
Experiences from building a WS–Agreement document analyzer tool (Including use cases in WS–Agreement and WSAg4People) v1.0

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Experiences from building a WS–Agreement document analyzer tool¹

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Abstract The WS–Agreement specification has gained a wide acceptance in the web services community as a means for establishing service level agreements between service providers and consumers. Although there are some implementations of the WS–Agreement protocol, the lack of user–friendly tools for the edition and analysis of WS–Agreement documents is still a problem. In this paper, we present some experiences gained during the design and implementation of the ADA framework and the *WSAg4People* language. On the one hand, ADA is a framework for the automated analysis of WS–Agreement documents, including the detection and explanation of conflicts, which can be used through a web service API and a web–based user interface. On the other hand, the *WSAg4People* language is a plain–text language equivalent to the XML–based language proposed in the WS–Agreement specification, which is much easier to read and write for human users than its XML–based counterpart. During our work, we have had to make decisions about the *variability points* in WS–Agreement and we have also identified potential enhancements to the current specification that could be of interest for the WS–Agreement practitioners in particular and for the web services community in general.

Key Words: WS–Agreement, SLA, agreement document analysis

1 Introduction

In a context of *service–oriented computing* (SOC), the provision and consumption of services should take place under the supervision of *service level agreements* (SLAs). In the last years, the WS–Agreement specification [1] has become the most relevant proposal related to SLAs in SOC. This specification describes both an XML–based language for specifying SLA documents and a web services protocol for the publication, discovery, and monitoring of SLAs between two parties, usually a service provider and a service consumer, or other entities acting on behalf of them.

Despite its popularity, the inherent built–in flexibility in the WS–Agreement specification presents some challenges for the automated or manual processing of compliant SLA documents. Although there are some implementations of the WS–Agreement protocol (see [2] for a comparison among them), the lack of user–friendly tools for the edition and analysis of WS–Agreement documents is still a problem to be solved in order to make the acceptance and use of WS–Agreement wider.

Our previous works on applying *constraint programming* to the automated procurement of web services [3], extending WS–Agreement with temporal awareness [4, 5], and explaining inconsistencies in WS–Agreement documents [6, 7], have paved the way for the development of ADA (*Agreement Document Analyser*), a framework for the automated analysis of WS–Agreement documents, including the detection of conflicts and their explanations. Together with ADA, on the one hand we have developed the *WSAg4People* language, which is a plain–text language with the same structure and semantics than the XML–based language proposed in [1] but much easier to read and write for human users than its XML–based counterpart. On the other hand, we have also developed a web–based rich user interface (<http://www.isa.us.es/ada>) for the edition and analysis of WS–Agreement documents that use both the ADA framework and the *WSAg4People* language in a user–friendly manner.

In this paper, we provide an introduction to ADA, *WSAg4People* and its user interface, and we also discuss some lessons learned during their development such as the decisions we have had to make about the *variability points* included as extension mechanisms in the WS–Agreement specification, developing XML–based *domain–specific languages* (DSLs) for that purpose. We have also identified some potential enhancements to the current WS–Agreement specification, that could be of interest for the community of WS–Agreement practitioners in particular and for the web services community in general.

¹ This work without the appendixes has been submitted to ICSOC’10 international conference.

46 The rest of the paper is structured as follows. Section 2 briefly introduces the WS–Agreement document
47 structure and variability points for those readers not familiar with [1]. Section 3 presents the ADA frame-
48 work, including some concrete DSLs, the *WSAg4People* notation and its web–based rich user interface
49 for the edition and analysis of SLA documents. Section 4 discusses potential enhancements to the current
50 WS–Agreement specification. Finally, Section 5 details the conclusions and future work.

51 2 WS–Agreement documents

52 The structure and semantics of the XML–based language proposed for SLA documents in [1] are briefly
53 discussed in this section from a practical point of view.²

54 2.1 WS–Agreement document general structure

55 The WS–Agreement recommendation [1] specifies two types of agreement documents, *offers* and *templates*,
56 as can be seen on the left of the UML class diagram³ in Fig. 1. Agreement offers are supposed to be
57 created by *agreement initiators* from discovered agreement templates previously published by *agreement*
58 *responders*.

59 Agreement templates can be considered as partially completed offers with default values for *offer items*,
60 which describe the relevant features of the services to be agreed upon. Templates can include *agreement*
61 *creation constraints* restricting the space of *template–compliant* offers that can be created from them. Cre-
62 ation constraints can specify not only the mandatory presence of specific offer items and their acceptable
63 values but also complex constraints involving more than one offer item.

64 2.2 WS–Agreement document metadata

65 From an abstract point of view, a WS–Agreement document is composed of *agreement metadata* and *agree-*
66 *ment terms*. Agreement metadata (identified by the *metadata* stereotype in the diagram in Fig. 1) include
67 an agreement identifier, an optional agreement name and an *agreement context*. The context contains op-
68 tional information about the agreement parties, the agreement’s lifetime, and references to the template
69 from which the agreement offer is created if this is the case. The only mandatory information in the context
70 is whether the service provider is the agreement *initiator* or *responder*.

71 2.3 WS–Agreement document terms

72 The terms section of a WS–Agreement document describes both the services to be agreed upon and the
73 guarantees on such services. Both kinds of elements can be grouped logically using *and*, *or* and *xor*–like
74 compositors, thus allowing the specification of agreement options and alternatives. At the top level of the
75 terms section, all terms must be inside an *and*–like compositor.

76 2.4 WS–Agreement service terms

77 Service terms describe those service features that are relevant for an agreement, including *service descrip-*
78 *tion terms*, *service references* and *service properties*. All service terms must have a name and are related
79 to one of the services under agreement by means of the *service name* attribute in the corresponding XML
80 elements, i.e. they can be considered as being *tagged* or *prefixed* with a service name.

81 Service description terms include the offer items that must be set by the agreement initiator when cre-
82 ating an offer and whose default values are specified by the agreement responder in a template. Service

² The WS–Agreement specification [1] contains some internal differences between the description in natu-
ral language and the proposed XML schema available at [http://schemas.ggf.org/graap/2007/03/
ws-agreement](http://schemas.ggf.org/graap/2007/03/ws-agreement). When necessary, we have taken the XML schema as the prevalent option since we are focused on
the automated treatment of SLAs.

³ The UML class diagram in Fig. 1 represents our interpretation of the metamodel described by the XML schema
specified in [1].

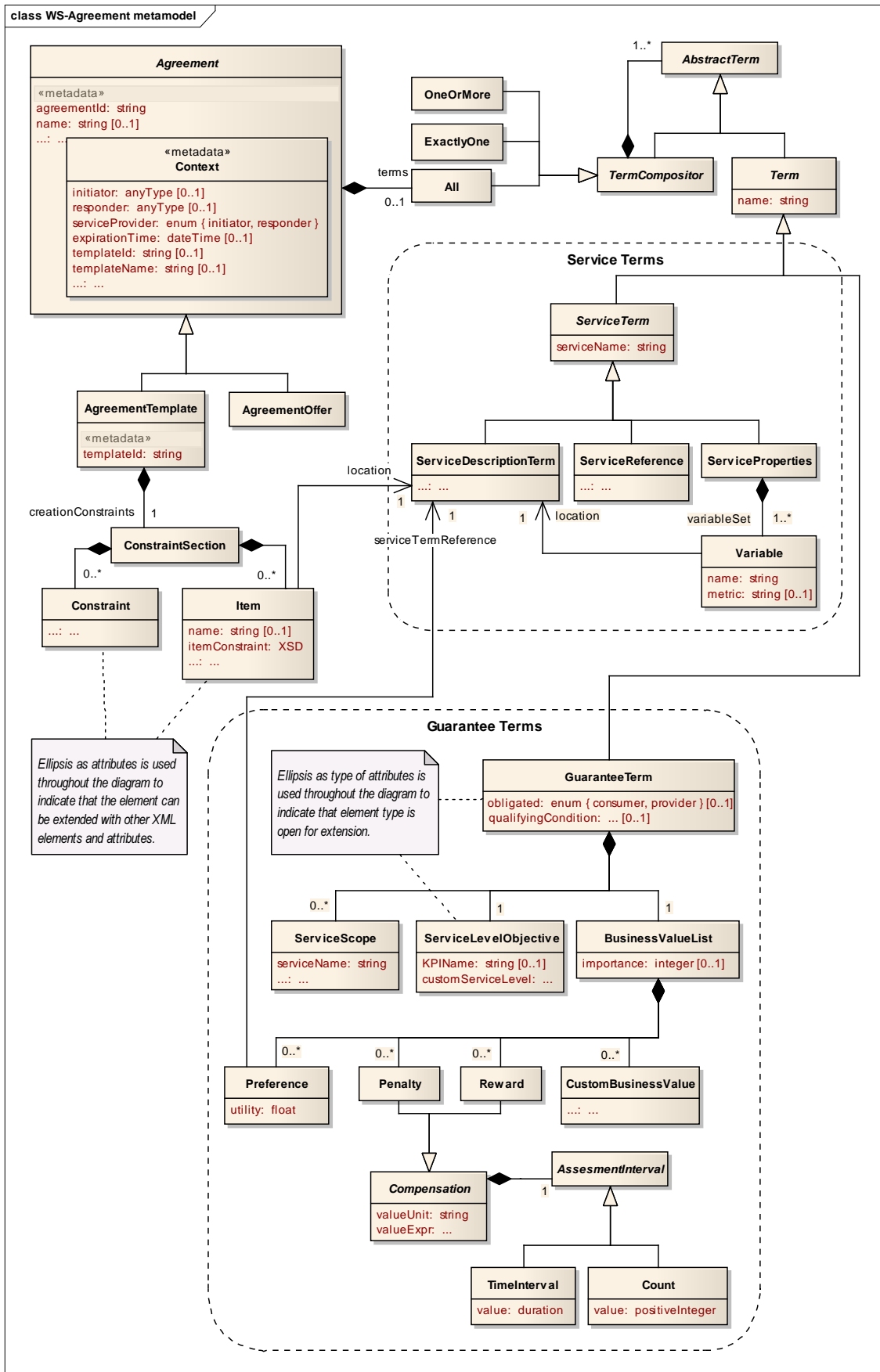


Figure 1: UML metamodel of WS-Agreement documents

83 references provide endpoint references for the services under agreement. Service properties define named
 84 sets of *variables* that can be used for the specification of *service-level objectives* and must be therefore
 85 considered for agreement monitoring. All variables must be related to one or more offer items inside some
 86 service description term.

87 2.5 WS-Agreement guarantee terms

88 Guarantee terms describe the assurance on *service quality* that an *obligated party*, usually the service
 89 provider, must fulfil as part of the SLA. Since guarantee terms can apply to several of the services (or
 90 service offer items) under agreement, they can be *scoped* with the corresponding service names (and ser-
 91 vice offer items references if needed). They can also be guarded by an optional *qualifying condition*, i.e.
 92 only if the qualifying condition holds the service quality is guaranteed. The structure of a guarantee term in
 93 the WS-Agreement specification also includes a *service level objective* (SLO) and a list of *business values*.

94 The SLO of a guarantee term is a predicate defined over service offer items and variables and over ex-
 95 ternal factors such as date, time, etc. Optionally, SLOs can be related to externally defined *key performance*
 96 *indicators* (KPIs).

97 The business values of a guarantee term can include the relative *importance* of meeting the SLO, *penal-*
 98 *ties* and *rewards* to be assessed for meeting the SLO or not, *preferences* for different alternatives of meeting
 99 the SLO, and other domain-specific customized business values. Penalties and rewards are expressed as the
 100 amount of *value units* (usually money) the obligated party loses (or earns) for not meeting (or meeting)
 101 the associated SLO during an *assessment interval*, which can be expressed as a *duration* (a week, a month,
 102 etc.) or as a service-specific *count* (number of service invocations, for example). Preferences are expressed
 103 as a list of pairs indicating the *utility value* of using a specific offer item to achieve the SLO associated to
 104 the guarantee term.

105 3 ADA: a WS-Agreement document analysis framework

106 ADA is an *Agreement Document Analysis* framework developed in Java mainly based on our previous theo-
 107 retical works on applying the *constraint satisfaction problem* (CSP) paradigm to the automated procurement
 108 of web services [3] and explaining inconsistencies in WS-Agreement documents [6, 7]. The main goal
 109 of ADA is to provide WS-Agreement practitioners not only with the automated capabilities of checking
 110 consistency and compliance properties of agreement offers and templates but also with the corresponding
 111 explanations if some problems are identified once checks are performed.

112 Foreseeing the need for more analysis operations, we have designed a *plug-in oriented architecture* for
 113 ADA so it could be easily extended in the future with new capabilities (see Fig. 2). Currently, ADA uses the
 114 open source Java library for CSP Choco [8], although other solvers, not necessarily CSP-oriented, could be
 115 used in the future.

