

Flow Studio

An online flow-based programming environment for domain-specific microservice applications

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Abstract

The introduction of microservice architectures in companies often increases the complexity of the already heterogeneous IT landscape. There are even more independent applications and the relevant information is even more distributed. In addition, the IT departments are usually busy and a new requirement from the specialist departments cannot be implemented fast enough.

This paper introduces a tool that enables domain experts to create complex data flow-based applications across multiple microservices without programming.

1 Introduction

Because of the requirements of digital transformation, companies are faced to realize new requirements with IT systems faster and faster. In order to remain competitive, all capacities of the IT departments are currently being invested in this task. The path from monoliths to microservices is a first step towards mastering this challenge. This, however, increases the complexity of the entire system as the information is distributed across many services.

Today, the development of a cross-sectional application over several microservices needs a team of experts. On the one hand, the team needs at least a domain expert, who understands and links the semantics of the data, a data science expert, who can analyze the data and develop the necessary algorithms and a computer science expert who can bring the application to production. Putting together such a team is at odds with the utilization of IT departments in digital transformation. It

would rather make sense to enable the domain experts to perform these tasks independently by combining and configuring building blocks. The approaches of the flow-based programming paradigm* (FBP) and the low-code development platform† (LCDP) idea pursue exactly this approach.

The tool Flow Studio presented in this paper combines these approaches with a domain-specific graphical notation and a model-driven engineering (MDE) approach especially for microservice architectures.

2 Flow Studio

Flow Studio is a web-based graphical development environment for model-driven development of data analysis applications. The basic idea of Flow Studio is based on the FBP paradigm. Each component, such as microservice or algorithm, is considered a black box that can be parameterized and linked. When developing an application with FBP, the concrete runtime environment and technology are not relevant. The user only has to understand with which black box he can manipulate his data. Furthermore, Flow Studio adds a domain-specific component to the FBP approach. This means that the available components are adapted to the domain. It is not about transferring the data from one system to another system with basic operations or developing algorithms graphically instead of programmatically as in the ETL process‡, but rather about digitizing and automating business processes.

Using the Flow Studio editor, the user first creates a platform-independent metamodel. Flow Studio then uses well-known MDE technologies like model verification and template-based code generators to turn the metamodel into executable code. The generated code can range from a simple microservice orchestration description, to rich Function as a service (FaaS) components, to complex microservice architectures.

In other words, Flow Studio abstracts all technical and mathematical challenges so that the domain expert can concentrate on creating the business logic.

3 Discussion, conclusion and future work

We have validated Flow Studio in various research projects (BigEnergy§, SMiLE**, Fraud Detection††) in different domains and are currently using it in two pilot projects. One in an industrial context for the creation of digital twins and one in a chemical context for the optimization of production plants. It has been shown that the broad orientation and adaptability of the tool has great potential. In comparison to similar tools such as Node-RED‡‡, Flow Studio offers the advantage that it can be integrated more flexibly into existing environments and, thanks to its domain-specific adaptability, is also suitable for users without an IT background.

The next step is to integrate additional domains and create mobility or business applications with the tool, for example. In addition, there is still room for improvement in usability in some areas, for example the integration of new domains currently requires some experience with the tool.

* https://en.wikipedia.org/wiki/Flow-based_programming

† https://en.wikipedia.org/wiki/Low-code_development_platform

‡ https://en.wikipedia.org/wiki/Extract_transform_load

§ BigEnergy - Big Data Analytics for Renewable Energy Related Time Series (LOEWE / HA-Project: 472/15-14)

** SMiLE - Smart Mobility and Logistics Ecosystems (BMVI mFund FKZ: 19F1016A)

†† A distributed hierarchical telecommunication fraud detection system (BMW ZIM ZF4126406BZ7)

‡‡ <https://nodered.org/>