

SLA and SLA Template Model

Keven Kearney

Organisation: Engineering Ingegneria Informatica, Italy

Date: 28/09/2010

Model for Service Level Agreements (SLAs) and SLA Templates.

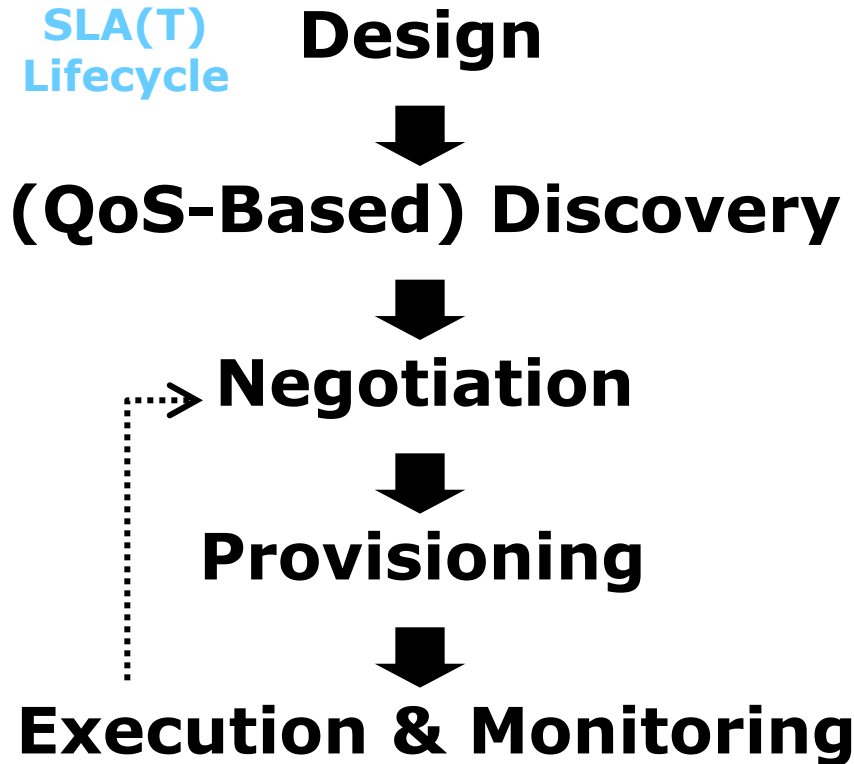
3 Key Objectives:

- support domain independent solutions at all stages of SLA(T) life-cycle,
- permit domain-specific extensions / customisation,
- language & technology independence

Objective 1 : Domain Independence



Managed
SLA(T)
Lifecycle



Characterised as ...

Constraint Satisfaction Problems



Fine-grained specification of "constraints"

(QoS = Quality of Service)

Diverse Use-Cases

- ◇ ERP Hosting
- ◇ Enterprise IT
- ◇ Live-Media Streaming
- ◇ Health-Care Provision

Diversity of ..

- ◇ Service Types (web-based v human-based)
- ◇ QoS Parameters
- ◇ Business Models (pricing / penalties)



Extensible & Customisable Service & QoS Terms

An SLA is an SLA no matter what language it is written in ...

- ◇ XML (cf. WS-Agreement)
- ◇ OWL (cf. semantic-based service descriptions)
- ◇ Human-readable formats
- WS-Agreement:
 - “An SLA is **an XML** document with properties x, y, z, ...”
- SLA@SOI:
 - “An SLA is **any** document with properties x, y, z, ...”



“Abstract” specification of SLA(T) Content

Objectives

Solution

Fine-grained specification of constraints

- The core of the model is a well-defined constraint language.

Extensible & Customisable

- Pluggable domain-specific “vocabularies”

Abstract

- The model specifies an “abstract syntax”
- Concrete Implementations

Abstract Specificaton ...

- Function *subtype-of* Value
- *Definition*: an ordered pair $\langle f, P \rangle$ where:
 - ◇ $f \in UUID$ identifies the function,
 - ◇ P is an ordered set $\{ p_1, p_2, \dots, p_n \}$ where $p_{0 < i < n} \in Param$

Concrete Examples ...

