3.2 RELIABLE GOVERNMENT AUTOMATION OF REGULATED INFRASTRUCTURES BY SERVICE LEVEL AGREEMENTS

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ABSTRACT

Public administration plays a leading role in providing adequate IT services to citizens and the need for accountability represents a fundamental principle; in particular, this need is of utter importance in the governance of IT infrastructures that support the general dynamics of administration. In this paper, we present the roadmap for a new generation of IT governance platforms that improve the level of transparency using blockchains while having a performant behavior. In addition, as a first step, we provide a high-level overview of the idea of Elastic Smart Contract as a novel element that addresses the analytical challenges present in IT governance.

INTRODUCTION

Public administration has a fundamental role in providing appropriate IT services to citizens, which would drive the increasing need for the digitalization of society. In such a context, the need for accountability represents a fundamental principle that should be intertwined into the layers of public organizations, but it is especially important in the IT infrastructures that support the general dynamics of administration.

To address a certain degree of accountability and increase transparency in IT systems, in recent years blockchain technology has become an appropriate choice to evolve current systems and incorporate nontampering mechanisms in distributed scenarios. In this paper, we present the roadmap toward a

new generation of IT governance platforms that take advantages of these new possibilities to improve the level of transparency, while having an efficient behavior in the governance. In particular, we outline promising first results with the development of the concept of Elastic Smart Contract which could be used as the framework to drive analytics that supports automated governance while maintaining appropriate levels of performance, non-manipulation, and transparency.

STATE OF THE ART

Public administration represents a complex scenario where a variety of stakeholders have to collaborate, sharing information between them and allowing each party to carry out analysis and provide decentralized services on shared data. Trust issues become critical in this environment, as multiple parties (one being the citizen) have to continuously agree on the validity of the data and services they need to integrate. Blockchain technologies fit naturally, providing transparency and non-alteration to shared data in a trustless network. In addition to these features, privacy and rights management can be considered by using different blockchain implementations, ranging from permissioned blockchains (Androulaki et al., 2018) to specific solutions tailored to IoT-based ecosystems (Dorry et al., 2017), including novel approaches to data management that focus on trust and privacy preservation (Zhaofeng et al., 2020).

In recent years, the novel element concept of Smart Contract has appeared to extend the blockchains as transaction placeholders to introduce a more proactive network and extend its capabilities; specifically, Smart Contracts represent a framework to develop a computational mechanism combining off-chain data with the one present in the blockchain.

Since the introduction of Smart Contracts (Buterin, 2013), blockchains have evolved from mere distributed digital ledgers to distributed computing platforms that can include not only an immutable data repository but also logical and behavioral information to automatically rule the relationships between stakeholders. Thus, Smart Contracts can encode functionality needed to provide additional services on top of the data registered in the blockchain. These contracts essentially aggregate some data under certain conditions that will trigger their execution. Although the data used within the contract logic is mostly obtained from the blockchain where the contract is deployed, oftentimes, there is a need to consider external data (commonly referred to as off-chain data). To preserve the untrustworthy characteristic of blockchains, an additional agent, namely an oracle, needs to provide the external data in a secured, trusted form.

CONTRIBUTION

The context of the current work has been the ANA project (Reliable Government Automation of Infrastructures Regulated by Service Level Agreements) where we have extended the pre-existing platform Governify, deployed in the Andalusian regional administration to support the IT governance in a concrete set of departments. Specifically, Governify is a service agreement management framework that boosts service governance by supporting audits in an automated way. It is composed of a set of integrated components that can be combined to create configurable architectures that adapt to each scenario. The governance platforms built with Governify gather evidence from multiple external sources in the organization (by means of their APIs) and provide visual dashboards to understand the current risks of not meeting targets. The Governify underlying agreement model (iAgree) provides a uniform modeling approach in a wide range of domains: from Service Level Agreements (SLA) in RESTful services to Service Objective/Penalties and Rewards in IT Service Support Desks driven by humans, or Best Team Practices in Agile Development Teams. These holistic capabilities allow the definition of integrated metrics, goals, and dashboards to create a common governance platform to drive the strategy of the organization. From a technological standpoint, Governify provides the native microservice architecture of RESTful components that can be easily deployed and operated as containers in the chosen infrastructure.

Nowadays, APIs are considered new business products and an increasing number of organizations are publicly exposing their APIs to create new business opportunities in this so-called API economy. In the case of the Public Administration, there is also a similar trend to adopt the so-called microservices architecture where the multiple information systems provide APIs to conform to a large ecosystem of integrated services. In such a context, defining the expected SLAs of API (including elements such as the quotas or fees for the different stakeholders) is becoming a crucial activity in the general governance of the platform. In particular, within a joint and collaborative work with the company EVERIS, we have addressed these challenges in the context of a widely used mobile application that helps citizens by aggregating in a single point, multiple services from the wide list of departments that conform to the administration. In such a scenario, that variety of services has a direct correspondence with an underlying layer of APIs that are provided by multiple scattered infrastructures that make up a wide and complex distributed scenario.

In order to improve the transparency in this scenario, we have extended the Governify platform to create a transparency layer that stores and develops analytics in a non-tampered way using blockchain technologies and the Smart Contract paradigm. Specifically, we can define two different kinds of data used as input for analysis (i.e., by means of Smart Contracts) in the blockchain

paradigm. On the one hand, the paradigm provides a persistent, immutable, and non-tampered way to store a set of transactions in the chain. On the other hand, for the sake of efficiency, in actual implementations of the paradigm, there are also other current (and mutable) data available in the ledger that can be used in analytics (such as the objects in Hyperledger Fabric). In such a context, although accessing and modifying that mutable data are highly efficient, as the global size of that kind of data increases, there could be a severe impact on the performance of the blockchain. Consequently, the performance implications of maintaining a large data set impose a trade-off on the appropriate size of data to be kept for the analysis while maintaining appropriate blockchain performance. This trade-off represents an important challenge that we address by proposing a new innovative concept: the Elastic Smart Contract.

Elastic Smart Contracts represent an extension of the pre-existing paradigm to incorporate an automated orchestration of data management and analytical transactions into the blockchain to avoid saturating the blockchain and maintain the acceptable overall performance of transactions. Our preliminary results show that this new model could be adapted to variable situations to have an automatic adaption of the analytics and support the challenges presented in the IT governance of infrastructures.

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