

Introduction to IoT

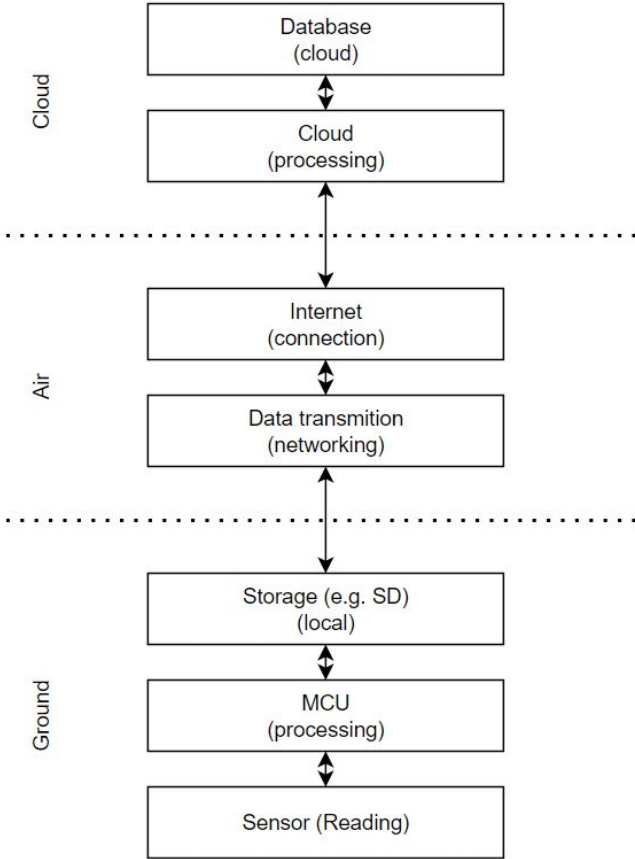
What is IoT ?

- IoT, IIoT, UW-IoT
- No common definition
- Ubiquitous
- Everything is identifiable and intelligent
- Interoperability

What is a “thing” ?

A “thing”, in the context of the internet of things (IoT), refers to any entity such as a device that forms a network and can transfer data with other devices over the network.

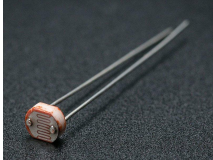
The IoT Stack



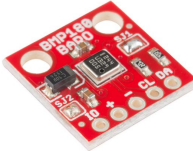
Sensors

An input device is a hardware device able to produce an electrical signal depending on a physical input. The electrical signal changes accordingly to the changes of the input and can be read from a computer.

Light:



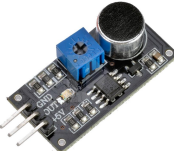
Pressure:



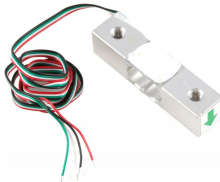
Human input:



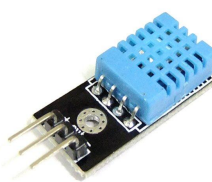
Sound:



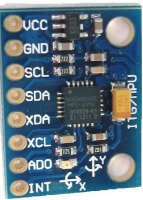
Weight:



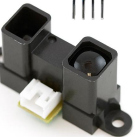
Humidity:



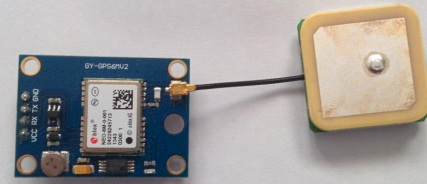
Motion:



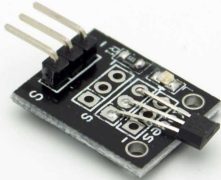
Distance:



Location:



Hall:



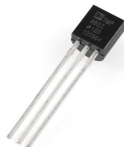
Presence:



CO2:



