

Build Air Quality Sensors with Python and choose your own adventure!

Python Barcelona 2022

26th of November 2022





# Marc Pous

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A screenshot of a YouTube video player window. The video is titled "PyDayBCN 2020 Track 2 - Building My First Python IoT Device with Containers in 20 minutes by M. Pous". The video has 78 views and was posted on Dec 15, 2020. The video duration is 25:00, and it is currently at 0:37. The video content shows an aerial view of a port with many shipping containers stacked in rows. A white overlay text box contains the text "Containers love IoT" and a small 3D cube icon. To the right of the video frame, there is a circular profile picture of a man wearing a t-shirt with "balenaEuler" on it. The YouTube interface includes a search bar, a magnifying glass icon, a microphone icon, and various control buttons like play, pause, and volume. The bottom right corner of the video frame features the "python barcelona" logo.

PyDayBCN 2020 Track 2 - Building My First Python IoT Device with Containers in 20 minutes by M. Pous

78 views · Dec 15, 2020

0:37 / 25:00

Containers love IoT

Containers love IoT

Building My First Python IoT Device with Containers

All Watched

How to Connect Github with PyCharm | #Hindi |

<https://www.youtube.com/watch?v=nWVJ7HfFC5E>





[https://pybcn.org/events/pyday\\_bcn/pyday\\_bcn\\_2021/](https://pybcn.org/events/pyday_bcn/pyday_bcn_2021/)

# Inspired by Ribbit Network



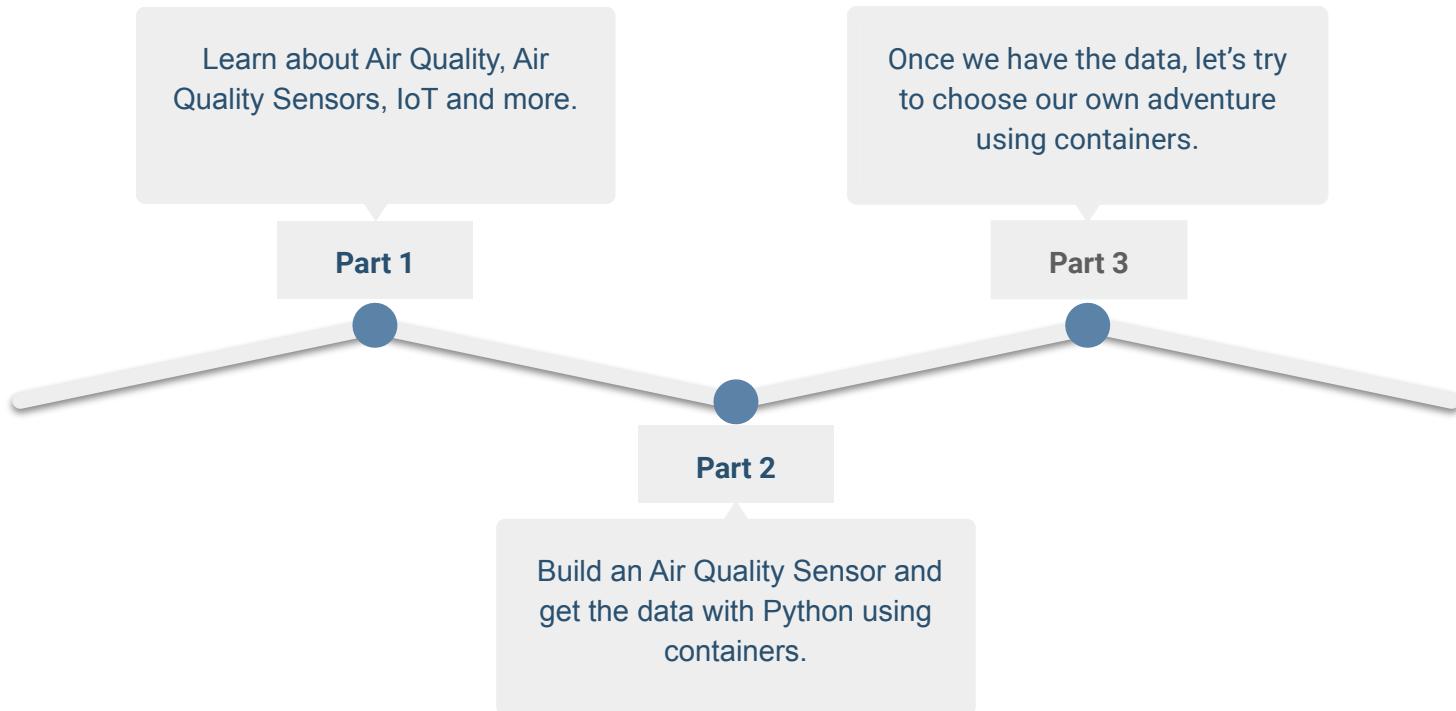
<https://www.rabbitnetwork.org/>



and by this ...



