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MOOG FOCAL™

IoT Platform for Condition Monitoring

Background

- Our team is working with MOOG Focal: an Atlantic Canadian division of MOOG and leader in the design and manufacturing of highly reliable marine rotary and data transfer solutions.
- Our client is currently investigating ways to connect their existing condition monitoring devices including, their 923-slip ring sensor, to the cloud to improve visualization and analytics. inside slip rings, Focal's 923-sensor collects various
- Designed to be placed directly types of data relating to the environment it's placed, and the device it's attached to such as temperature, humidity, shock, RPM and much more.
- Data analytics and visualization, however, is currently, only possible through a wired connection to a local computer running Focal's proprietary GUI software.

Project Objectives

Our project concerned two main layers of IoT platform development:

Embedded Systems Layer
- Establish a live connection with a sensor to stream real-time data into a local IoT gateway device connecting to the cloud.
- Setup a local database for incoming data storage.
- Implement an application/service for local analysis and visualization.
- Configure IoT gateway device and cloud connection.

Cloud Layer
- Configure cloud gateway service for data ingestion.
- Setup real-time processing/analytics engine.
- Configure and link warm and cold storage services.
- Design and implement cloud visualization; real-time dashboard.

Design Overview

Embedded Systems Layer

For our embedded systems layer our team chose EdgeX Foundry: an open-source cross platform, vender neutral IoT solution.
EdgeX Foundry is comprised of loosely-coupled microservices deployed through Docker containers. The three main microservices are as follows:

- **Device Modbus** microservice extracts data from the sensor and sends it to the core data micro service.
- **Core Data** microservice sends the data to the local Redis NoSQL database so that it can be retrieved by the export microservice.
- **Export** microservice pushes the data to the Azure Cloud Layer via an MQTT protocol.

EdgeX Foundry

Device Modbus Microservice	Core Data Microservice	Export Microservice
Modbus	redis	MQTT

