Reputation = \( f(\text{User Ranking, Compliance, Verity}) \)

Sravanthi Kalepu, Shonali Krishnaswamy and Seng Wai Loke  
*School of Computer Science and Software Engineering, Monash University, Australia*  
sravanthihere@hotmail.com, \{Seng.Loke, Shonali.Krishnaswamy\}@infotech.monash.edu.au

**Abstract**

The selection of web services is typically based on both functional and non-functional attributes of the service, such as the Quality of Service (QoS) levels. Reputation, a widely acknowledged non-functional QoS attribute is currently expressed as the average of user ratings given to the service. However, this expression confines reputation to the subjective perception of the end user and is limited by the lack of an objective representation of performance history. In this paper, we address the need for a reputation mechanism that couples the subjective perception of the end user with the objective view of performance history. To represent performance history, we propose a novel QoS metric termed verity. Verity measures the degree of consistency exhibited by the service provider in delivering the quality levels laid out in the service contract, over a range of previous transactions. We express reputation as a composition of user rating, the compliance levels exhibited by the provider and the verity value. We contend that this reputation expression is a more viable attribute of quality than user rating alone.

1. Introduction

Web services are evolving as an innovative mechanism for rendering services to arbitrary devices over the WWW [10]. As a consequence of the rapid growth of web service applications and the abundance of service providers, the consumer is faced with the inevitability of selecting the “right” service provider. In such a scenario the quality of service (QoS) serves as a benchmark to differentiate service providers and comprises of techniques that aim to bring a balance between the needs of the service requestor and those of the service provider while being constrained by the limited network and server resources [4]. QoS has typically been associated at a network/server level rather than the user level [5]. As the Internet expands the diversity of its applications these issues become increasingly critical and it is now necessary to relate the objective system quality to the users' subjective perception of quality [5].

QoS has been the distinguishing aspect in the works addressing quality aware UDDIs [1], distributed query processing [2], real time quality measurements [9], composition [8] and selection [13] of web services.

QoS enabled web services are typically associated with a service level agreement (SLA) which is used to guarantee quantifiable performance. It is a formal binding defining the relationship between the service provider and the customer often involving a third party to support the enactment of the contract [6]. It consists of descriptions of the parties involved, the service definitions, quality of service parameters and their service levels and possible penalties in the face of failure to comply with the agreed levels [7]. SLAs in web services have been developed to facilitate the complex relationships among providers and guarantee application performance [6].

Several quality attributes like response time, availability, performance and throughput are regarded the criteria for quality driven selection of web services [8, 2, 1] and typically are included in the SLA as part of the service definition. Currently expressed as the average user rating, reputation is a widely acknowledged non-functional QoS attribute and has been an area of intense activity in the e-market place and web pages realm [16, 17, 18, 19, 15]. A reputation system is intended to aggregate and disseminate feedback about participants’ past behaviour [12]. These systems encourage trustworthiness and help people choose the right system for service request. In the context of web services too, reputation is defined as the average of rankings given to a service by all users who invoked and rated the service [8]. In [11] an improvised reputation system is described where reputation is built up over its historical values, does not exceed a maximum value and is a weighted average of non-negative ratings. An agent based architecture for reputation and endorsement of web services has been developed in [3]. In this architecture, a Web Service Agent Proxy (WASP) conveys reputation data that is delivered by human intervention or provided by agents, to a Reputation and Endorsement Agency (RES) where it can be aggregated. The rating of a service is a vector of attribute values and the reputation is modelled as a vector of aggregate ratings of the attributes from different attribute groups [3].

Although we concur with the above works that reputation is chiefly influenced by the user perception, it should also be an indicator of the trustworthiness and
performance history. Based only on the average user rating, reputation remains merely a user perception, failing to indicate the success or failure in delivering agreed quality levels. It also cannot reveal how consistently the service or provider has been delivering these quality levels in the previous invocations. An average user ranking is also susceptible to unwanted manipulative rankings from competing service providers and hostile users who might rank a service poorly in spite of a good performance simply to tarnish its ranking.

