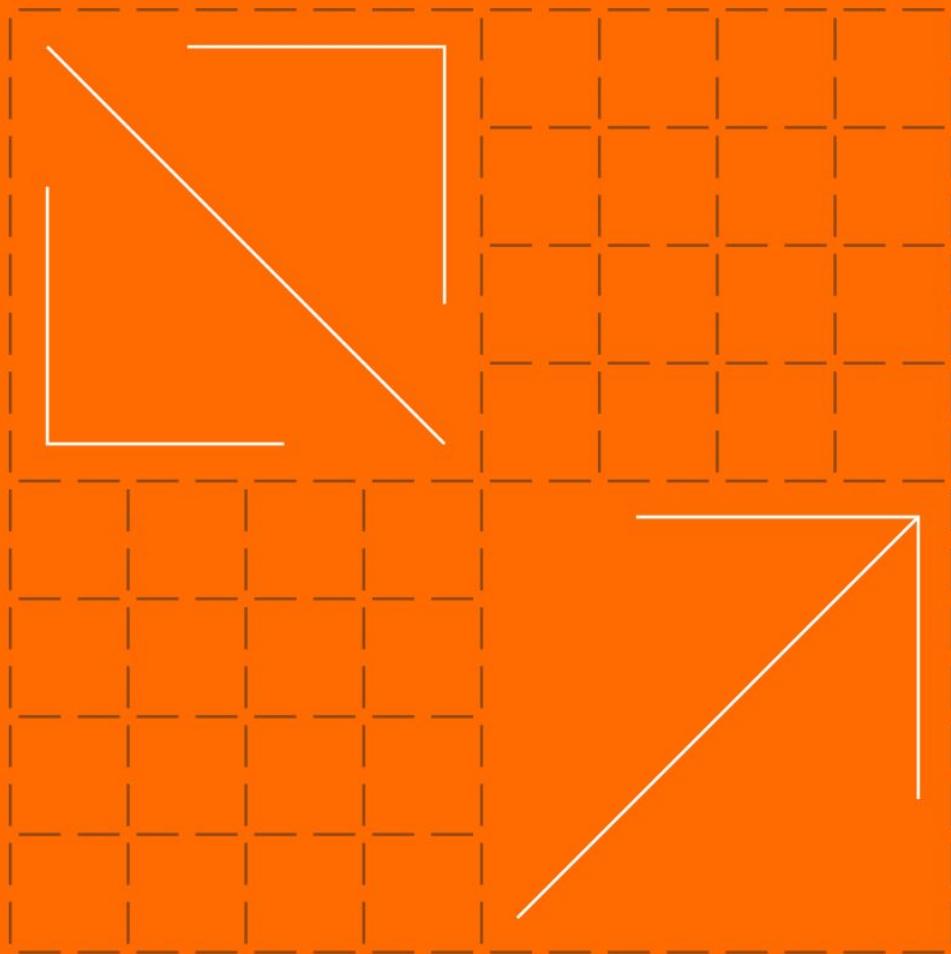


Learn what is LoRa, LoRaWAN and build your first LoRaWAN gateway, the easy way™

Marc Pous - Developer Advocate at balena.io

8th November 2022

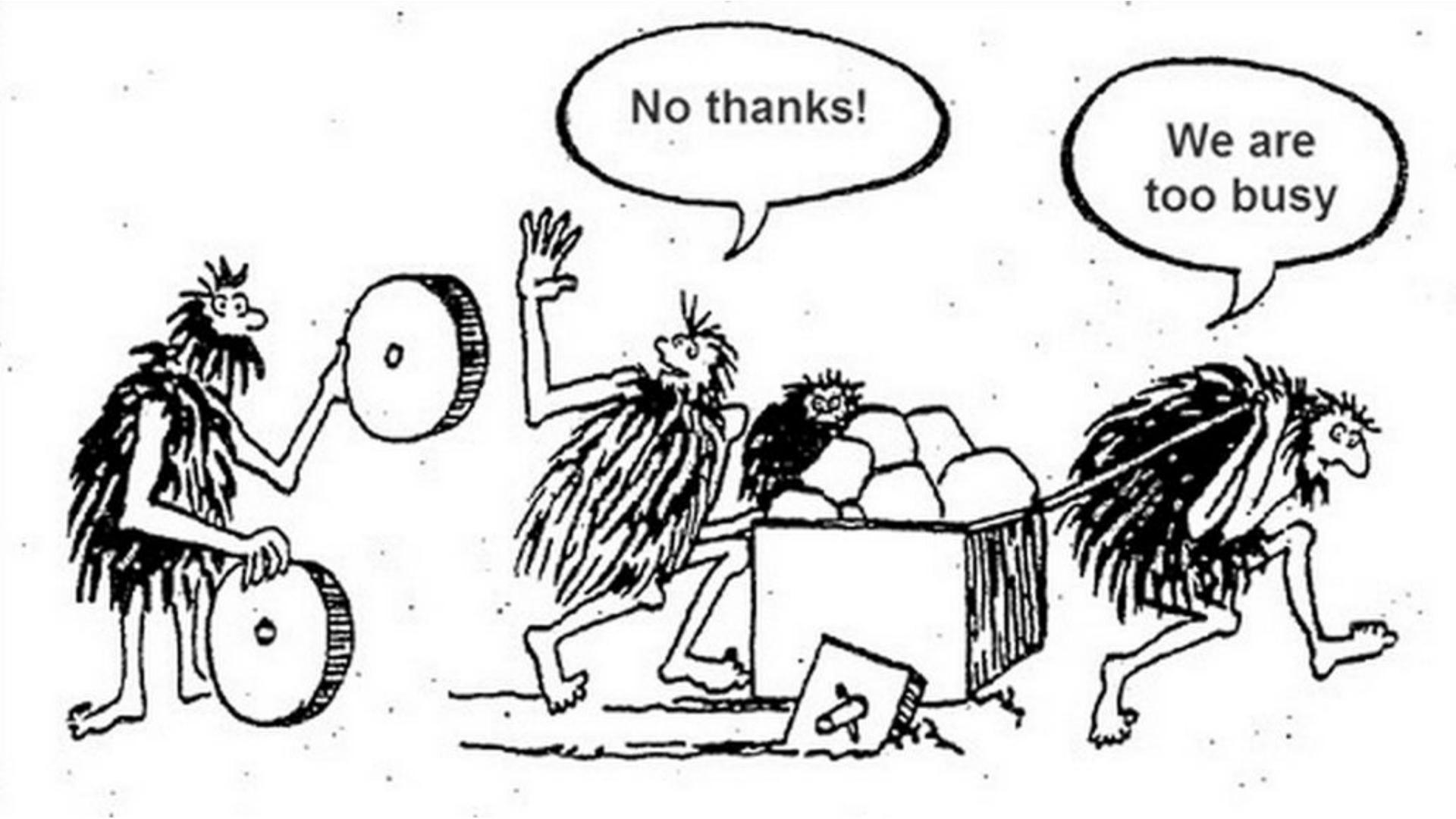




Marc Pous

Developer Advocate @ **balena.io**
Initiator **IoT Barcelona** and **IoT Stars**

e: marc@balena.io
t: @gy4nt



No thanks!

We are
too busy

Canada

END

UNITED
STATES

Mexico

Cuba

LPWAN

Low Power Wide Area Networks



seeed studio



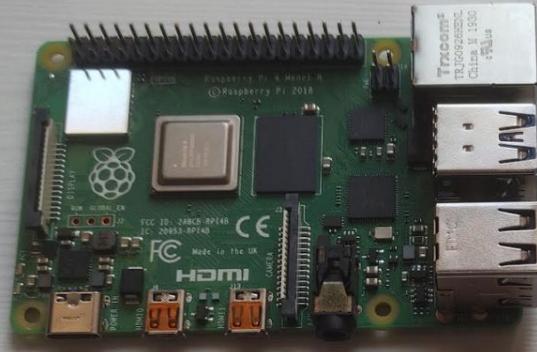
S2101



S2104

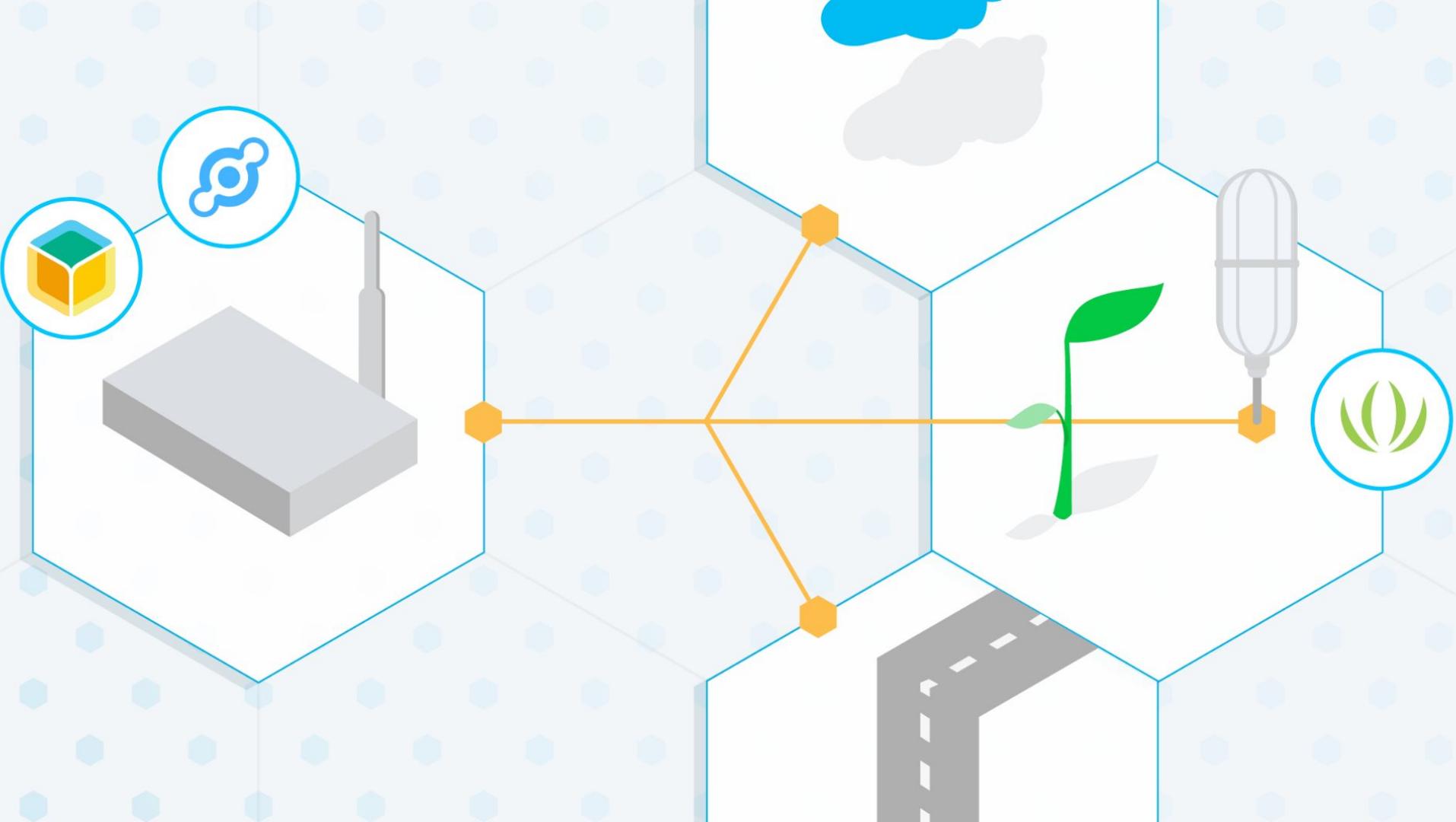
<https://www.seeedstudio.com/SenseCAP-S2101-LoRaWAN-Air-Temperature-and-Humidity-Sensor-p-5354.html>

<https://www.seeedstudio.com/SenseCAP-S2104-LoRaWAN-Soil-Temperature-and-Moisture-Sensor-p-5357.html>

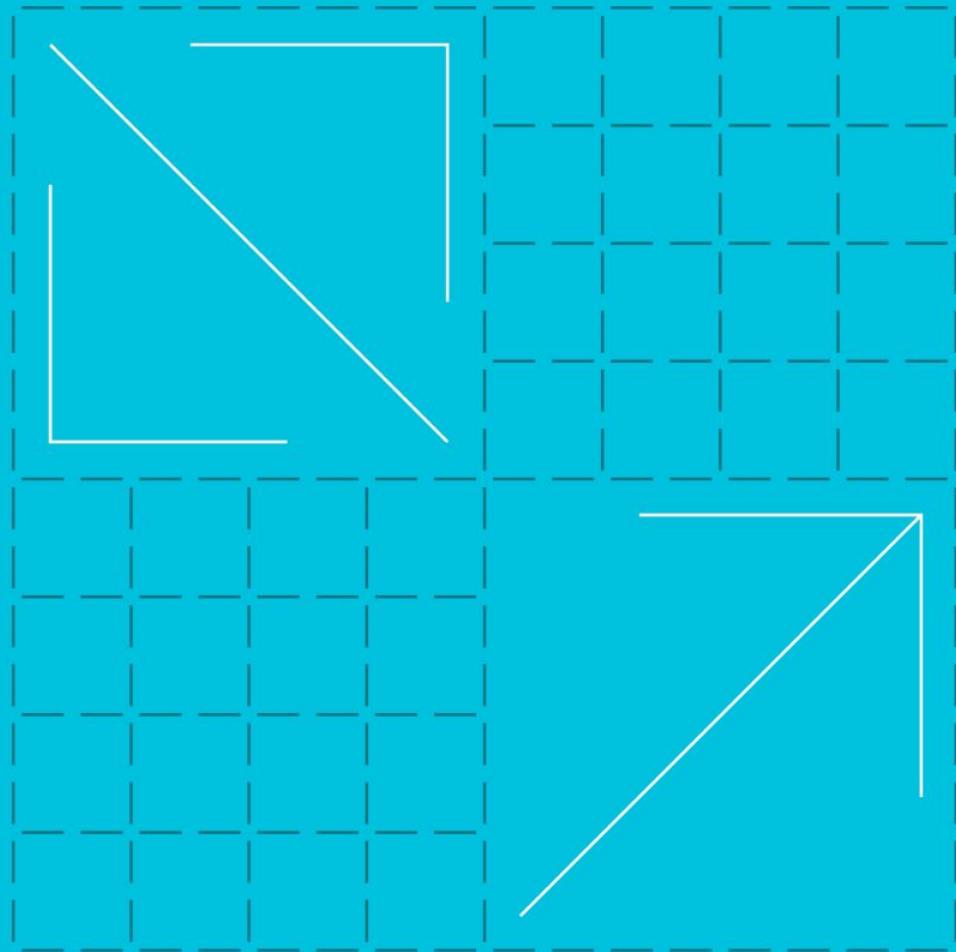




BYOH



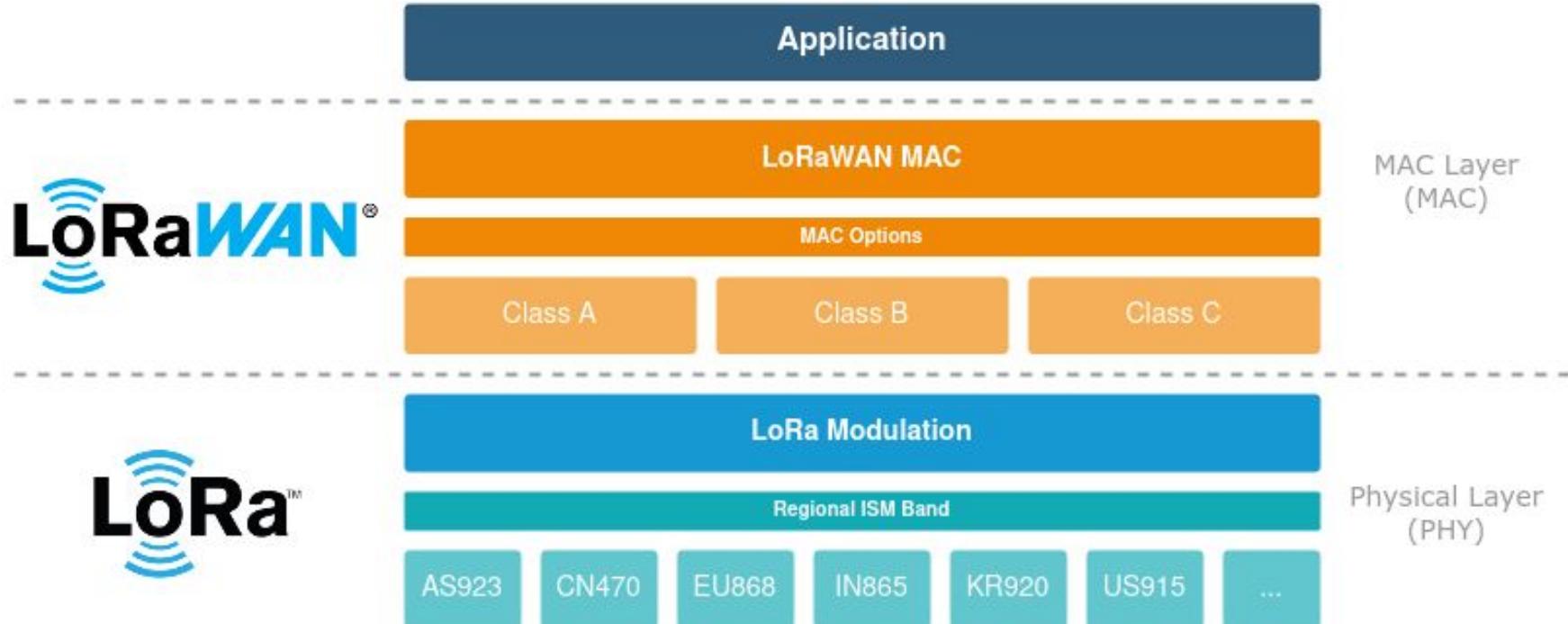
LoRa and LoRaWAN?

