Microservices architecture for collecting data related to electric consumption

Cloud Computing Technologies project

Federico Garegnani

Università degli Studi di Milano

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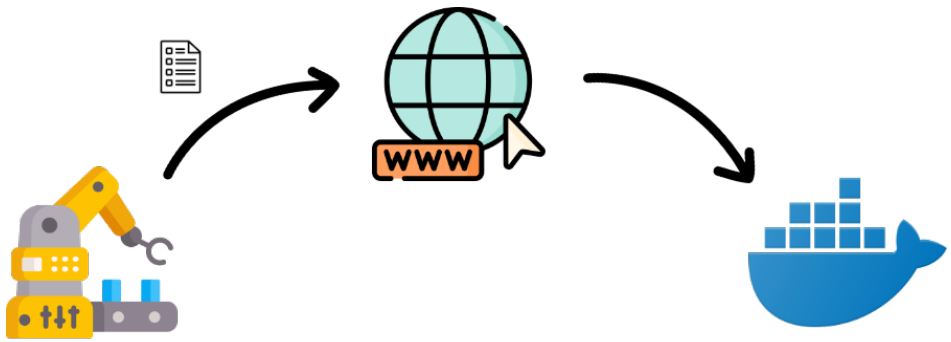
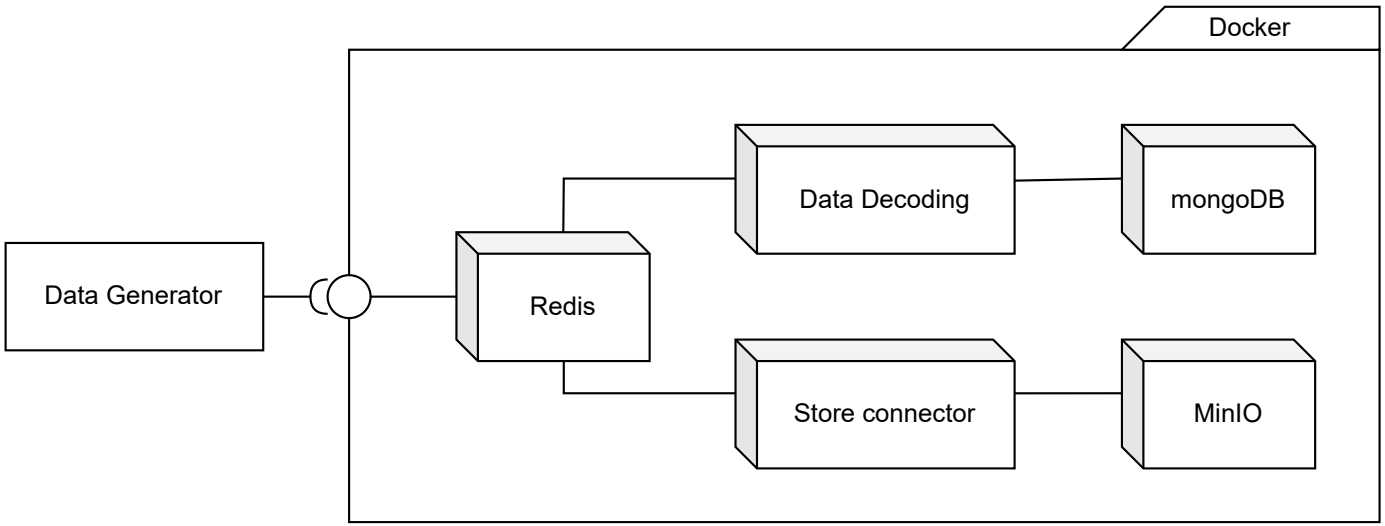
Application domain and working principle

- Industrial environment.
- An energy meter sends data regarding the electric consumption of a machinery through the internet.
- Data are received, analysed and collected by the cloud application.



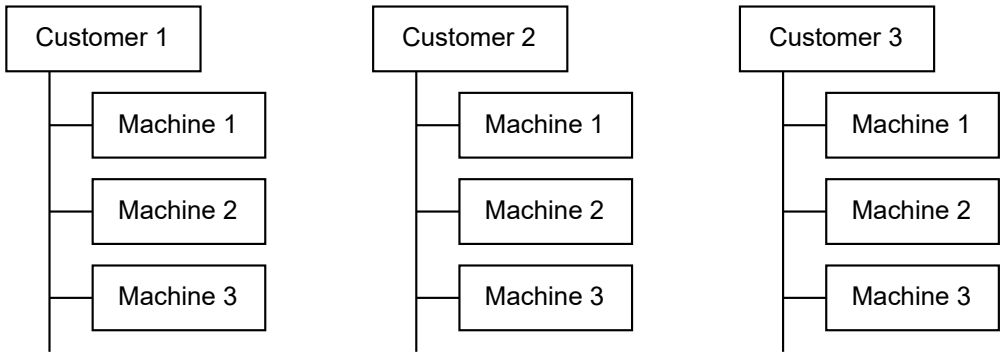
General structure of the system

- 5 microservices.
- Every microservice carry on a specific task.
- Only one entry point.



