

The eGovernment Use Case Scenario

SLA Management Automation of Public Services

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Abstract The SLA@SOI framework—a solution for the automated management of services on the basis of Service Level Agreements (SLAs)—is usually applied to automated software or hardware services. The eGovernment use case aims to assess the applicability of the framework to the management of hybrid services, which involve both automated and human-based activities, as is typical in the government domain. Due the continued growth of service demand, many public organisations outsource their services to private third parties or to other public institutions. SLAs are typically adopted as a way to control the quality of provided services; however, these SLAs are typically managed manually, limiting the possible benefits. Instead, by formalising SLAs it is possible to automate a set of activities such as monitoring, negotiation, planning and adjustment. Below we describe how this can be implemented and evaluated for a specific eGovernment service.

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1 Introduction

In this chapter we present a case study for applying the SLA@SOI framework to the eGovernment domain. The case study is intended to demonstrate SLA-based management as a general concept, not limited to computational services, but applicable to any kind of service, and in particular to human-based services, which are typical in the government domain.

While most government services can not be automated, several management activities—such as negotiation, monitoring, resource planning and adjustment—can be at least partially automated thanks to the adoption of formal SLAs. To demonstrate these opportunities, we have integrated two social services currently provided to citizens by the Italian region of Trentino: medical treatment services and mobility services. We identified five related usage scenarios, each exploiting different features of the SLA@SOI framework. This chapter reports on the technical lessons learned from this exercise, including how to customise the SLA@SOI framework to cover these scenarios, and the benefits of such automation from a business perspective.

The remainder of this chapter is organised as follows: Section 2 introduces the use case, describing its general business context and business objectives. Section 3 explains the identified scenarios, Section 4 describes the architecture used for the implementation of such scenarios, and Section 5 describes the actual SLAs used for the experimentation. Section 6 summarises the business evaluation approach and finally, Section 7 provides a summary of the actual state of the work and future plans.

2 Business Context

From an organisational point of view, there has been a recent trend towards considering health care and social care agencies as part of the same organisation, since both provide services to citizens. For this reason, this experiment focuses on the composition of services usually offered separately from the aforementioned organisations: health and mobility services. In the following, we describe these component services, the involved actors, and the business objectives of these actors in more detail.

2.1 *Mobility and health care services*

The mobility and health care services comprise three sub-services, as shown in Figure 1.

The *medical treatment service* is provided by the local health care agency (in Trentino, the Azienda Provinciale per i Servizi Sanitari, APSS) and covers the book-

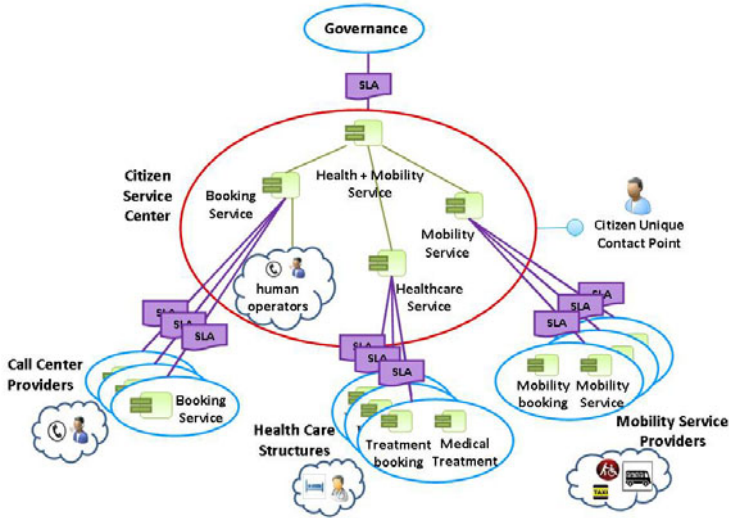


Fig. 1 Mobility and health care service, component services, and related SLAs.

ing and provisioning of medical treatments provided by different health care structures of the health care agency according to regulations and objectives defined by the governance (Provincia Autonoma di Trento, PAT).