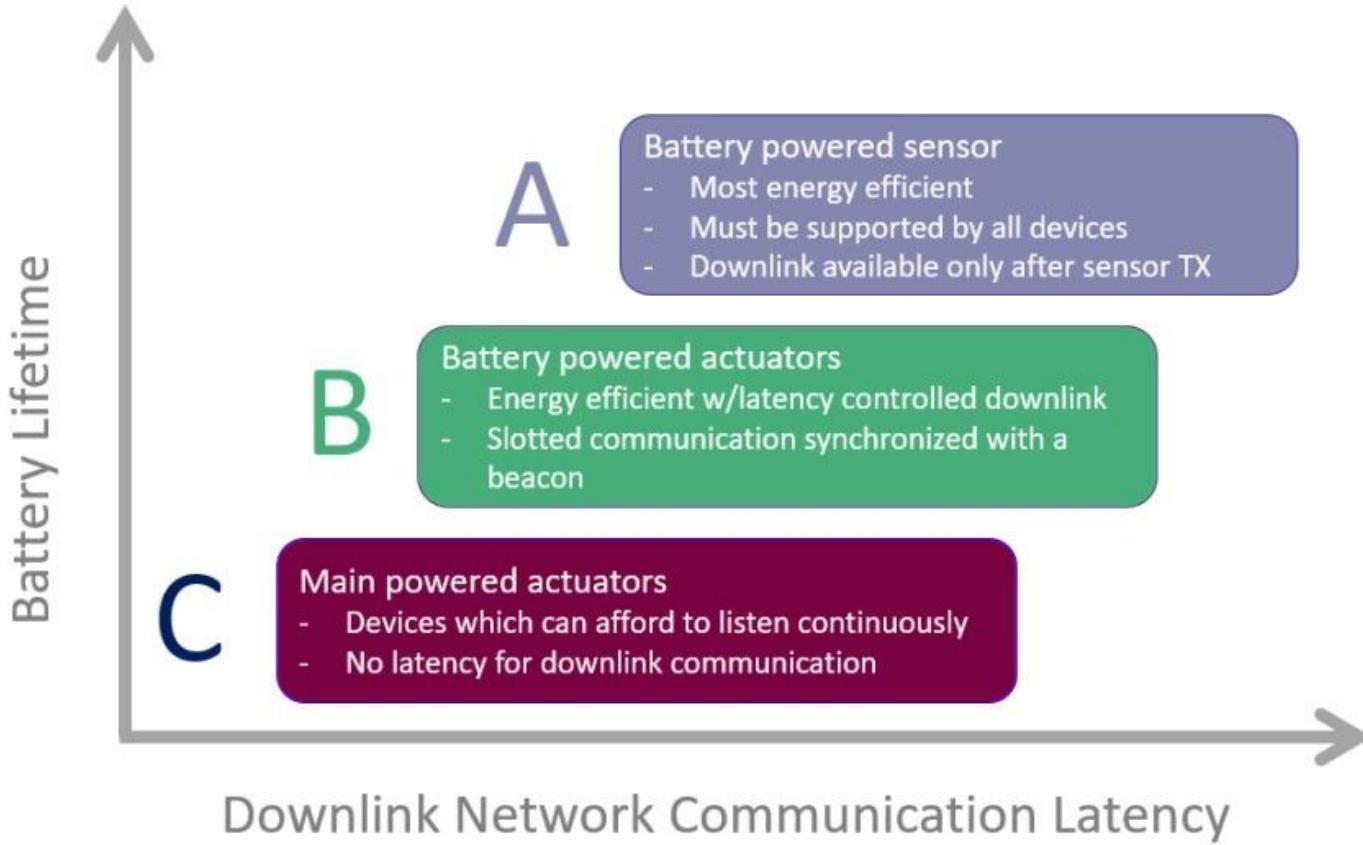


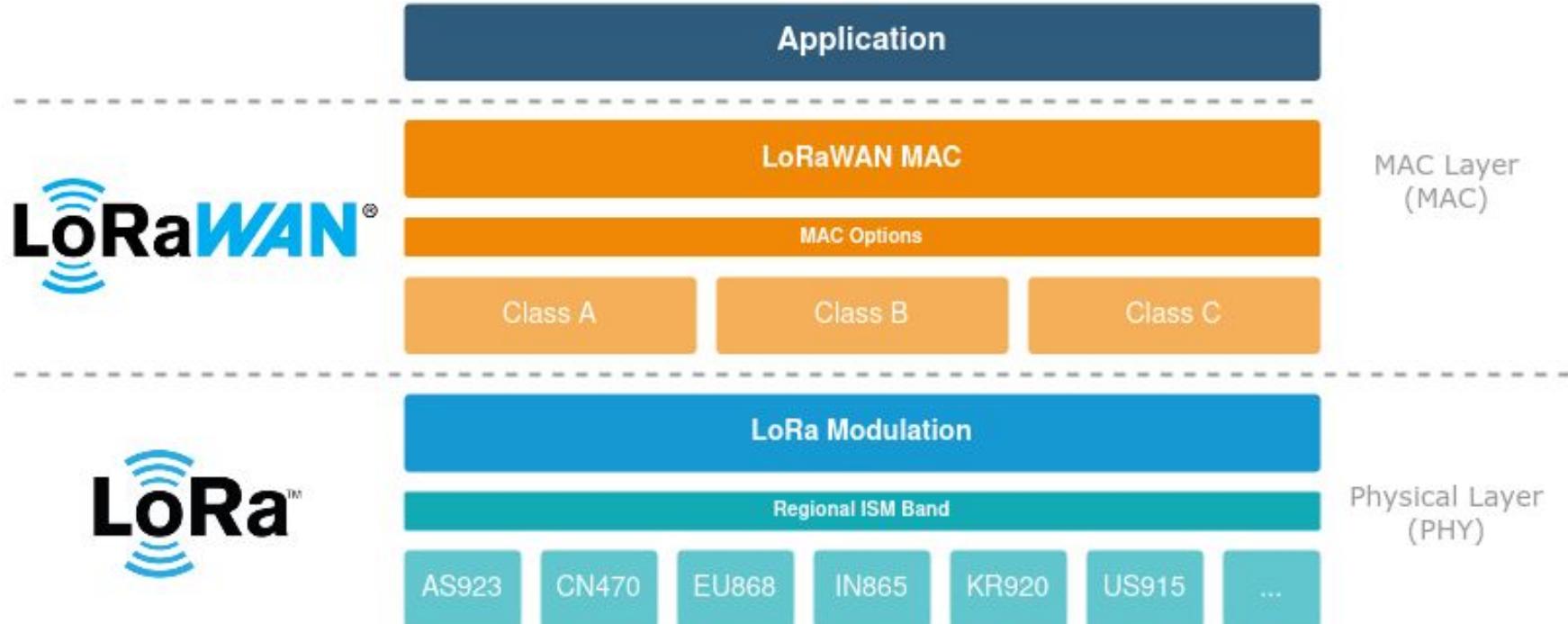
LoRa is a radio modulation meant for Long Range communication using very little power.

LoRa is a radio modulation meant for Long Range communication using very little power.

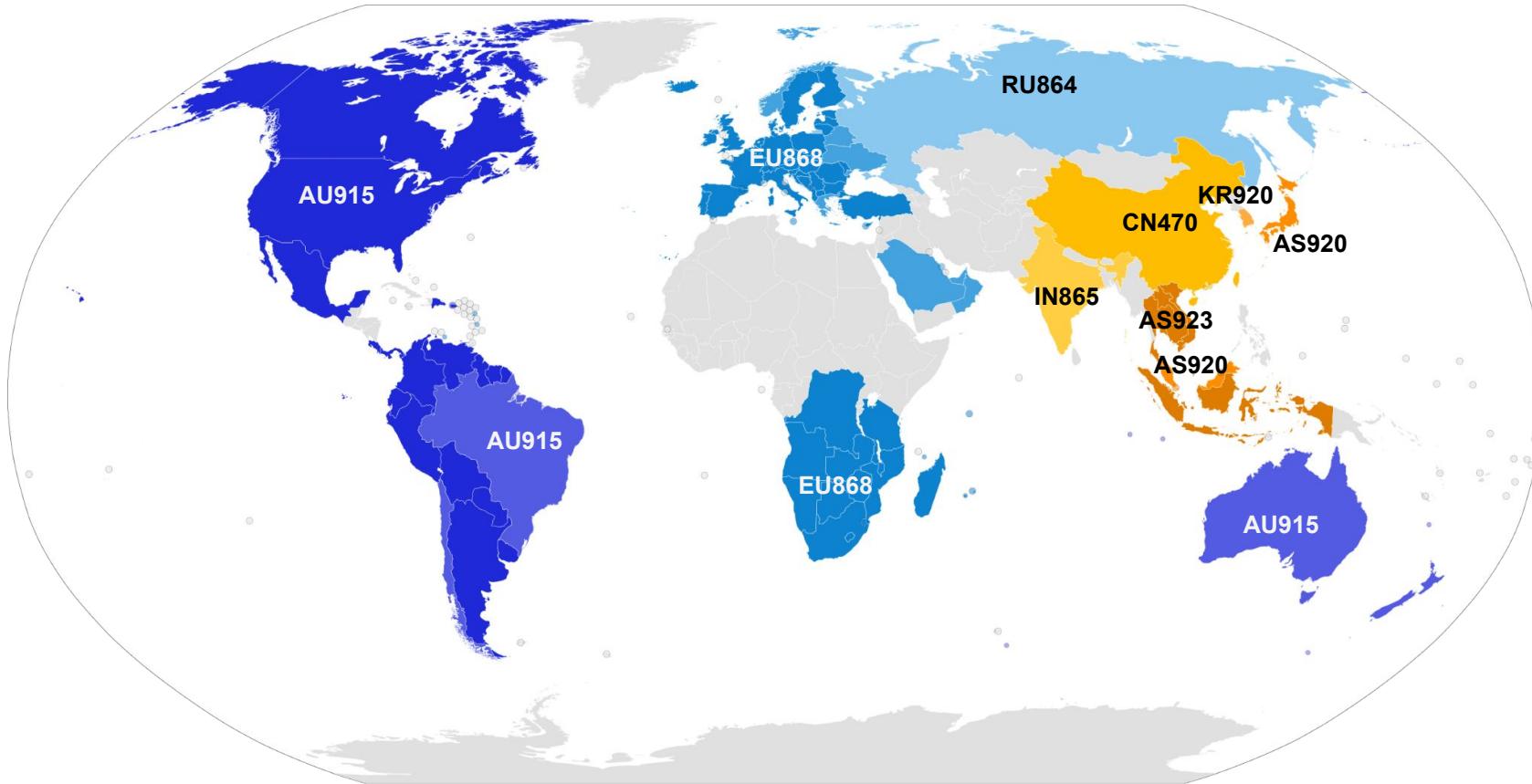
LoRaWAN is a Media Access Layer (MAC) protocol. A **software layer** that defines how devices use LoRa to transmit and receive messages on a network.



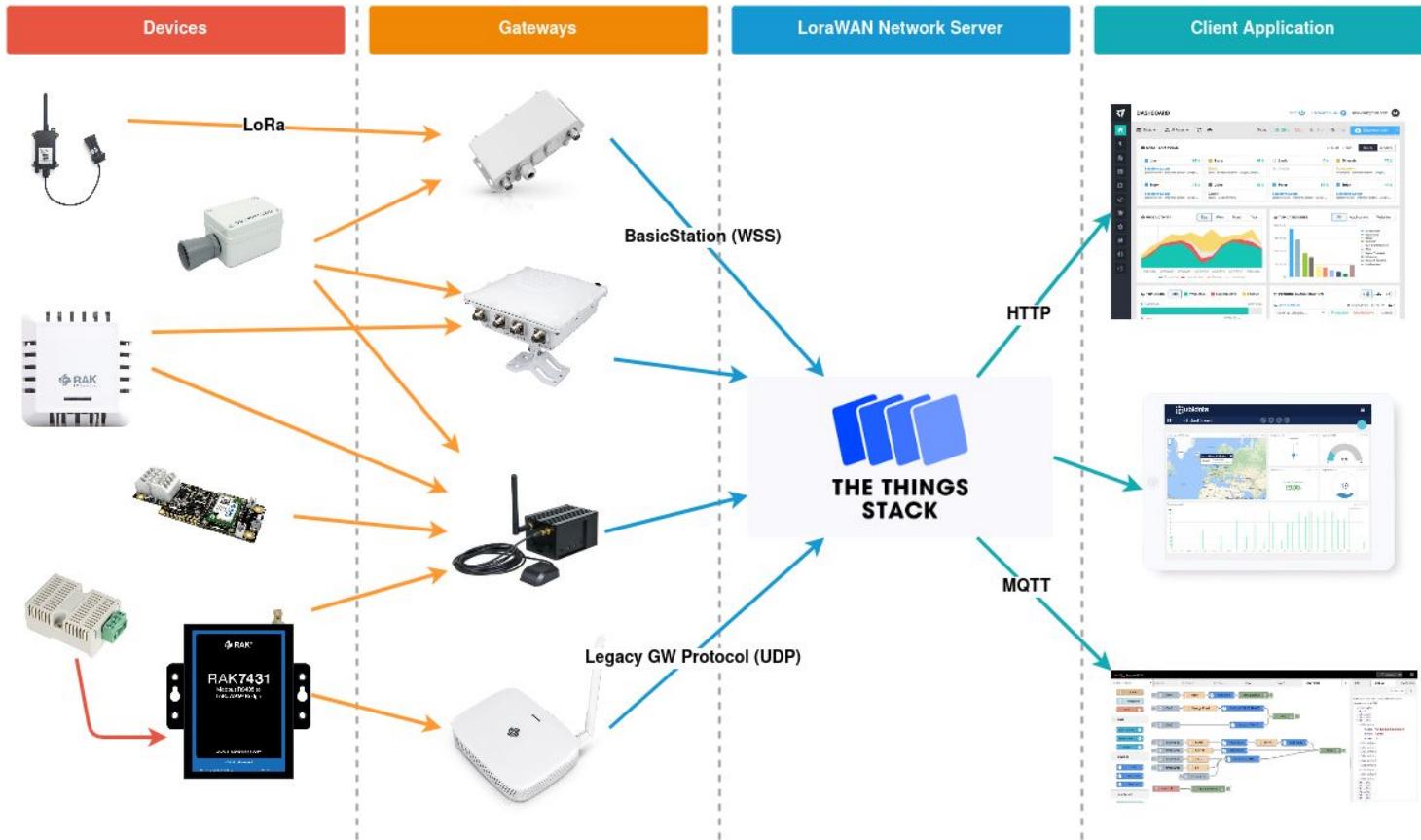




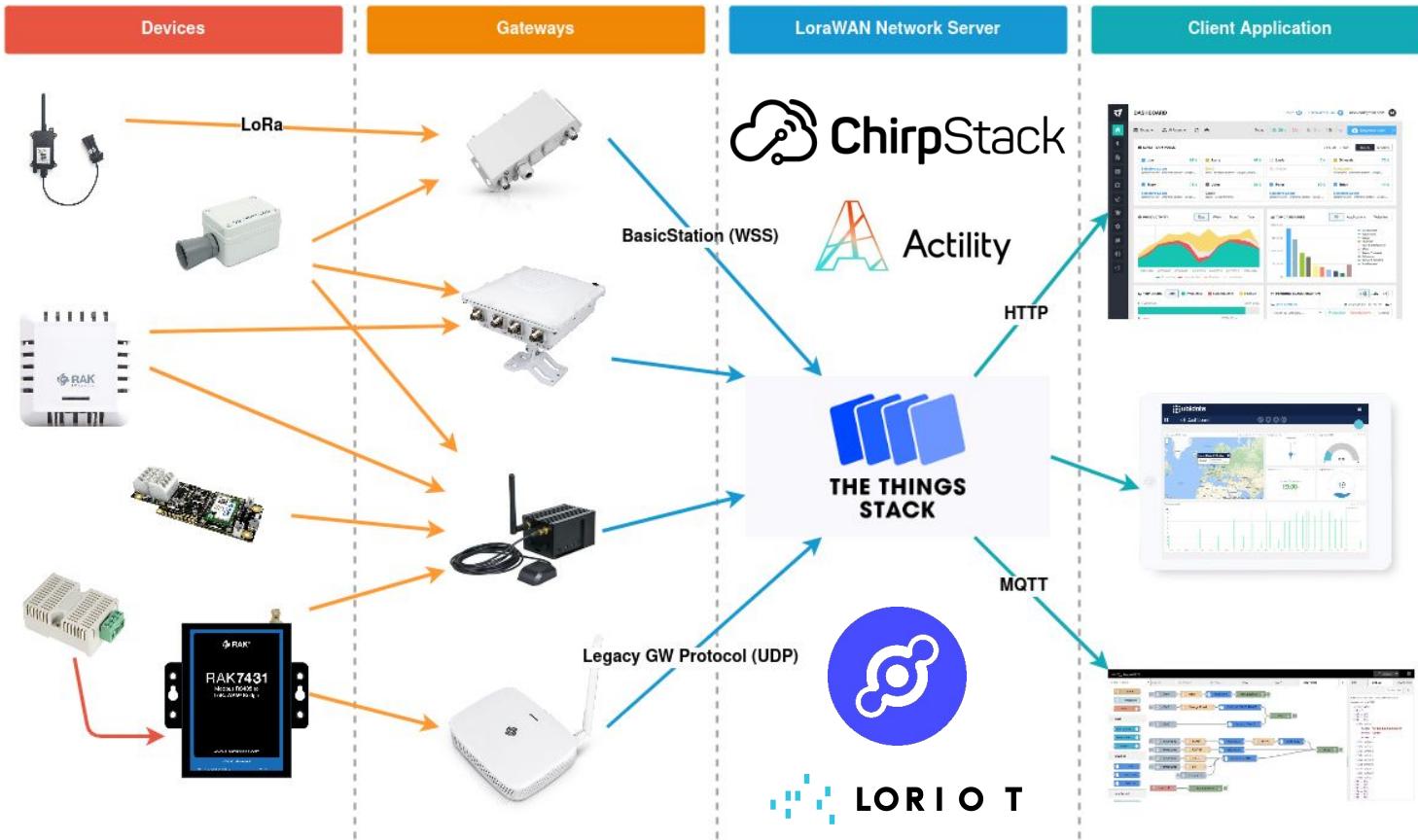
Regional frequencies



LoRaWAN Network Architecture



LoRaWAN Network Architecture



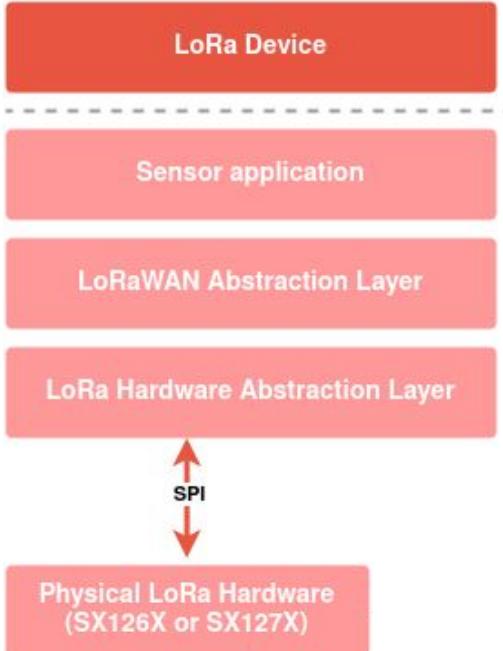
Low-power transmission = Long autonomy (in years)

Long Range (wide area) = Low-cost network (with low-cost subscriptions)

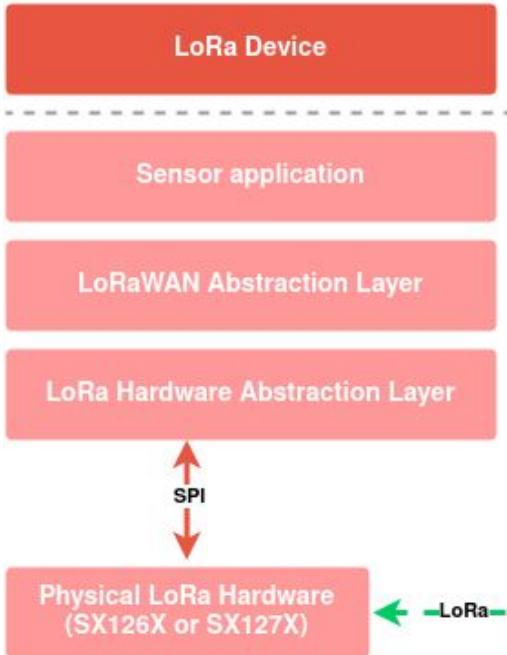
LPWAN have a common architecture

- The devices messages are captured by multiple antennas around.
- The antennas forward the messages to a network server owned by the network operator (private or public)
- Then the network server transfers the payload to the custom backend, eventually, roam it to another network server.

