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Understanding of Quality of Service in Web Services – A Review

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ABSTRACT: The concept of www in attracting business and advertising of the internet is a major contributor. The businessman deals to the clients with the use of application web through e-business. The users of mobile device use various services such as web surfing, email, video and audio streaming, etc. To provide high quality mobile network services, it is necessary to analyze the quality of the network such as QoS management, traffic engineering, etc.

The web service provides us with an application integration service, which helps in working through uniting many applications. Web Services are widely used everywhere on the internet. In order to maintain transparency in transaction proceedings in the field of business, clarification of the quality of web services and monitoring is required to give guarantee.To ensure successful execution of services and to maintain its quality,it has been proposed that monitoring of web services should be ensured, whereby the services of web services are faultless.

KEYWORDS: Service level agreements; Monitoring of web services; Implementing tools; QoS Values of WS composition; experiments; Monitoring Approaches.

I. INTRODUCTION

The monitoring phase is the important part of the Web service lifecycle, which explains how the service works in the operational environments. Mainly it concerns itself with service-level measurement; monitoring is the continuous and closed loop procedure of measuring, monitoring, reporting, and improving the QoS of systems and applications delivered by service-oriented solutions. Service monitoring involves many discrete activities including logging and analysis of service execution details, detecting business situations that require management attention, obtaining business metrics by analyzing service execution data, determining appropriate control actions to take in response to changing business situations, be it mitigating a risk or taking advantage of an opportunity, and using historical service performance data for continuous service improvement.

The service monitoring phase object the continuous evaluation of service-level objectives, monitoring the services layer for availability and performance, tracking interconnectivity of loosely coupled components, managing security policies, analyzing the root cause and correcting problems. To achieve this target, service monitoring requires that a set of QoS metrics be accumulated on the basis of SLAs, an SLA is an apprehension of service expectations.SLA-available QoS metrics are valuated based on measurable data about a service, periodic evaluations, performance during specified times. SLAs include other discernible objectives which are utile for service monitoring. Alert threshold and alert for compliance failure are the main aspect that define measurable purpose. For example, if the response time of a specific service is corrupting then the client could be automatically routed to a back-up service.

II. SERVICE-LEVEL AGREEMENTS (SLAs)

An SLA is defined with the architecture. An exponential relationship exists between the availability of any object and the level of cost related to it. Some customers are subject to excessive availability and are willing to pay more for that. So being a separate SLA with different affiliated costs is a general approach.

An SLA may contain the following parts:
• **Purpose:** It describes the cause of the creation of the SLA.
• **Parties:** It describes all the SLAs and related parties that are related to the roles.e.g. service provider and service consumer (client).
• **Validity period:** It describes the period of time that the SLA will cover. Determines the start and end time limit of this agreement.
• **Scope:** It describes the services involved in the agreement.
• **Restrictions:** It defines the necessary steps to be provided in order of the requested levels.
• **Service-level objectives:** It defines the levels of service that both the service customers(client)and the service providers concord on, and usually includes a set of service level indicators, like performance, availability and reliability. The level of goal will be to achieve all these aspects of service level.
• **Penalties:**It states that if service provider is subject to performance and is unable to fulfill the specified purpose, then what restriction should be imposed for SLA.
• **Optional services:** This specifies the services that are not generally required by the user, but may be required in case on an exception.
• **Exclusion terms:** It shows that what is not included in the SLA.
•**Administration:** It shows the processes and the measurable purpose in an SLA and defines the organizational authority for monitoring them.
We can say that SLAs can be either in static nature or dynamic nature. At the end of QoS in an SLA, tracing of Web services through multi-domain (geographical, technological, application, and supplier) infrastructures will be involved. In a specific scenario, each Web service can interact with multiple Web services, in order to be a consumer in other contacts, switch between the roles to be a service provider in some contacts. Each of these conversations may be controlled by an SLA. Thus, an important task which is accomplished by an SLA is addressing QoS at the source.

III. WHY IS A SERVICE LEVEL AGREEMENT IMPORTANT?

A good SLA is most important because it sets boundaries and expectations for the following aspects of service provisioning.
• ***Customer commitments.***The clearly defined promises reduce the chances of customers becoming depressed. These promises also help in focusing on the needs of the consumer and assuring to follow internal processes in the right direction.
• ***Key performance indicators for the customer service.*** By establishing these indicators, it becomes easy to understand how they can be integrated into the quality improvement process. By doing this, the purpose of a better customer satisfaction is a clear objective.
• ***Key performance indicators for the internal organizations***. An SLA runs internal processes by determining a clear, measurable standard. Consequently, this makes internal purpose and measurement easy.
• ***The price of non-conformance.*** By defining the penalties, the customer understands that the provider believes in its ability to achieve the specified performance levels. This helps in making the relationship clear and positive.

