

# 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.

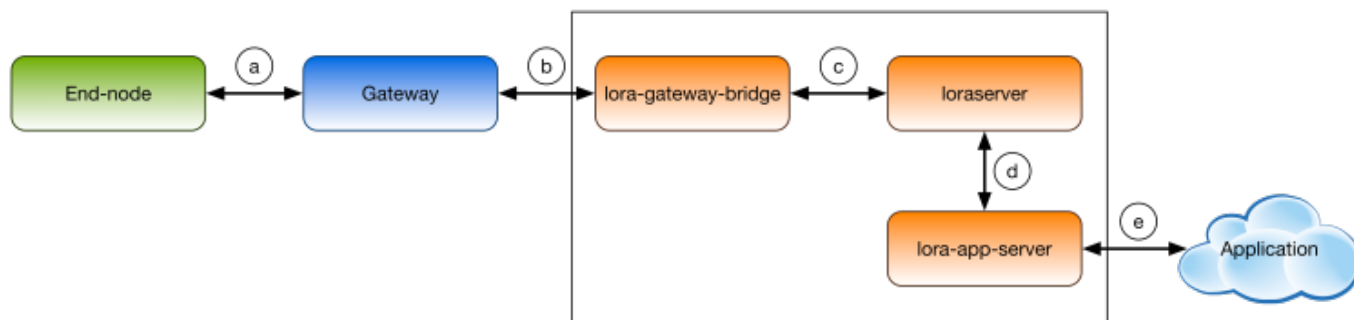


Figure 2. Architecture of the LoRaWAN Platform

## - 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). Communication is done over an SPI interface.

Start by making the connection between the modules: the connection pins are identified in Figures 2 and 3.

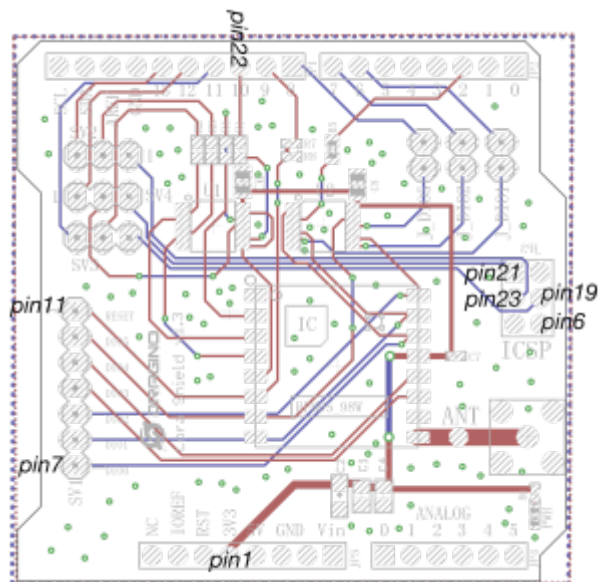


Figure 2. Dragino pin mapping

| Pin# | NAME                               |   | NAME                               | Pin# |
|------|------------------------------------|---|------------------------------------|------|
| 01   | 3.3v DC Power                      | ■ | DC Power 5v                        | 02   |
| 03   | GPIO02 (SDA1, I <sup>2</sup> C)    | ● | DC Power 5v                        | 04   |
| 05   | GPIO03 (SCL1, I <sup>2</sup> 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 <sup>2</sup> C ID EEPROM) | ● | (I <sup>2</sup> 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

Now you can 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](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
```

- Compile and run the packet forwarder as root.

```
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"
```

## -. Backend

### -. Loraserver

### -. The Things Network

## -. Applications

### -. MQTT spy

### -. Emoncms

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