This paper therefore takes an extended approach to reputation in Web services. To indicate the success or failure of delivering the agreed quality levels, we propose to calculate the difference in the projected and agreed levels of quality as the attribute compliance. Attribute compliance is further used to calculate the service compliance and service provider compliance. As a measure of the degree of consistency in delivering the agreed quality levels, we propose to measure the variance in compliance values as the verity. Verity translates the success or failure of a Web service or provider in meeting the projected quality levels to a numerical value.

Finally, we propose a reputation mechanism that expresses performance history of the service or service provider with respect to delivering agreed quality levels. When reputation is merely the aggregate of user ratings, it remains a user-driven perception with no objective indication of performance history, which is in fact the quintessence of reputation. When expressed in terms of verity, a metric that quantifies performance history into an easily discernible numerical value and user rating, reputation will be a more representative measure of quality. We advocate that verity should therefore be an important contributor to quality of service and reputation that numerically reflects the past behavioural aspects of the provider along with the user perception is the desired attribute for quality driven selection and composition of web services and providers. The reputation vector we define articulates not only the personal view of the user but also couples it with objective numerical values that quantify the compliance levels and their variance there by reflecting the performance history.

The remaining of this paper is organized as follows. Section 2 introduces the attribute verity and its relation to the reputation of the service and service provider and briefly formalises the verity calculations. Section 3 explores the architecture proposed to integrate verity with the QoS stream. Section 4 and 5 illustrate with simulated scenarios the need for coupling compliance and verity and importance of maintaining local and global profiles of service and provider performance.

2. Compliance, Verity and Reputation

In this section, we formulate our definitions of compliance, verity and reputation and briefly formalise the computations.

Compliance refers to the service provider's ability to meet the service level of each QoS parameter laid out in the SLA without incurring penalties. Compliance (or conformance) has been discussed in [4] and explored by [14]. The design for conformance in [14] consists of a contract template and a System Dictionary used to verify a contract. The customer specific data is inserted in the contract template and verified against the system measurements that were asserted while forming the contract. The contract is evaluated and the compliance results are presented as customized reports for each customer [14]. Here, compliance remains a graphical view to the end user and is not formally quantified. In this thesis, we quantify compliance at three levels: attribute compliance, service compliance and service provider compliance. Calculated successively in that order, these compliance values essentially capture the normalized difference in the projected and the actual values of a QoS attribute. The difference in the actual and projected values is ideally zero and is best kept to a minimum to achieve high compliance levels.

\[
L_{\text{compl}} = \sum_{j=1}^{m} \frac{ND_{a_i,j}}{m}
\]

where \( m \) is the number of times the service was invoked locally by a particular end user and \( ND_{a_i,j} \) is the normalized difference of projected and delivered values of attribute \( a_i \) when the service was invoked the \( j^{th} \) time. The normalised value is relative to the projected value and scales with different values of actual and projected values.

\[
ND_{a_i,j} = \frac{a_{pj} - a_{dj}}{a_{pj}}
\]

Local Compliance of a service is the mean of the compliance of all the quality attributes.

\[
W_{\text{compl}} = \frac{\sum_{i=1}^{r} L_{a_i,\text{compl}}}{r}
\]

where \( r \) is the number of quality attributes of the Web service and \( L_{a_i,\text{compl}} \) is the local compliance of parameter \( a_i \). The local compliance of a service provider is the average of the compliance values of all the web services invoked by the end user that were hosted by the service provider.
Local Compliance of service provider

\[ \text{SPL}_{\text{compl}} = \frac{\sum_{i=1}^{h} \text{WSL}(i)_{\text{compl}}}{h} \]

where \( \text{WSL}(i)_{\text{compl}} \) is the local compliance of a web service that was invoked by a particular end user and hosted by this service provider and \( h \) is the number of such services.

The mathematical variance in the compliance levels is a direct indicator of the service provider’s ability to consistently deliver guaranteed levels of service and is therefore a measure of verity. Lower values for variance implies that the provider is more successful in delivering consistent service levels. Verity is calculated at the service and service provider levels over a range of compliance values obtained from past invocations of the service. The temporal window over which the verity is calculated is an important factor in determining verity. Our model and evaluation demonstrates this. Therefore, we provide the user with the flexibility of specifying the temporal window for verity calculations.

