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Industrial Assessment Report

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Executive Summary

This deliverable aims at defining a set of guidelines to help external industrial stakeholders to adopt and use the project outcomes in their industrial developments.

A two phases approach is followed: in the current stage, an in-itinere analysis of the readiness of the project outcomes is performed; in the final stage, an ex-post readiness analysis will be carried out, and the adoption guidelines will be described to be used by external industrial organizations.

A technology and market readiness survey has been defined and undertaken by the industrial partners of SLA@SOI. As a result of the survey, it has been observed that SLA@SOI technology is a core platform that would improve products and services that face large and growing markets and, therefore, it provides a clear opportunity for early adopters. On the other hand, there are already existing alternatives in the market and a risk associated to a poor knowledge of the related patents state of the art.

The industrial use cases of SLA@SOI also provide a readiness analysis of the results at this stage, suggesting a number of improvements for the final phase of the project. From a readiness point of view, one of the clearest conclusions is that an effort has to be done to simplify the adoption of the SLA@SOI Framework, both from the software and the documentation perspective.

As the project incorporates four distinct and complementary industrial Use Cases, a consistent approach to evaluation in general, has been taken to ensure that the evaluation is realistic and can be reasonably interpreted in domains not considered in the project. As detailed in the Use Case Specification and Lab Demonstrator Deliverables, and summarised in the Scientific Evaluation, the detailed assessments of SLA Framework features at low-level, are explicitly set in the context of higher-level business objectives in each domain. This in turn clarifies the relationship between the performance of a single or group of features, and business impact. In the final phase of the project, this detailed evaluation will be integrated with the higher level assessment that is dealt with specifically in this document.
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1 Introduction

This deliverable describes to which extent the outcomes of the project SLA@SOI are ready for take-up by the industrial partners of the project. A subsequent version of this deliverable will make a refinement in this analysis and also include information so that external adopters can decide if the technology is suitable for their purposes.

This deliverable is related to D.B1a (Scientific Assessment) because the results of it are reflected in the maturity of the technology reflected in the surveys and analysis of this deliverable. It is also related to D.B8a (Exploitation plan), since the information gathered in this deliverable can be an input for the final exploitation plans.

The deliverable is structured as follows: in section 2, the objectives and methodology of the deliverable are presented; section 3 gathers a readiness analysis from the use cases, shows the results of a readiness survey, and depicts a global overview of the situation of the technology in the market and defines requirements for Year 3; finally, section 4 includes some conclusions and steps to be carried out during the 3rd year.
2 Objectives and Evaluation Process

2.1 Objectives

The main objectives of this deliverable are to evaluate the industry impact of SLA@SOI results and to describe the industrial and technical conditions and scope under which the SLA management framework can be used. This deliverable intends to be a summary of the applicability of the project results for industry uptake.

Therefore, there are three clear steps in this analysis:

- **Ex-ante** analysis, already done in the Description of Work.
- **In-itinere** analysis, that corresponds to this version of the deliverable.
- **Ex-post** analysis that will be carried out in the final version of this deliverable (M38).

For the *in-itinere* analysis, the focus will be concentrated on how the results achieved by the project to date are ready to be industrialized, and what actions must be taken in order to improve it by the end of the project. Therefore, the main objectives of this first version of the Industrial Assessment are as follows:

- Identify industrial and business benefits of SLA@SOI in the current status of the project.
- Identify the level of maturity and readiness of the achievements and outcomes of SLA@SOI project during the first two years of execution.

This report will be used to help to steer the project towards an effective exploitation of the results of the project in the third year.

In the *ex-post* analysis, by the end of the project, a new iteration of the analysis will be performed, and some guidelines will be provided so that external industrial stakeholders can assess whether the project results are usable in their specific industrial context.

2.2 Evaluation Process

Since this iteration of the deliverable is intended to provide a readiness analysis of the project results to date, this section describes how this analysis has been carried out, which information has been gathered, what factors have been taken into account and how it will be refined in the next iteration of the deliverable.

2.2.1 Industrial assessment process

In the following, we describe the basic process we followed to gather the needed information to evaluate the whole SLA@SOI results from an industrial point of view.

1. Gather information from the use cases about different aspects of the applicability of the results:
   - Industrial and Business Context description. A short description of the business and technological context in which the SLA@SOI improvements are to be applied.
Business improvements on factors and use case specific metrics. Analysis of the technology readiness and industrialization of the technology from the point of view of each use case in the light of the following:

- Major industrial/business advantages of SLA@SOI. Taking into account the common metrics and factors described below, and also the specific value dials of the use cases, identify and justify for each use case the most important factors and metrics.
- Technology Readiness. Analysis from the point of view of the use case, how innovative the technology provided by the project, in relation to the state of the art, patents, literature, etc. Detect those aspects of the project that are more mature to be industrialized (SLA Model, Architecture, SW components, any specific features...) or that provide better breakthroughs.
- Market Readiness. Analysis from the point of view of the use case, which are the main aspects of the target market of the use case, and what advantages can the project innovation provide in that market.

- Required improvements for Year 3. Of all the analyzed previously, identification of where SLA@SOI should make a bigger improvement in year 3, so that the results will be more likely to be industrialized and which are the most critical aspects to be developed in order to have a successful industry uptake.

2. Provide a survey to the industrial partners of the project following the market and technology perspectives of the Clover Leaf Model [1].
3. Analyze the results of the information gathered and provide a common view of the status of the project in terms of industrial applicability.
4. Identify the most important needs to be taken into account by the project for year 3. This evaluation could help to improve SLA@SOI refining strategies and expected results.

2.2.2 Readiness Survey

As stated above (step 2 of the process), in order to assess the readiness of the technology to be transferred or used by external industrial stakeholders, the Cloverleaf Model [1] has been selected, as a comprehensive methodology to determine when and which technologies are likely to be successful in the commercialization/industrialization process. This model proposes four different perspectives for the evaluation of a given technology: Market Readiness, Technology Readiness, Commercial Readiness and Management Readiness. This is the list of questions used to evaluate the different aspects:

**Market Readiness**
- The technology offers significant identifiable and quantifiable benefits
- The product/process has distinct advantages over competing products
- The technology has future uses
- There is a definable marketable product
- A defined market is accessible
- The market is a large one
- The market is a growing one
- The technology has immediate market uses
• The technology will be first-to-market
• Manufacturing is determined to be feasible

Technology Readiness
• The technology is a new, non-obvious invention
• The patent and literature search are complete and clear
• There are no other dominant patents
• The technology is state-of-the-art or major breakthrough
• The technology is a core or platform technology

Commercial Readiness
• Prospective licensees are identified
• Inventor has industry contacts
• Licensee financial support is available for further development/patenting
• There is access to venture capital
• A positive return on investment is expected
• Royalty/licensing income expected to provide positive net present value
• Government support available for additional development

Management Readiness
• Inventor will champion as a team player
• The inventor has realistic expectations for success
• The inventor is recognized and established in the field
• Commercialization skills are available
• Management capabilities are available

For each of the criteria conditions, the reviewer has to enter a score for extent to which the condition is met (1=not met, 2=partially met, 3=fully met) and the level of confidence on the answer (from 1 to 3).

