

# IoT...big data...cloud - let's start small!

Build Stuff conference  
Vilnius, 13-15 Nov 2024

Software  
Development  
Conference

Build  
Stuff

Nov. 13-15  
Lithuania



# IoT ... big data ... cloud - let's start small!

Thomas Hütter, Diplom-Betriebswirt

- Developer for ERP apps, SQL scripts and BI stuff
- Worked at consultancies, ISVs, end user companies
- 1995: SQL Server, 2014: R, 2020: Power\*, 2024: Arduino
- Speaker at SQL / data / dev events around Europe



 @DerFredo <https://twitter.com/DerFredo>

 [de.linkedin.com/in/derfredo](https://de.linkedin.com/in/derfredo)

 <https://bsky.app/profile/derfredo.bsky.social>



# sqlbits

{ } NDC  
Conferences



# Agenda

- IoT - the (inter)net of things
- The Arduino ecosystem
  - Hardware
  - Software
  - Cloud
- Azure cloud and IoT Central
  - Apps
  - Devices, groups and templates
  - Data explorer and dashboards
- Round-up, additional resources & learning

# IoT - the (inter)net of things

Entirety of devices („things“) that are connected to a global or local network, and may be equipped with any combination of

- sensors  
temperature, humidity, (air) pressure, light, sound, movement ...
- actuators  
LEDs, buzzers, motors, relays, valves, (water) pumps ...
- processing capability  
trade-off between use case requirements, cost, power consumption
- means of communicating  
Bluetooth/BLE, WiFi, Ethernet, LoRaWAN, GSM, satellite

# IoT - the (inter)net of things

Examples of IoT / „smart“ devices:

- Coke vending machine at Carnegie Mellon University, around 1982
- First web cam: Trojan room coffee machine, Uni of Cambridge, 1991/1993
- any remote webcams
- home automation / burglar alarm systems
- your mobile (smart) phone 😊
- wearables (smart watches, activity trackers)
- smart vehicles (thanks, GPS!)
- your smart fridge, ordering milk and groceries when they run empty ??
- and of course, all the many Arduino (compatible) units out there!

# The Arduino ecosystem

*Arduino* stands for

- A company  
that started as a students tool project at IDII, Ivrea/Italy in 2005,  
today is the producer of „original“ but open-source:
- hardware platform  
classic family (Uno R4), Nano (small boards, many features), MKR (ARM, crypto-chip, wireless) ,  
Mega (2560), Pro series, for all of which development takes place in the:
- software environment  
using the Arduino IDE available for Linux, macOS and Windows or the Arduino  
Web Editor (even on Chromebook), and the ~ 7000 libraries - official or contributed by the:
- maker community  
online forum, user groups, project hub, Arduino days and other events

# The Arduino ecosystem: hardware

- In the stricter sense, hardware produced by the Arduino company

[Genuine Arduino hardware](#)

- In a broader sense, also compatible products made by other manufacturers

[Wiki List of Arduino boards and compatible systems](#)

- Some more examples - in an even broader sense:

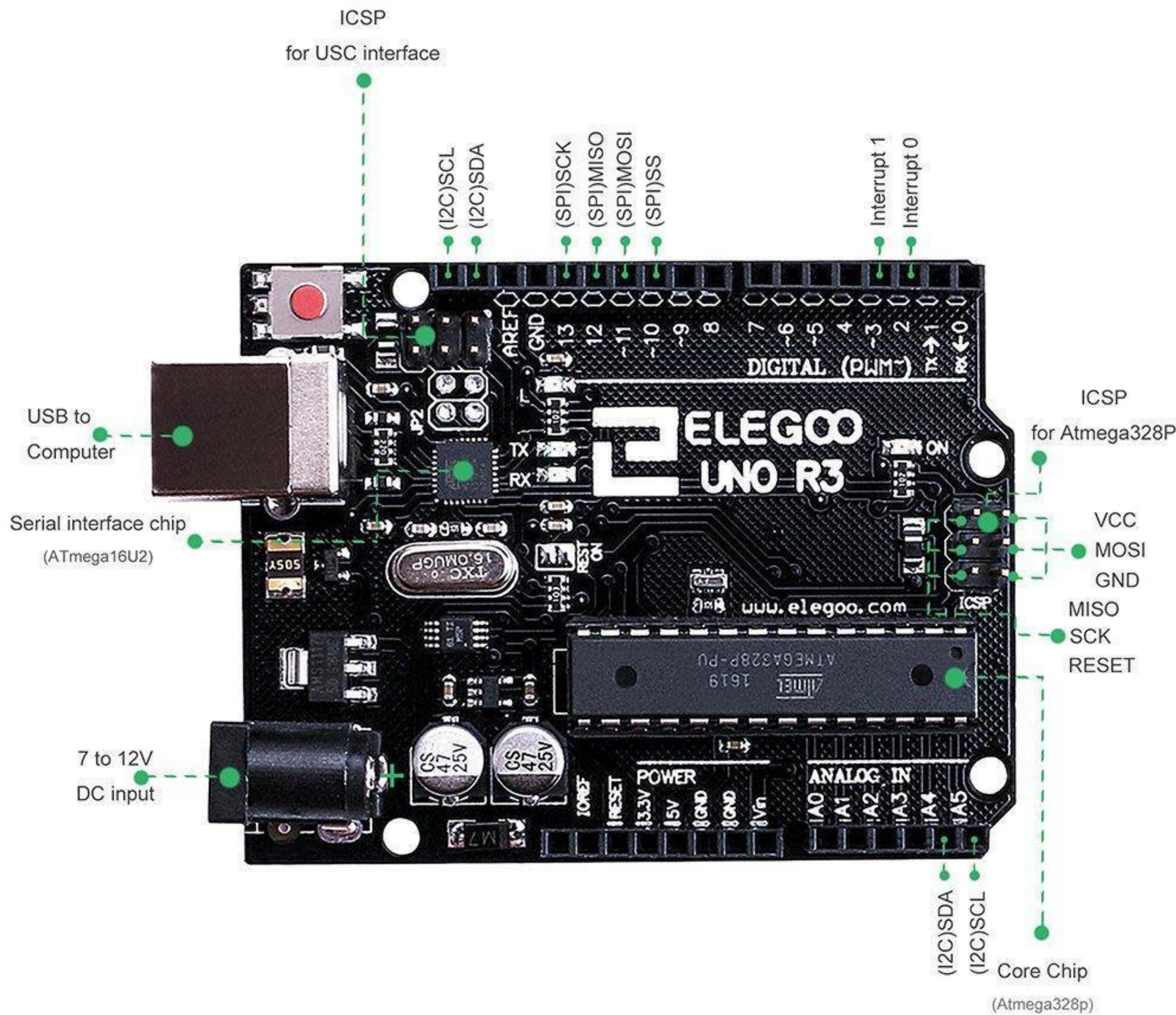
- ESP32 class boards: [AZ ESP32 DevKit M5Stick Plus2](#)

- Thumbnail format: [Seeedstudio Xiao Adafruit QT Py](#)

- Round boards: [AZ-Envy SparkFun LilyTiny](#)

- Other designs: [Keyestudio Uno R3 Raspberry Pico family](#)

# For starters: my compatible Uno R3



# The Arduino ecosystem: software

For local development and flashing of the device: [Arduino IDE](#)



## Arduino IDE 2.3.3

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.

For more details, please refer to the [Arduino IDE 2.0 documentation](#).

Nightly builds with the latest bugfixes are available through the section below.

### SOURCE CODE

The Arduino IDE 2.0 is open source and its source code is hosted on [GitHub](#).