Local verity of a Service

\[ \text{WSL}_{\text{verity}} = \frac{\sum_{i=1}^{m} (\text{WSL}_i^{\text{compl}} - \mu)^2}{m} \]

where \( m \) is the number of times the service WS was invoked by the end user, \( \text{WSL}_i^{\text{compl}} \) is the local compliance value when invoked the \( i \)th time by the end user and \( \mu \) is the mean of the compliance values \( \text{WSL}_i^{\text{compl}} \).

Local verity of a Service Provider

\[ \text{SPL}_{\text{verity}} = \frac{\sum_{i=1}^{h} (\text{WSL}(i)_{\text{compl}} - \mu)^2}{h} \]

where \( \text{WSL}(i)_{\text{compl}} \) is the local compliance of the \( i \)th web service hosted by the service provider that was invoked by a particular end user and \( h \) is the total number of such services.

Reputation is in turn based on compliance, verity and user rating. User rating is the average of ratings assigned over a range of past invocations and expresses the perception of the end user [8, 11, 3]. The user rating is calculated as the average of the ratings given by the end users to the service.

Local rating of a service \( \text{SL}_{\text{rating}} \)

\[ \text{SL}_{\text{rating}} = \frac{\sum_{i=1}^{n} S_i^{\text{rating}}}{n} \]

where \( S_i^{\text{rating}} \) is the local rating given to the service \( S \) the \( i \)th time it was rated by the end user and \( n \) is the number of times the service was ranked by this end user.

The user rating is calculated as the average of the ratings given by the end users to the service provider.

Local rating of a service provider \( \text{SPL}_{\text{rating}} \)

\[ \text{SPL}_{\text{rating}} = \frac{\sum_{i=1}^{n} S_P^i \text{rating}}{n} \]

where \( S_P^i \text{rating} \) is the rating given to the service provider \( SP \) the \( i \)th time a service hosted by \( SP \) was invoked by a particular end user and \( n \) is the number of times the service provider was ranked locally.

Compliance indicates the success or failure in delivering projected quality levels in positive or negative values respectively. Verity being the variance of compliance, indicates the degree of consistency in the delivering the quality levels.

Local Reputation of a web service is:

\[ < \text{WSL}_{\text{compl}}, \text{WSL}_{\text{verity}}, \text{SL}_{\text{rating}} > \]

Global Reputation of a web service is:

\[ < \text{WSG}_{\text{compl}}, \text{WSG}_{\text{verity}}, \text{SG}_{\text{rating}} > \]

Local Reputation of a service provider is:

\[ < \text{SPL}_{\text{compl}}, \text{SPL}_{\text{verity}}, \text{SPL}_{\text{rating}} > \]

Global Reputation of a service provider is:

\[ < \text{SPG}_{\text{compl}}, \text{SPG}_{\text{verity}}, \text{SPG}_{\text{rating}} > \]

This vector of reputation encompasses both the user perception and the performance history of the service or provider thereby being a true indicator of reputation. For a more detailed description of the computations please refer to [20].

Having discussed the concepts of compliance, verity and reputation, we now present the proposed architecture for incorporating them into the Web services operational framework.

3. Architecture for Verity in an SLA Environment

The architecture for an SLA-enabled web service typically consists of three components: the service provider, the end user and the service broker [6]. According to this architecture, the service provider publishes a SLA-enabled web service and sends it to the service broker for storage in a repository. An end user registers with the service broker searches and finalized the SLA with the appropriate service provider. After the provider and the end user negotiate the relevant parameters, the transaction needs to be monitored by a
third party to detect any violations of service level agreements. This is accomplished by the SLA monitoring model in [7] where a third party is assigned the job of verifying the values of SLA parameters in the agreement against the values obtained by probing or intercepting the client invocation. This model is restricted to taking corrective actions on behalf of the managed environment upon failing to comply with the SLA terms.

Compliance is not a new concept and has been mentioned in [4] and explored by [14] under the name of Conformance. Their design for Conformance consists of a contract template and a System Dictionary used to verify a contract. The customer specific data is inserted in the contract template and verified against the system measurements that were asserted while forming the contract. The contract is evaluated and the compliance results are presented as customized reports for each customer. This paper proposes extensions of the work in [8] and [3] by progressively recording the actual and achieved parameter values for each client invocation of a service and quantifying the compliance in numerical terms. This could be then coupled with verity and user-given ranking to indicate the reputation of the provider. The architecture for this proposed model is displayed in Figure 4.1.

