SLA@SOI – An Overview

Empowering the Service Economy with SLA-aware Infrastructures

September 2008
Wolfgang Theilmann
SAP
Agenda

Motivation & Goals

Expected Results

Project Data

(Industrial) Use Cases

Collaboration Spaces

Problem Perspectives & First Steps
Business Motivation

Vision
- A business-ready service-oriented infrastructure empowering the service economy in a flexible and dependable way.

Business-readiness requires
- predictability & dependability → prerequisite for acceptance & uptake of (new) services
- holistic SLA management → transparent IT management
- automated negotiation → dynamic, scalable service consumption

Impact on the knowledge economy
- decreased time to market for new services
- increased productivity and competitiveness
- lower entry barriers, especially for SMEs
Technical Motivation

Service Consumer
- dynamic demand for complex business solutions at low costs

Software Provider
- SOAs provide unprecedented flexibility

Service Provider
- service economy requires dependable services

Infrastructure Provider
- virtualization technologies allow for adaptive SOIs

Flexible usage Business Services
Engineering of predictable services
Automated SLA negotiation and management
SLA enforcement via adaptive infrastructures

Vision of SLA@SOI
A business-ready service-oriented infrastructure empowering the service economy in a flexible and dependable way
Envisioned Interaction

Customer

Service Demand

Business Use

Procurement

Service Provider

Contracting/Sales

SOA

Infrastructure Provider

virtual

SOI

physical

Software Provider
Envisioned Interaction

Customer
- Service Demand
- Business Assessment

Service Provider
- Business Assessment
- SLA (Re-)Negotiation
- Monitoring, Arbitration
- SOA Orchestration/Transformation/Aggregation
- SLA
- Resource Consumption Forecasting
- SOI Provisioning
- Mapping

Software Provider

Infrastructure Provider
- Business Demand Forecasting
- Service Demand Forecasting
- Resource Consumption Forecasting

Procurement
- Business Use

Contracting/Sales

SOA

SLA

virtual physical

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Envisioned Interaction

Customer
- Business Use
  - Service Demand
  - Business Assessment

Service Provider
- Contracting/Sales
- SLA (Re-)Negotiation
- Monitoring, Arbitration
- Orchestration/Transformation/Aggregation
- SLA
- Business Assessment
- Monitoring, Adjustment Alerting

Software Provider

Infrastructure Provider
- Provisioning
- Mapping
- Resource Consumption Forecasting
- Physical
- Virtual

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contributing to NESSI
Main innovations

■ SLA management framework
  ■ harmonizing perspectives of relevant stakeholders (software/service/infrastructure provider and customer)
  ■ standards for SLA specification and negotiation & systematic multi-layer SLA management (planning, optimization, and provisioning), monitoring and accounting
  ➢ guaranteed QoS in a dynamic and end-to-end fashion via consistent SLA handling across IT stack

■ adaptive SLA-aware infrastructures
  ■ standardized interfaces for adaptive infrastructures with harmonized access to different virtualization technologies.
  ■ advanced technologies for SLA enforcement on infrastructure level
  ➢ efficient resource usage w/ reliable SLA enforcement at infrastructure level

■ engineering methods for predictable service-oriented systems
  ■ modelling techniques and prediction tools for SOA and SOI components

■ business management suite for e-contracting
  ■ covers complete business lifecycle of a service provisioning/delivery
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Main project results

Open Source

SLA Core Architecture

Reference Implementation

NESSI Open Framework

Standardization

Reference demonstrator

ERP Hosting

Enterprise IT

Serv. Aggreg.

eGoverment

Financial Grids

- ERP as a service
- business value chains

- dynamic comprehension of service stack provisioning and business value

- user segmentation and predictive analysis
- public SLAs

- agreements driven by social aspects (not market logics)

- innovative financial products
- spatial-aware SLAs

Expected Results

Scientific results (from action line A)

- at least 95% of research results are public
- SLA management framework (report + prototype)
  - including all results from action line A (architecture, SLA foundation, business/service/infrastructure mgmt., predictable systems engineering)
  - contains architecture, methodologies, meta-models, tools, services, protocols, interfaces, integrated technical framework
- allows scientific community to precisely see scientific approach, developed solutions and technical evaluation results
- allows industrial community (software/service/infrastructure providers and service customers) to leverage prototype components
- basis for standardization activities
- designed for integration with NESSI open framework
**Expected Results ...**

**Impact-related results (from action line B)**

- Reference demonstrator (report, prototype)
  - demo scenario available as open source
    - allows scientific community to compare results and to do subsequent research (replay and modification of SLA-experiments)
    - allows industrial stakeholders to get hands-on experience

- Industrial use cases
  - will be made largely public
    - allows industrial stakeholders to get detailed insight

- Scientific/Technical Evaluation Report
  - precise description and assessment of scientific/technical results
    - community (IT managers & researchers) is able to understand the technical conditions under which the SLA framework can be used and receive guidance for implementing SLA projects

- Industrial Evaluation Report
  - precise description and assessment on the applicability of project results to different industrial setups (based on use cases and external requirements)
    - includes description & evaluation results from industrial use cases
    - CIOs can assess applicability of results for their organization
Contributions to NEXOF

Major contributions to NEXOF, i.e.