The *reservation* (booking) of patient treatments is provided by the local health care agency via a unique contact point, which is handled by a contact centre service (called CUP). The contact centre service may be outsourced to an external qualified call centre chosen with a request-for-tender process. The winning call centre provider adheres to the constraints and conditions imposed by the governance in a contract. In particular, the governance defines indicators to evaluate the process of the health care services and establish compliance with governance regulations.

The *mobility service* is owned by the local social care and welfare agency and provides on-demand transport services to needful people according to regulations and objectives defined by the governance. The mobility service is provided by a set of public and private companies or associations, certified by the welfare agency.

2.2 Roles

The set of actors involved in the mobility and health care services are:

- the *citizen* is the mobility and health care service consumer (i.e. the patient);

- the *governance* (PAT) is the customer of the mobility and health care services, defining regulations and business goals for provisioning of the mobility and health care services;
- the *Citizen Service Centre* is responsible for aggregating and monitoring the mobility and health care services, and providing the contact service (booking, information, cancellation, evaluation);
- the *call centre providers* provide the contact service;
- the *health care structures* provide bookings for medical treatments and medical treatments;
- the *mobility providers* provide bookings for the mobility service and the mobility service.

2.3 Business Objectives

The relationships between the aforementioned actors are ruled by formal contracts and SLAs that constrain the provisioning/consumption of different services and establish pricing and billing conditions. The management of an SLA is ruled by a life cycle that consists mainly of three steps: negotiation, provisioning, and monitoring and adjustment.

Currently, the negotiation, monitoring and enforcement of SLAs is not completely integrated and still partially paper-based. Governments and service providers must manually negotiate new SLAs and SLA evolution based on process execution is also manual. The objective of the SLA@SOI eGovernment use case is to automate such processes. Below, we summarise a way in which negotiations can be performed independently from the SLA@SOI framework:

- the SLA between governance and the call centre provider is defined in a canonical paper contract by the governance.
- governance submits the contract terms to different providers and waits for an offer.
- governance signs the contract with the provider that proposes the most convenient offer that fulfills the contract terms.

Usually the contract duration is four years. Some terms of the contract are renegotiable every six months.

In the provisioning phase, which is triggered after the contract has been signed, the contracted contact service provider (in accordance with the governance) outsources parts of the phone traffic to one or more external call centres. Management of the business relationship between the contact service provider and the external call centres is transparent to the governance and is ruled only by the resource optimisation strategy of the contact service provider. Typically the contract is renegotiated annually. More precisely, resource dimensioning deals with allocation of human operators internal to the contact service provider, and with the possibility

of outsourcing some phone traffic to an external call centre provider. Currently, resource optimisation is handled manually with the assistance of some utility tools.

Between the governance and the health care structure, and between the governance and the mobility provider, there is a limited negotiation. Each provider must accept the terms specified in a governance-defined contract, which specifies the quality of business service required, while the governance must accept the price asked by the provider. The governance should monitor the SLA with the providers to identify violations, apply penalties or modify contractual terms. Currently, each service provider periodically monitors the execution of its services (with a frequency defined in the contract) and reports the results to the governance that identifies and deals with SLA violations. The contact service provider is a deputy from the governance and monitors some KPIs belonging to the health care structure (e.g. maximum waiting time to secure an appointment).

Of course, each service provider is interested in monitoring its service execution to improve allocation of internal resources. For instance, the contact service monitors its operators' work to identify any trends that may require a change in phone traffic management. This can result in optimisation (adjustment) of the use of internal operators and in resizing of phone call traffic handled by the external contact centre through a renegotiation of the contract between the contact centre and the external contact centre. Without the SLA@SOI framework, the identification of negative trends and any adjustment actions must be completed manually. Adoption of the SLA@SOI framework is intended to automate all these operations.

3 Use Case Scenarios

Five scenarios have been identified to describe the ways in which the enhanced SLA management features offered by the SLA@SOI framework can produce benefits for stakeholders in a typical eGovernment context. The scenarios described assume a common main storyboard in which a citizen calls the Citizen Service Centre to book a health care treatment, and possibly a related mobility service, which is offered with an attempt to match the user profile and preferences. The citizen accesses the treatment and is then asked to provide feedback about the services.

