Identification of Module Boundaries in a Modular Monolith Architecture using Automated technologies

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The modular monolith architecture emerged in recent years as the harmonization of the monolithic and microservices architectures. The paradigm offers a compromise between modularity, flexibility, and scalability. Many monolithic applications are being migrated to modular monoliths or microservices entirely, to satisfy increasingly complex and volatile business requirements. This process is labour-intensive, slow, and may take months to years for larger codebases. Modularization of a codebase typically requires the developer to have an intimate knowledge of both the application code and domain.

In this thesis, we investigate the modular monolith software architecture, and how modules are typically determined as part of the modularization efforts. We propose an automated solution based on dependency analysis and machine learning algorithms to aid in the identification of module boundaries, and evaluate its effectiveness using a case study. We discuss the results and draw conclusions about the propsed solution.

Keywords: software architecture, monolith, microservices, modular monolith

Contents

List of Figures

List of Tables

List of Acronyms

API	Application Programming Interface
UI	User Interface

1. Introduction

1.1. Scope and goal

This research is centered around two research questions:

Research Question 1: Which challenges and opportunities arise when considering adoption of the modular monolith architecture in an existing codebase?

Research Question 2: How can *(automated technology)* effectively identify optimal module boundaries in a modular monolith architecture?

To answer the first research question, we first define the modular monolith architecture, and examine what sets it apart from monolithic and microservices architectures. Then, we proceed to investigate the merits and drawbacks of the software architecture when applied to an existing codebase.

For the second research question, we enumerate the existing technologies to aid modularization of monolithic codebases, and choose one automated technology for further examination. *(Automated technology)* is then implemented for a given use case, and compared to manual modularization efforts in terms of accuracy, efficiency, development velocity.

The goal of this research can be summarized as follows:

1. Investigate the merits and drawbacks of the modular monolith architecture in an existing codebase
2. Investigate the use of automated technologies to modularize a monolithic architecture

The proposed solution adds value to the field of software engineering, and can be used as a base for future improvements regarding automated modularization of monolith codebases.

1.2. Motivation

1.3. Methodology

1.4. Outline

The thesis is divided into three parts.

The first part comprises the background and related work. In Chapter 1, the scope and goal of the research is defined, and the research questions are formulated. The stakeholders are identified, and the methodology is explained. Chapter 2 introduces the reader to the research background and necessary concepts. In Chapter 3, the existing literature is reviewed, and the state of the art is presented.

The second part of the thesis, starting with Chapter 4, is dedicated to the first research question. The modular monolith architecture is defined, and its merits and drawbacks are discussed.

The third part aims to solve the second research question. Chapter 5 gives an introduction into the automated modularization of monolith codebases, focusing on one technology in particular. Chapter 6 applies the automated technology on a given case study, and compares it to manual modularization efforts.

Finally, Chapter 7 summarizes the findings, and gives an outlook on future work.

2. Background

2.1. Monolith architecture

2.2. Microservice architecture

3. Related work

4. Modular monolith architecture

4.1. Background

4.2. Challenges and opportunities

4.3. Modularization

5. Modularization

6. Case study

6.1. Background

6.2. Analysis

6.3. Evaluation and results

6.4. Discussion

7. Conclusion

7.1. Future work

References