

868Mhz kerlink gateway setup

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1. Revisions

30/7/2014 : NS	Initial release	0.1
14/10/2014 : NS	Re-scoped the document to limit it to gateway setup. Added support for the KNET monitoring agent. Updated all links and screen captures	0.2
17/10/2014	Clarified the gateway 10 channels allocation	0.3
18/05/2015 : MC	Replaced LoRaMAC with LoRaWAN. Updated with latest release forwarder2_0.tar	0.4
23/06/2015	Added the AutoDHCP patch documentation	0.5
25/06/2015	New software update process: one step to automatically install autoDHCP patch and Packet Forwarder, from USB key.	0.6
13/08/2015	2 updates archives now available, with or without AutoDHCP patch.	0.7

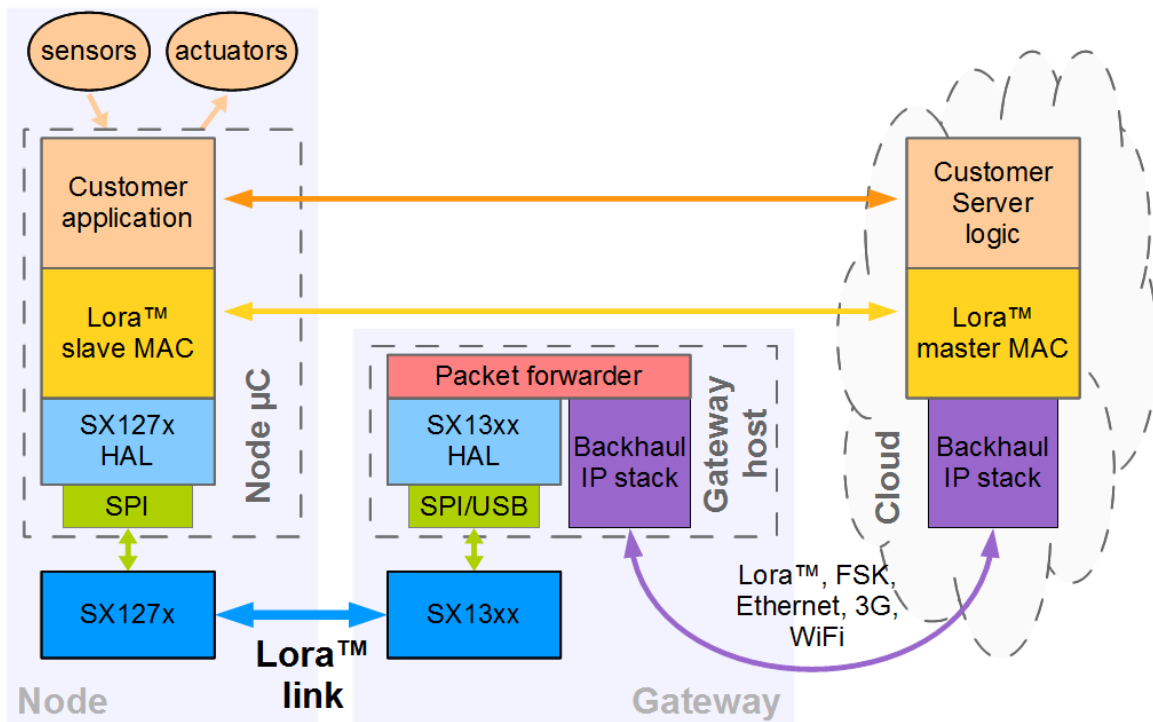
2. Introduction

This document describes the setup of a typical Kerlink 868Mhz gateway in a LoRaWAN network. You may install as many gateways as necessary. This document assumes you will be connecting the gateways to Semtech’s cloud hosted network demo server (iot.semtech.com)
 This document also assumes that the end-devices are compatible with the LoRaWAN protocol.