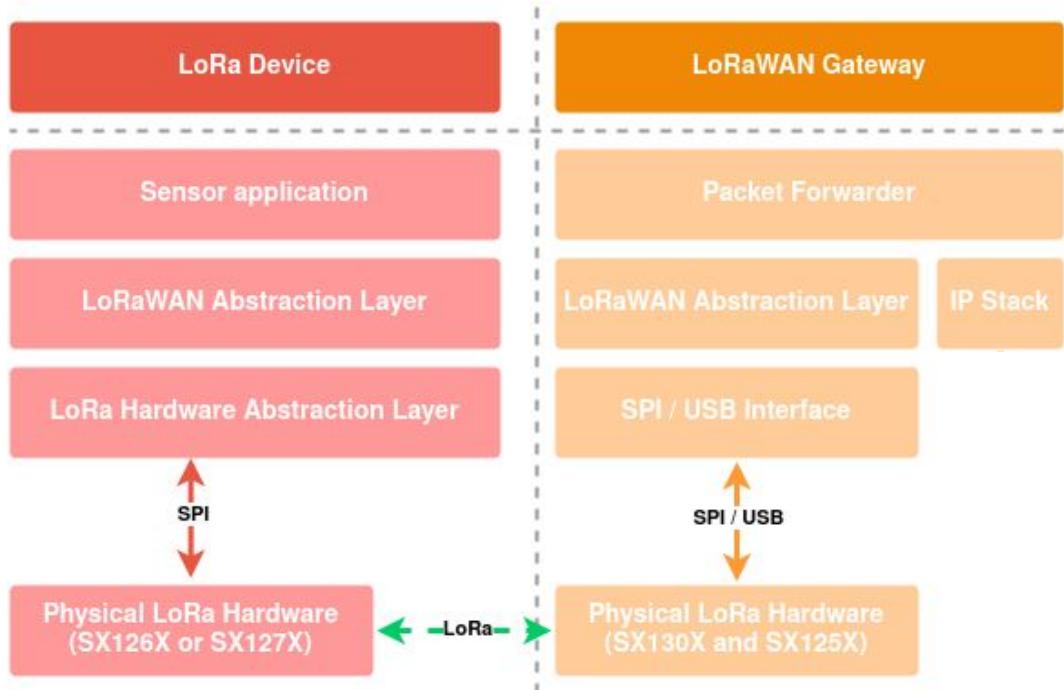
LoRaWAN Network Architecture



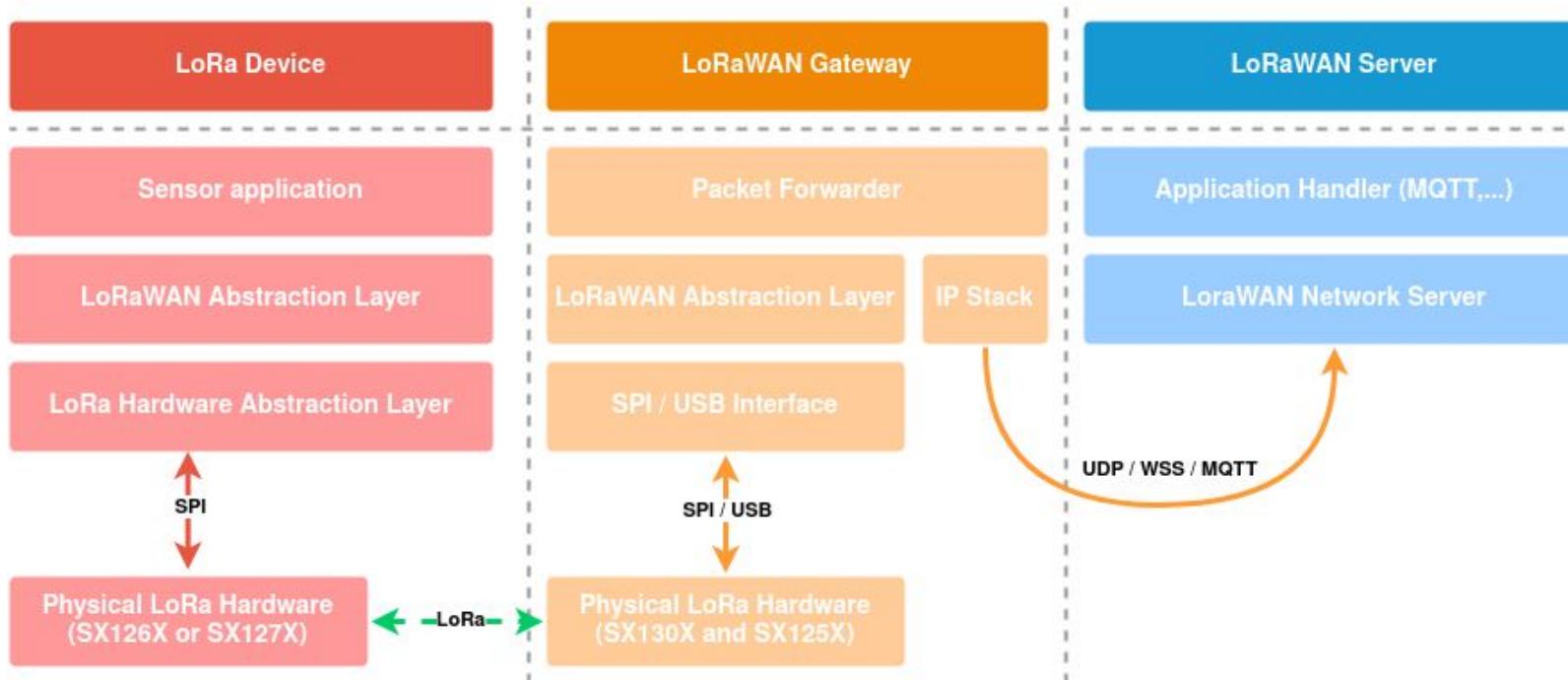
LoRaWAN Network Architecture



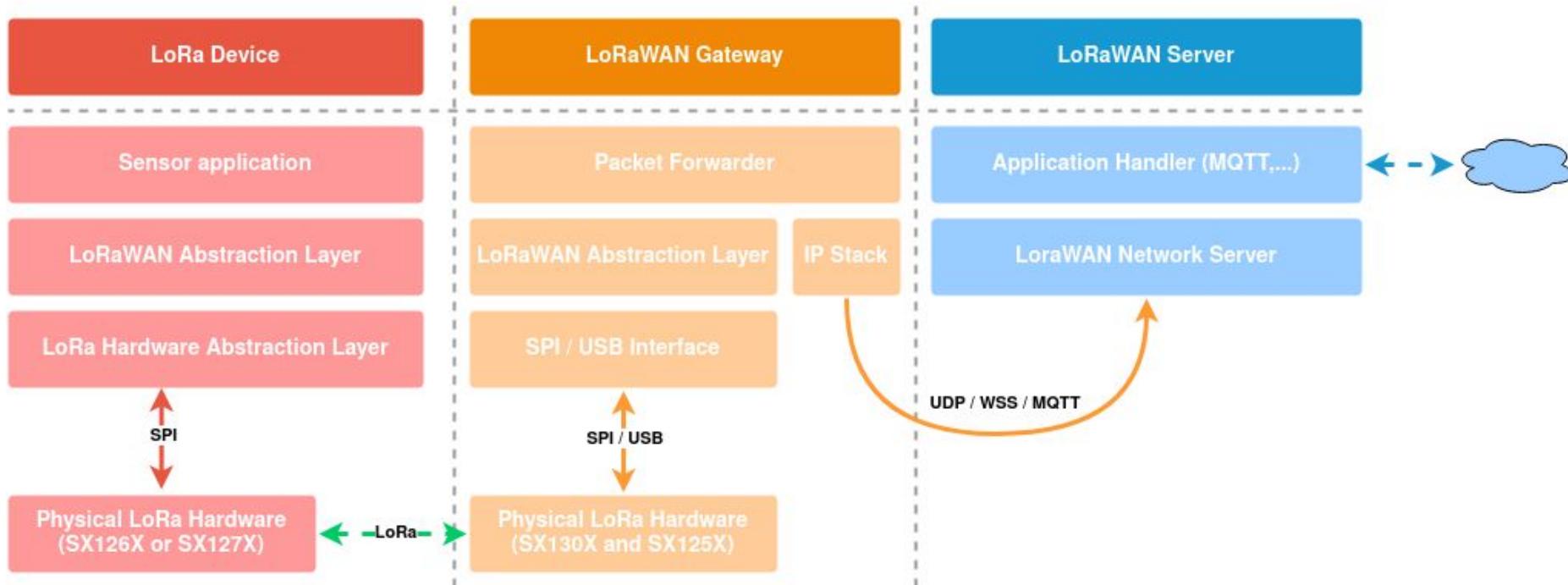
LoRaWAN Network Architecture



LoRaWAN Network Architecture



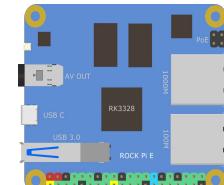
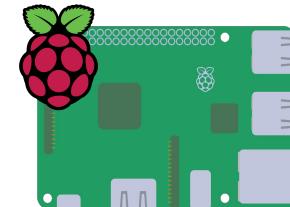
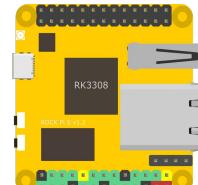
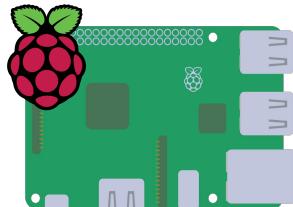
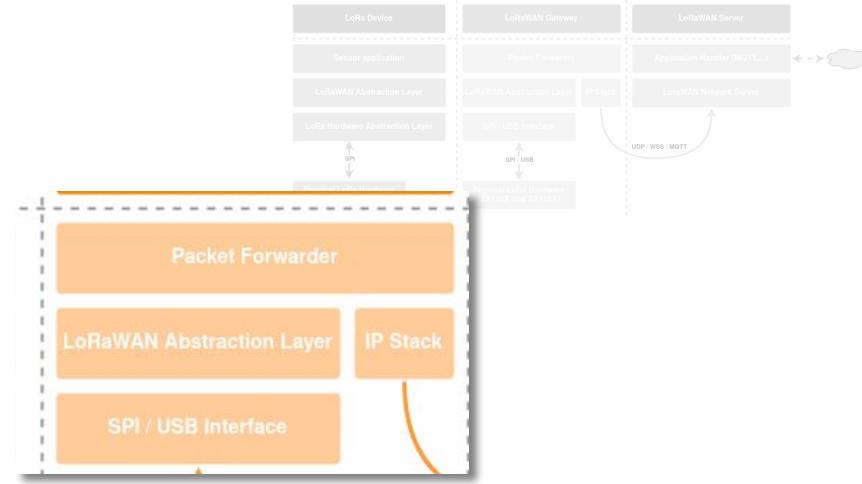
LoRaWAN Network Architecture



The Host

The **host** is usually a Linux machine responsible to run the LoRa and LoRaWAN abstraction layers and the packet forwarder service to forward packets to the LoRaWAN Network Server (**LNS**).

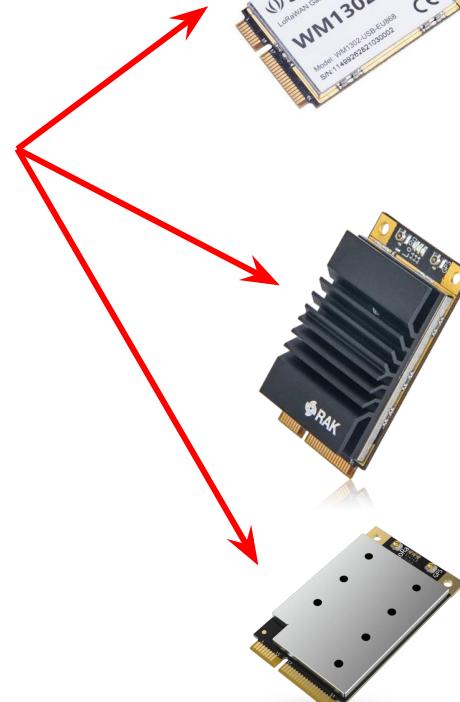
In this workshop we will use a **Raspberry Pi** running **balenaOS** with a **Basics™ Station** service as packet forwarder (and more containers).



LoRa concentrator



RAK2245
(SX1301)



WM1302
(SX1302)



RAK2287
(SX1302)

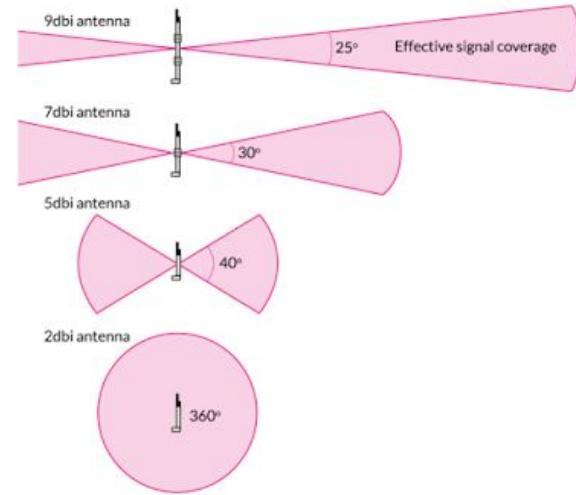
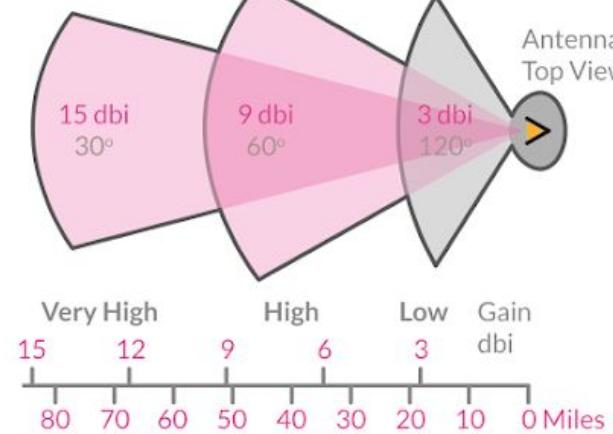
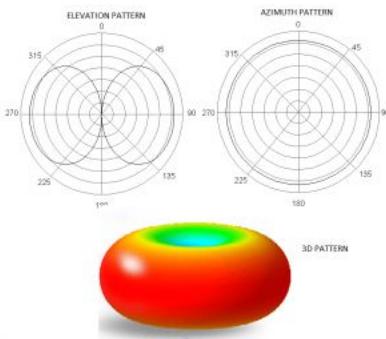


RAK5146
(SX1303)

The Antenna - Gain and directionality

An antenna does not “create” energy, it just **radiates it unevenly depending on the direction**. The gain is the relative radiated power in the direction of maximum radiated power related to an isotropic antenna. The more gain, the more directionality.

Prior to choose the gain we want, we should analyze the node distribution around the antenna.