IoT Gateway Device

+24VDC
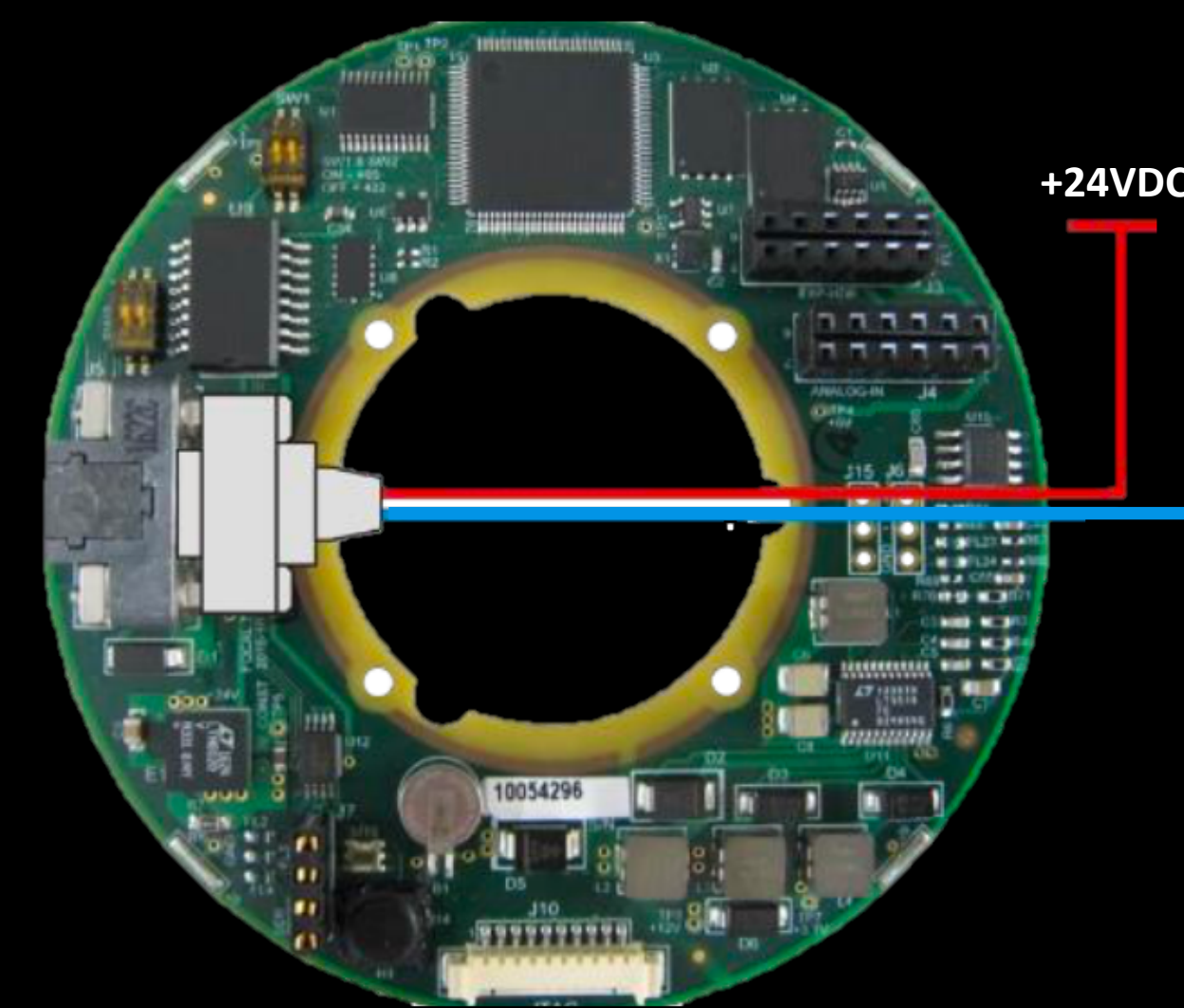