### DOWNLOAD OPTIONS

**Windows** Win 10 and newer, 64 bits

**Windows** MSI installer

**Windows** ZIP file

**Linux** AppImage 64 bits (X86-64)

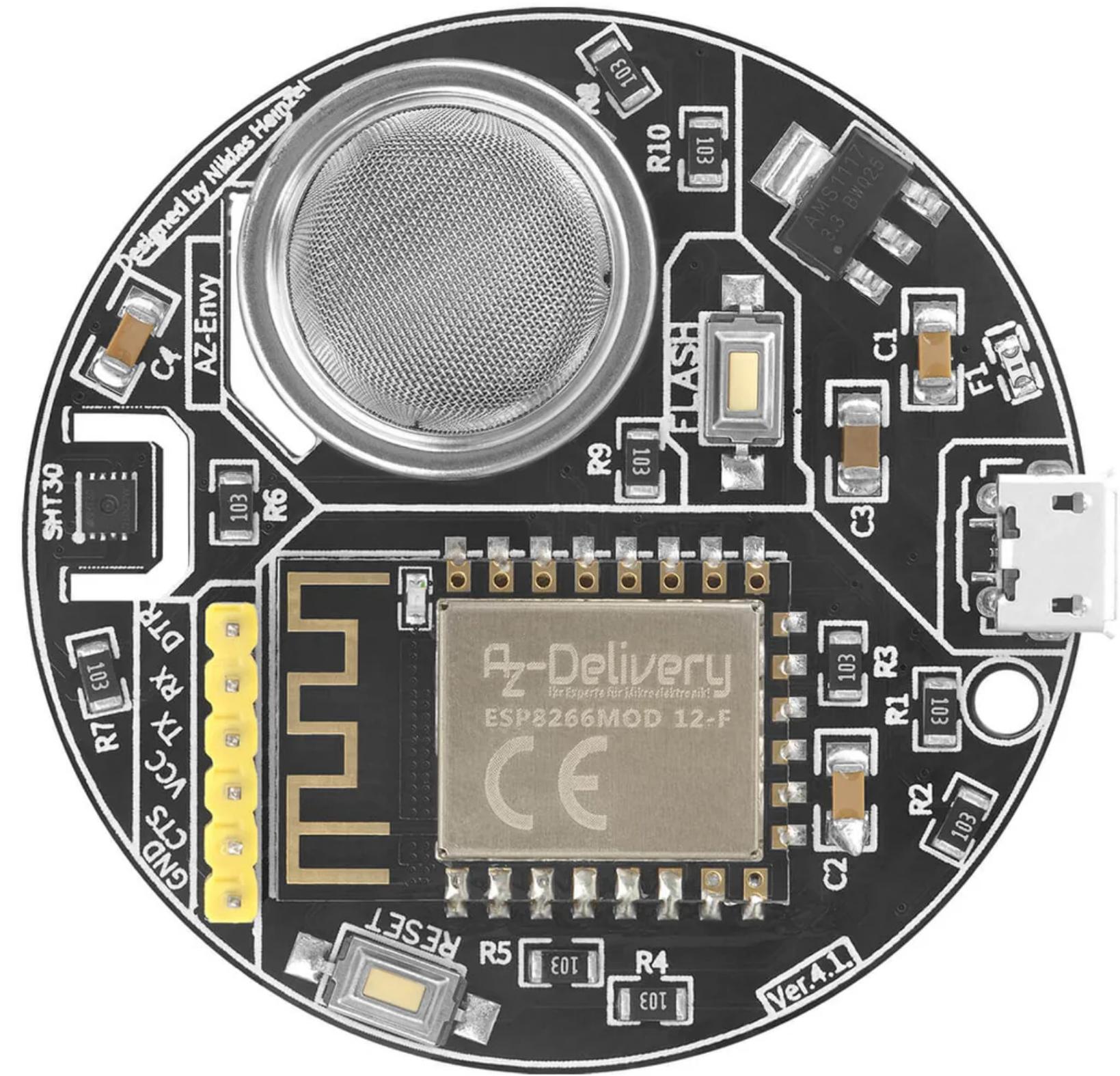
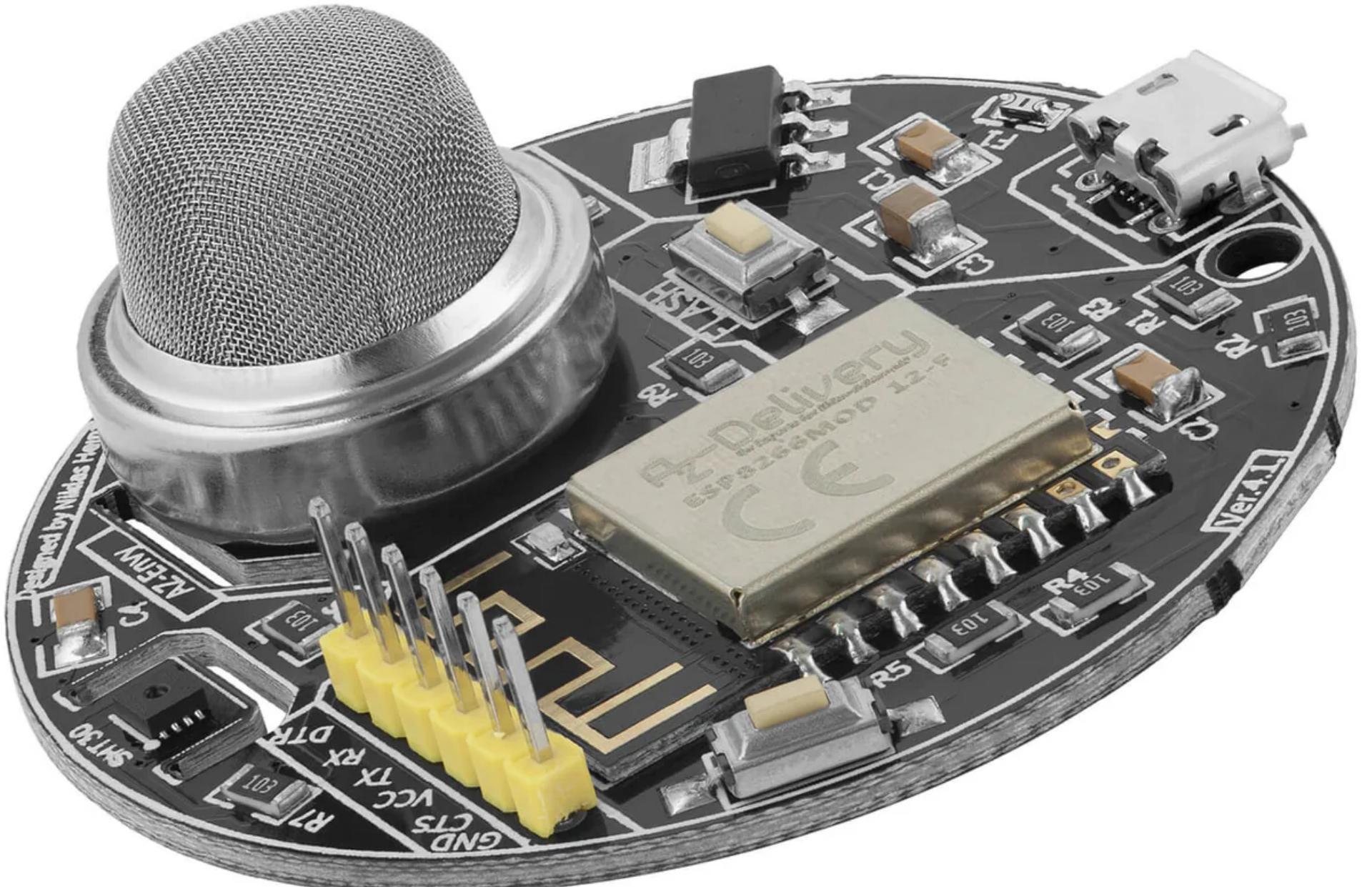
**Linux** ZIP file 64 bits (X86-64)

