Comparing Legacy System Modernization Approaches for a Service Oriented Architecture

Work-in-progress paper

Meredith A. Barnes and Charmain Cilliers
Department of Computer Science and Information Systems
Nelson Mandela Metropolitan University
P.O. Box 77000, Port Elizabeth, 6031
Tel: +2741 – 504 2094, +2741 – 504 2235
Meredith.Anne.Barnes@nmmu.ac.za, Charmain.Cilliers@nmmu.ac.za

Abstract - Legacy systems are often at the centre of business procedures of large organisations resulting in a need to modernize these systems as they can begin to resist change over time. The primary goal of this paper is to describe a comparative study of two modernization approaches applied to the same legacy system to generate data services. The two approaches are white-box and black-box. The white-box approach requires knowledge of legacy code and functionality whereas the black-box approach wraps the legacy code in a software adapter layer. The analysis of the data services generated by the modernization will be based on quality metrics for services, effectiveness of the services generated and developer’s effort to migrate the legacy systems to services. The contribution of this research is to provide developers with knowledge of which approach is more suitable to modernize legacy systems for a SOA.

I. INTRODUCTION

Legacy systems are defined as software systems that start to oppose changes after use for some time [7]. Two techniques exist for legacy system modernization. They are white-box and black-box. These approaches could be applied to an existing legacy system to generate services for a Service Oriented Architecture (SOA). SOA has become an accepted paradigm for an architecture that supports the development of distributed systems that satisfy business objectives [1].

It is unclear which approach should be used to provide a data service that adheres to Quality of Service (QoS) requirements. A comparison of the two approaches on a specific domain of a legacy system can clarify this. The two legacy system modernization approaches will be developed and applied to the same domain of a legacy system based on the case study used. The comparison of the modernization approaches will be based on three different sets of metrics. The metrics are QoS of the data service generated, developer’s effort [4] in creating the modernization approaches and the effectiveness of the tools to generate data services.

II. RELATED WORK

There is a need to modernize legacy systems, as they contain knowledge of utmost importance to the organization that uses the software [7]. Modernization includes changing the system structure, functionality or system attributes, yet preserving a large fraction of the system [7].

2.1 Service Oriented Architectures

A SOA is a combination of service providers and services consumers providing and requesting services, all of whose information is stored, and made accessible to actors, in a Service Registry [5]. Services can be defined as a collection of software elements, each of which can execute a business process [6]. A service should be platform independent and it should be able to interface with other services to share its self-reliant business process, which in turn should be loosely coupled with other services [6].

The term “self-reliant” infers the service’s ability to maintain the same core functionality when not coupled with other services [6]. Loosely coupled defines the ability of services to interface with one another without having knowledge of the core technical functionalities of the other services [6]. Services are required to be reusable in terms of functionality in more than one application [6].

2.2 Black Box Modernization

Black-box modernization is concerned with the evaluation of the inputs and outputs of the legacy system during operation to gain knowledge of the interfaces [7]. This task involves wrapping the legacy system in a software layer that masks the unnecessary intricacies of the old legacy system whilst generating a modern interface [7]. This approach disregards the internals after the legacy interface is analysed [7]. Fig 1 depicts a black-box approach to migrate a legacy system to a web service.

2.3 White Box Modernization

White-box modernization requires knowledge of the legacy system code and functionality [7]. Fig 2 depicts a white-box modernization approach. Once the code has been analysed...
and understood, code restructuring is often involved [7]. This restructure is usually a transformation from one representation to another at the same abstraction level to improve quality of the system, whilst still maintaining the external system functionality [7]. The Risk-Managed Modernization (RMM) approach (Fig 2) incorporates software engineering concepts and knowledge of the technologies defining the solution space of the information system [7]. The primary goal of this approach is to manage migration successfully and minimize risk [7].

Fig 2. Adapted from “Risk-Managed Modernization Approach” [7]

2.4 Data Services and Quality Metrics
Data services are described as having the core functionality of one specific business object, such as an order or an employee [3]. This data service is composed of service calls that can be used by an application to access and change any particular instances of a business object [3]. It thus follows that each data service has a “shape” which describes the information stored for the particular business object type [3].

Seven quality attributes, identified in [1], are to be adhered to when generating services for a SOA. They are performance (latency and throughput), availability of services, security (confidentiality and protection of data), testability for new versions of service software, interoperability (platform independence), modifiability (reusability of services) and reliability in terms of system errors and recovery.

The case study identified for this research is the Nelson Mandela Bay Municipality (NMBM) billing system. This legacy system requires modernization to provide the billing data as a service in a SOA. The need to modernize the legacy system to create a data service is relevant for the NMBM to migrate their systems towards a SOA.

III. RESEARCH METHODOLOGY
A comparative analysis will be the research method used to support the primary goal of this research. The primary goal is to measure which modernization approach, white- or black-box, is comparatively better when both techniques are applied to the NMBM case study.

A literature review will be conducted to investigate the two modernization approaches as well as the metrics for the comparison of the two approaches. Analysis of the NMBM billing system will be conducted and then the white- and black-box approaches will be developed and applied to the NMBM case study to generate data services for a SOA. The quality, developer effort and effectiveness of the tools will then be measured for each of the approaches to draw conclusions as to which approach is superior.

IV. CONCLUSION
Research has shown that there are two distinct modernization approaches which could be used to migrate legacy code to data services. The two modernization approaches will be developed and compared with one another in terms of QoS, effort required by the developer [4] to create the approaches and the effectiveness of the approaches to generate a data service.

A possible risk that could be encountered is the complexity of developing a white-box approach due to its requirement for the knowledge of legacy code and functionality. This could be overcome by maintaining contact with the IT personnel at the NMBM and investigating existing software or best practices in creating a white-box modernization tool.

The research conducted will aid in encouraging the NMBM to migrate their systems towards a SOA. The comparative analysis between the two modernization techniques could clearly show which approach is more suitable for generating data services for a SOA.

REFERENCES

Meredith A. Barnes received her BSc and BSc (Hons) in Computer Science and Applied Mathematics from Nelson Mandela Metropolitan University (NMMU). She is currently pursuing a MSc in Computer Science & Information Systems at NMMU.