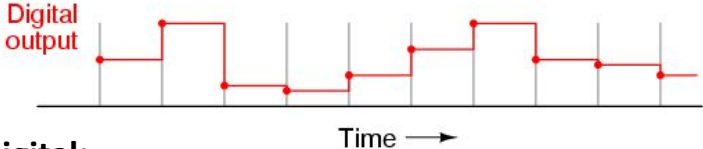
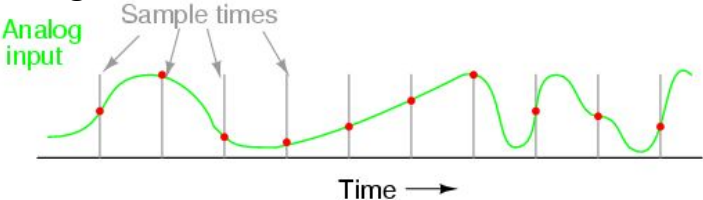
Temperature:



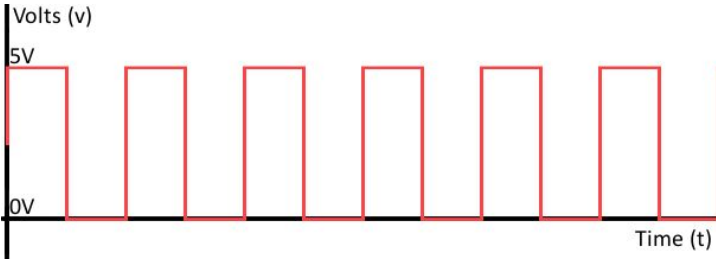
Sensors - Signals

Simple sensors have available connections using analog or digital signals. A microcontroller is usually able to read directly these signals.

Analog:

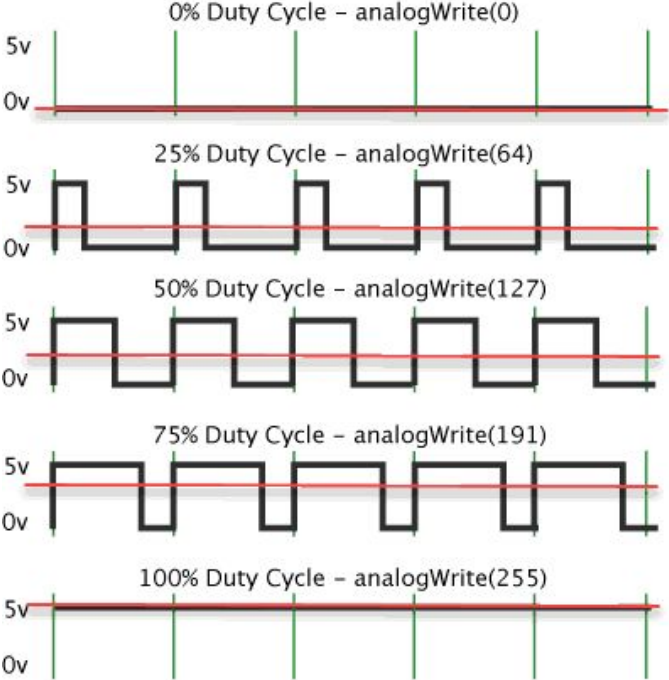


Digital:



Pwm:

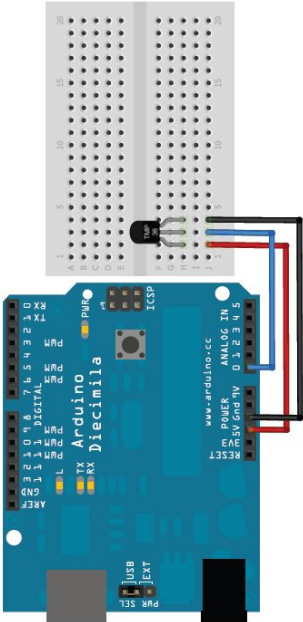
Pulse Width Modulation



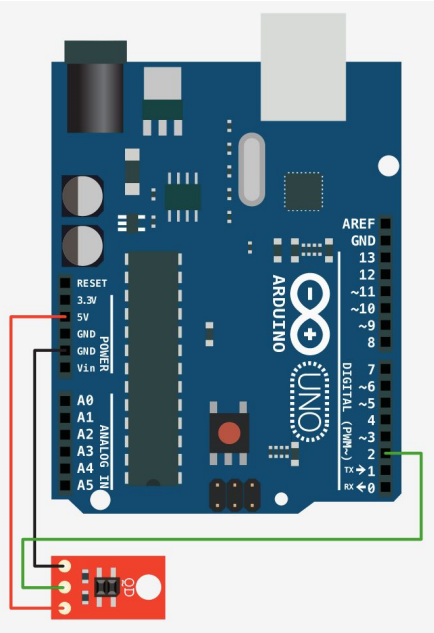
Sensors - Direct Connection

It is possible to directly connect several different sensors, using analog or digital signals.

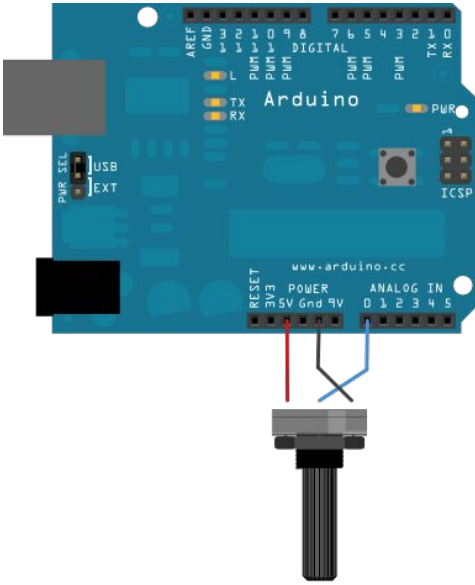
Temperature:



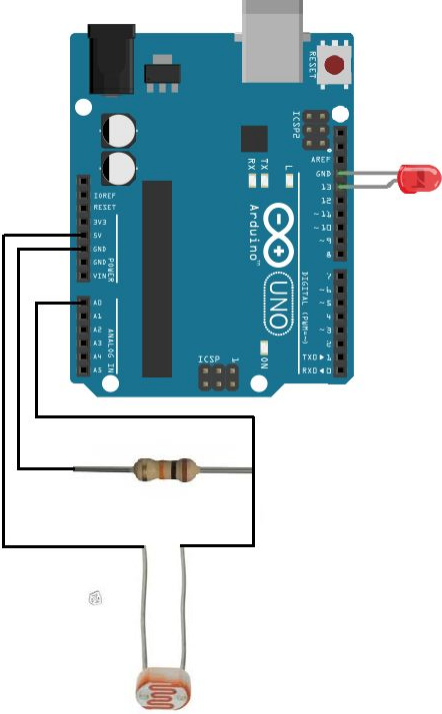
Reflectance:



Potentiometer:



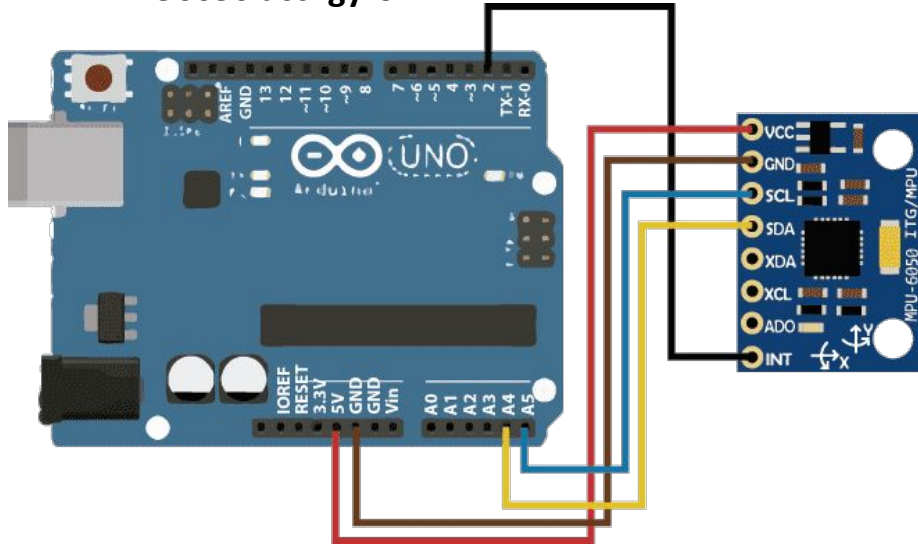
Light:



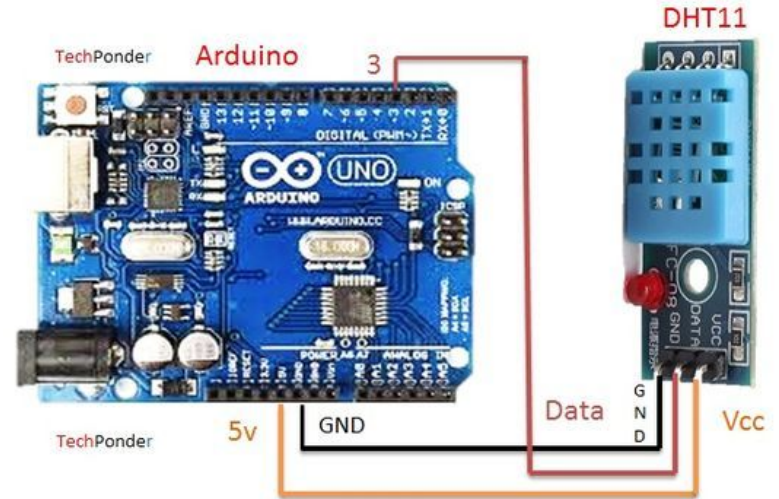
Sensors - Network and Libs

More sophisticated sensors have embedded additional hardware to manage the hardware of the sensor itself, to filter signal noises and to add network functionalities.

MPU6050 acc+gyro:

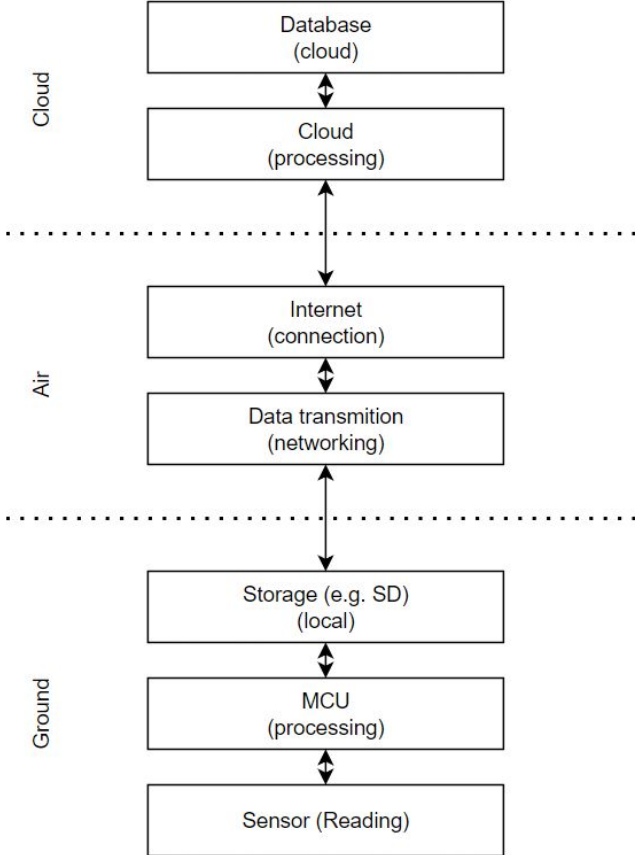


DHT11 humidity and temp:

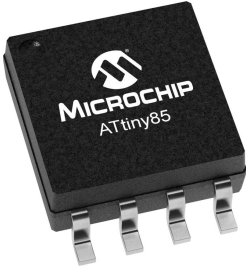


Humidity / Temperature (DHT11) Sensor interfacing to Arduino

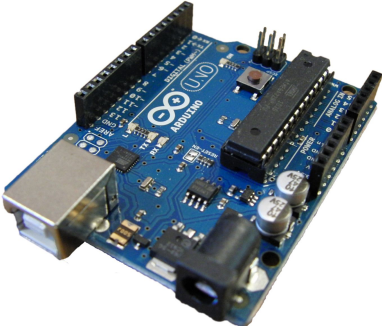
The IoT Stack



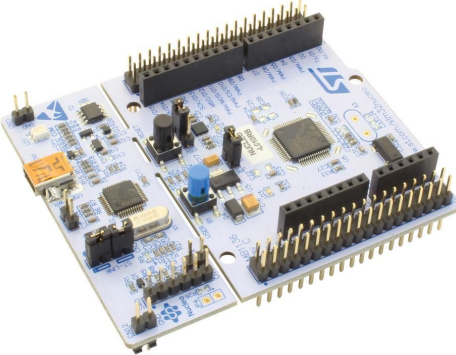
Microcontroller



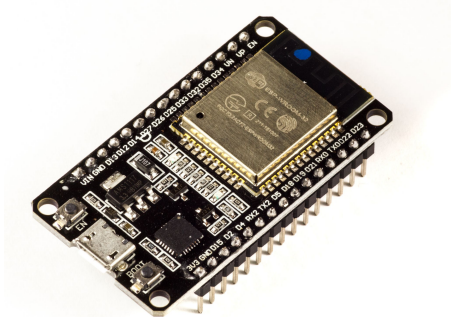
ATtiny85



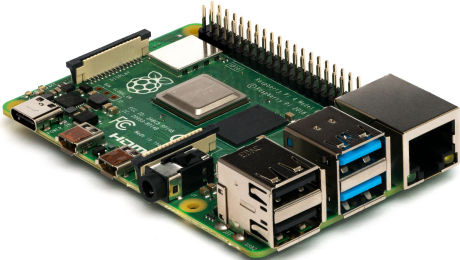
Arduino UNO



STM32

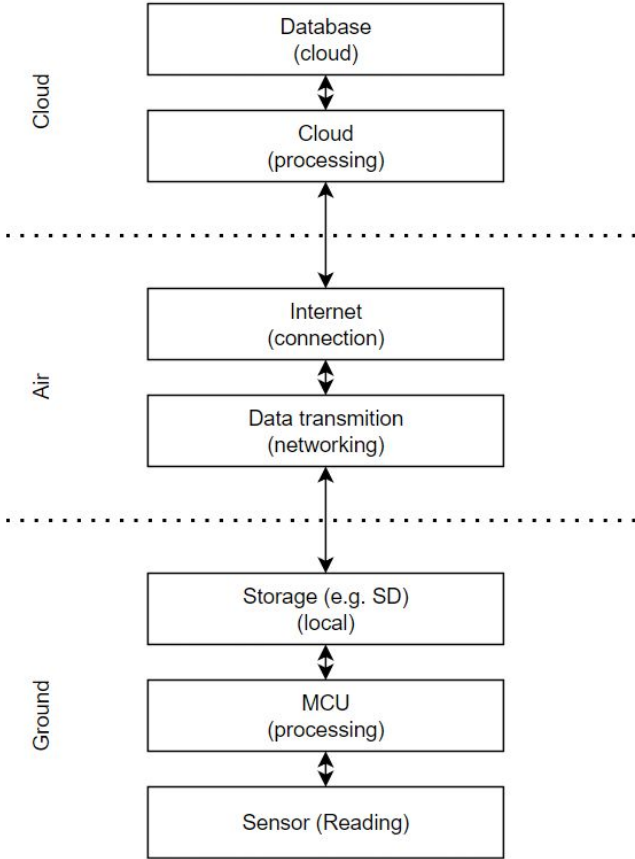


ESP32

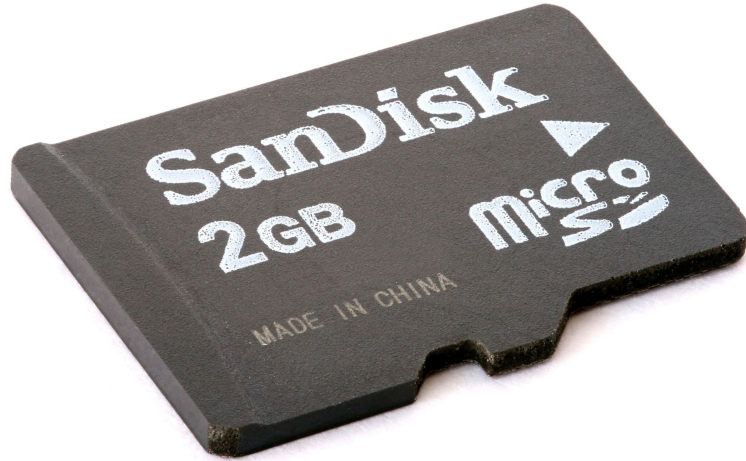