In this stage of the project, it has been decided to evaluate the project outcomes from the point of view of the technology and the market, and a survey has been filled in by all the industrial partners of the project, for all the market segments and products in which they intend to apply the outcomes of the project. The results are presented in section 3.2.

2.3 Measurable indicators vs. Impact

When specifying the four Industrial Use Cases, a consistent approach was taken in order to relate the performance of technical features of the SLA Management Framework to actual Business Process Performance. Each of the four domains has selected high level objectives that reflect objectives, tactics activities / business processes that would exist in real world instances of ERP Hosting, Enterprise IT, Service Aggregation and e-Government. These objectives are selected based on their centrality to the role or objectives of key stakeholders in these domains. Put simply, they are core to profitability, competitiveness, agility or customer satisfaction. A measurable improvement of systems or processes supporting these objectives, which can be realistically accredited to the contribution of SLA Management Features, will form part of the final Business Evaluation of the SLA Management Framework. The following are high level objectives include:
• Number of stakeholders needs met. Stakeholders might have own needs and might not fit perfectly with SLA@SOI features. With this metric, the mapping between features and industrial needs is measured. This information could be gathered with surveys.

• Industrial applicability. This means how the SLA@SOI result can be applied to the current industry in terms of products to be created, changes in the product chain-value, etc. to be measured. This metric ranks each SLA@SOI feature accordingly to industrial applicability in SLA@SOI partners.

• Time to market reduction for new products and services. One of the most important impacts in an IT company is the reduction of the time expended in the development of new products. This metric can be measured by ranking the expected reduction of the time to market if SLA@SOI features are adopted.

• Potential profits. The main objective of every company is just to increase its benefits. So, one of the most powerful tools to evaluate SLA@SOI result in the industry is by measuring the expected increase in the benefits.

• Expected increase on customer experience. Other important issue for IT companies is the experience of the customer. If customers perceive products as they expected, they will probably be loyal to the company. In order to measure the increase of this customer perception, a survey could be made between the industry stakeholders.

• Cost impact. Another way to increase profits is to reduce costs changing the production line. As this project aims to change how operators provide services, it could impact in costs reducing them. In order to measure this metric, a survey where stakeholders rank the features according to their cost impact could be acceptable.

• Impact on corporative image. One of the most important IT assets is the corporative image that customers have. Adopting SLA@SOI features can impact on corporative image. This issue can be measured by a survey.

• Possibility of creating competitive advantages. Another important issue in nowadays industry is the possibility of owning a competitive advantage that allows the company to have an extra profit. In order to measure this metric, a survey where stakeholders rank the features according to their cost impact could be acceptable.

The following sections include tables which relate value dials (in turn aligned with measurable performance indicators which can be associated with individual or combined Framework features) with these high level objectives.

A more comprehensive hierarchy of High Level Objectives and Value Dials is included in the individual Use Case Specification and Lab Demonstrator Deliverables.

While the integration and initial assessment of features is partial at this stage, it is expected that in the remaining phase of the project, the judgement-based assessment detailed in this document will not only be extended in its own right, but be complemented by a ground-up, fine-grained assessment based on the performance of specific aspects of the SLA Management Framework.
3 Analysis

This section includes a readiness analysis of the project results from different perspectives. First, a subjective analysis of each use case is provided. Then, the results of the survey based on the Cloverleaf model are presented. Finally, it includes a summary with the relevant and common issues.

3.1 Use cases readiness assessment

3.1.1 Use Case: ERP Hosting

Industrial and Business Context description

Currently we face as a key trend in software market the shift to on-demand business. Customers increasingly buy software services instead of software installations. Doing so, they rely on the availability and quality of these services for operating their own business. Hence, they require strong guarantees on the quality of service. Dependable service levels will become a major differentiator in the market of on-demand software solutions and the Internet of Services. At the same time market analysis shows that current SaaS offers still come with extremely limited service level guarantees [1].

Looking at the current trend from service-enabled applications to Software-as-a-Service and Internet of Service scenarios we foresee an enormous pressure for service providers to professionalize and automate the offering and management of their services by introducing the notion of SLAs in order to be competitive in upcoming service markets. This competition mainly relates to the areas of dependability, costs and ease of consumption.

Dependability is of utmost importance for all kinds of customers of business solutions as non-operating solutions would seriously impact their ability to continue business.

Cost is becoming increasingly important as the market is commoditizing. For such markets cost is a major buying decision which in turn requires providers to create very cost effective platforms where cost for hosting an additional tenant is minimized.

Agility / ease of consumption becomes increasingly important as we see a global trend from hard-wired value chains to flexible business value networks fixed business network where connections are dynamically added, changed or stopped [3].

Business improvements on factors and use case specific metrics

Major industrial/business advantages of SLA@SOI

Three of the main business advantages of SLA@SOI have been already introduced above, namely the improvements on agility, dependability, and cost. A fourth aspect which is purely motivated from a service provider perspective is the aspect of transparency. The challenge here is that advanced business solutions have complex dependencies on various software, middleware, and infrastructure artefacts. The management of these dependencies is complex and can easily lead
to errors. Therefore, increased transparency is a major business benefit for service providers and will eventually also contribute to increased efficiency, dependability but also the ability to flexibly react on changed market conditions.

The following table provides an overview of these areas including the most relevant measurable KPIs for the B3 use case.

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<th>Value Dial</th>
<th>Measurable KPI’s</th>
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<td>Agility</td>
<td>- time to provision</td>
</tr>
<tr>
<td></td>
<td>- time to adjust (intentional change)</td>
</tr>
<tr>
<td></td>
<td>- time to quotation</td>
</tr>
<tr>
<td>Dependability</td>
<td>- number of SLA terms specified</td>
</tr>
<tr>
<td></td>
<td>- number of SLA terms monitored</td>
</tr>
<tr>
<td></td>
<td>- time to react (on SLA violation)</td>
</tr>
<tr>
<td>Cost</td>
<td>- environmental/energy efficiency, i.e. energy consumption per system, tenant and business transaction</td>
</tr>
<tr>
<td></td>
<td>- technical efficiency, i.e. resource (e.g. CPU) usage per system, tenant and business transaction</td>
</tr>
<tr>
<td></td>
<td>- process efficiency, i.e. number of working hours per service request</td>
</tr>
<tr>
<td>Transparency</td>
<td>- end2end manageability of a complete service hierarchy</td>
</tr>
<tr>
<td></td>
<td>- number of tools/management consoles</td>
</tr>
<tr>
<td></td>
<td>- customizable entries per product offer</td>
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Table 1: Value Dials and KPIs for “ERP Hosting” use case

Agility, as perceived by customers, largely breaks down to the 3 core processes of quotation, provisioning and adjustment. Dependability becomes evident by the detail of the specified SLA terms, their monitorability, and the ability to react on violations. Cost breaks down into environmental and technical efficiency; both are measured per system, per tenant, and eventually per business transaction. Furthermore, process efficiency relates to human resources and their involvement in service requests (quotation, provisioning, maintenance, change). Transparency breaks down to indicators about the feasibility of consistent End2End management, the number of required tools, and the ability to customize management tasks and offerings across the stack.