IV. SLA LIFE CYCLE

W. Sun describes the SLA life cycle consists of six phases shown in Figure 4.1.

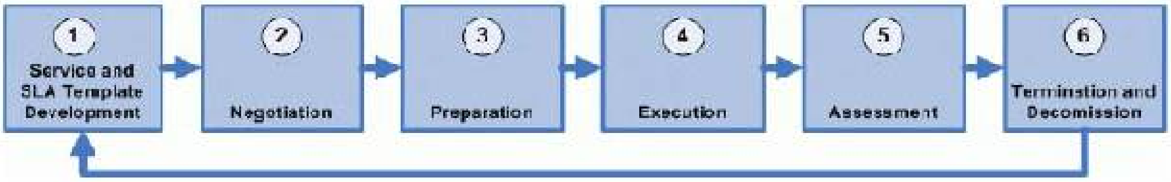
1
Service and SLA Template Development
2
Negotiation
3
Preparation
4
Execution
5
Assessment
6
Termination and Decomission

Fig. 4.1

1) ***Service and SLA Template Development:***Inthis phase identifying the appropriate service characteristics, identifying the service consumer needs, parametersin the service execution environment, and the preparation of standard SLA templates.[2][5]
2) ***Negotiation*****:** In negotiation phaseincluding sharing concerns, talk over in-scope and out-of-scope services, double-checking needs, goals and assumptions,reaching agreement, and of course documenting the contractual arrangements.
3) ***Preparation*****:** In preparation phase, this service is ready for consumer consumption. Resources that support the execution of services at this stage may require reconfiguration.
4) ***Execution*****:** Execution phase shows the actual operation of the service. In this phase, these are all included service execution and monitoring, service quality validation, real-time reporting and real-time SLA violation processing.
5) ***Assessment*****:** This phase has two parts: **a)**Assessment of the SLA and Quality of service, both are provided to an individual consumer. Periodic customer satisfaction for each SLA, is reviewed on potential improvements, Quality of services and changing needs.
b) Some work of assessment may be linked to internal business reviews.The elements to be included in this review are the Quality of service provided to all consumers, service goals and needs for reconstruction of operations, identifying service support issues, and the identification of the need for different service levels.
6) ***Termination and Decommission:***This step relates to the termination of service due to reasons for termination of contract or violation of rules.

V. EXPRESSING SLAs IN THE WSLA LANGUAGE

In this section, The *Parties* section describes the contractual parties and it has a party's technical properties, i.e. address and interface definitions. The *Service Description* section of the SLA determines the characteristics of the service and its discernible parameters as follows: For every *Service Operation***,** one or more *Bindings***,** i.e., the transport encoding for the messages to be exchanged, may be determined. Every SLA parameter refers to one Metric**,** which, in turn, may aggregate one or more other metrics, according to a measurement directive or a function. *Measurement Directives* elements are used when the value of a Metric should be measured directly from a resource by inquisitory or instrumentation of the system. Typical examples of measurement directives areprotocol message, or a query statement issued against a database or data warehouse. *Function* elements are used for a metric if the metric value is derived from the value of other metrics. There are eighteen types of functions used in WSLA document.i.e. various arithmetic operators. For every function, a *Schedule* is specified that defines the time intervals during which the functions are executed to retrieve and compute the metrics. These time intervals are specified by means of *start time, duration,* and *frequency*. i.e. *weekly, daily, hourly,* or *every minute. Obligations*isthe last section of an SLA, define the SLOs, guarantees and constraints that may be enforce on the SLA parameters.[8]