The Antenna - Connectors



TNC



BNC



Type N



SMA



RP-SMA



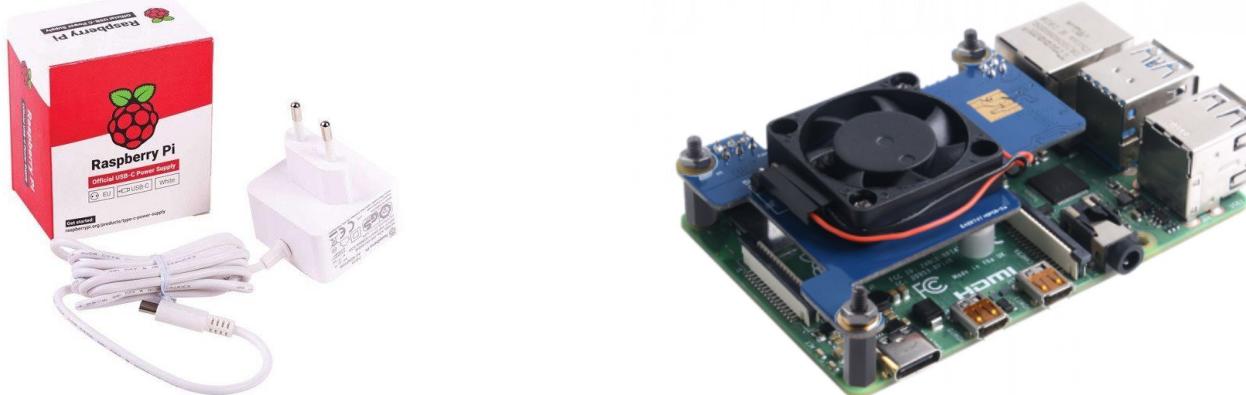
uFL / iPEX

Enclosures



Power supply

Finally we will need a **power supply** that can provide at least 10W (specially if its a Raspberry Pi 4). The official Raspberry Pi power supply is perfect. Optionally you might want to use **PoE** (Power Over Ethernet), especially if you plan to use Ethernet as a backhaul. At RAK we also have a great PoE hat you can use for this project.



<https://www.seeedstudio.com/Power-Over-Ethernet-PoE-HAT-for-Raspberry-Pi-4B-3B-p-4391.html>

Which one is the best gateway for me?

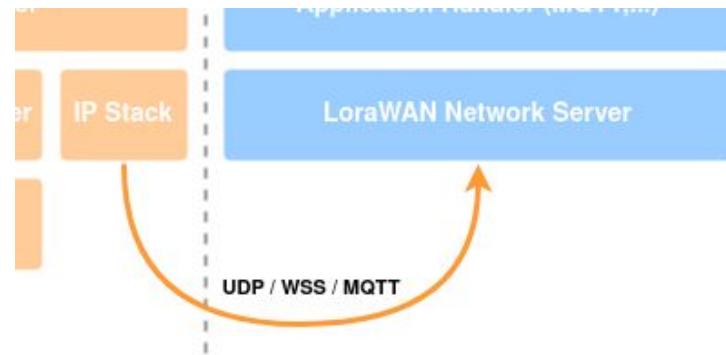
These are the critical key factors for your gateway:

- Convenience (already available parts, form factor, price, backhaul options...)
- Software maintenance and remote management
- Concentrator hardware (same chips, same base design)
- Antenna (frequency adaptation, reflection, frequency bandwidth, gain, short or no cables)
- Location (good view, no obstacles, certain high, ground connection)

What is a LoRa Packet Forwarder?

A **LoRa packet forwarder** is a service (software) running on the host of a LoRa-based gateway (with or without GPS). It forwards RF packets received by the concentrator (uplinks) to a *LoRaWAN Network Server* (LNS) through an IP link. It also transmits RF packets sent by the LNS (downlinks) through the same link to one or multiple devices.

Additionally, it may transmit beacon signals used for time coordinating devices within the network. These beacons may be transmitted GPS-synchronously across the entire network.



Semtech UDP packet forwarder

- This is the original LoRaWAN gateway packet forward protocol, developed as a proof of concept.
- **No built-in authentication or encryption.**
- Relies on a simple IP **UDP** protocol to one port.
- Makes it difficult to cross some firewalls and NAT
- No standardized gateway management options

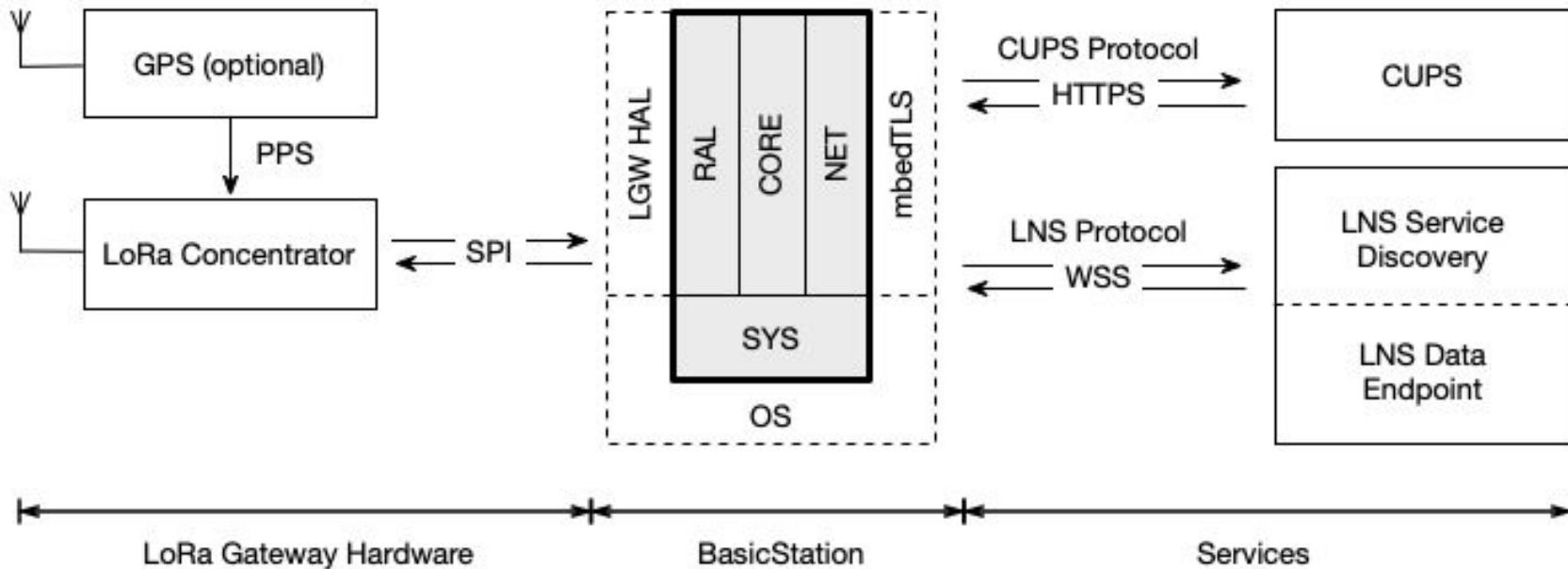
Poly packet forwarder

- UDP packet forwarder sending messages to different LNS at the same time

Multiprotocol packet forwarder

- Same as the poly packet forwarder but includes support for TTN Gateway Connector protocol over MQTT(S).

BasicStation – System Overview



To use the LNS backend protocol to connect to a LoRaWAN Network Server using Basics Station we will need:

- The **URL** of the LNS entry point
- A root or intermediate **certificate** to validate the communication
- A gateway **key** generated by the LNS to authorise the gateway connection

We will be using these parameters shortly in the hands-on part of this workshop...

What is a LoRaWAN Network Server?

A **LoRaWAN Network Server (LNS)** is the service (software) at the core of every LoRaWAN Network that enables connectivity, management, and monitoring of devices, gateways and end-user applications. It is responsible for the security, scalability and reliability of data routing throughout the network.

There are several LNS available as SaaS from different providers and also a few Open Source solutions. **The Things Stack** and **ChirpStack** are two of the most advanced open-source LNS solutions.



**THE THINGS
STACK**



How to deploy a LoRaWAN gateway?

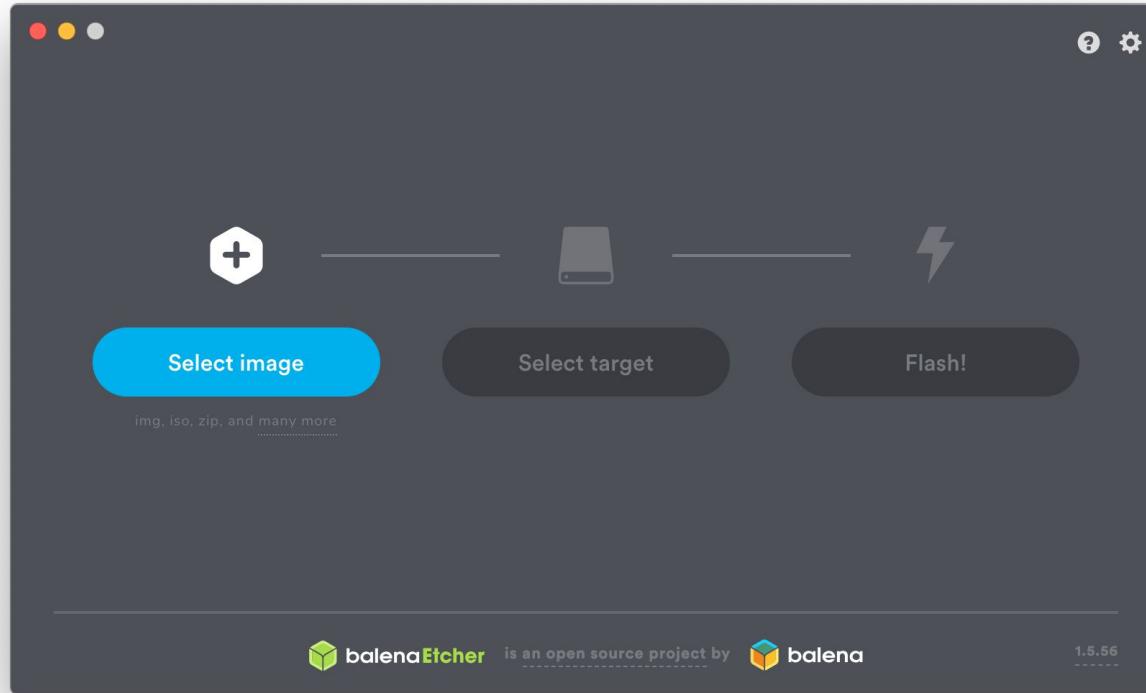


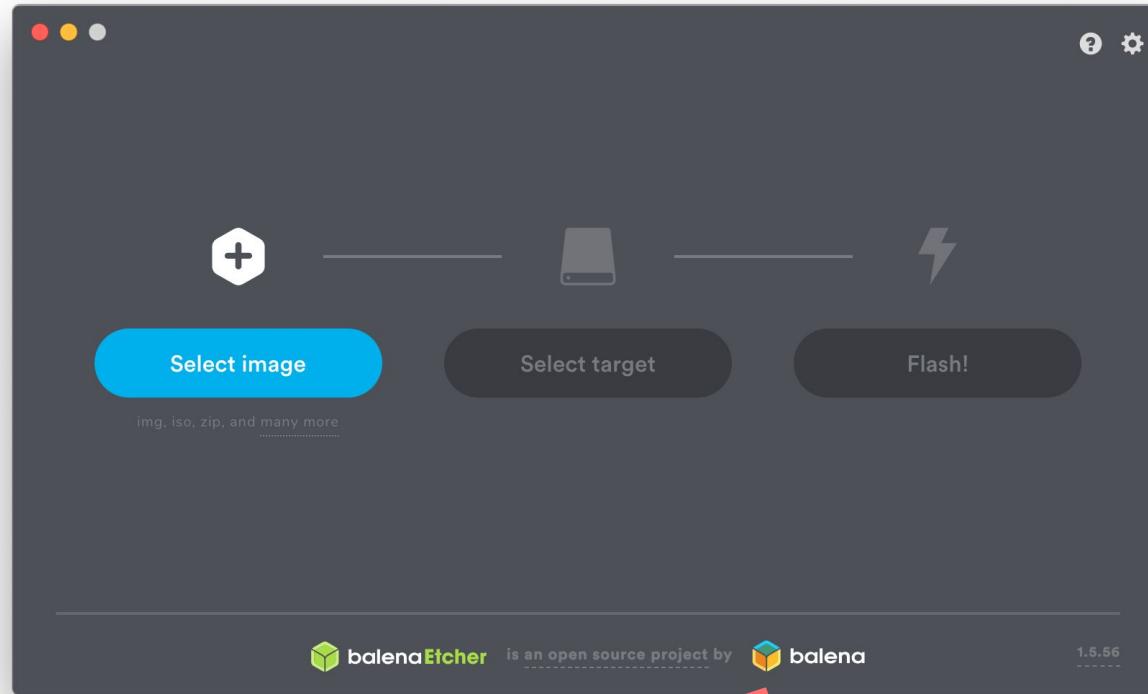
How to deploy a LoRaWAN gateway?

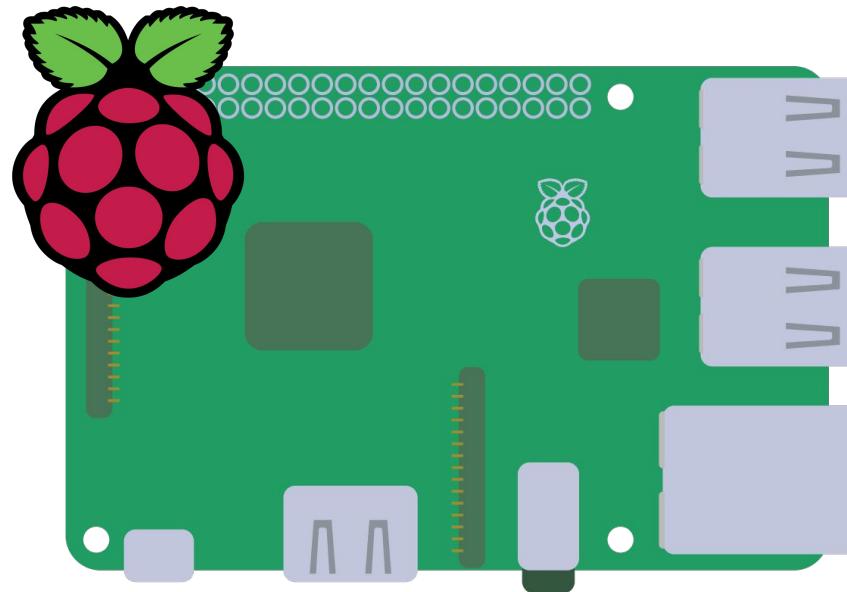


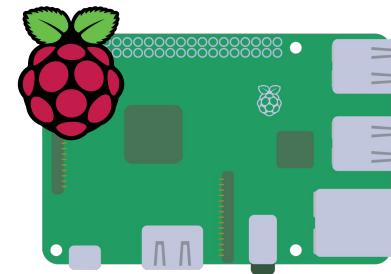
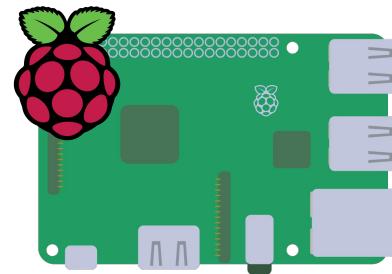
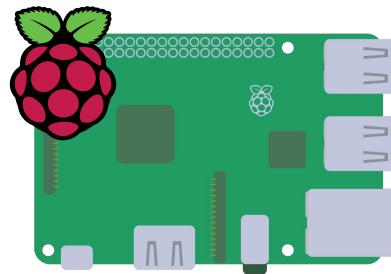
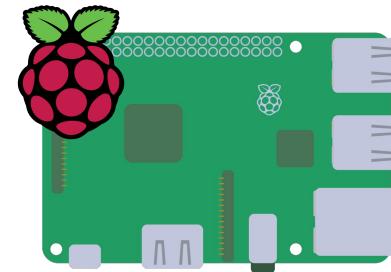
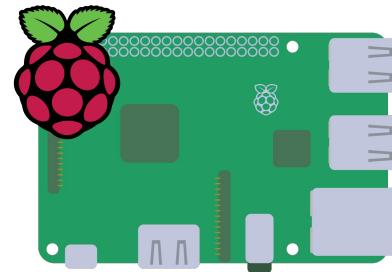
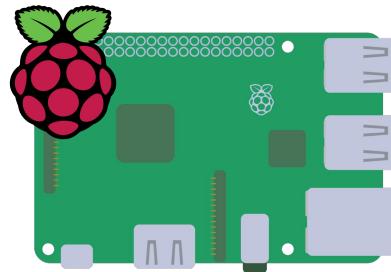
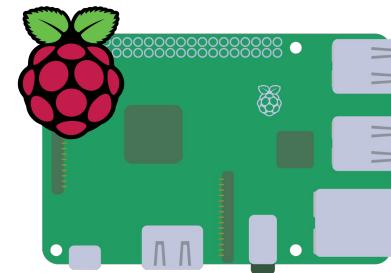
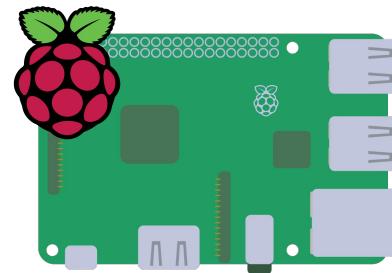
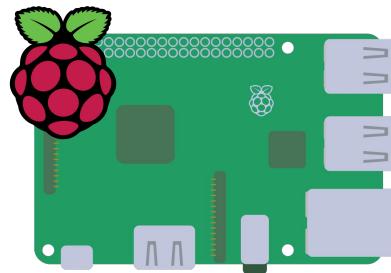
DISCLAIMER: I work at  balena