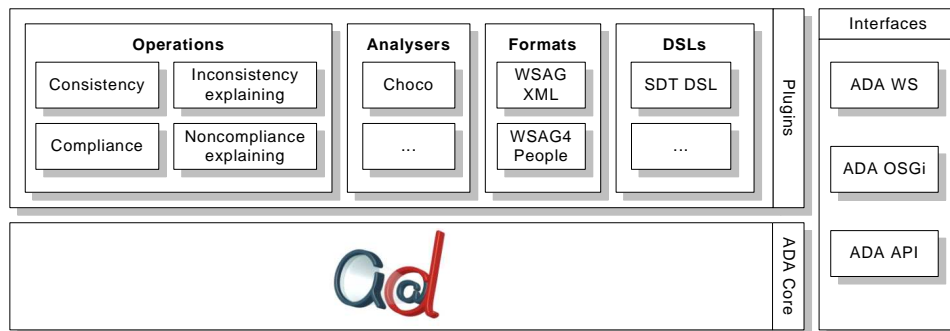


Figure 2: Architecture of the ADA framework

116 On the other hand, developers can use ADA through a conventional Java *application programming*
 117 *interface* (ADA-API); as an OSGi *bundle* [9] (ADA-OSGi), for example for its integration in the *Eclipse*
 118 *platform* [10]; or as a web service (ADA-WS) automatically generated from the OSGi bundle and deployed
 119 into an OSGi web container.

120 In order to provide the community of WS-Agreement practitioners with a user-friendly environment
 121 for the edition and analysis of WS-Agreement documents and get feedback for our research, we have
 122 developed a rich user interface that can be accessed via web using the *JavaFX* technology [11] at the ADA
 123 website (<http://www.isa.us.es/ada>), including demonstration videos in English and Spanish.

124 Some of the most relevant features of the rich user interface are the following, where the number in
 125 parenthesis refers to the corresponding part of Fig. 3: (1) *syntax highlight*; (2) *skeletons* for the creation of
 126 agreement documents, specially developed for users not familiar with the WS-Agreement complexity; (3)
 127 *multiple views* of agreement documents, including an XML view, a *WSAg4People* view and a *tree* view, that
 128 can be easily switched by the user using the button panel in (4); (5) a *wizard* to launch analysis operations
 129 and several document samples preloaded, in order to reduce the learning curve.

130 3.1 DSLs choices in ADA

131 The XML-based language for SLAs specified in [1] is intentionally open for extension in order to allow
 132 a high degree of flexibility. This flexibility is based on the use of specific XML-based DSLs in some
 133 *variability points*, thus allowing a whole *family* of WS-Agreement languages as depicted in the *feature*
 134 *model* [12] in Fig. 4, developed by the authors of this paper taking into account not only [1] but also the

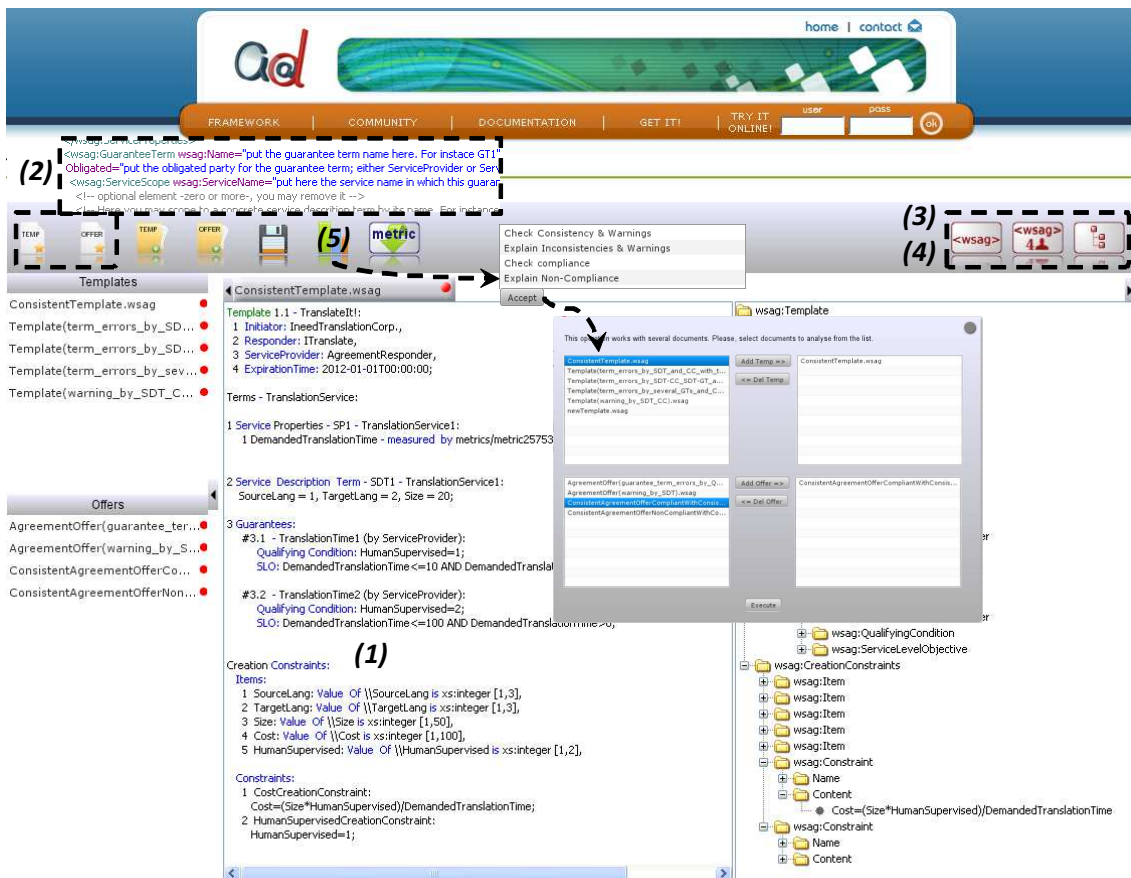


Figure 3: Screenshot of the rich user interface of the ADA framework

usage results of different WS–Agreement terms described in [2]. A brief description of these variability points is provided as follows.

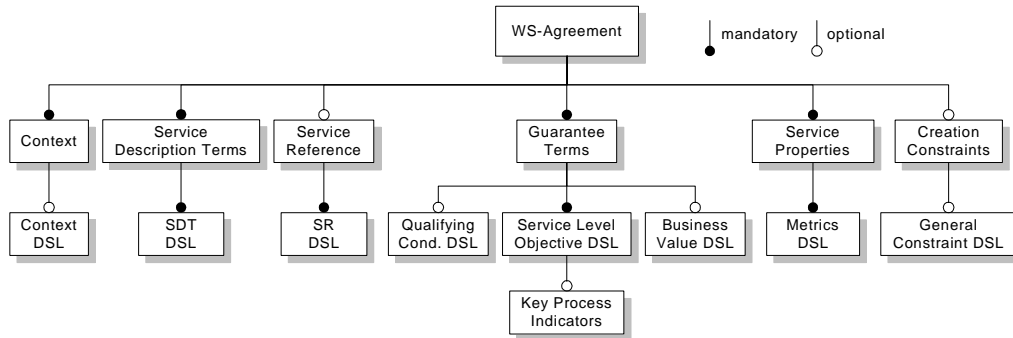


Figure 4: WS–Agreement feature model (variability points)

- **Context DSL:** the agreement metadata in the *context* element can be extended with any information needed by means of new XML elements and attributes. For example, some of the authors of this paper have proposed the extension of metadata for introducing temporal awareness in WS–Agreement [4, 5].
- **Service Description Term DSL:** the offer items describing the relevant features of offered or requested services must be expressed using a DSL. Most of the available examples of WS–Agreement documents [2, 1, 13] use the *Job Submission Description Language* [14] or WSDL as service description term DSLs.
- **Service Reference DSL:** the specification of the endpoint references for the services under agreement is considered as *domain specific* by the WS–Agreement recommendation and is therefore left open to the use of XML–based DSLs.
- **Guarantee Term DSLs:** *guarantee terms* can be extended using three different DSLs, described below.
 - **Qualifying condition DSL:** the *qualifying condition* can be expressed using any *predicate-oriented* DSL. For example, in [15], the WSLA [16] *predicate* tags are used as the qualifying condition DSL.
 - **Service Level Objective DSL:** in a similar way to the qualifying condition, the *service level objective* must be expressed using any predicate-oriented DSL. The only difference with the qualifying condition is the possibility to use externally defined, domain-specific KPIs in the expressions.⁴ The set of domain-specific KPIs can be considered as another variability point.
 - **Business Value DSL:** some *value* expressions inside *penalty* and *reward* elements, and the concept of *business value* itself can be expressed using DSLs.
- **Service property DSL:** the service properties are described as sets of variables defined over externally defined, domain-specific metrics, which can be considered as another variability point.
- **Creation constraint DSL:** the creation constraints of an agreement template can be specified at an offer item level using a subset of XSD [17], or at a general level using any predicate-oriented DSL. The former is fixed in the specification but the latter can be considered as another variability point.

In order to achieve our goals on the analysis of WS–Agreement documents, some DSLs must be set as the concrete choice of the previously discussed variability points. In ADA, we have specified three DSLs described as follows.

3.1.1 Service description term DSL

From our point of view, service description terms (SDTs) can be considered as named sets of offer items with their corresponding values, independently of their domain-specific, internal (possibly hierarchical)

⁴ The KPI element specification in section 4.2.6.3.1 of [1] is different from the one in the XML schema in the same document.

167 organization. With this in mind, we have decided to use a very generic language for the SDTs and their
 168 offer items, whose metamodel and an example in XML and *WSAg4People* (see Sec. 3.2) is shown in Fig.
 169 5. We consider that the advantages of using a generic DSL for SDTs are more relevant than the potential
 170 expressiveness of more specific (and complex) DSLs like JSDL or WSDL for example. Applying this
 171 generic approach, we can automatically process any SLA document independently of the specific nature
 172 of the services to be agreed upon, considering that the transformation from any XML-based DSL to our
 173 proposed format is straightforward.

174 3.1.2 Predicate-oriented DSL

175 Three of the previously identified variability points can be set with predicate-oriented DSLs, namely the
 176 DSLs for the expressions needed in service level objectives (SLOs), qualifying conditions (QFs) and general
 177 creation constraints (GCCs). Taking into account our experience on applying the CSP paradigm to several
 178 software engineering problems (see [12] for example), we have designed a plain-text predicate-oriented
 179 DSL that can be easily fed into any CSP solver. The abstract syntax of the predicate-oriented DSL is shown
 180 below, where *ID* is the identifier of an offer item or a service property variable and *lit* is a literal value. An
 181 example of use in both XML and *WSAg4People* is shown in Fig. 6.

$$\begin{array}{ll}
 P ::= P \text{ op}_L P \mid T & \text{-- predicate, where } \text{op}_L \in \{\wedge \mid \vee \mid \neg \mid \Rightarrow \mid \Leftrightarrow\} \\
 T ::= E \text{ op}_C E & \text{-- term, where } \text{op}_C \in \{= \mid \neq \mid > \mid \geq \mid < \mid \leq\} \\
 E ::= ID \text{ op}_A ID \mid ID \mid lit & \text{-- expression, where } \text{op}_A \text{ is algebraic operator defined} \\
 & \text{-- on the domain of the offer items, variables and literals}
 \end{array}$$

182 3.1.3 Metrics DSL

183 According to [1], the (mathematical) domain of service property variables can be specified by *domain-*
 184 *specific metrics*. In ADA, we have developed a simple yet effective metrics DSL for the definition of global
 185 metrics that can be used in any SLA document. An example of the metrics definition is shown in Fig. 7.

186 3.2 WSAg4People: a plain-text format for WS-Agreement documents

187 Although obviously readable for humans, XML is not as understandable as plain text, even if it is formatted
 188 for that purpose. We consider that, in order to make WS-Agreement easier to work with, a more human-
 189 friendly format than XML should be used while preserving the XML format for computer-related tasks.
 190 Our proposal is *WSAg4People*, a plain-text language equivalent to the XML schema specified in [1] but
 191 much easier to handle by humans.⁵ The mapping between both formats is shown in Tables 1 and 2.

