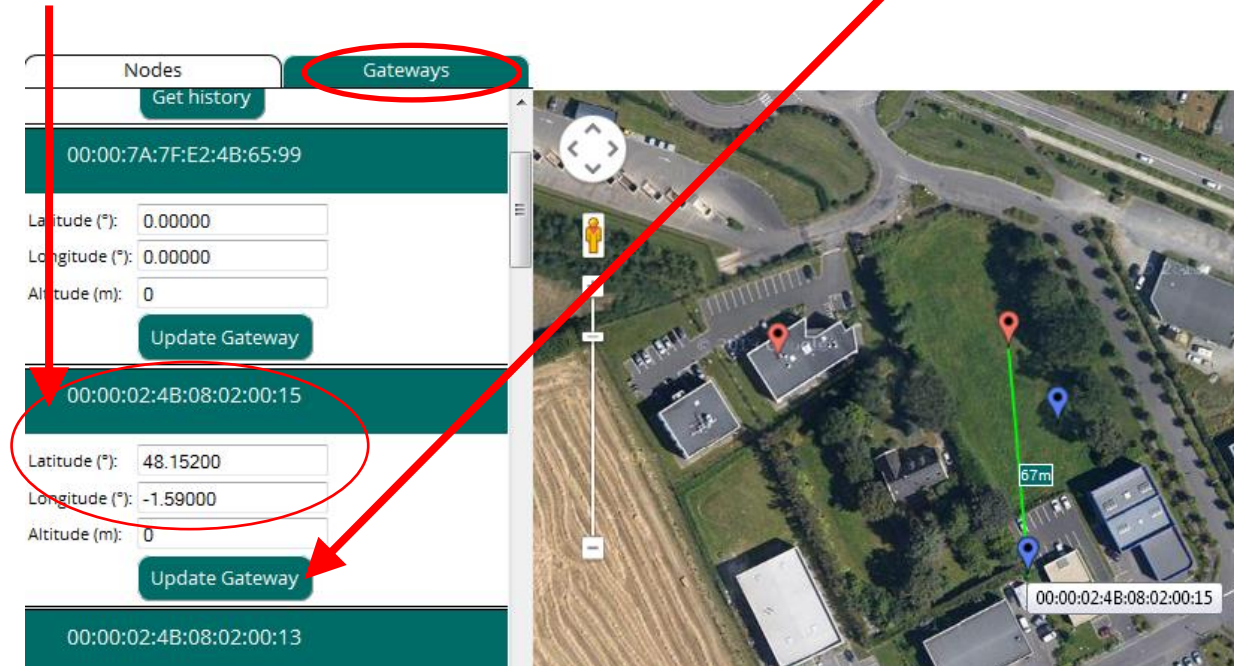
Click on the icon  to draw a green line between the Mote (orange pin) and it's gateway (blue pin).

Click on the icon  to draw the LoRaMote motions (blue line).

