

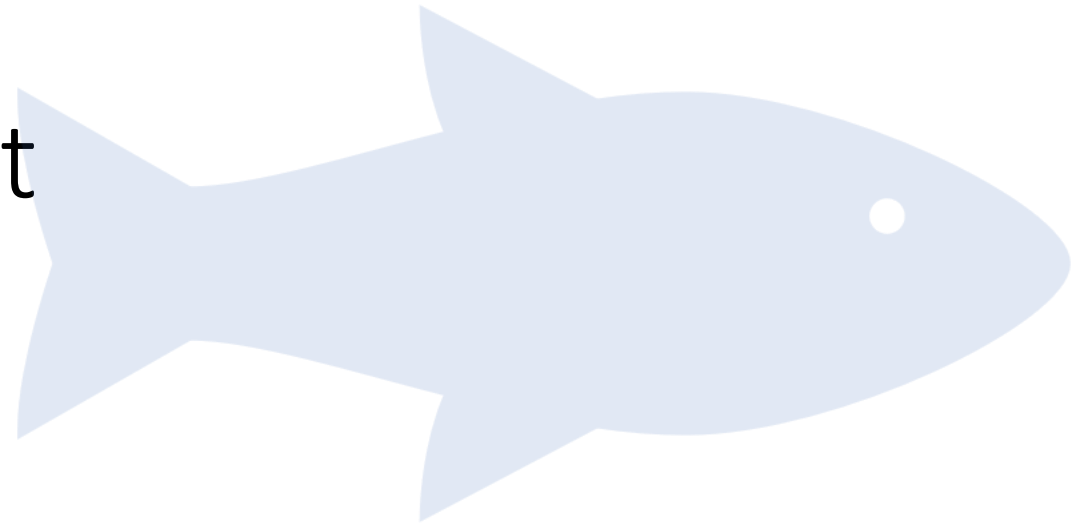
# Assignment 2

## Concept:

# Marine Environment Monitoring

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IoT Standards and Protocols 2024



# Overview

- A marine environment monitoring and logging solution.
- “Prototypical” solution
  - Focus on Data Collection, Communication, IoT infrastructure solution.
  - Scope out some physical aspects(Marine grade housing, marine deployment)



# Motivation



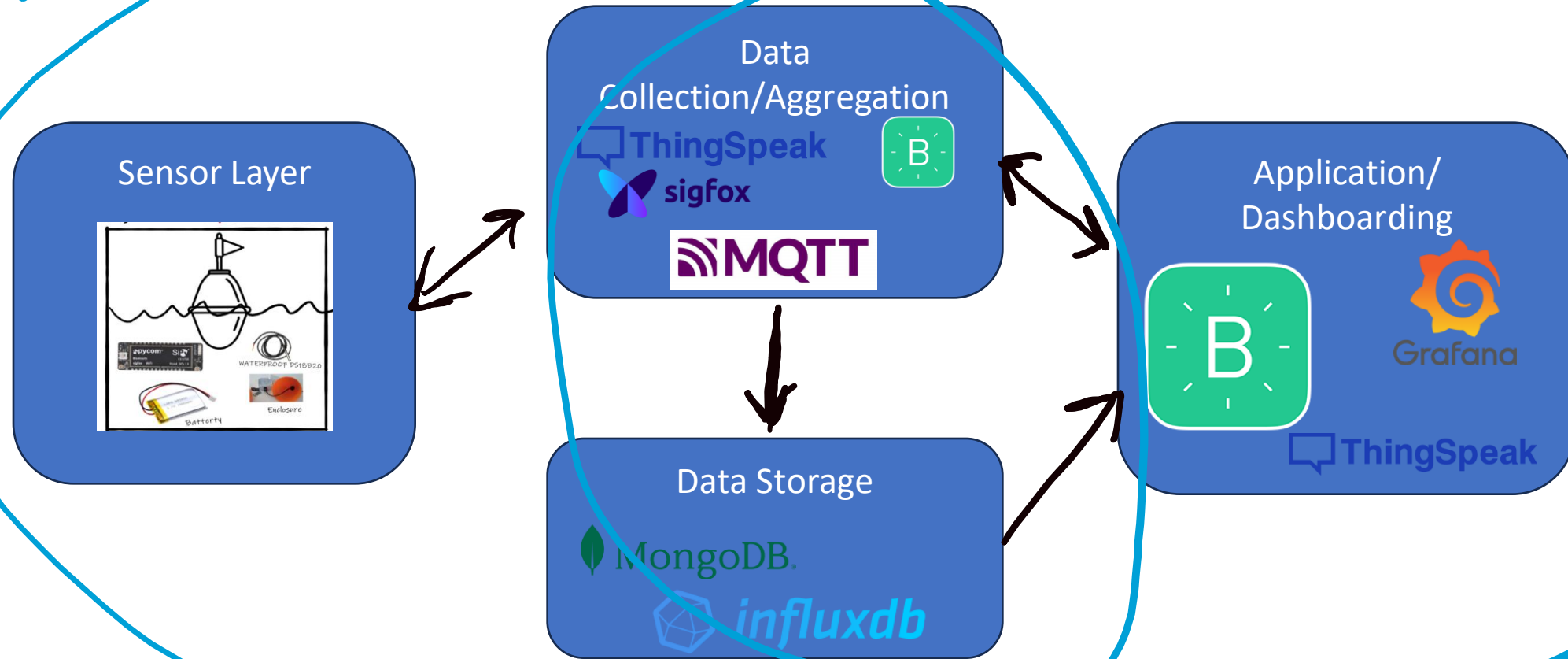
## May 4th 2023 Workshop on Technology for Marine Sensing - Presentations