⁵ There are examples available at appendix A and <http://www.isa.us.es/ada>

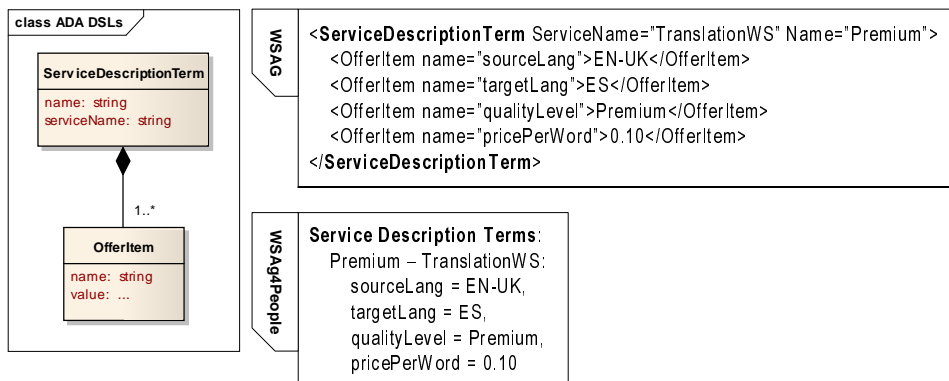


Figure 5: Metamodel and examples of the DSL for SDTs in ADA

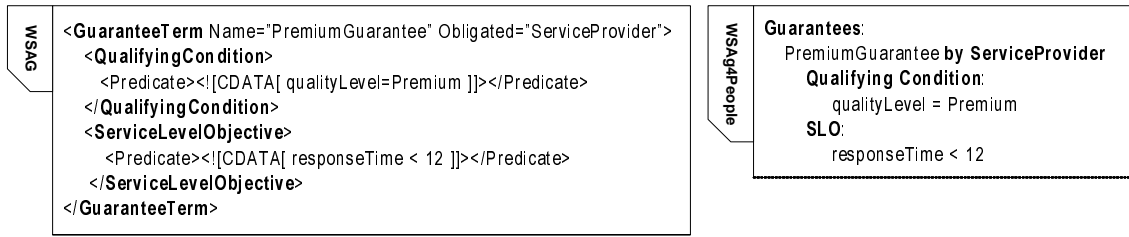


Figure 6: Examples of the DSL for predicates in ADA

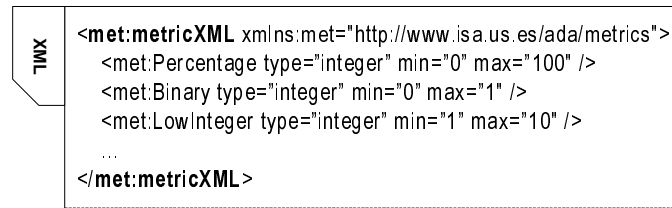


Figure 7: Example of the DSL for metrics in ADA

WS-Agreement XML Element	WSAg4People Mapping
<pre> <Template/AgreementOffer TemplateId/AgreementId="id" ...> <Name>name</...> <Context> <AgreementInitiator>initiator name</...>? <AgreementResponder>responder name</...>? <ServiceProvider>AgreementInitiator AgreementResponder</...> <ExpirationTime>datetime</...>? <TemplateId>templateId</...>? <TemplateName>templateName</...>? </Context> <Terms Name="terms set name"> <All> <!-- implicit All including terms and compositors as follows --> { <All>...</...> <OneOrMore>...</...> <ExactlyOne>...</...> <ServiceDescriptionTerm>⁽¹⁾...</...> <ServiceProperties>⁽¹⁾...</...> <GuaranteeTerm>⁽¹⁾...</...> }+ </All> </Terms> <CreationConstraints>...</...>? </Template/AgreementOffer> </pre>	<pre> Template/AgreementOffer id - name Initiator: initiator name?, Responder: responder name?, ServiceProvider: AgreementInitiator AgreementResponder, ExpirationTime: datetime?, TemplateId: templateId?, TemplateName: templateName? Terms - terms set name { All:... One Or More between:... Exactly One between:... Service Properties⁽¹⁾:... Service Description Terms⁽¹⁾:... Guarantees⁽¹⁾:... }+ Creation Constraints? </pre>
<pre> <All> <OneOrMore> <ExactlyOne> term/terms compositor₁,... term/terms compositor_n </...> </pre>	<pre> All: One Or More between: Exactly One between: term/terms compositor₁,... term/terms compositor_n </pre>
<pre> <CreationConstraints> <Item Name="item_i"> <Location>location_i</...> <ItemConstraint>itemConstraint_i</...> </Item> </pre>	<pre> Creation constraints: Items: item_i: Value of location_i is itemConstraint_i </pre>
<pre> <Constraint> <Name>constraint_i</...> <Content>GC expression_i</...> </Constraint> </CreationConstraints> </pre>	<pre> Constraints: constraint_i: GC expression_i,... </pre>

⁽¹⁾ The mapping of these terms is included in Table 2

Table 1: Mapping from WS-Agreement to WSAg4People: Metadata and Terms compositors

WS-Agreement XML Element	WSAg4People Mapping
<pre><ServiceDescriptionTerm Name="SDT" ServiceName="service"> <OfferItem name="OfferItem₁">value₁</...>,... <OfferItem name="OfferItem_n">value_n</...> </ServiceDescriptionTerm></pre>	<p>Service Description Terms: 1 <i>SDT</i> - <i>service</i> <i>OfferItem₁</i> = <i>value₁</i>,... <i>OfferItem_n</i> = <i>value_n</i></p>
<pre><ServiceProperties Name="SP" ServiceName="service"> <VariableSet> <Variable Name="var₁" Metric="metric₁"> <Location>location₁</...> </Variable> <Variable Name="var_n" Metric="metric_n"> <Location>location_n</...> </Variable> </VariableSet> </ServiceProperties></pre>	<p>Service Properties: 1 <i>SP</i> - <i>service</i> 1.1 <i>var₁</i> - measured by <i>metric₁</i> - related to <i>location₁</i>, 1.2 <i>var_n</i> - measured by <i>metric_n</i> - related to <i>location_n</i></p>
<pre><GuaranteeTerm Name="GT" Obligated="ServiceProvider/Consumer"> <ServiceScope ServiceName="service">scope</...>* <QualifyingCondition>QC expr</...>? <ServiceLevelObjective> <CustomServiceLevel>SLO expr</...> <KPITarget> <KPIName>KPI</...> <Target>target</...> </...> </ServiceLevelObjective> <BusinessValueList> <Importance>importance</...>? <Penalty> <AssesmentInterval> <TimeInterval>time</...> <Count>count</...> </...> <ValueUnit>unit</...>? <ValueExpr>expr</...> </Penalty>* <Reward>...</...>* <!-- as Penalty structure --> </BusinessValueList> <Preference> <ServiceTermReference>ref_i</...>* <Utility>utility_i</...>* </Preference>? <CustomBusinessValue>customBV</...>* </GuaranteeTerm></pre>	<p>Guarantees: Guarantee <i>GT</i> (by ServiceProvider/Consumer) Scopes: <i>service</i> - <i>scope</i>*, Qualifying Condition: <i>QC expr</i>? , SLO: <i>SLO expr</i> KPI: <i>KPI = target</i> Relative importance: <i>importance</i>? Penalty: <i>expr, unit.</i> <i>Assessed in time</i> <i>count</i>*, Reward: <i>expr, unit.</i> <i>Assessed in time</i> <i>count</i>*, Utility if selected: <i>ref_i -> utility_i</i>*, Business Value: <i>customBV</i>*</p>

Table 2: Mapping from WS-Agreement to WSAg4People: Terms and Creation Constraints

192 4 Potential enhancements to WS–Agreement documents

193 In this section we present some of the potential enhancements that could be applied to the WS–Agreement
194 documents but have not been applied in the ADA framework, since one of our primary goals was to be
195 compliant with [1]. The purpose of this section is to share our reflections with other WS–Agreement prac-
196 titioners and provide some suggestions for further versions of the specification.

197 4.1 Agreement metadata generalization

198 Although agreement metadata was not a problem during the building of ADA, we think that some of the
199 metainformation included in the agreement *context* could be treated more uniformly using a *meta* tag like
200 in XHTML. This would allow the addition of new metadata in future versions of the specification without
201 affecting existing tools.

202 4.2 Relationship between service description terms and service properties

203 After analysing relevant bibliography such as [1, 13, 2, 18], we think that the semantics of the relationship
204 between SDTs and service properties (SPs) should be clarified. We have identified two different approaches
205 to these semantics.

206 The first one seems to promote the use of XML–based DSLs inside SDTs (like JSDL or WSDL, for
207 example) and the declaration of as many SP variables as needed in order to name and identify relevant offer
208 items inside SDTs using XPath expressions. In other words, SP variables are *pointers* to relevant data inside
209 SDTs. In this approach, tools do not have to deal with the semantics of SDTs, only with SP variables and
210 their associated XPath expressions providing their values.

211 The second approach considers offer items inside SDTs and variables in SPs as different concepts. In
212 this approach, tools must know the semantics of the DSL used in SDTs because variables are defined only
213 for those SPs that are *measurable* and *exposed* [1, page 20], something we understand as *monitorable*. That
214 means that all the offer items that are relevant for the agreement but are not monitorable are not associated
215 with any SP variable. In this way, the XPath expressions associated to what we consider *monitorable vari-*
216 *ables* are *pointers* to the SDTs whose properties are being monitored. We think that, especially when only
217 one service is to be agreed upon, the XPath expressions are clearly dispensable if this approach is chosen,
218 as reported in [2, page 22].

219 In ADA, we have chosen the second approach, as presented in Sect. 3.1, because we prefer to deal with
220 as less XML–based DSLs as possible, promoting generic solutions. We have also considered that the only
221 difference between SDT offer items and SP variables is the monitorability of the latter, so their declaration
222 in SLA documents could be merged simply by indicating which of them are monitorable and can therefore
223 be used in guarantee terms (see Sect. 4.6).

224 4.3 Default, domain–independent KPIs and metrics

225 According to [1], the predicate expressions used in the SLOs can use offer items, SP variables and externally
226 defined, domain–specific KPIs. There are a number of *domain–independent* KPIs (with their corresponding
227 *metrics*) that should be available for agreements by default without having to be redefined once and again.
228 By *domain–independent* we mean KPIs that make sense independently of the nature of the services to be
229 agreed upon, for example *response time*, *availability*, *service request rate*, *mean time between failure*, *mean*
230 *time to recover*, etc. The metrics defined with the default set of KPIs could also be used for SP variables
231 and for offer item constraints, avoiding the need of defining usual types like *time*, *date*, *positive integer*, etc.

232 4.4 Semantics of term compositors

233 To avoid structural complexity, we think that one potential enhancement would be not to compose the XML
234 elements themselves, but name the composable elements and introduce composition expressions using their

235 corresponding names. This would reduce structural complexity and allow the reuse of partial (named) agree-
 236 ment definitions. Another enhancement would be to left service properties out of composition, whatever
 237 approach is adopted for their semantics, because of their merely declarative nature.

238 4.5 XML-independent metamodel

239 We think that the WS-Agreement specification is too dependent on XML syntax. Our background on soft-
 240 ware engineering in general and in conceptual modelling in particular, makes us miss an explicit conceptual
 241 model as the foundations of the XML schema in [1]. We think that some decisions like the use of XPath
 242 expressions in several elements or the use of XSD inside WS-Agreements item creation constraints do not
 243 facilitate the work of tool developers and make very difficult to understand the semantics of WS-Agreement
 244 documents, especially for people not familiar with the intricacies of XML schema. From our point of view,
 245 XML should be considered simply as a means for the serialization of SLA documents, but not for driving
 246 their structure and semantics.

247 4.6 Simplified structure of agreement documents

248 Considering some of the enhancements described in this section, a simplified structure for WS-Agreement
 249 documents can be proposed, as depicted in Fig. 8, where an agreement document has two main sections,
 250 *metadata* and *terms*, plus an optional section of *creation constraints* for templates only.⁶

251 Apart from metadata, the first section can contain external links to KPIs and types definition. In the
 252 *terms* section, *offer items* and *monitorable properties* are declared, with the possibility of indicating which
 253 offer items are optional. The other components in the terms section are the logical composition of *offer*
 254 *descriptions* (assignments to offer items previously declared) and *guarantees*. Finally, creation constraints
 255 are simplified because the mandatory presence of offer items or their types do not have to be specified (it is
 256 specified in the offer items declaration), only general constraints should be specified (if needed).

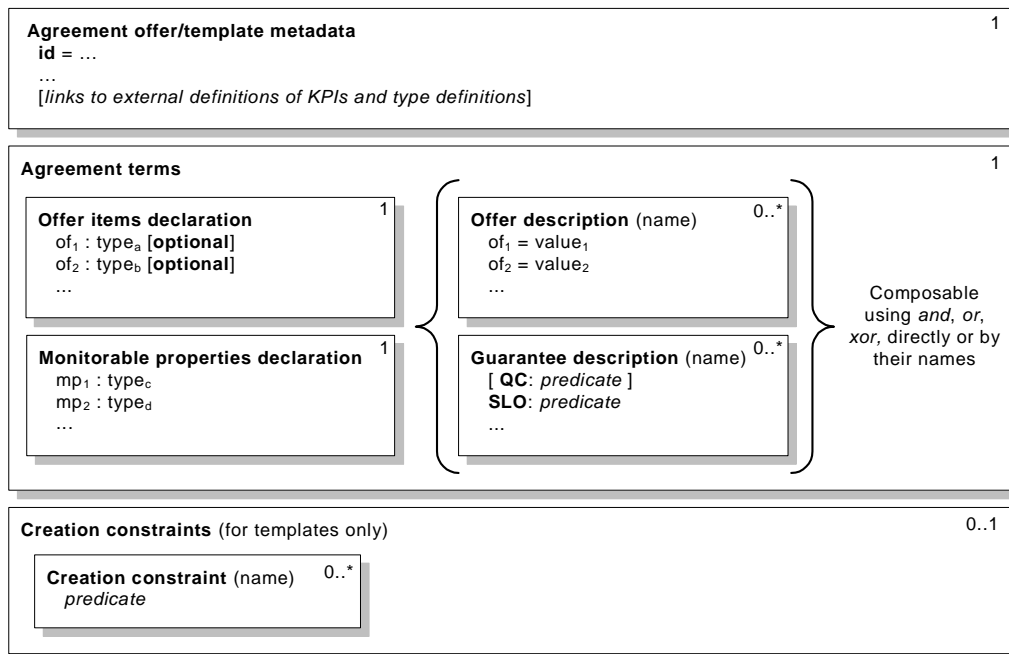


Figure 8: Simplified structure for WS-Agreement documents

⁶ The cardinality of sections is indicated at the top right corner of their boxes in Fig. 8.