Scenario 1: SLA-Driven Monitoring. This scenario demonstrates how the SLA@SOI framework's SLA-based *monitoring* (Chapter 'Translation of SLAs into Monitoring Specifications') and *reporting* (Chapter 'Penalty Management in the SLA@SOI Project') can be useful for monitoring hierarchically aggregated SLAs, and for automatically producing reports and billings related to established SLAs and levels of user satisfaction. To detect sources of user dissatisfaction and SLA violations, it is not sufficient to monitor specific services in isolation, since this gives a partial and unrealistic view of the aggregate service quality. On the contrary, dependencies between services and resources in the SLA hierarchies must be taken into account; software/non-software monitoring events (e.g. web-service invocation time, percentage of busy phone calls, user feedback)

must be properly recorded; and this information must be suitably aggregated to check for SLA violations. The SLA@SOI framework allows automation of these steps. Monitored properties include those related to events produced by citizens, call centre services (internal and outsourced), health care structures, and mobility providers. The collected monitoring information is then used by the framework to automatically provide periodic reports and billing information to the governance. The governance can use such reports to make decisions, review strategies and renegotiate SLAs.

Scenario 2: SLA-Driven Service Selection. This scenario demonstrates how the SLA-based *dynamic binding* feature of the SLA@SOI framework (Chapter ‘Managing Composite Services’) can be exploited within an eGovernment setting to automatically select mobility providers on the basis of their SLAs. In accordance with the mobility and health care business process offered by the Citizen Service Centre, citizens can book a mobility service to provide transport to their chosen health care structure. Thus the goal of this scenario is to automatically select a set of suitable mobility providers (e.g. shuttle, taxi, or human operator) based on the specific requirements of the service request and the user characteristics and preferences (available in their citizen profile). These selection criteria are expressed using SLA templates and are mainly based on the cost and characteristics of the provided service. Once selection is complete, the system contacts the selected providers to obtain possible appointments and then proposes different solutions so that the citizen can choose a preferred one.

Scenario 3: Runtime SLA Negotiation and Adjustment. In this scenario, the SLA@SOI framework’s SLA-based *automatic negotiation* (Chapter ‘A Generic Platform for Conducting SLA Negotiations’ and Chapter ‘Management of the Business SLAs for Services eContracting’) and *static prediction* (Chapter ‘Software Performance and Reliability Prediction’) features are used to dynamically adapt to exceptional situations that lead to an overload of the Citizen Service Centre. Consider, for instance, the occurrence of a pandemic flu. Such an event can directly affect the contract terms between the governance and the Citizen Service Centre, since the governance manually triggers a request for SLA renegotiation with the Citizen Service Centre. Such a renegotiation aims to guarantee citizens more health care bookings during the pandemic flu. The negotiation—thanks to the SLA@SOI framework’s capacity to model system resources, services and SLAs—is performed automatically from the side of the Citizen Service Centre. Using the *static prediction* feature, the framework (installed within the Citizen Service Centre) automatically checks whether its internal resources are sufficient to satisfy the proposed SLA, and if not, it can automatically (re-)negotiate related SLAs with third party providers (for instance, call centre providers). Eventually, negotiations between the governance and the Citizen Service Centre lead to an agreement, the Citizen Service Centre exploits the automatic adjustment feature of the SLA@SOI framework to redeploy its internal call centre infrastructure, the negotiation results are confirmed to the third parties. It is important to note that negotiations between the Citizen Service Centre and third party providers are dynamic and automatic, while negotiations

between the governance and the service centre are dynamic and (a) automatic on the service centre side, but (b) manual on the governance side. The static or design-time prediction component of the framework is used by the Citizen Service Centre to select a provisioning plan that is compatible with the currently established SLA, the status of its agreement terms, and the status of the internal resources involved in the services.