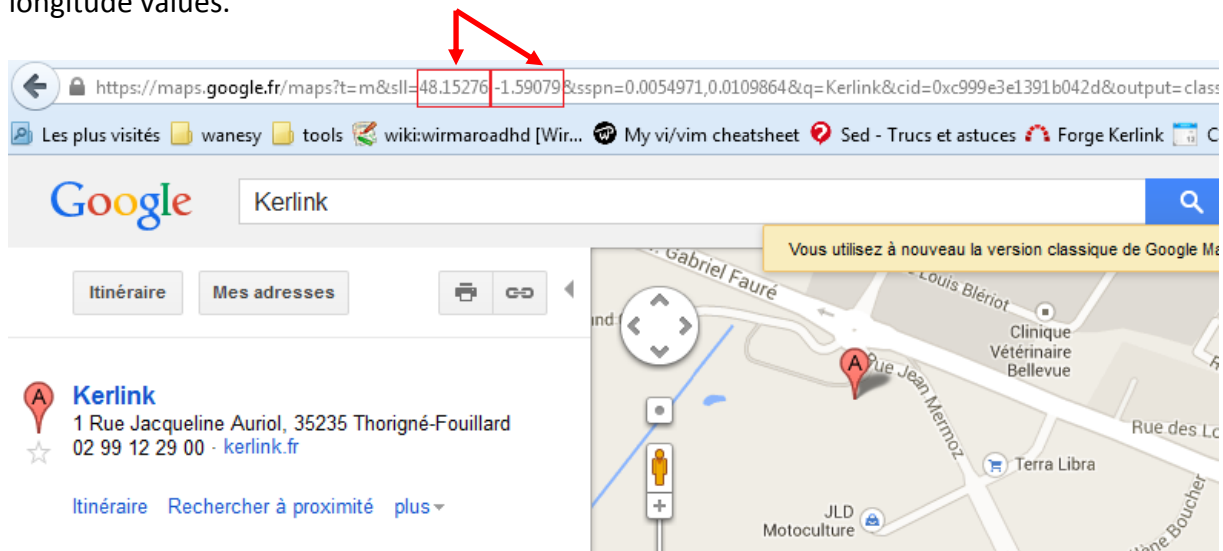
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### 3.2.2 gateway

It's possible to display the gateway position on the map. Enter the GPS position in the tab **<Gateways>**, click on **Update Gateway** to validate the position. Then click on the MAC address (green area), a blue pin will be displayed, showing the gateway position.



You can manually enter the gateway GPS position. You can use the googlemap latitude and longitude values.



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## 4. Embedded application: demo\_gps\_loramote (gateway)

Demonstration application demo\_gps\_loramote, running on the LoRa IoT Station, is based on Semtech demonstration code gps\_pkt\_fwd provided on the git repository:

[https://github.com/Lora-net/packet\\_forwarder/tree/master/gps\\_pkt\\_fwd](https://github.com/Lora-net/packet_forwarder/tree/master/gps_pkt_fwd)

### 4.1 Demonstration start-up

The directory is composed of the file manifest.xml (see [http://wikikerlink.fr/lora-station/doku.php?id=wiki:station&s\[\]=manifest#m2m\\_agent\\_application\\_management](http://wikikerlink.fr/lora-station/doku.php?id=wiki:station&s[]=manifest#m2m_agent_application_management)).

The application is automatically launched by the Kerlink embedded agent (knetd) at startup. No need to run it manually.

You can check with the « ps » command in a terminal (ssh connection or debug probe).

```
[root@Wirgrid_08020000 demo_loramote]# ps
  PID USER      VSZ STAT COMMAND
    1 root        2112 S   init [3]
...
...
1277 root        2548 S   /bin/sh /mnt/fsuser-1/demo_gps_loramote/gps-pkt-fwd.
1289 root       18784 S   ./gps_pkt_fwd
1310 root        2636 R   ps
[root@Wirgrid_08020000 demo_gps_loramote]#
```

### 4.2 Demonstration stop

To stop the demonstration application « demo\_gps\_loramote », modify the file /mnt/fsuser-1/demo\_gps\_loramote/manifest.xml :

```
<?xml version="1.0"?>
<manifest>
<app name="gps_pkt_fwd" appid="1" binary="gps-pkt-fwd.sh">
<start autostart="n" />
<stop kill="9" />
</app>
</manifest>
```

Reboot the Station, the application won't be launched by the Knet agent.

### 4.3 Delete the demonstration application

To delete the demonstration application demo\_gps\_loramote and relative files, delete the directory /mnt/fsuser-1/demo\_gps\_loramote/.

```
[root@Wirgrid_08020000 /root]# rm -r /mnt/fsuser-1/demo_gps_loramote
```

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## 5. LoraMote embedded code: LoRaMote/ClassA (node)

The source code of the binary running on the LoRaMotes is available on the Semtech git repository:

<https://github.com/Lora-net/LoRaMac-node/tree/master/src/apps/LoRaMac/classA/LoRaMote>

The LoRaMote sends pressure, temperature, battery level, GPS position.

**END OF FILE**

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