# What are we going to do today?



# Air Quality Sensors

# Air Quality

- Air quality is a measure of how clean or polluted the air is.
- Monitoring air quality is important because polluted air can be bad for our health.
- Air quality is measured with the Air Quality Index (AQI).

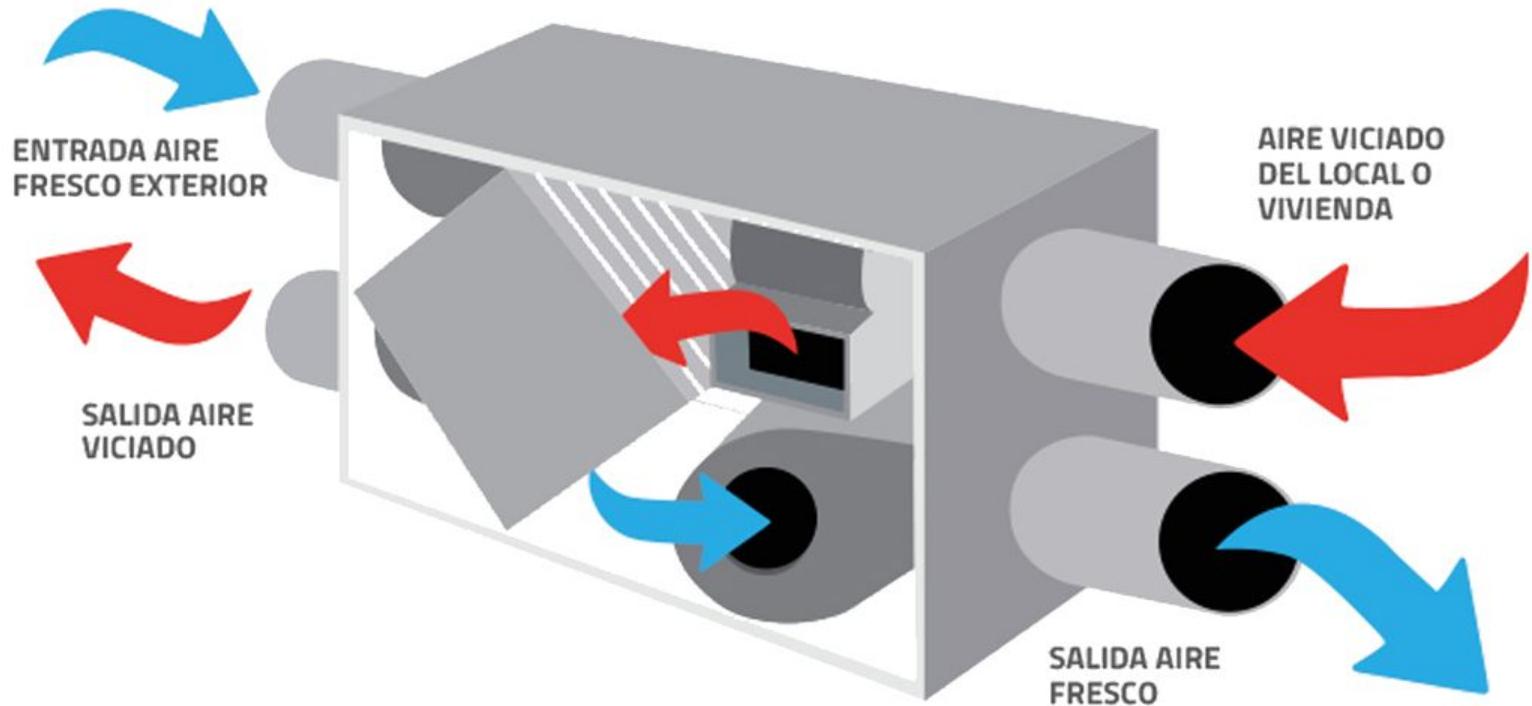


# Air Quality Index

The Air Quality Index is used by government and agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become.



