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Towards a Service and Choreography Governance Framework for Future Internet

Sarah Zribi, Frédéric Bénaben, Amira Ben Hamida, and Jean-Pierre Lorré

Abstract The Service Oriented Architecture (SOA) Governance refers to all measures, rules, decision-making, information and evaluation that ensure the proper functioning and control of services within an organization. In the Future Internet vision of services and in a choreography context, many heterogeneous services from several organizations need to collaborate together to achieve a common goal. In order to improve the interoperability, reuse, the good behavior, the control and the efficiency of a choreography, it is necessary to define a governance framework for services and choreographies. This paper addresses the raised issues by providing a governance framework vision. EasierGov deals with both services and choreographies.

1 Introduction

Since its inception, SOA was revealed as being the de facto paradigm for future systems. It combines best practices inspired from previous application models. Modularity, encapsulation, fine-grained, publication, and discovery help SOA to

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be widely used by developers and users. As a consequence, enterprise information systems are migrating to this new trend.

As systems are moving from classical IT to innovative SOA, essential functions need also to be exported and adapted. SOA Governance is a first and foremost function in IT systems. It ensures the best practices and the success of an SOA within an organization. To achieve an objective and respond to consumer requirements, services may need to collaborate with several services coming from other business entities. This is the first vision about what is service choreography.

This work is based on an ongoing work supported by the CHOReOS project funded by the European program. Petals Link¹ involvement in this project is focusing on governance of ultra large scale choreographies of services for the Future Internet.

The remainder of this paper is structured as follows. In section 2, we survey the state-of-the-art of both SOA Governance and Service Choreography. We introduce definitions of both concepts and study solutions from both the literature and the industrial worlds. In section 4, we describe our contribution: EasierGov: a Governance framework for services and choreographies for the Future Internet. Finally, section 5 concludes this paper and gives the future perspectives.

2 SOA Governance

2.1 *What is SOA Governance?*

In [1], the authors define SOA Governance as an act of governing or administrating something. By far the most common form of governance is that of an organization. More recently, IT Governance appears as an unavoidable issue for the management of modern organizations. SOA Governance extends IT Governance for the purpose of ensuring the SOA success. It ensures the best interests of an organization to be met through corporate decisions from strategy to execution [2]. Lack of governance can be a serious impediment to success and the most common reason for the failure of SOA projects [3]. The authors in [4] identify SOA governance as a major research area in the field of SOA design and development. Nevertheless, SOA Governance is not clearly defined in the literature. We rely on the following definitions to identify key topics in SOA Governance. First, in [5], IBM researchers assume SOA Governance to be an extension of IT Governance specifically focused on the lifecycle of services, metadata and composite applications in an organization's SOA. SOA Governance extends IT Governance by assigning decision rights, policies and measures around the services, processes, and life cycle of SOA to address such concerns as: service registration, versioning, funding,

¹ Petals Link <http://www.petalslink.com/>

monitoring, publishing, discovery, etc. Second, Sun [6] states SOA Governance as the ability to organize, enforce, and reconfigure service interactions within an SOA. Third, in [2], the author aggregates several definitions to give his own: SOA Governance is the definition, implementation and ongoing execution of a SOA stakeholder decision model, and accountability framework that ensures an organization is pursuing an appropriate SOA strategy aligned with business goals, and is executing that strategy in accordance with guidelines and constraints defined by a body of SOA principles and policies. SOA policies are enforced via a policy enforcement model, which is realized in the forms of various policy enforcement mechanisms such as governance boards and committees. To sum up, SOA Governance is revealed in the trilogy (decision, process and policy): doing the right SOA Things the right way for the stakeholders (decision makers).

2.2 SOA Governance Tools

SOA Governance needs to be achieved at several levels, from strategy to execution. Governance tools provide the functionality required to support the governance processes associated with a specific SOA initiative including: Policy management, Interoperability, Registry/Repository and metadata management, Service life cycle management, Statistical and Key Performance Indicators data collection and Monitoring. The following surveys approaches to SOA Governance.