**Technology Readiness**

Looking at the current market of hosted enterprise solutions [1], the technology of SLA@SOI is still highly innovative. Actually, very limited service level guarantees are typically offered, and if so they are poorly specified and tracked. The contributions of the framework (SLA/SCM models, architecture, prediction capabilities) are extremely useful and ready for actual industrial usage.

There is one aspect though which is by nature not addressed by the framework itself. This is the assessment of existing service stacks in order to derive appropriate models about their non-functional behaviour (dependencies between
components, performance, reliability, etc.). In practise such an understanding is a prerequisite to specify proper SLA/SCM models and to achieve dependable services.

**Market Readiness**

The target markets for the ERP Hosting use case are service providers for business applications. The results of SLA@SOI give them clear advantages in their competitive positioning, as they can save costs and increase agility, dependability, and transparency.

Due to the complexity of the topic, market readiness seems best for dedicated SaaS offerings (e.g. on collaboration tools or business functions for lines of businesses). Market readiness is also good but a bit less obvious for complex application suites (such as a complete business application suite).

**Required improvements for Y3**

The most relevant areas for further improvements are the following:

- Better support for analysing complex service stacks which helps providers to understand the non-functional characteristics of their components.
- Analysis of the relation between SLA management and business performance management – as eventually business performance is something we can sell to a customer.
- Better integration of meta model editing capabilities (SLA models, SCM model, prediction models, ...) to support the creation of consistent configurations.

### 3.1.2 Use Case: Enterprise IT

**Industrial and Business Context description**

The cloud computing market is evolving rapidly, with a fast-growing number of external cloud services and enabling technologies. This creates a need for tools such as the SLA@SOI framework to better understand the market, define cloud computing strategy, and facilitate adoption of cloud computing services that meet the need of today but are also capable of evolving over time to meet those of the future.

Cloud computing is about delivering a highly available computing environments where secure services and data are delivered on-demand to authenticated devices and users over a shared, scalable infrastructure that supports multiple tenants. Clouds offer the potential for highly flexible computing and storage resources, provisioned on demand, at theoretically lower cost than buying, provisioning, and maintaining more fixed equivalent capacity.

The primary object of the Enterprise IT use case is to help move enterprise from the traditional statically enforced written SLA contract today, to one which is automatically derived and bound to the services being offered.
Business improvements on factors and use case specific metrics

Major industrial/business advantages of SLA@SOI

It is important to identify the business value of the SLA@SOI work in quantifiable terms. Many new technologies will claim to improve business factors such as reliability, sustainability, manageability or total cost of ownership of IT systems and the SLA@SOI project is tasked with measuring these. In that context, the business value to be realised by the B4 use case are in three main areas:

- IT enabling the enterprise
- IT efficiency
- IT investment and technology adoption.

The direct benefits of these three areas to IT services are agility, dependability and automated response. The derived benefits range from efficiency via reduced cost of ownership to governance of future investment decisions. B4 defines these areas as ‘Value Dials’. For each value dial, the measurable Key Performance Indicators (KPI’s) which support the value dial are also listed. The use case is working to establish baselines for current performance of enterprise IT hosted services and then compare these to an SLA@SOI enabled hosted service using the KPI’s below. The complete mapping of value dials to KPIs for the use case is shown below in Table 2.

<table>
<thead>
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<th>Value Dial</th>
<th>Measurable Indicator(s)</th>
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<tr>
<td><strong>Agility</strong></td>
<td>- Time to Provision</td>
</tr>
<tr>
<td></td>
<td>- Number of Images</td>
</tr>
<tr>
<td></td>
<td>- Number of Management tools</td>
</tr>
<tr>
<td></td>
<td>- Streamlined communication (one stop shop)</td>
</tr>
<tr>
<td></td>
<td>- Reduction in customisation required to facilitate consumption</td>
</tr>
<tr>
<td></td>
<td>- Scalability</td>
</tr>
<tr>
<td></td>
<td>- Scale out services dynamically</td>
</tr>
<tr>
<td><strong>Dependability</strong></td>
<td>- Availability</td>
</tr>
<tr>
<td></td>
<td>- MTTR</td>
</tr>
<tr>
<td></td>
<td>- Number of SLA Terms</td>
</tr>
<tr>
<td></td>
<td>- Number of Monitored SLA terms</td>
</tr>
<tr>
<td></td>
<td>- Reporting</td>
</tr>
<tr>
<td><strong>Automated Response</strong></td>
<td>- Volume of Service requests</td>
</tr>
<tr>
<td></td>
<td>- Number of working hours per service request</td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>- Energy Consumption kW/hr</td>
</tr>
<tr>
<td></td>
<td>- Energy Savings</td>
</tr>
<tr>
<td><strong>Utilisation Efficiency</strong></td>
<td>- CPU Utilisation</td>
</tr>
<tr>
<td></td>
<td>- Memory Utilisation</td>
</tr>
</tbody>
</table>
### Technology Readiness

SLA management in IT is not new, however today’s solutions are usually manual, they are simplistic or focus on macro agreement terms such as availability without providing any real assurance or measurable guarantee that the agreed terms can even be measured, not to mention guaranteed. The framework architecture under development in this project represents a significant improvement on current best practice in the enterprise environment. It is a complex topic which presents many issues as the project defines a generic framework which needs to meet the diverse needs of the use cases which are driving its development. However, the process of defining these features, the obstacles it presents and the framework architecture and implementation are of immense interest in an area of growing importance in the IT world. The provisioning of SLA-aware service oriented infrastructures which is at the core of the SLA@SOI project, remains beyond the scope of today’s cloud providers and is thus innovative and rapidly approaching the point where industry adoption will become widespread.

### Market Readiness

The target market for the B4 use case is the corporate or enterprise IT environment. Areas such as automated SLA management have obvious benefits such as a value dials listed in this section for any business which has adopted or invested heavily in virtualisation technologies. The migration to these technologies has already yielded some initial benefits by either providing the same compute capacity with a much smaller hardware footprint or by providing...
much increased capacities with the same footprint. However, this use case is about taking the next step in this evolutionary road and realising those benefits fully through automation and manageability improvements to provide a true, guaranteed, utility computing service to the internal enterprise without having to outsource sensitive services to external cloud providers. B4 therefore is essentially a PaaS offering and the market is again at the point where adoption of such services is highly desirable, particularly in large enterprise settings. The difficulty with SLA guaranteeing SaaS services in such an environment is that the software running within virtual machines is almost infinitely diverse. While SLA-guaranteed SaaS services can be attempted for specific software stacks such as in the ERP Hosting use case, in the enterprise setting where this may not be feasible in every situation, guaranteed PaaS services provide a logical, next-best step in this direction.

