Dashboards, from data to infographics

IOT en Dashboards

Derek Land (d.d.land@hhs.nl)
Suzanne Verspaandonk - de Jong (s.d.dejong@hhs.nl)

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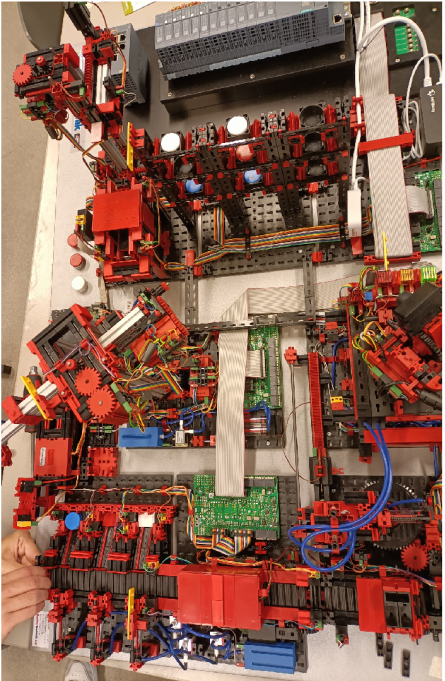
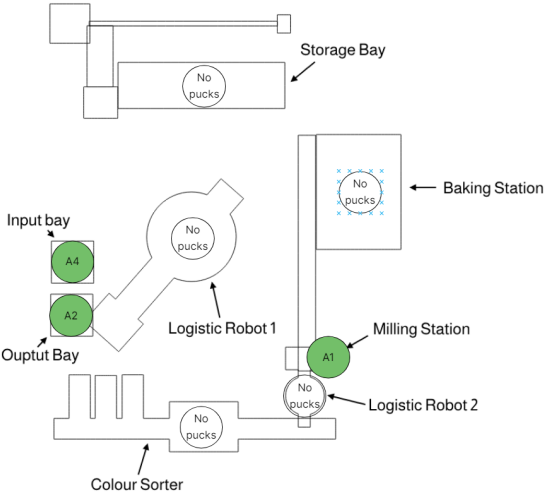
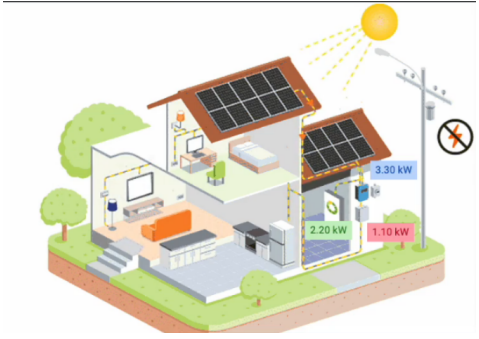
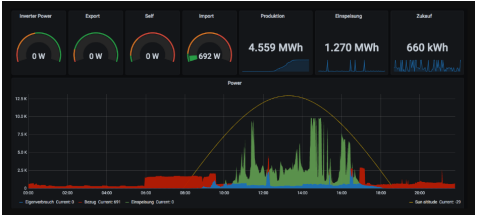



Storage Bay
No pucks
Baking Station
No pucks
Input bay
A4
A2
No pucks
Logistic Robot 1
Ouptut Bay
Milling Station
A1
No pucks
Logistic Robot 2
No pucks
Colour Sorter

Grafana





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Today

- 7 min Where does the data come from?
- 13 min Data storage?
- 10 min Display data in Dashboards
  - Using data for sustainable manufactoring

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Today

7 min Where does the data come from?

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Details

- Measuring data with an IOT device
- Sending data from an IOT device
- Receiving data using a IOT message protocol (MQTT)
- Collecting data in a graphical interface (Grafana)
- Using the information $\rightarrow$ up to you!

Today

7 min Where does the data come from?

13 min Data storage?

10 min Display data in Dashboards

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Applied University

- Working from sensor to Dashboard
- Handson experience
- Background information for further applications

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Who am I

And why do I give this talk?