First, authors of [7] address SOA Governance by proposing a generic model and two governance tools. Services are described according to their life cycle, activities and roles. The authors propose two tools: a Service Repository Console and a Service Browser. The Service Repository is used for creating service proposals and service descriptions, for specifying service relationships, and for defining service installations. The Service Browser is used for searching and browsing the service repository and for investigating service details, service relationships and service status. Second, the IBM approach to SOA Governance is presented in [5] as a four-step life cycle. It consists on a planning phase, a definition phase, an enabling phase, and finally a measurement phase. IBM proposes the IBM Web Sphere Service Registry and Repository [8], which offers a governance solution in IBM SOA; it supports service discovery and access. Besides, it offers features for service metadata management. Third, Mule Galaxy [9] is an open source SOA Governance platform. It provides a SOA Registry/Repository. Galaxy helps in the management of SOA by supporting features such as life cycle, dependency and artifact management, service discovery and reporting, and application deployment management. Finally, there are some other available tools, such as Petals Master SOA Governance Solution [10], WS02 [11], Progress's SOA tool Actional [12], Interoperability Framework [13], etc. They typically provide service discovery, dependency management, policy management and federation with other repositories.

3 Service Choreography

3.1 What is a Service Choreography?

A Service Choreography describes a collection of services that collaborate together in order to achieve a common purpose. According to the World Wide Web Consortium (W3C) Glossary [14], it concerns the interactions of services with their users. Any user of a Web Service, automated or otherwise, is a client of that service. These users may, in turn, be other Web Services, applications or human. A choreography gives a more distributed and scalable envision of service composition. A Service Choreography allows several processes of service composition to collaborate involving multiple services (potentially from different partners) and put a special emphasis on their interactions seen from a global perspective.

3.2 Service Choreography Approaches

While service composition languages are numerous, there are few languages for describing service choreography. In [15], the authors classify the choreography languages into two-abstraction level: Implementation-independent or specific.

Implementation-independent: on this level, the fundamental decisions about interactions are made. We can quote the newly OMG Specification Business Process Model and Notations (BPMN) version 2.0² which has been released fully in 2011. It integrates in this latest version the choreography graphical annotations. This later is interesting since it is an independent platform and it allows an easy representation of high-level Service Choreography;

Implementation-specific: on this level, the concrete message formats and communication protocol as well as security issues need to be addressed. On this level, we can find both W3C standards for describing choreographies: Web Service Business Process Execution Language (WS-BPEL or BPEL for short)³ and the Web Service Choreography Description Language (WS-CDL).⁴

The authors in [16] address this issue by proposing a framework for process transformation technique. Their approach converts a centralized BPEL process into a set of nested processes able to be deployed on dynamically bound services. The authors consider a graph-like representation of the process and a transformation algorithm. In [17], the authors consider a multi-agent system where BPEL activities

² <http://www.omg.org/spec/BPMN/2.0/>

³ http://docs.oasis-open.org/wsbpel/2.0/wsbpel_v2.0.html

⁴ http://www.w3.org/TR/2004/WD_ws_cdl_10_20041217/

are autonomously executed by agents and the mediation is supported via a coordination model. Moreover, the authors in [18] develop a concurrent service orchestration engine called OnceBPEL2.0 and based on Event-Driven Architecture (EDA). They target the improvement of performance under massive concurrency and design a scalable BPEL engine.

To summarize, the SOA Governance is a concept used for activities related to exercising controls over services and to achieve service integration within an organization. The approaches presented previously define a standard way and a solid model to consider SOA Governance and Service Choreography. Nevertheless, they are limitative and they do not address governing practices when multiple services coming from heterogeneous organizations or platforms need to collaborate together -such in a Service choreography- to respond to the client requirements. In order to ensure the effective interoperability between these multiple organizations, and the compliance between these different services, it is necessary to define and implement an SOA Governance framework for both services and Choreographies.

4 EasierGov: A Vision of Governance Framework for Services and Choreography

EasierGov is a vision of an SOA Governance Framework for both services and choreographies. In the following, we present its architecture and its main components.

4.1 Architecture

Future Internet environments challenge the SOA Governance by providing a set of policies and rules. SOA Governance activities ensure the adoption of the right way of doing things, at the right time and by the right persons. EasierGov is a framework that underlines, at design time and run-time, the whole service and choreography lifecycle, the IT system and at the borderline of three concerns: SOA Discovery, SOA Management and Governance Policies as illustrated in the Fig. 1.