**Required improvements for Y3**

In year 2, the enterprise IT use case is just beginning to implement the SLA@SOI framework in a real way. The year 1 specification defined some very ambitious scenarios that are going to require significant effort in year 3, specifically the scenarios around run-time adjustment and investment governance. These advanced scenarios are the most technically challenging, but they also offer the greatest return-on-investment and if successfully implemented, will be particularly relevant and are most likely to be consumed industrially.

In year 3, with the support of the consortium developers, the enterprise IT use case plans to make significant progress in the following areas:

- Implementation and evaluation of run-time and investment governance scenarios.
- Service interdependency; In an enterprise setting, the services running within the private cloud will realistically be interdependent as a finance owned service may talk to a HR owned service to obtain employee information, for example. An automated service dependency database would be very valuable in organically and dynamically keeping track of interdependencies. This would be a challenging area.
- ECF evolution; The ECF has been an excellent tool in getting the project to the end of year 2. However, it is not realistic to continue to use it to relate business level objectives (BLO’s) to the enterprise as it was never developed with such a purpose in mind. Industrial feedback has lead B4 to making the decision to evolve the ECF in year 3.
- Addition of year 3 SLAT agreement terms as defined in deliverable B4b.

### 3.1.3 Use Case: Service Aggregator

**Business Context**

Currently, most Telecom Operators are deploying or planning to deploy solutions aligned with Web2.0 principles to enable user-generated services through the exposure and mash-up of network features and data. Value-added services like automated discovery, negotiation and service composition, favours the appearance of service aggregators. A service aggregator plays the role of a service provider that offers an aggregated business function view of discrete separate business functions. That is, it consumes multiple services from different providers and aggregates their results behind the facade of a service offering a single business function. Thus the service aggregator operates as a service provider to its customers and as a service requestor to its suppliers.
To achieve it, most Telco operators are deploying Service Delivery Platforms to expose their Telco capabilities to third parties and to provide an environment for creation and delivery of services. Adding SLA capabilities to the SDPs environment is a major breakthrough and provides a number of benefits described in this section.

**Business improvements on factors and use case specific metrics**

**Major industrial/business advantages of SLA@SOI**

From the application of the SLA@SOI framework and concepts to the service aggregation use case, and especially, to the baseline of Service Delivery Platforms, it comes out a number of conclusions on the benefits of the project outcomes in relation to some of the defined value dials. Since the SDP platforms deployed and being deployed currently do not support SLA management, the first benefit from using SLA@SOI in this use case is a better quality of experience of end users and therefore, and improved **customer satisfaction**, due to the fact that the platform will automatically react and adjust the service in case of SLA breaches, increasing the service **dependability**. Moreover, the service providers can offer prices in accordance with the real quality provided, since the SLA breaches will eventually result in penalties.

Another important benefit of using SLA@SOI framework together with SDPs is the ability to have an **end to end manageability** and visibility of the services in use; the platform is aware of the real quality provided by each service or third party and the SLA breaches, and it is easier for the platform managers to take **fast decisions** on the commercial offer, services configuration, resource reallocation, etc. These reconfigurations are carried out in an **agile** way because of the automatic adjustment and negotiation mechanisms provided by SLA@SOI, leading to a **higher operational efficiency**.

<table>
<thead>
<tr>
<th>Value Dial</th>
<th>Measurable KPI’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer satisfaction</td>
<td>Rate of claims per customer&lt;br&gt;% reduction (elimination to zero) of undetected SLA violations</td>
</tr>
<tr>
<td>Dependability</td>
<td>Availability (% of the time the service is available, ex. 99,99%)&lt;br&gt;Mean time to recover from an SLA breach (in seconds)</td>
</tr>
<tr>
<td>End2End manageability</td>
<td>rate of monitored atomic services per total number of atomic services</td>
</tr>
<tr>
<td>Fast decision making</td>
<td>% of automatic penalties adjusted</td>
</tr>
<tr>
<td>Agility</td>
<td>average time to provision a service&lt;br&gt;average time to modify a service</td>
</tr>
<tr>
<td>Operational Efficiency</td>
<td>Opex associated to platform management</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Energy Consumption kW/hr&lt;br&gt;Energy Savings</td>
</tr>
</tbody>
</table>

**Table 3: Value Dials and KPIs for “Service Aggregator” use case.**
Technology Readiness

Although providing SLA management in SDPs is an obvious improvement of such platforms, current available SDPs do not provide a comprehensive SLA framework that covers the overall architecture (business, services and infrastructure). However, at this stage it is critical to follow up the evolution of the state of the art and patents on the field to identify the potential opportunities of industrialization of the project outcomes.

Fine grain SLA management provided by SLA@SOI framework at this stage sets the grass-roots for managing business SLAs for 3rd party providers stakeholders management, and the support for managing the platform level SLAs and the network resources QoS levels, which are critical for a successful multimedia services provision. The renegotiation of SLAs according to new services needs will be of major value for the applicability of SLA@SOI in the third year.

Market Readiness

Since most of the Telco operators are about to deploy SDPs, and most of telecommunications software and infrastructure providers already offer SDPs in their portfolio, it can be stated that it is a large and mature market to industrialize and deliver the outcomes of the project. SLA management can represent a clear added value to current SDP platforms and the comprehensive framework of SLA@SOI will keep the interest of Telco providers.

Required improvements for Y3

As a result of this analysis, some aspects will be taken into account for year 3 developments of the use case:

- Careful analysis of the commercial SDP offers in relation to the SLA capabilities.
- Deeper integration of SLA@SOI framework into SDP standards and architecture.
- Good support of renegotiation capabilities for dynamic re-provision of resources in case of different SLA requirements.
- Identification of most important SLA terms and KPIs in the SDP environment and application to the SLA(T) model.

3.1.4 Use Case: Service Aggregator (TaaS perspective)

Industrial and Business Context description

The business context of the use of SLAs in service aggregation from the Telecom as a Service perspective can be squarely situated at the crossroads of the declining profitability and the emergence of standardized computational needs in the telecommunications industry. With declining profitability in existing service offerings, this use case seeks new market opportunities to reuse existing capabilities in all possible manners, including their resale by external parties. Contemporaneously, the standardization of compute infrastructure utilized by telecommunication services have started to mature to the point that managing compute infrastructure as a consistent resource offering makes business sense. Combining these two trends, this perspective of the service aggregation use case aims at prototyping a telecommunications as a service (TaaS) running on a cloud platform offering in which external companies can create, run, and maintain electronic service aggregation offerings guided by the SLA@SOI model. By its foundational basis on SLA agreements, this telecom service platform will
differentiate itself from other emerging platforms by allowing the wholesale management of SLAs on the inputs and outputs of external entities business processes based on service aggregation.

**Business improvements on factors and use case specific metrics**

**Major industrial/business advantages of SLA@SOI**

The telecom as a service (TaaS) platform will be based on its contributions to the development of service infrastructure at Telekom Austria, its ability to enable new service creation by external entities, and the ability to manage the resulting services. The development of an SLA aware service infrastructure will be differentiated from existing methods by its **efficiency** of the utilized resources with the corresponding ease of **scalability** with reduced effort. The creation of service aggregations by external entities will be measured by the **agility** by which services offering may be constructed along with the **market opportunity** that such offerings enable. The management of the existing services will be assessed by the ability to combine **multi-party monitoring and reporting** of heterogeneous resources into a comprehensive system.