Who am I

And why do I give this talk?

- Lecturer at the Applied Physics department (THUAS)
  - Teaching computational related physics courses
- Researcher at the Smart Sensor Systems research group
  - Extracting the right data at the right time from sensors
  - In various fields (agriculture, predictive maintanance, well-being)

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IOT Device - What is data?

Sensor Data

The output from a device that responds to the environment

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IOT Device - What is data?

Sensor Data

The output from a device that responds to the environment

- RaspberryPi - Pico (WH)
- Many possible use-cases
- Onboard temperature sensor
- Wireless capabilities

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IOT Device - What is data?

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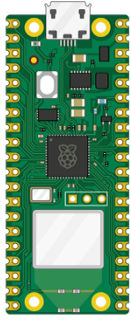

- RaspberryPi - Pico (WH)
- Many possible use-cases
- Onboard temperature sensor
- Wireless capabilities

Code already installed, ready to send data to the cloud!

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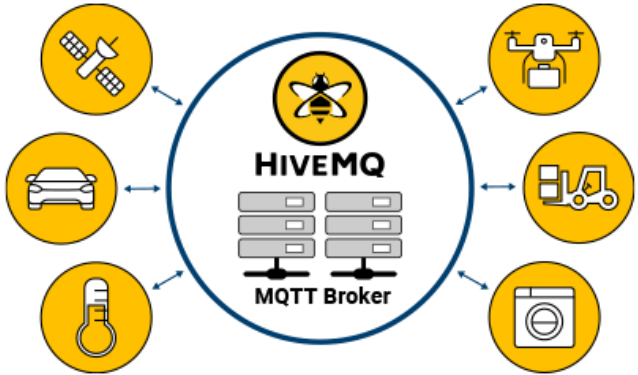
IOT device - Cloud - Dashboard

Many other options... But this one for today

MQTT - cloudprovider

hiveMQ.com

A free Cloud MQTT Broker that enables you to connect up to 100 devices.



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- Easy to see what is going on
- Nice for testing / learning / demonstrations
- Free to use with limited devices connected, easy to replace with other tools

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At home: RaspberryPi with mosquitto (MQTT) and a database container
Professional: Surf (Apache Kafka) or paid HiveMQ or own infrastructure

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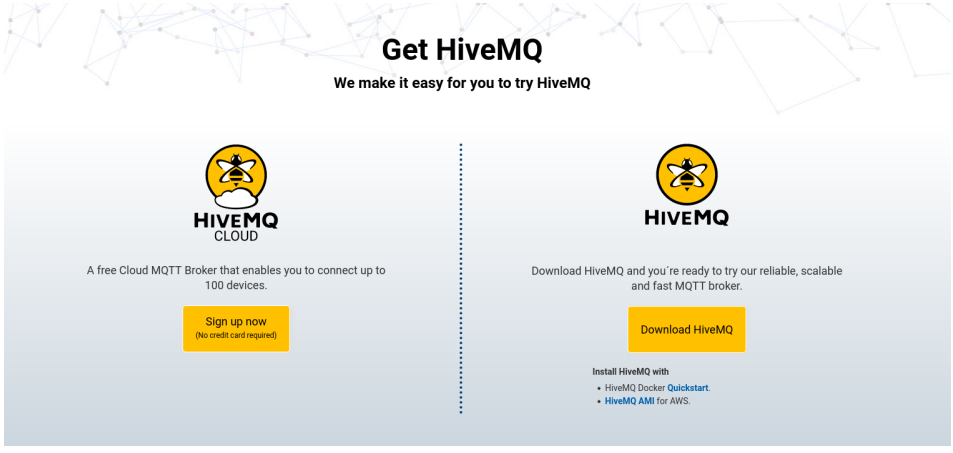
hiveMQ.com - registration



hiveMQ.com - registration

Select the HiveMQ Cloud plan you need

Serverless

FREE

By selecting **Get Started** you agree to our current SaaS Terms.