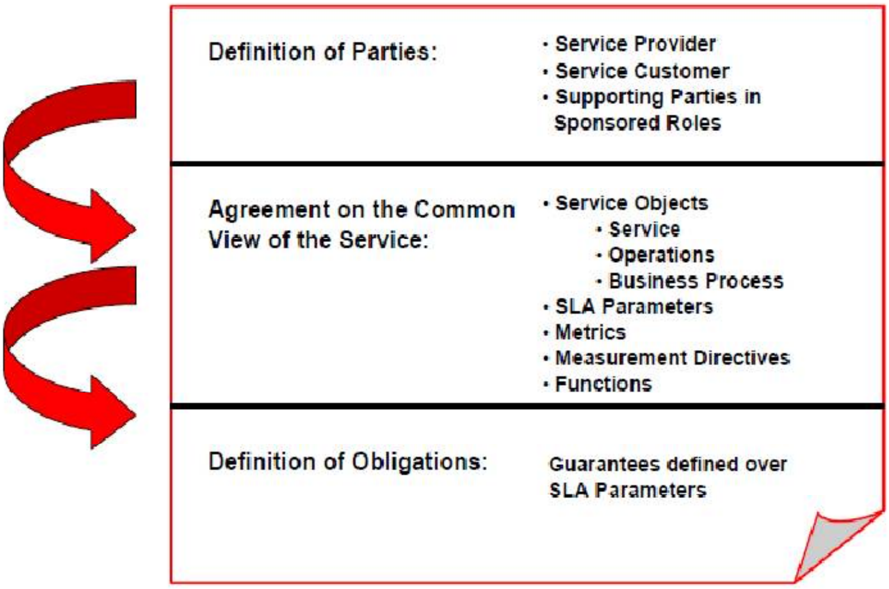

Figure 5.1: SLA structure as defined in WSLA

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VI. MONITORING OF WEB SERVICES

6.1 Services involved in SLA-compliance monitoring

When the SLA is reaches the final stage, SLA documents are provided for deployment by both provider and customer. The responsibility of the investigation of the validity of SLA is to deployment service and distributing it either in full or part to the supporting parties.

This fig.6.1 shows the service involved in the monitoring of compliance when joining multiple parties. The service that is a service measurement service or situation evaluation service may be the outsourced to the third party service.