257 5 Conclusions and future work

258 In this paper, we have tackled the lack of tools for the analysis and user-friendly edition of WS-Agreement
259 documents. The provided contributions are the following:

- 260 1. An UML metamodel of the XML schema for WS-Agreement documents that can facilitate the com-
261 prehension of its semantics, together with a feature model of its variability points and their associated
262 DSLs.
- 263 2. A brief introduction to the ADA framework, including its main capabilities, architecture, associated
264 DSLs, the *WSAg4People* language, and its web-based user interface available at <http://www.isa.us.es/ada>. We expect that the publication of WS-Agreement examples in technical reports and ar-
265 ticles using the *WSAg4People* notation, easier to understand than its XML-based counterpart, would
266 help the web services community know WS-Agreement better and eventually adopt it.
- 267 3. Some potential enhancements to the current WS-Agreement specification derived from our experiences
268 in developing the ADA framework, that could be of interest for the community of WS-Agreement
269 practitioners in particular and for the web services community in general.

271 However, there are still some open issues that require further research. For example, developing new
272 analysis operations such as the comparison of agreement documents for semantic equivalence; evaluat-
273 ing the use of other solvers apart from CSP-oriented ones; improving the temporal-awareness of WS-
274 Agreement documents as proposed in [5]; and integrating ADA capabilities as a service engine of an *En-*
275 *terprise Service Bus* (ESB). This would allow ADA to be used together with the proposed service engine
276 of the *Framework for Automated Service Trading* (FAST) [19], thus integrating the automated analysis of
277 SLAs in the whole service trading process.

278 Acknowledgments

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280 comments and suggestions helped us to improve the paper substantially. We also thank Jose Galindo for his
281 technical support during the evaluation of our approach.

282 References

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288 forge.gridforum.org/sf/go/doc15752?nav=1.
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315 WSLASpecV1-20030128.pdf](http://www.research.ibm.com/wsla/WSLASpecV1-20030128.pdf).
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317 <http://www.w3.org/TR/2004/REC-xmlschema-0-20041028/>.
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322 A Use cases

323 In this appendix, we present some use cases⁷ included in the current version of the rich user interface
324 (ADA-FrontEnd) depicted in Fig. 3 of Section 3 that can be accessed via web at the ADA website (<http://www.isa.us.es/ada>). The use cases regard with a translation service providing scenario in which
325 news agencies prepare agreement offers to be sent to the translation service provider. For each operation,
326 associated use cases are detailed in the XML-Schema of [1] and in WSAg4People, and the metrics for
327 service properties is defined in the external XML document 1.
328

```
329 <metricXML>  
330 <Percentage type="integer" min="1" max="100"/>  
331 <Time type="integer" min="1" max="100"/>  
332 <BinaryInteger type="integer" min="0" max="1"/>  
333 <LowInteger type="integer" min="1" max="10"/>  
334 <MediumInteger type="integer" min="1" max="100"/>  
335 <LargeInteger type="integer" min="1" max="500"/>  
336 </metricXML>  
337
```

External XML metrics document 1: Metrics for translation service properties

339 A.1 Operation Consistency Checking

340 The WS-Agreement template of document 2 and its equivalent WSAg4People document 3 are consistent
341 templates because they do not include any conflict inside themselves.

```
342 <?xml version="1.0" encoding="UTF-8"?>  
343 <wsag:Template wsag:TemplateId="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
344 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"  
345 xmlns:xs="http://www.w3.org/2001/XMLSchema"  
346 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd  
347 http://www.w3.org/2001/XMLSchema XMLSchema.xsd">  
348 <wsag:Name>TranslateIt!</wsag:Name>  
349 <wsag:Context>  
350 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>  
351 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>  
352 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>  
353 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>  
354 </wsag:Context>  
355 <wsag:Terms wsag:Name="TranslationService">  
356 <wsag:All>  
357 <wsag:ServiceProperties wsag:Name="SP1"  
358 wsag:ServiceName="TranslationService1">  
359 <wsag:VariableSet>  
360 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">  
361 <!-- Time in minutes -->  
362 <wsag:Location>\\DemandedTranslationTime</wsag:Location>  
363 </wsag:Variable>  
364 </wsag:VariableSet>  
365 </wsag:ServiceProperties>  
366 <wsag:ServiceDescriptionTerm wsag:Name="SDT1"  
367 wsag:ServiceName="TranslationService1">  
368 <OfferItem name="SourceLang">1</OfferItem> <!-- SourceLang "1" = EN-UK -->  
369 <OfferItem name="TargetLang">2</OfferItem> <!-- TargetLang "2" = SP -->  
370 <OfferItem name="Size">20</OfferItem>  
371 </wsag:ServiceDescriptionTerm>  
372 <wsag:GuaranteeTerm wsag:Name="TranslationTime1"  
373 wsag:Obligated="ServiceProvider">  
374 <wsag:QualifyingCondition>HumanSupervised=1</wsag:QualifyingCondition>  
375 <wsag:ServiceLevelObjective>  
376 <wsag:CustomServiceLevel>  
377 DemandedTranslationTime&lt;=10 AND DemandedTranslationTime&gt;0  
378 </wsag:CustomServiceLevel>  
379 </wsag:ServiceLevelObjective>  
380 </wsag:GuaranteeTerm>  
381 <wsag:GuaranteeTerm wsag:Name="TranslationTime2"  
382 wsag:Obligated="ServiceProvider">  
383 <wsag:QualifyingCondition>HumanSupervised=2</wsag:QualifyingCondition>  
384 <wsag:ServiceLevelObjective>  
385 <wsag:CustomServiceLevel>  
386 DemandedTranslationTime&lt;=100 AND DemandedTranslationTime&gt;0  
387 </wsag:CustomServiceLevel>  
388 </wsag:ServiceLevelObjective>  
389 </wsag:GuaranteeTerm>  
390
```

⁷ The use cases only include integer variable because currently ADA only allows such kind of variables as proof-of-concept.

```

391     </wsag:All>
392 </wsag:Terms>
393 <wsag:CreationConstraints>
394   <wsag:Item wsag:Name="SourceLang">
395     <wsag:Location>\\SourceLang</wsag:Location>
396     <wsag:ItemConstraint>
397       <xs:restriction base="xs:integer">
398         <xs:minInclusive value="1"/>
399         <xs:maxInclusive value="3"/>
400       </xs:restriction>
401     </wsag:ItemConstraint>
402   </wsag:Item>
403   <wsag:Item wsag:Name="TargetLang">
404     <wsag:Location>\\TargetLang</wsag:Location>
405     <wsag:ItemConstraint>
406       <xs:restriction base="xs:integer">
407         <xs:minInclusive value="1"/>
408         <xs:maxInclusive value="3"/>
409       </xs:restriction>
410     </wsag:ItemConstraint>
411   </wsag:Item>
412   <wsag:Item wsag:Name="Size"> <!-- Size in A4-pages -->
413     <wsag:Location>\\Size</wsag:Location>
414     <wsag:ItemConstraint>
415       <xs:restriction base="xs:integer">
416         <xs:minInclusive value="1"/>
417         <xs:maxInclusive value="50"/>
418       </xs:restriction>
419     </wsag:ItemConstraint>
420   </wsag:Item>
421   <wsag:Item wsag:Name="Cost">
422     <wsag:Location>\\Cost</wsag:Location>
423     <wsag:ItemConstraint>
424       <xs:restriction base="xs:integer">
425         <xs:minInclusive value="1"/>
426         <xs:maxInclusive value="100"/>
427       </xs:restriction>
428     </wsag:ItemConstraint>
429   </wsag:Item>
430   <wsag:Item wsag:Name="HumanSupervised">
431     <wsag:Location>\\HumanSupervised</wsag:Location>
432     <wsag:ItemConstraint>
433       <xs:restriction base="xs:integer">
434         <xs:minInclusive value="1"/> <!-- disabled the human supervision -->
435         <xs:maxInclusive value="2"/> <!-- enabled the human supervision -->
436       </xs:restriction>
437     </wsag:ItemConstraint>
438   </wsag:Item>
439   <wsag:Constraint>
440     <Name>CostCreationConstraint</Name>
441     <Content>Cost=(Size*HumanSupervised)/DemandedTranslationTime</Content>
442   </wsag:Constraint>
443   <wsag:Constraint>
444     <Name>HumanSupervisedCreationConstraint</Name>
445     <Content>HumanSupervised=1</Content>
446   </wsag:Constraint>
447 </wsag:CreationConstraints>
448 </wsag:Template>

```

WS-Agreement (XML) document 2: Consistent template 1.0

```

450 Template 1.0 - TranslateIt!
451 1 Initiator: IneedTranslationCorp. ,
452 2 Responder: ITranslate ,
453 3 ServiceProvider: AgreementResponder ,
454 4 ExpirationTime: 2012-01-01T00:00:00;
455
456 Terms - TranslationService:
457
458 1 Service Properties - SPI - TranslationService1:
459   1 DemandedTranslationTime - measured by metrics/metricXML:Time
460     - related to \\DemandedTranslationTime;
461
462
463 2 Service Description Term - SDT1 - TranslationService1:
464   SourceLang = 1, TargetLang = 2, Size = 20;
465
466 3 Guarantees:
467   #3.1 - TranslationTime1 (by ServiceProvider):
468     Qualifying Condition: HumanSupervised=1;
469     SLO: DemandedTranslationTime <=10 AND DemandedTranslationTime >0;
470
471   #3.2 - TranslationTime2 (by ServiceProvider):
472     Qualifying Condition: HumanSupervised=2;
473     SLO: DemandedTranslationTime <=100 AND DemandedTranslationTime >0;
474

```

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Creation Constraints:

Items:

- 1 *SourceLang*: **Value Of** *SourceLang* is *xs:integer* [1,3],
- 2 *TargetLang*: **Value Of** *TargetLang* is *xs:integer* [1,3],
- 3 *Size*: **Value Of** *Size* is *xs:integer* [1,50],
- 4 *Cost*: **Value Of** *Cost* is *xs:integer* [1,100],
- 5 *HumanSupervised*: **Value Of** *HumanSupervised* is *xs:integer* [1,2],

Constraints:

- 1 *CostCreationConstraint*:
Cost=(*Size***HumanSupervised*)/*DemandedTranslationTime*;
- 2 *HumanSupervisedCreationConstraint*:
HumanSupervised=1;

WSAg4People document 3: Consistent template 1.0

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494

The WS–Agreement template of document 4 and its equivalent WSAg4People document 5 are inconsistent templates because they include some conflicts inside. Concretely, the “Size” value assignment of service description term “SDT1” is out of its allowed domain; and the “HumanSupervisedCreationConstraint” creation constraint is conflicting with itself.

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555

```
<?xml version="1.0" encoding="UTF-8"?>
<wsag:Template wsag:TemplateId="1.1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
http://www.w3.org/2001/XMLSchema XMLSchema.xsd">
  <wsag:Name>TranslateIt!</wsag:Name>
  <wsag:Context>
    <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
    <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
    <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
    <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
  </wsag:Context>
  <wsag:Terms wsag:Name="TranslationService">
    <wsag:All>
      <wsag:ServiceProperties wsag:Name="SP1"
wsag:ServiceName="TranslationService1">
        <wsag:VariableSet>
          <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
            <!-- Time in minutes -->
            <wsag:Location>\\DemandedTranslationTime</wsag:Location>
          </wsag:Variable>
        </wsag:VariableSet>
      </wsag:ServiceProperties>
    <wsag:ServiceDescriptionTerm wsag:Name="SDT1"
wsag:ServiceName="TranslationService1">
      <OfferItem name="SourceLang">1</OfferItem> <!-- SourceLang "1" = EN-UK -->
      <OfferItem name="TargetLang">2</OfferItem> <!-- TargetLang "2" = SP -->
      <OfferItem name="Size">51</OfferItem> <!-- It is out of range -->
    </wsag:ServiceDescriptionTerm>
    <wsag:GuaranteeTerm wsag:Name="TranslationTime1"
wsag:Obligated="ServiceProvider">
      <wsag:QualifyingCondition>HumanSupervised=1</wsag:QualifyingCondition>
      <wsag:ServiceLevelObjective>
        <wsag:CustomServiceLevel>
          DemandedTranslationTime<it;=10 AND DemandedTranslationTime<gt;0
        </wsag:CustomServiceLevel>
      </wsag:ServiceLevelObjective>
    </wsag:GuaranteeTerm>
    <wsag:GuaranteeTerm wsag:Name="TranslationTime2"
wsag:Obligated="ServiceProvider">
      <wsag:QualifyingCondition>HumanSupervised=2</wsag:QualifyingCondition>
      <wsag:ServiceLevelObjective>
        <wsag:CustomServiceLevel>
          DemandedTranslationTime<it;=100 AND DemandedTranslationTime<gt;0
        </wsag:CustomServiceLevel>
      </wsag:ServiceLevelObjective>
    </wsag:GuaranteeTerm>
  </wsag:All>
</wsag:Terms>
<wsag:CreationConstraints>
  <wsag:Item wsag:Name="SourceLang">
    <wsag:Location>\\SourceLang</wsag:Location>
    <wsag:ItemConstraint>
      <xs:restriction base="xs:integer">
        <xs:minInclusive value="1"/>
        <xs:maxInclusive value="3"/>
      </xs:restriction>
    </wsag:ItemConstraint>
  </wsag:Item>
</wsag:CreationConstraints>
```

```

556 <wsag:Item wsag:Name="TargetLang">
557 <wsag:Location>\TargetLang</wsag:Location>
558 <wsag:ItemConstraint>
559 <xs:restriction base="xs:integer">
560 <xs:minInclusive value="1"/>
561 <xs:maxInclusive value="3"/>
562 </xs:restriction>
563 </wsag:ItemConstraint>
564 </wsag:Item>
565 <wsag:Item wsag:Name="Size"> <!-- Size in A4-pages -->
566 <wsag:Location>\Size</wsag:Location>
567 <wsag:ItemConstraint>
568 <xs:restriction base="xs:integer">
569 <xs:minInclusive value="1"/>
570 <xs:maxInclusive value="50"/>
571 </xs:restriction>
572 </wsag:ItemConstraint>
573 </wsag:Item>
574 <wsag:Item wsag:Name="Cost">
575 <wsag:Location>\Cost</wsag:Location>
576 <wsag:ItemConstraint>
577 <xs:restriction base="xs:integer">
578 <xs:minInclusive value="1"/>
579 <xs:maxInclusive value="100"/>
580 </xs:restriction>
581 </wsag:ItemConstraint>
582 </wsag:Item>
583 <wsag:Item wsag:Name="HumanSupervised">
584 <wsag:Location>\HumanSupervised</wsag:Location>
585 <wsag:ItemConstraint>
586 <xs:restriction base="xs:integer">
587 <xs:minInclusive value="1"/> <!-- disabled the human supervision -->
588 <xs:maxInclusive value="2"/> <!-- enabled the human supervision -->
589 </xs:restriction>
590 </wsag:ItemConstraint>
591 </wsag:Item>
592 <wsag:Constraint>
593 <Name>HumanSupervisedCreationConstraint</Name>
594 <Content>HumanSupervised=1 AND HumanSupervised=0</Content>
595 </wsag:Constraint>
596 </wsag:CreationConstraints>
597 </wsag:Template>