Get Started

A basic MQTT broker for learning and experimenting with MQTT.

A great place to play

- Shared MQTT platform

RECOMMENDED

Starter

Starts from ⓘ

$**0.34**/hour + $**0.80**/million messages

$**250**/month*

*estimated total

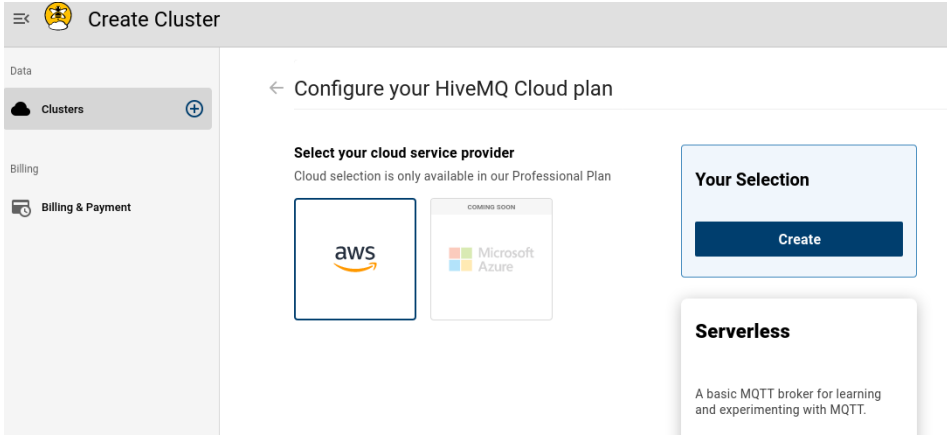
Try with Free Credits

Complete MQTT platform for testing and small-scale production.

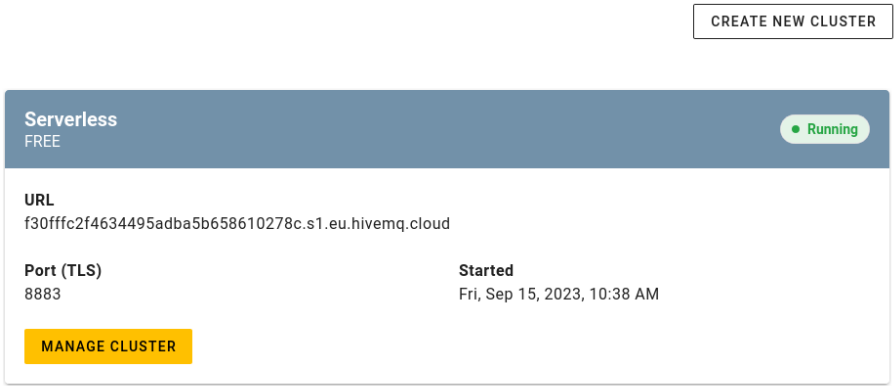
Everything in Serverless, plus

- Dedicated MQTT platform

hiveMQ.com - registration

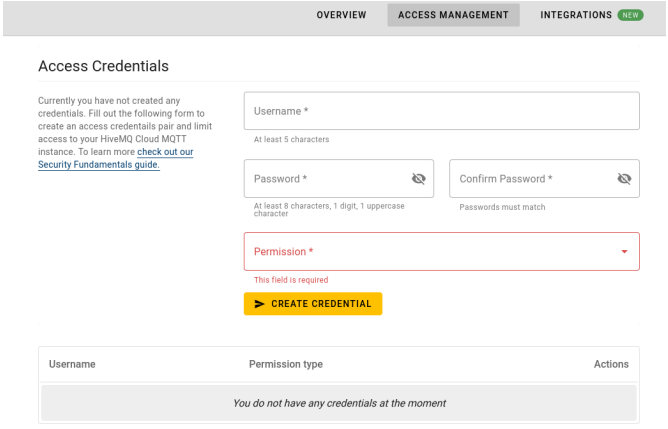


hiveMQ.com - registration



note the URL (will need that later!)

hiveMQ.com - cluster



create an account for your device (and the webviewer)

RaspberryPi Pico WH

- Circuitpython installed
- Accessable as a USB-device
- Connect Pico-W and edit `settings.toml`

Only need to change:

1. HIVE_cluster_url
2. HIVE_username
3. HIVE_password

With the generated credentials!
`https://github.com/ddland/MasterClass-Dashboards` for complete code!