# What is an Air Quality Sensor?



# Air Quality Sensors in the market

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89,91€ + envío: € 5,82 Mi Fans Life Store

smartmi

Smart Formaldehyde Monitor

Air Detector

126,63€ Nuevo usuario 3 dto. cada € 25 gastados 99 vendido(s) ★ 5 Envío gratis Mi Agara Yeelight Store

14,92€ Nuevo usuario 35 vendido(s) ★ 5 Envío gratis Mi Fans Store

117€ Envío gratis mijia youpin Store

smartmi

smartmi

smartmi

smartmi



# Air Quality Sensors in the market

The screenshot shows the IKEA website for the VINDRIKTNING Air quality sensor. The product is displayed in a white, rectangular box with a vertical slot on the front. It is shown in a room setting on a white cabinet next to a vase of branches and a stack of books. The price is listed as 17€ with a 5-star rating. The product must be paired with a LILLHULT USB cable. Delivery is available to store 08032 Badalona. An 'Add to cart' button is at the bottom.

VINDRIKTNING  
Air quality sensor

**17€**

★★★★★ (5)

Consistent financing

Must be completed with

LILLHULT  
USB-A to USB-C, 1.5 m  
4€

How to get it

Delivery to 08032  
Available

Badalona  
Store - In stock  
Locate product in store

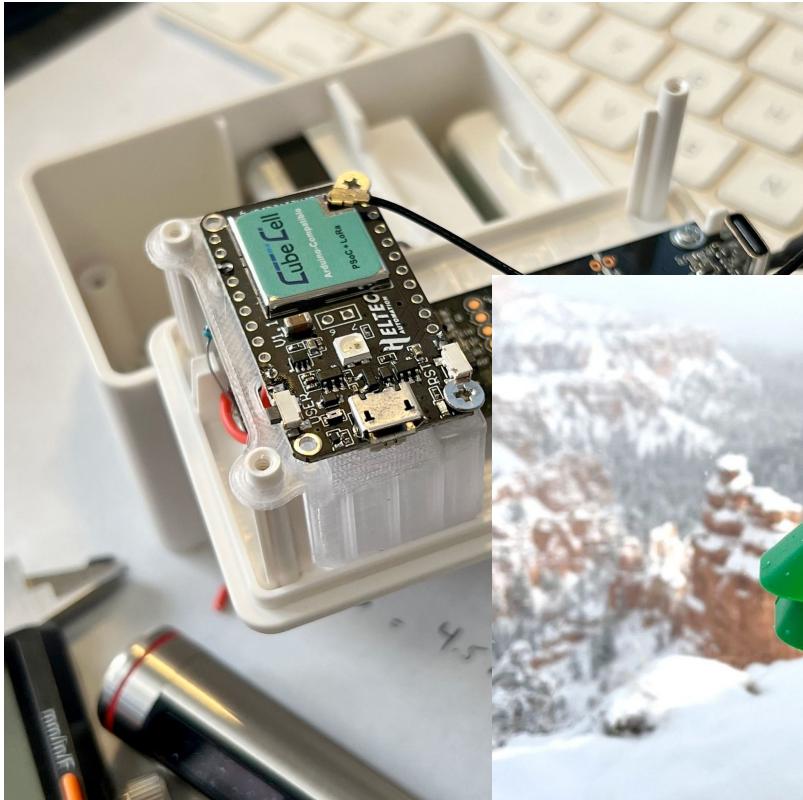
Add to cart

<https://www.ikea.com/es/en/p/vindriktning-air-quality-sensor-70498242/>



Let's optimize for fun!