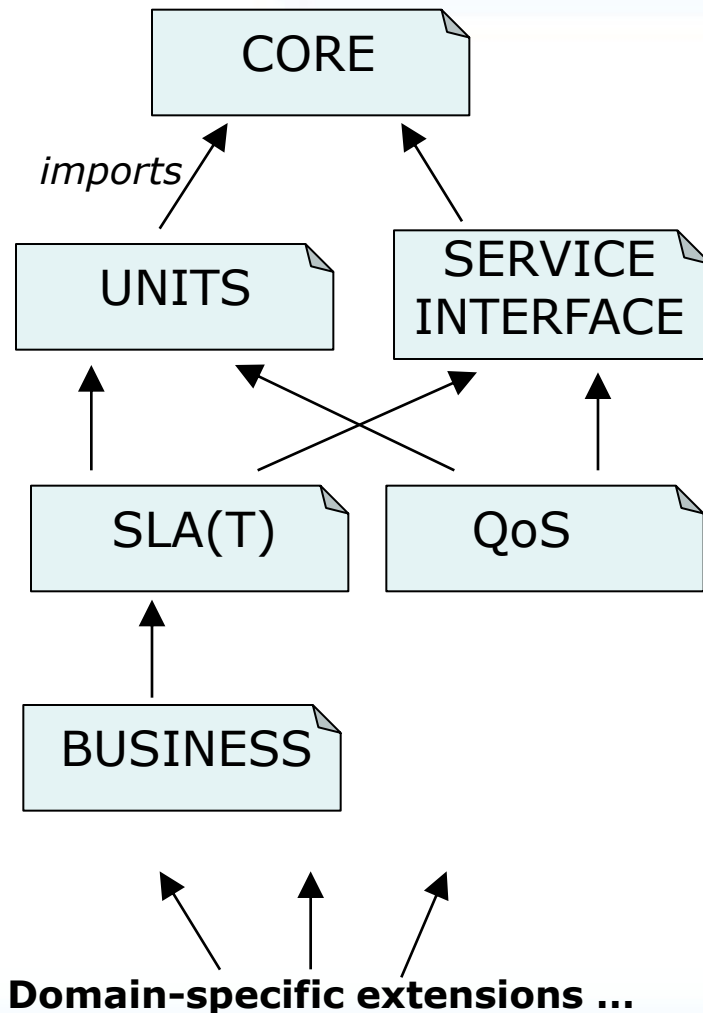
- ◇ "the completion-time of X" (human-readable)
- ◇ "completion_time(X)" (BNF)
- ◇ "<function uuid='completion-time'>
 <param>X</param>
</function>" (XML)

“Service levels” are modelled as constraints ...

- “completion-time(X) < 10 s”
- all aspects of this expression can be customised

Built-in support for ‘constraint satisfaction’ e.g. service discovery ...

- Provider offers: completion-time(X) <= 1000 ms
- Customer query: completion-time(X) < 1 s
- Problem: given the offer, can we guarantee that the customer’s requirements will be satisfied ?
- To answer:
 - ◇ data conversion formula – e.g. “X s” = “X*1000 ms”
 - ◇ semantic relations between comparison operators – e.g. that ‘<’ is more stringent than ‘<=’



❑ CORE

- Abstract constraint language (incl. standard comparison/logic/arithmetic operators)
- Vocabulary Specification

❑ UNITS

- Common metric unit definitions (incl. unit conversion formula)

❑ SERVICE INTERFACE

- Abstraction of WSDL 2.0

❑ SLA(T)

- SLA & SLA Template Content (parties, service level objectives, guarantees)

