

Serverless Big Data Processing using Matrix Multiplication as Example

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Over the last years, performance and scalability needs for big data processing have been rather successfully addressed. This has been achieved by infrastructure platforms based on open-source distributed computing frameworks, e.g., Spark, TensorFlow, and Flink, that run on servers provisioned by cloud infrastructure services, e.g., AWS EC2. However, operating staff costs and infrastructure costs present significant cost factors for processing data-at-scale. Furthermore, processing big data on cloud infrastructure requires extensive knowledge to define and execute jobs and to deploy, configure, and maintain the required infrastructure platform for running jobs. Hence, the reduction of both costs and entry barriers for processing data-at-scale are grand challenges of data management [Ma18].

Serverless computing [Jo19] is emerging as a popular alternative model to on-demand cloud computing [Le18]. A client no longer uses cloud infrastructure directly, and instead only provides application logic that the serverless provider executes. While first prototypical implementations for serverless big data processing have been proposed [He16], developers and decision makers require hard evidence to make knowledgeable decisions about using traditional cloud infrastructure versus using FaaS. In our original research paper presented at the **IEEE BigData 2018 Conference** [We18], we address the research question of whether serverless platforms are feasible and beneficial for analyzing data-at-scale.

We build on our extensive expertise and previous work on quality-driven design and evaluation of cloud-based systems and answer the research question by means of experimental evaluation [BWT17; KW18]. We present generic requirements for designing serverless data processing applications, a prototype for distributed matrix multiplication, and extensive experiment results (see figure 1).

We showed that the utilization of serverless infrastructure indeed can lower operational and infrastructure costs without compromising established system qualities. Our experimental results indicate that serverless implementations can situationally compete, match, and

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even outperform cluster-based distributed compute frameworks regarding performance and scalability. Furthermore, our approach enables developers to simply configure the cost/performance trade-off according to requirements at hand. Thus, a serverless solution can significantly reduce the entry barrier for new developers both in terms of costs and lowered complexity of configuring a sophisticated big data solution stack.



Fig. 1: Overview of our serverless processing architecture.

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