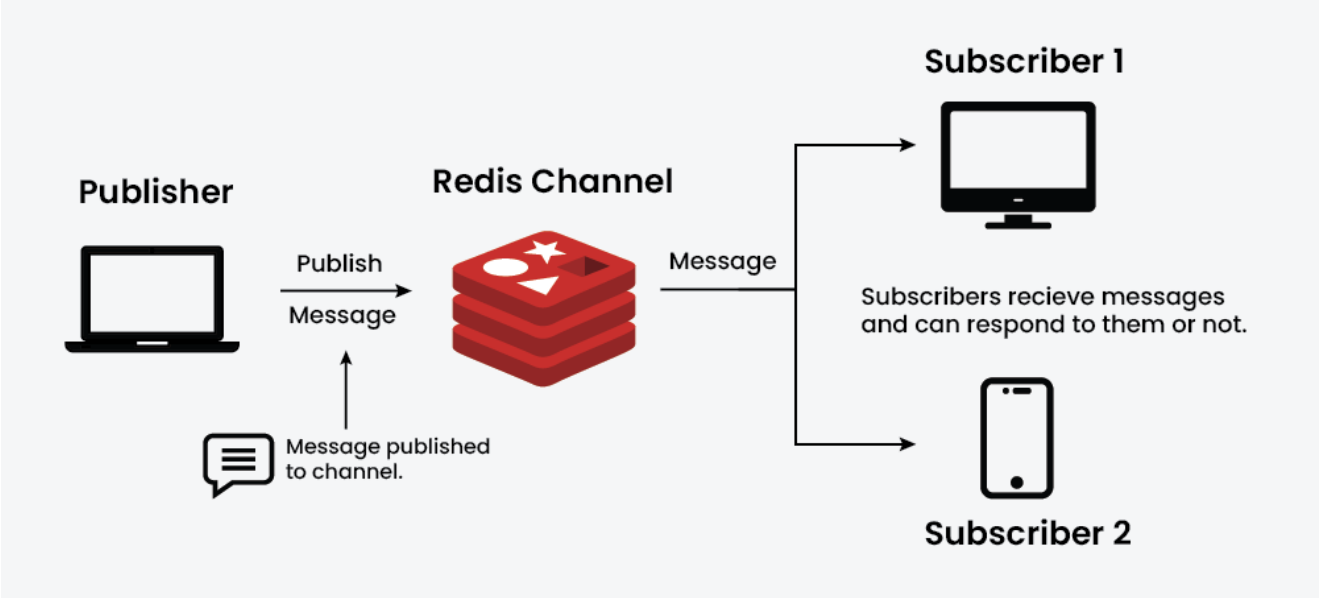
Data Generator

- It simulates data produced by each power meter.
- It publish data on a specific Redis channel.
  E.g. Data from `machine1` of `customer1` are published on `data.customer1.machine1`



Redis

- It is a key-value database that offers the functionalities of a message broker.
- It receives data from all the meters and forward them to two microservices: *DataDecoding* and *Storeroom*.
- It is the entry point of the entire system.



Data decoding

- It subscribes to Redis channel '`data.*`'.
- It receives a hexadecimal string that is split to obtain data, hour and numeric value of the measure.
  E.g. `'2024-09-07T19:53:19.561339'` $\rightarrow$ `'1268b41553b7'`
  Numeric value 68 `DEC` $\rightarrow$ 44 `HEX`.
  Then the two strings are concatenated: `'1268b41553b744'`.
- It prepares a JSON document and writes it into the database.

```
{
  "customer": "customer1",
  "machine": "machine1",
  "date": "2024-07-18T18:05:05Z",
  "EE": 32
}
```

Figure: Example of document

MongoDB Database

- It stores all measurements.
- It provides all data if a user wants to download or visualize them.

Store connector

- It subscribes to Redis channel '`data.*`'.
- It encapsulates raw data (hexadecimal strings) into text files.
- A unique filename is set to every file, given following this scheme `f"{self.machine_name}_{current_time}_{unique_id}"`, where `unique_id = uuid.uuid4()`.
- Files are sent for permanent storage.

MinIO Object Store

- It is an object store platform, organized in buckets and fully compatible with Amazon S3.
- It takes care of the permanent storage of raw data.
- One bucket for each customer.