**Chosen database: MongoDB Atlas, the fully managed cloud version of MongoDB**

The NoSQL databases are appropriate for Big Data and real-time systems such as capturing sensor readings.

MongoDB NoSQL database is ***schema-less*** and uses the concept of a ***document***with ***key-value pairs*** similar in structure to [***JSON***](https://en.wikipedia.org/wiki/JSON) object.

We looked at what databases can be integrated with Grafana for the user interface, and MongoDB was among the options.

We use A Time-Series MongoDB database that allows to save data with specific timestamps. This is advantageous to applications that regularly need to keep track of information every second, minute, or hour. In our case, we will need to record our sensor readings on a predefined interval. These databases are optimized to handle larger amounts of data than normal databases such as relational MySQL, PostgreSQL, or even Oracle Databases.

MongoDB integrates seamlessly with programming languages like Python. Libraries like **PyMongo** provide simple APIs for storing and retrieving sensor data.

MongoDB supports **replica sets**, ensuring high availability by replicating data across multiple servers. If one server fails, another replica can take over seamlessly. IoT systems often require uninterrupted data collection and analysis. MongoDB's fault-tolerant architecture ensures reliability. For real-time IoT systems that depend on continuous data flow, high availability is critical to avoid data loss or interruptions.

Sensor data often includes sensitive or proprietary information. MongoDB Atlas ensures secure transmission and storage of data.

Why use a database on the cloud?

* Scalability: IoT systems often generate vast amounts of data, and cloud storage can grow as the number of devices or sensors increases, ensuring you never run out of space.
* Accessibility: remote data retrieval and updates.
* Integration with Other Services: with Grafana

**Data structure:**

* Created a single collection, sensor\_readings, where each document stores the readings for all sensors at a specific timestamp for a specific room.

{

"room\_name": "Room\_1",

"timestamp": "2024-10-29T06:48:42.987448",

"temperature": 27.32,

"co2\_level": 434.13,

"voc\_level": 56.7,

"humidity": 40.5,

"air\_quality\_index": 15,

"sound\_level": 35.2

}

* Advantages of This Approach:
  + **Simplified Queries**:
    - Retrieve all sensor readings for a room at a specific time.
    - Easily calculate averages, trends, or correlations across sensors.
  + **Optimized Grafana Integration**:
    - Grafana supports MongoDB as a data source, and a single collection simplifies dashboard queries.
    - Allows seamless creation of multi-sensor graphs or comparisons.