# Build your own Air Quality Sensor

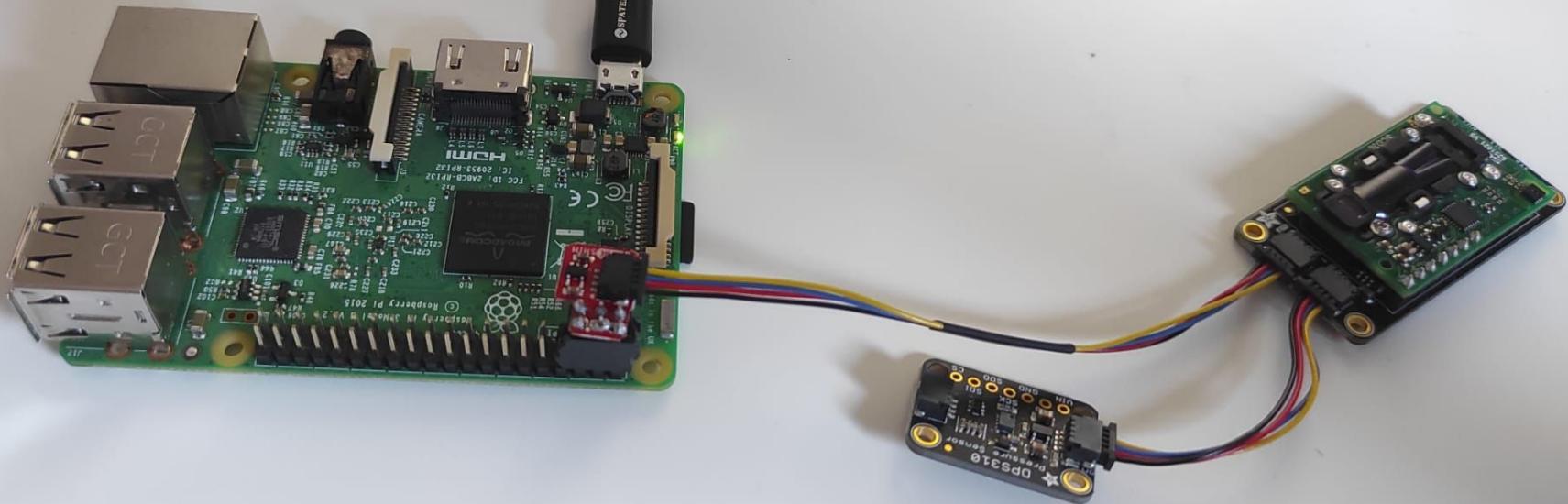


<https://github.com/jthiller/CubeCell-Helium-vindriktnings-particle-sensor>

<https://ribbitnetwork.org>

<https://balenair.com/>





# Air Quality Sensors?

Sensors, Gas / TVOC / Air Quality

<https://www.adafruit.com/category/897>

**Adafruit PMSA003I Air Quality Breakout - STEMMA QT / Qwiic**

PRODUCT ID: 4632

Breathe easy, knowing that you can track and sense the quality of the air around you with this Adafruit PMSA003I Air Quality Breakout. This sensor is great for monitoring air quality, in a compact plug-in format. Best of all, unlike almost all other sensors we've seen that are UART interface, this one is I2C interface, which makes it a great match for single-board...

**Add to Cart** \$44.95  
100 in stock

---

**Adafruit SGP40 Air Quality Sensor Breakout - VOC Index - STEMMA QT / Qwiic**

PRODUCT ID: 4829

\*sniff! \*sniff... do you smell that? No need to stick your nose into a carton of milk anymore, you can build a digital nose with the SGP40 Multi-Pixel Gas Sensor, a fully integrated MOX gas sensor. This is a very fine air quality sensor from the sensor experts at Sensirion, with I2C interfacing so you don't have to manage the heater and analog reading of a MOX...

**Add to Cart** \$14.95  
In stock

---

**Adafruit SCD-30 - NDIR CO<sub>2</sub> Temperature and Humidity Sensor - STEMMA QT / Qwiic**

PRODUCT ID: 4867

Take a deep breath in...now slowly breathe out. Mmm isn't it wonderful? All that air around us, which we bring into our lungs, extracts oxygen from and then breathes out carbon dioxide. CO<sub>2</sub> is essential for life on this planet we call Earth - we and plants take turns using and emitting CO<sub>2</sub> in an elegant symbiosis. But it's important to keep that CO<sub>2</sub> balanced - you...

**Add to Cart** \$58.95  
In stock

---

**PM2.5 Air Quality Sensor and Breadboard Adapter Kit - PMS5003**

PRODUCT ID: 3686

Breathe easy, knowing that you can track and sense the quality of the air around you with the PM2.5 Air Quality Sensor with Breadboard Adapter particulate sensor. Mad Max & Furiosa definitely should have hooked up one of these in their truck while scavenging the dusty desert wilderness of post-apocalyptic Australia. And for those of us not living in an Outback...

0.0 \*\*\*\*\*  
No rating available



# AQI calculations

The Air Quality Index scores from 0 (best air quality) to 99 (hazardous air quality). Each sensor has a range of readings that are categorized as “good”, “moderate”, “unhealthy”. These ranges are based in part on various governmental standards.