This model enhances the functionality of the service broker and the end user with the addition of a verity calculator to each of them. The interceptor is responsible for measuring the SLA parameter values delivered at the end of each service invocation. The end user initiates this interception at the start of each service and upon completion of the service the interceptor sends these values to both the end user and the service broker for verity calculations. The end user supplies the service broker with a copy of the finalized SLA at the beginning of every service invocation from which the former obtains the agreed values of the contract.

The end user and the service broker are equipped with local and global compliance databases respectively, where records of past invocations of the service are maintained. The local database typically consists of lesser records than its global counterpart since it records past transactions pertaining to the end user alone in comparison to the records of all the transactions of the broker in the global database. The databases maintain these records at both the service level and the service provider level. Each record consists of compliance, verity and user ranking values against each service or service provider.

The end user and the broker hold different views of the compliance and verity of a service and its provider since the corresponding past transaction records vary. Accordingly the end user and the service broker are equipped with individual verity calculators. The functionality of the two calculators is essentially the
same but produce different results owing to the different inputs.

This architecture advocates maintaining of two profiles for each service and service provider- one local and the other global. The local profile is necessary to identify the personal preferences of the end user which typically differ from the global perspective. A service favoured by the end user might have been assessed unfavourable by the rest of the users. If the end user had only the global profile to rely on, this personal preference cannot be exercised. The global profile being unavailable under unavoidable circumstances is also an incentive to maintain a personalised profile at the user’s end. This yields two different values of verity for each web service and provider.

The results of all the computations rely on the length of the period they are calculated on. The total number of times a service is invoked or the total number of services hosted by a provider is determined by the length of the temporal window. The end user and service broker can control this window for each calculation and the system can be directed to perform the computations over periods of days, weeks, months or years. An assessment over the past two months is an indicator of the recent performance and can be very different from a yearly performance. The temporal aspect gives the end user the flexibility to assess the provider and the associated services at different temporal granularities.

Adapting this architecture into the real world will require the implementation of a number of different mechanisms at both the client and provider ends. These will include the techniques for intercepting and probing the Web service for the SLA attributes, database management policies to regulate the quantity of information stored in the compliance databases and efficient software engineering techniques to streamline the entire process. We also identify the need for a selection mechanism that accommodates for the differences in the local and global profiles, the effect of the temporal window length and the significance of verity to efficiently incorporate reputation into the quality driven selection. It is required to build a decision support system based on multi-criteria decision making to incorporate these various attributes to support automated selection based on reputation.

4. Illustrating the Impact of Coupling Verity and Compliance in the Context of Reputation

In this research we contend that compliance value at a point in time alone fails to reflect the performance history of the provider. To capture this information, the verity value should be coupled with the compliance value in assessing the provider. While the compliance values serve as an indicator of deviance from agreed levels, the verity value indicates the provider’s consistency in delivering such levels. This is shown in a simulated scenario in Table 1.

<table>
<thead>
<tr>
<th>WS_ID</th>
<th>Invocation_Key</th>
<th>WS_Compl</th>
<th>WS_Verity</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS2</td>
<td>WS2C101</td>
<td>-0.2107144</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>WS2</td>
<td>WS2C102</td>
<td>-0.2018455</td>
<td>1.555077E-03</td>
<td>3</td>
</tr>
<tr>
<td>WS2</td>
<td>WS2C201</td>
<td>-0.2090336</td>
<td>1.353459E-03</td>
<td>3</td>
</tr>
<tr>
<td>WS2</td>
<td>WS2C203</td>
<td>-0.2107144</td>
<td>1.150267E-03</td>
<td>3</td>
</tr>
<tr>
<td>WS2</td>
<td>WS2C301</td>
<td>-0.2107144</td>
<td>9.850956E-04</td>
<td>3</td>
</tr>
<tr>
<td>WS2</td>
<td>WS2C302</td>
<td>-0.2052856</td>
<td>8.367582E-04</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1 High Verity but Consistently Negative Compliance

The web service WS2 at the last invocation displays high verity in the order of 10^4 indicating that the service has been delivering consistent compliance levels. This information can be however misleading if not seen in the light of the compliance values which have been consistently negative. This means that this service has been consistently failing to deliver agreed quality levels and is therefore not a prudent choice. The graph in Fig 2 displays this scenario. The graph is a plot of compliance values against each invocation of the service WS2. Since the compliance values are not highly varying, the plot is almost straight with a low slope.

