

Adaptive Compensation Mechanism Considering the Interaction of SLA and Manages for Web Services Management System

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Abstract—The Web Service has become one of promising technologies, and is getting widely adopted in business and also gradually deployed in real customer environment. The technology of Web Service is capable of providing a means to integrate different functional components over Internet and enabling business entities to interact one another through standard application program. The Quality of Services (QoS) plays an important role for Web Services in consequence of Web Service is a dynamic system which contains some unexpected factors. Users are desirous of service that they are offered with guarantee consequently the concept of Service Level Agreement (SLA) is growing momentous by degrees. Consequently, service provider and service requester each takes what they need under the protection of SLA. This paper proposed an SLA-based Web Services Management System for Auto-Compensation. The System aims to manage and monitor the SLA that had been negotiated between the service requester and the service provider. The system would handle the violation with some appropriate functionality while any actions infringe on SLA. While the efficiency and quality of the Web Service performance becomes lower, the system could discover the problems and operate compensation in advance. Service requester makes use of the service as usual and service provider has taken the necessary precaution beforehand. Both sides could benefit from it and construct the constant relationship.

Keywords: Web Service, Quality of Service, Service Level Agreement, Web Service Auto-Compensation.

1. Introduction

Web Service technology [1] has all-pervading operated in different part of domain in recent years in consequence of it could integrate all kinds of

heterogeneous system resources. More and more enterprises use Web Service as a method of resource integrating; moreover, it stimulates the rapid growth of Web Service. Generally speaking, Web Service which is a software component makes use of the existing Internet communication protocol and related standards to integrate heterogeneous systems that establish through variant programming language in different platforms. Web Service uses XML as document format while communicating between heterogeneous platform and system and links up with other Web Service technology such as SOAP for message transmission protocol in distributed environment. Moreover, the related techniques are WSDL and UDDI. The major function of WSDL is to describe the service content, format and method. UDDI helps service provider release service and service requester inquire service.

Quality of Service (QoS) is the key factor of Web Service as the result of Web Service is a kind of dynamic system with lots of unexpected factors and service provider could not promise offer promptly service to service requesters. Requesters are desirous of service that they are offered with guarantee consequently the concept of Service Level Agreement (SLA) is growing momentous by degrees. The major function of SLA could evaluate whether the Web Service approaches the level they set up or not. SLA not only uses to dig out the part the service provider has to amend but also propose solutions for the sake of requesters trust. In the cause of confirming that Web Service achieve the level SLA definite, it need a mechanism which could monitor the interaction between service provider and requester and report the processing that back. The system of the paper proposed is out of this purpose.

System framework the paper proposed aims at SLA to monitor the Web Service QoS and analysis the detail service quality parameters. The context

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of SLA define the quality clearly of service provider supply for in consequence of the system could monitor the status of service through SLA. The system which could take control of the interaction between service requesters and service providers not only monitors the Web Service QoS, but also transmits the violation message. The two parties have their own right and duty through SLA. The automatic compensation Web Service management system not only inform and deal properly with all kinds of situations while someone violate the SLA, but also does compensation in advance. Consequently, the service of service requester has will last for and upgrade. As for the service provider, the chance of violating the SLA and compensation would be lower. Both of them benefit greatly from the system.

The paper is organized as follows. The next section will introduce the background and related work about Web Service technologies, Quality of Service, Service Level Agreement, and methods of compensation for Web Service. Section 3 will introduce the system proposed in the paper. The system architecture, system notations, and methods of auto-compensation will detailed introduce. Proposed system implementation and function demonstration will display in Section 4. Finally in the Section 5, conclusions and future work will be mentioned.

2. Related Work

Extensible Markup Language (XML) is a general-purpose specification for creating custom markup languages. It is classified as an extensible language because it allows its users to define their own elements [2]. Markup language means the symbol recognized by general computers. Using these languages, computers can communicate with each other to process information. Markup language includes descriptions about storage layout and logical structure. A software module called an XML processor is used to read XML documents and provide access to their content and structure.

SOAP is a protocol for exchanging XML-based messages over computer networks, and primary used to Web Services [3]. The purpose of SOAP is to simplify Web Server to get the XML data, and to be able to exchange information with XML format between different applications over HTTP communication protocol. SOAP is platform independent, language independent, simple, and extensible. Due to HTTP is common used, and XML parser is easy to get, hence, SOAP to be able

to used and developed easily. Additionally, SOAP can communicate with other systems easily and has more efficiency. The primary advantage of SOAP is to provide solutions to solve the integration and communication between heterogeneous systems. It provides a way to communicate between applications, and executes on any platforms and programs. SOAP used HTTP to transmit XML documents through port 80, hence, SOAP be able to across the firewall to integrate systems in the industry. SOAP provides a method to transmit XML document between two systems in a distribution environment.

