Progress Report

Title of the Bachelor's Thesis

Service meshes like Istio

submitted by

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Contents

1 Bachelor's Thesis Project: Simulated Internet of Things Cloud **3**
1.1 Project Description 3
1.2 Microservices Description 4
1.2.1 Microservice Controller 4
1.2.2 Microservice IoT 4
1.2.3 Microservice Fog 4
1.2.4 Microservice Analytics 4
1.2.5 Microservice Prediction 4
1.3 Microservices Diagram 5

1 Bachelor's Thesis Project: Simulated Internet of Things Cloud

1.1 Project Description

Since the focus of the bachelor's thesis is on service meshes that enable service-to-service communication between microservices, the bachelor's thesis project will be based on a set of polyglot microservices that will be developed using different programming languages to gain additional functionality and efficiencies not available in a single language. Altogether, the microservices will constitute an Internet of Things application.

The **Internet of things (IoT)** is the term used to describe physical objects ("things") that are equipped with sensors and other technology to connect them to other devices and systems over the Internet so that data can be exchanged between the objects.

As the use of a single IoT device provides only a limited view of a situation and therefore limited results, the project will deploy multiple IoT devices, share available sensor data, derive valuable insights by aggregation the sensor values and apply predictive techniques.

Hence, the project will include the following **microservices**:

- Controller,
- IoT,
- Fog,
- Analytics,
- Prediction.

These **technologies** will be used in developing the application:

- Java,
- Python,
- Docker,
- Kubernetes,
- Istio,
- PostgreSQL.

1.2 Microservices Description

1.2.1 Microservice Controller

The Controller microservice is the gateway that redirects the call to the appropriate microservices and runs the tests.

1.2.2 Microservice IoT

The IoT microservice simulates two different IoT devices – temperature and pressure – by publishing sensor data. This is achieved by providing a single implementation and multiple instances (SIMI). The differences in the devices are represented by means of configuration files. According to a configured data type, an IoT device simulation strategy is injected to generate and publish a stream of simulated sensor data on an hourly basis. Standard sensor values, deviation from them, anomaly sensor values and their frequency are defined to simulate reasonable sensor data. The generated data has to be sent to the Fog.

1.2.3 Microservice Fog

The Fog microservice is used to avoid the high network load caused by the deployment of multiple IoT devices. Fog computing performs an aggregation of sensor values received from IoT devices before analyzing them. Each unique data type is handled by a different Fog instance. This is achieved by providing a single implementation and multiple instances (SIMI). The differences between the instances are represented in configuration files. The configurable ones are aggregation mode, received data type and aggregation interval. Once the Fog starts collecting sensor data, Fog's aggregation strategy is injected, which is determined by the configured aggregation mode. The introduced aggregation operations are the calculation of average, maximum and minimum sensor values. After obtaining the sensor values over the entire aggregation interval, the sensor data is aggregated and stored in the database.

1.2.4 Microservice Analytics

The Analytics microservice accesses the database and calculates statistical data for a certain period, for example, the average daily temperature for January-March.

1.2.5 Microservice Prediction

The Prediction microservice analyzes the data aggregated by the Fog and stored in the database and foresees upcoming behavior.

1.3 Microservices Diagram

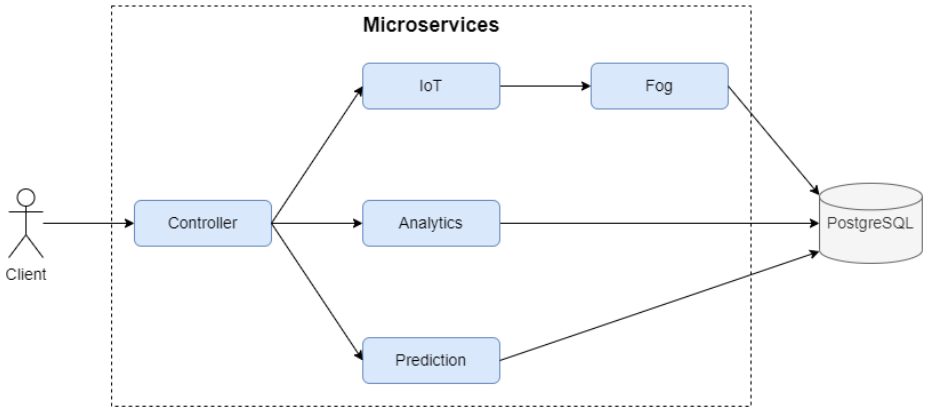

Figure 1: Simulated Internet of Things Cloud

Figure 1 illustrates the microservices architecture.