Figure 2 Consistent Negative Compliance

This scenario can also be extended to a web service having highly variant albeit positive values of compliance. The test data in Table 2 shows one such scenario, where a service has positive compliance values.
indicating that it has been delivering better than the agreed levels. These values however vary in the range of 0.0 and +0.3445 yielding a high variance in the order of $10^{-2}$. The verity value in this case works against the reputation of the service if the compliance values are overlooked.

Just as compliance alone is not a complete indicator, verity too is not a complete indicator by itself as the following test data shows. The compliance of the web service WS1 at the last invocation is +0.1578 which indicates that the provider delivered the agreed levels well during this invocation. However, this does not indicate the fact that the same service has been performing poorly in the past invocations with compliance values of -0.0122549, -0.02508, and -0.0265. An examination of the verity value corresponding to the current invocation reveals a decrease in the verity from the previous invocations indicating that there has been a high variance (0.005 as compared to 0.0002 in the previous invocation) in the compliance levels of this web service and that it has not always been performing well.

<table>
<thead>
<tr>
<th>WS_ID</th>
<th>Invocation Key</th>
<th>WS_Compl</th>
<th>WS_Verity</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS3</td>
<td>WS3C101</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>WS3</td>
<td>WS3C102</td>
<td>0.3445517</td>
<td>0.0263813</td>
<td>5</td>
</tr>
<tr>
<td>WS3</td>
<td>WS3C103</td>
<td>3.059488E-02</td>
<td>2.111705E-02</td>
<td>4</td>
</tr>
<tr>
<td>WS3</td>
<td>WS3C104</td>
<td>0</td>
<td>3.295499E-02</td>
<td>5</td>
</tr>
<tr>
<td>WS3</td>
<td>WS3C105</td>
<td>0.4634992</td>
<td>3.8763E-02</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2 WS3 with High compliance but poor verity

<table>
<thead>
<tr>
<th>WS_ID</th>
<th>Invocation Key</th>
<th>WS_Compl</th>
<th>WS_Verity</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1</td>
<td>WS1C101</td>
<td>-5.29207E-2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>WS1</td>
<td>WS1C102</td>
<td>-2.65114E-2</td>
<td>1.74363E-04</td>
<td>2</td>
</tr>
<tr>
<td>WS1</td>
<td>WS1C201</td>
<td>-0.0250817</td>
<td>1.638343E-04</td>
<td>2</td>
</tr>
<tr>
<td>WS1</td>
<td>WS1C202</td>
<td>-0.0122549</td>
<td>2.184997E-04</td>
<td>2</td>
</tr>
<tr>
<td>WS1</td>
<td>WS1C301</td>
<td>0.157884</td>
<td>0.0057744</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3 WS1 with good Compliance but poor Verity

5. Illustrating the need for Local and Global Profiles

Each end user maintains a local database of the service invocations which is a subset of the records in the global database. The local database enables the end user to exercise personal preference and user subjectivity. It also facilitates using our approach in cases where a centralised global history is not maintained or available for querying. The reputation vectors of a service or provider typically differ significantly between the local and global profiles. This difference is shown by the test data in Table 3 and 4. While Table 4 shows a web service’s local reputation vector as seen by an end user and the following Table 5 shows the same web service’s global reputation vector.

The web service has always been performing well when invoked by the end user US1 but has been giving different results to other end users globally. This could also suggest that the service provider for this service may have been using customer relationship management in his business process and this end user is one of the preferred customers. Maintaining a local profile at the user end provides the means to identify such provider specific information. If the end user had no way of maintaining local invocation details, the same information would be lost in the large customer base of the global profile. This scenario therefore strongly recommends the presence of a local verity database.