923-Slip Ring Sensor
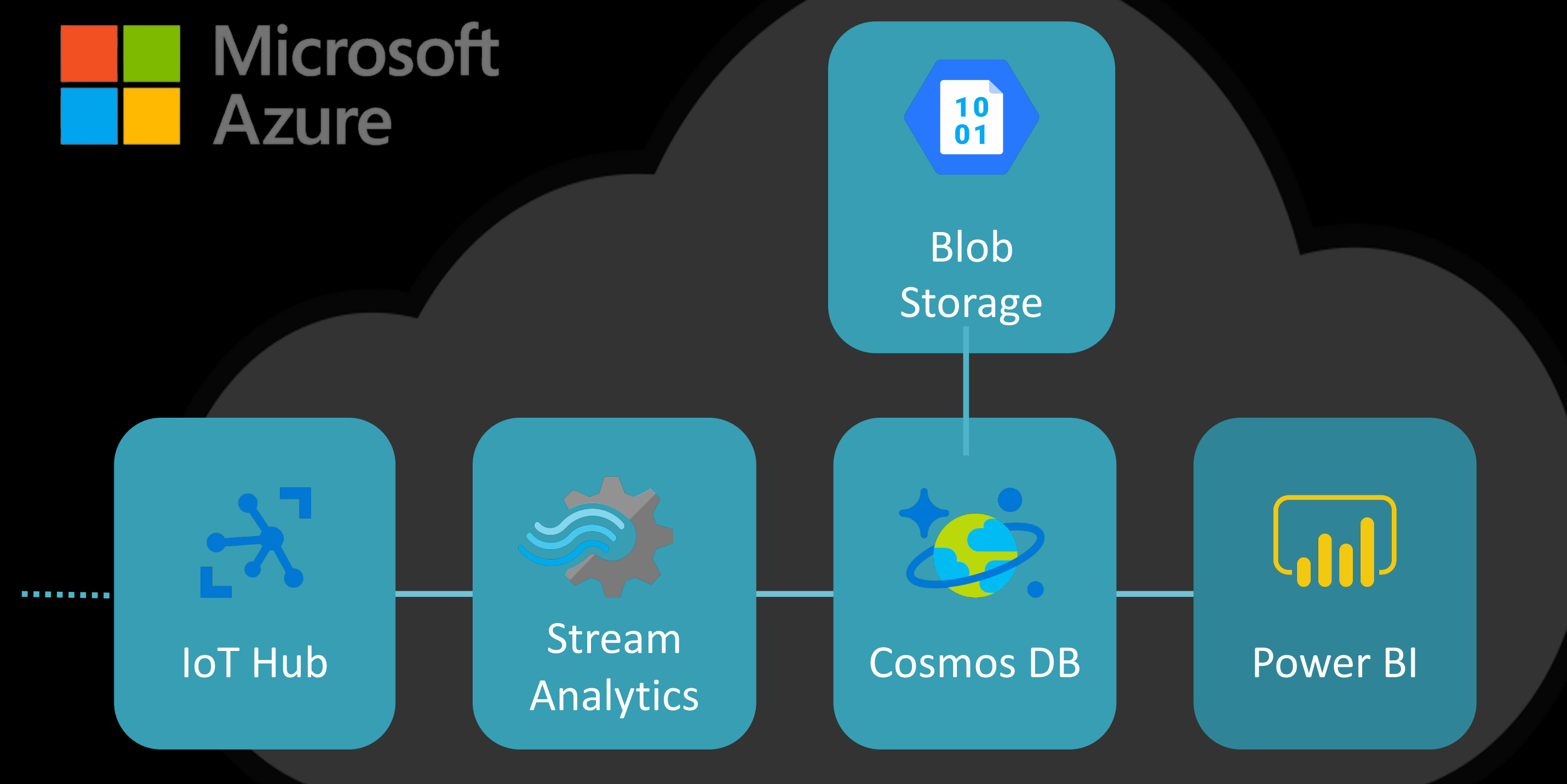