3. Network architecture

A LoRaWAN network is made of 3 main blocks:

1. Nodes or end-devices implementing the LoRaWAN protocol
2. Gateways essentially acting as bridges between the air radio interface and the IP network
3. A cloud based LoRaWAN master server



Each of the network gateways is listening to the same set of 10 channels. Those 10 channels are not all equivalent. Some are dedicated to Adaptive Data Rate communication with end-devices, 1 is dedicated to high speed LORA communication and a last one to high speed FSK (Frequency Shift Keying)

Gateway logical Channel	Usage
CH0 to CH7	Support Lora data rate from SF12 to SF7 with 125kHz bandwidth, used for Adaptive Data rate communications
CH8	Supports only SF7 / 250 or 500kHz bandwidth. Used for high speed transfer with end-devices
CH9	Supports only FSK modulation , used for high speed transfer with end-devices or between gateways

On each of the 8 first channels any of the 6 LORA data rates can be used at any time. When a LORA gateway receives a frame, it simply check the radio PHY layer CRC then forwards it to the network server through any IP link (Ethernet , cellular, ..). The gateway does not perform any of the LoRaWAN protocol tasks, but rather acts as a pure bridge between the air and the IP network.

Each uplink from an end-device may be received by several gateways and though multiple copies of the same uplink frame may reach the network server.

The server de-duplicates the received frames, performs the authentication, decrypts the payload and provides it to the customer. In the demo the payload is logged in an SQL database and accessible through a web page.

4. Required Software

a. Required PC software

You might need the following software installed on your computer

- PUTTY, an SSH client , this will be used to control the kerlink gateway :
<http://www.putty.org/>

b. Gateway software source code

The gateway software sources are provided **for information and documentation purposes only**. Compiling those sources requires a dedicated development environment which isn't part of the package and is outside the scope of this documentation. The software to run on the gateway is provided as a pre-compiled executable in the package.

The gateway radio driver sources can be found at:

https://github.com/Lora-net/lora_gateway/tree/master/libloragw

The gateway packet forwarder software sources are at:

https://github.com/Lora-net/packet_forwarder/tree/master/basic_pkt_fwd

The packet forwarder is a piece of software that forwards to a programmable IP address on the internet all the packets received by the LORA radio interface.

c. LoRaWAN server

The LoRaWAN server is the center of the LoRaWAN start network.

You do not need to install any code for the LoRaWAN server as it is running in the Semtech's cloud and is freely accessible by anybody. The server home page is at iot.semtech.com. Simply point your WEB browser to iot.semtech.com.

5. Lora 868Mhz “Kerlink” gateway setup

a. Presentation & hardware connection

The gateway can be purchased directly from Kerlink:

<http://www.kerlink.com/en/products/wirgrid/wirgrid-station>



The gateway is supplied and communicates through a standard 10/100T Ethernet cable. The PoE power injector is supplied with the gateway. The antenna must be connected through a low loss N type coaxial cable. We recommend a 3 to 8dBi vertically polarized antenna.

The gateway integrated RF filters are sufficient to reject all cellular out of bands interferers even from nearby base stations. The gateway can safely be installed out-door and is IP65 water proof.

The gateway power supply is provided through the Ethernet data cable. The gateway is supplied with an adequate PoE injector. Connect the “Data” port of the PoE injector to your Ethernet router, and connect the “Data + power” port to the gateway.



The gateway must have access to the internet through the Ethernet router else the packet will not be forwarded to Semtech’s network server.

Once this is done plug the PoE injector to the 220V main. The gateway boots up.



The gateway has an internal backup battery to maintain power during power outages. To reset the gateway **do not unplug it**, but use the “reset” button. Or enter “reboot” at the command prompt

b. Updating factory software

The following software components have to be installed on the gateway, on top of its factory default setup.

Both components mentioned below can be found on

[http://iot.semtech.com/resources/Kerlink IoT station page](http://iot.semtech.com/resources/Kerlink_IoT_station_page).

Download the `kerlink_IoT_LoRa_update.zip` or `kerlink_IoT_LoRa_update_DHCP.zip` archive and follow the instructions in the readme file. It is a simple “one-step” update process performed from a USB key.

The `kerlink_IoT_LoRa_update_DHCP.zip` contains the DHCP patch described below, and `kerlink_IoT_LoRa_update.zip` does not. Choose one or the other, as preferred.