- the **NESSI reference model** and the **NESSI architecture**
- a complete SLA management infrastructure for service-oriented utility infrastructure. This includes in particular:
  - an **e-contracting platform** between service consumers and providers
  - a framework for mapping, planning and coordination within multiple levels in an organizational/IT structure
  - **access and provisioning layer** for SLA-aware infrastructure

<table>
<thead>
<tr>
<th>Service Consumers</th>
<th>The project will provide standardized models, protocols and methods for SLA contracting procedures between service providers and consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM view</td>
<td>Methods and tooling for analysis of business processes and service user behavior (independently from the functional service aspects)</td>
</tr>
<tr>
<td>Composition</td>
<td>Standardized models, methodologies and frameworks for holistic SLA management</td>
</tr>
<tr>
<td>Services</td>
<td>Standardized models, methodologies and frameworks for holistic SLA management</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Standardized interfaces for a service-oriented infrastructure including implementations of selected components</td>
</tr>
</tbody>
</table>
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Problem Perspectives & First Steps
Consortium

- Engineering Ingegneria Informatica
- FZI
- SAP
- Queen's University Belfast
- technische universität dortmund
- TELEKOM AUSTRIA
- City University London
- DIPARTIMENTO DI ELETTRONICA E INFORMAZIONE
- Information Society Technologies
- SENSI-TREDIUM Programme
- contributing to NESSI
**Fact sheet**

**Duration**
- June 2008 – May 2011

**13 Partners**
- 6 industrial, 1 SME, 4 academic, 2 research centres
- 7 countries: Austria, Germany, Ireland, Italy, Slovenia, Spain, United Kingdom

**Budget**
- 15.2 M€

**Info**
- [http://www.sla-at-soi.eu](http://www.sla-at-soi.eu)
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Collaboration Spaces

Problem Perspectives & First Steps
A use-case driven project

Open Source

SLA Core Architecture

Reference Implementation

NESSI Open Framework

Standardization

Open Reference Case

ERP Hosting
- ERP as a service
- business value chains

Enterprise IT
- dynamic comprehension of service stack provisioning and business value

Serv. Aggreg.
- user segmentation and predictive analysis
- public SLAs

eGoverment
- agreements driven by social aspects (not market logics)
- innovative financial products
- spatial-aware SLAs

Financial Grids

Industrial Evaluation Report: “How to run an SLA-driven business”
Open Reference Case

Idea
- a reference demo application (as open source)
- a reference SLA management demo scenario (as open source)
  - allows scientific community to compare results and to do subsequent research (replay and modification of SLA-experiments)
  - allows industrial stakeholders to get hands-on experience

Features of the ORC
- an existing Java-based application
- precise specification & modelling available
- addresses management of retail chains (w/ core enterprise and several stores)
- different service selection and deployment options
Open Reference Case – Scenario

Store 1

Business Process: ...
- scan goods
- handle payment
- book sale

Service Orchestration:
- Product Information
- Payment
- CRM
- Booking

Web Service:
- Inventory WS
- cardValidation WS
- paymentDebit WS
- CRM WS
- accounting WS

SaaS

Headquater „Retail Chain“

Business Process: ...
- Process Activity 1
- Process Activity 2
- Process Activity 3

Service Orchestration:
- Business Service 1
- Business Service 2
- Business Service 3

Web Service:
- Web Service A
- Web Service B
- Web Service C
- Web Service D
- Web Service E

SaaS

Software Provider

Infrastructure Provider

SLA

External Supplier (bank, CRM,...)