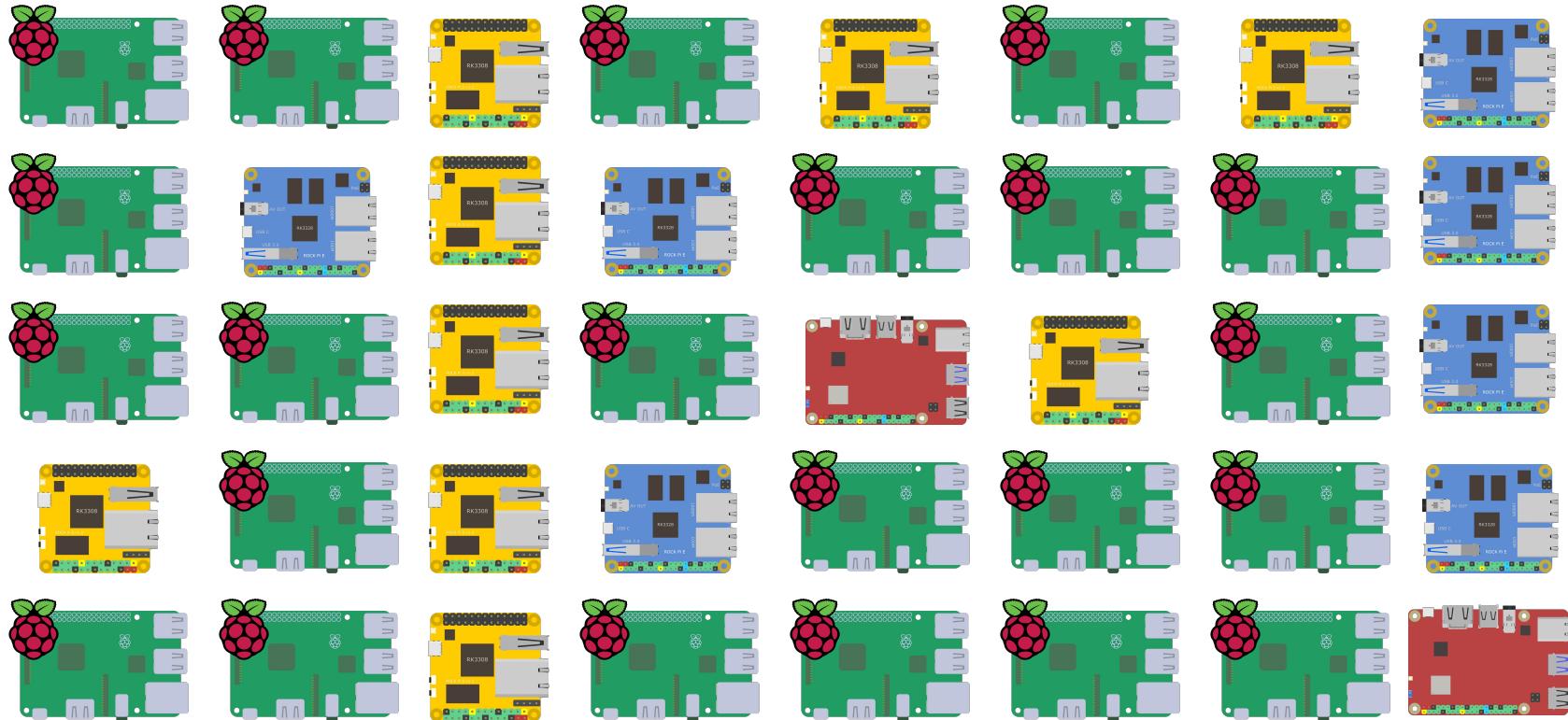
Anyone know this?











Fleet management

dashboard.balena-cloud.com

David Tischler DT

Applications > DemoApplication

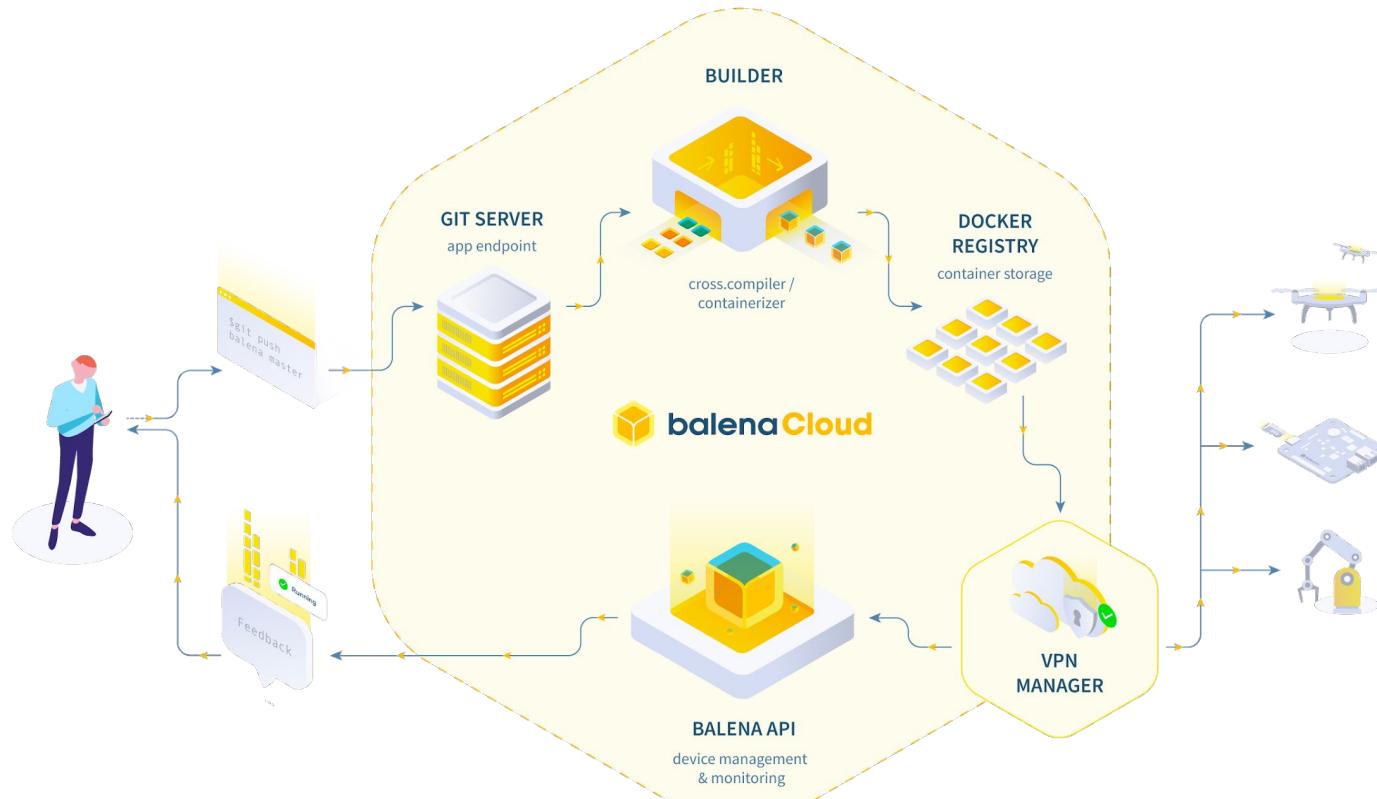
Fleet Location

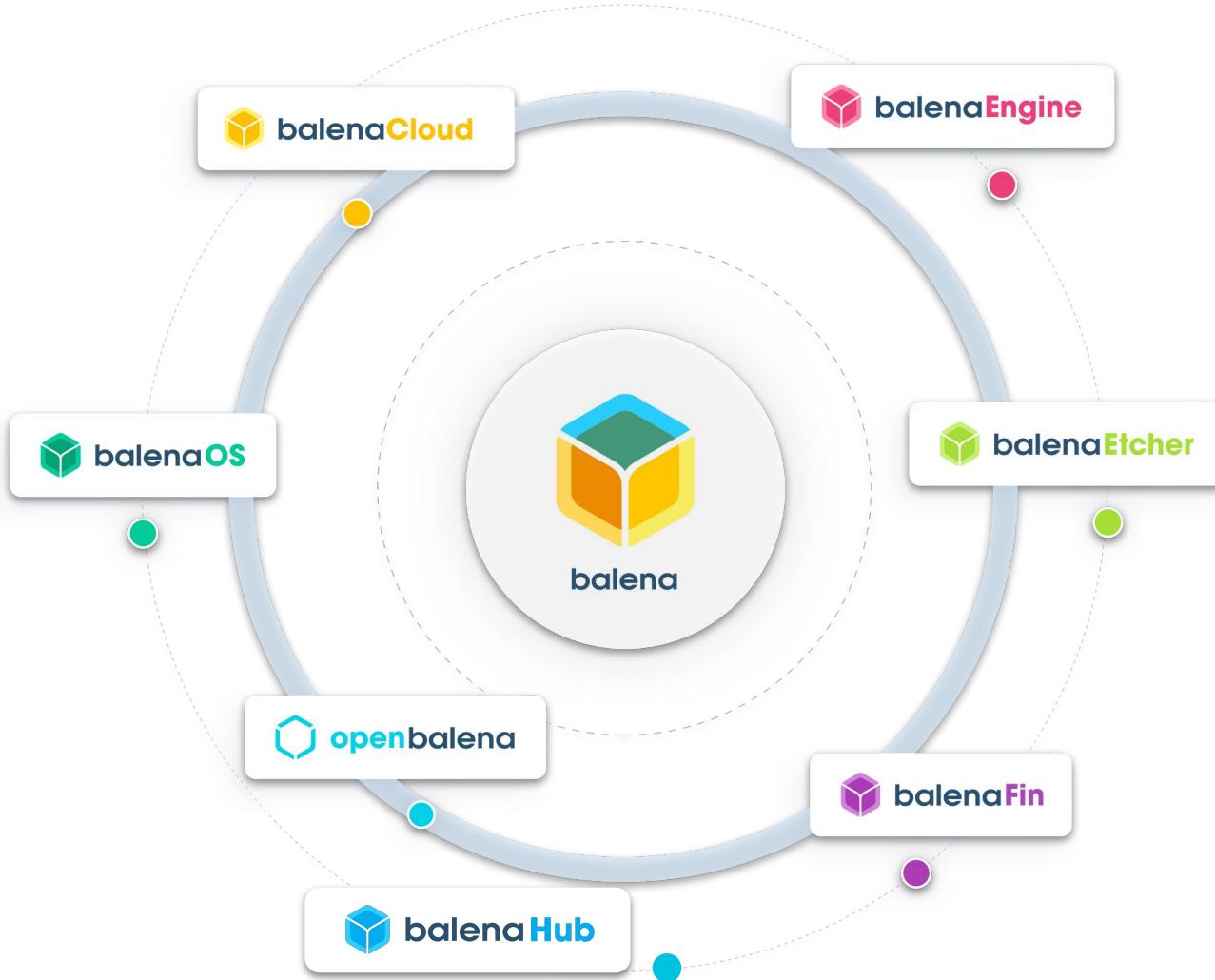
The screenshot shows a fleet management interface for a "DemoApplication" on the balenaCloud dashboard. The left sidebar has a dark blue header with the balenaCloud logo and navigation links: Home, Devices, Fleet Configuration, Environment Variables, Service Variables, Releases, Location (which is highlighted in dark blue), and Members. The main content area is titled "Fleet Location" and displays a world map with yellow dots indicating device locations. Labels on the map include: Greenland, Iceland, Sweden, Norway, Finland, Russia, Mongolia, Japan, South Korea, China, India, Thailand, Pakistan, Saudi Arabia, Iran, Iraq, Turkey, Afghanistan, Algeria, Libya, Egypt, Sudan, Niger, Chad, Nigeria, DRC, Tanzania, Indonesia, Australia, New Zealand, Chile, Argentina, Peru, Bolivia, Venezuela, Colombia, Brazil, Mexico, United States, Canada, and the North Pacific, North Atlantic, South Pacific, South Atlantic, Indian, and Southern Oceans.

Google

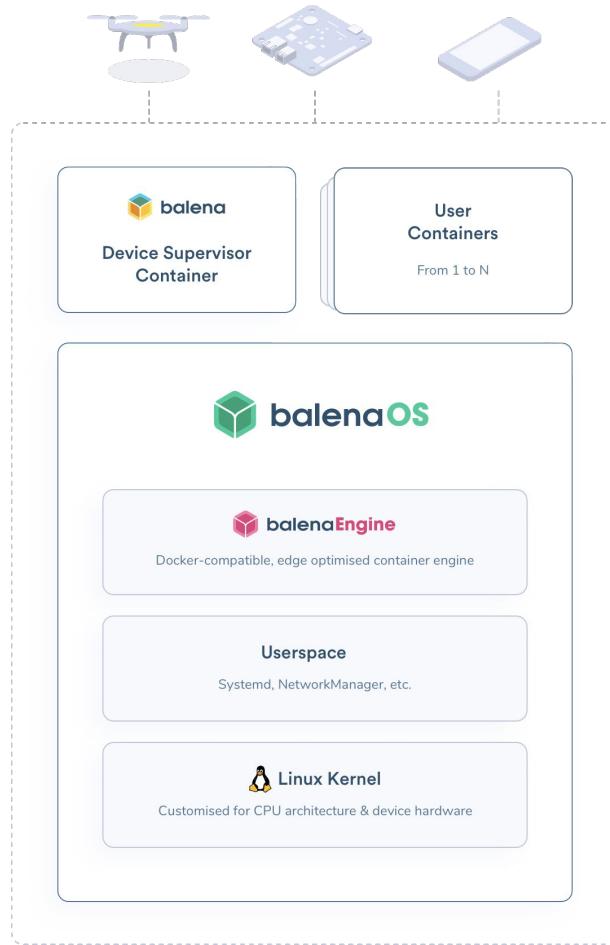
Map data ©2020 | Terms of Use

Software update as a service

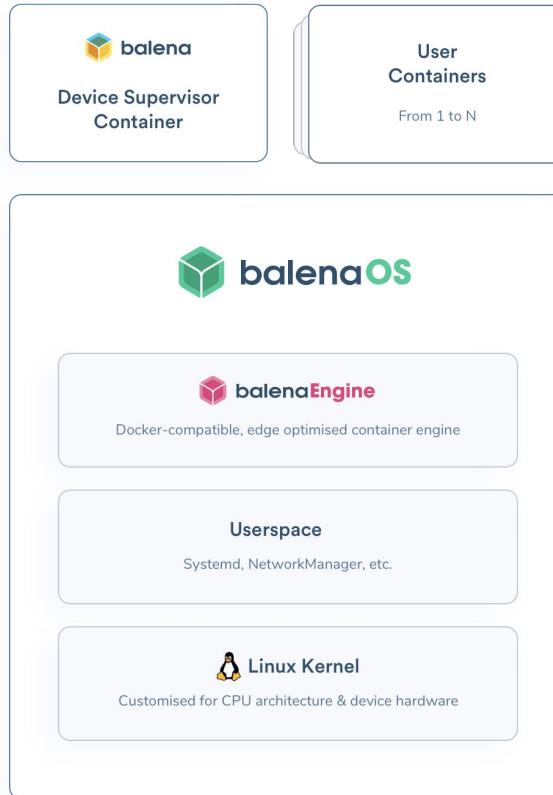




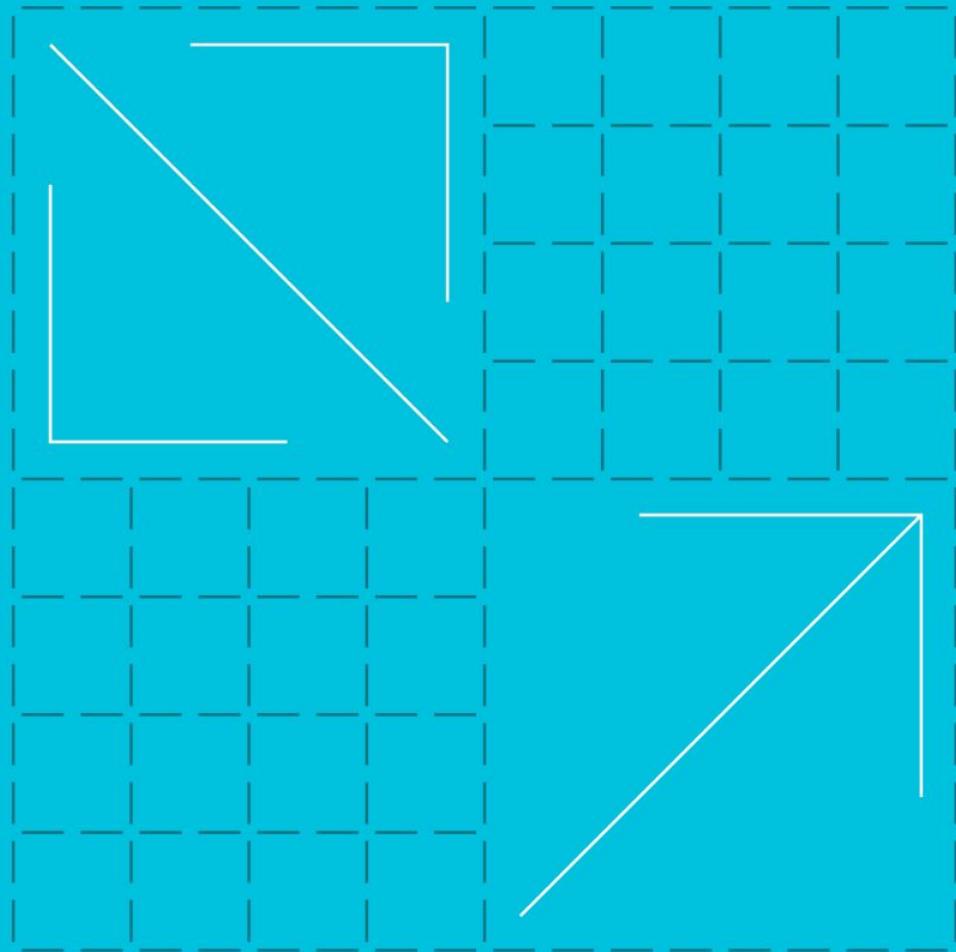
How does it work balena?



Take the benefit of running containers in the edge



**Let's start
coding ...**





BYOH



Hardware

- Raspberry Pi 3 or 4
- LoRa concentrator (e.g. Seeed [WM1302](#) or similar)
- An antenna connected to the LoRa concentrator
- SD card
- Power Supply
- Ethernet Cable or WiFi Access Point for Internet connectivity.
- [SenseCAP S2104](#) (if you have another LoRa node, bring it!)

Software

- [balenaEtcher](#)
- [balenaCloud](#) account
- SenseCAP mobile application (if you use the SenseCAP 210x)

What we are going to build today?