1. [The Need for Marine Sensing](#) - Prof. Carlos Garcia de Leaniz
2. [Sensort Technologies for Remote Environmental Aquatic Monitoring](#) - Ben Clifford, John Lau, Tim Mortensen
3. [Design, Fabricating, and Optimizing an Optical Sensor to Detect Marine Toxins](#) - Dr. Mitra Abedeni
4. [Sensor Technologies for Remote Environmental Aquatic Monitoring](#) - Benyuan Yu
5. [STREAM - A Data Collection Perspective](#) - John Ronan
6. [Case Study of Marine Monitoring around Ireland](#) - Dr. Ronan Browne

# Overview of potential solution

WP1

WP2



# 1. Sensor/Data Collection Layer

- Sensor

- Type: Waterproof Digital Temperature sensor (expandable to other environmental metrics in future iterations).
- Connection: Wired connection to the MCU/SBC.
- Data Format: Numeric temperature data in Celsius.



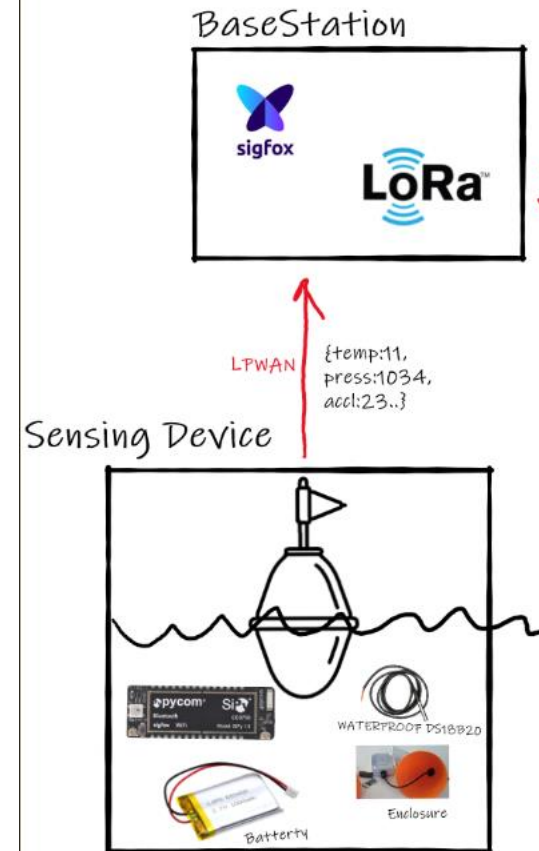
- MCU/SBC

- Type: Network-capable MCU/SBC (e.g., RPi, PyCom SiPy/LoPy, ESP32, STM32 with LoRa module, ).
- Functionality:
  - Collects data from the digital sensor.
  - Processes the data (e.g., averages, timestamping).
  - Sends data via LPWAN/Wireless protocol.