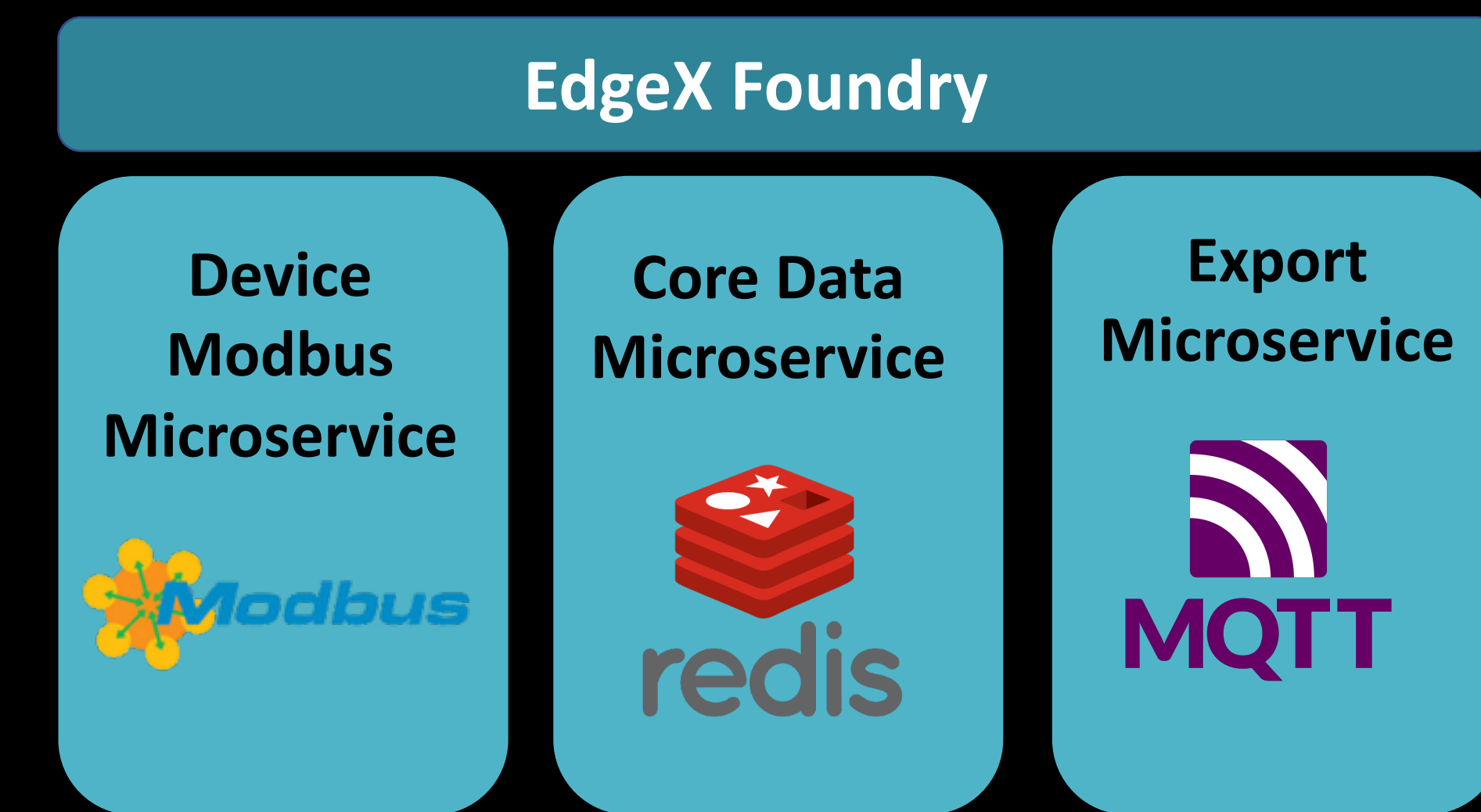
Cloud Layer