- DHCP patch

In its factory default setup, the gateway boots, checks if a DHCP server is present on the Ethernet connection, and if not, defaults back to a fixed IP address. Usually the gateway boots faster than the router she is attached to. The outcome is that after a power interruption, the gateway can reboot faster than the Ethernet router, and will end-up with a fixed IP address because the DHCP server is not yet alive when the gateway checks for DHCP.

To solve this issue, a DHCP patch is applied. This patch will check for a DHCP server every 30sec.

- Packet Forwarder

The packet forwarder is the software which will allow the gateway to send the packets it receives from endpoints, to the remote server `iot.semtech.com`. And in return, it will also allow the gateway to send data from the server to the endpoints.

The gateway runs an agent (KNET) that monitors certain processes and restarts them automatically if they happen to crash. The KNET agent will also automatically start those processes when the gateway boots. We want the packet forwarder to be part of those processes.

This is done through “manifest.xml” configuration file which is part of the `forwarder_network_demo` directory installed by this update process.



You should have only one instance (the latest version) of the `forwarder_network_demo` directory in the `mnt/fuser-1` directory. Remove all previous instances. If a previous version with a `manifest.xml` file is present then the KNET agent will launch two concurrent instances of the packet forwarder (the old and the newer version) which will result in a nonfunctional gateway.

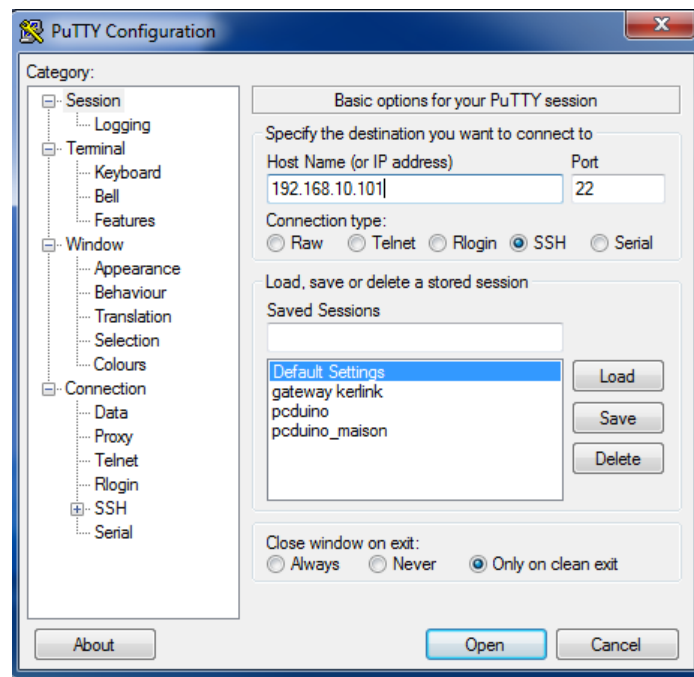
c. Logging on the Gateway

The gateway runs a DHCP service and will automatically get its IP address from any DHCP enabled router. The gateway must have access to the internet network to be able to route the received packets to the network server.

Open the router configuration page and search for the gateway allocated IP address. The gateway appears as Wirgrid_XXXXXXX in the DHCP lease list.

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
incasmm	192.168.10.247	00:21:cc:b6:24:bf	11h 59m 18s
Wirgrid_08040053	192.168.10.101	02:4b:08:04:00:53	11h 58m 9s

Start PuTTY on your PC and configure it for an SSH session with the gateway IP address and port 22 as in the following screen capture.



