ICAI 2023
12th International Conference on Applied Informatics
Eger, Hungary, 2023

Evaluation of Scalability in the Fission Serverless Framework

Balázs Fonyódi[a], **Norbert Pataki**[a], **Ádám Révész**[a]

[a]Department of Programming Languages and Compilers
Eötvös Loránd University
fonyodi1balazs@gmail.com, patakino@elte.hu, reveszadam@gmail.com

Abstract

Containerization has become an emerging approach in modern software engineering since it enables the shipping of the software products with all required dependencies in a platform-independent way [1]. Containerization eliminates the virtualization costs of not used OS services and the kernel itself per container. Moreover, containerization supports isolation effectively since the containers are seem to be separate operating systems but they use a shared kernel [6].

The containers are lightweight and they enable the fast and simple deployment and configurations. However, this approach is limited only one host. Kubernetes is a container orchestration system which manages Docker containers over multiple Docker hosts [8].

Function as a Service (FaaS) is a category of cloud computing services that provides a platform allowing programmers to develop, maintain, operate, scale and manage application functionalities without the complexity of building and maintaining the infrastructure typically associated with developing and deploying an application. This new abstraction approach eliminates further configuration and deployment cost. Building an application following this model is one way of achieving a "serverless" architecture [2]. This serverless programming approach provides the deployment of standalone function without launching any virtual machine or container [8].

Serverless programming is a rather new approach, however, there are real-world applications, for instance, Coca-Cola, Santander Bank and Expedia take advantage of this new paradigm [3].

Many frameworks are available for serverless programming, OpenFaaS, Kube-

less and Fission to name a few open source tools [4]. Earlier, we defined our functional approach for the Kubeless realm [7, 8]. However, it is still an open source artifact, VMWare has decided to stop driving and updating Kubeless [9]. Moreover, according to many aspects, Fission was evaluated as the most efficient serverless framework [5]. Furthermore, it has a wide language support and provides autoscaling which will be useful for measuring the speed of algorithms with different CPU settings.

In this paper, we present our efforts of the migration from Kubeless to Fission. We consider how these frameworks can be associated. We make connection between the elements of the frameworks. For a deeper comprehension, we measure and evaluate the scalability of Fission framework. This subtle distributed approach requires a comprehensive evaluation. We implement and execute some parallel algorithms for analyzing the scalability of the entire system. The main focus of testing this environment are sorting algorithms e.g. mergesort and testing both the parallel and non paralellized versions of these algorithms.

References

[1] D. Bernstein: *Containers and Cloud: From LXC to Docker to Kubernetes*, IEEE Cloud Computing 1.3 (2014), pp. 81–84.

[2] P. Castro, V. Ishakian, V. Muthusamy, A. Slominski: *Serverless Programming (Function as a Service)*, in: 2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS), Los Alamitos, CA, USA: IEEE Computer Society, June 2017, pp. 2658–2659, doi: 10.1109/ICDCS.2017.305, url: https://doi.ieeecomputersociety.org/10.1109/ICDCS.2017.305.

[3] P. Castro, V. Ishakian, V. Muthusamy, A. Slominski: *The Rise of Serverless Computing*, Commun. ACM 62.12 (Nov. 2019), pp. 44–54, issn: 0001-0782, doi: 10.1145/3368454, url: https://doi.org/10.1145/3368454.

[4] K. Kritikos, P. Skrzypek: *A Review of Serverless Frameworks*, in: 2018 IEEE/ACM International Conference on Utility and Cloud Computing Companion (UCC Companion), 2018, pp. 161–168, doi: 10.1109/UCC-Companion.2018.00051.

[5] S. K. Mohanty, G. Premsankar, M. di Francesco: *An Evaluation of Open Source Serverless Computing Frameworks*, in: 2018 IEEE International Conference on Cloud Computing Technology and Science (CloudCom), 2018, pp. 115–120, doi: 10.1109/CloudCom2018.2018.00033.

[6] Á. Révész, N. Pataki: *Containerized A/B Testing*, in: Proceedings of the Sixth Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications, ed. by Z. Budimac, Belgrade, Serbia: CEUR-WS.org, 2017, 14:1–14:8, url: http://ceur-ws.org/Vol-1938/paper-rev.pdf.

[7] Á. Révész, N. Pataki: *LambdaKube - A Functional Programming Approach in a Distributed Realm*, in: 2021 4th International Conference on Geoinformatics and Data Analysis, ICGDA 2021, Marseille, France: Association for Computing Machinery, 2021, pp. 67–72, isbn: 9781450389341, doi: 10.1145/3465222.3465233, url: https://doi.org/10.1145/3465222.3465233.

[8] Á. Révész, N. Pataki: *Stack Traces in Function as a Service Framework*, in: Proceedings of the 11th International Conference on Applied Informatics (ICAI) (Eger, Hungary, Jan. 29–31, 2020), ed. by I. Fazekas, G. Kovásznai, T. Tómács, CEUR Workshop Proceedings 2650, Aachen, 2020, pp. 280–287, url: http://ceur-ws.org/Vol-2650/#paper29.

[9] Q. L. Trieu, B. Javadi, J. Basilakis, A. N. Toosi: *Performance Evaluation of Serverless Edge Computing for Machine Learning Applications*, 2022, doi: 10.48550/ARXIV.2210.10331, url: https://arxiv.org/abs/2210.10331.