Web Services Description Language (WSDL) based on XML Schema to define the Web Service contents [4]. WSDL development does not limit to languages and platforms and aims to integrate with Web Services in the network. WSDL has flexibility. Through WSDL, service requesters can know how to use the service on the premise service providers provide the WSDL document. Therefore, when service providers publish their services, providers have to build a WSDL document, and register the Web Service and WSDL document to UDDI. When service requesters acquire Web Services information from UDDI, they can acquire WSDL documents at the same time.

Universal Description, Discovery and Integration (UDDI) is a mechanism of register standard for electronic commerce to exchange messages among industries. In the architecture of Web Services, UDDI provides a register mechanism for service providers to register and publish their services, and service requesters can query the service they want to use through UDDI. Service providers can describe the information of services and what kinds of services or techniques [5].

More and more enterprises use Web Service as a method of resource integrating; moreover, it stimulates the rapid growth of Web Service. Hence, QoS for Web Service becomes an important thing for service requesters and service providers.

In the reference [6], it present an approach that does not only enable the QoS integration in Web Services, but also the selection of appropriate services based on QoS requirements regarding server and network performance. Additionally, it also presents how application requirements regarding communication QoS are mapped onto the underlying QoS aware network at runtime.

SLA usually made in natural languages, generated and monitored factitiously. SLA can use to manage the QoS of Web Services. SLA provides guarantee to ensure QoS of Web Services,

and it can reach automatic QoS management of Web Services to provide better services. The life-cycle of SLA can separate into four stages, as follows: [7] Negotiation: A customer locates a service provider and presents the desired properties and preference of the services that the provider likes to provide. Signing Up: After all the parties reach an agreement regarding their rights and obligations, they will sign a contract and keep it as a legal file. Maintenance and Evolution: The signed contract is deployed and enforced. The enforcement will be monitored and the corrective management actions would be triggered in case of un-met service level requirements or system errors. Termination: When the contract expires or is broken by any party, it will go to termination automatically.

SLA describes which QoS parameters need to monitor, including all of the definitions of QoS parameters and methods to measure. The roles to monitor SLA may be service requesters, service providers, or the third parties. According to the results of measurement, it can determine if QoS violated the service level defined in the SLA. If measured QoS violated SLA, the correct actions will be executed. When SLA contract has established, the service requester and the service provider must sign on the contract to guarantee the authority and duty. Once the contract become effective, SLA can be monitored and managed. According to the contents and validity of SLA, the third party can monitoring QoS of Web Services and analyze the results to service providers. When the contract expired or the service provider violate the contract, related information will notify of contract parties and the third parties will do some actions according to violated contents and rules. Reference [8] describes a compensation technique implemented in the Web Service transaction, based on the active database concept of triggers. Because Web Service has the character of Loosely-Coupled, it is adequate to use this mechanism of compensation. Reference [9] proposes an approach for the evaluation and comparison of performance and recovery time in Web Services infrastructures. This approach is based on fault injection and is illustrated through a concrete example for Web Services deployment. Reference [10] mentions that, compensation is becoming increasingly important as more complex service-based applications are deployed. Yet most current treatments neglect the dependency information underlying compensated Web Services. Hence, it shows how dependencies potentially affect the composite Web Services. Reference [11] mentions that, failure recovery is to assure that minimum work is lost and normal Web

Services execution can be continued. Explains some failure reasons about Web Services executed failure. Finally, proposed an architecture, called Global Failure Manager (GFM), to recover Web Service failures. Reference [12] mentions that, the compensation mechanism usually adopted is too fixed and cannot satisfy the various requirements of different applications. Hence, analyze the compensation protocol of current standards. Then it enriches the protocol by allowing flexible compensation and extends their proposed multiple-compensation mechanism in Web Service environment.

3. Auto-Compensation of SLA-based Web Services Management System

In this section, proposed auto-compensation of SLA-based web service management system will be introduced.

The paper proposes an Auto-Compensation Web Service Management System, called ACMS, which is based on SLA and manages the interaction between both of service requesters and service providers. The system could not only monitor the Quality of Service (QoS) but also inform the message of contract violation. It operates Pre-Compensation service while the service quality might be lower to violate SLA. It helps the service provider decrease the opportunity of SLA violation and the compensation money also. Both of service providers and service requesters could benefit from the system.