```

WS-Agreement (XML) document 4: Inconsistent template 1.1

```

599 Template 1.1 – TranslateIt!:
600 1 Initiator: IneedTranslationCorp.,
601 2 Responder: ITranslate,
602 3 ServiceProvider: AgreementResponder,
603 4 ExpirationTime: 2012-01-01T00:00:00;
604
605 Terms – TranslationService:
606
607 1 Service Properties – SP1 – TranslationService1:
608 1 DemandedTranslationTime – measured by metrics/metricXML:Time
609 – related to \DemandedTranslationTime;
610
611 2 Service Description Term – SDT1 – TranslationService1:
612 SourceLang = 1, TargetLang = 2, Size = 51;
613
614 3 Guarantees:
615 #3.1 – TranslationTime1 (by ServiceProvider):
616 Qualifying Condition: HumanSupervised=1;
617 SLO: DemandedTranslationTime <=10 AND DemandedTranslationTime >0;
618
619 #3.2 – TranslationTime2 (by ServiceProvider):
620 Qualifying Condition: HumanSupervised=2;
621 SLO: DemandedTranslationTime <=100 AND DemandedTranslationTime >0;
622
623 Creation Constraints:
624 Items:
625 1 SourceLang: Value Of \SourceLang is xs:integer [1,3],
626 2 TargetLang: Value Of \TargetLang is xs:integer [1,3],
627 3 Size: Value Of \Size is xs:integer [1,50],
628 4 Cost: Value Of \Cost is xs:integer [1,100],
629 5 HumanSupervised: Value Of \HumanSupervised is xs:integer [1,2],
630
631 Constraints:
632 1 HumanSupervisedCreationConstraint:
633 HumanSupervised=1 AND HumanSupervised=0;
634
635
636

```

WSAg4People document 5: Inconsistent template 1.1

638 The WS–Agreement template of document 6 and its equivalent WSAg4People document 7 are inconsis-
 639 tent templates because they include some conflicts inside. Concretely, the “Size” value assignment of service
 640 description term “SDT1” is conflicting with the “SizeCreationConstraint” creation constraint; the “InputEr-
 641 rorsGT” guarantee term is conflicting with the “InputErrorsCreationConstraint” creation constraint; and the
 642 “TargetLang” value assignment of service description term “SDT1” is conflicting with the “TargetLangGT”
 643 guarantee term.

```

644 <?xml version="1.0" encoding="UTF-8"?>
645 <wsag:Template wsag:TemplateId="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
646 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
647 xmlns:xs="http://www.w3.org/2001/XMLSchema"
648 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
649 http://www.w3.org/2001/XMLSchema/XMLSchema.xsd">
650 <wsag:Name>TranslateIt!</wsag:Name>
651 <wsag:Context>
652 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
653 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
654 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
655 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
656 </wsag:Context>
657 <wsag:Terms wsag:Name="TranslationService">
658 <wsag:All>
659 <wsag:ServiceProperties wsag:Name="SP1"
660 wsag:ServiceName="TranslationService1">
661 <wsag:VariableSet>
662 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
663 <!-- Time in minutes -->
664 <wsag:Location>\\DemandedTranslationTime</wsag:Location>
665 </wsag:Variable>
666 <wsag:Variable wsag:Name="InputErrors" wsag:Metric="metrics/metricXML:Percentage">
667 <!-- Input text errors in percentage -->
668 <wsag:Location>\\InputErrors</wsag:Location>
669 </wsag:Variable>
670 </wsag:VariableSet>
671 </wsag:ServiceProperties>
672 <wsag:ServiceDescriptionTerm wsag:Name="SDT1"
673 wsag:ServiceName="TranslationService1">
674 <OfferItem name="SourceLang">1</OfferItem> <!-- SourceLang "1" = EN-UK -->
675 <OfferItem name="TargetLang">2</OfferItem> <!-- TargetLang "2" = SP -->
676 <OfferItem name="Size">20</OfferItem>
677 </wsag:ServiceDescriptionTerm>
678 <wsag:GuaranteeTerm wsag:Name="TranslationTime1"
679 wsag:Obligated="ServiceProvider">
680 <wsag:QualifyingCondition>HumanSupervised=1</wsag:QualifyingCondition>
681 <wsag:ServiceLevelObjective>
682 <wsag:CustomServiceLevel>
683 DemandedTranslationTime&lt;=10 AND DemandedTranslationTime&gt;0
684 </wsag:CustomServiceLevel>
685 </wsag:ServiceLevelObjective>
686 </wsag:GuaranteeTerm>
687 <wsag:GuaranteeTerm wsag:Name="TranslationTime2"
688 wsag:Obligated="ServiceProvider">
689 <wsag:QualifyingCondition>HumanSupervised=2</wsag:QualifyingCondition>
690 <wsag:ServiceLevelObjective>
691 <wsag:CustomServiceLevel>
692 DemandedTranslationTime&lt;=100 AND DemandedTranslationTime&gt;0
693 </wsag:CustomServiceLevel>
694 </wsag:ServiceLevelObjective>
695 </wsag:GuaranteeTerm>
696 <wsag:GuaranteeTerm wsag:Name="TargetLangGT"
697 wsag:Obligated="ServiceProvider">
698 <wsag:ServiceLevelObjective>
699 <wsag:CustomServiceLevel>TargetLang&gt;2</wsag:CustomServiceLevel>
700 </wsag:ServiceLevelObjective>
701 </wsag:GuaranteeTerm>
702 <wsag:GuaranteeTerm wsag:Name="InputErrorsGT"
703 wsag:Obligated="ServiceConsumer">
704 <wsag:ServiceLevelObjective>
705 <wsag:CustomServiceLevel>InputErrors&lt;=1</wsag:CustomServiceLevel>
706 </wsag:ServiceLevelObjective>
707 </wsag:GuaranteeTerm>
708 </wsag:All>
709 </wsag:Terms>
710 <wsag:CreationConstraints>
711 <wsag:Item wsag:Name="SourceLang">
712 <wsag:Location>\\SourceLang</wsag:Location>
713 <wsag:ItemConstraint>
714

```

```

715     <xs:restriction base="xs:integer">
716       <xs:minInclusive value="1"/>
717       <xs:maxInclusive value="3"/>
718     </xs:restriction>
719   </wsag:ItemConstraint>
720 </wsag:Item>
721 <wsag:Item wsag:Name="TargetLang">
722   <wsag:Location>\ TargetLang</wsag:Location>
723   <wsag:ItemConstraint>
724     <xs:restriction base="xs:integer">
725       <xs:minInclusive value="1"/>
726       <xs:maxInclusive value="3"/>
727     </xs:restriction>
728   </wsag:ItemConstraint>
729 </wsag:Item>
730 <wsag:Item wsag:Name="Size"> <!-- Size in A4-pages -->
731   <wsag:Location>\ Size</wsag:Location>
732   <wsag:ItemConstraint>
733     <xs:restriction base="xs:integer">
734       <xs:minInclusive value="1"/>
735       <xs:maxInclusive value="50"/>
736     </xs:restriction>
737   </wsag:ItemConstraint>
738 </wsag:Item>
739 <wsag:Item wsag:Name="Cost">
740   <wsag:Location>\ Cost</wsag:Location>
741   <wsag:ItemConstraint>
742     <xs:restriction base="xs:integer">
743       <xs:minInclusive value="1"/>
744       <xs:maxInclusive value="100"/>
745     </xs:restriction>
746   </wsag:ItemConstraint>
747 </wsag:Item>
748 <wsag:Item wsag:Name="HumanSupervised">
749   <wsag:Location>\ HumanSupervised</wsag:Location>
750   <wsag:ItemConstraint>
751     <xs:restriction base="xs:integer">
752       <xs:minInclusive value="1"/> <!-- disabled the human supervision -->
753       <xs:maxInclusive value="2"/> <!-- enabled the human supervision -->
754     </xs:restriction>
755   </wsag:ItemConstraint>
756 </wsag:Item>
757 <wsag:Constraint>
758   <Name>HumanSupervisedCreationConstraint</Name>
759   <Content>HumanSupervised=1</Content>
760 </wsag:Constraint>
761 <wsag:Constraint>
762   <Name>InputErrorsCreationConstraint</Name>
763   <Content>InputErrors>1</Content>
764 </wsag:Constraint>
765 <wsag:Constraint>
766   <Name>SizeCreationConstraint</Name>
767   <Content>Size<lt;20</Content>
768 </wsag:Constraint>
769 </wsag:CreationConstraints>
770 </wsag:Template>

```

WS-Agreement (XML) document 6: Inconsistent template 1.2

```

772 Template 1.2 – TranslateIt!:
773
774 1 Initiator: IneedTranslationCorp.,
775 2 Responder: ITranslate,
776 3 ServiceProvider: AgreementResponder,
777 4 ExpirationTime: 2012-01-01T00:00:00;
778
779 Terms – TranslationService:
780
781 1 Service Properties – SP1 – TranslationService1:
782   1 DemandedTranslationTime – measured by metrics/metricXML:Time
783     – related to \DemandedTranslationTime,
784   2 InputErrors – measured by metrics/metricXML:Percentage
785     – related to \InputErrors;
786
787 2 Service Description Term – SDT1 – TranslationService1:
788   SourceLang = 1, TargetLang = 2, Size = 20;
789
790 3 Guarantees:
791   #3.1 – TranslationTime1 (by ServiceProvider):
792     Qualifying Condition: HumanSupervised=1;
793     SLO: DemandedTranslationTime <=10 AND DemandedTranslationTime >0;
794
795   #3.2 – TranslationTime2 (by ServiceProvider):
796     Qualifying Condition: HumanSupervised=2;
797     SLO: DemandedTranslationTime <=100 AND DemandedTranslationTime >0;
798

```

799 #3.3 – *TargetLangGT* (by *ServiceProvider*):
800 SLO: *TargetLang* >2;
801
802 #3.4 – *InputErrorsGT* (by *ServiceConsumer*):
803 SLO: *InputErrors* <=1;
804
805
806 **Creation Constraints:**
807 **Items:**
808 1 *SourceLang*: **Value Of** *SourceLang* is *xs:integer* [1,3],
809 2 *TargetLang*: **Value Of** *TargetLang* is *xs:integer* [1,3],
810 3 *Size*: **Value Of** *Size* is *xs:integer* [1,50],
811 4 *Cost*: **Value Of** *Cost* is *xs:integer* [1,100],
812 5 *HumanSupervised*: **Value Of** *HumanSupervised* is *xs:integer* [1,2],
813
814 **Constraints:**
815 1 *HumanSupervisedCreationConstraint*:
816 *HumanSupervised*=1;
817 2 *InputErrorsCreationConstraint*:
818 *InputErrors* >1;
819 3 *SizeCreationConstraint*:
820 *Size* <20;