Reading	Description	Sensor Type	good range (0 - 50)	moderate range (51 - 74)	unhealthy range (75 - 99)
PM2.5	Smoke, dust, dirt, pollen	PMSA003I	12 - 34 ug/m3	35 - 54 ug/m3	55+ ug/m3
PM10	Dust, smoke, exhaust, tiny particles	PMSA003I	0 - 53 ug/m3	54 - 149 ug/m3	150+ ug/m3
CO2	Exhaled breath and burning fossil fuels	SCD-40	400 - 999 PPM	1000 - 1999 PPM	2000+ PPM
VOC	Gasses emitted by solid and liquid products	SGP-30	0 - 499 PPB	500 - 999 PPB	1000+ PPB



# How to build my own Air Quality Sensor



# Bill of Materials

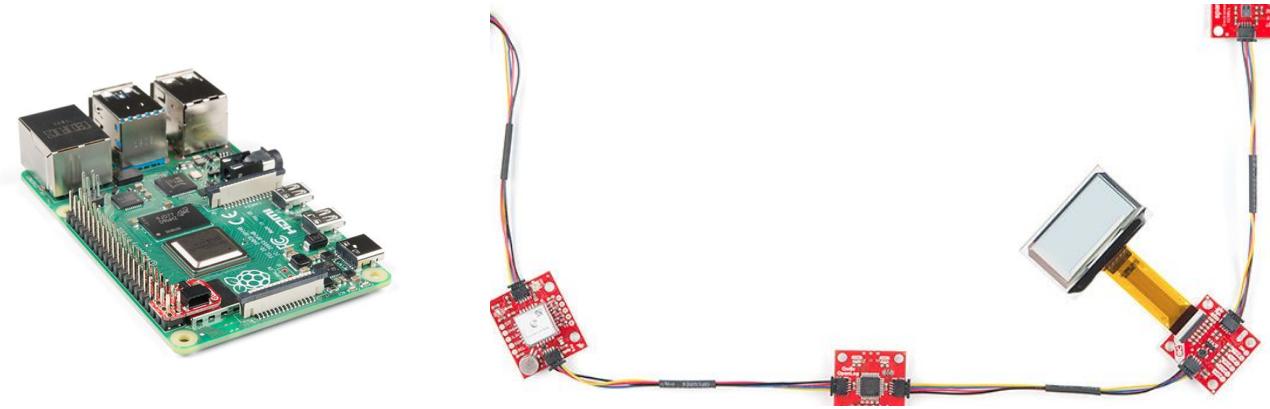
This is a project based on the Ribbit Network Frog sensor

- Raspberry Pi 3 / 4
- Adafruit SCD-30 ( $\text{CO}_2$ , temperature and humidity)
- Barometer DPS-310
- Sparkfun Qwiic
- Qwiic 4-pin cables
- Power supply unit and SD card



# What is the i<sup>2</sup>c?

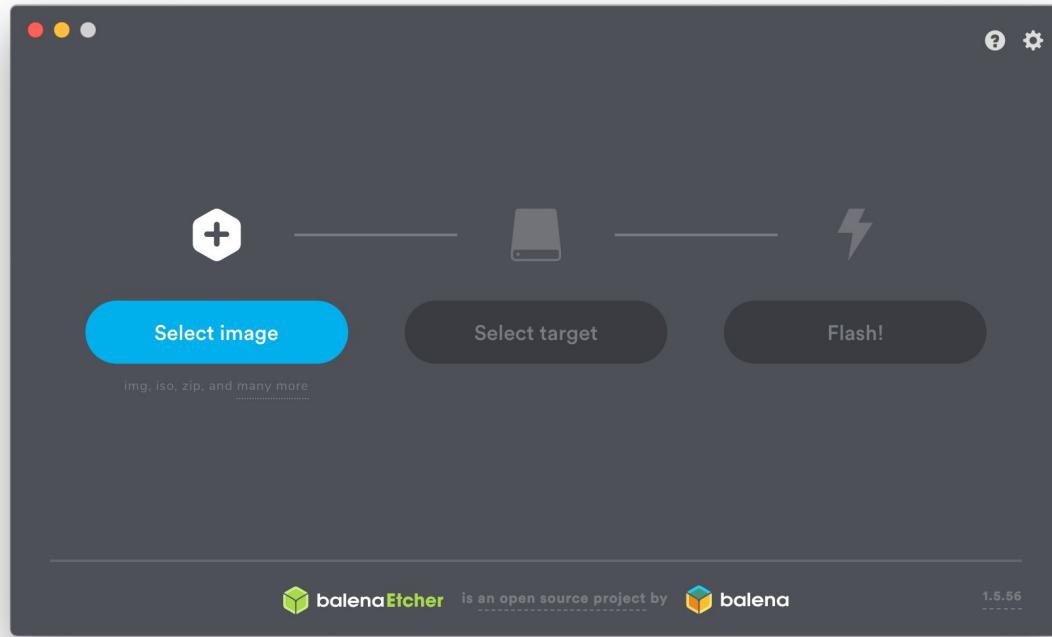
The i<sup>2</sup>c (*Inter-Integrated Circuit*) is a protocol for communications between integrated circuits with on-board peripherals.