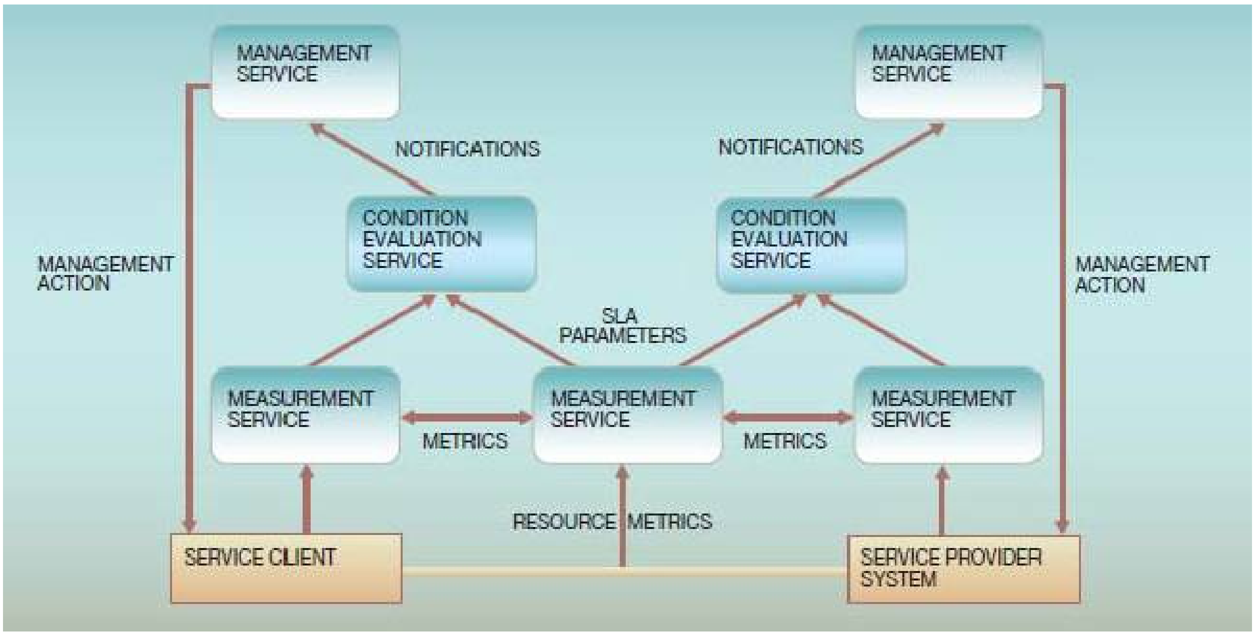

Figure 6.1: Services involved in SLA-compliance monitoring with multiple parties

The *measurement* service maintains information or data on the current system configuration and runtime information on the metrics that are part of the SLA. It evaluate SLA parameters, such as availability or response time, either from inside, by recovering resource metrics directly from managed resources, or from outside the service provider's domain. A measurement service may measure all parameters or a subset of the SLA parameters. Multiple measurement services may simultaneously measure the same metrics. Figure 6.1, measurement services may be cascaded, i.e. a third measurement service may be used to combine data computed by other measurement services. In resource metrics, itrefer to metrics that are retrieved directly from managed resources. In composite *metrics*, in contrast, are created by aggregating many resource metrics according to a specific algorithm, such as averaging one or more metrics over a specific amount of time or by breaking them down according to specific criteria. It is usually done by a measurement service within the domain of a service provider, but can be outsourced to a third-party measurement service as well.

The *condition evaluation service* is responsible for monitoring compliance of the SLA parameters at runtime with the agreed-upon service level objective (SLO). It obtains measured values of SLA parameters from one or more measurement services and tests them against the guarantees given in the SLA. This can be done each time a new value is available, or periodically.

Finally, both service customer and provider have a *management service*. The main objective of the management service is to perform corrective work on behalf of the managed environment, if any condition evaluation service indicates that the SLA has been violated.

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VII. MONITORING AND MANAGING SLAs

This Figure 7.1 shows a conceptual architecture for an SLA monitoring and management infrastructure. Both service user and service provider are added to the instrumentation, from which metrics generated. The measurement subsystem acceptthe metrics from the instrumentation on one or more elements and aggregate data to produce values for the parameters specified in the SLA.Figure 7.1 shows measurement subsystem components or elementson the service user and service provider sides, but there are also other alternatives. The measurement subsystem could subsist only on the service user side or only on the service provider side, but the party supplying measurement needs to be trusted by the other party. Measurement could also be partially or totally implemented by a third-party component running on a separate machine. Figure 7.1 shows the values of the SLA parameters are input for the evaluation procedure, which can run on

•both the service user and service provider
• either the service user or service provider
• a third-party machine

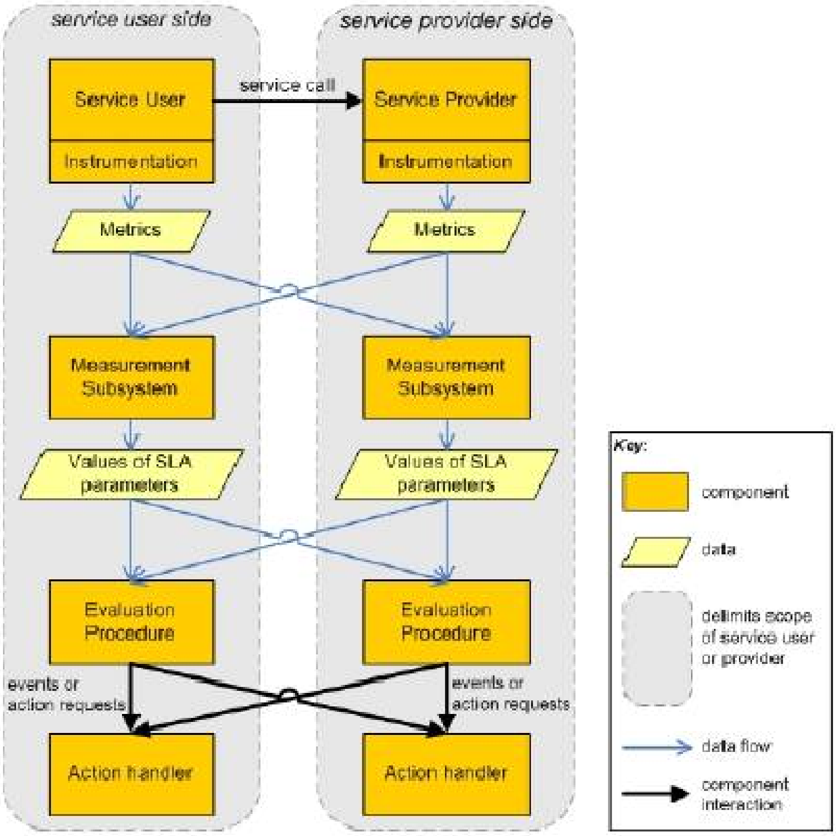

Figure 7.1: Conceptual Architecture for SLA Monitoring and Management

Values of SLA guaranteed conditions are examined by the evaluation process. If any value violates a condition in the SLA, then predefined actions are applicable. Action-handler components are responsible for processing each action request. While the functionality they execute will vary, it will likely include some form of violation notification or recording. Action handlers maybe present on the service user machine, service provider machine, and/or third-party machines.