The *SOA Discovery* covers the services registries and repositories which provide service discovery capabilities. They serve not only to inventory, catalogue service data, but also serve as a place to store metadata about services, necessary to governance (such as the Web Service Description Language,⁵ documents, capabilities, locations of their service contracts, etc). In EasierGov, we intend to provide registry/repository functionality both for services and choreographies.

⁵ <http://www.w3.org/TR/wsdl20/>

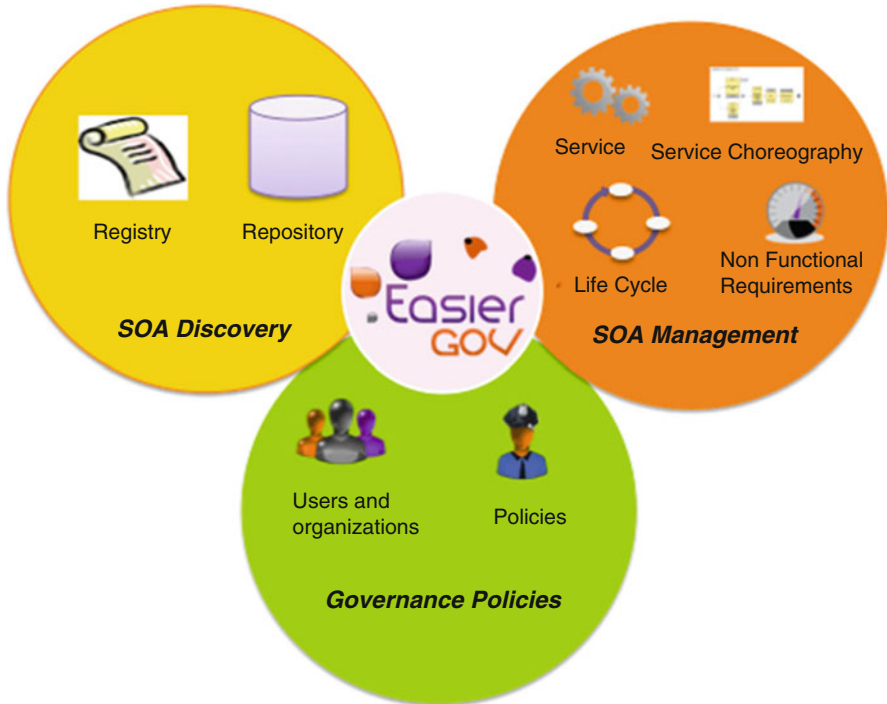


Fig. 1 Overview of the SOA Governance Framework "EasierGov"

The provider of the service as well as the designer of the choreography will publish services and choreographies on such registries/repositories. Then, consumers looking for services and choreographies can refine their search according to non-functional concerns, for instance: performance, usage frequency, rating, etc. Section 4.2 addresses these concerns.

The *SOA Management* covers the management of the service, choreographies and agreements lifecycles from design until run time phase. It includes the definition of the several stages of the corresponding lifecycles and the definition of the right policies to apply. Moreover, SOA Management includes the run time evaluation of the non-functional requirements of services and choreographies. We describe our contribution concerning SOA Management in section 4.3.

The *Governance Policies* are the cornerstone of the governance paradigm. Through the adoption and enforcement of a set of policies and standards, SOA governance makes the exposed services compliant with other services coming from different organizations. Both SOA Discovery and SOA Management are concerned with Governance Policies as they define each step of the lifecycle. Each stakeholder involved in the governance process has a clearly identified role and responsibility. We detail the selected governance policies in section 4.4.

4.2 *EasierGov, Governance Registry and Repository*

Having a robust service discovery mechanism promotes the services publication, discovery, and reusability. Governance capabilities, such as looking for a service or a choreography, retrieving it, or managing its lifecycle, are needed.

EasierGov answers these requirements by providing an innovative registry dedicated for both services and choreographies. Indeed, it will enable the discovery of business services and choreographies at both design and run times. This functionality is essential for dealing with a large number of heterogeneous services coming from different sources.. In order to tackle this heterogeneity of business services and to facilitate the SOA Discovery adoption, it is important to coalesce around a uniform and common service description language. For this purpose, we adopt a unified description language.