Scenario 4: Runtime Predictions and Resource Adjustment. This scenario demonstrates how automatic *adjustment* of available resources can be triggered by the *runtime prediction* (Chapter ‘Run-time Prediction’) feature of the framework. In this case, a suggestion is made to the manager of the Citizen Service Centre that internal resources be adjusted, but unlike Scenario 3, this suggestion is made *after* negotiating and signing an agreement with governance and *after* service provisioning. The prediction model, used by the relevant framework component, is used alongside SLA-based service monitoring data to prevent a possible non-fulfillment of agreement terms by the service provider.

Scenario 5: Runtime Predictions and Process Adjustment. This scenario demonstrates how *runtime predictions* can also trigger a different kind of service adjustment that, in this case, involves software services. In fact, SLA-based monitoring of the evolution of the provisioned service—along with a model predicting the behaviour of the service itself—can determine an *automatic adjustment of the BPEL process* (Chapter ‘Managing Composite Services’) that embodies the service offered by the Citizen Service Centre. Modifying the structure of the BPEL process aims to improve service performance, for instance by allowing activities originally executed in sequence to run in parallel.

4 SLA Management Architecture

The system architecture implemented for the eGovernment use case is shown in Figure 2. We adopted a customised version of the SLA@SOI framework (Chapter ‘Reference Architecture for Multi-Level SLA Management’) deployed at the Citizen Service Centre (CSC). The component services of the mobility and health care service are aggregated by means of a BPEL process deployed in a modified version of the ActiveBPEL engine, called the Dynamic Orchestration Engine (DOE). The DOE offers probes to collect process variables, and adaptors to apply dynamic binding on the adopted partner services. These processes interact with call centre facilities offered by the CSC’s internal call centre (ICC), and with a set of external partner services: the call centres, which allow citizens to book health care treatments and mobility services, the health care structure, which provide health care treatments, and the mobility providers, which move users to health care structures.

In general, even if the CSC has an internal call centre, it can outsource part of that service to external call centre providers if the number of virtual operators is insufficient to satisfy the contract negotiated with the governance. The adoption of an external call centre also implies that a contract must be negotiated between the

CSC and the external call centre provider. External call centre providers are not required to adopt the SLA@SOI framework, but just to expose standard interfaces for monitoring and negotiation.

