

**BEST PRACTICES FOR MONOLITHIC
TO MICROSERVICE TRANSFORMATION**

Buddhika Anjalee Ratnayake

158245N

Degree of Master of Science

Department of Computer Science and Engineering

University of Moratuwa

Sri Lanka

January 2019

DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature:

Date:

The above candidate has carried out research for the Masters thesis under my supervision.

Signature of the supervisor:

Date:

ACKNOWLEDGEMENTS

I am deeply grateful to my supervisor Dr. Indika Perera from the University of Moratuwa Department of Computer Science and Engineering, whose help, motivation, suggestions and encouragement helped me in all the time to complete this work.

Also, I would like to thank my family and friends for their understanding during the period of the project and gave me support. Without their help I would face many difficulties in the time of the project. And finally, my grateful thanks to all the people who help me during the project.

ABSTRACT

Monolithic software systems could become a challenge in certain scenarios when the software system needs to be enhanced. A single change in the system requires full redeployment. This result in high cost of adding new functionalities while reducing the competitive advantage in the market for adding new features, since there has to be a full functional test of the application and this will increase the time a new functionality is introduced to the market. Microservices comes in to play in order to provide a solution. The study is carried out from this research aims to find the best practices when transforming from a monolithic to microservice architecture.

This research tries to find the software architecture issues and challenges when changing the software architecture of a monolithic application in to microservice architecture. Microservice architectural style is about an approach which creates a single business application as a set of simple service units. Each service corresponds to a single business process which could run independently. The communication is through light weight mechanisms such as HTTP resource APIs. One single microservice is independently deployable and build around a specific business functionality.

The microservice API is the entry point which provides the interface for multi-channel client requests. The implementation logic is hidden behind the API interface, which is in here RESTful web service API. This API accepts and process the client calls.

The proposed best practices and methodology can be effectively used in the conversion of monolithic to microservice architecture. This research also considers the practical issues a business will have to face when doing the conversion. The end goal here is to suggest a cost effective and a time efficient technique and best practices with a minimum impact to the existing business logic to convert a monolithic style application architecture in to a microservice architecture.

TABLE OF CONTENT

DECLARATION	ii
ACKNOWLEDGEMENTS.....	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF FIGURES	vii
CHAPTER 1	1
INTRODUCTION	1
1.1 Background.....	2
1.1.1 Issues with Monolithic architecture	3
1.1.2 Microservices.....	4
1.2 Research Problem Statement.	6
1.3 Research Objectives	8
1.4 Overview of the document.....	9
CHAPTER 2	11
LITERATURE REVIEW	11
2.1 Defining services for microservice approach.....	12
2.1.1 Services identification and service planning	12
2.1.2 Conceptual Elements of SOA Migration Framework	19
2.2 Web Services.....	24
2.2.1 RESTful web services.....	25
2.3 Microservices	29
2.3.1 Architecting Microservices	32
2.3.2 Disadvantages of using microservices.	32
2.4 OData – Open Data Protocol	33
2.4.1 Case studies with OData approach	34
CHAPTER 3	38
METHODOLOGY	38
3.1 Proposed Solution.....	39
3.1.1 Factors to be considered during the Transition	39

3.1.2	Organizational impacts of the transition	42
3.1.3	Techniques used.....	43
3.1.4	Refactoring process - Refactor functionality.....	45
3.1.5	Refactoring process - Refactor Database	46
3.1.6	Methodology conclusion	50
3.2	Evaluation Plan	51
CHAPTER 4	.....	52
IMPLEMENTATION	.....	52
4.1	Identifying the candidate services from the monolithic system	54
4.1.1	Proof of concept.....	57
4.2	Protocols used for microservices.....	58
4.2.1	Service Metadata Document	61
4.2.3	Handling various operations through the services.....	63
CHAPTER 5	.....	77
EVALUATION AND CONCLUSION	.....	77
5.1	Evaluation.....	78
5.1.1	User survey to evaluate microservices.....	80
5.2	Conclusion.....	84
References	.....	87

LIST OF FIGURES

Figure 1 Traditional vs IT as a service [1]	3
Figure 2 Rapid growth of cloud computing	6
Figure 3 Service oriented Migration and Reuse Technique Approach[8]	13
Figure 4 SOA bridge design to dynamically expose MVC functionality through web services[9]	15
Figure 5 Bridge algorithm[9].....	16
Figure 6 Gradual change in generations of learning management systems.	17
Figure 7 Overview of SOA migration framework	20
Figure 8 Monolithic vs microservice architecture	30
Figure 9 Before and after using oData services[33]	36
Figure 10 Various types of testing for the monolith	40
Figure 11 Anti-corruption layer between microservices and monolithic system	49
Figure 12 Underlying functions of the anti-corruption layer.....	50
Figure 13 Extract services from the system [47]	54
Figure 14 A single microservice	59
Figure 15 OData service details from .svc	60
Figure 16 OData service request.....	61
Figure 17 OData metadata document.....	62
Figure 18 Functions exposed through services.....	64
Figure 19 OData GET request with Query parameters	64
Figure 20 Creating a new resource through OData request	66
Figure 21 Transition process	67
Figure 22 The data viewed through the microservice.....	71
Figure 23 Basic service oriented architecture derived from the research	72
Figure 24 CsdIAbstractEdmProvider class [37]	73
Figure 25 Metadata document for Product resource.....	76
Figure 26 Experience levels of the participants.....	81
Figure 27 Experience with SOA or microservices	82
Figure 28 Benefits of Microservice usage with the order of importance (%)	82
Figure 29 The importance of challenges with regard to microservices	83

LIST OF TABLES

Table 1 Evaluation Criteria for microservice vc Monolith	81
--	----