<table>
<thead>
<tr>
<th>WS_ID</th>
<th>Invocation Key</th>
<th>WS_Compl</th>
<th>WS_Verity</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS7</td>
<td>WS7C101</td>
<td>1.718582E-02</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C102</td>
<td>9.373322E-03</td>
<td>1.525558E-05</td>
<td>2</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C103</td>
<td>1.195064E-02</td>
<td>1.05626E-05</td>
<td>2</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C104</td>
<td>6.687484E-03</td>
<td>1.501099E-05</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4 Local Profile of Service WS7 with a Positive Reputation Vector

The local profile however, is not a replacement to the global profile. Consider a scenario where a service provider provides two different services WS1 and WS2, WS1 with a good reputation vector and WS2 not reputed to perform well. Consider an end user who has previously invoked WS1 from this provider and is now in need of WS2. The end user should not choose WS2 predisposed by the reputation of WS1 and should not...
rely on the local reputation profile of SP1 alone to make this choice. The global profile of WS2, which reveals a low reputation, has to be examined before opting to employ this service. This scenario recommends that the local and global reputation profiles are complementary to each other and the end user has to put them to the best use for an efficient selection.

<table>
<thead>
<tr>
<th>WS_ID</th>
<th>Invocation Key</th>
<th>WS_Compl</th>
<th>WS_Verity</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS7</td>
<td>WS7C101</td>
<td>1.718582E-02</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C102</td>
<td>9.373322E-03</td>
<td>1.525878E-05</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C103</td>
<td>1.195064E-02</td>
<td>1.056498E-05</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C104</td>
<td>6.687484E-03</td>
<td>1.50134E-05</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C201</td>
<td>6.687484E-03</td>
<td>1.541376E-05</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C301</td>
<td>-9.101989E-03</td>
<td>6.554328E-05</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C401</td>
<td>-2.505943E-02</td>
<td>1.830603E-04</td>
<td>4</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C501</td>
<td>-4.408118E-02</td>
<td>3.978254E-04</td>
<td>3</td>
</tr>
<tr>
<td>WS7</td>
<td>WS7C601</td>
<td>-0.1992671</td>
<td>4.146725E-03</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5 Global Reputation Vector of WS7 Indicates Poorer Verity and Compliance Values than the Local Counterpart

### 6. Conclusion

We have established that reputation should reflect the past behavioural aspects of the provider along with the user perception. We have defined and formalised a QoS metric which reflects the performance history of a service or service provider: verity. We have proposed an expression for reputation that objectively indicates the level of quality delivered to the end user. We have expressed reputation as a vector of compliance, verity and user ranking. The user rating expresses the personal opinion of the end user and the verity value numerically expresses how consistent the provider has been in delivering the projected quality levels. This couples the subjective perception of the user rating with the objective performance history of the provider. This combination allows reputation to become the desired attribute for quality driven selection and composition of Web services and providers. Furthermore, the personal invocation profile maintained at the user end enables the user to exercise personal preference in the selection and also identify the preferred set of service providers. We have practically shown that compliance and verity values complement each other in the selection process.

Selecting a service or service provider is a non-trivial task since there are various aspects to be considered in the reputation vector. The service provider’s local profile reflects the personal preferences of the end user which can be used to override the global profile. The length of the temporal window greatly varies the reputation vector and thus is an important contributor in the selection. Since reputation is no longer a single digit user rating, merely assigning a weight to it [8] is not sufficient. A more intuitive approach to judging the reputation vector is necessary. An end user might select a service provider in spite of a bad global profile simply because the provider has always delivered well to this particular end user. A service provider who recovered in the current month from a bad performance in the last month can be chosen over another provider who has been delivering well in the entire year simply because the service is not mission-critical and failures can be tolerated. Therefore we identify the need for a selection mechanism that accommodates for the differences in the local and global profiles, the effect of the temporal window length and the significance of verity to efficiently incorporate reputation into the quality driven selection. We intend to build a decision support system based on multi-criteria decision making to incorporate these various attributes to support automated selection based on reputation as part of our future work.

### 7. Acknowledgements

This research is funded by the Australian Research Council Discovery Grant DP0345713.

### 8. References


[16] Slashdot http://slashdot.org


