Environmental Station Monitoring System

Made with ThingsBoard, RIOT OS and LoRaWAN

Main idea

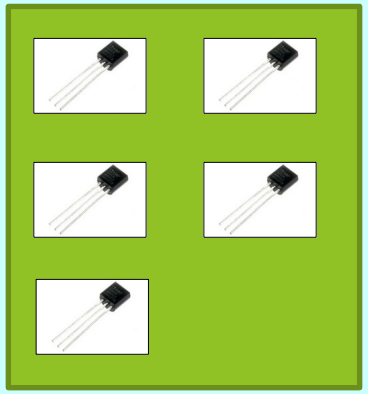
- We want to monitor 2 environmental stations, each with 5 sensors:
  - Temperaure (- 50 … 50 °C)
  - Humidity (0 … 100 %)
  - Wind Direction (0 … 360 Degrees)
  - Wind Intensity (0 … 100 m/s)
  - Rain Height (0 … 50 mm/h)

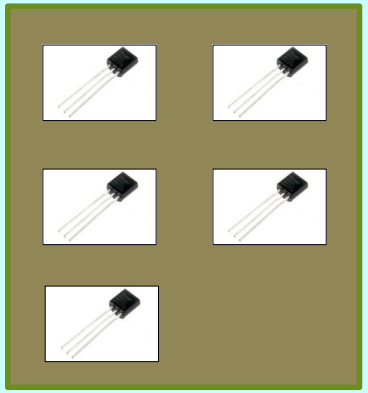
- We use the LoRaWAN network to provide communication between the stations and our application.

  To do this we'll need a LoRaWAN network server and a bridge to forward data to the dashboard where we'll visualize it.

Architecture

Environmental Station 1





Environmental Station 2

IoT-Lab testbed

LoRaWAN

THE THINGS NETWORK

MQTT Channel

Python Bridge

MQTT Channel

ThingsBoard IoT Platform

ThingsBoard Dashboard

Implementation

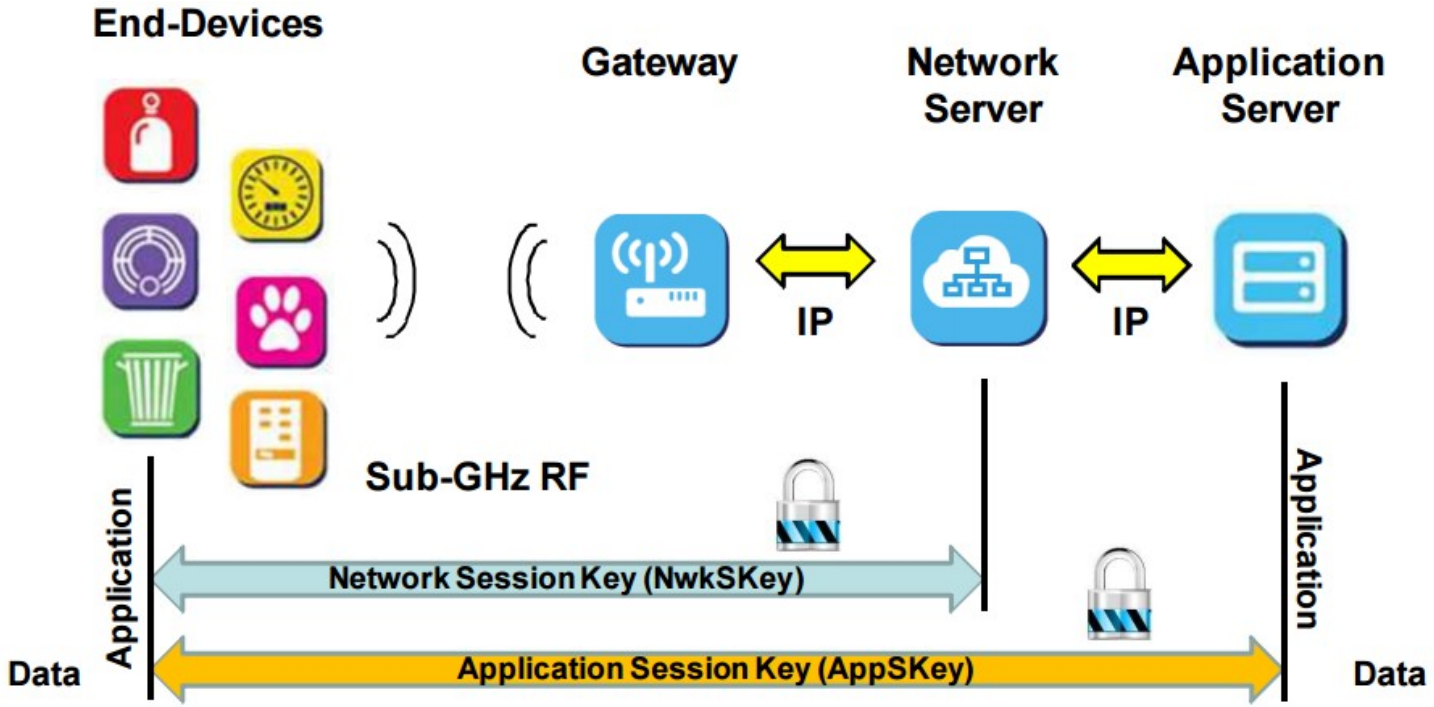
- The sensors and environmental stations are simulated by a simple program done with RIOT OS. This is deployed on two ST B-L072Z-LRWAN1 IoT-Lab nodes, one for each station.