**macOS** Intel, 10.15: "Catalina" or newer, 64 bits

**macOS** Apple Silicon, 11: "Big Sur" or newer, 64 bits

[Release Notes](#)

# Generating data for the Arduino cloud: AZ-Envy



# The Arduino ecosystem: cloud

Develop online and manage devices and data in the [Arduino cloud](#)

## Explore our possibilities

Arduino Cloud's features provide seamless IoT solutions, delivering connectivity and control tailored for schools, individuals, and enterprises.

 **For individuals**

 **For schools**

 **For business**

**The all-in-one IoT platform fueled by the trusted Arduino community**

- ⌚ Create your project quickly
- ⌚ Visualise and control your sensor data from anywhere
- ⌚ Learn and play

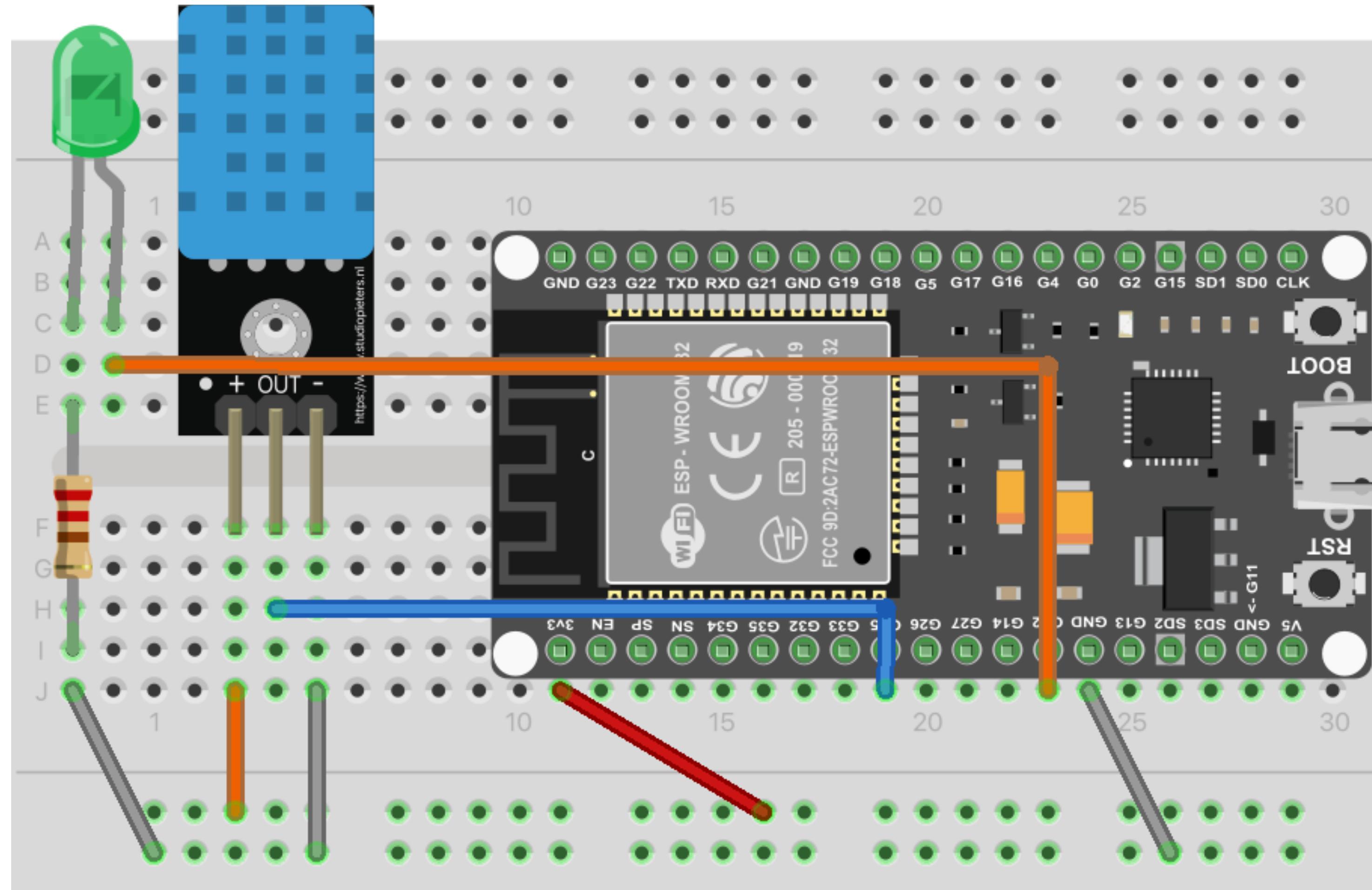


# The Arduino ecosystem: cloud

Arduino cloud with different paid plans, free plan offers (as of August 2024):