The Unified Service Description Language (USDL⁶) enables the expression of the common business services descriptions in a unique agreed way. According to its specification, it is a generic language for service description. The W3C USDL Incubator Group is working on the standardization of this language to make services tradable and consumable. USDL provides a way to model services from a business and operational views and align this with a technical perspective. This approach is useful and efficient for EasierGov where we intend to cover the main important concepts to design services, describe what a service is offering and how consumers are able to access it. On a whole, USDL is made up of a set of modules: Service, Foundation, Participants, Technical, Pricing, Functional, Legal, Service Level, and Interaction. These modules are inter-dependent and cover the main SOA Governance aspects related to services, policies, metadata management, processes and control and management of the lifecycle. Moreover, it is worth mentioning that the USDL is extensible and enables to model new concepts and explore new possibilities that are needed to implement the EasierGov framework. Besides, the discovery functionality, our framework provides capabilities dedicated to the management of services, contracts, and choreographies. In the following section, we address these concerns.

4.3 *EasierGov: Governance Management*

Governance Management covers the definition of the several stages of the life cycle of the business services, choreographies and service level agreements (SLA). To ensure its good behavior, it is essential to apply the appropriate policies at each phase of the lifecycle. In Fig 2, we define the lifecycle steps for both services and choreographies. We assume that for each of these steps we apply adequate governance policies. We distinguish between design time policies and run time ones.

⁶ USDL, http://www.internet_of_services.com/index.php?id=264&L=0&tx_ttnews

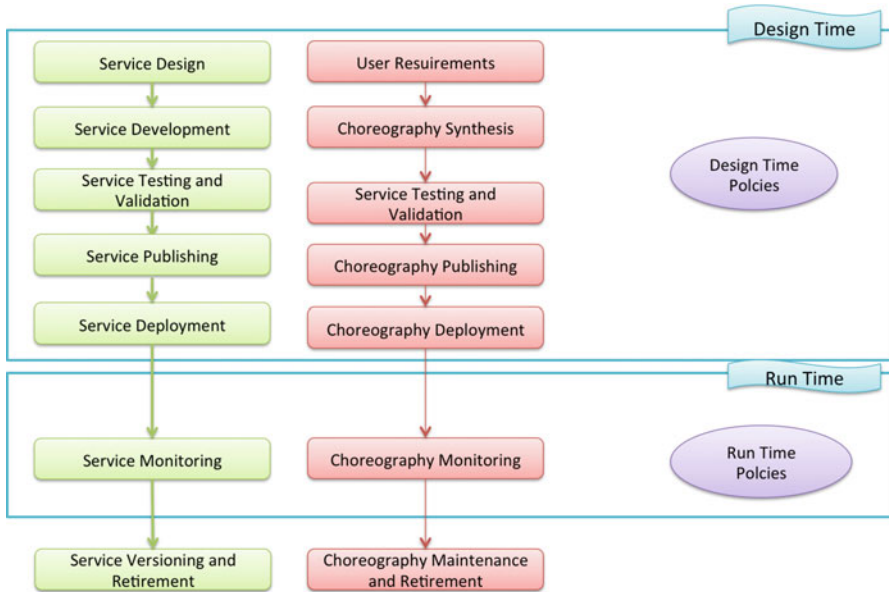


Fig. 2 Service and Choreography Lifecycles in “EasierGov”

Concerning services, EasierGov provides capabilities for managing services for their design, development, testing and validation, publication in the registry (presented in section 4.2), deployment on top of a middleware, monitoring at runtime and finally versioning and retirement. Moreover, EasierGov enables the creation, negotiation and assessment of service level agreements. By analogy the choreographies are also managed using EasierGov, as described in the previous figure.