WSAg4People document 7: Inconsistent template 1.2

822 The WS–Agreement template of document 8 and its equivalent WSAg4People document 9 are inconsis-
823 tent templates because they include some conflicts inside. Concretely, the “InputErrorsGT1” guarantee term
824 is conflicting with the “InputErrorsGT2”; and the “Implication1CreationConstraint” creation constraint is
825 conflicting with the “Implication2CreationConstraint” creation constraint.

```

826 <?xml version="1.0" encoding="UTF-8"?>
827 <wsag:Template wsag:TemplateId="1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
828 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
829 xmlns:xs="http://www.w3.org/2001/XMLSchema"
830 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
831 http://www.w3.org/2001/XMLSchema XMLElement.xsd">
832 <wsag:Name>TranslateIt!</wsag:Name>
833 <wsag:Context>
834 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
835 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
836 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
837 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
838 </wsag:Context>
839 <wsag:Terms wsag:Name="TranslationService">
840 <wsag:All>
841 <wsag:ServiceProperties wsag:Name="SP1"
842 wsag:ServiceName="TranslationService1">
843 <wsag:VariableSet>
844 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
845 <!-- Time in minutes -->
846 <wsag:Location>\DemandedTranslationTime</wsag:Location>
847 </wsag:Variable>
848 <wsag:Variable wsag:Name="InputErrors" wsag:Metric="metrics/metricXML:Percentage">
849 <!-- Input text errors in percentage -->
850 <wsag:Location>\InputErrors</wsag:Location>
851 </wsag:Variable>
852 </wsag:VariableSet>
853 </wsag:ServiceProperties>
854 <wsag:ServiceDescriptionTerm wsag:Name="SDT1"
855 wsag:ServiceName="TranslationService1">
856 <OfferItem name="SourceLang">1</OfferItem> <!-- SourceLang "1" = EN-UK -->
857 <OfferItem name="TargetLang">2</OfferItem> <!-- TargetLang "2" = SP -->
858 </wsag:ServiceDescriptionTerm>
859 <wsag:GuaranteeTerm wsag:Name="TranslationTime1"
860 wsag:Obligated="ServiceProvider">
861 <wsag:QualifyingCondition>HumanSupervised=1</wsag:QualifyingCondition>
862 <wsag:ServiceLevelObjective>
863 <wsag:CustomServiceLevel>DemandedTranslationTime<=10</wsag:CustomServiceLevel>
864 </wsag:ServiceLevelObjective>
865 </wsag:GuaranteeTerm>
866 <wsag:GuaranteeTerm wsag:Name="TranslationTime2"
867 wsag:Obligated="ServiceProvider">
868 <wsag:QualifyingCondition>HumanSupervised=2</wsag:QualifyingCondition>
869 <wsag:ServiceLevelObjective>
870 <wsag:CustomServiceLevel>DemandedTranslationTime<=100</wsag:CustomServiceLevel>
871 </wsag:ServiceLevelObjective>
872 </wsag:GuaranteeTerm>
873 <wsag:GuaranteeTerm wsag:Name="InputErrorsGT1"
874 wsag:Obligated="ServiceConsumer">
875 <wsag:ServiceLevelObjective>
876 <wsag:CustomServiceLevel>InputErrors<=1</wsag:CustomServiceLevel>
877 </wsag:ServiceLevelObjective>
878 </wsag:GuaranteeTerm>
879 </wsag:All>

```

```

880     <wsag:GuaranteeTerm wsag:Name="InputErrorsGT2"
881       wsag:Obligated="ServiceConsumer">
882       <wsag:ServiceLevelObjective>
883         <wsag:CustomServiceLevel>InputErrors&gt;1</wsag:CustomServiceLevel>
884       </wsag:ServiceLevelObjective>
885     </wsag:GuaranteeTerm>
886     <wsag:GuaranteeTerm wsag:Name="MinimunTranslationTime"
887       wsag:Obligated="ServiceProvider">
888       <wsag:ServiceLevelObjective>
889         <wsag:CustomServiceLevel>DemandedTranslationTime&gt;0</wsag:CustomServiceLevel>
890       </wsag:ServiceLevelObjective>
891     </wsag:GuaranteeTerm>
892   </wsag:All>
893 </wsag:Terms>
894 <wsag:CreationConstraints>
895   <wsag:Item wsag:Name="SourceLang">
896     <wsag:Location>\\ SourceLang</wsag:Location>
897     <wsag:ItemConstraint>
898       <xs:restriction base="xs:integer">
899         <xs:minInclusive value="1"/>
900         <xs:maxInclusive value="3"/>
901       </xs:restriction>
902     </wsag:ItemConstraint>
903   </wsag:Item>
904   <wsag:Item wsag:Name="TargetLang">
905     <wsag:Location>\\ TargetLang</wsag:Location>
906     <wsag:ItemConstraint>
907       <xs:restriction base="xs:integer">
908         <xs:minInclusive value="1"/>
909         <xs:maxInclusive value="3"/>
910       </xs:restriction>
911     </wsag:ItemConstraint>
912   </wsag:Item>
913   <wsag:Item wsag:Name="Size"> <!-- Size in A4-pages -->
914     <wsag:Location>\\ Size</wsag:Location>
915     <wsag:ItemConstraint>
916       <xs:restriction base="xs:integer">
917         <xs:minInclusive value="1"/>
918         <xs:maxInclusive value="50"/>
919       </xs:restriction>
920     </wsag:ItemConstraint>
921   </wsag:Item>
922   <wsag:Item wsag:Name="Cost">
923     <wsag:Location>\\ Cost</wsag:Location>
924     <wsag:ItemConstraint>
925       <xs:restriction base="xs:integer">
926         <xs:minInclusive value="1"/>
927         <xs:maxInclusive value="100"/>
928       </xs:restriction>
929     </wsag:ItemConstraint>
930   </wsag:Item>
931   <wsag:Item wsag:Name="HumanSupervised">
932     <wsag:Location>\\ HumanSupervised</wsag:Location>
933     <wsag:ItemConstraint>
934       <xs:restriction base="xs:integer">
935         <xs:minInclusive value="1"/> <!-- disabled the human supervision -->
936         <xs:maxInclusive value="2"/> <!-- enabled the human supervision -->
937       </xs:restriction>
938     </wsag:ItemConstraint>
939   </wsag:Item>
940   <!--wsag:Constraint>
941     <Name>CostCreationConstraint </Name>
942     <Content>Cost=(Size*HumanSupervised)/DemandedTranslationTime </Content>
943   </wsag:Constraint -->
944   <wsag:Constraint>
945     <Name>HumanSupervisedCreationConstraint</Name>
946     <Content>HumanSupervised=1</Content>
947   </wsag:Constraint>
948   <wsag:Constraint>
949     <Name>Implication1CreationConstraint</Name>
950     <Content>HumanSupervised=1 IMPLIES Size&gt;20</Content>
951   </wsag:Constraint>
952   <wsag:Constraint>
953     <Name>Implication2CreationConstraint</Name>
954     <Content>HumanSupervised=1 AND Size&lt;20</Content>
955   </wsag:Constraint>
956 </wsag:CreationConstraints>
957 </wsag:Template>

```

WS-Agreement (XML) document 8: Inconsistent template 1.3

```

959 Template 1.3 – TranslateIt!:
960 1 Initiator: IneedTranslateCorp.,
961 2 Responder: ITranslate,
962 3 ServiceProvider: AgreementResponder,
963

```



```

964 4 ExpirationTime: 2012-01-01T00:00:00;
965
966 Terms - TranslationService:
967
968 1 Service Properties - SPI - TranslationService1:
969 1 DemandedTranslationTime - measured by metrics/metricXML:Time
970 - related to \DemandedTranslationTime,
971 2 InputErrors - measured by metrics/metricXML:Percentage
972 - related to \InputErrors;
973
974
975 2 Service Description Term - SDTI - TranslationService1:
976 SourceLang = 1, TargetLang = 2;
977
978 3 Guarantees:
979 #3.1 - TranslationTime1 (by ServiceProvider):
980 Qualifying Condition: HumanSupervised=1;
981 SLO: DemandedTranslationTime <=10;
982
983 #3.2 - TranslationTime2 (by ServiceProvider):
984 Qualifying Condition: HumanSupervised=2;
985 SLO: DemandedTranslationTime <=100;
986
987 #3.3 - InputErrorsGT1 (by ServiceConsumer):
988 SLO: InputErrors <=1;
989
990 #3.4 - InputErrorsGT2 (by ServiceConsumer):
991 SLO: InputErrors >1;
992
993 #3.5 - MinimunTranslationTime (by ServiceProvider):
994 SLO: DemandedTranslationTime >0;
995
996
997 Creation Constraints:
998 Items:
999 1 SourceLang: Value Of \SourceLang is xs:integer [1,3],
1000 2 TargetLang: Value Of \TargetLang is xs:integer [1,3],
1001 3 Size: Value Of \Size is xs:integer [1,50],
1002 4 Cost: Value Of \Cost is xs:integer [1,100],
1003 5 HumanSupervised: Value Of \HumanSupervised is xs:integer [1,2],
1004
1005 Constraints:
1006 1 HumanSupervisedCreationConstraint:
1007 HumanSupervised=1;
1008 2 Implication1CreationConstraint:
1009 HumanSupervised=1 IMPLIES Size >20;
1010 3 Implication2CreationConstraint:
1011 HumanSupervised=1 AND Size <20;
1012

```

WSAg4People document 9: Inconsistent template 1.3

1013 Despite of the WS-Agreement template of document 10 and its equivalent WSAg4People document 11
1014 include warnings, they are consistent templates.

```

1015 <?xml version="1.0" encoding="UTF-8"?>
1016 <wsag:Template wsag:TemplateId="1.4"
1017 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1018 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
1019 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1020 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
1021 http://www.w3.org/2001/XMLSchema/XMLSchema.xsd">
1022 <wsag:Name>Translatelt!</wsag:Name>
1023 <wsag:Context>
1024 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
1025 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
1026 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
1027 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
1028 </wsag:Context>
1029 <wsag:Terms wsag:Name="TranslationService">
1030 <wsag:All>
1031 <wsag:ServiceProperties wsag:Name="SPI"
1032 wsag:ServiceName="TranslationService1">
1033 <wsag:VariableSet>
1034 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
1035 <!-- Time in minutes -->
1036 <wsag:Location>\DemandedTranslationTime</wsag:Location>
1037 </wsag:Variable>
1038 </wsag:VariableSet>
1039 </wsag:ServiceProperties>
1040 <wsag:ServiceDescriptionTerm wsag:Name="SDTI"
1041 wsag:ServiceName="TranslationService1">
1042 <OfferItem name="SourceLang">1</OfferItem> <!-- SourceLang "1" = EN-UK -->
1043 <OfferItem name="TargetLang">2</OfferItem> <!-- TargetLang "2" = SP -->
1044 <OfferItem name="Size">20</OfferItem>
1045

```

```

1046     <OfferItem name="HumanSupervised">1</ OfferItem>
1047 </ wsag: ServiceDescriptionTerm>
1048 <wsag: GuaranteeTerm wsag:Name="TranslationTime1"
1049 wsag: Obligated="ServiceProvider">
1050   <wsag: QualifyingCondition>HumanSupervised=1</ wsag: QualifyingCondition>
1051   <wsag: ServiceLevelObjective>
1052     <wsag: CustomServiceLevel>DemandedTranslationTime<lt ;=10</ wsag: CustomServiceLevel>
1053   </ wsag: ServiceLevelObjective>
1054 </ wsag: GuaranteeTerm>
1055 <wsag: GuaranteeTerm wsag:Name="TranslationTime2"
1056 wsag: Obligated="ServiceProvider">
1057   <wsag: QualifyingCondition>HumanSupervised=2</ wsag: QualifyingCondition>
1058   <wsag: ServiceLevelObjective>
1059     <wsag: CustomServiceLevel>DemandedTranslationTime<lt ;=100</ wsag: CustomServiceLevel>
1060   </ wsag: ServiceLevelObjective>
1061 </ wsag: GuaranteeTerm>
1062 <wsag: GuaranteeTerm wsag:Name="TranslationTime3"
1063 wsag: Obligated="ServiceProvider">
1064   <wsag: QualifyingCondition>SourceLang=3</ wsag: QualifyingCondition>
1065   <wsag: ServiceLevelObjective>
1066     <wsag: CustomServiceLevel>DemandedTranslationTime<gt ;=60</ wsag: CustomServiceLevel>
1067   </ wsag: ServiceLevelObjective>
1068 </ wsag: GuaranteeTerm>
1069 <wsag: GuaranteeTerm wsag:Name="MinimunTranslationTime"
1070 wsag: Obligated="ServiceProvider">
1071   <wsag: ServiceLevelObjective>
1072     <wsag: CustomServiceLevel>DemandedTranslationTime<gt ;0</ wsag: CustomServiceLevel>
1073   </ wsag: ServiceLevelObjective>
1074 </ wsag: GuaranteeTerm>
1075 </ wsag: All>
1076 </ wsag: Terms>
1077 <wsag: CreationConstraints>
1078   <wsag: Item wsag:Name="SourceLang">
1079     <wsag: Location>\\ SourceLang</ wsag: Location>
1080     <wsag: ItemConstraint>
1081       <xs: restriction base="xs: integer">
1082         <xs: minInclusive value="1"/>
1083         <xs: maxInclusive value="3"/>
1084       </ xs: restriction>
1085     </ wsag: ItemConstraint>
1086   </ wsag: Item>
1087   <wsag: Item wsag:Name="TargetLang">
1088     <wsag: Location>\\ TargetLang</ wsag: Location>
1089     <wsag: ItemConstraint>
1090       <xs: restriction base="xs: integer">
1091         <xs: minInclusive value="1"/>
1092         <xs: maxInclusive value="3"/>
1093       </ xs: restriction>
1094     </ wsag: ItemConstraint>
1095   </ wsag: Item>
1096   <wsag: Item wsag:Name="Size"> <!-- Size in A4-pages -->
1097     <wsag: Location>\\ Size</ wsag: Location>
1098     <wsag: ItemConstraint>
1099       <xs: restriction base="xs: integer">
1100         <xs: minInclusive value="1"/>
1101         <xs: maxInclusive value="50"/>
1102       </ xs: restriction>
1103     </ wsag: ItemConstraint>
1104   </ wsag: Item>
1105   <wsag: Item wsag:Name="Cost">
1106     <wsag: Location>\\ Cost</ wsag: Location>
1107     <wsag: ItemConstraint>
1108       <xs: restriction base="xs: integer">
1109         <xs: minInclusive value="1"/>
1110         <xs: maxInclusive value="100"/>
1111       </ xs: restriction>
1112     </ wsag: ItemConstraint>
1113   </ wsag: Item>
1114   <wsag: Item wsag:Name="HumanSupervised">
1115     <wsag: Location>\\ HumanSupervised</ wsag: Location>
1116     <wsag: ItemConstraint>
1117       <xs: restriction base="xs: integer">
1118         <xs: minInclusive value="1"/> <!-- disabled the human supervision -->
1119         <xs: maxInclusive value="2"/> <!-- enabled the human supervision -->
1120       </ xs: restriction>
1121     </ wsag: ItemConstraint>
1122   </ wsag: Item>
1123   <wsag: Constraint>
1124     <Name>HumanSupervisedCreationConstraint</Name>
1125     <Content>HumanSupervised=1</ Content>
1126   </ wsag: Constraint>
1127   <wsag: Constraint>
1128     <Name>SourceLandCreationConstraint</Name>
1129     <Content>SourceLang<lt ;=2</ Content>
1130   </ wsag: Constraint>
1131 </ wsag: CreationConstraints>
1132 </ wsag: Template>