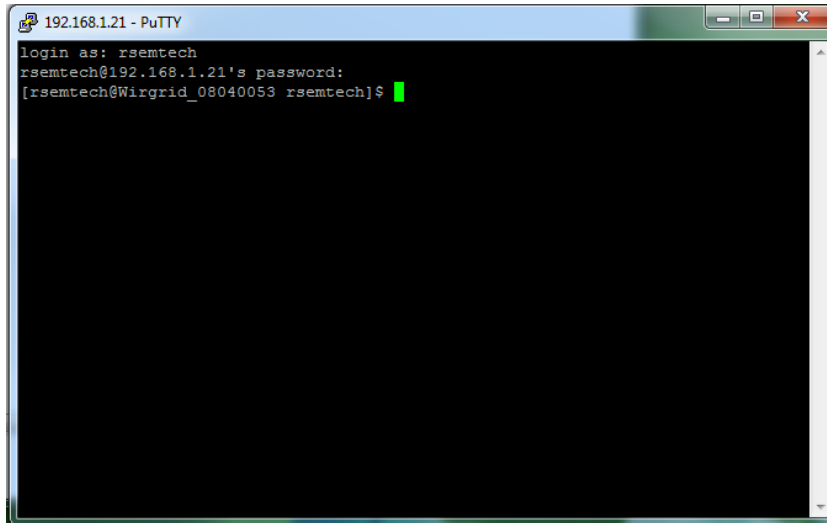
The terminal appears asking for login/password.

Login: rsemtech

Password: sem4tech

The terminal window should look like this:

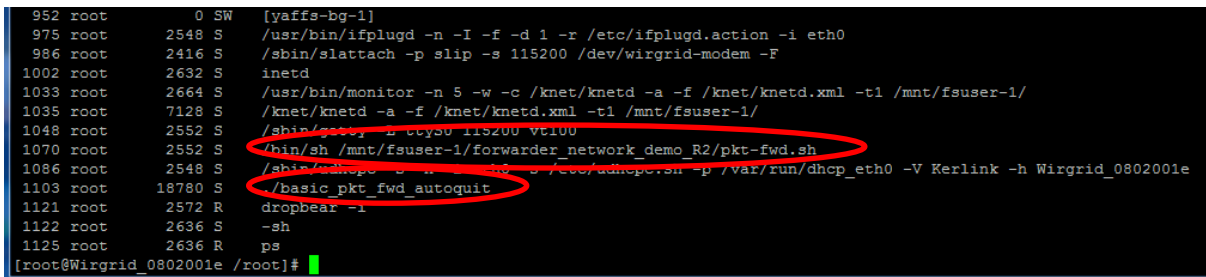
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d. Checking the packet forwarder

The packet forwarder is installed in /mnt/fsuser-1/forwarder_network_demo/ directory, and should already be running, as it is started automatically after the previous update process.

To verify this, you can type 'ps' after you have logged on the gateway with putty. This lists the process currently running on the gateway, you should see.



This means that the packet forwarder process has been launched by the KNET agent. The process will be automatically launched if it crashes or if the gateway loses network connectivity temporarily.

The TTY window can safely be closed. This will not stop the forwarder process. To stop the forwarder use the “./kill-pkt-fwd.sh” script provided.

To restart it use: ./restart-pkt-fwd.sh

Please note that the pkt-fwd.sh script will automatically update the gateway_ID field in local_conf.json file, based on the gateway MAC address, so that it is sure to use a unique gateway ID on the network.

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For example, if the gateway's MAC address is 02:4B:08:04:00:53, the gateway_ID in local_conf.json will be "xxxxxxxx08040053". The last 8 digits of the gateway_ID correspond to the last 8 digits of the MAC address.

Please, make sure the gateway can ping the iot.semtech.com server and if not, solve the connectivity issue.

```
[root@Wirgrid_08040053 forwarder_network_demo_R0]# ping iot.semtech.com
PING iot.semtech.com (80.83.53.26): 56 data bytes
64 bytes from 80.83.53.26: seq=0 ttl=44 time=618.691 ms
64 bytes from 80.83.53.26: seq=1 ttl=44 time=543.654 ms
64 bytes from 80.83.53.26: seq=2 ttl=44 time=212.551 ms
```

To check that the KNET agent has registered the packet forwarder correctly:

1. Stop the packet forwarder by running the `./kill-pkt-forwarder.sh` script
2. Reboot the gateway, type `reboot` in the terminal. The gateway goes down for reboot, the TTY terminal will lose connection.

After a minute, reopen a new TTY terminal and type `ps`. This lists the process currently running on the gateway, you should see.

All the basic pieces are now in place.

The gateway is now configured to forward all received packets to the iot.semtech.com network server with the default frequency channels. If you want to change the frequency channels please read the "Kerlink_gateway_channel_setup" document.

Proceed identically for all the gateways in your network.