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STIPENDIEN

Trustworthy Context-Aware Access Control in IoT Environments based on the Fog Computing Paradigm

Zwischenbericht | Call 15 | Stipendium ID 5294

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1 Introduction

This report describes the progress within the scope of scholarship 5294, done by Nemanja Ignjatov.

The goal of this scholarship is the finalization of the dissertation entitled “Trustworthy Context-Aware Access Control in IoT Environments based on the Fog Computing Paradigm.” In this thesis, the distribution of security mechanisms (e.g., Access Control, Trust, Identity Management) based on the Fog Computing capabilities is researched. Moreover, integration of IoT environment context information into security policies has been set as the second major research goal in the thesis.

2 Status

The progress in the scholarship's previous period has been split into four milestones. Further details on each milestone are provided in the upcoming sections.

2.1 Exams

As part of the work, the lecture course on Distributed Systems at Technical University of Vienna has been successfully passed ahead of schedule already at the beginning of this year. Thus, all required exams in the dissertation’s agreement have been successfully passed, and this project milestone is finished.

2.2 Dissertation writing and publications

In the previous period, further work on the research questions and writing the dissertation resulted in significant progress. The dissertation has been submitted for review to the mentor and improved according to comments from the first review. One major feedback concerns improving performance the evaluation testbed with more powerful hardware, which required redoing performance evaluations. New performance evaluation results have been collected and presented during a colloquium at the University of Vienna at the beginning of April. However, it is agreed with the mentor that the dissertation requires an additional review and improvements, introducing delay to the initial plan. This feedback round is scheduled for July 2021, after which the dissertation will be submitted, and evaluation by external reviewers will start immediately afterwards.

The initial plan for publications has deviated, causing delays in this project milestone. The deviation is mainly caused by shifting the required effort to the “Exams” project milestone and the previously mentioned testbed setup and reevaluation of the developed solution. Hence, the conference paper addressing Access Control distribution using Fog Computing is currently under submission, and a second paper, describing context-aware Access Control, will be submitted by the end of August.

2.3 Software development

Planned tasks within this project milestone resulted in publishing the developed software components, which are executed in the Cloud environment. Initially, for the sake of development simplicity and deployment setup, the components have been hosted on the Gitlab servers of the University of Vienna and have then been migrated to GitHub under Apache License 2.0.

Moreover, shared libraries that implement security mechanisms, which are required for the project, have been developed and published. Through that, the Fog components development has been simplified and accelerated. Thus, the finalization and publication of the Fog component on GitHub under Apache License 2.0 will occur in the upcoming weeks according to the original schedule.

2.4 Blogs

Until now, the following blog contributions have been published:

1. December 2020: “Motivation for researching IoT security”
2. March 2021: “Managing trustworthy IoT environments”
3. May 2021: “Modeling IoT Access Control”

Published blog articles aim at design decisions that have been made in the previous part of my research, with extensive reasoning and review on the State of the Art in IoT security areas. In the upcoming blogs, I plan to focus on architecture and implementation details concerning the dissertation project. Thus, the topics covered by further blogs will include:

1. Guidelines for integrating context into Access Control.
2. Bringing Trust close to the IoT devices.
3. Fog Computing-based security protocols overhead in IoT systems.

3 Summary of Plan Update

Generally, significant progress in all project milestones has been achieved in the previous months. The most significant deviation concerns planned publications, together with a minor delay concerning dissertation improvements. Since other dissertation project milestones are mostly done, the planned effort will be shifted to submitting publications and finalizing the dissertation.

Thus, in the next period, the emphasis will be put on publications and further dissertation improvements. In the updated plan, two publications are set to be submitted during the summer. In parallel, dissertation reviews and modifications will occur before its final submission in the autumn of this year. All in all, it is expected that the entire project will be finished successfully in time.