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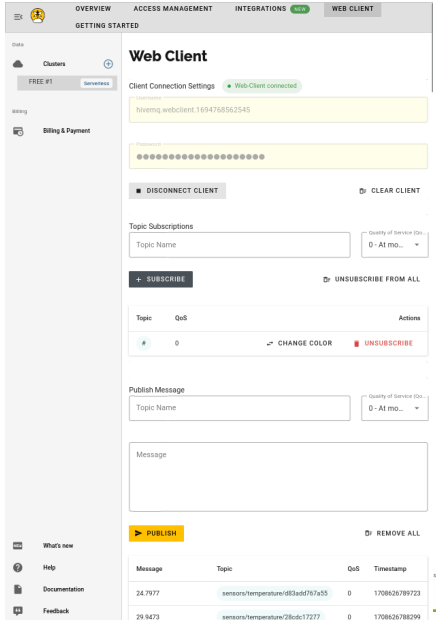
Data?

- Web client receives (and displays) data
- Temperature data with Timestamps
- Topic per sensor



Dashboard

How to display the data?

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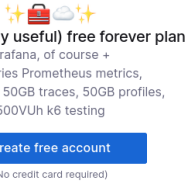
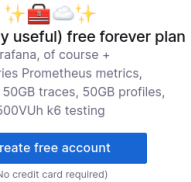
Grafana.com



- Self-hosted, opensource
- Cloudbased, subscription model
- Free account nice for testing and learning

Grafana.com



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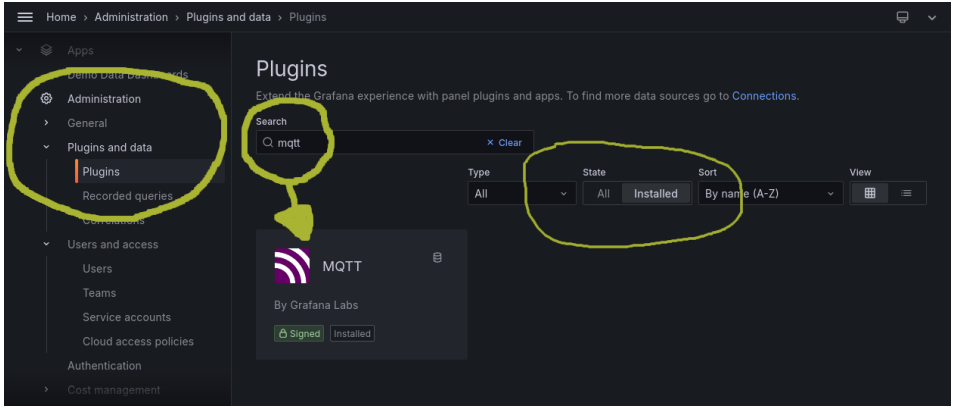
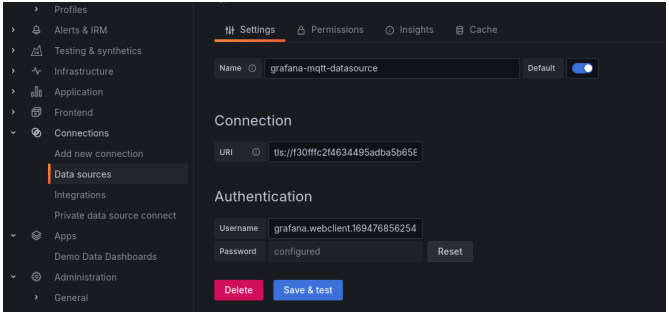
→ sign-up... and launch Grafana-stack (skip introduction)