Service Provider

SLA

provides SaaS

provides SaaS

provides SaaS

provides SaaS

provides

provides

provides

provides

provides

NIFPs

SLA

SLA

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SLA
Open Reference Case – Scenario

Business Process 91.6%

Service Orchestration

Web Service

CoCoMe component (Legacy)

IT Infrastructure

SLA Availability > 95.5%
Industrial Use Case: ERP Hosting

Partner & roles
- SAP: software & service provider
- Intel: infrastructure provider

Business context
- business applications (ERP, SCM, CRM, …)
- hosted in a Software-as-a-Service model

Technical service/SLA features
- Service types: A2A/B2B Web Services, UI services, business processes
- SLAs on performance, availability & security

Challenges
- complexity in terms of number of services, components, configurations & usage variants
- process flow partly implemented in a constraint model (no explicit flow information)
- underspecified environment: various parameters unknown at design time
Industrial Use Case: Enterprise IT

Partner & roles
- Intel: lead, use cases and infrastructure provider
- XLAB: specification, design & implementation contributions
- SAP: ERP process knowledge, monitoring capabilities
- UDO: design & implementation contributions

Business context
- SLA-aware dynamic provisioning of Enterprise IT Suite
- Supporting continuously evolving role and priorities of Enterprise IT
- CMF, ECF, Scalability + TCO

Technical service/SLA features
- Demonstrate tuned adaptation to provision competing demands appropriately
- SLAs potentially describing relative priority, response times & temporal variation
- Realistic infrastructure, services & workload simulation

Challenges
- Efficiently reconciling and dynamically provisioning a technology capability or investment relative to a specified process with business level metrics
Industrial Use Case: Service Aggregator

Partner & roles
- eTel (lead)
- TID, FBK, Intel (contributors)

Logistical Fulfillment
- For a product's technical fulfillment various SLAs have to be fulfilled in aggregate across the heterogeneous technical landscape

Tripleplay (or Quadplay) services (implemented)
- (quadplay exists but not sold as such)
  - Television
  - Phone
  - IP
  - Add on services

SLA for services
- multiple instances
  - DSL (8Mbits for 1 setup box)

Carrier routing
- VOIP/trunking arbitrage of minutes between carriers
  - spot markets created for
Industrial Use Case: E-Government

Partner & roles
- ENG: WP Lead., Design & Implementation Lead.
- CITY, INTEL: requirement specification

Business context
- Social and Health assistance to elderly people: home meal delivering
- Government (Governance, Social Care Body), Citizens, Health Care Structures
- Integrated management of Citizen needs, Structures activities, Governance of costs, quality and performances.

Technical service/SLA features
- G2G: SLAs on key performance indexes, norms, regulations, accounting
- G2C: SLAs on quality, privacy issues
- G2B: quality, security, accounting
- SOA platform provided by GPI in compliance to SPCoop (Italian standard for G2G).

Challenges
- Human Based Services (e.g. meal delivery) and integration with automatic services and monitoring.
- No one big centralized workflow, but related/synchronized processes.
- Relationships between G2G, G2C and G2B SLAs (related to different processes) and automatic derivation.
- Probably each SLA will contain both business and technical constraints.
- The Service Provider selection is possibly operated by a Request for BID (the consumer provides a SLA Template that the provider must instantiate and agree to).
Industrial Use Case: Financial Grid

Partner & roles
- BeSC: Grid and Computational Finance provider
- XLAB: Implementation
- Intel: infrastructure provider

Business context
- Financial applications (Risk Management, Implied Volatility, Back testing)
- Competitive and volatile sector with demand for Risk analysis on ever larger data sets increasing by order of magnitude
- Solutions to be deployed as a highly available and scalable online services

Technical service/SLA features
- Service types: B2B Web Services, UI services, Infrastructure Services
- Online services – dynamic composition and deployment of spatially aware services
- SLAs on availability, location, compliance, system architecture, networking capability
- Vendor and architecture neutral services

Challenges
- Complexity in terms of dynamic service composition, auto deployment and un-deployment
- Service Discovery and selection based on
  - Location, networking bandwidth and non-functional metadata e.g. legal and jurisdiction issues
- Service Assurance in such a complex and dynamic environment
- Highly regulated and compliance aware sector (MiFID - EU FSA, CRD, SarbOx, Basel2)
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Problem Perspectives & First Steps
Collaboration spaces

**NEXOF-RA**
- early input delivered to RFP roadmap

**SSAI Concertation WG on “SLAs and QoS”**
- co-lead by SLA@SOI (Tariq Ellahi)

**SSAI Concertation WG on “Standardization”**
- co-lead by SLA@SOI (Philip Wieder)

**SSAI Concertation WG on “Virtualization”**
- active participation (Joe Butler)

**Future Internet**
- participation in “Management & Governance”
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Collaboration Spaces

Problem Perspectives & First Steps
**Topic Areas**

- **Predictable systems engineering**
  - engineering
  - modelling
  - analysis

- **Business Management (provider – consumer)**
  - specification & negotiation
  - business & legal assessment
  - arbitration & penalty management

