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Poster: Reengineering Legacy Systems for Supporting SOA

A Case Study on the Brazilian's Secretary of State for Taxation

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ABSTRACT

The migration of legacy systems to a service-oriented architecture (SOA) allows to deal with the demand for interoperability and the need to provide a robust high-available service interface. However, such migration presents a considerable risk, as it often involves the use of different techniques on systems with elevated technical debt and high maintenance costs. For this purpose, a process is instantiated to provide an appropriate set of techniques that will minimize risks and at the same time ensure quality improvement of the systems throughout the migration process. In this sense, this work reports on a case study of the application of a process for the reengineering of legacy systems to support the implementation of SOA project. This study has been applied to the evolution of legacy systems of the Secretariat of State for Taxation of Rio Grande do Norte (SET/RN), Brazil, providing significant results regarding the achievement of important quality goals.

CCS CONCEPTS

• **Applied computing → Service-oriented architectures**; • **Computer systems organization → Client-server architectures**; • **Software and its engineering → Software reverse engineering**;

KEYWORDS

SOA, Reengineering, DevOps

1 INTRODUCTION

The advent of technology has reshaped the whole tax administration process [1]. In order to assist public administrations in detecting and preventing tax evasion, the Secretariat of State of Taxation

of Rio Grande do Norte (SET/RN)[1] develop e-Government platforms to support auditors in carrying out their activities, as well as to provide the interface between citizens and tax services. Currently, the UVT (*Unidade Virtual de Tributação* - Taxation Virtual Unit) system is the main communication interface between the taxpayer [2] and SET/RN.

Over the years and due to lack of good software engineering practices, the UVT system has accumulated a series of technical debts [6], which motivated a critical assessment of UVT. The high cost of maintenance and evolution and the necessity of interoperability between other systems, together with demands for the renewal of its Web portal and the provision of services on mobile devices have intensified the desire for modernization of UVT. However, this requires much more than the renewal of interfaces (GUI) and adoption of development techniques for mobile devices. In fact, it has demanded a revision of the whole system architecture and infrastructure suitability, considering a redesign directed to reuse, as well as a revamp on the methods employed for construction and delivery of software solutions. These needs led to SET/RN to adopt Service Oriented Architecture (SOA) as target in order to obtain systems with better quality attributes.

Since SOA deployment is unique in each enterprise, the challenge considered by this work is the need for a development process that supports the reengineering of legacy systems and DevOps[4] (i.e., continuous integration, delivery and deployment), having as target SOA paradigm. In this sense, the main contribution of this paper is an industry report, a case study of the reengineering of a legacy system to target SOA. One of the results of this case study is the identification of an instantiation of a SOA development process geared towards supporting reengineering of legacy systems. As a case study, the process is being applied in the context of the modernization project of the SET/RN UVT system.

2 THE SPREAD PROCESS

The **SPReaD** (SOA Process for Reengineering and DevOps) is an instantiation of MSOAM [2] focused on Software Reengineering, integrating DevOps to handle some phases of MSOAM Deployment.

SPReaD takes as basis SOA principles (e.g., Standardized Service Contract, Service Loose Coupling, Service Reusability) [2] as guidance for a Software Reengineering process [5] with the goal of achieving SOA objectives. Complementary to the reengineering