**Technology Readiness**

Although the future trend is to have the systems that comprise the basis of a telecommunications company be based on standardized software services running on generalized computing infrastructure, this is not the current technological reality. The construction of the TaaS platform requires a fair amount of adapting existing telecommunications systems to provide the provisioning, monitoring, and control hooks necessary at the SLA@SOI level of abstractions. For the pure software side of the TaaS platform in which we offer SLA-aware virtualization containers to external entities, we encountered a much higher level of technological readiness on the part of SLA@SOI components. The SLA@SOI model probably formed the most heavily used component, where we can report a reasonable level of readiness for adoption, with the one notable exception being able to rapidly create models based on metrics that were not previously considered.

**Market Readiness**

Given the overwhelming current interest in cloud computing, we find it quite auspicious to the marketability of SLA@SOI derived service aggregation offerings that most of the emerging aggregation platforms continue to treat their offered SLAs as a legal requirement from which the business and technical ramifications are then derived. In this manner, these competing service offerings will continue to follow an ad-hoc, labour intensive approach to SLA management. For companies which offer electronic service aggregations, we feel that the SLA@SOI model’s translation between the technical and business aspects of service manageability to be a clearly superior market differentiator. Once a business gains the capability to view all of its SLA agreements across all its suppliers and customers as a holistic entity as the SLA@SOI approach enables, we believe that the advantages in efficiency and scalability will drive market adoption.

**Required improvements for Y3**

In Y3, we will extend the SLA@SOI elements in more sophisticated service aggregation with greater complexity that more closely correspond to actual business scenarios. To achieve this we will need to express requirements for (and develop technological solutions for):
More realistic multi-party reporting based on actual business requirements that are then translated to the necessary technical KPIs

Specialized prediction for software offerings of service aggregation based on the REST compositional model afforded by the TaaS

The continued adoption of the SLA@SOI model to the specific requirements of both telecommunications as a service and to the management of a multi-tenant computing cloud

3.1.5 Use Case: E-Government

Industrial and Business Context description

Many PA (Public Administration) both local and central are moving toward a service based paradigm where the services are not all necessarily web- or e-services. On the other side, citizens are changing their life style adapting to this new trend due to new needs interacting remotely with the different PA and relying more and more on services outsourced by the PA to third party providers.

Given this situation it is quite important to provide a standardized and well recognized approach to manage the quality of these services and react in case of infringements of the SLAs. The PAs already define SLAs and to track these but when a service involves several related component services, it is quite difficult to monitor all related SLAs. This makes difficult to control the real service quality and to adjust it in a timely way, to provide to the Citizens a transparent view on the quality of the delivered services and complicate the construction and adaptation of services to fulfill new citizen needs.

At the right moment there are not standardized technologies to monitor the SLA and there is not at all technological support to offer these to the real final users in a user friendly manner. More in general there is low automatic support to SLA management and SLA related activities such as resource management or SLA negotiation.

In a society where everything is moving toward a service based business the simplification of the SLA management is an important requirement to its continuous improvement.

Despite the focus of the project is mainly on hardware and software services and enterprise business, part of the SLA@SOI results for SLA management are perfectly suitable with the public administration and citizens services context, that at the right moment is suffering a lack of technologies supporting the monitoring, reporting and semiautomatic negotiation of the SLA.

Business improvements on factors and use case specific metrics

Major industrial/business advantages of SLA@SOI

While the SLA@SOI framework is still in a relatively early stage, several potential benefits may be identified.

The main positive impacts of the SLA@SOI Framework in the eGovernment domain are expected on Efficiency, Agility, SLA Compliance and Customer satisfaction.

Concerning the efficiency aspects the main improvement is expected in lower costs for human resources. Indeed having an integrated solution for automatic monitoring will possibly reduce the human resources currently needed to collect
and aggregate data and to check the violations of SLAs. The ability to predict possible violations in a systematic way, both in the design phase using the simulation facilities of the framework and during the operations of the services using the runtime prediction facilities, will allow a more rational allocation of human and automatic resources needed for the SLA satisfaction.

A significant improvement of the PA agility is also foreseen thanks to automatic management of monitoring and negotiation. Both features will allow reducing the time needed to adapt the services to different workload and to new needs formalized in SLAs.

The improvement in resources allocation is expected to reduce the number of SLA violations in a significant way. On turn the improvement of SLA Compliance will contribute to improve the Citizens satisfaction. Another key contribution to citizen satisfaction will come from the augmented transparency of QoS thanks to the possibility to adopt the SLA approach in a systematic way for each PA service and to publish the data about the SLA satisfaction.

Improvements may also be foreseen with respect to Scalability and Manageability Costs, thanks to the intrinsic scalability of the SLA@SOI architecture and of the manageability of the full service lifecycle thanks to a standard model of realization.

The SLA@SOI platform have the potential to have a high impact in any context where SLAs can be used, included the eGovernment domain, also due to the big dimension of the potential market and its growing trend. Anyway to achieve such benefits the SLA@SOI Framework needs to be further stabilized and the adoption effort for the main features must be reduced. The Table 4 specifies the Value Dials measured in Y2, which have been designed to evaluate the user satisfaction and the efficient usage of resources in the citizen center.

<table>
<thead>
<tr>
<th>Value Dials</th>
<th>Measurable KPI’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Preference Matching</td>
<td>- Average number of calls a user needs to complete a mobility reservation</td>
</tr>
<tr>
<td>Integrated offer of services</td>
<td>- Average time to book a Mobility &amp; Health service</td>
</tr>
<tr>
<td>SLA compliance and performance awareness</td>
<td>- Number of SLA violations in the time interval T</td>
</tr>
<tr>
<td>Resource allocation efficiency</td>
<td>- Busy rate</td>
</tr>
<tr>
<td></td>
<td>- Idle rate</td>
</tr>
</tbody>
</table>

*Table 4: Value Dials and KPIs for “eGovernment” use case measure in Y2*

**Technology Readiness**

The tools actually used in the eGovernment domain does not offer yet a fully integrated solution for monitoring SLAs of both IT services and human based services at the same time, and to automate the related management operations such as resource adjustment and negotiation with third parties. The SLA@SOI framework instead is designed to allow this.

Therefore, from an innovative point of view the project results are definitely meaningful because it offers a flexible, scalable and customizable approach to the SLA Management. In addition to this, one of the added value of the project for this specific use case, is that all the results will be open source and that the SLA model are general purpose and suitable of any kind of service and context.
Market Readiness

The market that this use case is addressing is particularly sensitive to the topics related to the SLA. In fact in Europe most of the PAs are moving toward a service based business. It is obvious that nowadays not all the services can be provided as web- or e-services and for some of them it is still necessary the interaction with the human being. Despite all, whatever is the means the service is provided, the need to describe and manage the SLA is more and more important, not only for the PAs themselves that increasingly turn to third party providers the service delivery but also for the citizens benefiting of these services. Citizens at the right moment do not have any idea about the SLA underlying most of the service they daily use without any means to formally protest and proceed for any SLA violations. The protests up to now are based on a subjective perception of the quality of the service while we have to turn toward an objective and clear one to be more effective and transparent toward all the involved actors (consumer, provider and prosumer).