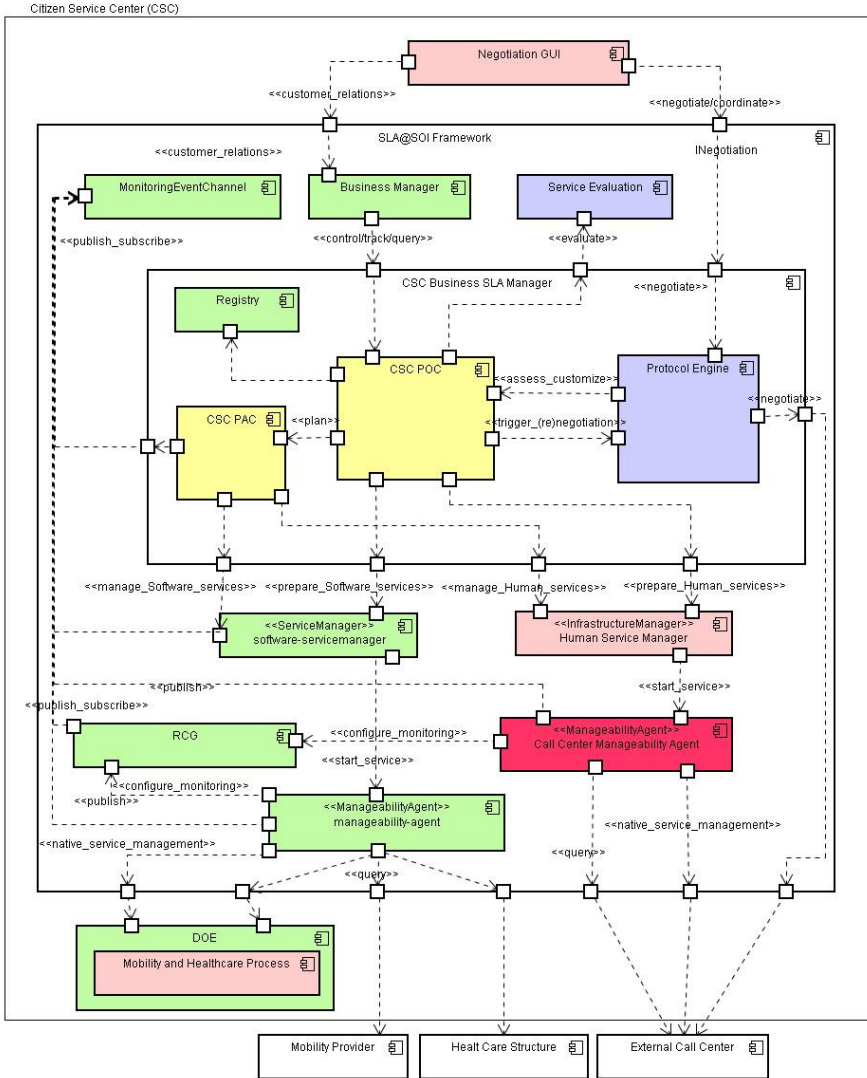


Fig. 2 The architecture of the eGovernment use case

Each component of the SLA@SOI framework is used as-is, is configured, or is customised. Below we explain these categories:

- **As-is** Framework components are adopted without modification (see green components in Figure 2). These components include: the *monitoring event channel*, which receives monitoring data/events (e.g., information about the medical treatment, the conditions of transfer to the health care structure, or the status of a service booking). These data come from the mobility and health care process and from third party providers. The *SLA registry* and *SLA template registry* store and update negotiated contracts and templates respectively. The *RCG* controls whether warnings have been issued or violations have occurred. If violations or warnings are discovered, the *RCG* notifies dependent components by publishing a message on the monitoring event channel. It also uses monitoring data to dynamically predict the call centre's performance. The *service manager* coordinates the provisioning and management of resources at the software level: that is, it manages the binding and structure of the mobility and health care process. The DOE's *manageability agent* configures sensors at the DOE and in its services. It also configures a set of actuators available at the DOE to perform rebinding of partner services.
- **Configured** Some components of the SLA@SOI framework are properly configured to support the requirements of eGovernment (see purple components in Figure 2). For example, the *protocol engine* is instrumented with suitable protocols to discipline negotiations between the governance and the CSC, and between the CSC and the external call centre. Configuration does not require recompilation of the component.
- **Customised** Some components require modification or extension of the source code and recompilation. For example, the Planning and Adjustment Component (*PAC*) is customised to support the adjustment of human virtual operators at the internal call centre. Similarly, the Provisioning and Optimisation Component (*CSC POC*) is customised to generate—during the negotiation phase—suitable plans for the provisioning and monitoring of managed resources. It also plays a particular role in the negotiation phase, since it can decide to trigger negotiations between the internal call centre and an external call centre if the ICC does not have sufficient resources to complete a negotiated contract.

The architecture is also composed of domain-specific components (see pink components in Figure 2). First, a *negotiation GUI* is provided to allow the CSC and the governance access to information regarding their negotiated SLAs and fulfillment of their guarantee terms. The GUI also allows the governance to renegotiate existing SLAs. Finally, the architecture provides a *human service manager* to coordinate provisioning of the virtual operators at the ICC.

To avoid penalties, the CSC must continuously comply with SLAs it has signed with the governance. To this end, the *RCG* regularly performs specific prediction warning analyses to evaluate operator response time and decide whether the CSC must adjust its internal resources to allow it to fulfill the SLA. For instance, if there is a higher than acceptable probability that the daily operator response time will exceed the threshold fixed by the SLA, then an adaptation of the internal booking service will be triggered. This will result in an increase in the number of virtual operators for the next work shift. The adjustment is required to fully satisfy the

contract with the governance, and also acts to minimise penalties while maximising total turnover.

