



University of Bamberg
Distributed Systems Group



Master Thesis

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Topic:

Model Based Pre - Warming to Mitigate the Cold Start of Serverless Function

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Contents

| | | |
|----------|--------------------------------|----------|
| 1 | Introduction | 1 |
| 2 | Theoretical Background | 2 |
| 2.1 | Cloud Computing | 2 |
| 2.2 | Serverless Computing | 2 |
| 3 | Conclusion | 3 |
| | References | 4 |

List of Figures

List of Tables

Listings

Abbreviations

SaaS Software as a Service

PaaS Platform as a Service

IaaS Infrastructure as a Service

1 Introduction

In today's world of cloud computing serverless computing has become quite a phenomenon as it has taken the responsibility of the underlying infrastructure where the applications will run on and the developers can solely focus on the coding aspect. The term serverless has been coined up to portray that the developers do not have to worry about anything related to servers.

As serverless has taken away all the managerial aspects from the developers but unfortunately, it comes with specific challenges. Among them, 'Cold Start' is a potential problem. Cold Start refers to the idea when a serverless function is invoked for the first time or has remained inactive for a long period and needs some time to be prepared for execution ([MSD⁺19], [SA20]) The size of the deployed package and the employed programming languages are a couple of the aspects that have an impact on this issue [MEHW18]

In this thesis paper, I will present an overview of the cold start problem in serverless function in particular. Further, I will analyze possible problems when running applications on serverless computing platforms by programming my own application [CIMS19].

2 Theoretical Background

2.1 Cloud Computing

Cloud computing has transcended its initial emergence decades ago to become a foundational pillar of modern technological advancement. It has brought revolution by ensuring flexibility, scalability, and cost-effectiveness. Through the ingenious power of virtualization, cloud computing has pioneered a model where both software and hardware resources are delivered on demand, precisely mirroring the user's requirements [Cho15]. The cloud's inherent global reach enables seamless access to applications and files from any device, anywhere in the world, fostering enhanced collaboration and productivity[MG11].

Cloud computing offers diverse service models to cater to a range of technical capabilities and project demands. **Software as a Service (SaaS)**: SaaS offers readily available, pre-configured software applications accessible through a web browser [OAAAGW18, HBS21]. **Platform as a Service (PaaS)**: PaaS offers a development environment with programming tools and resources to the users where they can leverage this platform to build custom applications without managing the underlying infrastructure [OAAAGW18, HBS21]. **Infrastructure as a Service (IaaS)**: IaaS grants users fine-grained control over computing resources such as servers, storage, and network components to build applications [OAAAGW18, HBS21].

2.2 Serverless Computing

The relentless evolution of cloud computing ushers in a new era with the captivating emergence of serverless computing. This novel paradigm fundamentally reshapes the existing model by shifting the focus from infrastructure management to code execution. This platform abstracts away the underlying server complexities, empowering developers to concentrate on crafting the business logic of their applications [BCC⁺17, SA20]. serverless computing offers a cost-effective, scalable, and elastic platform. It offers the scaling of resources that adapts to the fluctuating demands without any manual intervention. This results in cost savings as the developers only pay for the resources the application requires [CIMS19].

3 Conclusion

This is the last chapter of this thesis.

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