

An Architecture Design of Life Cycle Based SLA Management

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Abstract--In the Web services environment, appropriate guarantee for the service quality can maximize the ability of web services and ensure the services to be carried out effectively and controllable, and that's what SLA contracts can offer. An SLA(service level agreement) is a contract agreed between a service client and a service provider which defines a series of service quality characters and metrics.. In SLA management , the SLA life cycle should be considered carefully because the SLA life cycle is special that includes some issues that out of the service runtime environment, so a common web service management architecture will not meet the SLA management requirements. It is needed to divide the management functions base on the SLA life cycle. Thus, in this paper, the life cycle of SLA is discussed and the SLA-supported Web service architecture and management requirements are also presented. An SLA management platform is designed for SLA definition, service SLA registration and run-time SLA monitoring and controlling mainly base on the SLA life cycle. The paper furthermore shows a model for the mapping from SLA parameters which are advertised by service providers to QoS parameters which are required by service clients.

Keyword- SLA, Life, Cycle, QoS, Web Services, SLA Management, SLA parameter

I. INTRODUCTION

One direction of development of Internet service is to provide the service with difference to make sure that services can be customized and guaranteed QoS assurance. Both end-users and enterprise applications think the quality issues of the third-party services should be more concerned about.

Web Service is the object that deployed on the Web based on a series of XML and open technology based Web norms. Web services management is a set of

capabilities including Web services architecture in the monitoring and controlling of existing resources[9, 11, 12], the availability of resources, service health information, usage, and configuration, in Which, QoS management is a very important module. QoS mechanisms and strategies must be supported by Web Service as it is an important part of the application layer. Thus the only QoS mechanisms of network cannot fully solve the problem of end to end QoS control. it is necessary to establish service contract with quality agreement detail in order to ensure the business process can be smooth.

SLA is a s a formal contract between a service provider and a client guaranteeing quantifiable service performance at defined levels, it describe in detail about service type, scope, quality, and can monitor the service in runtime to check that if there is any default. SLAs offer service providers a way to distinguish themselves from their competitors in today's volatile and competitive market.

Some specifications about QoS and SLA have proposed, such as the Web Service Offerings Language (WSOL) [14] or Web Service Level Agreement (WSLA) [13] language. In QoS aspect, more attentions are paid to composition based on QoS. Framework supporting QoS-enabled web services is proposed in [15]. An SLA-driven management systems is discussed in [2][4].

The benefit of a Web Service with SLA management can be described as follow:

1. Enhance consumer satisfaction;
2. the billing for services will be more reasonable as the services and resource quality are agreed in detail. Service costs will be more transparent. Service clients only need to pay for the services they really use, service providers can provide differentiate services;
3. Service failures can be easier set by runtime monitoring

In this paper, we will discuss SLA Life Cycle in section2 and SLA supported Web service architecture in section 3. The SLA management system architecture will be described in section 4 and the SLA parameter

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discussion in section 5.

II. SLA LIFE CYCLE

The maintenance of SLA management is a cross-business life cycle processes. Generally, SLA lifecycle management includes five major stages: Service development, Negotiation and marketing, Development, Implementation, and Evaluation. But in our SLA management, there are two phases of services that should be cared: pre-runtime and runtime.

The works should be done before the service runtime are: service SLA registration, service inquire and contract negotiation. At this stage, service providers need to register the SLA template their services provide to the SLA management system. The service clients will search services in system service library based on their own QoS requirements. Service clients and service providers will get a personalized, customized SLA contract by negotiating with each other about the SLA details to make sure the service the clients pay can meet their requirements, including: SLA metrics, SLA strategy and punishments rules. When in service operation stage, also be called as the runtime stage, SLA management system's mainly duties are: monitoring and controlling. monitoring is to monitor SLA property metrics, controlling is to make sure the SLA metrics can meet the requirements and make punishment decisions when offense situations happen.

III. SLA WEB SERVICE ARCHITECTURE

The architecture without SLA management often requires three service roles: a service provider, a service client, and a service broker to shield heterogeneous. But the SLA-covered Web service architecture will requires four service roles: a service provider, a service client, and a service broker to shield heterogeneous as before, in addition there will be a SLA manager. The service provider publishes a SLA-covered Web service by creating a Web service on an appropriate platform and generating a WSDL[14] document and a basic SLA for the service. It next sends service details to the SLA manager for storage in a repository. The service client registers with the SLA manager, and then searches and finds the appropriate Web service in the manager's repository, retrieving the WSDL and SLA for the service. It then negotiates with the provider to formalize and finalize the SLA and bind to its Web service.