Our case study also supports context-dependent binding. This is supported by the PAC, which uses established SLAs to automatically select a set of providers that suit the user's needs, then asks the DOE manageability agent to bind selected providers. When requesting a possible appointment, the process will only invoke bound providers. If the PAC cannot perform an adjustment action, it will ask the POC for an alternative plan.

Finally, the governance can renegotiate existing contracts. The renegotiation request is issued by the governance through the negotiation GUI, and is forwarded to the protocol engine. The request includes the ID of the SLA to be renegotiated and the parameters to renegotiate.

After the protocol engine receives the negotiation request, it assesses the quality of the proposal by invoking the POC. To evaluate feasibility of the request, the POC must be aware of the number of virtual operators that can be provisioned by the internal call centre. This allows the POC, using the static prediction feature, to assess whether it is possible to provide enough operators to satisfy the SLA, or whether it is necessary to outsource part of the services to an external call centre provider.

In the latter case, another negotiation must be initiated between the CSC and the external call centre provider, using a similar mechanism. The external call centre may reply with a counterproposal. The acceptance of this counterproposal is determined by the CSC, which aims to maximise the total turnover generated by handled calls (where total turnover is the difference between the generated turnover of handled calls and the cost of the external provider).

After a certain number of negotiation rounds, the external call centre will accept the SLA and this decision will be forwarded via the POC to the protocol engine, which will accept the governance SLA and notify the governance of this decision. The governance will then ask the protocol engine to sign the negotiated contract and thus create the new SLA with the CSC. The protocol engine will then trigger creation of the CSC's SLA with the third party call centre, and following reception of an acknowledgement from the call centre, the new SLAs will be stored in the SLA registry. The POC then triggers re-provisioning of the new service.

5 SLAs

The SLAs involved in the scenarios described in Section 3 are shown in Figure 3.

SLAs between governance and the Citizen Service Centre involve aspects such as support for citizens throughout the life cycle of service consumption (i.e. service information gathering, service booking, cancellation, and evaluation); coordinating the different infrastructures and service providers involved; and periodically reporting QoS and billing information to the governance.

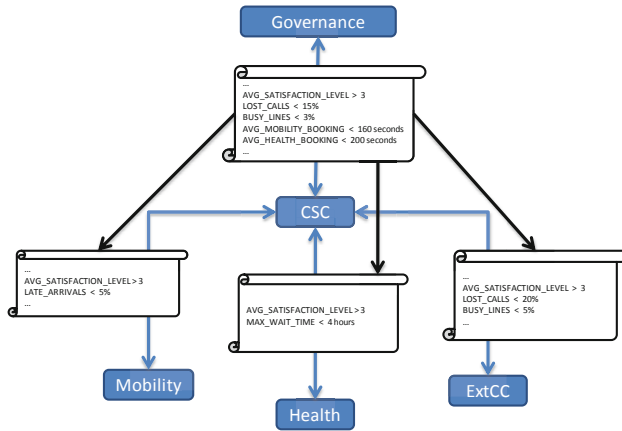


Fig. 3 SLAs and their relationships

SLAs between mobility providers and governance deal with the booking and execution of on-demand transportation services. The SLAs rule aspects such as management of the mobility service agenda and its provisioning as a web-service to the citizen contact centre; provisioning of the mobility service to citizens; and management of accounting and payment for the mobility service.

SLAs between health care structures and governance concern management of the booking system and its provisioning as a web-service to the Citizen Service Centre; the provisioning of medical treatment to citizens, and management of accounting and payment for medical treatments.

SLAs between the Citizen Service Centre and external call centres concern outsourcing the contact service portion of the mobility and health care service to third party call centre providers, to properly address reservation and booking needs. The aspects agreed in the SLAs relate to the provisioning of a set of human operators and answering machines that can provide information on the mobility and health care service and handle related bookings, cancellations and modifications.