```

WS-Agreement (XML) document 10: Consistent template 1.4

```

1134 Template 1.4 – TranslateIt!:
1135
1136 1 Initiator: IneedTranslationCorp.,
1137 2 Responder: ITranslate,
1138 3 ServiceProvider: AgreementResponder,
1139 4 ExpirationTime: 2012-01-01T00:00:00;
1140
1141 Terms – TranslationService:
1142
1143 1 Service Properties – SP1 – TranslationService1:
1144 1 DemandedTranslationTime – measured by metrics/metricXML:Time
1145 – related to \\DemandedTranslationTime;
1146
1147
1148 2 Service Description Term – SDT1 – TranslationService1:
1149 SourceLang = 1, TargetLang = 2, Size = 20, HumanSupervised = 1;
1150
1151 3 Guarantees:
1152 #3.1 – TranslationTime1 (by ServiceProvider):
1153 Qualifying Condition: HumanSupervised=1;
1154 SLO: DemandedTranslationTime <=10;
1155
1156 #3.2 – TranslationTime2 (by ServiceProvider):
1157 Qualifying Condition: HumanSupervised=2;
1158 SLO: DemandedTranslationTime <=100;
1159
1160 #3.3 – TranslationTime3 (by ServiceProvider):
1161 Qualifying Condition: SourceLang=3;
1162 SLO: DemandedTranslationTime >=60;
1163
1164 #3.4 – MinimunTranslationTime (by ServiceProvider):
1165 SLO: DemandedTranslationTime >0;
1166
1167
1168 Creation Constraints:
1169 Items:
1170 1 SourceLang: Value Of \\SourceLang is xs:integer [1,3],
1171 2 TargetLang: Value Of \\TargetLang is xs:integer [1,3],
1172 3 Size: Value Of \\Size is xs:integer [1,50],
1173 4 Cost: Value Of \\Cost is xs:integer [1,100],
1174 5 HumanSupervised: Value Of \\HumanSupervised is xs:integer [1,2],
1175
1176 Constraints:
1177 1 HumanSupervisedCreationConstraint:
1178 HumanSupervised=1;
1179 2 SourceLandCreationConstraint:
1180 SourceLang <=2;

```

WSAg4People document 11: Consistent template 1.4

1182 The WS-Agreement offer of document 12 and its equivalent WSAg4People document 13 are incon-
1183 sistent agreement offers because they include some conflicts inside. Concretely, the “TranslationTime1”
1184 guarantee term has a conflicting qualifying condition; the “InputErrorsGT” guarantee term has a conflict-
1185 ing service level objective; and the “InputErrorsGT2” guarantee term has a qualifying condition conflicting
1186 with the service level objective.

```

1187 <?xml version="1.0" encoding="UTF-8"?>
1188 <wsag:AgreementOffer wsag:AgreementId="1.0"
1189 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1190 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
1191 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1192 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
1193 http://www.w3.org/2001/XMLSchema XMLSchema.xsd">
1194 <wsag:Name>guaranteeTermErrors</wsag:Name>
1195 <wsag:Context>
1196 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
1197 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
1198 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
1199 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
1200 <wsag:TemplateId>1.1</wsag:TemplateId>
1201 <wsag:TemplateName>TranslateIt!</wsag:TemplateName>
1202 </wsag:Context>
1203 <wsag:Terms wsag:Name="TranslationService">
1204 <wsag:All>
1205 <wsag:ServiceProperties wsag:Name="SP1"
1206 wsag:ServiceName="TranslationService1">

```

```

1208 <wsag:VariableSet>
1209 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
1210 <!-- Time in minutes -->
1211 <wsag:Location>\\DemandedTranslationTime</wsag:Location>
1212 </wsag:Variable>
1213 <wsag:Variable wsag:Name="InputErrors" wsag:Metric="metrics/metricXML:Percentage">
1214 <!-- Input text errors in percentage -->
1215 <wsag:Location>\\InputErrors</wsag:Location>
1216 </wsag:Variable>
1217 </wsag:VariableSet>
1218 </wsag:ServiceProperties>
1219 <wsag:ServiceDescriptionTerm wsag:Name="SP_Translation_by_Computer"
1220 wsag:ServiceName="TranslationService1">
1221 <OfferItem name="DemandedTranslationTime">2</OfferItem>
1222 </wsag:ServiceDescriptionTerm>
1223 <wsag:GuaranteeTerm wsag:Name="TranslationTime1"
1224 wsag:Obligated="ServiceProvider">
1225 <wsag:QualifyingCondition>InputErrors=1 AND InputErrors=2</wsag:QualifyingCondition>
1226 <wsag:ServiceLevelObjective>
1227 <wsag:CustomServiceLevel>
1228 DemandedTranslationTime<=10 AND DemandedTranslationTime>0
1229 </wsag:CustomServiceLevel>
1230 </wsag:ServiceLevelObjective>
1231 </wsag:GuaranteeTerm>
1232 <wsag:GuaranteeTerm wsag:Name="InputErrorsGT"
1233 wsag:Obligated="ServiceConsumer">
1234 <wsag:ServiceLevelObjective>
1235 <wsag:CustomServiceLevel>
1236 InputErrors<=1 AND InputErrors>1
1237 </wsag:CustomServiceLevel>
1238 </wsag:ServiceLevelObjective>
1239 </wsag:GuaranteeTerm>
1240 <wsag:GuaranteeTerm wsag:Name="InputErrorsGT2"
1241 wsag:Obligated="ServiceProvider">
1242 <wsag:QualifyingCondition>InputErrors<=10</wsag:QualifyingCondition>
1243 <wsag:ServiceLevelObjective>
1244 <wsag:CustomServiceLevel>InputErrors>10</wsag:CustomServiceLevel>
1245 </wsag:ServiceLevelObjective>
1246 </wsag:GuaranteeTerm>
1247 </wsag:All>
1248 </wsag:Terms>
1249 </wsag:AgreementOffer>

```

WS-Agreement (XML) document 12: Inconsistent agreement offer 1.0

```

1251 AgreementOffer 1.0 – guaranteeTermErrors
1252 1 Initiator: IneedTranslationCorp.,
1253 2 ServiceProvider: AgreementResponder,
1254 3 TemplateID: 1.1,
1255 4 TemplateName: TranslateIt!;
1256
1257
1258 1 Service Properties – SPI – TranslationService1:
1259 1 DemandedTranslationTime – measured by metrics/metricXML:Time
1260 – related to \\DemandedTranslationTime,
1261 2 InputErrors – measured by metrics/metricXML:Percentage
1262 – related to \\InputErrors;
1263
1264
1265 2 Service Description Term – SP_Translation_by_Computer – TranslationService1:
1266 DemandedTranslationTime = 2;
1267
1268 3 Guarantees:
1269 #3.1 – TranslationTime1 (by ServiceProvider):
1270 Qualifying Condition: InputErrors=1 AND InputErrors=2;
1271 SLO: DemandedTranslationTime <=10 AND DemandedTranslationTime >0;
1272
1273 #3.2 – InputErrorsGT (by ServiceConsumer):
1274 SLO: InputErrors <=1 AND InputErrors >1;
1275
1276 #3.3 – InputErrorsGT2 (by ServiceProvider):
1277 Qualifying Condition: InputErrors <10;
1278 SLO: InputErrors >=10;

```

WSAg4People document 13: Inconsistent agreement offer 1.0

1280 Despite of the WS-Agreement offer of document 14 and its equivalent WSAg4People document 15
1281 include warnings, they are consistent agreement offers.

```

1282 <?xml version="1.0" encoding="UTF-8"?>
1283 <wsag:AgreementOffer wsag:AgreementId="1.1"
1284 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

```

```

1286 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
1287 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1288 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
1289 http://www.w3.org/2001/XMLSchema/XMLSchema.xsd">
1290 <wsag:Name>guaranteeTermErrors</wsag:Name>
1291 <wsag:Context>
1292 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
1293 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
1294 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
1295 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
1296 <wsag:TemplateId>1.1</wsag:TemplateId>
1297 <wsag:TemplateName>TranslateIt!</wsag:TemplateName>
1298 </wsag:Context>
1299 <wsag:Terms wsag:Name="TranslationService">
1300 <wsag:All>
1301 <wsag:ServiceProperties wsag:Name="SP1"
1302 wsag:ServiceName="TranslationService1">
1303 <wsag:VariableSet>
1304 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
1305 <!-- Time in minutes -->
1306 <wsag:Location>\\DemandedTranslationTime</wsag:Location>
1307 </wsag:Variable>
1308 <wsag:Variable wsag:Name="InputErrors" wsag:Metric="metrics/metricXML:Percentage">
1309 <!-- Input text errors in percentage -->
1310 <wsag:Location>\\InputErrors</wsag:Location>
1311 </wsag:Variable>
1312 </wsag:VariableSet>
1313 </wsag:ServiceProperties>
1314 <wsag:ServiceDescriptionTerm wsag:Name="SP_Translation_by_Computer"
1315 wsag:ServiceName="TranslationService1">
1316 <OfferItem name="DemandedTranslationTime">2</OfferItem>
1317 </wsag:ServiceDescriptionTerm>
1318 <wsag:GuaranteeTerm wsag:Name="InputErrorsGT2"
1319 wsag:Obligated="ServiceProvider">
1320 <wsag:QualifyingCondition>DemandedTranslationTime>2</wsag:QualifyingCondition>
1321 <wsag:ServiceLevelObjective>
1322 <wsag:CustomServiceLevel>InputErrors>=10</wsag:CustomServiceLevel>
1323 </wsag:ServiceLevelObjective>
1324 </wsag:GuaranteeTerm>
1325 </wsag:All>
1326 </wsag:Terms>
1327 </wsag:AgreementOffer>

```

WS-Agreement (XML) document 14: Consistent agreement offer 1.1

```

1329 AgreementOffer 1.1 – guaranteeTermErrors
1330
1331 1 Initiator: IneedTranslationCorp.,
1332 2 ServiceProvider: AgreementResponder,
1333 3 TemplateID: 1.1,
1334 4 TemplateName: TranslateIt!;
1335
1336 1 Service Properties – SP1 – TranslationService1:
1337 1 DemandedTranslationTime – measured by metrics/metricXML:Time
1338 – related to \\DemandedTranslationTime,
1339 2 InputErrors – measured by metrics/metricXML:Percentage
1340 – related to \\InputErrors;
1341
1342
1343 2 Service Description Term – SP_Translation_by_Computer – TranslationService1:
1344 DemandedTranslationTime = 2, DemandedTranslationTime = 2;
1345
1346 3 Guarantee – InputErrorsGT2 (by ServiceProvider):
1347 Scope;
1348 Qualifying Condition: DemandedTranslationTime >2;
1349 SLO: InputErrors >=10;