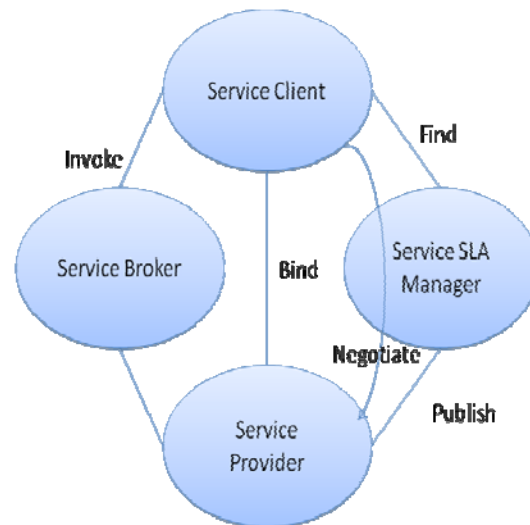


Figure 1. Roles in SLA-supported Web Services

With these four roles, the process to invoke a Web service in a SLA-covered environment:

1. Service providers publish their services on SLA management system with the service SLA details as well as WSDL;
2. Service client searches the appropriate Web service in the manager's repository by requirement;
3. SLA manager find services in its repository;
4. Service client negotiates with the service provider about the SLA details; they finally make a SLA contract.
5. Service clients get best service URL and port from SLA manager;
6. Service client use the service through service broker.

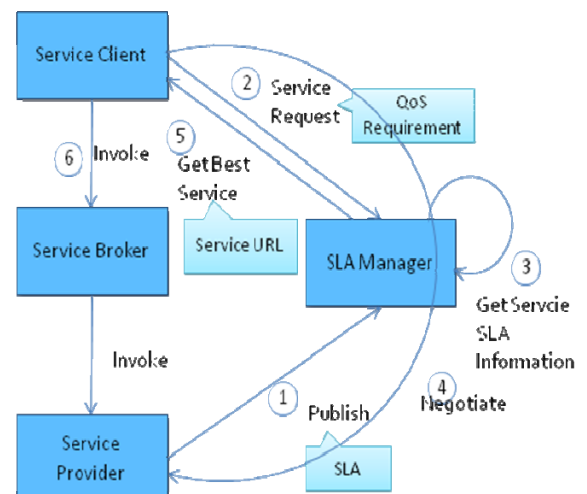


Figure 2. Service Invoke Process for SLA-supported Web Services

Because of the service management requirement is not the same as the service invoke, for example, registering service SLA or setting SLA template is before the service operation. Therefore, the operation of any service existing interface can not meet demands of SLA monitoring. Web services should develop management interface on demand in order to meet SLA management needs.

IV. SLA MANAGEMENT SYSTEM ARCHITECTURE

This section illustrates the SLA management system. As what has been discussed before, the management functions are divided into two main modules according to the two phases SLA management should consider: “pre-runtime” and “runtime”. The two modules are: SLA registration and inquiry management module, and service runtime management module. The former module focuses on registration and service search which will not involve any of the services run-time parameters. For example, it will not responsible for guaranteeing monitor function to make sure that the service is in line with the agreement before. The latter one, on the contrary, will monitor and control the service runtime states.

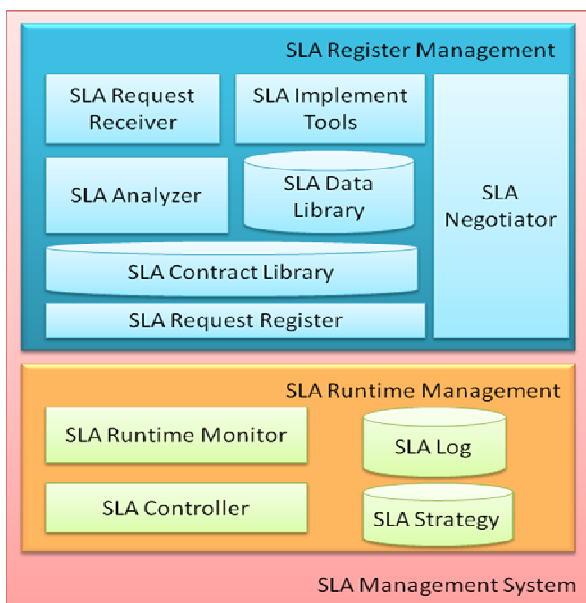


Figure 3. SLA Management System Architecture

A. SLA registration and inquiry management

- SLA Register: for service providers to register their SLA parameters to SLA management system;
- SLA Request Receiver: to receive service inquire with QoS requirements from service clients;
- SLA Analyzer: to accurately map QoS d to service SLA parameters;
- SLA Implement Tools: to query services which

meet the QoS requirement in SLA system;

- SLA Data Library: the storage of all services related information such as WSDL;
- SLA Contract Library: the SLA contract database;
- SLA Implement Tool: to send service information to service users and trigger the consultation process between service client and service provider, and save the final SLA contract into the SLA contract library; If the service run-time environment changes, it is allowed to reset SLA contracts.
- SLA Negotiator: the entity used for the SLA contract negotiation between service clients and service providers. It may be a web page.

B. Service runtime management

Run-time SLA management is responsible for getting run-time parameters and mapping them into the corresponding\SLA parameters, and determining if there is any breach of contract occur.