Figure 3 shows the relationships between the aforementioned SLAs plus details about the guaranteed states that are negotiated. The black arrows indicate that the SLAs agreed between the Citizen Service Centre and service providers (mobility providers, health care structures and external call centres) are derivatives of the SLA agreed between the governance and the Citizen Service Centre. For example, constraints on the average satisfaction level of citizens—which have been agreed between the Citizen Service Centre and the governance—are preserved within contracts that the Citizen Service Centre negotiates with the mobility and health care providers. However, other agreement terms—for instance, the maximum level for

delays of the mobility services or the maximum time that patients should wait within a health care structure—are relevant only to SLAs that the Citizen Service Centre negotiates with its providers.

More peculiar relationships exist between SLAs that the Citizen Service Centre negotiates with external call centre providers, and SLAs that the Citizen Service Centre negotiates with the governance. These two SLA types are strongly connected, since the former is the result of externalisation of a service that the Citizen Service Centre can provide by itself in the form of an internal call centre. For this reason, terms that appear in these SLA types will partially overlap. For example, when negotiating with an external call centre provider, the Citizen Service Centre will aim to preserve some of the constraints to which it has committed in its previously negotiated contracts with the governance. However, the Citizen Service Centre also has some freedom in its negotiations with external call centre providers: depending on its own internal strategies, it can relax particular constraints in return for a minor price to be paid to the provider, for example. Hence, constraints that appear in SLAs with governance are maintained, though they may be relaxed. Scenario 3 (Runtime SLA Negotiation and Adjustment), within Section 3, demonstrates such a chain of SLAs and relevant negotiations. The renegotiation of an SLA between governance and the Citizen Service Centre, triggered by the former, results in a (re-)negotiation with external call centre providers by the latter. In this case, the SLA@SOI framework plays the role of provider for the *upward* negotiation, and the role of customer for the *downward* negotiation; it also guarantees that negotiations on the Citizen Service Centre side are automatic, while on the other side, they are manual.

6 Evaluation: Practice and Experience

In this section we present the evaluation process applied to the SLA@SOI features with respect to the use case scenarios of Section 3 and the SLAs of Section 5.

Evaluation is a part of a continuing management process consisting of design, implementation, and evaluation. We consider it useful to maintain this continuous cycle until the final version of the monitoring system is implemented and is shown to satisfy specified requirements and end user evaluation.

There are several stages in the evaluation process we intend to use:

- **Laboratory evaluation:** We evaluate the implemented system, taking into account the specified requirements.
- **Area evaluation:** We evaluate whether the implemented system is useful and how best to use it, trying to provide auditing notes.
- **End-user evaluation:** We work with a subset of final users to evaluate the system.

Laboratory evaluation or technical evaluation is the first of the three stages in the SLA@SOI evaluation process and is still in progress. This phase is devoted to

preliminary evaluation of the system and assesses the question: "Does the system satisfy its requirements?". We answer this question by analysing the specified requirements against a first implementation of the system. By requirements, we refer to the non-functional properties that express the main benefits of the SLA@SOI framework in the eGovernment domain. A list of expected benefits can be found in [3] and includes properties such as efficient resource usage, SLA compliance, agility, and so on. Each of these properties is assigned a metric with measurable KPIs that we take into account. We have conducted the laboratory evaluation using real data—suitably anonymised—provided by the GPI call centre service provider. Indeed, the SLAs presented in Section 5 derive from real contractual terms currently used by service providers and governance. The threshold values and expected results are therefore real and derived from historical data.

In Table 1, we summarise some of the business outcomes we expect from adoption of the SLA@SOI framework. These outcomes reflect the requirements expected of the framework in terms of resource usage, SLA compliance and agility, and will be measured on the basis of the SLAs defined.

The monitoring system as a whole has been evaluated, simulating different versions of the same service (e.g. mobility providers with special prices or cancellation policies). We plan to evaluate the complete implementation of the monitoring and runtime prediction functionalities in the next stage of the evaluation process.

As summarised in Table 1, depending on the stakeholder (citizens, governance or CSC), we considered different kinds of business outcomes.