Raspberry Pi

The IoT Stack



Storage - Local

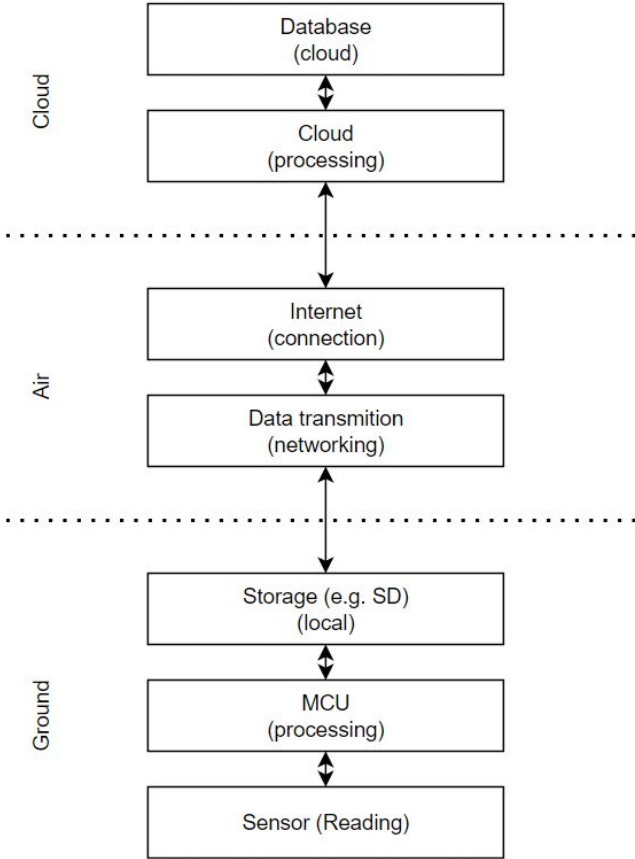


MicroSD



EPROM/EEPROM/FLASH

The IoT Stack



Data Transmission Tech

- Ethernet and PoE
- WiFi
- Mobile-Data-Communication
- Bluetooth
- LoRa

Ethernet and PoE

- Network with a Router and Switches
- IP based
- Cable needed (PoE -> with power)
- Commonly used
- Very stable connection
- High data throughput