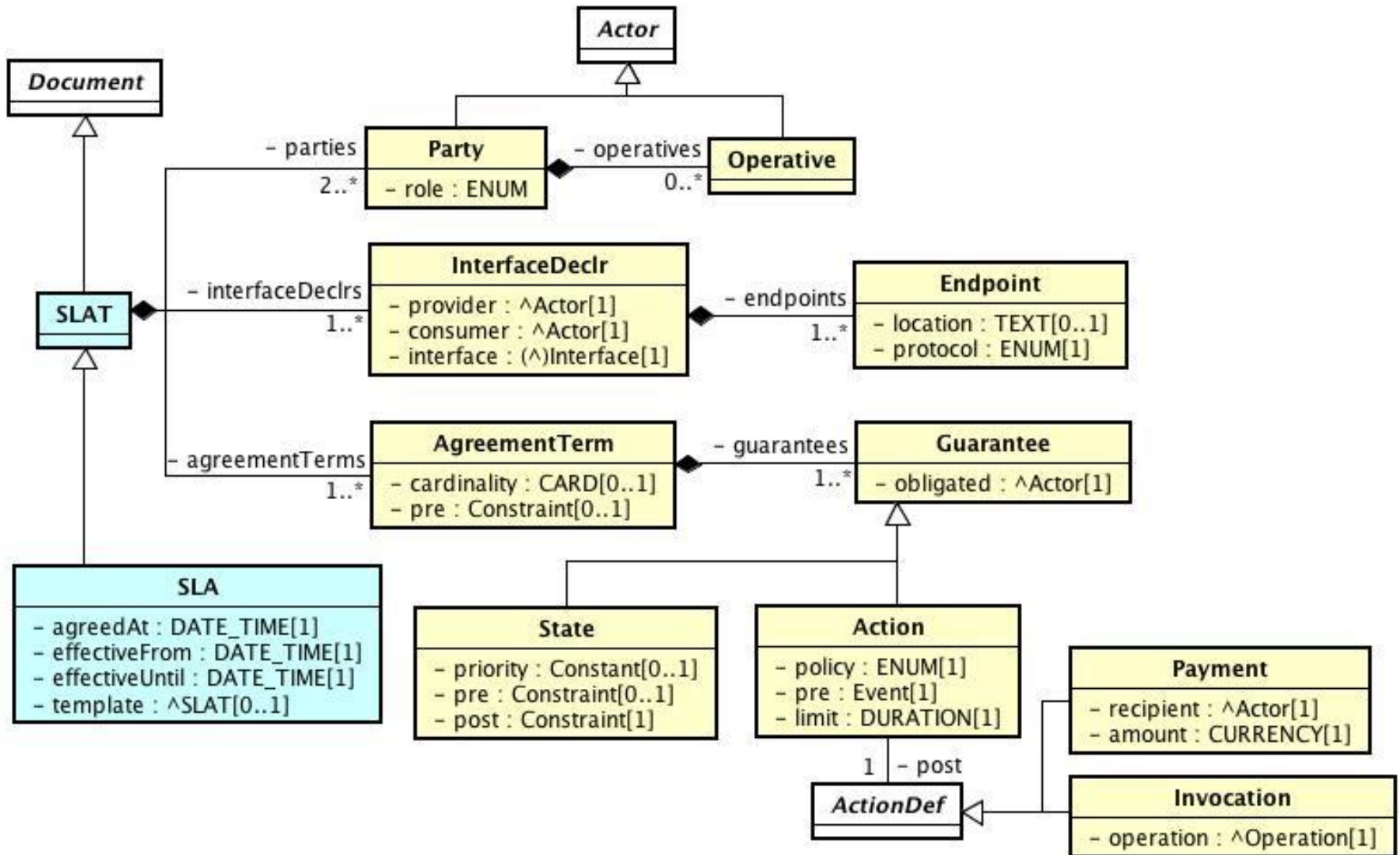
❑ QoS

- Common QoS Parameters

❑ Business

- Pricing & penalty information, termination clauses

The SLA(T) Vocabulary



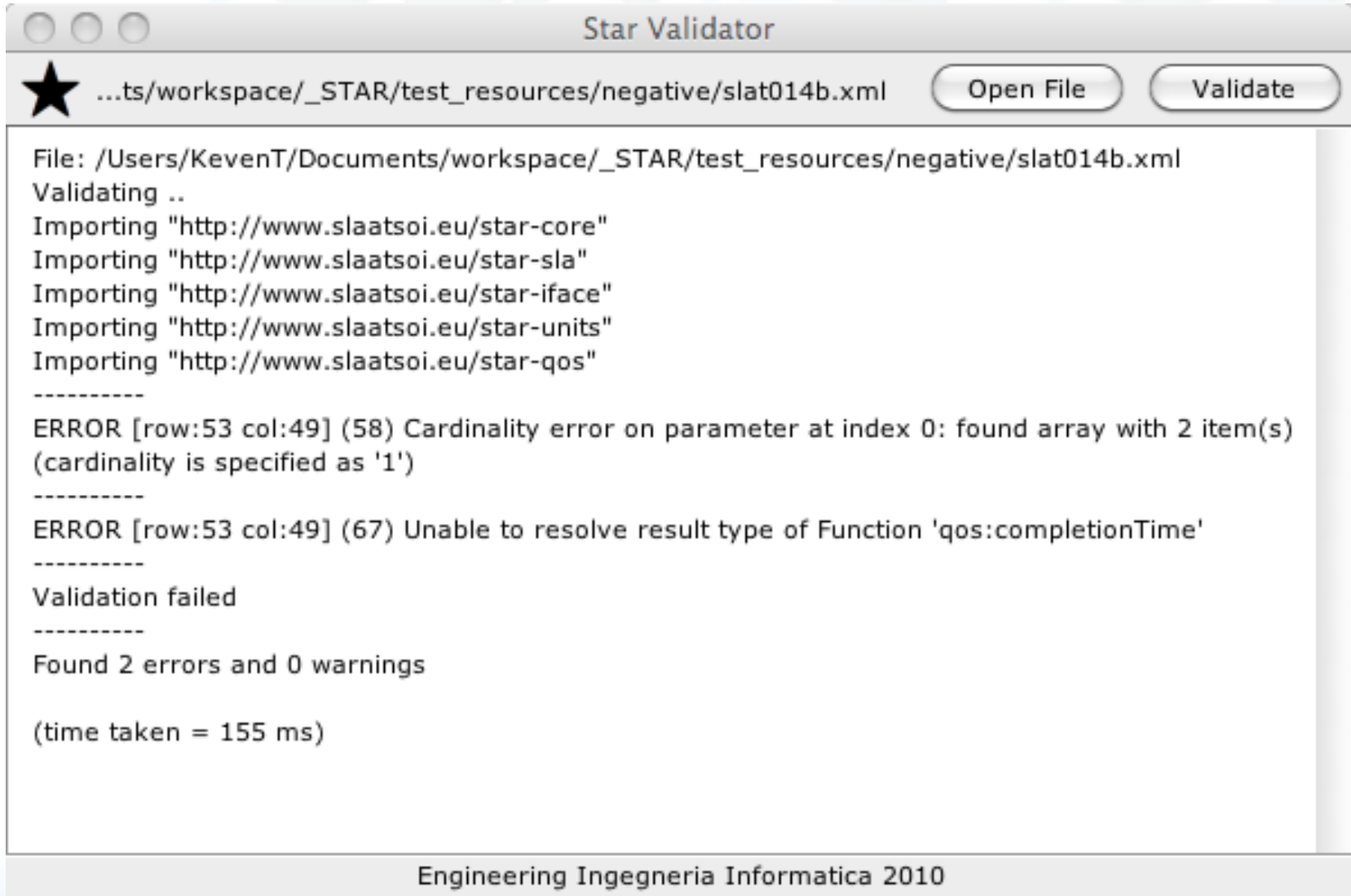
```
* Parametric{
  @ name : qos:completionTime
  @ role : units:DURATION
  @ defn : ...
  @ parameters :
    * Param{
      @ valuetype : iface:Service
      @ cardinality : 1
    }
}
```

QoS Vocabulary definition
of "completion-time"

```
52 <AtomicConstraint>
53   <Function op="qos:completionTime">
54     <array>
55       <item>aaaaa</item>
56       <item>bbbbbb</item>
57     </array>
58   </Function>
59   <AtomicDomain op="core:less_than">200 ms</AtomicDomain>
60 </AtomicConstraint>
```

Use of "completion-time"
in an SLA Template

Validation Example



The screenshot shows a window titled "Star Validator" with a star icon in the title bar. The address bar contains the file path: "...ts/workspace/_STAR/test_resources/negative/slat014b.xml". There are two buttons: "Open File" and "Validate". The main text area displays the following output:

```
File: /Users/KevenT/Documents/workspace/_STAR/test_resources/negative/slat014b.xml
Validating ..
Importing "http://www.slaatsoi.eu/star-core"
Importing "http://www.slaatsoi.eu/star-sla"
Importing "http://www.slaatsoi.eu/star-iface"
Importing "http://www.slaatsoi.eu/star-units"
Importing "http://www.slaatsoi.eu/star-qos"
-----
ERROR [row:53 col:49] (58) Cardinality error on parameter at index 0: found array with 2 item(s)
(cardinality is specified as '1')
-----
ERROR [row:53 col:49] (67) Unable to resolve result type of Function 'qos:completionTime'
-----
Validation failed
-----
Found 2 errors and 0 warnings

(time taken = 155 ms)
```

Engineering Ingegneria Informatica 2010

Domain-independence

- 'constraint satisfaction' is an issue at all stages of SLA(T) life-cycle (discovery, negotiation, monitoring)
- Core the model is a well-defined & fine-grained constraint language
- Modular & minimal specification (use only what you need).

Extensibility / Customisability

- Supports modular extension through domain-specific vocabularies
- Default vocabularies for common operators, metric units, QoS & business terms

Language (or Technology) Independence

- Model is 'abstract' : defines the form, but not the tokens
- Generic notion of Service & SLA (not restricted to Web-Services)
- Compatible with existing XML standards (WSDL & WS-Agreement), but not restricted to XML.