- **Service-enabled Business Logic**
  - for complex layered architectures
  - for different application types

- **Service/ SW management (provider)**
  - landscape modelling
  - discovery
  - monitoring
  - steering
  - provisioning

- **Infrastructure Management**
  - harmonized virtualization technologies
  - adaptive, SLA-aware management
  - monitoring support

- **SLA foundations**
  - negotiation
  - brokering
  - translation
  - planning
  - monitoring
  - adjustment
**Topic Areas & Interactions**

**Business Management (provider – consumer)**
- specification & negotiation
- business & legal assessment
- arbitration & penalty management

**Service-enabled Business Logic**
- for complex layered architectures
- for different application types

**Applications / Processes**
- Business logic
- Middleware
  - landscape
  - discovery
  - monitoring
  - steering
  - provisioning

**Predictable systems engineering**
- engineering
- modelling
- analysis

**Infrastructure Management**
- harmonized virtualization technologies
- adaptive, SLA-aware management
- monitoring support

**SLA foundations**
- negotiation
- brokering
- translation
- planning
- monitoring
- adjustment

**SLA@SOI**

**NESSI**

**Contributing to**
## Conceptual system lifecycle

<table>
<thead>
<tr>
<th>Process</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering</strong></td>
<td>- Engineering of system’s building blocks (software &amp; hardware)</td>
</tr>
<tr>
<td></td>
<td>- Modelling of system structure and (non-functional) behaviour</td>
</tr>
<tr>
<td></td>
<td>- Clean room experiments / measurements</td>
</tr>
<tr>
<td><strong>Negotiation &amp; Planning</strong></td>
<td>- Translation of business SLA to technical level</td>
</tr>
<tr>
<td></td>
<td>- concrete workload characterisation &amp; non-functional requirements</td>
</tr>
<tr>
<td></td>
<td>- Translation &amp; prediction &amp; planning across whole business/IT stack</td>
</tr>
<tr>
<td></td>
<td>- based on templates &amp; historical traces &amp; models</td>
</tr>
<tr>
<td><strong>Provisioning</strong></td>
<td>- Actual resource allocation</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>- Actual workloads</td>
</tr>
<tr>
<td></td>
<td>- SLA Monitoring &amp; enforcement/adjustment</td>
</tr>
<tr>
<td></td>
<td>- Collection of historical data for improved model calibration / prediction</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>- Detailed analysis of trace data</td>
</tr>
<tr>
<td></td>
<td>- to update performance KPIs</td>
</tr>
<tr>
<td></td>
<td>- to identify the necessity for manual efforts</td>
</tr>
</tbody>
</table>
Conceptual Architecture: Data View

Business Rules Repository
- Business values
- CRM
- Service providers info

Service Registry (collects offers from 1 provider)
- Portfolio, Catalogs
- Composite services / products

Service Landscape
- Composition
- Instances + SLA

SLA Template Registry
- Agreement terms
- SLA Templates

Policy Repository
- IT Operation rules

Software Landscape
- Middleware
- Application, packaging
- Configuration, execution
- Agents (demons, active processes)

Infrastructure Landscape
- Physical resources
- Virtualization
- Allocation
- Sensors and Actors
- Appliances

Monitoring
- software
- infrastructure

Historical Info Repository
- Post-processed monitoring data
- Usage profiles

Design-Time Repository
- Design-time artifacts
- NFP Annotations
- Profiles

Legend
- Data Store (passive): Data Source (active):
- Feed info to:
Possibly feed info to:
Owner:

Public registries
- offers from different service providers
- owned by 3rd party

Data Source
- feeds info to:
Possibly feeds info to:
Owner:

SP

SP

IP

SB

So

IP

IP

IP

IP

IP

IP
Conceptual Architecture: Provisioning View

Service Registry
- Portfolio, Catalogs
- Composite services/products

SLA Template Registry
- Terms
- Templates

Business Rules Repository
- Business values
- CRM

Design-Time Repository
- Design-time artifacts
- NFP Annotations
- Profiles

Software Landscape
- Middleware
- Apps, packaging
- Configuration, exec.

Infrastructure Lands.
- Physical resources
- Virtualization
- Allocation
- Sensors and Actors

Prediction Services

SLA (Re-) Negotiation

SLA Translation

SLA Planning & Optimization

SLA Provisioning

Service Landscape
- Composition
- Instances + SLA

Policy Repository
- IT Operation rules

Legend
- Data Store (passive):
- Data Source (active):
- Control Flow:
- Data Flow:
- Function Module:
Thank you!