Generally, Web Services can run based only upon their functional requirements. However, for an efficient participation in a corporate environment, a service should also provide some guarantees about its availability, dependability, efficiency, in short about its Quality of Services (QoS). The QoS parameters for a service are very important to maintain its trust. They are defined in the Service Level Agreements (SLA). The SLA is a commonly used way for designing non-functional objectives to be reached by the business service. In a choreography context where a large number of services interoperate, EasierGov needs to provide a governance solution that considers a choreography level agreement between this collection of services. Indeed, it is a form of policy that the choreography must respect in order to satisfy the user requirements. The conformance of these policies to the specific service, choreography or non-functional agreements is evaluated. Services and choreographies must respect all the policies defined at the design time and must fulfill the non-functional requirements as defined in the SLA and the choreography global agreement that were agreed.

In order to set up the governance system, an important step resides in defining which, when and where to use policies and standards in order to insure compliance between them. In the following section we survey our selection of standards and policies.

4.4 EasierGov: Governance Policies Standards

In order to ease the EasierGov interoperability, it is necessary to adopt common agreed technological standards for both design and development phases. In choreography context where several heterogeneous services collaborate together, adopting standards and rules is a good way to provide governance on top of such scalable systems. The Fig. 3, presents a classification of some SOA policies and protocols according to the scope to which they can be related.

These policies are commonly used by SOA community and are the ones that we are likely to manage in the EasierGov governance framework. We classify the level of policies adoption into three classes: services, choreography and transaction. Service policies are dedicated to the service level. For instance, a service would abide policies concerning its description as WSDL. Besides, the contract between the service consumer and the service provider would be defined in accordance with the Web Service Agreement (WS-Agreement) specification. Process policies concern the process and collaboration between several services. It includes the Service Choreography. Moreover, a choreography would abide the BPMN 2.0 and BPEL specifications for the representation of the business and technical processes. Finally, the transaction level refers to the policies that can be evaluated at the level of the messages transmitted between services within a process. For instance, the messages within transactions have to follow Web Service Security and Simple Object Access Protocol (SOAP⁷) protocols specification to guarantee the software interoperability.

5 Conclusion and Perspectives

SOA Governance can be defined as a set of processes, rules, policies, mechanisms of control, enforcement policies, and best practices put in place throughout the life cycle of services to ensure the successful achievement of the SOA implementation. In this paper, we survey approaches dealing with SOA Governance and Service Choreography. Then, we propose an initial framework, namely EasierGov, for

⁷ SOAP, <http://www.w3.org/TR/soap/>

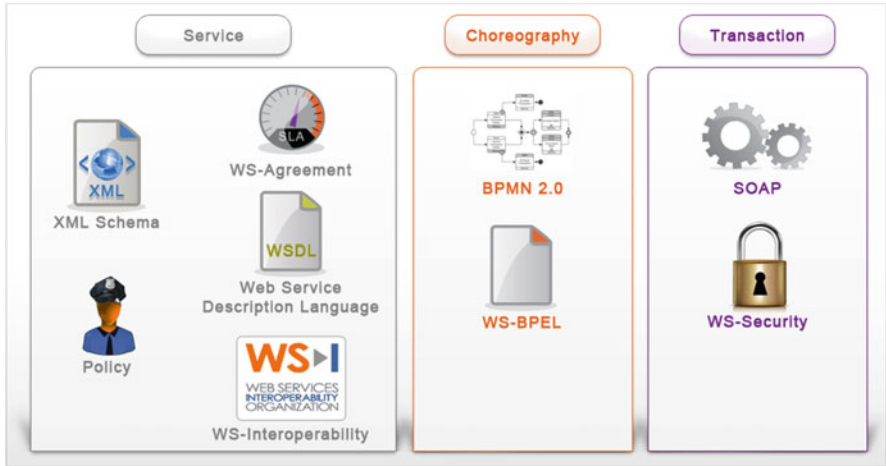


Fig. 3 Services, Process and Transaction policy standards for Governance

governance of services and choreographies. EasierGov is presented according to three main concepts, SOA Management, SOA Discovery and Governance Policies.

We intend, as perspectives to this work, first to make stronger this conceptual approach of EasierGov, in particular by aligning the specifying design of the Governance Framework with the several components of the theory of Gregor and Jones [19].

Moreover, in order to concretize our approach we started the implementation of EasierGov prototype basing on the USDL service model. Further, we need to define the right policies and rules. Meanwhile, by considering the deployment of services and choreographies on top of run time middleware, we will be able to check and validate the policies compliance and the respect of non-functional agreements.

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