Thus, the trend in the next future is to have a SLAs Knowledge and related Service Quality Transparency to make the PAs in the position to better monitor the service chain, to manage the costs in a more efficient way and allocate the resources promptly and effectively.

From the citizens’ point of view, the benefits are to be able to identify dependable services, be aware of the recognition of their feedbacks and requirements.

Required improvements for Y3

There are different aspects where an improvement would be useful. Following they are described in order of importance from a business prospective.

SLA@SOI Framework has incorporated an important number of valuable features during the last iteration. However, in order to achieve a successful industrialization of the results, it is still required an effort to drive the platform to a more stable status and to simplify its adoption.

The adoption of the Framework also requires a more user oriented documentation, less focused on the needs of the framework developers and more tied to the point of view of application developers and final users.

From the functionality point of view, it would be valuable for the eGovernment domain that the framework provided more fine grained reporting information. This way, both the customer and the provider would be able to identify the cause of violations and, more in general, of inefficiencies.

It is important to continue the analysis of how to adopt the SLA@SOI Framework in a multiprovider environment, as this is a common situation in the eGovernment domain, assuring a seamless integration with third party providers that have not adopted SLA@SOI Framework.

Finally, from the prospective of eGovernment, it would be desirable to generalize the SLA model in order to simplify the description of SLAs in situations where provider side services are integrated with customer side services. In such a context some of the terms guaranteed by the main provider are explicitly conditioned by the satisfaction of SLAs of the customer with its third party providers.
3.2 **Surveys Results**

In the rest of the section the data collected from the different partners are compared to identify the mean score obtained in each parameter and the parameters that have higher or lower score.

3.2.1 **Common Metrics survey**

In this section the results of the analysis of the different surveys are provided. In the next section an interpretation of the results is provided. This survey has been filled in for each of their target product/market:

<table>
<thead>
<tr>
<th>Market</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact centers services</td>
<td>Booking services for healthcare</td>
</tr>
<tr>
<td>Internal IT Organisation</td>
<td>iCloud Managability</td>
</tr>
<tr>
<td>3rd party services</td>
<td>SDP with SLAs</td>
</tr>
<tr>
<td>Business Software (ERP, CRM, ...) for SMEs</td>
<td>On Demand product for complete business software suite</td>
</tr>
<tr>
<td>Enterprise Collaboration Software</td>
<td>On Demand product for semi-formal collaborations</td>
</tr>
<tr>
<td>Business Software for LoBs of LEs</td>
<td>On Demand applications with special line of business scope</td>
</tr>
<tr>
<td>SMEs using remote support and remote collaboration</td>
<td>ISL Online</td>
</tr>
<tr>
<td>Telecommunication as a Service</td>
<td>Cloud-based telco service platform</td>
</tr>
</tbody>
</table>

**Table 5 Target market and products considered in the survey.**

**Market Readiness and Technology Readiness**

Table 6 shows the average market readiness and technology readiness for each analysed parameter. The green background is used to highlight the parameters that on average have the higher score. Instead, in yellow the parameters with the lower score on average are shown.

<table>
<thead>
<tr>
<th>Market Readiness</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>The technology offers significant identifiable and quantifiable benefits</td>
<td>4,88</td>
</tr>
<tr>
<td>The product/process has distinct advantages over competing products</td>
<td>6,25</td>
</tr>
<tr>
<td>The technology has future uses</td>
<td>5,75</td>
</tr>
<tr>
<td>There is a definable marketable product</td>
<td>4,88</td>
</tr>
<tr>
<td>A defined market is accessible</td>
<td>5,75</td>
</tr>
<tr>
<td>The market is a large one</td>
<td>7,00</td>
</tr>
<tr>
<td>The market is a growing one</td>
<td>7,00</td>
</tr>
<tr>
<td>The technology has immediate market uses</td>
<td>3,75</td>
</tr>
</tbody>
</table>
The technology will be first-to-market: 6.38
Manufacturing is determined to be feasible: 4.50

<table>
<thead>
<tr>
<th>Technology Readiness</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>The technology is a new, non-obvious invention</td>
<td>5.13</td>
</tr>
<tr>
<td>The patent and literature search are complete and clear</td>
<td>1.63</td>
</tr>
<tr>
<td>There are no other dominant patents</td>
<td>1.88</td>
</tr>
<tr>
<td>The technology is state-of-the-art or major breakthrough</td>
<td>4.00</td>
</tr>
<tr>
<td>The technology is a core or platform technology</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Table 6: Average Market Readiness and Technology Readiness

**Figure 1 Average Market Readiness Scores**

**Figure 2 Average Technology Readiness Scores**
### Top-rated Business metrics

<table>
<thead>
<tr>
<th>Max Market Readiness</th>
<th>Target Market</th>
<th>Business Software for Lines of Business (LoBs) of Large Enterprises (Les)</th>
<th>3rd party services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Product</td>
<td>On Demand applications with special line of business scope</td>
<td>SDP with SLAs</td>
<td></td>
</tr>
<tr>
<td>MAX Market Readiness Score</td>
<td>73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max Technology Readiness</th>
<th>Target Market</th>
<th>Business Software for LoBs of LEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Product</td>
<td>On Demand applications with special line of business scope</td>
<td></td>
</tr>
<tr>
<td>MAX Technology Readiness Score</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

### Lowest-rated Business metrics

<table>
<thead>
<tr>
<th>Min Market Readiness Score</th>
<th>Target Market</th>
<th>Enterprise Collaboration Software</th>
<th>Telecommunication as a Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Product</td>
<td>On Demand product for semi-formal collaborations</td>
<td>Cloud-based telco service platform</td>
<td></td>
</tr>
<tr>
<td>MIN Market Readiness Score</td>
<td>36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Min Technology Readiness Score</th>
<th>Target Market</th>
<th>Telecommunication as a Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Product</td>
<td>Cloud-based Telco service platform</td>
<td></td>
</tr>
<tr>
<td>MIN Technology Readiness Score</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.2.2 Industrial Readiness survey

##### 3.2.2.1 Average Market readiness parameters

From the average score of the parameters in Table 6 we can see an agreement among the partners that in general assigns the maximum score to the Market readiness parameters related to the characteristics of the market and like its size and evolution, in particular, the market is a large one and the market is a growing one.

Similarly, all the partners agrees on assigning a low score to the parameter “The technology has immediate market uses”, which means that the outcomes of
SLA@SOI framework still have a long way to be reach the market as part of a final product or service.

### 3.2.2.1.2 Average Technology Readiness parameters

The average values of the evaluation shows how the technology is seen from the partners as a platform technology as it gets on average the higher score. Finally most of the partners perceive that the patent and literature search is not yet completed.