- 2 Things
- Unlimited dashboards
- 100 MB to store sketches
- 25 compilations per day
- ML tools
- only 1 day data retention 😞

# Project hardware for Azure cloud: ESP32 & DHT11



fritzing

# Azure cloud and IoT Central

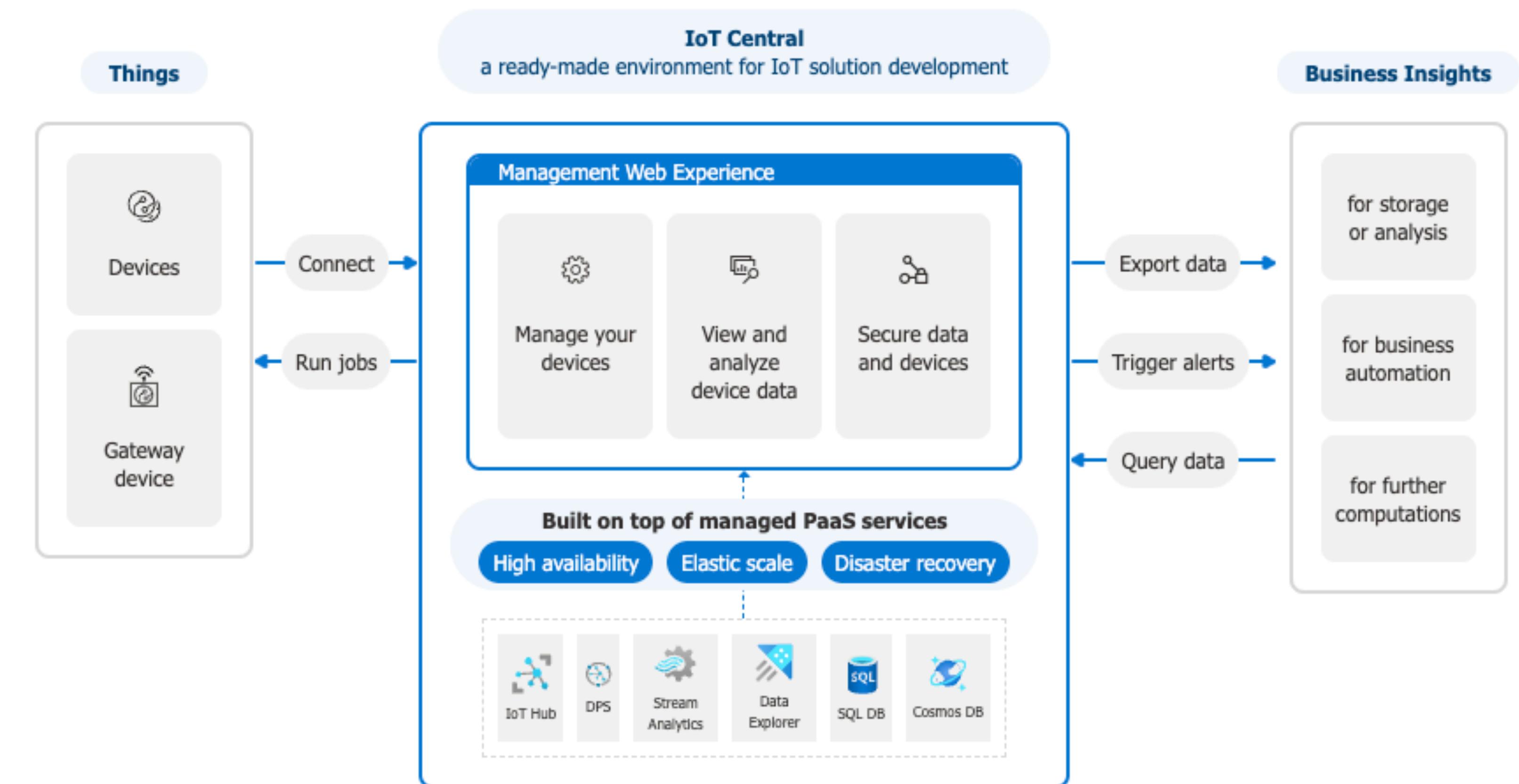
Everything is managed from the [Azure IoT Central Home](#)

## Architecture

IoT Central gives you a **ready to use UI and API surface** built to connect, manage, and operate fleets of devices at scale.