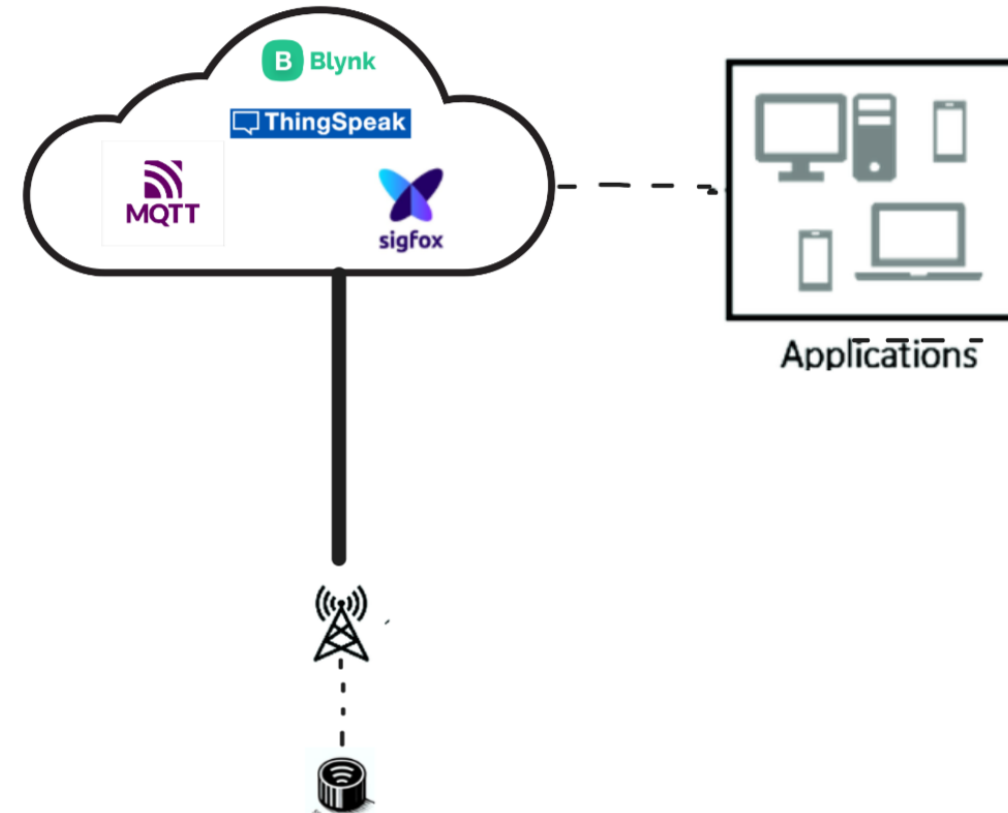
## 2. Remote Device Connectivity

- **LPWAN**
  - Type: LoRaWAN, Sigfox, or NB-IoT
- **Wifi**
- **Bluetooth/Zigbee**
- Selection based on availability, coverage, range power consumption, and data transmission needs.
- **Functionality:** Transmit sensor data from the Collection device to base station/Gateway device.