### 3.2.2.1.3 Top-rated Business metrics

Referring to the maximum score obtained in the market readiness evaluation the products which are more prone to a fast industrialization are the on demand business applications for lines of large companies and the Service Delivery Platforms with SLA management.

For the technology readiness, most of the products reflect a similar score around 20 points out of 45, which means that a final effort must be done in order to prepare SLA@SOI framework for a successful industrialization.

### 3.2.2.1.4 Lowest-rated Business metrics

Minimum scores in the evaluation are obtained by the Enterprise Collaboration Software and the Remote Collaboration Software, both in the market and technology perspectives. This, as it was said above, could be due to the fact that the market needs solutions that are more focused on specific business needs rather than general systems. Similarly also the Cloud-based Telco as a Service obtains a low score due to the fact that it is a highly innovative product (even without comprehensive SLA management).

### 3.3 Industrial and Business Assessment

#### Summary

#### 3.3.1 Business Metrics Analysis

What comes out from the analysis of the industrial and business advantages reported in the SLA@SOI use cases is that SLA@SOI technology is a very promising one in terms of business improvements and benefits.

Despite the use cases are different among them, they have been identified value dials (or metrics) common to all them (ref. Section 2.3). Among these metrics agility, dependability, efficiency are those that all the Use Cases recognised as important and strategic for their industrial and business improvement.

The reason for this is that in all use cases it have identified the need to have a solution, such as the one provided by SLA@SOI, able to react promptly and in an easy way to the market needs (agility) guaranteeing an higher and higher degree of dependability.

The other value dial that SLA@SOI results is expected to satisfy is a more effective efficiency management in terms of energy, resource and operations efficiency that is reflected also in a minor impact in terms of costs to bear.

This is expected to be achieved thanks to well defined SLA customizable for different application domains and supporting tools enabling a SLA management more flexible with automatic adjustment and negotiation mechanisms.
What is derived from the analysis of the Business Metrics analysis is that, despite the project prototypes are still raw, thanks to SLA@SOI what the final users expect to obtain is a greater customer satisfaction thanks to a complete, automatic and flexible SLA Management set of tools.

### 3.3.2 Technology Readiness

While the novelty of the holistic SLA management framework is recognised, further development is required to fulfil the expectations of the use cases in their various domains. To summarize, the survey and information gathered from the use cases reflects that it is a complex topic which presents many issues as the project defines a generic framework which needs to meet the diverse needs of the use cases which are driving its development. However, the process of defining these features, the obstacles it presents and the framework architecture and implementation are of immense interest in an area of growing importance in the IT world.

These specific survey results also reflect the current status of the project and the complexities and obstacles met so far. In fact, most of the project results are still at an early prototype phase and not all the requirements have been still implemented. As a consequence the integration of all the functionalities in the general SLA@SOI framework is partial and the training and confidence of the final users toward the adoption of the SLA@SOI tools is still weak and rough.

### 3.3.3 Market Readiness

This section provides a short summary of the observations on market readiness as provided by the use cases in sections 3.1.1 through 3.1.5, and then some brief remarks on the common trends.

For ERP hosting, market readiness was felt to reside more in discrete service offerings rather than in complete application suites due the simpler nature of such deployments. For enterprise IT, the market is judged to be ready for the much more fully automated manageability improvements that our project is investigating, feeling that providing such capabilities has the potential to be a solid evolutionary step over current offerings. For service aggregation of telecommunications services the ability to “bake-in” SLA management offers the business layer a key unique selling point over current offerings. The ability to translate these business concepts to technical aspects of manageability on the basis of a common model provides a key component of this differentiation. For the eGovernment market the ability of this common model to provide a reference point for evaluation and disputes about service quality for services definitions based on both human and electronic resources provides a transparency not matched by current offerings.

We can then summarize the market readiness appraisals as each arguing that SLA@SOI does indeed potentially provide a useful novelty in all of the proposed application domains, indicating that each use case should be able to provide a further assessment on the relative impact and relevance of this innovation when the individual scenarios are more mature. For all applications, one of the key aspects of this innovation was felt to be the applicability of a common model over existing offerings. And finally in all of these markets, the potential of our approach to increase the agility by which business processes may be enacted, modified and monitored was judged to be a prime potential advantage over existing solutions.
3.3.4 **Improvements required for Year 3**

As for the iterative technological improvements currently judged as being necessary to meet the market readiness opportunities, the common trends may be summarized as follows. If SLA@SOI is to meet the needs for automation, it needs to provide improved abilities to introspect existing service configurations to provide a starting point for their integration. Additional support for specifying a knowledge base of service interdependencies would increase the sophistication of the scope of scenarios where this automation might be applied.

Although perhaps the most heavily used component, the SLA@SOI modelling techniques are judged not to be complete from the needs of the use cases. Among requested improvements lie in an embedding within a richer meta-model allowing more complex links to be maintained between instances to enhance the consistency of derived operational configurations.

Almost all users of the model will need to continue to add additional KPIs and agreement model forming the basis of Y3 requirements for expansion to the model expressivity. The links between the monitoring information emitted from the framework and the models should additionally be strengthened to enhance the intelligibility of violations when they occur.

The need of the model and attendant prediction capabilities to support multi-tenant, multi-domain service based applications has only started to be tested in the current iteration of the use cases leading to the more detailed requirements coming from both the service aggregator and the eGovernment applications as it is now much more clear as to what is needed and what is possible with our project’s approach.

From the adoption of the technical results from a business perspective, it is also clear that we would need documentation that is more related to the perspective of anticipated users rather than the implicit software developer to which it is probably best characterized as to being addressed.
4 Conclusions

4.1 Summary

This deliverable represents the first iteration towards a strategy to make easier the uptake, use and exploitation of SLA@SOI project outcomes by external stakeholders. It contains the first phase of the methodology proposed, in which a readiness analysis of the technology and the market is carried out.

First, a survey has been defined from the Cloverleaf model proposal, focusing on those aspects that are relevant for the project in this stage (technology and market). This survey has been filled in by all the industrial partners, and the results are analyzed in the document. Besides, a readiness analysis has been carried out by all the use cases of the project, focusing on their own metrics and value dials, and the business and technology readiness of the project.

In that sense, the use cases have also provided a number of needs and requirements that have to be considered by the project in order to improve the readiness of the outcomes to be uptake and exploited by external stakeholders after the end of the project.

4.2 Outlook on Future Work

As it has been defined in this deliverable, the next iteration of this deliverable must include:

- A refinement of the readiness analysis, taking into account additional factors as standardization results or dissemination activities.
- A detailed assessment of the value dials of each use case and their business impact.
- An expectations analysis from external stakeholders through a survey to external industrial organizations, taking advantage of networking events like ICT 2010, NESSI events, etc.
- A set of guidelines to allow external industrial stakeholders to assess if the project outcomes are suitable for their industrial requirements.