- SLA Runtime Monitor: to get service runtime parameters, such as: service request time, service response time, whether the service call is successful, whether the services running successfully.
- SLA Log: the log database;
- SLA Strategy: the SLA strategy database, like how much will the service providers repay if the services delay more than 10 seconds as what made in the contract before.
- SLA Controller: comparing SLA parameters computed by service run-time parameters with SLA metric in SLA Data Library to see if there are violations. If so, make punishment decision referring to SLA Strategy.

V. SLA PARAMETERS AND MAPPING

A. SLA parameters

From the perspective of Web service management, Web services need to consider the contents of the six aspects of QoS, performance, availability, accessibility, integrity, reliability and security. SLA service management as an important content of the SLA parameters which need to cover the management characteristics of Web services, so SLA management parameters set as follows:

1. Performance: service performance indicators are mainly based on its throughput capacity and delay measurements. The larger the value of throughput and smaller delay time means a good Web service performance. Throughput is a number of Web service requests in a given period of time. Delay is

the time between service request and response time

The main factors and time-specific are: response time, maximum throughput, the actual average throughput, execution time, transaction time, network delay, delays variation.

In SLA management, the parameters needed for service performance are: service request time, service response time. The metrics needed to define are: network delay, average delay time, execution time, transaction time.

2. **Availability:** the percentage of service available time. Whether Web services exist or have been ready for immediate use. The availability is the possibility that the service is available. The larger the value means that the service has been available at all times, the small value means that is not possible to know if service is available in a particular. Repair time is also relevant. Ideally, a small repair time is desirable.
3. **Accessibility:** The extent Web services can response the service request. The possibility can be expressed as a scale, used to indicate the rate of a successful service instantiation at one time point. The situation that a Web service can used but cannot access may exist.
4. **The integrity of Web services** refers to maintaining the correctness of the initial situation. The appropriate implementation of Web services results in correct response. A transaction refers to a series of things that will be treated as a single unit. A successful transaction needs complete success of all activities. If one transaction is not completed, then all the changes are rolled back.
5. **Reliability,** refers to the capacity of maintain the quality of service.
The number of failures per unit time is a measure of Web service reliability. Another sense is to make sure the service requestor and service providers can send and receive messages orderly.
6. **Safety:** authentication mechanisms, confidentiality, data integrity of data exchange.
The safety parameter service provider need to explain is what safety mechanism they will offer.

B. SLA and QoS mapping

In the side of service providers, the parameters and

metrics are always illustrated, becoming what we call SLA template.

In the side of users, the same thing has the different name called QoS requirements. Actually, in order to make the effective service there are 4 things need to be done.

- SLA parameters must be set up by the SLA service templates.
- Service providers set up the service parameter metrics based on the related parameter templates.
- Users set up the QoS requirements based on the related parameter templates.
- The best possible service is given by matching the service provider parameter metrics and the user QoS.

SLA metrics initially provided by the service providers, and Web service providers need to establish the priority control mechanism which can refuse the low-priority request. Service providers can also provide QoS hierarchy, based on cost of different levels to establish QoS. Service providers can provide a service or a set of metrics; the results reflected in the final price of the different data better measure of the cost will be charged more.

One SLA template can be chosen and used by several service clients. As discussed before, the SLA and QoS mapping relationship can be very flexible, as follows:

A service provider can offer several SLA templates, and a service client can use several Web services and several SLA templates.

VI. CONCLUSIONS

SLA is a way to guarantee service QoS assurance. A managed Web service needs to provide special management interface for SLA management. From the perspective of service providing SLA life cycle often covers two phases: pre-service run-time and service runtime. The SLA management system is designed based on these two phases. The relationship between service SLA and QoS requirement of service clients can be very flexible, so it is needed to provide explicit SLA parameters and metrics. One of the future works we have not discussed presently is the semantic SLA which is a very meaningful matter for efficiency and effectiveness of SLA management.

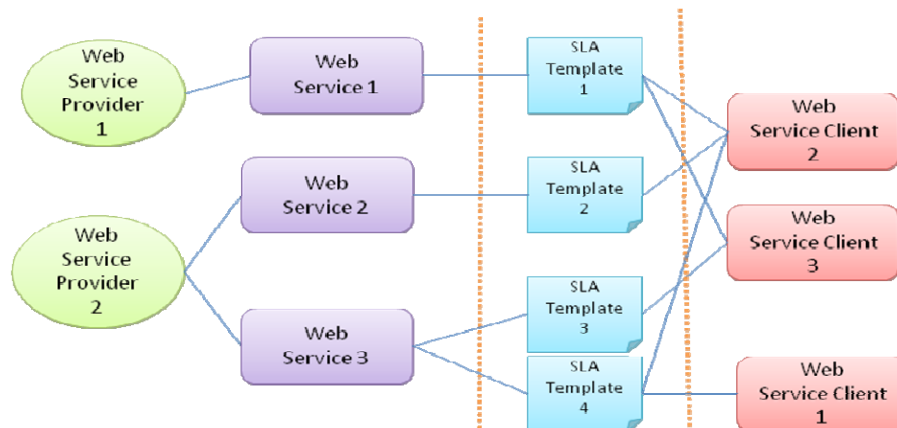


Figure 4. SLA Mapping in SLA-supported Web Services Environment

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