How to build my own  
Air Quality Sensor  
using Python  
(and containers)



# Anyone know this?



# Fleet management

The screenshot shows the balena dashboard interface for a device named "mean-rainfall".

**Device Summary:**

- Status: Online (UUID: 79274f1c47d09ad5888d3d092a01e049)
- Type: Balena Fin (CM3)
- Online for: 5 days
- Host OS Version: balenaOS 2.83.21+rev1 (development)
- Supervise Version: 12.10.3
- Current Release: 4e72605
- Target Release: 4e72605
- Local IP Address: 10.136.210.127
- Public IP Address: 79.153.223.19
- MAC Address: B8:27:EB:F0:4F:09  
AC:3F:A4:EB:21:EC  
AC:3F:A4:EB:2B:EC
- Public Device URL: [View](#)
- Tags: No tag configured yet

**Services:**

Service	Status	Release
grafana	Running	4e72605
influxdb	Running	4e72605
mqtt	Running	4e72605
node-red	Running	4e72605
wifi-connect	Running	4e72605

**Metrics:**

- CPU: ~42% Usage
- Temperature: ~50C
- Memory: 350 MB / 970 MB
- Storage: 1.0 GB / 6.4 GB

**Logs:**

```
07.10.22 02:35:02 (+0000) [influxdb] [httpd] 172.18.0.2 - - [07/Oct/2022:02:35:02 +0000] "GET /query?db=balenak8sshowfieldkeys HTTP/1.1" 200 70 "-" "Python-urllib/3.7" a5493ed45e8b11ed-8075-0242act120003 159
07.10.22 02:35:02 (+0000) [grafana] Interim dashboard sync skipped: No schema found.
07.10.22 02:35:12 (+0000) [influxdb] [httpd] 172.18.0.2 - - [07/Oct/2022:02:35:12 +0000] "GET /query?db=balenak8sshowfieldkeys HTTP/1.1" 200 70 "-" "Python-urllib/3.7" ab42ab82-45e8-b11ed-8076-0242act120003 1302
07.10.22 02:35:12 (+0000) [grafana] Interim dashboard sync skipped: No schema found.
07.10.22 02:35:22 (+0000) [influxdb] [httpd] 172.18.0.2 - - [07/Oct/2022:02:35:22 +0000] "GET /query?db=balenak8sshowfieldkeys HTTP/1.1" 200 70 "-" "Python-urllib/3.7" b1ba54f4-45e8-b11ed-8077-0242act120003 1974
07.10.22 02:35:22 (+0000) [grafana] Interim dashboard sync skipped: No schema found.
```

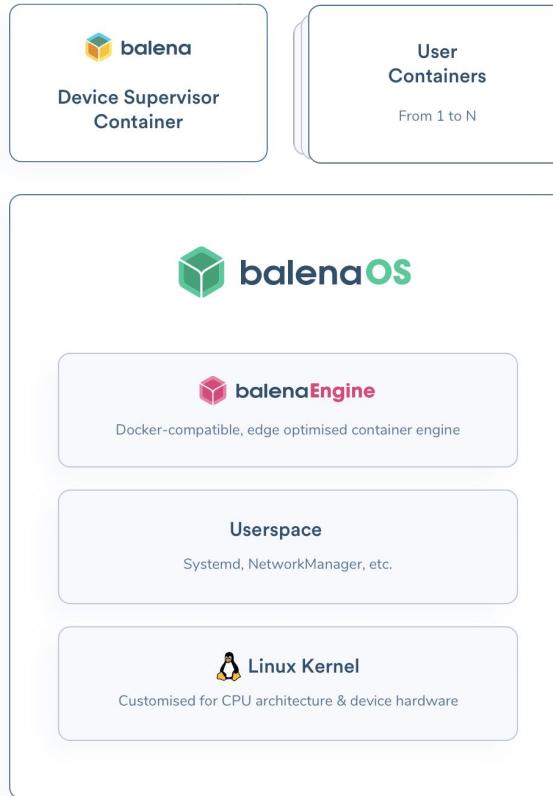
**Terminal:**

Select a target [View](#)