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[1] *Secretaria de Estado da Tributação do Rio Grande do Norte*
[2] Taxpayer is any person, whether physical or juridical, who carries out, usually or in volume that characterizes commercial purpose, operations of movement of goods or services of interstate and intermunicipal transportation and communication.
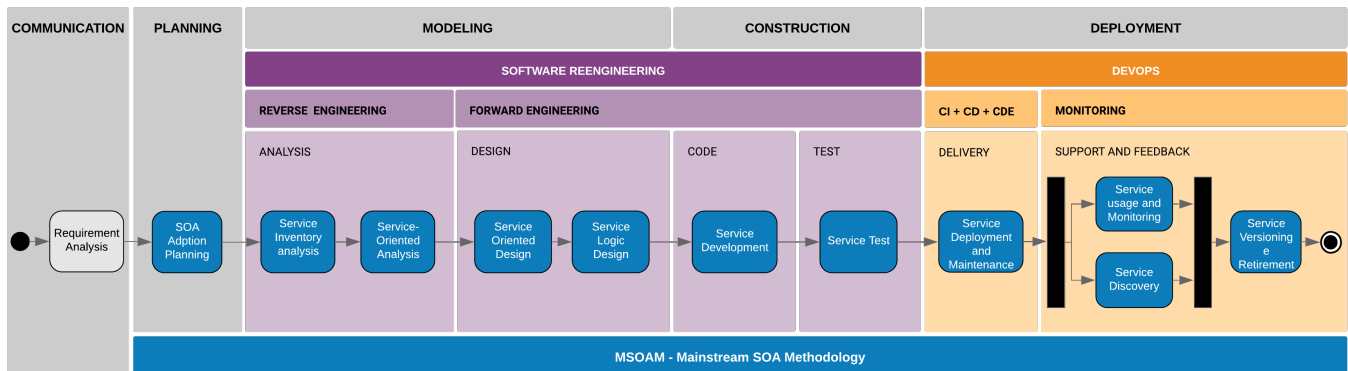
Figure 1: Relationship between SOA, Software Reengineering and DevOps

process, we have also employed DevOps techniques as means for delivery, support and monitoring of services.

SPReaD organizes the phases of MSOAM based on the five phases of the process model described by [3]: communication, planning, modeling, construction and deployment. Based on the relationship between software process and MSOAM, we have added activities pertinent to Software Reengineering as well as related to DevOps, as shown in Figure 1.

3 EVALUATION AND CONCLUSION

The application of SPReaD produced several benefits: Standardized Service Contract, Real-time service monitoring, Monitoring business dynamics and Alignment between IT and Business. In addition, the business rules coupled into a monolithic legacy system, now have a better componentization. This represented greater portability, reuse and a significant improvement in software maintainability, as demonstrated in Table 1.

Table 1: The technical debt of UVT system before and after migration.

Issues Type	Before migration	After migration
Bug	249 (9d)	0 (0d)
Vulnerabilities	22 (1d)	0 (0d)
Code Smells	3339 (70d)	1940 (42d)
Total	3610 (80d)	1940 (42d)

Analyzing this table, we can notice the reduction of 249 Bug issues to none, and the reduction on the amount of Code Smells issues, from 3339 to 1940. In Days of effort (d), this represented a reduction of 47% of reduction on technical debt.

In addition, the services in production environment presented significant results as availability and performance efficiency. Table 2 shows some performance indicators obtained for a few months of 2017 regarding the number of requests (#Requests), and average of the Response time (in milliseconds) on each month, and the number of users (#Users) of the system. The pilot of UVT was officially launched on June/2017 for an initial user base of under 1,000 users. Until August/2017 both the old and the new system have been

active in parallel. However, in September/2017 the old system has been deactivated, and all users now had to consume services from the new UVT system. In this way, we had an increment of 116% on the user base (from 5,162 users to 11,156 users) and an increment of 496% on the number of requests (from 652,455 requests to 3,889,923 requests). This was a moment of apprehension for the team, but despite the huge increase in the load, the average response time remained stable around 200 miliseconds.

Table 2: Results of availability and performance efficiency)

Month	#Requests	Response time (ms)	#Users
Jun/2017	197,458	222,00	939
Jul/2017	484,665	184.92	4,079
Aug/2017	652,455	199.21	5,162
Sep/2017	3,889,923	187.69	11,156

Based on the results obtained with UVT system, there is now a real demand for applying SPReaD to other systems of SET/RN, which will provide the means for the consolidation and evolution of SPReaD. Furthermore, the adoption of service orientation is paving the way for the use of Business Process Management tools and techniques with a strong alignment with IT, which has been raised as a demand from the managerial team of SET/RN for future projects.

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