For the citizens, it is important to minimise the effort required to use health care services; thus we measure the number of phone calls required to reserve a medical treatment and mobility service, and the time required to complete that operation. In this regard, a key success factor is the ability of the framework to identify the type of service that better matches the citizen's preferences (e.g. low cost, timely, etc).

The governance value early (or advance) notice of SLA violations, enabling prompt reaction (e.g. by changing the terms of the contract). Here, we exploit the framework's ability to identify potential and real SLAs violations to enable it to raise violation warnings or notifications.

Finally, the CSC is interested in improving management of resources (e.g., operators and lines) and maintaining a timely view of their use and the state of related SLAs. In this case, the framework should help service providers by managing the busy and idle status of their resources.

Area evaluation is the second phase of the evaluation process and is devoted to the usability of the system. It answers the question: "Is the system useful and how can we best use it?". We plan to answer this question by gathering an entire statistical picture and accurately testing each system functionality. We also plan to provide auditing at this stage, and to suggest system improvements. During area evaluation, our heuristics, metrics and prediction capabilities will be refined using historical data produced by the service provider during operations with and without the framework. The idea is to run the framework with different configurations of the prediction feature, and to simulate various types of citizen behaviour. During this

intensive sequence of simulations, we will verify the SLAs mentioned above and re-compute the business outcomes of Table 1. The results obtained will be compared to those produced by the laboratory evaluation and improvements to the framework's implementation and configuration will be suggested.

Table 1 Business indicators and baselines.

Business Value	Benefit	Metric
Citizen	User Preference Matching	$E_{call}(T) := (\sum_{c \in C, p \in PN_{call}(T, c, p)} b) / (\sum_{c \in C, p \in PN_{service}(T, c, p)})$
	Integrated offer of services	$AVG(D_{bhm}(e), T) \leq AVG(D_{bh}(e), T) + AVG(D_{bm}(e), T)$
Governance	SLA compliance and performance awareness	$\#SLA_{KO}(T) :=$ SLA violations per time interval T
Citizen Service Center	SLA compliance and performance awareness	$\#SLA_{KO}(T) :=$ SLA violations per time interval T $\#SLA_{WARN}(T) :=$ predicted SLA violations per time interval T
	Resource efficiency / Optimisation	$BR(T) := R_B(T)/N(T)$ % Busy resources during interval T $IR(T) := R_I(T)/N(T)$ % Idle operators during interval T

End-user evaluation is the final stage in the SLA@SOI monitoring system evaluation process. We plan to conduct an evaluation using feedback from a subset of final users. As the services involved are critical and errors in their execution could impact the citizens, we plan to involve only a selected set of citizens who have agreed to use an experimental system. This agreement is also necessary because data used in the experiments could affect patient privacy. We expect that this phase of the evaluation will produce unexpected results, as evaluating levels of citizen satisfaction is a qualitative and subjective process that depends on the personal judgment of users. We have thus based the system's evaluation not only on the quality perceived by citizens, but also on metrics agreed upon with service providers and governance, where these metrics are based on objective measurements of the health care and mobility services and on the behaviour of the service providers.

As described above, evaluation is part of a continuing and cyclic management process. Based on results of the evaluation process, we intend to propose revisions of system features, and of the system's monitoring and prediction capabilities in particular.

7 Conclusions

The introduction of the Citizen Service Centre and of the SLA@SOI framework allows a better matching of user preferences and the provisioning of integrated services with considerable advantages for citizens. Thus far, it has been up to human users to run the different services (e.g. booking health care treatments and mobility providers). The Citizen Service Centre provides a unique contact point, mediating between customers and service providers to manage service consumption, complaints about QoS, and other feedback.

Our experiments thus far demonstrate the applicability of several key features (monitoring, reporting, design time/static prediction) of the SLA@SOI framework, and we are beginning to experiment with other important features (automatic negotiation, automatic binding, runtime prediction, SLA enforcement through resource adjustment and automatic negotiation). While the current implementation does not allow a complete evaluation of its business value, expert estimates show that the adoption of the SLA@SOI framework may indeed improve the value of services to the citizen, governance and the provider of the aggregated service (the Citizen Service Centre).

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