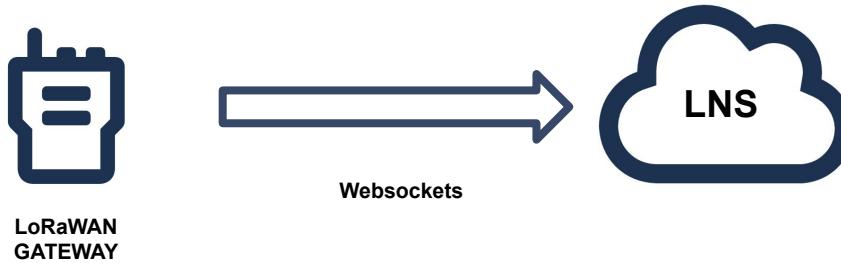
What we are going to build today?

-  Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS
-  Connect a LoRa node to The Things Stack LNS
-  Build your own private LoRaWAN with The Things Stack taking the advantage of the edge with MING.
-  Use the MING stack to visualize data from the LoRa Nodes in the edge.

What we are going to build today?



Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS



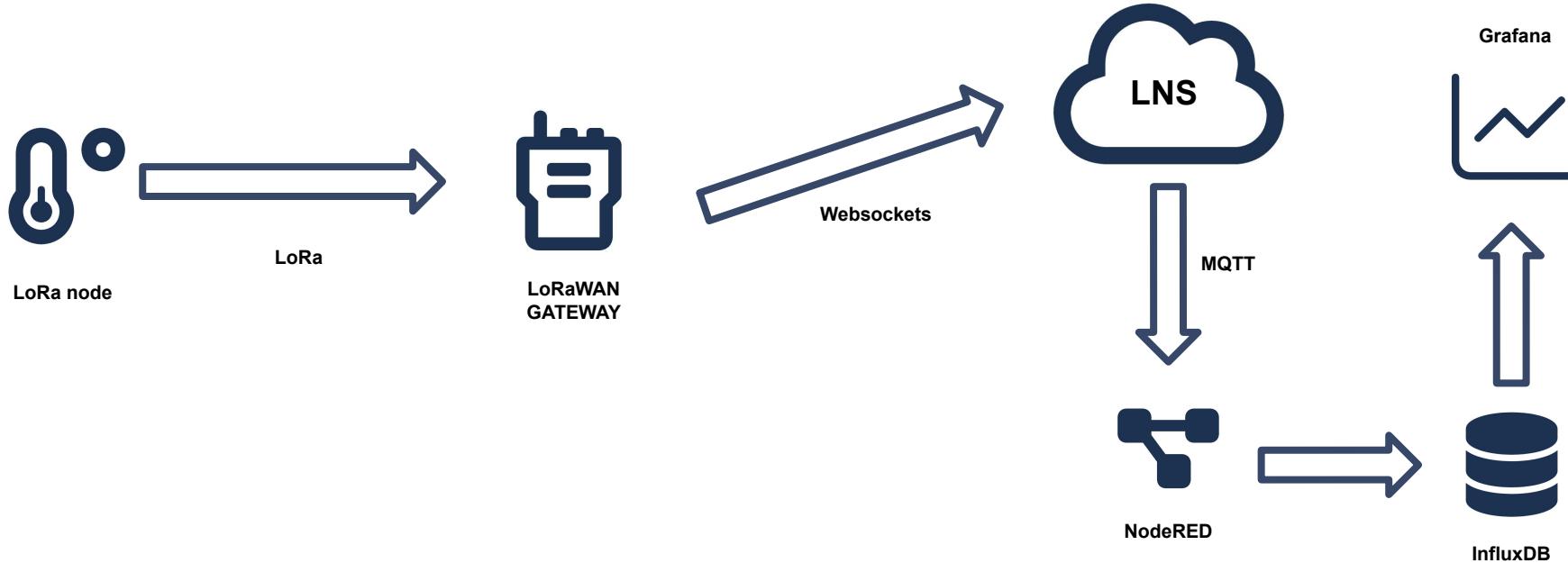
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What we are going to build today?

- + Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS. And connect a LoRa node to The Things Stack LNS.
- + Build your own private LoRaWAN with The Things Stack taking the advantage of the edge with MING.



What we are going to build today?

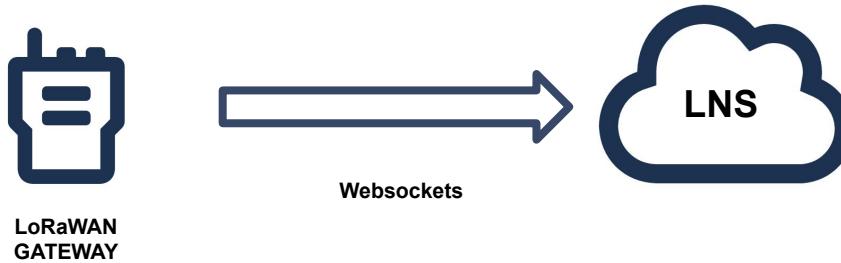
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What we are going to build today?



Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS



balenaHub: an easier way to find... +

https://hub.balena.io/fleets

Fleets

Publish a fleet Search entries...

Add filter Views

Apps Blocks Organizations Device Types

balena-rpiplay by rahul-thakoor Updated

Turn a Raspberry Pi into an Airplay server using RPiPlay to enable screen mirroring on tvs, monitors and projectors.

WORKS WITH 2 more... v0.3.1

screenly-ose-pi3 by screenly-ose

The most popular digital signage project on GitHub

WORKS WITH 1 more... v0.0.0+rev13

HELIUM-RAK by NebraLtd

Manage your RAK v1.5, v2 or MNTD Helium Miner remotely using Nebra and balenaCloud.

WORKS WITH 1 more... v0.0.1+rev37

rosetta-at-home-arm by balenaLabs

Fold for Covid - Help fight the COVID-19 pandemic with your old laptop, Raspberry Pi, or other spare computer

WORKS WITH 2 more... v0.6.5

balenaSound by balenaLabs Updated

Build a single or multi-room streamer for an existing audio device using a Raspberry Pi! Supports Bluetooth, Airplay and Spotify Connect

WORKS WITH 2 more... v3.9.2

Pi-hole by gh_klutchell's Organization

Pi-hole is a Linux network-level advertisement and Internet tracker blocking application!

WORKS WITH 2 more... v2022.10.0+rev1

chi-edge-workers by Chameleon

Enroll your edge / IoT device into the CHI@Edge testbed for computer science research. Note: you must be associated with a Chameleon allocation...

WORKS WITH 2 more... v0.1.0+rev13

screenly-ose-pi4 by screenly-ose

The most popular digital signage project on GitHub

WORKS WITH 1 more... v0.0.0+rev13

pety by Coolab

Pety uses Pi-Hole to schedule Internet blocks, sync

alpha by Samizdapp Updated

No description

balena-sound by g_ema_alvarez's Organization

Build a single or multi-room streamer for an

Moultimmediat by stephane_bettbeder's Organization

No description

Send feedback

standalone-lorawan-gw by Xose Pérez +

https://hub.balena.io/organizations/xoseperez/fleets/standalone-lorawan-gw

balenaHub

What is balenaHub? Contribute Community

Back to Fleets

standalone-lorawan-gw by Xose Pérez

Map Hybrid Bethlehem Church 255

Get standalone-lorawan-gw It's free and open source

1 Active devices, last 28 days

Get started

Bethlehem Church 255

skoda Repair 236

Boswell Porter 4H range 247

235 259 166 50 269 295 277 274 150 190 185 3090 401 3090 401 188

Brazos River

Santa's Wonderland Temporarily closed

Blue Lake Church

Millican Reserve Millican

SNOK RODEO ARENA

Description Deploy TTS Stack, BasicStation and other tools for a standalone LoRaWAN network solution.

Works With 1 2 3 4 400 2 more...

Version v0.0.0+rev113 View code | 169 MB | last updated at: 22 Sep 2022

Fork this fleet Report issue

Release notes v0.0.0+rev113 | 22 Sep 2022 No release notes

More from Xose Pérez

Send feedback

Screenshot of a GitHub repository page for "standalone-lorawan-gateway-balena".

The repository has 2 branches and 0 tags. The master branch was last updated on 20 Sep by mpous, with 34 commits.

The README.md file describes the project as deploying the The Things Stack LoRaWAN Network Server (Open Source Edition), Basics™ Station packet forwarder and other services using Docker or Balena.io. It runs on a PC, a Raspberry Pi 3/4, Compute Module 3/4 or balenaFin with SX1301, SX1302 or SX1303 LoRa concentrators (e.g. RAK831, RAK833, RAK2245, RAK2247, RAK2287, RAK5146, Seeed WM1302 and IMST IC880a among others).

This is a Work In Progress. This is NOT meant for production environments but it should work just fine for local (LAN) deployments.

Introduction

Deploy a Standalone LoRaWAN Gateway running the Basics™ Station Semtech Packet Forwarder and The Things Stack LoRaWAN Network Server in a docker container or as a balena.io fleet.

Main features:

- Support for AMD64 (x86_64), ARMv8 and ARMv7 architectures.
- Support for SX1301, SX1302, EX1303 and SX1308 concentrators.
- Timeseries database and dashboard applications included.
- Almost one click deploy and at the same time highly configurable.

Components used:

- The Things Stack
- Basics™ Station
- Node-RED

About

Deploys the The Things Stack LoRaWAN Network Server Open Source Edition, BasicsStation and Backend tools using Balena.

Tags: raspberry-pi, influxdb, node-red, grafana, its, lora, lorawan, lorawan-gateway, ttn, the-things-network, ins, balena, basicsstation, lorawan-network-server, the-things-stack

Readme, Apache-2.0 license, 12 stars, 5 watching, 6 forks

Releases

No releases published. Create a new release

Packages

No packages published. Publish your first package

Contributors 2

xoseperez Xose Pérez
mpous Marc Pous



Deploy with balena



Fork this fleet

The screenshot shows a web browser window titled "balena dashboard | Login" at the URL "dashboard.balena-cloud.com/login". The page features the "balenaCloud" logo and a message stating "Your first ten devices are fully-featured and free". A callout bubble on the left side of the page says "To continue, login to balenaCloud" and points to the login form. Below this, there is a card for a "Standalone LoRaWAN Gateway" by user "xoseperez". The card includes a small icon of a device with a signal, the title, the author's name, and a brief description: "Deploys TTS Stack, BasicStation and other tools for a standalone LoRaWAN network solution." At the bottom of the page, there is a diagram showing a drone-like device connected to a circular base with a signal, and another smaller device nearby. The main login area has a "Log in" button, links for "Log in with GitHub" and "Log in with Google", and fields for "Email*" and "Password*". There is also a "Forgot password?" link and a "Need help?" button.

balena dashboard | Login

dashboard.balena-cloud.com/login

balenaCloud

Your first ten devices are fully-featured and free

To continue, login to balenaCloud

Standalone LoRaWAN Gateway

by xoseperez

Deploys TTS Stack, BasicStation and other tools for a standalone LoRaWAN network solution.

Log in

New to balena? Sign up for free.

Log in with GitHub Log in with Google

or log in with

Email*

Password*

Log in

Forgot password?

Need help?

balena dashboard | standalone - X +

https://dashboard.balena-cloud.com/fleets/1969815

90% ⚡ Getting Started Docs Forums Status Marc Pous 🌐

balenaCloud

- Organizations
- Marc Pous
- Fleets
- standalone-lorawan-gateway-arm-dev-summit-2022

Summary

Devices

Releases

Variables

Configuration

Provisioning Keys

Members

Teams

Add device Modify Search entries...

standalone-lorawan-gateway-arm-dev-summit-2022

Architecture aarch64

Slug marc6/standalone-lorawan-gateway-arm-dev-summit-2022

Created Sep 23rd 2022, 2:17 pm

Microservices

Devices

3

Online Config Updating Offline Past prov Inactive

Releases

1

track latest

Standalone LoRaWAN Gateway Learn more

Create release

Name	Status	Device type	Last seen	Created on	UUID	OS version	OS line	OS variant	Supervisor version	Support access	IP address	⋮
Marc-pi4	Online	Raspberry Pi 4 (using 64bit OS)	Online (about 17 hours)	Oct 5th 2022, 12:43 AM	b9fbcd4	balenaOS 2.105.1+rev1	Development	14.2.0	Off	192.168.1.46	7	
muddy-pie	Offline	Raspberry Pi 4 (using 64bit OS)	about 1 month ago	Sep 19th 2022, 10:27 PM	f723db7	balenaOS 2.103.1+rev1	Development	14.0.14	Off	10.0.89.101	8	
icy-time	Offline	Raspberry Pi CM4 IO Board	about 1 month ago	Sep 23rd 2022, 2:33 PM	bbcb4a9	balenaOS 2.94.4+rev1	Production	12.11.36	Off	10.42.0.242	7	

Changelog v15.15.13

Help

balena dashboard | Marc-pi4

<https://dashboard.balena-cloud.com/devices/b9fbcd42b0de09e5b655aa77b2edc1ff>

80% Getting Started Docs Forums Status Marc Pous

Marc-pi4

Status: Online (b9fbcd4)

Type: Raspberry Pi 4 (using 64bit OS)

OS VARIANT: development

CURRENT RELEASE: balenaOS 2.105.1+rev1

TARGET RELEASE: d3542ad

SUPERVISOR VERSION: 14.2.0

SUPPORT ACCESS: Off

FLEET: marc6/standalone-lorawan-gateway-arm-dev-...

IS ACTIVE: On

LOCAL IP ADDRESS: 192.168.1.46

PUBLIC IP ADDRESS: 79.153.119.0

MAC ADDRESS: DC:A6:32:55:4B:34

PUBLIC DEVICE URL: Off

NOTES: EUI: DCA632FFFF554B34 URL: https://bal...

Services

Service	Status	Release
basicstation	Running	d3542ad
grafana	Running	d3542ad
influxdb	Running	d3542ad
node-red	Running	d3542ad
postgres	Running	d3542ad
redis	Running	d3542ad
stack	Running	d3542ad
wifi-connect	Running	d3542ad

Logs

```

2022-11-22 08:11:57 (+0000) stack INFO Client error {"duration": 0.0068, "error": "error:pkg/auth:token (invalid token)", "http.method": "GET", "http.path": "/traffic/eui-DCA632FFFF554B34", "http.status": 400, "namespace": "web", "peer.address": "172.18.0.1:65144", "peer.real_ip": "172.18.0.1", "request_id": "0IGH30HCS4VDAQH94BTSNGVGF5"} basicstation 2022-11-05 08:11:57.611 [AIO:ERRO] [4] WS upgrade failed with HTTP status code: 400
2022-11-22 08:11:57 (+0000) basicstation 2022-11-05 08:11:57.611 [AIO:ERBU] [4] WS connection shutdown...
2022-11-22 08:11:57 (+0000) basicstation 2022-11-05 08:11:57.612 [TC:VERB] Connection to MUXS closed in state 3
2022-11-22 08:11:57 (+0000) basicstation 2022-11-05 08:11:57.612 [TC:INFO] INFO reconnect backoff 10s (retry 1)
2022-11-22 08:12:02 (+0000) stack INFO Request handled {"duration": 0.0001, "http.method": "GET", "http.path": "/health/live", "http.status": 200, "namespace": "web", "peer.address": "127.0.0.1:56262", "request_id": "0IGH30HFP0AJ4 STCD005PW34T3"}
2022-11-22 08:12:04 (+0000) influxdb [httpd] 172.18.0.4 - - [05/Nov/2022:08:12:04 +0000] "GET /query?db=balena&q=showfield+keys HTTP/1.1" 200 70 "-" "Python-urllib/3.7" 88643c4e-5ce1-11ed-8014-024ac120005 1140
2022-11-22 08:12:04 (+0000) grafana Interim dashboard sync skipped: No schema found.

```

Terminal

Select a target

Start terminal session

Changelog v15.13

A screenshot of a Firefox browser window. The title bar shows three tabs: "balena dashboard | Marc-pi4", "Avis: Risc potencial de seguretat", and a blank tab. The address bar indicates an "Insegur" connection to "https://192.168.1.46". The main content area displays a yellow warning icon followed by the text "Avís: Risc potencial de seguretat". Below this, a message states: "El Firefox ha detectat una amenaça potencial de seguretat i ha interromput la connexió a 192.168.1.46. Si visiteu aquest lloc, els atacants podrien robar informació com ara contrasenyes, correus electrònics o detalls de targetes de crèdit." A section titled "Què hi podeu fer?" provides information: "Molt probablement, l'error és del lloc web i no hi podeu fer res per resoldre'l. Si esteu en una xarxa empresarial o utilieu programari antivirus, podeu posar-vos en contacte amb l'equip d'assistència tècnica. També podeu notificar el problema a l'administrador del lloc web." At the bottom, there are two buttons: "Vés enrere (recomanat)" and "Avançat...".

balena dashboard | Marc-pi4 X Login - Account - The Things Stack X +

https://192.168.1.46/oauth/login?n=%2Foauth%2Fauthorize%3Fclient_id%3Dconsole%26redirect_uri%3D%252Fconsole%252Foauth%252Fcallback%26response_type%3Dcode%26state%3DssDVaXjuNGuvT

THE THINGS STACK
Open Source

The Things Stack for LoRaWAN Account

Please login to continue

User ID *

Password *

Login Create an account Forgot password?

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A large blue map of a city grid, divided into numerous square cells. Each cell contains a different blue icon representing a type of IoT device or service. Visible icons include a house, a bus, a puzzle piece, a phone, a lock, a Wi-Fi signal, a ship, an eye, a central processing unit (CPU), a thermometer, a speech bubble, and a checkmark. The map serves as a background for the right side of the dashboard.

EN v3.21.0 Documentation

balena dashboard | Marc-pi4 Overview - Console - The Thing + https://192.168.1.46/console/ admin

THE THINGS STACK Open Source Overview Applications Gateways Organizations

Welcome to the Console!

Get started right away by creating an application or registering a gateway.

Need help? Have a look at our [Documentation](#).