```

WSAg4People document 15: Consistent agreement offer 1.1

1351 The WS-Agreement offer of document 16 and its equivalent WSAg4People document 17 are consistent
1352 agreement offers.

```

1353 <?xml version="1.0" encoding="UTF-8"?>
1354 <wsag:AgreementOffer wsag:AgreementId="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1355 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
1356 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1357 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
1358 http://www.w3.org/2001/XMLSchema/XMLSchema.xsd">
1359 <wsag:Name>TwoOptions</wsag:Name>
1360 <wsag:Context>
1361 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
1362 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>

```

```

1364 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
1365 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
1366 <wsag:TemplateId>1.1</wsag:TemplateId>
1367 <wsag:TemplateName>TranslateIt!</wsag:TemplateName>
1368 </wsag:Context>
1369 <wsag:Terms wsag:Name="TranslationService">
1370 <wsag:All>
1371 <wsag:ServiceProperties wsag:Name="SP1"
1372 wsag:ServiceName="TranslationService1">
1373 <wsag:VariableSet>
1374 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">
1375 <!-- Time in minutes -->
1376 <wsag:Location>\\DemandedTranslationTime</wsag:Location>
1377 </wsag:Variable>
1378 </wsag:VariableSet>
1379 </wsag:ServiceProperties>
1380 <wsag:ServiceDescriptionTerm wsag:Name="Translation_by_Computer"
1381 wsag:ServiceName="TranslationService1">
1382 <OfferItem name="Size">20</OfferItem>
1383 <OfferItem name="HumanSupervised">1</OfferItem>
1384 <OfferItem name="DemandedTranslationTime">2</OfferItem>
1385 <OfferItem name="Cost">10</OfferItem> <!-- (20*1)/2 in euros -->
1386 </wsag:ServiceDescriptionTerm>
1387 <wsag:GuaranteeTerm wsag:Name="TranslationTimeOffer"
1388 wsag:Obligated="ServiceProvider">
1389 <wsag:ServiceLevelObjective>
1390 <wsag:CustomServiceLevel>
1391 DemandedTranslationTime&lt;=100 AND DemandedTranslationTime&gt;0
1392 </wsag:CustomServiceLevel>
1393 </wsag:ServiceLevelObjective>
1394 </wsag:GuaranteeTerm>
1395 </wsag:All>
1396 </wsag:Terms>
1397 </wsag:AgreementOffer>

```

WS-Agreement (XML) document 16: Consistent agreement offer 1.2

```

1399 AgreementOffer 1.2 – TwoOptions
1400 1 Initiator: IneedTranslationCorp.,
1401 2 ServiceProvider: AgreementResponder,
1402 3 TemplateID: 1.1,
1403 4 TemplateName: TranslateIt!;
1404
1405 1 Service Properties – SP1 – TranslationService1:
1406 1 DemandedTranslationTime – measured by metrics/metricXML:Time
1407 – related to \\DemandedTranslationTime;
1408
1409 2 Service Description Term – Translation_by_Computer – TranslationService1:
1410 Size = 20, HumanSupervised = 1, DemandedTranslationTime = 2, Cost = 10;
1411
1412 3 Guarantee – TranslationTimeOffer (by ServiceProvider):
1413 Scope;
1414 SLO: DemandedTranslationTime <=100 AND DemandedTranslationTime >0;
1415
1419

```

WSAg4People document 17: Consistent agreement offer 1.2

1418 The WS-Agreement offer of document 18 and its equivalent WSAg4People document 19 are consistent
1419 agreement offers.

```

1420 <?xml version="1.0" encoding="UTF-8"?>
1421 <wsag:AgreementOffer wsag:AgreementId="1.3" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1422 xmlns:wsag="http://schemas.ggf.org/graap/2007/03/ws-agreement"
1423 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1424 xsi:schemaLocation="http://schemas.ggf.org/graap/2007/03/wsagreement agreement_types.xsd
1425 http://www.w3.org/2001/XMLSchema/XMLSchema.xsd">
1426 <wsag:Name>TwoOptions</wsag:Name>
1427 <wsag:Context>
1428 <wsag:AgreementInitiator>IneedTranslationCorp.</wsag:AgreementInitiator>
1429 <wsag:AgreementResponder>ITranslate</wsag:AgreementResponder>
1430 <wsag:ServiceProvider>AgreementResponder</wsag:ServiceProvider>
1431 <wsag:ExpirationTime>2012-01-01T00:00:00</wsag:ExpirationTime>
1432 <wsag:TemplateId>1.1</wsag:TemplateId>
1433 <wsag:TemplateName>TranslateIt!</wsag:TemplateName>
1434 </wsag:Context>
1435 <wsag:Terms wsag:Name="TranslationService">
1436 <wsag:All>
1437 <wsag:ServiceProperties wsag:Name="SP1"
1438 wsag:ServiceName="TranslationService1">
1439 <wsag:VariableSet>
1440 <wsag:Variable wsag:Name="DemandedTranslationTime" wsag:Metric="metrics/metricXML:Time">

```

```

1442     <!-- Time in minutes -->
1443     <wsag:Location>\DemandedTranslationTime</wsag:Location>
1444   </wsag:Variable>
1445 </wsag:VariableSet>
1446 </wsag:ServiceProperties>
1447 <wsag:ServiceDescriptionTerm wsag:Name="Translation_by_Computer"
1448   wsag:ServiceName="TranslationService1">
1449   <OfferItem name="Size">20</OfferItem>
1450   <OfferItem name="HumanSupervised">1</OfferItem>
1451   <OfferItem name="DemandedTranslationTime">2</OfferItem>
1452   <OfferItem name="Cost">1</OfferItem> <!-- the right cost would be (20*1)/2=10 in euros -->
1453 </wsag:ServiceDescriptionTerm>
1454 <wsag:GuaranteeTerm wsag:Name="TranslationTimeOffer"
1455   wsag:Obligated="ServiceProvider">
1456   <wsag:ServiceLevelObjective>
1457     <wsag:CustomServiceLevel>
1458       DemandedTranslationTime<=100 AND DemandedTranslationTime>0
1459     </wsag:CustomServiceLevel>
1460   </wsag:ServiceLevelObjective>
1461 </wsag:GuaranteeTerm>
1462 </wsag:All>
1463 </wsag:Terms>
1464 </wsag:AgreementOffer>

```

WS-Agreement (XML) document 18: Consistent agreement offer 1.3

```

1466 AgreementOffer 1.3 - TwoOptions
1467 1 Initiator: IneedTranslationCorp.,
1468 2 ServiceProvider: AgreementResponder,
1469 3 TemplateID: 1.1,
1470 4 TemplateName: TranslateIt!;
1471
1472 1 Service Properties - SP1 - TranslationService1:
1473   1 DemandedTranslationTime - measured by metrics/metricXML:Time
1474     - related to \DemandedTranslationTime;
1475
1476
1477 2 Service Description Term - Translation_by_Computer - TranslationService1:
1478   Size = 20, HumanSupervised = 1, DemandedTranslationTime = 2, Cost = 1;
1479
1480 3 Guarantee - TranslationTimeOffer (by ServiceProvider):
1481   Scope;
1482   SLO: DemandedTranslationTime <=100 AND DemandedTranslationTime >0;
1483

```

WSAg4People document 19: Consistent agreement offer 1.3

1485 A.2 Operation Inconsistency and Warning Explanation

1486 An explanation is not needed neither for the consistent template of documents 2-3, nor for the consistent
 1487 agreement offers of documents 16-17, and 18-19. However, the other WS-Agreement documents depicted
 1488 in previous section would have the following explaining.

1489 The explaining result for the consistent template of documents 10-11 would include the following warn-
 1490 ings:

```

1491 Explaining Result:
1492 Warnings:
1493   Qualifying Condition of: TranslationTime2,
1494   explainedBy: TranslationTime2 (QualifyingCondition: HumanSupervised=2), SDTI (HumanSupervised=1).
1495
1496   Qualifying Condition of: TranslationTime3,
1497   explainedBy: TranslationTime3 (QualifyingCondition: SourceLang=3), SDTI (SourceLang=1).
1498

```

Explanation Result 20: Explaining result got from documents 10-11

1500 The explaining result for the consistent agreement offer of documents 14-15 would include the following
 1501 warnings:

```

1502 Explaining Result:
1503 Warnings:
1504   Qualifying Condition of: InputErrorsGT2,
1505   explainedBy: InputErrorsGT2 (QualifyingCondition: DemandedTranslationTime >2),
1506   SP_Translation_by_Computer (DemandedTranslationTime=2).
1507

```

1508

Explanation Result 21: Explaining result got from documents 14-15

1509

The explaining result for the inconsistent template of documents 4-5 is as follows:

1510

1511

1512

1513

```
Explaining Result:  
Inconsistent terms:  
explainedBy: SDTI (Size=51), HumanSupervisedCreationConstraint.
```

Explanation Result 22: Explaining result got from documents 4-5

1515

The explaining result for the inconsistent template of documents 6-7 is as follows:

1516

1517

1518

1519

1520

1521

```
Explaining Result:  
Inconsistent terms:  
explainedBy: SDTI (Size=20), SizeCreationConstraint (Size <20);  
SDTI (TargetLang=2), TargetLangGT (TargetLang >2);  
InputErrorsGT (InputErrors <=1), InputErrorsCreationConstraint (InputErrors >1).
```

Explanation Result 23: Explaining result got from documents 6-7

1523

The explaining result for the inconsistent template of documents 8-9 is as follows:

1524

1525

1526

1527

1528

1529

```
Explaining Result:  
Inconsistent terms:  
explainedBy: Implication1CreationConstraint (HumanSupervised=1 IMPLIES Size >20),  
Implication2CreationConstraint (HumanSupervised=1 AND Size <20);  
InputErrorsGT1 (InputErrors <=1), InputErrorsGT2 (InputErrors >1).
```

Explanation Result 24: Explaining result got from documents 8-9

1531

The explaining result for the inconsistent agreement offer of documents 12-13 is as follows:

1532

1533

1534

1535

1536

1537

```
Explaining Result:  
Inconsistent terms:  
explainedBy: TranslationTime1 (InputErrors=1 AND InputErrors=2);  
InputErrorsGT (InputErrors <=1 AND InputErrors >1);  
InputErrorsGT2 (InputErrors <10, InputErrors >=10).
```

Explanation Result 25: Explaining result got from documents 12-13

1539

A.3 Operation Compliance Checking

1540

1541

1542

1543

1544

1545

1546

The consistent WS–Agreement offer of documents 16-17 is compliant with the consistent template of documents 2-3 because the service description term of the offer is compliant with the template creation constraints (WS–Agreement template compliance in Fig. 9), and the offer terms are compliant with the template terms (extended WS–Agreement template compliance⁸ in Fig. 9).

However, the consistent WS–Agreement offer of documents 18-19 is not compliant with the consistent template of documents 2-3 because the service description term of the agreement offer is not compliant with the template creation constraints.

1547

A.4 Operation Non-Compliance Explanation

1548

1549

1550

An explanation is not needed for the compliant WS–Agreement offer of documents 16-17 with the template of documents 2-3. However, the non-compliance WS–Agreement offer of documents 18-19 with such template needs the following explaining.

⁸ This extended WS–Agreement template compliance notion was defined in [7]

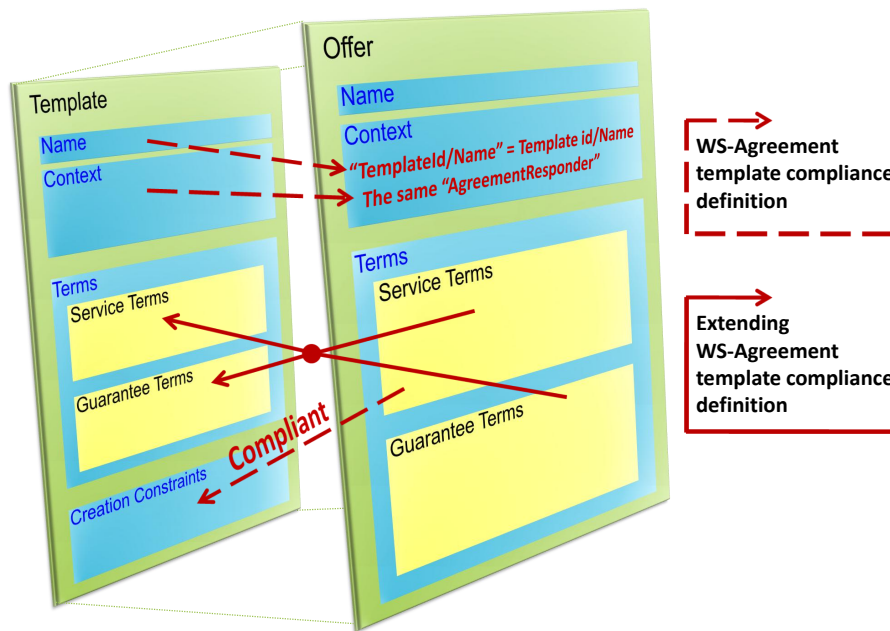


Figure 9: Summary of Compliance between WS-Agreement templates and offers (detailed in [7]).

1551
1552
1553
1554
1555

Explaining Result:

Non-Compliance terms:

From template: *CostCreationConstraint (Cost=(Size*HumanSupervised)/DemandedTranslationTime),*
From offer: *Translation_by_Computer (Cost=1) //The right cost would be (20*1)/2=10.*

Explanation Result 26: Explaining result got from non-compliant offers 18-19 with template 2-3