### 3. Data Collection/ Aggrigation

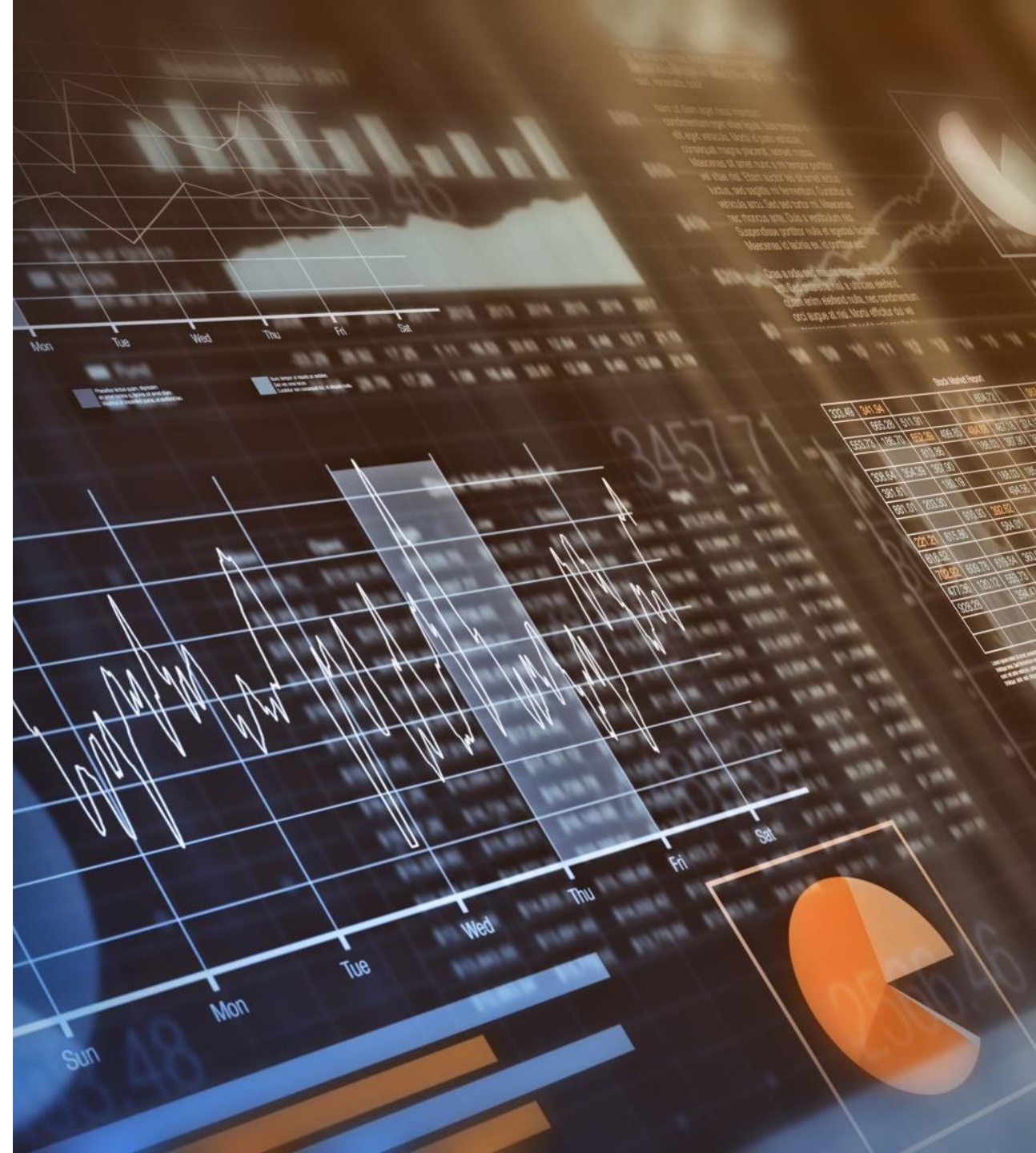
- **Base Station/Gateway**
  - Receives data transmitted over LPWAN/ Other Wireless Network
  - Transmits to Cloud Platform/MQTT broker
  - RESTful API providing data access/ingestion(web hook for other services)
- **Publishing Process**
  - Consumes data from the RESTful API.
  - Publishes data to a MQTT broker(or other IoT messaging platform) for real-time updates.
  - Stores data in DB(time-series or other) for historical analysis and trend monitoring.





## 4. Applications/Dashboarding

- **Grafana**
  - Data visualisation.
  - Provides dashboards for real-time and historical data analysis.
- **Blynk**
  - Utilized for developing a mobile app.
  - Offers a user-friendly interface for (pseudo) real-time monitoring and control over the system.
- Third Party Service integration





# Design Considerations:

The following should be included in design:

- **Scalable:** Design the system with scalability in mind, allowing for easy integration of additional sensors, and collection devices.
- **Expandable:** design for future integration of additional environmental data and sensors (e.g., pH, salinity) without major changes
- **Secure:** Implement secure data transmission protocols (remember TLS and message encryption for MQTT)
- **Data Validation:** Validate data at collection. Use Timestamping/UIDs for data tracing
- **Data Analytics:** use analytics and machine learning models for predictive maintenance, anomaly detection, and trend forecasting.
- **UX:** Custom alerts, thresholds, and automated actions based on sensor data.