- The data is sent through the LoRaWAN network to The Things Network server. A Python bridge is subscribed to it: the bridge receives data representing the sensors' values, it puts the data in the appropriate format and then it forwards it to ThingsBoard. All of this is done through MQTT messages.

- ThingsBoard IoT platform collects data through the MQTT channel (MQTT broker integrated in the platform) and shows it on its dashboard, which is public so that anyone could check it out.

Technology: LoRaWAN

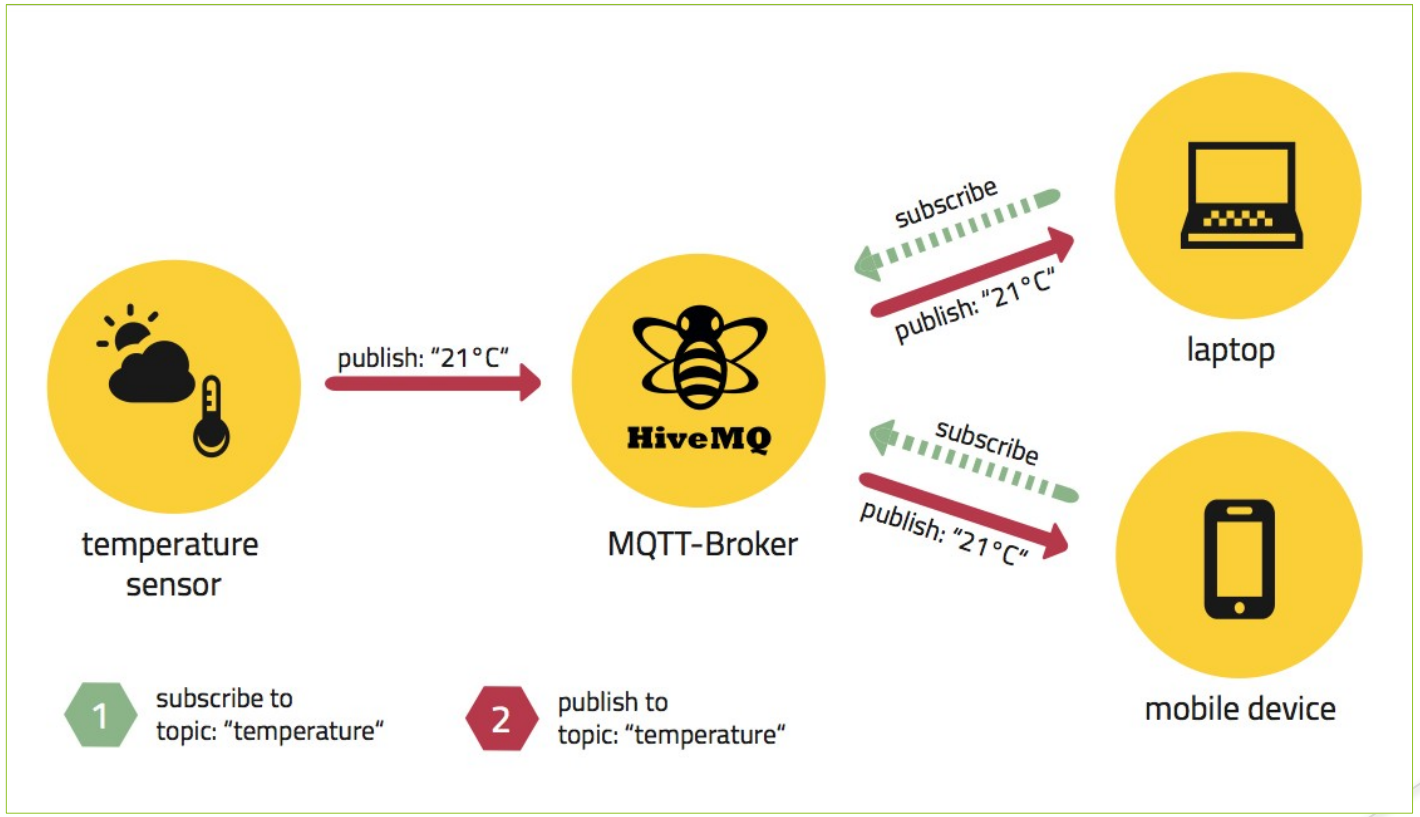
- LoRaWAN is a Low Power Wide Area Network protocol. It was designed to connect ‘things’ in regional or global networks. It’s focus is on:
  - saving battery;
  - bi-directional communication;
  - security;
  - mobility and localization.
- The architecture is the following:



Technology: MQTT Protocol

- MQTT is a machine-to-machine connectivity protocol, designed to be lightweight and work well even in situations where little resources are provided. Because of this, it's ideal for sensor communication.

- It's based on the publish subscriber paradigm



Technology: RIOT OS

- RIOT OS is an open source operating system designed for the Internet of Things. Supports most low power devices and microcontroller architectures (32-bit, 16-bit and 8-bit).

- It's programmable in C and C++, uses wide spread tools such as gcc and valgrind, and it's compliant with POSIX.

- It supports most IoT standards and it's resource friendly. When a program it's executed usually there are two threads running: the main thread that executes the task, and the idle thread which runs when the main thread stops. The idle thread puts the device in a "sleep mode" to save energy and resources.

Technology: FIT IoT-Lab

- FIT IoT-Lab is an open testbed: it provides a very large scale infostructure to test your application on a real environment.

- It offers a lot of different devices, either fixed or mobile, where you can deploy your code.

- It's part of the FIT experimental platform, a structure for academic and industrial users to do research and experiment.

Technology: The Things Network

- The Things Network is an open source LoRaWAN network server. It is a contributor member of the LoRa Alliance.

- It provides robust end-to-end encryption and global coverage

Technology: ThingsBoard

- ThingsBoard is an open-source IoT platform to collect, process, visualize data and manage devices.
- Enables connectivity through standard IoT protocols like CoAP, HTTP, MQTT and supports cloud deployment.
- The pillars of this platform are scalability, fault-tolerance and performance.

References

- RIOT OS: http://riot-os.org/
- FIT IoT-Lab: https://www.iot-lab.info/
- The Things Network: https://www.thethingsnetwork.org/
- ThingsBoard: https://thingsboard.io

Thank you for you attention!