The propose system architecture divided into three stages listed below: Web Service Sustained: The system will monitor the status of Web Service automatically and confirm the Web Service constantly working when the system has operated. Performance Lower: The system operates Pre-Compensation while it monitors the performance of Web Service is lower. So far as the quality of Web Service would violate the range that SLA was defined and the service requester make use of the Web Service without interruption. Service Interruption or QoS Violation of SLA: The system operates Post-Compensation automatically while it finds mout the Web Service with interruption or the service quality violation of SLA regulations.

To find out the issues and operate Pre-Compensation as the efficiency or quality of Web Service that the service provider offered. Not only the service requester could make use of Web Service as usual but also the service provider could take necessary precautions beforehand and lower the compensation. Both of service providers and

requesters get what they need and also construct a long and consistent relationship. Consequently, Pre-Compensation of Web Service is one of the important mechanisms. The paper proposes a Pre-Compensation framework and makes a description of every step in detail: First of all service provider registers at UDDI, and upload the Web Services. Then service requesters can choose what kinds of services to use. The UDDI will return successful message pass to service provider. And Service requesters could inquire about all of the Web Service that service providers offered through UDDI while they need to make use of and which one they prefer. UDDI will return a list of overall Web Services that service requester could choose. Then Service requesters sign SLA contract with service providers to ensure their own right while they had chosen the Web Service they need. The Service provider uploads the SLA contract negotiated with service requester. After that, Service requesters begin to make use of Web Service. The Service requesters obtain the Web Service they need. And ACMS monitors the Web Service that service provider offered and measure QoS parameters defined in the SLA. It obtains the outcome of service quality condition. As the QoS parameters reach the threshold of Pre-Compensation, ACMS will notify the service provider of the actual conditions and ask for the Pre-Compensation. The proposed system executes Pre-Compensation mechanism while measured QoS values did not violate the threshold of SLA. On the contrary, the only solve method is executing Post-Compensation if it does.

The paper also proposes a Post-Compensation framework and makes a description of every step in detail: First of all service provider registers at UDDI, and upload the Web Services. Then service requesters can choose what kinds of services to use. The UDDI will return successful message pass to service provider. And Service requesters could inquire about all of the Web Service that service providers offered through UDDI while they need to make use of and which one they prefer. The UDDI will return a list of overall Web Services that service requester could choose. Service requesters sign SLA contract with service providers to ensure their own right while they had chosen the Web Service they need. And Service provider uploads the SLA contract negotiated with service requester. After that, Service requesters begin to make use of Web Service. The Service requesters obtain the Web Service they need. The ACMS monitors the Web Service that service provider offered and measure QoS parameters defined in the SLA. It obtains the outcome of

service quality condition. As the QoS parameters violate the threshold of SLA, ACMS will notify the service requester and the service provider of the actual conditions and ask for the Post-Compensation.

4. Proposed System Implementation

Implementation of proposed system function divided into two parts. One part is SLA contract analysis and management The other part of the proposed system function is Web Service monitor management and violation compensation.

Figure 1 shows the actual system execution. This figure shows all the SLA contents, QoS parameters, QoS threshold, and some related information.

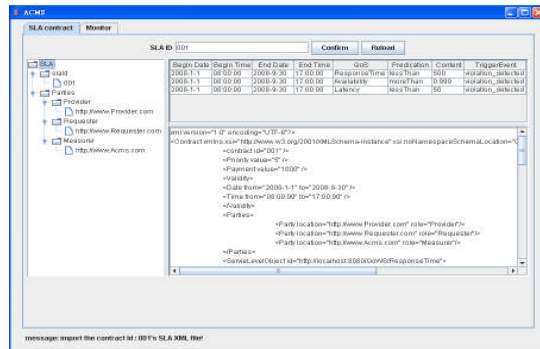


Figure 1. System Execution

5. Conclusions and Future Work

The paper proposes an Auto-Compensation Web Service Management System, called ACMS, which is based on SLA and manages the interaction between both of service requesters and service providers. The system not only can monitor the QoS but also inform the message of contract violation. It operates Pre-Compensation service while the service quality might be lower to violate SLA. It helps the service provider decrease the opportunity of SLA violation and the compensation money also. When the service qualities violate SLA actually, it operates Post-Compensation service to compensate for service requesters. The proposed system not only informs and deals properly with all kinds of situations while someone violate the SLA, but also does compensation in advance. Consequently, the service of service requester has will last for and upgrade. As for the service provider, the chance of violating the SLA and compensation would be lower. Both of service providers and service requesters could benefit from the system.

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