After completing a comprehensive analysis of several popular cloud solutions available (AWS, Google Cloud etc.) we determined a Microsoft Azure-based architecture would be best suited.

Our cloud architecture consists of cloud services that perform a variety of functions:

- **IoT Hub:** Acts as the cloud gateway.
- **Stream Analytics:** is the data processing engine. It enables real-time data formatting, sorting, error correction and many other functions to be applied to the incoming data.
- **Cosmos DB:** is the real-time warm storage/database service. It allows temporary storage and low latency querying of collected data.
- **Blob Storage:** is the cold storage service. It allows bulk, long-term storage of collected data.
- **Power BI:** is the visualization interface. It allows real-time dashboarding of incoming data and even report generation.

Microsoft Azure

Blob Storage

IoT Hub · Stream Analytics · Cosmos DB · Power BI

Results

Our team was successfully able to connect the Model 923 sensor to the Azure cloud layer using EdgeX Foundry. All results can be seen below.

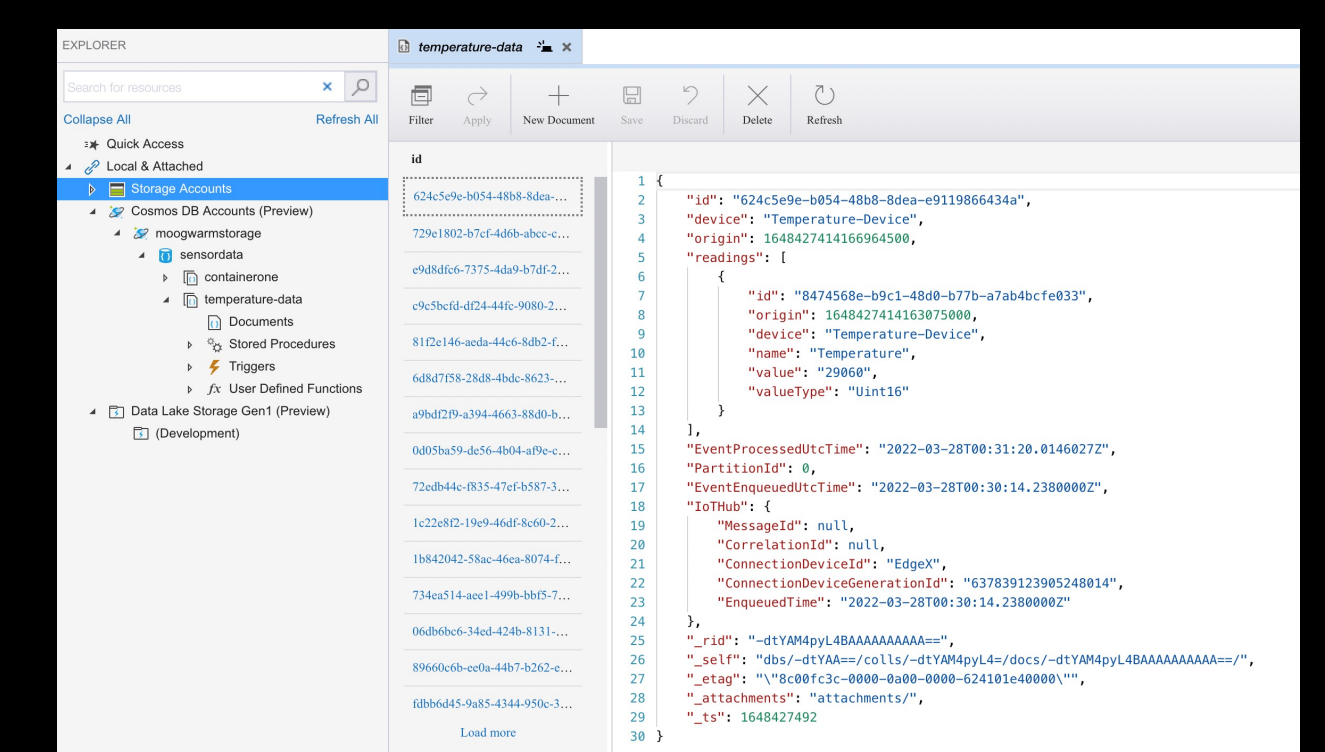**1. Incoming data from sensor, as seen on device Modbus microservice**

```
2022/03/28 02:11:53 modbus: sending 01 03 00 0b 00 01 f5 c8
2022/03/28 02:11:53 modbus: received 01 03 02 73 60 9d 5c
```
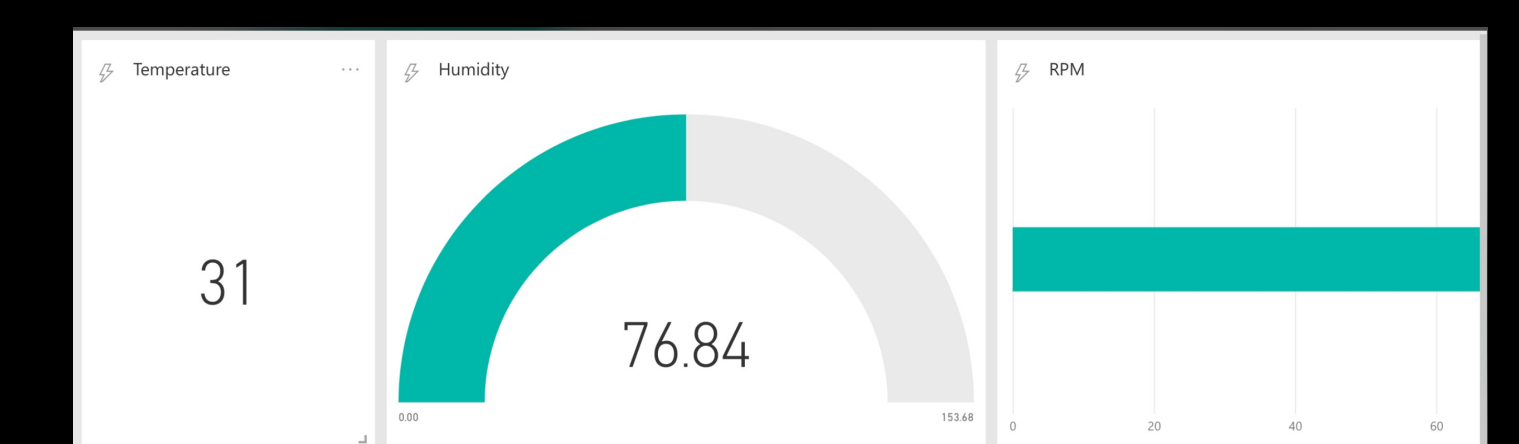
2. Data persisted in local database.

3. Input JSON data persisted in cloud database.

4. Output PowerBI dashboard showing temperature data.

Temperature: 31   Humidity: 76.84   RPM

Acknowledgements