Start terminal session



# Let's take advantage of the containers in the Edge



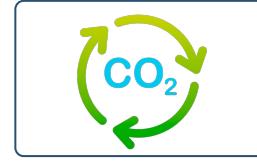
# Let's take advantage of the containers in the Edge



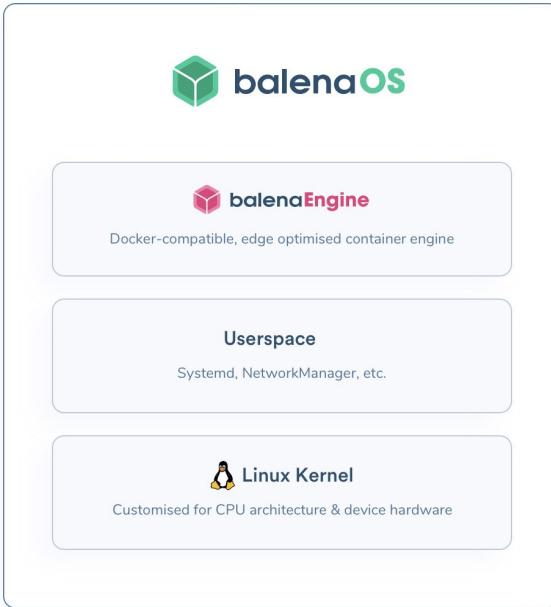
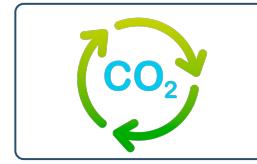
Device Supervisor  
Container



User  
Containers  
From 1 to N



# Let's take advantage of the containers in the Edge



Let's build it live!

# Go to the repo and start playing

<https://github.com/mpous/co2-sensor>



# Now it's time to choose your own adventure!

What else would you like to use?



# Let's wrap-up!



# Why do we do this?

- Reduce friction to create IoT devices using Python (and more).
- Enable the IoT developers and professionals to manage their fleets.
- Contributors are welcome!





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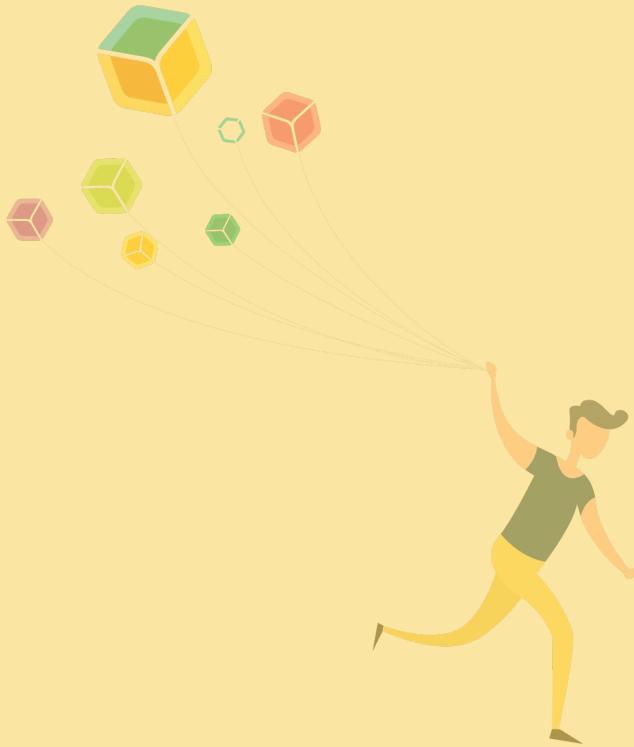
e: [marc@balena.io](mailto:marc@balena.io)

g: [github.com/mpous](#)

t: [twitter.com/gy4nt](#)



# Questions?



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