Create an application



Register a gateway

Version info Component status

balena dashboard | Marc-pi4 Add gateway - Console - The Ti X + https://192.168.1.46/console/gateways/add admin

THE THINGS STACK Open Source Overview Applications Gateways Organizations

Add gateway

General settings

Gateway ID ① *

Gateway EUI ②

Gateway name ③

Gateway description ④

Optional gateway description; can also be used to save notes about the gateway

Gateway Server address

The address of the Gateway Server to connect to

Require authenticated connection ⑤
 Enabled
Controls whether this gateway may only connect if it uses an authenticated Basic Station or MQTT connection

Gateway status ⑥
 Make status public
The status of this gateway may be visible to other users

Gateway location ⑦
 Make location public

THE THINGS STACK
Open Source

Overview Applications Gateways Organizations

admin

ARM DEV SUMMIT

Overview Live data Location Collaborators API keys General settings

Gateways > ARM DEV SUMMIT

ARM DEV SUMMIT
ID: armdevsummit

Disconnected

1 Collaborator 0 API keys

General information

Gateway ID	armdevsummit
Gateway EUI	DC A6 32 FF FE 55 4B 34
Gateway description	None
Created at	Nov 7, 2022 00:00:27
Last updated at	Nov 7, 2022 00:00:27
Gateway Server address	192.168.1.46

LoRaWAN information

Frequency plan	EU_863_870_TTN
Global configuration	Download global_conf.json

Live data

See all activity →

Waiting for events from armdevsummit...

Location

Change location settings →

No location information available

< Hide sidebar

THE THINGS STACK
Open Source

Overview Applications Gateways Organizations admin

ARM DEV SUMMIT

Overview Live data Location Collaborators API keys General settings

Add API key

Name: My new API key

Expiry date: dd / mm / aaaa

Rights *

Grant all current and future rights

Grant individual rights

Select all

Delete gateway

View gateway information

Link as Gateway to a Gateway Server for traffic exchange, i.e. write uplink and read downlink

View gateway location

Retrieve secrets associated with a gateway

View and edit gateway API keys

Edit basic gateway settings

View and edit gateway collaborators

View gateway status

Write downlink gateway traffic

Read gateway traffic

Store secrets for a gateway

Create API key

balena dashboard | Marc-pi4 Add API key - ARM DEV SUMMIT + https://dashboard.balena-cloud.com/devices/b9fbcd42b0de09e5b655aa77b2edc1ff/envvars 80% Getting Started Docs Forums Status Marc Pous Views

Add variable Search entries...

Name	Fleet value	Device value	Service name	Actions
MODEL	RAK5146	SX1302	All services	
TC_KEY	null	NNSXS.UAW7HS2XRLU7KWMIHXGEFPFSUQCBCD... ⓘ	All services	
TC_TRUST	not defined	-----BEGIN CERTIFICATE-----MIIDvOCQAqSgAwIBA... ⓘ	All services	
TC_URI	not defined	wss://localhost:8887	All services	
TTS_DOMAIN	null	192.168.1.46	All services	

Device Variables Device Configuration Actions Settings Diagnostics Location

Changelog v15.15.13 Need Help

THE THINGS STACK
Open Source

Overview Applications Gateways Organizations

admin

ARM DEV SUMMIT

Overview Live data Location Collaborators API keys General settings

Gateways > ARM DEV SUMMIT

ARM DEV SUMMIT
ID: armdevsummit

0 0 • Last activity 53 seconds ago

1 Collaborator 1 API key

General information

Gateway ID: armdevsummit

Gateway EUI: DC A6 32 FF FE 55 4B 34

Gateway description: None

Created at: Nov 7, 2022 00:00:27

Last updated at: Nov 7, 2022 00:00:27

Gateway Server address: 192.168.1.46

LoRaWAN information

Frequency plan: EU_863_870_TTN

Global configuration: Download global_conf.json

Live data

See all activity →

Waiting for events from armdevsummit...

Location

Change location settings →

No location information available

< Hide sidebar

What we are going to build today?

- + Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS
- + Connect a LoRa node to The Things Stack LNS



seeed studio



S2101



S2104

<https://www.seeedstudio.com/SenseCAP-S2101-LoRaWAN-Air-Temperature-and-Humidity-Sensor-p-5354.html>

<https://www.seeedstudio.com/SenseCAP-S2104-LoRaWAN-Soil-Temperature-and-Moisture-Sensor-p-5357.html>

1



GET IT ON
Google Play



Download on the
App Store

Download SenseCAP Mate App

2



Connect App to Sensor via Bluetooth

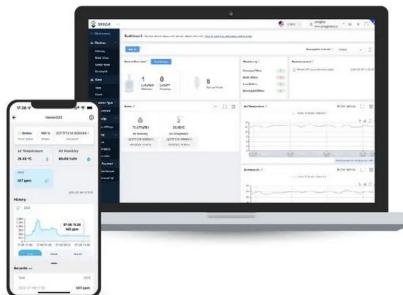
3



Set parameters

- Platform and frequency plan
- Uplink Interval
- EUI and key

4



Get the data on App and Web Portal

0:34 | 5,4KB/s

47%



114992867223400315



General

Setting

Platform

The Things Network

Frequency Plan

EU868

Uplink Interval (min)

10

Activation Type

OTAA

Device EUI

2CF7F1C0435003D9

APP EUI

91A806202810B5C9

APP Key

DADE33D1283EAA0BE47ABDF6CEE1D780

Packet Policy

1N

Restore Factory

Send

The screenshot shows a web browser window titled "Applications - Console - The Things Stack". The URL is <https://192.168.1.46/console/applications>. The page header includes the "THE THINGS STACK Open Source" logo, navigation tabs for "Overview", "Applications", "Gateways", and "Organizations", and a user profile for "admin". The main content area displays a table with columns for "ID", "Name", "End devices", and "Created at". A search bar and a "Add application" button are also present. The message "No items found" is centered below the table.

balena dashboard | Marc-pi4 X Applications - Console - The Things Stack X +

https://192.168.1.46/console/applications

THE THINGS STACK Open Source

Overview Applications Gateways Organizations admin

Owned applications All (Admin) Deleted (Admin)

Search Add application

ID	Name	End devices	Created at
No items found			

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balena dashboard | Marc-pi4 Overview - Temperature - The Things Stack

https://192.168.1.46/console/applications/seeded-temperature

THE THINGS STACK Open Source Overview Applications Gateways Organizations admin

Temperature

Overview End devices Live data Payload formatters Integrations Collaborators API keys General settings

Applications > Temperature

Temperature ID: seeded-temperature

No recent activity

0 End devices 1 Collaborator 0 API keys

General information

Application ID: seeded-temperature

Created at: Nov 7, 2022 00:05:39

Last updated at: Nov 7, 2022 00:05:39

Live data See all activity →

Waiting for events from seeded-temperature...

End devices (0)

ID Name DevEUI JoinEUI Last activity

No items found

Search Import end devices Add end device

Hide sidebar

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balena dashboard | Marc-pi4 Register end device - Temperature + https://192.168.1.46/console/applications/seeded-temperature/devices/add/repository Overview Applications Gateways Organizations admin

THE THINGS STACK Open Source

Temperature

Overview

End devices

Live data

Payload formatters

Integrations

Collaborators

API keys

General settings

THE THINGS STACK Open Source

Applications > Temperature > End devices > Register from The LoRaWAN Device Repository

Register end device

From The LoRaWAN Device Repository Manually

1. Select the end device

Brand ⓘ *

Type to search... | ▾

Cannot find your exact end device? [Try manual device registration.](#)

2. Enter registration data

Please choose an end device first to proceed with entering registration data

Register end device

Hide sidebar

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balena dashboard | Marc-pi4 Register end device - Temperature + https://192.168.1.46/console/applications/seeded-temperature/devices/add/repository Overview Applications Gateways Organizations admin

THE THINGS STACK Open Source

Temperature Overview End devices Live data Payload formatters Integrations Collaborators API keys General settings

Applications > Temperature > End devices > Register from The LoRaWAN Device Repository

Register end device

From The LoRaWAN Device Repository Manually

1. Select the end device

Brand * Model * Hardware Ver. * Firmware Ver. * Profile (Region) *

SenseCAP SenseCAP S2101- L... 1.0 1.0 EU_863_870

SenseCAP S2101- LoRaWAN® Air Temperature and Humidity Sensor
LoRaWAN Specification 1.0.2, RP001 Regional Parameters 1.0.2 revision B, Over the air activation (OTAA), Class A

 SenseCAP 2101 air temperature & humidity sensor satisfies industrial IoT long-distance data acquisition with measuring ranges from -40°C to 85°C and 0 to 100 %RH respectively. With Bluetooth 5.0 for easy wireless configuration and firmware upgrade and a built-in replaceable battery for minimal maintenance, it also supports three different LoRaWAN® network architectures to make it easily become Helium-compatible IoT device.

[Product website](#) | [Data sheet](#)

2. Enter registration data

Frequency plan * Europe 863-870 MHz (SF9 for RX2 - recommended)

AppEUI * 00 00 00 00 00 00 00 00 Fill with zeros

< Hide sidebar

THE THINGS STACK
Open Source

Overview Applications Gateways Organizations

admin

Temperature

Overview End devices Live data Payload formatters Integrations Collaborators API keys General settings

eui-2cf7f1c0435003d9

ID: eui-2cf7f1c0435003d9

↑ n/a ↓ n/a • No activity yet

Overview Live data Messaging Location Payload formatters Claiming General settings

General information

End device ID	eui-2cf7f1c0435003d9
Frequency plan	Europe 863-879 MHz (SF9 for RX2 - recommen...
LoRaWAN version	LoRaWAN Specification 1.0.2
Regional Parameters version	RP001 Regional Parameters 1.0.2 revision B

Created at: Nov 7, 2022 00:53:24

Live data

See all activity →

Waiting for events from eui-2cf7f1c0435003d9...

Hardware

Brand	sensecap
Model	sensecaps2101-temp-humid
Hardware version	1.0
Firmware version	1.0

Activation information

AppEUI	91 A8 06 20 28 10 B5 C9
DevEUI	2C F7 F1 C0 43 50 03 D9
AppKey	*****

Location

Change location settings →

No location information available

https://192.168.1.46/console/applications/seeed-temperature/devices/eui-2cf7f1c0435003d9/data

THE THINGS STACK
Open Source

Overview Applications Gateways Organizations

admin

Temperature

Overview End devices Live data Payload formatters Integrations Collaborators API keys General settings

eui-2cf7f1c043500054
ID: eui-2cf7f1c043500054

↑ n/a ↓ n/a * Last activity 12 seconds ago

Overview Live data Messaging Location Payload formatters Claiming General settings

General information

End device ID	eui-2cf7f1c043500054
Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen...)
LoRaWAN version	LoRaWAN Specification 1.0.2
Regional Parameters version	RP001 Regional Parameters 1.0.2 revision B

Created at Nov 7, 2022 19:50:34

Hardware

Brand	sensecap
Model	sensecaps2104-soil-moisture-temp
Hardware version	1.0
Firmware version	1.0

Activation information

AppEUI	2C F7 F1 C0 43 50 00 54
DevEUI	2C F7 F1 C0 43 50 00 54
AppKey	*****

Live data See all activity →

↑ 19:50:46 Forward join-accept message DevAddr: 01 F1 E9 39
↓ 19:50:45 Accept join-request DevAddr: 01 F1 E9 39

Location Change location settings →

No location information available

< Hide sidebar

THE THINGS STACK Open Source

Overview Applications Gateways Organizations admin

ARM DEV SUMMIT

Gateways > ARM DEV SUMMIT > Live data

Time Type Data preview Verbose stream Export as JSON Pause Clear

	Time	Type	JoinEUI:	DevEUI:	Data rate:	SNR:	RSSI:
Overview	↑ 01:10:58	Receive uplink message	80 00 00 00 00 00 09	2C F7 F1 C0 43 50 03 D9	SF12BW125	7	-31
Live data	↑ 01:07:58	Receive uplink message	80 00 00 00 00 00 09	2C F7 F1 C0 43 50 03 D9	SF12BW125	7	-26
Location	↑ 01:02:49	Receive uplink message	48 00 08 A5	FFPort: 2	Data rate: SF12BW125	SNR: 11.75	RSSI: -34
Collaborators	↑ 01:02:40	Receive uplink message	48 00 08 A5	FFPort: 2	Confirmed uplink	Data rate: SF12BW125	SNR: 11 RSSI: -33
API keys	↑ 01:02:31	Receive uplink message	48 00 08 A5	FFPort: 2	Confirmed uplink	Data rate: SF12BW125	SNR: 7 RSSI: -34

General settings

Hide sidebar

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balena dashboard | Marc-pi4 Application data - Temperature balena Node-RED : 192.168.1.46 ARM DEV SUMMIT - Grafana +

<https://192.168.1.46/console/applications/seeded-temperature/data>

THE THINGS STACK Open Source Overview Applications Gateways Organizations admin

Temperature Applications > Temperature > Live data

	Time	Entity ID	Type	Data preview	Verbose stream	Export as JSON	Pause	Clear
Overview	↑ 15:21:06	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610E45790000010710C4220000331A", valid: true }	01 06 10 E4 57 00 00 01			
End devices	↑ 15:11:04	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "01061088579000010710842D00008687B", valid: true }	01 06 10 80 57 00 00 01			
Live data	↑ 15:01:06	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "01061088579000010710182E000006A1", valid: true }	01 06 10 80 57 00 00 01			
Payload formatters	↑ 14:51:06	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C5790000010710742700006932", valid: true }	01 06 10 1C 57 00 00 01			
Uplink	↑ 14:41:06	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C579000001071088240000E071", valid: true }	01 06 10 1C 57 00 00 01			
Downlink	↑ 14:30:58	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610B856000000107107300000F648", valid: true }	01 06 10 B8 56 00 00 01			
Integrations	↑ 14:21:04	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610B85600000010710900008786", valid: true }	01 06 10 B8 56 00 00 01			
MQTT	↑ 14:11:01	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "00070064000A000106101C5700000010710442F0000832C", valid: true }	00 07 0			
Webhooks	↑ 14:00:59	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C5790000010710C02B0000BA84", valid: true }	01 06 10 1C 57 00 00 01			
Pub/Subs	↑ 13:51:01	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C57900000107105424000005E2", valid: true }	01 06 10 1C 57 00 00 01			
LoRa Cloud	↑ 13:40:59	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C579000001071002900000B0E", valid: true }	01 06 10 1C 57 00 00 01			
Collaborators	↑ 13:31:09	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C57900000107108841C00004AE", valid: true }	01 06 10 1C 57 00 00 01			
API keys	↑ 13:21:03	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C579000001071068100000576C", valid: true }	01 06 10 1C 57 00 00 01			
General settings	↑ 13:11:09	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C5790000010710041000008762", valid: true }	01 06 10 1C 57 00 00 01			
	↑ 13:00:59	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "0106101C5790000010710CC10000086BC", valid: true }	01 06 10 1C 57 00 00 01			
	↑ 12:51:07	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610B856000000107103C0F00001C06", valid: true }	01 06 10 B8 56 00 00 01			
	↑ 12:41:09	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610545600000010710AC0D00000002", valid: true }	01 06 10 54 56 00 00 01			
Hide sidebar	↑ 12:31:00	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610F055000000107100887000000FB", valid: true }	01 06 10 F0 55 00 00 01			
	↑ 12:21:04	eui-2cf7f1c043500054	Forward uplink data message	DevAddr: 01 95 AB AB <> Payload: { err: 0, messages: [..], payload: "010610F055000000107107C2E000000A4C", valid: true }	01 06 10 F0 55 00 00 01			

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What we are going to build today?

- + Build a LoRaWAN Basics™ Station gateway with the Raspberry Pi, Seeed WM1302 concentrator, balena and The Things Stack LNS. And connect a LoRa node to The Things Stack LNS.
- + Build your own private LoRaWAN with The Things Stack taking the advantage of the edge with MING.



balena dashboard | Marc-pi4 MQTT - Temperature - The Thing balena Node-RED : 192.168.1.46 ARM DEV SUMMIT - Grafana +

https://192.168.1.46/console/applications/seeded-temperature/integrations/mqtt

THE THINGS STACK Open Source Overview Applications Gateways Organizations admin

Temperature

Overview End devices Live data Payload formatters Uplink Downlink Integrations MQTT Webhooks Pub/Subs LoRa Cloud Collaborators API keys General settings Hide sidebar

Applications > Temperature > MQTT

MQTT

MQTT is a publish/subscribe messaging protocol designed for IoT. Every application on TTS automatically exposes an MQTT endpoint. In order to connect to the MQTT server you need to create a new API key, which will function as connection password. You can also use an existing API key, as long as it has the necessary rights granted.

Further resources

[MQTT server](#) | [Official MQTT website](#)

Connection information

MQTT server host

Public address: 192.168.1.46:1883

Public TLS address: 192.168.1.46:8883

Connection credentials

Username: seeded-temperature

Password: [Generate new API key](#) [Go to API keys](#)

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balena dashboard | Marc-pi4 Live data - eui-2cf7f1c04350054 balena Node-RED : 192.168.1.46 ARM DEV SUMMIT - Grafana

192.168.1.46:1880/#flow/8ba0200717f564e9

Flow 1

```

graph LR
    MQTT((v3/+devices/+up)) --> Function(function)
    Function --> InfluxDB[v1.x influxdb:8086/balena]
    
```

The screenshot shows the balena Node-RED interface with a single flow named "Flow 1". The flow consists of three main nodes connected sequentially: an MQTT input node ("v3/+devices/+up") on the left, a function node in the center, and an InfluxDB output node ("[v1.x] influxdb:8086/balena") on the right. The MQTT node has a green "connected" status indicator. The function node is orange and labeled with a lowercase 'f'. The InfluxDB node is brown and includes the text "[v1.x] influxdb:8086/balena". The flow starts with the MQTT node, which has a single output connection leading to the function node. From the function node, there is a single output connection leading to the InfluxDB node. The entire flow is contained within a white rectangular area with rounded corners.