HiveMQ - Grafana



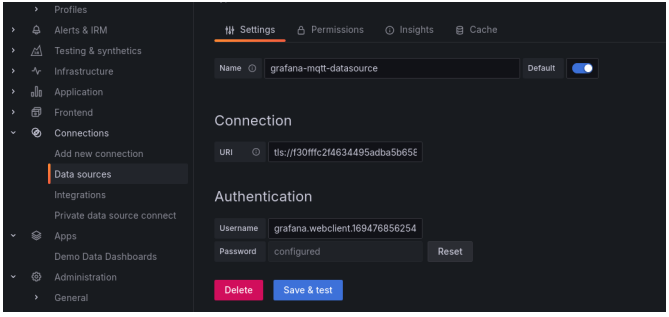
- Install MQTT plugin
- Only streaming data, no storage!

Grafana - MQTT



- URL from HiveMQ (add the tls://, port :8883 at the end of the address)
- Username / password credentials from HiveMQ
- Save & Test

Grafana - MQTT



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Testing OK? → explore data

Copy TOPIC from HiveMQ (or Raspberrypi Pico) in Explore Topic field

Do you see some data?

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Grafana - Dashboard

Grafana Dashboard

A Grafana dashboard consists of panels displaying data in beautiful graphs, charts, and other visualizations.

So explore, add some panels and visualise the sensor data!

Grafana - Dashboard

Grafana Dashboard

A Grafana dashboard consists of panels displaying data in beautiful graphs, charts, and other visualizations.

So explore, add some panels and visualise the sensor data!

- Does your temperature measure the same as your neighbours?
- When should there be an alert colour?
- What do you want to bring across with the panel?
- Who is the intended audiance?

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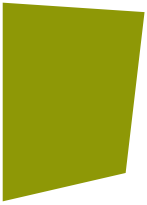
Take aways

- Where does the data come from?
- Does your measurement represent the data your want?
- How do you get the data to the end-user?
- What do you want to display?
- How do you make sure your message is understood?



Transforming data to information

First challenge in dashboard design is defining the information value of your data

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Transforming data to information

First challenge in dashboard design is defining the information value of your data

- Average temperature?

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Transforming data to information

First challenge in dashboard design is defining the information value of your data

- Average temperature?
- Realtime temperature?

Transforming data to information

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- Temperatures below or above a certain value?

Transforming data to information

First challenge in dashboard design is defining the information value of your data

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- Combination?

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Transforming data to information

Then you can choose how to present that information

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Transforming data to information

Then you can choose how to present that information

- Average temperature? $\rightarrow$ Number, bar graph

Transforming data to information

Then you can choose how to present that information

- Average temperature? $\rightarrow$ Number, bar graph
- Realtime temperature? $\rightarrow$ Graph, table, gauge chart

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Transforming data to information

Then you can choose how to present that information

- Average temperature? → Number, bar graph
- Realtime temperature? → Graph, table, gauge chart
- Temperatures below or above a certain value? → Graph, number, gauge chart (with boundaries)

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Transforming data to information

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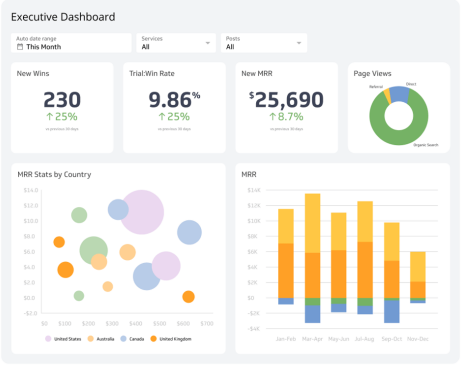
Make it easy and attractive

- Alignment
- Colour
- Avoid information overflow

Make it easy and attractive

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