An important output of SLA management not shown in Figure 7.1consists of reports that includes analyses of the metrics and thresholds. These reports provide guidelinefor planning and implementation of improvements to the service infrastructure.
The same service may be applicable by different service users under different SLA(service level agreements). In that case, each service call may need to identify the agreement that applies to that charge.

VIII. EXPERIMENTAL EVALUATIONS

In this part, we experimentally measure some basic metrics of webservices. We provide diagrams that illustrate the performance of the services. It is worthmentioning that our experimental findings confirm to a great extent the theoreticalanalysis of the previous chapter.To provide a representative overview on the QoS values, we monitored theWeb services for over 10 hours, while constantly evaluating all parameters. Our Webservices were implemented with Java and the composition was fulfilled in theActiveBPEL environment.All experiments were carried out in a PC with processor Intel Core2 Duo 1.80GHz, 2 GB Ram, and running Windows 8.1 64-bit. Also, time was measured inmilliseconds and the throughput in requests per second. We assumed that the cost ofa web service is measured in Euros for our experiments.

MONITORING TOOLS

Cremona

The Cremona is an Agreement Provider component,whose structure incorporates, among other things, a Status Monitor. Thiscomponent is specific to the system providing the service. Once an agreementhas been accepted by both parties (the client and the provider), then its validity is checkedat run-time by a Compliance Monitor.

Colombo

Colombo manages both incoming and outgoing messages by passing them throughtwo corresponding pipes of dedicated policy verifiers and enforcers, it can discover inaccurate behavior in atimely fashion. It provides support for important issues,such as security.

GlassFish

It isan open-source community implementation of a server for Java EE 5 applications.GlassFish provides a number ofspecific tools. The nature of the monitored aspects based on the level ofmonitoring chosen for a given service. There are three possible levels: a)-*low*, whichmonitors response times, throughput, and the total number of requests and faults;*b)-medium*, which adds message tracing under the form of content visualization; c)-*off*,in which no data is collected. Captured information can also be automaticallyaggregated to obtain minimum response times, maximum response times,average response times, etc.

IBM Tivoli Composite Application Manager for SOAs

In this environment, traditional tools that monitor individual resourcesperformance typically cannot solve composite application performance and Availability problems. Instead, Web services need to be incorporated into the end-toned management domain over composite applications and resources that support anSOA environment.[7]

BP-Mon: Query-Based Monitoring of BPEL Business Processes

BP-Suite offers a uniform, query-based, user-friendly interface thatgracefully combines the analysis of process specifications, monitoring of run timebehavior, and log analysis, for a comprehensive process management. BP-Suiteconsists of three tightly coupled query subsystems: BP-QL allows one to query andanalyze BP specifications; BP-Mon allows for monitoring the execution of BPinstances; and BP-Ex allows for a posteriori analysis of the their execution traces(logs).[4]

IX. CONCLUSION

In this technical report, we propose a system that aggregate the monitoring system of Sun Application Server GlassFish with SLA documents, written in WSLA, an XML-based language. Our system requires the availability of both the Web services to be deployed on the application server and the corresponding SLA of the Web service. If these requirements are fulfilled, then the system compares the pre-agreed metric conditions with the monitored metric values and if there is a infringement, it alerts the interested parties with the detected differences. The results are satisfying, compared to other similar systems, as they seem to be fast and precise. Furthermore, these results are very helpful for the service provider, who can take corrective actions in case metric values don't comply with SLAs. In addition, statistical analysis of the results can extract many useful conclusions to assist the provider in developing new and more effective Web services.

As a future work, this will be ideal to make our monitoring system working on the runtime with the Web service execution engine. In this way, the provider could take statistical results and correct any violations very quickly and without any mediators. Another interesting direction is to focus on the corrective actions after a violation is detected. This can be performed by another management service that would take as input the condition evaluation results and then, if appropriate, would try to make the service compliant with the SLA document. All this procedure would be ideal to be distributed.

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