

Deploying an End-to-End LoRaWAN Platform

Starting from September 2016, Saint-Joseph University of Beirut (USJ) will be deploying the first academic **LoRa** network in Lebanon. The network will support monitoring of micro-climate conditions in vineyards. Here below you can find a detailed description of the experimental platform implementing an end-to-end LoRaWAN solution.

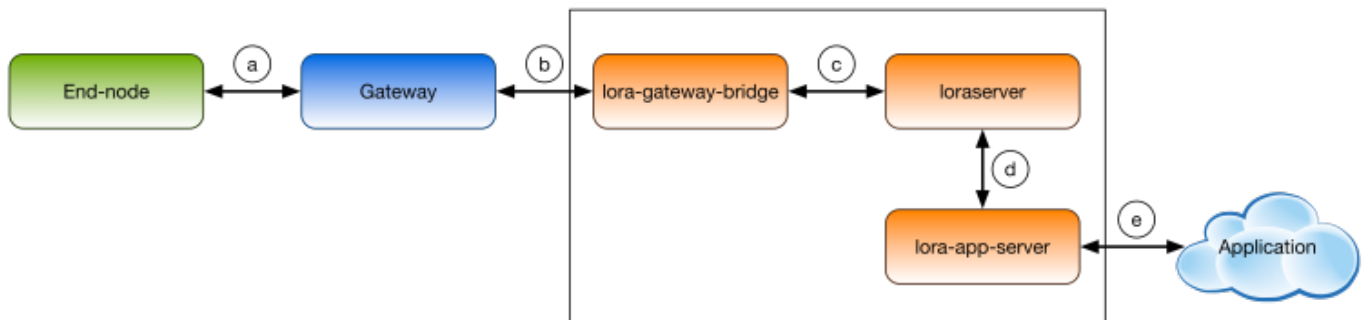


Figure 2. Architecture of the LoRaWAN Platform

- End-nodes

- Autonomo with LoRaBee

- Arduino with Dragino Shield

- Gateways

- Single Channel Gateway

The single channel gateway includes a LoRa transmission module (Dragino Shield) connected to a Raspberry Pi (2 or 3) as shown in Figure 1. Communication between the two modules is done over an SPI interface.

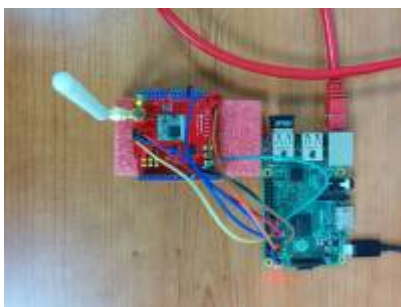


Figure 2. LoRa single channel gateway

In order to assemble the gateway, start by making the wire connections: the connection pins are identified in Figures 2 and 3.

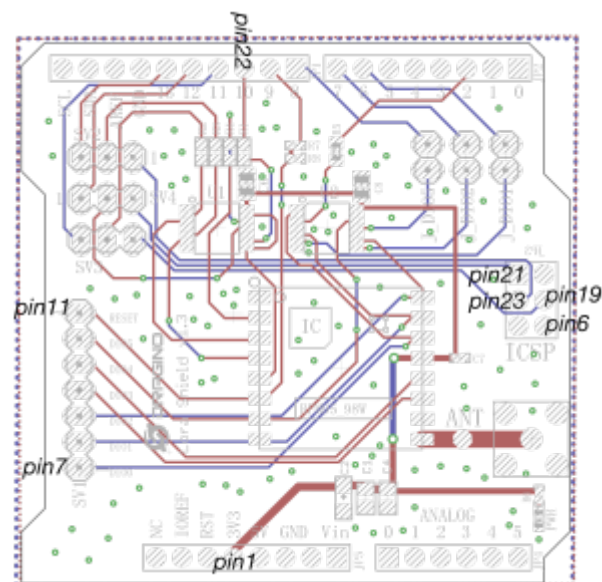


Figure 2. Dragino pin mapping

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1, I ² C)		DC Power 5v	04
05	GPIO03 (SCL1, I ² C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I ² C ID EEPROM)		(I ² C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40



Figure 3. Raspberry pi 3 pins

Connect the Raspberry Pi to the Internet and install the packet forwarding software. The source code of the single channel packet forwarder is available on:

https://github.com/samerlahoud/single_chan_pkt_fwd. In order to install it, you need to:

- Enable SPI on the Raspberry Pi using raspi-config
- Download and unzip the source code:

```
wget https://github.com/hallard/single_chan_pkt_fwd/archive/master.zip
unzip master.zip
```

- Install the wiring library:

```
apt-get update
apt-get install wiring
```

Now you can compile and run the packet forwarder as root.

```
make all
nohup ./single_chan_pkt_fwd &
```

```
{
  "SX127x_conf":
  {
    "freq": 868100000,
    "spread_factor": 7,
    "pin_nss": 6,
    "pin_dio0": 7,
    "pin_rst": 0,
    "pin_led1": 4
  },
  "gateway_conf":
  {
    "ref_latitude": 33.86576536772,
    "ref_longitude": 35.56378662935,
    "ref_altitude": 165,

    "name": "ESIB SC Gateway",
    "email": "cimti@usj.edu.lb",
    "desc": "Dragino Single Channel Gateway on RPI",

    "servers":
    [
      {
        "address": "router.eu.thethings.network",
        "port": 1700,
        "enabled": true
      },
      {
        "address": "212.98.137.194",
        "port": 1700,
        "enabled": true
      },
      {
        "address": "172.17.17.129",
        "port": 1700,
        "enabled": false
      }
    ]
  }
}
```

```
gcc version 4.6.3
unrecognized command line option '-std=c++11'
CFLAGS = -std=c++0x -c -Wall -I include/
```

-. Kerlink IoT Station

```
# activates eth0 at startup
ETHERNET=yes
# claims dhcp request on eth0
ETHDHCP=yes

# Selector operator APN
GPRSAPN=gprs.touch.com.lb
# Enter pin code if activated
GPRSPIN=0000
# Update /etc/resolv.conf to get dns facilities
GPRSDNS=yes
# PAP authentication
GPRSUSER=
GPRSPASSWORD=

# Bearers priority order
#BEARERS_PRIORITY="eth0,ppp0,eth1"
BEARERS_PRIORITY="ppp0,eth0,eth1"
```

```
./gps-pkt-fwd.sh > /dev/null &
```

```
3270 root      2548 S    /bin/sh ./gps-pkt-fwd.sh
3288 root      34908 S   ./gps_pkt_fwd
```

```
/etc/init.d/gprs start
```

```
[root@Wirgrid_0b03008c demo_gps_loramote]# /etc/init.d/gprs status
pppd (pid 5273) is running...
Session: Rx=58, Tx=163
Globals: Rx=1130457, Tx=1195592
Sum:      Rx=1130515, Tx=1195755
[root@Wirgrid_0b03008c demo_gps_loramote]#
```

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