WiFi

- Mostly used in conjunction with Ethernet network
- IP based
- Costly on larger areas
- High power consumption
- Most of the times stable
- Medium to high data throughput

Mobile Connection

- Big differences
- IP based
- Dependent on service provider
- No need for own infrastructure
- Costly

Mobile Connection

4G	5G	NB-IoT
Medium throughput	Medium - High throughput	Low throughput
Long distance	"Short" distance	Very long distances
High energy consumption	High energy consumption	Low energy consumption
Good structure penetration	Bad structure penetration	Very good structure penetration
Good for connecting Routers or Gateways to the Internet	Good for ultra-reliable low latency applications	Good for sensors

Protocols in IP-based Systems

- Easy to connect to wide area network (WWW)
- Most important
- Reliability can differ
- Solutions exist → standardized protocols
- Example: MQTT
- Problems: Inefficient for small data package

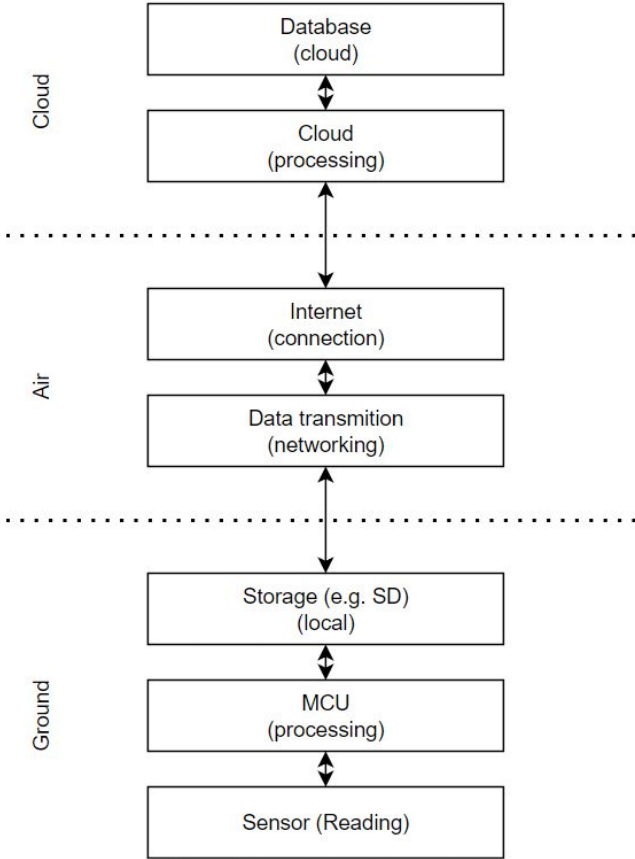
Bluetooth

- Multitool
- Short distance
- Different speeds possible
- BLE → Low Energy
- No standard protocol

LoRa

- Long Range
- Ultra Low power
- Infrastructure can be self build
- Best for remote long life sensors

The IoT Stack



Database

ORACLE

 mongoDB



 Azure




Microsoft
SQL Server







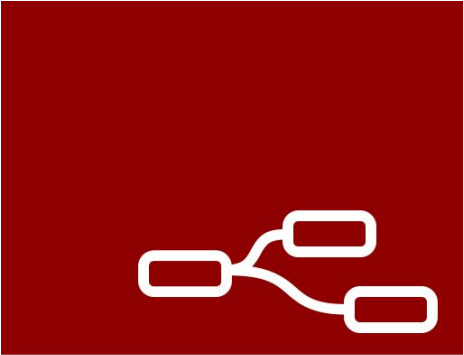
 redis







Cloud Processing



Node-RED

Node-RED



DATA CAKE



Wylidrin Studio

Dashboarding



Grafana

Your Custom
Solution here