Finally, it must be remarked that the conclusions and requirements obtained for year 3 will constitute an important feedback for the scientific activities of A line work packages, which will presumably fulfil better the technological needs of the use cases. These changes should be reflected in a new and more complete survey that should eventually take these improvements into account, together with the changes in the industry and the industrial partners.
5 References


Appendix A: Glossary

The following list shows the most important entries of the SLA@SOI glossary. Note that terms that are specific for the current document and not part of the overall project wide glossary are marked with an asterix *.

**Agreement Initiator**
An agreement initiator is a party to a *service level agreement*. The initiator creates and manages an agreement on the availability of a service on behalf of either the service customer or service provider, depending on the domain-specific signalling requirements.

**Agreement Offer**
An offer is the description of the agreement relationship that is sent from *agreement initiator* to *agreement responder* during agreement creation, indicating the relationship which the initiator would like to form.

**Agreement Responder**
The agreement responder is a party to a *service level agreement*. The responder implements and exposes an agreement on behalf of either the service provider or service customer, depending on the domain-specific signalling requirements.

**Agreement Template**
An agreement template is an XML document used by the *agreement responder* to advertise the types of offers it is willing to accept.

**Agreement Term**
Agreement terms define the content of a *service level agreement*.

**Business Service**
A business service is exposed/invoked via at least some non IT elements.

**Business Manager**
A specialization of *service provider*: person that defines the SLATs of products and joins available services in a product.

**External Service**
External services are exposed across the boundaries of an organization, i.e. across at least two administrative domains.

**Framework Administrator**
A specialization of *service provider*: person that configures/adapts the SLA@SOI framework for a specific application.

**Guarantee Term**
Guarantee terms define the assurance on service quality associated with the service described by the service definition terms. They refer to the service description that is the subject of the agreement and define service level objectives, qualifying conditions and business value expressing the importance of the service level objectives.

**Hybrid Service**
A hybrid service is a set or bundle of other services where all these services are exposed to the customer but have different service interface types (e.g. an IT service and a business service).

**Infrastructure Manager**
A specialization of *infrastructure provider*: person/system that is interested to measure and control infrastructure properties.

**Infrastructure Provider**
A specific kind of service provider that focuses on the provisioning of *infrastructure services*. 
Infrastructure Service
An infrastructure service is a specific IT service which exposes resource/hardware-centric capabilities.

Internal Service
Internal services are exposed within the boundaries of an organization, i.e. within one administrative domain.

IT Service
An IT service is exposed/invoked by means of information technology. Specific classes of IT services may be software services, infrastructure services or media services.

Offered Service
An abstract service (more precisely: service type) which is offered by a specific Service Provider to its Service Customers.

Operation Level Agreements: A specification of the conditions under which an internal service or a component is to be used by its “customer”.

Service
A means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks. See also service interface type, service concreteness, service exposure

Service Concreteness
The stage a service reaches over time from a fully abstract type to actually instantiated. See also service type, offered service, service implementation, service instance

Service Consumer
Person(s) who actually consume/use the provided services. Typically they belong to the service customer.

Service Customer
Someone (person or group) who orders/buys services and defines and agrees the service level targets.

Service Description Term
Service Description Terms describe the functionality that will be delivered under the service level agreement. The agreement description may include also other non-functional items referring to the service description terms.

Service Exposure
Services can be exposed either internally (within the same administrative domain) or externally. See also internal service, external service

Service Implementation
A service implementation is a possible concrete realization of a given service type.

Service Instance
A concrete realization of an offered service which is ready for consumption by service users. It relies on the instantiations of all the resources required for a given service implementation.

Service Interface Type
Describes the nature of an actually exposed service, i.e. about the nature of his invocation interface. See also business service, IT service, hybrid service

Service Level Consequence
An action that takes place in the event that a service level objective is not met.

Service Level Agreement
An agreement defines a dynamically-established and dynamically managed relationship between parties. The object of this relationship is the delivery of a service by one of the parties within the context of the agreement. The management of this delivery is achieved by agreeing on the respective roles, rights and obligations of the parties. The agreement may specify not only functional properties for identification or creation of the service, but also non-functional properties of the service such as performance or...
availability. Entities can dynamically establish and manage agreements via Web service interfaces.

**Service Level Objective** Service Level Objective represents the quality of service aspect of the agreement. Syntactically, it is an assertion over the agreement terms of the agreement as well as such qualities as date and time.

**Service Provider** An organization supplying services to one or more internal customers or external customers.

**SLA Manager** A specialization of service provider: person/system that is responsible for managing SLATs and SLA relationships.

**Software Designer** A specialization of software provider: person that designs/develops the architecture and components of a specific SLA based application.

**Software Manager** A specialization of service provider: person that defines software-based services, takes care of their management and supports the SLA manager in creating appropriate SLA templates.

**Software Provider** An organization producing software components which might be used by a service provider to assemble actual services.

**Software Service** A software service is a specific IT service which is exposed/invoked by means of software entities such as Web services, user interfaces, or software-based business processes.

**Software Component** Software components are the entities produced at design-time by a software provider.

**Service Type** A service type (or abstract service) specifies the external interface of a service possibly including non-functional aspects. It does not specify any means (components, resources) which are needed for the actual provisioning of that service.

### Appendix B: Abbreviations

- **AOP** Aspect Oriented Programming
- **BM** Business Manager
- **B-SLAM** Business SLA Manager
- **EMF** Eclipse Modelling Framework
- **ERP** Enterprise Resource Planning
- **IE** Interaction Event
- **FCR** Finite capacity regions
- **ISLAM** Infrastructure SLA Manager
- **ISM** Infrastructure Service Manager
- **IoC** Inversion of Control
- **KPI** Key Performance Indicator
- **LLMS** Low Level Monitoring System
- **LQN** Layered Queueing Networks
- **MA** Manageability Agent
- **MRE** Monitoring Result Event
- **MVC** Model View Controller
- **NFP** Non-functional property
- **ORC** Open Reference Case
- **OVF** Open Virtualization Format
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>PA</td>
<td>Public Administration</td>
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<tr>
<td>QoS</td>
<td>Quality of Service</td>
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<tr>
<td>QPN</td>
<td>Queueing Petri Nets</td>
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<tr>
<td>PAC</td>
<td>Provisioning and Adjustment Component</td>
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<tr>
<td>POC</td>
<td>Planning and Optimization Component</td>
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<tr>
<td>POJO</td>
<td>Plain Old Java Objects</td>
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<tr>
<td>SaaS</td>
<td>Software as a Service</td>
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<td>SE</td>
<td>Service Evaluation</td>
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<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
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<tr>
<td>SLAM</td>
<td>SLA Manager</td>
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<td>SLAT</td>
<td>Service Level Agreement Template</td>
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<tr>
<td>SM</td>
<td>Service Manager</td>
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<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
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<td>SOA</td>
<td>Service Oriented Architecture</td>
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<td>SW-SLAM</td>
<td>Software SLA Manager</td>
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<tr>
<td>SW-SM</td>
<td>Software Service Manager</td>
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<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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<tr>
<td>TOGAF</td>
<td>The Open Group Architecture Framework</td>
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