Nodes

- common
 - inject
 - debug
 - complete
 - catch
 - status
 - link in
 - link call
 - link out
 - comment
- function
 - function
 - switch
 - change
 - range
 - template
 - delay
 - trigger
 - exec
 - filter
- network

Deploy

debug

all nodes

8/1/2022 1:41:40 node: 5cbcfc38ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg.payload : Object > { temperature: 21.9, soil: 0 } 8/1/2022 1:51:34 node: 5cbcfc38ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg : Object > { topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054", payload: object, qos: 0, retain: false, _msgid: "26672b9843b12765" } 8/1/2022 2:01:38 node: 5cbcfc38ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg : Object > object topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054/up" > payload: object temperature: 22 soil: 0 qos: 0 retain: false _msgid: "266ec623693d2303" measurement: "eui-2cf7f1c043500054"

balena dashboard | Marc-pi4 Live data - eui-2cf7f1c04350054 balena Node-RED : 192.168.1.46 ARM DEV SUMMIT - Grafana

192.168.1.46:1880/#flow/8ba0200717f564e9

Flow 1

```

graph LR
    subgraph Flow1 [Flow 1]
        v3["v3/+devices/+up"] --> f1["function"]
        f1 --> msg["msg"]
        msg --> v1x["[v1.x]"]
    end

```

Edit mqtt in node

Properties

- Server: stack:1883
- Action: Subscribe to single topic
- Topic: v3/+devices/+up
- QoS: 2
- Output: a parsed JSON object
- Name: Name

Enabled

debug

```

8/11/2022 1:41:40 node: 5cbcfc38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg.payload : Object
> { temperature: 21.9, soil: 0 }

8/11/2022 1:51:34 node: 5cbcfc38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> { topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054", payload: object, qos: 0, retain: false, _msgid: "26672b9843812765" }

8/11/2022 2:01:38 node: 5cbcfc38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> object
topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054"
payload: object
temperature: 22
soil: 0
qos: 0
retain: false
msgid: "2e6ec623693d2303"
measurement:
"eui-2cf7f1c043500054"

8/11/2022 2:11:30 node: 5cbcfc38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> object
topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054"
payload: object
temperature: 22.2
soil: 0
qos: 0
retain: false
msgid: "cdaef6697ca0b57"
measurement:
"eui-2cf7f1c043500054"

```

balena dashboard | Marc-pi4 Live data - eui-2cf7f1c04350054 balena Node-RED : 192.168.1.46 ARM DEV SUMMIT - Grafana

192.168.1.46:1880/#flow/8ba0200717f564e9

balena Node-RED

Flow 1

filter nodes

common

- inject
- debug
- complete
- catch
- status
- link in
- link call
- link out
- comment

function

- function
- switch
- change
- range
- template
- delay
- trigger
- exec
- filter

network

192.168.1.46:1880/#mqtt-broker-tab-security

Edit mqtt in node > Edit mqtt-broker node

Delete Cancel Update

Properties

Name: Name

Connection Security Messages

Username: seed-temperature

Password:
.....

Enabled 1 node uses this config On all flows

Deploy

debug

all nodes all tabs

```

8/1/2022 1:41:40 node: 5cbcb38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg.payload : Object
> { temperature: 21.9, soil: 0 }

8/1/2022 1:51:34 node: 5cbcb38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> { topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054", payload: object, qos: 0, retain: false, _msgid: "26672b9843b12765" }

8/1/2022 2:01:38 node: 5cbcb38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> object
topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054"
payload: object
temperature: 22
soil: 0
qos: 0
retain: false
msgid: "2e6ec623693d2303"
measurement:
"eui-2cf7f1c043500054"

8/1/2022 2:11:30 node: 5cbcb38ce3d4b76
v3/seeded-temperature/devices/eui-2cf7f1c043500054/up:
msg : Object
> object
topic: "v3/seeded-temperature
/devices/eui-2cf7f1c043500054"
payload: object
temperature: 22.2
soil: 0
qos: 0
retain: false
msgid: "cdaef6697ca0b57"
measurement:
"eui-2cf7f1c043500054"

```

balena dashboard | Marc-pi4 MQTT - Temperature - The Thin X balena Node-RED : 192.168.1.46 X ARM DEV SUMMIT - Grafana X +

192.168.1.46:1880/#flow/8ba0200717f564e9

balena Node-RED

Flow 1

filter nodes

common

- inject
- debug
- complete
- catch
- status
- link in
- link call
- link out
- comment

v3/+devices/+up

msg

[v1.x]

function

Edit Influxdb out node > Edit Influxdb node

Delete Cancel Update

Properties

Name: Name

Version: 1.x

Host: influxdb Port: 8086

Database: balena

Username:

Password:

Enable secure (SSL/TLS) connection

Enabled 1 node uses this config On all flows

Deploy

all nodes

debug

8/1/2022 1:41:40 node: 5cfcfb38ce03d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg.payload: Object { temperature: 21.9, soil: 0 } 8/1/2022 1:51:34 node: 5cfcfb38ce03d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg: Object { topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054", payload: object, qos: 0, retain: false, _msgid: "26672b9843b12765" } 8/1/2022 2:01:38 node: 5cfcfb38ce03d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg: Object { topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054", payload: object, temperature: 22, soil: 0, qos: 0, retain: false, _msgid: "2e6ec623693d2303" } measurement: "eui-2cf7f1c043500054" 8/1/2022 2:11:30 node: 5cfcfb38ce03d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg: Object { topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054", payload: object, temperature: 22.2, soil: 0, qos: 0, retain: false, _msgid: "c6daef6697ca0b57" } measurement: "eui-2cf7f1c043500054"

The screenshot displays the balenaCloud interface for a device named "Marc-pi4".

Device Summary:

- Status:** Online (UUID: b9fbcd4)
- OS:** Raspberry Pi 4 (using 64bit OS)
- Online For:** about 14 hours
- Supervisor Version:** 14.2.0
- Support Access:** Off
- Local IP Address:** 192.168.1.46
- Public IP Address:** 79.153.119.0
- Tags:** EUI:DCA632FFF554B34, URL: https://192.168.1.46
- Notes:** EUI : DCA632FFF554B34

Services:

Service	Status	Release
basestation	Running	d3542ad
grafana	Running	d3542ad
influxdb	Running	d3542ad
node-red	Running	d3542ad
postgres	Running	d3542ad
redis	Running	d3542ad
stack	Running	d3542ad
wifi-connect	Running	d3542ad

System Monitoring:

- CPU:** -76% (Temperature: -60C)
- Memory:** 1.1 GB/3.8 GB
- Storage:** 2.7 GB/28.3 GB

Logs:

```
2022-11-22 01:17:02 (+0000) influxdb [httpd] 172.18.0.5 - - [08/Nov/2022:01:17:02 +0000] "GET /query?db=balena&q=showFieldKeys HTTP/1.1" 200 278 "-" "Python-urllib/3.7" 8ce2ef34-5f03-11ed-8986-0242ac120004 3629
2022-11-22 01:17:02 (+0000) grafana [Interim dashboard sync complete.]
2022-11-22 01:17:05 (+0000) basestation 2022-11-08 01:17:05.155 [SYN:VERB] Time sync rejected: quality=286 threshold=267
2022-11-22 01:17:12 (+0000) influxdb [httpd] 172.18.0.5 - - [08/Nov/2022:01:17:12 +0000] "GET /query?db=balena&q=showFieldKeys HTTP/1.1" 200 278 "-" "Python-urllib/3.7" 131401bf-5f03-11ed-8987-0242ac120004 1727
2022-11-22 01:17:13 (+0000) grafana [Interim dashboard sync complete.]
2022-11-22 01:17:15 (+0000) basestation 2022-11-08 01:17:15.658 [SYN:VERB] Time sync rejected: quality=274 threshold=267
```

Terminal:

```
Connecting to b9fbcd42b0de09e5b65aa77b2edc1ff...
Spawning shell...
root@27005dcbb608:/# influx
Connected to http://localhost:8086 version 1.7.11
InfluxDB shell version: 1.7.11
> create database balena
> 
```

balena dashboard | Marc-pi4 X Live data - eui-2cf7f1c04350054 X balena Node-RED : 192.168.1.46 X ARM DEV SUMMIT - Grafana X +

192.168.1.46:1880/#flow/8ba0200717f564e9

balena Node-RED

Flow 1

common

- inject
- debug
- complete
- catch
- status
- link in
- link call
- link out
- comment

function

- function
- switch
- change
- range
- template
- delay
- trigger
- exec
- filter

network

v3/+/devices/+/up connected

function

Edit function node

Properties

Name: Name

Setup On Start On Message On Stop

```
1 var decoded = {};
2
3 var message = msg.payload.uplink_message.decoded_payload.messages;
4 var device = msg.payload.end_device_ids.device_id;
5
6 var temperature = 0;
7 var soil = 0;
8
9 for (var i = 0; i < message.length; i++) {
10    var item = message[i].measurementId;
11    if (item == 4102) {
12    }
13    temperature = message[i].measurementValue;
14  } else if (item == 4103) {
15    soil = message[i].measurementValue;
16  }
17}
18 msg.measurement = device;
19 msg.payload = {"temperature": temperature, "soil": soil};
20
21 return msg;
```

Enabled

Deploy

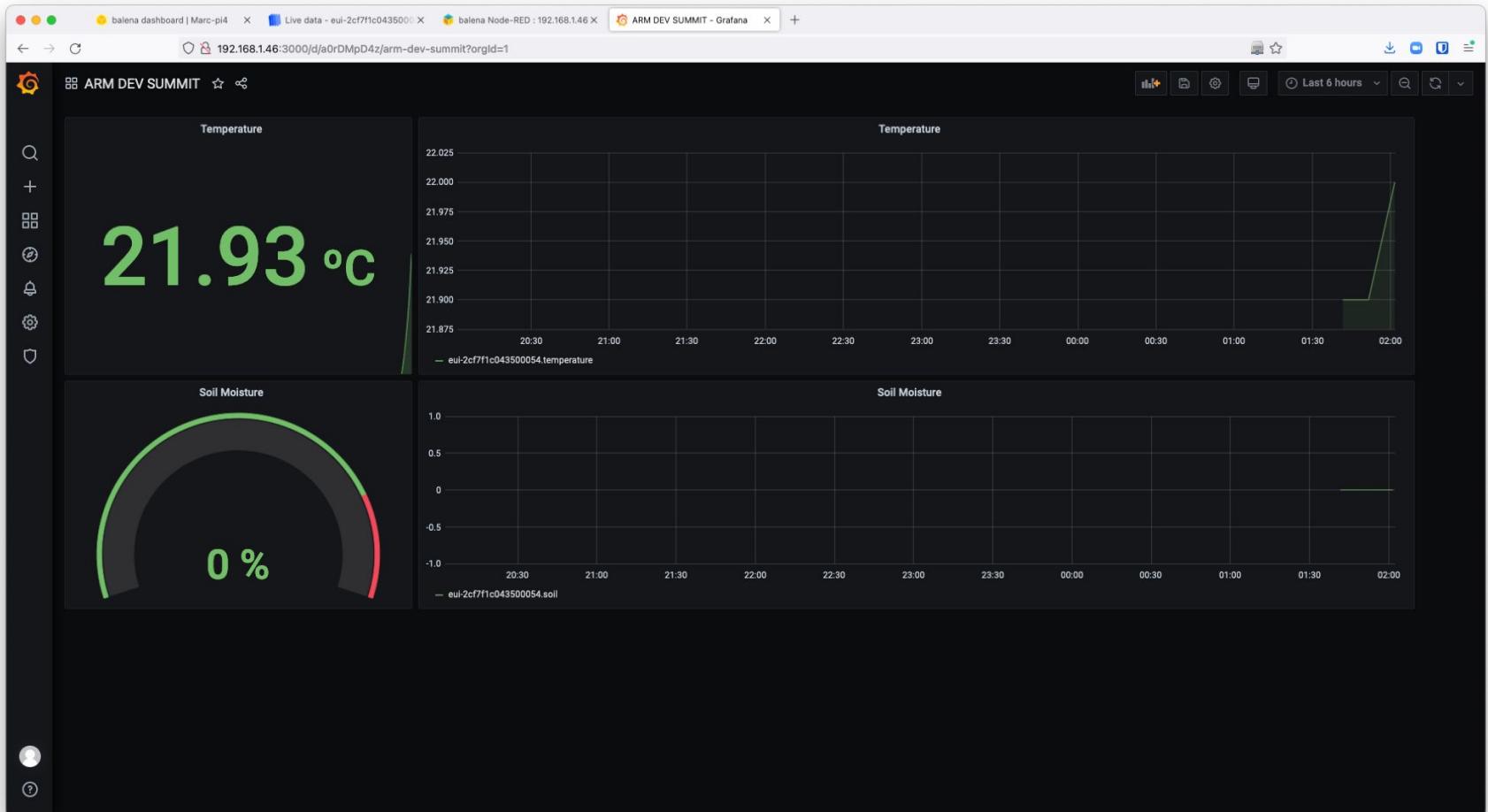
debug

all nodes

8/11/2022 1:41:40 node: 5cbc738ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg.payload : Object
 > { temperature: 21.9, soil: 0 }

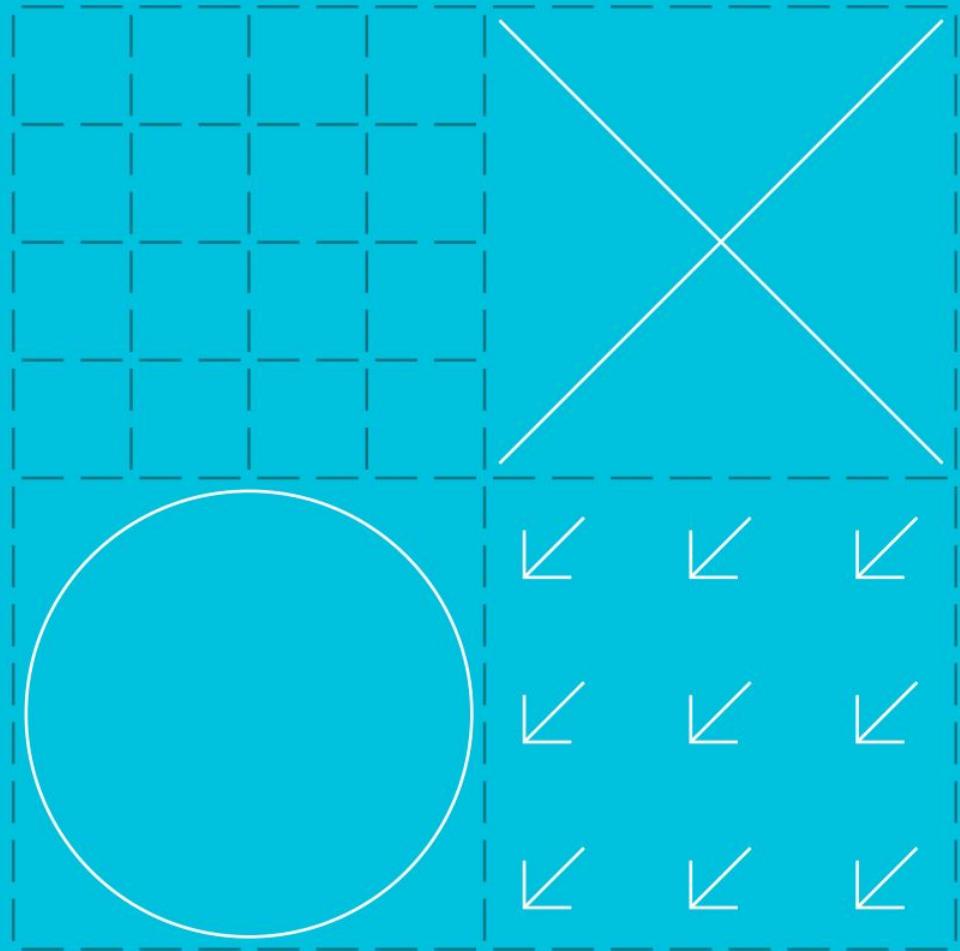
8/11/2022 1:51:34 node: 5cbc3b8ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg : Object
 > { topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054", payload: object, qos: 0, retain: false, _msgid: "26672b9843b12765" }

8/11/2022 2:01:38 node: 5cbc738ce3d4b76 v3/seeded-temperature/devices/eui-2cf7f1c043500054/up: msg : Object
 > object
 topic: "v3/seeded-temperature /devices/eui-2cf7f1c043500054"
 > payload: object
 temperature: 22
 soil: 0
 qos: 0
 retain: false
 _msgid: "2e6ec623693d2303"
 measurement:
 "eui-2cf7f1c043500054"





Summary



- LPWAN are here ready to use!
- Reduce the friction to manage your fleet, the easy way™.
- Use modern tools to get benefit of the edge computing.

- LPWAN are here ready to use!
- Reduce the friction to manage your fleet, the easy way™.
- Use modern tools to get benefit of the edge computing.
- **Please, contribute!**



Marc Pous

Developer Advocate @ balena.io

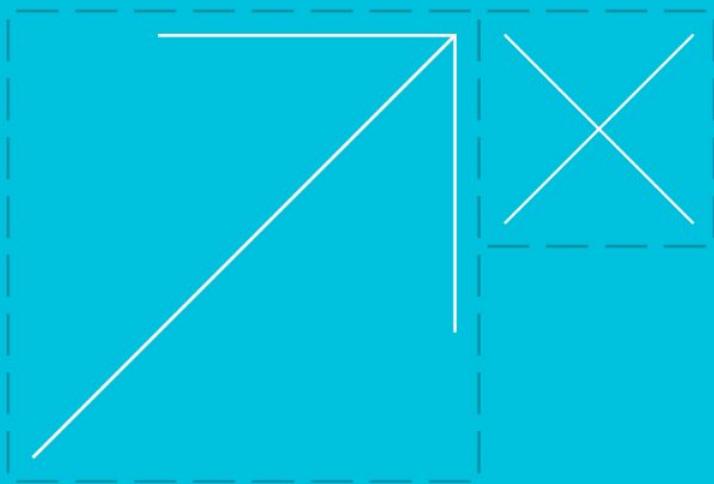
e: marc@balena.io

t: [@gy4nt](https://twitter.com/@gy4nt)

Questions?

and feedback?

<https://forums.balena.io/>



Thank You

Gràcies

Danke

Gracias

謝謝

ありがとう

Asante

Merci

감사합니다

ধন্যবাদ

Kiitos

شکرًا

ধন্যবাদ

האודה

**Learn what is LoRa,
LoRaWAN and build your
first LoRaWAN gateway,
the easy way™**

Marc Pous - Developer Advocate at balena.io

arm Dev Summit 2022



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