All the power of PaaS services, operated and managed for you.

[IoT Central architectural concepts >](#)



# Azure cloud and IoT Central

## Azure IoT Central

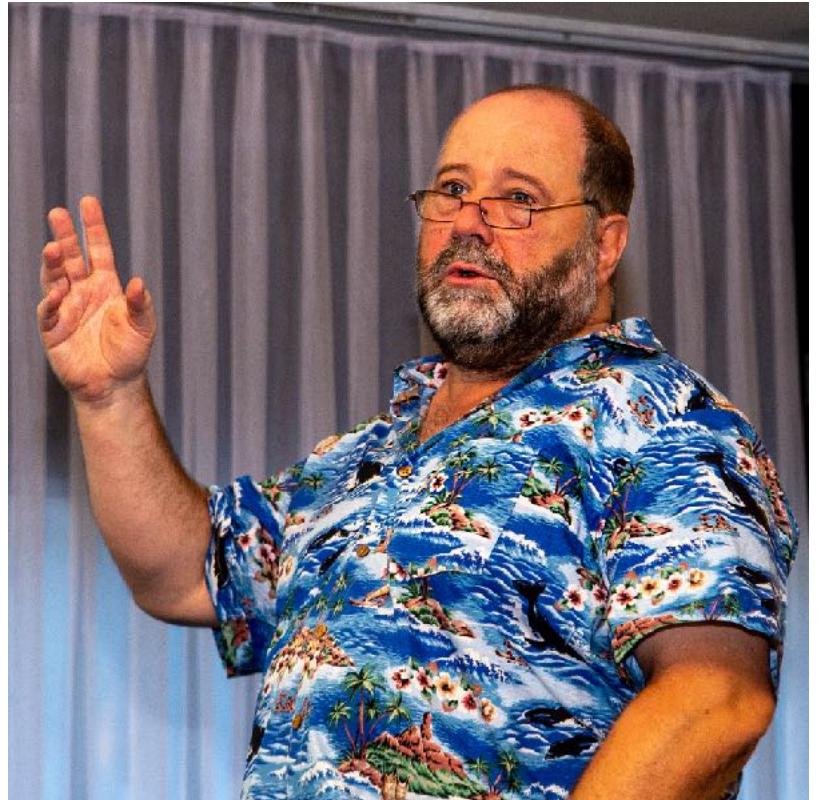
- Pricing includes 2 free devices in any plan, so why not go for „Standard 2“ from the start = 30000 messages/month?
- Start by creating an app
- Templates define device configuration and capabilities
- Devices in groups inherit from templates
- Data explorer for queries and aggregates
- Dashboards allow for tiled visualizations
- Rules to trigger actions
- Export data to Azure Data Explorer, Event Hub, Blob Storage

# Additional resources & learning:

- IoT overview: [https://en.wikipedia.org/wiki/Internet\\_of\\_things](https://en.wikipedia.org/wiki/Internet_of_things)
- Arduino overview: <https://en.wikipedia.org/wiki/Arduino>
- Arduino: <https://www.arduino.cc/> links to docs, community and blog; <https://www.arduinolibraries.info/>
- Microsoft [sample projects](#) for connecting Arduino to Azure IoT
- Arduino courses from [Arduino](#), [ClassCentral](#), [Coursera](#), [Udemy](#) and others
- Microsoft learning on [Azure IoT Central](#) and [Azure IoT in general](#)
- plus your usual suspects of search engines, video and blog platforms 😊

# IoT ... big data ... cloud - let's start small!

- Twitter X @DerFredo <https://twitter.com/DerFredo>
- LinkedIn [de.linkedin.com/in/derfredo](https://de.linkedin.com/in/derfredo)
- Mastodon <https://bsky.app/profile/derfredo.bsky.social>



This file can be found at:

<https://bit.ly/DerFredoVilnius24>

