



**University of
Zurich^{UZH}**

Department of Informatics

Binzmühlestrasse 14
CH-8050 Zürich-Oerlikon
Switzerland

Prof. Dr. Harald C. Gall
Software Evolution and
Architecture Lab

Phone +41 44 635 43 35
Fax +41 44 635 68 09
gall@ifi.uzh.ch
<http://seal.ifi.uzh.ch>

Stefan Würsten
Allenbergstrasse 81
8712 Stäfa
stefan.wuersten@uzh.ch

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Bachelor Thesis Specification

Title: Automated Transformation of Java Applications to AWS Lambda

Introduction

A challenge of engineering cloud-based software [2] is how to integrate state-of-the-art cloud services, such as Amazon's EC2, Elastic Beanstalk, or Lambda, with standard software development environments and existing programming languages and their infrastructures. For instance, while AWS Lambda can technically be used in conjunction with the Java programming language, actually integrating Lambda into a complex JEE enterprise application, including its surrounding processes and tool chains, is not easy.

The goals of this thesis

In this bachelor thesis, a Java-based system will be prototyped that fosters the more seamless development of Java-based Lambda applications. The general idea will follow the development model pioneered by JCloudScale [3], wherein cloud applications are built as local Java applications and cloud services are "injected" at application startup via bytecode transformation. JCloudScale so far only supports Infrastructure-as-a-Service (IaaS).

Task description

In this thesis, the viability and usefulness of the JCloudScale development model for AWS Lambda will be evaluated. This leads to the following main tasks:

1. Read up on the state of the art related to client-side middleware for cloud computing. Additionally, it may be necessary to investigate academic literature related to aspect-oriented programming, bytecode modification, and program transformation.
2. Devise an application model that ports the core ideas of JCloudScale to AWS Lambda.
3. Design and implement a prototypical Java-based framework that implements this application model. Where applicable, existing code from the JCloudScale open source implementation may be reused.



4. Evaluate the concept and implementation of the system in terms of usefulness (through a case study) and overhead (by comparing to a native implementation with Lambda).
5. Write down the results of the thesis in an academic report (bachelor thesis).
6. Defend the results of the thesis as part of the seal softtalk series.

Deliverables

The project is expected to run in three phases. During the first phase, existing scientific literature and existing tools need to be surveyed in order to gain an understanding of the current state of the art. Further, the student needs to familiarize himself with existing cloud services, their usage, billing, and limitations. This phase is expected to run for one month or less. The second phase consists of devising the architecture and high-level design of the project solution, as well as the implementation of a first iteration of the solution. The phase runs over the next 2 months. In the third phase, running over the last 2 months, the project will be evaluated and refined based on concrete demos and scenarios, and the bachelor thesis and defense talk will be prepared.

General thesis guidelines

The typical rules of academic work must be followed. In [1] Bernstein describes a number of guidelines which must be followed. At the end of the thesis, a final report has to be written. The report should clearly be organized, follow the usual academic report structure, and has to be written in English using our s.e.a.l. \LaTeX -template. As implementing software is also part of this thesis, state-of-the-art design, coding, and documentation standards for the software have to be obeyed.

Advisors:

Professor:

Prof. Dr. Harald C. Gall

Responsible assistant:

Dr. Philipp Leitner

Signatures:

Stefan Würsten

Prof. Dr. Harald C. Gall



References

- [1] A. Bernstein. So what is a (diploma) thesis? a few thoughts for first-timers. Technical report, Dynamic and Distribution Information System Group, University of Zurich, 2005.
- [2] J. Cito, P. Leitner, T. Fritz, and H. C. Gall. The making of cloud applications: An empirical study on software development for the cloud. In *Proceedings of the 2015 10th Joint Meeting on Foundations of Software Engineering, ESEC/FSE 2015*, pages 393–403, New York, NY, USA, 2015. ACM.
- [3] R. Zabolotnyi, P. Leitner, W. Hummer, and S. Dustdar. Jcloudscale: Closing the gap between iaas and paas. *ACM Trans. Internet Technol.*, 15(3):10:1–10:20, July 2015.